Suggestion/Comments on draft Specification received for IOT based real time water level indicator by different Firms from 05.04.2025 to 06.05.2025

Clause no.	Clause as Exists in RDSO Spec./ Description	M/s A-Paul	M/s Kirti Telnet Pvt.Ltd	Brainwave Labs	J K EXIM	Rittal India Pvt. Ltd.	*Notofire Pvt Ltd*	Encardio Rite	Sriveen	CRIS Comments	RT vision	RDSO Remarks
2.2	Water level indicator system for passenger coaches requires higher reliability of various components especially the critical components and reliable internet connectivity during entire journey for real time water level monitoring and syncing data with existing railway network (CRIS server). Note: During tendering the firms shall comply the eligibility criteria specified by the purchaser.	Water level indicator system for passenger coaches requires higher reliability of various components especially the critical components and reliable internet connectivity during entire journey for real time water level monitoring and syncing data with existing railway network (CRIS server). Note: During tendering the firms shall comply the eligibility criteria specified by the purchaser. In case connectivity is not available the data packets to be transmitted will be stored in the Control unit and transmitted on network availability.										**Not agreed** **Only real time data shall be updated at 15 minutes interval as old data may obsolete in due time and water level may be much lower.** **Same is also advised by CRIS in their comments,**
2.4.	Firm should posses ISO: 9001 certificate issued by International Accreditation forum (IAF) under multilateral Recognition arrangement (MLA) for its works address	Firm should posses ISO: 9001 certificate issued by NABCB accredited certification body ~~International Accreditation forum (IAF) under multilateral Recognition arrangement~~										**Agreed** **NABCB accreditation shall also be added.**

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	covering the items under manufacture, supply and installation etc. Firm should have established quality control system and organization to ensure quality of the product.	~~(MLA)~~ for its works address covering the items under manufacture, supply and installation etc. Firm should have established quality control system and organization to ensure quality of the product.										
2.5.	Firm should have well-established design facilities with qualified & competent design personnel and well established manufacturing facilities required for real time water level indicator system.	Firm should have well-established design facilities with qualified & competent design personnel and well established manufacturing facilities for electronic cards and products required for real time water level indicator system.										**Not agreed** **Too specific requirement may restrict the open competition.**
6.	DESIGN REQUIREMENTS:							We suggest that “section 6 - Design Requirements” in the draft specifications be substantially modified, to make the level monitoring system viable.				**Noted** **Same shall be reviewed during finalization.**
6.1.	System shall be designed with hydrostatic water level sensor & IoT based MPU having connectivity of	System shall be designed with hydrostatic water level sensor & IoT based MPU having connectivity of										**Not agreed** **It may be 4G /5G depending upon network availability of the operators**

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	internet using 4G/5G /LTE (M2M) through e-SIM of GSM network. In case of non availability of network automatic switching to available 3G/2G network.	internet using 4G/~~5G~~ /LTE (M2M) through e-SIM of GSM network. In case of non availability of network automatic switching to available 3G/2G network.										
6.3.	The MPU shall monitor the corresponding signal of each water level sensor for conditioning & converting into digital form for uploading on cloud platform (preferably on CRIS sever). Frequency of polling water level data along with location, battery health, date and time stamp etc shall be 15 minutes or as agreed by purchaser.	The MPU shall monitor the corresponding signal of each water level sensor for conditioning & converting into digital form for uploading on cloud platform (preferably on CRIS sever). Frequency of polling water level data along with location, battery health, date and time stamp etc shall be 1 hour or as agreed by purchaser., however using adaptive level monitoring, in case the rate of consumption is greater than 20 liters in any 15 minutes , the status will be updated to the server in such 15 minutes.										**Not agreed** **1 hour is too high to evaluate the water level and if system is out of network during intermediate cycle of polling data it may increase to 2 hour or more.**

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6.4.	The sensor calibration program (program to convert the output signal of the sensor which is in mA (milli-ampere) to a percentage) should be stored in the EEPROM of MPU unit to facilitate conversion from raw data to water level percentage. Software should be able to compensate the atmospheric pressure variation of different geographic location of pan India rail network.	The sensor calibration program (program to convert the output signal of the sensor ~~which is in mA (milli-ampere) to a percentage~~) should be stored in the ~~EEPROM~~ non voltatile memory of MPU unit to facilitate conversion from raw data to water level percentage. Software should be able to compensate the atmospheric pressure variation of different geographic location of pan India rail network.	Not possible. The sensor comes with its own calibration software, provided by the sensor manufacturer. This software may be kept separate and does not need to be installed on the MPU's controller or transmitter board. The supplier may also provide an additional test process along with the sensor					Software should be able to compensate the atmospheric pressure variation of different geographical location of pan India rail network With Barometric pressure sensor should be provided in the Main Processing unit to compensate for local atmospheric pressure variations due to weather changes and atmospheric pressure variations due to elevation of different geographic locations of pan India rail network.				**A-Paul comment : Partially agreed.** **Non volatile memory may be used as it is more generalized form.** **Kirti : not agreed** **Encardio : Partially agreed.** **Requirement of operating condition should be fulfilled irrespective of the technology adopted,**
6.5.	All MPU must have a unique ID (MAC ID of the microprocessor unit / microcontroller) registered along with the corresponding coach numbers in CMM portal (CRIS server). CRIS will map the all unique ID to Rake Link ID with running train status and				Communication between device and CRIS will always be initiated from device. Hence device will always make HTTPs get call to CRIS server for picking latest configuration.					CRIS can provide interface to map all unique ID of MPU with coaches but cannot map with rake link id as the same is also not required as we will link the coach with train using direct integration with ICMS, Also, CRIS will be		**CRIS comment : Agreed** **Clause shall be modified**

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	upcoming stations accordingly. CRIS shall use HTTPS GET or any other protocol to push data from CMM to MPU and update the unique ID of the coach if required.									able to push data to MPU if the API is being provided by the vendor to update it.		
6.6.	MPU shall have appropriate low power modes and watchdog timer to ensure that the sensor keeps running continuously and system restarts automatically in case of a software fault. For power saving of battery, MPU shall be designed to go in sleep mode, if GPS location is same for more than 6 hour and wake up every hour to check the GPS location to return the MPU in Normal mode	MPU shall have appropriate low power modes and watchdog timer to ensure that the sensor keeps running continuously and system restarts automatically in case of a software fault. For power saving of battery, MPU shall be designed to go in sleep mode, if GPS location is same for more than 6 hour and wake up and return to normal mode on detecting a movement using its on-board accelerometer. The MPU will send a packet once every 3 hours to the server as a DEVICE ALIVE indication ~~check the GPS location to return the MPU in Normal mode.~~										**Not agreed** **The requirement of checking GPS location after every hour in case of system goes to sleep mode is to be complied.**

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6.7.	The MPU should call the HTTPS GET API every 6 hours to update the database in the form of feedback from CRIS & MPU shall send data only once per cycle (i.e.15 minutes) and there should not be any repetition of data. In case of no network data shall be queued and uploaded to CRIS server as soon network restores.	The MPU should support ONE-M2M service of CDOT (based on MQTT TLS ~~call the HTTPS GET API~~ to update the database in the form of feedback from CRIS & MPU shall send data only once per cycle (i.e.one hour, modifiable to 15 minutes on occurence of higher than normal consumption) and there should not be any repetition of data. In case of no network data shall be queued and uploaded to CRIS server as soon network restores.								What type of API is required from CRIS End. (parameters etc) to update the database in the form of feedback from CRIS ?. Also, in case of no network, data shouldn't be queued as it will be a real time application and data received from the queue might be obsolete		**CRIS comment : agreed** **A-paul comment : Not agreed as CRIS has already advised for HTTPS protocol in clause 6.9**
6.8.	The data communication between the transmitter (MPU) and the receiver (CRIS server) shall be encrypted with AES 128-bit and the key for encryption/ decryption will be issued by CRIS. Further data communication protocol between the MPU and the CRIS server shall	The data communication between the transmitter (MPU) and the receiver (CRIS server) shall be encrypted with AES 256 ~~128~~-bit and the key for encryption/ decryption will be issued by CRIS. Further data communication protocol between the MPU and the CRIS server shall be MQTT TLS.			Data Encryption: HTTPs protocol is used for encryption of data in trainset. As HTTPs protocol will be used to send data from device to CRIS, no additional encryption like AES-128 bit is required. Using AES128		Enhanced Security Measures Proposed: Building upon the specified AES encryption and HTTPS protocols, security could be further bolstered by implementing Zero Trust Architecture principles, ensuring			CRIS can encrypt the data but encryption/decryption, may create unnecessary overhead for the application and introduce delay in processing the data, which is expected to act nearly real time. Also, as no sensitive data is being received there		**Cris and JK Exim comment : agreed** **Clause shall be modified as per minimum requirements to fulfill the need of communication without need of encryption to avoid any delay in processing.**

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	be HTTPS.	~~HTTPS~~.			bit encryption will create a lot of issues and overheads on CRIS server to decode the encrypted data and also manage so many AES keys for each coach in not practical. From scalability point of view, it is not recommended to use AES-128 bit encryption over SSL as data is also not sensitive. In case of PII (Personal Identiable Information) like credit card or storing username password, we use AES-128 bit encryption.		secure boot processes for the MU and incorporating robust signed Over The Air (OTA) firmware update mechanisms. Network Segmentation to isolate the WLI system from other networks would also add a significant Layer of security			is no such need.		
6.9.	Communication protocol for transceiver between MPU and CRIS server shall be as per cloud service provider (preferably CRIS). Details of communication protocol shall be									All the communication will be on https protocol with token-based security wherein token is required to be sent to server in form of header for each communication		**Agreed** **Clause shall be modified accordingly to specify CRIS requirement of JSON format data.**

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	shared by CRIS during design stage / installation & commissioning.									. All the data will be shared in json format as being done currently.		
6.10.	MPU shall be capable of sending broadcast / RCS messages to all predefined numbers of concerned watering supervisors at next watering stations enroute.	The MPU shall be tracked at CRIS servers, that shall send ~~MPU shall be capable of sending~~ broadcast / RCS messages to all predefined numbers of concerned watering supervisors at next watering stations enroute							Most of the additional functionality desired in this MPU is already available in the MPU of PAPIS. There is no need to duplicate the features. It should be mentioned that this product should Integrate with PAPIS wherever possible. If not, a smali MPU with functionality to send recuired information to CRIS Server/authorized phone numbers would be enough. Does the MPU have to send the messages directly or route them through CRIS server? Responsibility of identifying .. the. phone	CRIS is already handling these messages sending to next watering station supervisor in case of critical alerts. CRIS will also provide interface to update contact no of station watering supervisors. If this functionality is provided by the MPU then Railways need to take a call to remove the redundancy of the functionality.		**Agreed with CRIS** **Clause shall be suitably modified to avoid redundancy of MPU sending broadcast messages to concerned watering supervisors.**

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									number should be-with concerned Railway, and this should be mentioned in the specification			
6.12.	CRIS shall update the database of each coach by using the link between the Unique ID, Rake link ID and coach number already filled by the depots in the water level fitment form.									This is already implemented in CMM application. CRIS can provide interface to map all unique ID of MPU with coaches but cannot map with rake link id as the same is also not required as we will link the coach with train using direct integration with ICMS. CRIS will push data to MPU through API provided by the vendor to update it. Details of the API including communication protocol may please be shared with CRIS in advance.		**Agreed with CRIS** **Clause shall be modified**

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6.13.	A WEB interface shall be developed by CRIS for monitoring the water level, viewing on PC/Mobile apps train rake wise, depot wise, zone wise of all coaches by all concerned users at watering station, depot, zone etc and automatic alert messaging to the concerned train supervisor of next upcoming watering station.									This is already implemented in CMM application. The following suggestions are proposed for inclusion in the specification: 1. All data generated by the WLI system shall be the exclusive property of Indian Railways. it shall retain full rights to use, manage, and distribute this data at its discretion. 2. The Vendar/Supplier shall not store, publish, or transmit any data generated by the system to any server, cloud service or external storage, solution unless explicitly authorised by Indian Railways.		**Agreed**
7.	TECHNICAL REQUIREMENT							We suggest that “section 7 – Technical Requirement”				**Noted**

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								in the draft specifications be substantially modified, to make the level monitoring system viable.				
7.1.	Main processing unit (MPU) shall be designed with 32 bit Microprocessor / microcontroller based system with inbuilt e-SIM LTE (M2M) module, Wi-Fi module, Bluetooth Low Energy (BLE) module, GPS module for real time location & USB, RS232 and RS485 ports etc. it should have Minimum 16 channel A/D Converter (analogue to digital converter) and 16 channel DIO (digital input output) port should be onboard to handle future up-gradation of the system, system shall also have Ethernet port and VGA/HDMI port along with system software and application program for easy	MAIN PROCESSING UNIT Main processing unit (MPU) shall be designed with 32 bit Microprocessor / microcontroller based system with inbuilt e-SIM LTE (M2M) module, ~~Wi-Fi module,~~ Bluetooth Low Energy (BLE) module, GPS module for real time location & USB, ~~RS232 and RS485 ports etc~~. it should have Minimum 16 channel A/D Converter (analogue to digital converter) ~~and 16 channel DIO (digital input output) port should be onboard to handle future up-gradation of the system, system shall also have Ethernet port and VGA/HDMI port along with system software and~~	MPU shall be designed with a 32-bit microcontroller-based system with inbuilt e-SIM LTE (M2M), BLE, GPS, USB, minimum 4-channel ADC and 4-channel DIO, and Ethernet, along with system software for configuration. **Justification-** To conserve power in lithium battery-based systems, MCUs are preferable due to lower consumption. BLE is suggested over Wi-Fi for energy efficiency. Fewer DI/DO channels reduce board size. VGA/HDMI should be removed due to lack of utility in coaches and increased cost. OTA firmware updates and VAPT certification						Wi-Fi module Frequency bands and distance to be specified. Bluetooth Low Energy (BLE) module-BLE version and Class to be specified. What is the potential use of Wifi & BLE? What is the need for additional A/D and DIO ports? What is the need for Ethernet and VGA/HDMI ports? This will unnecessarily increate the cost of the system. It is best to interface a smaller MPU unit with MPU of PAPIS. Most of the additional functionality desired in this MPU is already available in the MPU of PAPIS. There is no need to duplicate the features. It should be mentioned that this product should Integrate with PAPIS wherever possible. If not, a smali MPU with functionality to send recuired information to CRIS Server/authorized phone numbers would be enough.		USB may be used for configuration, log reading, debugging, etc. It is necessary for easy configuration and one-time firmware download. Since the USB peripheral will be built into the MCU, battery consumption will be limited to short durations, and overall cost will be reduced. 2. Additional 16 ADC inputs and 16 DIO inputs may also be included, as they do not significantly impact the cost and are integrated within the MCU. The selected MCU will be a high-performance, feature-rich device with precise ADC capabilities. However, Wi-Fi and BLE modules do impact battery consumption and cost. Since their use is mentioned in the document for future upgrades, battery specifications	**Agreed** **Specification of MPU regarding VGA/HDMI port shall be suitably modified as recommended by stakeholders. However other requirements of Wi-Fi and BLE module to be retained for future other applications of coaches. same is also advised by CRIS.**

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	configuration of the system.	~~application program for easy configuration of the system~~	are recommended for security.								may be improved in the future to support longer battery life. There is no issue in provisioning Wi-Fi and BLE modules, as many cost-effective modules are available with both capabilities integrated. And it is easily interfaced with Host MCU using standard protocols. The WLI system does not require high-speed or wired LAN communication. Strictly Recommended not keep provision of Ethernet or VGA or HDMI interface.	
7.2.1.	Main processing unit, battery pack and other electronic circuit shall be enclosed in a Stainless steel (AISI 304) enclosure unit (preferable size 300mm x 300mm x 150 mm) & shall have IP65 ingress protection. Enclosure unit and system shall have IK-10 rating for impact resistance to withstand ballast hit etc.	Main processing unit, battery pack and other electronic circuit shall be enclosed in a Stainless steel (AISI 304) or fire retardant polycarbonate enclosure unit (preferable size 300mm x 300mm x 150 mm) & shall have IP65 ingress protection. Enclosure unit and system shall have IK-10 rating for impact resistance to withstand ballast hit etc.	MPU, battery pack, and electronics shall be enclosed in SS (AISI 304) with IP65 ingress protection and IK10 impact resistance. **Justification-** Provides robust protection against dust, water, and impacts like ballast hits, ensuring reliable performance in harsh conditions.			**SUGGESTION** - Main processing unit, battery pack and other electronic circuit shall be enclosed in a Stainless steel (AISI 304) **(1.4301 (V2A) with 1.5mm thickness folded and tig welded from a single piece with protection channel around the door opening**, enclosure unit						**A Paul comment not agreed : Only SS material to be used for enclosure.** **IS:17050 standard equivalent to EN 50102 and IEC 62262 standards shall be incorporated for IK10 rating.** **Clause shall be suitably modified.**

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						(preferable size 300mm x 300mm x 150 mm) & shall have IP65 ingress protection **as per IEC 60 529, PU foam gasket with sustainable IP throughout product life**. Enclosure unit and system shall have IK-10 rating for impact resistance to withstand ballast hit etc **as per EN 50102/IEC 62262**.						
7.2.2.	Enclosure unit shall be mounted under slung with suitable brackets on cross member of under frame with the help of prevailing torque type nut bolt. Provision of connection of level sensor shall be done through M12 4 pole A-coded male connector provided on Enclosure unit. Antenna and other connections shall be suitably			**Placement of Control Unit:** Control unit can be placed behind the door panel, inside the coach. However necessary provision should be made to keep the GPS antenna outside. This will ensure the safety of control unit and battery.					**It is best to have the MPU inside the coach difficult to have mounted under-slung. Moreveor, there is no benefit to have this under slung, Further, for AC coach under slung water tank the M22 connector is possible only at MPU side. Please**			**Not agreed for alternate location.** **Majority of responses have agreed with specified location.** **As other location will require more wiring. Thus making system prone to failure due to wire damage /cut etc.** **Location of fitment shall be incorporated in**

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	sealed to prevent ingress of dust and water.								**mention at the tank/sensor side needed**			**the final draft spec.**
7.2.4.	Necessary test certification for compliance of EN50155 specification shall be done on one system for design validation by national accredited labs for this purpose					**SUGGESTION -** Necessary test certification for compliance of EN50155 specification shall be done on one system for design validation by national accredited labs for this purpose. **Enclosure should have UL certified and manufactured in accordance with IEC 62208.**						**Not Agreed** **Complete system should be compliant to EN 50155/EN 60571.**
7.3.	4G/LTE MODULE, The SIM module shall have 4G network support with 2G fallback using M2M eSIM with URL white listing. It should be from reputed vendors like SimCom, Quectel, etc. It should be provided with a good antenna tuned for 4G and 2G having a minimum gain of	4G/LTE MODULE, The SIM module shall have 4G network support with 2G fallback using M2M eSIM with URL white listing. It should be from reputed non-border country vendors like ~~SimCom,~~ ~~Quectel~~, Telit , Sierra Wireless etc. It should be provided with a good internal antenna tuned for										**Partially agreed : for non border country vendors.** **Clause shall be modified suitably.**

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	3dBi. The SIM module should be GNSS-supported so that the current location of the train can be sent to the CRIS server. E-SIM provided in IOT shall have active data and SMS through leading GSM service provider with national roaming for pan-India connectivity.	4G and 2G having a minimum gain of 3dBi. ~~The SIM module should be GNSS-supported so that the current location of the train can be sent to the CRIS server~~. E-SIM provided in IOT shall have active data and SMS through leading GSM service provider with national roaming for pan-India connectivity.										
7.4.1.	Level sensor type shall be hydrostatic pressure transducer of Reputed make RS Pro, Siemens, TE or any other make with prior approval of RDSO, suitable for fitment on ¼" BSP threaded socket of water tank piping and shall be capable to measure absolute pressure. Following common specification shall be followed for the water level Sensor Level sensor body - stainless steel 316L IP rating of sensor - Minimum IP-65 & above Diaphragm - Piezo-Resistive Ceramic Operating voltage -10V to 30 V D.C. Load /impedeance - ~ 500 Ohm Measuring range - 0 to 1Meter water column. Response time - ~	iv. Operating voltage - ~~10V to 30 V~~ 5 D.C.			Sensor Type: Using Pressure transmitter before the Water Lifting pump and after filter Water column is not required because an additional piping arrangement has to be made. It will also serve as same as mounting pressure transmitter / transducer on a common pipe feeding to Water Lifting		We at Notofire Private Limited, would like to inform you that we shall be using the Hydrostatic Pressure Transducer of make RS Pro, Siemens and also propose to use our own make Hydrostatic Pressure Transducer, datasheets relevant to our Notofire make Hydrostatic	Absolute Pressure Sensor to be used for the application are: i. Level sensor body Stainless steel 316L ii. Type Absolute pressure sensor iii. IP rating IP-68 iv. Range +/- 3.5 m of water column v. Over range > 100 % vi. Inaccuracy < 1 % FS vii. Full span output 10 V or digital viii. Interface connection ¼" BSP male thread			**The important selection criteria for Hydrostatic Pressure Sensors, for interchange-ability purposes, are as follows:** • Output Measured Pressure Type:(ex-Absolute) •Output signal Type: (ex- 4-20mA) • Supply Voltage Range: (Example: 10-30V)	**No change required in clause.** **However more makes of sensors and absolute pressure sensor requirement may be added.**

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Clause no.	Clause as Exists in RDSO Spec./ Description	M/s A-Paul	M/s Kirti Telnet Pvt.Ltd	Brainwave Labs	J K EXIM	Rittal India Pvt. Ltd.	*Notofire Pvt Ltd*	Encardio Rite	Sriveen	CRIS Comments	RT vision	RDSO Remarks
	500 ms Accuracy - 99 % Interface connection - 1/4" BSP male Thread Cable length - To suit the requirement with M12 socket 4 pole A coded connector.				Apparatus. Necessary calibration can be made for slight difference. This approach can be easily maintainable from Railways perspective.		Pressure Transducer shall be shared with RDSO before use of the same with prior approval from RDSO	ix. Cable Fire retardant as per RDSO specifications ELRS/SPEC/ELC/0019 x. Cable length To suit requirement for connection to data logger			•Connection Interface as M12 socket A coded • Fitting Type as ¼ BSP Male Thread. • Measuring Range as Pressure measuring capacity	
7.5.	Power requirements for power supply of MPU shall be met with Lithium Iron Phosphate (Li-$FePO_4$) / Lithium Thionyl Chloride ($LiSOCl_2$) Batteries only, which should last for at least 6 months without recharge / exchange. Specification of Lithium Iron Phosphate (Li-$FePO_4$) Batteries shall be as below: Battery Type: Lithium Iron Phospha	Min Voltage of Battery Pack- ~~10 V~~ 3.3V-3.6V use of parallel cells is more energy effiient as no power is dissipated across internal resistance of series cells. We request 3.6V battery pack be permitted. This is the standard voltage of a lithium thinyl pack recommended by RDSO. Higher operating	A- Minimum xxAH battery capacity to support 6 months of operation. **Justification-** Battery sizing should be left to system developers as long as the 6-month operational life requirement is met. This allows design optimization. B- List of certifications to be specified under IEC/EN standards.	Battery Certifications- UN 38.3 (Recommended) **Description-** Safety of lithium batteries in transport. Battery Certifications- IEC 62133 / UL 1642 (Recommended) **Description-** Battery safety (charging, discharging, etc.).	Battery voltage - 12.8V LFP with min 10V and max 14.5V.		Strengthened Operational Stability: To complement the watchdog timers and network fallback consider incorporating dual SIM / eSIM capabilities for enhanced network resilience in diverse terrains. Exploring redundant power sources or enhanced battery management systems beyond the 6 month target could further improve uptime. Physical tamper detection on		We believe that battery pack is not required. It would add unnecessary complication and cast, and would be very difficult to find space for this.		Safe for Battery Operation : These components are feasible with 48Ah battery over 6 months: • RS232 • RS485 • Wi-Fi + BLE If the design aims for 6 months of battery life: • Avoid using Ethernet and VGA/HDMI. • RS232, RS485, and Wi-Fi/BLE are acceptable, especially with smart power management (e.g., sleep modes).	**Partially agreed** **Battery pack min voltage may be made as recommended 3.3V-3.6V.** **But battery should last at least 6 months as specified or more.**

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		te / Lithium Thionyl Chloride	voltages (such as 5V), if required by the designer, can be generated inside the MPU by use of boost regulators.					the enclosure unit could also provide valuable alerts.					
	Max Voltage of Battery Pack	12.6 to 12.8V											
	Min Voltage of Battery Pack	10 V											
	Capacity of Battery Pack	Minimum											