AUTONOMOUS METRO TRAIN WITH AUTOMATIC OBSTACLE DETECTION

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Abstract -- The major problem associated with the train transportation is either due to track failure or due to obstacles at the junctions. As today's trains are almost autonomous, the risk for the safety of passengers becomes a question mark. Our project entitled as autonomous trains with automatic obstacle detection provides a solution for this problem with obstacle detection by using ultrasonic sensor. When it detects any faults, the engine will automatically slow down and can reduce the risk of autonomous train. Hence, the efficiency of autonomous train will increases.

1.Introduction

India's first railways were launched in Madras in 1832. From 1832 to till now , there was a tremendous growth in the transportation(from bullock cart to metro trains). Autonomous transportation has become one of the major factors for today's transportation system. Day-by-day the technology has been improving. Thus the vehicles and its effects are increasing. Hence, it's a difficult task for the people to reach their destination safely and securely either due to traffic or due to accidents.

To meet the needs of present day people metro trains were implemented. But anything operated by the human influence may not accurate. Hence autonomous metro trains were developed. But these autonomous trains can also produce some drastic effects when there are some faults in the obstacles like vehicles or people before the track. This thing can be reduced just by using ultrasonic sensors.

Drawbacks of the existing system:

1. Too risky when vehicles on track are not detected in time.
2. More delay of time.
3. Passenger counting is not possible.
4. Failure of occurrence is high.

3.Proposed system

Block diagram:

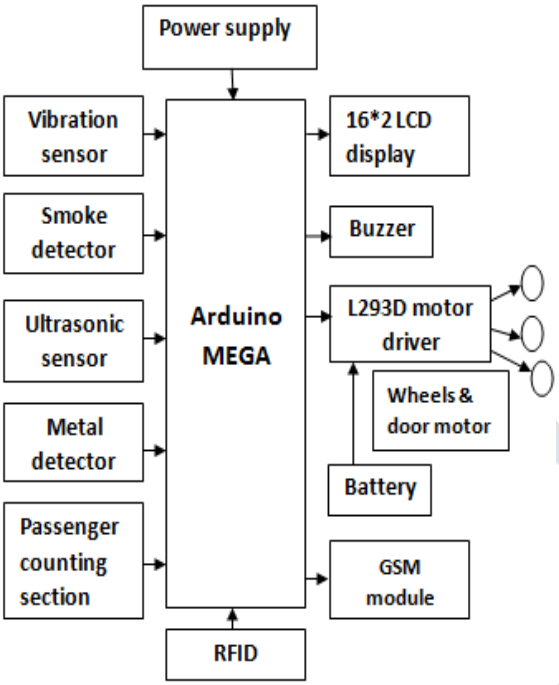

Fig 1: Block diagram

Hardware requirements:

1. Arduino Mega
2. Power Supply
3. RFID
4. L293D Motor Driver
5. Ultrasonic sensor
6. Vibration Sensor
7. Buzzer
8. Battery-12V
9. Door Motor
10. 16*2 LCD Display
11. GSM Module
12. Passenger Counting Section

Software requirements:

1. Keil
2. Proteus
3. Progisp

Arduino:- This project is based on train automation. To acquire this, Arduino MEGA is used. This is a micro controller board based on AT mega 2560.It can be powered either by with USB or with an external power supply. The recommended range is 7 to 12V. Thus, it acts as a heart for the whole project.

Power supply:- As micro controller is a heart, power supply becomes the brain of the system. Here, we provide 12V supply as an input to the by using a USB cable. Whenever the system gets powered then the Arduino starts working makes the entire system to be autonomous.

RFID:- RFID is an defined as Radio -frequency identification. It consists of two parts. Those are RFID tags and RFID readers. These tags are placed at each station and the reader is placed in train. Whenever the train reached the station, the reader reads the tag and that information is given to the Arduino. The Arduino gives the signal to the motor driver to apply brakes to the wheels and the doors will open by using the door motor with a sound by buzzer.

Passenger counting section:-Passenger counting section is used to count the number of passengers entering into the train and exit from the train. It displays this information on the LCD display. This section works by the use of IR modules. IR modules will work by using IR waves which cannot penetrate from the walls.

Ultrasonic sensor:- Ultrasonic sensors are generally working with the principle of echo i.e. whenever the signal gets transmitted from the sensor, then that signal will reflect back. Based on the reflected signal, the obstacle on the track can be detected, then the engine will automatically slow down with a sound by buzzer and the GSM module will send the location of the train to the nearest station.

Metal detector:- Metal detectors are used to detect different metals like iron, gold, titanium, tin, etc. As the railway tracks are usually made up of iron. By using proximity sensor, it can detect track failures. If there is a track failure, the engine will slows down with a sound by buzzer. The location of the train sends to the nearest railway station by using GSM module.

Vibration sensor and smoke detector:- Vibration sensor can be used to shut down the engine if it detects the much vibrations during the failure of brakes or other things and the smoke detector can be used to detect smoke during fire occurrence in the train. The location of the train will send to the nearest station with a buzzer to alert the passengers by automatically opening the doors.

Motor driver:- The micro controller used here is a device operates with very low output current. Hence, by connecting this to the motors directly results in not working on the motor and destroying the micro controller. Hence, motor driver L293D is used.

Keil:- The Keil a development tool used to solve complex problems occurred in embedded software development. It provides different facilities like source code editing, program debugging, complete simulation and so on in one powerful environment. It used to create a HEX file using C or assembly language.

Proteus and Progisp are the two software environments used to provide the same working pattern with different micro controllers.

Proteus:- Proteus is the software which consists of schematics, simulation and also PCB designing. During the simulation of this human interference can also be allowed which provides real time simulation.

Progisp:- Progisp is a software which is generally used to load the HEX file on to the target chip. This HEX file is created by using the Keil software.

4.Implementation

The implementation of the proposed system can be simply explained in a diagram as given. From that the operation of the circuit can be as follows:

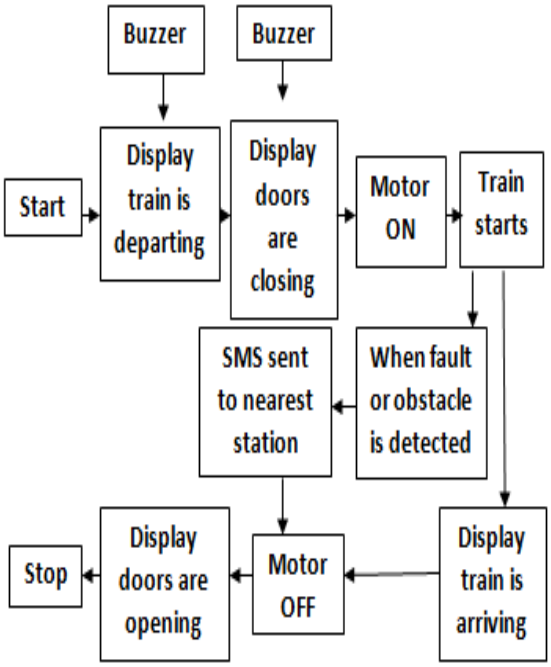

Fig 2: Implementation diagram during departure and arrival of train

Initially, when the train starts from a station, the buzzer will ring with a message on the display that the doors are closing. The train starts by changing the motor position from off to on.

When the faults on the track or obstacles are near the track of the train are detected, the train will stops by changing the motors from on to off by sending a message to the nearest station using GSM module. Here the doors will automatically open with the buzzer alert.

If the train safely reached the next station without any track failures and obstacles, the train will stop by displaying a message with the arrived station name. Here the doors will automatically open with a buzzer sound to alert the passengers.

Result:

By considering the prototype, this project will be discussed clearly. Here, the DC motors are connected to the wheels. A CD drive can be used as a door for automatic opening and closing. For every door operation, the buzzer will operates. An IR sensor can be used for counting of passengers in and out of the train. The speed of the motors can be controlled by motor driver with a supply voltage of 12V battery. An ultrasonic sensors and proximity sensor can be used for track and obstacle failure detection.

Through the RFID sensors, the automatic door operation can be controlled. By the use of programming, some delay can be provided between the opening and closing of doors. The ultrasonic sensor at the front side of the train will detects the obstacles and makes the train stops by sending the location of the train by the use of GSM module. The vibration sensor senses the train action. If the vibration of the train is increased either due to accident or due to any damage in the train these sensor makes the signal to stop the train by sending the location to the nearest station.

Future scope:

Today's train accidents are not only due to the obstacles placed on the track but also due to the track failures. Many train accidents in the world are due to the obstacles but there are also some cases where track failures lead to an accident.

Hence, track detector which are nothing but the metal detectors can be used to overcome these track failures. Proximity sensors are a type of sensors used to track the railway line and detects the faults on the track. Whenever it detects the faults, then it sends that data to micro controller. This micro controller can sends the information to the motor driver to stop the motors and automatically the engine will stops.

Conclusion:

This project provides an efficient way for transportation with fully automatic driverless train operation with less travelling time, less consumption of electricity, vibration detection, obstacle detection and track detection etc. For better quality of services and for perfect timings of the train arrival and departure, this will be a solution. It reduces the overall cost. Thus this system will provides an efficient way for transportation.

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