Journal of Telecommunications System & Management

Reddy et al., J Telecommun Syst Manage 2018, 7:2
DOI: 10.4172/2167-0919.1000165

Review Article Open Access

Safeguard of Railway Crossing Using IoT

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Abstract

The main prototype of this paper is to develop an application based on Internet of Things. In the present day world, railway gates at the crossings were monitored and operated manually. The master of the station gets the information about the arrival and the departure of the train and its timings. There is the more chances of occurrence of the accidents at the railway-crossings due to the miss communication or delay in the information or irresponsibility of the master. Sometimes the accidents may occur in the presence or absence of him. He may suddenly from their due any kind of reason. In that case the accidents may occur and chances to put many lives of innocent people in danger.

Keywords: Internet of things (IoT); IR senors; Rasberry-pi; Python

Introduction

India is one among the most developing country in the world in the fields of the economic and technology. It is the second populous country in the world. The population in India is increasing at the rapid growth. Thus, they require the different modes of transportation to move from one place to the other. India is the country of the population lying below the poverty line they require the cheaper mode of transportation. Railway is the cheaper mode of the transportation. Mostly, people used to travel from place to other using railway. As India is the developing country in the field of technology, the communication is usually done manually. The station master gives the information about the arrival and the leaving of the train to the master at the near-by railway crossings in order to control the flow of the traffic and prevent the accidents. Sometimes there are the chances for train for delay or early due to any reasons or chances for the miss-communication due to the technical issues. In that situation, there is the more chances for the occurrence of the accidents and loss of many innocent people. To overcome this situation, a latest application based on IoT is introduced. This application is highly used at the remote areas and rural areas where the availability of the station masters are not available properly and without the presence of proper communication system [1-5].

Related Information

The key objective of this application is public safety. The existing system is completely manual based and the more chances to put the public in danger, this invention of the technology are required. As the Internet of Things is the sensors based application, we require the sensors to monitor the movement of the trains. For this, we require the IR sensors to be deployed at the both sides of the gates. These sensors are used to communicate the railway tracks with the crossing gates and LED signal lights. This communication system helps the people to be alert about the arrival and the departure of the trains and secures themselves from the accidents. The advancement in the technology helps to build a safe and secure application to operate the system, so the system will be secured for the people in order to avoid the mistakes done by the security-guards to avoid the occurrence of the accidents. The IoT applications can be used to develop the monitoring kind of applications like the fire accidents to give the alarms when suddenly the fire occurs, to check the quality of the goods or to monitor the location of the food items for the passengers on the train etc. The authors mentioned in the references used the microcontrollers for the opening and the closing of the gates, but the work with them is difficult when compared to the microprocessors [6-10].

System Architecture

As the railway is a huge transportation system and one of the cheapest means of transport of the people where every individual can meet the expenses of it, thousands of people used to travel by the trains every day. As this is heavy network and path is laid in a way such that it meets the many surrounding villages where we encounter the railway-crossings at towns and villages. The trains in India travel with the different speeds based upon the type of it. The highest speed of the train is India is noticed as 95 km/hr, whereas the lowest is 57 km/hr. Due to the variations in the speeds of the trains, the developed application should also support the trains with different speeds. We require the IR sensors to know the arrival and the departure of the trains at the railway-crossings and the railway stations. For this we place the IR sensors to railway tracks. One among the sensors is placed at the distance of 10 km from the crossing or the station. The other sensor is placed at a distance of 7 km from the station or the junction. The distance between the sensors is to be at least 3 km. These help in regulation of the information regarding the arrival of the train. In similar, two more sensors are placed at a distance of 7 km and 10 km from the junction to know the departure of the train. These sensors are connected with 14 V DC Motors in order to regulate the opening and closing of the gates. The architecture is placed in the opposite direction

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Received July 30, 2018; **Accepted** July 31, 2018; **Published** August 10, 2018

Citation: Reddy GBK, Reddy GSK, Reddy RR, Navya G (2018) Safeguard of Railway Crossing Using IoT. J Telecommun Syst Manage 7: 165. doi: 10.4172/2167-0919.1000165

of the track. When the train approaches the first sensor, this system contains the two light-emitting diodes. It is p-n junction diode that has the two LED's-red and yellow. When the train approaches near to the junction or the station, the red LED light will glow indicating the arrival of the train. When the train moves away from the junction, the yellow LED light will glow indicating the departure of the train. These changes in the lights indicate the arrival and the departure of the train. The DC motors are connected to the sensors that are connected near to the crossing. When the train arrives the first sensor, it gives the change signal lights by glowing the red LED light when the sensor gets the sufficient voltage. When the train approaches the second sensor, it starts communicating with the speakers by producing the sound that indicates the arrival of the train and at the same time, the DC motor will helps to close the gate at the junction. When the train crosses the crossing and reaches the first sensor that is nearer to the gate on the left-side, it changes the LED signal light from RED to YELLOW indicating the train leaving. When the train reaches the last sensor, it gets communicated with the sound system indicating that the train has left by opening the gate. These sensors require a device to communicate with the other devices named Rasberry-pi. Rasberry-pi is component used to connect the sensors with the other devices to carry out their work efficiently. It is of the size of a ATM card. It is small and easy to carry. It has RAM upto 1 GB. It is cheaper of cost and works effectively when compared with the other devices such as Aurdino, Beagle Board etc., components. Raspberry-pi is provided with the different types of the pins. It has audio and video pins so that we can watch and listen to it. It is provided with the two USB ports so that we can connect the USB to it and the Ethernet port of it is used to connect the wi-fi LAN of the local router to it for the internet facility. When the train is detected by the sensors, information of the train is sent to Pi to turn on the changes in the LED signal lights. Later, the DC Motor that is connected to the Pi helps in opening and closing of the gate with the help of information about the train from the Pi. These hardware components require a medium of communication for the interaction of one device with the other device. That language is Python. It is the more effective language and easy to learn. It is the only language that supports the IoT based applications. This language helps in passing the information about the train from the sensors to the LED signalling lights and the DC Motor through the Pi. The connectivity of the hardware components is shown in Figure 1.

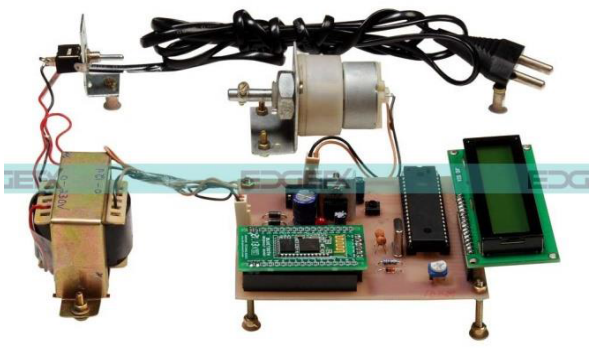
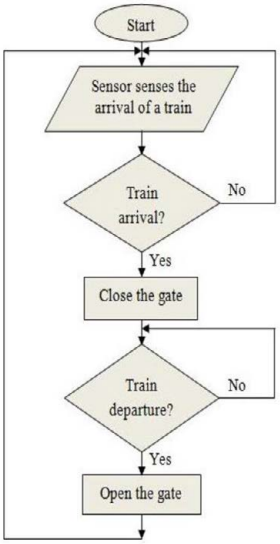


Figure 1: The connectivity of the hardware components is shown in the following diagram.

Algorithm



The algorithm for the opening and the closing of the gates during the arrival and the departure of the train is as follows.

Step 1: Start.

Step 2: Check the current status of IR sensors and the LED yellow light.

Step 3: Continuously check the status of the red LED light.

Step 4: If the both IR sensor on right side whether they gets the required voltage, the yellow LED light is turned into red, then go to step 5, else go to step 3.

Step 5: Now activate the motor to close the gate and turn on the RED light and turns off the yellow light for the indication of the people about the arrival of the train.

Step 6: Now check the status of the left side IR sensors.

Step 7: If the both IR sensors on left side gets activated, then go to step 8, else go to step 6.

Step 8: Now activate the motor to open the gate and turn on the yellow light and turns off the red LED light indicating the people about the departure of the train.

Drawbacks

1. Control of the gates becomes difficult with the mico-controller when compared with the microprocessor.
2. Aurdino is delicate device and it should be handled with very difficulty.
3. Because of the complexity in the circuit board and its architecture, the development of the prototype involves a huge time for development.

To overcome the above issues, Aurdino is replaced by the Raspberry-pi as it is easy to handle and it consists of 900 MHz quad-core ARM Cortex A7. It is cheaper of cost. It is very efficient in handling the circuits and the connectivity when compared to the other devices. Microcontrollers are replaced by the microprocessors for the automatic signalling of the signal lights and controlling the gates.

The operations that are performed by this application are:

1. Automatic changes in the LED signalling lights fro yellow to red indicating the train arrival and departure.
2. The automatic opening and closing of the gates during the arrival and the departure of the train [11-17].

Conclusion

This prototype is an advanced technology developed to avoid the accident and control the flow of the fast developing traffic. This kind of applications is mainly used in the areas where there is high-flow of the traffic and in the far-way places where the availability of the station-masters is not available. This technology is mainly useful in backward areas where there is no proper communication facility for the station-masters and the areas where huge crowd uses the crossing in their day-to-day life. This technology replaces the all the guards at the railway-crossings and may put the many employees in the risk of losing their jobs. As the IoT is a monitoring technology in many fields, a there is chance of lose in the employment opportunities.

References

1. Wang X, Bin N, hang CY (1992) A new microprocessor based approach to an automatic control system, International Sym-posium on Industrial Electronics, pp. 842-843.
2. Kottalil AM, Abhijith S, Ajmal MM, Abhilash LJ, Babu A (2014) Automatic Railway Gate Control System, International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, 3: 2.
3. Mahdi AS, Al-Zuhairi (2013) Automatic Railway Gate and Crossing Control based Sensors and Microcontroller. International Journal of Computer Trends and Technology (IJCTT) 4: 7.
4. Pwint HNY, Tun ZM, Tun HM (2014) Automatic Railway Gate Control System Using Microcontroller, International Journal of Science, Engineering and Technology Research (IJSETR), 3: 5.
5. Chellaswamy C, Srinivasan S, Ramesh Babu R (2014) A Humanitarian Intelligent Level Crossing Controller Utilizing GPS and GSM, 2014 IEEE Global Humanitarian Technology Conference-South Asia Satellite (GHTC-SAS) September 26-27 Trivandrum.
6. Krishnamurthi K, Bobby M, Vidya V, Baby E (2015) Sensor Based Automatic Control of Railway Gates, International Journal of Advanced Research in Computer Engineering and Technology (IJARCET) 4: 2.
7. Chandrappa S, Dharmanna L, Shyama Srivatsa Bhatta UV, Sudeeksha Chiploonkar M, Suraksha MN (2017) Design and Development of IoT Device to Measure Quality of Water. IJ Modern Education and Computer Science 4: 50-56.
8. Chandrappa S, Dharmanna L, Jagadeesha S, Kumar R (2015) Segmentation of Retinal Nerve Fiber Layer in Optical Coherence Tomography (OCT) Images using Statistical Region Merging Technique for Glaucoma Screening International Journal of Computer Applications Vol. 128.
9. Kishore V, Anthony LB, Jayarin PJ (2014) Prioritized traffic management and transport security using rfid. ICT and Critical Infrastructure: Proceedings of the 48th Annual Convention of Computer Society of India 1: 757-764.
10. Han Q, Liang S, Zhang H (2015) Mobile cloud sensing big data and 5g networks make an intelligent and smart world. IEEE Network 29: 40-45.
11. Perera C, Liu CH, Jayawardena S, Chen M (2014) A survey on internet of things from industrial market perspective. IEEE Access 2: 1660-1679.
12. Aboelela E, Edberg W, Papakonstantinou C, Vokkarane V (2006) Wireless sensor network based model for secure railway operations. IPCCC 2006. 25th IEEE International.
13. Ai B, Cheng X, Kurner T, Zhong ZD, Guan K, et al. (2014) Challenges toward wireless communications for high-speed railway IEEE Transactions on Intelligent Transportation Systems 15: 2143-2158.
14. Pascale A, Varanese N, Maier G, Spagnolini U (2012) A wireless sensor network architecture for railway signalling, Proc. 9th Italian Netw. Workshop, pp: 1-4.
15. Mansingh BB, Selvakumar K, Kumar SV (2015) Automation in unmanned railway level crossing. Intelligent Systems and Control (ISCO) 2015 IEEE 9th International Conference, pp: 1-4.
16. Mahdi AS, Zuhairi Al (2013) Automatic railway gate and crossing control based sensors and microcontroller. International Journal of Computer Trends and Technology (IJCTT) 4: 2135-2140.
17. Biswas S, Bhuiyan RH, Hoque S, Hasan R, Khan TN (2013) Pressure sensed fast response anti-collision system for automated railway gate control. American Journal of Engineering Research (AJER) 2: 163-173.