Design and Development of Train Tracking System in South Central Railways

Shaik Nahid, Srinivas Padala, V. Samson Deva Kumar

Abstract: ***Rail tracking system (RTS) is an advanced method used to track and monitor any train equipped with a MCU unit that receives and transfers signals through GPS satellite. RTS is a combination of Global Positioning System (GPS) that provides actual geographic real time position of each train. The entire transmission mechanism of RTS setup depends on GPS satellite, a receiver on the train, a GSM system and controller based tracking for dispatch. The GSM communication system is generally the same as cellular phone network. The two most common RTS systems are like GPS based and Signpost based. The Signpost-based RTS system was used earlier but with the development of modern satellites GPS used technology is more use now. This Automatic rail Tracking system is now widely used in a variety of market system that offers excellent communication or train tracking solution. This project is aimed to track the vehicles that which mean to locate the position of the train. The location of the train is indicated using GPS (global positioning system) technology. Communication link is made possible through a GPS receiver. GPS will give the information of parameters like longitude, latitude and attitude. Here the communication takes place between GPS receiver and GPS satellite. GPS satellite continuously tracks the missing train and the position of the train is send to the controller from GPS receiver. train is associated with LCD display which sends the continuous information about the position of the train to the control unit and the train position should be send to the GSM.***

1. INTRODUCTION

This project is aimed to track the vehicles that which mean to locate the position of the train. The location of the train is indicated using GPS (global positioning system) technology. Communication link is made possible through a GPS receiver. GPS will give the information of parameters like longitude, latitude and attitude.

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The rest of the paper is as follow. In Section 2, we explain the proposed setup of the system i.e., the block diagram and its description. Section 3 explains the working of the proposed system. We conclude the paper in Section 4 describing our accomplishments.

2. Proposed Method

The block diagram consists of different components interfacing to a microcontroller. The block diagram is shown in Fig.1.

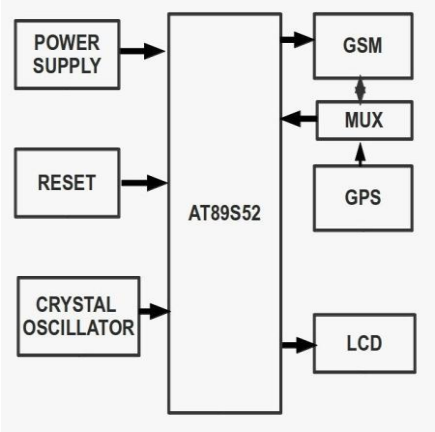

Fig.1: Block Diagram

The various components in the block diagram are mentioned below:

1. AT89S52 Microcontroller
2. Power Supply
3. Crystal Oscillator
4. Reset
5. 16x2 Liquid Crystal Display(LCD)
6. MAX 232
7. Multiplexer
8. GSM Modem
9. GPS Module

2.1 Microcontroller Unit

The AT89S52 is a low-power, high performance CMOS 8- bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry standard 80C51 and 80C52 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash ona monolithic chip, the

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Shaik Nahid, M.Tech student, Nimra College of Engineering and Technology, Ibhrampatnam,Vijaybada (A.P.), India

Srinivas Padala, Assistant Professor, Nimra College of Engineering and Technology, Ibhrampatnam,Vijaybada (A.P.), India

V.Samson Deva Kumar, Project Manager,Software Development and Training center,South Central Railways(wwo)

Atmel AT89S52 is a powerful micro- controller which provides a highly-flexible and cost-effective solution to many embedded control applications.
Features of the microcontroller:

1. It is a 8-bit microcontroller.
2. 8K Bytes of In-System Programmable (ISP) Flash Memory.
   a. -Endurance: 1000 Write/Erase Cycles
3. Fully Static Operation: 0 Hz to 33 MHz
4. 256 x 8-bit Internal RAM.
5. 32 Programmable I/O Lines.
6. Three 16-bit Timer/Counters.
7. Eight Interrupt Sources.
8. Full Duplex UART Serial Channel.

2.2 Power Supply

The input to the circuit is applied from the regulated power supply. The microcontroller voltage is of 5V. The A.C. input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output
obtained from the rectifier is a pulsating D.C voltage. So in order to get a pure D.C voltage, the output voltage from the rectifier is fed to a filter to remove any A.C components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant dc voltage. We are using an IC 7805 as voltage regulator to get a 5V output Voltage.

2.3 Crystal Oscillator

A crystal oscillator is an electronic oscillator circuit that uses the mechanical resonance of a vibrating crystal of piezoelectric material to create an electrical signal with a very precise frequency. This frequency is commonly used to keep track of time (as in quartz wrist watches), to provide a stable clock signal for digital integrated circuits, and to stabilize frequencies for radio transmitters and receivers. The most common type of piezoelectric resonator used is the quartz crystal, so oscillator circuits designed around them became known as "crystal oscillators". This block provides necessary frequency sine wave to the micro controller. This frequency is converted to square wave within the micro controller.

2.6 Reset

Control reset is to execute the entire program cycle from beginning.

2.7 Liquid Crystal Display (LCD)

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD means it can display 16 characters per line and there are

2 such lines. In this JHD 16x2A LCD each character is displayed in 5x7 pixel matrix. The schematic diagram of 16x2 LCD is shown in Fig.2. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Some of the LCD command codes are listed in Table 1.
Features:

Code(Hex)	Command to LCD Instruction Register
01	Clear display of the screen
06	Automatic increment
38	2 line 5x7 Matrix
0F	Display is on and the cursor blinks
80	Force Cursor to begin from 1st line
C0	Force Cursor to begin from 2nd line

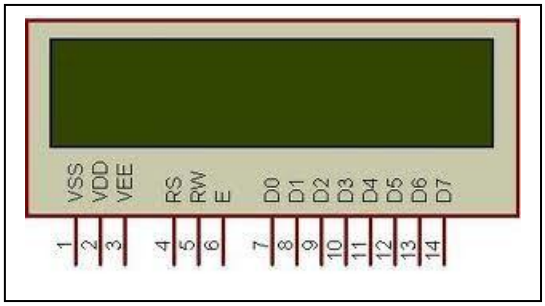
Table 1: LCD Command Codes

The LCD display is connected to the output port of micro controller to display the cyclic operations of vigilance control device.

2.12 MAX232

The microcontroller can communicate with the serial devices using its single serial port. The logic levels at which this serial port operates is TTL logics. But some of the serial devices operate at RS 232 logic levels. So in order to communicate the microcontroller with modem, a mismatch between the logic levels occurs. In order to avoid this mismatch, in other words to match the Logic levels, a serial driver is used. A MAX232 is a serial line driver used to establish communication between modem and microcontroller. The interfacing of GSM modem with microcontroller using MAX 232 as a serial line driver is shown in Fig.3. The voltage levels of Max 232 are given in Table 2.

1. Interface with either 4-bit or 8-bit microprocessor.
2. Display data RAM.



3. 80x8 bits (80 characters).
4. Character generator ROM and RAM.
5. 160 different 5x7 dot-matrix character patterns.
6. 8 different users programmed 5x7 dot-matrix patterns.
7. Numerous instructions.
8. Clear Display, Cursor Home, Display ON/OFF, Cursor.
9. ON/OFF, Blink Character, Cursor Shift, Display Shift.
10. Built-in reset circuit is triggered at power ON.

Table 2: Voltage levels of Max 232

RS232 Line Type & Logic Level	RS232 Voltage	TTL Voltage to/from MAX232
Data Transmission (Rx/Tx) Logic 0	+3 V to +15 V	0V
Data Transmission (Rx/Tx) Logic 1	-3 V to -15 V	5V
Control Signals (RTS/CTS/DTR/DSR) Logic 0	-3 V to -15 V	5V
Control Signals (RTS/CTS/DTR/DSR) Logic 1	+3 V to +15 V	0V

2.13 Global System for Mobile communication (GSM)

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves. It operates at either the 900MHz or 1800MHz frequency band. It supports voice calls and data transfer speeds of up to 9.6kbits/s, together with the transmission of SMS (Short Message Service). The GSM Modem comes with a serial interface which the modem can be controlled using AT command interface. The interfacing of GSM modem with the microcontroller is shown in Fig.3.

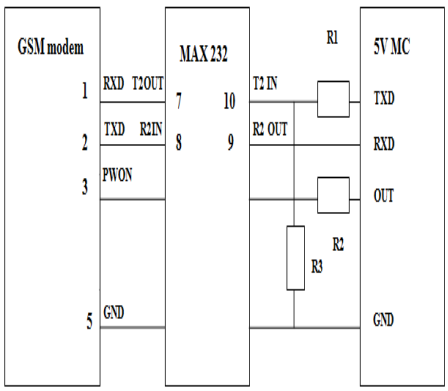


Fig.3: Interfacing of GSM modem with microcontroller

7.3 Here a GSM modem SIMCOM made SIM300 V interfaced with the microcontroller operates in 900MHz frequency and is operated at voltage levels of 3.5 to 5V. The modem is provided with network status indication LED lamp. It is also provided with buzzer to indicate incoming call. The GSM modem is shown in Fig.4.

4: GSM Modem Prototype

The working of GSM modem is based on commands, the commands always start with AT (which means ATtention) and finish with a <CR> character. AT commands are used to control the MODEMs. Since one of the main objective for this application is to show how to send the message, only a subset of the AT command set needs to be implemented. The AT commands are given to the GSM modem.

2.14 Global Positioning System (GPS)

The Global Positioning System (GPS) is a satellite based PC or controller and the navigation system that sends and receives radio signals. A GPS receiver acquires these signals and provides the user with information. Using GPS technology one can determine location, velocity and time, 24 hours a day, in any weather conditions anywhere in the world for free. GPS was formally known as the NAVSTAR (Navigation Satellite Timing and Ranging). The basis of the GPS technology is a set of 24 satellites that are continuously orbiting the earth. These satellites are equipped with atomic clocks and sent out radio signals as to the exact time and location. These radio signals from the satellites are picked up by the GPS receiver. Once the GPS receiver locks on to four or more of these satellites, it can triangulate its location from the known positions of the satellites. It is a higher performance, low power satellite based model. It is a cost effective and portable system which accurately detects the location. The GPS receiver used here is Sky Traq Venus 6 GPS module ST22 which is having TTL logics and also RS232 as option. The GPS receiver is shown in Fig.5. This GPS is used to track the position of the train after the emergency brake is applied in order to avoid the accidents. This application is used only after the train is stopped

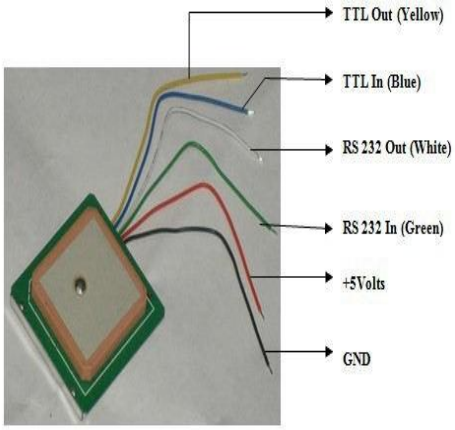


Fig.5: GPS Receiver

GPS Receiver Specifications:

1. 65 channels-1Hz Update rate
2. Hot Start- 1sec
3. Baud rate- 9600bits/s
4. Operating Voltage-5Volts dc
5. O/P Format-NMEA 0183-RS232
6. Operating Temperature: -40 to +85°C
7. Sensitivity- Tracking: -160 dBm

Reacquisition: -158 dBm

Cold Start (Autonomous): -148 dBm

3. Working

Soon after applying the power supply, the naming of theproject will be displayed and it waits for the input message which can be sent from our mobile. MCU in the kit, recognizes the input and process it and fetches the Gps co ordinates. The co ordinates will be displayed on the Lcd and at the same time the co ordinates will be sent to the number specified in the MCU. The number of the sim is placed in an another GSM modem which is connected to the PC where our tracking software is installed. As soon as the message is received, the software enables the google earth and shows the position automatically. We integrate a mutliplexer here as we need to connect 2 serial communication devices to only for one channel.

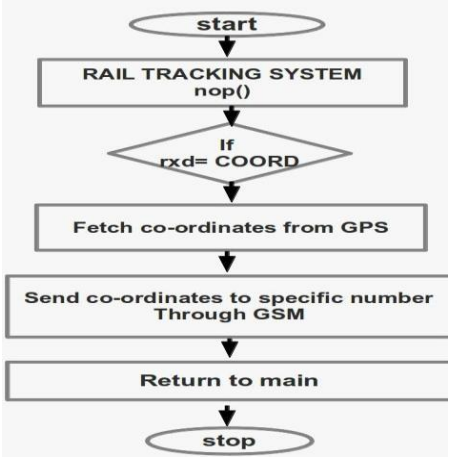


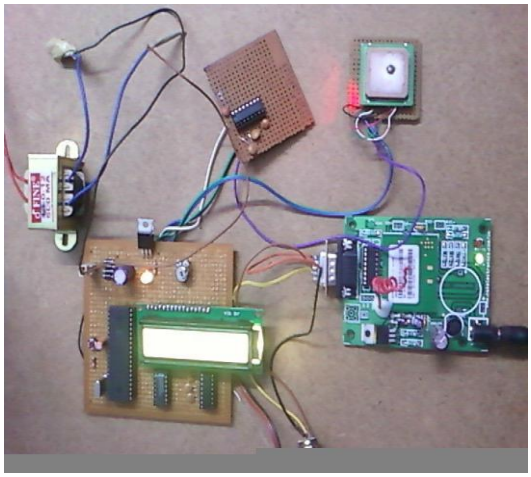
Fig. 6: Flow chart of the System

The flow chart shown in Fig.6 gives the clear explanation of the working of the modern vigilance control device. By using this flow chart the source code is developed. The source code is written in embedded C language. The map according to the co-ordinates is as follows.

4. CONCLUSION

This method of tracking a vehicle is enormous and very applicable. It is even advantageous for rail tracking to know the accurate position of the train. We can upgrade it for touch screen system which is already running in the railways. We can implement very widely so that every passenger can know about the train status being anywhere and he/she can be in time there.

5. RESULT



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