Preclusion of Accidents on Rail Line to Avoid Mishap

Vinoth Kumar.P [1], D.Deepa [2], M.Balasubramanian [3], T.Thiruvenkada Perumal [4], B.Vasanthan [5], K.K Pramesh [6], Sakthivel. R [7]

[1] Associate Professor, Department of Electrical and Electronics Engineering, Sri Krishna College of Engineering and Technology, Kuniamuthur, Coimbatore, India. Email Id: vinothkumarktp@gmail.com

[2] Assistant Professor (SRG), Department of Computer Science and Engineering, Kongu Engineering College, Perundurai, Tamilnadu, India. Email Id: deepa@kongu.ac.in

[3] Assistant Professor, Department of Electrical and Electronics Engineering, Government College of Engineering, Tirunelveli-627007, Tamilnadu, India. Email Id: srivibalu_svpr@yahoo.co.in

[4,5,6,7] Department of Electrical and Electronics Engineering, Sri Krishna College of Engineering and Technology, Kuniamuthur, Coimbatore, India.

Abstract: Train accidents happen due to mistakes of human errors it ends up in death. Additional measurements needed to regulate this mishap and this work can be done as a detection method in automation. The unfavorable nature of the operating setting and also the monotonous nature of the train driving increase the risk of accidents. Due to the speed of train and more different pathway it seems to be very complicated to provide a safety measurement system to avoid mishap. The results of this work based upon the communication to convey the alertness to the train driver. Sometimes a reckless or distracted pedestrian cause a collision on the tracks during arrival of train. Therefore this work can facilitate the train drivers to spot the humans, animals presence on the rail line with alarm provided at driver's engine box and another alarm provided on the particular spot where the pedestrian passes. This paper is based on sensor technologies and wireless communication for detection and communication with the train drivers and humans.

I. INTRODUCTION

For the security of railways to detect any obstacles before trains, software system and sensing element technologies are exploited and the extracted data is processed in Arduino controller and provides output data as signals to engine controller. These processes are automatic, therefore it works with the presence of controller, alarm indicators wireless communication, sensors and relay [1]. The sensor is needed to send information to the receiver part to detect humans or obstacles to make alarm to train drivers [2]. In advance level image capturing camera instead of sensors used, but here the accuracy of the system is based on the quality of image processing which may get reduced in the rainy and winter environment. Though the railway system provided railway gate level crossing where we can see lots of accidents occurs due to human errors, it can be controlled by this automated railway detection system when the target detected by soon the information will be transmitted to the control room [3]. There is another

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approach based on ultra wide bandwidth system(UWB) combined with optical fiber at railway level crossing but the safety measurements were provided only for level crossing areas [4]. The usage of infrared sensors on level crossing improved both electrical and mechanical way of work but the infrared sensors detection will not be accurate at the variation of temperature [5].

There are different protection types that are examined on the impact of various kinds of aspects which influenced the protection on railway system to improve their safety measurements [6]. In the advancement of communication technologies, the mobile application system had been established for this detection technique, by using the way of GPS tracking which might spot and track the arrival of train. By using this driver, move on with the open and closing of gate, however the operation will be clashed when there is arrival of two trains or more on a same track [7]. There are different aspects such as visualization and speed which will make more complexity on detection technique like image processing and tracking technique [8]. Even though there is lot of technology provided, manmade and mechanical error also reasons for the accidents in train. The fault in brake bean bolt part is one of the important fault occurs in train that leads to severe accidents [9]. There are several intellectual technologies used on railway technologies to prevent the railway accidents that occur due to human errors [10, 11].

In 2014 according to the railway safety measures in Finland (2008 – 2010) an idea was established for the railway level crossing and railway track detection by the way of both GPS and intellectual technology system, but the analysis shows there should be improvement in reliability level and there are alarms were missing at major areas[12]. In advanced level the detection process were also done by observing the obstacle in optical flow method along with their direction [13]. Moreover the image processing will be suitable in roadways also where image capturing and detection technique with immediate action and the data transformation had done. Compared to roadways most of the railway accidents which was done while the train is on shunting mode [14] [15]. In the proposed system the overall process were done according to the train model prototype by comparing the track size and area coverage. Suitable sensors, battery, relays, microcontroller, wireless communication was used. The project will be more supportive for automatic railway line system to the train drivers to safeguard the humans or animals presence at the railway line track by wireless communication with the help of alarm LED strip Glow.

II. WORKING OF PROPOSED TECHNOLOGY

The working of the system consists of two major parts, transmitter & receiver. The train model work as the receiver one and the infrared red sensor work as transmitter part. On first when an object is detected by the transmitter, it sends frequency to receiver part where a LED strip will glow brightly. Second detection process is done by receiver part when an object is detected by ultrasonic sensor on rail line way to detect the target. The LED strip will glow brightly at detection process and the LCD display on arduino will show object detected. The alarm detection to the train drivers is done with wireless communication by using Wireless RF receiver and transmitter. The working components in the proposed technology are discussed.
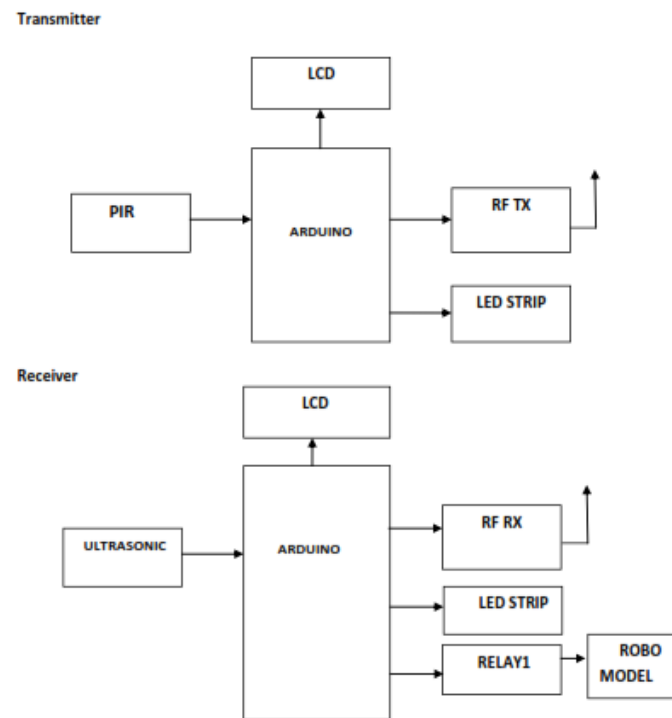
Fig.1. Block diagram of the proposed system

A. Arduino UNO

The Arduino Uno are often a microcontroller board supported the ATmega328, it's fourteen digital input/output pins, six analog inputs, a sixteen rate ceramic resonator, USB affiliation and it contains everything required to support the microcontroller. In our proposed work a LCD display had attached to the arduino and when an object detects by a sensor 'Object detected' command will be displayed on display. It will be shown on both display of transmitter and receiver part. The decision is made by this controller with the programming done based on the sensors input provided.

B. Passive Infrared and Ultrasonic sensors

PIR sensors sense motion and it is cheap, low-power, straightforward to use and do not wear out. Hence, this sensor is normally found in appliances and gadgets employed in homes or businesses and they are sometimes cited as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors. This PIR sensor on transmitter part detects an obstacles or humans or vehicles or animals on rail line way. When detected immediately LED strips will glow brightly. In PIRs the detection range will be short, so it is applicable for small prototype train track level. The receiver contains two 6 volts batteries, which makes the receiver to perform alone without the help of transmitter part. These batteries were used as the power supply for the receiver to help in detection and to energize the LED to glow. In the proposed work ultrasonic sensor is used on receiver part and when a detection target was found by this sensor the LED will glow brightly. This detection process is done within few seconds according to the programming mode as coded.

C. Relays

Relay is an electrically operated switch and in this work it uses as operating switch at receiver part of the train to control and operate. Considering the real time application this prototype model had done. When the prototype train detects it will stop moving and LED glows brightly. It works on the principle of automated braking system when object detects the moving prototype will be stopped for few seconds according to the code programmed to it. This braking system was only suitable for this prototype model; in real time application it won't be applicable because of train high speed.

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D. Wireless Communication

This circuit utilizes the RF module (Tx/Rx) for creating a wireless remote where the signals will be transferred and received through wireless communication. RF module uses frequency to send signals. This communication plays a major role, when objects are detected by the sensor at transmitter part and soon the frequency is transmitted to receiver part. As a result the LED strip will glows brightly on transmitter part and receiver part. By means of quick transmission there will be no manual work and time saving of life is done.

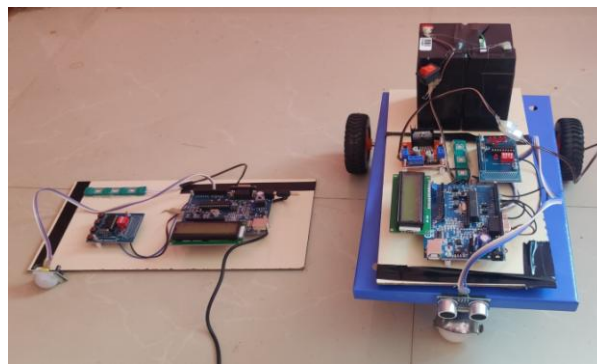## III. EXPERIMENTAL RESULTS

Fig.2. Working model of the proposed system

The working model is separated as two parts one as transmitter and the other as receiver. It consists of sensors for detection and wireless communication devices. The train model work as the receiver part and initially when any obstacles are detected by the transmitter, it sends frequency to receiver part to create alarm to slow down or stop the train. Arduino board on the train model acts as a controller that make decisions and decides the braking activity with the comments obtained from the ultrasonic sensor. The LED strip connected to the transmitter part is used as an indicator when detection process is done. The LCD display connected with the arduino is used to display the type of object the sensors detected. The alarm detection to the train drivers is done with wireless communication by using Wireless RF receiver and transmitter. The working components in the proposed technology are listed in the Table 1.

TABLE 1: COMPONETS OF THE WORKING MODEL

S.No	Components	Types	Quantity
1.	Microcontroller	Arduino UNO	2
2.	Sensors	PIR, Ultrasonic	1,1
3.	Wireless Communication	RF – Transmitter & Receiver	1
4.	Operating Switch	Relays	1
5.	Battery	6 Volts	2
6.	Light	LED Strip	2

A. Before Detection- LED will not glow brightly

On real time the train and track path was very large, so considering it this prototype had done. The detection and alarm systems will be done by two ways. The first one was transmitter part and another one was receiver part. The train works as receiver part and rail track works as receiver part so the sensor will be fixed as an lamp post near the track another sensor will be placed on the train prototype. The LED's which used as an alarm will be glow in dull mode because of no detection occurs. The transmitter and receiver parts had connected with wireless communication (i.e) RF module, where the alarm results from transmitter part will be transferred to receiver part with the help of this module is shown in Fig.3.
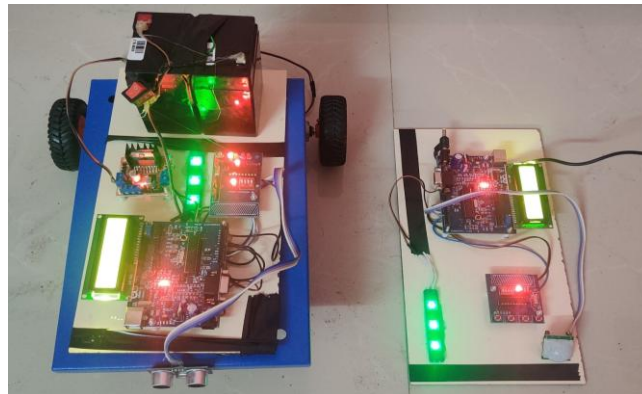

Fig.3. Working model of the proposed system before detection
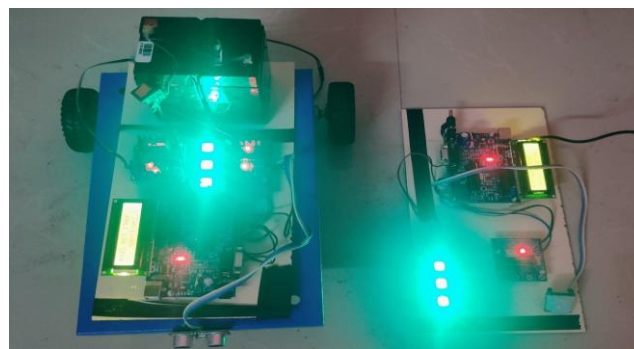
B. After Detection- LED glows brightly

Fig.4. Working model of the proposed system after detection

When the obstacles or humans or objects detected on track path by sensor at transmitter part the LED will glow brightly and soon the detection signal will be transmitted to receiver part and the LED which placed on receiver part part will glow, this total process done with the help of RF module. The Arduino which was placed on transmitter part have a LCD display in that it shows "OBJECT DETECTED" when detection process done. This proposed work has another side of detection work which will done by receiver part without the help of transmitter part, two batteries had attached on receiver part with relay and microcontroller. Relay operates the train moving and stopping .When detection occurs as same as receiver part LED glows brightly and "OBJECT DETECTED" will be displayed on LCD as shown in Fig 4.

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CONCLUSION

There are several methods and systems have been proposed regarding the train obstacles detection, train tracking system and railway level crossing. But the systems and methods will not be applicable on real time due to their disadvantages like sensors affected by temperature, distance detection will not be accurate & more. These disadvantages are rectified in our proposed system since it is based upon automation where the sensors working progress were improved comparatively to other system. Train drivers and the humans crossing the railtrack both of them can able to notify the detection alarm. The main purpose of this system is it will improve the development of safety and prevention measures on railway system. According to the real train model and long rail track path we need the sensor to detect or sense for long distance because of the train speed, in future this work can be implemented by using the sensors that are used for long distance detection such as LiDAR sensor and Time of Flight sensor.

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