

DRIVERLESS METRO TRAIN INCORPORATED WITH AUTOMATION FOR SECURITY

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Abstract—Nowadays modern technologies are making human life much better. This project is to demonstrate the technology used in all advance metro train system. The additional features have been added in this project electronically and mechanically as well, so to achieve high safety, quick delivery without any traffic congestions. The train runs between two predefined stations without having any driver inside in it. The most significance attributes of this prototype project is its safety system. This project makes use of microcontroller as central processing unit which control every functions of the train. This Advance Mechanized Metro Train perform automatic open and closing of door in each station and collision avoidance whenever the two train lies on the same track. The train is highly sensitive to any hurdle that comes into the track. The train will gradually stop and the information is sent to the next station and also to central hub using IR sensor. In case of underground metro transportation we use LIFI communication to pass the message to next station when any obstacle or crack is detected on track to prevent from being happening of any casualties, count of the passenger inside the compartment will be monitored accordingly door locking system will work, RFID card is used for ticketing as prepaid metro card. Here we are also using renewable sources such as solar and we use piezoelectric source alternatively to produce electricity which can be utilized efficiently in metro. We can implement metal detector or bomb detector features in metro's door itself which produce more security. LCDs are used for corresponding displays.

Keywords—Driverless,RFID, LIFI, Piezoelectric, Solar panels, LPC2148 microcontroller, LCD, DC motor.

I. INTRODUCTION

Railway system conquers important place in the kingdom of transportation. Comparing with other means of transportation system, this specific mode has grater benefits as it can carry a large number of

passenger and large & heavy loads to long distances. In some cases metro is regarded as rapid transit train system. As of April 2014, 168 metro systems in 55 countries are listed. In terms of the reliability and safety parameters, we have not yet reached truly global standards. Though rail transport in India is growing at a rapid pace, the associated safety infrastructure facilities have not kept up with the aforesaid proliferation.

The automated system for a metro rail is an integrated application which makes announcements and displays the relevant station information when the train reaches a particular station. The implementation of the project is based on Radio Frequency Tags and corresponding readers. Serial communication, non-volatile memory storage, voice chip implementation and others assist in bringing out the desired functionality. It is optimized to meet the cost and power consumption requirements.

Radio Frequency Identification (RFID) has been an emerging technology in recent years. RFID technology can be effectively employed in number of claims due to its proclivity for efficiency. Radio Frequency Identification (RFID) is a generic term for technologies that use radio waves to automatically identify and track product, animal, or person by means of using RFID tags that are applied or incorporated on them. An RFID system consists of a tag, basically a microchip with an antenna and an interrogator or reader with an antenna. A central system of RFID consists of two primary components: The reader circuit and tag. The RFID tag and the reader circuit set up communication via waves of electromagnetic nature. Since there is no signal in underground we struggle more to communicate so we use LIFI communication for underground communication. IR transmitter and receiver is used for crack detection in track.

II. LITERATURE REVIEW

In the paper titled “A Driverless Metro Train using ARM7” by Parkash Ratan Tambare, and Chandra Jogi, tell us how a metro train can be made to travel from one platform to another without the aid of driver by using ARM 7 processor with the LPC2148 microcontroller. The functions are not only limited to travelling but it also automatically opens the door, waits for the passengers to board and deboard and closes the door automatically. The system will know if the train has arrived at the station or not, through the IR reflectance sensors. The walls adjacent to the train runs out when the station arrives because of which the IR rays are not reflected back, indicating to the train that the station has arrived. [1]

In the paper titled “Advance Mechanized Metro Train” by Bomdar Bagra1, Vinay Kesharwani, Neeraj Singh, RoheetKhambe, Niranjana Samudre tell us about how we can enhance the safety of passengers in metro trains by incorporating certain feature to it using AT-MEGA 328p as central processing unit. It provides features such as collision avoidance using ultrasonic sensors and monitoring the temperature of wheels of the train using IR sensors. Based on the data provided by these sensor systems the train will stop and avoid any casualties. [2]

In the paper titled “Automatic metro train to shuttle between two stations” by Prem chand bharti1, Ratneshpandey, Ashwini.v.mathurkar, Ashish mishra, Pradhyana.w.bawangade and Umesh bhandekar, they tell us about a prototype train which incorporated with locomoting from a station to another, using Arduino 328 board and ATMEGA 328p. the arrival of station is detected IR sensors. The number of passengers boarding and deboarding is monitored by 2 pairs of IR sensors. The opening and closing of the doors are also based on the output of IR sensors. It only represents a small portion of the technology that can be incorporated in the upcoming years for a better transport system. [3]

In the paper titled “Driverless Metro Train” by Divyang Kaka, Harshad Sonawane, Hemang Jani and Abhishek Patel, they talk about employing various automation features for the enhanced performance of the metro train by using Arduino MEGA as the microcontroller and a 12v battery for the power supply, IR sensors are used for knowing the arrival of station, opening and closing of doors and counting the passengers boarding and deboarding, a solar panel is installed on top to run light sockets and other auxiliaries, there’s also smoke detection using MQ2 smoke detector and emergency button provided. [4].

ENERGY GENERATED BY SOLAR PANEL

The global formula to estimate the electricity generated in output of a photovoltaic system is :

$$E = A * r * H * PR$$

E = Energy (kWh)

A = Total solar panel Area (m²)

r = solar panel yield or efficiency(%)

H = Annual average solar radiation on tilted panels (shadings not included)

PR = Performance ratio, coefficient for losses (range between 0.5 and 0.9, default value = 0.75)

III. PROJECT OBJECTIVES

In this project the train is supposed to travel from one station to another in a predefined path without the help of onboard staff(driver) and by using a microcontroller. Providing a facility where a single metro card holder can buy tickets for multiple passengers. Harnessing piezo electric energy and solar energy as renewable sources of energy. Monitoring the passenger count while boarding and deboarding using IR sensors. Automatic announcements, opening and closing of doors when the train arrives at the platform and an announcement while departure to alarm the passengers. Monitoring the tracks using IR sensors and stopping if any crack or obstacle is detected and send a message to the near by station using LI-FI and prevent casualties. Implementing metal detectors and bomb detector features in metro door itself for more security purpose, camera is placed to identify the intruder. Electricity i.e generated by piezoelectric is used as primary source to operate entry and exit gates of metro station. We can also introduce GPS systems in every station to display the location of train since it is driverless.

IV. PROBLEM STATEMENT

- ✓ manual service monitoring.
- ✓ more manpower is required and possibility of human error is more.
- ✓ Single metro card is not efficient to buy tickets for multi passengers.(multi ticketing system is not possible for single card)
- ✓ manual passenger counting.
- ✓ Installation and intergration is time consuming
- ✓ Poor communication in underground tunnels.
- ✓ Failure in detection of any fire accidents.

V. PROPOSED SYSTEM

In proposed system our project will detect the rail road crack, measuring distance for two rail road and also measure pursuing human in the railway track. IR sensors are used for detecting the crack in the track. If any crack occurs in the track, longitude and latitude of the place are messaged to the nearest station and ultrasonic sensor are used to measure the distance between the two tracks if any small

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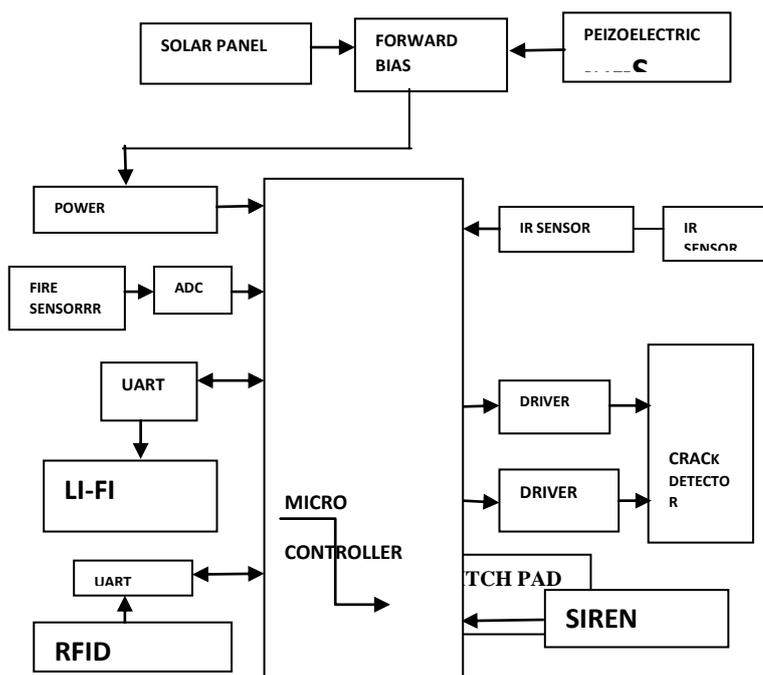
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variance is detected, a message to the nearest station is sent using LI-FI Transceiver modem. When the crack is detected immediately train will stop. Fire sensor is used to monitor the condition of the compartment, it alerts through siren if fire is detected. RFID is used for ticket booking; The RFID reader circuit is installed at the entry point and at the exit of the platform gate. When the passenger enters the platform gate, the passenger should expose the tag to the reader circuit placed at the platform gate. Similarly, the passenger, while getting down at the desired station, should show the tag in front of the reader circuit placed at the exit point. The platform door will open while entering and leaving from the platform. The cost equivalent to the distance travelled by the user is hence calculated. The information regarding passengers inside the train compartment, the platform and the ticket fare is all displayed using LCD's. For the power supply we are making use of solar energy and piezo electric energy, it is connected through a forward bias to maintain the direction of flow of current towards the battery.

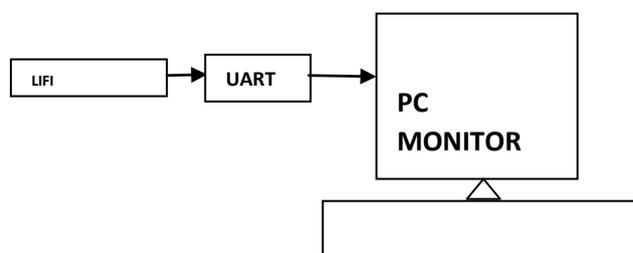
In order to achieve driverless operations, we need to write a code to instruct, which is done in C-language. To convert it into hex file for the microcontroller to work on, we use KEIL IDE/MPLAB and develop micro controller code. Express PCB is used for designing schematics and FLASH MAGIC/ BOOT LOADER for dumping the hex file into controller. ARM-7 LPC2148 is the Micro controller that we are using here, it is a 32-bit controller which gives us faster execution and 64 pins will offer more input and output functionality. We use a DC motor to achieve the movement of the train and it is controlled by the microcontroller. The motors require a power supply of 12v and microcontroller requires only 3.3v, to switch between these voltages we use a motor driver. To alert during any fire accidents we are using fire sensors whose output is given to an analog to digital converter before it reaches the input of micro controller to be processed. The tickets consist of RFID tag which is read as ticket count by a RFID reader. To monitor the tracks, we use IR sensor that will check for the continuity of the track and once any discontinuity (i.e crack) is detected the train immediately stops and the message of the location is sent to the monitoring unit. Since communicating in underground tunnels through electromagnetic waves is difficult we make use of LI-FI to communicate. UART is responsible for transmission and receiving of messages and the information is displayed on LCD screen at the monitoring unit.

VI. BLOCK DIAGRAM

Block Diagram: Transmitter unit (railway unit)



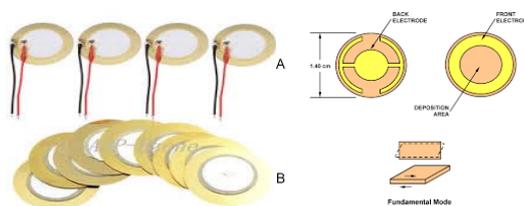
Receiver unit (monitoring unit)



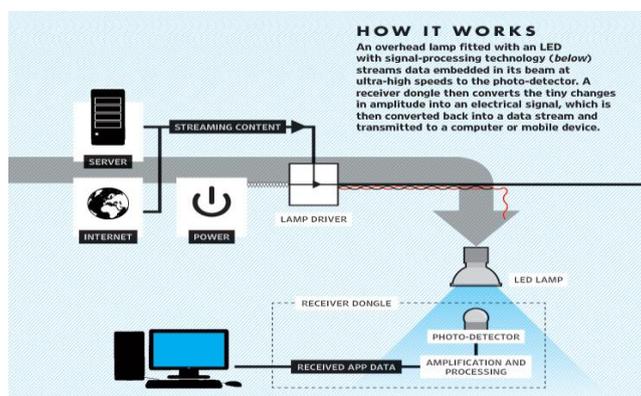
SOLAR PANEL:- Solar-powered photovoltaic (PV) panels convert the sun's rays into electricity by exciting electrons in silicon cells using the photons of light from the sun. This electricity can then be used to supply **renewable energy**.

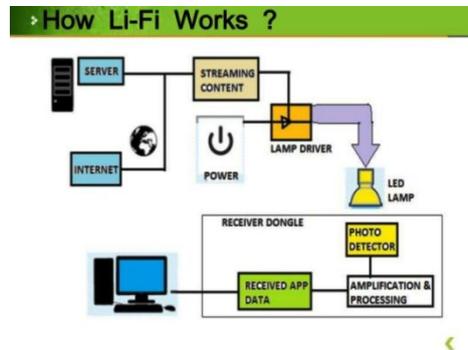


PIEZOELECTRICITY:- It is the electric charge accumulates in certain solid materials in response to apply mechanical stress. The word piezoelectricity means electricity resulting from pressure and latent heat.



LIFI Communication:- LIFI is a technology for wireless communication between devices using light to transmit data and position. In its present state only LED lamps can be used for the transmission of visible light.





V.CONCLUSION

The proposed ticketing system is presented in this project; the operation would be fully automated, efficient, enhanced and cost-effective. The proposed system can also be implemented in other places like toll gates, bus ticketing and others. The efficiency of the RFID system, as mentioned in this project, would make the implementation practical and effective. From the overall examination of current research on crack on railway track it is found that crack in the track have been recognized to the main factor of derailments in the past. Hence virtue of the vital solution of this problem. There are many advantages with the proposed system when compared with traditional detection technique.

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