



# RMS-N100

## Railway Facility Monitoring Suite

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**RMS-N100** is the end-to-end total solution for monitoring railway facilities and train equipment, significantly reduces maintenance cost, enables pre-emptive actions to prevent railway accidents.



**RMS-N100**  
RAILWAY FACILITY  
MONITORING SUITE

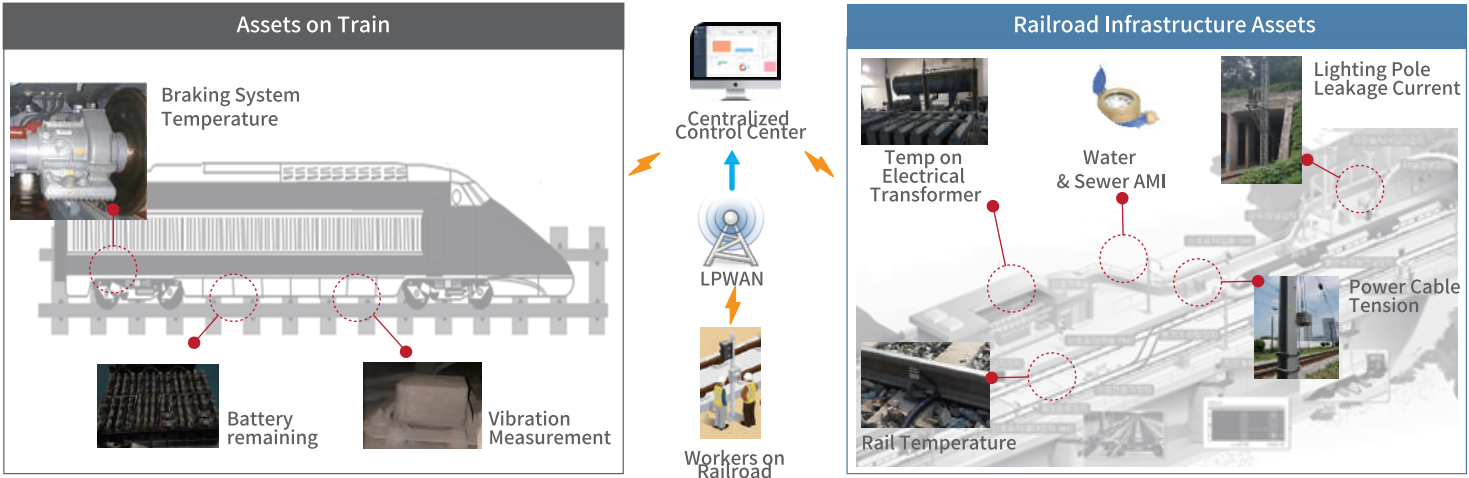


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## Railway Facility Monitoring Suite

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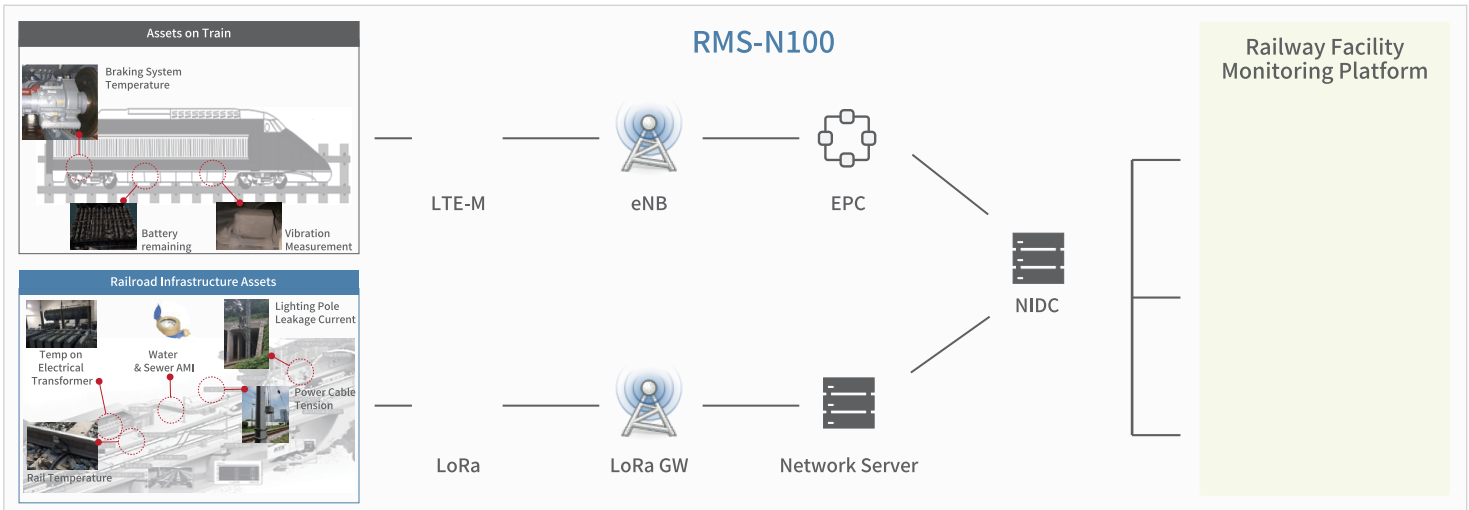
**High Quality maintenance** enabled by 24/7 real-time monitoring for railway assets and preventive actions to problematic parts.

**Improving work safety** by Identifying work/accident area and alerting both workers and drivers as the train approaches.

### Significant Maintenance Cost reduction

by predicting optimized maintenance window based on real-time analysis on the problematic parts.

### SERVICE DIAGRAM



- Automatic Tension Device
- Rail temperature monitoring
- Transformer temperature monitoring
- Leakage current monitoring
- Rolling stock Bogie vibration monitoring
- Speed reducer temperature monitoring
- Battery voltage monitoring
- Water metering
- Alert of working site / accident area
- Bearing temperature monitoring
- Engine Coolant temperature monitoring

### Commercial references

2017	KoRail	Monitoring of railway facilities and train equipment Custom designed devices & Network Server & Monitoring platform	3 items of vehicles 5 items for facilities
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# AUTOMATIC TENSION DEVICE MONITORING

## SPECIFICATION

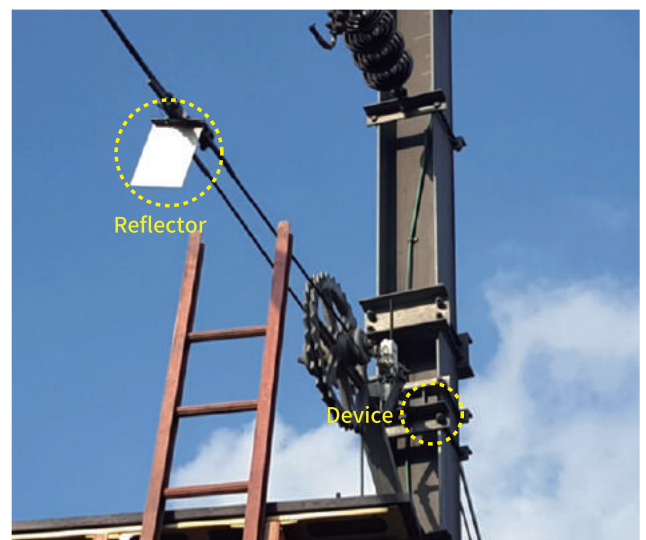
Item	Specification
Size(mm)	86 x 130 x 52
Material	PC(polycarbonate) + UV
Sensor	Air Temperature Sensor x 1 Ultrasonic Wave Sensor x 1
Applicable Object Automatic Tensioning Device	Tension, Spring
Communication	LPWA (LoRa)
Antenna	External Antenna x 1
Battery	17,000 mAh

## BACKGROUND

- Currently, on-site visual inspection is a common way to find the defects on Automatic Tensioning Device.
- Defects on Automatic Tensioning Device can result in interruption of train operation or accidents by failing to control the tension of overhead cables.
- Need for a monitoring system that immediately detects the fault of Automatic Tensioning Device due to abnormal high temperature.

## FUNCTION

- Measuring the tension of the cable to the Reflector using Ultrasonic Sensor
- Monitoring the tension trend along with the air temperature measured by Temperature Sensor
- Alarming when the loss of tension exceeds the configured threshold
- The period of data transmission is configurable.



# RAIL TEMPERATURE MONITORING

## SPECIFICATION

Item	Specification
Size(mm)	86 x 130 x 52
Material	PC(polycarbonate) + UV
Sensor	Air Temperature Sensor x 1 Ultrasonic Wave Sensor x 1
Applicable Object Automatic Tensioning Device	Tension, Spring
Communication	LPWA (LoRa)
Antenna	External Antenna x 1
Battery	17,000 mAh

## BACKGROUND

- Rail can contract or expand significantly along with temperature variation.
- Consistent exposure to high temperature may cause buckling in a rail, which can lead to serious railway accidents e.g., derailment.
- Rail temperature monitoring includes correlation analysis between rail temperature and air temperature
- Rail temperature monitoring enables pre-emptive actions and efficient maintenance to prevent rail accidents.

## FUNCTION

- Monitoring the rail temperature using magnetic rail thermometer being attached to the side of the rail.
- Specially manufactured Installation Unit to adjust the rail thermometer to the rail.
- Simultaneous measuring of rail temperature and air temperature.
- Alarming when the temperature exceeds the configured threshold.



# TRANSFORMER TEMPERATURE MONITORING

## SPECIFICATION

Item	Specification
Size(mm)	86 x 130 x 52
Material	PC(polycarbonate) + UV
Sensor	Air Temperature Sensor x 1 Ultrasonic Wave Sensor x 1
Measured Temp.	-55°C ~ 125°C
Communication	LPWA (LoRa)
Antenna	External Antenna x 1
Battery	17,000 mAh

## BACKGROUND

- The defect of transformer or cable may cause abnormal increase of temperature at the connection point of transformer cable.
- Currently, the temperature is measured manually using thermo-graphic camera in general.
- Transformer temperature monitoring automates the high temperature detection and enables pre-emptive actions to prevent power failure.

## FUNCTION

- Measuring temperature using contact-type temperature sensor at the connection point of transformer cable
- Temperature sensor to be insulated to minimize the influence of high voltage
- Alarming when the temperature exceeds the configured threshold



# LEAKAGE CURRENT MEASUREMENT OF LIGHTNING ARRESTOR

## SPECIFICATION

Item	Specification
Size(mm)	86 x 130 x 52(Device) 95 x 98 x 31(Sensor)
Material	PC(polycarbonate) + UV
Sensor	Current measuring Sensor (CT Sensor) x 1
Gauge Span	0.00mA ~ 60A (AC), Accuracy 0.01mA
Communication	-20°C ~ 50°C
Antenna	LTE-M

## BACKGROUND

- Leakage current flows through the ground wire of the arrestor located at the entrance of the tunnel, and into the rail.
- Currently the leakage current is measured manually using portable sensor and workers are exposed to the electric shock by more than 25,000 kV high voltage.
- The monitoring system to measure the leakage current of the arrestor significantly reduces the danger of workers and enhance the maintenance efficiency.

## FUNCTION

- Measuring the current variation by installing the current sensor for the ground wire of the arrestor
- Device and sensors are installed in the enclosure to be protected from external environment.
- Constant power is supplied for frequent measuring and short period of time for data transmission.
- The threshold and data transmission period are configurable.



# ROLLING STOCK BOGIE VIBRATION

## SPECIFICATION

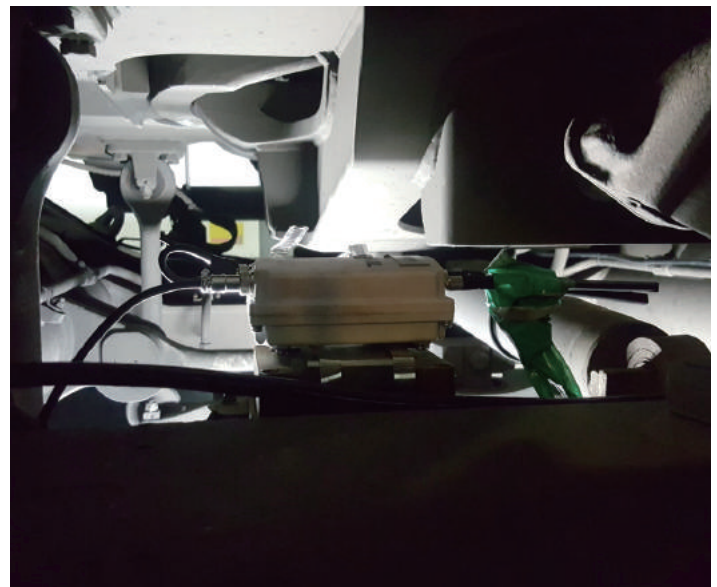
Item	Specification
Size(mm)	86 x 130 x 52
Material	PC(polycarbonate) + UV
Sensor	Tri-axial acceleration sensor x 1
Measured Temp.	±2g, accuracy 0.25mg
Communication	-40°C ~ 85°C
Antenna	LTE-M
Battery	External Antenna x 2

## BACKGROUND

- Abnormal vibration of bogie frame can cause derailment of the train.
- The train is equipped with the vibrometer, but the level of vibration can be checked only from the driver's compartment.
- The monitoring system for bogie vibration enables continuous and centralized maintenance of rail car wheels to provide safe and efficient railway operations.

## FUNCTION

- Measuring the vibration by installing the sensor on top of the vibrometer.
- Measuring and monitoring of x, y, z axis using multi accelerometer.
- Using the power of the train battery for constant supply.
- The thresholds for each x, y, z axis are configurable.





# ROLLING STOCK SPEED REDUCER TEMPERATURE MONITORING

## SPECIFICATION

Item	Specification
Size(mm)	86 x 130 x 52
Material	PC(polycarbonate) + UV
Sensor	Temperature Sensor x 1
Gauge Span	-55°C ~ 125°C
Measured Temp.	LTE-M
Communication	External Antenna x 2

## BACKGROUND

- Abnormal high temperature produced by a Speed Reducer in a braking system is regarded as a defect.
- In general, the reducer should be detached from the train to measure the temperature, therefore it has not been possible to measure the temperature during the operation.
- The monitoring system enables real-time monitoring of the reducer temperature to prevent malfunction of the braking system.

## FUNCTION

- Bolt type temperature sensor is installed at the joint of reducer for temperature monitoring
- Alarming when the temperature exceeds the threshold during the operation.



# ROLLING STOCK BATTERY VOLTAGE MONITORING

## SPECIFICATION

Item	Specification
Size(mm)	86 x 130 x 52
Material	PC(polycarbonate) + UV
Voltage measurement	Using ADC, by connecting to the train battery
Gauge Span	0 V ~ 100 V
Communication	LTE-M
Antenna	External Antenna x 2

## BACKGROUND

- In the train, multiple rechargeable batteries are serially connected and continuous recharging and discharging reduces output voltage which causes problem in power supply.
- Currently, voltages of each cell is manually measured on site on a daily basis.
- The monitoring system for battery voltage enhances maintenance efficiency by identifying problematic battery cells.

## FUNCTION

- Measuring the voltage using ADC by connecting the device to the train battery
- Installing the device on top of the battery
- Real-time measurement and data transmission



# SMART METERING OF WATER USAGE

## SPECIFICATION

Item	Specification
Size(mm)	165 x 108 x 44
Material	PC(polycarbonate) + UV
Measuring Method	TTL(UART)/RS-232C/Pulse
Operating Temp.	-20°C ~ 60°C
Communication	LPWA (LoRa)
Battery	17,000 mAh

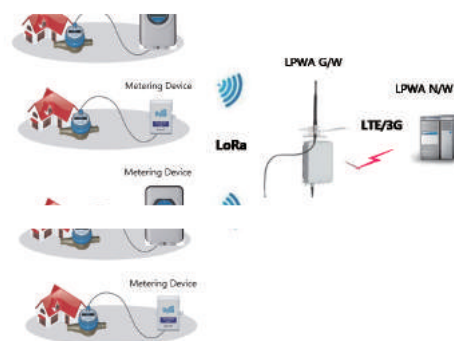
## BACKGROUND

- Remote, automatic measuring of the water usage through the digital water meter installed in customer's houses.
- Remote accessibility reduces the labor cost by reducing the onsite visit to check the water meter.
- Constant monitoring of water usage prevents fabrication of data and enables usage pattern analysis.

## FUNCTION

- Installing digital water meter and device for remote metering
- Able to check the water usage onsite as well through external LCD of the device
- Hourly measuring and data transmission in every 6 hours (4 times/24 hours)
- Battery life : approx. 5 years

## ARCHITECTURE

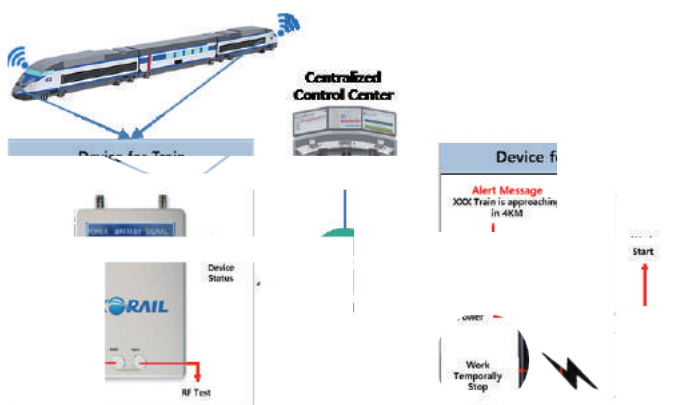


# ALERTING OF TRAIN APPROACH FOR RAILWAY WORKERS

## SPECIFICATION

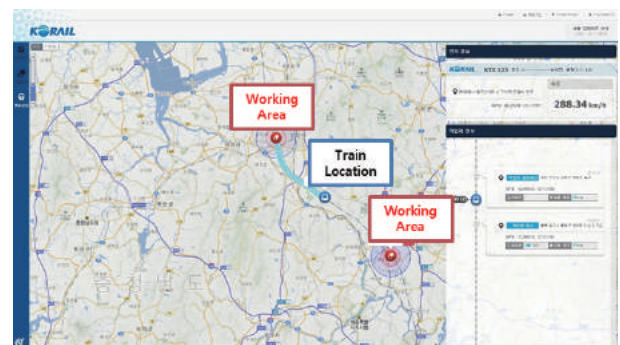
ITEM	SPECIFICATION	
	VEHICLE DEVICE	WORKER DEVICE
Communication	LPWA (LoRa)	LPWA (LoRa)
Sensor	GPS	GPS
Power	Constant power + battery for emergency	Rechargeable battery(1,000mAh)
Output UI	LCD	LCD, vibration, Speaker (over 100db)
Input UI	Power button, Signal test button	Power, Operation start, Operation end, Pause
Size(mm)	150 x 80 x 20	140 x 60 x 10

## SOLUTION ARCHITECTURE



## SERVICE SCENARIO

- Transmitting the location of the train in real-time.
- Transmitting the location of construction worker's device in real-time.
- Along with the train approaching the working area, the monitoring system transmits the alert to worker's device and the device sets off the audible and visual alarm and vibration as well.



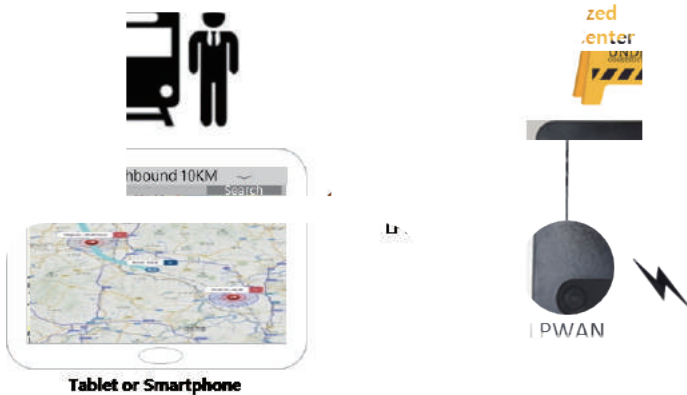
# WORKING / ACCIDENT AREA ALERT FOR TRAIN DRIVER

## SPECIFICATION

Item	Specification
LoRa	LPWA 917MHz ISM and the 868MHz ETSI
GPS	U-blox M8 Concurrent GNSS modules
Max.Current	144mA @ 3.8V
Sleep.Current	19µA @ 3.8V
Operating Temp	-30 °C ~ 70 °C
Storage Temp	-40 °C ~ 85 °C
Status LED	Battery (4Level), Information 2EA

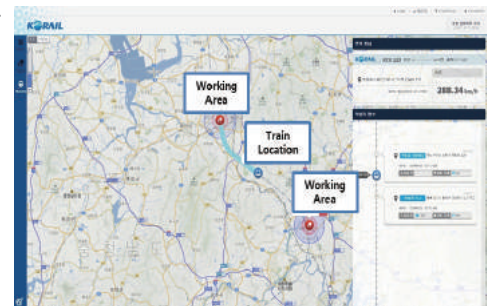


## SOLUTION ARCHITECTURE



## SOLUTION ARCHITECTURE

- Turning on Construction Info Device.
- The system collects the location information of the construction/ accident site in real-time and broadcasts to driver's devices.
- The location information is displayed on train driver's tablet or smartphone.
- When the train approaches the site, the device sets off the alarm to train drivers.



# ENGINE COOLANT LEVEL MONITORING

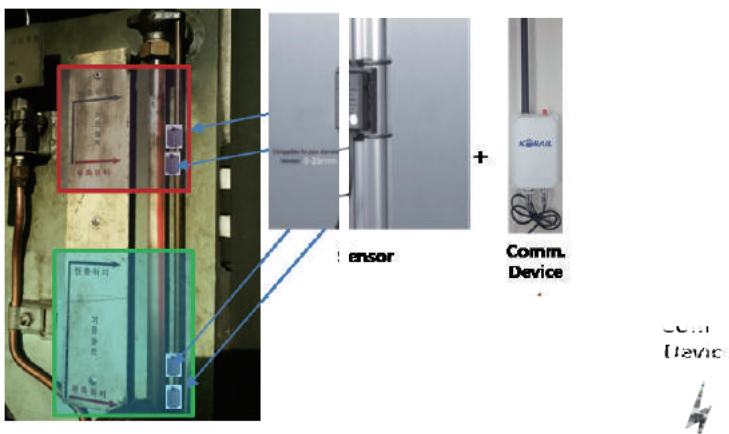
## SPECIFICATION

Item	Specification
Size(mm)	86 x 130 x 52
Material	PC(polycarbonate) + UV
Sensor	Contactless Capacitance Sensor x 1
Accuracy	± 1L
Communication	LPWA (LoRa)
Antenna	External Antenna x 1

## BACKGROUND

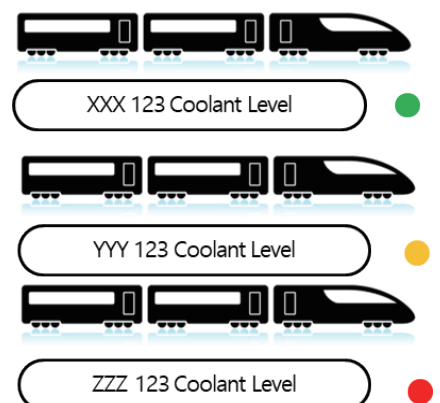
- Inefficient train operation is caused by manual checking of the Coolant level of engines.
- Monitoring the level of Coolant enables predictive maintenance and enhances the operational efficiency by identifying problematic engines.

## SOLUTION ARCHITECTURE



## SOLUTION ARCHITECTURE

- Checking the level of engine coolant If Coolant level is higher than the threshold, the system generates alarm for maintenance check.
- The analytic system provides predictive maintenance for each train's break system maintenance period



# TRAIN BEARING TEMPERATURE MONITORING

## SPECIFICATION

Item	Specification
Size(mm)	86 x 130 x 52
Material	PC(polycarbonate) + UV
Sensor	Temperature Sensor x 1
Gauge Span	-55°C ~ 125°C
Communication	LTE-M
Antenna	External Antenna x 2

## BACKGROUND

- Inefficient train operation is caused by manual checking of the temperature of wheel bearings and can lead to longer maintenance time.
- The monitoring system for the temperature of wheel bearing enables predictive maintenance and enhance the operational efficiency by identifying problematic wheel bearing.

## SOLUTION ARCHITECTURE



Comm.



## SERVICE SCENARIO

- Automatic gathering of wheel bearing temperatures
- If temperature is higher than the threshold, the system alert to train driver and maintenance team
- The analytic system provides predictive maintenance for each wheel bearing in a timely manner.

