GOVERNMENT OF INDIA, MINISTRY OF RAILWAYS

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Specification For

IP Based
Integrated Passenger Information System

Specification No. RDSO/SPN/TC/108/2019, Ver. 2.0 d1

Issued by

S&T DIRECTORATE
(TELECOM SECTION)
RESEARCH DESIGNS & STANDARDS ORGANISATION

MANAK NAGAR, LUCKNOW-226011

I. AMENDMENT HISTORY

S. N.	Amendment date	Version	Reasons for Amendment
1.	07.02.2020	Version 0.0	First Issue, as per Railway Board letter No. 2010/Tele/9(1)/1 Pt. dated 18.6.2019. Approved by ED/Tele at page NP-5 of File No. STT/IP based IPIS/Spec/885.
2.	05.09.2023	Version 1.0	Integration with CAP & NTES as per latest API and to add some missing data communication protocol. Approved by PED/S&T on date 05.09.2023 at Note#113 in e-Office File No. RDSO-TELE0LKO(TECH)/6/2019-O/o Jt. DIRECTOR/TELE-1/RDSO
3.	xx.xx.2025	Version 2.0d1	1. 42nd TCSC Agenda Item No. 337 approved vide Railway board's letter No. 2020/Tele/9(2)/1 dated 04.01.2025. 2. Minutes of meeting held on 18.02.2025 in AM/Tele's chamber circulated through Railway board's letter No. 2020/Tele/TCM/1 (3321710) dated 20.02.2025.

II. DOCUMENT DATA SHEET

Document Number:	RDSO/SPN/TC/108/2019 Version 2.0 d0
Document Title:	Specification for IP Based Integrated Passenger Information System (IPIS)
Prepared by, Designation:	Director/Telecom- I
Approved by, Designation:	PED/S&T
Abstract: This document specifies technical specification of IP Based Integrated Passenger Information System Consisting of True color Video-cum-Train Information Display Boards, Coach Guidance Display Boards and Announcement System.	

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IV. SUMMARY:

This specification covers the general, functional, technical and performance requirements of IP Based Integrated Passenger Information System suitable for displaying Train arrival and departure indication, coach guidance and PC based announcement system and for showing True color Commercial Advertisements and video displays.

V. SOURCE:

Draft specification No. RDSO/SPN/TC/108/2019, Version - 0.0 has been prepared by RDSO, Lucknow as per Railway Board letter No. 2010/Tele/9(1)/1 pt., dated 18.6.2019.

VI. FOREWORD:

RDSO Specification No. RDSO/SPN/TC/108/2019 is issued as draft specification. This specification is circulated to customers/ Railways and field inspection units for comments.

In the absence of IRS specification, procurement may be made as per RDSO/SPN/TC/108/2019 specification.

This specification requires the reference to the following specifications:

IRS: S23	Electrical signaling and interlocking equipment
RDSO/SPN/144	The Safety and reliability requirement of electronic signaling equipment
IS:9000	Basic environmental testing procedures for electronic and electrical items

Wherever, reference to any specifications appears in this document, it shall be taken as a reference to the latest version of that specification unless the year of issue of the specification is specifically stated.

For the purpose of this specification, the terminology given in IRS: S23 and RDSO/SPN/144 shall apply.

1.0 **SCOPE:**

This specification covers the general, functional, technical and performance requirements of IP Based Integrated Passenger Information System used for giving train arrival and departure information and any other video/image/alert information to passengers, which includes different type of display i.e. Single Line, Multiline, True color advance, indoor and outdoor video display, At a glance, coach guidance and PC based announcement system, placed at various places of the station with feature of networking, Operations from local operator and remote monitoring from a central place.

2.0 **SYSTEM DESCRIPTION:**

2.1 The IP Based Integrated Passenger Information System (IPIS) will consist of Firewall, Central Data Controller (CDC) loaded with software for announcement & display, ~~Remote monitoring Server (RMS) with~~ Network Monitoring Software (NMS), PDC, LED display (TV), Advance Video Display (AVD) and display boards of different sizes like Single Line, Multiline, At a glance, True color Indoor and outdoor video display, Coach Guidance along with facility of backward compatibility with all older versions of IPIS system installed as per previous version of specifications i.e. RDSO/SPN/TC/108/2019 and RDSO/SPN/TC/61.

2.2 Multiline Display Board to display train Information in mono color i.e. Train number, Name, time of arrival and departure and platform number. It will show information of up trains/ down trains or both as decided by the purchaser. The multiline display boards will be placed at main entrance/ concourse of the station.

2.3 **True color Indoor and Outdoor Video Display** shall display train information in multi-color, commercials, entertainment programs and other information to passengers.

2.4 **Platform Display Board** to display the information of the train scheduled for arrival/departure from that platform i.e. Train number, Name, time of arrival and departure in mono color. The Platform display boards will be placed at suitable places on platforms/ foot-over bridges.

2.5 **At-A-Glance Display Board** for displaying information of the train arriving and departing from that platform along with coach composition in mono color.

2.6 **Coach Guidance Display Board** to indicate position of coach No. scheduled for arrival/ departure from that platform for guidance of passengers in mono color.

2.7 **Display Monitor/ LED TV** (Industrial grade capable of working 24x7) to display train information being displayed on **Multiline Display Board**. Display monitor shall be provided in the enquiry offices, waiting rooms or at any suitable Indoor application only.

2.8 **Advance Video Display Boards** (AVD) is a very compact and rugged 4 mm LED Video wall for railway environments. It shall display the train Information as done by multiline boards.

2.9 It should also be possible to network all systems provided at different locations at a station for carrying out operation from a centralized place.

2.10 All devices shall be connected at the station with LAN network. LAN network shall be arranged by the purchaser.

2.11 CDC shall host an open REST API to disseminate train information data and messages to display boards ~~on demand, this will replace the older methods of push type data communication and shall ease out interoperability among vendors.~~ CDC shall also be able to disseminate train information data and messages to all older versions of IPIS system i.e. RDSO/SPN/TC/108/2019 and RDSO/SPN/TC/61 to ensure interoperability with older versions.

2.12 All display boards shall have provision for LED short and open detection feature, the display board shall host a https webserver within itself which can be viewed using any of the shelf browser like chromium, MS Edge, Opera etc. Additionally, the fault information should be available over an API at the CDC. The system shall log the detected anomalies in the NMS for proactive maintenance.

2.13 The https webserver hosted inside the display board shall be capable to configure the display board parameters like Board Type, PF No, IP address etc. by using GUI over the commonly used browsers and must be password protected at OEM level. Operating system once installed at station to be handed over to the operator with Separate "User" Account Profile. Main "Administrator" Profile to be used only by System Engineer/Telecom maintenance Personnel. No software installation permitted with Operator's User Account. All unused port to be disabled.

2.14 The display shall periodically test the LED open / short status once in a day preferably when train data is not available or mainly during night between 1:00 AM – 3:00 AM once every day and the same status shall be stored until next cycle, this information must be available when the website hosted inside the display is viewed by the user/administrator. User shall be able to check the status of LEDs from CDC software and NMS. Also, automatic LED checking time shall be user configurable.

2.15 All Display board used in the IPIS system shall have unique MAC address issued by IEEE and can be linked to the manufacturer under license.

2.16 ~~If~~ The OEM shall provide ~~is an OEM of IPIS then an undertaking shall be submitted along with submission of the tender for technical support for hardware failure replacement (under warranty)/maintenance throughout post-commissioning maintenance period. Also providing~~ necessary software upgrades free of cost throughout the codal life of the equipment, as and when required, due to up gradation of IPIS specification from time to time.

~~2.17 If tenderer is not OEM of IPIS then MOU for technical support for installation, testing and commissioning, post commissioning maintenance problems, failures of equipment including after sale support and also providing necessary upgrades of software free of cost as required due to upgradation of specification of IPIS from time to time throughout~~

~~the life of the equipment to be submitted from OEM of IPIS along with submission of the tender~~.

All the IPIS devices and system shall support SNMPv3 protocol. Also protocol converter (if required) shall be provided at Edge NMS for existing or old IPIS specification.

3.0 SYSTEM REQUIREMENT:

3.1 Hardware Requirements: The IP based IPIS shall Consist of following units/subsystems:-

a) Central Data Controller (CDC)
b) Central Data Switch (CDS)
c) Platform Data Controller (PDC)
d) Multiline Display Board (MLDB)
   i. Mono color MLDB
   ii. True color MLDB (Indoor video display (IVD) & Outdoor video display (OVD))
   iii. Advance Display Board
e) Platform Display Board (PFD)
f) At-a-glance display Board (AGDB)
g) Coach Guidance Display Board (CGDB)
h) Display Monitor/ LED TV (industrial grade)
i) Remote Monitoring Server with NMS
j) Firewall

3.2 Central Data Controller:

3.2.1 The Central Data Controller (CDC) shall consist of two CPUs (PCs) in redundant mode connected through an CDS for data synchronization, one 17" (minimum) Color monitor to be connected through a Keyboard-Video-Mouse (KVM), speaker and microphone for live announcement.

3.2.2 The CPU of CDC shall be of industrial grade/24x7 working capacity & reputed make having following minimum configuration:

a) 14th or latest generation i7 processor or equivalent ~~or higher processor~~
b) Min. 16 GB or higher DDR4 RAM
c) Storage space: Solid State Disk Min. 1 TB or higher
d) Standard I/O Ports (Min. 4 USB 3.0 or latest)
e) Windows-11 or higher version Operating System (OS)
f) Gigabit Ethernet Port- 10/100/1000 Mbps
g) Audio Input /Output ports
h) Keyboard & Optical Mouse
i) Schema based DBMS like MySQL/ SQL server 2000, MS Access, Oracle or schema less like MongoDB, Tableau or any other type of file handling like XML file, JSON file or similar.
j) 2GB Graphic Card (If not inbuilt in CPU)

3.2.3 Both the CPUs of CDC shall be pre-loaded with necessary software and database packages for working of Integrated Passenger Information System (IPIS). There shall be continuous data synchronization between both the CPUs connected through a LAN link. At a time only one CPU will work but database of both CPUs shall be updated automatically.

3.2.4 It should be possible to operate CDC from a suitable control center or enquiry office, preferably a dust free or AC environment. User Railway to ensure the same.

3.2.5 CDC shall be provided with voice recording and playback facility for making live PC based announcement. There shall be provision for one speaker with volume control to monitor the announcement.

3.2.6 The Audio output for PC based announcement shall be connected to existing audio amplifier of public address system eliminating any ground noise or hum.

3.2.7 UPS of minimum 1 KVA with minimum 25 minutes battery backup on 0.8 KVA shall be provided for uninterrupted operation of the CDC.

3.2.8 Deleted

3.2.9 Cabinet of the equipment shall be well designed to sustain external vibration due to movement of trains.

3.2.10 Cabinet of CDC should be of standard design as per schematic shown in diagram-2 & made of Cold Rolled Closed Annealed (CRCA) sheet of minimum 1.2 mm thicknesses. It should be powder coated in ivory/gray color to protect from rust. Shelves of suitable height shall be provided to accommodate the equipment. Proper power supply distribution with plugs & sockets of appropriate capacity and earthing connection point shall be provided on the cabinet. Gland plates shall be provided on the top panel of cabinet for cable entry.

3.2.11 The cabinet shall have locking arrangement for front and back doors for equipment safety. Front side of the cabinet may have two or three doors. Only keyboard & mouse shall be accessible to operator whereas the other equipment's remain in locked condition. Front door of the cabinet shall be of toughened glass/ transparent UV polycarbonate sheet.

3.2.12 **Integration with NTES:**

3.2.12.1 System shall be fully equipped with suitable hardware & software to acquire updated data of running trains from NTES via NTES REST API 951 & 952 using HTTPS protocol or any central server. The time interval for fetching of data from NTES shall be 1 minute.

3.2.12.2 Backward Integration with NTES for PF Update: - System shall be able to send all changes in the Train Platform done by IPIS Software operator, from IPIS Software to NTES via NTES REST API 861.

3.2.13 **Integration with CAP:** System shall be able to get early warning information provided by National and State Disaster Management authorities through Common Alerting Protocol (CAP) based Integrated Alert System during emergencies like floods, cyclones and Covid pandemic etc.

3.2.13.1 In case of disaster situations, IPIS software shall be able to automatically announce the alert message through the existing PA system periodically and also send the disaster related message on the display boards. In Multiline Display Board (Mono color & True

color MLDB) disaster message shall be displayed on the last line of display boards in a scrolling manner and when no alert is active/available, all lines should be used for displaying train information. For other display board like Platform Display Board (PFD) & At-a-glance display Board (AGDB) disaster message shall be displayed alternately along with train information in a scrolling manner. The display time of both the train information and the alert messages should be configurable and repetition interval of the announcements should also be configurable.

3.2.13.2 System shall be able to display message of min 306 character lengths in English, Hindi & Regional Language in scrolling manner.

3.2.13.3 Common Alerting Protocol (CAP) API shall be provided by C-DOT (Centre for Development of Telematics) of the Department of Telecommunications (DoT), Ministry of Communications, Government of India. Any change in data protocol shall be updated time to time.

3.2.13.4 IPIS operators shall be notified about the new alerts at the arrival of the same by generating a pop up window in the IPIS software which shall contain the alert details such as alert message, start time, end time, audio availability, urgency, severity and certainty as received through the CAP API.

3.2.13.5 A separate tab in the IPIS software shall be provided for displaying all the active alerts. Alert parameters like alert message, audio availability, urgency, severity, certainty, start time and end time as received through CAP API shall be displayed for viewing by the operator. This tab shall contain two buttons which can be used to override/pause message dissemination and audio dissemination of the selected alerts. The pause duration shall be configurable and Selection of alerts should be possible by a single click.

3.2.14 CDC shall host an API which shall provide train information details to display boards and shall also receive fault and health data from each display board.

3.3 Central Data Switch:

3.3.1 The Central Data Switch (CDS) shall provide Ethernet and optical connectivity for data communication between both CPUs of CDC, PDC and Display boards.

3.3.2 Minimum 4 X SFP+ (optical) ports & minimum ~~8~~ 24 LAN (copper) ports Layer 3 switch (as per site requirement or as specified by Purchaser) with MAC table 32k, RAM – 2GB and Flash Memory – 2GB shall be used as Central Data Switch.

3.3.3 Data communication between CDS to display boards shall be on Ethernet using STP CAT-6 cable or it should be on Optical Fiber cable if distance is more.

3.3.4 CDS shall be of industrial grade & reputed make like HP, CISCO, Juniper, Brocade, IBM, Alcatel, Lucent, Avaya, Netgear, D-link, Moxa, Phoenix Contact, Digisol, WatchDog etc. or any other similar make.

Note: Local content (LC) shall be as per Table-A (List of telecom product, Services and works) issued by Department of Telecommunications, Ministry of communications vide notification published in the Gazette of India Extraordinary (Part I Sec. I), New Delhi, 21st October 2024 or latest as issued by DoT.

3.4 Platform Data Controller (PDC):

3.4.1 The Platform Data Controller shall drive Platform display boards, At-a-glance display boards and Coach guidance display boards.

3.4.2 The Platform Data Controller Shall act as a Gateway for all the platform devices.

3.4.3 The Platform Data Controller shall have Layer-2 switch compatibility features for routing packets between CDC and field devices like Platform display boards, At a Glance Display Board and Coach Guidance display boards.

3.4.4 The Platform Data Controller shall periodically hit the REST API hosted in CDC and gather data for the specific platform at a fixed interval of 5 Second.

3.4.5 Platform Data Controller shall Host another REST API which will disseminate the data to Platform devices like CGDB, AGDB, PFD.

3.4.6 The PDC shall have minimum six optical Ethernet ports with single mode optical interface and at least four Copper Ethernet ports for connecting CDC through CDS and field Display Devices.

3.4.7 The Platform Data Controller design should be based on minimum 32-bit microcontroller. The PDC shall route the data/ instructions coming from the Central Data Controller to the downstream display devices and health/ diagnostics information from the display devices to CDC.

3.4.8 Connectivity of coach guidance display shall be on daisy chain like structure and in case of failure (like power down of specific pole) of any device, extension of communication link shall not be affected. Also, in case of removal of any Display Board for repair it should not affect working of other display Boards.

3.4.8.1 Daisy chain structure and CGD connectivity shall be achieved using separate junction box which shall bypass the connectivity to next unit in case of power down.

3.4.8.2 Junction Box shall have Minimum one input and 2 output ethernet ports.

3.4.8.3 When Power to Junction box is available it shall act as an active ethernet switch.

3.4.9 All the ports shall have LED indications for monitoring the communication status of the connected devices.

3.4.10 Platform Data Controller shall be installed on each platform to cater data connectivity requirement of all the display board Connected to It.

3.4.11 It should be possible to mount PDC on wall. PDC, fiber termination box, power strip etc. shall be accommodated in a standard 19” Euro Rack of suitable height.

3.4.12 The PDC shall communicate with the CDC and display devices connected to it.

3.4.13 All Ethernet copper ports of PDC should be standard RJ-45 Ethernet connector. The pin out of RJ-45 connector shall be as per as per IEEE802.3.

3.4.14 All Optical ports of PDC shall be fully loaded standard SC or LC type connector. SC-APC or LC-APC connector may be used.

3.5 General Requirements of Mono color multiline display, At a glance display, platform display board & coach guidance display board:

3.5.1 Following character sizes shall be used for displaying information on Display boards:

a) Preferably Character Size on display board with 32 Rows of LEDs: For English and Numeric, the character size shall be adjusted to appropriate character width subject to maximum of 28x17 & for Hindi or Regional Language it should be maximum up to–32x24 LED matrix. There should be a gap of min. 32x2 LED matrix between two consecutive characters and 32x4 LED matrix between two consecutive words. However, actual character size may depend on type of font used.

b) Character Size for coach composition data display:

For English, the character size shall be preferably of 12x7 LED matrix. There should be a gap of minimum16x1 LED matrix between two consecutive characters and 16x3 LED matrix between two consecutive words. However, actual character size may depend on type of font used.

3.5.2 Protective grid made of Glass filled Nylon/ PC-ABS of black color shall be provided on LED matrix for uniform intensity of the display boards.

3.5.3 All mono color display boards shall be protected with U.V. stabilized polycarbonate sheet with matte finish film and antiglare features having thickness of 3mm ± 0.3mm for better visibility and protection against dust/Rain.

3.5.4 Only single polycarbonate sheet without any joint should be used to cover all type of display boards however for Multi line display boards of more than two lines can be covered either by a single polycarbonate sheet for complete board or for individual line.

3.5.5 Material used for the printed circuit board (PCB) shall be copper clad glass epoxy of grade FR-4 or equivalent. The PCB thickness shall be 1.6 mm ± 0.16mm.

3.5.6 All Display boards of mono color shall be manufactured using 32x96 LED matrix. The pitch of mono color LED matrix shall be 5 ± 0.1 mm.

3.5.7 The housing of various display boards should be made of ~~Cold Rolled Closed Annealed (CRCA)~~ Aluminium Sheet of minimum ~~1.2~~ 2.0 mm thickness. It ~~should~~ shall be powder coated in black color to protect from rust.

3.5.8 The Mechanical dimensions of display board shall be as under:

Display board Type	***Physical Dimensions in mm***
Multiline display board (Single Color) (For Min 2 lines)	3550(L) ± 10 x 600(H) ± 5 x ~~130~~ 150(D) ± 5 - Single sided. 3550(L) ± 10 x 600(H) ± 5 x ~~180~~ 200(D) ± 5 - Double sided. Gap between two adjacent lines: 80 ± 5 Increase in Height for each additional line: Max 240
Single line display board	3550(L) ± 10 x 350(H) ± 5 x ~~130~~ 150(D) ± 5 - Single sided. 3550(L) ± 10 x 350(H) ± 5 x ~~180~~ 200(D) ± 5 - Double sided.
At-a-glance display board	2150(L) ± 10 x 500(H) ± 5 x ~~130~~ 150(D) ± 5 - Single sided 2150(L) ± 10 x 500(H) ± 5 x ~~180~~ 200(D) ± 5 - Double sided
Coach guidance display board	540(L) ± 5 X 250(H) ± 5 X 200 ± 5 (Depth Top) & 178 ± 5 (Depth Bottom)

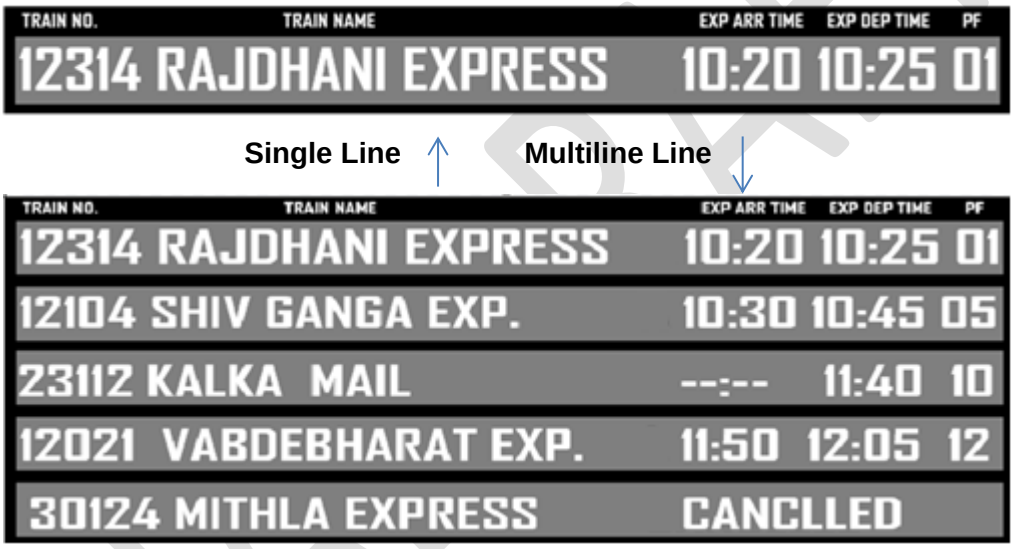
Note: At-a-glance display board, Coach guidance display board and Single line display board shall be as per Diagram-3 to Diagram-5.

3.5.9 Sun guard/ rain hood made of CRCA Sheet of minimum 1.2 mm thickness shall be provided on the top of all the display boards which are installed outside shed area to protect them from direct sun light, rain and dust.

3.5.10 Field format of Single/multiline display board, each line consisting of the LED matrix of 32x672 should be preferably as per following format:

93	4	340	4	84	4	84	4	55
Train No.		Train Name		EAT		EDT		PF No.
5 Digits				4 Digit + Colon		4 Digit + Colon		3 Digits
44444		AAAAAAA EXP		20:45		20:50		10

3.5.11 Display format of Single & multiline display board (32x672) shall be as under:



3.5.12 Field format of At-a-glance Display board shall be preferably as per following format with LED matrix of 64x384. However, actual format will depend on the font type and information to be displayed.

53	3	192	3	48	3	48	3	31
Train No		Train Name		EDT		EAT		PF No

C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14
C15	C16	C17	C18	C19	C20	C21	C22	C23	C24	C25	C26	C27	C28

3.5.13 At-a-glance display board shall be displaying coach composition information in a two-line LED matrix of each 16x384 at bottom.

3.5.14 At-a-glance display board shall be displaying train information in one-line LED matrix of 32x384 at top.

3.5.15 Each coach shall be displayed within 24 columns followed by 4 LED gaps.

3.5.16 Display format for at a glance Display Board (64x384) shall be as under:

3.5.17 Train Name in Top Line shall be displayed in English, Hindi and regional in a sequential manner as per requirement.

3.5.18 Deleted

3.5.19 CGDB shall be double faced & other Display Boards can be single or double faced as specified by the purchaser. However, if not specified default will be ~~double~~ single face.

3.5.20 Deleted

3.5.21 CGDB shall be of LED matrix 32x96.

3.5.22 Display format for Coach Guidance Display Board:

3.6 General Requirements of True Color Video Display Board (OVD, IVD & AVD):

3.6.1 The LED video display board shall be made up of multiple LED modules and cabinets. Each module shall consist of LEDs and respective drivers. LED modules/cabinets shall be arranged vertically and horizontally to construct the actual display. These LED modules shall be interchangeable and shall be used anywhere.

3.6.2 LED Display module shall be manufactured using 16 X 48 LED matrix.

3.6.3 Pitch for IVD and OVD shall be ~~8mm~~ 7mm± 0.1mm, ~~Pitch for IVD shall be 6mm ± 0.1mm~~ and pitch for AVD shall be 4mm ± 0.1mm.

3.6.4 Glass filled nylon / PC-ABS based LED trays shall be used to fix LED panels for all display boards.

3.6.5 Fans wherever required shall be provided for circulation of air inside the cabinets of the display board. Air filters are also to be provided to avoid dust entry into these cabinets.

3.6.6 Each cabinet shall have water and dust proof connectors for data in and data out and power cables.

3.6.7 Audio output shall be available from display controller which may be connected to a suitable audio amplifier.

3.6.8 The mechanical mounting of LED matrix should be easy for replacement of LED module in case of repair. Such replacement shall not affect operation of any other modules of the system.

3.6.9 Display Board cabinet shall be made up of minimum ~~1.2~~ 2.0 mm thick ~~CRCA~~ Aluminium sheet with powder coating.

3.6.10 The door shall be provided with gaskets to avoid water and dust entry into the cabinet.

3.6.11 Multi-line train info display format on Video Display Board shall be as under:

General Requirements Indoor / Outdoor Video Display (OVD) Board:

3.6.11.1 ~~The pitch of Indoor and Outdoor video display boards shall be of 8 mm 7 mm ± 0.1 mm.~~

3.6.11.2 ~~The OVD display PCB shall be of matrix 16x48.~~

3.6.11.3 Front side of LED Modules shall be protected from rain and dust with suitable protective material.

3.6.11.4 If the Video Display is installed outdoor then ~~The outdoor video~~ the display board shall be IP 65 front and IP 54 back for environmental standard compliant to protect it against dust & rain.

3.6.11.5 ~~Parameters of outdoor video display boards:~~

~~SN~~	~~Description~~	~~Specifications~~		
		~~6-Line~~	~~12-Line~~	~~18-Line~~
~~1.~~	~~Pixel LED~~	~~3-in-1 (RGB) SMD LED~~		
~~2.~~	~~Pixel Resolution (W x H)~~	~~576 x 128 160~~	~~576 x 256 320~~	~~576 x 384 480~~
~~3.~~	~~No. of lines~~	~~6 Line~~	~~12 Line~~	~~18 Line~~
~~4.~~	~~Color Processing~~	~~12-Bit per color or more~~		
~~5.~~	~~Line Height~~	~~20 25 pixels~~		
~~6.~~	~~Scan Rate~~	~~1:4 Scan~~		
~~7.~~	~~PCB Thickness~~	~~1.6 mm ± 0.16 mm~~		
~~8.~~	~~PCB Mask & Legend~~	~~Black/Green Mask & White Legend~~		

3.6.11.6 The display shall be flicker-free to ensure stable and comfortable visual performance under all operating conditions.

3.6.11.7 **Parameters of Indoor and Outdoor video display boards:**

3.6.12 ~~**General Requirements Indoor Video Display (IVD) and Outdoor Video Display (OVD) Board:**~~

3.6.12.1 ~~The pitch of Indoor video display boards shall be of 6 mm 7 mm ± 0.1 mm.~~

3.6.12.2 ~~The IVD display PCB shall be of matrix 16x48~~

SN	Description	Specifications		
		6-Line	12-Line	18-Line
1.	Pixel LED	3-in-1 (RGB) SMD LED		
2.	Pixel Resolution (W x H)	576 x ~~128~~ 160	576 x ~~256~~ 320	576 x ~~384~~ 480
3.	No. of lines	6 Line	12 Line	18 Line
4.	Color Processing	12-Bit per color or more		
5.	Line Height	~~20~~ 25 pixels		
6.	Scan Rate	1:~~8~~ 4 Scan or better		
7.	PCB Thickness	1.6 mm ± 0.16 mm		
8.	PCB Mask & Legend	Black/Green Mask & White Legend		

3.6.13 **General Requirements Advance Video Display (AVD) Board:**

3.6.13.1 The pitch of ~~Indoor~~ Advance video display board (AVD) shall be of 4 mm± 0.1 mm.

3.6.13.2 The AVD display PCB shall be of matrix 32x96.

3.6.13.3 Parameters of Advance video display boards:

SN	Description	Specifications

1.	Pixel LED	3-in-1 (RGB) SMD LED
2.	Pixel Resolution (W x H)	384x160
3.	No. of lines	10 Line
4.	Color Processing	12-Bit per color or more
5.	Line Height	16 pixels
6.	Scan Rate	1:16 Scan or better
7.	PCB Thickness	1.6 mm ± 0.16 mm
8.	PCB Mask & Legend	Black/Green Mask & White Legend

3.6.13.4 AVD shall be protected with U.V. stabilized Polycarbonate sheet with matte finish film and antiglare features having thickness of 3 mm ± 0.3 mm for better visibility and protection against dust/Rain.

3.7 Specification of LED for Mono color Display and Clock:

3.7.1 LEDs specification for Mono color multiline display, at a glance display, platform display board & coach guidance display boards:-

3.7.1.1 Cool White color Chip Type SMD LEDs of uniform intensity shall be used for better visibility in all types of display boards. However Amber Color SMD LED may be used in all type of Display boards except CGDB, **if specified by the Purchaser**.

3.7.1.2 Diffused Chip Type SMD LED meeting following parameters shall be used for display boards.

S. No	Parameters	White LED	Amber LED
1.	LED Type & Size	Chip Type SMD 3.6mm x 3.6mm (Over all max. dimension)	
2.	Color	White	Amber
3.	Wave Length	Color Temperature 6500ºK ± 10 %	595±7nm
4.	Viewing Angle (50% I_V in mcd)	Minimum ~~90º~~ 100°	
5.	Luminous Intensity @ 20mA biased current	≥ ~~1500~~ 1800 mcd	≥ 500 mcd
7.	Make	Avago / Nichia / Osram/ Everlight/ CREE/MIC India®	

3.7.2 **LED for Advance, Indoor & outdoor Video Display Boards:**

3.7.2.1 Super bright 3-in-1 (RED, GREEN and BLUE) SMD type LEDs of uniform intensity shall be used for true color with longer visibility in advance Indoor & outdoor Video Display boards.

3.7.2.2 3-in-1 (RGB) SMD type LEDs for Indoor Video Display (IVD) & outdoor Video Display (OVD) shall have the following parameter:

S. No.	Parameters	Board Type	RED LED	GREEN LED	BLUE LED
1.	LED Type & Size	AVD	SMD 3-in-1 (RGB) LED ~~2.05~~ 2.15 mm x 2.15mm (maximum)		

S. No.	Parameters	Board Type	RED LED	GREEN LED	BLUE LED
		IVD and OVD	SMD 3-in-1 (RGB) LED ~~3.5mm x 3.5mm (maximum)~~ 3.2mm x 2.8mm (minimum)		
		~~OVD~~	~~SMD 3-in-1 (RGB) LED 5.5mm x 5.5mm (maximum)~~		
2.	Wave Length	AVD	622 ± 8 nm	526 ± 8nm	470 ± 8nm
		IVD & OVD	~~626 ± 10nm~~ 625 ± 6nm	~~530 ± 10nm~~ 525 ± 6nm	~~470 ± 10nm~~ 470 ± 6nm
3.	Viewing Angle (50% I_V in mcd)	AVD, IVD & OVD	Minimum ~~90°~~ 100°		
4.	Luminous Intensity @ 20mA Bin Range	AVD	≥ ~~200~~ 410 mcd	≥ ~~600~~ 625 mcd	≥ ~~80~~ 90 mcd
		IVD & OVD	≥ ~~270~~ 700 mcd	≥ ~~750~~ 2200 mcd	≥ ~~190~~ 400 mcd
		~~OVD~~	~~≥ 680 mcd~~	~~≥ 1800 mcd~~	~~≥ 400 mcd~~
5.	DC Forward Current (IF)	AVD	≤30mA		
		IVD & OVD	≤20mA		
6.	Pulse Forward Current (iFP)	AVD	≥45mA		
		IVD & OVD	≥90mA		
7.	Make	AVD, IVD & OVD	Avago / Nichia / Osram/ Everlight / CREE/MIC India®		

3.7.2.3 The luminous Intensity bin range of the LED should start from the minimum specified value.

3.8 General Requirements of LED Monitor Display Board (TV)

3.8.1 Monitor Display Board (LED TV) of minimum 40 inch or as specified by the purchaser shall be used for Display of train information for Indoor application only.

3.8.2 Smart Industrial Grade LED TV (capable of working 24x7) shall be used for Monitor Display Board.

3.8.3 All Monitor display Board shall be connected over LAN as per IP Schema.

3.8.4 CDC Server shall host a URL (Uniform Resource Locator) for TV display, the smart TV shall call the URL and display the content available in full screen mode.

3.8.4.1 Number of rows to be displayed in TV display shall be configurable between 4 to 8 lines.

3.8.4.2 There should be programmable option to display CGD of trains in rotational manner.

3.8.4.3 There should be programable option to display / hide manual messages.

3.8.4.4 CAP messages whenever arrive shall be displayed at the bottom line.

3.8.4.5 The reference display format for TV display shall be as per reference diagram 1A.

3.8.5 There shall be provision to play media with audio on Monitor display Board.

3.8.6 Monitor Display Board shall automatically switch between active servers (Primary/ Secondary).

3.9 Edge NMS (E-NMS) and Centralized NMS (C-NMS):

~~3.9.1 Remote Monitoring Server (RMS) with NMS software shall be provided at each station for remote monitoring.~~

~~3.9.2 CDC shall be connected to RMS and the same shall be connected to Railnet for remote monitoring.~~

~~3.9.3 Configuration of RMS shall be as per Clause No. 3.2.2.~~

~~3.9.4 SNMP based NMS software shall be loaded in RMS to monitor the network devices in IPIS System.~~

~~3.9.5 RMS shall have firewall supporting IPS (Intrusion prevention system).~~

~~3.9.6 NMS shall be user-friendly with intuitive dashboard and visualization tool, detailed logs with filtering options.~~

~~3.9.7 NMS shall have the option of sending SMS alerts on failure of any device.~~

~~3.9.8 NMS shall use SNMPv3 or latest protocol for monitoring of devices, SNMP payload shall provide information for board health status and current intensity.~~

3.9.1 General Requirement

i.) The IPIS, as specified in RDSO/SPN/TC/108/2019, comprises distributed display boards (e.g., MLDB, PFD, AGDB, CGDB, and video display units), a Central Data Controller (CDC), Platform Data Controllers (PDCs), and supporting communication infrastructure. The NMS is intended to provide local and centralized monitoring, configuration, control, and diagnostics for all networked devices within the IPIS.

ii.) The system shall have two level of Network management. One at station level, namely Edge NMS, to monitor system components installed at the station. Second at Divisional level, namely Central NMS, for monitoring IPIS devices and systems of all stations of the division.

iii.) All the IPIS devices and system shall support SNMP V3 or latest protocol and protocol converter shall be provided at Local Edge NMS for existing or Old IPIS specifications.

iv.) The Local Edge NMS shall monitor IPIS system, displays and devices of the station. It will send all the events and device information to Centralized IPIS NMS via SNMPv3 over Railnet or IPMPLS network.

v.) The IPIS system and equipment shall send event in case of failure, startup, information and periodic status to Local Edge NMS over SNMP.

vi.) The failure event shall contain asset/device identification, event type, health status, failure description, timestamp.

vii.) The startup event shall contain asset/device identification and startup time stamp.

viii.) In case of any information like status of LED Matrix, Power Supply and other parameters the information event shall be sent from IPIS devices/Systems.

ix.) The Centralized NMS shall be able to monitor all the stations IPIS systems in the division irrespective of OEMs/Vendor of IPIS.

x.) Station wise graphical display shall be provided with real time status of all network equipment. The time of identifying event and display on the Graphical user interface shall not be more than 10 seconds.

xi.) The Status and information provided by the IPIS system for NMS monitoring shall include, but not limited to, the following:

- The status of LED Matrix of each LED display board
- Link status of PDC, TADDB, CGDB and other display device
- Status of Power Supply unit of each display unit and networking component
- Port status of PDCH
- Status of Audio output of CDC
- Status of Fan of display board
- Load current of the equipment PDCH, CDC, TADDB and CGDB
- Log of NTES connectivity
- Health status of display boards (e.g., MLDB, PFD, AGDB, CGDB, and video display units), a Central Data Controller (CDC), Platform Data Controllers (PDCs).

xii.) The IPIS NMS system shall provide predictive alert based on the history of events received for the IPIS devices and systems which will help maintainers in predictive maintenance.

xiii.) The NMS Software shall be certified from STQC. The certificate must cover Functional Testing, Interoperability Testing (including SNMPv3 and REST API), and Security Testing (static analysis and basic OWASP checks).

xiv.) Security Verification Certification: The System Software shall have security features which can be deployed meeting all the parameters applicable to software for security, vulnerabilities, etc. with relevant and equivalent safeguards as per the latest OWASP Top 25 from STQC (Ministry of Electronics & Information Technology) only for testing and issuing the certificate / clearance.

xv.) Both the NMS shall store all the event logs for at least 30 days.

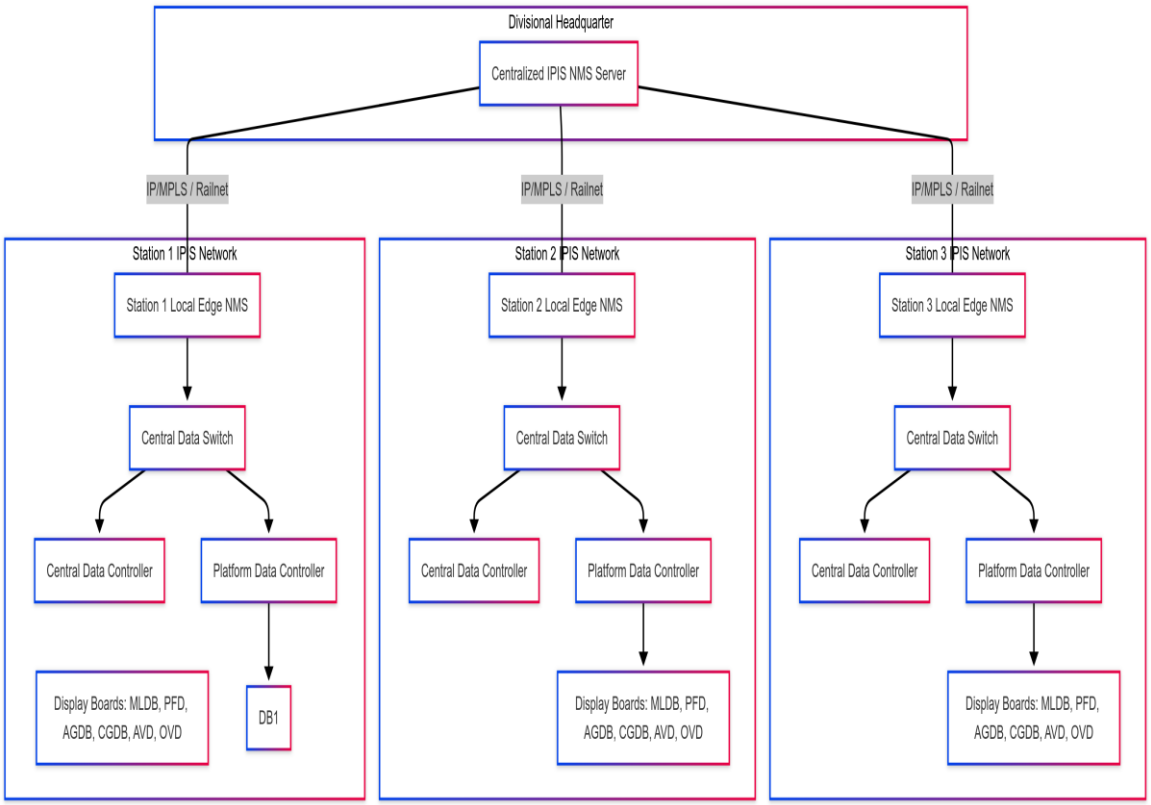
xvi.) Centralized NMS (C-NMS) shall be provided at Divisional Level in 1+1 redundancy working in Hot Standby mode.

3.9.2 NMS System Architecture

i.) The IPIS NMS System architecture is depicted in following diagram.

ii.) IPIS NMS would have two major components one at divisional headquarter for monitoring all stations IPIS devices and systems and another component at local station level monitoring as Edge NMS.

iii.) The Centralized NMS and Edge NMS will be connected over IPMPLS or Railnet.



iv.) **Network Topology and Interfaces**

a. **Network Topology:**

The NMS shall interface with the IPIS LAN network which interconnects:

- Central Data Controller (with dual redundant CPUs)
- Central Data Switch (providing Ethernet and optical connectivity)
- Platform Data Controllers on each platform
- Display boards (Multiline, Platform, At-a-glance, Coach Guidance, and Video Display Boards)
- Local Station Edge IPIS NMS

b. **Communication Protocols:**

- Primary: TCP/IP (with standard protocols for data transfer and control)
- Support for UDP for broadcast communications
- SNMPv3 (or latest) for real-time device monitoring and alarm management

c. **Interoperability:**

The NMS must work seamlessly with heterogeneous devices and vendors as long as they adhere to the standard IP-based communication protocols specified in the IPIS documentation.

3.9.3 **NMS Application Functional requirement:** The NMS application shall provide following functionalities with reference to IPIS system.

i.) **Device Discovery and Inventory:**

a. All the IPIS network devices including display boards information shall be stored in local and centralized NMS.

b. Automatic detection and registration of all networked devices (CDC, CDS, PDC, display boards, etc.).
c. Maintain an updated asset/inventory including Make, Model, data of Installation, device type, firmware version, physical location (Platform Number), Latitude/Longitude which shall be mapped to unique asset ID.

ii.) **Real-Time Monitoring:**

a. Real time device status (online/offline, operational health, communication link status). The device status shall be updated on NMS application within 10 seconds.
b. Monitor key performance indicators such as memory usage, CPU load and storage information for CDC.
c. Dashboard view for network health and system performance.

iii.) **Alarm and Event Management:**

a. Generate alarms for faults (e.g., loss of connectivity, performance degradation, hardware faults).
b. Support event logging and historical data analysis for troubleshooting.
c. Notification system via email/SMS to alert maintenance personnel.

iv.) **Network Topology Visualization:**

a. Render a real-time network topology map showing all Divisional HQ ↔ Station connections, switch interlinks, and device status (color-coded).
b. Enable drill-down from any node into detailed status and recent events.

v.) **GIS View:**

a. The GIS Map view shall be available at centralized NMS server where all the IPIS equipment and devices shall be visible in layered architecture.
b. All CDC shall be shown in one layer, all display board shall be shown in one layer.
c. By clicking on the tabular view of any devices, it shall redirect and navigate to GIS Map.

vi.) **Security and Access Control:**

a. Role-based access control for different user levels (administrator, operator, maintenance).
b. Secure Application access over HTTPs.
c. Audit trails for configuration changes and access logs.

vii.) **Reporting and Analytics:**

a. Generate periodic reports on network performance, device health, and alarm statistics.
b. Provide graphical analytics (trend analysis, real-time graphs) for proactive maintenance.

c. All the reports shall be searched by selecting from date, to date and time.
d. The centralized NMS shall provide following reports with user query

- Failure report shall contain station information, OEM information, Device type, date and time stamp and Failure duration.
- It shall generate most frequently failure assets along with information
- Mean Time to Repair report
- Device availability report

e. All reports shall be exported in PDF / CSV file

viii.) **Integration Requirement:**

a. The Edge NMS should interact with the station IPIS CDC and other devices to fetch operational data and push centralized NMS over SNMP V3 or latest.
b. The unique asset ID shall be maintained to identify Station, Device Type, Location (Platform No. / Equipment Room).
c. Ensure that any changes or replacement of IPIS equipment, display board and other subsystems is updated in NMS
d. **Integration with Telecom Maintenance Management Systems (TMMS):** The NMS can be integrated with an TMMS to automatically generate work orders, schedule maintenance tasks, and track the resolution of predicted issues.

3.9.4 **Key Functions of Predictive Maintenance:**

a. **Historical Trend Analysis:** The NMS collects historical performance data (response times, temperature trends, error logs) to predict when a device is likely to fail.
b. **Anomaly Detection:** By comparing real-time metrics against historical baselines, the system can forecast potential issues (e.g., a rising temperature trend or increasing response time indicating degrading performance) and trigger maintenance actions.
c. **Proactive Notifications:** When predictive analytics indicate an increased risk of failure, the NMS sends early alerts to the maintenance team. For instance, if a Platform Data Controller shows a gradual increase in response time, a detailed inspection is scheduled to prevent sudden downtime.

3.9.5 **Software and User Interface Requirements**

a. **User Interface (UI):**
   - Web-based, responsive design accessible via standard browsers.
   - Interactive dashboards with drill-down capabilities for detailed device and network status.
   - Graphical and Tabular View shall be available for all alarms
b. **Software Features:**
   - Intuitive configuration screens for device settings, alarm thresholds, and network parameters.
   - Search and filter functionalities to quickly locate specific devices or issues.
   - Integration of help menus and online documentation for end users.
c. **Remote Monitoring:**
   - Support for remote access to the system via a secure web portal.
   - Real-time event notification and remote troubleshooting tools.

3.9.6 Hardware Requirement – Edge NMS (E-NMS)

Component	Minimum Specification	Purpose
CPU	Intel Core i5	Handles concurrent processing and monitoring tasks.
RAM	8 GB or higher	Supports real-time data processing and analytics.
Storage	500 GB SSD	Fast access to OS/app data and log storage.
Network Interfaces	2 x Gigabit Ethernet NICs	Ensures reliable network connectivity and redundancy.
Cooling	Fanless	Maintains optimal operating temperatures.
OS/Virtualization	Open Source	Flexibility and efficient resource management.

3.9.7 Hardware Requirement – Central NMS (C-NMS):

Component	Minimum Specification	Purpose
CPU	10 Core or higher	Handles concurrent processing and monitoring tasks.
RAM	128 GB or higher	Supports real-time data processing and analytics.
Storage	2 TB SSD	Fast access to OS/app data and log storage.
Network Interfaces	4 x Gigabit Ethernet NICs	Ensures reliable network connectivity and redundancy.
Form Factor	Rack-mounted	Space-efficient deployment in data centers.
Power Supply	Dual redundant power supplies	Minimizes downtime due to power failures.
Cooling	Enhanced cooling for high-density deployment	Maintains optimal operating temperatures.
OS/Virtualization	Open Source	Flexibility and efficient resource management.
Security	Hardware-level encryption, Secure Boot	Ensures system integrity and secure operations.

3.9.8 Performance and Reliability Requirements

a. **Scalability:**
   - Capable of monitoring and managing all devices across a typical station's network, with scalability to larger deployments.

b. **Reliability:**
   - Designed to operate 24x7 with redundant servers and fault-tolerant mechanisms.

- Fast recovery from network interruptions and automatic re-synchronization with devices after downtime.

c. **Latency and Throughput:**

- Real-time monitoring with minimal latency (configurable thresholds for update intervals).
- Ensure that management commands are executed promptly without affecting the operational performance of IPIS.

3.9.9 Testing, Quality Assurance, and Compliance

a. **Pre-Deployment Testing:**

- Unit, integration, and system-level tests for all NMS functionalities.
- Simulated network fault injection to test alarm generation and recovery mechanisms.

b. **Acceptance Criteria:**

- Compliance with all specified performance, interoperability, and security requirements.
- Successful demonstration of remote management, reporting, and automated alert functionalities.

c. **Compliance:**

- Ensure adherence to relevant standards (e.g., ISO 9001:2015 as referenced in the IPIS specification) and industry best practices for network management.

3.10 Firewall

3.10.1 Hardware Requirement

i. Dual core architecture and dedicated network process unit for better performance.

ii. Preinstalled 4 x 1 GbE copper ports, 2 x 2.5 GbE copper ports, 2 x SFP+ ports, flexible to use any port as LAN, WAN, or DMZ ports, 1 x COM RJ45, 1 x Micro-USB and 1U rack mount and dual power.

iii. 64 GB SSD or higher with local storage for logging, reporting and email quarantine purpose. In absence of local storage vendor can provide external logging solution with storage capacity of 500 GB and above.

3.10.2 Performance Requirement

i. Firewall throughput 18 Gbps, NGFW throughput 4.5 Gbps, IPS throughput 5.5 Gbps, Concurrent Connections 6.5 million, New Sessions per Sec 100K, IPsec VPN throughput 6 Gbps, Threat Protection throughput 4.5 Gbps, SSL/TLS Inspection throughput 1.5 Gbps.

ii. Dual Gateway Anti-virus and at least one anti-virus must have own scan engine.

3.10.3 Features Requirement

i. Routing: static, default, multicast (PIM-SM) and dynamic (RIP, BGP, OSPF) and DoS attacks and port scan blocking and features like restricting network traffic from specific Country or Continent basis in firewall rule.

ii. Advanced Threat Protection capability to Detect and block network traffic attempting to contact command and control servers using multi-layered DNS, AFC and firewall.

iii. Web protection feature should have URL Filter database with millions of sites across in categories and file type filtering by mime-type, extension and active

content types (e.g. Activex, applets, cookies etc.) and control over application traffic based on category/individual application, characteristics, technology and risk level.

iv. SD-WAN capability and have feature to create SLA profile with Jitter, Latency, Packet Loss. Protection against Zero Day Threat, Sandboxing with behavior and AI based analysis and Capable to inspect TLS1.1, TLS1.2 and TLS 1.3 inspection.

v. Pre-defined dashboards for Traffic, Security and User behavior analysis report. Granular Web & Application usage reporting, Network & Threats (IPS, TP, Wireless), VPN, Email, Compliance like HIPAA, PCI, GLBA, CIPA reports and Export reports as HTML, PDF, Excel.

vi. Able to authenticate users with local database and also capability to integrate active directory, LDAP server, RADIUS Server, TACACS+ Server and e-Directory, Built-in Capability for Multi Factor Authentication for Users without any additional cost.

vii. Three Year Subscription license for Firewall, Gateway Anti-Virus/ Anti-malware, DPI SSL, Web Filtering Service, App Control Service, Advanced Malware Protection, Sandbox Cloud Service, Botnet/C&C protection/ATP, Intrusion Prevention System (IPS), 24x7 support, security and software updates, adv. exchange warranty for the period.

viii. The NGFW Firewall OS or hardware family should be certified under security related functions EAL4+, ICSA Lab Firewall Certification, MTCTE certification from TEC.

Note: Local content (LC) shall be as per Table-A (List of telecom product, Services and works) issued by Department of Telecommunications, Ministry of communications vide notification published in the Gazette of India Extraordinary (Part I Sec. I), New Delhi, 21st October 2024 or latest.

4.0 FUNCTIONAL REQUIREMENTS:

4.1 Display board shall be of below types, depending on its location.

a) True color Video Display Boards (IVD, OVD, AVD) for displaying information of multiple trains in multi color and Railway promotional videos or commercial advertisement etc.

b) Monochrome MLDB shall be used for display of multiple train information.

c) Monochrome Platform Display Board for displaying information of single train.

d) Monochrome At-A-Glance Display Board for displaying information of the train arriving and departing from that platform with coach composition.

e) Monochrome Coach Guidance Display Board to indicate position of coach No. scheduled for arrival and departure from that platform for guidance of passengers.

4.2 Hardware and software of IPIS system of different vendors shall be interoperable. Addition of any new device of any developmental/approved vendors shall be Plug-and-play (PnP) and only require configuration of IP in the network. It is mandatory for all the vendors to ensure proper interoperability among themselves. At any station, during installation, it is the responsibility of existing OEM/Vendor to support the new OEM/Vendor so that overall system can run in smoothly.

4.3 The software shall be designed as per Annexure-A (API) so that software shall be independent of the hardware and interoperable with different vendors.

4.4 All the equipment of the system shall be connected on a single network at the station. This network will be connected through CDC. CDC shall be connected to edge NMS ~~RMS Server~~ & edge NMS ~~RMS~~ ~~can~~ shall be connected to Central NMS through Railnet/ any other compatible network for remote monitoring.

4.5 All Display Board except CGDB shall be having inbuilt two Ethernet ports (one Copper and other optical) for data transfer. CGDB shall be having one Ethernet port (Copper/optical).

4.6 Multiline display board shall be located at the concourse/ main entrance of the station. Platform display boards shall be placed at the respective platforms. The exact location is to be indicated by the purchaser.

4.7 Multiline mono color display board shall be of 2 lines or more and maximum up to ~~10 lines~~ 12 lines. Purchaser has to specifically mention the number of lines in each main display board as per site requirement.

4.8 True color video display (IVD & OVD) shall be 6-Lines/ 12-Lines/ 18-Lines. Purchaser has to specifically mention the number of lines in each OVD & IVD display board as per site requirement.

4.9 True color Advance Video Display (AVD) shall be of 10-Lines and shall be used similar to TV display.

4.10 At major stations separate multiline display boards for UP and DN trains are to be provided if specified by the purchaser, otherwise a common display board showing information of all trains can be provided.

4.11 Data transfer from CDC to all display boards shall be only on Ethernet using standard API based communication.

4.12 The Common Area Display Boards shall periodically hit the CDC API to acquire data.

4.13 The Platform Area Display Boards shall periodically hit the PDC API to acquire data.

4.14 The API hit frequency shall be configurable in the steps of 5 sec minimum.

4.15 ~~The Application shall also generate a Text file compatible for backward compatibility as described in "Annexure B".~~ The Application Software of SPN/TC/108 - Ver 2.0 shall also generate a Text file for backward compatibility as described in "Annexure- C". The CDC software already installed and running as per previous IPIS versions shall be upgraded by their respective OEMs so that the older versions can read the Text file generated as mentioned above and run their respective display devices. All the connectivities shall be managed by the latest version of IPIS software. In case of Multiple IPIS version, the latest version shall be used in frontend and older version will continue to run in backend on the same CDC unit.

4.16 In case, the information is more than the number of lines in display board then information shall be displayed on time slot basis.

4.17 The Platform Display board (PFD) shall display the information of a train scheduled for arrival and departure on that platform. If the platform display board is common between two or more platforms, it can be used to display the train information of trains scheduled on all the configured platforms sequentially.

4.18 Fixed titles on all display boards except CGDB viz. train number, name, expected time, arrival and departure, platform number shall be screen printed or stickered preferably in white/ yellow color on the top of first display line on casings in capital letters. The character size of these titles shall be minimum 6 cm height. Title language shall be decided by the purchaser.

4.19 It should be possible to mount or fix a display board on wall at the platform entry or inside a concourse/main entry of a Railway station.

4.20 The information on display boards shall be displayed in English, Hindi and also in a regional language, if required by the purchaser. The information shall be displayed for a specific period of up to 30 seconds and shall be selectable in the step of 10 seconds from the Central Data Controller.

4.21 LEDs with equal fringe and uniform intensity are to be used to manufacture display boards to ensure that the information being displayed is with excellent contrast & without any visible black patches on the display screen and it shall be flicker free.

4.22 All display boards shall be constructed using PCB modules. Fixing of these modules shall be such that easy replacement of PCB module should be possible in case of failure. Such replacement shall not call for removing any other PCBs.

4.23 Intensity of display boards shall be adjustable by software in manual mode or automatic timer mode basis. The selection of the mode shall be user configurable. It shall be possible to adjust intensity of selected display board through software from CDC in steps of minimum 25% in the range from 25% to 100%.

4.24 ICs used for the display boards shall be preferably of surface mounted devices (SMD) to ensure high reliability.

4.25 The Coach Guidance Display (CGD) Board shall indicate the Coach No./ Train No. scheduled to arrive/depart from that platform.

4.26 Individual coach display board across the platform should display Train No &. Coach No. alternatively like GEN, D1, S10, B1, A1, H1 in English and “अना., डी-1, एस-10, बी-1,ए-1, एच-1” etc. in Hindi. The information of second Train No/ Coach No shall be displayed alternatively at an interval of 10 second. The information of Train No/Coach No. shall be displayed in Hindi and English alternatively with synchronization. Time period for display of information should be programmable in step of 10 second.

4.27 The synchronization between various coaches shall be based on Time division multiplexing.

4.28 The display systems shall be suitable for working in AC/ DC electrified and non-electrified sections. It shall be suitable in all sections including where locomotives thyristor controlled single phase or 3-phase induction motors having haul passenger or freight trains and chopper-controlled EMU stocks are operated.

4.29 Performance of the system shall not be affected in AC/DC electrified area.

4.30 When there is no data to be displayed, it should not display any garbage on the display board. The boards shall have proper built-in recovery mechanism like watchdog timers to automatically recover the information in case the processor goes haywire.

4.31 Construction of different type of display boards should be modular, such that any defective module (i.e. PCB, connector, cable, power supply unit etc.) can be easily replaced to make the system functional.

4.32 Display board of IPIS of various vendors shall be interoperable and plug and play (PnP) type. It should be possible to acquire & display train information data from CDC of other firm using standard API. From CDC, it shall also be possible to transfer data to display boards of other make and monitor link status & health of the display devices connected in the system.

4.33 Conformal coating shall be applied on assembled and tested printed circuit boards to protect them from Humidity, Dust and dirt, Airborne contaminants like smoke and chemical vapors, conducting particles like metal clips and filings, Accidental short circuit by dropped tools, fasteners etc.

4.34 The solder masks (green/black/combination of both) shall be applied on the solder side and component side of the card/PCB.

4.35 Wiring between different modules should be done with the help of male/female type of connectors. There should not be any requirement of rewiring, re-soldering/de-soldering for replacement of defective module.

4.36 Suitable 'Earthing' point shall be provided for earthing the body of display board. Brass bolt of 6 mm diameter shall be provided at appropriate place & suitably marked.

4.37 ~~Proper Earthing arrangement shall be ensured by Railways for display boards.~~

4.38 ~~The Earthing arrangement is to be provided by the OEM to ensure that all display boards along with CDC should have resistance not greater than 2 Ω.~~ The Earthing arrangement shall be provided by the Railway and it shall be ensured that earth resistance for all display boards along with CDC is less than 2 Ω.

4.39 For installation of coach guidance display board on uncovered portion of the platform shall be provided using GI pipe of minimum 3-inch diameter or as specified by purchaser.

4.40 Manufacturer shall maintain proper account of LEDs being used. The record shall include various details like source of supply, procurement invoice number & date, quantity, incoming rejection, lot wise consumption etc. which can be verified by the inspecting officials.

4.41 LEDs used in LED display units shall be of high-performance quality and from reputed manufacturers as stipulated by RDSO. LED make & their part number shall not be changed without prior approval of RDSO.

4.42 Following information shall be etched/ screen printed on the component side of the PCB.

b. Manufacturer's name

c. PCB name/Part number

d. Component outline (in proximity of the component)

4.43 Following information shall be engraved or marked with permanent ink on the PCB

a. Card serial number

b. Month and year of manufacture

5.0 SOFTWARE REQUIREMENTS:

5.1 General Software Features:

5.1.1 The software dealing with operational transactions like train arrival/ departure & platform specific data entry should be standard windows based application.

5.1.2 ~~RMS (Remote Monitoring software) should be a web-based application loaded in RMS Server. This shall allow the access to the applications from any of the standard PCs remotely connected in LAN, having standard browser tool only for monitoring and reporting purpose.~~

5.1.3 It should be possible to categorize users. Creation of a new category user shall also be possible. Data integrity should be maintained in both servers (CDC & ~~RMS~~ Edge NMS) even though the system is being accessed and controlled by different user.

5.1.4 It should be possible to generate different reports in both servers (CDC & ~~RMS~~ Edge NMS) as per requirement for all operational & functional activities being done in the system like announcement, train send for coach display and trains send for TADDB.

5.1.5 Any failure in data transfer from CDC to display boards shall be available in the both systems (CDC & ~~RMS~~ Edge NMS) as an event for use of Administrator. Event logging shall also be available.

5.1.6 History of events or log of information transferred to various display boards shall be available in CDC for 45 calendar days for analysis & logs beyond 45 days shall be automatically deleted. However, Logs in ~~RMS server~~ Edge NMS should be maintained at least 90 days.

5.1.7 It should be clearly distinguished from user interface that which train information has been sent to display and which is yet to be sent.

5.1.8 HELP menu shall be provided.

5.1.9 All the master data entry forms and configuration screens shall be provided for the initial installation of the system, for any station.

5.1.10 Different display colors shall be configurable to different train status messages being displayed on AVD, OVDs & IVDs.

5.1.11 CDC Software shall host a REST API which shall disseminate the required data to display boards and PDC when asked (please refer Annexure - A for API details).

5.1.12 The REST API shall automatically collect the display link status when the API is triggered by the display boards or PDC

5.1.13 The software shall have both Auto and Manual mode of operation, as per below

5.1.13.1 **Manual Mode**: in manual mode of operation the operator shall be able to update the train information either manually or from NTES server and can start or stop the audio announcement.

5.1.13.2 **Automatic Mode:** In automatic mode, the user will not be allowed to perform any operation and the system shall automatically acquire train information data from NTES and update the API for the display boards so that they can fetch latest information from CDC. In this mode the audio announcement shall also be automatically triggered based on time and status inputs received from NTES API.

There shall be provision to mask trains which should not be updated automatically from NTES.

5.1.14 The software shall have provision for interoperability test with display device of another vendor, where the CDC software shall generate a report of the device being tested with the software API, along with data sent and device IP, which will be verified during type test at RDSO.

5.1.15 There shall be one new TAB on front screen in the name of HSR (Health Status Report). inside this the LED health status of all display boards shall be available. It shall display the mirror image of all display boards on front screen as being actually displayed.

5.2 Video Display Software Feature:

5.2.1 The CDC shall accept different file formats of video content and images to be played on Video Display Boards. A minimum of the following formats should be supported by the display system: (i). Image: .bmp, .jpeg, .jpg, .png, .tiff (ii). Video: .mpeg, .mp4, .wmv, .dat, .avi, .mov.

5.2.2 Software shall accept the user/operator configuration about the schedule of items, where each item may be of any still, animated and video format data. Software shall accept to store different play lists, each with different user-configurable name. Software shall play continuously item after item sequentially for the selected play list. If all the items in the play list are completed over a time, the play list shall be repeated.

5.2.3 Software shall provide the option to configure the different display & clearing effects/ transition effects in case the item being inserted into the play list is of still image format.

5.2.4 The display controller of indoor or outdoor video display board shall accept the schedule configuration and the data for the scheduled items from the CDC. It shall be possible to configure the attributes like repeat count, stay time, etc., for each of the items in the play list.

5.2.5 The software shall be customized to get the specific train arrival/ departure information or any other passenger service-related information as desired by the purchaser, from railway designated server system, through standard & open protocols/interfaces, if specified by purchaser. Software shall be customizable for processing the obtained data and displaying the information in pre-configured formats on the display board. Protocol of such system is to be arranged by purchaser.

5.2.6 All operations related to display board scheduling, schedule content changing & pushing the train arrival/departure information to the display board shall be possible from the CDC to all the display controller over Network.

5.2.7 Preview of files feature shall be available to the user such that user shall be able to view the content of selected item or selected schedule and make alterations if necessary in schedule before display on the display board.

5.2.8 Feature of adjustable display time for still images shall be available which shall allow the user to adjust the display time or stay time (in seconds) for the still images on display boards. It shall be also possible to set different durations for different images.

5.2.9 Feature of display of special messages during live display shall be available which shall facilitate user to display some special messages (flashing or stay for configured time in the

bottom of display boards) on display boards. These messages shall be displayed in English / Hindi or regional language in different font sizes and different colour.

5.2.10 Feature of fit to display board maintaining the aspect ratio shall be available. This feature at CDC shall be helpful when the actual data referred in the scheduled items (still or animated or video) are bigger / smaller than the actual display screen in terms of pixel resolution. This feature is to avoid unnecessary efforts of the operator to reduce / increase the actual data sizes.

5.3 Train Arrival/Departure Information Entry Features:

5.3.1 It should be possible to configure the language of information to be displayed through software i.e. English, Hindi and regional language.

5.3.2 It shall be possible to apply various effects like Scrolling effects, typing effects, flashing effects, Curtain effects, etc. through configuration menu to the information being displayed.

5.3.3 It should also be possible to increase/decrease running speed of display information.

5.3.4 It shall be possible to add, modify & delete timings of existing trains in the master data base. These modification transactions should be logged for security reasons.

5.3.5 The entry into Master Data Base should be password protected. It should be also possible to add data of new trains. There should be provision to change the password.

5.3.6 Mouse click should be used to transfer data from CDC to various Display Boards.

5.3.7 The information displayed at various boards (PFDs and CGDs) shall be selected automatically related to those boards only based on the platform number.

5.3.8 Whenever user modifies details of a train (arrival time, departure time, late, PF number etc.), the application has to take care of automatically updating user database.

5.3.9 The modified information shall be automatically saved as soon as it is transferred to the display board, so that in case of any failure the information data remains updated.

5.3.10 Health status of display boards should be available on the central data controller.

5.3.11 If two Trains are merged to form a single Train at a particular station, it should be clearly indicated on display boards by showing number of both Trains alternatively and shall be suitable announced on a PA system about the two merged Trains.

5.3.12 There should be provision to display the status of train like late, rescheduled, cancelled, diverted, indefinite late etc. In case of reschedule of train, reschedule time and “reschedule” text should be displayed alternatively in arrival/departure field of display board. Similar sequence of display shall be given for the status 'Change of Source', ‘Terminated at’ (i.e. Change of Destination) and Diverted'.

5.3.13 Different stages of train arrival/departure information shall be displayed based on the following formats.

Main Status	Sub Status	Status Code	English and Hindi Display		
			Exp. Time	A/D	PF No.
ARRIVAL	Running Right Time	0x01	05:30	A	1

	Will Arrive Shortly	0x02	05:30	A	1
	Is Arriving On	0x03	05:30	A	1
	Has Arrived On	0x04	Arrived / आ चुकी है		1
	Running Late	0x05	05:30	A	1
	Cancelled	0x06	Cancelled		रद् की गई है
	Indefinite Late	0x07	Indefinite Late		अनिश्चित देरी से
	Terminated At	0x08	Terminated At		<स्टेशन का नाम>
			<Station Name>		तक जायेगी
	Platform Changed	0x09	05:30	A	1
Departure	Running Right Time	0x0A	05:30	D	1
	Cancelled	0x0B	Cancelled		रद् की गई है
	Is Ready to Leave	0x0C	05:30	D	1
	Is on Platform	0x0D	05:30	D	1
	Departed	0x0E	05:30	D	1
	Rescheduled	0x0F	Rescheduled		परिवर्तित समय
			05:30	D	1
	Diverted	0x10	Diverted		परिवर्तित मार्ग
			<Route in English>		<स्टेशन का नाम>
	Delay Departure	0x11	05:30	D	1
	Platform Change	0x12	05:30	D	1
	Change of Source	0x13	Start at		<स्टेशन का नाम>
			<Station Name>		से जाएगी

For example, Expected Time is taken as “05:30 Hrs” & platform number as “01”.

a. For the types “Running Right Time”, “Running Late”, “Rescheduled”, “Cancelled”, “Indefinite Late” & ”Change of Source”, platform number is optional. For the rest, it is mandatory.

b. For the types “Rescheduled”, “Terminated at”, “Change of Source” and “Diverted” two separate display texts containing as shown above shall be displayed alternatively with configurable duration.

5.4 Coach Guidance Software Features:

5.4.1 The software should have preloaded information of coach composition of all the trains arriving or departing from the station. When the train is likely to arrive at station or depart from the station, the concerned operator is required to enter the train number and update position of coaches i.e., from ENGINE to GUARD Brake Van.

5.4.2 It shall be possible to acquire & update data of coaches for Rake formation of a train from the central server of Coach Operation Information System (COIS) via NTES REST API 951 or any other central server using HTTPS protocols having information of coach composition. The protocols will be arranged by the concerned Railways.

Handling of Special Cases

Remarks: The Train Coach Position which is given by NTES is always position from Engine/Locomotive w.r.t Train Moving Direction.

Case-1 Rake Reversal:

Rake Reversal At many stations of IR, Train/rake Reversal takes place i.e. Engine is detached from one end and attached to the other end. Due to that coach position is reversed at that station & all upcoming stations in the train route. So, for those stations where Train/rake Reversal takes place, it should be possible to show Coach position according to both Train Arrival & Departure events. i.e. it takes at least 10-15 minutes for Train reversal, so once the train arrives at reversal station, IPIS should show the Coach position as per the Arrival event. Once the engine is detached & attached at the other end, it should start showing coach position as per Departure event.

Example:

Train No. 12963, it reverses at "COR" Station. So at "COR station" it should show both Arrival & Departure coach position according to engine detachment & attachment.

1. Arrival Coach Position

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
ENG	GEN	GEN	GEN	S1	S2	S3	S4	S5	S6	S7	B6	B5	B4	B3	B2	B1	A2	A1	H1	GEN	GEN	PWR
ENG	GEN	GEN	GEN	SL	SL	SL	SL	SL	SL	SL	3A	3A	3A	3A	3A	3A	2A	2A	1A	GEN	GEN	PWR

2. Departure Coach Position

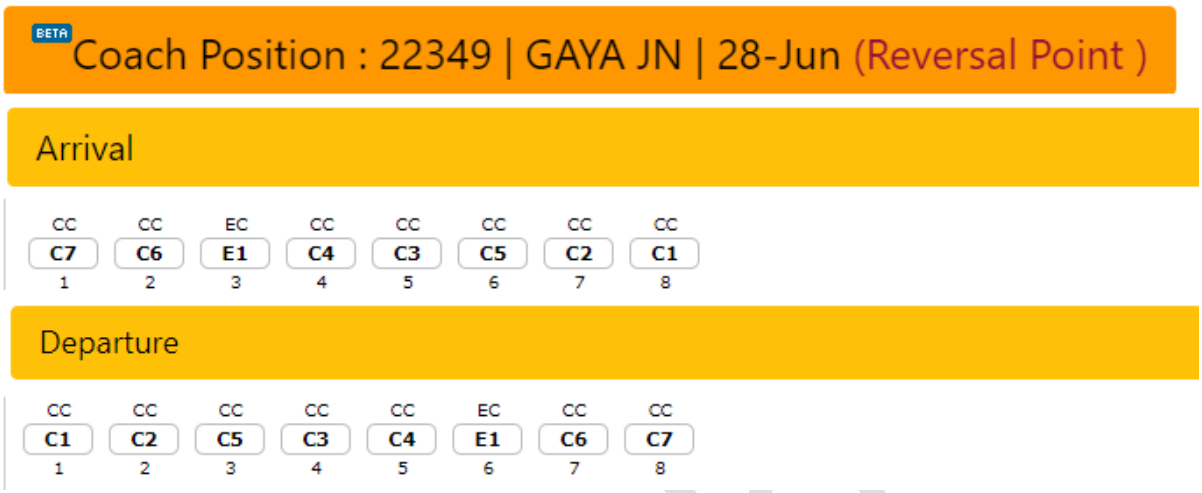
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
ENG	PWR	GE	GE	H1	A1	A2	B1	B2	B3	B4	B5	B6	S7	S6	S5	S4	S3	S2	S1	GE	GE	GE
ENG	PWR	GE	GE	1A	2A	2A	3A	3A	3A	3A	3A	3A	SL	SL	SL	SL	SL	SL	SL	GE	GE	GE

Case-2 Train Sets Handling:

Now in Indian Railways we have Train sets (i.e Vande Bharat Trains), which do not have locomotives. They actually have train driving cabin at both ends. So for those cases there will be no locomotives. As a general passenger practice/behaviour they always look for the locomotive & figure out the position of their respective w.r.t Loco motive. Here Train don't have locomotive.

So here 2-scenario can occur

1. Train arriving on a station and departing without Rake Reversal. Here whatever coach position is coming from NTES needs to be shown as it is.
2. Train arriving on a station and departing with Rake Reversal. Here because Train don't have locomotives, both Arrival & Departure coach positions need to be shown (same as case-1) along with the train moving direction logic.
   For example; if the Train is yet to arrive: show Arrival Coach Position.
   if the Train has arrived: show Departure Coach Position.



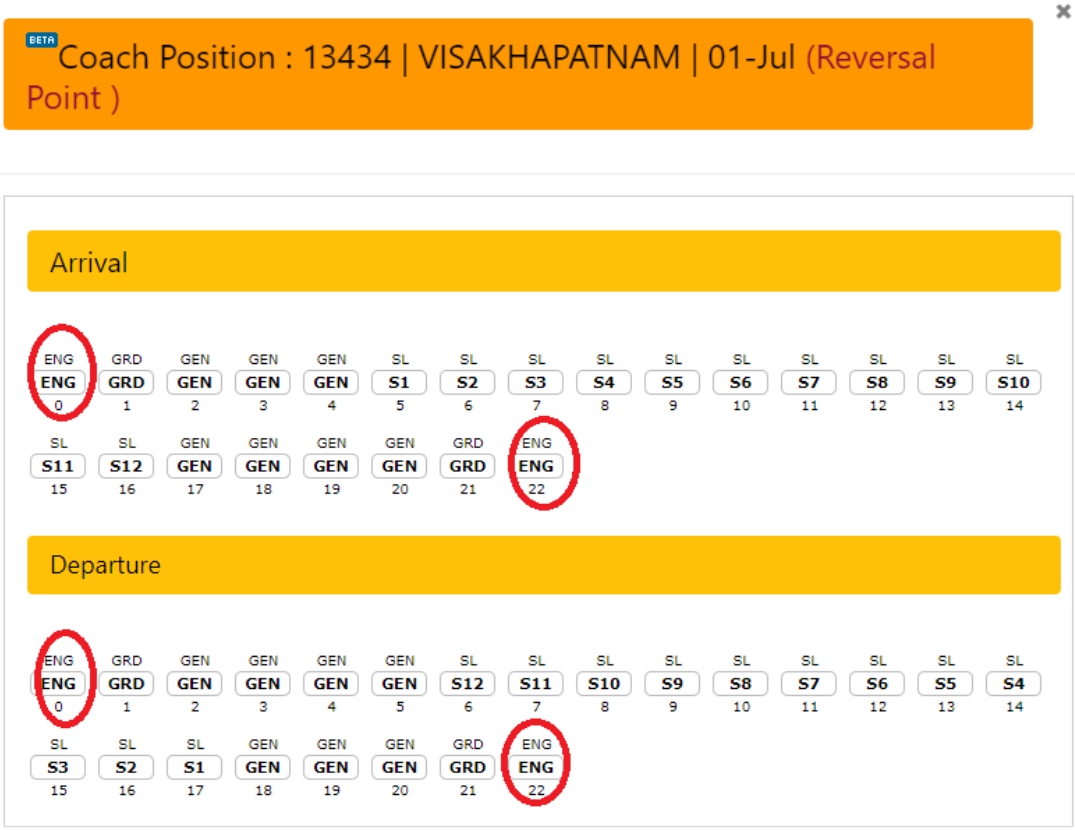
Case-3 Push-pull Train Handling:

Now in Indian Railways we have Trains which are having 2 locomotives (one at front-pull & one at rear-push), as a general passenger practice/behaviour they always look for the locomotive & figure out the position of their respective w.r.t Loco motive. Here Train have 2 locomotives (front & rear).

So here 2-scenario can occur

1. Train arriving on a station and departing without Rake Reversal. Here whatever coach position is coming from NTES needs to be shown as it is.

2. Train arriving on a station and departing with Rake Reversal. Here because Train have 2-locomotives (front & rear), both Arrival & Departure coach positions need to be shown (same as case-1) along with the train moving direction logic.
   i.e. if the Train is yet to arrive : show Arrival Coach Position.
   if the Train has arrived: show Departure Coach Position.



Case 4 Composite Coach Handling:

In many IR Trains, First coach after locomotive/Engine/Driving car or last coach at the end of the train is a **"Composite coach"** i.e. Coach having multiple classes (non-PRS) like for example:

GEN + LUG + TM + PWD (GENERAL + LUGGAGE + TRAIN MANAGER + DIVYANGJAN FRIENDLY COMPARTMENT)

Composite Class Details (Non-PRS)

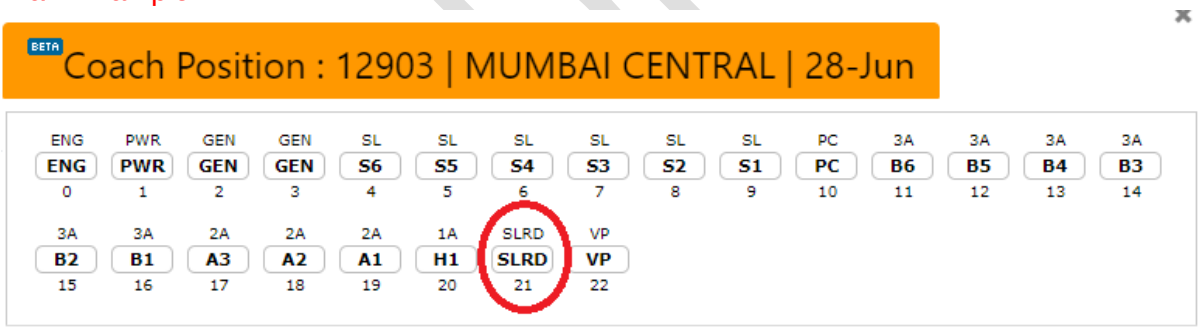
SN.	Alpha Code	Coach Class	Description
1	S	GEN	GENERAL
2	R	TM	TRAIN MANAGER
3	L	LUG	LUGGAGE
4	D	PWD	DIVYANGJAN FRIENDLY COMPARTMENT
5	F	LDS	LADIES

At present 6 composite classes (as shown in Table- A) exist in IR (may add more in future).

1	SLR	GEN + LUG + TM
2	SLRD	GEN + LUG + TM + PWD

3	SR	GENERAL+ TRAIN MANAGER
4	SRD	GEN + LUG + TM + PWD
5	LR	LUG + TM
6	LRD	LUG + TM + PWD

Train Example:



The above coach is physically “one coach” with 4 portions. So here, for this coach the CGS system should show all 4 possible portions in flip mode like at an interval of 2-3 seconds;

GEN-->LUG-->TM --> PWD-->GEN-->LUG-->TM --> PWD-->.....

Therefore, IPIS Coach Guidance system should be capable of handling all above mentioned there Special cases.

5.4.3 On the corresponding platform the train coach positions details are displayed on the individual display boards (double faced), installed for display of each coach across the platform.

5.4.4 Information display period shall be programmable from the control console with respect for Coach No. & Train number.

5.4.5 It should be possible to display data on Coach Guidance Display Boards in English & Hindi only.

5.4.6 It should be possible to add, modify, insert, shift (Left & Right), reverse & delete coach composition of trains in the master table and local table.

5.4.7 There shall be provision for adding new coach type in coach master database.

5.4.8 The entry into Master Data Base shall be password protected. It shall also be possible to add new trains. The operator shall be able to enter details by typing only train number and modification to coach nos.

5.4.9 While deleting or modifying any train entry on the monitor, the software shall prompt user before transferring data, so that the information at board always matches with monitor information.

5.4.10 The modified information shall be saved as soon as it is transferred to the display board, so that in case of any failure the information remains updated.

5.5 Features of Announcement System:

5.5.1 The system supplied shall be of Windows based fully programmed for the announcement of all type of passenger carrying trains through key board and GUI.

5.5.2 Announcement shall be made by using AI based ~~speech to~~ text to speech synthesizing algorithm or by traditional recorded wave file format, this will ensure future modification and upgradation of announcement systems.

5.5.3 It should be possible to make repeated announcements without affecting other operations. However, for making a repeated announcement just by repeated pressing of keys shall not be possible until the initiated announcement is finished successfully or stopped by the operator.

5.5.4 The format of the operation for the updating and announcement shall be user friendly.

5.5.5 Software shall be user friendly to the maximum extent so that addition and alterations can be done by the Railway Engineer without the help of suppliers and programmer. For any newly added train, it shall be possible to record a file externally or AI enabled voice and attached to the train through user interface. The application shall take care of placing the recorded or AI Generated file at appropriate internal application folder. However, any newly added train shall automatically play unless the train name or station is specific.

5.5.6 The system shall have provision to select messages and language to be broadcasted. The announcement shall be fluent and professional enough to avoid unnatural pauses between two pieces of voice clips.

5.5.7 The entire voice recording shall be done in a sound proof professional studio.

5.5.8 Mainly there will be three types of announcements one for a train arriving on platform, one for train arrived on platform and one for train departing from platform in English, Hindi & a regional language as per user preference. It should be possible to update announcement if Platform No./Train No. is changed.

5.5.9 Provision shall be made for the operator to send announcement related to train number, platform numbers, and arrival/ departure just by entering the train number, platform number and status in conditions.

a. Late arrival of trains.
b. Platform No. of arriving/ arrived trains and change in platform No.
c. Right time arrival of trains.

d. Departure of trains at scheduled or unscheduled time.
e. Announce/display that trains is arriving/ departing shortly or terminated or and Current status of the train.
f. Cancellation of train
g. Route Diversion of train
h. Any other message required to be announced/ displayed regarding train arrival/departure.
i. Terminated at
j. Change of Source

5.5.10 Voice files used in announcement for hour, minute and status (i.e. बजकर, बजे etc.) shall be recorded by the same announcer & same shall be used.

5.5.11 Announcements of newly added trains shall be automatic without any recording to be modified unless the train name or station name is specific.

5.5.12 Format for online data entry screen for announcement & display of train's details shall be preferably as per the Diagram- '1'.

6.0 POWER SUPPLY:

6.1 Switch Mode Power Supply (SMPS) modules of standard make of suitable capacity working on AC source of 160V to 270 Volts of appropriate current capacity shall be used in all types of display boards. SMPS modules shall be DIN Rail Mountable (DIN Rail Mountable is optional) of reputed make like lambda, Meanwell, OMRON, Delta, Phoenix Contact etc. or any other make which shall be meet following requirements:

a. Suitable DC out-put may be selected depending upon type of display or controller used. The out- put voltage shall be within ±2% of the rated output voltage.

b. Power supply module shall have input under voltage cut-off of 160VAC±10V & over voltage cut-off of 270V±10V AC.

c. Power supply module shall be protected against over/under voltage, short circuit and over load.

d. Power supply should have normal convection cooling with air.

6.2 Overall load on power supply units shall not exceed more than 70% of rated capacity.

6.3 Suitable ~~Class C~~ surge protection shall be provided at input of the power supply to protect against transient voltages suspected in the power supply source ~~shall be provided~~. ~~The parameters of Class C protection device shall be as per clause no. 5.9 of specification No. RDSO/SPN/TC/98/2011, Rev.0 or latest. Applicable parameters are given below:-~~ The parameters of SPD device shall be as per clause No. 3.12.1(a) of specification No. RDSO/SPN/215-2018 or latest. SPD shall be voltage clamping device, thermal disconnecting type and tested as per IEC 61643 with the following characteristics and features-

~~SN~~	~~Parameters~~	~~Limits~~	
		~~Between Line & Neutral~~	~~Between Neutral & Earth~~
~~1.~~	~~Nominal Voltage (UO)~~	~~230V~~	~~230V~~
~~2.~~	~~Maximum continuous operating voltage (UC)~~	~~≥300V~~	~~≥255V~~
~~3.~~	~~Nominal discharge current 8/20µs (In)~~	~~≥3KA~~	~~≥3KA~~
~~4.~~	~~Maximum discharge current 8/20 µs (Imax)~~	~~≥5KA~~	~~≥5KA~~
~~5.~~	~~Voltage protection level (UP)~~	~~≤1.5 KV~~	~~≤1.5 KV~~
~~6.~~	~~Indication~~	~~Mandatory~~	~~Optional~~
~~7.~~	~~Degree of Protection~~	~~IP20~~	~~IP20~~
~~8.~~	~~Housing~~	~~Fire retardant as per UL 94~~	~~Fire retardant as per UL 94~~

SN	Parameters	Limits (between Line & neutral)	Between Neutral & Earth
1	Nominal Voltage (U_0)	230V	230 V
2	Maximum continuous operating voltage (U_C)	≥ 253V	≥ 253V
3	Temporary Over Voltage (UT_{OV}) withstands for 120 minutes	438V	438 V
4	Nominal discharge current 8/20 µs (I_n)	≥ 10KA	≥ 10KA
5	Maximum discharge current 8/20 µs (I_{max})	≥ 40KA	≥ 40KA
6	Response time (T_r)	≤ 25 ns	≤ 25 ns
7	Voltage protection level (U_p)	≤ 1.5 KV	≤ 1.5 KV
8	Operating temperature / RH	- 25 ^{O}C to + 80 ^{O}C/ 95%	- 25 ^{O}C to + 80 ^{O}C/ 95%
9	Mounted on	Din rail	Din Rail
10	Health Indication/End of life indication	Mandatory	Mandatory
11	Pluggability	Mandatory	Mandatory
12	Potential free contact for remote monitoring	Mandatory	Mandatory
13	Degree of protection	IP20	IP 20
14	Housing	Fire retardant as per UL 94	Fire retardant as per UL 94
15	Approvals	National/ International Labs like KEMA, VDE etc. or any other accredited test lab (Details of accreditation shall be submitted)	National/ International Labs like KEMA, VDE etc. or any other accredited test lab (Details of accreditation shall be submitted)

6.4 Flexible PVC insulated 3-core x 2.5 sq. mm multi strand power cables provided for each of the display boards shall conform to specification No. IS: 694:1990 reaffirmed 1995 or latest.

7 DATA COMMUNICATION PROTOCOL:

7.1 Open API based data transfer shall be used for data transfer between various display boards of both mono color and true color displays.

8 TESTS AND REQUIREMENTS:

8.1 Conditions of Tests:

8.1.1 Unless otherwise specified all tests shall be carried out at ambient atmospheric conditions.

8.1.2 For inspection of material, relevant clauses of IRS: S 23 and RDSO/SPN/144 shall apply.

8.1.3 Inspection and testing shall be carried out to the effect that all requirements of this specification are complied with.

8.1.4 Inspection shall be carried out for various types of display boards, control units and software. PC for Central Data Controller, Remote Monitoring System, Central Data switch etc. shall be checked during inspection for their functional performance required for proper working of complete system as per specification.

8.2 Routine Tests:

8.2.1 The following shall comprise the routine test and shall be conducted by manufacturer on each equipment and the test results shall be submitted to the inspecting authority before final inspection. The application software shall also be submitted to the inspection authority in advance in proper format.

i. Environmental Stress Screening tests (ESS) on PCBs :100%

a) ON-OFF test on power supply modules: 60 cycles for 1 hour.

b) Thermal cycling (rapid temperature) on assembled boards: 9 cycles of 0°C to 70°C & stay for ½ Hour at each Temp and 1 hour at each temp. for 10th cycle.

ii. Card-level functional tests on all the cards.

iii. High Voltage Test (Clause 9.3)

iv. Insulation Resistance Tests (Clause 9.2)

v. Visual inspection of complete system (Clause 9.1)

vi. Performance test (Clause 9.5)

vii. System level functional tests

viii. LED parameter test (Clause 9.7)

8.3 Acceptance Tests:

8.3.1 Following shall constitute the acceptance test which shall be carried out by the inspecting authority for the purpose of acceptance on 20% of the lots (minimum 2 each type of system) offered for inspection by the Firm:

i. Insulation Resistance Tests (Clause 9.2)

ii. Applied High Voltage Test (Clause 9.3)

iii. Visual inspection of complete system (Clause 9.1)

iv. Performance test (Clause 9.5)

v. System level functional tests.

vi. LED parameter test (Clause 9.7)

vii. Endurance Test (Clause 9.6)

8.3.2 Any other tests shall be carried out as considered necessary by the inspecting authority.

8.4 **Type Tests:**

8.4.1 For type test, complete system consisting of different size of display boards shall be subjected to following tests as applicable:

i. Visual inspection (Clause 9.1)

ii. Insulation Resistance Test (Clause 9.2)

iii. Applied High Voltage Test (Clause 9.3)

iv. Environmental/ Climate Tests (Clause 9.4)

v. Performance Test (Clause 9.5)

vi. Endurance test (Clause 9.6)

vii. Card-level functional tests on all the cards.

viii. System level functional tests.

ix. Test for interoperability

x. LED parameter tests (Clause 9.7)

8.4.2 Separate prototype module of 32x96 three-line single sided card each from MLDB PFD AGDB to be assembled in single unit, prototype module of AVD, IVD and OVD of minimum 32 X 48 matrix size with proper enclosure shall be fabricated for carrying out environmental/ climatic tests. LED modules, processor cards, driver cards & power supply modules should be taken from multiline/ platform display board/AGDB, IVD and OVD, on which functionality tests were carried out, for constructing these prototype test modules. The display pattern of these proto type modules shall be: all LED glow.

8.4.3 Following tests are to be carried out as per details given below:

Tests	Prototypes Modules				Display Boards						
	MLDB/ PFD/ AGDB (32x96 three-line single	AVD (64x96 min)	IVD (32x48 min)	OVD (32x48 min)	PFD Single\double side	AGDB Single\double side	MLDB min. 3-Lines	AVD	IVD min. 6-Lines	OVD min. 6-Lines	CGDB one no.
Visual Inspection	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Performance Test	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Insulation Resistance test	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Applied high voltage test	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Environmental/ Climatic test	Yes	Yes	Yes	Yes	No	No	No	No	No	No	Yes
Endurance test	Yes	Yes	Yes	Yes	No	No	No	No	No	No	Yes
Card/ module functional tests	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
System Level Functional Tests	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LED parameter test	From the lots used in manufacturing the display boards.										

8.4.4 Following systems should be preserved after type approval.

i) One number of 32x672 single line single/double side display board.

ii) Two number of coach guided display boards (One, on which environmental testing has been conducted & one additional).

iii) One AVD (64x96 min), One OVD (32x48 min) & One IVD (32x48 min) on which environmental testing has been conducted.

iv) One PDC

v) One set of complete software in CD.

8.4.5 Only one complete system shall be type tested for this purpose. The system shall successfully pass all the type tests for proving conformity with this specification. If any one of the equipment fails in any of the type tests, the inspecting authority or his nominee at his discretion, may call for other equipment/ card(s) of the same type and subject it to

all tests or the test(s) in which failure occurred. No failure shall be permitted in the repeat test(s).

8.4.6 Total system on which type tests are to be conducted shall consist of:

i. One rack of CDC with Two CPUs loaded with software, CDS and all other accessories.
ii. One PDC
iii. One ~~RMS~~ Edge NMS Server ~~Loaded with remote monitoring software~~
iv. One Single Line single/double side Platform Display Boards
v. One single/double side AGDB
vi. Four Coach Guidance Display Boards
vii. One minimum 3-Lines single sided mono color multiline Display Board
viii. One IVD minimum 6-lines
ix. One OVD minimum 6-lines
x. One Display monitor (LED TV) minimum 40”
xi. One AVD Display
xii. Speaker to test audio announcement interface and video displays.

8.4.7 Any other test may be carried out as considered necessary by the inspecting authority.

9 TEST PROCEDURE:

The test procedure shall be based on the system design. The methodologies to be adopted for various tests shall be decided taking into account the system design/ configuration.

9.1 Visual Inspection:

Each equipment of the system shall be visually inspected to ensure compliance with the requirement of clause 3 to 6 of this specification. The visual inspection shall broadly include:

9.1.1 System Level Checking:

i) Constructional details.
ii) Dimensional check.
iii) General workmanship.
iv) Configuration.
v) Mechanical polarization on cards.

9.1.2 Card Level Checking:

i) General track layout.
ii) Quality of soldering and component mounting.
iii) Conformal Coating.
iv) Legend printing.

9.1.3 Module Level Checking:

i) Indications and displays.
ii) Mounting and clamping of connectors.

iii) Proper housing of cards.

9.2 **Insulation Resistance Test: -** IR test shall be carried out:

i. Before the high voltage test

ii. After the high voltage test

iii. After completion of the climatic test

The values shall not be less than 10 Mega ohms. The measurement shall be made at a potential of 500V DC.

9.3 **Applied High Voltage Test: -** The equipment shall withstand for one minute without puncture and arcing, a test voltage applied between line terminal and earth as mentioned below:

(i) AC line terminals and earth, test voltage of 1500V AC

(ii) DC line terminals and earth, test voltage of 500V AC

The test voltage shall be alternating of approximately sinusoidal waveform of any frequency between 50 Hz and 100 Hz. Printed circuit cards shall be removed during the test

9.4 **Environmental/ Climatic Tests:-**

9.4.1 The various types of display boards and controller shall be capable of working in non-air conditioned environment in the field.

9.4.2 The various types of display systems and controller shall meet the following climatic and environmental requirements:

SN	TEST		REFERENCE
1.	**Change of temp test**		IS 9000 Part XIV Sect. II
	Low temp	–10°C ± 3°C	
	High temp	+70°C ± 2°C	
	Rate of change in temperature	1°C / min	
	Duration	3 hrs at each temp. –10°C & +70°C	
	Cycle	3	
	Condition	Fully functional during test	
2.	**Dry heat test**		IEC-571; IS:9000 Part-III Sect 3
	Temp	+70°C ± 2°C	
	Duration	16 hrs	
	Condition	Fully functional during test	
3.	**Cold test**		IS 9000 Part II Sect. III
	Temp	–10°C ± 3°C	
	Duration	2 hours	
	Condition	Fully functional during test.	
4.	**Damp heat test (Cyclic)**		IS 9000 Part V Sect. 2 Variant 1
	Upper temp	40°C ± 2°C	
	Humidity	95% (+1%, -5%)	

	Cycles		6	
	Condition		Fully functional during one hour period towards end of each cycle. Stabilization shall be done at 25° ±3°C	
5.	**Damp heat test (Steady state storage)**			IS 9000 Part IV
	Temp		40° ± 2°C	
	Humidity		93% (+2%, -3%)	
	Severity		4 days	
	Condition		Fully functional during test.	
6.	**Salt mist test**			IS 9000 Part XI procedure 3
	Mist + Damp heat	Procedure 3 (2 hours +22 hours)		
	Temp	35° ±3°C		
	Humidity	93% (+2%, -3%)		
	Hours	22		
	Cycle	3		
	Condition	After this test, electrical parameters shall be monitored in addition to physical checks.		
7.	**Dust test**			IS 9000 Part XII
	Duration	1hour		
	Condition	After this test, electrical parameters shall be monitored in addition to physical checks.		
8.	**Bump test**			IS 9000 Part VII, Sec. 2
	PCBs/Modules/units in packed condition shall be subjected to bump test as under:			
	No of bumps	1000		
	Peak acceleration	400m/s^2		
	Pulse duration	6ms		
	No of axes	3		
	Condition	After this test, electrical parameters shall be monitored in addition to physical checks.		
9.	**Vibration test**			QM-333
		Up to & including 75 Kgs. weight	Over 75 Kgs.	
	Freq. Range	05-350 Hz	5-150 Hz	
	Amplitude	±6 mm constant displacement or 15m/ sec.^{2} constant acceleration.	±6 mm constant displacement or 15m/ sec.^{2} constant acceleration.	
	No. of axes	3	3	
	No of sweep cycle	20	10	
	Total duration	105 min/axis	105 min/axis	

	If resonance is observed	10 min at each resonant freq.	10 min at each resonant freq.	
	Condition	After this test, electrical parameters shall be monitored in addition to physical checks.		

9.4.3 **Driving Rain Test:**

Besides environmental/ climate tests on various types of display system, driving rain test is also to be conducted on module of **outdoor video display board only** as per following procedure.

TEST		REFERENCE
Driving Rain test		IS 9000 Part XVI Test condition 'c'
Water spray for 1 hour		
Condition	After this test, electrical parameters shall be monitored in addition to physical checks.	

9.5 **Performance Test:**

The equipment shall comply with the requirements as specified in Clauses 3 to 7.

9.6 **Endurance Test:**

9.6.1 **During type test**, endurance test shall be conducted for continuous operation which shall be 168 hours at 60^0C burning for LED without giving any deterioration in light output.

9.6.2 **During acceptance test**, endurance test shall be conducted on complete system for continuous operation which shall be 48 hours at room temperature burning for LED without giving any deterioration in light output.

9.7 **LED Parameter Test:**

9.7.1 The manufacturer shall submit the LED data sheets at the time of inspection. The parameters of LED shall be tested as per Clause No. 3.7 & procedure enclosed as **Annexure-'B'**. Samples shall be tested as follows:

a. For type test, 10 nos. of single color SMD type LEDs & 10 nos. of 3-in-one RGB SMD LEDs shall be tested from the lots used in manufacturing display boards.

b. For acceptance test, 8 nos. of single color SMD type LEDs & 8 nos. of 3-in-one RGB SMD LEDs shall be tested from the lots used in manufacturing display boards.

c. For routine test, one LED from a batch of 5000 LEDs shall be tested. If it fails, then total batch of LEDs shall be tested, of which if more than 1% of LEDs fails, then entire batch of LEDs shall be rejected.

10. QUALITY ASSURANCE:

10.1 All materials & workmanship shall be of good quality.

10.2 Since the quality of the equipment bears a direct relationship to the manufacturing process and the environment under which it is manufactured, the manufacturer shall ensure Quality Assurance Program of adequate standard.

10.3 Validation and system of monitoring of QA procedure shall form a part of type approval. The necessary plants, machineries and testing equipment's required for production &

quality assurance as per Scheduling of Technical Requirements (STR) shall be available with the manufacturer.

10.4 Firm to submit Bill of Material, its make & rating used in Type Test Sample.

11. MARKING & PACKING:

11.1 The following information shall be clearly marked at a suitable place on each equipment:

i. Name and Address of the manufacturer.
ii. Year of the manufacturer.
iii. Serial number of Equipment
iv. Specification number
v. Wiring diagram of the equipment to be shown on the side of the cover for ready reference.

11.2 The equipment and its sub-assemblies shall be packed in thermocol boxes and the empty spaces shall be filled with suitable filling material. Before keeping in the thermocol box, the equipment shall be wrapped with bubble sheet. The equipment shall be finally packed in a wooden case of sufficient strength so that it can withstand bumps and jerks encountered in a road/rail journey.

12. DOCUMENTS TO BE SUPPLIED BY THE MANUFACTURER:

12.1 The following documents in two sets should be supplied along with the system:

i. Mechanical drawings of each sub system/ rack.
ii. Installation and maintenance manual incorporating trouble shooting exercises, printed cards patterns, software etc.
iii. Operating and troubleshooting manual.
iv. Pre-commissioning check list.

13. INFORMATION TO BE FURNISHED BY THE PURCHASER:

The purchaser should clearly indicate details of required items including hardware and software before tendering which shall mainly consist of following items as specified.

SN	Description of the Item	Quantity
1.	Central Data Controller consisting of two CPUs with other accessories.	One Set
2.	~~RMS Server~~ Edge NMS with software	One
3.	Central Data Switch **Note**: Minimum 4 X SFP+ (optical) ports & minimum ~~8~~ 24 LAN (copper) ports Layer 3 switch with MAC table 32k, RAM- 2GB and Flash Memory- 2GB. If requirement of the port (optical & copper) is more, port of CDS to be decided by the purchaser.	One No.
4.	Announcement recordings in digital format as per details given by Railways	One Set
5.	Software for announcement system, various types of display boards information management & Display monitor	One set with system and one set of soft copy in CD for each station.
6.	**Color of LEDs:** White or Amber for PFD, AGDB &	White /Amber

SN	Description of the Item	Quantity
	MLDB (mono colour) other than CGDB. **Note:** i. Unless otherwise specified by purchaser the color should be white. ii. Color of CGDB should be only White.	
7.	Provision of Earthing to all display board & CDC:	Each platform should have one earthing location
8.	Platform Data Controller	To be specified by purchaser
9.	Platform Display Board: (32x672) Single or double sided, unless specified default is single side.	To be specified by purchaser
10.	At A Glance Display Board: (64x384) Single or double sided, unless specified default is single side	To be specified by purchaser
11.	Multiline Display Boards (Single or Double sided and number of lines), unless specified default is single side	To be specified by purchaser
12.	Language of Fixed titles on display boards viz. train no., name, expected time, Arrival and departure, PF no.	To be specified by purchaser
13.	Indoor Video Display Board (6/12/18 Lines)	To be specified by purchaser
14.	Outdoor Video Display Board (6/12/18 Lines)	To be specified by purchaser
15.	Advance Video Display	To be specified by purchaser
16.	Coach Guidance Display double sides	To be specified by purchaser
17.	Display monitor Board (LED TV)	To be specified by purchaser
18.	Data Cable (in meters) (STP CAT 6 or higher grade)	To be specified by purchaser
19.	Data Cable (in meters) (OFC)	To be specified by purchaser
20.	Power Cable and extension boards	To be specified by purchaser
21.	Any other items or features required by the purchaser	To be specified by purchaser
22.	Firewall as per technical specifications	Two Nos. in HA mode

14. TRAINING:

Onsite training shall be provided to the Railway staff which shall include complete assembly of the system through the use of various modules, integration of hardware with software and complete operation of the system.

15. DIAGRAMS:

Detailed construction diagrams of Cabinet, Multiline Display Board (single sided & double sided), OVD, IVD, Platform Display Board (single sided & double sided), Coach Guidance Display Board etc. shall be submitted by the OEM.

16. All the provisions contained in RDSO's ISO procedures laid down in Document No. QO-D-8.1-11 (Latest Version) (titled "Vendor-Changes in approved status") and subsequent versions/ amendments thereof, shall be binding and applicable on the successful vendor/vendors in the contracts floated by Railways to maintain quality of products supplied to Railways.

Annexure – 'A'

Application Programming Interface (API) for data communication

A.1 Scope

This document defines networking and data communication API for IP based Integrated Passenger Information System as per specification no: RDSO/SPN/TC/108/2019. This system consists of train arrival and departure Information display boards and Coach Guidance display boards with PC based Central Data Controller. The entire system data transmission and networking shall be built on Ethernet only.

A.2 Acronyms:

MSB	-	Most Significant Bit
LSB	-	Least Significant Bit
JSON	-	JavaScript Object Notation
API	-	Application programming Interface

A.3 Overview:

Passenger information system shall consist of mainly two types of display boards, Train arrival and departure display boards placed at different places of a railway station and Coach Guidance display boards on each platform. The updated Data shall be made available to these display boards from central data controller API.

The data to all the systems, both train arrival and departure information & coach composition are disseminated and routed through the network. Each PDC disseminates data to both TADDB and CGDB on the respective platform.

The architecture and system block diagram can be referred in **Annexure-'D'** of specification.

A.4 Systems Description:

A.4.1 Communication Type & Architecture

i. All Communication shall be on Ethernet (HTTPs based REST API protocol) using OFC / STP CAT-6 cables.

ii. Link Check for all type of boards shall be through standard PING Command or API Trigger ~~Time~~ from the display board.

iii. Spanning Tree should be preferably implemented at network level to ensure implementation of Ring network.

iv. All display board shall support SNMPv3 or latest protocol for NMS open-source software's.

v. All devices in the network shall have unique IP address for particular stations.

vi. IP Addressing should be of type IPv4 apart from commonly used 192.168 series to avoid conflicts with existing older version systems.

vii. IP Addressing shall be as below:

Device	General	PF	Special PF (1A, 10A)
CDS / PDC Gateways	10.0.0. 252	10.0. PF. 252	10.0.100+PF. 252
Primary Server	10.0.0.253		
Secondary Server	10.0.0.254		
CGDB		10.0. PF.2 to 39	10.0.100+PF.2 to 39
OVD	10.0.0.40 to 70		
IVD	10.0.0.71 to 100	10.0. PF.71 to 100	10.0.100+PF.71 to 100
MLDB	10.0.0.101 to 130	10.0. PF.101 to 130	10.0.100+PF.101 to 130
AGDB	10.0.0.131 to 160	10.0. PF.131 to 160	10.0.100+PF.131 to 160
PFDB	10.0.0.161 to 190	10.0. PF.161 to 190	10.0.100+PF.161 to 190
AVD	10.0.0.191 to ~~220~~ 230	10.0. PF.191 to ~~220~~ 230	10.0.100+PF.191 to ~~220~~ 230
~~NW Clock~~	~~10.0.0.221 to 230~~	~~10.0. PF.221 to 230~~	~~10.0.100+PF.221 to 230~~
NW Switch	10.0.0.231 to 250	10.0. PF.231 to 250	10.0.100+PF.231 to 250

NOTE : Gateways of all devices in 10.0.0.X shall be 10.0.0.252, and gate ways for other series shall be 10.0.x.252

IP Schema – ~~RMS~~ Central NMS(for interconnecting to Railnet – WAN)							
~~RMS~~ NMS ~~Server~~	10. Station Code. Divisional Code. XXXXX100	Bit 7 to 3 in forth octet represent zonal code as below					
		01 NR	02 NER	03 NFR	04 ER	05 SER	06 SCR
		07 SR	08 CR	09 WR	10 SWR	11 NW	12 WCR
		13 NCR	14 SECR	15 ECoR	16 ECR	17 SCoR	
Example (First Station, First Division, Northern Railway - RMS) - 10.1.1.12							

A.4.2 Central Data Controller (CDC):

CDC provides complete control and data entry for IPIS. The CDC communicates with all systems connected in the network in the defined methods and protocol.

The CDC shall fulfil the following data communication functions.

i. Make data available for AVD, IVD, OVD & MLDB
ii. Make data available for TADDB & CGDB
iii. Get Link Status of AVD, IVD, OVD, MLDB, TADDB & CGDB
iv. Set and get the configuration of IVD, OVD, MLDB, TADDB & CGDB

v. Soft Reset of AVD, IVD, OVD, MLDB, TADDB & CGDB

A.4.2.1 Sending Data to IVD/ OVD

i. AVD, IVD & OVD shall acquire data from CDC at a ~~programable periodic~~ fixed periodic interval of 5 second.
ii. Media Files shall be transferred to IVD/OVD by TCP File transfer protocol.

A.4.2.2 Sending Data to MLDB, AGDB & TADDB

i. AVD, IVD & OVD shall acquire data from CDC at a ~~programable periodic interval~~ fixed periodic interval of 5 second.
ii. It shall identify the success response from the destination system.

A.4.2.3 Sending Data to CGDB:

Coach Guidance Display Boards are required to display train number and coach number alternatively in synchronization. In order to achieve this, the following procedure is to be adopted.

i. All CGDB shall acquire data from PDC at a programable periodic interval.
ii. PDC Shall identify the success response from the destination system.
iii. The CGDB shall synchronize its RTC with the PDC time and changes the page at modulus of the set time period

A.4.2.4 Get Link Status of TADDB, PDC & CGDB:

i. Ethernet link status shall be obtained by pinging any node as and when required.
ii. CDC shall get the link status of TADDB and CGDB maintained in respective connected hubs when the same hit the API and POST the link status.

A.4.2.5 Set and a Get the Configuration:

i. CDC Shall Set and Get the configuration for All Connected nodes:
    a. It shall give the intensity and time period for which the sent data is valid for displaying in the API.
    b. It shall give the colour configuration table for AVD/IVD/OVD
    c. Get configuration shall acquire the data from the display board via POST method when respective boards hits the API.
        i. Intensity
        ii. Data validity time
ii. Set and Get the configuration for PDC:
    a. CDC shall send the command to set the switch Port configuration table, which shall contain the information of CGDB identification numbers in relation to the port it is connected.
    b. Get command shall get the PDC port configuration table stored in that PDC.

A.4.2.6 Soft Reset:

CDC shall send this information to TADDB/CGDB/PDC to reset itself and clear all the data content when respective device hit the API.

A.4.3 Platform Data Controller:

The PDC is the Data hub for all TADDB and CGDB in each platform. The PDC receives all the data and command information from CDC and directs to its destination. The device in which i.e. TADDB/CGDB is connected to PDC shall be determined from the switch configuration table. It responds to the command addressed to it. In the event of invalid packet, non-availability of port configuration table, invalid IP etc., the PDC shall report error to CDC.

The PDC shall fulfil the following data communication functions:

i. Validate the received packets.
ii. Make data available for the respective device.
iii. Send response for packets addressed to it.
iv. Report error to CDC in case of any failure.
v. Maintain the communication link status of all the systems connected.
vi. Send Link status to CDC on request.
vii. It shall poll CGDB's & TADDB's at regular intervals for its status.
viii. It shall receive port configuration table from CDC and store in non-volatile memory.

A4.4 Train Arrival Departure Display Board (TADDB):

The TADDB shall fulfil the following data communication functions.

i. Validate the received packets over Ethernet from API.
ii. Report error in case of any failure.
iii. Send Link status when acquiring data from API.
iv. It shall receive configuration from CDC/PDC and store in non-volatile memory.

A.4.5 Coach Guidance Display Board (CGDB):

The CGDB shall fulfil the following data communication functions.

i. Validate the received packets over Ethernet from API.
ii. Segregate Packet information addressed to it.
iii. Report error in case of any failure.
iv. It shall receive configuration from CDC through PDC and store in non-volatile memory.

A.5 Data Transfer and Routing Overview:

The common area display boards or display boards configured for all platforms like MLD, AGD, PFD, AVD, IVD, OVD and PDC shall directly hit the API as hosted by CDC, the platform specific display boards like PFD, AGD and CGD shall hit the API hosted by PDC. This way any device will have only one level of data communication dependability.

A.6 API Information for all types of Display Boards

The display devices firmware at respective locations should call this service in intervals of every 5 Second to get the latest list of trains to display in display boards.	
Service URL	http://[SERVER IP]:[PORT NO]/IPIS/LiveData [SERVER IP] – CDC IP for all common area display boards & PDC [SERVER IP] – PDC IP for all Platform area display boards & CGD [PORT NO] – Port Number for Http Request Must be 20000 http://[SERVER IP]:[PORT NO]/IPIS/MediaData/[FileName] – API to get Video and

<table>
<tr><td></td><td>Image
This API must be called by AVD, IVD & OVD to download the media files to be played.</td></tr>
<tr><td>Service Call Method</td><td>POST</td></tr>
<tr><td>Authentication</td><td>Request Header:
<table><tr><th>Header Name</th><th>Header Value</th></tr><tr><td>Station Code</td><td>3/4 Digit station code</td></tr></table></td></tr>
<tr><td>Sample Input Display Boards</td><td>JSON:
1. {"vendor":"XYZ", "device":"MLD", ”IP”:”xxx.xxx.xxx.xxx", “PF”:”YYY” , “INT”:50, “HSR”:”All OK” }
Vendor: describe the vendor’s name for ease of interoperability
Device : can be any one of the device types like “AVD”, “OVD”, “IVD”, “MLD”, “PFD”, “AGD”
IP: will be the IP address of the device
PF: PF number where the device is installed, it can be “ALL” for common boards
INT: Current Intensity of the board
HSR: Health Status Report can be “All OK” when No LED Is faulty, and accordingly can adapt below table
<table><tr><th>LED Status</th><th>Value</th></tr><tr><td>LED Short (Line 1, Row10, Column,15)</td><td>“S-L1R10C15”</td></tr><tr><td>LED Open (Line 1, Row10, Column,15)</td><td>“O-L1R10C15”</td></tr><tr><td>Multiple Faults to be separated by #</td><td>“S-L1R10C15# O-L1R10C15”</td></tr></table></td></tr>
<tr><td>Sample Input PDC</td><td>JSON:

{ "Device": [{ "vendor":"XYZ", "device": "PDC", "IP": "192.168.1.252", "PF": "1", "TotalDB": 7 }], "DisplayList": [{ "vendor":"XYZ", "device": "PFD", "IP": "192.168.1.161", “INT”:50, “HSR”:”All OK” }, { "vendor":"XYZ", "device": "PFD", "IP": "192.168.1.162",“INT”:50, “HSR”:”All OK” }, { "vendor":"XYZ", "device": "AGD", "IP": "192.168.1.131",“INT”:50, “HSR”:”All OK”}, {"vendor":"XYZ", "device": "CGD", "IP": "192.168.1.2",“INT”:50, “HSR”:”All OK” }, { "vendor":"XYZ", "device": "CGD", "IP": "192.168.1.3",“INT”:50, “HSR”:”All OK” }, {"vendor":"XYZ", "device": "CGD", "IP": "192.168.1.4",“INT”:50, “HSR”:”All OK” }, {"vendor":"XYZ", "device": "CGD", "IP": "192.168.1.4",“INT”:50 , “HSR”:”All OK”}] }</td></tr>
<tr><td>Sample Input Data for Configuration API</td><td>{"vendor":"XYZ", "device":"MLD", ”IP”:”xxx.xxx.xxx.xxx" }

Vendor: describe the vendor’s name for ease of interoperability
Device : can be any one of the device types like “AVD”, “OVD”, “IVD”, “MLD”, “PFD”, “AGD”,”PDC”,”CGD”
IP: will be the IP address of the device
PF: PF number where the device is installed, it can be “ALL” for common boards</td></tr>
</table>

Respons e Code

HTTP CODE	Description	Schema
200	Created. Successful response	Order
400	Bad Request. Invalid request or validation error.	Error
401	Authentication failure, check your authentication details	Error
403	Forbidden; please provide authentication credentials	Error
404	Not found: mistake in the host or path of the service URI	Error
405	Method not allowed: for example, you mistakenly used a HTTP GET instead of a POST	Error

Sample Output for Mono color Train Information (AGD, PFD, MLD) to be hosted on both CDC (for all platform display board and PDC) and on PDC for specific platform

Service Output field name	Service output field description	Service output field value
TNO	5 numeric digits of train Number	XXXXX (X ranges from 0-9)
TNE	Train Name in English (max 50 Characters)	Train Name in English Unicode
TNH	Train Name in Hindi (max 50 Characters)	Train Name in Hindi Unicode
TNR	Train Name in Regional (max 50 Characters) – this field is optional based on-site requirements	Train Name in Regional Unicode
ADF	Train type	"A" or "D"
EAT	Train Expected Arrival Time	"HH:MM" or "--:--"
EDT	Train Expected Dep. Time	"HH:MM" or "--:--"
PNO	Train Platform Number	"XXX" or "- -" X can be any number
STA	Train Status code as per 5.3.13, followed by status message in all languages separated by "#" for status to be displayed	"0x01" or "Canclled#रध्#বাতিল" or "Terminated#तक जाएगी#প্রজন্ত জাবে -Agra#आगरा#আগরা"
CCD	Coach Composition data in CSV format, each coach to be separated by "," and coach name in English and Hindi to be separated by "#".	"ENG#ईजन , SLR#ब्रे. या , S1# स1, A1#ए1,GRD#र्गाड"
Further trains if available shall follow the same format to be added here, any number of trains available for the display board shall be added here in similar fashion followed by the fixed parameters as below		
INT	Board Intensity Level	25, 50, 75, 100
PTO	Display Page Time Out	10 to 120 in step of 10
DTO	Display Time Out	60 to 240 in step of 30
CHR	Display Character size	0x00 to 0x05 as per table 1.3
EFF	Display Effect	0x00 to 0x09 as per table 1.1
SPD	Effect Speed	0x00 to 0x05 as per table 1.2
MSG	Display Message if available	Display message data
MST	Default or normal Message	"Default" / "Normal"
TOD	Time of Day in "HH:MM:SS"	"10:24:45"
RST	Apply Soft Reset	"Y"/"N"

Sample Output for true color Train Information (AVD, IVD, OVD) to be hosted on CDC

Service Output name	Service output field description	Service output field value
TNO	5 numeric digits of train Number	XXXXX (X ranges from 0-9)
TNE	Train Name in English (max 50 Characters)	Train Name in English in Unicode
TNH	Train Name in Hindi (max 50 Characters)	Train Name in Hindi in Unicode
TNR	Train Name in Regional (max 50 Characters) – this field is optional based on-site requirements	Train Name in Regional Unicode
ADF	Train type	"A" or "D"
~~SAT~~ EAT	Train ~~Schedule~~ Expected Arrival Time	"HH:MM" or "--:--"
~~SDT~~ EDT	Train ~~Schedule~~ Expected Dep. Time	"HH:MM" or "--:--"
PNO	Train Platform Number	"XXX" or "- -" X can be any Digit
STA	Train Status code as per 5.3.13, followed by status message in all languages in Unicode separated by "#" for status to be displayed	"0x01" or "Canclled#रद्द#বাতিল" or "Terminated#तक जाएगी#প্রজন্ত জাবে -Agra#आगरा#আগরা"
CCD	Coach Composition data in CSV format, each coach to be separated by "," and coach name in English and Hindi to be separated by "#".	"ENG#ईजन , SLR#ब्रे. या , S1# स1, A1# ए1,GRD#र्गाड"
COL	Train Color for 7 fields namely "TNo, TName, A/D, SAT, SDT, PF, STATUS"	"FFFFFF,FFFF00,FF00FF,00FFFF, 808080,800000,008000"
Further trains if available shall follow the same format to be added here, any number of trains available for the display board shall be added here in similar fashion followed by the fixed parameters as below		
INT	Board Intensity Level	25, 50, 75, 100
PTO	Display Page Time Out	10 to 120 in step of 10
DTO	Display Time Out	60 to 240 in step of 30
CHR	Display Character size	0x00 to 0x05 as per table 1.3
EFF	Display Effect	0x00 to 0x09 as per table 1.1
SPD	Effect Speed	0x00 to 0x05 as per table 1.2
MSG	Display Message if available	Display message data
MST	Default or normal Message	"Default" / "Normal"
MSC	Color for message line	"00FFFF"
BRC	Border Color	"FFFFFF"
VID	Videos to be played separated by #	"XYZ.MP4#ABC.MP4"
IMG	Images to be played separated by #, time in second separated by $	"XYZ.BMP$5#EFG.JPG$10"
TOD	Time of Day in "HH:MM:SS"	"10:24:45"
RST	Apply Soft Reset	"Y"/"N"

Sample Output for Coach guidance boards to be hosted on PDC

Service Output field name	Service output field description	Service output field value
TNO	5 numeric digits of train Number	XXXXX (X ranges from 0-9)
NOC	Total Number of Coaches	Max value 28
CCD	~~Coach Composition data in CSV format, each coach to be separated by "," and~~ Coach name in English and Hindi to be separated by "#".	"ENG#ईजन, ~~SLR#ब्रे. या , S1# स1, A1#ए1, GRD#गॉड"~~
Further trains if available shall follow the same format to be added here, any number of trains available for the CGD board shall be added here in similar fashion followed by the fixed parameters as below		
INT	Board Intensity Level	25, 50, 75, 100
PTO	Display Page Time Out	10 to 120 in step of 10
DTO	Display Time Out (Mins)	60 to 240 in step of 30
CHR	Display Character size	0x00 to 0x05 as per table 1.3
EFF	Display Effect	0x00 to 0x09 as per table 1.1
SPD	Effect Speed	0x00 to 0x05 as per table 1.2
TOD	Time of Day in "HH:MM:SS"	"10:24:45"
RST	Apply Soft Reset	"Y"/"N"

A.7 i: Sample Service Output for Color Display Boards:

{ "TrainList": [{ "TNO": "12314", "TNE": "RAJDHANI EXPRESS", "TNH": "राजधानी एक्सप्रेस", "TNR": "রাজধানী এক্সপ্রোস", "ADF": "A", "SAT": "10:10", "SDT": "--:--", "PNO": "12B", "STA": "Terminated#तक जाएगी#প্রজন্ত জাবে -Agra#आगरा#আগরা", "CCD": "ENG#ईजन, SLR#ब्रे. या, A1# ए1, A2# ए2, A3#ए3, A4#ए4, H1#एच1, H2#एच2, B1#बी-1, B2- बी-1, B3- बी-3, B4- बी-4, B5- बी-5, B6- बी-6, GRD-गॉड", "COL": ["FFFFFF", "FFFF00", "FF00FF", "00FFFF", "808080", "800000", "008000"] }, { "TNO": "12304", "TNE": "RAJDHANI EXPRESS", "TNH": "राजधानी एक्सप्रेस", "TNR": "রাজধানী এক্সপ্রোস", "ADF": "A", "SAT": "10:15", "SDT": "--:--", "PNO": "10", "STA": "0x01", "CCD": "ENG#ईजन, SLR#ब्रे. या, A1#ए1, A2#ए2, A3#ए3, A4#ए4, H1#एच1, H2#एच2, B1#बी-1, B2#बी-2, B3#बी-3, B4#बी-4, B5#बी-5, B6#बी-6, GRD#गॉड", "COL": ["FFFFFF", "FFFF00", "FF00FF", "00FFFF", "808080", "800000", "008000"] }], "LineConf": [{ "INT": 50, "PTO": 10, "DTP": 60, "CHR": 3, "EFF": 9, "SPD": 0,"VID": "XYZ.MP4#ABC.MP4" ,"IMG":"XYZ.BMP$5#EFG.JPG$10", "TOD":"10:24:45","RST":"N", "CONF":"N"}] }

ii: Sample Service Output for CGD Boards:

{ "TrainList": [{ "TNO": "12314", "NOC": 14, "CCD": "ENG#ईजन"}], "LineConf": [{ "INT": 50, "PTO": 10, "DTP": 60, "CHR": 3, "EFF": 9, "SPD": 0, "TOD":"10:24:45", "RST":"N" , "CONF":"N"}] }

A.8 Display Mode Tables:

TABLE 1.1 - Available Display Effects

Effect Value	Effect Name
0x00	Reserved
0x01	Curtain Left to Right
0x02	Curtain Top to Bottom
0x03	Curtain Bottom to Top
0x04	Typing Left to Right
0x05	Running Right to Left
0x06	Running Top to Bottom
0x07	Running Bottom to Top
0x08	Flashing
0x09	Stable / Static

TABLE 1.2 Available Effect Speed

Speed Value	Relevant Speed
0x00	Lowest
0x01	Low
0x02	Medium
0x03	High
0x04	Highest

TABLE 1.3 - Available letter sizes for English language

~~Size Value~~ Identifier	~~Display Font Size~~	Height in Pixel	Width in Pixel
0x00	~~7~~	12	7
0x01	~~8~~	16	10
0x02	~~10~~	20	12
0x03	~~12~~	24	14
0x04	~~14~~	28	17
0x05	~~16~~	32	28

Note: ~~Only16 size~~ 32x28 (pixel height x pixel width) fonts are available for Hindi & other regional languages.

TABLE 1.4 – following Fonts shall be used for display different language as given below in table. Reference English, Hindi fonts along with special characters are given in Annexure E.

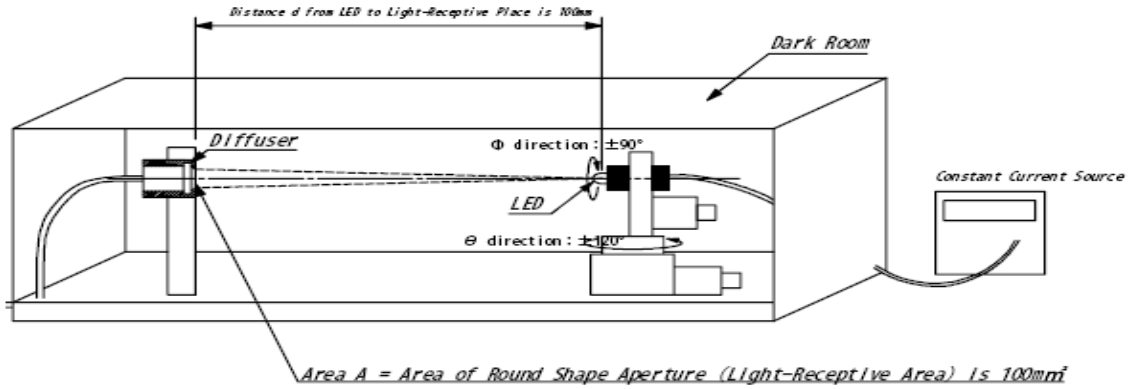
Sn No	Language	Font
1	English	Arial
2	Hindi	Kokila
3	Assamese	Shonar Bangla
4	Bengali	Shonar Bangla
5	Bodo	Kokila
6	Dogri	Kokila
7	Gujarati	Nirmala UI
8	Kannada	Nirmala UI
9	Kashmiri	Nirmala UI
10	Konkani	Kokila
11	Maithili	Kokila
12	Malayalam	Nirmala UI
13	Manipuri	Shonar Bangla
14	Marathi	Kokila
15	Oriya	Shonar Bangla
16	Punjabi	Gurmukhi
17	Tamil	Nirmala UI
18	Telugu	Vani

Annexure-'B'

B- Procedure for LED Parameter measurement:

B.1 Measurement of Viewing Angle of LED:

Typical setup diagram is show below:



B.1.1 Connect the LED under test as shown in the above set up in a dark room.

B.1.2 Bias the LED such that the rated current flows in the LED under test.

B.1.3 Adjust the distance between the tip of the LED and Chromo meter or Spectrometer diffuser to 10 cm exactly.

B.1.4 Place the Chromo meter or Spectrometer to measure the intensity in Lux in the position indicated in the setup. Rotate the LED so that the chromo meter or Spectrometer records maximum Lux. Record this value and position of LED in degrees.

B.1.5 Rotate the LED in Horizontal (X-direction) to a point, at which the Lux reading is half of the value that was observed in the clause B.1.4. Record the position of LED in degrees. Calculate the degrees the LED was rotated from the maximum intensity value to half intensity value. Record this value is as θ_a (Theta). Similarly rotate the LED in opposite direction from the maximum intensity value and mark the point where the Lux value observed is half the value to the one observed in the center. Calculate the rotation in degrees from maximum Lux value and record this value as θ_b.

B.1.6 **Calculation of dispersion Angle:**

Dispersion Angle= $\theta_a + \theta_b$

B.2 Intensity Measurement of LED:

B.2.1 Connect the LED under test as shown in the above set up in a dark room.

B.2.2 Bias the LED such that the rated current flows in the LED under test.

B.2.3 Adjust the distance between the tip of the LED and white board to 30 cm exactly.

B.2.4 Use the Chromo meter or Spectrometer to measure the intensity in Lux at the center of the pattern formed on the white board due the illumination of the LED. The Value of the Lux observed at the center of the Pattern on the white board is the intensity of the LED in Lux.

B.2.5 Intensity of LED (mcd) = 92.9*Lux value observed.

Annexure-'C'

Backward compatibility text file for older version of IPIS

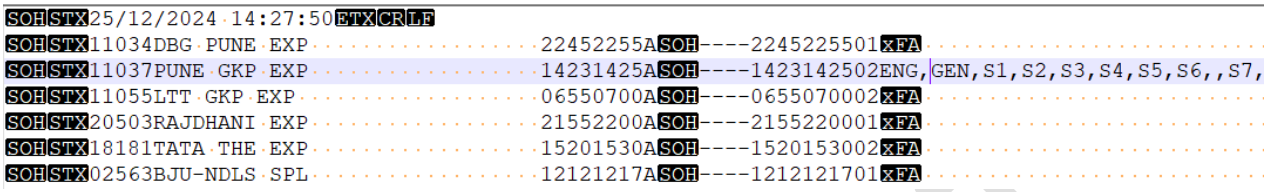
C.1 Text File generation

A text file of data output shall be generated in following format by every IPIS vendors and stored in a shared folder for access of other vendors for processing and display of data on other make display boards of older version.

Byte No.	Parameters	Possible Range	Remarks
1-2	Start of the Record	$01 $02	Record Starts
3-12	Date Stamp	DD/MM/YYYY	Computer Date
13	Date and Time Separator	$32(ASCII Space)	
14-21	Time Stamp	HH:MM:SS	Computer Time
22-24	End of the Record	$03 $0D $0A	Record Ends
25-26	Start of the Record	$01 $02	Record Starts
26-31	Train Number	Train number in ASCII	
32-61	Train Name in English	Train Name in ASCII. This will be in capital letters only	
62-65	Scheduled Arrival Time of the train	---- or valid time in 24 hours format	
66-69	Scheduled Departure Time of the train	---- or valid time in 24 hours format	
70	A/D	Arrival/ Departure feeded	
71	Status of the train	Please refer Status table	
72-75	Late By Time	---- or valid time in 24 hours format	
76-79	Expected Arrival Time of the train	---- or valid time in 24 hours format	
80-83	Expected Departure Time of the train	---- or valid time in 24 hours format	
84-85	PF Number in Alphanumeric in two characters		
86-285	Coach Marshaling of the train	Coach Marshaling in ASCII	It will start from coach no. 1 and continue upto the last coach where every coach position will be separated by „ (comma) and $FA will mark the end of coach

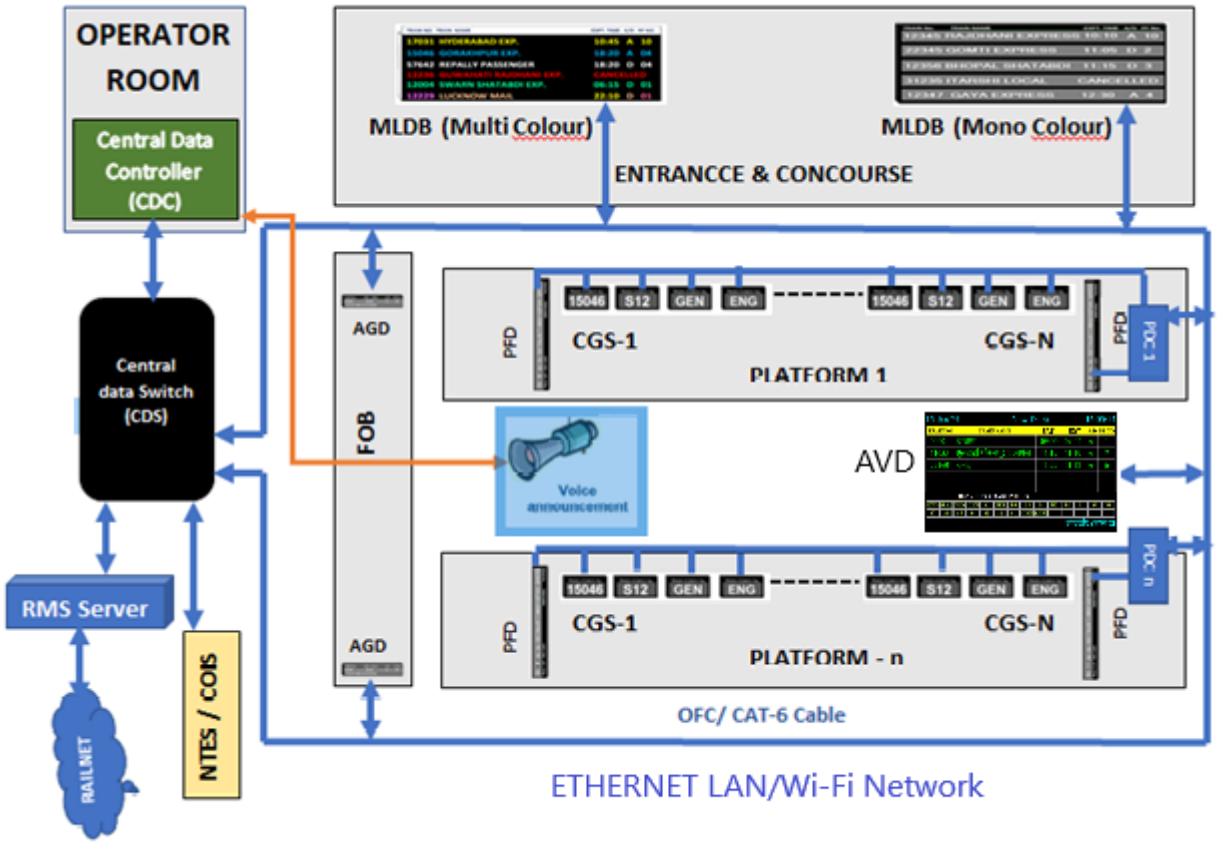
			marshaling.
286-288	End of Record	$03 $0D $0A	Record Ends

C.2 Sample of text file

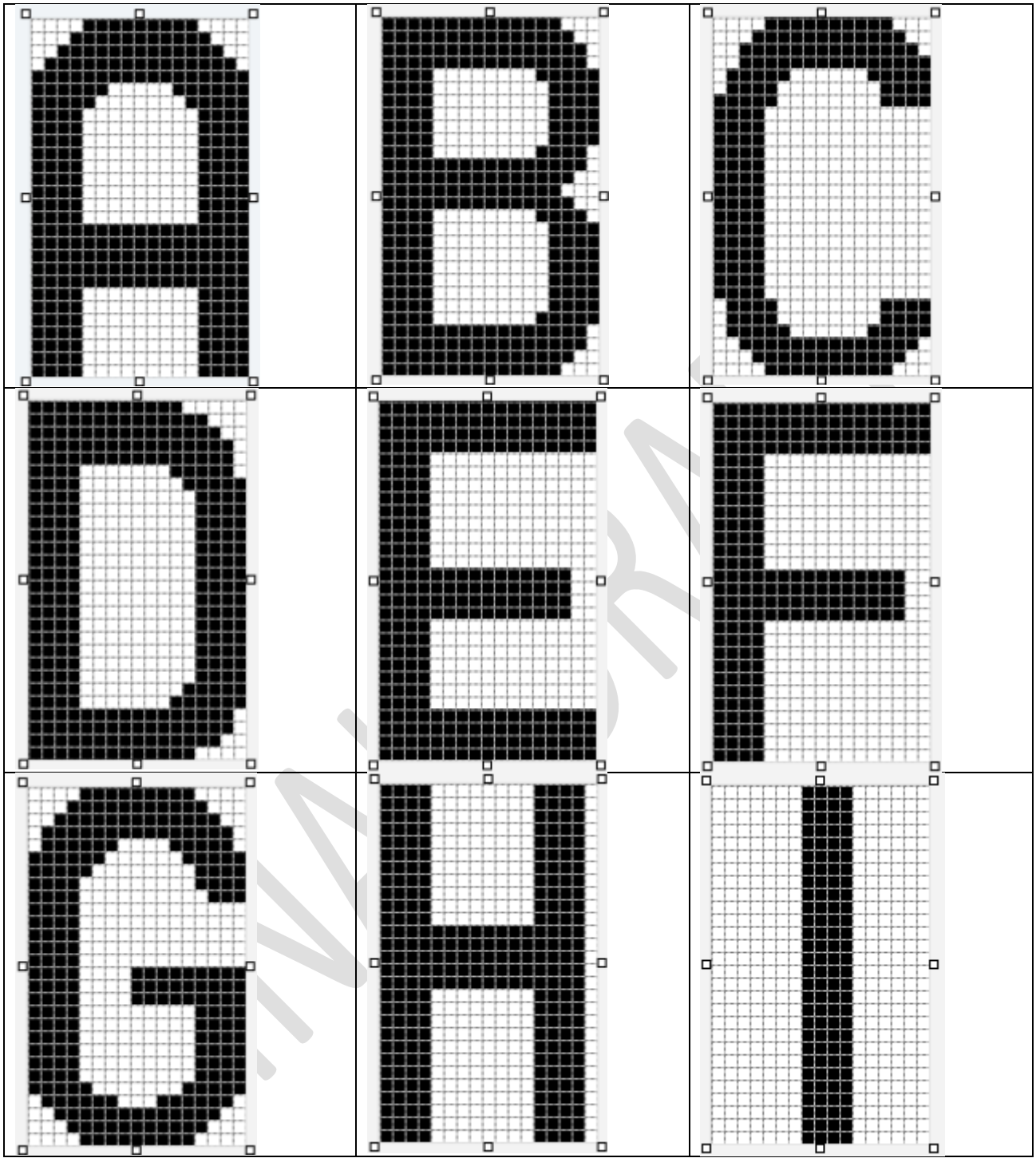


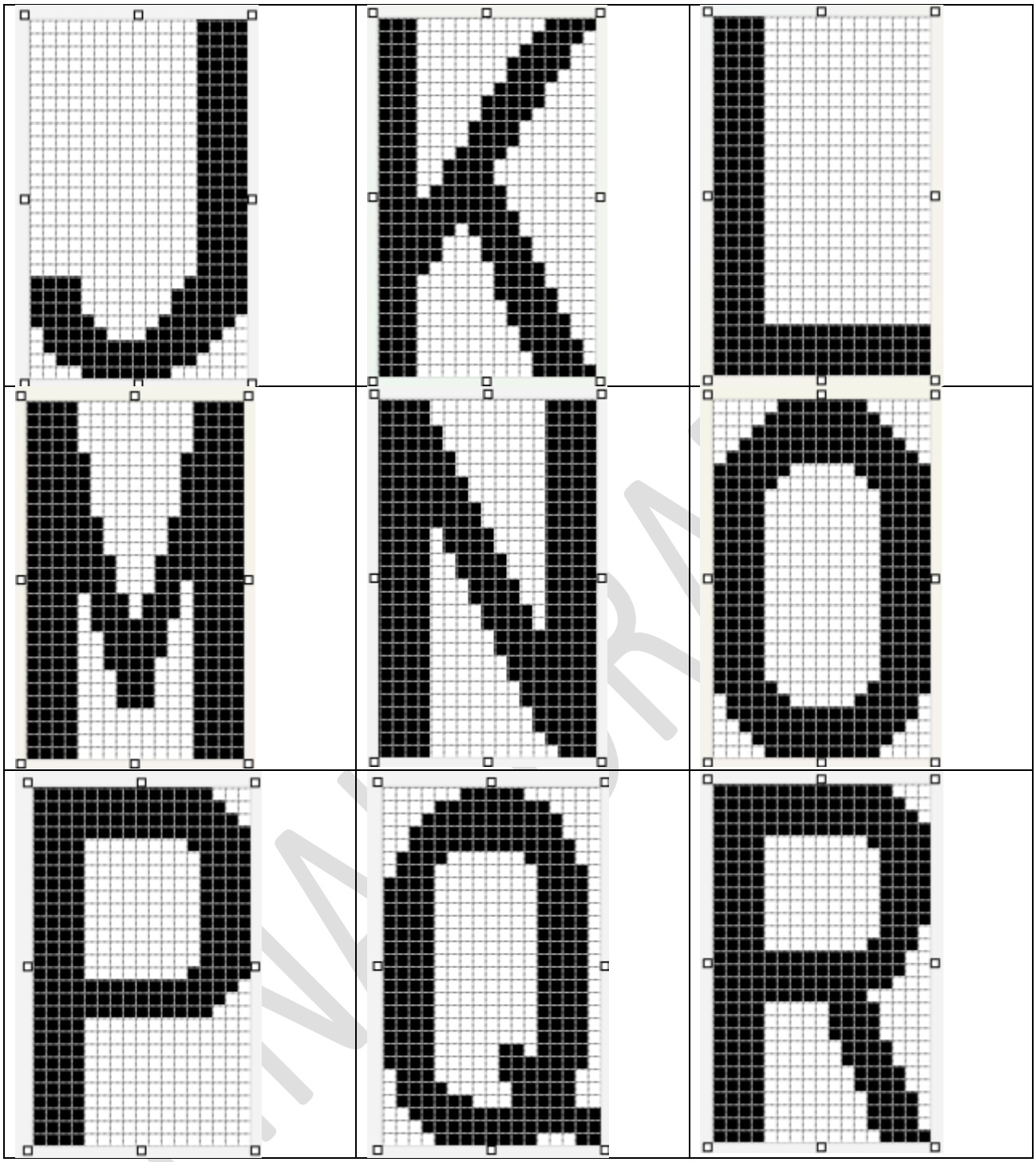
Annexure-D

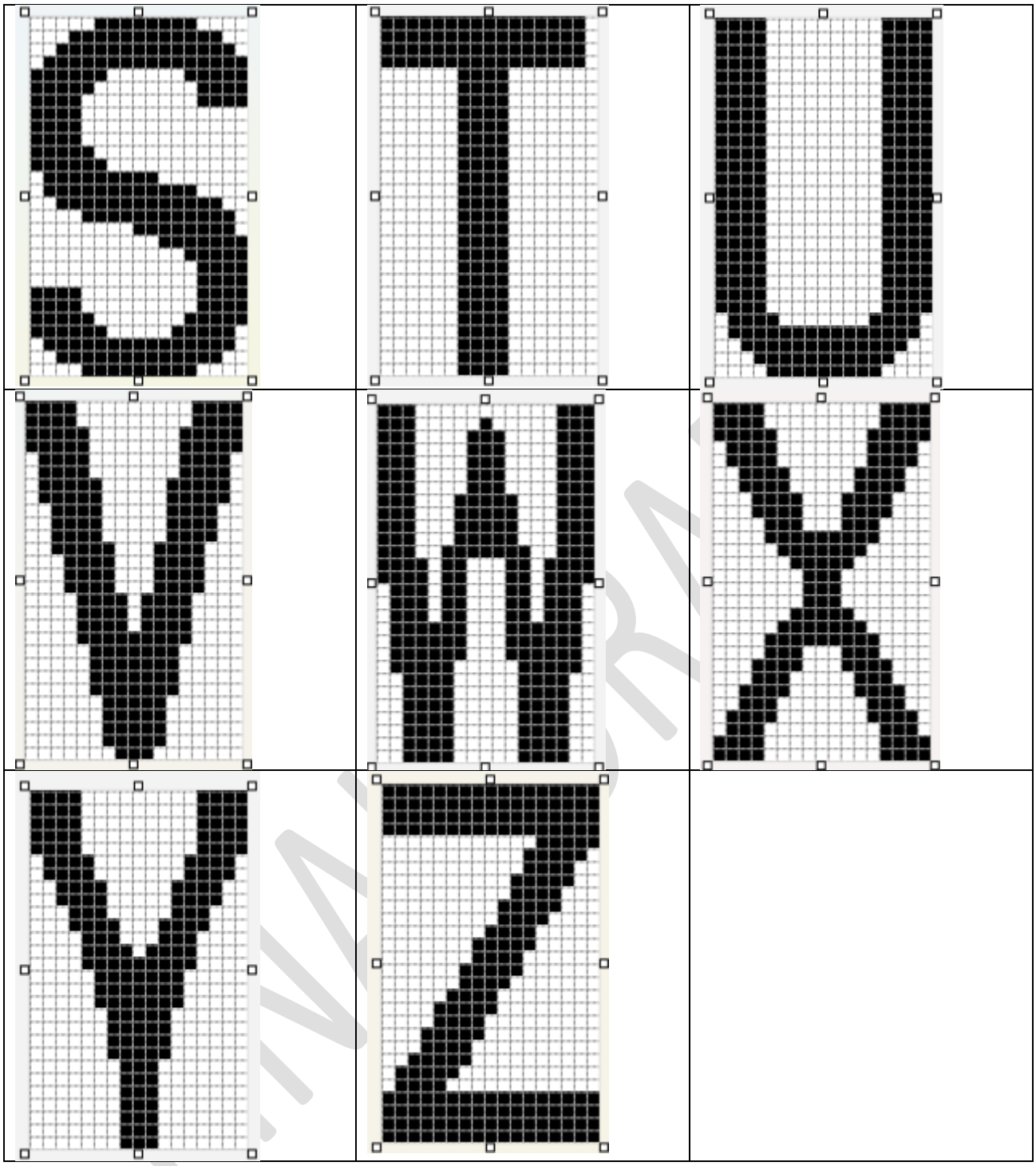
SYSTEM ARCHITECTURE

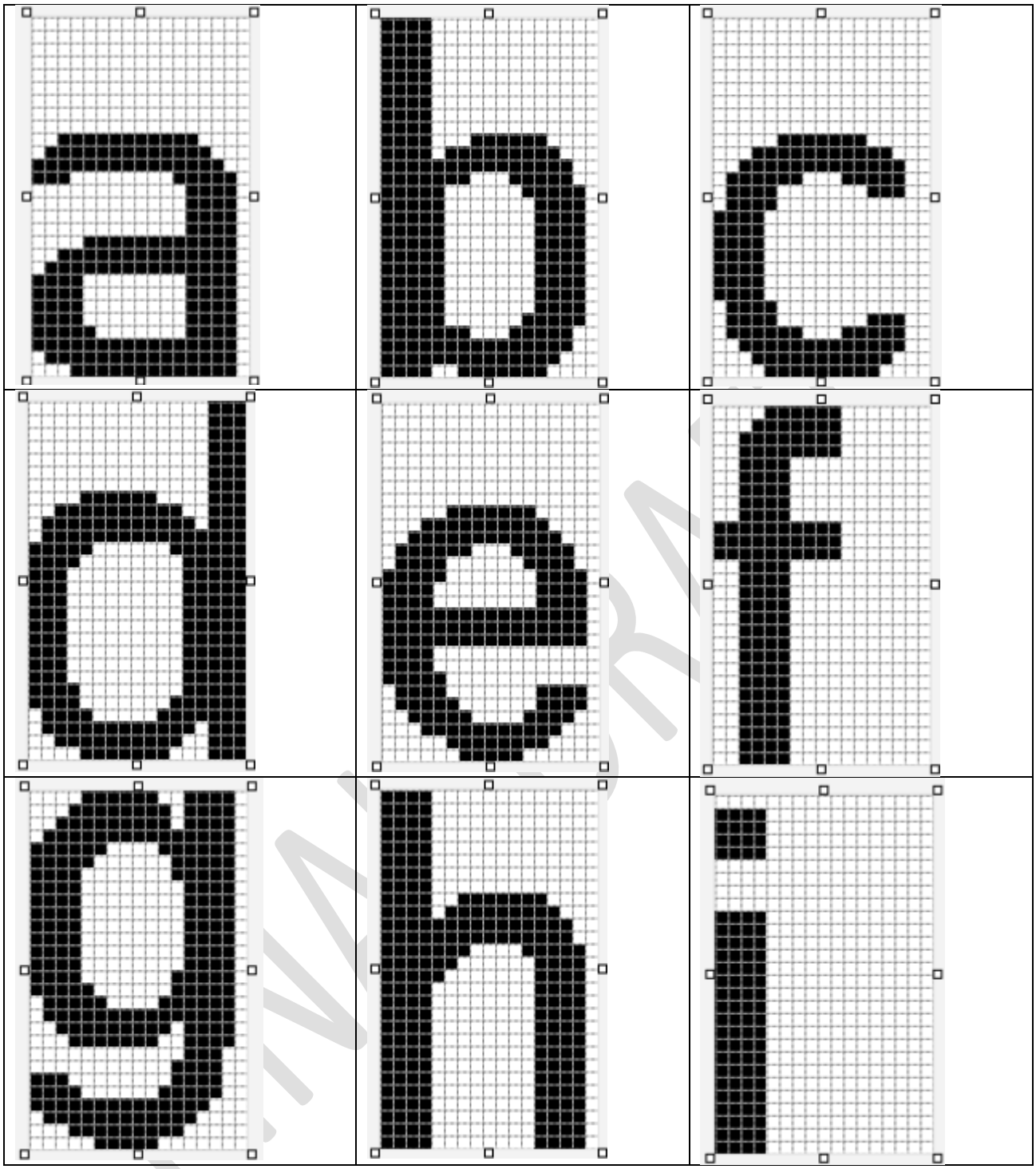


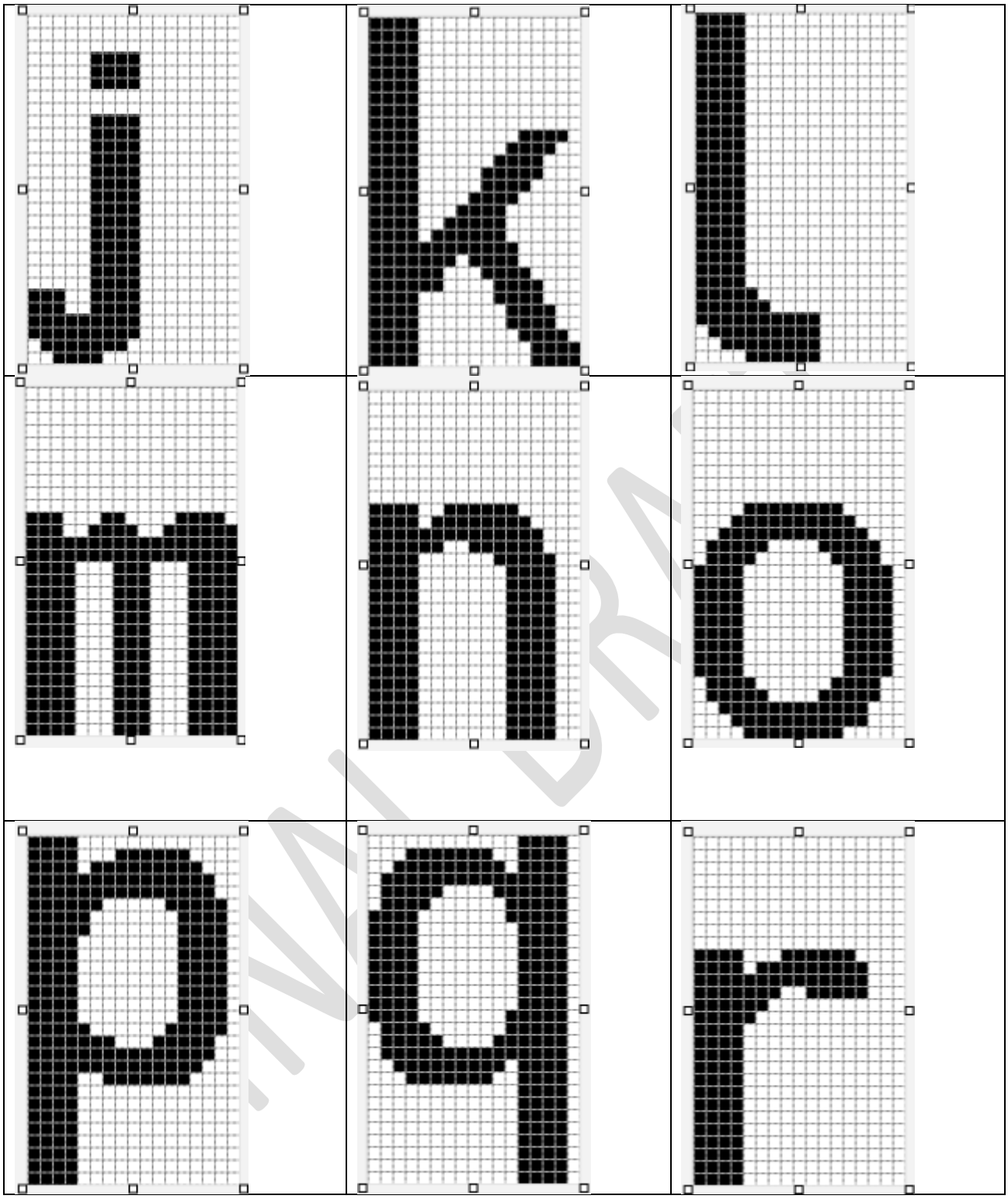
Annexure-E

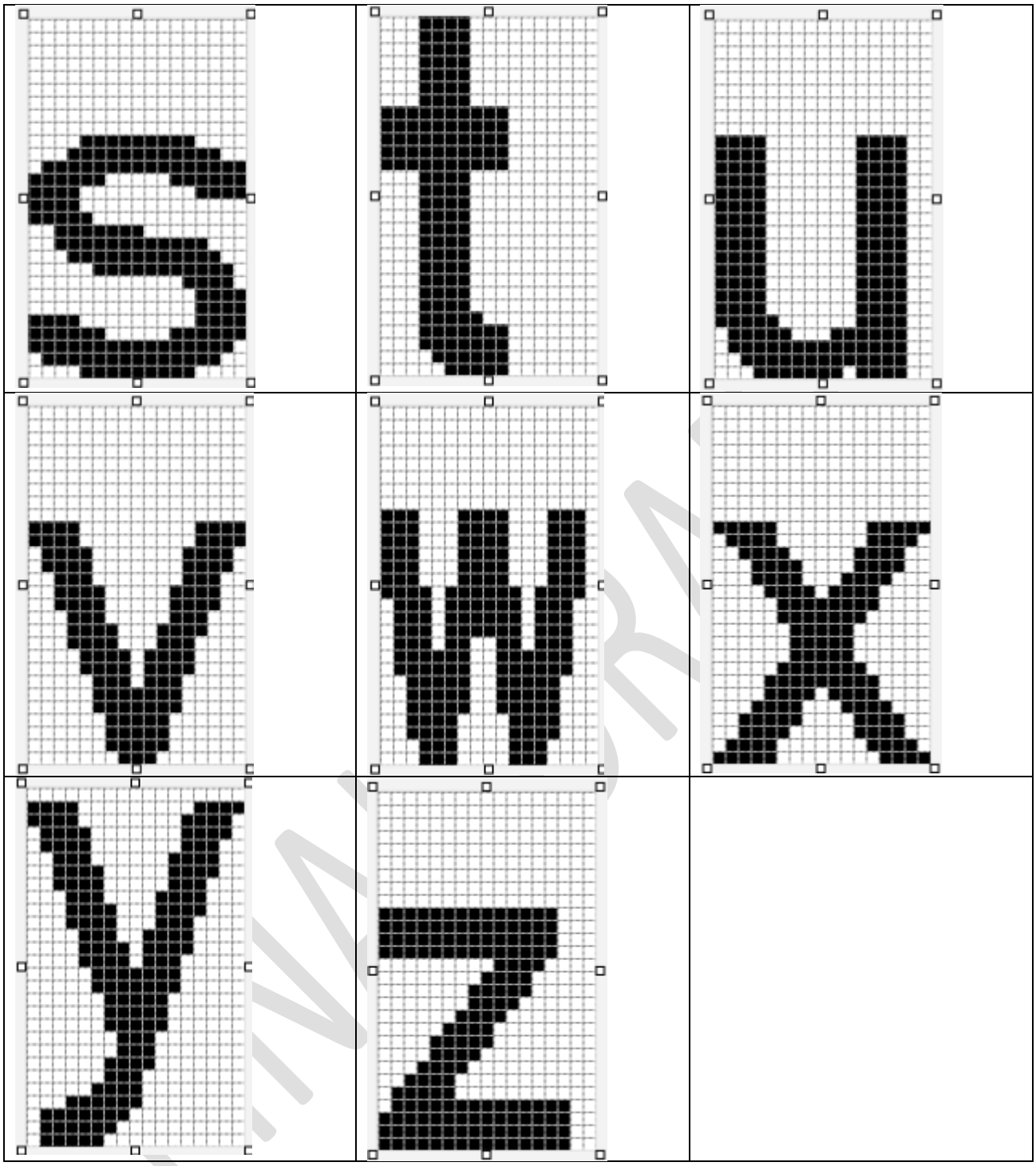


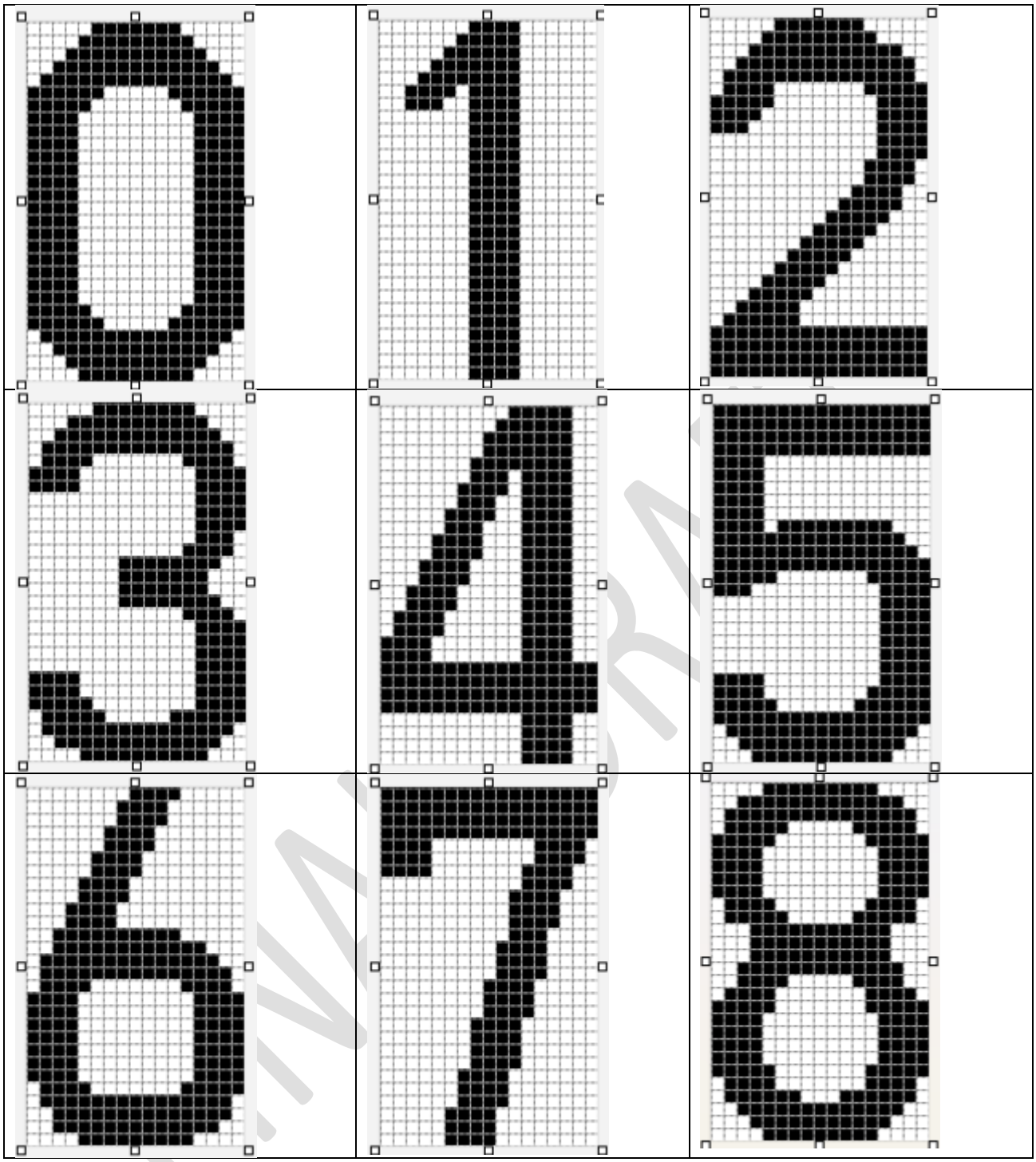


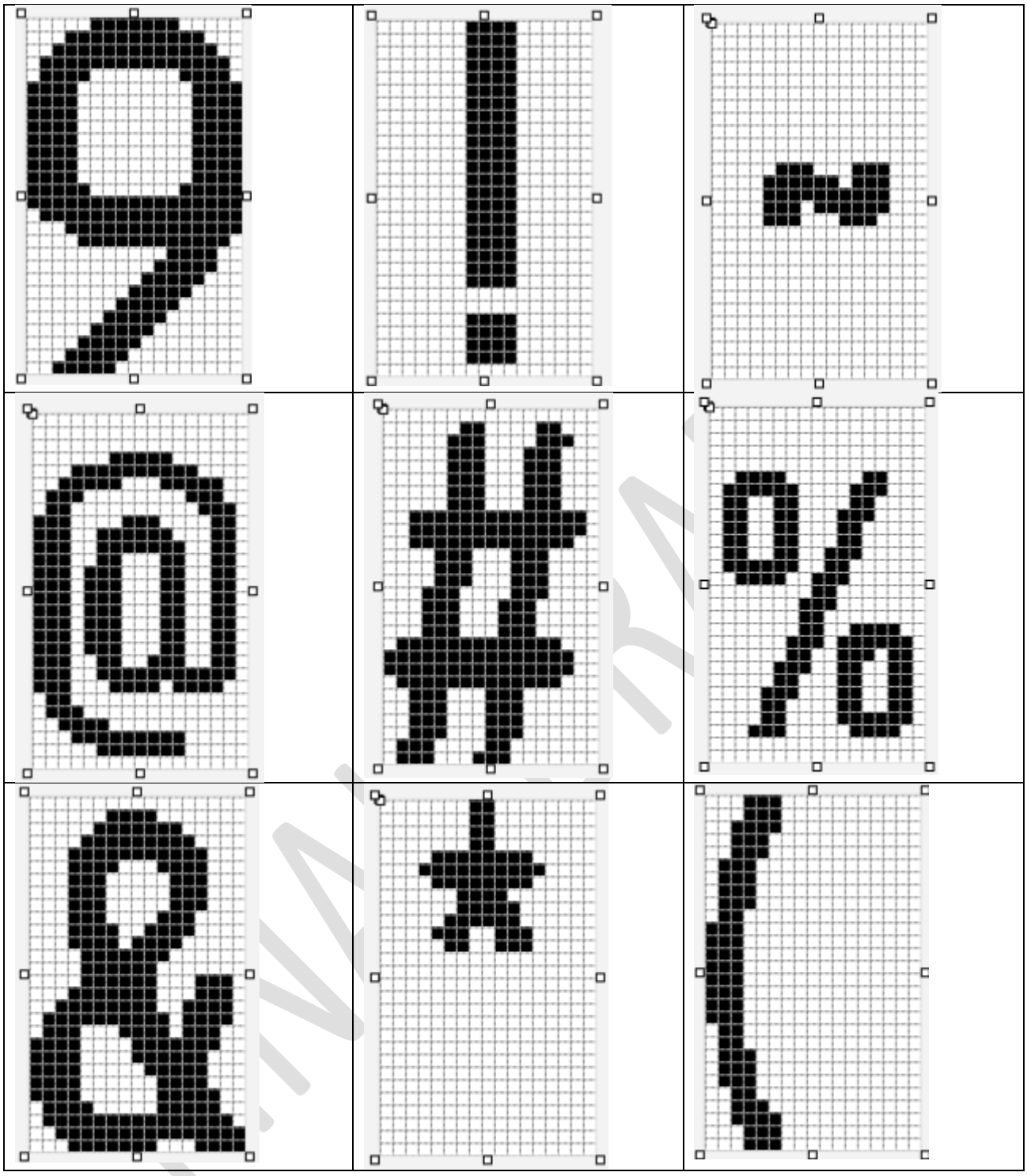


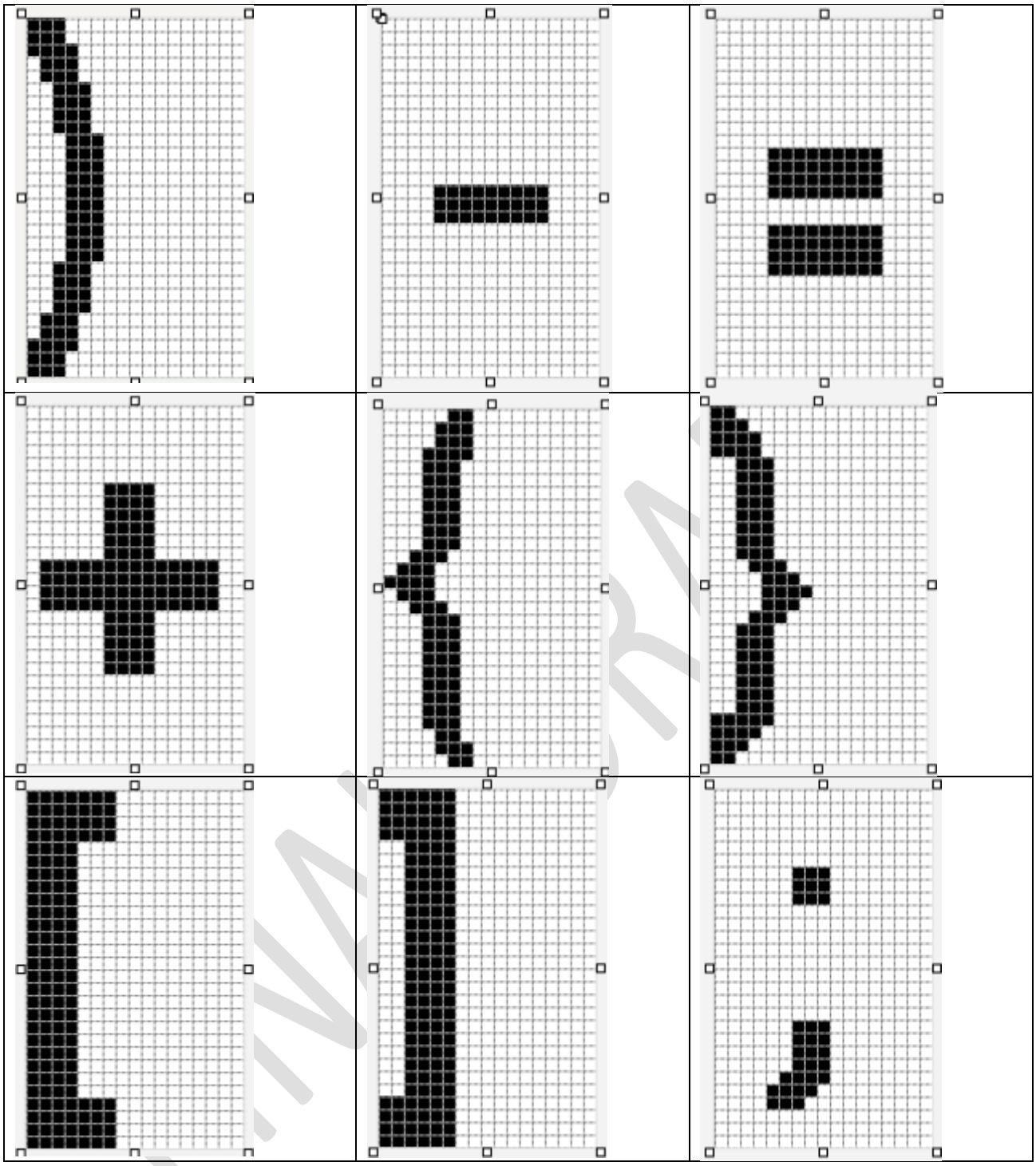


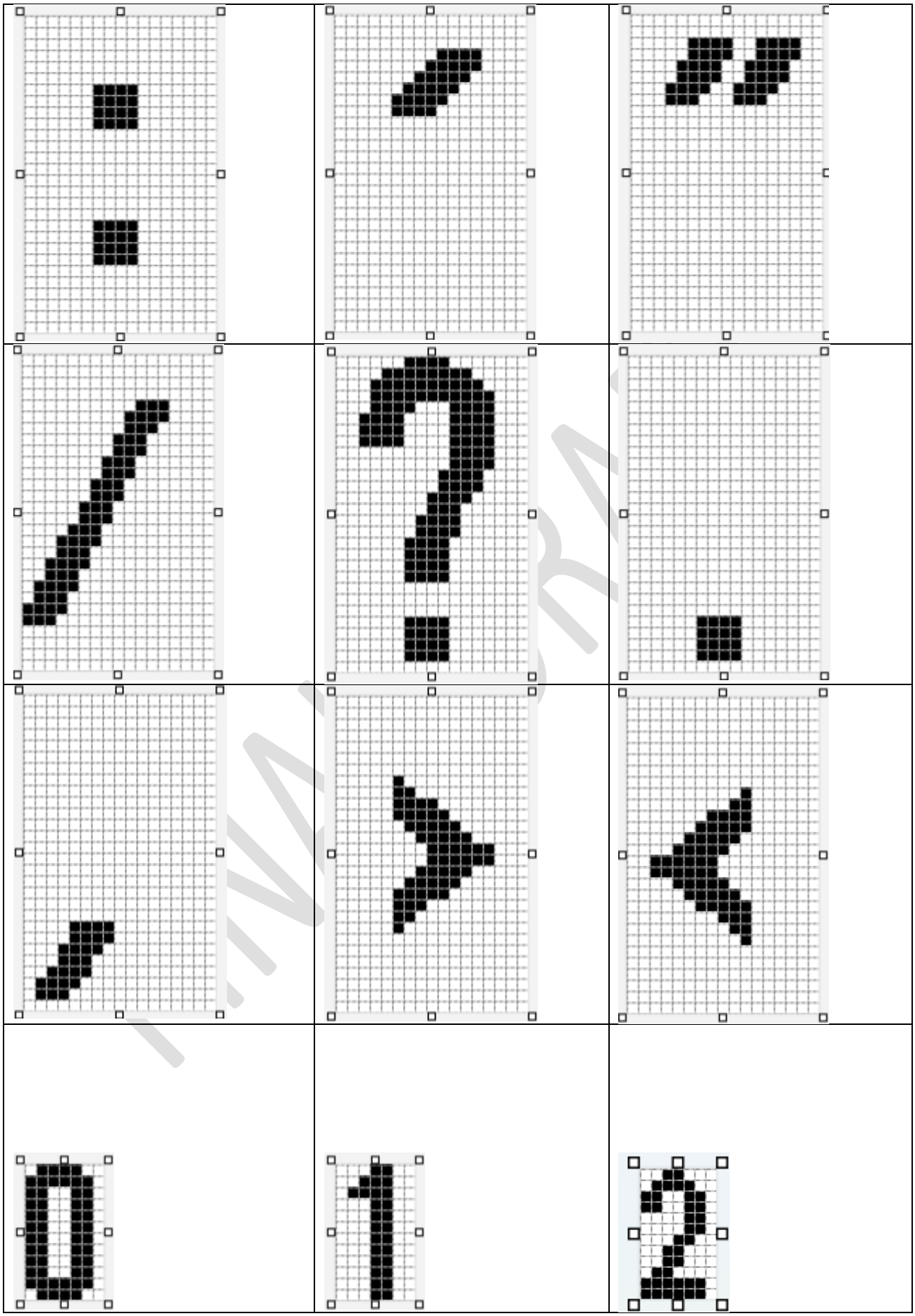


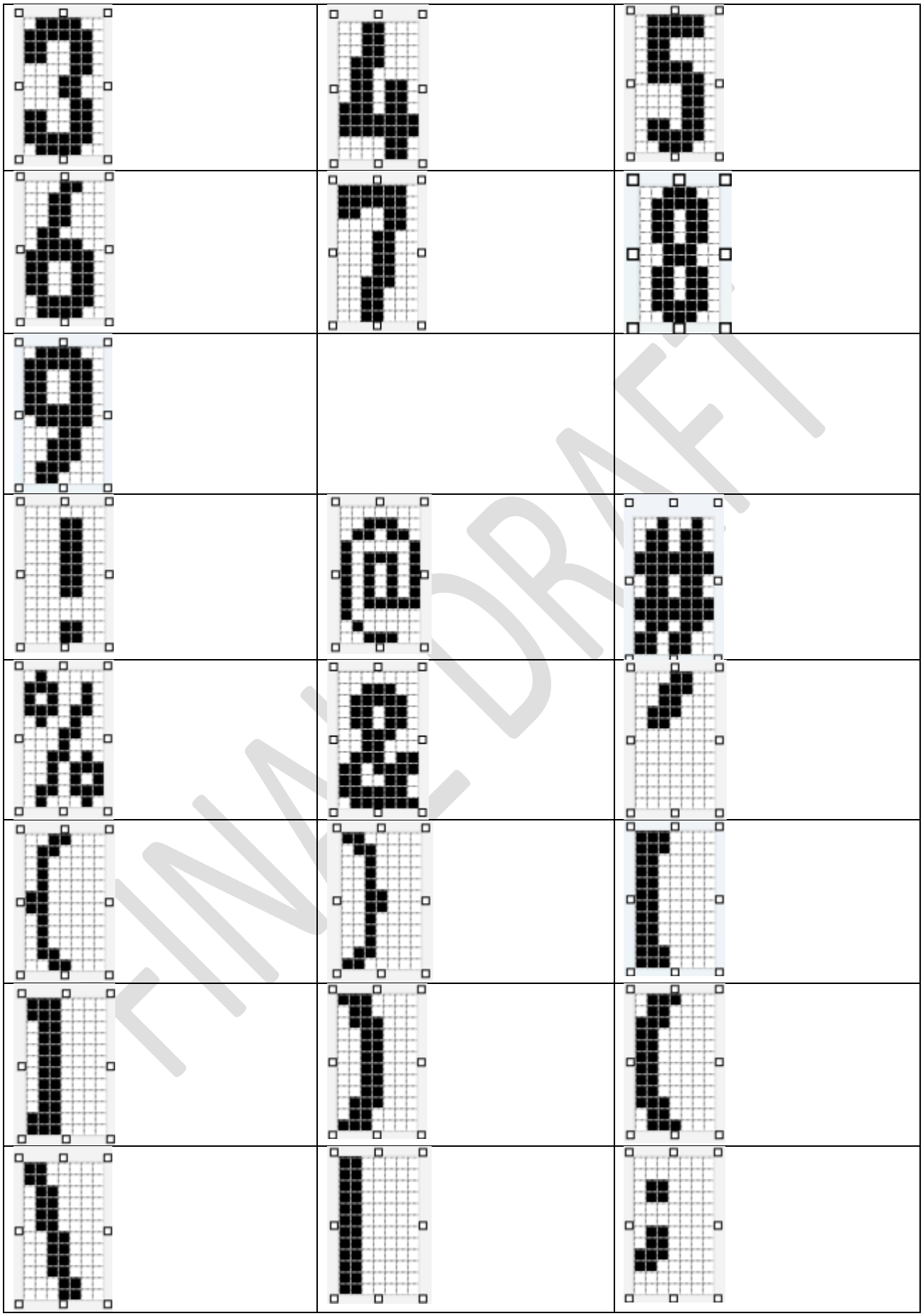


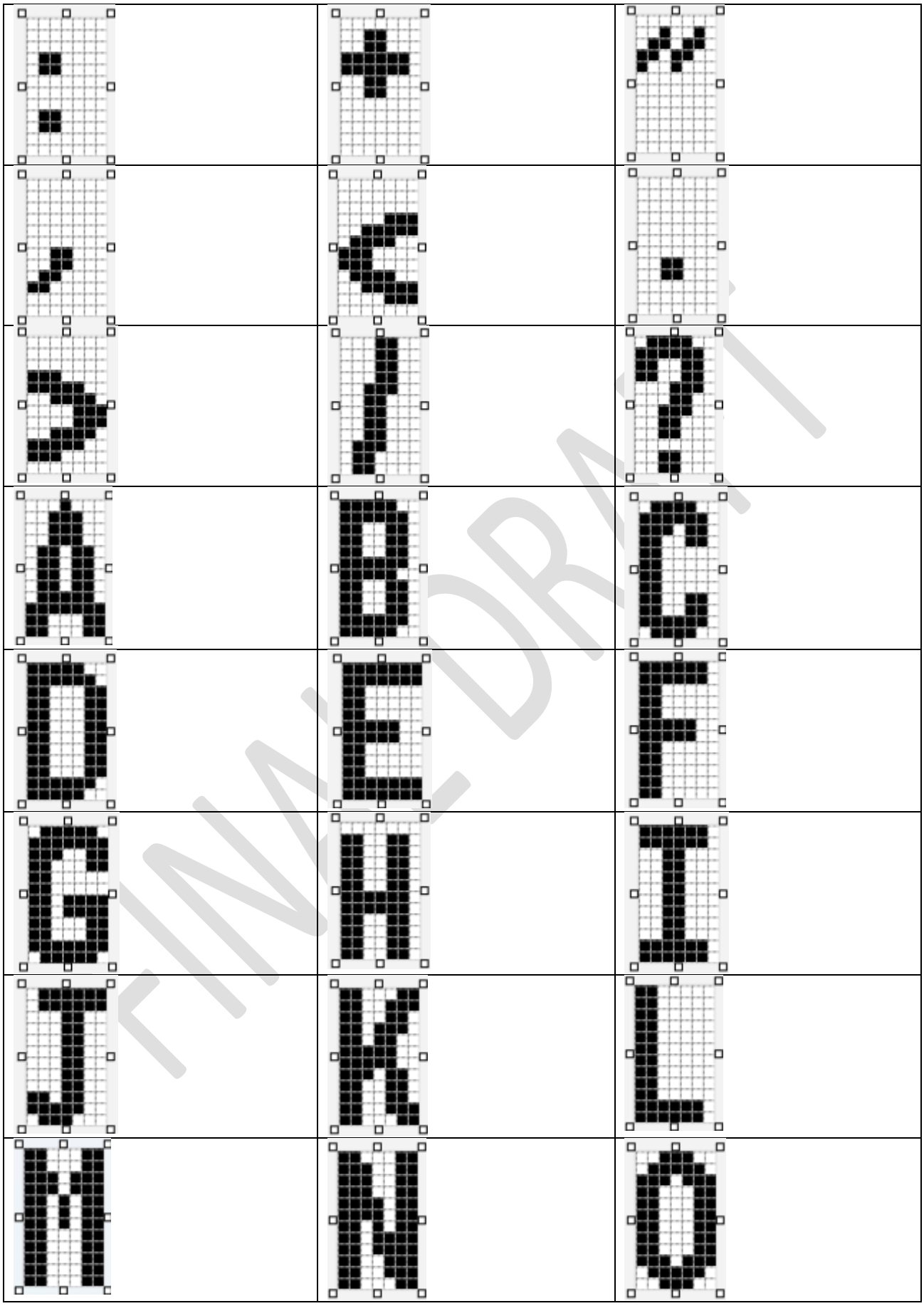


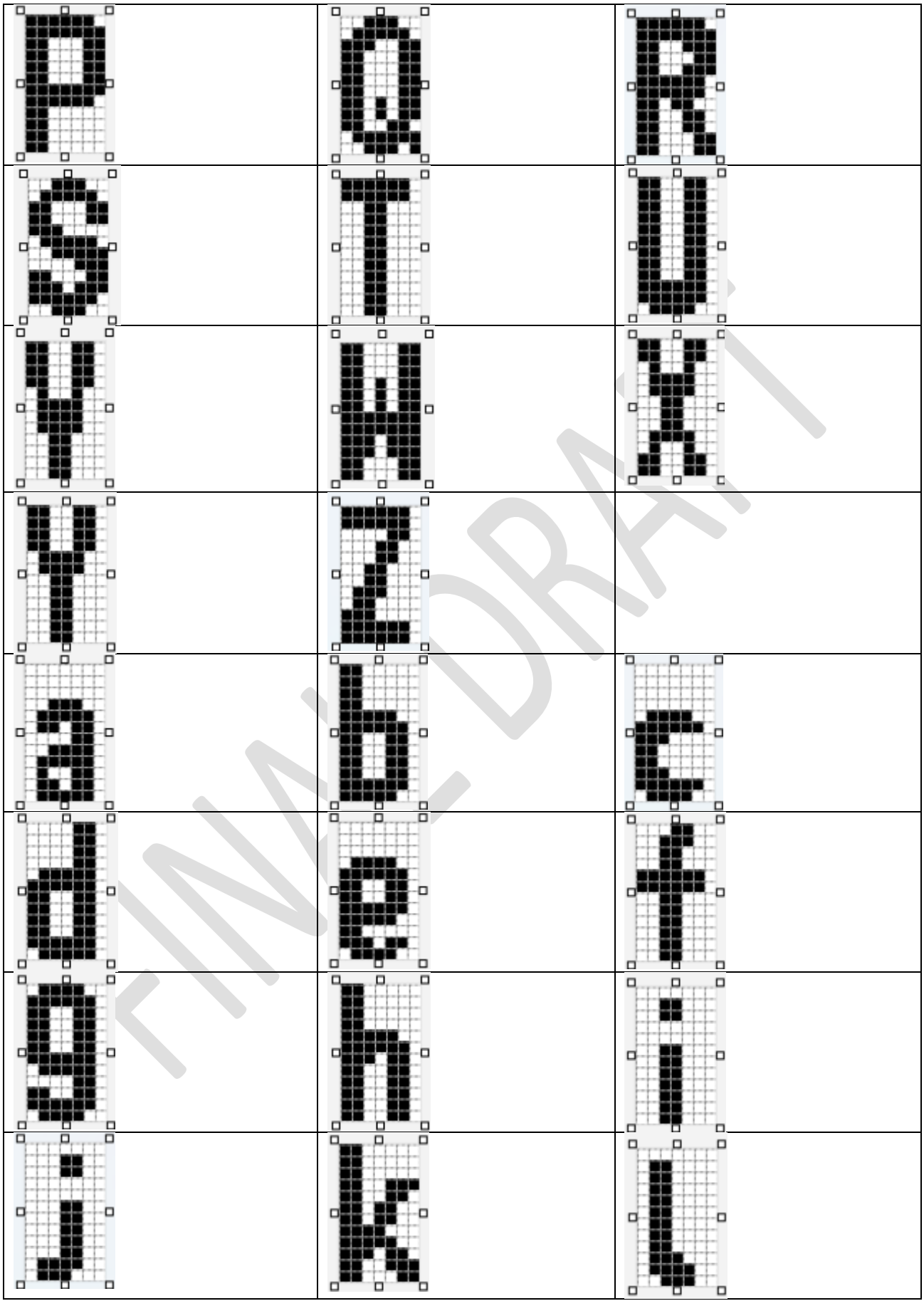


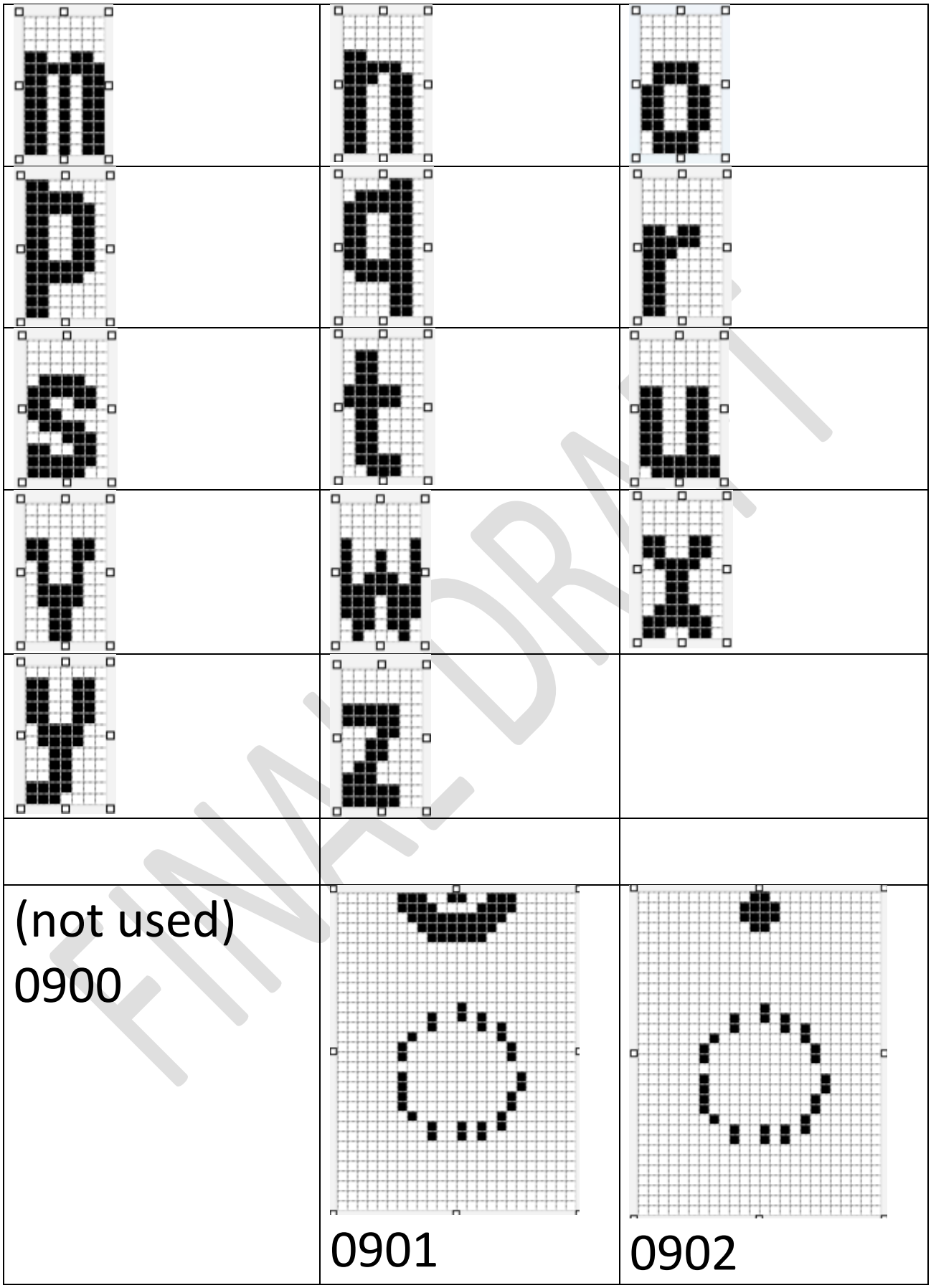












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0901

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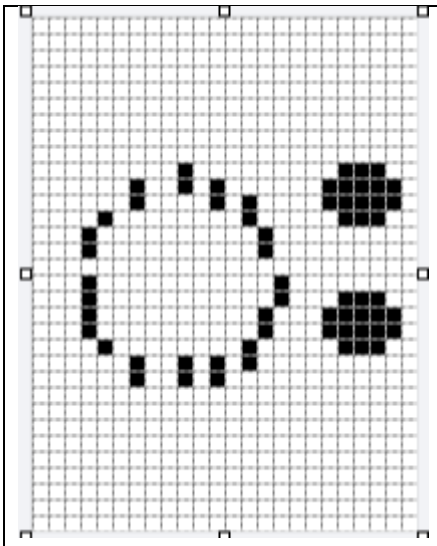

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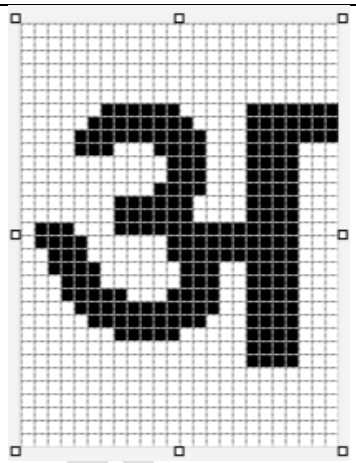

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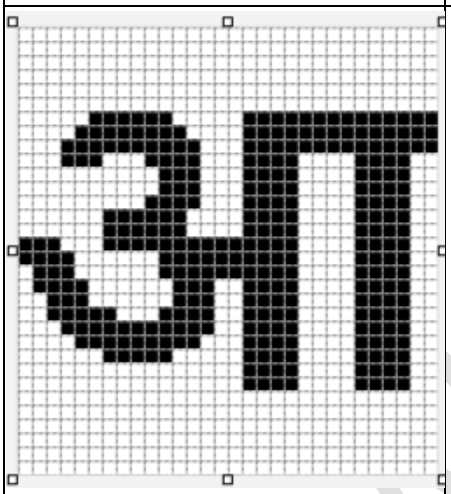

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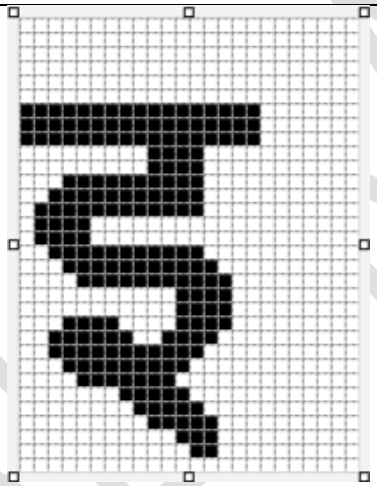

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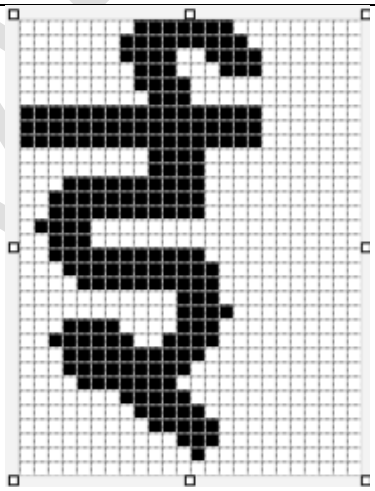

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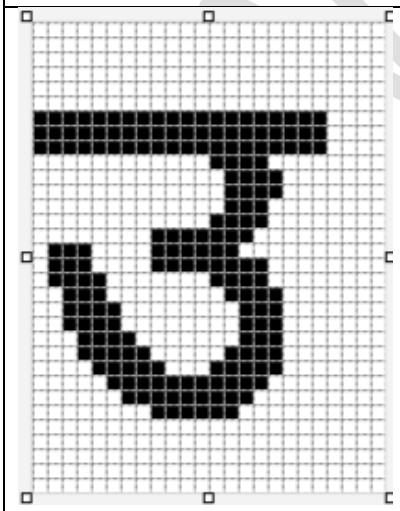

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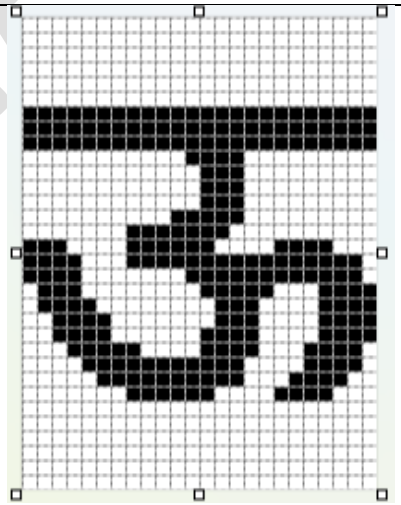

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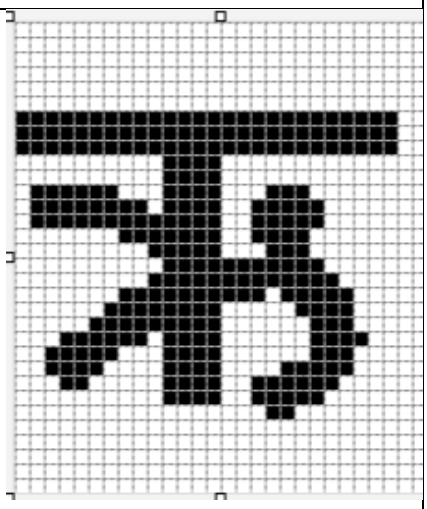

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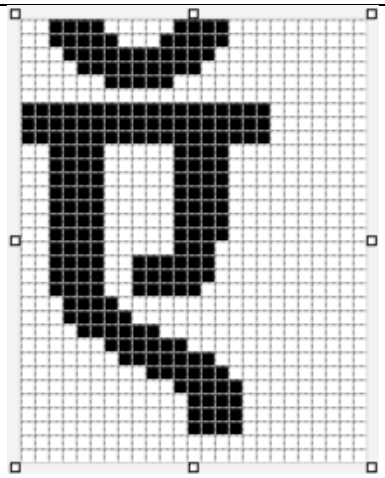
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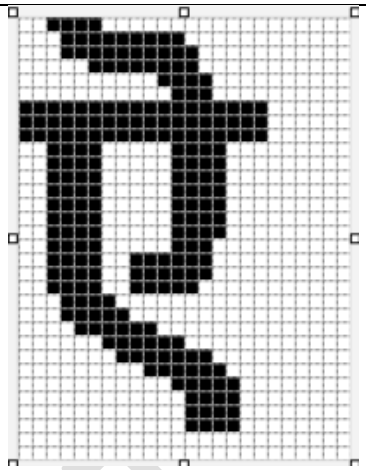
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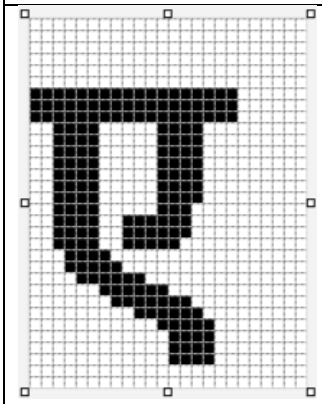
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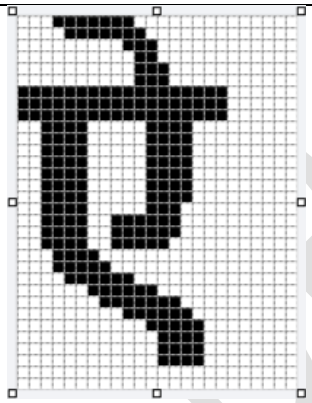
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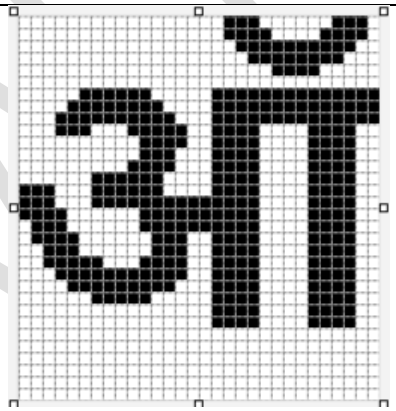
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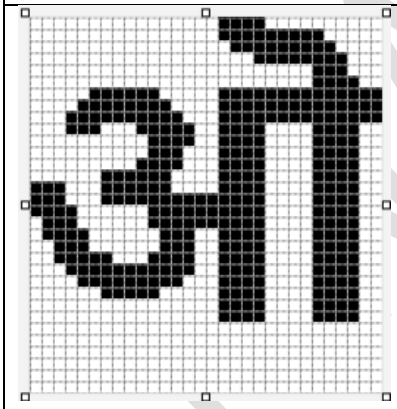
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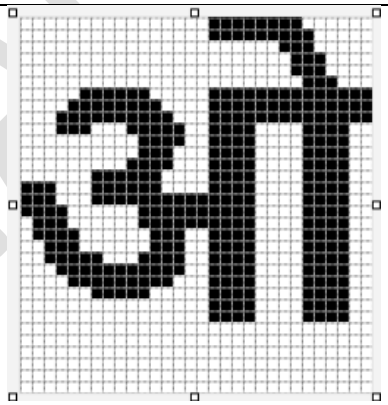
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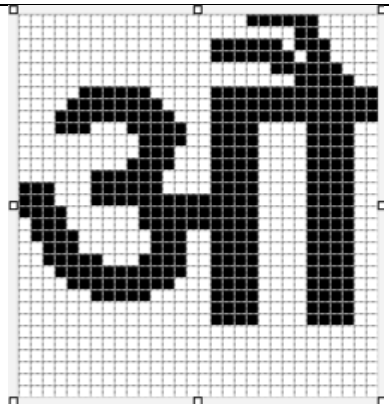
0914


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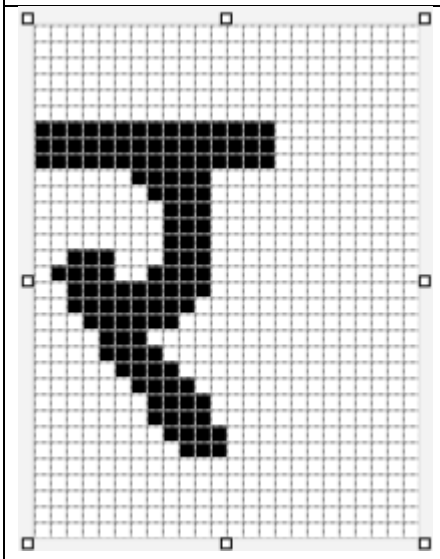
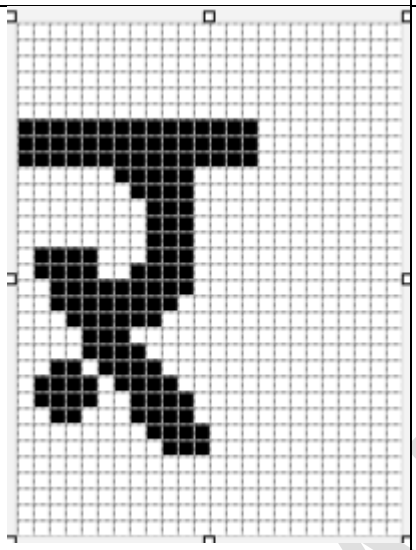
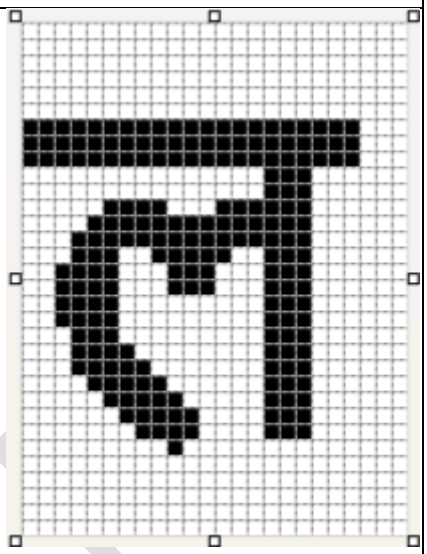
092D	092E	092F
		
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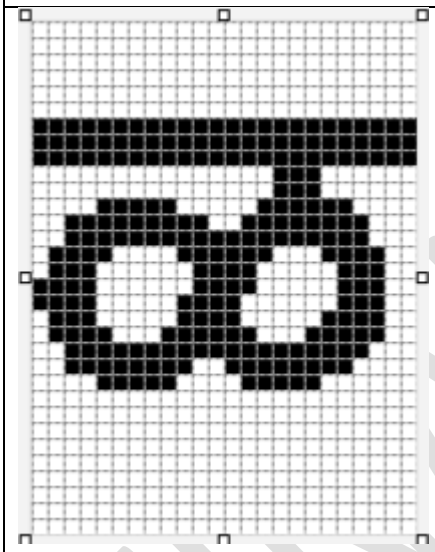	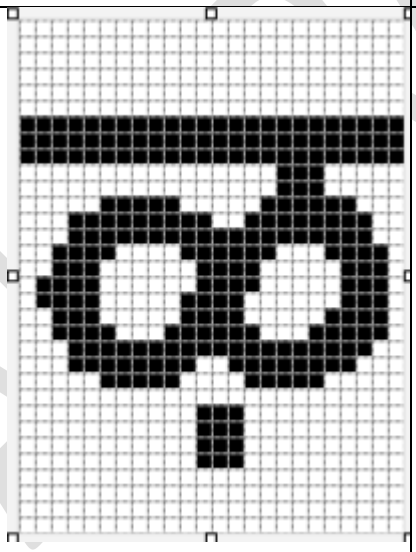	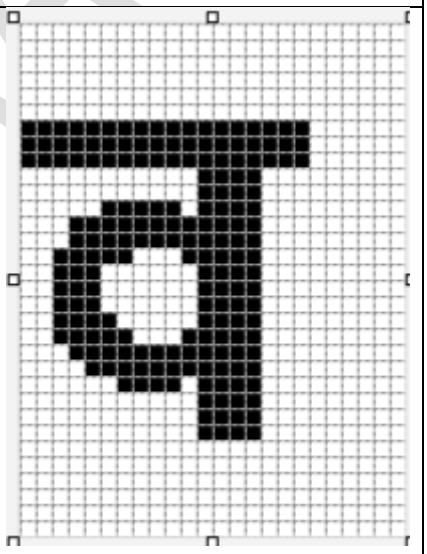
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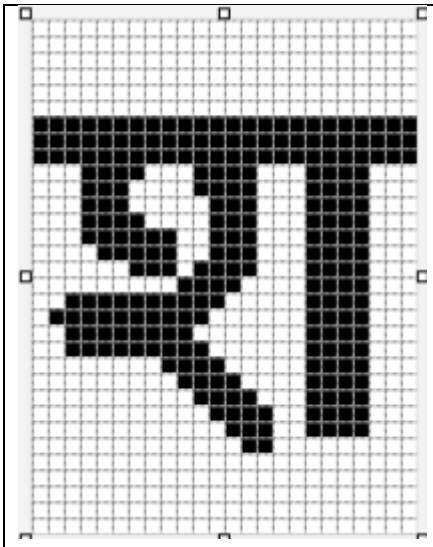
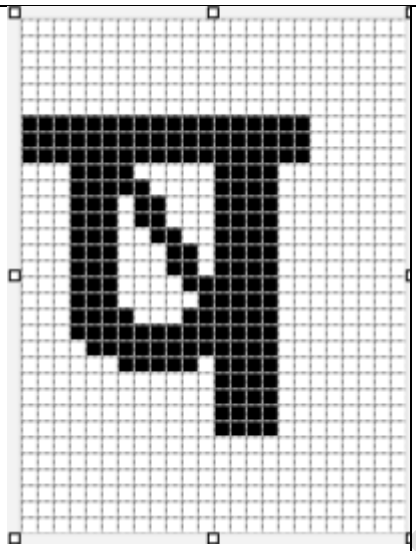
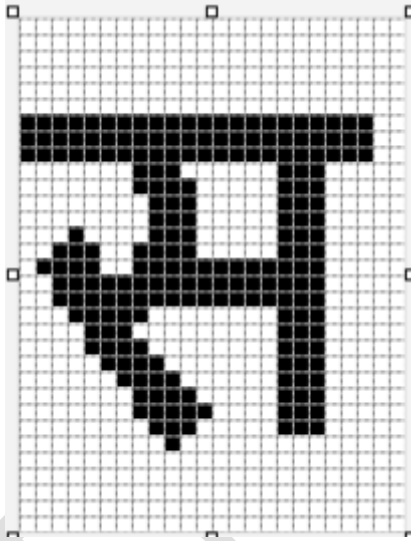
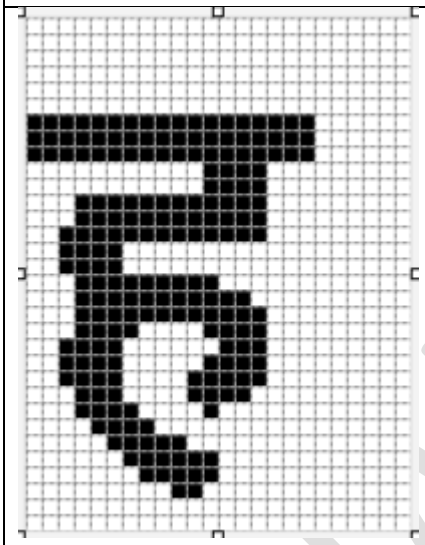
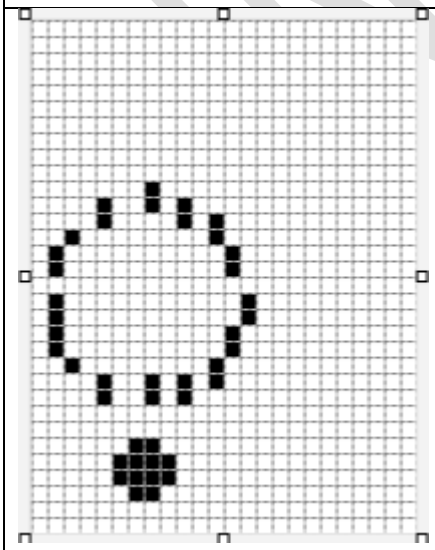
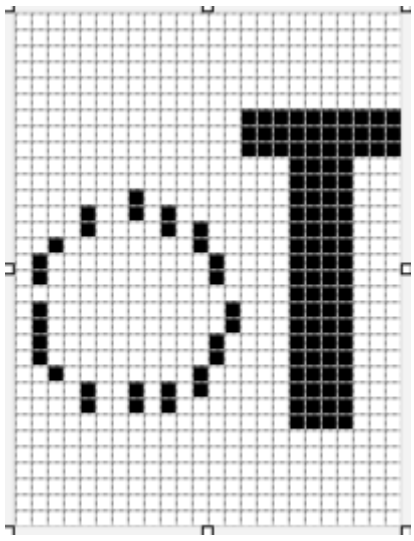
 0936	 0937	 0938
 0939	(not used) 093A	(not used) 093B
 093C	(not used) 093D	

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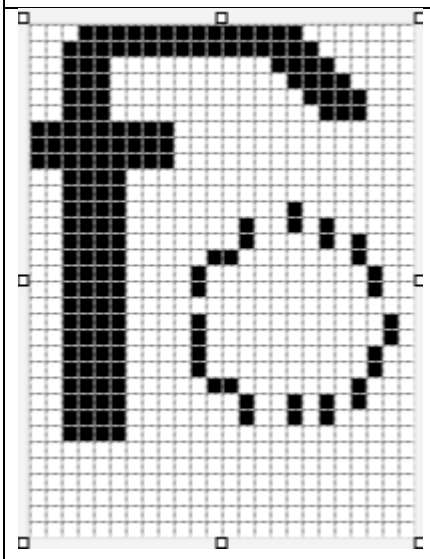
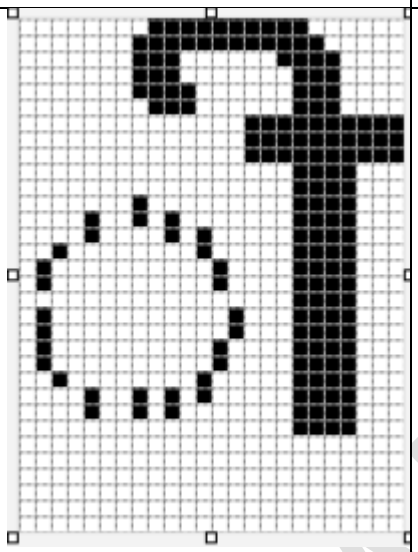
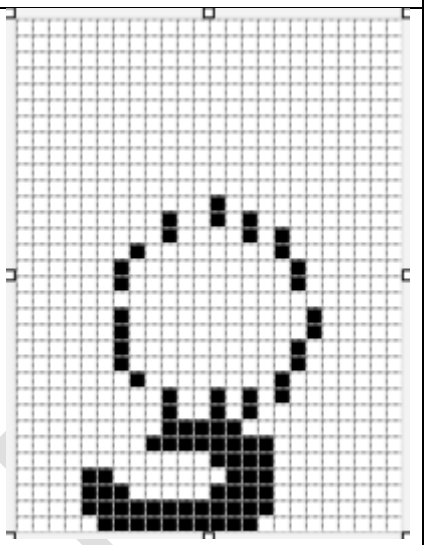
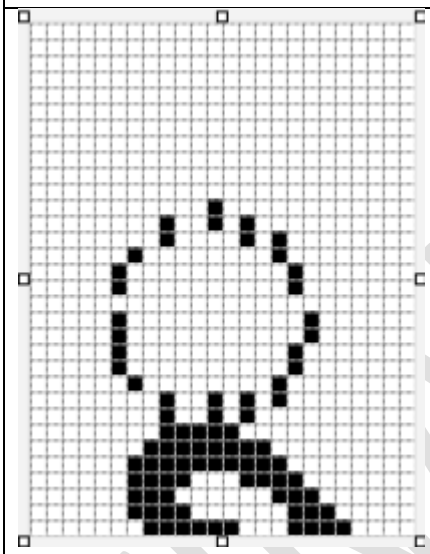
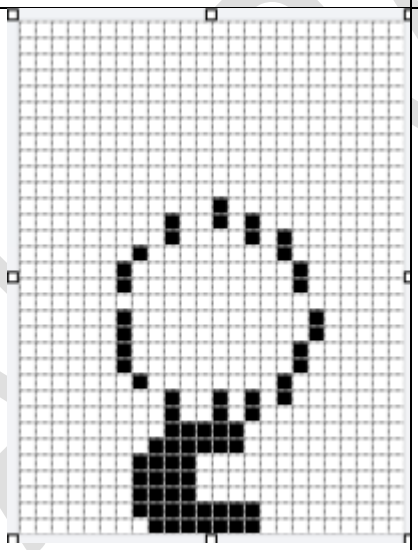
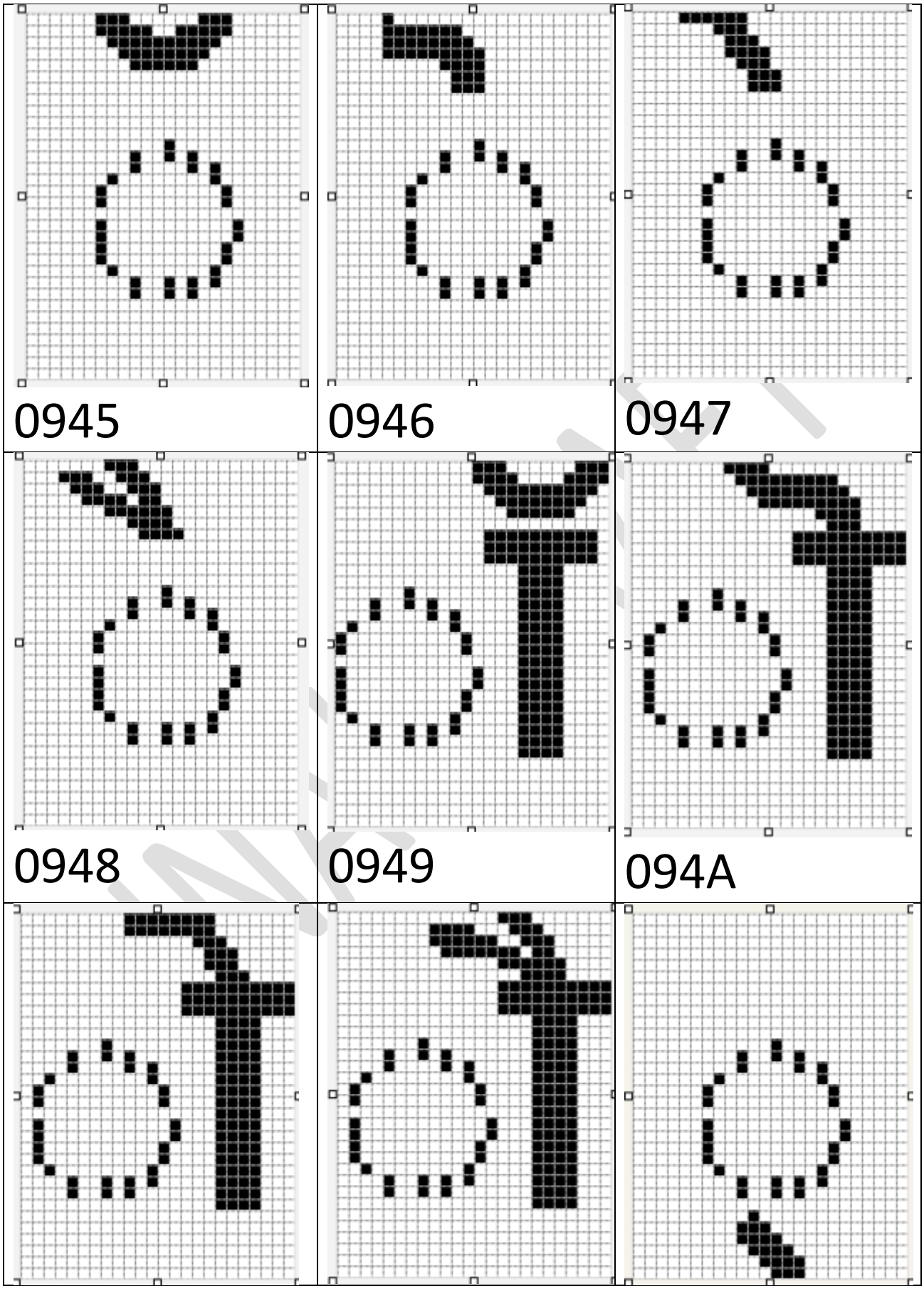
 093F	 0940	 0941
 0942	 0943	(not used) 0944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094A

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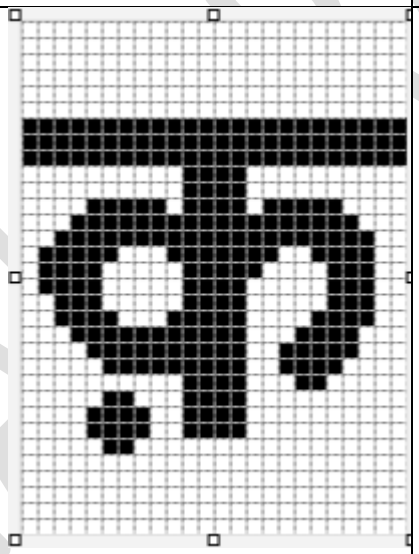
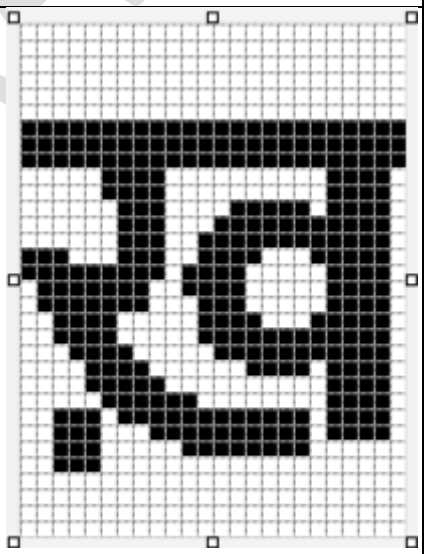
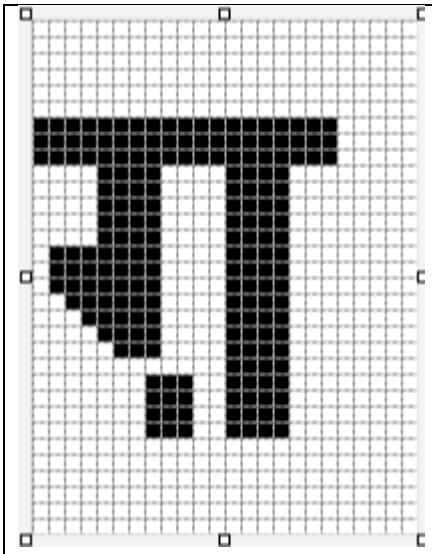
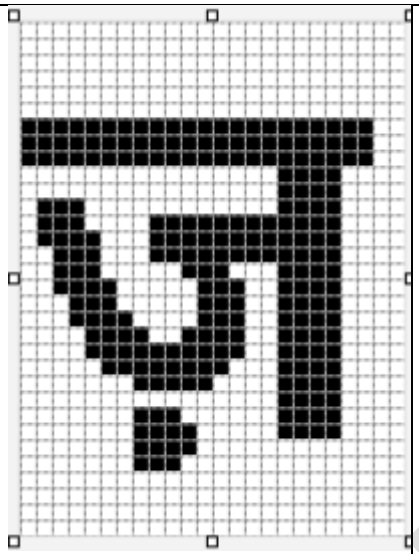
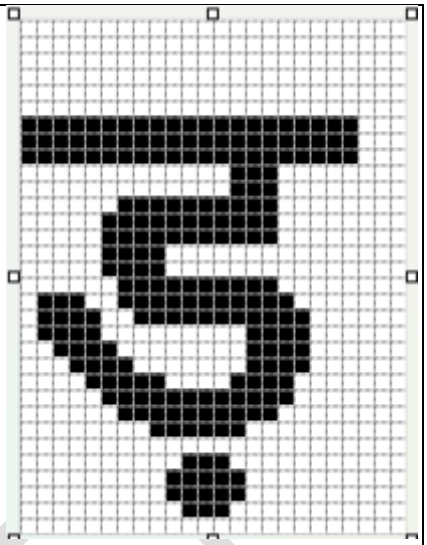
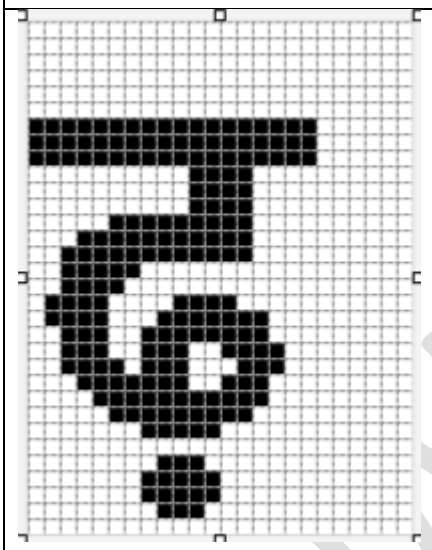
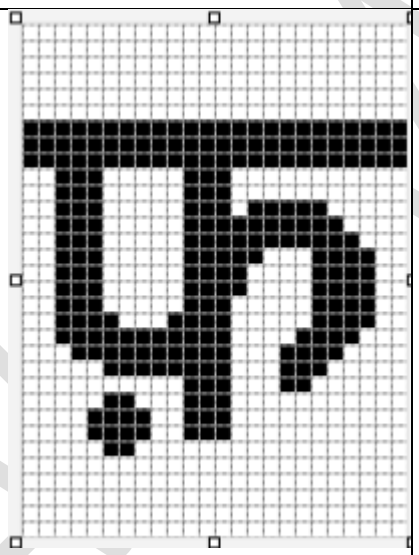
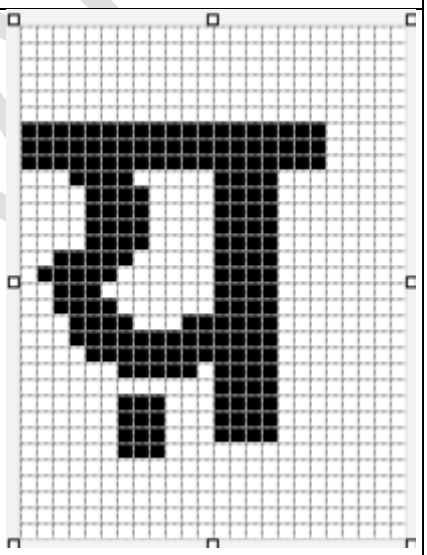
(not used) 0957	 0958	 0959

 095A	 095B	 095C
 095D	 095E	 095F
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(not used) (not used) 0969	(not used) (not used) 096A	(not used) (not used) 096B
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(not used) 0975	(not used) 0976	(not used) 0977
(not used) 0978	(not used) 0979	(not used) 097A
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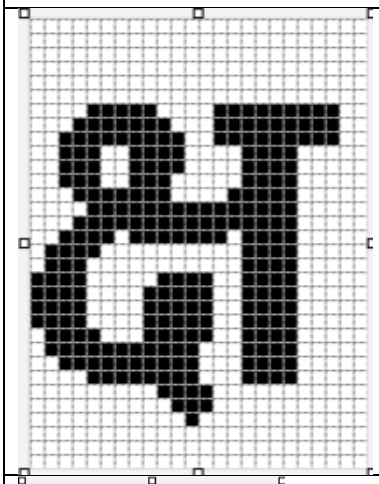
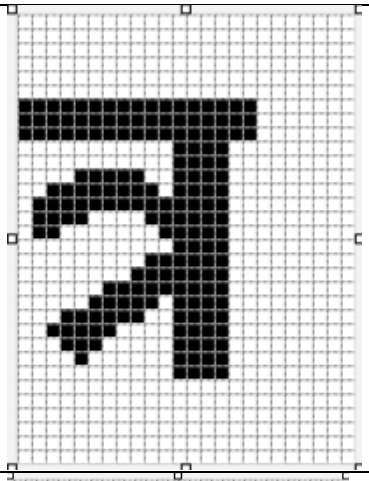
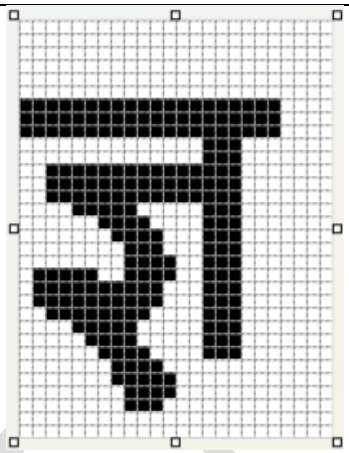
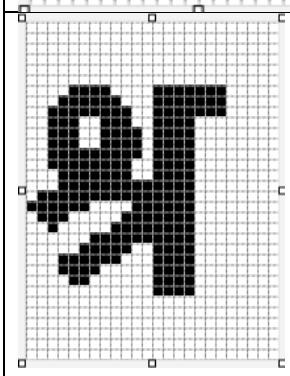
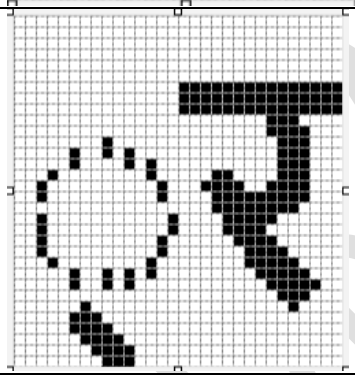
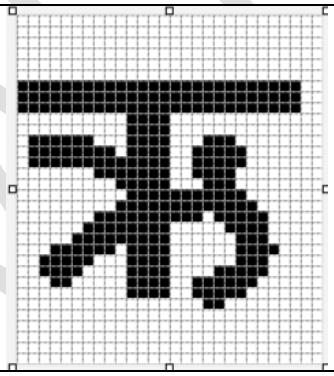
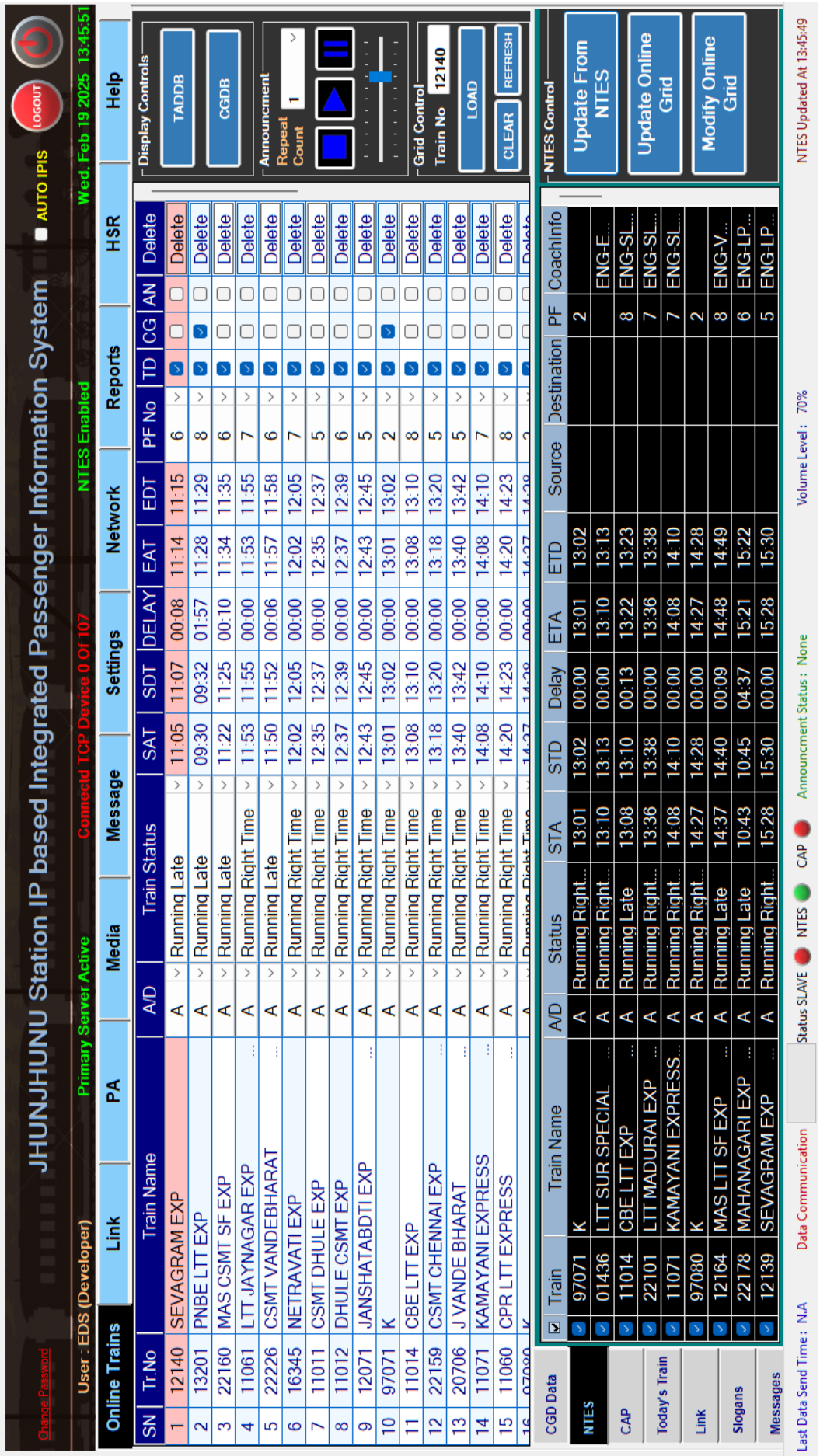
097E	097F	
		
		

Reference for Main Software Home Screen

Diagram-1

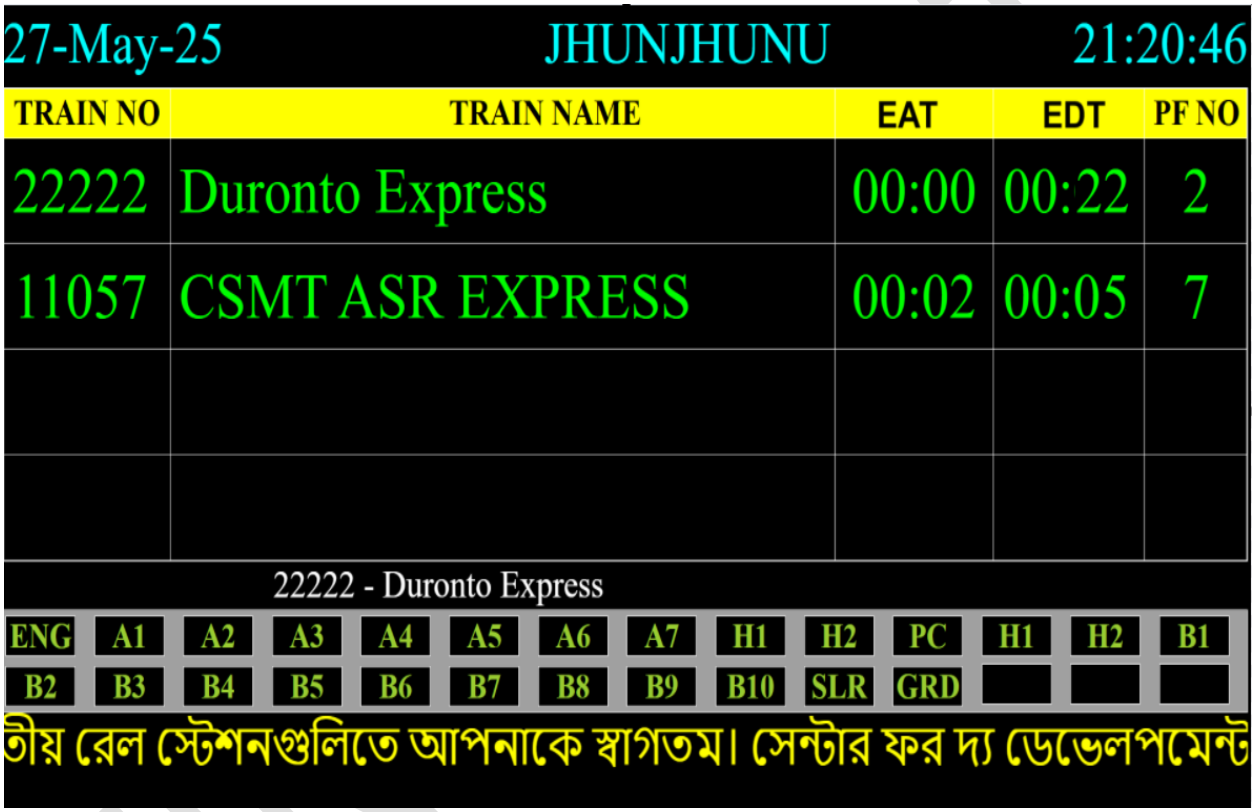


SN	Tr.No	Train Name	A/D	Train Status	SAT	SDT	DELAY	EAT	EDT	PF No	TD	CG	AN	Delete
1	12140	SEVAGRAM EXP	A	Running Late	11:05	11:07	00:08	11:14	11:15	6	☑	☐	☐	Delete
2	13201	PNBE LTT EXP	A	Running Late	09:30	09:32	01:57	11:28	11:29	8	☑	☑	☐	Delete
3	22160	MAS CSMT SF EXP	A	Running Late	11:22	11:25	00:10	11:34	11:35	6	☑	☐	☐	Delete
4	11061	LTT JAYNAGAR EXP	A	Running Right Time	11:53	11:55	00:00	11:53	11:55	7	☑	☐	☐	Delete
5	22226	CSMT VANDEBHARAT	A	Running Late	11:50	11:52	00:06	11:57	11:58	6	☑	☐	☐	Delete
6	16345	NETRAVATI EXP	A	Running Right Time	12:02	12:05	00:00	12:02	12:05	7	☑	☐	☐	Delete
7	11011	CSMT DHULE EXP	A	Running Right Time	12:35	12:37	00:00	12:35	12:37	5	☑	☐	☐	Delete
8	11012	DHULE CSMT EXP	A	Running Right Time	12:37	12:39	00:00	12:37	12:39	6	☑	☐	☐	Delete
9	12071	JANSHATABDTI EXP	A	Running Right Time	12:43	12:45	00:00	12:43	12:45	5	☑	☐	☐	Delete
10	97071	K	A	Running Right Time	13:01	13:02	00:00	13:01	13:02	2	☑	☑	☐	Delete
11	11014	CBE LTT EXP	A	Running Right Time	13:08	13:10	00:00	13:08	13:10	8	☑	☐	☐	Delete
12	22159	CSMT CHENNAI EXP	A	Running Right Time	13:18	13:20	00:00	13:18	13:20	5	☑	☐	☐	Delete
13	20706	J VANDE BHARAT	A	Running Right Time	13:40	13:42	00:00	13:40	13:42	5	☑	☐	☐	Delete
14	11071	KAMAYANI EXPRESS	A	Running Right Time	14:08	14:10	00:00	14:08	14:10	7	☑	☐	☐	Delete
15	11060	CPR LTT EXPRESS	A	Running Right Time	14:20	14:23	00:00	14:20	14:23	8	☑	☐	☐	Delete
16	97080	K	A	Running Right Time	14:27	14:29	00:00	14:27	14:29	2	☑	☐	☐	Delete

☑	Train	Train Name	A/D	Status	STA	STD	Delay	ETA	ETD	Source	Destination	PF	CoachInfo
☑	97071	K	A	Running Right...	13:01	13:02	00:00	13:01	13:02			2	
☑	01436	LTT SUR SPECIAL ...	A	Running Right...	13:10	13:13	00:00	13:10	13:13				ENG-E...
☑	11014	CBE LTT EXP ...	A	Running Late	13:08	13:10	00:13	13:22	13:23			8	ENG-SL...
☑	22101	LTT MADURAI EXP ...	A	Running Right...	13:36	13:38	00:00	13:36	13:38			7	ENG-SL...
☑	11071	KAMAYANI EXPRESS...	A	Running Right...	14:08	14:10	00:00	14:08	14:10			7	ENG-SL...
☑	97080	K	A	Running Right...	14:27	14:28	00:00	14:27	14:28			2	
☑	12164	MAS LTT SF EXP ...	A	Running Late	14:37	14:40	00:09	14:48	14:49			8	ENG-V...
☑	22178	MAHANAGARI EXP ...	A	Running Late	10:43	10:45	04:37	15:21	15:22			6	ENG-LP...
☑	12139	SEVAGRAM EXP ...	A	Running Right...	15:28	15:30	00:00	15:28	15:30			5	ENG-LP...

Reference for Main Software Home Screen

Diagram-1A



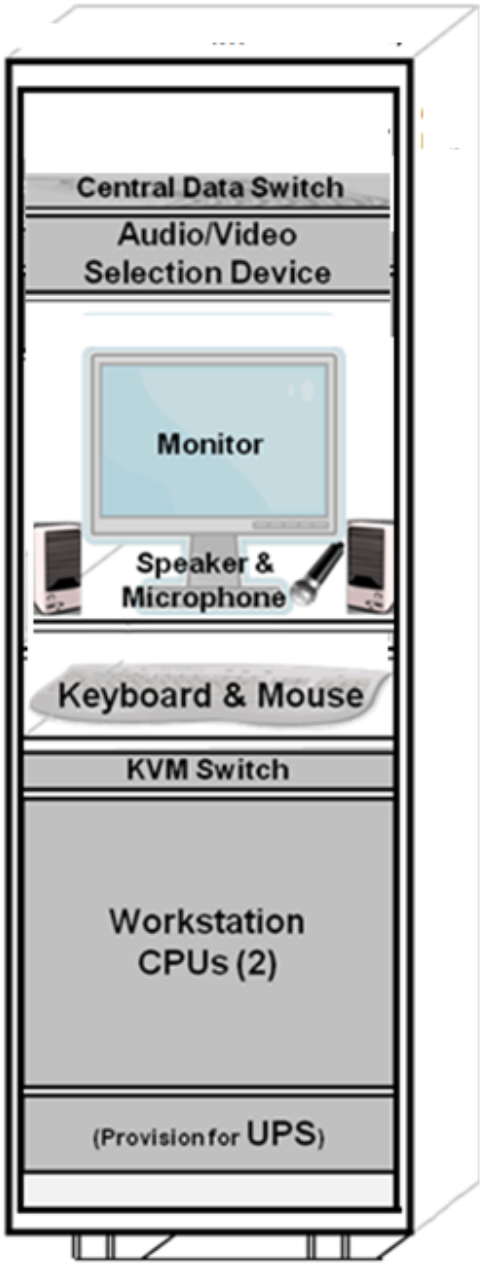


Diagram-2

Note: Equipment mentioned in CDC rack, Location is indicative only.

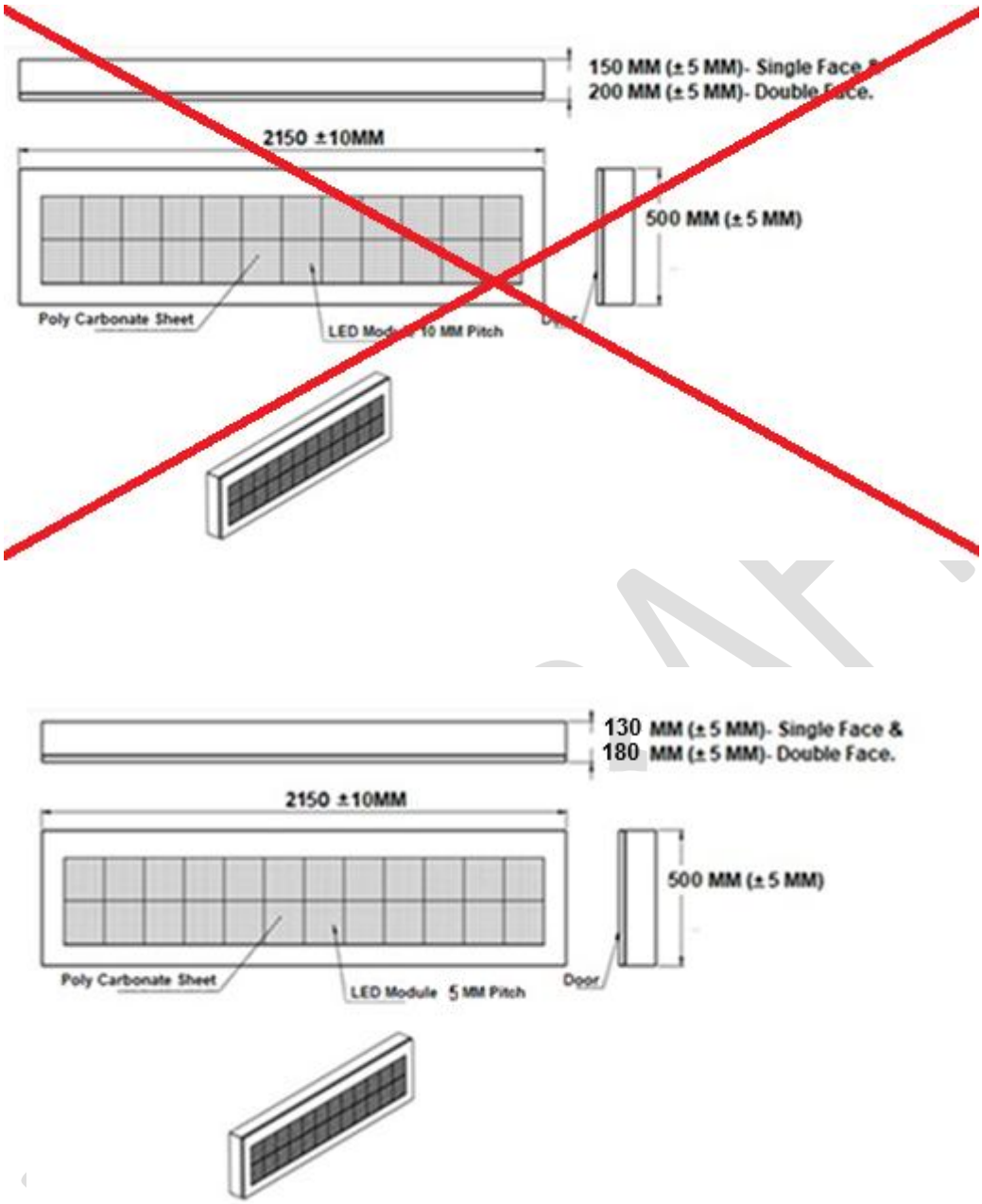


Diagram – 3

Line Diagram AGDB

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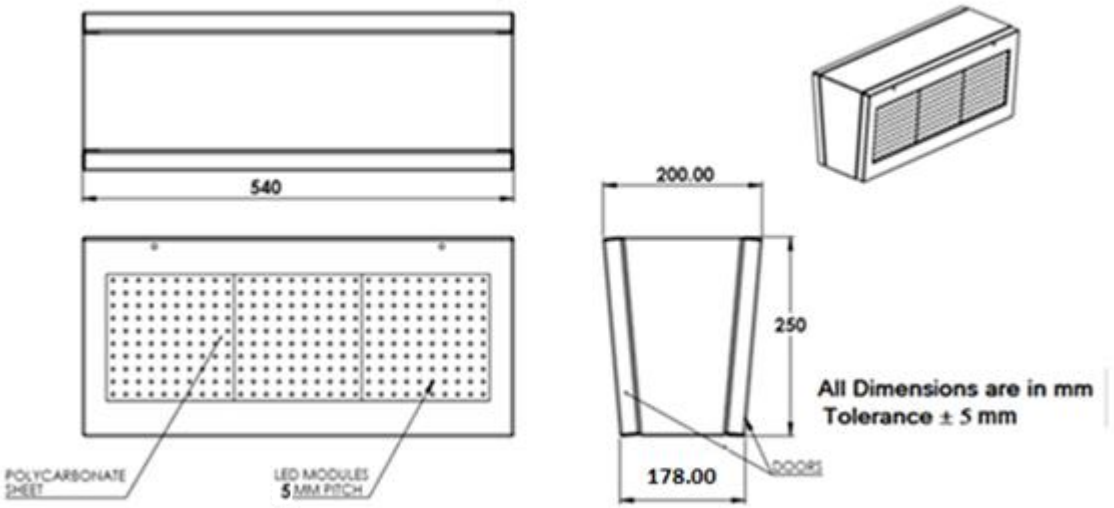

Diagram - 4

Line Diagram CGDB

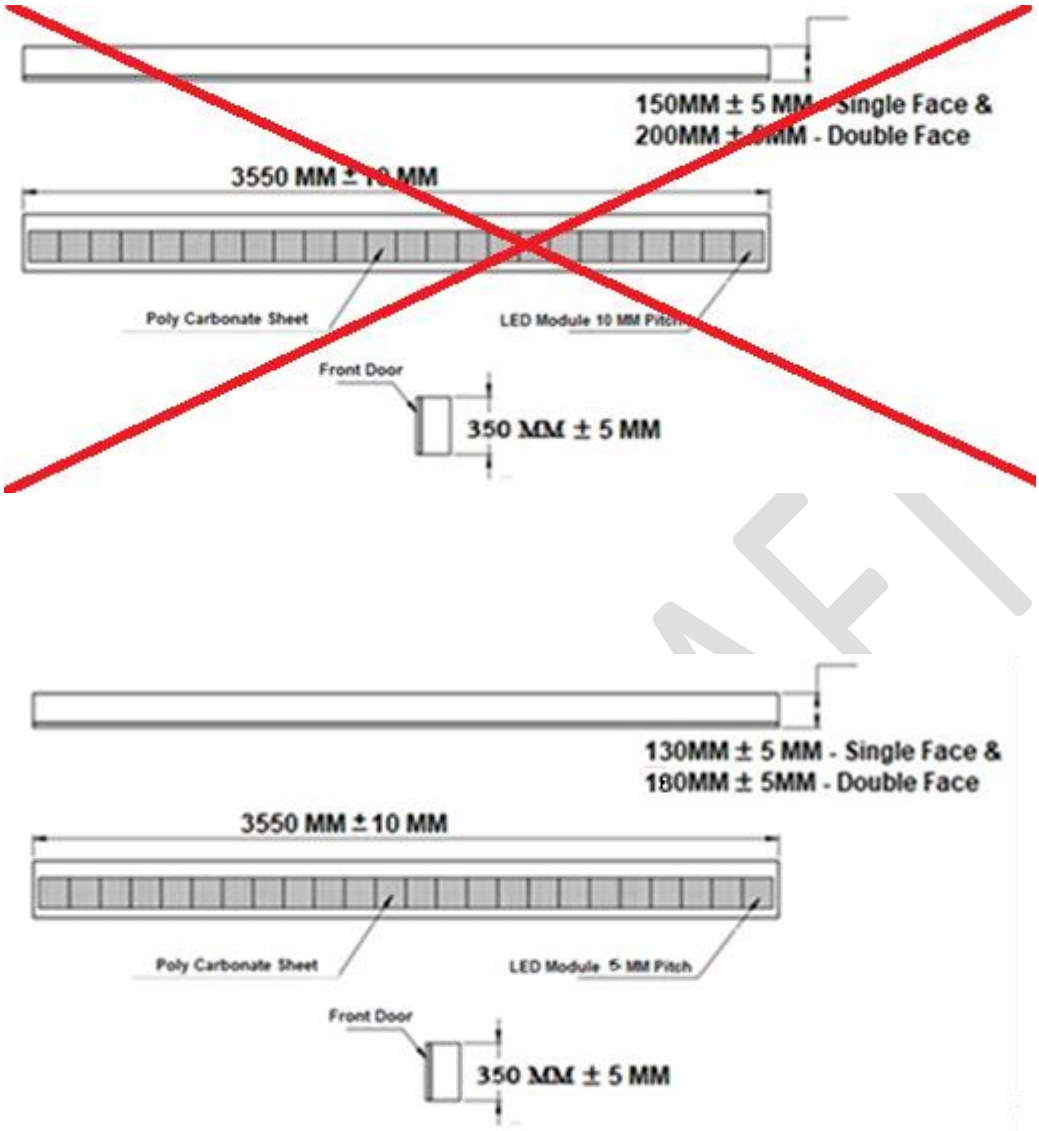

Diagram – 5

Line Diagram PFD

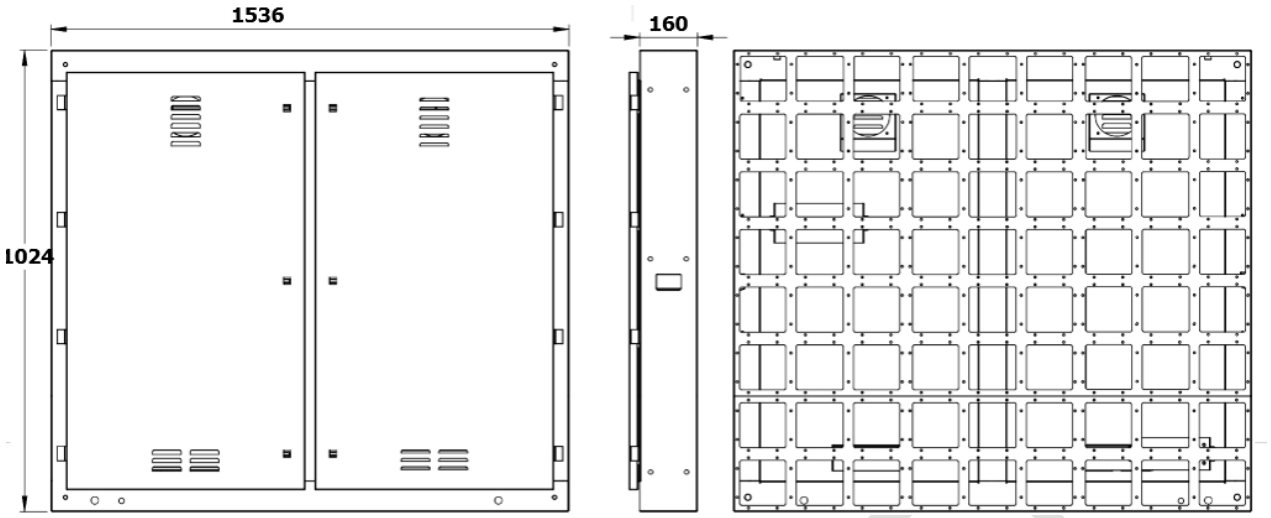

Diagram – 6

Line Diagram OVD

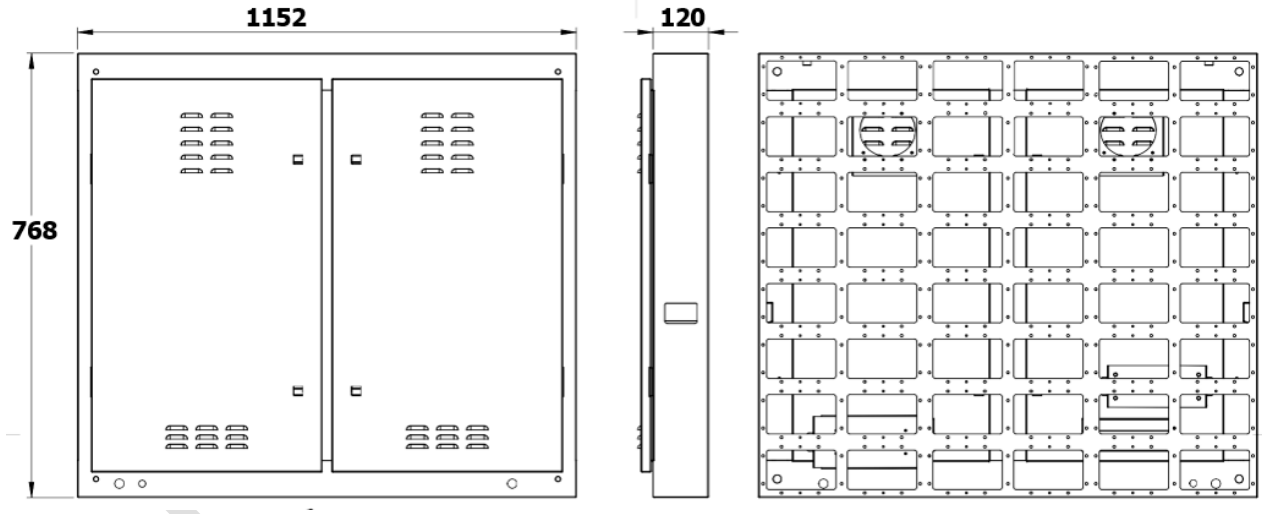

Diagram – 7

Line Diagram IVD

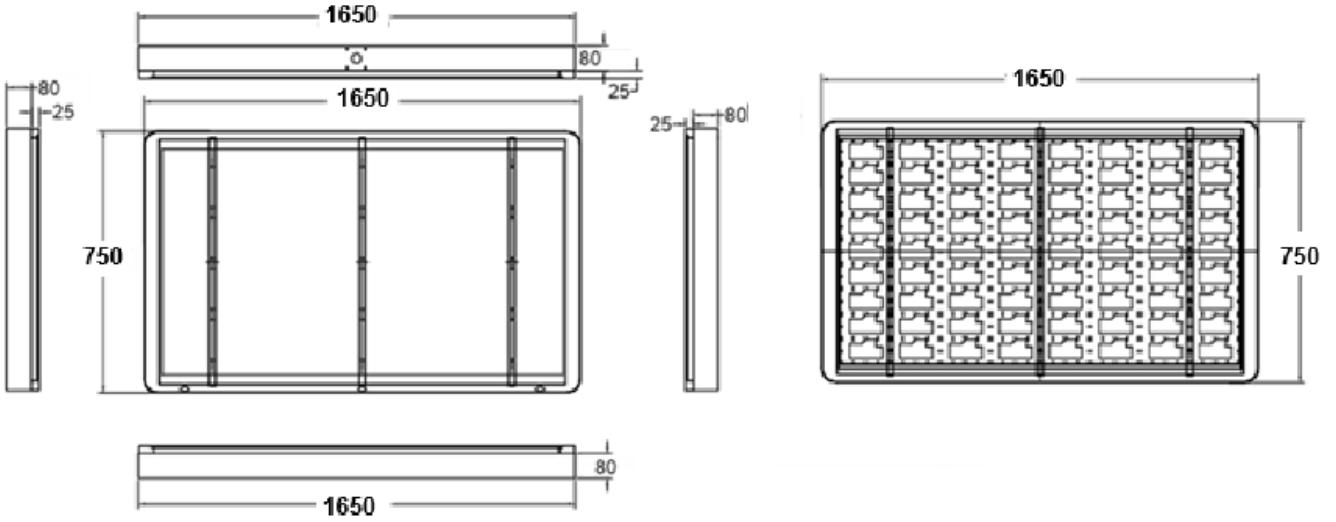

Diagram – 8

Line Diagram AVD