# RAILWAY AUTOMATION AND MONITORING USING PC

A PROJECT REPORT

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***In partial fulfillment for the award of the degree***

***of***

**BACHELOR OF ENGINEERING**

***in***

**(ELECTRONICS & COMMUNICATION)**

**Group No: 45**

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**May, 2014**

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**For,**
**Techno Weigh Systems Pvt. Ltd.**

(Authorized Signature)

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**Patel Urmil** **Bhavsar Nirav** **Shah Sagar** **Patel Deep**

# ABSTRACT

This project work aims to Automate and Monitor the Railway System Using PC. The principle objective of this project is to improve the current train service effectively and efficiently. This project deals to develop a prototype of railway system that function automatically by using microcontroller which can also be monitored and controlled using PC.

In monitoring part with the help of GSM Module we can control Trains various parameter such as Speed, Starting or stopping train, automatically stopping Train at desired station and preventing accidents by stopping trains when they come close to each other from PC. All these controls can be monitored by using VB Application on PC, and then sending data to various trains by GSM Module.

In automation part there is automatic Railway Gate control which is implemented by using two IR Sensor, whenever the Train passes through any IR Sensor Railway Gate will be automatically closed by using stepper motor and opened when train passes through another IR Sensor.

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# List of Abbreviations

| | | |
|---|---|---|
| GPS | - | Global Positioning System |
| GSM | - | Global System for Mobile |
| AT Command | - | Attention Command |
| VB | - | Visual Basic |
| USB | - | Universal Serial Bus |
| TX | - | Transmitter |
| RX | - | Receiver |
| SMS | - | Short Message System |
| LOC | - | Location |
| PC | - | Personal Computer |
| DC | - | Direct Current |
| AC | - | Alternating Current |
| GND | - | Ground |
| GM | - | Google Map |
| IDE | - | Integrated Development Environment |
| GUI | - | Graphic User Interface |
| HEX | - | Hexadecimal |

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# 1. Introduction to Project

# 1.1 Introduction

This project work aims to Automate and Monitor the Railway System Using PC. The principle objective of this project is to improve the current train service effectively and efficiently. This project deals to develop a prototype of railway system that function automatically by using microcontroller which can also be monitored and controlled using PC via GSM SIM900A Module.

- Our project is divided into two parts: - Automation part and Monitoring part.

- In Automation part there is automatic Railway Gate control which is implemented by using two IR Sensor, whenever the Train passes through any IR Sensor Railway Gate will be automatically closed by using stepper motor and opened when train passes through another IR Sensor. We have interfaced buzzer and red & green LEDs for the indication of trains arrival and departure. The Microcontroller we have used in this part is Philips 89V51RD2.

- In Monitoring part we are going to implement this task by creating a Visual Basic application on PC. This application will show complete graphical user interface having visual buttons to control train and will also show the location of train which is sent by GPS Module located on train unit. So when the user presses any button from VB application, some data will be sent to microcontroller via GSM module connected with PC.

    - Depending on the data received by microcontroller it will generate control signals and send it wirelessly through another GSM Module which is connected with receiver side or train unit.

    - On receiver side (which will be in Train) microcontroller will receive the control signal given by user through VB application and depending on signals received, microcontroller will decide what parameters of train are to be controlled. The Microcontroller we are using is ARM LPC2148.

    - On receiver side the microcontroller has two serial ports, on one serial port GSM module is connected for receiving message sent from the PC side and to second serial port GPS is connected for sending the location of train to PC by GSM module connected on first serial port.

## 1.2 Project Block diagrams and its Description

### 1.2.1 Monitoring Part

#### 1.2.1.1 Transmitting Section

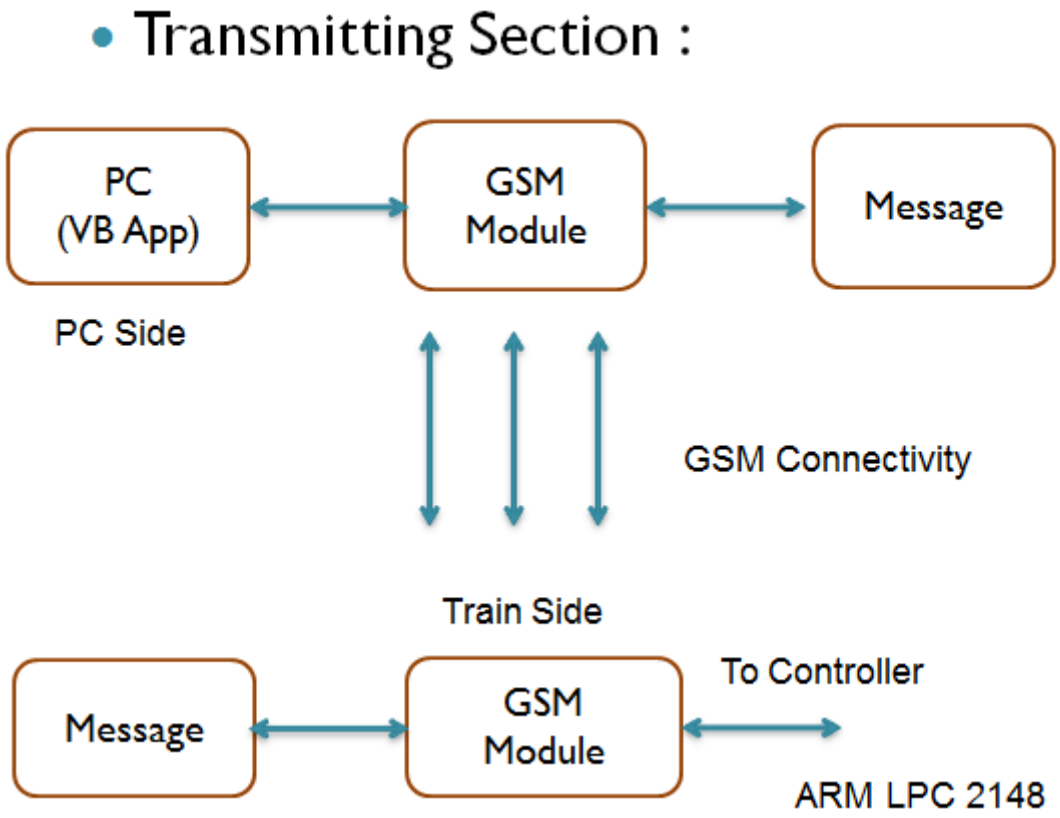



**Figure 1: Transmitting Section**

- This section includes controlling train through PC via VB Application.
- A VB Application is created on PC which will show complete graphical user interface will have control buttons like Starting of Train, Stopping of Train, Varying its speed and getting location of train.

### 1.2.1.2 Detail Diagram of Transmitting Section:

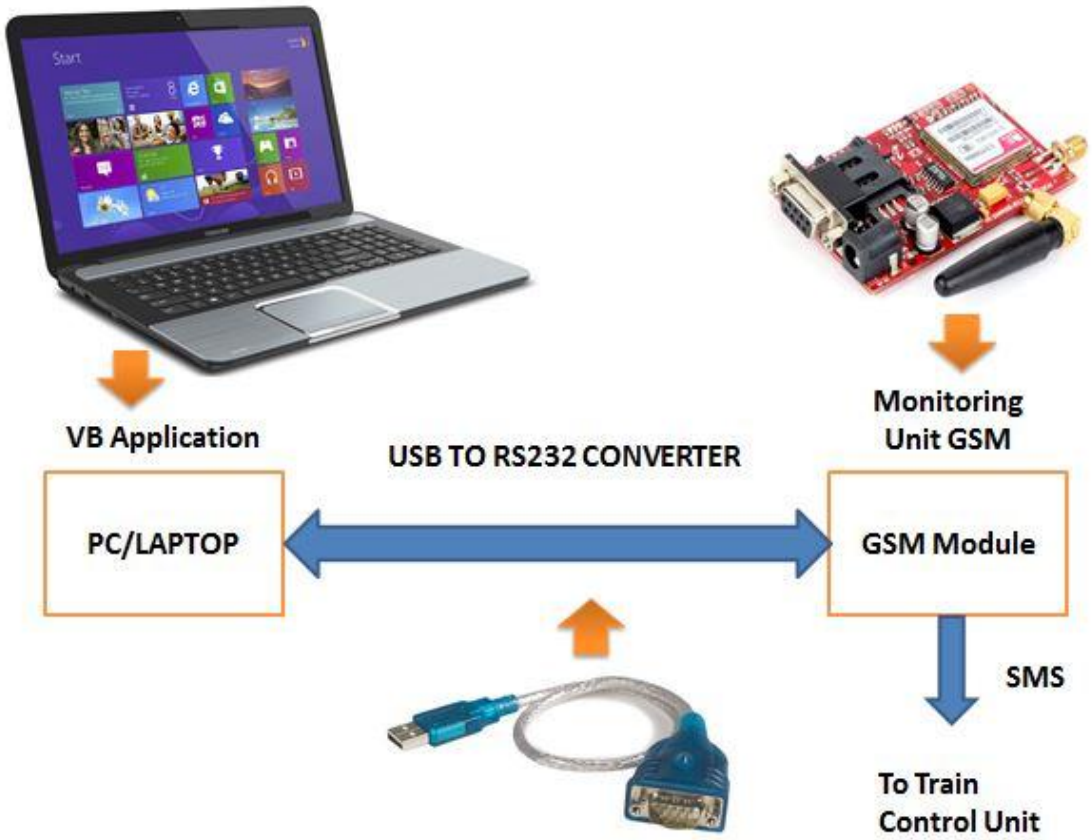



**Figure 2: Detail Diagram of Transmitting Section**

## 1.2.1.3 Description of Transmitting Section

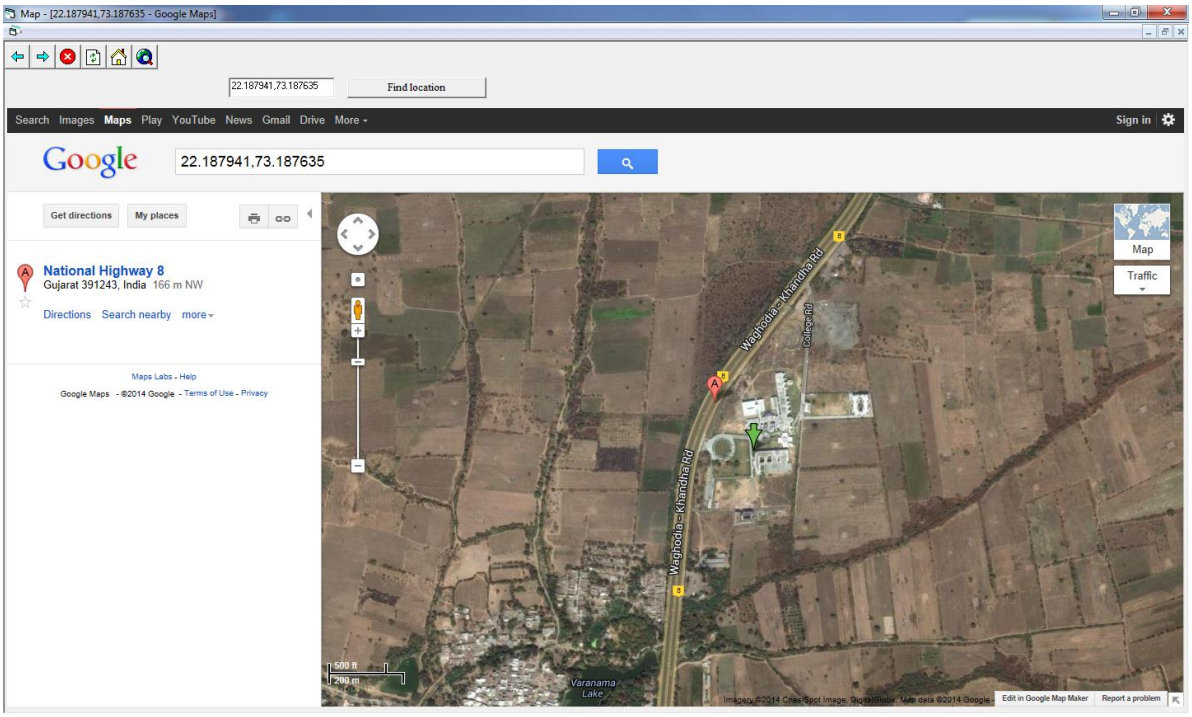



**Figure 3: Train's Location shown in map**

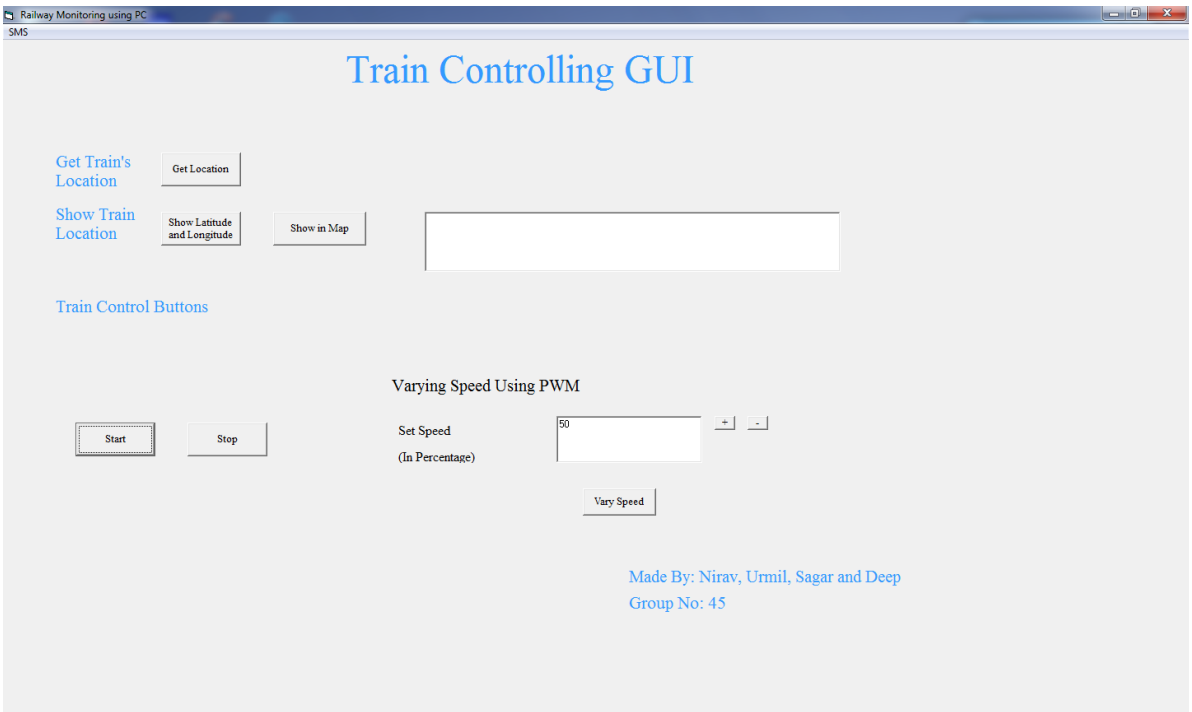



**Figure 4: Train Controlling GUI Created in VB**

- So, whenever any control button is pressed some message is send via GSM module connected through Serial port.

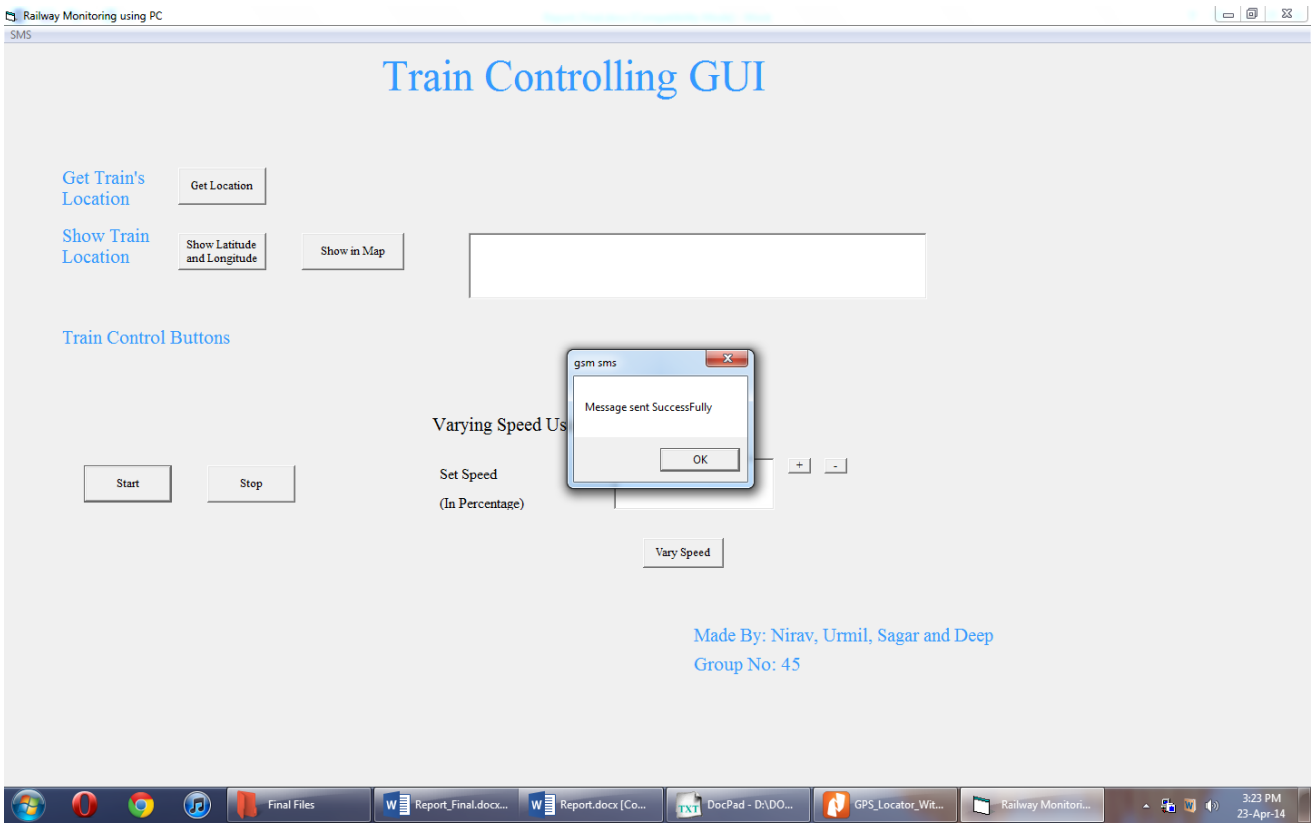



**Figure 5: Message Send Successfully Message box in VB**

- The message that was send by GSM module will be received by another GSM module on train unit and depending on message received Train is controlled.

### 1.2.1.4 Receiving Section

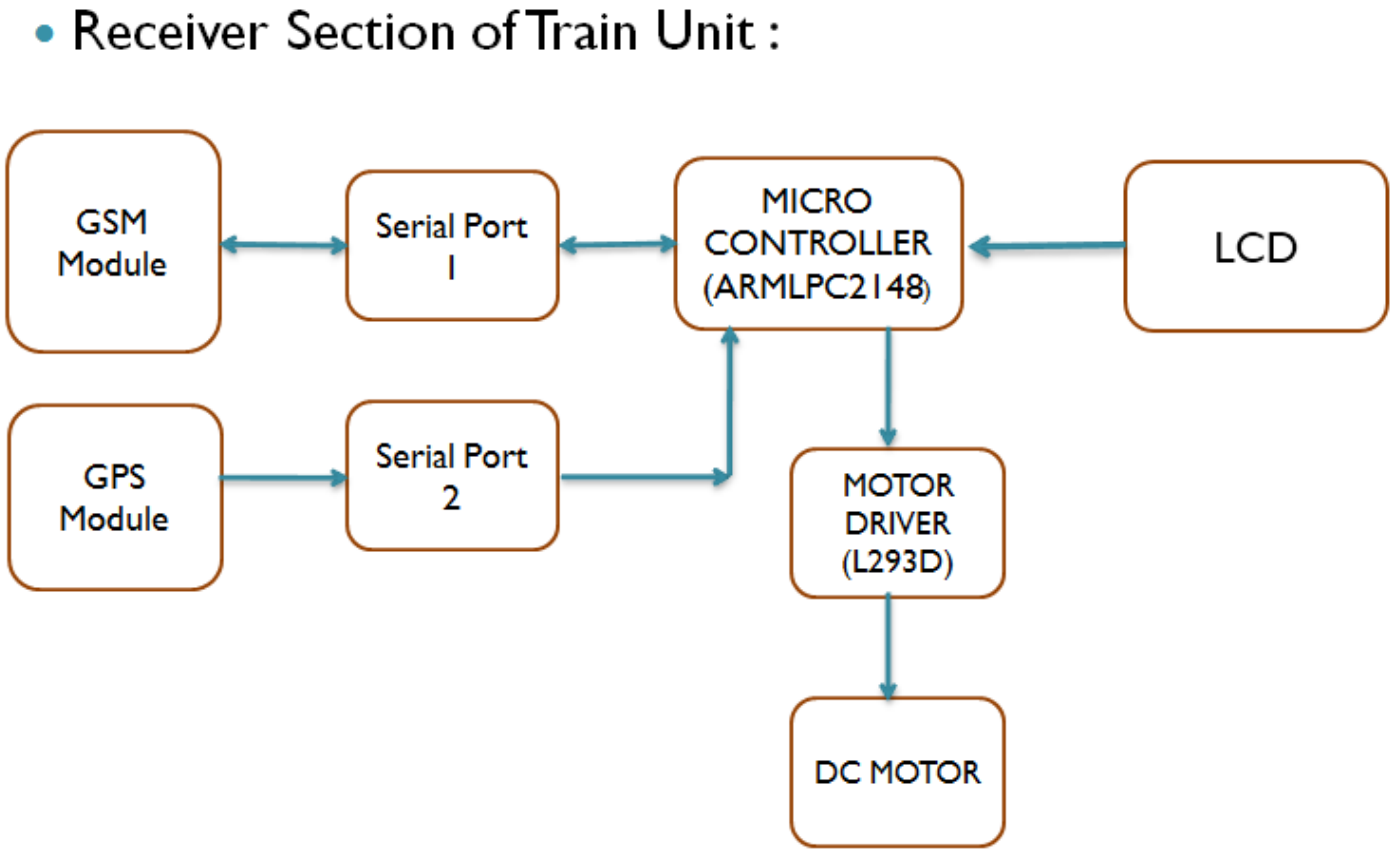



**Figure 6: Receiving Section**

- Upper Fig shows the receiver section for Train unit.
- First GSM module will receive the message transmitted by GSM module connected to PC.
- LPC2148 will decode the data according to the program written in it and will convert the serial data to parallel data.
- Also the LCD on ARM module will show us the message that we have sent from the PC unit which is helpful to understand the position of train.
- Motor driver (L293D) is for driving the DC Motor of train in either direction in order to run the train and control as per desire.

- On train unit ARM with 2 USART is used. On one USART a GPS is interfaced and it will give location of train and on other USART GSM/GPRS module is interfaced which will send the data of GPS will be decoded by LPC2148 and will be sent to PC.

- The location of the train is cached by GPS module which will be eventually decoded into coordinates and sent to PC by GSM module which is connected on other USART.

- The Location can be track continuously after 1 or 2 seconds interval and can be shown on the PC by interfacing map.

### 1.2.1.5 Circuit Diagram For Receiving Section:

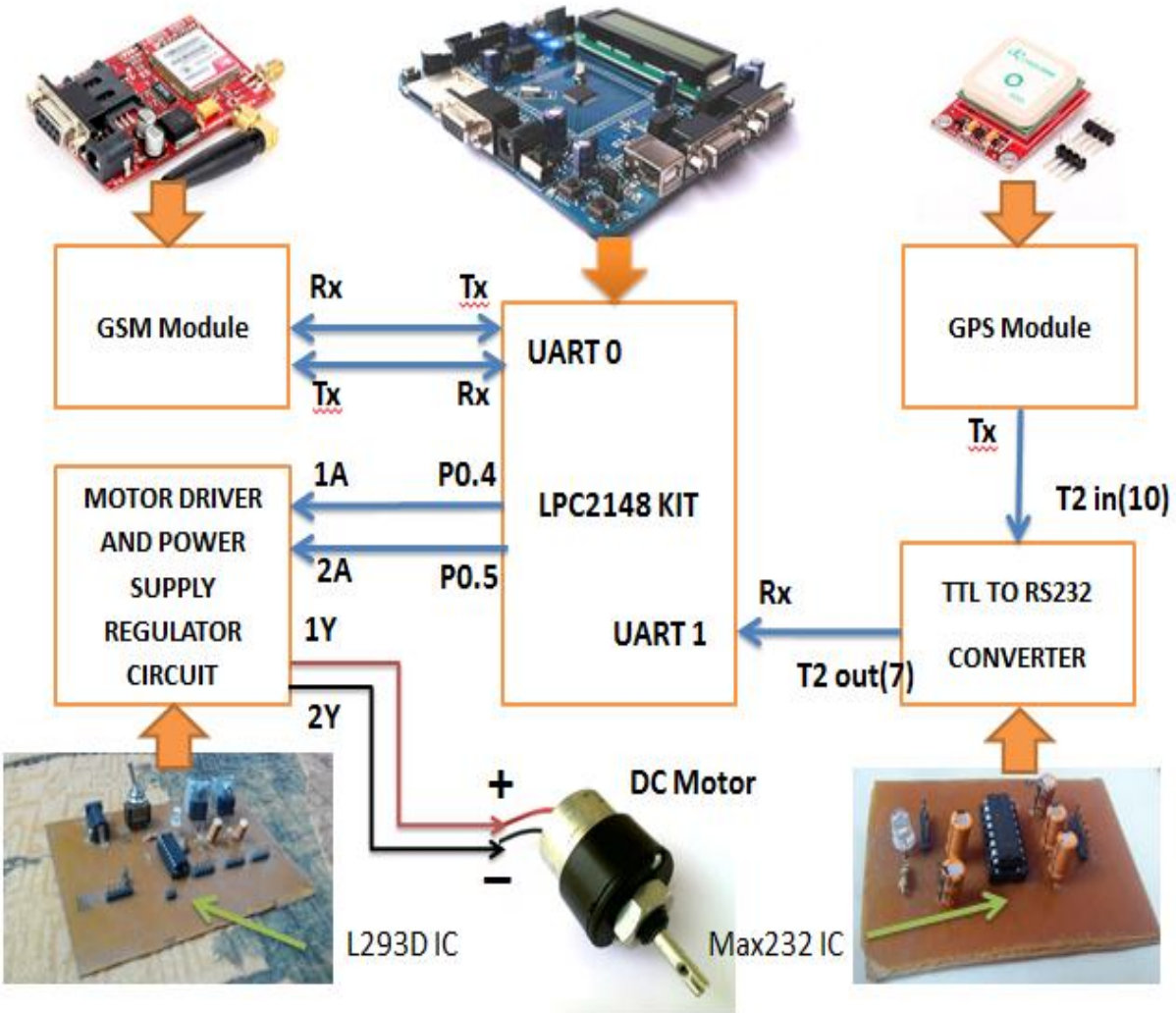



**Figure 7: Circuit Diagram of Receiving Section**

### 1.2.1.6 Explaining Concept of both Transmitting and Receiving Section

- Suppose you want to start the train so simply press the button named "START" on VB application so message named "Start" will be sent via GSM module connected on PC.

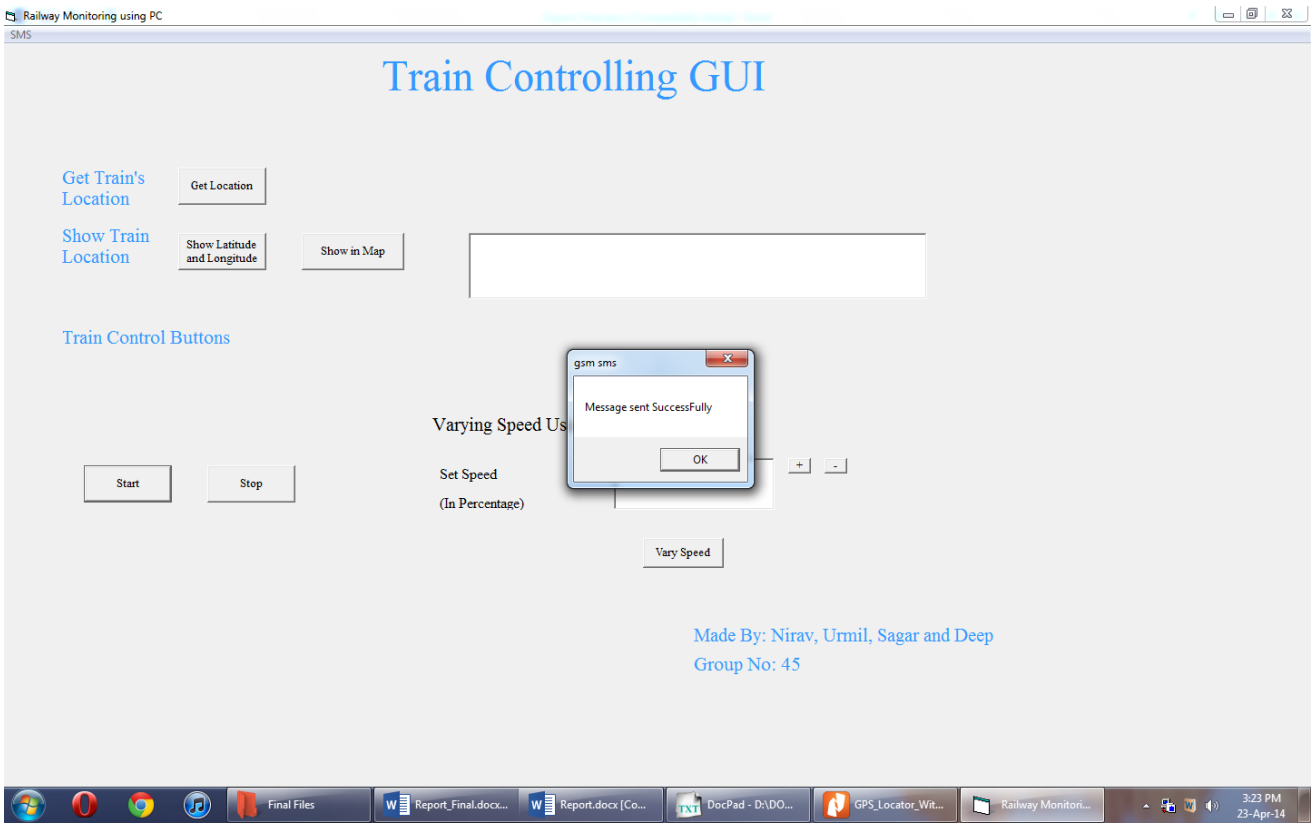



**Figure 8: Start Button Pressed in VB App**

- That "Start" message will be received by GSM Module connected on train unit and LCD will display that "Train Vadodara Started".

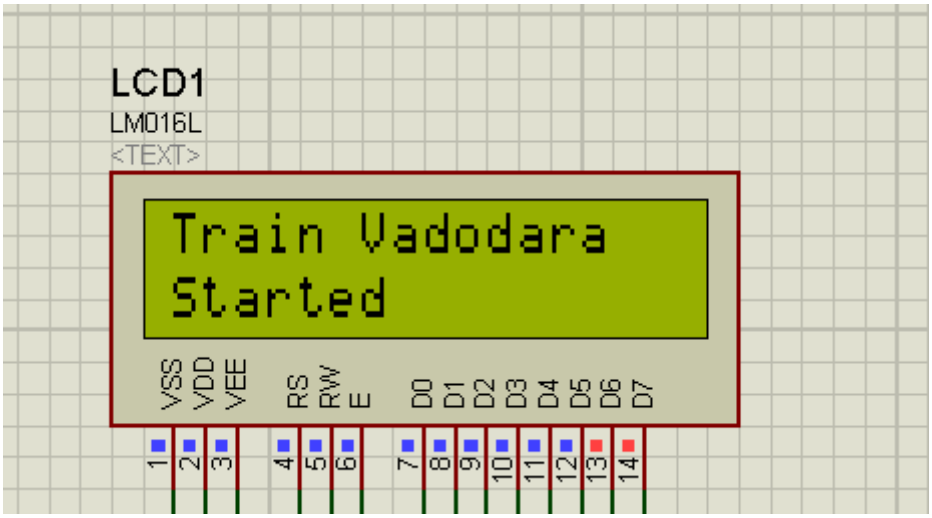



**Figure 9: Train Vadodara Started displayed on LCD**

- Now the Decoding of this Message is written as a program in ARM LPC2148 Microcontroller on train Unit, so whenever the start message is received by the train unit the controller has a program written to rotate the motor clockwise and train will start.

- To vary the speed simply write speed in % in 'Set speed' text box in VB And then click "Vary speed" button.

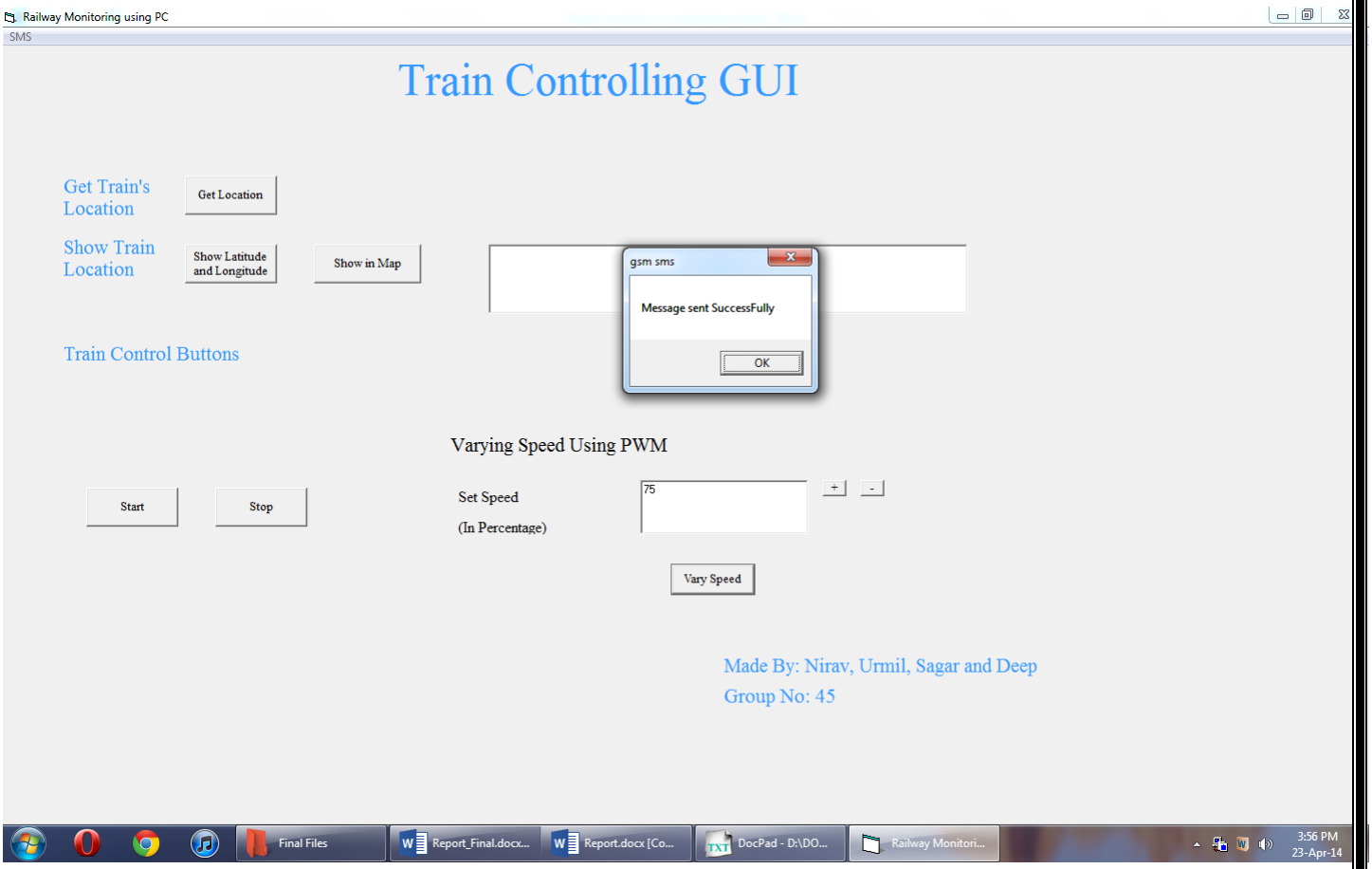



**Figure 10: Train Speed set to 75% in VB App**

- After the train unit receives this message, the LCD will display following:

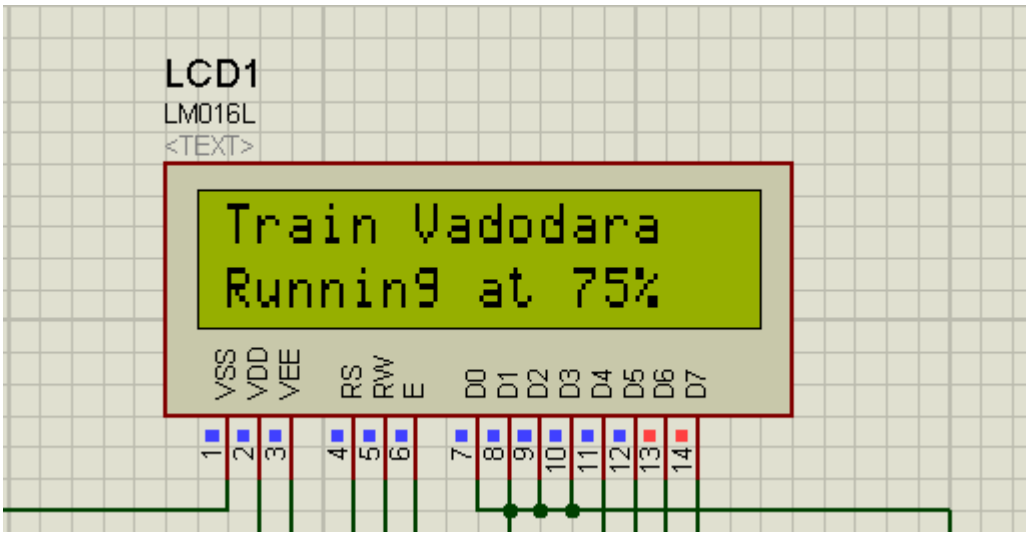



**Figure 11: Train's speed shown on LCD**

- Similarly to Stop the train Click on "Stop" button in VB, and Following will be displayed on LCD

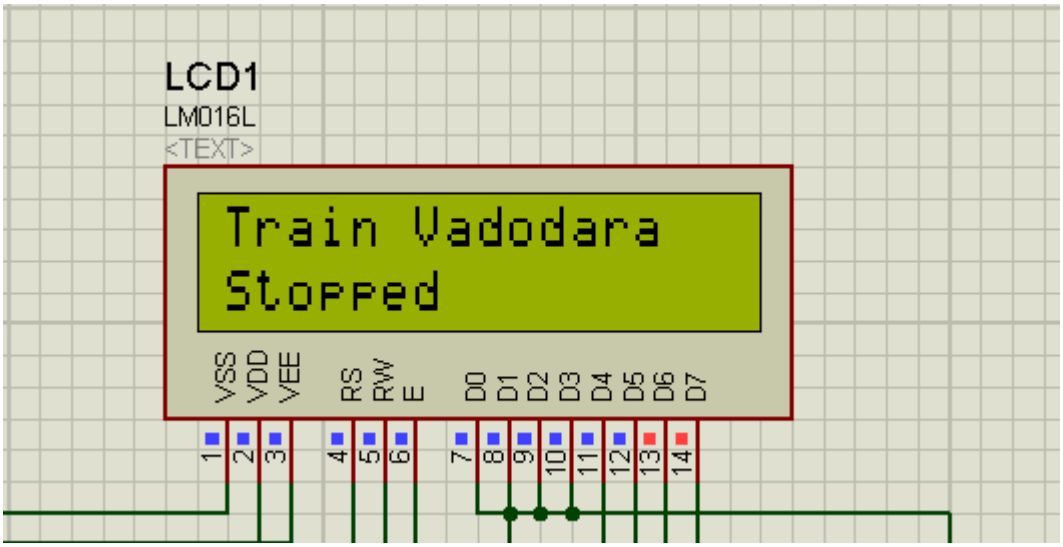



**Figure 12: Train Stopped confirmation on LCD**

- We can also get location of train on LCD at the starting of execution of program

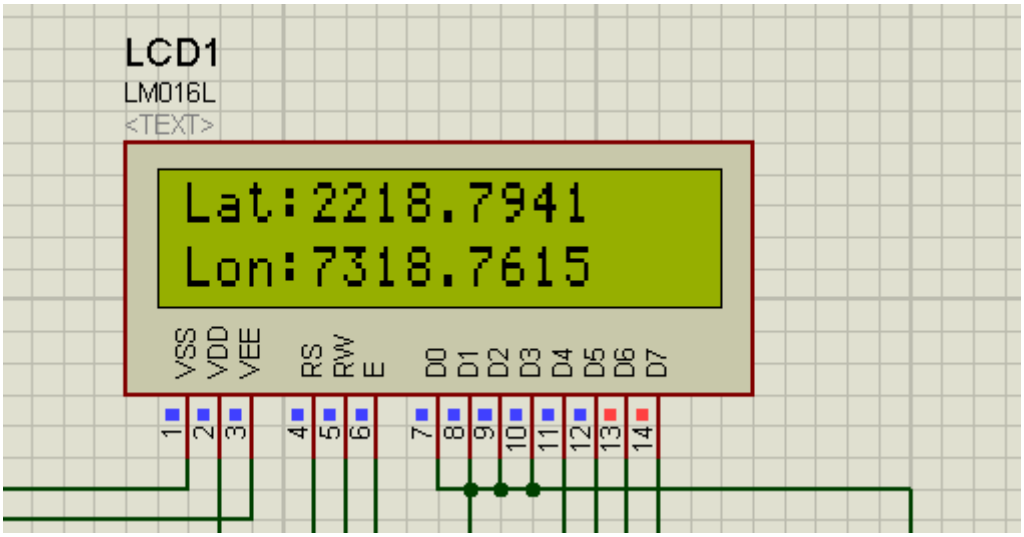



**Figure 13: Train's location shown on LCD**

- This location will also be send to PC side where its location can be seen on Google Map.

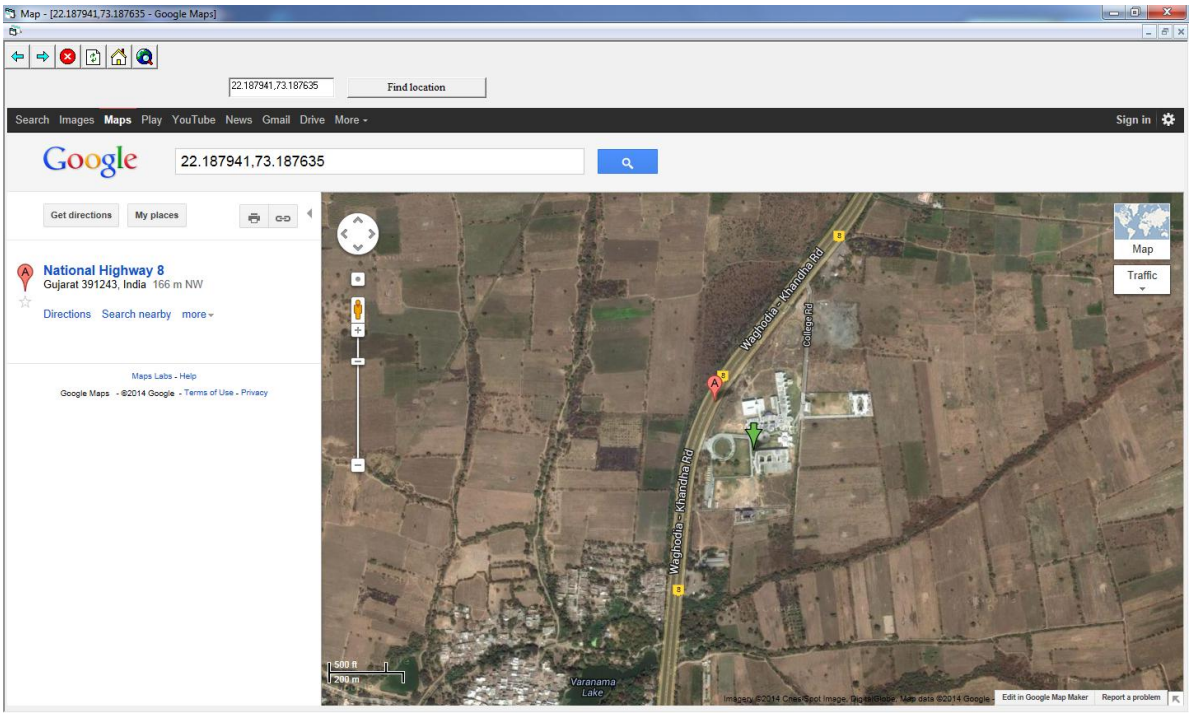



**Figure 14: Train's location Show on Google Map in VB App**

## 1.2.2 Automation Part

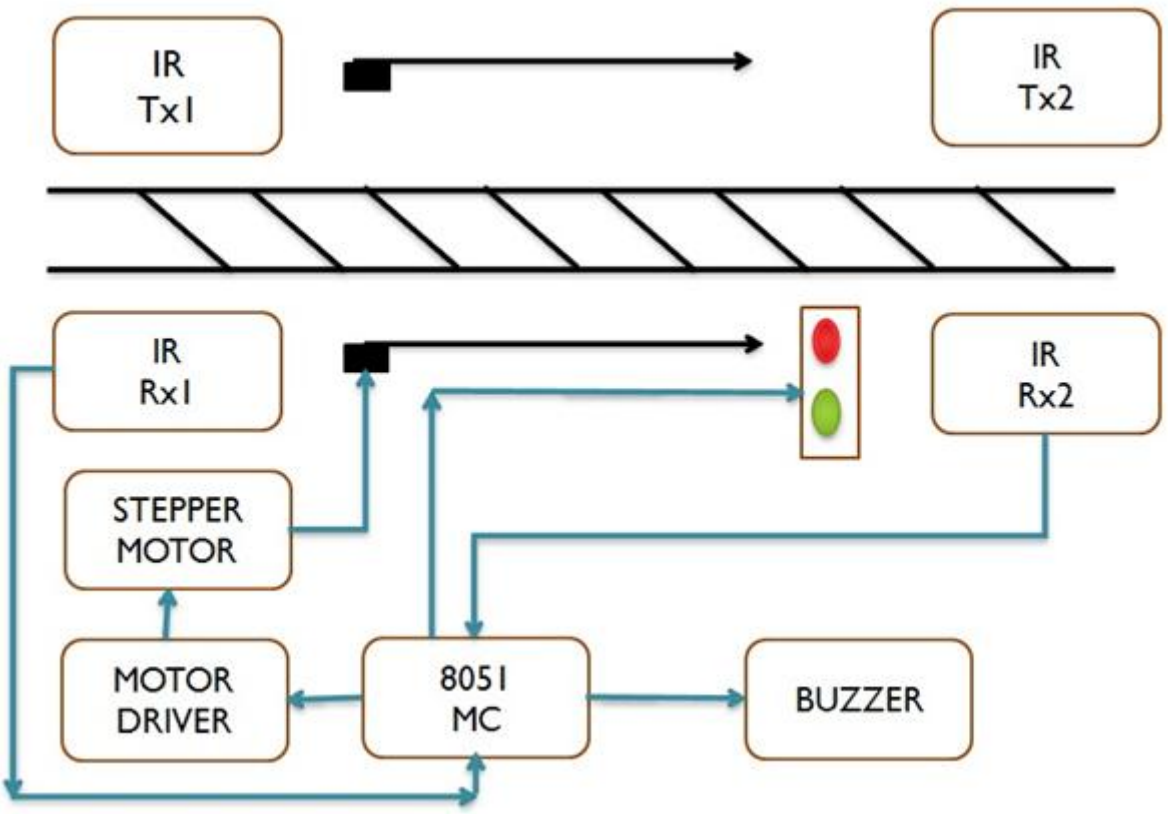



**Figure 15: Gate Control Section**

- This is the block diagram for Gate control.
- Two IR Sensor are placed on either side of gate at some predetermined distance and at some height like 8 ft. above ground so whenever the train is supposed to come, Sensor should Sense train only and not another object.
- So whenever train comes from any side of gate that sensor is turned ON and then Buzzer is turned on indicating train is coming along with signal indicator and then gate is closed.
- Now when train gets passed by other sensor then and only then the gate is opened.
- The opening and closing of gate is done by using stepper motor which will be operated by Motor Driver (L293D).
- Here for controlling gate, 8051 Microcontroller is being used.
- This sensors are placed at around 5 to 8 km from Gate.

### 1.2.2.1 Circuit Diagram For Gate Control:

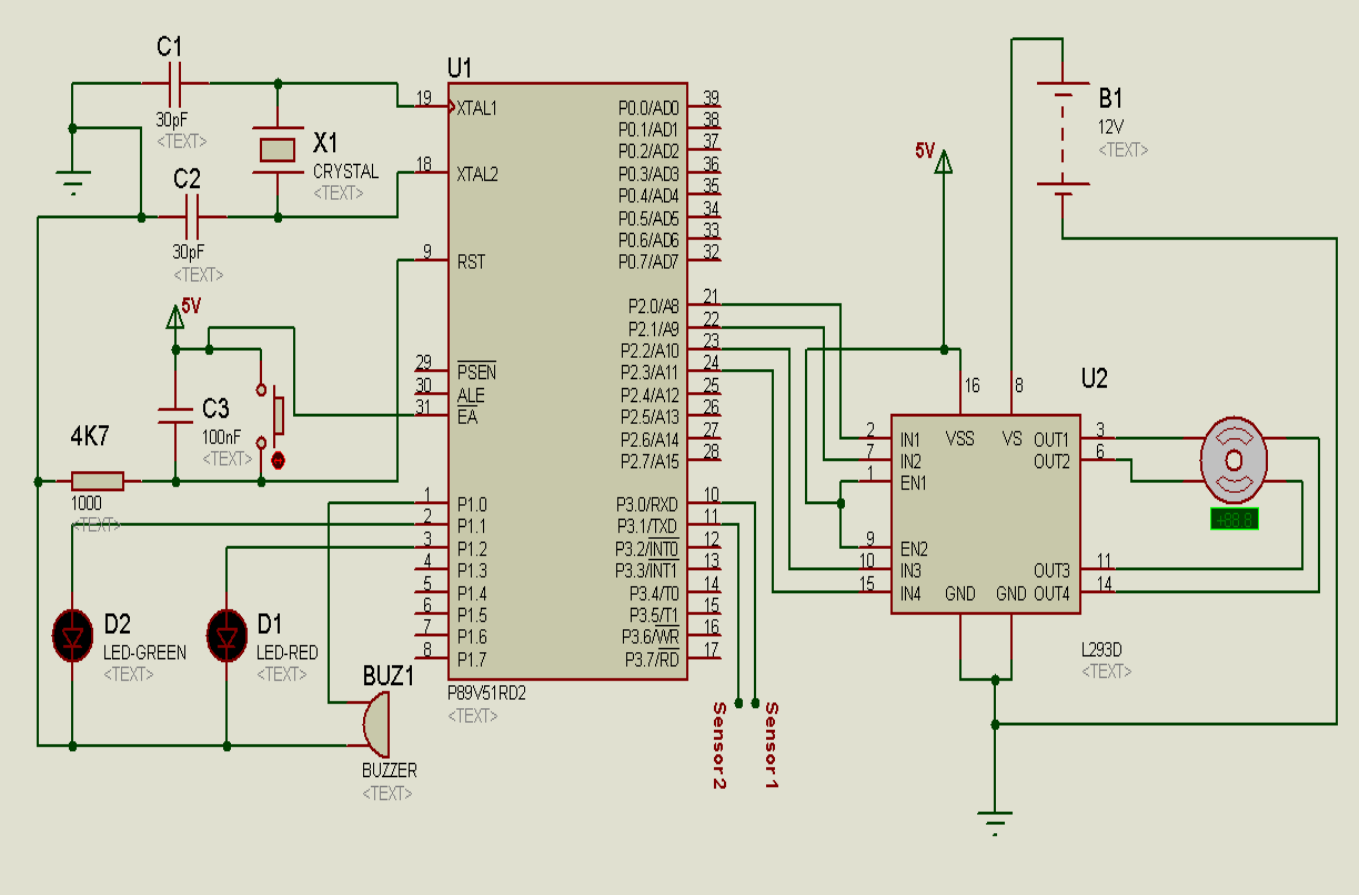



**Figure 16: Circuit Diagram for Gate Control**

- The circuit Diagram for gate control that has been designed in Proteus Software.
- Microcontroller 8051, L293d Motor Driver (H Bridge), Stepper Motor, Buzzer, Two Red and Green Signaling LEDS are located in diagram.

# Chapter

# 2. Literature survey

## 2.1 Literature survey

- In Current Systems the Train Accidents are increasing because of careless in Human Efforts and lack of Technology.

- We have designed the System which is desirably Automated and Monitored by the computer so chances of accidents can be minimized at noticeable extent.

- The accidents like when two trains are in front of each other, when two trains are back to back can be completely prevented by this system. This can be implemented by slowing or stopping the train by PC at some predetermined calculated distance. This is possible because we will have full graphical view of the railway system along with train's position on PC.

- At present scenario, in the level crossing line the railway gate is operated normally by a gate keeper. This happens when the railway line is cross over the road and there are a gate that have to be controlled. The gate keeper work after receiving the information about the train arrival from the nearer station. When the train starts to leave the station, the particular station delivers the information to give the signal for gate keeper to get ready. This is the operation are followed for operating the railway gates.

- In addition, this automatic railway gate system can contribute a lot of benefit either to the road user or to the railway management. This type of gate can be implementing in the level crossing where the chances of accidents are higher. The computer integration will be used to provide addition in the latest technology.

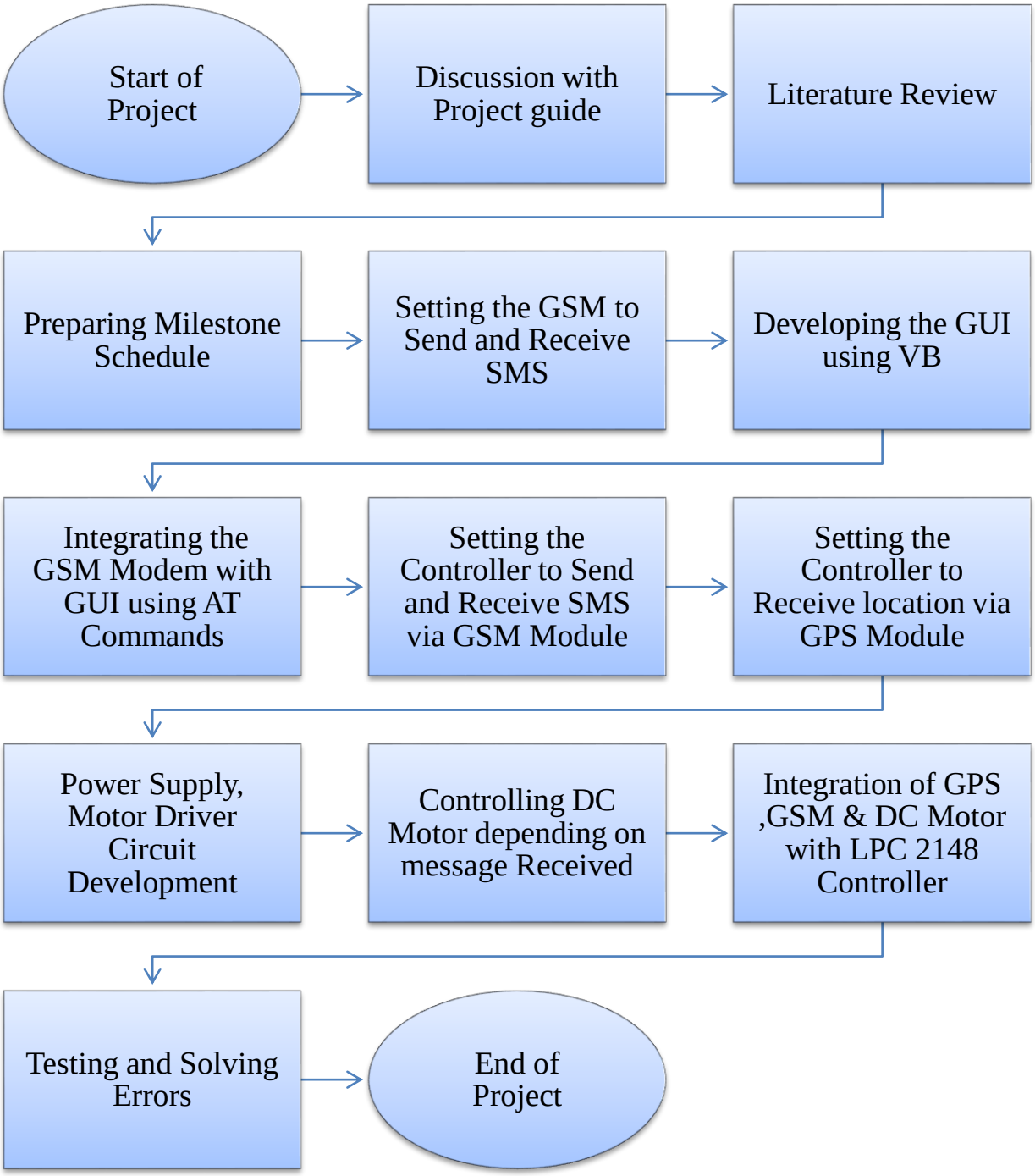
- Lighting signal also provided at the certain distance as pre cautionary step for Driver. Meanwhile, the nearer station also will provide an indication Buzzer to remind them about the crossing train. If anything happened at the gates, this Buzzer will alert the station.

# Chapter

# 3. Flow Chart

## 3.1 Flow Chart of Project

In order to achieve the objectives of this project, it will go through the several phases, which are:



- The figure shows the flow chart which indicates the modular concept that we have used in the implementation of our whole project. This concept includes the implementation of individual quantities and after getting success in one the next step is to relate or connect them and create a whole model, so to make the whole process quite easier we decided to use modular concept.

## 3.2 Phases of the Project

**Phase1**:- Discuss the whole idea and outcomes of our project with the project guide in order to get better understanding and to make clear decisions that our project is suitable for this level and present the project progress or finding.

- Then, research further information about the title of the project, collect the information about GSM modem, GPS Module, GUI that will be used (Visual Basic Express Edition) from supervisor, retrieved from website, books, IEEE journal, thesis, and so on. Try to understand the concept & desired result for this project.

- After that, obtain the datasheet of component involved such as GSM Modem, GPS Module, and ARM7 LPC 2148 microcontroller, voltage regulator, Oscillator and other components.

**Phase2**:- For this phase, the aim was to prove our project in terms of social impact because after all any project is the way of making the people's life easier and that's what decides the quality of project apart from it is big or small. So in order to consolidate our project in terms of its outcomes and prove it valid as well as solid at final year stage we made the literature review of project.

- We survey of the entire previous Railway Automation System with GPS Locator and GSM project is done to find the best method and approach for the project.

- Literature survey from journal and internet is carried out. The comparison method of GUI is performed in order to enlist the best technique to be implementing in this project.

**Phase3**:- For this phase, the aim was to prepare the firm schedule of the whole project in small steps or modules on the paper. Then we understood the functions of GSM and GPS in order to use them in the project.

**Phase4**:- For this phase, the aim was to initialized and understood the GSM to send and receive messages. For this, we have used the 'Hyper Terminal' in the computer. After initialized GSM successfully on hyper terminal we checked it by using Online AT Command tester in M2M Support website.

**Phase5**:- In this phase, we made Graphical User Interface (GUI) in VB application. That means we made the Visual Buttons named START, STOP, FAST, and SLOW etc. for controlling the train. Behind each button there is a prewritten code that make it work as our desire for ex. if we press the START button the train will start!!

- This was a tough ask because in the code we were dealing with GSM and GPS both and In GUI we have not only made the buttons but we are also taking the location of train in terms of longitude and latitude and for having complete idea of location we have interfaced the map.

- In this phase, the aim was to make the GSM and VB application work together and for that we interfaced the GSM modem and VB application i.e. GSM modem with PC. in this what happened is, when user press the button according to the code written behind the button message will send by GSM and this message will received by another GSM connected with train unit. The code which make the button work is written using AT commands.

**Phase6**:- The next phase was bit harder because in this step we were going to make the controller work as we wanted. For that the code should be written in the controller to send and receive message. In this part we made a code for sending and receiving message by the controller and check it severally by tapping method on hyper terminal. We also saw its working on hyper terminal again by tapping method. At last we made a successful working code and dumped it into microcontroller LP2148.

**Phase7**:- The previous phase was to make a code for GSM only. In this phase aim was to make a code for receive location by GPS and the concatenation of both of them. So we made a final code for send the commands by GSM and also receive the location by GPS and interfaced the controller with computer for getting the location in VB application.

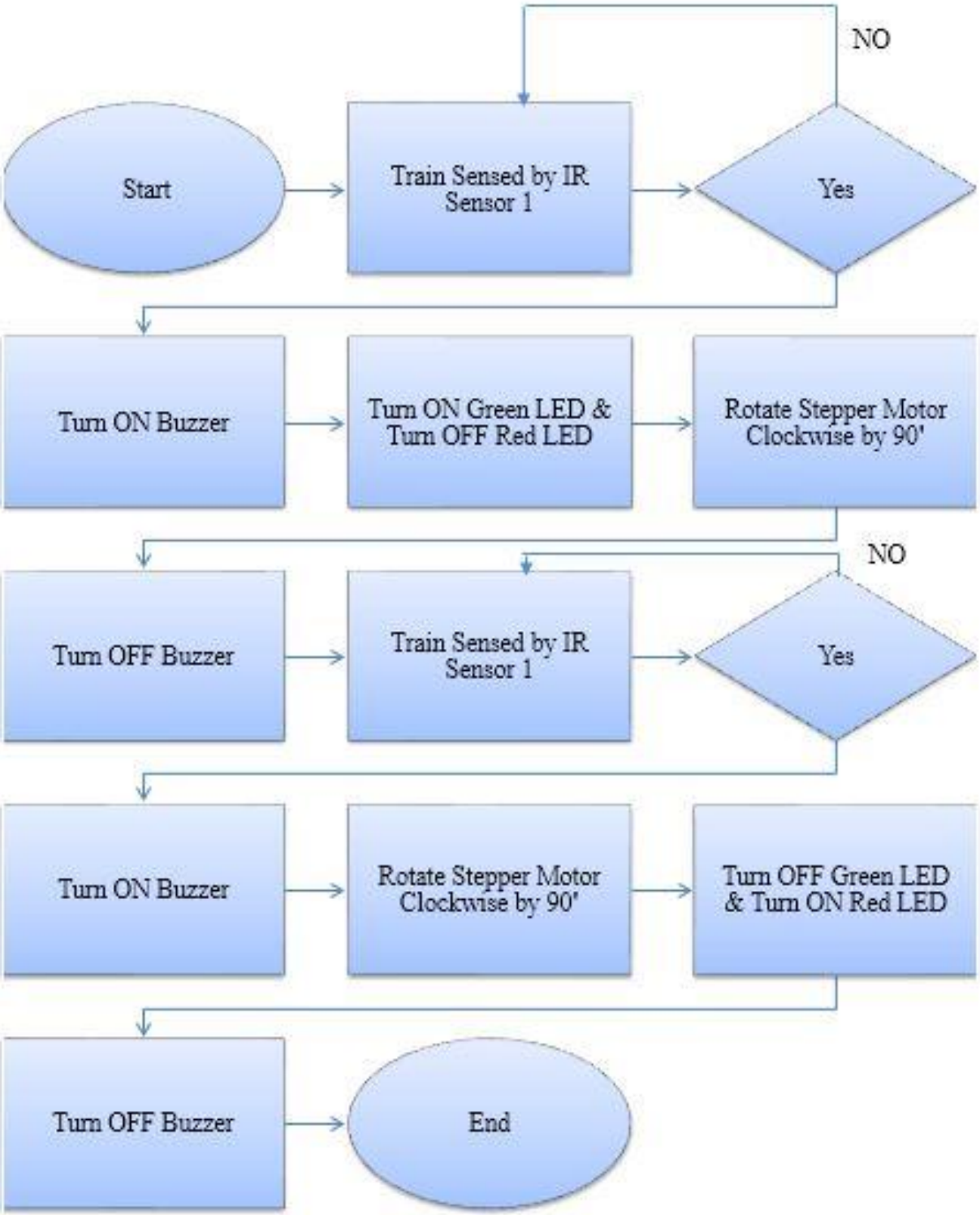
**Phase8**:- In this phase, we made a power supply PCB including 5v, 8v and 12v supplies and motor driver.

**Phase9**:- The next phase was to make the Motor to drive according the message received i.e. if user press START button the motor should rotate forward in order to start the train. For that we made a code by pulse width modulation (PWM) method for controlling the speed of train and added it into the main code which includes GSM and GPS logic.

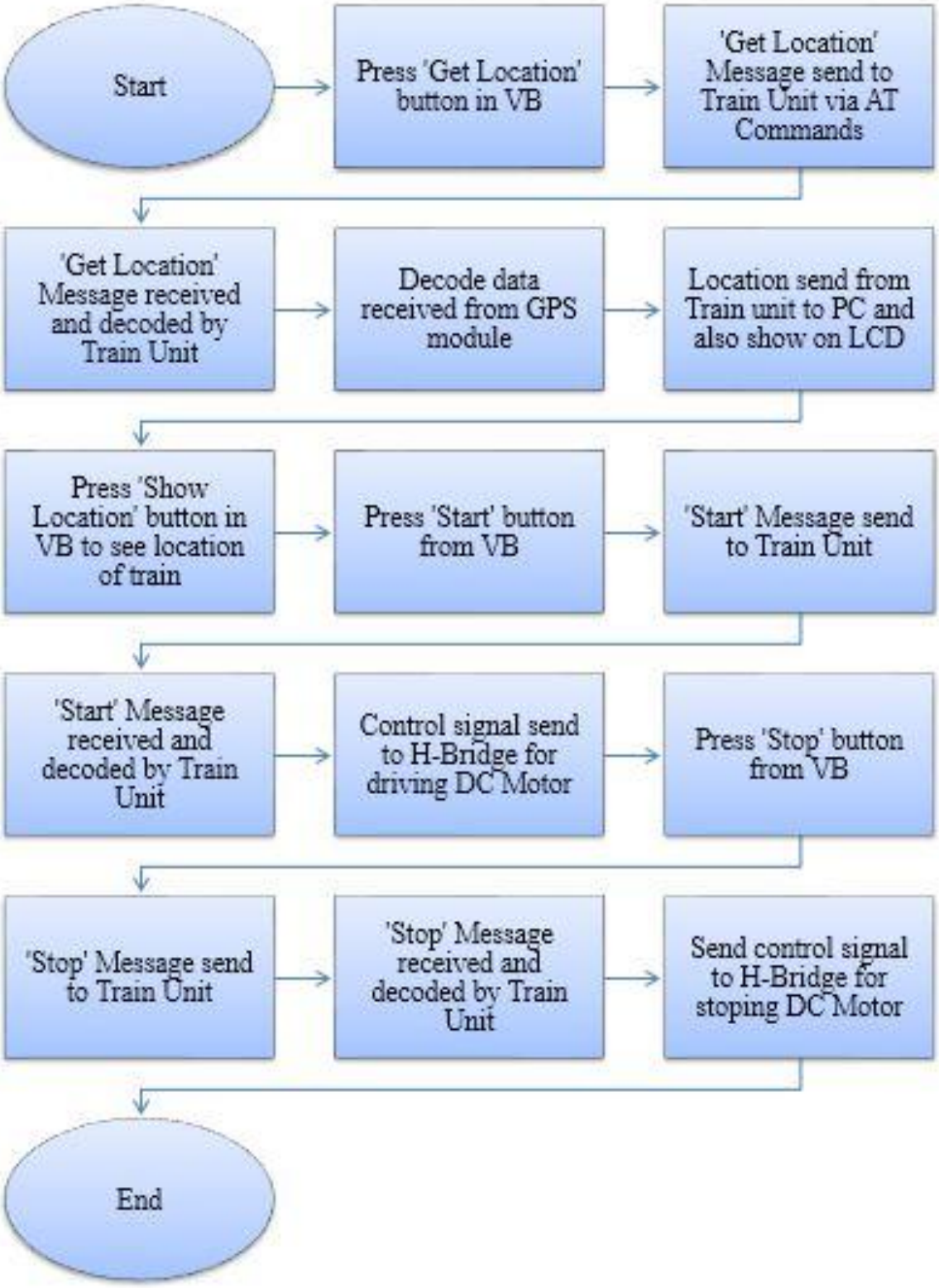
**Phase10**:- After building of full code in order to implement the whole project, we interfaced all the modules like GSM, GPS, LPC2148 kit and DC Motor for real time working of code and whole project.

**Phase11**:- For this phase, the software part is combined with hardware part to get the final result and carried out the comparison between the two approaches. After that the functionality, ability & weakness of circuit design and software test are studied, next the conclusion based on the findings is prepared.

## Flow Chart of Automation Part



## Flow Chart for Monitoring Part



# Chapter

# 4. Introduction to microcontroller

# 4.1 Introduction to microcontroller

A **microcontroller** is a small and low-cost computer built for the purpose of dealing with specific tasks, such as displaying information in a microwave led or receiving information from a television's remote control. **Microcontrollers** are mainly used in products that require a degree of control to be exerted by the user.

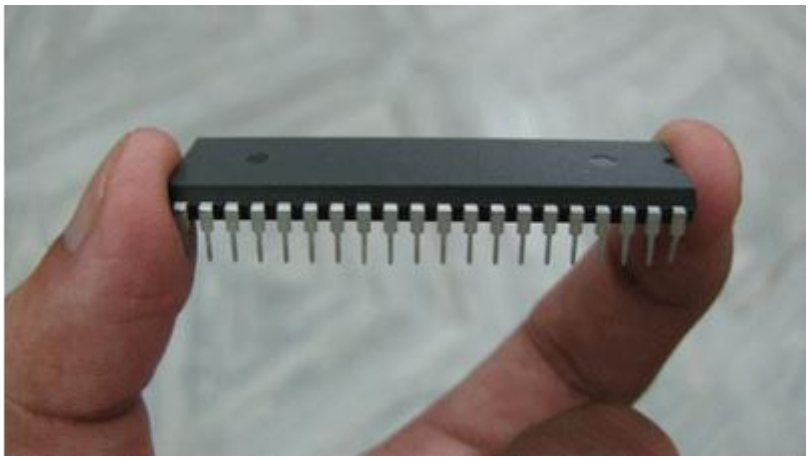


**Figure 17: Microcontroller 8051 Physical View**

**Microcontroller v/s microprocessor**

Microprocessors are used to execute big and generic applications, while a microcontroller will only be used to execute a single task within one application. Some of the benefits of microcontrollers include the following:

**Cost advantage:** The biggest advantage of **microcontrollers** against larger microprocessors is that the design and hardware costs are much lesser and can be kept to a minimum. A microcontroller is cheap to replace, while microprocessors are ten times more expensive.

**Lesser power usage:** Microcontrollers are generally built using a technology known as Complementary Metal Oxide Semiconductor (CMOS). This technology is a competent fabrication system that uses less power and is more immune to power spikes than other techniques.

**All-in-one:** A microcontroller usually comprises of a CPU, ROM, RAM and I/O ports, built within it to execute a single and dedicated task. On the other hand, a microprocessor generally does not have a RAM, ROM or IO pins and generally uses its pins as a bus to interface to peripherals such as RAM, ROM, serial ports, digital and analog IO.

**How does a Microcontroller work?**

Microcontroller has an input device in order to get the input and an output device (such as LED or LCD Display) to exhibit the final process. Let us look into the illustration of how a microcontroller works in a Television.

The Television has a remote control as an Input device and the TV screen as the output device. The signal sent from the remote control is captured by the microcontroller. The microcontroller controls the channel selection, the amplifier system and picture tube adjustments such as hue, brightness, contrast etc.

**General architecture of a microcontroller**

The architecture of a microcontroller depends on the application it is built for. For example, some designs include usage of more than one RAM, ROM and I/O functionality integrated into the package

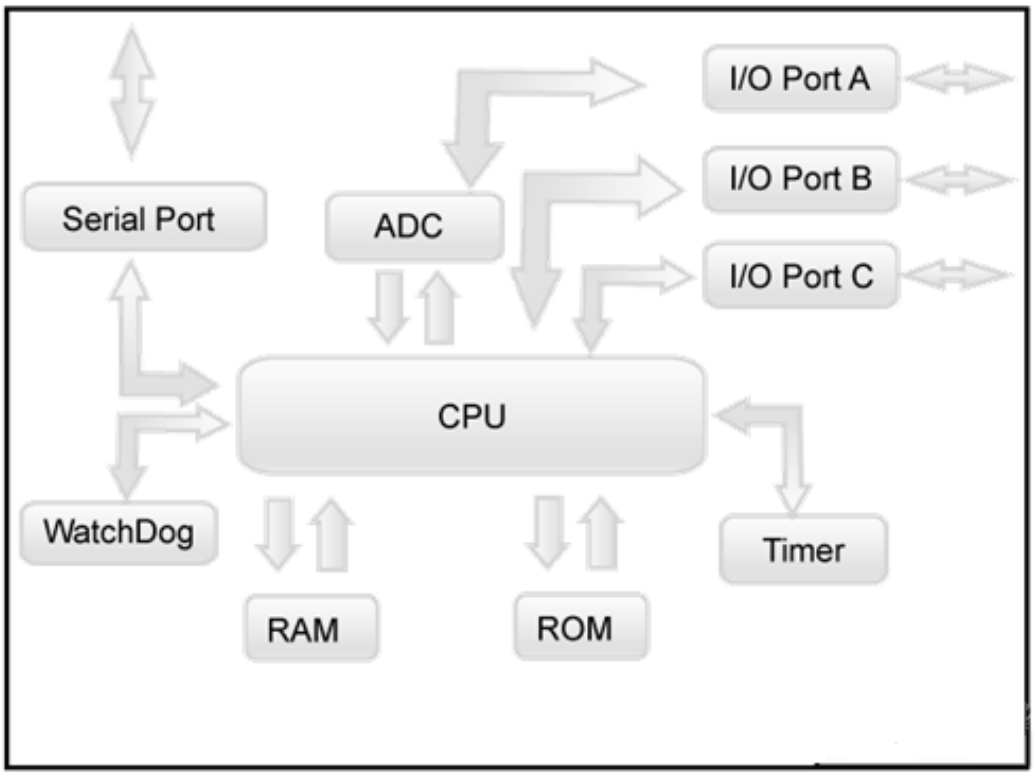



**Figure 18: Architecture of microcontroller**

The architecture of a typical microcontroller is complex and may include the following:

1. A CPU, ranging from simple 4-bit to complex 64-bit processers.
2. Peripherals such as timers, event counters and watchdog.
3. RAM (volatile memory) for data storage. The data is stored in the form of registers, and the general-purpose registers store information that interacts with the Arithmetic logical unit (ALU).
4. ROM, EPROM, EEPROM or flash memory for program and operating parameter storage.
5. Programming capabilities.
6. Serial input/output such as serial ports.
7. A clock generator for resonator, quartz timing crystal or RC circuit.
8. Analog-to-digital convertors.
9. Serial ports.
10. Data bus to carry information.

## 4.2 8051 Microcontroller

### 4.2.1 Introduction of 8051 Microcontroller

Some of the features that have made the 8051 popular are:

- 4 KB on chip program memory.
- 128 bytes on chip data memory (RAM).
- 4 register banks.
- 128 user defined software flags.
- 8-bit data bus
- 16-bit address bus
- 32 general purpose registers each of 8 bits
- 16 bit timers (usually 2, but may have more, or less).
- 3 internal and 2 external interrupts.
- Bit as well as byte addressable RAM area of 16 bytes.
- Four 8-bit ports, (short models have two 8-bit ports).
- 16-bit program counter and data pointer.
- 1 Microsecond instruction cycle with 12 MHz Crystal.

## 4.2.2 Pin description of 8051 Microcontroller

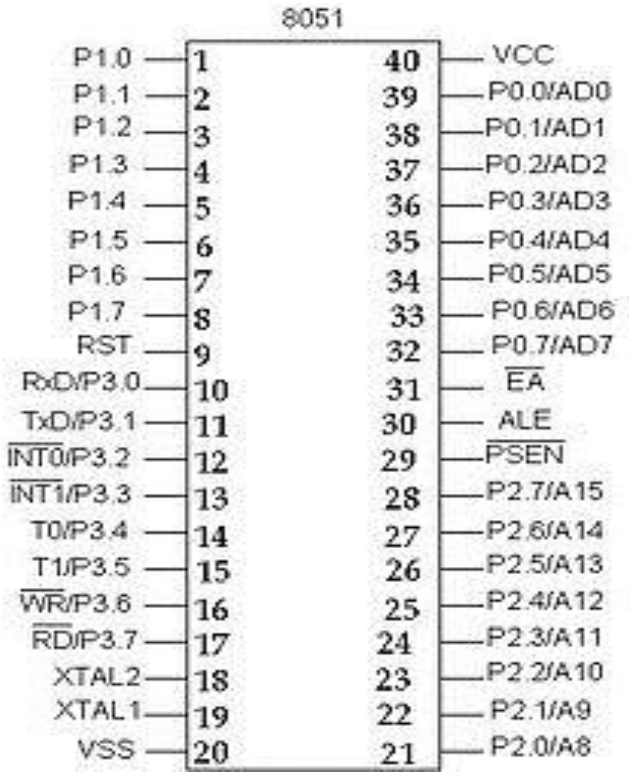



**Figure 19: Pin description of 8051 Microcontroller**

**Pins 1-8:** Port 1 Each of these pins can be configured as an input or an output.

**Pin 9**: RS a logic one on this pin disables the microcontroller and clears the contents of most registers. In other words, the positive voltage on this pin resets the microcontroller. By applying logic zero to this pin, the program starts execution from the beginning.

**Pins10-17:** Port 3 Similar to port 1, each of these pins can serve as general input or output. Besides, all of them have alternative functions:

**Pin 10:** RXD Serial asynchronous communication input or Serial synchronous communication output.

**Pin 11:** TXD Serial asynchronous communication output or Serial synchronous communication clock output.

**Pin 12:** INT0 Interrupt 0 input.

**Pin 13:** INT1 Interrupt 1 input.

**Pin 14:** T0 Counter 0 clock input.

**Pin 15:** T1 Counter 1 clock input.

**Pin 16:** WR Write to external (additional) RAM.

**Pin 17:** RD Read from external RAM.

**Pin 18, 19:** X2, X1 Internal oscillator input and output. A quartz crystal which specifies operating frequency is usually connected to these pins. Instead of it, miniature ceramics resonators can also be used for frequency stability. Later versions of microcontrollers operate at a frequency of 0 Hz up to over 50 Hz.

**Pin 20:** GND Ground.

**Pin 21-28:** Port 2 If there is no intention to use external memory then these port pins are configured as general inputs/outputs. In case external memory is used, the higher address byte, i.e. addresses A8-A15 will appear on this port. Even though memory with capacity of 64Kb is not used, which means that not all eight port bits are used for its addressing, the rest of them are not available as inputs/outputs.

**Pin 29:** PSEN if external ROM is used for storing program then a logic zero (0) appears on it every time the microcontroller reads a byte from memory.

**Pin 30:** ALE Prior to reading from external memory, the microcontroller puts the lower address byte (A0-A7) on P0 and activates the ALE output. After receiving signal from the ALE pin, the external register memorizes the state of P0 and uses it as a memory chip address. After that, the ALU pin is returned its previous logic state and P0 is now used as a Data Bus. In other words, this port is used for both data and address transmission.

**Pin 31:** EA By applying logic zero to this pin, P2 and P3 are used for data and address transmission with no regard to whether there is internal memory or not. It means that even there is a program written to the microcontroller, it will not be executed. Instead, the - program written to external ROM will be executed. By applying logic one to the EA pin, the microcontroller will use both memories, first internal then external (if exists).

**Pin 32-39:** Port 0 Similar to P2, if external memory is not used, these pins can be used as general inputs/outputs. Otherwise, P0 is configured as address output (A0-A7) when the ALE pin is driven high (1) or as data output (Data Bus) when the ALE pin is driven low (0).

**Pin 40:** VCC +5V power supply.

### 4.2.3 Architecture of 8051 Microcontroller

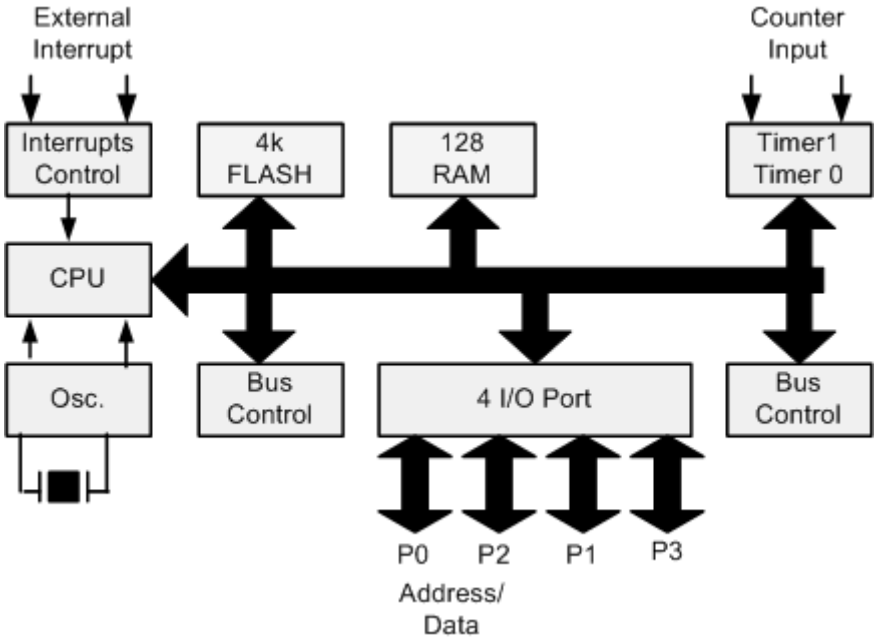



**Figure 20: Architecture of 8051 Microcontroller**

**Central Processor Unit (CPU)**: As you may know that CPU is the brain of any processing device. It monitors and controls all operations that are performed in the Microcontroller. User have no control over the work of CPU. It reads program written in ROM memory and executes them and do the expected task.

**Interrupts**: As its name suggests, Interrupt is a subroutine call that interrupts Microcontroller's main operation or work and causes it to execute some another program which is more important at that time. The feature of Interrupt is very useful as it helps in cases of emergency. Interrupts gives us a mechanism to put on hold the ongoing operation, execute a subroutine and then again resumes normal program execution.

The Microcontroller 8051 can be configured in such a way that it temporarily terminates or pause the main program at the occurrence of interrupt. When subroutine is completed then the execution of main program starts as usual. There are five interrupt sources in 8051 Microcontroller. 2 of them are external interrupts, 2 timer interrupts and one serial port interrupt.

**Memory**: Microcontroller requires a program which is a collection of instructions. This program tells Microcontroller to do specific tasks. This program requires a memory on which these can be saved and read by Microcontroller to perform specific operation. The memory which is used to store the program of Microcontroller is known as code memory or Program memory. It is known as '**ROM**'(**Read Only Memory**).

Microcontroller also requires a memory to store data or operands temporarily. The memory which is used to temporarily store data for operation is known as Data Memory and we uses '**RAM**'(**Random Access Memory**) for this purpose. Microcontroller 8051 has 4K of Code Memory or Program memory that is it has 4KB Rom and it also have 128 bytes of data memory i.e. RAM.

**Bus**: Basically Bus is a collection of wires which work as a communication channel or medium for transfer of Data. These buses consist of 8, 16 or more wires. Thus these can carry 8 bits, 16 bits simultaneously. Buses are of two types:

- Address Bus
- Data Bus

**Address Bus**: Microcontroller 8051 has a 16 bit address bus. It used to address memory locations. It is used to transfer the address from CPU to Memory.
**Data Bus**: Microcontroller 8051 has 8 bits data bus. It is used to carry data.

**Oscillator**: As we know Microcontroller is a digital circuit device, therefore it requires clock for its operation. For this purpose, Microcontroller 8051 has an on-chip oscillator which works as a clock source for Central Processing Unit. As the output pulses of oscillator are stable therefore it enables synchronized work of all parts of 8051 Microcontroller.

**Input/output Port**: As we know that Microcontroller is used in embedded systems to control the operation of machines. Therefore to connect it to other machines, devices or peripherals we require I/O interfacing ports in Microcontroller. For this purpose Microcontroller 8051 has 4 input output ports to connect it to other peripherals.

**Timers/Counters**: Microcontroller 8051 has 2 16 bit timers and counters. The counters are divided into 8 bit registers. The timers are used for measurement of intervals, to determine pulse width etc.

## 4.3 ARM LPC2148 Microcontroller

**Figure 21: Physical view of ARM LPC2148 Microcontroller**

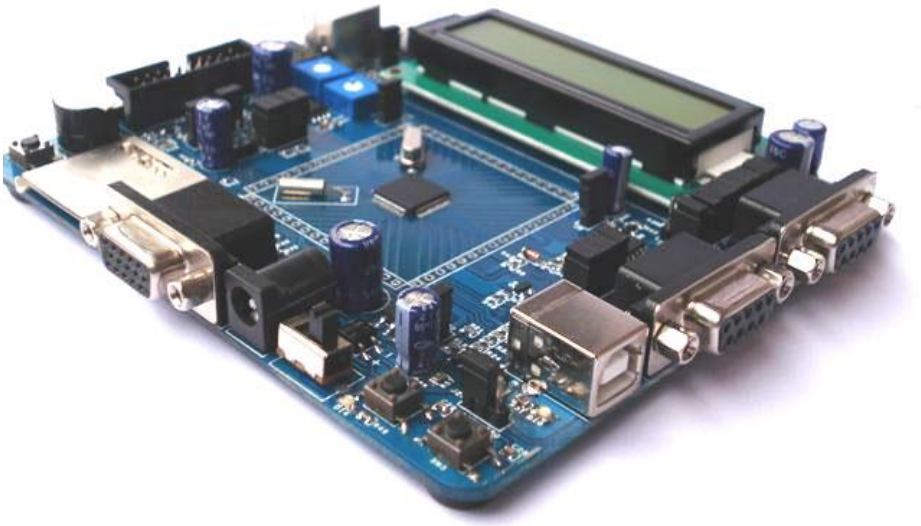


**Figure 22: Physical view of ARM LPC2148 Kit**

### 4.3.1 Description of LPC2148 Pro Development Board

- LPC2148 Pro Development Board is a powerful development platform based on LPC2148 ARM7TDMI microcontroller with 512K on-chip memory. This board is powered by USB port and does not need external power supply. It is ideal for developing embedded applications involving high speed wireless communication (Zigbee / Bluetooth / WiFi), USB based data logging, real time data monitoring and control, interactive control panels etc.

- The on-chip USB controller provides direct high speed interface to a PC/laptop with speeds up to 12Mb/s. The UART boot loader eliminates need of an additional programmer and allows you to program using serial port.

- The on board peripherals include SD/MMC card interface, USB2.0 interface, 4Kbit I2C EEPROM, Xbee / Bluetooth / WiFi wireless module interface, ULN2003 500mA current sinking driver, L293D DC motor controller, 16X2 character LCD and many more. The on-chip peripherals and the external hardware on the development board are interconnected using pin headers and jumpers.

- The I/O pins on the microcontroller can be accessed from a 50 pin male header. This direct access to I/O pins enables you to connect your own devices very easily to the processor. The board is made from double sided PTH PCB board to provide extra strength to the connector joints for increased reliability.

### 4.3.2 Technical Specifications

- Microcontroller: LPC2148 with 512K on chip memory
- Crystal for LPC2148: 12Mhz
- Crystal for RTC: 32.768KHz
- 50 pin Berg header for external interfacing
- On board 512 bytes of I2C external EEPROM
- USB Type B Connector
- SD / MMC card holder with SPI interface
- No separate programmer required (Program with Flash Magic using on-chip boot loader)
- No Separate power adapter required (USB port as power source)
- 10pin(2X5) FRC JTAG connector for Programming and debugging
- 50 Pin Expansion header for easy access to I/O pins
- On board Two Line LCD Display (2x16) (with jumper select option to disable LCD)
- L293D 600mA Dual DC motor Driver
- ULN2003 500mA driver
- Two RS-232 Interfaces (For direct connection to PC's Serial port)
- Real-Time Clock with Battery Holder
- 2 Analog Potentiometers connected to ADC
- TSOP1738 IR receiver
- 4 USER Switches
- 4 USER LEDs
- Reset and Boot loader switches
- 3V button cell for on chip RTC
- On Board Buzzer Interface

## 4.3.3 Block diagram

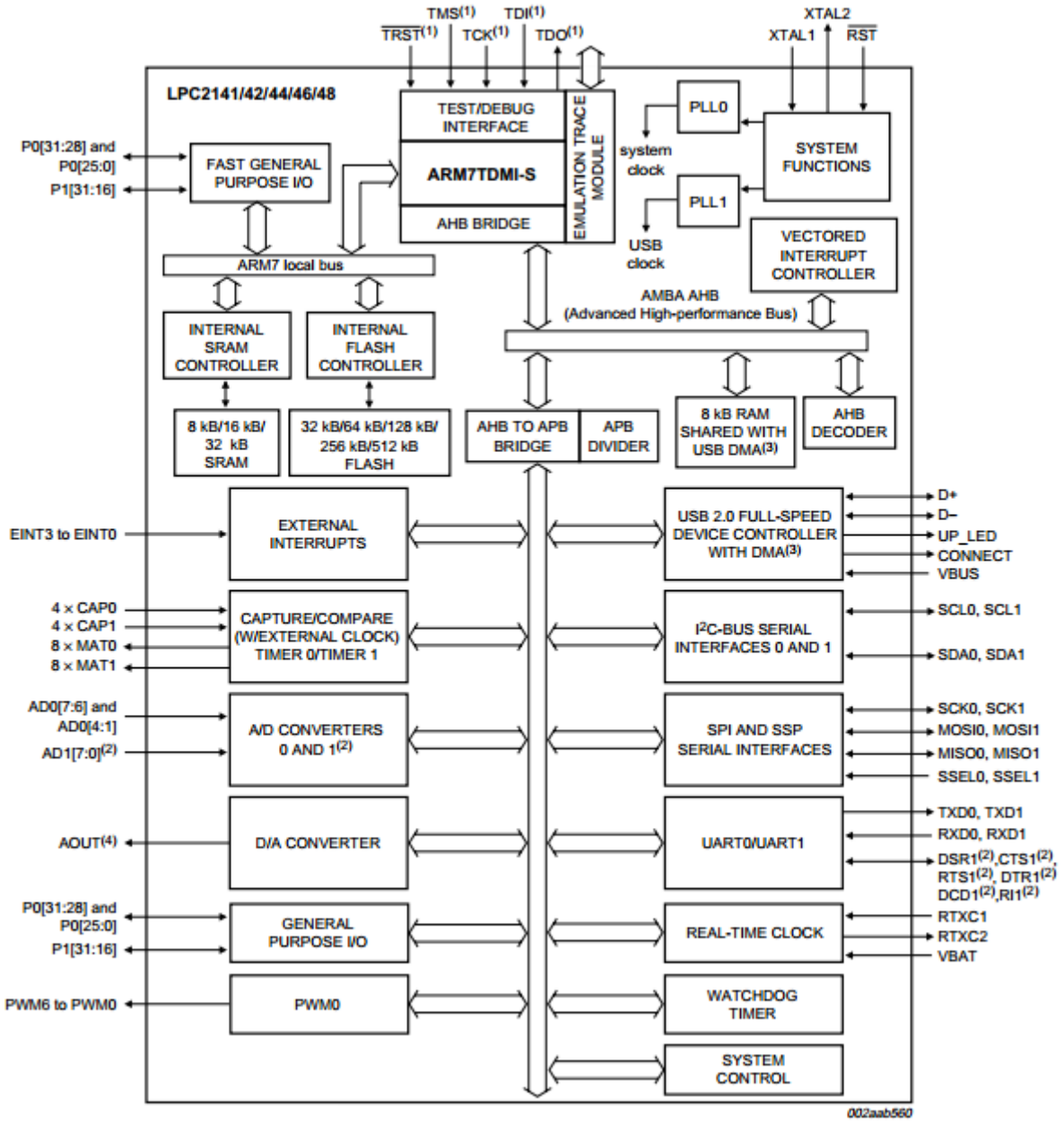



**Figure 23: Block Diagram of ARM LPC2148**

### 4.3.4 Key features of ARM LPC2148

- 16-bit/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package.
- 40 kB of on-chip static RAM and 512 kB of on-chip flash memory.
- In-System Programming/In-Application Programming (ISP/IAP) via on-chip boot loader software.
- Embedded ICE RT and Embedded Trace interfaces offer real-time debugging with the on-chip Real Monitor software and high-speed tracing of instruction execution.
- USB 2.0 Full-speed compliant device controller with 2 kB of endpoint RAM.
- Two 10-bit ADCs provide a total of 14 analog inputs
- Single 10-bit DAC provides variable analog output
- Two 32-bit timers/external event counters (with four capture and four compare channels each), PWM unit (six outputs) and watchdog.
- Low power Real-Time Clock (RTC) with independent power and 32 kHz clock input.
- Multiple serial interfaces including two UARTs, two Fast I²C-bus (400 kbit/s), SPI and SSP with buffering and variable data length capabilities.
- Vectored Interrupt Controller (VIC) with configurable priorities and vector addresses.
- Up to 45 of 5 V tolerant fast general purpose I/O pins in a tiny LQFP64 package.
- 60 MHz maximum CPU clock available from programmable on-chip PLL with settling time of 100 us.
- On-chip integrated oscillator operates with an external crystal from 1 MHz to 25 MHz
- Power saving modes include Idle and Power-down.
- Individual enable/disable of peripheral functions as well as peripheral clock scaling for additional power optimization.
- Processor wake-up from Power-down mode via external interrupt or BOD.
- Single power supply chip with POR and BOD circuit CPU operating voltage range of 3.0 V to 3.6 V (3.3 V +- 10 pct) with 5 V tolerant I/O pads.

## 4.3.5 Pin Diagram

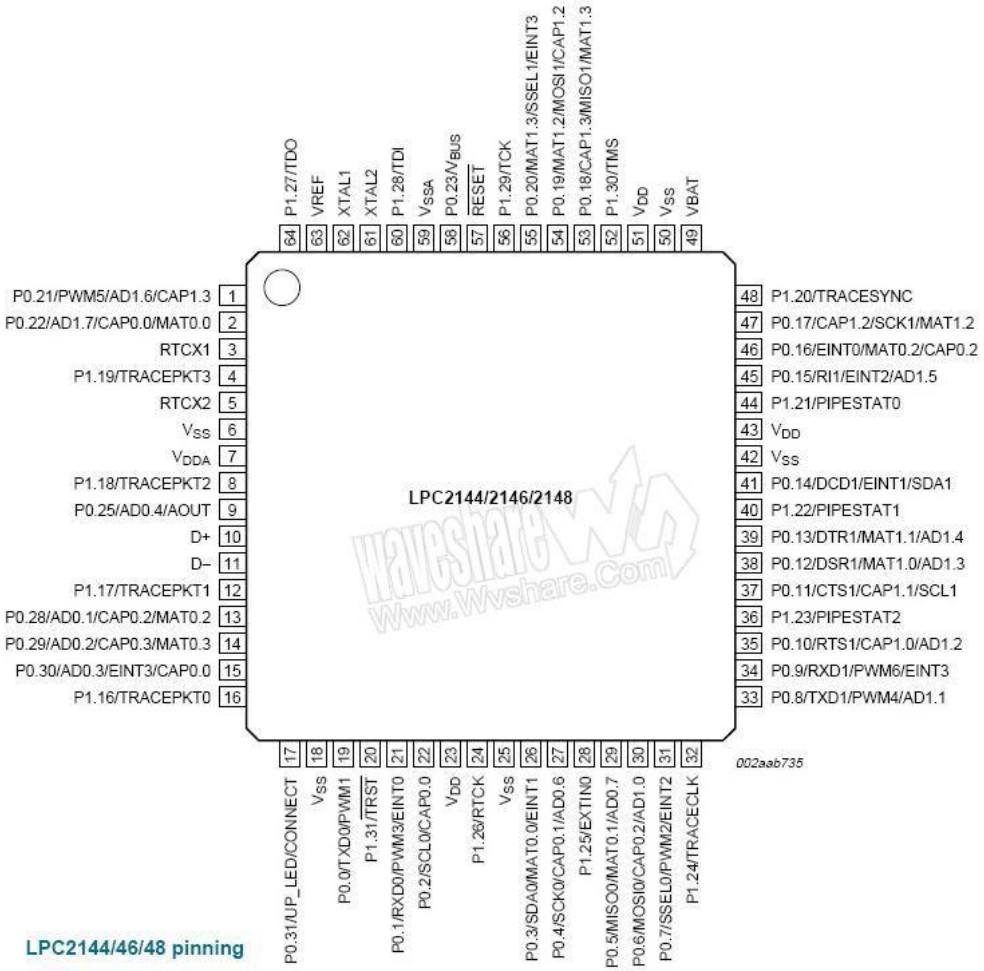



**Figure 24: Pin Diagram of ARM LPC2148**

# Chapter

# 5. GSM Module SIM900A

# 5.1 Overview of GSM Module SIM900A

**Figure 25: Physical view of GSM Module SIM900A**

- GSM/GPRS Modem-RS232 is built with Dual Band GSM/GPRS engine- SIM900A, works on frequencies 900/1800MHz. The Modem is coming with RS232 interface, which allows you connect PC as well as microcontroller with RS232 Chip (MAX232). The baud rate is configurable from 9600-115200 through AT command. The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS, Voice as well as DATA transfer application in M2M interface.

- The onboard Regulated Power supply allows you to connect wide range unregulated power supply. Using this modem, you can make audio calls, SMS, Read SMS, attend the incoming calls and internet through simple AT commands

## 5.2 Features and Hardware Description

- High Quality Product (Not hobby grade)
- Dual-Band GSM/GPRS 900/ 1800 MHz
- RS232 interface for direct communication with computer or MCU kit
- Configurable baud rate
- High sensitive Antenna( SMA connector with GSM Antenna Optional )
- SIM Card holder.
- Built in Network Status LED
- Inbuilt Powerful TCP/IP protocol stack for internet data transfer over GPRS.
- Normal operation temperature: -20 °C to +55 °C
- Input Voltage: 12V DC.

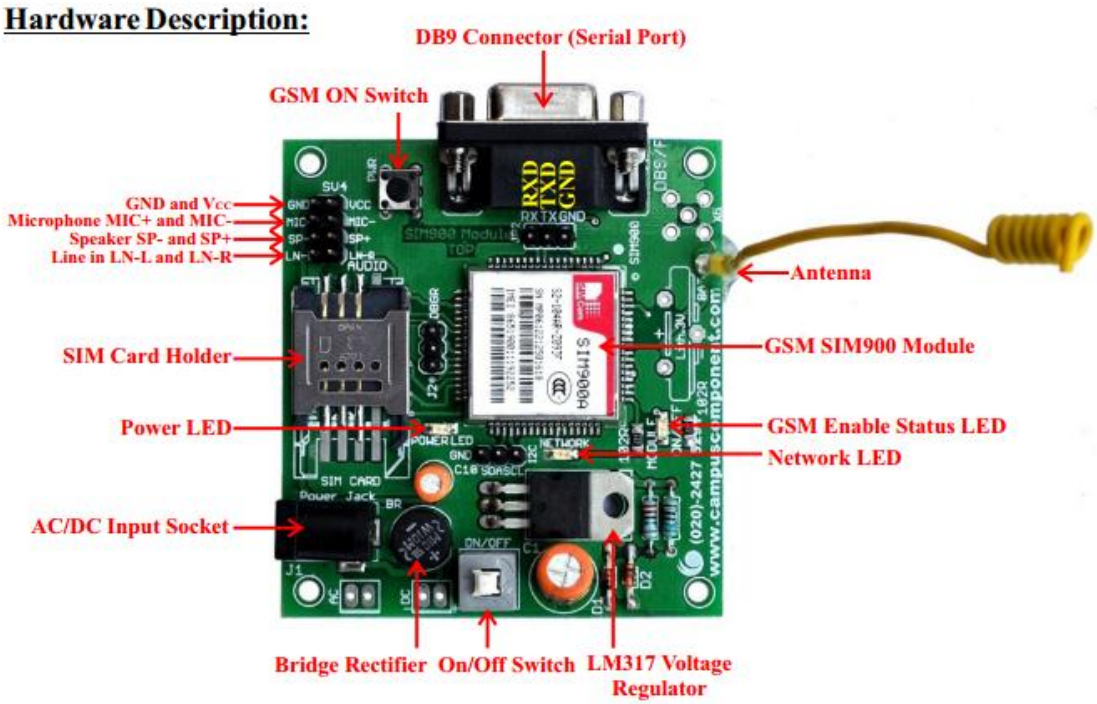



**Figure 26: Hardware Description of SIM900A**

The SIM900A is a complete Dual-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications allowing you to benefit from small dimensions and cost-effective solutions. Featuring an industry-standard interface, the SIM900A delivers GSM/GPRS 900/1800MHz performance for voice, SMS, Data, and Fax in a small form factor and with low power consumption. With a tiny configuration of 24mm x 24mm x 3 mm, SIM900A can fit almost all the space requirements in your applications, especially for slim and compact demand of design.

| GSM/GPRS Specification | |
|---|---|
| GSM/GPRS Module | SIM900A |
| Frequency | 900MHz/1800MHz |
| Modem Interface | RS232 Serial Interface |
| Baud Rate(Default factory) | 9600bps |
| Power requirement | 4.5V to 12V |
| Current requirement | <590mA |
| SIM900A module operating temperature | -40°C to +85°C |
| Weight | 40g |

**Table 1: SIM900A Specification**

## 5.3 Pin Diagram

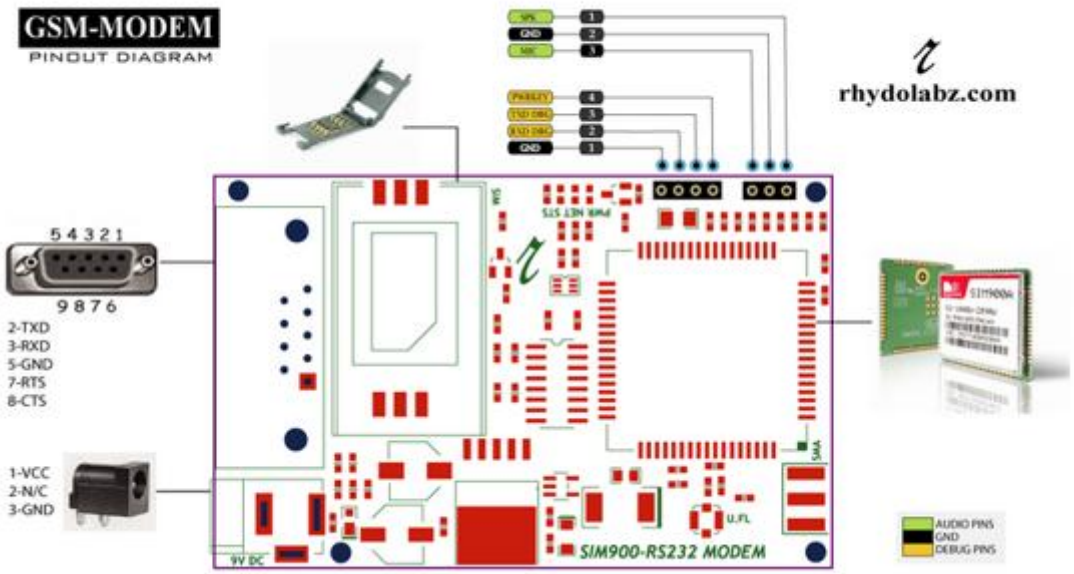



**Figure 27: Pin diagram of SIM900A**

# 5.4 Pin Description

**K1 DC CONNECTOR**

| Pin No | Pin Name | I/O | Details |
|---|---|---|---|
| 1. | VIN | Power IN | Positive Power supply(4.5V to 12V ) |
| 2. | - | - | N/C |
| 3. | GND | Power GND | Ground |

**K4 DEBUG**

| Pin No | Pin Name | I/O | Details |
|---|---|---|---|
| 1. | GND | GND | Ground |
| 2. | RXD DBG | I/P | Receiver pin for upgrading & debugging firmware |
| 3. | TXD DBG | O/P | Transmitter pin for upgrading & debugging firmware |
| 4. | PWRKEY | I/P | Power key for upgrading firmware. Power key should be connected to GND when GSM modem is upgrading firmware |

**K5 AUDIO**

| Pin No | Pin Name | I/O | Details |
|---|---|---|---|
| 1. | SPEAK | O/P | Audio output |
| 2. | GND | GND | Ground |
| 3. | MIC | I/P | Audio input |

**K6 DB9 FEMALE**

| Pin No | Pin Name | I/O | Details |
|---|---|---|---|
| 1. | - | - | N/C |
| 2. | TXD | O/P | Transmitter pin of DB9 Female |
| 3. | RXD | I/P | Receiver pin of DB9 Female |
| 4. | - | - | N/C-Not Connected |
| 5. | GND | GND | Ground |
| 6. | - | - | N/C |
| 7. | RTS | I/P | Request to send |
| 8. | CTS | O/P | Clear to send |
| 9. | - | - | N/C |

**Table 2: Pin Description of SIM900A**

# Chapter

# 6. GPS Module

# 6.1 Overview and Description


**Figure 28: Physical View of GPS Module**

## 6.1.1 Description

This is New Version (V2) of our famous GPS Receiver (5VTTL Serial) , with 4pin 2.54mm pitch Berg strip connector option. It is made with third generation POT (Patch Antenna on Top) GPS module. The onboard 3V3 to 5V level convertor enable us to directly interface with normal 5V Microcontrollers. Its low pin count (4Pin) will make it easy to interface and it is bread board friendly with 2.54mm (0.1") Pitch connector pads. The 4 Pins are 5V, TXD, RXD and GND. Yes, there is no setting required, just plug in to the power (5v), your data (NMEA0183) is ready at TX pin. This is a standalone 5V GPS Module and requires no external components .It is built with internal RTC Back up battery. It can be directly connected to Microcontroller's USART.

With the use high gain GPS engine providing a solution that high position and speed accuracy performances as well as high sensitivity and tracking capabilities in urban conditions & provides standard NMEA0183 strings in “raw” mode for any microcontroller. The module provides current time, date, latitude, longitude, speed, altitude and travel direction / heading among other data, and can be used in a host of applications, including navigation, tracking systems, fleet management, mapping and robotics.

The module can support up to 51 channels. The GPS solution enables small form factor devices. They deliver major advancements in GPS performances, accuracy, integration, computing power and flexibility. They are designed to simplify the embedded system integration process.

## 6.2 Features

- Single 5VDC supply @ 55 mA (typical)
- TTL asynchronous serial interface
- Data output Baud rate: 9600 bps(Default)
- Standard NMEA0183 output format
- Standard 4-pin Berg strip interface -2.54mm 0.1") Pitch.
- Module will be provided with two type berg strip (Normal & Right angled)
- Based on MediaTek Single Chip Architecture.
- Patch Antenna Size: 25mm x 25mm x 4mm
- Low Power Consumption: 55mA @ acquisition, 40mA @ tracking
- L1 Frequency, C/A code, 51-channel
- High Sensitivity: Up to -158 dBm tracking, superior urban performances
- Position Accuracy: < 3m CEP (50%) without SA (horizontal)
- Cold Start is Under 36 seconds (Typical)
- Warm Start is Under 34 seconds (Typical)
- Hot Start is Under 1 second (Typical)
- Max. Update Rate : 5Hz (Default: 1 Hz)

## 6.3 Specification

| GPS Module Specification | |
|---|---|
| GPS Chipset : | Media Tek MT 3318, 51 Channels |
| Frequency : | L1,1575.42MHz; C/A Code |
| Sensitivity : | Acquisition:-146dBm(Cold State),Tracking:-158dBm,Reaquisition:-156dBm |
| Position accuracy : | <3 CEP(50%)without SA(horizontal) |
| TTFF(Time To First) Fix : | Cold Start : <36 Seconds(Typical)<br>Warm Start: <34Seconds(Typical)<br>Hot Start: <1Seconds(Typical) |
| Protocol : | NMEA 0183 v3.01,MTK NMEA Command |
| DGPS : | RTCM protocol WAAS,EGNOS,MSAS |
| AGPS : | Supported (Offline Mode) |
| Interface : | UART |
| Baud Rate : | Baud Rate 9600 bps(Default) |
| Update Rate: | 1~5 Hz |
| Working Temperature | -40 $^{0}$C to +85 $^{0}$C |

**Table 3: Specification of GPS Module**

## 6.4 Pin Diagram

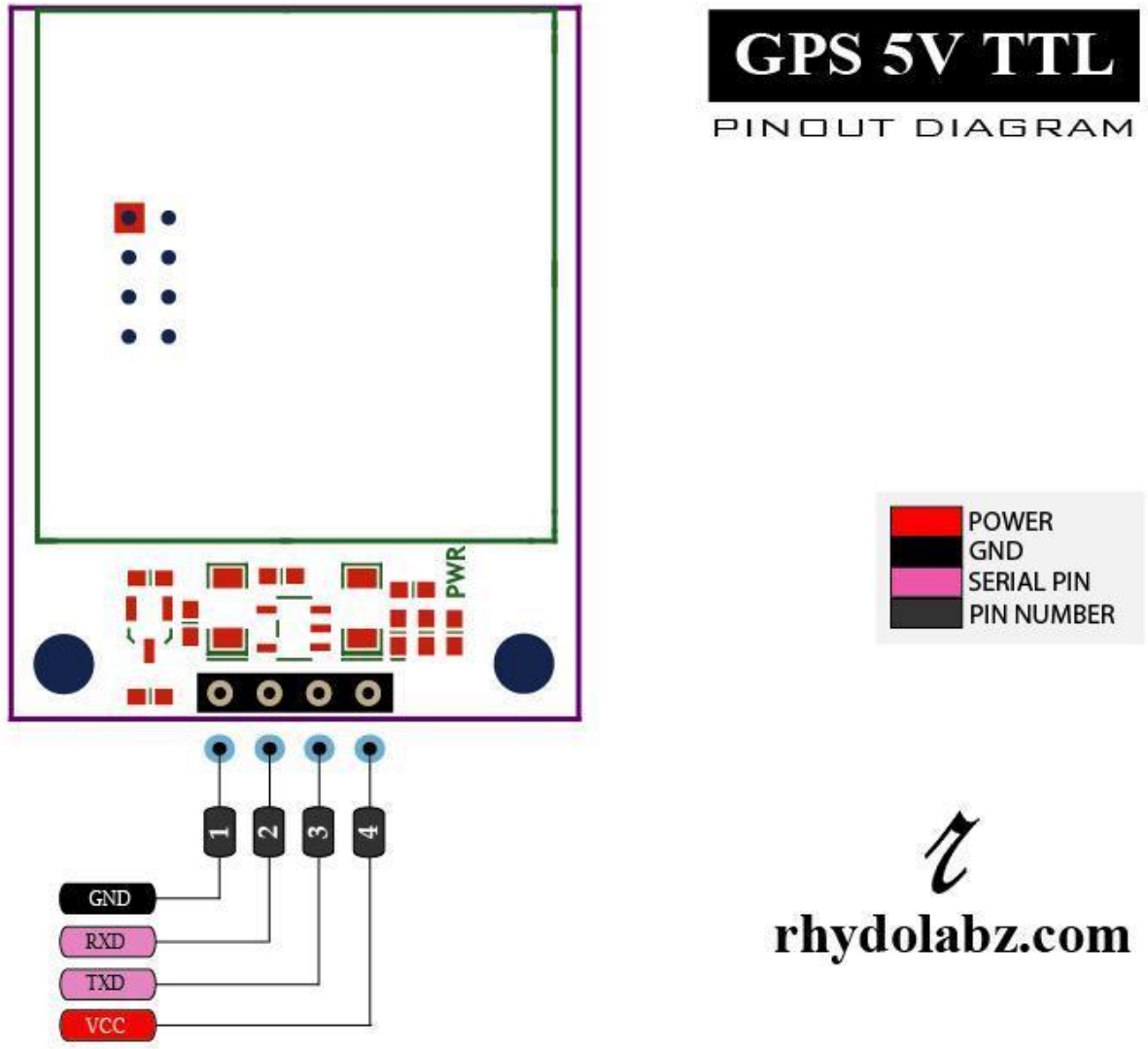



**Figure 29: Pin Diagram of GPS Module**

GPS Receiver with Antenna (5V TTL SERIAL) PIN descriptions are as below

| Pin No | Pin Name | I/O | Details |
|---|---|---|---|
| 1. | VCC | Power IN | Positive Power supply,3V3 Regulated Power |
| 2. | TXD | O/P | Transmit Pin of the Module |
| 3. | RXD | I/P | Receive Pin of the Module |
| 4. | GND | Power GND | Ground |

**Table 4: Pin Description of GPS Module**

## 6.5 GPS Data Format

- Here one sample test was done using GPRMC (Recommended Minimum Specific GNSS Data) header. GPRMC tells the latitude, longitude, speed, time and date. The details of GPRMC message is shown below.

$GPRMC,161229.487,A,3723.2475,N,12158.3416,W,0.13,309.62,120598,,*10

Table 1.9 – RMC Data Format

| Name | Example | Units | Description |
|---|---|---|---|
| Message ID | $GPRMC | | RMC protocol header |
| UTC position | 161229.487 | | hhmmss.sss |
| Status | A | | A=data valid or V data not valid |
| Latitude | 3723.2475 | | ddmm.mmmm |
| N/S Indicator | N | | N=north or S=south |
| Longitude | 12158.3416 | | dddmm.mmmm |
| E/W | W | | E=east or W=west |
| Speed Over Ground | 0.13 | knots | |
| Course Over Ground | 309.62 | degrees | True |
| Date | 120598 | | ddmmyy |
| Magnetic Variation | | degrees | E=east or W=west |
| Checksum | *10 | | |
| <CR><LF> | | | End of message termination |

**Table 5: GPS Data Format**

## 6.6 GPS Data Viewed in Hyper Terminal

- Letter '**V**' in GPRMC header represents a weak signal received by the GPS receiver, as shown below

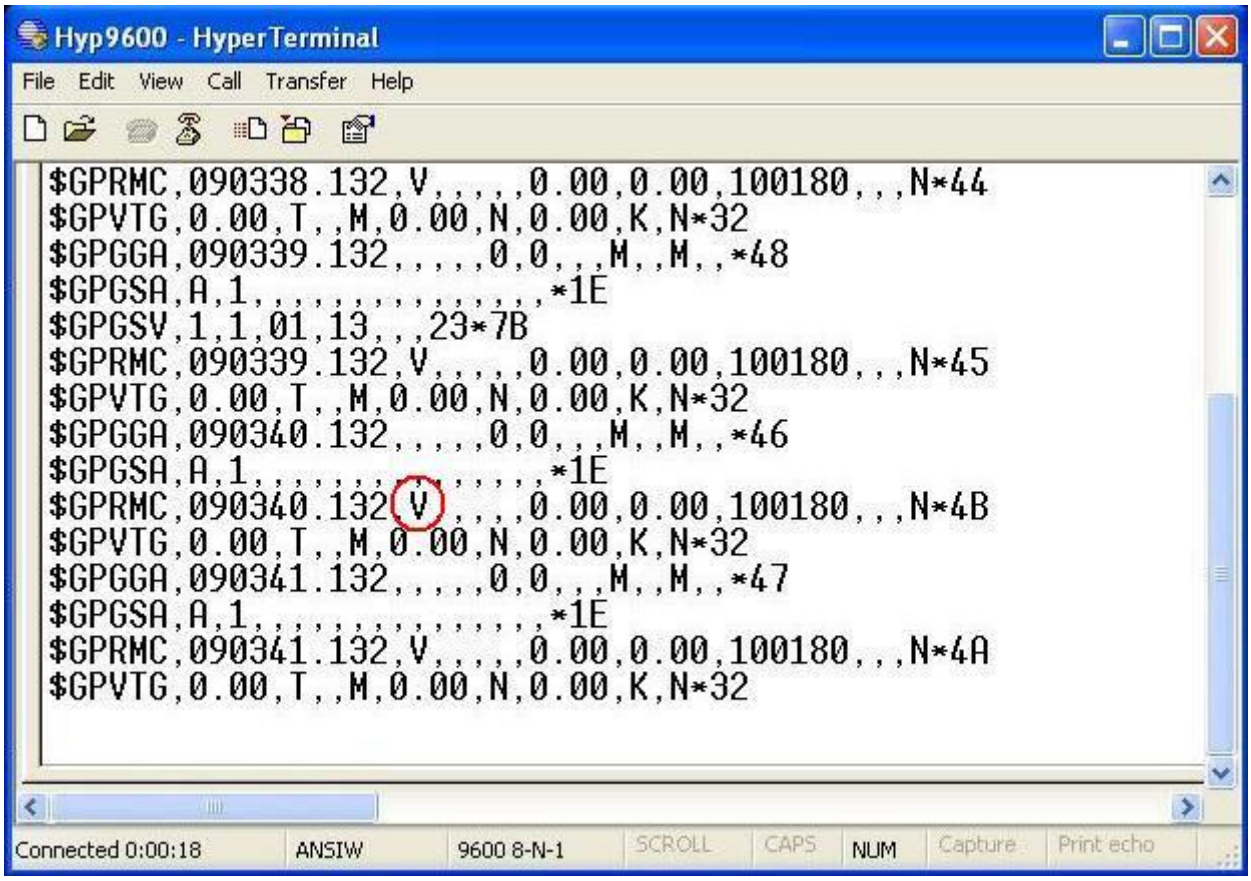



**Figure 30: GPS Data Viewed in HyperTerminal**

- When GPS receiver gets stronger signal from the satellite, the received data is as shown in the figure. Here the letter 'A' in GPRMC header represent the strong signal

.

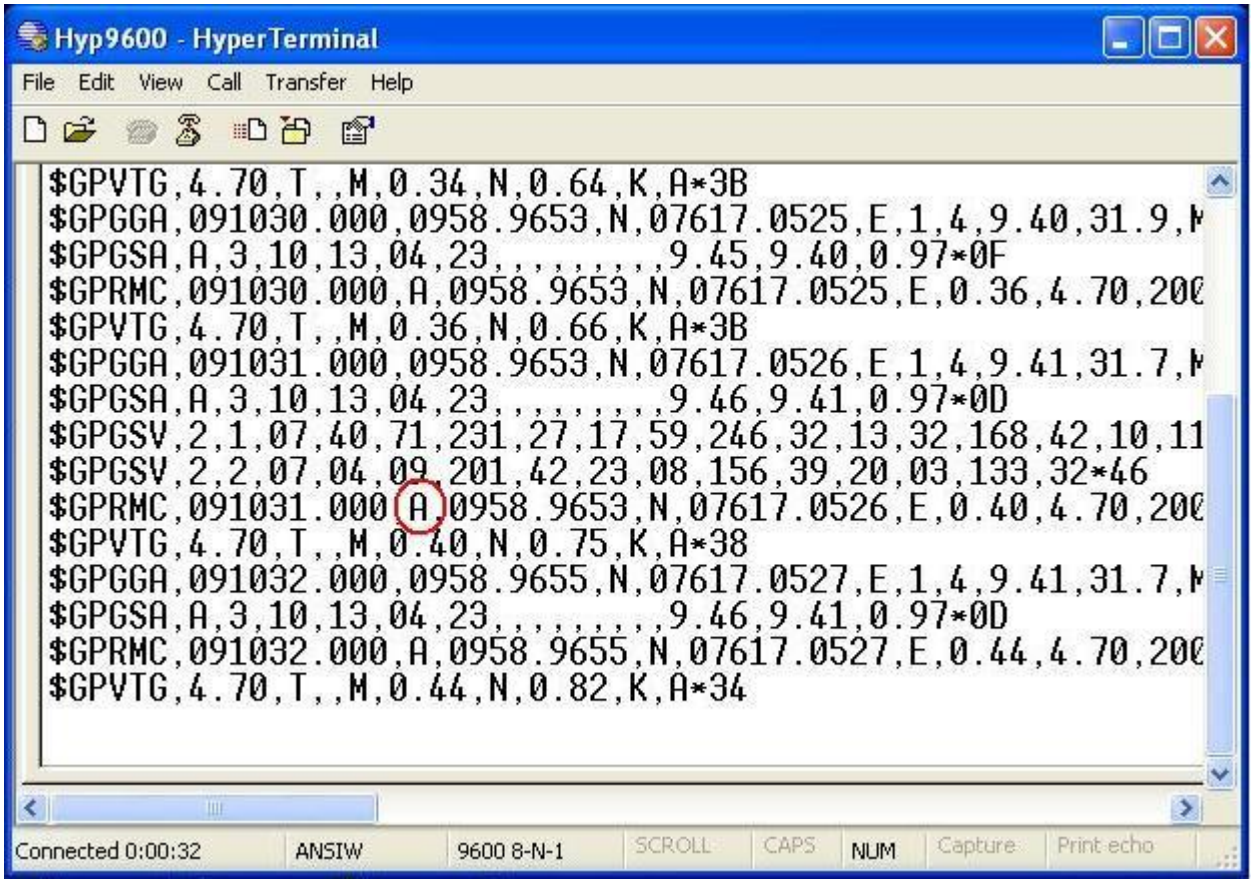



**Figure 31: GPS Data Viewed in HyperTerminal Window**

- This code can be decoded and longitude and latitude can be obtained.

- Since this GPS Module gives TTL output, we need to convert that TTL data to RS232 Compatible data. For that we use TTL to RS232 Convertor.

# 6.7 TTL to RS232 Convertor

## 6.7.1 Description TTL to RS232 Convertor

- One of the tools we use most when debugging our projects is serial input/output. Serial is very easy to implement, and it allows you to send/receive any data you need from your microcontroller to a computer's serial port so it can be viewed using a terminal emulator. These two devices are compatible from a software perspective, however you can't just hook a microcontroller up to a computer because the hardware interfaces are not compatible.

- Most microcontrollers these days have built in UARTs (universally asynchronous receiver/transmitter) that can be used to receive and transmit data serially. UARTs transmit one bit at a time at a specified data rate (i.e. 9600bps, 115200bps, etc.). This method of serial communication is sometimes referred to as TTL serial (transistor-transistor logic). Serial communication at a TTL level will always remain between the limits of 0V and vcc, which is often 5V or 3.3V. A logic high ('1') is represented by vcc, while a logic low ('0') is 0V.

- The serial port on your computer (if it's lucky enough to have one, they're quickly becoming a relic) complies with the RS-232 (Recommended Standard 232) telecommunications standard. RS-232 signals are similar to your microcontroller's serial signals in that they transmit one bit at a time, at a specific baud rate, with or without parity and/or stop bits. The two differ solely at a hardware level. By the RS-232 standard a logic high ('1') is represented by a negative voltage – anywhere from -3 to -25V – while a logic low ('0') transmits a positive voltage that can be anywhere from +3 to +25V. On most PCs these signals swing from -13 to +13V.

- The more extreme voltages of an RS-232 signal help to make it less susceptible to noise, interference, and degradation. This means that an RS-232 signal can generally travel longer physical distances than their TTL counterparts, while still providing a reliable data transmission.

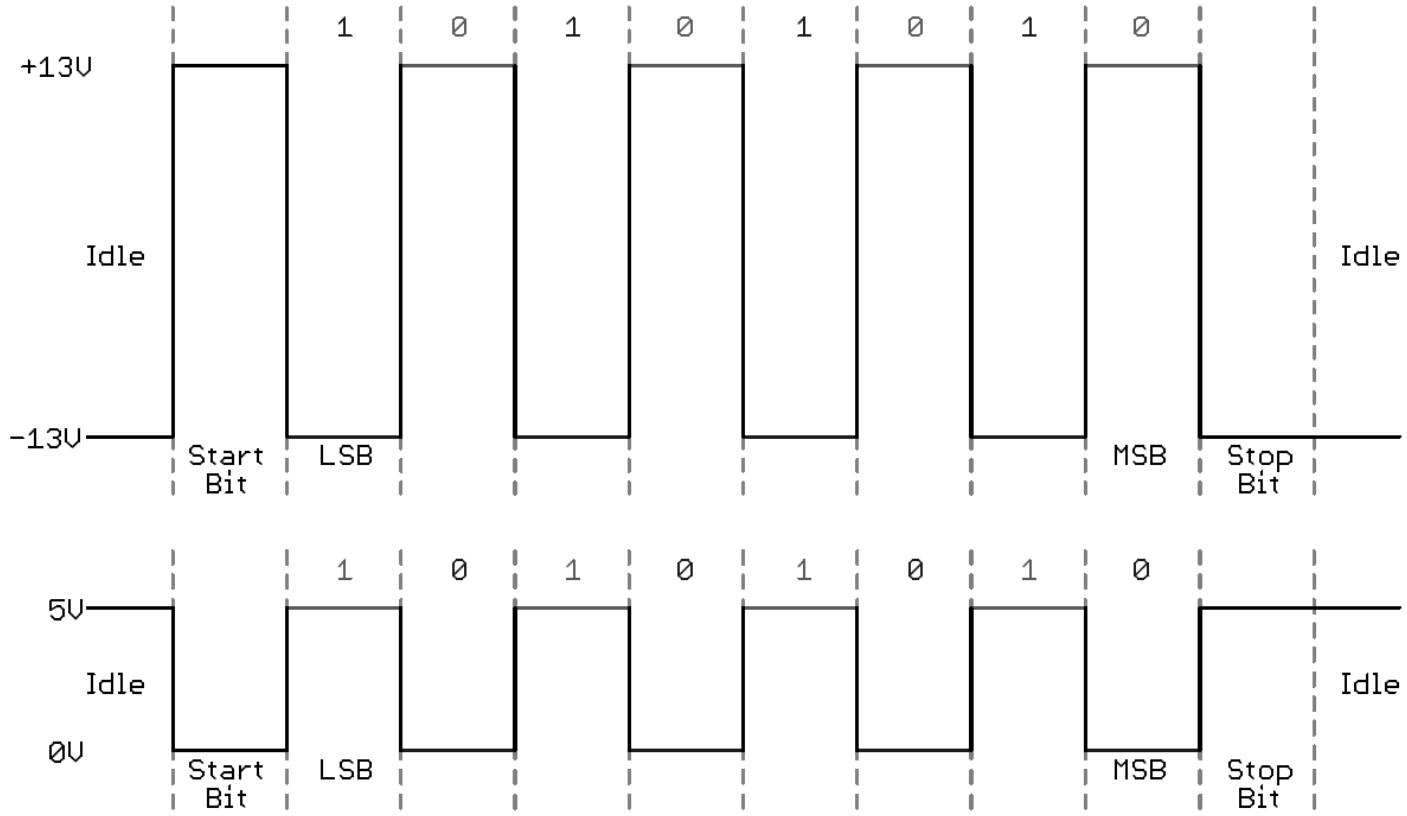



**Figure 32: Timing diagram that shows both a TTL (bottom) and RS-232 signal sending**

## 6.7.2 Solutions

- So, you may see where the problem lies in interfacing these two signals. To connect these two ports you not only have to invert the signals, but you also have to deal with regulating the potentially harmful RS-232 voltages to something that won't destroy a microcontroller's serial pins. There are a handful of solutions to this problem of voltage converting and inverting. The most common, and easiest solution is just plugging a MAX-232 in between the two devices:

### 6.7.3 Circuit Diagram

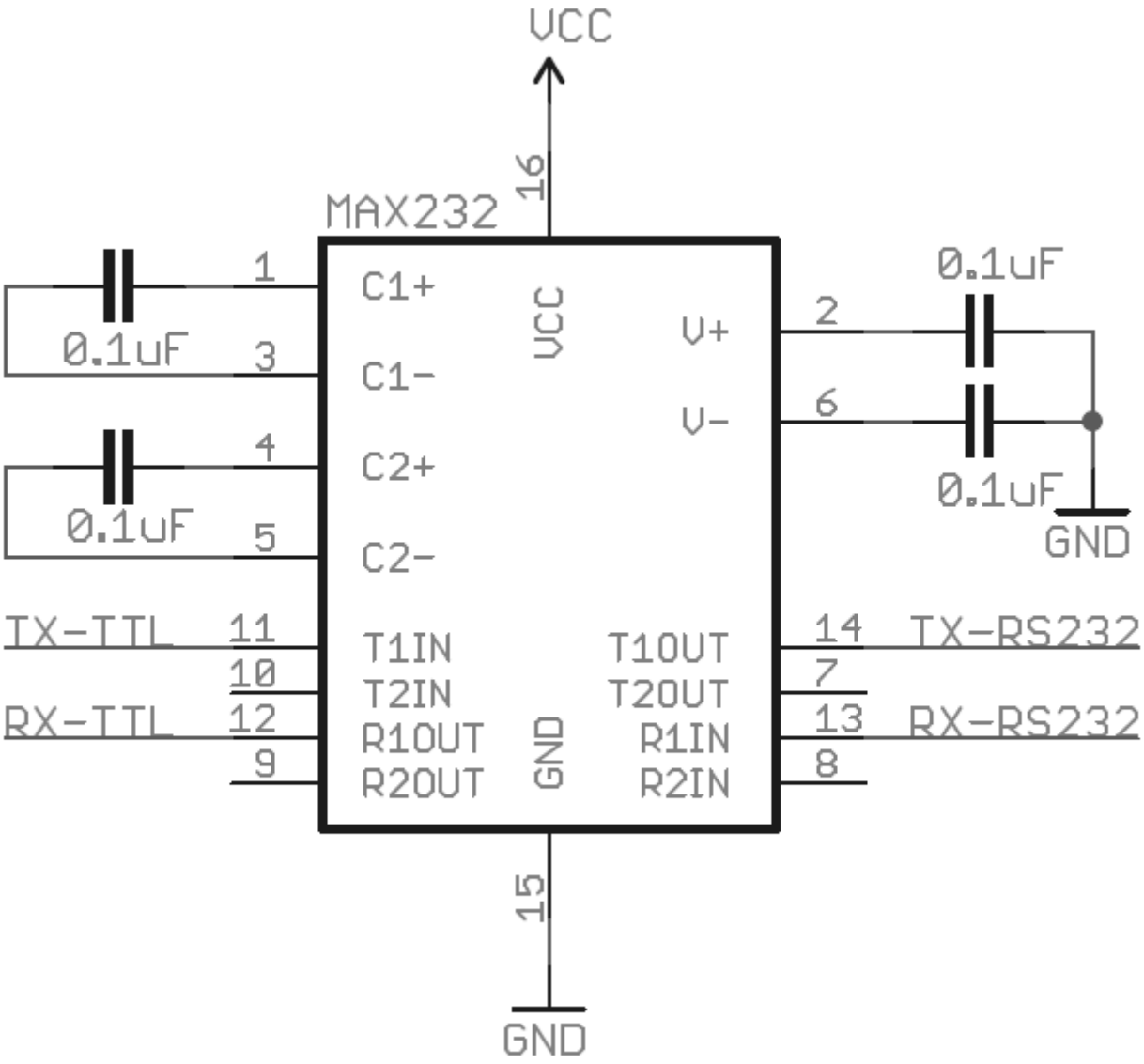



**Figure 33: Circuit Diagram of TTL to RS232 Convertor using MAX232 IC**

### 6.7.4 Physical view

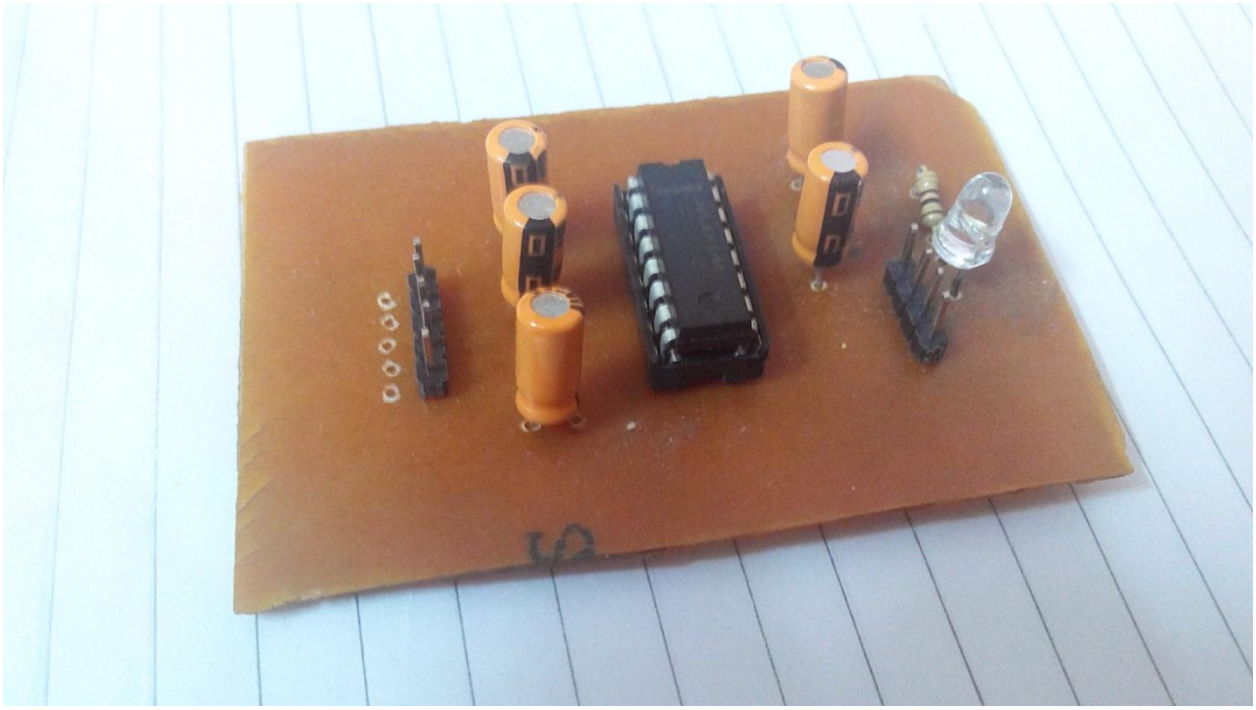


**Figure 34: Physical View of TTL to RS232 Converter PCB**

- Above image is Physical View of TTL to RS232 Converter.
- GPS gives TTL Output so we have to convert it into RS232 format.
- We have made this PCB for Troubleshooting with incorrect GPS data.

# Chapter

# 7. Stepper motor

# 7.1 Introduction to stepper motor

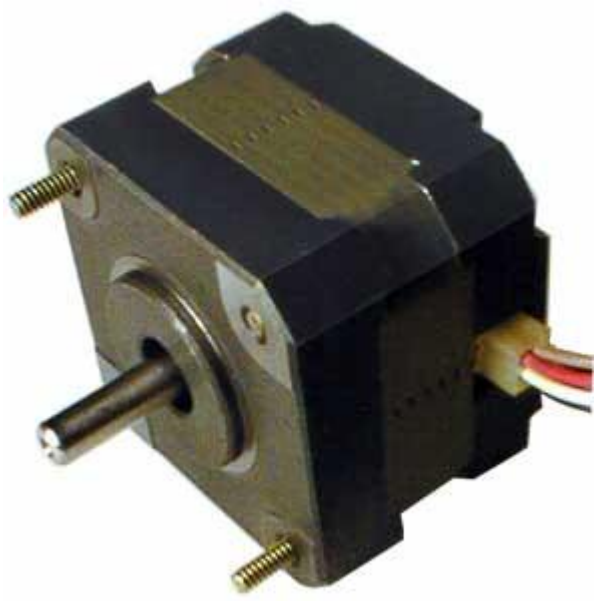


**Figure 35: Stepper Motor physical view**

**Stepper Motor** is an electro-magnetic actuator. It is an incremental drive (Digital) actuator and is driven in fixed angular steps.

This means that a digital signal is used to drive the motor and every time it receives a digital pulse it rotates a specific number of degrees in rotation.

- Each step of rotation is the response of the motor to an input pulse (or digital command).

- Step-wise rotation of the rotor can be synchronized with pulses in a command-pulse train, assuming that no steps are missed thereby making the motor respond faithfully to the pulse signal in an open-loop manner.

- Stepper motors have emerged as cost-effective alternatives for DC servomotors in high-speed, motion-control applications (except the high torque-speed range) with the improvements in permanent magnets and the incorporation of solid-state circuitry and logic devices in their drive systems.

- Today stepper motors can be found in computer peripherals, machine tools, medical equipment, automotive devices, and small business machines, to name a few applications.

## 7.1.1 Stepper Motor Basics

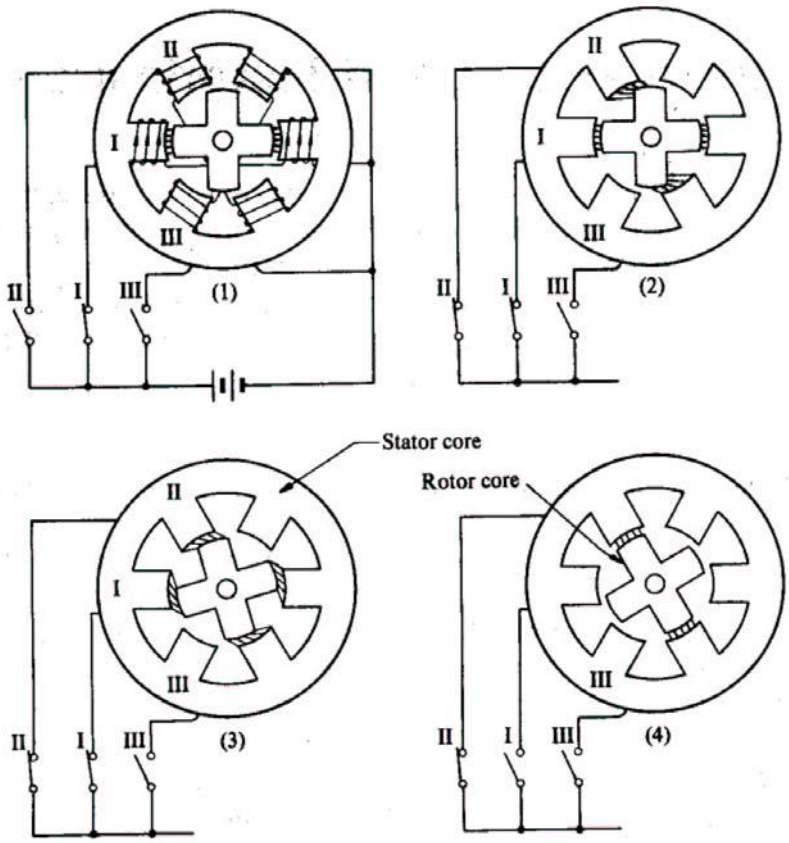



**Figure 36: Stepper Motor States for Motion**

The above figure is the cross-section view of a single-stack variable-reluctance motor. The stator core is the outer structure and has six poles or teeth. The inner device is called the rotor and has four poles. Both the stator and rotor are made of soft steel. The stator has three sets of windings as shown in the figure. Each set has two coils connected in series. A set of windings is called a "phase". The motor above, using this designation, is a three-phase motor. Current is supplied from the DC power source to the windings via the switches I, II, and, III.

Starting with state (1) in the upper left diagram, note that in state (1), the winding of Phase I is supplied with current through switch I. This is called in technical terms, "phase I is excited". Arrows on the coil windings indicate the magnetic flux, which occurs in the air-gap due to the excitation. In state I, the two stator poles on phase I being excited are in alignment with two of the four rotor teeth.

Next, switch II is closed to excite phase II in addition to phase I. Magnetic flux is built up at the stator poles of phase II in the manner shown in state (2), the upper right diagram. A counter-clockwise torque is created due to the "tension" in the inclined magnetic flux lines.

The rotor will begin to move and achieve state (3), the lower left diagram. In state (3) the rotor has moved 15°.

When switch I is opened to de-energize phase I, the rotor will travel another 15° and reach state (4). The angular position of the rotor can thus be controlled in units of the step angle by a switching process. If the switching is carried out in sequence, the rotor will rotate with a stepped motion; the switching process can also control the average speed.

## 7.1.2 Step Angle

The step angle, the number of degrees a rotor will turn per step, is calculated as follows:

$$\text{Step Angle } (\Theta S) = 360/S$$

$S = mNr$

$m$ = number of phases

$N_r$ = number of rotor teeth

## 7.1.3 Advantages of Stepper Motors

- Position error is non-cumulative. A high accuracy of motion is possible, even under open-loop control.
- Large savings in sensor (measurement system) and controller costs are possible when the open-loop mode is used.
- Because of the incremental nature of command and motion, stepper motors are easily adaptable to digital control applications.
- No serious stability problems exist, even under open-loop control.
- Torque capacity and power requirements can be optimized and the response can be controlled by electronic switching.

# 7.2 Types of Stepper Motors

## 7.2.1 Unipolar motors

- A unipolar stepper motor has one winding with center tap per phase. Each section of windings is switched on for each direction of magnetic field. Since in this arrangement a magnetic pole can be reversed without switching the direction of current, the commutation circuit can be made very simple (e.g., a single transistor) for each winding. Typically, given a phase, the center tap of each winding is made common: giving three leads per phase and six leads for a typical two phase motor. Often, these two phase commons are internally joined, so the motor has only five leads.
- A micro controller or stepper motor controller can be used to activate the drive transistors in the right order, and this ease of operation makes unipolar motors popular with hobbyists; they are probably the cheapest way to get precise angular movements.

## 7.2.2 Bipolar motors

- Bipolar motors have a single winding per phase. The current in a winding needs to be reversed in order to reverse a magnetic pole, so the driving circuit must be more complicated, typically with an H-bridge arrangement (however there are several
- Off-the-shelf driver chips available to make this a simple affair). There are two leads per phase, none are common.
- Static friction effects using an H-bridge have been observed with certain drive topologies.
- Dithering the stepper signal at a higher frequency than the motor can respond to will reduce this "static friction" effect.
- Because windings are better utilized, they are more powerful than a unipolar motor of the same weight. This is due to the physical space occupied by the windings. A unipolar motor has twice the amount of wire in the same space, but only half used at any point in time, hence is 50% efficient (or approximately 70% of the torque output available). Though a bipolar stepper motor is more complicated to drive, the abundance of driver chips means this is much less difficult to achieve.

# Chapter

# 8. Motor Driver H-Bridge (L293D)

# 8.1 Introduction of L293

- Whenever a robotics hobbyist talk about making a robot, the first thing comes to his mind is making the robot move on the ground. And there are always two options in front of the designer whether to use a DC motor or a stepper motor. When it comes to speed, weight, size, cost... DC motors are always preferred over stepper motors. There are many things which you can do with your DC motor when interfaced with a microcontroller. For example you can control the speed of motor, you can control the direction of rotation, you can also do encoding of the rotation made by DC motor i.e. keeping track of how many turns are made by your motors etc. So you can see DC motors are no less than a stepper motor.

- In this part of tutorial we will learn to interface a DC motor with a microcontroller. Usually H- Bridge is preferred way of interfacing a DC motor. These days many IC manufacturers have H- Bridge motor drivers available in the market like L293D is most used H-Bridge driver IC. H- Bridge can also be made with the help of transistors and MOSFETs etc. rather of being cheap, They only increase the size of the design board, which is sometimes not required so using a small 16 pin IC is preferred for this purpose

# 8.2 Pin description of L293D

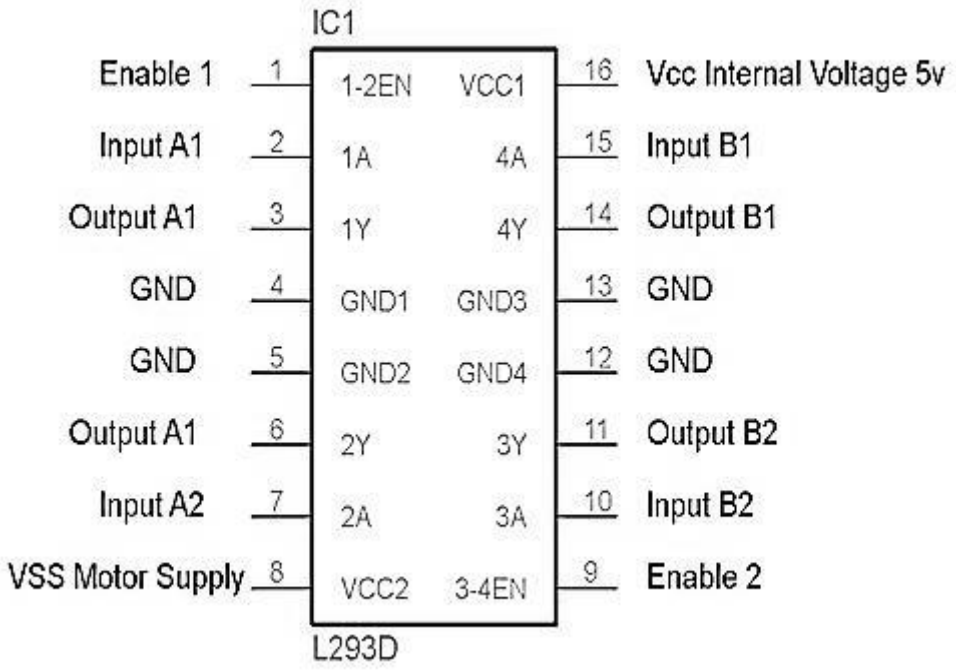



**Figure 37: Pin description of L293D**

## 8.3 Working of L293D

- The there are 4 input pins for this L293d, pin 2,7 on the left and pin 15 ,10 on the right as shown on the pin diagram. Left input pins will regulate the rotation of motor connected across left side and right input for motor on the right hand side. The motors are rotated on the basis of the inputs provided across the input pins as LOGIC 0 or LOGIC 1.

- In simple you need to provide Logic 0 or 1 across the input pins for rotating the motor.

**L293D Logic Table**

Lets consider a Motor connected on left side output pins (pin 3,6). For rotating the motor in clockwise direction the input pins has to be provided with Logic 1 and Logic 0.

• **Pin 2** = **Logic 1** and **Pin 7** = **Logic 0** | Clockwise Direction
• **Pin 2** = **Logic 0** and **Pin 7** = **Logic 1** | Anticlockwise Direction
• **Pin 2** = **Logic 0** and **Pin 7** = **Logic 0** | Idle [No rotation] [Hi-Impedance state]
• **Pin 2** = **Logic 1** and **Pin 7** = **Logic 1** | Idle [No rotation]

In a very similar way the motor can also operate across input pin 15, 10 for motor on the right hand side.

## 8.4 Circuit Diagram for L293d motor driver IC controller

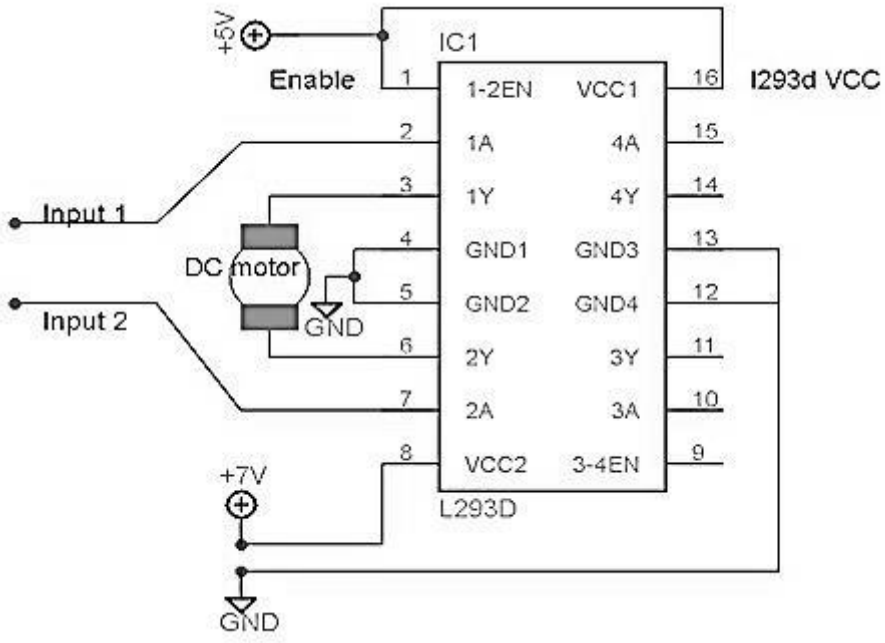



**Figure 38: Circuit Diagram for L293D motor driver IC controller**

## 8.5 Voltage Specification

- VCC is the voltage that it needs for its own internal operation 5v; l293D will not use this voltage for driving the motor. For driving the motor it has a separate provision to provide motor supply VSS (V supply). L293d will use this to drive the motor. It means if you want to operate a motor at 9V then you need to provide a Supply of 9V across VSS Motor supply.

- The maximum voltage for VSS motor supply is 36V. It can supply a max current of 600mA per channel. Since it can drive motors Up to 36v hence you can drive pretty big motors with this l293d.

- VCC pin 16 is the voltage for its own internal Operation. The maximum voltage ranges from 5v and up to 36v.

## 8.6 Physical View

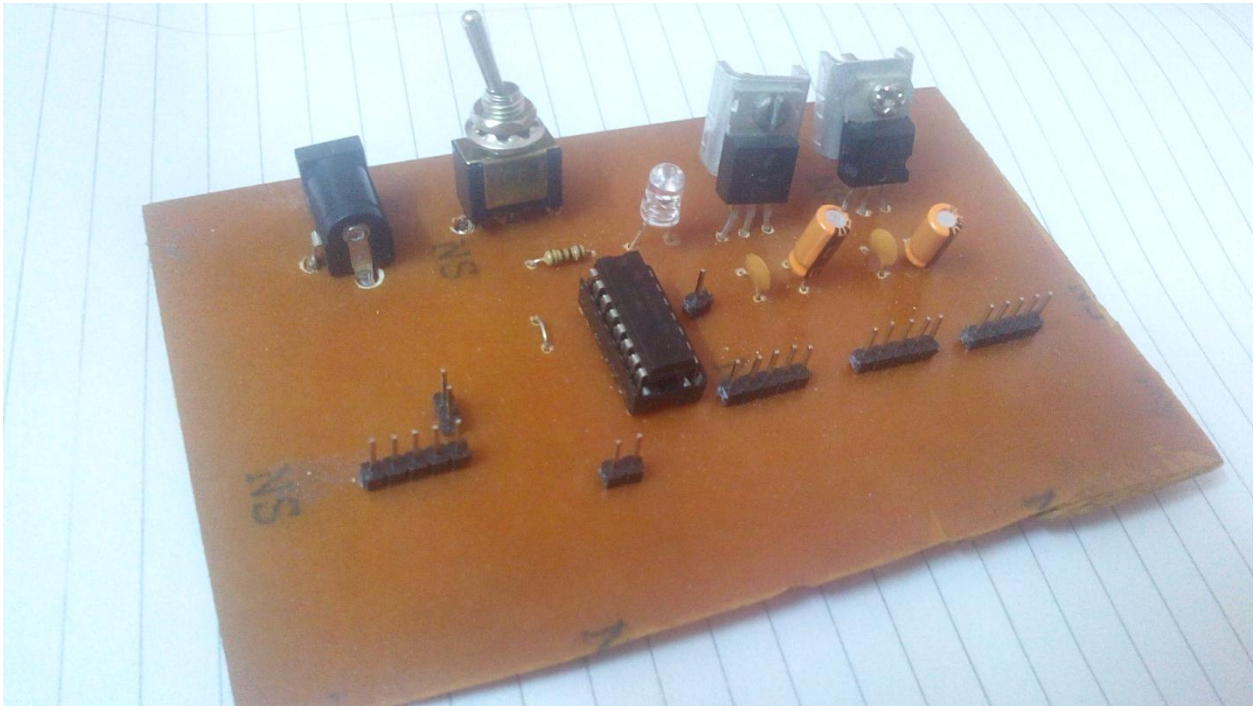


**Figure 39: Physical View of H-Bridge and Regulated Power Supply PCB**

# Chapter

# 9. Comparator IC LM 358

# 9.1 LM358 & its Features

## 9.1.1 Pin Description of LM339

The LM358 is a most commonly used comparator, designed for use in level detection, low−level sensing and memory applications in automotive and industrial electronic applications. It has four inbuilt comparators; it compares two input voltage levels and gives digital output to show the bigger one. These comparators additionally have a unique characteristic in that the input common-mode voltage range includes ground, in spite of the fact that they are operated from a single power supply voltage.

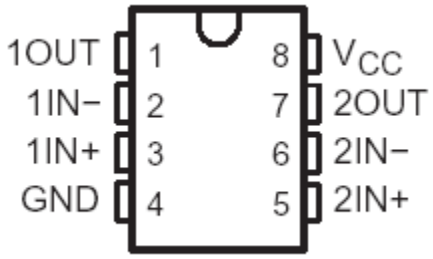



**Figure 40: Pin Description of LM358**

## 9.1.2 Features of LM358

- Signal or dual supply operation
- Wide operating supply range (VCC=2V~36V)
  - Max Rating: 2 V to 36 V
  - Tested to 30 V: Non-V Devices
- Input common-mode voltage includes ground
- Low supply current drain (IF=0.8mA)
- Open collector outputs for wired and connection
- Low input bias current 25nA
- Low output saturation voltage
- Output compatible with TTL, DTL, and CMOS logic system

- Differential input voltage range equal to the power supply voltage

Potential dividers of LM358 are connected to the inverting and non-inverting inputs of the op-amp to give some voltage at these terminals. Supply voltage is given to +V and –V is connected to ground. The output of this comparator will be logic high if the non-inverting terminal input is greater than the inverting terminal input of the comparator.

### 9.1.3 Working of LM358

- When the power is applied to non-inverting terminal which is less than the inverting voltage of op-amp then the output becomes zero which means there is no current flow. Because we already know that when **"+ > – = 1"**. Here the '+ 'sign indicates non-inverting terminal and '-'sign indicates the inverting terminal.
- If the non-inverting voltage is greater than the inverting voltage then the current flow will be in the device.
- The LM358 is act as an open-collector that's why we connected the resister from the supply, if we remove the resister then there is no current flow in the circuit.

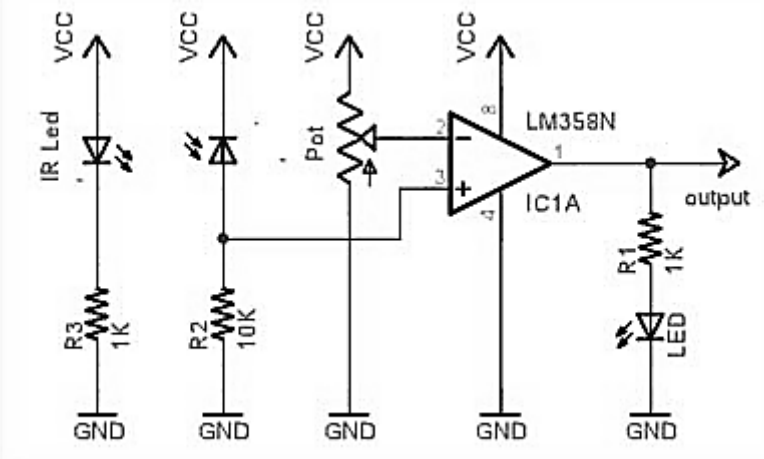



**Figure 41: Circuit Diagram of IR Sensor**

# Chapter
# 10. IR Sensors

# 10.1 Introduction of IR Sensors

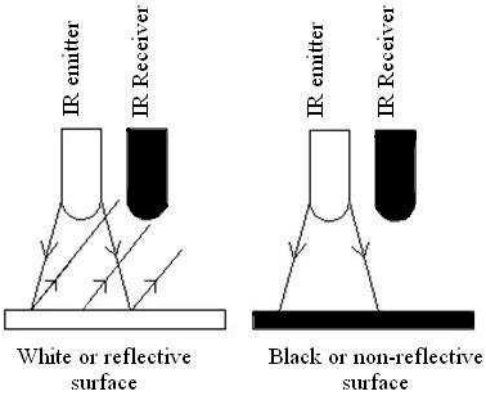



**Figure 42: IR Sensors basic principle**

## General Description

IR (Infrared) is the typical light source being used in the sensor for robot to detect opaque object. In this project, no programming, microcontroller and soldering are required.

**IR Sensor (IR Receiver and IR Emitter)**

- The basic principle of IR sensor is based on an IR emitter and an IR receiver. IR emitter will emit infrared continuously when power is supplied to it. On the other hand, the IR receiver will be connected and perform the task of a voltage divider.
- IR receiver can be imagined as a transistor with its base current determined by the intensity of IR light received. The lower the intensity of IR light cause higher resistance between collector-emitter terminals of transistor, and limiting current from collector emitter.
- This change of resistance will further change the voltage at the output of voltage divider. In others word, the greater the intensity of IR light hitting IR receiver, the lower the resistance of IR receiver and hence the output voltage of voltage divider will decreased. Usually the IR emitter and IR receiver will be mounted side by side, pointing to a reflective surface.
- The further distance away between emitter and receiver decrease the amount of infrared light hitting the receiver if the distance between the sensor and a reflective surface is fixed.

# 10.2 The CKT Diagram of IR Sensor Using LM 358

## Summary:

This sensor is analogous to human's visionary senses which can be used to detect an obstacle which is one of its common applications. In robotics, a group of such modules are used so that a robot can follow a line pattern.

This circuit is made using the following:

1. LM358 IC.
2. IR Transmitter and Receiver Pair
3. Resistors of the range of Kilo ohms
4. Variable Resistors
5. LED

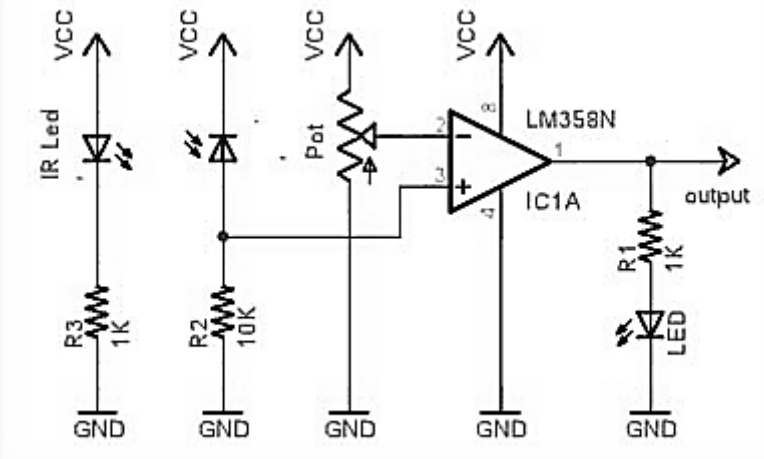



**Figure 43: Circuit Diagram of IR Sensor Using LM 358**

## 10.3 Description

The transmitter part of the sensor project is an Infrared (IR) Led which transmits continuous IR rays to be received by an IR receiver. The output of the receiver varies depending upon its reception of IR rays. Since this variation cannot be analyzed as such, therefore this output can be fed to a comparator.

Here operational amplifier (op-amp) of LM 358 is used as comparator. When the IR receiver does not receive signal the potential at the inverting input goes higher than that that at non-inverting input of the comparator (LM 339). Thus the output of the comparator goes low and the LED does not glow .When the IR receiver receives signal the potential at the inverting input goes low. Thus the output of the comparator (LM 358) goes high and the LED starts glowing. Resistor R1 (100Ω), R2 (10kΩ) and R3 (330 Ω) are used to ensure that minimum 10 mA current passes through the IR LED, photodiode and normal LED, respectively. Resistor VR2 (preset=5kΩ) is used to adjust the output. Resistor VR1 (preset=10kΩ) is used to set the sensitivity of the circuit. Read more about IR sensor here.

# Chapter
# 11. Interfacing Devices

# 11.1 Interfacing of Stepper Motor with L293

Stepper motors can be used in various areas of microcontroller projects such as making robots, robotic arm, automatic door lock system etc. here, I will discuss Interfacing Techniques (using L293D) to control stepper motor.

## Interfacing of Stepper Motor Using L293

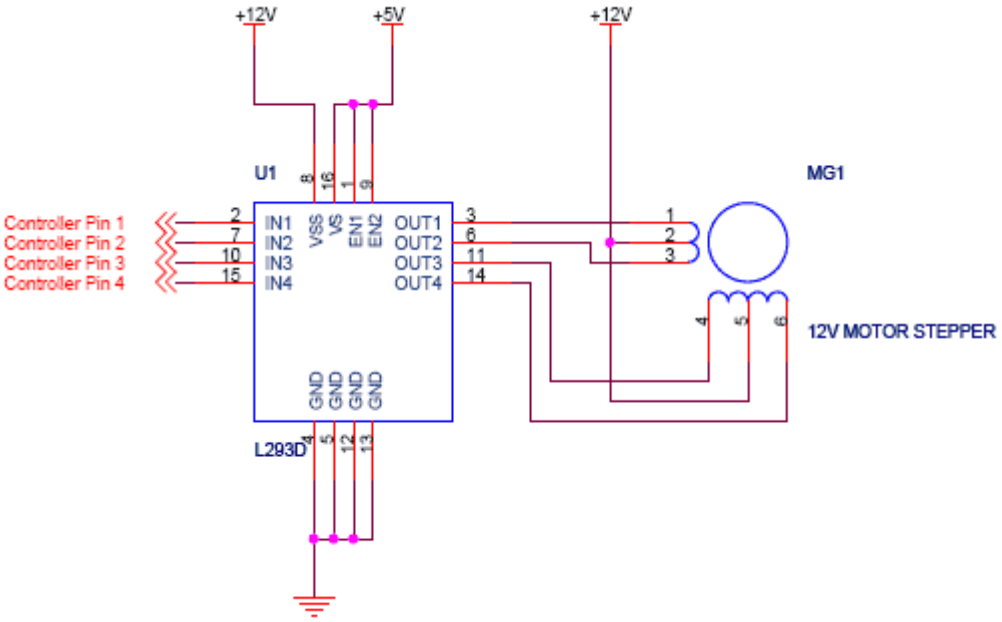



**Figure 44: Interfacing of Stepper Motor Using L293**

# 11.2 Stepper Motor Interfacing with 8051 Using L293

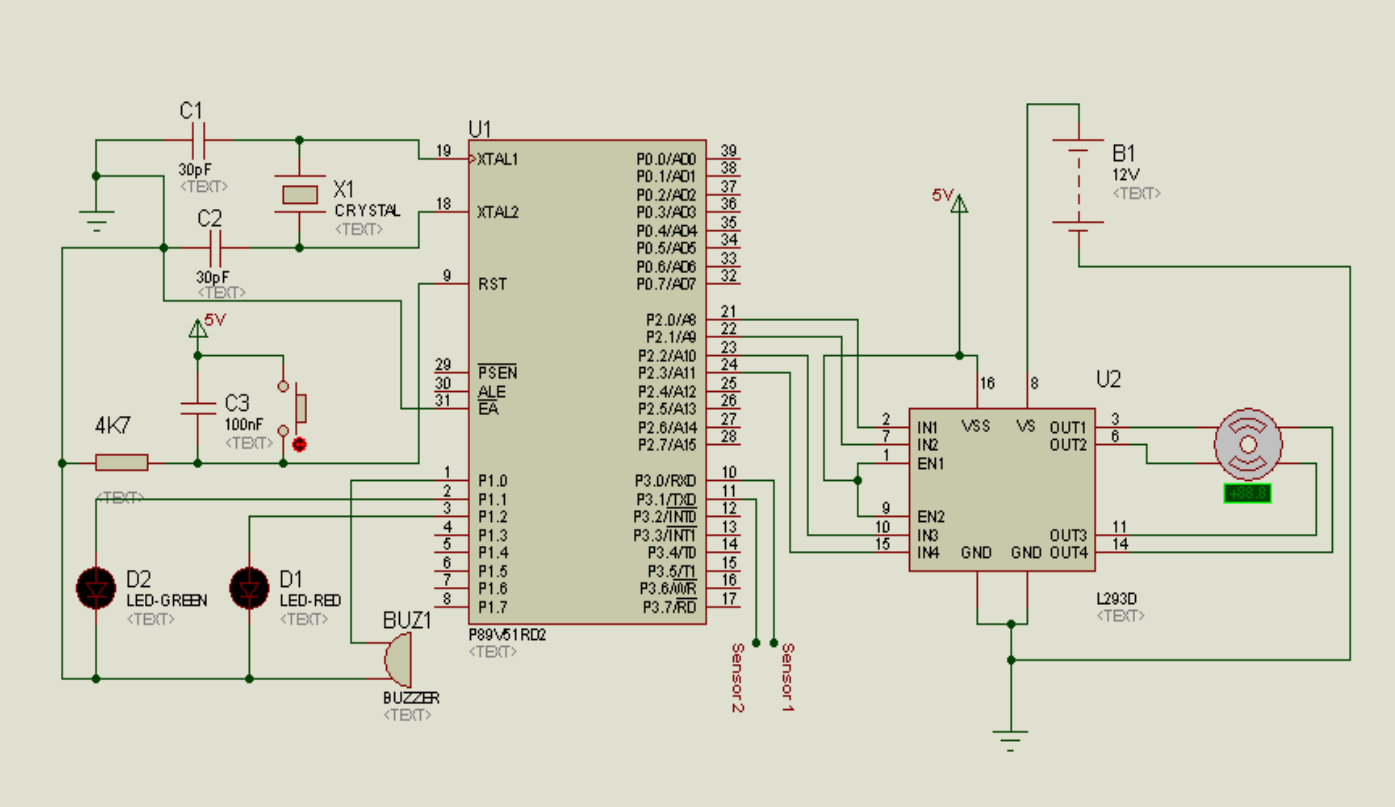



**Figure 45: Stepper Motor Interfacing with 8051 Using L293**

# Chapter

# 12. Regulated Power Supply

## 12.1 Regulated power supply:

A variable regulated power supply also called a variable bench power supply is one which you can continuously adjust the output voltage to your requirements. Varying the output of the power supply is recommended way to test a project after having double checked parts placement against circuit drawings and the parts placement.

This type of regulation is ideal for having a simple variable bench power supply. Actually this is quite important because one of the first projects a hobbyist should undertake is the construction of a variable regulated power supply. While a dedicated supply is quite handy e.g. 5V or 12V its much handier to have a variable supply on hand, especially for testing.

Most digital logic circuits and processors need a 5 volt power supply. To use these parts we need to build a regulated 5 volt source. Usually you start with an unregulated power to make a 5 volt power supply; we use a LM7805 voltage regulator IC (Integrated Circuit).

### 12.1.1 LM 7805 Voltage Regulator IC

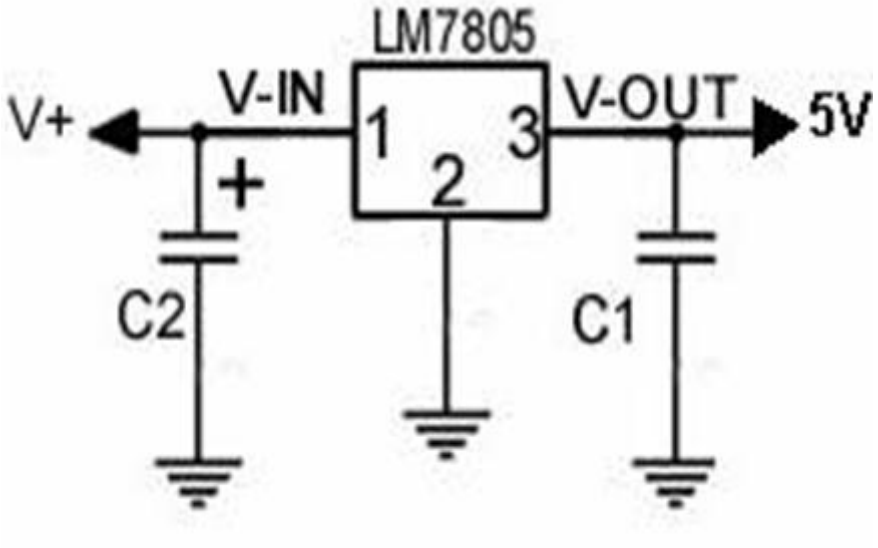



**Figure 46: LM 7805 basic circuit diagram**

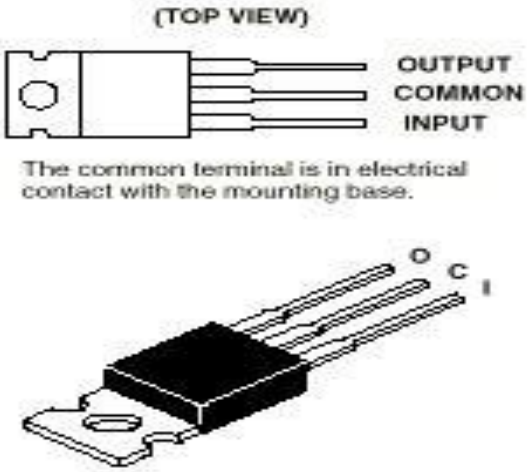



**Figure 47: Pin Representation of LM 7805**

The LM7805 is simple to use. You simply connect the positive lead of your unregulated DC power supply(anything from 9VDC to 24VDC) to the Input pin, connect the negative lead to the Common pin and then when you turn on the power, you get a 5 volt supply from the Output pin.

**Circuit features:**

- **Brief description of operation**: Gives out well regulated +5V output, output current capability of 100mA.
- **Circuit protection**: Built-in overheating protection shuts down output when regulator IC gets too hot.
- **Circuit complexity**: Very simple and easy to build.
- **Circuit performance**: Very stable +5V output voltage, reliable operation
- **Availability of components:** Easy to get, uses only very common basic components.
- **Applications:** Part of electronics devices, small laboratory power supply.

## 12.1.2 LM 7808 Voltage Regulator IC

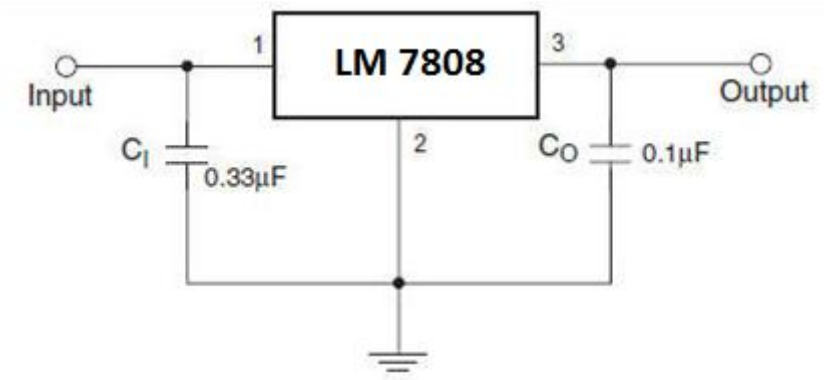



**Figure 48: LM 7808 basic circuit diagram**

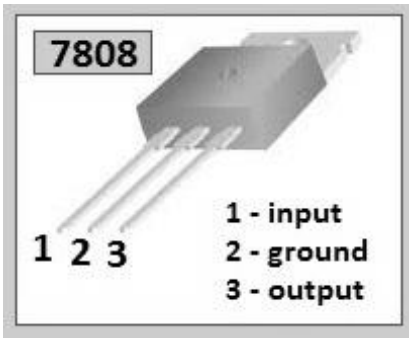



**Figure 49: Pin Representation of LM 7808**

The LM7808 is simple to use. You simply connect the positive lead of your unregulated DC power supply(anything from 9VDC to 24VDC) to the Input pin, connect the negative lead to the Common pin and then when you turn on the power, you get a 8 volt supply from the Output pin.

**Circuit features:**

- **Brief description of operation**: Gives out well regulated +8V output, output current capability of 1A.
- **Circuit protection**: Built-in overheating protection shuts down output when regulator IC gets too hot. Thermal Overload Protection, Short-Circuit Protection, Output Transistor Safe Operating Area Protection

- **Circuit complexity**: Very simple and easy to build.
- **Circuit performance**: Very stable +8V output voltage, reliable operation
- **Availability of components:** Easy to get, uses only very common basic components.
- **Applications:** Part of electronics devices, small laboratory power supply.

## 12.2 Regulated Power Supply PCB Board

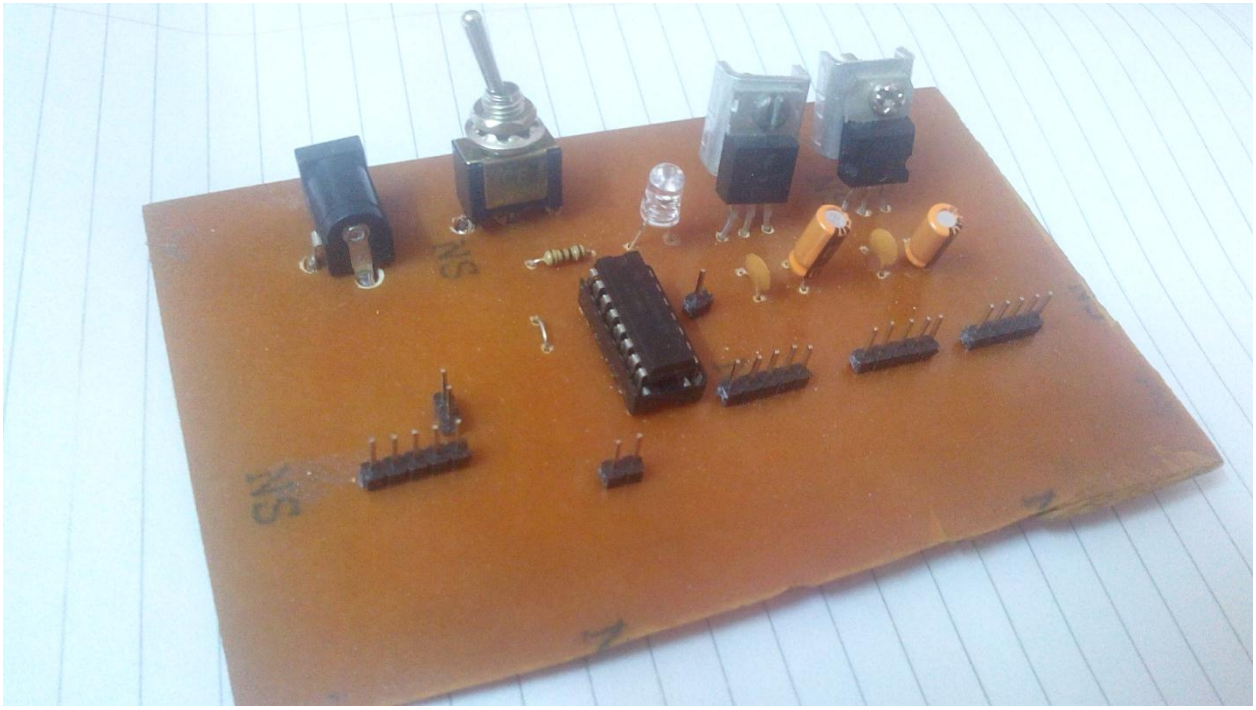


**Figure 50: Physical View of Regulated Power Supply and H-Bridge PCB**

- We have made this PCB Board for Regulated and controlled Power Supply.
- This PCB have following Features:
  - It will give 12V,8V,5V simultaneously with their Respective male pins
  - It has Motor Driver IC so we can run DC motor also with this PCB Board.

# Chapter

# 13. Visual Basic Application for Monitoring and Control

# 13.1 Introduction

## 13.1.1 Use computers to control the real world

The diagram on the right is a simplified model for computer control. It starts with the user interface. Users give instructions and read information from the control target through the user interface. The software in the computer will process the instructions and send it to the control/interface board through a communication port. The control/interface board will interpret and execute the instructions according to a pre-written protocol.

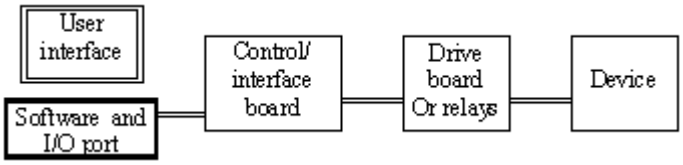



**Figure 51: Block Diagram of Use computers to control the real world**

The interface board uses a micro controller to interpret and execute the instructions from computer. To make the micro controller understand the instructions, it needs to be loaded with software. The software is called "**Firmware**" to differentiate it from the software in the computer. The micro controller can read status of an input and give feedback to the computer. It can also switch an output to high (normally 5 volt) or low (0 volt).

However, an interface board cannot drive an electric device directly since the output from the micro controller can only take very small amount of current (normally less than 20 mA). So we need to use a relay or a driving board between the interface board and an electric device. A driving board normally consists of integrated circuits (IC) that can take larger current and can be switched by the micro controller outputs.

## 13.1.2 User interface, Software and Computer Communication

I here put the 3 topics under one section since they are very closely related to each other. A user interface is a part of software that is used to get information from user and to display the information it received. The software needs to be written using a programming language. There are many programming languages available for writing a software, such as assembly language, C language, Java, Basic, and Visual Basic. Among these languages, C language is the most powerful and is the major language for making complicated application software. As it is not easy to command, the language is normally for professional software engineers. Visual Basic (here after we will refer it as VB) is a powerful and very user friendly language from Microsoft. It is easy to remember the commands and easy to build user interface. VB is an excellent tool for those who want to develop automation solution but do not have training

on programming. It services as a good example about the capability of VB. The software written using a programming language need to be translated to a format that can be executed by a computer. We call this process "**Compile**". The tool used for the translation is called "**Compiler**". Each language need its specific compiler.

The software sited in a computer talks to a interface board through a communication port. It can be a RS232 port, a parallel port, a LAN port, or a USB port. RS232 port was mainly used for modem connection. It is also convenient for interfacing with small instruments. Parallel port is mainly used for controlling a printer. LAN port is useful for networking such as internet connection. USB port is just getting more and more popular nowadays because of its hot "plug/play" feature. It is very easy for a device user. However for a USB interface developer, it demands very profound knowledge in computer operation system.

For a VB based software, the most convenient communication approach is using a RS232 port. This is because RS232 is very simple to setup (only need two wires for communication) and VB can send commands and receive feedback through a RS232 port directly. Even if a PC does not have a RS232 port, a USB port can be easily converted using a USB/RS232 converter. The price of a converter ranges from 20 to 40 dollars. You can find more details about how to use VB to send out commands through a RS232 port in section 2.

## 13.2 Control/interface board and microcontroller

### 13.2.1 Microcontroller

A microcontroller is an integrated circuit (IC) that includes data processor, program storage, data storage, and input/output. It needs to be programmed before it can be used. The developer first write a software (firmware) using a specific language. Then the firmware is compiled to a format usable by the microcontroller. The compiled software is then loaded to the microcontroller. This step is called programming and the tool for loading firmware is called **Programmer**. The firmware in the microcontroller interprets the commands from computer and tells the microcontroller what to do. It will also report its status to computer. To come out a right firmware, the developer needs to know detailed structure of a microcontroller and the communication protocol between the computer and the microcontroller. This is normally the biggest barrier for a person to develop an automation solution without a background in computer control.

### 13.2.2 Input and Output of a Microcontroller

Input is like the ears or eyes and the output is like mouth or hands. An output drives a device to do something and an input checks the status and gives feedback to controllers. In a control, it is not sufficient just to be able to tell a device what to do. It is necessary to monitor the status of the devices so that we know if a device has done what it is supposed to do and decide next action according to its status. The first type control is called "**open loop**" control and the second type is called "**closed loop**" control.

Input and output can be of analog type or digital type according to the signals they process or generate. An analog signal has continuous value (such as voltage and current) while a digital signal consists of "0" and "1" or their combinations.

## 13.3 Drive electric devices

An electric device can be a light bulb, a valve, or a motor. Each device has a working range in voltage and current. If the voltage applied to a device is above the upper limit of a device, the device may get damaged. On the other hand, if a device draw more current than the output current of a driving board or a power supply, the system may shut down or even get permanent damage.

### 13.3.1 Use a microcontroller output to drive a device

Suppose we want to control a valve with a 12 volt working voltage and 700 mA current. An output on a microcontroller can only draw less than 20 mA current and can only provide 5 volt. So it cannot drive the valve directly.

One approach is using a relay. A relay is like a switch that allows you to use a smaller power to switch a bigger power. The diagram on the right shows how a relay works. When a small trigger voltage is applied to a relay, a larger power can be switched on (for the valve, the power supply should have a 12 volt output voltage and above 700 mA output current). When the trigger voltage is removed, the power supply for the device is also cut off. Some relays can be triggered directly by a microcontroller output (such as some solid state relays).

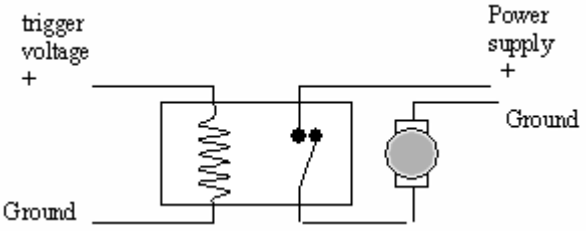



**Figure 52: Relay for Driving a Valve**

### 13.3.2 Match supplied voltage with the working voltage of a device

Sometimes the output voltage of a power supply is too large for a device. A voltage regulator may be used to lower a portion of the output to the desired voltage. There are many low cost voltage regulators available in the market (such as LM317, L7805, and L7812). Their connection is quite simple. Another approach is connecting a resistor in series with the device so that the resistor will consume the extra power. Although this approach is very easy to do, the resistor simply convert the power to heat and gets it wasted. So this is normally used when the total current is very small.

A more advanced approach is using the pulse width modulation technique (**PWM**). In a PWM regulated output, a continuous supply is divided into many small pulses. During each pulse period, the output is set to high for some time and set to low for the rest of the period. The number of pulses per second is called PWM frequency. The ratio of time that an output is maintained high to the total time of a pulse is called **Duty cycle**. A PWM output can be used to switch a power supply on and off quickly. It will lower the current flowing through a device without interrupting its operation. For example, we may use a 24 volt power supply to drive a 12 volt heating element by setting the PWM duty cycle at 50%. PWM output can also be used to control the speed of DC motors. 1.4.3 Match the working current of a device with the output current of a supply

For voltage, we need to make sure the supplied voltage not be higher than the working voltage of a device. In term of current, it is the other way round. We must make sure supplied current capacity (output current) is higher than the working current (or rated current) of a device.

The working current of a device depends on two factors: supplied voltage and the resistance of the device. For most cases, the current can be estimated using Ohm's law. Let us use the relay in section 1.4.1 as an example. If the coil has a resistance of 100 Ohm and its working voltage is 5 volt, we can estimate the current flowing through the coil will be 50 mA. If we use a microcontroller output to drive the relay coil directly, the current flowing through the output will be too high (one output can only allow 20 mA). The microcontroller will either shut down or get damaged. We may try to add a resistor in between to regulate the current. If the resistor is too large, it may reduce the power below the working range and the coil may not be powerful enough to do a switch. Other options include selecting a relay with smaller working current (such as a solid state relay) and using a transistor type IC in between.

For a DC motor, we cannot simply use Ohm's law to estimate the working current. This is because a running DC motor can generate an opposite current to suppress the current flow. The faster it runs, the lower the net current flowing through the motor. The current flowing through a free running motor is normally 10-20% of the value estimated using Ohm's law. When a DC motor is slowed down due to increased load, its current will increase to make it move faster. If the motor is stopped due to blockage or overloading, the current will surge by 5 to 10 times. If the power is not cutoff quickly, the system can get damaged. In some DC motor systems that require high reliability, current detection circuit is built in.

# 13.4. Visual Basic Programming for Control

## 13.4.1 Introduction

VB is a very easy yet very powerful application development tool under the Microsoft Windows family. As you may already know, it is possible to get your first program running in less than an hour. There are three editions of VB, they are the learning edition, the professional edition, and the enterprise edition. To develop software for control, a professional edition is necessary. The tutorial here is based on professional edition of VB6.

When we start up VB, a dialog panel will appear, asking us to select a project type (see figure 1). For control software development, we will mainly use the "Standard.exe" project under the "New" menu bar. When you click on the icon representing “Standard.exe", the VB development environment will show up (see figure 2). Double click on an icon in the tool box, that icon will appear in the "Form1" frame and the relevant properties will be displayed in the property panel. Each icon represents an object, such as a button, a text box, or a timer.

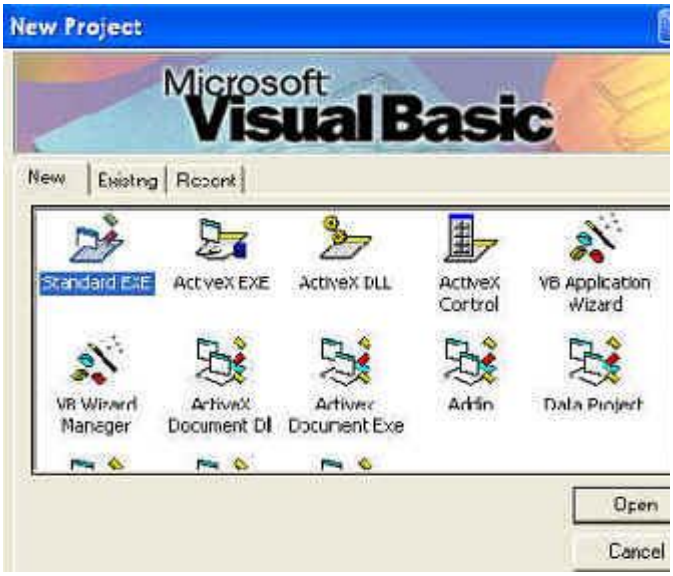



**Figure 53: VB project selection panel**

Figure 1

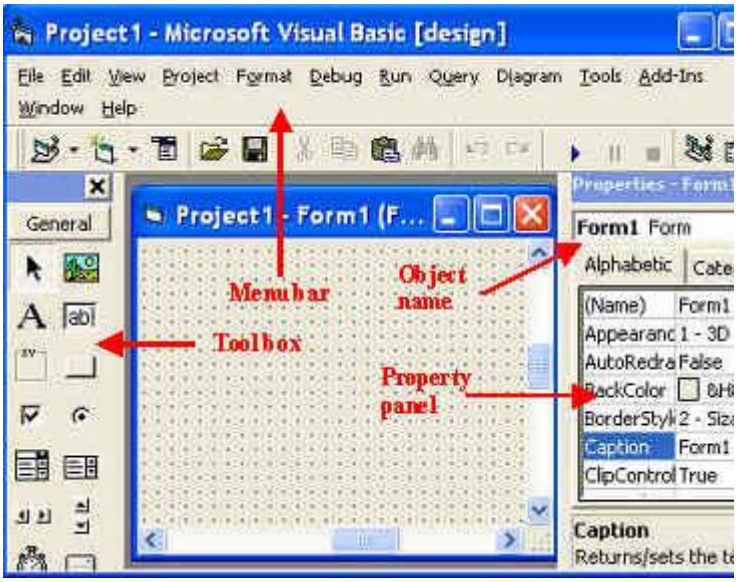



**Figure 54: VB development environment**

Figure 2

In a VB program, all the actions must be triggered by letting something happen to an object. For example if we want a text box to change content, something must happen to an object. This event can be a mouse click at a button, a timer is enabled, or a check box is checked. This is one of the major difference between VB and other traditional programming language.

## 13.4.2 Setup Programming Environment

VB has a special function for RS232 communication called MScomm. It is not included in the standard tool box. It needs to be added before making a control software. To do this, first go to menu bar "Project" and select "Components" in the drop down list. Then check "Microsoft Comm Control 6.0" (see figure 3) and click on the "Apply" button. A telephone icon will appear in the tool box. Double click at the icon, it will appear in the form and its properties will appear in the properties panel (see figure 4). One important property is CommPort value. It is the number of the RS232 port (COM port) used for communicating with the interface board. The default value is 1. If your computer has more than one COM port or you use a USB converted port, the number could be different. If this setting is not correct, the PC will not be able to communicate with the interface board. It can automatically detect the port number. Another important property is the communication speed in RS232 setting. It must be the same as the setting in the interface board. The default value in the VB is 9600 (bit per second).

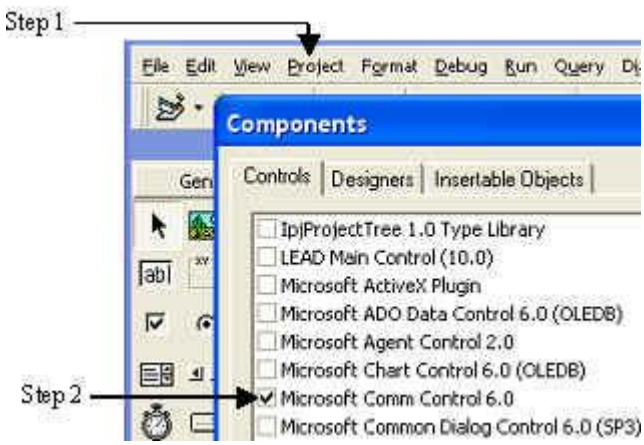



**Figure 55: Add MScomm to the tool box**

Figure 3

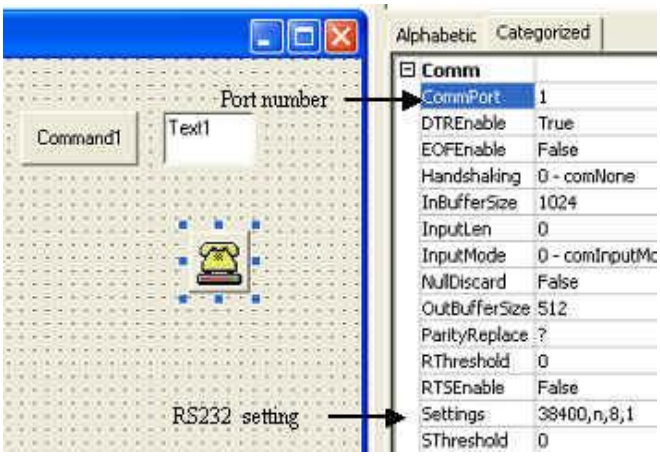



**Figure 56: Set right properties for RS232 communication**

Figure 4

# 13.5 Control DC motors

## 13.5.1 Introduction

It is very easy to make a DC motor turn. It can be done by simply connecting one of the wire to the positive end of a power supply and the other wire to the negative end of the power supply. It is also easy to make a DC motor change direction. Simply swapping the connection of the two wires will achieve this. The task becomes more challenging if we want to make the direction change occur automatically, to make a DC motor move at a steady speed when its load is changing, or to make a DC motor move to a certain position. A DC motor tends to move faster when its load is low. When the load is increased, the DC motor will slow down and the current flowing through the coil will increase. When we want a DC motor to stop, it will keep moving for some time, making it difficult for position control. The control becomes more complicated than controlling stepper motors. However, DC motors have their advantages over stepper motors in that the hardware connection is simpler, move is smoother, and their loading capacity is larger than stepper motors of similar wattage or size. When the load becomes too heavy, a stepper motor will simply give up (step slipping). But a DC motor will slow down and increase the current to keep the load moving. A geared DC motor is very good for moving heavy loads.

## 13.5.2 Control direction of DC motors

To change moving direction of a DC motor without manually swapping wire connection, a H-bridge circuit is needed. Two outputs are needed to enable direction control. Either of these four output pairs can be used for direction control: 1 and 2, 3 and 4, 5 and 6, and 7 and 8. Let us use output 5 and 6 as an example. When output 5 is set to high and output 6 is set to low, current will flow from output 5 to DC motor and then to the ground through output 6. When output 5 is set low and output 6 is set high, the current flow direction and the motor moving direction will change. When both outputs 5 and 6 are set high, motor will be stopped with a braking effect. We can also stop a motor by setting the two outputs to low but it will take longer time since there is no braking effect.

## 13.6 Visual Basic Application for Train Control

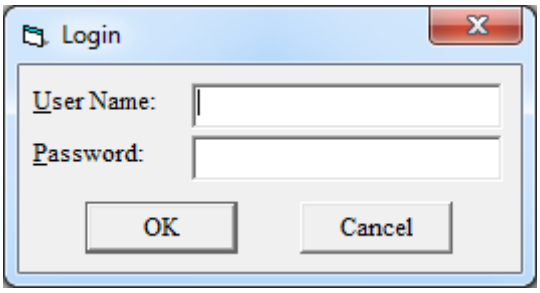



**Figure 57: Login Screen of VB Application**

- With the help of this GUI we can control train's various parameter by sending SMS, and also see train's location.
- So whenever any button like 'Start' is pressed, some message is send to train unit and depending on message received the train gets started.
- Similarly Speed of train is controlled by sending specific message depending on the number written in text box of set speed.

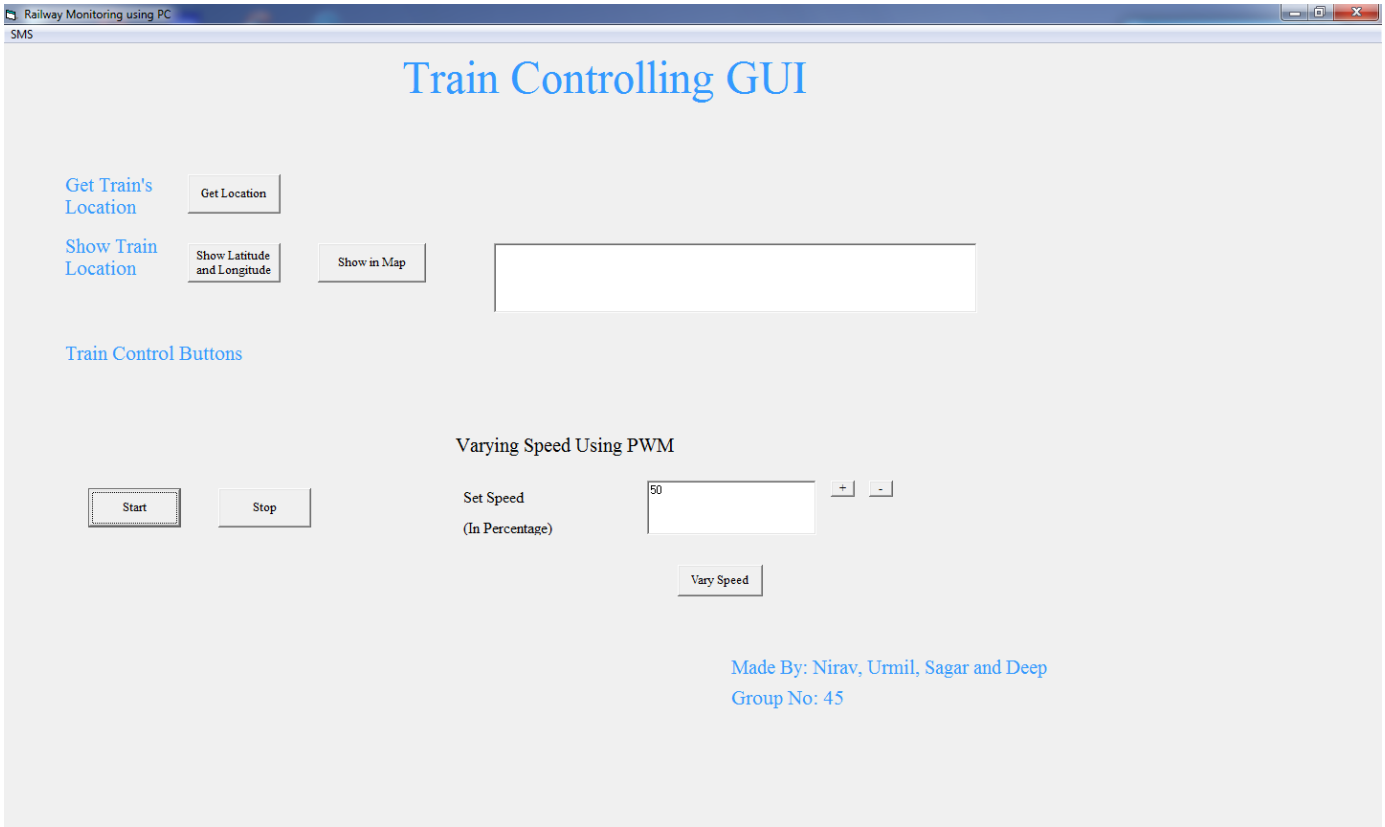



**Figure 58: Train Controlling GUI Created in VB**

- Also we can receive location of by Clicking ‘Show latitude and longitude’ button and it can also be seen in Map by Clicking ‘Show in map’ button.

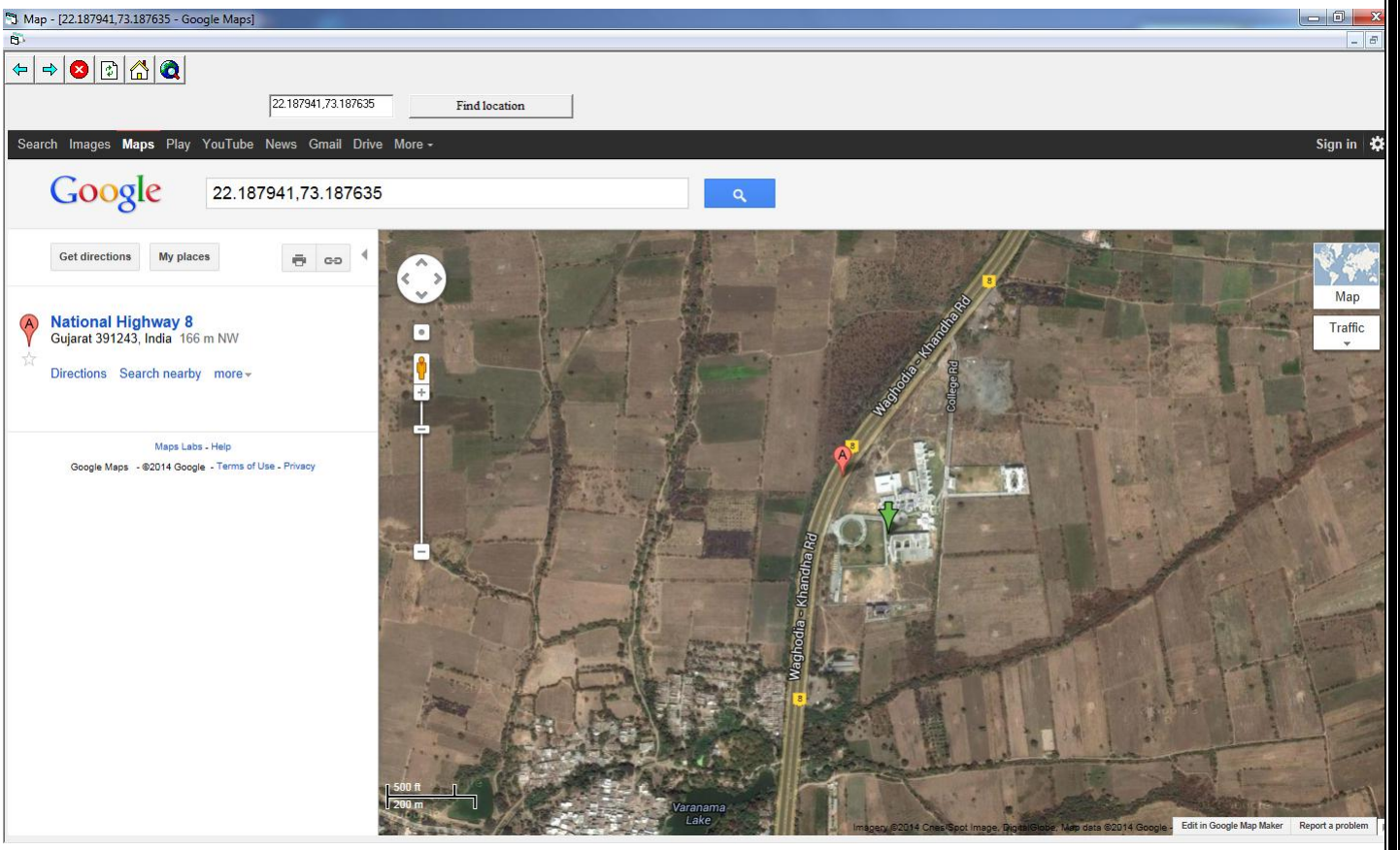



**Figure 59: Location shown in map**

# Chapter

# 14. Software and Programming

# 14.1 SOFTWARE:

- **In this project we have used 4 software's namely:**

  1. Eagle: - For PCB Layout Designing.
  2. Proteus: - For Circuit Design and Simulation.
  3. Keil Uvision: - For C Programming and Creating HEX File.
  4. Flash Magic: - For dumping HEX File into Microcontroller.

## 14.1.1 Keil Uvision

- **OVERVIEW**

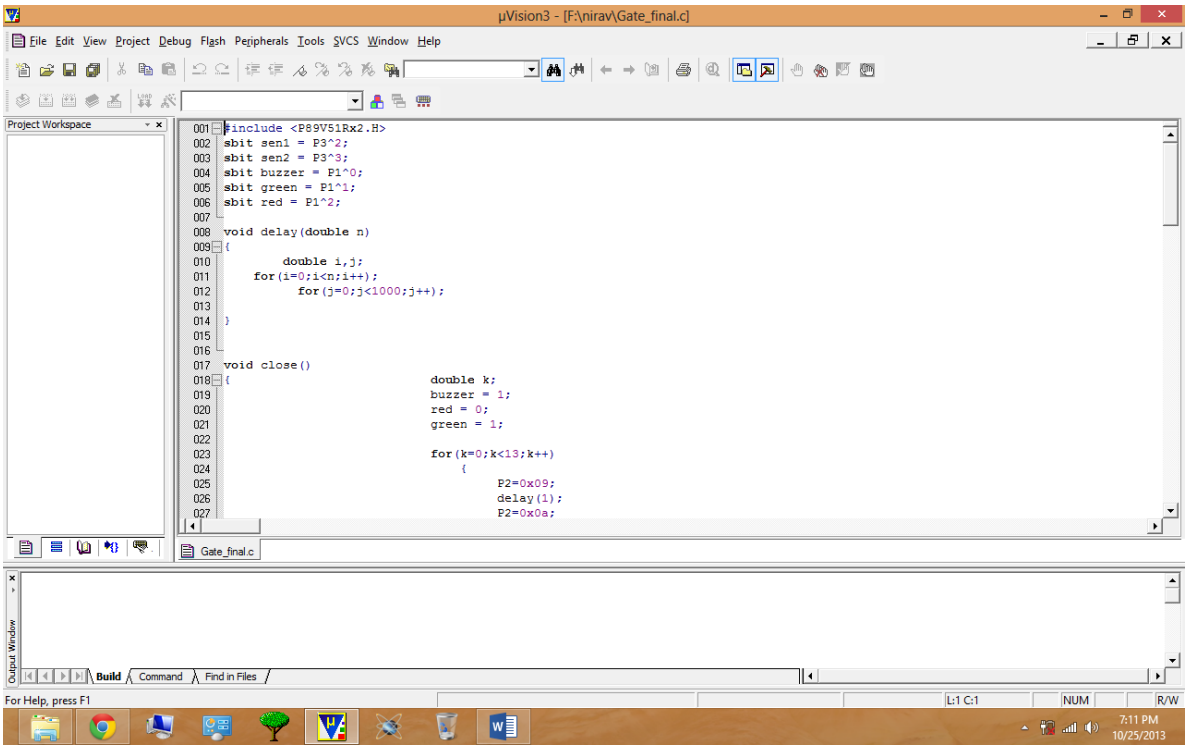



**Figure 60: Keil Uvision Screenshot**

- The Keil 8051 Development Tools are designed to solve the complex problems facing embedded software developers.

- When starting a new project, simply select the microcontroller we use from the Device Database and the µVision IDE sets all compiler, assembler, linker, and memory options for you.

- Numerous example programs are included to help to get started with the most popular embedded 8051 devices.

- The Keil µVision Debugger accurately simulates on-chip peripherals ($I^2C$, CAN, UART, SPI, Interrupts, I/O Ports, A/D Converter, D/A Converter, and PWM Modules) of your 8051 device. Simulation helps you understand hardware configurations and avoids time wasted on setup problems. Additionally, with simulation, you can write and test applications before target hardware is available.

- **How to use??**

1. Open Keil from the Start menu

2. The Figure below shows the basic names of the windows referred in this document

3. Select New µVision Project from the Project Menu

4. Name the project 'Toggle'

5. Click on the Save Button.

6. The device window will be displayed.

7. Select the part you will be using to test with. For now we will use the Philips.

8. Double Click on the Philips.

9. Scroll down and select the 89V51RD2 Part.

10.Click OK

11.The startup file request will appear.

If you want to make c program click yes and If you want to make assembly program click no.

12.Click File Menu andselect New.

13.A new window willopen up in the Keil IDE.

14. Click on File menu and select Save As…

15. Name the file *.c

16. Click the Save Button

17. Select *.c

18. Click Add button and close.

## 14.1.2 Flash Magic

Flash Magic is a PC tool for programming (downloading code to program the target hardware). It is developed and maintained by embedded systems academy. Flash magic uses the in-system programming capabilities of microcontrollers produced by NXP to achieve its purpose.P89C61X2 and P89V51RD2 are both example of 8051 based microcontrollers which can be programmed using Flash Magic. Both of these microcontrollers are compatible with UNI-51-SDK.

❖ **Open Flash Magic.**

After doing this, we need to supply Flash Magic with the following data/options:

- **Device:** The microcontroller which we are using we will select '89V51RD2'
- **COM Port:** This is the port no. to which our UNI-51-SDK experimentation board is connected.
- **Baud Rate:** We will keep this 9600 bits per second, so that programming happens fast.
- **Interface:** The interface refers to the kind of hardware interface between the PC and the target board (UNI-51-SDK experimentation board). Since we are not using any special hardware device to program the microcontroller, we have to select 'none (ISP)'.
- **Erase all Flash:** Check this checkbox to erase all flash memory before writing the latest program into it.
- **Hex file:** This is where we need to enter the location of the Hex file generated by SDCC. We can use the browse button to navigate to the files location which will be inside the release folder of blink leds. A typical location would be:
  **C:**\Documents settings\swapnil\workspace\blinkleds\release\blinkleds.hex

When we press the browse button, the program would look for file with the extension of .hex.

- **Verify after programming:** Select this checkbox if you want to verify the data written to microcontroller's program memory. After entering all the data, turn on the power supply to the UNI-51-SDK board by turning on the mains power switch and the power switch on the experimentation board Then click on start button in flash magic and in a moment we will get final output on kit.

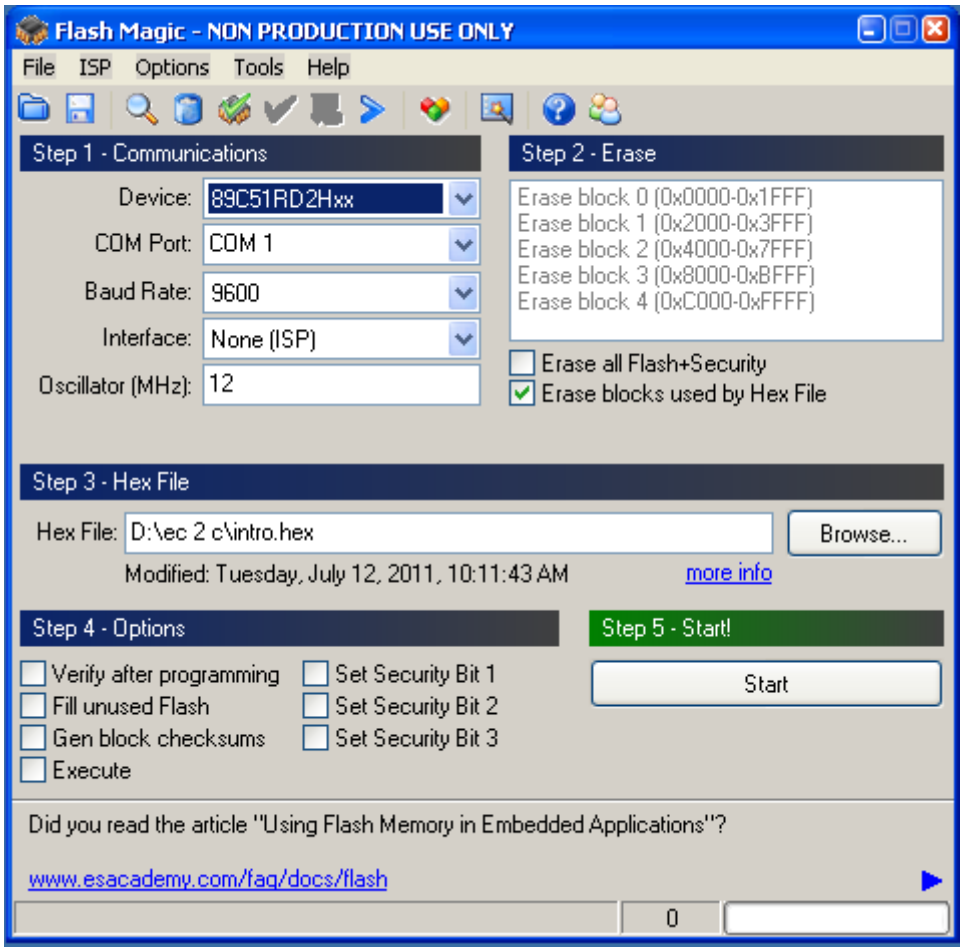



**Figure 61: Flash Magic Screenshot**

### 14.1.3 Proteus

Proteus is a Virtual System Modeling and circuit simulation application. The suite combines mixed mode SPICE circuit simulation, animated components and microprocessor models to facilitate co-simulation of complete microcontroller based designs.

Proteus also has the ability to simulate the interaction between software running on a microcontroller and any analog or digital electronics connected to it. It simulates Input / Output ports, interrupts, timers, USARTs and all other peripherals present on each supported processor.

**ISIS Schematic Capture**

ISIS lies at the heart of the Proteus system, and is far more than just another schematics package. It combines a powerful design environment with the ability to define most aspects of the drawing appearance. Whether your requirement is the rapid entry of complex designs for simulation and PCB layout, or the creation of attractive schematics for publication, ISIS is the tool for the job.

Use the left hand navigation menu for more information on various features of the ISIS schematic capture software.

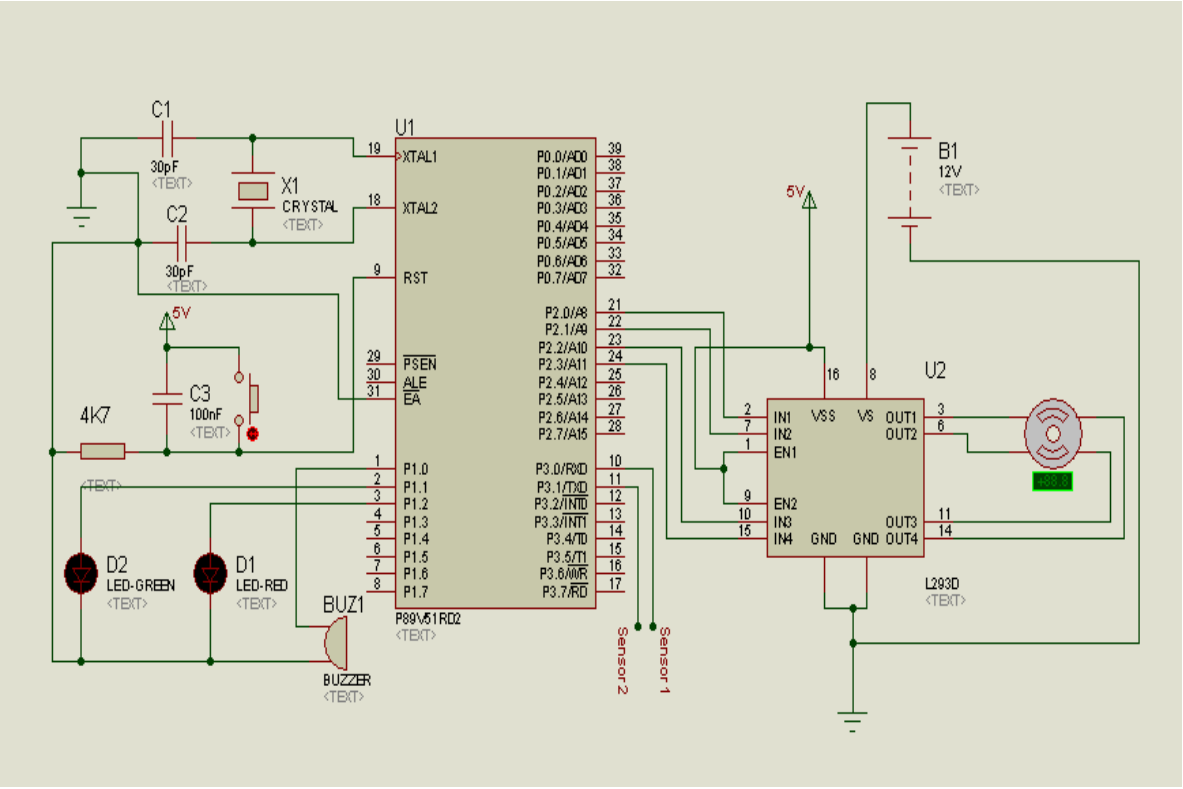



**Figure 62: Proteus Screenshot**

## 14.1.4 Eagle Software and PCB Layouts

EAGLE contains a schematic editor, for designing circuit diagrams. Parts can be placed on many sheets and connected together through ports.

Electronic software that can be used to create electronic schematic and PCB design is CAD soft Eagle**.** With CAD soft Eagle we can draw schematic and make layout PCB design automatic easily, manually or automatically.

The PCB layout editor allows back annotation to the schematic and auto-routing to automatically connect traces based on the connections defined in the schematic.

### 14.1.4.1 PCB Layout of IR Sensor

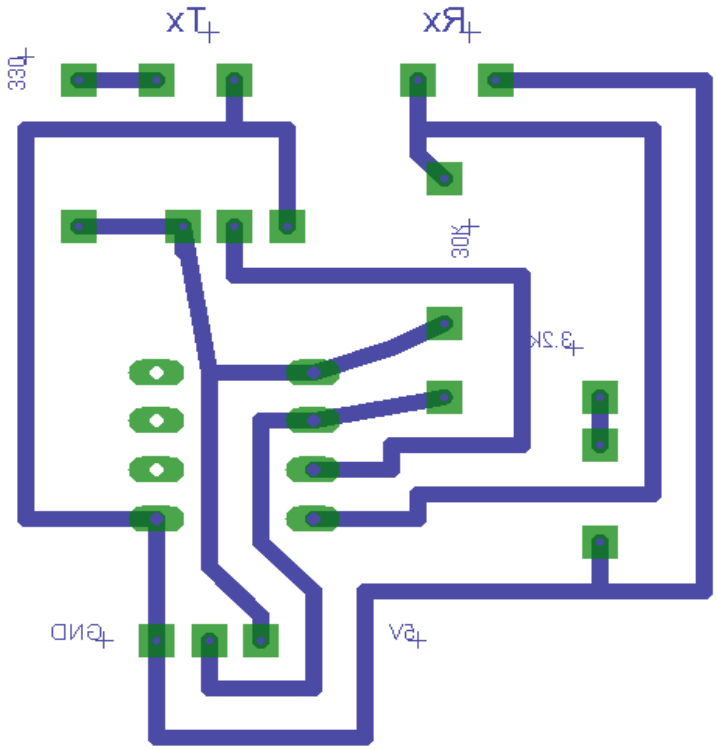



**Figure 63: PCB Layout of IR Sensor**

### 14.1.4.2 PCB Layout of TTL To RS232 Converter for GPS

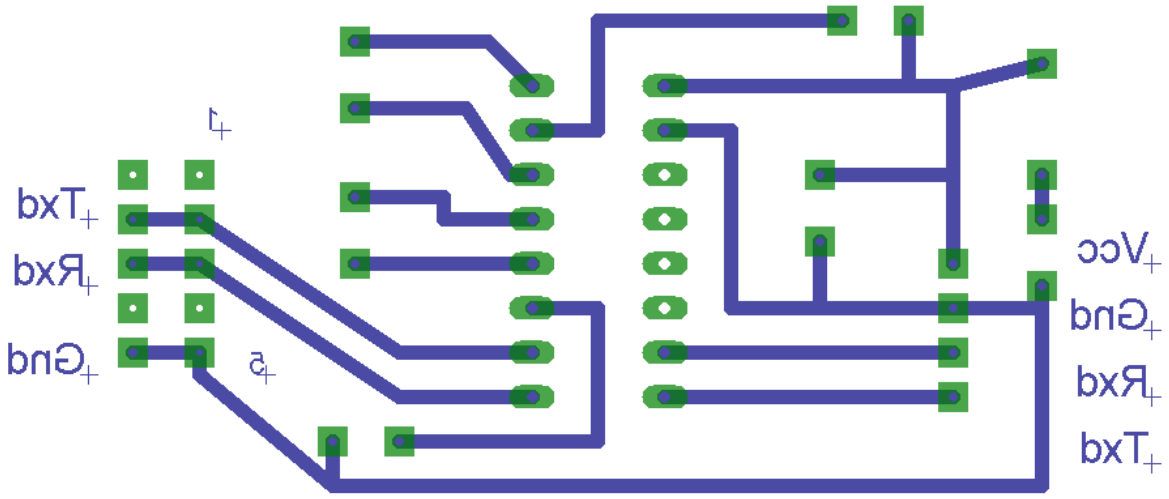



**Figure 64: PCB Layout of TTL To RS232 Converter for GPS**

### 14.1.4.3 PCB Layout of Gate Control

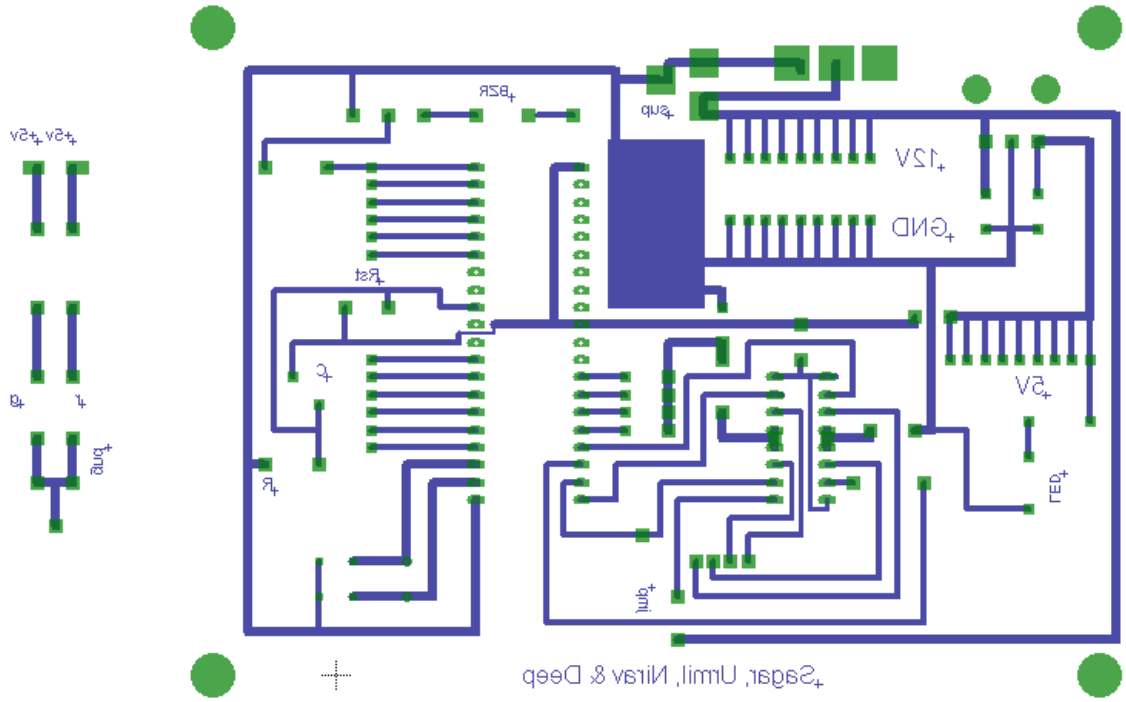



**Figure 65: PCB Layout of Gate Control**

### 14.1.4.4 PCB Layout of H-Bridge and Regulated Power Supply

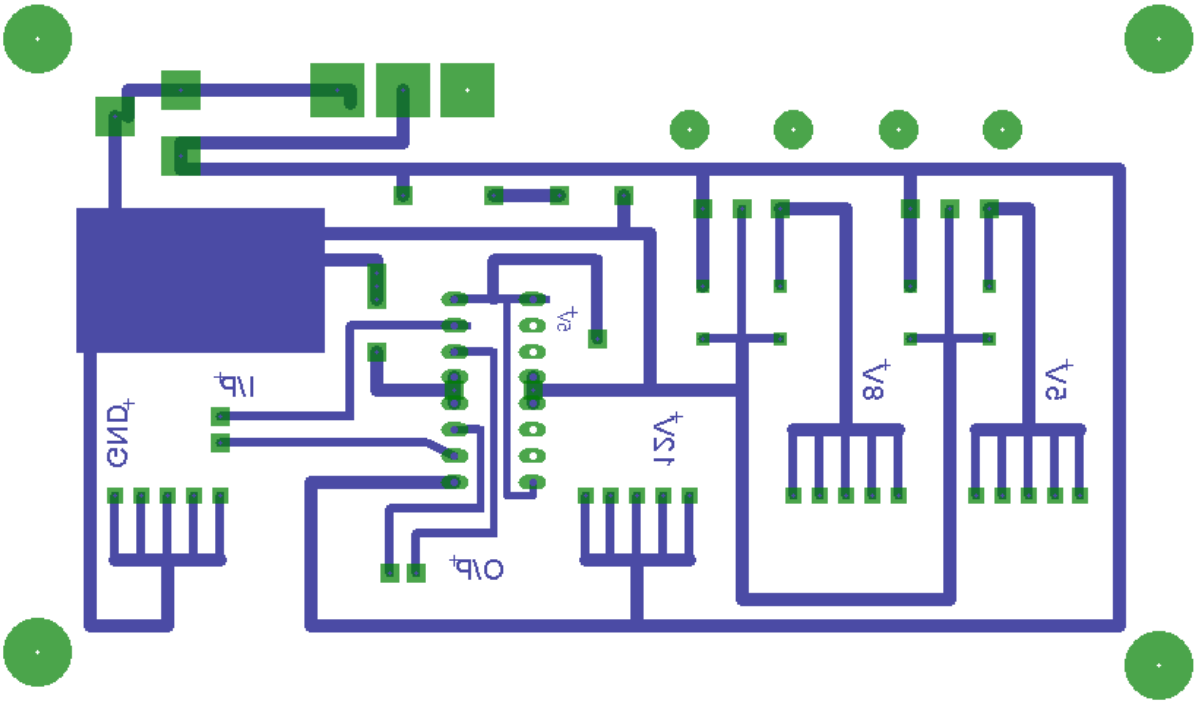



**Figure 66: PCB Layout of Train Control Unit**

## 14.2 Software Programming

### 14.2.1 C Program for gate control

```
#include<reg51.h>
sbit sen1 = P3^2;
sbit sen2 = P3^3;
sbit buzzer = P1^0;
sbit green = P1^1;
sbit red = P1^2;
void delay(double n)
{
        double i,j;
    for(i=0;i<n;i++);
        for(j=0;j<1000;j++);
}

void close()
{
                                        buzzer = 1;
                                        red = 0;
                                        green = 1;
                    P2=0x09;
                    delay(1);
```

```
                    P2=0x0a;
                    P2=0x06;
                    delay(1);
                    P2=0x05;
                    delay(1);
                    P2=0x09;
                    delay(1);
                    P2=0x0a;
                    delay(1);
                                buzzer = 0;

}

void open()
{
                        buzzer = 1;

            P2=0x0a;
            delay(1);
            P2=0x09;
                delay(1);
            P2=0x05;
                delay(1);
            P2=0x06;
                delay(1);
```

```
                    P2=0x0a;
                        delay(1);

                    P2=0x09;
                        delay(1);

                            buzzer = 0;

                            green = 0;

                            red = 1;
}


    void main(void)

        {

                P2=0x00;

                P1=0x00;

                P3=0x00;

               red=1;

               for(;;)

        {

               if(sen1 == 1)

               {

                    delay(10000);

                    if(sen1 == 1)

                    {

                    close();

                    while(sen2 == 0);
```

```
                delay(5000);
                while(sen2 == 1);
                open();
            }
            }
            if(sen2 == 1)
            {
                delay(10000);
                if(sen2 == 1)
                {
                close();
                while(sen1 == 0);
                delay(5000);
                while(sen1 == 1);
                open();
                }
            }
        }
}
```

# Chapter

# 15. Troubleshooting

# 15.1 Troubleshooting

- We have two parts in our project Automation and monitoring part so it is obvious that we had two different kind of uncertainties to deal with.
- We had managed to get rid of almost all the problems by the teamwork and researching through internet.
- The biggest three problems that we had faced and troubleshoot are below.

## 15.1.1 Coding

- In Automation part the first problem that we faced was to build a proper code so that we can get the proper timing for the gate to be opened and closed because in the toy model, the timing is very important like the time when sensors sense the train and the time when the gate should be closed because in the toy model both the sensors and gate are seems to nearer to each other than it should be, so in the program it is important to deal with the timing of opening and closing of gate before the train passed from the gate.

- First we had made the code and tried it in the proteus software and by the time we modified it several times in the proteus by varying the delay of the code and we also dumped it several times in the microcontroller to see the real time working of the code.

- Actually we made the code by ourselves so we faced much more difficulties and of course we had solved it. The actual code is also given in the Automation part.

- We had faced much more difficulties in monitoring part than automation part because in this part we had to deal with GSM, GPS and concatenation of both. Individual codes for the GSM and GPS was not so hard though it was difficult to make a code because we have never been taught any kind of studies about GSM and GPS in the academics in fact both of them are not part of our studies and the same reason we were not comfortable at all to build the code related to send the message and get the location with the help of ARM LPC2148 kit so we took the help of teacher and made some part by ourselves.

- The biggest problem that we faced was the concatenation of both GSM and GPS code so we tried and edited it several time with the help of teacher and finally we made it successfully.

### 15.1.2 Designing PCBs

- Second biggest problem that we faced was design of PCBs. We had designed lots of PCBs in our project by our own and that I think the biggest strength of our project.

- We have designed the PCBs like Gate control with buzzer and indicators, Sensors, RS232 to TTL convertor and Power supplies like 5V, 8V and 12V along with motor driver.

- In PCB designing the steps are very crucial because the success is not definite in that because first we have to take printout of circuit design on glossy or butter paper and then to print it on the copper board by the help of ironing and in this process sometimes circuits may print and sometimes may not. We had actually designed and failed around 40 to 50 times in whole project but to troubleshoot this problem is simply to try again!!

### 15.1.3 Wiring and power supply

- The third big problem at last we faced that was to give power supply and wiring of massive model.

- How to give power supply to train unit because it is not static unit it is moving all the time so to get rid of this problem we decided to make special PCB that has various power supplies like mentioned above 5v, 8v and 12v.

- We also bought the portable wires called bucks trips for the wiring of our project.

# Chapter

# 16. Outcome of the Project

Our project is divided into two parts: - Automation part and Monitoring part.

## 16.1 Automation Part

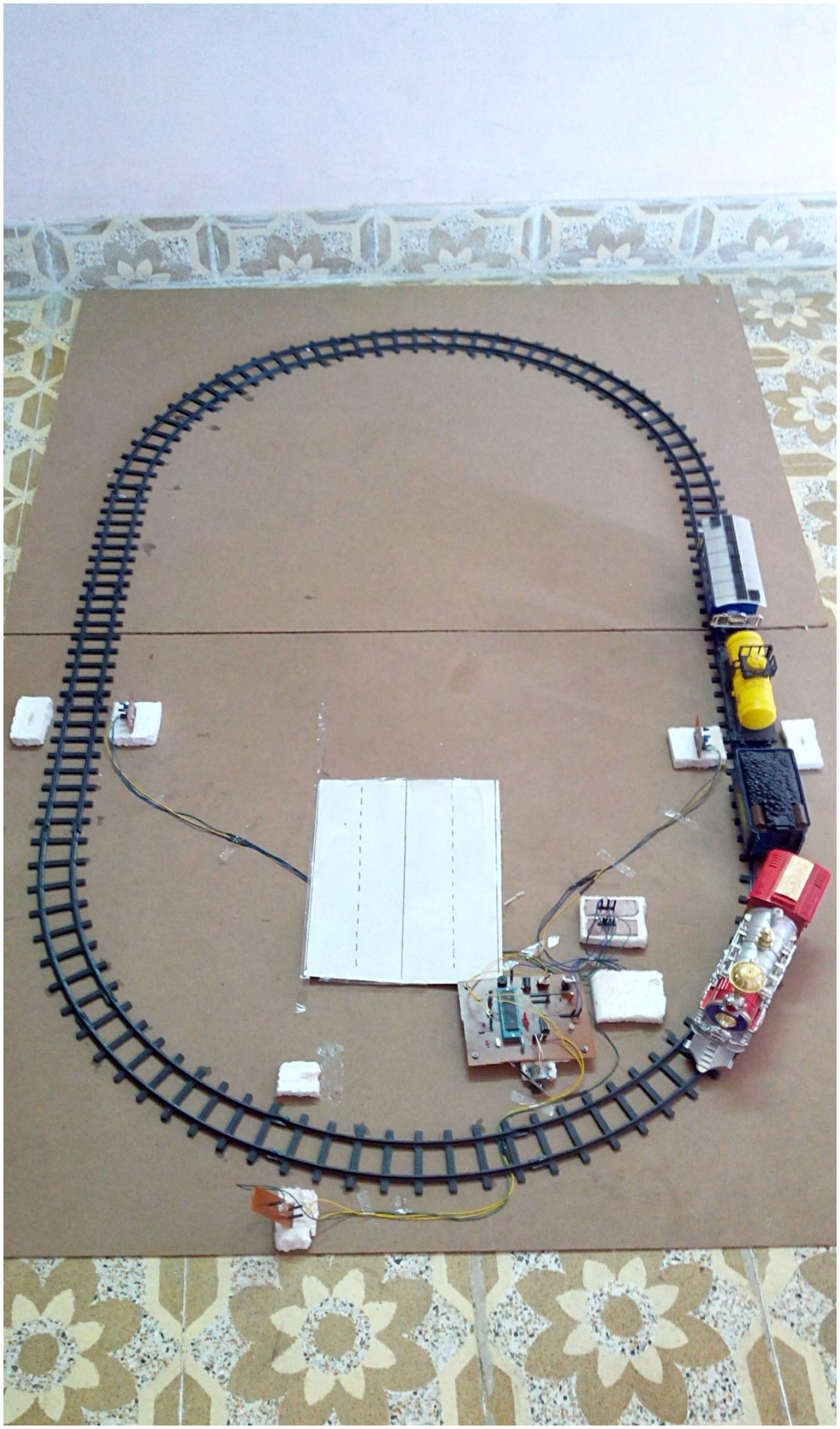


**Figure 67: Final View of Automation part**

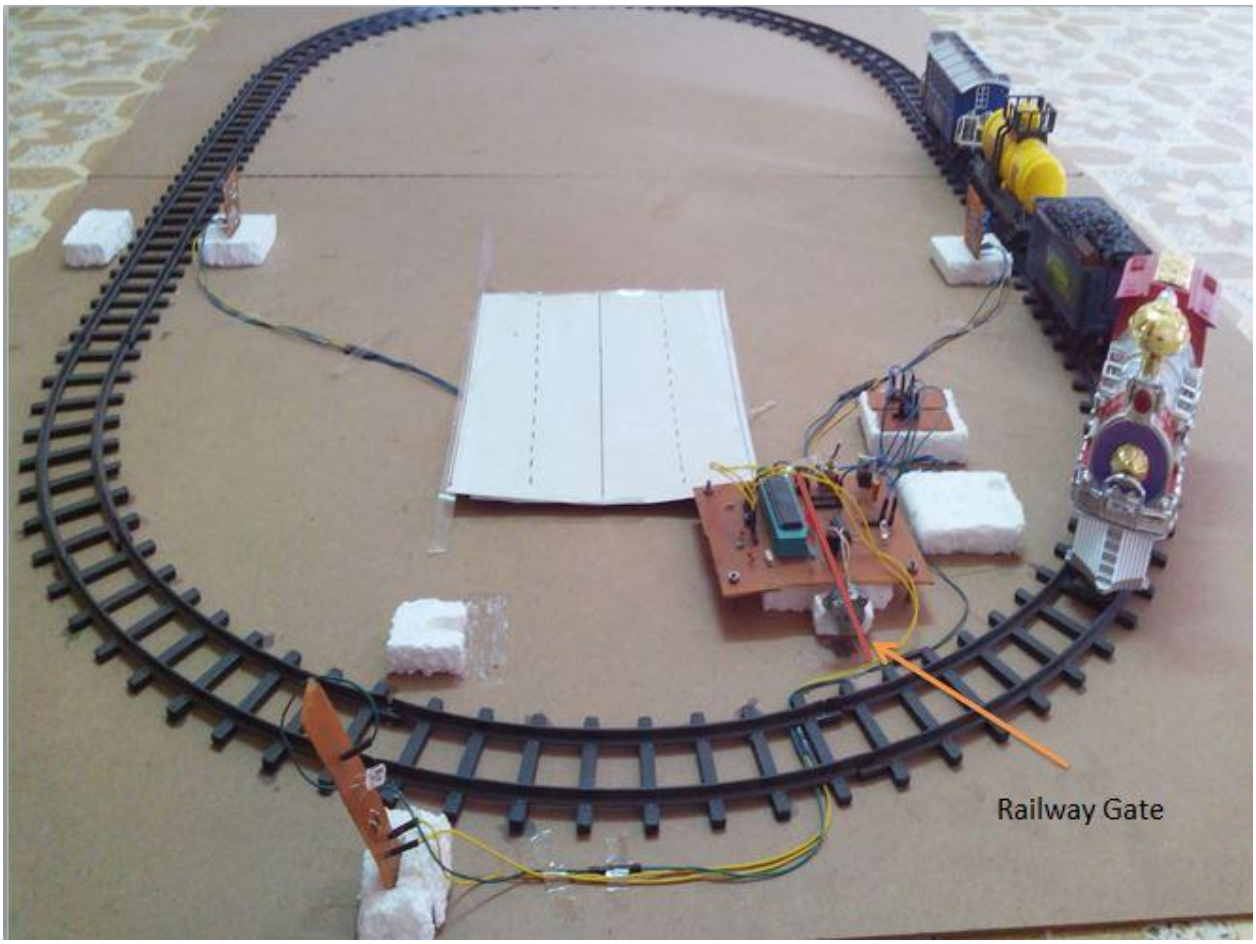



**Figure 68: Nearest View of Railway gate Control**

- In Automation part there is automatic Railway Gate control which is implemented by using two IR Sensor, whenever the Train passes through any IR Sensor Railway Gate will be automatically closed by using stepper motor and opened when train passes through another IR Sensor. We have interfaced buzzer and red & green LEDs for the indication of trains arrival and departure. The Microcontroller we have used in this part is Philips 89V51RD2.

## 16.2 Monitoring Part

In Monitoring part, there are two parts :- Transmitting Section and Receiving Section

### 16.2.1 Transmitting Section (Railway Control Room)

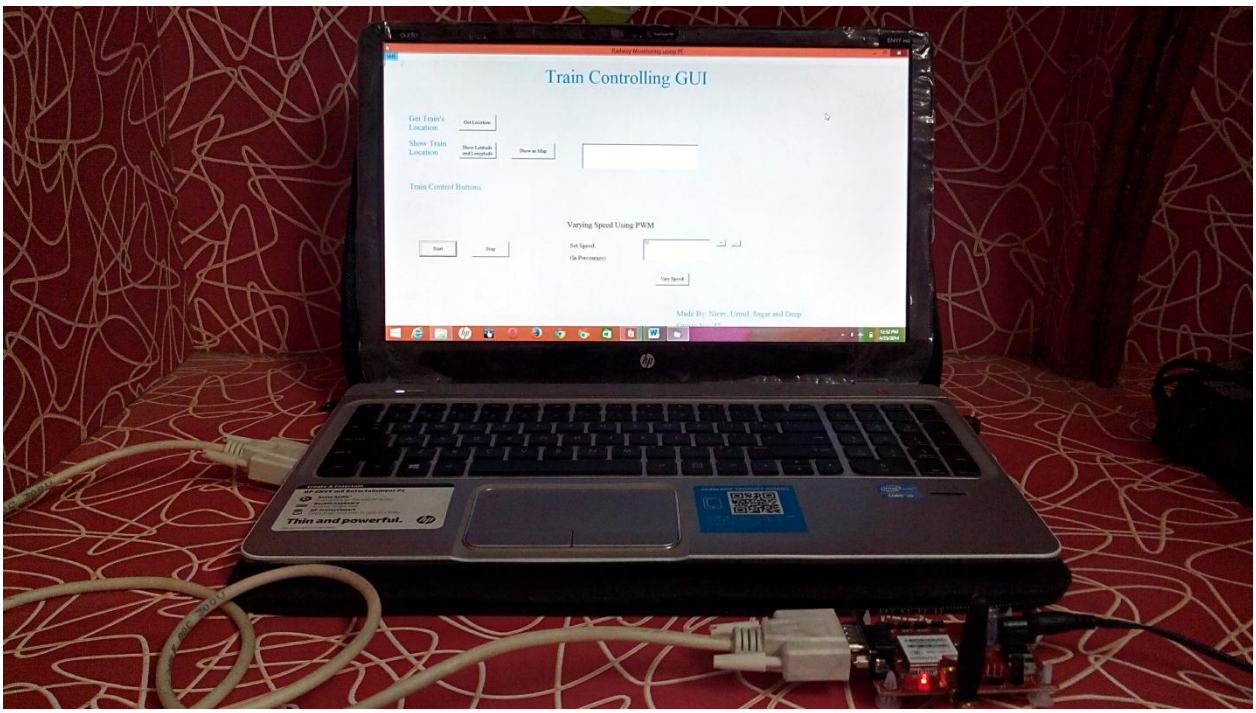



**Figure 69: Physical View of Transmitting Section (Railway Control Room)**

- Transmitting section is said to be Railway Control room.
- All trains are monitored and Controlled in this Section.
- we are going to implement this task by creating a Visual Basic application on PC. This application will show complete graphical user interface having visual buttons to control train and will also show the location of train which is sent by GPS Module located on train unit. So when the user presses any button from VB application, some data will be sent to microcontroller via GSM module connected with PC.

### 16.2.2 Receiving Section (Train Unit)

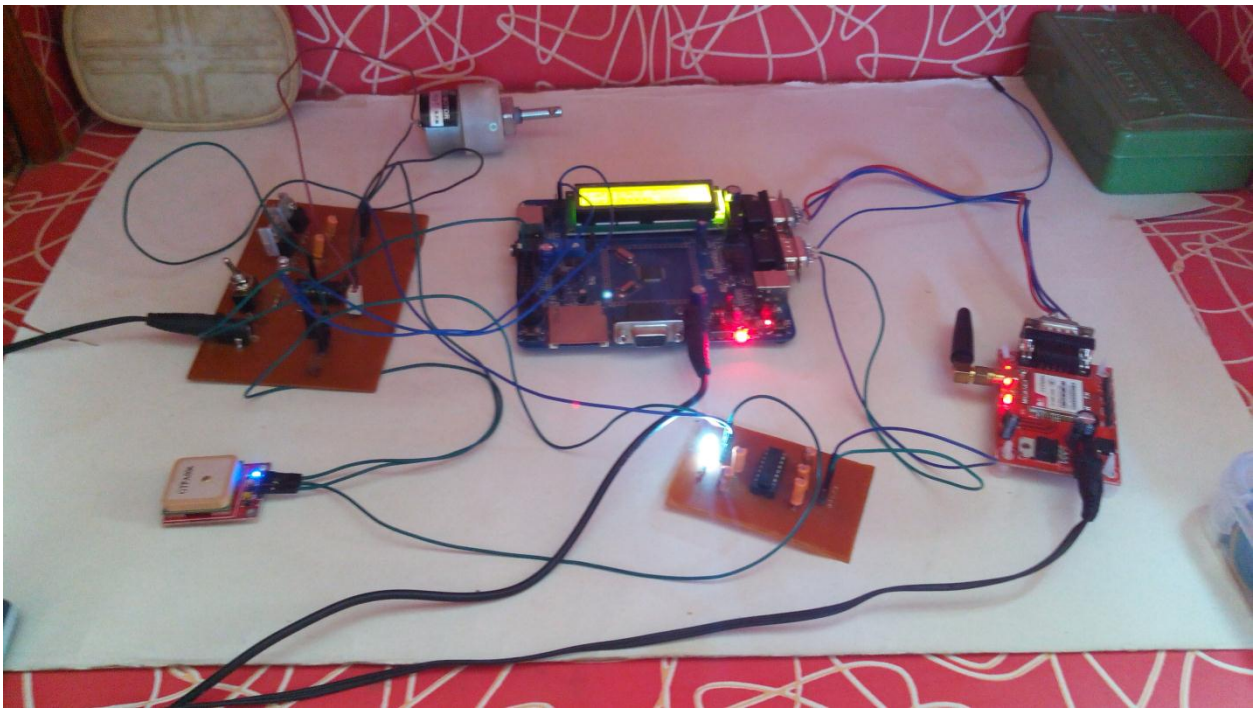


**Figure 70: Final View of Receiving Section (Train Unit)**

- Receiving section is an Individual Train Unit.
- In this section there are GSM Module, GPS Module, ARM LPC 2148 Kit, TTL to RS232 Converter, Motor Driver and Regulated Power Supply Board are Used on same panel.
- Depending on the data received by microcontroller it will generate control signals and send it wirelessly through another GSM Module which is connected with receiver side or train unit.
- On receiver side (which will be in Train) microcontroller will receive the control signal given by user through VB application and depending on signals received, microcontroller will decide what parameters of train are to be controlled. The Microcontroller we are using is ARM LPC2148.
- On receiver side the microcontroller has two serial ports, on one serial port GSM module is connected for receiving message sent from the PC side and to second serial port GPS is connected for sending the location of train to PC by GSM module connected on first serial port.

# Chapter

# 17. Conclusion

## 17.1 Conclusion

From the above discussion and information of this system, we now surely come to know that it is highly reliable effective and economical at dense traffic area, sub urban area and the route where frequency of trains is more.

As it saves some auxiliary structure as well as the expenditure on attendant it is more economical at above mentioned places than traditional railway system. We know that though it is very beneficial but it is also impossible to install such system at each and every place, but it gives certainly a considerable benefit to us, thereby to our nation.

## 17.2 Scope of project

- This project is developed in order to help the INDIAN RAILWAYS in making its present working system a better one, by eliminating some of the loopholes existing in it.

- Based on the responses and reports obtained as a result of the significant development in the working system of INDIAN RAILWAYS, this project can be further extended to meet the demands according to situation.

- This can be further implemented to have control room to regulate the working of the system. Thus becomes the user friendliness.

- This circuit can be expanded and used in a station with any number of platforms as per the usage.

- Additional modules can be added without affecting the remaining modules. This allows the flexibility and easy maintenance of the developed system.

This system consists of following features over manual system:

- There is no time lag to operate the device.
- Accuracy
- Simulation is provided to reflect the present status of the system.
- End user can operate this without knowing about electronics.

## 17.3 Future Enhancement

- To improve the accuracy of this system, instead of using GSM Modem for communication alternatives like 3G Modem which has better connectivity can be used, WIFI network can be established alongside the railway track; by keeping WIFI Modem at every 1 Km distance to get continuous connection with train unit, Satellite communication can also be used.

- This system is a prototype and can be used in other fields also like for controlling robot through PC, in various industries for controlling electrical devices through PC by using specific relay driver circuit, Aircraft in Auto pilot mode, in automatic control of cars and buses; where by giving route details in GPS and then putting it in auto pilot mode, it can reach to destination on its own.

# Chapter

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# FEEDBACK CERTIFICATE

*This is to certify that following students,*

**PATEL URMIL P (100050111007)**
**BHAVSAR NIRAV N (100050111015)**
**SHAH SAGAR N (100050111025)**
**PATEL DEEP H (100050111039)**

*of BITS Edu. Campus, Varnama (Electronics & Communication Department) have Completed "**Railway Automation and Monitoring Using PC**" project with our company and the certificate has been given for excellent work on their Project. The effort and Commitment demonstrated to Complete this Project has been Outstanding.*

**For,**
**Techno Weigh Systems Pvt. Ltd.**

(Authorized Signature)

# Techno Weigh Systems Pvt. Ltd.

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# UTILIZATION CERTIFICATE

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**PATEL DEEP H (100050111039)**

*of BITS Edu. Campus, Varnama (Electronics & Communication Department) have used necessary Resources very efficiently and conservatively for completing* ***"Railway Automation and Monitoring Using PC"*** *Project.*

**For,**
**Techno Weigh Systems Pvt. Ltd.**

(Authorized Signature)

## UNDERTAKING ABOUT ORIGINALITY OF WORK

We hereby certify that we are the sole authors of this IDP/UDP project report and that neither any part of this IDP/UDP project report nor the whole of the IDP/UDP Project report has been submitted for a degree by other student(s) to any other University or Institution.

We certify that, to the best of our knowledge, the current IDP/UDP Project report does not infringe upon anyone's copyright nor violate any proprietary rights and that any ideas, techniques, quotations or any other material from the work of other people included in our IDP/UDP Project report, published or otherwise, are fully acknowledged in accordance with the standard referencing practices. Furthermore, to the extent that we have included copyrighted material that surpasses the boundary of fair dealing within the meaning of the Indian Copyright (Amendment) Act 2012, we certify that we have obtained a written permission from the copyright owner(s) to include such material(s) in the current IDP/UDP Project report and have included copies of such copyright clearances to our appendix.

We have checked the write up of the present IDP/UDP Project report using anti-plagiarism database and it is in the allowable limit. In case of any complaints pertaining to plagiarism, we certify that we shall be solely responsible for the same and we understand that as per norms, University can even revoke BE degree conferred upon the student(s) submitting this IDP/UDP Project report, in case it is found to be plagiarized.

Team: 45

| **Enrolment number** | **Name** | **Signature** |
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| 100050111025 | SHAH SAGAR N | |
| 100050111039 | PATEL DEEP H | |

Place: _____ Date: _____

Name of Guide Signature of Guide

**Mr. Naitik Kapadia**
Assitant Professer
E & C Dept.
BIT.

# GUJARAT TECHNOLOGICAL UNIVERSITY

## ONLINE PROJECT REPORT SUBMISSION CERTIFICATE

**Date of Receipt**: 4/26/2014 8:19:10PM

This is to certify that, GTU has received the project report of ***PATEL URMILKUMAR PRAVINBHAI, BHAVSAR NIRAV NARHARIBHAI, SHAH SAGAR NITINKUMAR, PATEL DEEP HIMANSHU*** entitled on ***RAILWAY AUTOMATION AND MONITORING USING PC*** from ***Electronics & Communication Engineering*** of ***Babaria Institute Of Technology, Varnama***

**The Receipt No is: GTU/PT/2014/BE/685**

**Disclaimer**:

This is a computer generated copy and does not indicate that your report has been evaluated. This is the receipt that GTU has received a copy of the file that you have uploaded as your project report.

## PATENT DRAFTING EXERCISE (PDE) REPORTS

**Submitted as a part of the**

**PROJECT REPORT**

# "RAILWAY AUTOMATION AND MONITORING USING PC"

***Submitted By:***

**PATEL URMIL P (100050111007)**
**BHAVSAR NIRAV N (100050111015)**
**SHAH SAGAR N (100050111025)**
**PATEL DEEP H (100050111039)**

***In partial fulfillment for the award of the degree of***

**BACHELOR OF ENGINEERING**

**IN**

**ELECTRONICS AND COMMUNICATION**

**BABARIA INSTITUTE OF TECHNOLOGY**

**Gujarat Technological University**

**Ahmedabad**

**APRIL, 2014**

**BABARIA INSTITUTE OF TECHNOLOGY**
VADODARA-MUMBAI NH#8,
VARNAMA,
VADODARA -391240

# DECLARATION

We hereby declare that the PDE Reports, submitted along with the Project Report for the project titled **"RAILWAY AUTOMATION AND MONITORING USING PC"** submitted in partial fulfillment for the degree of **Bachelor of Engineering** in **Electronics and Communication** to Gujarat Technological University, Ahmadabad, is a Bonafide record of the project work carried out at **Babaria Institute of Technology** under the supervision of **(Mrs.Kashish Makhijani)**and that no part of any of these PDE reports has been directly copied from any students' reports or taken from any other source, without providing due reference.

| | **Name of Students** | **Sign of Students** |
|---|---|---|
| 1 | Patel Urmil | |
| 2 | Bhavsar Nirav | |
| 3 | Shah Sagar | |
| 4 | Patel Deep | |

# BABARIA INSTITUTE OF TECHNOLOGY

VADODARA-MUMBAI NH#8,

VARNAMA,

VADODARA -391240

# CERTIFICATE

*This is to certify that the PDE Report, submitted along with the project entitled "**PLC CONTROLLED MATERIAL MIXING**" has been carried out by*

**PATEL URMIL P (100050111007)**
**BHAVSAR NIRAV N (100050111015)**
**SHAH SAGAR N (100050111025)**
**PATEL DEEP H (100050111039)**

*under my guidance in partial fulfillment for the degree of **Bachelor of Engineering** in **Electronics and Communication 8th Semester** of Gujarat Technological University, Ahmedabadduring the academic year 2013-14. These students have successfully completed PDE activity under my guidance.*

**Project Guide:**

**Mr. Naitik Kapadia**
Assitant Professer
E & C Dept.
BIT.

**Head of the Department:**

**Dr. Jaimin Bhalani**
H.O.D.
E & C Dept.
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# GTU Innovation Council

## Patent Drafting Exercise (PDE)

**GIC Patent Drafting Exercise** Project Team: 685

| | |
|---|---|
| **FORM 1**<br>**THE PATENTS ACT 1970**<br>**(39 OF 1970)**<br>**&**<br>**THE PATENTS RULES, 2003**<br>**APPLICATION FOR GRANT OF PATENT** | **(FOR OFFICE USE ONLY)**<br>**Application No:** 366<br>**Filing Date:**<br>**Amount of Fee paid:**<br>**CBR No:** |

### 1. APPLICANT(S)

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### 2. INVENTOR(S)

**NOTE**: This is just a mock Patent Drafting Exercise (PDE) for semester 8, BE students of GTU. These documents are not to be submitted with any patent office.

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## 3. TITLE OF INVENTION / PROJECT

RAILWAY AUTOMATION AND MONITORING USING PC

## 4. ADDRESS FOR CORRESPONDENCE OF APPLICANT/AUTHORIZED PATENT AGENT IN INDIA

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## 5. PRIORITY PARTICULARS OF THE APPLICATION(S) FIELD IN CONVENTION COUNTRY

| Country | Application No. | Filing Date | Name of the Applicant | Title of the Invention |
|---|---|---|---|---|
| *N/A* | *N/A* | *N/A* | *N/A* | *N/A* |

## 6. PARTICULARS FOR FILING PATENT COOPERATION TREATY (PCT) NATIONAL PHASE APPLICATION

| International application number | International filing date as alloted by the receiving office |
|---|---|
| *N/A* | *N/A* |

## 7. PARTICULARS FOR FILING DIVISIONAL APPLICATION

| Original(First) Application Number | Date of filing of Original (first) application |
|---|---|
| *N/A* | *N/A* |

## 8. PARTICULARS FOR FILING PATENT OF ADDITION

| Main Application / Patent Number | Date of filing of main application |
|---|---|
| *N/A* | *N/A* |

## 9. DECLARATIONS:

**(i) Declaration by the inventor(s)**

I/We, the above named inventor(s) is/are true & first inventor(s) for this invention and declare that the applicant(s) herein is/are my/our assignee or legal representative.

Date: 28-April-2014

| Name | Sign & Date |
|---|---|
| 1 Patel Urmilkumar Pravinbhai | _____ |
| 2 Bhavsar Nirav Narharibhai | _____ |
| 3 Shah Sagar Nitinkumar | _____ |
| 4 Patel Deep Himanshu | _____ |

**(ii) Declaration by the applicant(s) in the convention country**

I/We, the applicant (s) in the convention country declare that the applicant(s) herein is/are my/our assignee or legal representative.

*Not Applicable*

**NOTE**: This is just a mock Patent Drafting Exercise (PDE) for semester 8, BE students of GTU. These documents are not to be submitted with any patent office.

**(iii) Declaration by the applicant(s)**

I/We, the applicant(s) hereby declare(s) that:-

☑ I am/We are in possession of the above mentioned invention.

☑ The provisional specification relating to the invention is filed with this application.

☒ The invention as disclosed in the specification uses the biological material from India and the necessary permission from the competent authority shall be submitted by me/us before the grant of patent to me/us.

☑ There is no lawful ground of objection to the grant of the patent to me/us.

☑ I am/we are the assignee or the legal representative of true & first inventors.

☒ The application or each of the application,particulars of each are given in the para 5 was the first application in the convention country/countries in respect of my/our invention.

☒ I/we claim the priority from the above mentioned applications(s) filed in the convention country/countries & state that no application for protection in respect of invention had been made in a convention country before that date by me/us or by any person from which I/we derived the title.

☒ My/Our application in India is based on international application under Patent Cooperation Treaty (PCT) as mentioned in para 6.

☒ The application is divided out of my/our application(s) particulars of which are given in para 7 and pray that this application may be treated as deemed to have been filed on _____under section 16 of the Act.

☒ The said invention is an improvement in or modification of the invention particulars of which are given in para 8.

**NOTE**: This is just a mock Patent Drafting Exercise (PDE) for semester 8, BE students of GTU. These documents are not to be submitted with any patent office.

## 10. FOLLOWING ARE THE ATTACHMENTS WITH THE APPLICATION:

- [✓] (a) Provisional specification/Complete specification
- [✘] (b) Complete specification(In confirmation with the international application) / as amended before the international.Preliminary Examination Authority(IPEA),as applicable(2 copies),No.of pages.....No.of claims.....
- [✘] (c) Drawings(In confirmation with the international application)/as amended before the international Preliminary Examination Authority(IPEA),as applicable(2 copies),No.of sheets.....
- [✘] (d) Priority documents
- [✘] (e) Translations of priority documents/specification/international search reports
- [✓] (f) Statement and undertaking on Form 3
- [✘] (g) Power of Authority
- [✘] (h) Declaration of inventorship on Form 5
- [✘] (i) Sequence listing in electronic Form

(j) .....

Fees Rs.XXX in Cash/Cheque/Bank Draft bearing No.XXX Date: XXX on XXX Bank.

I/We hereby declare that to the best of my /our knowledge, information and belief the fact and mtters stated herein are correct and I/We request that a patent may be granted to me/us for the said invention.

Dated this ..... day of ..... 20.....

| | **Name** | **Sign & Date** |
|---|---|---|
| 1 | Patel Urmilkumar Pravinbhai | _____ |
| 2 | Bhavsar Nirav Narharibhai | _____ |
| 3 | Shah Sagar Nitinkumar | _____ |
| 4 | Patel Deep Himanshu | _____ |

To
The Controller of Patent
The Patent Office, at Mumbai.

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**FORM 2**
**THE PATENTS ACT, 1970**
**(39 OF 1970)**
**&**
**THE PATENTS RULES, 2003**
**PROVISIONAL SPECIFICATION**

## 1. TITLE OF INVENTION / PROJECT

RAILWAY AUTOMATION AND MONITORING USING PC

## 2. APPLICANT(S)

**Patel Urmilkumar Pravinbhai (Indian )**
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**Shah Sagar Nitinkumar (Indian )**
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**Patel Deep Himanshu (Indian )**
14/1 geetangli society, chikuwadi jetalpur road, vadodara 390007

## 3. PREAMBLE TO THE DESCRIPTION

The following specification describes the invention.

## 4. DESCRIPTION

### a. Field of Application / Project / Invention

This project work aims to Automate and Monitor the Railway System Using PC. This invention deals to develop a prototy

### b. Prior Art / Background of the Invention / References

In current System the Train Accidents are increasing because of careless in Human Efforts and lack of Technology .

We have designed the System which is desirably Automated and Monitored by the computer so chances of accidents can be minimized at noticeable extent.

The accidents like when two train are in front of each other, when two trains are back to back can be completely prevented by this system. This can be implemented by slowing or stopping the train by PC at some predetermined calculated distance. This is possible because we will have full graphical view of the railway system along with train's position on PC.

At present scenario, in the level crossing line the railway gate is operated normally by a gate keeper. This happens when the railway line is cross over the road and there are a gate that have to be controlled. The gate keeper work after receiving the information about the train arrival from the nearer station. When the train starts to leave the station, the particular station delivers the information to give the signal for gate keeper to get ready. This is the operation are followed for operating the railway gates.

In addition, this automatic railway gate system can contribute a lot of benefit either to the road user or to the railway management. This type of gate can be implementing in the level crossing where the chances of accidents are higher . The computer integration will be used to provide addition in the latest technology.

Lighting signal also provided at the certain distance as pre cautionary step for Driver. Meanwhile, the nearer station also will provide an indication Buzzer to remind them about the crossing train. If anything happened at the gates, this Buzzer will alert the station.

### c. Summary of the Invention/Project

This project deals to develop a prototype of railway system that function automatically by using microcontroller which can also be monitored and controlled using PC via GSM SIM900A Module.

Our project is divided into two parts: - Automation part and Monitoring part.

Automation part deals with controlling railway gate using IR Sensor.

While monitoring part deals with controlling Train's Speed using PC .

### d. Objects of the Invention/Project

We can develop wireless and time efficient advance railway system that will reduce human Efforts .
We can Control any train at desired time & place using PC.
We can estimate & control the Speed of train.
We can continuously get the location of train on real time Google map .
If two trains are in front of each other then we can stop both of them.
Railway gate will be automatically opened and closed.

### e. Drawing(s)

### f. Description of the Invention

In Automation part, there is automatic Railway Gate control by using two IR Sensors on either side of Gate so whenever the Train passes through any IR Sensor, Railway Gate will be automatically closed or opened.

This task is implemented through microcontroller P89V51RD2. Both IR sensors are connected to microcontroller and microcontroller will receive commands and made the stepper motor rotate. The motor driver L293D is used for rotating motor in both directions.

The caution in this task should be taken care such that the sensors should be at predetermined height so any animal or human being can't sense by sensor. Also some delay is necessary to be given so that any bird can't sense by sensor.

This sensors are placed at around 5 to 8 km from Gate.

In Monitoring part we are going to implement this task by creating a Visual Basic application on PC. This application will show complete graphical user interface having visual buttons to control train and will also show the location of train which is sent by GPS Module located on train unit

When the user presses any button from VB application, some data will be sent to microcontroller via GSM module connected with PC. Depending on the data received by microcontroller it will generate control signals and send it wirelessly through another GSM Module which is connected with receiver side or train unit. On receiver side (which will be in Train) microcontroller will receive the control signal given by user through VB application and depending on signals received, microcontroller will decide what parameters of train are to be controlled. The Microcontroller we are using is ARM LPC2148. On receiver side the microcontroller has two serial ports, on one serial port GSM module is connected for receiving message sent from the PC side and to second serial port GPS is connected for sending the location of train to PC by GSM module connected on first serial port.
There is a predetermine code behind all the visual buttons of VB application so whenever user press any button, according to that code the message will be sent through GSM module and this message will be received by the another module connected to train unit and LCD will display the action of train such as starting or stopping etc. Then this Message will be processed by microcontroller and train will be controlled by motor connected to Microcontroller. This Concept is better understood by below example.

example: Suppose you want to start the train so simply press the button named "START" on VB application so message named "start" will be sent to the GSM module of train unit and LCD will display that "Train is starting……", Now the Decoding or Processing of this Message is written as a program in ARM LPC2148 Microcontroller on train Unit, so Whenever the start message is sent to the train unit the controller has a program to rotate the motor clockwise and train will start. Here the number where we are sending the message is already written in the program so the message will only go to this number which is of GSM module connected with train unit. The number can be changed or encrypted by password.

### g. Examples

### h. Unique Features of the Project

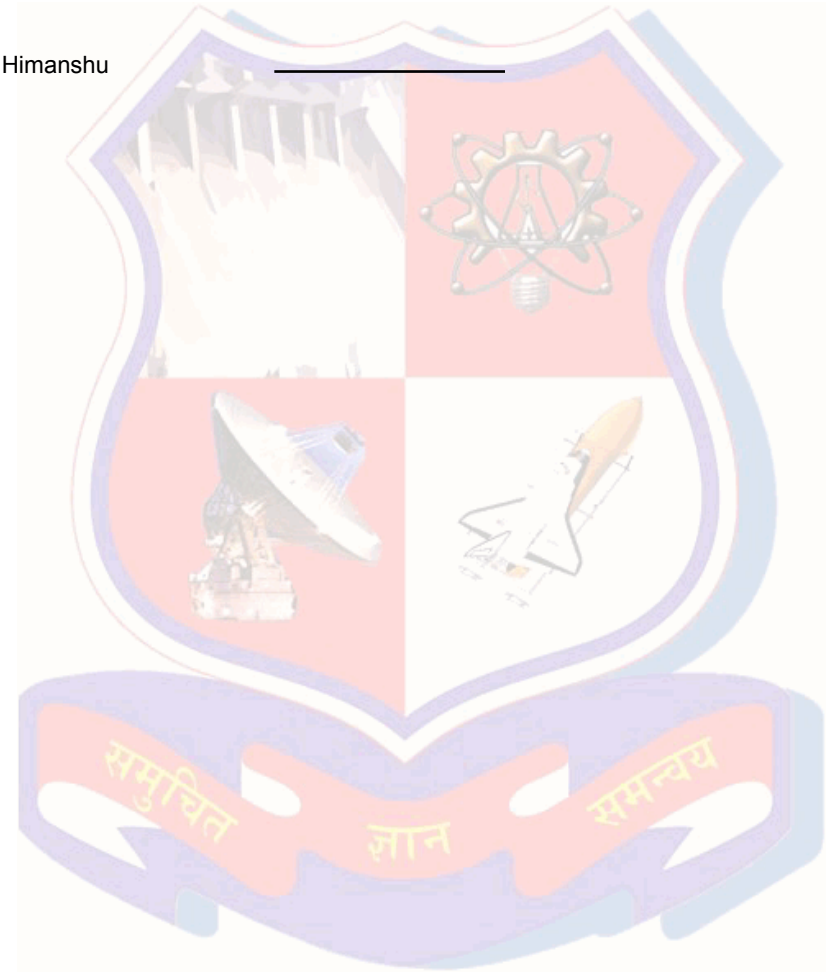
Not required

## 5. DATE & SIGNATURE

Date: 28-April-2014

**NOTE**: This is just a mock Patent Drafting Exercise (PDE) for semester 8, BE students of GTU. These documents are not to be submitted with any patent office.

| | **Name** | **Sign & Date** |
|---|---|---|
| 1 | Patel Urmilkumar Pravinbhai | _____ |
| 2 | Bhavsar Nirav Narharibhai | _____ |
| 3 | Shah Sagar Nitinkumar | _____ |
| 4 | Patel Deep Himanshu | _____ |




**NOTE**: This is just a mock Patent Drafting Exercise (PDE) for semester 8, BE students of GTU. These documents are not to be submitted with any patent office.

## 6. ABSTRACT OF THE INVENTION

This project work aims to Automate and Monitor the Railway System Using PC. The principle objective of this project is to improve the current train service effectively and efficiently. This project deals to develop a prototype of railway system that function automatically by using microcontroller which can also be monitored and controlled using PC.

In monitoring part with the help of GSM Module we can control Trains various parameter such as Speed, Starting or stopping train, automatically stopping Train at desired station and preventing accidents by stopping trains when they come close to each other from PC. All these controls can be monitored by using VB Application on PC, and then sending data to various trains by GSM Module.

In automation part there is automatic Railway Gate control which is implemented by using two IR Sensor, whenever the Train passes through any IR Sensor Railway Gate will be automatically closed by using stepper motor and opened when train passes through another IR Sensor.

**NOTE**: This is just a mock Patent Drafting Exercise (PDE) for semester 8, BE students of GTU. These documents are not to be submitted with any patent office.

**FORM 3**

**THE PATENTS ACT, 1970**
**(39 OF 1970)**
**&**
**THE PATENTS RULES, 2003**
**STATEMENT AND UNDERTAKING UNDER SECTION 8**

## 1. Declaration

I/We, Patel Urmilkumar Pravinbhai
Bhavsar Nirav Narharibhai
Shah Sagar Nitinkumar
Patel Deep Himanshu

## 2. Name, Address and Nationality of the joint Applicant

**Patel Urmilkumar Pravinbhai (Indian )**
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**Patel Deep Himanshu (Indian )**
14/1 geetangli society, chikuwadi jetalpur road, vadodara 390007

hereby declare:

(i) that I/We have not made any application for the same/substantially the same invention outside India.

(ii) that the right in the application(s) has/have been assigned to,

| Name of the Country | Date of Application | Application Number | Status of the Application | Date of Publication | Date of Grant |
|---|---|---|---|---|---|
| *N/A* | *N/A* | *N/A* | *N/A* | *N/A* | *N/A* |

(iii) that I/We undertake that up to the date of grant of patent by the Controller, I/We would keep him inform in writing the details regarding corresponding application(s) for patents filed outside India within 3 months from the date of filing of such application.

Dated this _____day of _____ ,20____

## 3. Signature of Applicants

**NOTE**: This is just a mock Patent Drafting Exercise (PDE) for semester 8, BE students of GTU. These documents are not to be submitted with any patent office.

| (Sign and Date) | (Sign and Date) | (Sign and Date) |
|---|---|---|
| Patel Urmilkumar Pravinbhai | Bhavsar Nirav Narharibhai | Shah Sagar Nitinkumar |

(Sign and Date)
Patel Deep Himanshu

To
The Controller of Patent
The Patent Office, at **Mumbai.**

# Report
Digital signed

Title: RAILWAY AUTOMATION AND MONITORING USING PC
Author: SUN Group
Processing date: Mon, 5.5.2014 6:51:45 CEST

A total of 850 fragments were analysed. As a result 64 fragments (7.5%) were found in other documents. In the document preview below the fragments are marked light blue and clickable.

## Cross reference documents

Following list of found documents is grouped by document titles and ordered by found fragements. With a mouseclick on "x fragments" the relevant fragments in the document are colored blue and the window scrolls to the first location. Click on "x fragments" again resets the special marks.

14 fragments were found in a text with the title: "Rayleigh Distribution Definition", located on:
http://www.cyut.edu.tw/~yangfy/download_data/Assembly_Language/Chap_01_The_8051_microcontrollers.pdf
http://www.b-u.ac.in/syl_college/1011/p47.pdf
http://discovery.bits-pilani.ac.in/discipline/eee/rrsingh/EEE-G512-01.pdf
http://www.b-u.ac.in/syl_college/pg_an28b9.pdf
http://www.karunya.edu/academics/syllabus/ece.pdf
http://www.sscoetjalgaon.com/mandatory/md-part-II-09.pdf
http://www.bput.ac.in/syllabus/bput_mtech_cse_2010.pdf
http://partnerjuarez.com/eclipse/org.eclipse.pde.doc.user_3.0.1.pdf
http://media.wiley.com/product_data/excerpt/40/04706220/0470622040-149.pdf
http://radionicsmagic.com/files/magic_of_radionics.pdf
http://download314.avast.com/files/manuals/user-manual-home-eng.pdf
http://download532.avast.com/files/manuals/user-manual-pro-eng.pdf
http://download812.avast.com/files/manuals/user-manual-pro-eng.pdf
http://download796.avast.com/files/manuals/user-manual-home-eng.pdf
http://download302.avast.com/files/manuals/user-manual-home-eng.pdf
http://www.olimex.cl/tutorial/Tutorial_ARM_rev2.pdf
http://www.sparkfun.com/tutorial/ARM/ARM_Cross_Development_with_Eclipse.pdf
http://files.myopera.com/eketab0/blog/1OReilly.A.plus.Network.plus.Security.plus.Exams.in.a.Nutshel.pdf
http://nptel.iitm.ac.in/courses/Webcourse-contents/IISc-BANG/Microprocessors_and_Microcontrollers/pdf/Lecture_Notes/LNm1.pdf
http://www.perdaman.com/media/7487/sections_1_and_2_-_introduction_and_project_location.pdf
http://www.kesher.org/centennial/documents/KesherIsraelCentennialBrochure.pdf

11 fragments were found in a text with the title: "Stepper motor", located on:
http://en.wikipedia.org/wiki/Stepper_motor

8 fragments were found in a text with the title: "2. Features", located on:
http://www.nxp.com/documents/data_sheet/LPC2131_32_34_36_38.pdf

7 fragments were found in a text with the title: "User manual", located on:
http://www.nxp.com/documents/user_manual/UM10120.pdf

4 fragments were found in a text with the title: "1. General description 2. Features LPC2292/LPC2294 16/32-bit ARM microcontrollers; 256 kB ISP/IAP flash with", located on:
http://www.eng.auburn.edu/~nelson/courses/elec5260_6260/lpc2292.lpc2294.pdf

4 fragments were found in a text with the title: "Explore the Performance of the ARM Processor Using JPEG", located on:
http://www.enggjournals.com/ijcse/doc/IJCSE10-02-01-03.pdf

2 fragments were found in a text with the title: "Sensor based real-time mechatronic control of computer integrated manufacturing", located on:
http://researchspace.ukzn.ac.za/xmlui/bitstream/handle/10413/298/Kumile_CM_2008thesis.pdf?sequence=1

2 fragments were found in a text with the title: "Control of Fuel Cells", located on:
http://ntnu.diva-portal.org/smash/get/diva2:122424/FULLTEXT01

2 fragments were found in a text with the title: "Eagle (program)", located on:
http://en.wikipedia.org/wiki/Eagle_(program)

2 fragments were found in a text with the title: "Rate of convergence of the Swendsen-Wang dynamics in image segmentation problems : a theoretical and experimental study", located on:
http://archive.numdam.org/ARCHIVE/PS/PS_1997__1_/PS_1997__1__259_0/PS_1997__1__259_0.pdf

2 fragments were found in a text with the title: "Three-Tier Distribution Architecture, Page 1 of 4", located on:
http://www.cs.wustl.edu/~schmidt/PLoP-96/hirschfeld.ps.gz

2 fragments were found in a text with the title: "Abstract /TR-2007-12.pdf", located on:
http://www.site.uottawa.ca/eng/school/publications/techrep/2007/TR-2007-12.pdf

2 fragments were found in a text with the title: "Exploring large coherent spin systems with solid state NMR", located on:
http://dspace.mit.edu/bitstream/handle/1721.1/34432/70684104.pdf?sequence=1

1 fragment found in a text with the title: "filament chip : implementing embedded networks", located on:
http://dspace.mit.edu/bitstream/handle/1721.1/46249/42278264.pdf?sequence=1

1 fragment found in a text with the title: "ABSTRACT Low-Power Color TFT LCD Display for Hand-Held Embedded Systems", located on:
http://nesl.ee.ucla.edu/pw/ee202a/dpm_lcd.pdf

1 fragment found in a text with the title: "To our customers, Old Company Name in Catalogs and Other Documents", located on:
http://documentation.renesas.com/eng/products/mpumcu/62teds.pdf
http://documentation.renesas.com/eng/products/mpumcu/rej03b0032_32c82ds.pdf
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1 fragment found in a text with the title: "Data Connection Limited", located on:
http://www.metaswitch.com:80/download/mplsprotwp2.pdf?dcredir=true

1 fragment found in a text with the title: "Real-Time Automization of Irrigation system for Social Modernization of Indian Agricultural System", located on:
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http://cephis.uab.es/resources/pdf/papers/JCRA_2005_Wlancam.pdf

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1 fragment found in a text with the title: "Framework for livestock policy development in South Korea", located on:
http://idl-bnc.idrc.ca/dspace/bitstream/10625/3683/1/33122.pdf
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1 fragment found in a text with the title: "Malaysian Perspective: Designing Interactive Multimedia Learning Environment for Moral Values Education", located on:
http://www.ifets.info/journals/7_4/14.pdf

1 fragment found in a text with the title: "Titration by datA Locus in the Bacterial Choromosome", located on:
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http://myriadstore.sics.se/docs/mstorethesis.pdf

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1 fragment found in a text with the title: "A framework for complaints and suggestions management system (CSMS) and e-CSMS", located on:
http://eprints.utm.my/6146/1/SalwanaMohamadMFSKSM2007TTT.pdf

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http://eprints.uthm.edu.my/1007/1/24_Pages_from_QUALITY_OF_SERVICE_PERFORMANCES_OF_THREE_MOBILE_AD_HOC_NETWORK_PROTOCOLS.pdf

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1 fragment found in a text with the title: "Consultant Team", located on:
http://www.transportation.njit.edu/nctip/final_report/brownfieldsreport.pdf

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1 fragment found in a text with the title: "Determining durations for right-of-way acquisition and utility adjustment on highway projects", located on:
http://repositories.lib.utexas.edu/bitstream/handle/2152/6628/sohnt34801.pdf?sequence=2

1 fragment found in a text with the title: "Ethnicity amongst second generation Sikh girls: a case study in Nottingham", located on:
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1 fragment found in a text with the title: "Northern bluefin tuna", located on:
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1 fragment found in a text with the title: "1 Introduction Fundamentals of Decentralized Optimization in Autonomic Systems", located on:
http://www.cs.unibo.it/self-star/papers/tot.pdf

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1 fragment found in a text with the title: "Ontwerp van intelligente aanstuurcircuits in een hoogspanningstechnologie voor het minimaliseren van het vermogenverbruik in bistabiele beeldschermen", located on:
https://biblio.ugent.be/input/download?func=downloadFile&fileOId=490865&recordOId=470744

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1 fragment found in a text with the title: "SUMMER UNDERGRADUATE FELLOWSHIPS IN SENSOR TECHNOLOGIES", located on:
http://www.ese.upenn.edu/~sunfest/pastProjects/TechReports/TR-CST12SEP08.pdf

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http://repository.tudelft.nl/assets/uuid:93b98564-0839-4ac1-9f2f-361b8e811e9d/ooms_20081128.pdf

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http://fs.gallup.unm.edu//Vasantha-Book10.pdf

1 fragment found in a text with the title: "Floor Fields for Tracking in High Density Crowd Scenes", located on:
http://longwood.cs.ucf.edu/~vision/papers/TrackingInCrowds_ECC2008.pdf

1 fragment found in a text with the title: "Labor Market Segmentation in Vietnam - survey Evidence", located on:
http://www.eaber.org/intranet/documents/42/1977/CIEM_Nguyen_2005.pdf

1 fragment found in a text with the title: "Integrating natural language processing with FlyBase curation", located on:
http://psb.stanford.edu/psb-online/proceedings/psb07/karamanis.pdf

1 fragment found in a text with the title: "High-Level Object-Oriented Program Language for Mobile Microrobot Control", located on:
http://topcat.iit.bme.hu/~urbi/publ/urbi10_ines03.pdf
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1 fragment found in a text with the title: "Cap mòbil amb tecnologia led RGBW controlat per DMX", located on:
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1 fragment found in a text with the title: "Diseño Y Construccion De Un Inversor Monofasico Tipo Puente De Control De Frecuencia Y Modulacion De Ancho De Pulso (Pwm)", located on:
http://www.dspace.espol.edu.ec/bitstream/123456789/3029/1/5546.pdf

1 fragment found in a text with the title: "Sistem Monitoring Catu Daya (SIMONICA)", located on:
http://repository.usu.ac.id/bitstream/123456789/11832/1/09E00071.pdf

1 fragment found in a text with the title: "http://people.ee.duke.edu/~mbrooke/Thesis/youngjoong.pdf /youngjoong.pdf", located on:
http://people.ee.duke.edu/~mbrooke/Thesis/youngjoong.pdf

1 fragment found in a text with the title: "Chapter IX A Content-Based Approach to Medical Image", located on:
http://www.dcs.warwick.ac.uk/people/research/Chia-Hung.Wei/06Book.pdf

1 fragment found in a text with the title: "Helper Threads via Virtual Multithreading On An Experimental Itanium 2 Processor-based Platform", located on:
http://www-users.cs.umn.edu/~zhai/courses/5980/readings/lec2/helper.pdf

1 fragment found in a text with the title: "From the ground up : an agent-based model of regional structural change", located on:
http://library2.usask.ca/theses/available/etd-10262005-121704/unrestricted/From_the_Ground_Up.pdf

1 fragment found in a text with the title: "Diseño e implementación de un prototipo electrónico para el conteo automático de personas, con servicios de comunicación remota y gestión de avisos audibles para las unidades de transporte de servicio público", located on:
http://repositorio.espe.edu.ec/bitstream/21000/262/6/T-ESPE-021753.pdf

1 fragment found in a text with the title: "Product Number Output Voltage Tolerance Package Operating Temperature", located on:
http://www.fairchildsemi.com/ds/LM/LM7805.pdf

1 fragment found in a text with the title: "Art Unlimited: an investigation into contemporary digital arts and the free software movement", located on:
http://eprints.mdx.ac.uk/4963/1/ChunLeeThesis.pdf

1 fragment found in a text with the title: "Prediction of not-yet-synthesized solids at extreme pressures, and the development of algorithms for local optimization on ab-initio level", located on:
http://elib.uni-stuttgart.de/opus/volltexte/2007/2894/pdf/thesis_fwv.pdf

1 fragment found in a text with the title: "AMIC Study Seminar on Development Communication : Singapore, April 22-29, 1976 : [summary]", located on:
http://dr.ntu.edu.sg/bitstream/handle/10220/157/AMIC_1976_04_18.pdf?sequence=1

1 fragment found in a text with the title: "Class Mutation: Mutation Testing for Object-Oriented Programs", located on:
http://www-users.cs.york.ac.uk/~jac/papers/ClassMutation.pdf

1 fragment found in a text with the title: "OER Discipline-Specific Sources", located on:
http://www.nongnu.org/fhsst/fhsstmaths.pdf

1 fragment found in a text with the title: "The effects of web 2.0 on interaction design in a web design company : case study: Satama Interactive", located on:
https://publications.theseus.fi/bitstream/handle/10024/10512/Kuikkaniemi, Kalle.pdf?sequence=2

1 fragment found in a text with the title: "Confronting Confucian Understandings of the Christian Doctrine of Salvation : A systematic theological analysis of the basic problems in the Confucian-Christian dialogue", located on:
http://www.doria.fi/bitstream/handle/10024/3053/confront.pdf?sequence=3

1 fragment found in a text with the title: "Millennial Students Relationship with 2008 Top 10 Social Media Brands via Social Media Tools", located on:
http://etd.ohiolink.edu/send-pdf.cgi/Agozzino%20Alisa%20L.pdf?bgsu1262651087
http://etd.ohiolink.edu/send-pdf.cgi/Agozzino Alisa L.pdf?bgsu1262651087

Subsequent the examined text extract:

# RAILWAY AUTOMATION AND MONITORING USING PC

A PROJECT REPORT

***Submitted by:***

**PATEL URMIL P (100050111007)**
**BHAVSAR NIRAV N (100050111015)**
**SHAH SAGAR N (100050111025)**
**PATEL DEEP H (100050111039)**

***In partial fulfillment for the award of the degree***

***of***

**BACHELOR OF ENGINEERING**

***in***

**(ELECTRONICS & COMMUNICATION)**

**Group No: 45**

**Internal Guide:**
Mr. Naitik Kapadia
Professor
E & C Dept.,
BIT-Varnama.

**External Guide**:
Mr. Biju Antony
Senior Engineer,
Techno Weigh Systems
Vadodara.

**BITS Edu Campus, Varnama 391240**

**Gujarat Technological University, Ahmedabad**

**May, 2014**