International Journal of Engineering & Technology, 7 (2.7) (2018) 414-417

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Research Paper

Energy conservation technique for smart transportation system

V. Rahul [1] *, Ch. Kowsalya Devi [1], Dr. Mohammed Ali Hussain [2]

[1] B. Tech, Dept. of ECM, Koneru Lakshmaiah Education Foundation, Guntur Dist., Andhra Pradesh, India.
[2] Professor, Dept. of ECM, Koneru Lakshmaiah Education Foundation, Guntur Dist., Andhra Pradesh, India
**Corresponding author E-mail: rahulvaddiv@gmail.com*

Abstract

Electricity is a primary concern everywhere and for everyone. In our daily transportation, we observe most of the time electricity is used unnecessarily and Electric short-circuits occur frequently. Railway coaches are mainly considered in this paper. We have described how to reduce electricity consumption in railway coaches using the raspberry pi and ultrasonic sensors interconnected to the cloud. Considering present smart coaches in railways, the passenger count and their comfort are taken as challenging, but not the production and conservation of electricity. The annual power consumption of Indian Railways is nearly 4% out of countries annual power consumption. Not only in railways systems, this can be further implemented in any other transport systems or in any platforms as well, by this we can reduce the human intervention. Where the loco pilot can control the electricity usage from his cabin, if not it is automated. However, the wireless communication technologies are secured by SSL (Secure Socket Layer). Simply we connect all the required interfaces to pi to acquire the output.

Keywords: *Raspberry Pi; Ultrasonic Sensors; Interface; and SSL.*

1. Introduction

In present, electrified generation power production, its management, and conservation became a major problem. Most of the cases, electricity and its uses are crucial to surviving in the present world. However electricity is produced by introducing new techniques day by day, its conservation will be the constant sense that should be aware of. Based on Indian electric statistics 2017, 76.5% of electricity is being produced using coal rest of the electricity is produced by (Hydro-10.5%, wind-3.7%, and others-9.2%), analysing the present electricity producing, techniques solar-62%, wind power-34% and others-4%.From the above statistics, 4% of electricity is utilized by the Indian railways annually. The electrified root trackage including all railways is around 23, 555 kilometres, where 7, 216 railway stations along with 13, 313 trains extended with passenger coaches of 54,506 addition to that EMU/MEMU/DMU are of 8,805 which consumes 4% of electricity from annual electricity consumption of India. Indian railways help passengers to reach their destination that carries around 22.21 million passengers per day, 8.107 billion annually, in this process, electricity consumption is increasing while increasing comfort for the customers and also increasing in electric short circuits are graphed and safety is concerned. The LHB coaches and ICF coaches far away updated with smoke detection sensors. Now this paper enhances into further developments that help railway coaches to be automated using Raspberry Pi along with ultrasonic sensor and any other additions.

Every railway coach is placed with this module that helps to power on/off of an electric device that is placed near every berth in a railway compartment automatically/manually by the loco pilot that helps railway to conserve more electricity than before and bring down the electric short circuit accidents. However, The Indian railway is trying to introduce solar power production by placing solar panels [7] on top of every compartment. Memorizing the above point, this paper will be very much useful to railways to build with automated equipment.

2. Existing work

Based on the research finding of author Dr.Md.Ali Hussain he has discussed about the security for e-commerce by using SSL (Secure Sockets Layer), in this SSL it performs the major role like mutual authentication between client and server to establish a secure communication channel between them. The author concluded that to make SSL more reliable and secure, we want to provide back end and front end the web server and internet service. SSL (Secure Sockets Layer) is not present in railways it should be implemented. Only Wi-Fi (Wireless Fidelity) is implemented in some tourist trains and in railway stations.

Ch. Sukesh Reddy define a method to calculate the length of the objects using raspberry pi and ultrasonic sensor that the distance between the ultrasonic sensor and the object is measured with help of servo, moves the ultrasonic sensor from 0-180 degrees and detect the angle at which side of the person starts and ends as well as the distance calculated is stored in a variable, the data collected is transferred to the application over Wi-Fi. This is taken as a reference such that the count of ultrasonic sensors will decrease while this is used passenger detecting purpose.

The author M.Shravanth Vashist proposed an experiment to quantify the reduction in diesel consumption of the end-on-generation that powers the electrical load such that one solar railway coach can generate electricity up to 18 kWh in a day and saves around 108 million litres of diesel annually. According to our experiment, the electricity usage can be reduced 15%-20% more than M.Shravanth Vashist proposed.

Copyright © 2018 V. Rahul et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

3. Block diagram

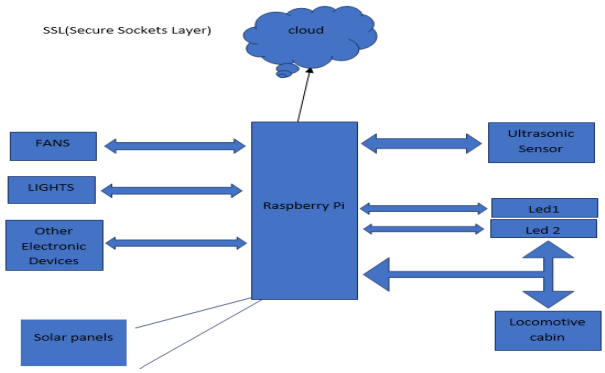


Fig. 1: Device Connectivity through Cloud.

Firstly raspberry pi is programmed according to the proposed work in fig.1 using python programming language and interfaced with an ultrasonic sensor, LED lights and a buzzer (if required), also the interior electronic devices like fans, lights, power sockets and other devices are connected. The data, as well as running processes date, are being updated in the cloud. So that, the railway authorities and loco pilot can monitor and control the system manually (if required).

- The raspberry pi is programmed to control lights, fans, and other electronic devices automatically using python language.
- The ultrasonic sensor is connected to raspberry pi to calculate the distance [4]. In other terms to sense the presence of the passenger and the objects in the locomotive.
- Parallelly fans, lights, LED indicators, wi-fi enabled electronic devices are connected to raspberry pi based on their necessity.
- The ultrasonic sensor updates for every 8 minutes and turned off itself into off state.
- This process of sensing is done thrice until a passenger or an object is spotted.
- If not available the whole working devices in that particular area are turned off automatically.
- This on/off state of the devices can be easily noticed by LED indicators (RED, GREEN).
- This LED indicators connected to raspberry pi are placed in railway compartment as well as in locomotive cabin.
- This whole process is continuously uploaded to cloud.
- So, that the updating, manipulation, inquiry, monitoring, analysis can be done.
- This cloud data can be used to refer to further developments.
- The whole system is secured using SSL(Secure Socket Layer), Where the information and maintenance of these are kept confidential.

4. Proposed work

The main objective of this paper is to reduce the usage of electricity in the railway coaches and in any other transport systems. Because of overuse and unnecessary use of electricity in railway compartments, electric short-circuits are happening. To reduce such type of accidents and electricity usage this model will be useful. The working process of this model is to sense the minimum height of the passenger along with their luggage that is to sense the presence of the passenger for a particular number of times in the given limited height. If the passenger or any object is sensed by the sensor. The lights, Fans, power sockets and any other electronic devices maintained by the railways [9] will be turned off if not turned on until next sensing happens. Generally, the raspberry is programmed such a way that it turns ON for every 8minutes if any passenger or any object is not detected for 3 times of its consecutive run the whole electronic devices available[3] in a particular area, are turned off. And the data is continuously sent to the railway cloud so that if anything is noticed wrong then the railway would become alert. This can be designed such a way that it is operated manually/Automatically mostly automatic use is preferred. The indication using different coloured LEDs, whether the electronic devices are turned on/off is shown in the locomotive cabin. So that the above idea is satisfied. And also the solar panels [6] are indirectly connected to the module so that the power generation and storing is managed accordingly. Thereby the electricity is conserved in the areas where ever it is possible. Power supply system of Indian Railway Coaches is done in few different ways Self Generating (SG), End of Generation (EOG), Head On Generation (HOG) [8].

5. Component description

5.1. Raspberry Pi

The Raspberry Pi is a small-sized embedded device that can be plugged into your TV as well as keyboards. This little computer is capable of being used in electronics paper, and in many more things like your desktop, PC does things like spreadsheets, word processing, surfing the internet, and playing games. It also capable of plays high-definition video. Our goal is to see that these devices should be used by kids all over the world for learning programming.



Fig. 2: Raspberry Pi Board.

The Raspberry Pi 3 in fig.2 is the third generation which is modified version of Raspberry Pi 2 Model B in February 2016. Compared to the Raspberry Pi 2 it has a 1.2GHz 64-bit quad-core ARMv8 CPU is built in along with 802.11n Wireless LAN, Bluetooth 4.1,Bluetooth Low Energy (BLE), 1GB RAM,4 USB ports,40 GPIO pins, Full HDMI port, Ethernet port, Combined 3.5mm audio jack and composite video, Camera interface (CSI), Display interface (DSI), Micro SD card slot (now push-pull rather than push-push), Video Core IV 3D graphics core.
This is the main core device that helps to build this paper. We used this Pi to monitor and control the electronic devices.

5.2. Ultrasonic sensor (HC-SR04)



Fig. 3: Ultrasonic Sensor.

An ultrasonic sensor in Fig.3 is a device that uses ultrasonic waves and calculates the distance to an object. The distance is calculated by sending an ultrasonic wave of a specific frequency and receives the echo. Then the elapsed time between the sound wave [5] that

is generated and the sound wave that is bounced back is recorded. We know that sound travels through air at a speed of 344m/s and however the same speed calculated back so it is multiplied by the value. After the calculation, the final value is divided into half because the sound travels in two directions.
We used this sensor for the similar process, but it turns on/off for every 8minutes and senses for 3 consecutive times. The working process is very simple the distance will be calculated automatically since raspberry Pi is programmed with python language.

5.3. LED

Light Emitting Diode in fig.4 is a semiconductor device. It emits visible light when electricity passes through it. The led output can range from red (wavelength approximately 700 nanometers) to blue-violet (wavelength approximately 400 manometers LED converts an electrical energy [1] into the light.
In our paper LEDs are connected to the raspberry pi. These are placed in the compartments and locomotive's cabin that indicates the state of the electric device present in that area whether it is On/Off.

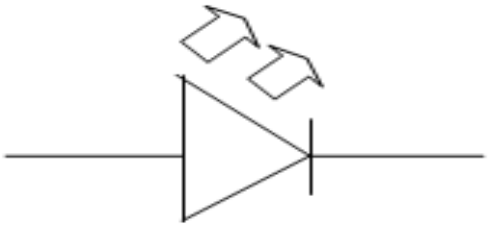


Fig. 4: Light Emitting Diode.

5.4. Fans



Fig. 5: Fan.

(Ref: RDSO/PE/SPEC/TL/0021-2005, REV-2, COR-1, BLDC).
The DC carriage fans of sweep 400mm work on 110V DC supply. And they are suitable under voltage range of 90-140 (Ref: RDSO/PE/SPEC/TL/0021-2005, REV-2, COR-1, BLDC) DC. The motor of the fan is permanent magnet type; it is lightweight and small in size. These fans are presently used in all the railway coaches.

5.5. Lights



Fig. 6: Lights.

Fluorescent Light (FL) filling works at 110V AC/DC
Ballast and is provided with polycarbonate diffuses universal type AC/DC ballast, these type of lights used in general, 2nd class, Sleeper coaches. Where, 14-watt lamps, LED light for night lamps are used in chair cars. Not only FL but also doorway light, lavatory, light, night light, passenger alarm coach indication light comes under light fittings, where we have to replace and reduce their use.

5.6. Solar panel



Fig. 7: Solar Panel.

Solar Photo-Voltaic (SPV) Panel in fig.7 is required to convert solar radiation directly into electricity with a maximum power rating of 300 Wp per module. The total number of solar panels per coach shall be 16 and size of each panel shall be around 2m x 1m and maximum weight per panel 23 kg. Net Voltage of the rooftop solar panels shall be around 120V dc. If so, 28 LED lights of 9watts each, 27 BLDC Fans of 32watts each and mobile charging sockets of 10watts each can run, such that more than 600 crores per year can be saved.

5.7. SSL (secure socket layer)

SSL (Secure Sockets Layer) [2] is used for transferring data between the client and the server. SSL fig.8 uses both Asymmetric and symmetric encryption techniques for transfer of data between client and the server. It is a successor of Transport Layer Security (TLS). AS a reference of OSI model it acts between the application layer and the transport layer.IN session layer between application layer protocol HTTP and transport layer protocol TCP it acts as an interface as shown in figure1.SSL is inbuilt with Netscape and it is compatible. In order to establish a communication between the client and server SSL handshake is established between them.

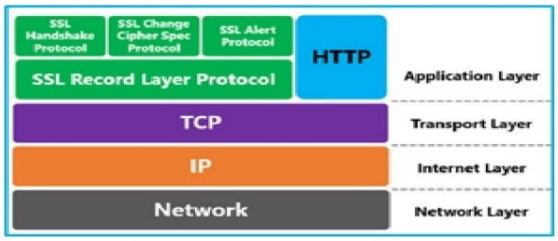


Figure 1. SSL Protocol stack.

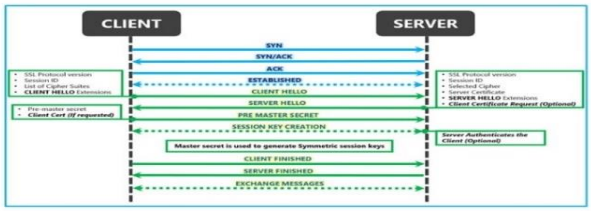


Figure 2. SSL Hand Shake.

Fig. 8: SSL Protocol.

The tracking data is continuously sent to the railway cloud so that spotting the disturbances and manual operations can be done easily. In future, any interfaces are connected to detect fire and to control solar power consumption. The data and running system will be secured by this model.

6. Conclusion

A model can be designed in such a way that it can be operated automatically and manually if needed. It reduces the power consumption and electric short circuit accidents in railway coaches make railway more secure than before. There is a chance of reduc-

ing 20% of electricity use in the railway department if this model is equipped with railway stations, manufacturing units, and mainly in railway coaches. This model can be further implemented by adding some more features like fire sensors, alarms etc. If this model gives good feedback it can be used in any other transport systems. Therefore the energy is conserved.

References

[1] Rail coaches with rooftop solar photovoltaic systems: A feasibility study. Article (PDF Available) *in* Energy 118:684-691 · January 2017 *with* 178 Reads, Received 13 May 2016, Received in revised form 19 September 2016, Accepted 24 October 2016, Available online xxx.

[2] Length Calculator Using Ultrasonic Sensor and Raspberry Pi with Android App CH. Sukesh Reddy*, Atul Motilal Tiwari, Bala Murugan P Department of Electrical and Electronics Engineering, Saveetha School of Engineering, Saveetha University, Chennai, India.

[3] Power Supply System of Indian railway Coaches, Mahesh Kumar Jain, September 20, 2014.

[4] Obstacle Detection for Visually Impaired using Raspberry Pi and Ultrasonic Sensors. Ayush Wattal Dept. of Information Technology JSSATE Noida. India.

[5] Solar photovoltaic assistance for LHB rail coaches Article (PDF Available) *in* Current science 107(2):255-259 · July 2014 *with* 138 Reads.

[6] Dynamic Analysis of Indian Railway Integral Coach Factory Bogie.Article (PDF Available) International Journal of Vehicle Structures and Systems 6(71):16-20 · May 2015 *with* 1,971 Reads.

[7] Peripheral control with a Raspberry Pi - An ultrasonic sensor Saba Ahsan Dept. of Communication and Networking School of Electrical Engineering Aalto University, Espoo, Finland firstname.lastname@aalto.fi.

[8] Md.Ali Hussain, M. Ravi Shankar, V. Vijaya Kumar, and Y. Srinivasa Rao, Energy Conservation Techniques in Adhoc Networks, International Journal of Computer Science & Information Technologies (IJCSIT), Vol.2 Issue 3 May-June 2011, ISSN 0975 – 9646.

[9] Mohammad Arshad, Dr. Md Ali Hussain Secure Framework to Mitigate Man-in-the-Middle Attack over SSL Protocol, Indian Journal of Science and Technology, Vol 9(47), DOI: 10.17485/ijst/2016/v9i47/103383, December 2016.