

## Automatic metro train to shuttle between two stations

Prem chand bharti<sup>1</sup>, Ratnesh pandey<sup>2</sup>, Ashwini.v.mathurkar<sup>3</sup>, Ashish mishra<sup>4</sup>,  
Pradhyana.w.bawangade<sup>5</sup>, Umesh bhandekar<sup>6</sup>

<sup>1,2,3,4,5,6</sup> Dept. of electronics and communication engineering,  
Priyadarshini Indira Gandhi college of engineering, Nagpur, Maharashtra, INDIA

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**Abstract** - This paper illustrates the equipment used in metro train motion which are used in most of the progressed countries. In this automatic metro train, we have provided Arduino based controller that facilitates the programmed stopping of the train from one station to another station. This work presents the enhancement process of a framework for a driverless train instigated using Arduino based controller. The hardware circuit's design, which are built on circuit boards, are provided with various sensors for automation purposes. The hardware is assembled in a toy-like train framework. Driverless trains are outfitted with a control system, which is programmed to make them follow a precise path. Stations on such a path, timings of the train and distances between stations are all predefined. Messages and warnings are automatically generated and announced to the passengers. This paper presents the development process of a framework for a driverless train implemented using a ATMEGA328p ARDUINO. The hardware circuits, which are built on handmade PCB board are interfaced with various sensors for automation purposes. The Arduino C programming language is used for programming the Arduino.

**Keywords:** framework, automation, Arduino, actuators, sensors.

### 1. INTRODUCTION

Recent technological advancements are being assimilated in almost all point of our life including transit transportation, where a lot of upgradation has been made. Railroad transport, for fact, has undergone a huge transformation, starting with the early steam operated engines to the most recent bullet train.

Many developments in transit transport has utilized the existing infrastructure, where the existing metro system is being modernized and equipped with automatic train control and safety system in order to make them more productive. Driverless automated concepts have been adopted,

The intent of this project is to drive the train automatically with the help of sensors and safety of passengers is the basic concern of our model-based prototype metro train. In this work, part of this automation tasks is considered, and a Arduino-based prototype is developed. work such as running through a given path with predefined stations, and sensing the arrival at the station and hence, proper stopping are

implemented in the framework. Information that are synched with the train's movement through its path are announced to passengers via a LCD display. Moreover, alarm signals are produced as appropriate. Controlling of the doors in terms of open and close and timings of such actions are considered.

"Proposed New London Underground" Has Explained about the driverless automated concept. [1]

"Justifying automation" has explained about the operational safety enhancement device used to help automate operations of trains. [2]

Metro Automation Facts, figures and trends has explained about the modern trend used in the metro automation. [3] J.M. Erbina, and C. Soulasa.[4] has proposed the Twenty Years of Experiences with Driverless Metros has explained about the experiences without driverless automated train

Development of Onboard Train Automatic Control System for Korean Standard EMU. Processing's of the ISIE has explained about the onboard train automatic control system.[6]

Development of a Multi-train Operation Simulator with Interactive Human Computer Interfaces has explained about the multi-train operation simulator with interactive human computer interfaces [7].

Driverless CBTC has explained about specific requirements for CBT systems to overcome operation challenges. WIT Transactions on the Built Environment [8].

### 2. OBJECTIVES

1. This paper is intended to manifest the technology used in metro train motion which are used in most of the progressing countries.

2. This train is equipped with a controller that enables the automatic running of the train from one station to another.

3. The objective of the proposed system is an autonomous train and it eliminates the need of any driver. Thus, any human error is ruled out. In this project 'Arduino 382' has been used as CPU.

4. Whenever the train arrives at the station it stops automatically, as sensed by an IR sensor. Then the door opens so that the passengers can go inside the train.

5. 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 20 passengers is the limit – after 20 passengers getting into the train the doors will be automatically closed.

6. 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 Arduino 382 board.

7. The movement of the train is controlled by a motor driver IC interfaced to the Arduino.

8. The train incorporates a buzzer to alert the passengers before closing the door and also warn them before starting. When the train reaches its next stop the process is being repeated to achieve its desired operation.

9. Further the work 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 the train consists of the parameters like, expected arrival and departure time etc. passengers. The status of the train consists of the parameters like, expected arrival and departure time.

### 3. Methodology

METRO TRAIN PROTOTYPE is an Arduino 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 ARDUINO 382 as CPU. The motion of the train is controlled by the Stepper Motor, for displaying message in the train. 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.

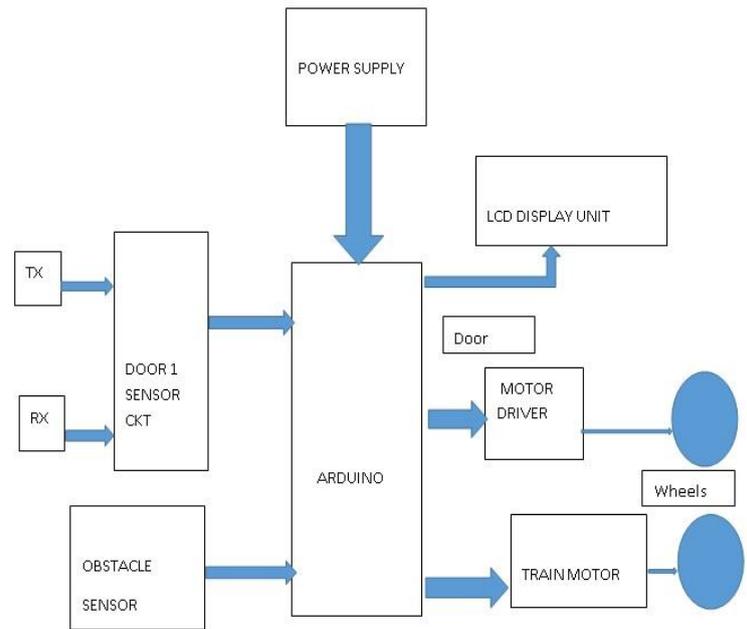


Fig :- Block Diagram of automatic metro train to shuttle between two stations

Fig -1: Block diagram of automatic metro train

### 4. Implementation

The role of any train conveyance system is to provide secure, consistent, efficient and high-quality service to passengers. As many transit lines run at or near their capacity limits, automation is often the only way to maximize the operative performance of a train service system. Applied on prevailing lines, mechanization is in many cases more remunerative than constructing new lines or increasing platforms.

The thought to train automation can be justified by their various benefits: itinerary of train operations become more exact and timely, the frequentness of the trains can be improved, especially in low traffic hours, as more and trains can be inserted in traffic without the need for more operational staff, and the augmented safety, where the element of human error is taken out completely. Besides, mechanization can reduce the wear-and-tear of train by optimizing energy consumption and capacitively reducing the operating costs through more effective and regular train operation. In a fully automatic transit system, care should be taken for all the processes that are normally requiring human participation. The initial train departure, trips between two stations, timing of train stoppage at individual stations, and controlling the train doors are examples of such processes. In addition, there are normally various activities that should be automated too. The safety systems represent important activities that renegade trains must have; like fire alarms with automatic fire fighting systems, sensing of any possible damage in the track and providing the information to the next train on the same track as well as to the base.

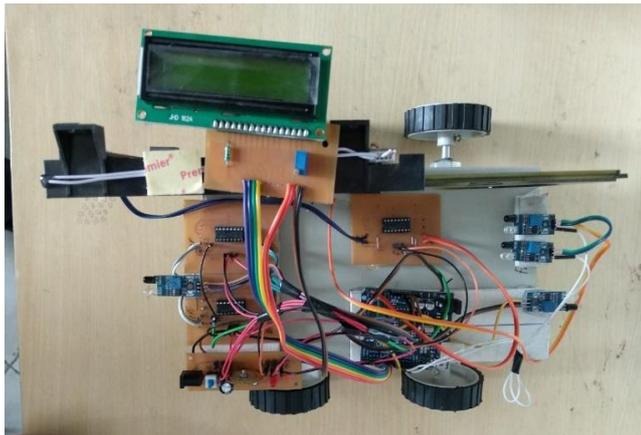


Fig -1: Final prototype Design

### 5. Result

An example of how embedded technology is used in application, specifically in the transport sector is presented in this paper.

1. It is working on Arduino. 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 20 peoples and there is timing sensor with 30 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 30 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 20 people or after 30 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 30 second and it's again move to next stations.
7. it also has an obstacle sensor which determines the obstacle immediately stopping the train.

Table -1: RESULT

INPUT	SIGNAL	OUTPUT
1 <sup>st</sup> IR sensor	0	Train stops and door opens (forward direction)
2 <sup>ND</sup> IR sensor	0	Train stops and door opens (reverse direction)
1 <sup>ST</sup> IR counting sensor	1	Counts +1
2 <sup>ND</sup> IR counting sensor		
1 <sup>ST</sup> IR counting sensor	0	Counts -1
2 <sup>ND</sup> IR counting sensor		

### 6. Conclusion

The driverless train that is framework presented in this paper is in fact a final year project. A general conclusion that can be said about such engineering projects is that they are presenting students to an open horizon of developments. Such projects can only represent a minor part of what the future and technology integration may look like for the modernization of different service sectors including transport. Researching and developing a working prototype enhance self-confidence and assure that it is possible to design a system and apply it for solving a particular problem by acquiring the necessary information. Moreover, developing a prototype system can serve as a basis of a far more sophisticated and advance form of control system such as a real driverless train system. In this paper we have decried how metro train can be automated with the help of paper presented above and it main advantage is counting the no of passengers automatically as they enter the train. This counting helps to reduce the overpopulation inside the train. The counting on the other hand is displayed on 16\*2 LCD display.

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