Smart Metro Train

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Abstract—**The proposed system is driverless train which is preprogrammed to run between two stations. For this, ARM 7 microcontroller is used. It exterminates need of any driver. Thus, human blunder is ruled out. The prototype provides detection of passengers at platform. RFID module is used when passenger is entering into station, passenger will swipe the card and if it is valid then the passenger can enter into train. Passenger count is displayed on the ThingSpeak webpage for future use.**

Index Terms— ARM7, GPS module, GSM module, RFID module, Servo motor, ThingSpeak

I. INTRODUCTION

Nowadays, modern relocation has become the most economical and safe way of public transportation system. It helps to connect two major cities and provides a high speed transportation services to the public. Due to the features high security and high performance, driverless metro trains are widely used over the world.

The objective behind this approach is to allow smart metro train system which is completely unmanned and is precise and flawless in its operation. With the help of RFID module, detection of passengers takes place. This module is mounted on the platform. The information about total rupees is provided in the respected pass that is RFID tag. When the passenger is entering into station, passenger will swipe the tag, if it is valid then door will open and passenger can enter. Fire alarm is also provided for the protection of passengers. Location of station is tracked using GPS. Name of tracked station, latitude and longitude is also displayed on the LCD. In this project, one more feature is added that is passenger count is displayed on the webpage for future use using ThingSpeak.

II. LITERATURE SURVEY

The comparison of different methodologies which were previously implemented is shown in Table-1. In this table different papers which were published by various authors have been studied and compared in tabular form.

III. PROPOSED SYSTEM

A) Existing vs. Proposed systems:

The existing system involves the information about train like arrival and departure time, station name, etc., are announced manually. While in proposed system, an automated system is made with very less human intervention. Few demerits of the existing system are:

- More human intervention.
- Its cost is very high.
- Required manpower is more.
- Required time is more for Installation integration.
- Inflexibility
- It requires large investment of capitals

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

- Automated system which requires less manpower.
- The model provides feature like automatic opening of doors.
- In market, various types of RFID Tags and readers are available with different size and shape which can be selected as per the requirement.
- Passenger count is displayed and stored as database.

TABLE I
COMPARISON OF DIFFERENT TECHNIQUES

| Name of Author	Title	Publication and Year	Information
Trima P. Fernandese Fizardo, Egas Nunes, Yatish Naik, Jesuslee Pereira	Smart Metro Train	IJSR 2015	The system is implemented using PIC microcontroller Passengers counting and generates warning signal when the compartment are full.
X. Sun, S. Zhang, H. Dong, Y. Chen H. Zhu	Optimization of Metro Train Schedules with a Dwell Time Model Using the Lagrangian Duality Theory"	IEEE June 2015	Lagrangian duality theory is adopted to solve this optimization problem with high dimensionality.
V. Sridhar	Automated System Design for Metro Train	IJCSE 2012	Announcement system for Train using voice IC and the radio frequency wireless card for tracking the station data.

IV. BLOCK DIAGRAM
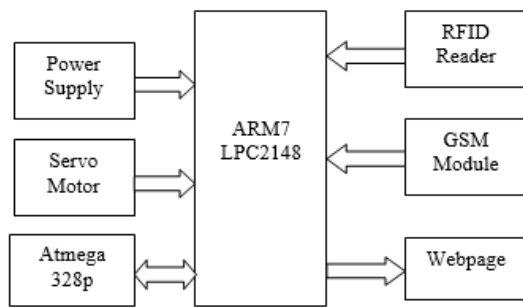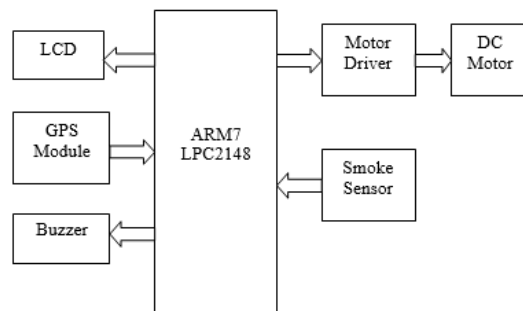

Fig. 1. System block diagram (Platform Side)

Fig. 2. System block diagram (Train Side)

There are two sections:

A) Platform side:

Whenever the passenger wants to avail the facility of metro train, passenger is supposed to swipe the RFID card (unique) through RFID reader on the platform. If that card has sufficient balance/money, user enters into the next step i.e. doors are automatically opened for that passenger.

Here servomotor acts as door of platform as soon as the RFID card is swiped by the user, the passenger count is incremented in the ThingSpeak website which is an IOT based platform. This record of passenger contains the date and time which can be used as database for further use. Here GSM module is used for the communication between the ARM and train. When passenger reaches its destination, tag is again swiped in order to calculate the distance. The specific amount is deducted from the tag of the passenger.

B) Train side:

When the passenger enters into the train, "Welcome" message is displayed on the 16x2 LCD. GPS is used to track the current location of the train. Smoke sensor is used for the safety concern for the passengers. As any kind of gas is detected, buzzer will start and then the train will stop.

1) 5V AC adapter:

An AC adapter is a type of external power supply. It is same as an AC plug. They are also used as chargers or rechargers. AC adapters are used with electrical devices which require power but do not include internal components to derive the required voltage and power from mains power.

2) Servomotor:

A servomotor is a rotary actuator or sometimes it is also called as linear actuators. It controls angular or linear position of velocity and acceleration. It contains a suitable motor coupled to a sensor. It also requires a relatively smooth controller. Servo motor is used in closed loop system.

3) ARM7 LPC2148:

LPC2148 is the widely used IC from ARM-7 family. It is an ARM&-TDMIS based high performance microcontroller. It is manufactured by Philips (NXP) and it is pre-loaded with many inbuilt peripherals making it more efficient and a reliable option for the beginners as well as high end application developer. It is 32-bit CPU with real-time emulation and embedded trace support that combine the microcontroller with embedded high speed flash memory ranging from 32 KB to 512 KB. A128 bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. Serial communications interfaces ranging from a USB 2.0 full–speed device, multiple UARTs, SPI, SSP to I2C bus and on-chip SRAM of 8kb up to 40kb.

4) Atmega328p:

This microcontroller is 8-bit AVR RISC based and have features like 32KB ISP flash memory, 1 KB EEPROM, 2KB SRAM, 23 general purpose I/O lines. This device has serial programmable USART byte-oriented 2-wire serial interface. It operates between 1.8 to 5.5V.

5) RFID Reader:

The operating frequency for EM18 reader is 125 KHz. It is inexpensive. The module is powered up with a 5V power supply and is consists of on chip antenna, buzzer and on board LED for pass indication. 9600bps baud rate is used for serial communication. Show your card within the reading distance and the card number is thrown at the output.

4) RFID tag:

RFID tag is an identification system which uses small radio frequency waves for identification and tracking purposes. An RFID tag is sometimes also called as RFID transponder. An RFID tag comes with different shapes and size. An RFID tagging system contains the tag itself, a read/write device, and a host system application for data collection, processing, and transmission. An RFID tag consists of a chip , some memory and an antenna. The range of RFID tag which is used in this prototype is approximately about 10cm.

5) GSM Module:

This is a GSM/GPRS-compatible Quad-band cell phone, which works on frequency of 900MHz and which can be used to access the internet as well as for oral communication and for SMSs. The GSM900 device integrates an analog interface, A/D converters, an RTC, an SPI bus, an I2C, and a PWM module.

6) ThingSpeak:

ThingSpeak is an open source internet of things (IOT) application. It is an API to store and retrieve data from things using the HTTP protocol over the internet or via a local area network. Thingspeak enables the creation of sensor logging applications, location tracking applications, and a social network of things with status updates. ThingSpeak have support from the numerical computing software MATLAB from Mathworks. This allows users to analyse and visualise uploaded data using MATLAB without requiring the purchase of a MATLAB license from Mathwork.
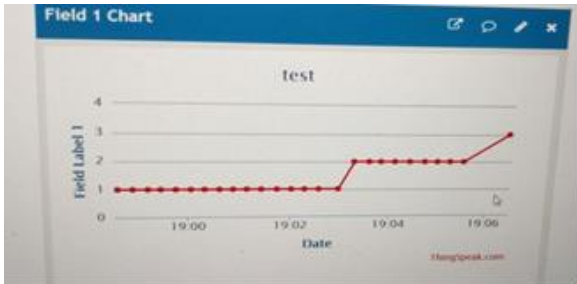

Fig. 3. Passenger count on ThingSpeak

7) LCD:

Most common LCDs connected to the microcontroller are 16x2 and 20x2 displays.16x2 LCD is used in the project. This means 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively. While interfacing with microcontroller, total 11 port pins are required and three ground and contrast adjustment purpose. From those 11 pins, 3 control pins are used which are EN, RS, and RW and D0 to D7 for sending data and commands to LCD.

8) GPS Module:

GPS receivers use a constellation of satellites and ground stations to calculate position and time almost anywhere on earth. At any time, there are at least 24 active satellites which are orbiting over 12,000 miles above earth. The positions of the satellites are constructed in a way that the sky above your location will always contain at most 12 satellites. The primary intention of the 12 active satellites is to transmit information back to earth over radio frequency (ranging from 1.1 to 1.5 GHz).

9) Smoke Sensor:

A smoke sensor is a device that senses smoke, typically as an indicator of fire. Commercial security devices issue a signal to a fire alarm control panel as part of a fire alarm system, while household smoke detectors, also known as smoke alarms, generally issue a local audible or visual alarm from the detector itself.

10) Buzzer:

A buzzer or beeper is an audio signalling device, it can be mechanical, electromechanical, or piezoelectric. Buzzers and beepers can be used as timers, alarm devices, and confirmation of user input such as a mouse click or keystroke.
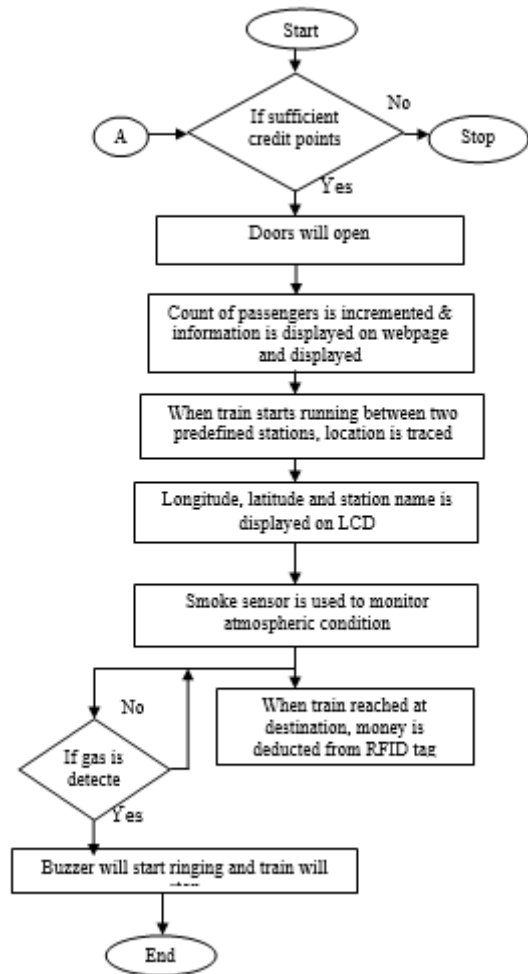
V. METHODOLOGY

Fig. 4. System flowchart

VI. HARDWARE SETUP AND RESULT

Fig. 5. Smart Metro Train System

VII. FUTURE SCOPE

- This system can be implemented for bus as well.
- Mobile application can be developed for the metro so that passengers can book a ticket online & can access the information about metro (arrival time, date, departure time, etc.).
- With the help of backup information (in this case), we can monitor the traffic at peak hours in order to increase the number of metros for respective route.
- More features like Wi-Fi can be added for the comfort of passengers.

VIII. CONCLUSION

Nowadays the accidents of trains are increasing day by day because of human flaws. The main reason behind this project is reducing mistakes which can be done by human. By using this smart metro train, it avoids a lot of discomfort of the passengers. The queuing of passenger can be reduced to great extent. It also eliminates the possibility of theft entering into the metro. Hence after extrapolation, this framework makes the platform smart and even metros smart. This project will greatly reduce the human intercession in the control of trains and hence saves a lot of money and time. Therefore, this project is very useful in all aspects of transport.

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