

# A Low Cost Yet Super efficient Means to Prevent Overloading as Well as Accidents Due to Faulty Tracks in an Autonomous Metro Train Running without Human Labor

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**Abstract** - This proposed system is an autonomous public transport and it eliminates the need of any driver. Thus, any human error is ruled out. In this project microcontroller has been used as CPU. Whenever the public transport 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 public transport. The door then closes after a prescribed time set. It is also equipped with a passenger counting section, which counts the number of passengers leaving and entering the public transport. The door closes when it reaches maximum occupancy level irrespective of time allotted for the door to remain open. The passenger status is displayed on a LCD as interfaced to the microcontroller. The movement of the public transport is controlled by a motor driver IC interfaced to the microcontroller. When the limit of the passengers so set is crossed then the buzzer will start emitting sound as well as there will be a status display on the LCD. The lights and fans inside the public transport can be adjusted according to the number of passengers as described further. Also this is the prototype that I have extended so that it will be able to avert accidents due to faulty tracks or would help in faulty track detections along with preventing the problems due to overloading.

**Key Words:** Public transport, door, sensors, microcontroller, limiting count of passengers, LCD, motor, capacitive switch, conservation, eco-friendly, faulty track detections.

## 1. INTRODUCTION

This project is designed to create a prototype of a modern driverless public transport equipped with eminent features. It uses embedded technology which is software or hardware that is hidden embedded in a large device or system. It typically refers to a fixed function device, as compared with a PC, which runs general purpose

application. These public transports (prototype) are equipped with the CPU, which control the public transport. The public transport is programmed for the specific path. Every station on the path is defined; stoppage timing of the public transport and distance between the two stations is predefined. Also the following prototype will be able to avert accidents due to faulty tracks or would help in faulty track detections.

## 2. EXISTING VS. PROPOSED SYSTEMS

Few disadvantages of the existing system are:

- Constant human intervention.
- High cost.
- More Manpower is required.
- Installation and integration is time consuming.
- Overloading and under loading.

The proposed system overcomes the above disadvantages and has the below mentioned merits:

- Automated system requiring less manpower.
- It uses a capacitive sensor cum switch to sense the incoming passengers as well helps to limit the number of passengers.
- The capacitive sensor cum switch is made of biodegradable waste material thus being eco friendly.
- Display unit and buzzers are provided thus reducing any inconveniences caused.
- Automatic closing of door is provided after the pre-scribed numbers of persons enter.
- The lights and fans inside the public transport like metro trains, buses will be automatically switched off or is adjusted depending upon the number of passengers.
- The following prototype will be able to avert accidents due to faulty tracks or would help in faulty track detections.

### 3. MATERIALS USED

#### 3.1 AT89C51 Microcontroller

The IC is a low-power; high-performance CMOS 8-bit microcomputer with 4K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density non-volatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel IC 8051 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications. The IC 8051 provides the following standard features: 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, 2 16-bit timer/counters, a five vector two-level interrupt architecture, full duplex serial port, on-chip oscillator and clock circuitry. In addition, the IC 8051 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port and interrupt system to continue functioning.

#### 3.2 L293D IC

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively. Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

#### 3.3 LCD

LCD stands for Liquid Crystal Display. LCD is finding wide spread use replacing LEDs (seven segment LEDs or other multi segment LEDs) because of the following reasons:

1. The declining prices of LCDs.
2. The ability to display numbers, characters and

graph-ic 's. This is in contrast to LEDs, which are limited to numbers and a few characters.

3. Incorporation of a refreshing controller into the LCD, thereby relieving the CPU of the task of refreshing the LCD. In contrast, the LED must be refreshed by the CPU to keep displaying the data.
4. These components are "specialized" for being used with the microcontrollers, which means that they can-not be activated by standard IC circuits. They are used for writing different messages on a miniature LCD.

#### 3.4 IR Sensor

IR reflectance sensors contain a matched infrared transmitter and infrared receiver pair. These devices work by measuring the amount of light that is reflected into the receiver. Because the receiver also responds to ambient light, the device works best when well shielded from ambient light, and when the distance between the sensor and the reflective surface is small (less than 5mm). IR reflectance sensors are often used to detect white and black surfaces. White surfaces generally reflect well, while black surfaces reflect poorly. One of such applications is the line follower of a robot.

#### 3.5 DC Motor

An electric motor is a machine which converts electrical energy into mechanical energy.

Principles of operation:

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. Let's start by looking at a simple 2-pole DC electric motor (here red represents a magnet or winding with a "North" polarization, while green represents a magnet or winding with a "South" polarization).

#### 3.6 AND GATE

A Boolean operator which gives the value one if and only if all the operands are one, and otherwise has a value of zero.

It can be also defined as a circuit which produces an output signal only when signals are received simultaneously through all input connections.

#### 4. MAKING OF CAPACITIVE SWITCH CUM SENSOR

A capacitance switch needs only one electrode to function. The electrode can be placed behind a non-conductive panel such as wood, glass, paper (hard cardboard like material) or plastic. The switch works using body capacitance, a property of the human body that gives it great electrical characteristics. The lamp keeps charging and discharging its metal exterior to detect changes in capacitance. When a person touches it, it increases the capacitance and triggers the switch.

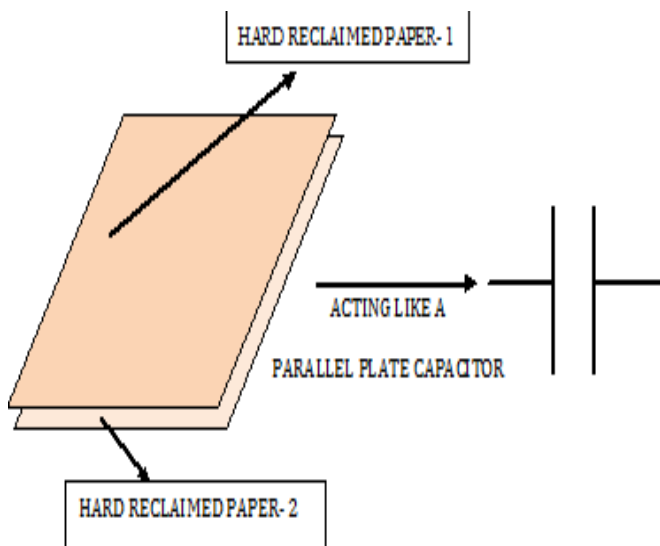


Fig -1: A parallel plate capacitor

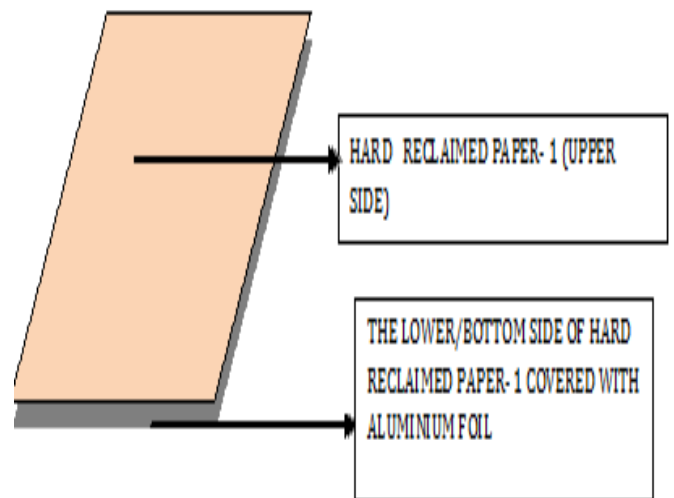


Fig -2: Reclaimed Paper 1 with aluminum foil

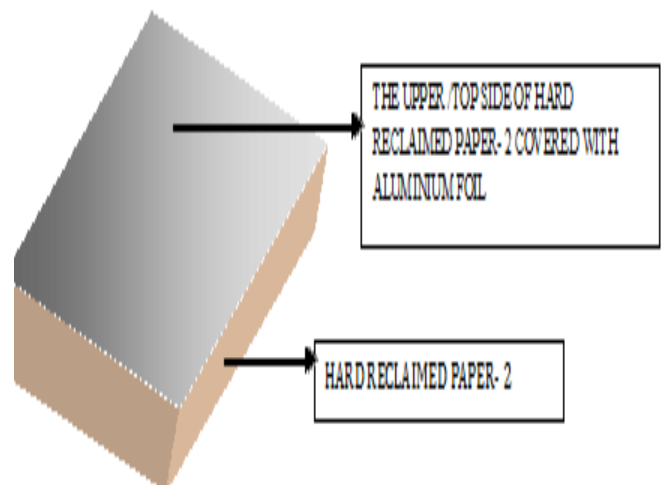


Fig -3: Reclaimed Paper 2 with aluminum foil

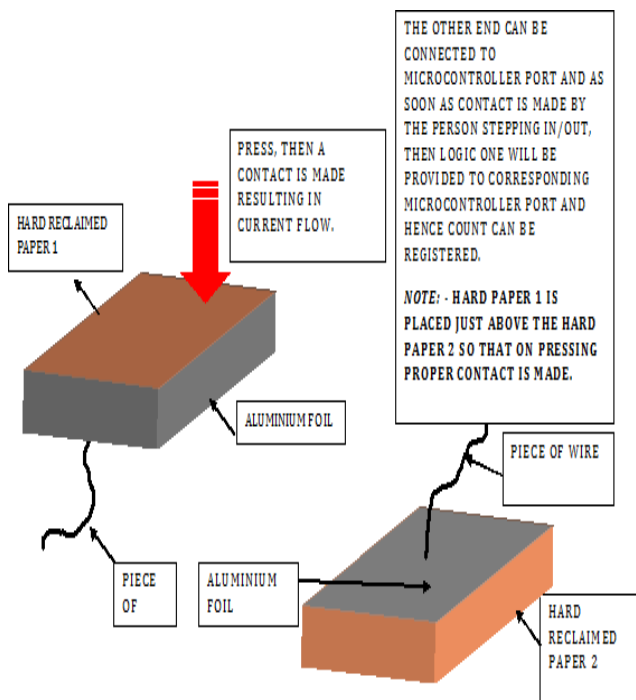


Fig -4: Working of the capacitive switch cum sensor

### 5. CONTROLLING THE NUMBER OF LIGHTS AND FANS OR SWITCHING THEM 'ON'/'OFF' ACCORDING TO THE NUMBER OF PASSENGERS

The counting section for the passengers is implemented using reclaimed materials by using the capacitive switch cum sensor. These (i.e. the capacitive sensor cum switch) can be used two in numbers, so that once the person steps in or out ; he will step on the first sensor first and then as soon as the person steps on the second sensor, after that ,the count of person will be considered and a logic one will be provided to the microcontroller. As soon as this count is registered on the microcontroller, the controller will make note of the persons and accordingly switch 'on'/'off' the lights and fans.

### 6. WORKING OF THE PROJECT

The motion of the public transport is controlled by the motor driver IC interfaced to the microcontroller AT89C51 to function as a CPU and which is used to control the rotation of motor. Name of each station is displayed over LCD along with other details and accordingly the different delay for each station is provided. Whenever the public transport 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 public transport. The door closes when it reaches maximum occupancy level or when the time allotted for the door to remain open is exceeded after indicating the message on the LCD as well as via the buzzer. The public transport then heads towards the destination. The passenger counting section that counts the number of passengers leaving and entering the public transport is implemented using capacitive switch like sensor. The real innovation lies in the making of the capacitive sensor that is not bought but is made using waste and reclaimed materials thus making it low cost yet extra-ordinary. Depending upon the number of passengers inside the transport, the intensity as well as the number of lights and fans that are 'on' will be automatically adjusted.

### 8. LOGIC GATE CIRCUIT USED FOR FAULTY TRACK DETECTION

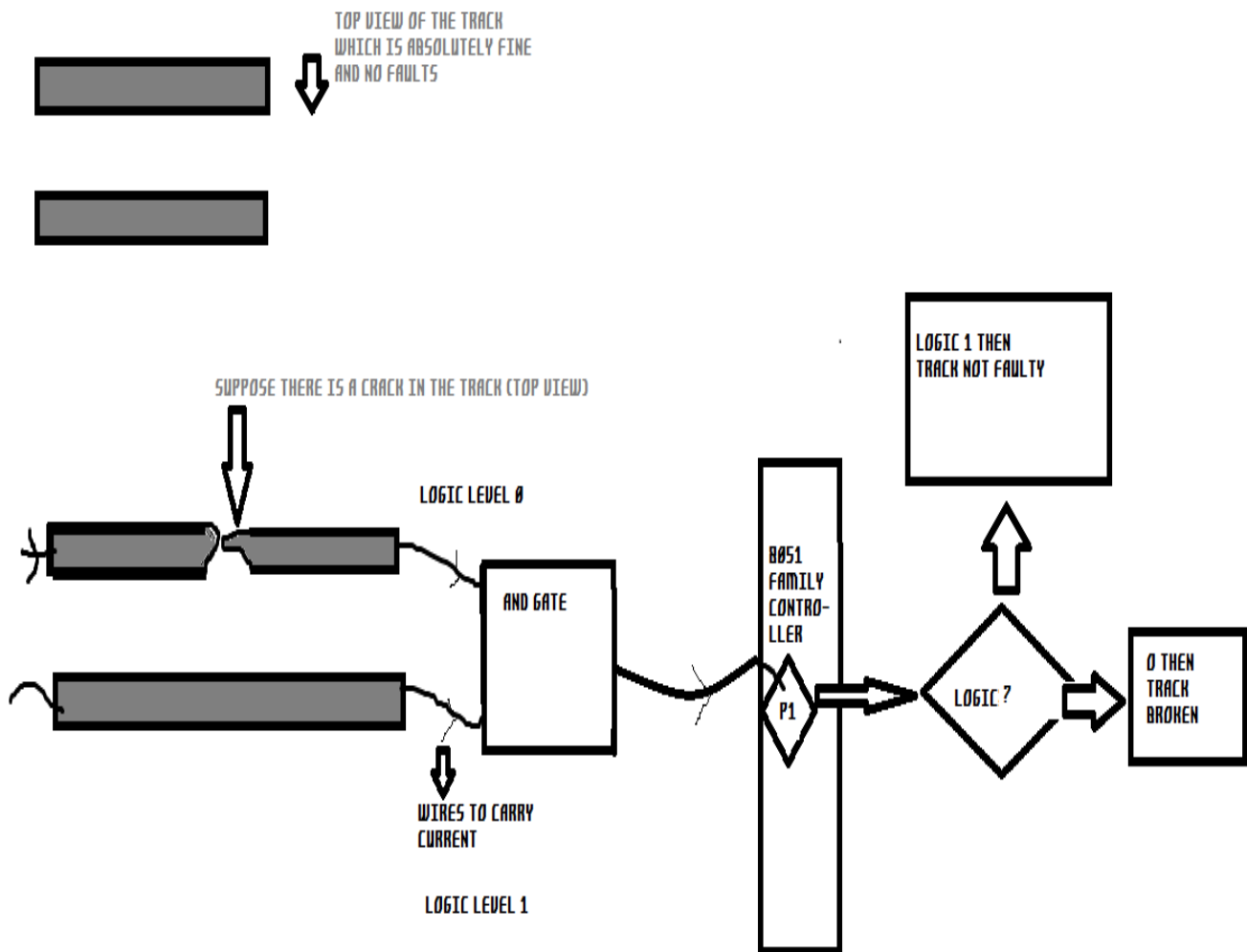
As shown in the logic diagram the accidents due to faulty tracks can be prevented as follows:-

The first one shows the top view of a track line with no breaks but in the second figure there is a break as a result of which derailment may occur and to avoid this we do the following. We may run wires collinear along the tracks or in parallel with the tracks. These wires may carry a voltage which is very small. This small voltage can be generated easily, thus the broken track will have a zero voltage or say zero logic and the one fit and fine will have some voltage say logic level one. This wires may be put as the two inputs of the AND gate ( for prototype purpose only) and then the AND GATE output will be one only when both the inputs are one thus as a result of which in case of breaks always there will be a low level logic and thus the port say P1 will have a logic 0 as a result of which we can conclude that there is a fault in the track.

Refer figure 5 below

### 7. RESULT

Hence the project is implemented to run the metro train without driver within specified time limit and also using IR sensor which works on line of sight principle. The public transport prevents the overloading of passengers as well as helps to conserve energy by adjusting the lights and fans as per the count of passengers. Not only this it will also be preventing the accidents due to faulty tracks.



**Fig -4:** Working of the Logic circuitry to prevent disasters and accidents due to faulty tracks

## 8. CONCLUSION

Nowadays the accidents are increasing day by day. Of these major accidents are occurring due to overloading on the vehicles whether it is bus or public transport and also due to human faults. A man can do a mistake but a programmed processor doesn't have a chance of doing error. This is the main reason behind this project. This highly advanced technology prevents overloading as well as is a prototype for a modern driverless public transport. By using this public transport the timings of the public transport will be exact and will avoid inconveniences caused to the passengers. This project will greatly reduce the human intervention in the control of public transports and hence saves a lot of time and money. This prototype helps to conserve energy by auto-adjustment of lights and fans, thus making the coming future secure. Thus the project "USING CAPACITIVE SWITCH CUM SENSOR MADE OF RECLAIMED MATERIALS FOR PREVENTING OVERLOADING AND CONSERVING ENERGY IN A PUBLIC TRANSPORT" is greatly useful in many aspects.

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## BIOGRAPHIES



Rupal Jain has remained consistently good in academics as well as co-curricular activities. She has won prizes for drawing and painting at the National and International level. Some of these include- "Picasso International Golden Artist Award, M.F. Hussain Award, Shipra Shreshtha Kalankan Award, Highly Commended Jury Award and many more. She is a person with self-reliance and good levels of self-confidence.