DRIVERLESS SHUTTLING TRAIN

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ABSTRACT : The train designed here is intended to run between the two busy stations automatically without any manual involvement.Here a prototype module is constructed for the live demonstration. The proto type module is constructed with electro mechanical components and the μC unit controls the movement over the track between two reference points. To simulate the train a small trolley is constructed with 4 wheels, this is a motorized trolley and DC motor is used to drive the trolley. Magnetic switches are used to detect the destination (where the train must be stopped); permanent magnets are arranged at reference points and to maintain secrecy these magnets can be put under the ground.

Key Words : Train,Prototype,Module,Electro Mechanical Components,Motorized,Secrecy,Magnets

1.INTRODUCTION :

The driverless Train concept involves highly automated and control technologies, lot of care must be taken while implementing it practically to avoid accidents. Many advanced countries from all over the World implemented this kind of automated train systems to carry the passengers from airport to the central city, for this purpose separate tracks are laid down under the ground, these are called subways or metro lines. In this regard to study the technology of automated train systems and prove the concept practically, we decided to construct a basic module of driverless train which runs between the two stations.

2.BLOCK DIAGRAM :

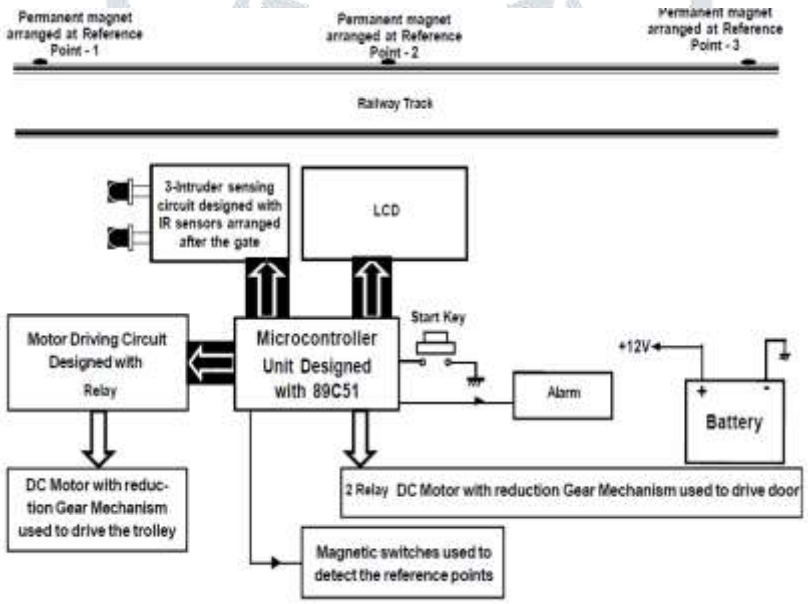

Fig 1 : Block diagram of driverless shuttling train

3.HARDWARE COMPONENTS :

1. **LCD :** A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector.In recent years LCD is finding widespread use replacing LED's, because of the ability to display numbers, characters, and graphics. Another advantage is, because of its compactness and ease of programming for characters and graphics, more information in the form of text message or graphics can be displayed.

Fig 2 : Lcd display in metro train

2. **DC MOTOR :** An electric motor is a machine, which converts electrical energy into mechanical energy. It is based on the principle that when a current-carrying conductor is placed in a magnetic field, it experiences a mechanical force whose direction is given by Fleming's Left-hand rule and whose magnitude is given by

Force, F = B i L Newton

Where 'B' is the magnetic field in weber/m^2.

'i' is the current in amperes and

'L' is the length of the coil in meter.

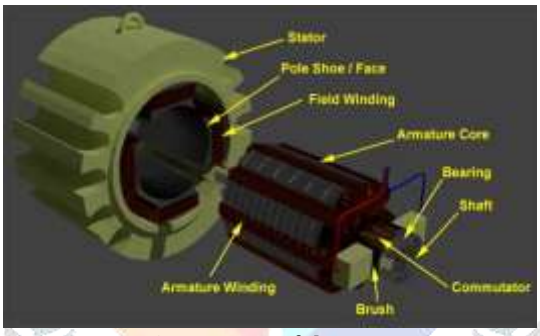

Fig 3 : Parts of dc motor

3. **MICROCONTROLLER 89C51:** A Microcontroller based on ATMEL 89C51 which is an 8- bit Microcontroller with 32 I/O lines configured as four ports, 4Kbytes of flash programmable memory, 128 bytes of data memory five interrupts and optimized 111 instruction set is used in the project work which can control all the activities of the train. A sensor based on magnetism technology is adopted in this design to perform many functions. The outputs of all the sensors are fed to microcontroller through various I/O lines. Depending up on the signals produced by the sensors, the microcontroller controls the two DC motors independently.

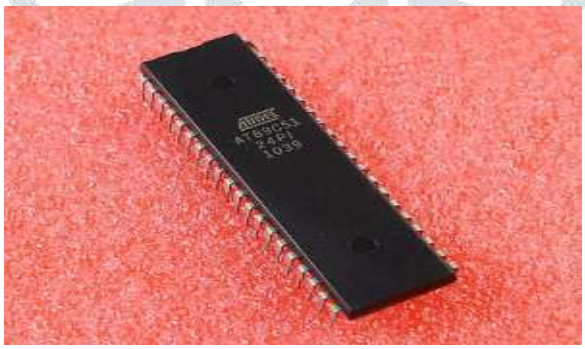

Fig 4 : Micro Controller AT89C51

4. **H-BRIDGE :** H-Bridge is an electronic circuit which enables a voltage to be applied on either side of the load and the H-bridge DC motors allow the car to run backwards or forwards. H-Bridge is a configuration of 4 switches, which switch in a specific manner to control the direction of the current through the motor.

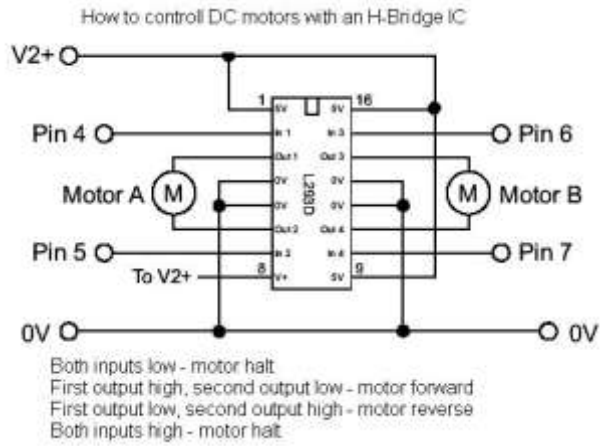

Fig 5: Dc Motor control with H-Bridge

S1	S2	S3	S4	Operation
1	0	0	1	Motor moves right
0	1	1	0	Motor moves left
0	0	0	0	Motor free runs
0	1	0	1	Motor brakes
1	0	1	0	Motor brakes
1	1	0	0	Short Power Supply
0	0	1	1	Short Power Supply
1	1	1	1	Short Power Supply

Fig 6 : H-Bridge Operation Summary

4. WORKING :

To simulate the train, the vehicle in the form of trolley is designed to run over a track, for this purpose an aluminum channel is used and it is laid over a wooden plank. DC motor is used to create the motion in the trolley and this motor is controlled by the microcontroller. Similarly one more DC motor with reduction gear mechanism is used to control the gate automatically. The control circuit is designed with 89C51 controller, since it is a self-controlled trolley; it moves between the three fixed reference points and at the reference points permanent magnets are arranged.Whenever the train reaches to the reference point at the station, the magnetic switch will be activated and based on this signal the controller stops the trolley by disconnecting the supply to the motor. Again the countdown timer for 30 seconds will be counted and during this duration again counts the passengers entering and exiting through the IR sensors placed at the door. At the last stop there won't be any countdown time, but the train stops until the total number passengers gets out of the train.

Initially before starting from the station, when the coach is empty, the gate remains in open condition. The controller counts the incoming passengers through the gate for specific time duration and after closes the gate automatically. Now the trolley travels in one direction to reach the other station. Once the trolley reaches to the station, it stops there automatically and opens the gate and the passengers are passed out through gate. After exiting the last passenger, again the passengers entering will be counted and again the process is repeated. Facility is provided such that the train waits at station for the passengers for a specific time and starts automatically.

The passengers count is done through the optical sensors arranged at the gate. The IR transmitter and receiver are arranged at the gate that senses the passing of the passengers and indicated to the controller. The controller counts the number of passengers and displays the count in the digital display interfaced to it. Heavy-duty re-chargeable battery is used to provide supply to the entire system. The two DC motors used are of reduction gear box mechanism type and are driven by a H – Bridge driver IC. And also an obstacle sensing circuit is designed infront of the train on track such that when any obstacle is identified, automatically the train will be stopped and activates the alarm. Once the obstacle is removed, automatically starts again.

5. CIRCUIT DIAGRAM :

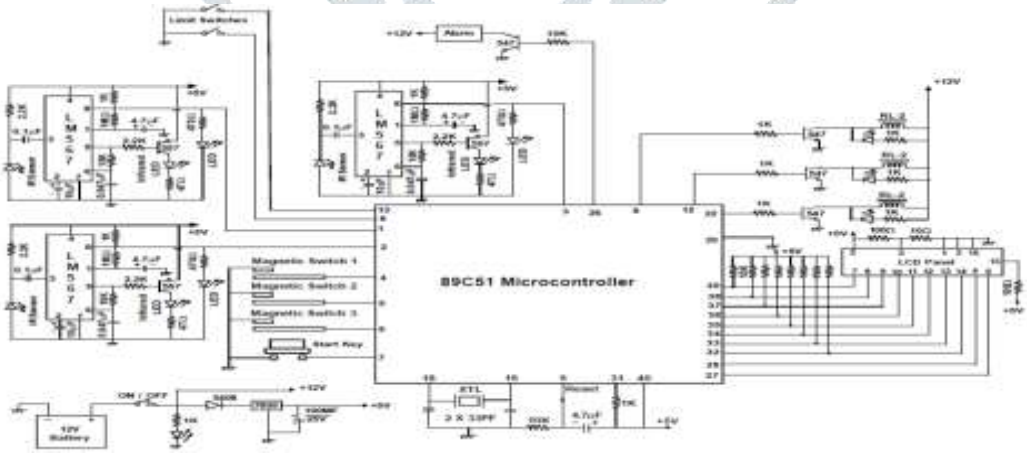

Fig 7 : Circuit Diagram of Driverless Shuttling Train

6. ADVANTAGES :

1. Trains can be shorter and instead run more frequently without increasing expenditure for staff.
2. Intruder detection systems can be more effective than humans in stopping the trains if someone is on the tracks.
3. Automatic closing of door is provided after the pre-scribed numbers of persons are entered or After a Certain time.
4. Less human error and no driver induced delays.
5. Driverless system tends to use shorter trains and frequent service. Shorter train, more frequent service results in less customer wait time and better customer satisfaction

7. FLOW CHART :

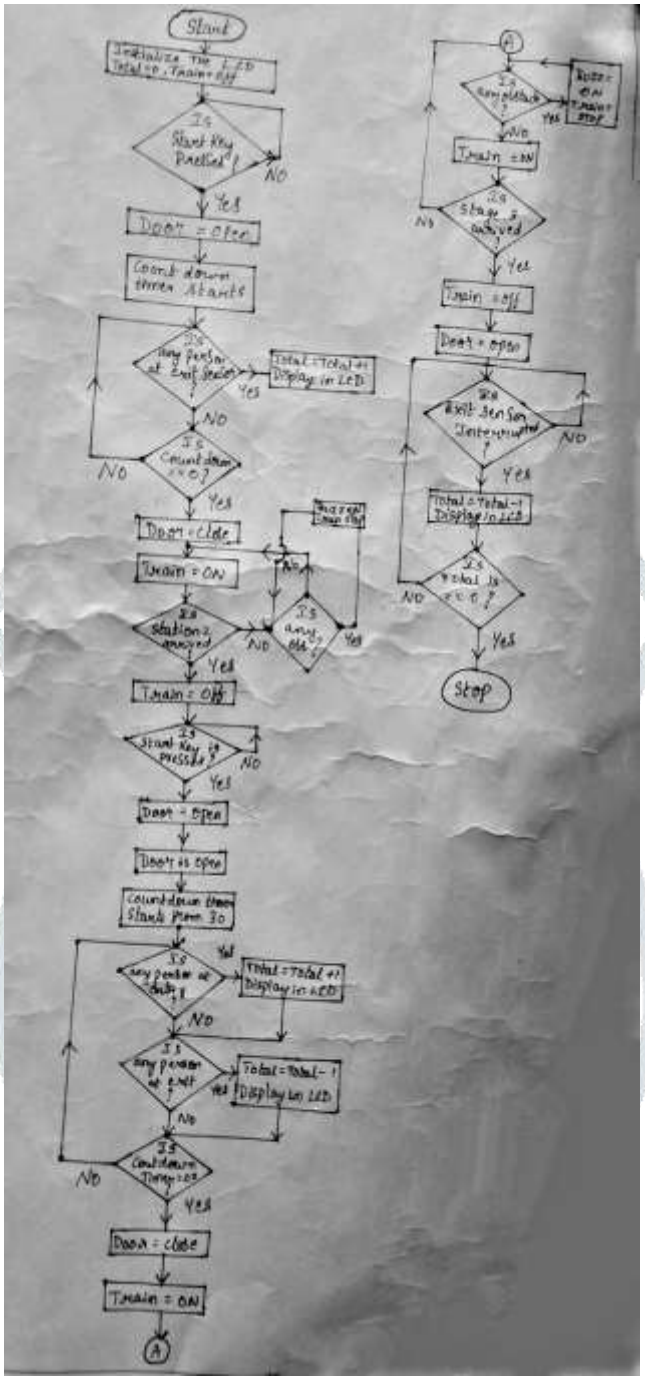

Fig 8 : Flow Chart

8.RESULTS : Hence the Design is implemented to run the train without driver and also using IR sensor which works on line of sight principle.

Fig 9 : Final Prototye design of Driverless Shuttling Train

9.CONCLUSION : This paper revealed that building a relatively low cost, high precision automatic driverless shuttling train is possible. Also the benefits of this system are seen with this Prototype design. Future decisions are to improve the system and make it useful for many other applications.

To prove the concept practically, a prototype module is constructed for the live demonstration, mechanical trolley is designed to run over a track, and a track is laid over a wooden plank, with these arrangements the environment is created to simulate the train and its track. The step by step approach is implemented to complete the work, at the end results are found to be satisfied.

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