



AUTOMATIC METRO TRAIN SHUTTLE BETWEEN THE STATIONS

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ABSTRACT:

This paper is designed to demonstrate the technology used in Metro train movement which are used in most of the developed countries. This train is equipped with a controller that enables the automatic running of the train from one station to another station. This proposed system is an autonomous train and it eliminates the need of any driver. Whenever the train arrives at station it stops automatically as sensed by an IR sensors. The door will opens automatically, so that the passengers can go inside the train and it is also equipped with a passenger counting section, which counts the number of passengers leaving and entering the train will show on display on a seven segment LED display interfaced with micro controller. The motion of the train is controlled by the Motor driver IC. Before starting and after stopping train at station the controller blows the Buzzer. Also the red and green signals are indicated using LEDs.

Keywords: Microcontroller, IR sensor, LCD screen, Buzzer, DC Motor

[1] INTRODUCTION

This project is developed to understand the technology used in the driverless metro train system which is mostly used by some other developed countries like Germany Japan and France [1]. It solves the problem of mass transportation as well as the high transportation cost in the metro train system. It also reduces the energy consumption by 30% [2]

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of the metro train as it also uses the solar panels on the top for running the accessories of the train [5]. It also gives accurate timing control of the train on station arrivals and departures [4].

This project is designed so that students can understand the technology used in now-a-days driverless metro trains which are utilized as a part of the greater part of the created nations like Germany, France, and Japan and so forth. This proposed framework is a self-ruling train and it kills the need of any driver. Along these lines, any human mistake is discounted. In this venture PIC microcontroller has been utilized as CPU. The entryway then closes after an endorsed time set in the controller by the program. The mechanized framework for a metro rail is a coordinated application which make shows the significant station data when the prepare achieves a specific station. This implanted application mainly focuses on overcoming escape clauses in the current framework. It is advanced to meet the cost and power utilization necessities.

HARDWARE REQUIREMENTS:

Diodes, Capacitors, Resistors, 8051 series Microcontroller, 7- Segment Display, IR LEDs, Photo Diodes ,Door, Robot Chassis, Motor Driver IC, Battery, Crystal, LEDs , Buzzer ,DC Motors.

SOFTWARE REQUIREMENTS:

Keil compiler

Language: Embedded C or Assembly

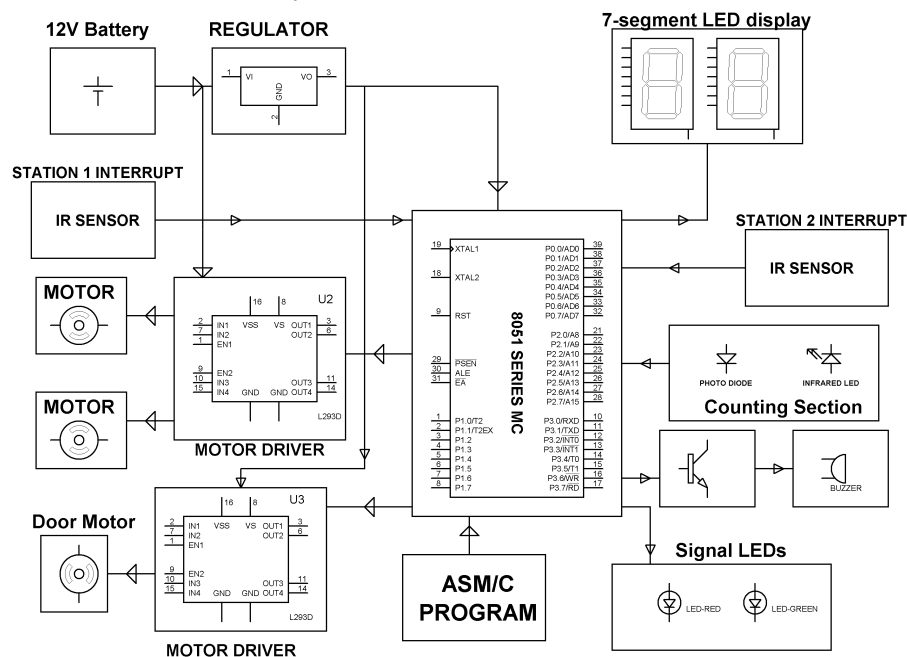


Figure: 1. Block Diagram of Automatic Metro Train

[2] DESIGN and IMPLEMENTATION

The working of the project can be understood by use of the state diagram for the arrival and departure of the train on the station [4] We have used Arduino Mega as the main controller. The supply of 5V to the Arduino is given by a source like power bank. All the components which are used for the different operation of the train are connected to the Arduino. At first, the train will get supply from a source and gets ready to move. Here we have used the 12V battery for giving supply to the motor driver IC and door motor. But before that, the LCD will display

the message that “The train will depart from the station in few minutes”. The buzzer operates for every LCD message and for door operation.

The passenger counting section came into action and count the passenger by use of IR modules and display it on the LCD. Then the LCD will display the message that “Doors are closing” with buzzer operation. The state of the motor is changed from off state to on state and the train starts moving and departs from the station. When the train is arriving on the station, the LCD will display the message that “Train is arriving on the station in few minutes” with buzzer operation. The state of the motor changes from on state to off state by use of RFID sensor and RFID tags. RFID sensor is fixed on the train and RFID tags are fixed near the station. By detection of RFID tags by RFID sensor, the train changes its state of motors from on state to off state.

Then the LCD will display the message that “The doors are opening” and the door control will open the door. The whole operation of departure and arrival is repeated on every station during the train operation. This project also contains some additional features like GSM based SMS service. We can track the position of the train by using this system and send the information to the control center by using this service. This train is having a solar panel on the top for running the auxiliaries of the train like LCD displays, mobile charging sockets, lighting, fans etc. The produced solar power can be converted into AC power according to the requirement by the inverters. The use of solar panels reduces the power consumption of the train.

This project also includes smoke detection via the MQ2 smoke sensor for the protection purpose. When there is some problem in the train due to system failure or electric shocks, smoke is produced which is detected by the smoke sensor and give the signal to the Arduino for protection of the train. It protects the train against fire as well as short circuits in the train. This project also consists an emergency braking button placed on the train. It is used at the time of emergency for apply brakes on the train. We have also used vibration sensor for the protection purpose. When the emergency occurs in the train due to any type of failure, that causes vibration and so vibration sensor senses it and gives an indication to control center by GSM facility.

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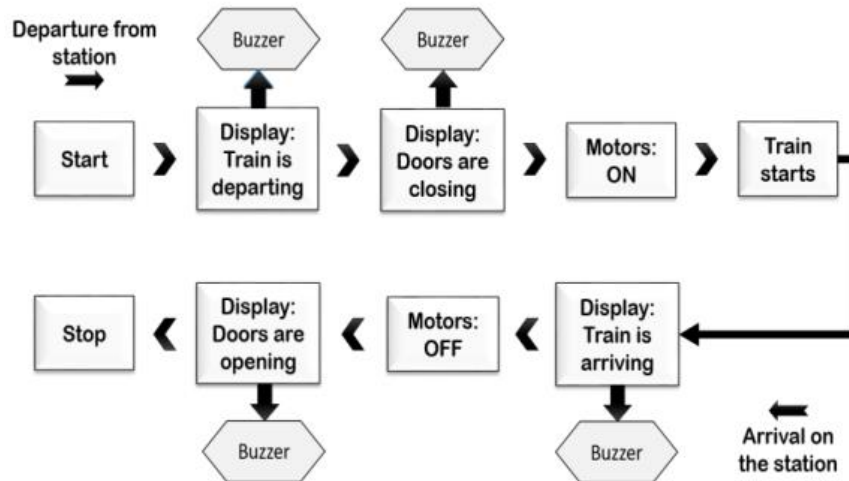


Figure: 2. Functional diagram of train during arrival and departure on the station.

[3] WORKING:

This train is equipped with a controller that enables the automatic running of the train from one station to another. This proposed system is an autonomous train and it eliminates the need of any driver. Thus, any human error is ruled out. In this paper 8051 Micro Controller has been used as CPU. Whenever the train arrives at the station it stops automatically, as sensed by an IR sensor. Then the door opens automatically so that the passengers can go inside the train. It is equipped with a passenger counting section, which counts the number of passengers leaving and entering the train. There should be a passenger limit for example 10 passengers is the limit- after 10 passengers getting into the train the doors will be automatically closed. The door then closes and the train starts after a prescribed time (there will be a time set already as to how many minutes. the train will stop at every station) set in the controller by the program. The passenger counts and the stations are displayed on a LCD display interfaced to the 8051 Micro Controller. The movement of the train is controlled by a motor driver IC interfaced to the 8051 Micro Controller. The train incorporates a buzzer to alert the passengers before closing the door and also warn them before starting. As the train reaches the destination the process repeats thus achieving the desired operation. Further the paper can be enhanced by making this system more advanced by displaying the status of the train over a larger display unit for the convenience of the passengers. The status of th

e train consists of the parameters like, expected arrival and departure time etc.

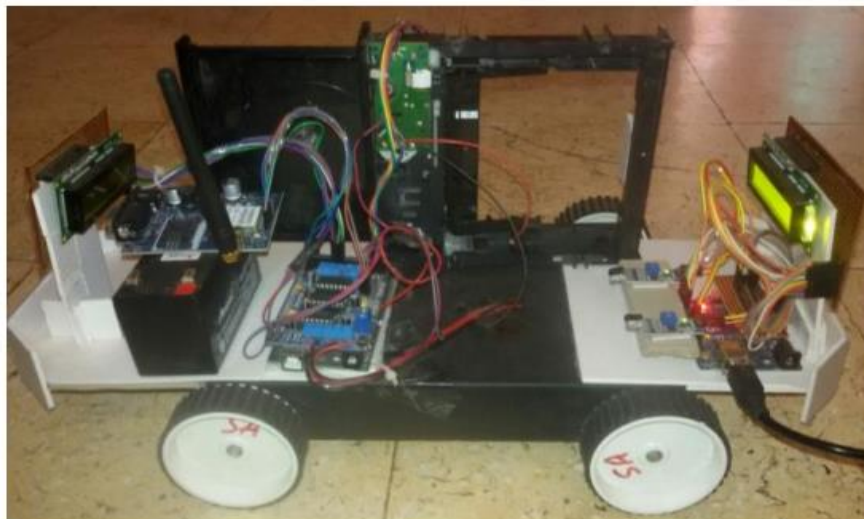
[4] CONTROL METHODOLOGY:

Metro Train Prototype is an 8051 Micro Controller Based Device. It is used in driverless metro train, which is used in most of progressing countries. These trains are equipped with CPU, which control the chain. The train is programmed for the specific path. Every station on the path is defined; stoppage timing of the train and distance between the two stations is predefined. The 230 volts is attenuated by 9 volts by transformer. Then it is rectified by the bridge rectifier made up of diodes. Then the 9 v is regulated by 7805. 1000 micro farad capacitor is used to filter the DC voltage. The LED attached to it checks the flow of power supply. In this project we try to give the same framework for this type of trains. We are using 8051 Micro Controller as CPU. The motion of the train is controlled by the Motor Driver I C. In our project, we have used IR sensors, where at proper locations with respect to each station,

an IR transmitter is situated. Whereas the other part of the IR sensor, the receiver, is installed on the train. Whenever a train travelling between stations, decodes a relevant IR signal, it will start its preparation to stop at the coming station.

[5]RESULTS AND DISCUSSION:

1. It is working on 8051 Micro Controller. It's a robotic train with sensors at both end.
2. If the train comes on to the station it stops automatically at the station with the help of IR sensor means that it has got an automatic start and stop arrangement.
3. Then its count the number of peoples entering in the train. For e.g. there is the counting sensor which count number of people entering in the train with timing sensor (e.g. sensor count 10 peoples and there is timing sensor with 20 second).
4. When the peoples enter in the train the sensor count the no of people entering in the train, when counting complete the train door automatically closed or if in the 20 second the counting not completed the door will automatically closed.
5. Then the train start to moving next station after either completing the count of 10 people or after 20 second.
6. When the train arrives at the predefined destination train stops automatically and the door of the train opens and then with the help of sensor again counting starts for the people who exit from the train and then it checks the number of people who enters in the train and after checking. The counting begins after 20 second and it's again move to next stations.
- 7 .it also has an obstacle sensor which determines the obstacle immediately stopping the train.



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[6] CONCLUSION:

The main reason behind this paper is to raise the attractiveness of public transport and ultimately contributing to improving the quality of life in our cities. This paper implemented for the new technology development to the metro train. This paper will greatly reduce the human intervention in the control of trains and hence saves time and money. By utilizing this auto metro prepare the timings of the prepare will be correct and it keeps away from a great deal of burden to the travelers. This venture will incredibly lessen the human mediation in the control of trains and subsequently spares a great deal of time and cash. In this manner the venture "AUTO METRO TRAIN TO SHUTTLE BETWEEN STATIONS" is enormously valuable in all angles.

[7] FUTURE SCOPE:

This system can be further improved in future by making use of high-speed sensors which enables fast and more efficient operation. In the future this system can be improved by creating a highly reliable metro trains with the help of new automatic train control and protection by the use of communication based train control, by implementing this the human intervention can be further reduced as a results it reduces the threats which are caused by human error. This project will lead to increase in technological trends and this will help the people in many ways.

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