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Shuttling Metro Train between Stations

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Abstract-*Our project aims at demonstrating the technology used to shuttle metro trains between stations in most of the developed countries. The train consists of IR controllers that enable it to detect and stop at stations as they arrive. The system allows for running trains without any human intervention. This also rules the possibilities of human errors. The system uses IR sensors along with a microcontroller of 8051 family in order to achieve this goal. The train and station are equipped with ir sensor pairs. This helps rain to detect station as it arrives and make a halt automatically. After that the train doors are also equipped with IR sensors that help to determine the number of passengers in the train. The passenger count is also displayed in the train. If the train reaches its maximum passenger capacity, the door closes automatically. The door opens for specified time interval at each station, closes after that. The system also consists of a buzzer like alarm which alerts the users as soon as the doors begin to close. The process is repeated at each station.The whole system works using 8051 microcontroller*

Keywords— *8051 microcontroller, motor driver , DC motor, seven segment display, IR sensor.*

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I. INTRODUCTION

There has been much advancement in the urban railway transit, starting from the engine to the metro trains and to recent automatic metro trains. Driverless metro train is an intelligent and innovative mass transit solution. Driverless technology meets a many number of objectives, including high capacity, speed and regularity, reduced operational cost, adaptability, and flexibility; it fulfils the idea of new approach to mobility.

Modern Technology has developed a lot in all aspects of our life including transportation where huge transformation has undergone[1]. Even though, the accidents of trains are increasing day by day. Main cause of accidents and crashes are due to human errors and more than half of the people's death is due to accidents. To prevent this problem we have introduced a prototype of auto metro train where human interruption is not required. The objective of this paper is to drive the train automatically. This paper is implemented in many countries like France, Germany, etc. This paper main aim is to represent the technology used in shuttling metro train between stations. But considering present days the accidents rate has increased day by day, of these disasters are occurring due to human irregularity and irresponsibility. Processor doesn't have aprobability of doing errors but a man can do a mistake. The control of a train depends on the arduinoprogramming[2,9].Considering the safety of passengers we had used a flame sensor, whenever causing a fire accident it gives a signal to the passengers.Due to the human errors many accidents occur. In electric trains fault occurring chances are more. Metro Train is an integrated application which displays and announces the station names when it reaches a particular station. The existing system can have more chances to get miscommunication with the passengers while announcement.

II. LITERATURE REVIEW

Thabit sultan Mohammed, Wisam Fahmi AlAzzo, Mohammed Ahmed Akaak and Mohammed LaheebSuroor proposed a concept on "Full Automation in Driverless trains" [1]. The system concept proposes a solution to many of the major challenges related in existing metro trains systems. They used PIC microcontroller as CPU and to stop the train automatically they used IR sensors.

The unmanned train operation (UTO) [6] which doesn't require a driver's supervision has been implemented in many countries. Several other countries namely France, japan, had been testing out new technologies in this aspect, however there are fully functional driverless systems in countries like Dubai [2], is said to be the largest working metro line in the world. The driverless metro transit system in Torino, Italy [3] is among the successful metro systems in the world. They used the Siemens VAL technology [3] as a main component to complete an entirely autonomous metro transit to administer a high quality service to the commuters. Their main aim was to reduce the traffic congestions and also to reduce the structural circulation problems. V Sridhar wrote a paper on "Automated System Design for metro train" [5], it provides certain new applications such as automated announcement system using voice integrated circuits and radio frequency for tracking station data. It also mentions the usage of encoded RFID coils which are placed in every station, while the train is provided with a reader, at the time of train arrival the reader comes in contact with the RFID tags the reader receives the data and is programmed to stop when receiving the data while announcing the station details through the voice chip. Judith M. Cohen, Alexander S. Barron, Richard J. Anderson, and Daniel J. Graham wrote the paper called "Impacts of unattended train operations on productivity and efficiency in metropolitan railways" [6]. This paper gives the idea about the terminologies such as Grades of Operations (GoA), and the several types of it. GoA1 is a manually operated train, GoA2 is an automated train with a driver in it to perform crucial operations, GoA3 also has an automated train but it has a train attendant in the passenger car, GoA4 is a fully automatic train which doesn't require any supervision [4] Yap Kwee Seng, Ng Hon Wai, Dr Samuel Chan, Leong Kwok Weng wrote a paper which give the necessary steps to assure the security, availability and, reliability of the metro trains.

The "Mythologies, Metro Rail systems and Future Urban Transport" [7] by Dinesh Mohan gives reasons as to why the improvement of metro systems is necessary to increase the access and mobility in India. It also gives the information about the History, technology and urban transportation from the pr-1850 till the recent developments. It also discloses the problems such as "sustainable urban mobility" which were faced during construction of the Indian metro system and how they dealt with it.

A.Problem in the present system Rail based 'Mass

Rapid Transit System' has been extensively acknowledged as a solution for most of the traffic related problems which are faced in the majorly populated cities around the world. With the increasing in traffic, in addition to the increase in number of vehicles, the traffic congestion has significantly increased over the past years. In order to improve the public transportation system, the 'Mass rapid Transit Systems' have been provided or being planned around the world.

The main problems existing in the system are

- Constant need of human interference to ensure the safe operation.
- The implementation requires high cost and the installation consumes more time.
- Since the current system depends on man power for operation there exits risk of safety and many discrepancies.
- Over occupancy is among the major problems in the existing system as it may cause train delays and disrupt the schedule.

III. PROPOSEDSYSTEM

A.Description of System

Our proposed system decreases human interference by making the train operation automatic therefore reduces the risk of safety and availability.

The automatic commuter counting enables to point the heavy load point and adjust the schedule therefore reducing the over occupancy and also preventing train delaying. The obstacle detecting unit prevents from any accidents by sensing any interference ahead of the train movement.

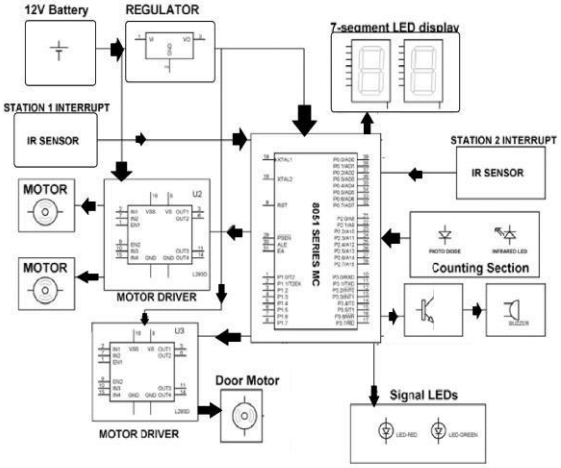

Fig. 1 Block diagram

The system will also display the necessary details about the stations with the help of 7-segment display. At the time of train arrival to the stations it reads the 8 bit data programmed in the controller and the train stops automatically. Two motor drivers are essential in this project, one for the train movement and the other one is for door operation. Power supply of 12V is necessary for operation.

B.Working

The circuit consists of 8051 AT895S52 microcontroller, infra-red sensors, DC motors, motor drivers, buzzer, battery and 7 segment display.

The prominent part of this project is 8051 controller. It acts as CPU, the seven segment display, IR sensors and the motor drivers are interfaced to it. The fig 1 shows the block diagram if the circuit where the microcontroller acts as the CPU . The input from IR sensors are taken to count the passengers and also the controller is programmed to stop the train upon sensing the any interference and after stopping it is programmed to open and close the door automatically with the help of motor drivers L293D and L298H, after a prescribed time. Microcontroller takes the supply of 12V from the lead acid battery.

The motion of the prototype is controlled by the L298H motor driver interfaced with the AT89S52 microcontroller,

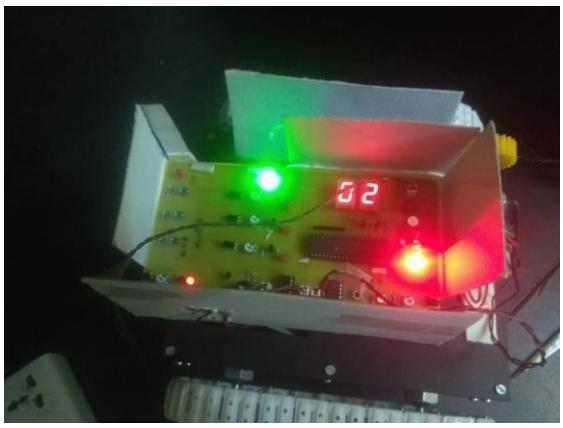

Fig. 2 Robot structure 1

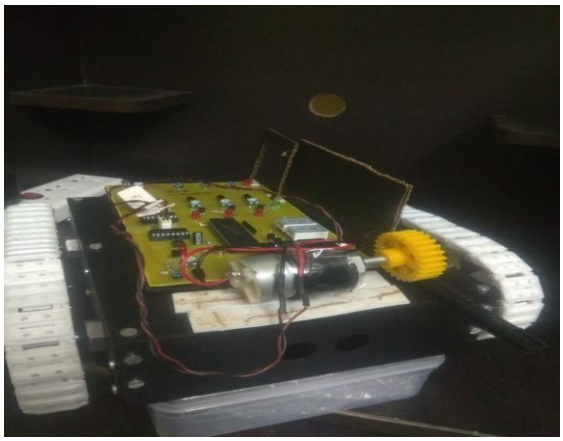

Fig. 3 robot structure 2

Prototype moves by controlling the rotation of two motor. Details of the each station is displayed in the display as the prototype stops after sencing the stayion and the door opens, this operation is done by L293D motor driver which operates the door by controlling the rotation of a single motor. The door closes when the prescribed time is reached or when the maximum occupancy is reached; the display. The passenger counting operation is done with the help of three IR sensors placed at the door, one sensor counts the passengers entering and the other sensor counts the passenger leaving the train. The front of the train is mounted with an IR sensor which is interfaced to the microcontroller. It acts as an obstacle detection unit along with the buzzer, when the sensor senses any object in front of the train, the train stops while the buzzer gives a warning sound.

IV. COMPONENTS

- AT89S52 microcontroller
- Seven segment display
- L298H driver
- L293D driver
- DC motors
- IR sensors
- Registors and capacitor
- buzzer

1.AT89S52 is a low-power, highperformance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density non volatile memory technology and is compatible with the industry standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed insystem or by a conventional non volatile memory programmer. By combining

a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highlyflexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry

- Seven segment displays are the output display device that provide a way to display information in the form of image or text or decimal numbers which is an alternative to the more complex dot matrix displays. It is widely used in digital clocks, basic calculators, electronic meters, and other electronic device that display numerical information. It consists seven segments of light emitting diodes (LEDs) which is assembled like numerical 8.
- L293d IC is known as a motor driver. It is a low voltage operating device like other ICs. The other ICs could have the samefunctions like L293d but they cannot provide the high voltage to the motor. L293d provides the continuous bidirectional Direct Current to the Motor.

A DC motor is an electric motor that runs on direct current (DC) electricity. In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.

- IR sensors- An infra-red sensor is an electronic instrument senses certain characteristics of its surroundings by either emitting or receiving infrared radiation. The IR sensor consists of IR LED and a IR photo diode. Its output voltage ranges from 3 to 5 volts and has a detection range of 2 to 30 cm. .
- Buzzer- piezoelectric buzzer is used to alarm when the IR sensors detect any obstructions to the train.

V. CONCLUSION

In recent days there are many documented failure of automatic system due to several reasons which include error caused by operators. The main objective of this project is to demonstrate that a processor can be programmed to avoid such incidents effectively and also to minimize the effects of overloading and due to that the time delay can be reduced and the frequency of the train improves by providing a better medium for transport. Mainly this prototype reduces the cumbersomeness by minimizing the human supervision as much as possible.

A.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.

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