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Lora Based Railway Signaling System

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A B S T R A C T

Internet of Things an emerging technology that has great potential to be applied in critical environments. In that regard, IoT is a remarkable solution to the challenge of collecting data from physical environments, flexibility, low cost, and ease of deployment. It has always been a dependent factor for early alert signals for the possibility of unforeseen technical issues that may occur within the mass transport networks. Our proposed infrastructure, IoT, and LoRA are able to detect either rail track damages due to unbearable temperature or determine the fixed object in a far-away distance in a railway network. Thus, an early warning system is deployed to avoid unforeseen fatal accidents. The system comprises LoRa transceivers at both train stations and along the railway tracks, allowing continuous monitoring and control of train movements. Signals related to train speed, location, and track conditions are transmitted using LoRa modules to a centralized control unit, where decisions are made regarding track changes and signal displays. Additionally, the low power consumption of LoRa makes it ideal for remote locations where power supply is limited. This LoRa based signaling system promises to enhance the safety and reliability of railway operations, reduce infrastructure costs and simplify maintenance.

Keywords: Temperature sensor, accelerometer sensor, LoRA02, ESP32,Ardiuno NANO

1. INTRODUCTION

Zigbee modules on the destination and source nodes to transceiver data. Zigbee modules are used which do not have a long-range and could fail over poor hardware. By over come of these problem the LoRA module,ESP32 and Ardiuno uno is replaced. It overcome for the large wired connection and the use of high speed internet data. To increase the range of communication, LoRa technology with spread spectrum modulation is used. Manual inspection of track is a tedious job**.**

2. LITERATURE SURVEY

M. Ghazel, "A control scheme for automatic level crossings under the ertms/etcs level 2/3operation", IEEE Transactions on Intelligent Transportation Systems, vol. 18, no. 10.Level crossing (LC) safety is a crucial issue for railway operators and infrastructure managers. Accidents at LCs give rise to serious material and human damage, while seriously impacting the reputation of railway safety. In particular, some typical scenarios are behind the main part of train-car collisions, which occur at LCs. On the other hand, European Rail Traffic Management System (ERTMS) is the standard railway control-command and signaling system that is currently being implemented throughout Europe and elsewhere. The aim is to ensure railway interoperability while enhancing safety and competitiveness of the railway transportation. ERTMS specifications only provide a rough description when dealing with LC control. This paper elaborates on a functional control architecture for automatic LCs in the context of ERTMS operation Levels 2 and 3.

3. BLOCK DIAGRAM

There are two circuits presented one is transmitter another one is receiver the transmitter is placed on the railway compartments to observe the temperature speed. Is compartment has a same devices and the receiver placed in the next station and transmitter have a two switches to pasty signals in Red and green colors then red indicates the danger and the green indicates the normal. Transmitter consists of ESP32 and RA05 LoRA module ESP32 is used to store the program and give instructions to the receiver and Laura module made a communication between transmitter and receiver with the white dress communication with the help of antenna. The help of Laura module the passing of information is quickly and it can help to give instruction between the long range.The temperature sensory is used to measure the temperature of the compartment if any fire accident is occurs it gives the information to the substation under the driver compartment.SOS also used in the same compartment if any dance or a course the passengers can easily push and give the information to the loco pilot and also the next substation to take the action. Accelerometers is used to measure the speed of the train and also speed of the compartment if any compartment is filled down it by measuring the speed it can give the information to the loco pilot and

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also the next station. LCD display is used to display the data required from the transmitter and also in the receiver. Receiver circuit is consist of arduino nano and RA05 LoRA module receiver get signal from transmitter picture in the each compartment.

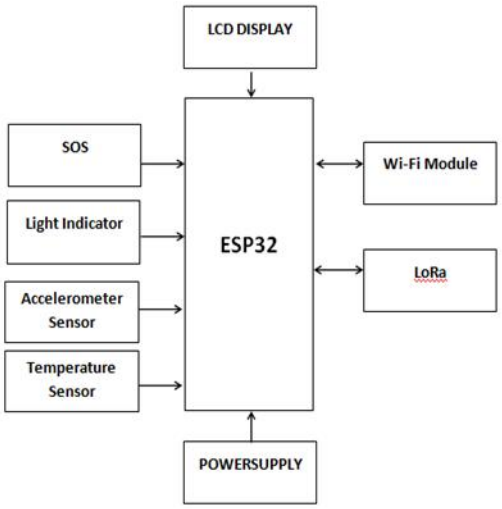

Figure 1:LoRA based railway signalling system(transmitter)

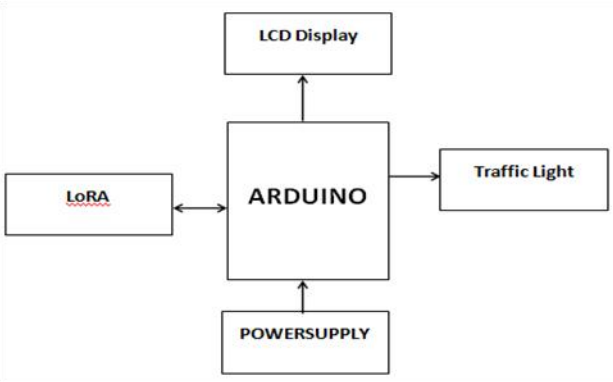

Figure 2:LoRA based railway signalling system(receiver)

4. SIMULATION DIAGRAM

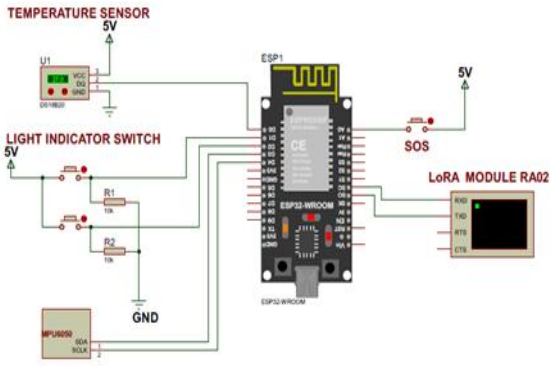

Figure3:LoRA (transmitter)

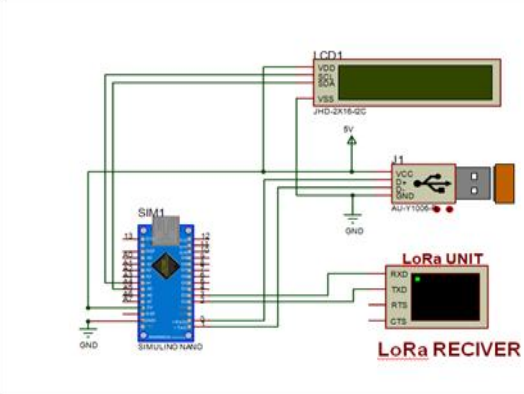

Figure4:LoRA(receiver)

5. OUTPUT WAVEFORM

Figure5:Simulation diagram for temperature monitor

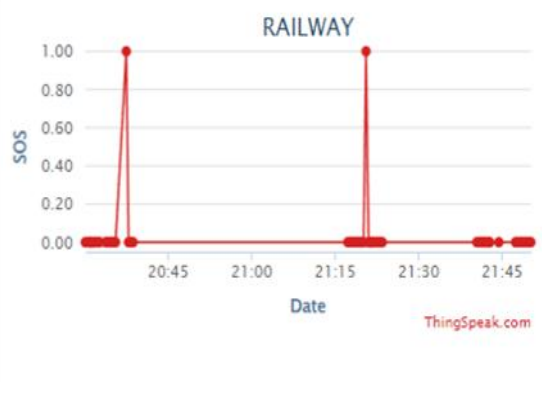

Figure6:Simulation diagram for sos monitor

Figure6:Simulation diagram for red signal monitor

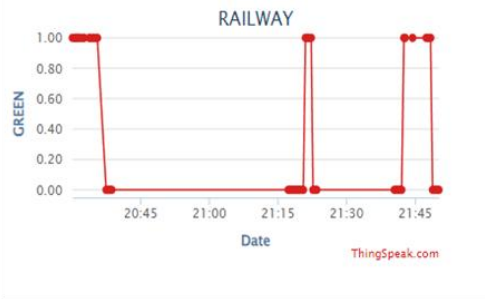

Figure7:Simulation diagram for green signal monitor

6. CONCLUSION

LoRA low cost, low power and low range connectivity make it a cost-effective option for railway signaling systems. LoRA long range wireless technology is reliable and can detect trains early. LoRA energy efficiency is a key feature of the technology. Improved communication range LoRa use of Spread Spectrum modulation improves the range of communication. There are also some challenges to consider when using LoRA based railway signaling systems. If the gateway's range to its end devices is not enough to meet safety distances based on train speed, repeaters may need to be installed. Network connectivity in remote areas can be a challenge whether it's wireless

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