

Track Workers Safety System Based on IoT

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Abstract

There are several incidents of accidents that happen while the track workers were doing the work for the maintenance of the railway tracks, mostly it happened because they were not able to get alert on time that train is coming on their way. The purpose of this study is to create a safety system for track workers and alert them before time so that they can move outside the track and no harm will be done. This study presents concluding remarks on the limitations of existing studies and provides recommendations for further research and appraisal practices.

Keywords: - *ESP8266, Laser sensor, Laser transmitter, Solar panels, Train detection, IoT.*

INTRODUCTION

We are developing a Track worker safety system in which we are creating a safe zone for track workers so that they can work in that zone, and they will get notified if the train is entering the safe zone. This will be done by train detection using laser sensor technology and the esp8266 Wi-Fi module.

The ESP8266 Wi-Fi Module is a self-contained SOC with an integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

1. A laser transmitter projects a beam of laser light outward while raising and

lowering the beam. The beam may define a conical surface of varying inclination. The transmitter includes a laser source that directs a beam generally vertically and a beam diverting element.

2. An LDR or photoresistor is made of any semiconductor material with high resistance. It has a high resistance because there are very few electrons that are free and able to move - the vast majority of the electrons are locked into the crystal lattice and unable to move. Therefore in this state, there is a high LDR resistance.
3. As light falls on the semiconductor, the light photons are absorbed by the semiconductor lattice, and some of their energy is transferred to the electrons. This gives some of them sufficient energy to break free from the crystal lattice so that they can then conduct electricity. This results in a lowering of the resistance of the semiconductor and hence the overall LDR resistance.

The process is progressive, and as more light shines on the LDR semiconductor, so more electrons are released to

conduct electricity, and the resistance falls further.

Solar panels work by letting photons released by the sun knock electrons free from atoms and thus generate a flow of electricity. Solar panels are composed of many smaller photovoltaic cells linked together.

The model developed by using the above technology summarizes the following:

1. Train detection by using the laser transmitter and LDR.
2. Data transmission using the Wi-Fi network of esp8266 to pass on the signal of train detection on a particular node.
3. Store the data received on each node of esp8266 on a website.

If the train is detected on the first node, it will pass on the signal to the next node, and it will generate the alarm to alert the workers working around that area, and they will get some time to move out of the track before the train arrives at that location.

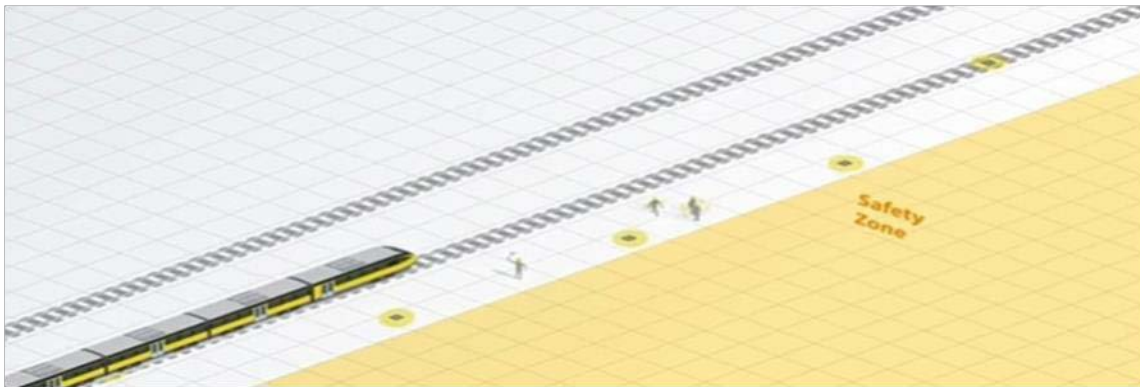


Figure 1

ANALYSIS

8 May 2020 - 15 migrant workers sleeping on rail tracks were crushed to death by goods train in Aurangabad district of Maharashtra.

22 July 2020 - 3 railway employees from Hyderabad died when a double-engine train ran over them. A total of 12 workers were working on track when the incident happened, and 9 were able to save their lives. The incident took place between Vikarabad and Chittigadda railway station. The incident raised concerns about the safety of the railway employees and seemed to be due to negligence from higher authorities.

LITERATURE SURVEY

In the past few decades, the railway infrastructure has been widely changed in both urban and rural areas; safety has been a common goal for all railway workers and railway civil engineers.

After having research, it was found that to accomplish the above expectations; it is necessary to create awareness among the workers and engineers to avoid such accidents. Our main focus is to avoid accidents, and in this case, we created a safety zone for workers so that they can move aside quickly as the buzzer buzzes.

COMPONENTS

1. Solar Panels

- The solar panel's output between 5V to 6V with direct sun.
- The solar panels charge the lithium battery through the TP4056 battery charger module. This module is responsible for charging the battery and prevent overcharging.
- The lithium battery outputs 4.2V when fully charged.

2. Esp8266

The **ESP8266** Wi-Fi Module is a self-contained SOC with an integrated TCP/IP

protocol stack that can give any microcontroller access to your Wi-Fi network. The **ESP8266** is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. We are using esp8266 to transmit the signal from the first node to the next so that the workers could get an alert before the train reaches that node, and the accident can be avoided.

3. Laser Transmitter and LDR

When the laser pen shines on the LDR, the green LED will light up to signify that the circuit is ready. When the laser

beam is broken, the LED turns off, and the buzzer sounds. LDR produces variable resistance depending on the amount of light falling on their sensor. When the LDR does not detect light from the laser, it will drop its resistance and trigger the esp8266 to send voltage to the pin controlling the buzzer.

4. HTML

The HyperText Markup Language or HTML is the standard markup language for documents designed to be displayed in a web browser. We have created a small web page to show the data of each node when it gets the signal of train detection and sends it to the next node.

PROPOSED METHODOLOGY

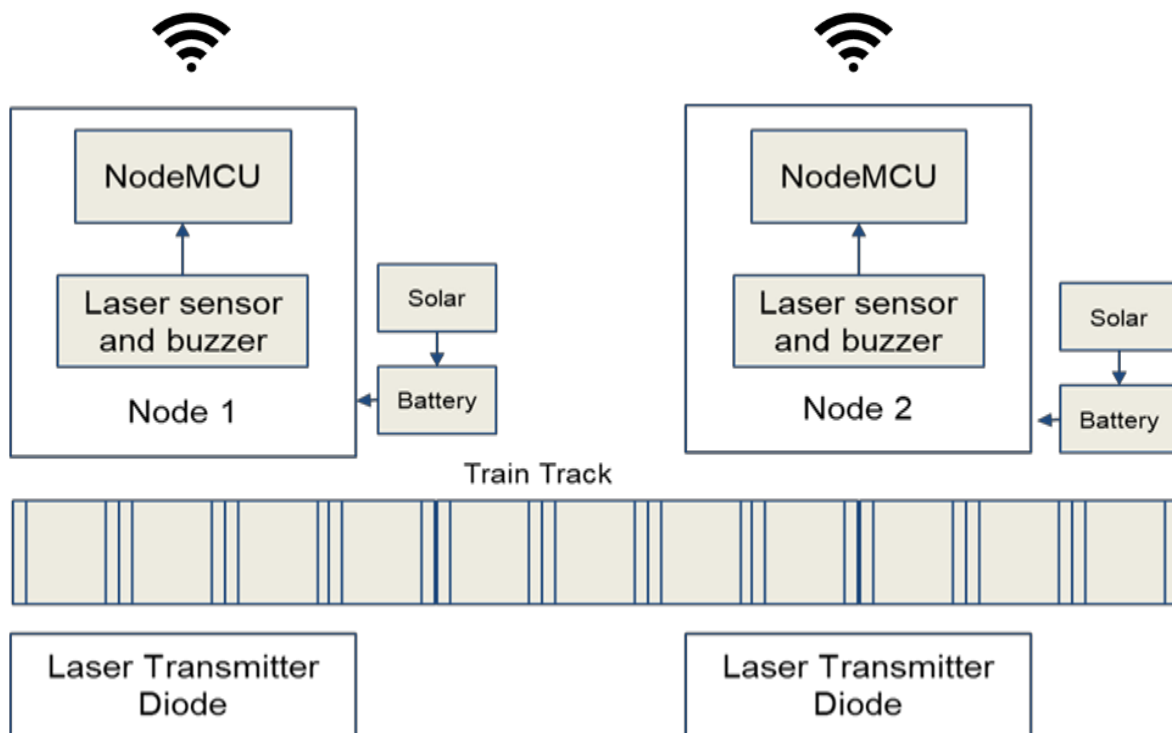


Figure 2

We have created the two modules, each containing esp8266, laser sensor, buzzer, LDR. Each module is connected to the battery, which is rechargeable by the solar panels.

When the laser beam is on, and the transmitter keeps receiving the signal from the laser beam, the value is continuously zero. But when the train cuts off the laser beam, it turns to one; as it turns the one, the esp8266 will send the signal that the train is detected, and the buzzer will generate, and the signal will pass on to the next node.

Both the wifi modules have unique IPs assigned to them so that we can detect exactly at which node the train is detected. Then that node will pass on the signal to the next node that the train is detected, and the buzzer will be generated so the workers working in that area will get alert and move out of the track.

We can create several such modules in case we want to increase the area of the safe zone, where this same procedure will continue. At the very moment, the train is detected at any node. It will pass on the signal to its corresponding nodes and that to another, and this will go on until the last node of the safe zone.

CONCLUSION

The proposed work ensures the safety of workers and railway engineers working on the track. This paper describes the general preventive measures targeted to reduce railway workers' accidents because of the coming high-speed train. It discusses the existing countermeasures for reducing accidents.

FUTURE SCOPE

In this study, we have used only laser technology, but for better results, object detection and radar technology also can be used. This can also be implemented in various geographical locations.

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