

IoT Based Automatic Vehicle Detection for Railway Gates

Suraj Singh^{1*}, Ketaki Sabde², Roshani Jais³, Ashwini Ukudde⁴, Priyanka Kshirsagar⁵,
 Ashish Mohod⁶

^{1,2,3,4,5}Student, Department of Computer Science and Engineering, Priyadarshini J. L. College of Engineering,
 Nagpur, India

⁶Professor, Department of Computer Science and Engineering, Priyadarshini J. L. College of Engineering,
 Nagpur, India

*Corresponding author: vikwithaish@gmail.com

Abstract: This paper proposes the design of Internet of Things (IoT) based Automatic vehicle detection system on railway gate can be used to detect the vehicle on railway gate The importance of Automatic vehicle detection in product development. This paper provides a comprehensive review of the state-of-the-art research in this field. Automatic vehicle detection entails various issues related to traffic handle. With respect to a holistic view of Automatic vehicle detection, key challenges and future research directions are given. The importance of Automatic vehicle detection is to control the traffic rule and follow the traffic rule in signal it's also protect the major accident in signal. It's also used for people to cross road easily.

Keywords: IoT device.

1. Introduction

Internet application development demand is very high. So IoT is a major technology by which we can produce various useful internet applications India has the biggest rail network and becomes major mode of public transportation. According to the survey of public relation office of Indian railways, there are more than 30,300 railway crossings in India. More than 11000 railway crossings are unmanned where there is no man to manage barriers while arrival and departure of trains. Many techniques have been developed to enhance the security system of railway crossings. Many of the systems use ultrasonic sensors and infrared sensors to detect the arrival of train and access it at control room that can manage railway barriers. Some systems used GPS and GSM for tracking train to avoid accidents at railway crossings. Image processing has also been used to develop a system for secured railway crossings. Overall, a reliable system is required to operate in robust condition and able to prevent accident at the railway tracks. Review of various systems which has been proposed is discussed in the section of literature survey. An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. Using this project, we can find out the vehicle which cross the railway line which break the rule of railways.

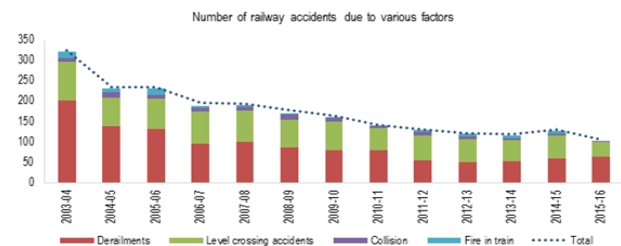


Fig. 1. Number of accidents in Indian Railways

2. Literature Review

1. Nisha S. Punekar et al. proposed a system for the safety of railways by detecting obstacles and tracking trains. GSM and GPS technologies have been exploited to develop a tracking system of trains. For this, sensor is mounted on the train to sample the acquired signals from GPS satellite systems. Extracted information is processed in data processing workstation where position and sensor's velocity has computed to find the location of train. Infra-red i.e. IR sensor has been deployed to detect any obstacle and alarmed the system before any casualty. The system which has been proposed has many flaws for its practical usage. As for large area coverage, the system needs repeaters to get installed which increases the complexity of system. Bandwidth provided by the GSM is shareable which may interrupt the resultant data. GPS signals may get fluctuated in dense areas which leads failure of the system or may provide inaccurate information. Furthermore, use of infrared sensors for obstacle detection is not a reliable option for the system as it has the capability to control one device at a time and uses for short range. Transmission rate of data, provided by IR sensors is very low. So the proposed system is not an effective and reliable option to get implemented.
2. K. Vidyasagar et al. proposed an automated system to control barriers at railway crossings and also presented a technique to prevent accidents. Approached method exploited piezoelectric transducer as a vibrator sensor to operate the barriers. Use of Ultrasonic sensor ensured the

presence of any illicit object on the track. Conditions, on which proposed system relies, i.e. Detection of object and positional state of the gate, are managed and observed at the control room via wireless communication protocol. Although the use of piezoelectric transducer and ultrasonic sensors are not the reliable option as both are sensitive to change in nature. Vibrator sensors used in this system is highly sensitive to hike in temperature whereas ultrasonic sensor may get harmed due to dust, water and in high temperature. This sensitivity of installed sensors may oscillate the overall accuracy of system.

- Eric Trudel et al. proposed a method relies on acquired data to scrutinize the effect of various aspects which can influenced the protection at railway crossings and concluded the key reasons for increasing safety at rail crossings. Proposed study took the database of accidents held at Canadian rail-crossings. Analyzed result is able to spot the main factors which can highly contribute to increase the safety and prediction of collision at rail crossings. Evaluation of the efficacy of geometric characteristics and factors involving in the collision of trains and vehicles at Canadian grade crossings taken place in the paper. Investigational outcomes shown three factors i.e. DSTOPPED, area of sight and clearance distance are highly influenced constraints for accidents. Various techniques like model fusion; which merges the result of separate systems to generate a comparative result with better accuracy, has been suggested to develop an effective system. Considering a model, based on weather and time will also be helpful to develop a reliable system.

3. Proposed System

The proposed application will help to when the train is pass through railway gate that time the gates are closed for passing the train and Vehicles wait for some time. Whenever gate is closed so that time any vehicle is not pass from below the gate, but some people breaks the rule and pass through below the gate. It is very dangerous due to that many accidents will happen. To avoid such kind of accidents here we propose a system i.e. "IOT based automatic vehicle detection system on railway gates." These systems itself check all operation whenever the railway gate is close and the object crossing the railway gate, it detects that object in that condition automatically rising led and buzzer also the camera capture that vehicle photo and stored in database, so that no need of mankind. And also the system provides prevention and Alertness of People for accident on railway gate. The proposed system gives a convenient and time saving solution for the existing system.

In this research work are used two steps. Firstly, we are used Node MCU ESP8266 for performing hardware operation. The IR Sensor, Buzzer and Led is connected with Node MCU. The USB wire connected with Node MCU and TTL serial chip communicate between host computer and Node MCU. TTL

level will always remain between limits of 0V and Vcc, which is often 5V or 3.3V. In these project we are used 5V TTL serial. Secondly the host computer operates Application (.exe file) and Camera, for capture vehicles or object image and stored in database file.

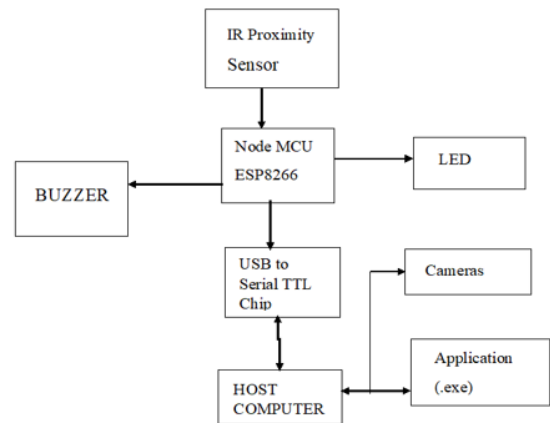


Fig. 2. Architecture of process

A. Automatic railway gates operation

In India the average maximum speed at which a train moves is 91.82km/hr and the minimum speed of a passenger/goods train is 59km/hr. Hence the ideal distance at which the sensors could be placed to detect the arrival and departure of the train from the level crossings and thus the gate will not be closed for more than 5 minutes. The proposed technique uses IR sensors, one LED, Camera application on Both side and one Buzzer for the automation process of railway gates operation.

B. Opening of railway gates

In real time, the IR sensors and Cameras are placed behind the track of pole on both sides of the level crossing. When any vehicle passes below the gate the IR sensor (infrared sensor) detect the object, it sends the signal to the microcontroller. After detecting the object then the microcontroller activates the buzzer and led lights for alertness and the value of Buzzer and Led is high both buzzer and led will glow. Due to buzzer and led glow that person and other person should know that they do something wrong or it is dangerous for them. Also at the same time using Blynk Application notification and email send by controller and in charge. Two camera is attach on the setup behind track of pole to capture the image of detected object. After capturing the image, it will be send by controller and save into the database for further process using Host computer application file. Also we classified the image for easy to next process using that image controller take action on that particular detected object.

C. Obstacle detection between the railway gates

In the proposed system, while automating the railway gates operation, there may be a chance that a vehicle may be locked between the crossing gates. Thus, in order to save them, the system has been taken some fruitful steps for save human life.

The system IR sensor take important role to detect the vehicles crossing the railway gates on both side and the cameras also play the important role ton capture the images and stored in database. It is helpful to identify the person who break the railway crossing rule and the controller take strict action of that person.

D. Safety measure to avoid collision

In this situation, the microcontroller activates the Blynk application for sending notification and mails. Blynk is designed for the Internet of Things. It can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things. Blynk Server - responsible for all the communications between the smartphone and hardware. The Blynk app sends the information about the obstacle through the alert SMS and mails to the controller and gatekeeper. The SMS and Mails has been sent by gathering the contacts from the updated database of Indian Railways. Even though the information conveyed to the controller, they can manage all data and storing capturing image into database. Using these system we can avoid train accidents and deteaction. Also these is applicable for Parking as well as Non Parking area.

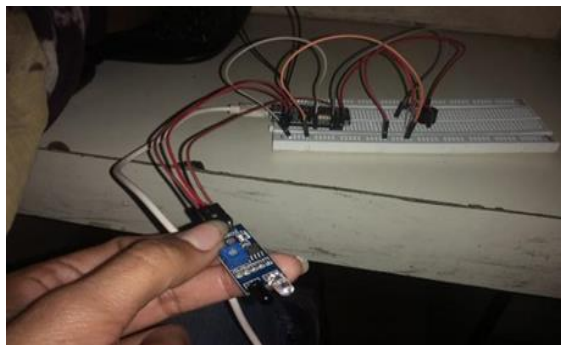


Fig. 3. Hardware setup

Steps involved in project implementation:

1. Start
2. Initializing UART/Serial monitor in Arduino Software
3. Initializing GPIO as digital I/O pin in Microcontroller
4. Initializing Blynk IoT using mobile
5. Redding IR Sensor input GPIO Pin.
6. After redding Input GPIO pin If Sensor == Low and the Vehicle is detected then the system performs further Operation.
7. Else sensor==High then Go to step 5.
8. When the object is detected then that time Buzzer and Led will On for alertness.
9. Using Blynk send notification and mails to the controller.
10. After send CMD Serially to computer application for capture image and stored image into database.
11. Wait for 2 sec.
12. Automatically Buzzer and Led OFF
13. Stop.

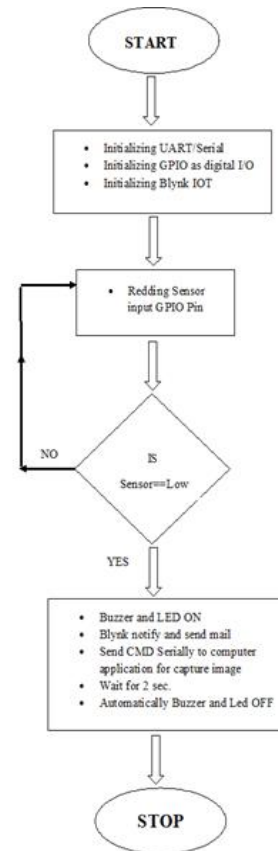


Fig. Process Flow Diagram

Fig. 4. Process flow diagram

4. Conclusion

In this project, we tried to attempt to effectively introduce the concept of IOT based automatic Vehicle detection. We explain the concept of online automatic vehicle detection system. We also give the brief overview of the technologies used during the development of our proposed system. This project can be further refined and extended by introducing new and more innovative features.

Also in this work of project, we have studied the existing railway systems, their benefits and drawbacks to create an improved system that can help in decreasing the number of accidents occurring due to human negligence and failure. The proposed model aims to make railways a more reliable source of transport by replacing existing manual systems with automatic Vehicles detection system.

In future railways and other transportation system can modify these systems by applying their high levels ideas and rules i.e. whatever camera capturing that vehicles number or object image they can classify all vehicle number according to their database, so that controller can automatically send challan or rule break cost to that person. For further improvement, motion sensors can be deployed at the railway crossing area and alert the driver if there is someone stuck between the barriers so that he can stop the train in time. This project can be further

refined and extended by introducing new and more innovative features.

Acknowledgement

We would like to thank our guide Professor Ashish Mohod for her valuable suggestions and support throughout this project and the following research paper. We would also like to thank PJIJCE Computer Science Department for giving us an opportunity to go forward with this idea and provide us with the resources which led to the successful completion of the project. We also convey our sincere gratitude to the authors and publications that provided relevant research material for our reference in improving and modelling this paper.

References

[1] Nisha S. Punekar, Archana A. Raut, "Improving Railway Safety with Obstacle Detection and Tracking System using GPS-GSM Model",

- International Journal of Scientific & Engineering Research, Volume 4, Issue 8, August 2013.
- [2] Sina Aminmansour, et al., "Near-Miss Event Detection at Railway Level Crossings", IEEE 2014.
- [3] K. Vidyasagar et al. "Anti-Collision and Secured Level Crossing System", International Journal of Computer Applications, Volume 107, No. 3, December 2014.
- [4] Bhuvanewari. P. T. V., et al., "Wheel Detection based Level Crossing Safety System", International Conference on Computational Intelligence and Communication Networks, IEEE 2015.
- [5] Atul Kumar Dewangan, Meenu Gupta, and Pratibha Patel, "Automation of Railway Gate Control Using Microcontroller, International Journal of Engineering Research & Technology, pp.1-8, 2012.
- [6] Rohan D. Dudam, Mandar C. Koshti, Nirmal Kumar, "Automatic Railway Gate Control System."
- [7] M. Kottalil, Abhijith S., Ajmal M. M., Abhilash L. J., Ajith Babu, Automatic Railway Gate Control System, International Journal of Advance Research in Electrical Electronics and Instrumentation Engineering, Vol. 3, February 2014.