International Journal of Research in Engineering, Science and Management
Volume-3, Issue-6, June-2020
www.ijresm.com | ISSN (Online): 2581-5792

Enhanced Safety and Management System for Metro Train

K. N. Vanisha[1*], Sahana Girish Shetty[2], M. K. Rakshitha[3], Prathiba Wadeyar[4], P. Suma[5]
[1,2,3,4]*Student, Department of Electronics and Communication Engineering, East West Institute of Technology, Bengaluru, India*
[5]*Lecturer, Department of Electronics and Communication Engineering, East West Institute of Technology, Bengaluru, India*
*Corresponding author: vanishan1998@gmail.com

***Abstract*: In order to achieve high safety, we need advanced metro train system. In order to overcome the drawbacks of existing system we are presenting Enhanced safety and management system for metro train. Here train runs between two predefined stations without having any driver inside in it. It helps to rescue the people from unexpected situations such as fire accidents and also provides medical alert, Theft alert and emergency alert to next station as well as control unit which is not present in current metro train system. It ensures safe journey of trains by monitoring the tracks through monitoring unit.**

***Keywords*: Driverless, Wi-Fi, Microcontroller, Monitoring unit, Coach unit, Control unit.**

1. Introduction

The current metro train system has a lot of improvements which can be implemented using automation. The automated system for a metro train is an integrated application which makes announcements when the train reaches the station and displays the train status at control unit. This embedded application mainly focuses on overcoming loop holes in the existing system. It is optimized to meet the cost and power consumption requirements.

The principle problem has been the lack of cheap and efficient technology to detect problems in the rail tracks and of course, the lack of proper maintenance of rails which have resulted in the formation of cracks in the rail and other similar problems caused by people which jeopardize the security of operation of rail transport overloading of passengers in coaches can cause wear and tear of tracks and train parts.

Passengers have no access to contact control room during panic situation like theft or during medical emergency, hence the system is installed with emergency alert system to trigger an alert as per the events like theft or medical emergency immediately to control via wireless so that control room will be ready for the situation when train approaches the platform [1]. Fire detection system is necessary which will alert the control room immediately.

2. Methodology

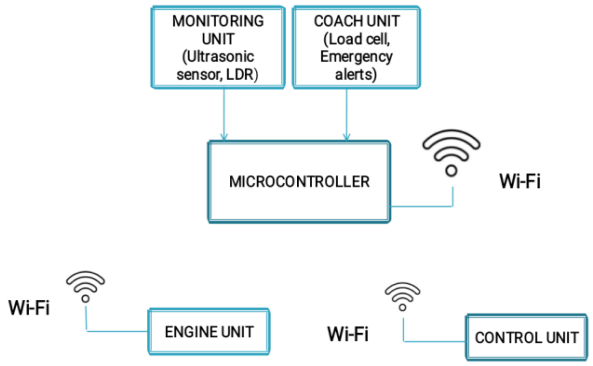

Fig. 1. Methodology

The proposed system as shown in Fig. 1 is mainly streamed towards end to end automation in metro train technology which includes majorly 4 different modules.

- Monitoring Unit.
- Coach Unit.
- Driverless Metro.
- Control unit

A. Monitoring Unit

The system includes monitoring unit which runs ahead of metro train to ensure the safe journey of train by conducting the safety check before train approaches that spot, the system always leads the train which checks for the crack defects in track using LDR module and LED combination mechanism where light is passed using LED and LDR module is used to monitor the light which penetrates through the crack defects [2]-[4].

B. Coach Unit

Every coach unit is installed with load cell which monitors the weight of passengers boarding on the coach, when the load exceeds the limit it is considered as overload condition and alert is provided to the control room and also the metro train will stop

automatically. The unit is also installed with emergency alert system where passenger can select the type of emergency condition using keys and screen to select, the selected emergency alert is sent to control room over the wireless module [5].

C. *Driverless Metro*

Nearest control room is used to trigger the metro train journey by using control switch and thereafter the metro train will stop automatically at every station without any human required to drive it manually. Using the LDR module and LED combination the train is stopped at every station for some regular interval of time and it moves automatically to next station [6], [7]. Wi-Fi technology is used to audio announce the control room and platform about the approached train on the station.

D. *Control Unit*

Control room unit is equipped with LCD which will display the alerts received from the monitoring unit and train's coach unit. And audio circuit is use to announce the alerts.

3. Implementation

This project makes use of microcontroller as central processing unit which controls every functions of the train. As shown in Fig. 2, indicates the interfacing of sensors with microcontroller in monitoring unit.

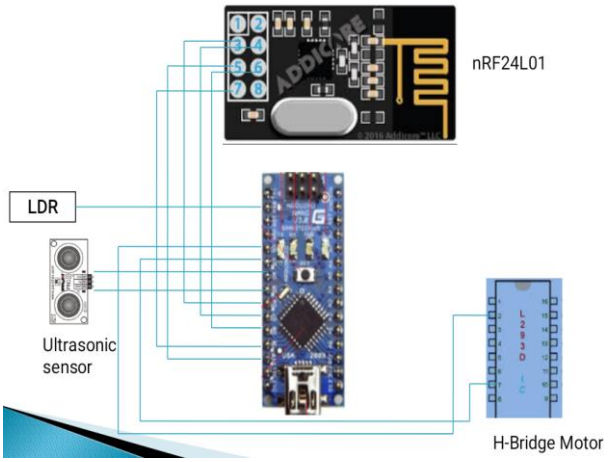

Fig. 2. Interfacing set up of monitoring unit

On the basis of this flowchart which is shown in fig. 3 we developed software to our model. When the monitoring unit starts it first initializes the wireless module then it checks if any obstacle is present in front of monitoring unit by sending ultrasonic waves.

If ultrasonic waves reflect back it indicated that obstacle is present, then monitoring unit will stop and send the message to engine unit to stop the train. If there is no obstacle on track, then it checks for track cut using LDR [8].

If there is track cut, then monitoring unit will stop and sends the messages to engine unit to stop the train and to control unit to take the necessary measures. If there is no track cut, message is send to engine unit and control as "ROUTE IS CLEAR".

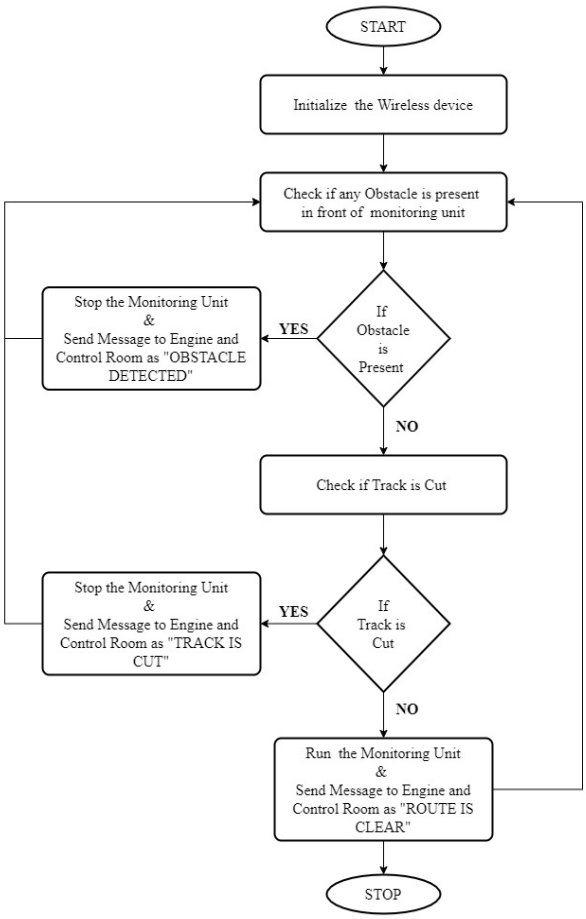

Fig. 3. Flow chart of monitoring unit

As shown in Fig. 4, indicates the interfacing of sensors with microcontroller in coach unit.

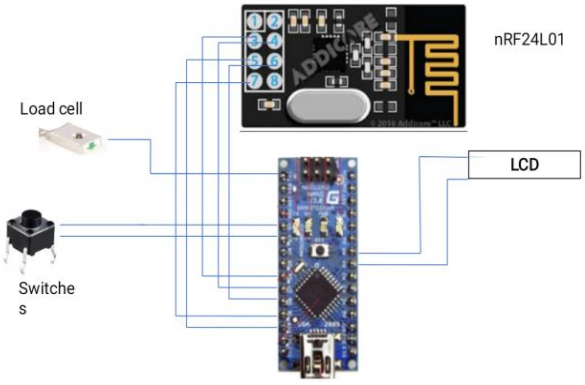

Fig. 4. Interfacing set up of coach unit

The flowchart of coach unit shown in fig. 5. In this first we will initialize the wireless device.

In our project we are using transceiver module. First we will check the load value for some kg since it is prototype we will check only for grams. If it is exceeded, then it will send the

message to engine and control unit to stop the train. If it is in normal condition it will checks for any emergency button is pressed. In this we are only showing fire detection.

As shown in fig. 6, indicates the interfacing of sensors with microcontroller in engine unit.

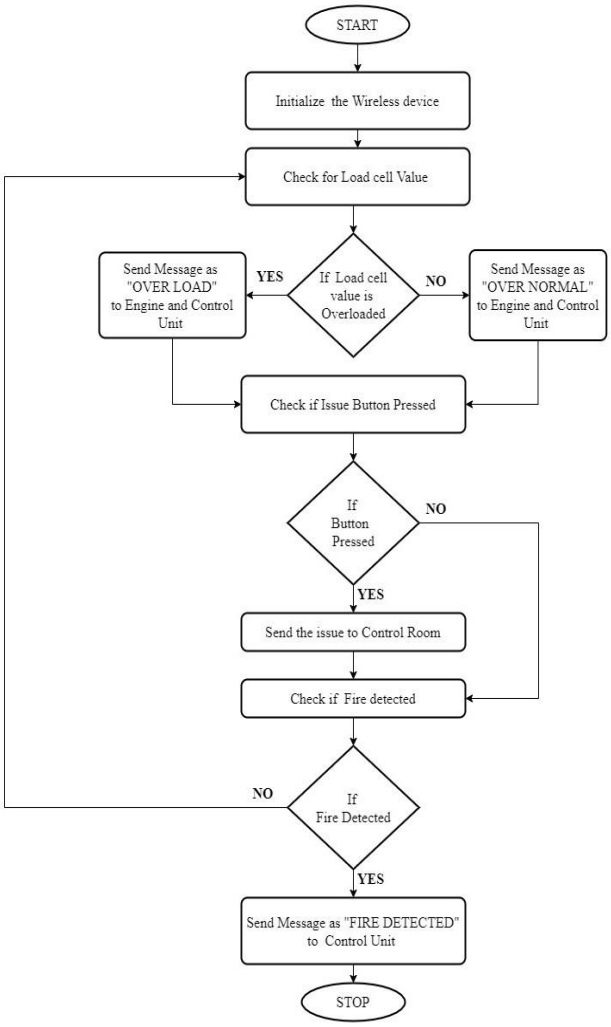

Fig. 5. Flow chart of coach unit

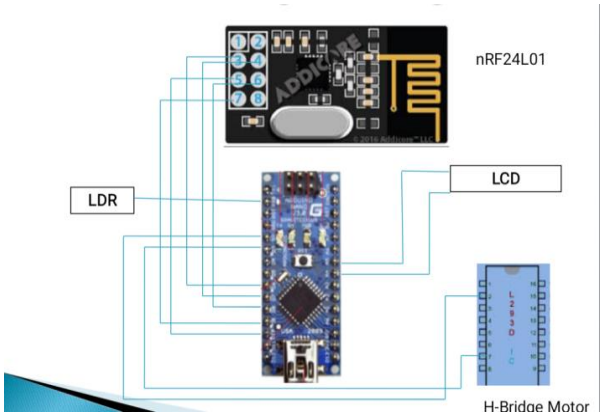

Fig. 6. Interfacing set up of engine unit

As shown in fig. 7, indicates the interfacing of sensors with microcontroller in Control unit.

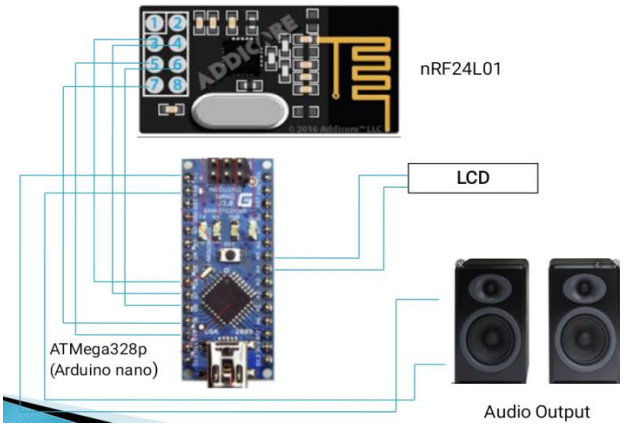

Fig. 7. Interfacing set up of control unit

4. Results

A. *Monitoring Unit*

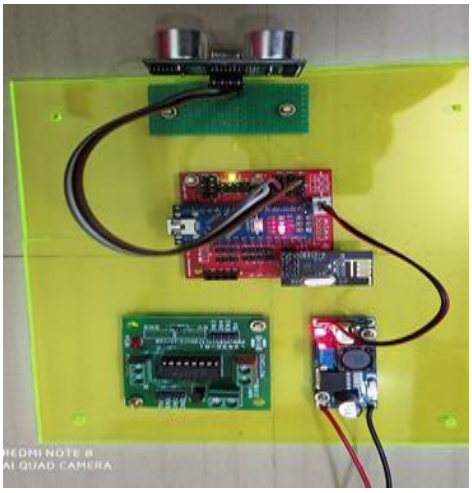

Fig. 8. Monitoring unit

As shown in fig. 8, In this project, by building a prototype we would demonstrate that the train travels from one station another without onboard staff assistance. Automatic acknowledgement of station arrivals, announcements on arrival, opening and closing of the doors by the microcontroller are also achieved without driver assistance.

B. *Coach Unit*

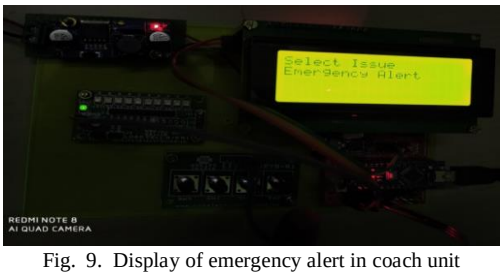

Fig. 9. Display of emergency alert in coach unit

Fig. 10. Display of overload condition

We are implementing Issue Selector in order to provide Medical alert, Theft alert and Emergency alert which helps to rescue the people from emergencies as shown in Fig. 9.

A Coach is where the passengers will sit inside the train so we have installed a load cell to monitor the weight contained inside the coach and to avoid any accidents that can occur by overloading as shown in Fig. 10. It monitors the weight of the compartment such that it does not exceed the train capacity.

C. Driverless Metro

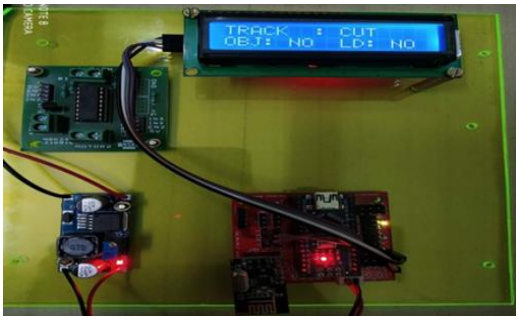

Fig. 11. Driverless metro

This unit receives the information or messages from monitoring unit if any abnormalities occurs then it will stop the train as shown in the Fig. 11. This is basically driving the train so here we have installed an LCD. So LCD displays any status that is occurring in the monitoring unit.

D. Control Unit

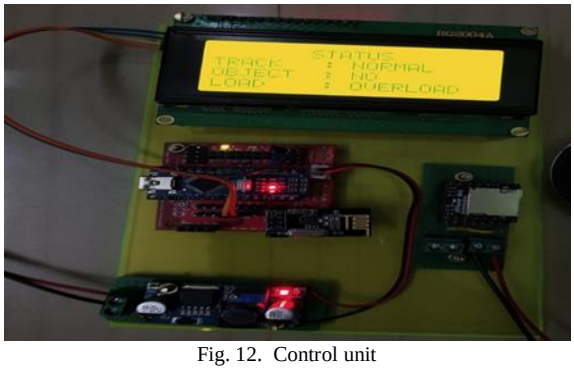

Fig. 12. Control unit

This unit receives the information from monitoring unit, engine unit and coach unit to take the necessary actions. When the train is in moving condition if there is any obstacle in the way, the ultrasonic waves reflects back and it is updated to control unit. Fig. 12 shows the output of control unit.

5. Conclusion

Metro train or rapid mass transit is one of the latest developments in railway systems. In spite of the advance developments there are some loop holes that can be overcome using automation. In this project we are overcoming the drawbacks of the current system by implementing appropriate automation. Human error is reduced by driverless operations which will reduce the rate of accidents. Automatic announcement, track monitoring, load monitoring inside the coach will provide better traveling experience and safety.

Acknowledgement

The authors would like to express their gratitude for the logistical support provided by East West Institute of Technology, Bangalore, during the completion of the study.

References

[1] Mehaboob Mujawar, Sangam Borkar, “Design and implementation of wireless security system for railway tracks”, IEEE 2017 IEEE International Conference on Power, Control, Signals and Instrumentation Engineering (ICPCSI).

[2] Nagib Mahfuz, Omor Ahmed Dhali, Safayet Ahmed, Mehen Nigar, “Autonomous railway crack detector robot for Bangladesh: SCANOBOT”, IEEE 2017 IEEE Region 10 Humanitarian Technology Conference (R10-HTC).

[3] Selvamraju Somalraju, Vigneshwar Murali, Gourav Saha, V. Vaidehi, “Robust railway crack detection scheme (RRCDS) using LED-LDR assembly”, IEEE 2012 International Conference on Recent Trends in Information Technology.

[4] Fatima Imdad, Muhammad Tabish Niaz and Hyung Seok Kim, "Railway Track Structural Health Monitoring System", 2016 15th International Conference on Control, Automation and Systems (ICCAS 2016).

[5] Victoria J. Hodge, Simon O’Keefe, Michael Weeks, and Anthony Moulds, "Wireless Sensor Networks for Condition Monitoring in the Railway Industry: A Survey", IEEE Transactions On Intelligent Transportation Systems, 2017.

[6] Prashanth. Addagatla, G. Koteshwar Rao, "A Modern Method for Detecting Cracks in Railway Tracks by the Efficient Utilization of LDR and LED System", International Journal of Engineering Science Invention.

[7] Shailesh D. Kuthe, Sharadchandra A. Amale and Vinod G. Barbuddhye, "Smart Robot for Railway Track Crack Detection System Using LED Photodiode Assembly", Advance Research in Electrical and Electronic Engineering, Volume 2, Number 5, April – June, 2015.

[8] K. Saritha, and Ch. Lavanya, "Embedded based crack inspection and mapping system for railway track maintenance by using robot", International journal of scientific engineering and technology research volume 4, issue 32, August 2015.