

Design and Implementation of Intelligent Railway Gate Management Systems Utilizing Internet-of-Things (IoT) Technologies

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ABSTRACT

The main objective of this paper to propose the smart system of controlling the railway gate automatically to avoid the accident while crossing the railway gate as well as smart way of railway gate crossing using the mobile application. In this system we are using the Internet of Thing (IoT). IoT is a network of interconnected devices which are connected with sensors. For IoT device can communicate with no human interrupton. By implementing these, it will provide control of railway gate to the device which operates the railway gate. It reduces the time, gatekeeper carelessness for operating the gate close and open than the gatekeeper. So this system is useful for reduction of the accident at level crossing. In addition to this, one more additional feature is implemented for the driver's convenience who can use for the level crossing. Here, driver needs to install the mobile application in their mobile by which they can check the railway gate is open or close. The Ultrasonic sensor detect the train is coming or not and with help of NodeMCU send to the Google Firebase and Firebase will send the same information to NodeMCU which is located at level crossing and close the gate with the help of Servo Motor, and when the train departure from the another side Ultrasonic Sensor it will again send data to Google Firebase and Firebase again give command to NodeMCU to open the gate which is located at level crossing. This is cost effective, real time and time saving automatic system.

Keywords:-NodeMCU, Ultrasonic Sensor, Servo Motor, LED (Light Emitting Diode), Aurduino IDE, Google Firebase, MIT App Inventor, Wi-Fi .

INTRODUCTION

India has the world's fourth longest railway network. The railway system in India and other countries is most commonly used transportation mode and it is also a one of the low cost transportation mode which applied in various transportation modes. In India there are thousands of rails running on track every day. In railway system, it is impossible to stop some of the critical situations or emergencies which are arising during the running of train. In this transportation many accidents are happen at railway level crossing because of the carelessness of gatekeeper. To avoid these accidents we are introducing the automatic railway gate controlling and smart way of level crossing. In order to avoid the human mistakes that could occur during the operation of railway gates, a new automatic railway gates control system using IoT is developed. The proposed system attempts to develop a system which automates the gate operations, which also

reduces human power and also increases the efficiency. It minimizes the maintenance cost and one time installation is done instead of various times installation.

The proposed automatic railway gate control system is to run automatically without gateman. An arrangement of physical components in a such way that the sensor sense the arriving of the train and departure of the train, gate is open and close automatically whenever it get the commands from the sensor through the Google Firebase. Two Ultrasonic sensors placed near about 6-7 Km away from the railway gate crossing on both the side. This Ultrasonic sensor is connected to NodeMCU and NodeMCU should connected to Wi-Fi. At railway gate crossing Servo Motor is connected to

RELATED WORK

opened or closed user has to install the RGCPPoint (Railway Gate Check Point) in

Proposed Technique	Author	Year	Published in
Pressure Sensed Fast Response AntiCollision System for Automated Railway Gate Control	Subrata Biswas, Rafiul Hoque Bhuiyan, Samiul Hoque, Robiul Hasan, Tanzila Nusrat Khan	2013	American Journal of Engineering Research (AJER)
Automatic Railway Gate Control System Using RFID with High Alerting System	Rohini Jadhav, Harshal Patil, Prof. M. S. Wagh	2017	Concepts Journal of Applied Reasearch (CJAR)
Automatic Control of Railway Gates and Destination Notification System using Internet of Things (IoT)	Chandrappa S, Dharmanna Lamani, Shubhada Vital Poojary, Meghana N U	2017	Morden Education and Computer Science (MECS)
Unmanned Multiple Railway Gates Controlling and Bi-directional Train Tracking with Alarming System using Principles of IoT	Afsana Ahmed, Kazi Rifah Noor, Ahmed Imteaj, Tanveer Rahman	2018	Innovations in Science, Engineering and Technology (ICISSET)

another NodeMCU which will open and close the gate.

In addition to these railway gates are opened or closed, a checking mobile application is developed. For the information of gate is

Pressure Sensed Fast Response AntiCollision System for Automated Railway Gate Control

It develops the anti-collision system when sometimes vehicles get stuck at the level crossing of the rail-line and train is coming to that level crossing the railway gate automatically control and it will not change the signalling light for the train. The whole operation of this project has been controlled by a Microcontroller PIC16F84A.

Automatic Railway Gate Control System Using RFID with High Alerting System

This paper deals with control system of railway gate using the microcontroller. This model uses automatic control or operation of gate and reduces the human labors. The concept of the paper is to control the railway gate using microcontroller PIC16F877A.

his/her mobile. For sending the information of railway gate same Google Firebase service is used. Whenever the railway gate data changes it will also reflect on the mobile application.

Automatic Control of Railway Gates and Destination Notification System using Internet of Things (IoT)

This paper proposed the advanced system of controlling the railway gate using Rasbery-Pi. A special feature is added to this system it also sends the destination notification using RFID (unique Id assigned for each train). To send the message to passengers an online portal way2sms is used. Here passenger needs to provide name, email id, password, and phone number.

Unmanned Multiple Railway Gates Controlling and Bi-directional Train Tracking with Alarming System using Principles of IoT

This paper developed the controlling of the railway gate by using the GPS (Global Positioning System) module to find out the location of train and distance between rail gate and train. And it also uses the GSM (Global

Ultrasonic sensors and digital pins D2, D3 of NodeMCU are connected to Echo of sensors. Digital pin D5 is connected to Green LED, D6 is connected to Red LED, D7 is connected to Servo Motor, D8 is connected Buzzer. GND of all components are connected to GND of NodeMCU. 5V of Servo Motor and VCC of Ultrasonic Sensor is connected to 3V of NodeMCU.

The following Figure 2 is the actual implementation of the hardware. All components are connected to microcontroller NodeMCU and also it operates by the NodeMCU. There are 16 general purpose input output pins in NodeMCU. It also has inbuilt Wi-Fi module. So we are using only signal NodeMCU. In this we are using only one NodeMCU, two Ultrasonic Sensor, one Servo Motor, one Buzzer and Red and Green LED.

Uploding Code to NodeMCU

We are using Aurdino IDE for uploading the code to the NodeMCU. For uploading the code we have to use USB cable. Arduino IDE is a software by that we can do the programming for the various IoT base hardware like NodeMCU. The Arduino IDE programming language is similar to C/C++ languages. We install

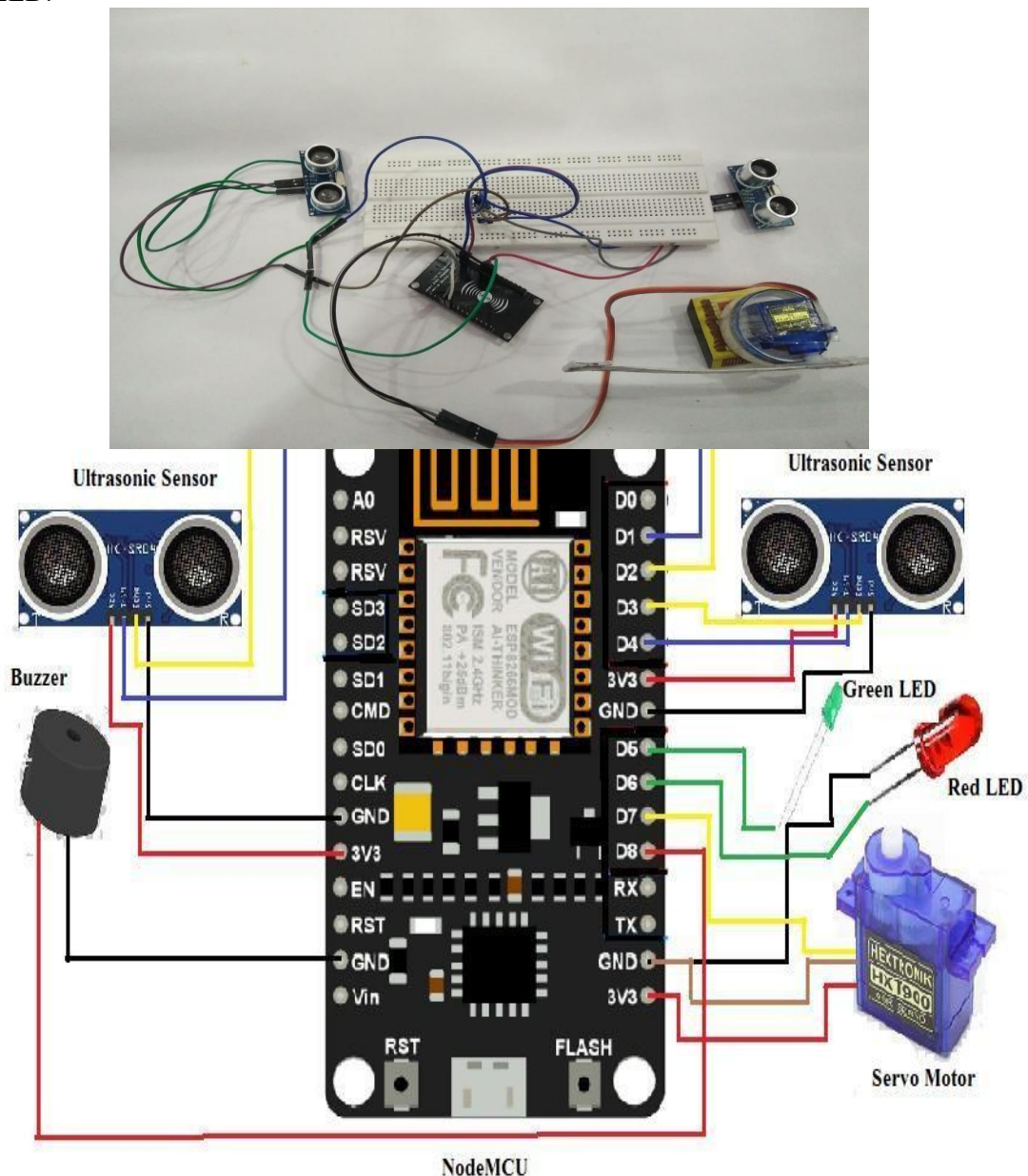


Fig. 1: Hardware Arrangement and Physical Connection

ESP8266 board by ESP8266 Community to make the interface between the Aurdino IDE and NodeMCU. For sending the data to the Google Firebase we include the preprocessing library FirebaseArduino.h. This will help to make connection between NodeMCU and Google Firebase, it also done the coding for other component in C language.

Developing Mobile Application

In this project we are using the MIT App Inventor for developing the mobile application. MIT App Inventor is a web application integrated development environment. It is originally provided by Google, and now maintained by the Massachusetts Institute of Technology (MIT). We can develop Android Mobile Application. It is open source for the developing the mobile application.

We developed the application for checking the status of the railway gate. We are using the same Google Firebase data to show the status in mobile application. Whenever the firebase data is changed by the NodeMCU that changed reflect in Mobile Application.

The above Figure 4 shows the status of Railway Gate can be check through mobile from anywhere in the world. It required the internet to get the data in mobile application. Mobile application get the data from the same Google Firebase and shows the Railway Gate is

Working of Automatic Railway Gate

The following Figure 3 is showing how the working of the Automatic Railway Gate Control.

Whenever the train arrives and sense by the sensor it will send 1 to the NodeMCU and NodeMCU will send the same data to the Google Firebase. As the data is changed of Sensor-1 and got by the NodeMCU which is placed at level crossing it will ringing the Buzzer for few second, Green-LED will OFF and Red-

Working of Mobile Application:

LED will ON and Gate will Close. Gate will remain closed until the train does not depart from the Sensor-2. As the train departs from the

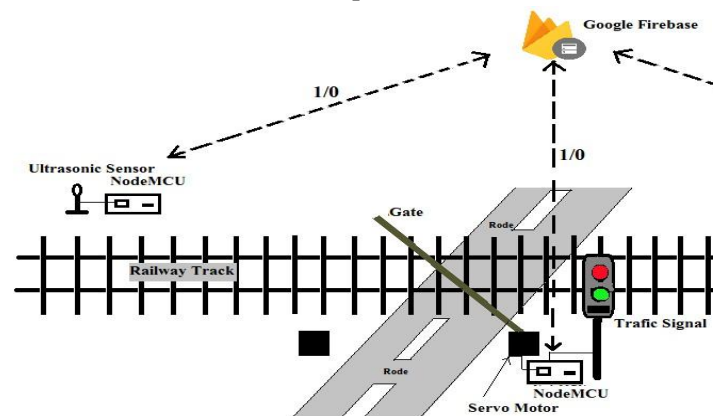


Fig.3:-Working of Automatic Railway

Sensor-2 it send 1 data to the Google Firebase and again as the data is change in Firebase and got by the NodeMCU it will Open the gate and RedLED will OFF and Green-LED will ON. Open or Close. As the data changes in the Firebase same reflect in Mobile Application.

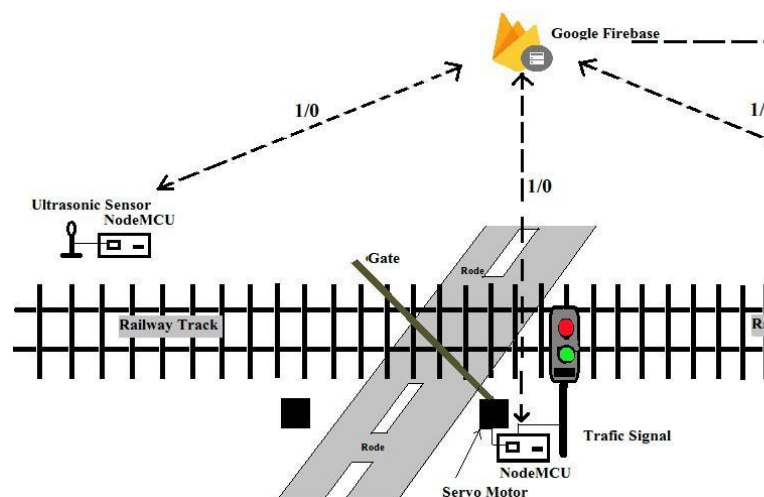


Fig.4:-Working of Mobile Application

OUTPUT

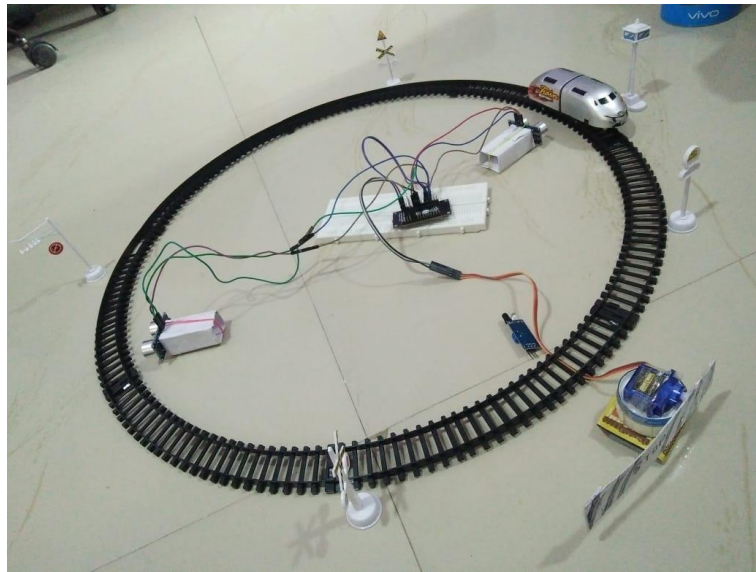


Fig.5:-Train has arrived from sensor-1 and gate is closed.



Fig.6:-Mobile application shows gate is close

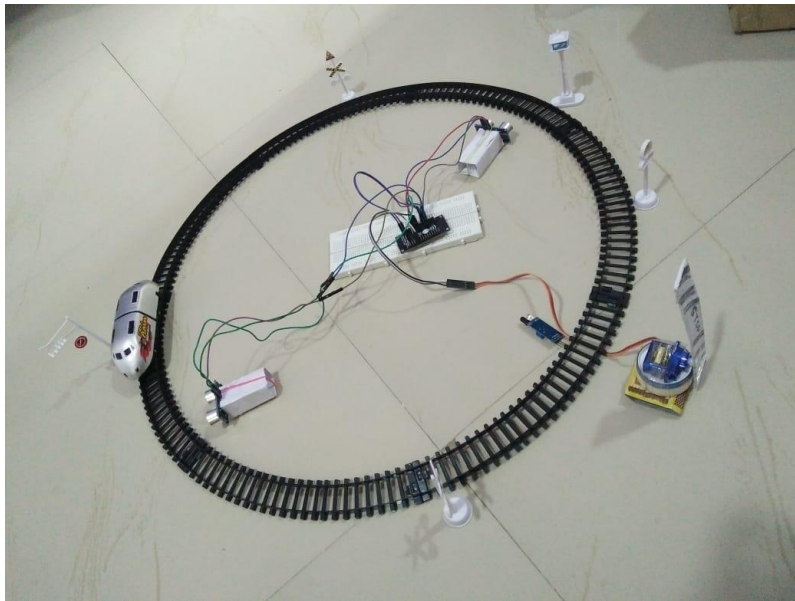


Fig.7:-Train departs from Sensor-2 and Gate is Open



Fig.8:-Mobile application shows gate is open

CONCLUSION AND FUTURE SCOPE

Thus, the project developed the Automatic Railway Gate Control using IoT, which control the Railway Gate, Signals, Buzzer and also send same data on the Mobile Application. This project is fully automated thus this project is very useful in remote places and villages where the railway gatekeeper is not present. The Mobile Application is also shows the accurate status of Railway Gate.

Future scope of this project any kind of railway gate can control and increases the efficiency of controlling the railway gate which is helpful for avoiding the level crossing accident, also Mobile Application saves the time of level

crossing vehicle as they know the status of Railway Gate.

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