Project Synopsis

on

"Intelligent Railway Security System with Energy Conservation "

Submitted in partial fulfillment of the requirement for the degree of

Bachelors of Engineering by:

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Prathamesh Chavan
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Under the guidance of
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LOKMANYA TILAK COLLEGE OF ENGINEERING
Affiliated to
UNIVERSITY OF MUMBAI

Department of Electronics & Telecommunication Engineering

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LOKMANYA TILAK COLLEGE OF ENGINEERING

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Department of Electronics & Telecommunication Engineering

Synopsis

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Course: B.E.(Electronics & Telecommunication Engineering)

Title of project: Intelligent Railway Security System with Energey Conservation

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Date:

“CERTIFICATE”

This to certify that **Anoop Chauhan, Ashish Pandey, Prathamesh Chavan, Zeeshan haider**, have delivered seminar for Project Stage- I on **‘Intelligent Railway security System with Energy Conservation ’**on , 29th Oct 2021 and submitted a report in the , Lokmanya Tilak College of Engineering, Navi Mumbai for the partial fulfilment of the degree of B.E in “ Electronics and Telecommunication Engineering” from University of Mumbai, for the year 2021-22.

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We also take this opportunity with great pleasure to thank our Principal **Dr.Vivek Sunnapwar** whose timely support and encouragement has helped us succeed in our venture.

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“ABSTRACT”

Over 2000 people died in 93 train accidents in year 2012 -2013,the cause of these accidents varies from human error to the derailment o trains, in this project we are focusing upon security of the passengers. we have designed a system that detects track in the railway track as well as overhead wires which are running at 25000 volts ,we have provided a protection for workers in tunnel as well as power saving mode in the tunnel. using rail as a medium for communication between motor men and guard for preventing major accidents . This is security based project is still not implemented in India , but it is partially implanted in metro rail , So there is lots of market scope for this project in not only in India also In Asia .the system track break detector is not implemented on any track so manual (gang man) effort are required ,which is less reliable and economically unsafe also

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Chapter 1

INTRODUCTION

Indian Railways (reporting mark IR) is a state owned national transporter, and responsible for rail transport in India. It is owned and operated by the Government of India through the Ministry of Railways. As we know, the Railways provide the cheapest and most convenient mode of passenger transport for both long distance and suburban traffic. Although Indian Railways have progressed a lot, both quantitatively and qualitatively, during the last few years, the system is still facing with a number of problems which require attention. The first passenger train in India ran between Bombay (Bori Bunder) and Thane on 16 April 1853.

The 14-carriage train was hauled by three steam locomotives: Sahib, Sindh, and Sultan. This was also the first railway bridge in India. Mumbai Suburban Railway consists of exclusive inner suburban railway lines augmented by commuter rail on main lines serving outlying suburbs to serve the Mumbai Metropolitan Region. Spread over 465 kilometres (289 mi), the suburban railway operates 2,342 train services and carries more than 7.5 million commuters daily. By annual ridership (2.64 billion), the Mumbai Suburban Railway is one of the busiest commuter rail systems in the world and it has some of the most severe overcrowding in the world.

IR carried 8.107 billion passengers (more than 22 million passengers per day), transported 1.101 billion tons of freight, and had 7,216 stations.The basic objective of this project is to develop an automation system which is used to find the detection of cracks in the railway networks. In 2011, IR carried over 8,900 million passengers' annually or more than 24 million passengers daily and 2.8 million tons of freight daily. To demonstrate the gravity of the problem, official statistics say that there have been 14 accidents in 2011 15 accidents in 2012. On further analysis of the factors that cause these rail accidents, recent statistics reveal that approximately 90 percent are due to cracks on the rails either due to natural causes (like high expansion due to heat, water floods) or due to antisocial elements and 10 percent are due to signal and gate operation during crossing and due to bomb. So in this proposed model we are giving the solution for the security of train. Our design is based on automation system of digitallogics i.e binary 0 and 1

Chapter 2

BLOCK DIAGRAM

2.1 Intelligent Railway Security System with Energy Conservation

2.1.1 Platform create and discreate

Suppose a path is created and train is coming then sensor will detect that train which will give RED signal to that train and the train will stop. Many of the Indian Railways has creating a problem for the handicapped person means they are not providing any facilities for the handicapped. So we are giving some kind of facility for handicapped with the help of embedded technology or we can give facility for senior citizen as well. In this application the RF Transmitter and receiver is given to the handicapped passenger and the school student as soon as they press it, a path is created between the two platforms. In case if the train has already arrived then the path will not open between the two platforms even if the RFTX/RX is pressed.

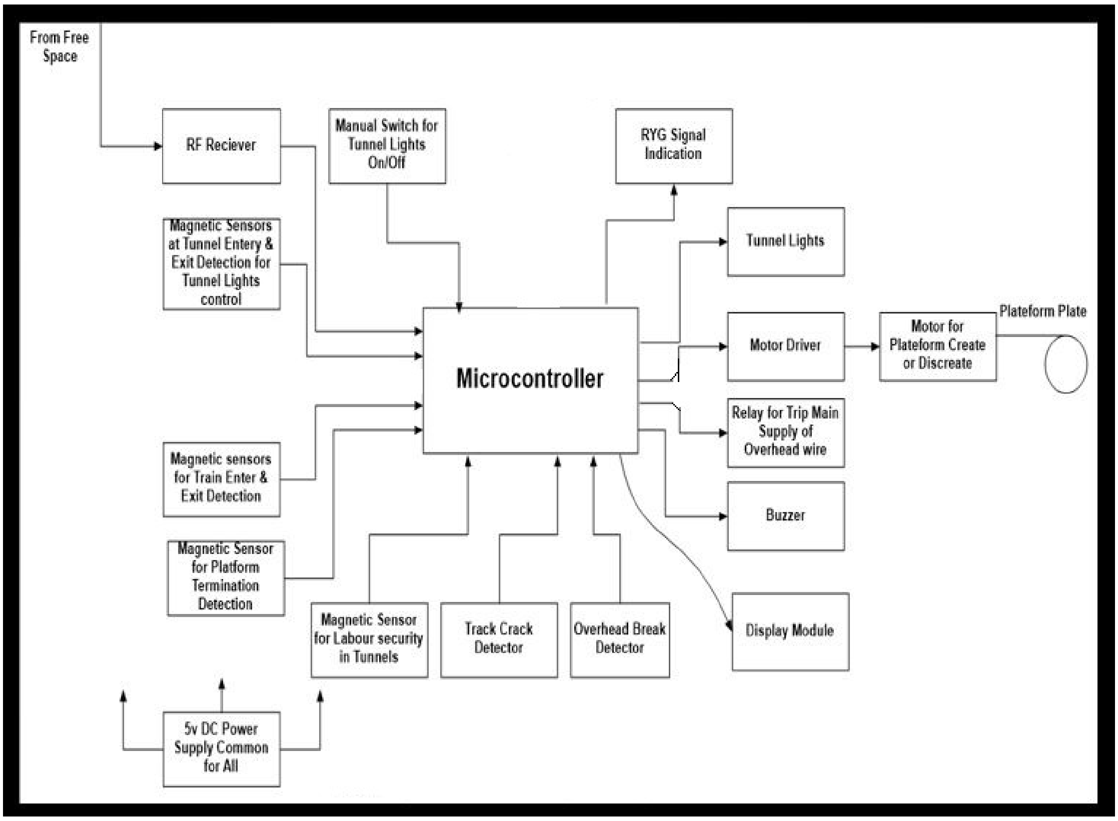


Figure 2.1: Intelligent Railway security System with Energy Conservation

2.1.2 Track crack Detection

If there is no crack in the track between two stations the voltage across both the wires from each station should be 0 volts.However, if there is a crack between the tracks then one of the wires from station is raised high and other is low. These signals are compared and they are given to microcontroller and micro controller gives output and sends message to the operator.

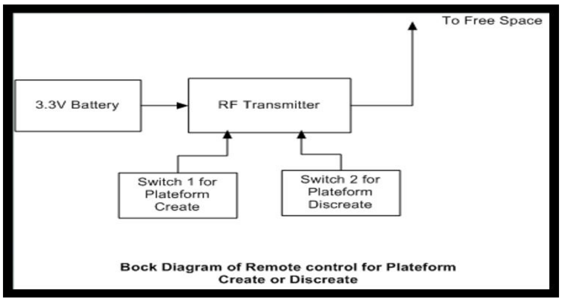


Figure 2.2: Platform create and discreate

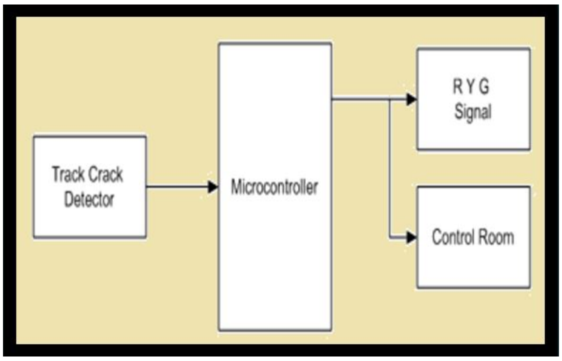


Figure 2.3: Track Crack detection

2.1.3 Overhead wire break Detection

As shown in above Figure we can detect the overhead wire breaking. Pin P1.0 of the microcontroller is set to Logic 0 by Programming, because externally it connected to the overhead wire which having a supply of 5V. So that P1.0 pin is at Logic 1 at a normal condition. Figure B. shows the condition of breaking the overhead wire. As the wire breaks, then the pin P1.0 get to the Logic 0 state, which was set by programming. Therefore, that microcontroller will understand the changes in status of pin P1.0.Broken-conductor detection is challenging becausethe conductor may remain suspended without causing any fault current.

Even if the conductor falls to the ground, the fault current might remain low, depending on the fault resistance. For lowresistance faults, a relay can detect faults and trip the line breakers. However, because the relay cannot determine whether the fault is permanent, it may attempt to reclose, causing further stress

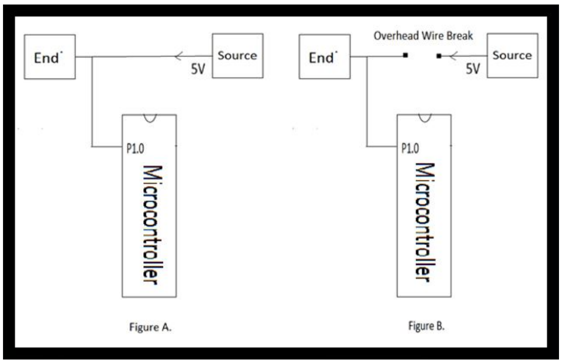


Figure 2.4: Overhead wire break Detection

to the power system. This paper describes a new algorithm that uses only single-ended measurements to reliably detect broken conductors and estimate their location by using the charging current of the line. The phase angle of this current leads the voltage by about and the magnitude is a function of line length.

This method is suitable for power lines that have measurable charging current, and it detects broken conductors successfully if the relay can measure the charging current while the conductor is falling in midair. Broken-conductor detection can be used to trip the breakers before the conductor touches the ground and creates a shunt fault. Thus, the algorithm can prevent such faults and block any attempt to reclose the line. Detecting broken conductors and their location information provided by the algorithm can help in quickly resolving broken-conductor faults. This paper presents three field events from 57.1 kV and 220 kV lines and results from Electromagnetic Transients Program (EMTP) simulations that validate the algorithm.

2.1.4 Power saving inside the Tunnels

Road tunnel lighting is one of the most complex problems in electrical lighting. The high impact of lighting in safety is even more important when dealing with tunnels because of different eventualities. There are three main kinds of problems that can arise when dealing with tunnel lighting Maintenance problems, like replacement of lamps, effects of pollution on luminaries, road and walls

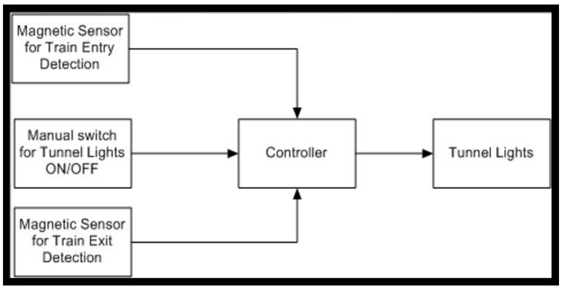


Figure 2.5: Power Saving inside the Tunnel

Psychological problems that concern the lack of attention from the side of the driver. This lack of attention may arise due to different factors such as flickering, effect of bright or dark cells (leading to claustrophobia) and many other.

Physiological problems, like visual adaptation and other that are not well understood yet. One of the most important is melatonin suppression and its impact on the human circadian system. The absolute and spectral sensitivities to light by the human circadian system are behind of many alterations and disorders on the health of people exposed to high levels of illuminance during night time. It is a well-know fact that melatonin is released only during night time and the exposure to light above a given threshold can suppress this release thus breaking the circadian rhythm.

The spectral composition of the light sources used for lighting during nigh time, specially for very long road tunnels, must be carefully chosen in order to avoid this kind of distortions that may lead to serious physiological consequences . Most of these problems can be solved by means of an accurate lighting, specially during daytime, that help the driver to get adapted to the levels of luminance inside the tunnels with no negative effect.The achievement of such lighting requires permanent working of quite powerful luminaries or projectors whose consumption trough the year can be extremely high in both economical and environmental terms.These high costs are especially dramatic in the so called “threshold zone” of the tunnel, which is the first one immediately after the gate and, hence, the most consuming one for evident reasons of visual adaptation during daytime

2.1.5 Labour Security inside the Tunnels

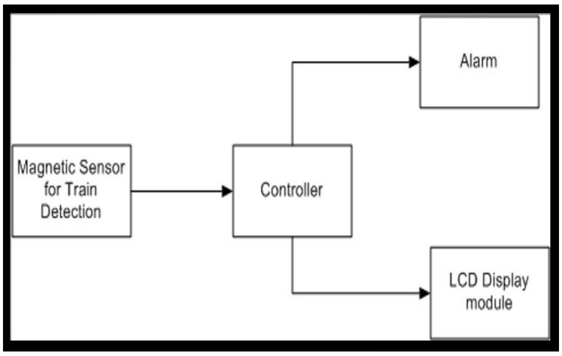


Figure 2.6: Labour Security Inside the Tunnels

There will be a magnetic sensor place outside the tunnel to detect whether train is coming or not. Suppose, If the train is coming the magnetic sensor place outside the tunnel will detect the train and it will pass the signal to the Controller module. The controller module will give the output to the two component place as the output from the controller i.e. a buzzer which will act as a Alarm and a Display module. The signal from controller will be given as the output to buzzer and LED display. The buzzer will start ring and the display will display the message that the train is arriving, so that the labour working inside the tunnnel will be alerted, to stop the work.

Chapter 3

Circuit DIAGRAM

3.1 Introduction to Circuit Diagram

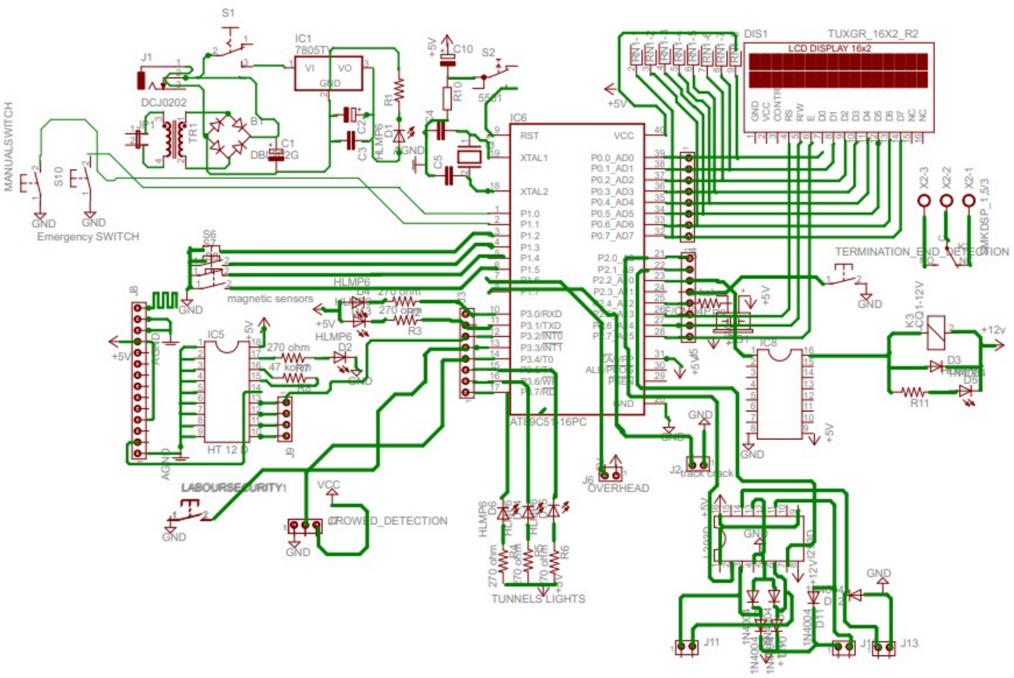


Figure 3.1: Circuit Diagram

3.1.1 Block Diagram Discription

- **UART communication :** In UART communication, two UARTs communicate directly with each other. The transmitting UART converts parallel data from a controlling device like a CPU into serial form, transmits it in serial to the receiving UART, which then converts the serial data back into parallel data for the receiving device. Only two wires are needed to transmit data between two UARTs. Data flows from the TX pin of the transmitting UART to the Rx pin of the receiving UART.

- **8051 Microcontroller :** The Intel 8051 is an 8-bit microcontroller which means that most available operations are limited to 8 bits. There are 3 basic "sizes" of the 8051: Short, Standard, and Extended. The Short and Standard chips are often available in DIP (dual in-line package) form, but the Extended 8051 models often have a different form factor, and are not "drop-in compatible". All these things are called 8051 because they can all be programmed using 8051 assembly language, and they all share certain features (although the different models all have their own special features). Some of the features that have made the 8051 popular are:

- i. 4 KB on chip program memory.
- ii. 128 bytes on chip data memory(RAM)
- iii. 32 bytes devoted to register banks
- iv. 16 bytes of bit-addressable memory
- v. 80 bytes of general-purpose memory
- vi. 4 reg banks.
- vii. 128 user defined software flags.
- viii. 8-bit data bus
- ix. 16-bit address bus
- x. 16 bit timers (usually 2, but may have more, or less).

- xi. 3 internal and 2 external interrupts.
- xii. Bit as well as byte addressable RAM area of 16 bytes.
- xiii. Four 8-bit ports, (short models have two 8-bit ports).
- xiv. 16-bit program counter and data pointer.
- xv. 1 Microsecond instruction cycle with 12 MHz Crystal.
- **16x2 LCD :** A 16X2 LCD has two registers, namely, command and data. The register select is used to Switch from one register to other. RS=0 for command register, whereas RS=1 for data register.
- **Command Register :** The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to d o a predefined task like initializing it, Clearing its screen, setting the cursor position, controlling display etc. Processing for commands happen in the command register.
- **Data Register:** The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. When we send data to LCD it goes to the data register and is processed there. When RS=1, data register is selected.
- **Buzzer :** A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices timers, and confirmation of user input such as a mouse click or keystroke.

- **Power supply :** A power supply is an electrical device that supplies electric power to an electrical load. The primary function of a power supply is to convert electric current from a source to the correct voltage, current, and frequency to power the load. As a result, power supplies are sometimes referred to as electric power converters. Some power supplies are separate standalone pieces of equipment, while others are built into the load appliances that they power.

  Examples of the latter include power supplies found in desktop computers and consumer electronics devices. Other functions that power supplies may perform include limiting the current drawn by the load to safe levels, shutting off the current in the event of an electrical fault, power conditioning to prevent electronic noise or voltage surges on the input from reaching the load, power-factor correction, and storing energy so it can continue to power the load in the event of a temporary interruption in the source power (uninterruptible power supply).

3.1.2 Six Major Applications Used in Circuit

- The handicapped passenger, school student, senior citizen and pregnant women are not able to cross the bridge while moving from one platform to another due to crowd and rush of people at bridge where they are unable to cross comfortably.
- Another problem is of the track crack detection, wherein the motorman does not come to know about the crack thereby leading to accident.
- The workers who are working in tunnels are not aware about the trains which are coming from both side, and due absence of communication with the train they are prone to accidents.
- 4. Saving of power is very important for developing nation like India where there is acute power shortage and hence it very much important to save power in trains/tunnels, like for example unnecessarily the lights and fans are continuously ON in trains and light being ON in tunnels.
- One of the problem is of the overhead wire because of some issue the overhead wire breaks and it leads to the accidents and major of the people die because of sure severe accidents.
- There are so much crowd and rush on the bridge and therefore the passengers falls ,there is no such system which will measure the density of the crowd and it will not allow the people to enter in to the bridge and there is a lack of emergency rescue button because if people face any sort of harm or if they are in trouble there is no such a facility provided so that they can take help from the control room.

Chapter 4

PROJECT HARDWARE

4.0.1 Listing of Components

- Microcontroller ATMEL 89c52
- LCD 16 x 2
- IR Module
- Buzzer
- 5V Relay
- Magnetic Sensor
- LED
- Push to ON Switch
- Motor Driver L293D
- Motor
- DVD Player for platform create and de-create
- HT12D/B544G1106G2 - IC
- HT12E/B212B5014-1 - IC

4.0.2 Cost of Component used in circuit

Sr.no.	Components	Values	Quantity	Cost
	MAIN COMPONENTS PCB			
1	MICROCONTROLLER with UART	89c51	1	310
2	Crystal Ceramic Capacitor (c1,c2)	11.0592Mhz	2	20
3	Electrolytic Capacitor	10uf / 63v	2	20
4	Electrolytic Capacitor	470uf / 25v	1	10
5	Box Capacitor	0.1uf	1	10
6	Pullup register	4.7 kohm	1	15
7	Register	8.2 kohm	1	8
8	Reset Switches	Push	1	15
9	Power Switches	Toggle	1	10
10	DC Jack connector female		1	20
11	Regulator IC	7805	1	30
12	UART		1	25
13	LCD CKT	16*2	1	400
14	40 pin IC Base		1	30
15	16 pin IC Base		2	40
16	**POWER SUPPLY PCB**			
17	Regulator Ic	7805	1	30
18	Electrolytic Capacitor	10uf / 63v	2	20
19	Electrolytic Capacitor	470uf / 25v	1	10
20	Box Capacitor	0.1uf	1	3
21	Power Switches	Toggle	1	10
22	DC Jack connector female		1	20
	ANALOG SIGNAL PCB			
23	Buzzer	+5v	1	20
24	Single Relay			
	i) 1 Relay	+5v DC	1	15
	ii) Transistor	BC 557 B	1	8
	iii) Diode	1N4007	1	6
	iv) Register for LED	270 ohm	1	4
	v) Register	1 kohm	1	4
	vi)LED		1	8
			Total	Rs.1,121

4.1 Description of Components :

4.1.1 Power Supply

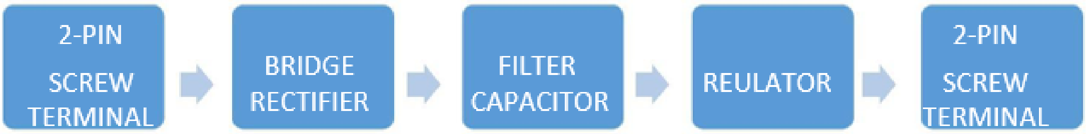


Figure 4.1: Power Supply

- **CONNECTOR:** 2-PIN Screw terminal is basically a connector used to interface power supply section with other circuits through wires i.e. wires are inserted in connectors.
- **BRIDGE RECTIFIER:** W10 full wave bridge rectifier is used to convert incoming AC signals into varying DC signals i.e. it consists of ripple at the output. As a result, varying DC signal is not suitable for electronic circuits unless they include a smoothing capacitor.
- **FILTER CAPACITOR:** Filter Capacitor of 2200uf at output bridge rectifier is used to provide less ripple at the output which is suitable for most electronic circuits. But their output is not regulated hence we are using regulator at the output side.
- **REGULATOR:** Regulator IC is used to provide constant DC or Smooth output with no ripple. Regulator IC mainly used are 7805, 7809, 7812. 78XX represents positive voltage regulator and last two digits represent output voltage.
- 7805= +5V
- 7809= +9V
- 7812= +12V

There are many types of power supply. Most are designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices. A power supply can be broken down into a series of blocks, each of which performs a particular function.

4.1.2 TRANSFORMER + RECTIFIER

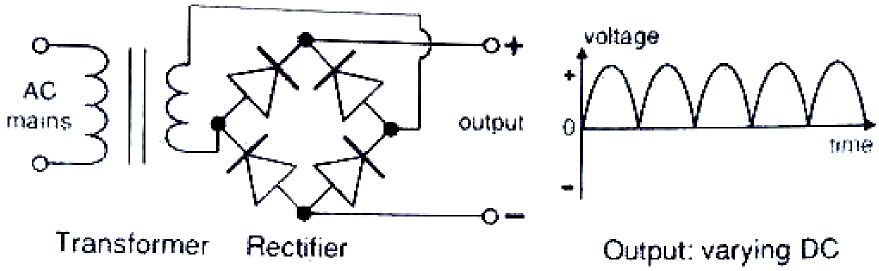


Figure 4.2: Transformer + Rectifier

The varying DC output is suitable for lamps, heaters and standard motors. It is not suitable for electronic circuits unless they include a smoothing capacitor.

4.1.3 TRANSFORMER + RECTIFIER + SMOOTHING

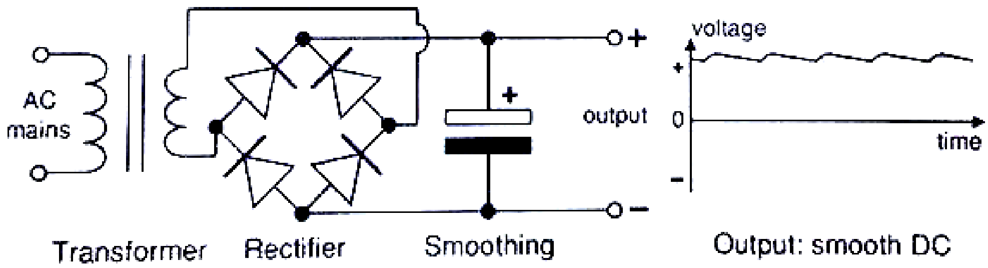


Figure 4.3: TRANSFORMER + RECTIFIER + SMOOTHING

The smooth DC output has a small ripple. It is suitable for most electronic circuits.

4.1.4 TRANSFORMER + RECTIFIER + SMOOTHING + REGULATOR

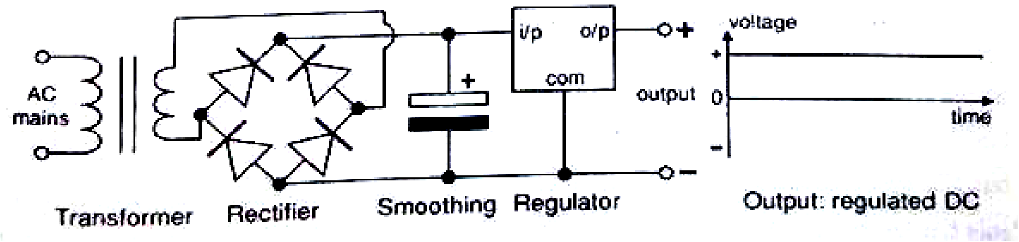


Figure 4.4: TRANSFORMER + RECTIFIER + SMOOTHING + REGULATOR

The regulated DC output is very smooth with no ripple. It is suitable for all electronic circuits.

The fig. above shows the circuit diagram of the power supply unit.

This block mainly consists of a two regulating IC 7805 and a bridge rectified and it provides a regulated supply) approximately 5V.The transformer used in this circuit has secondary rating of 7.W.The main function of the transformer is to step down the AC voltage available from the main. The main connections are given to its primary winding through a switch connected to a phase line.

The transformer provides a 7.5V AC output at its secondary terminals and the maximum current that can be drawn from the transformer is I Amp which is well above the required level for the circuit.The bridge rectified the AC voltage available from the secondary of the transformer, i.e. the bridge rectifier converts the AC power available into DC power but this DC voltage available is not constant. It is a unidirectional voltage with varying amplitude.To regulate the voltage from the bridge rectifier, capacitors are connected. Capacitors Cl filter the output voltage of the rectifier but their output is not regulated and hence 7805 is connected which is specially designed for this purpose.

Although voltage regulators can be designed using op -amps, it is quicker and easier to use IC voltage regulator. Furthermore, IC voltage regulators are available with features such as programmable output current/ voltage boosting, internal short circuit current limiting, thermal shut down and floating operation for high voltage applications.The 78)0C series consists of three terminals via, input, output and ground. This is a group of fixed positive voltage regulator to give and output voltage ranging from 5V to 24V. These IC's are designed as fixed voltage regulators and with adequate heat sinking, can delivery output current in excess of 1 Amp although these devices do not require external components and such components can be used to obtain adjustable voltage and current limiting. In addition, the difference between the input and output voltages (V in VO) called the dropout voltage must be typically 2V even from a power supply filter. Capacitors C2, C3, C4, and C5 are small filters which are used for extra filtering. LEDI and LED2 are used for Power ON indicator for ICI and IC2, current-limiting resistors R2 and R4, which prevents the LED's from getting heated and thus damaged.

4.1.5 MICROCONTROLLER

An embedded microcontroller is a chip which has a computer processor with all support functions (clock and reset). Memory (both program and data) and I/O (including bus interface) built into the device. These built in functions minimize the need for external circuits and devices to be designed in the final application.

The AT89C51 is a low -power, high-performance CMOS 8 -bit microcomputer with 4K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Phillips's high -density nonvolatile memory technology and is compatible with the industry - standard MCS-5 I instruction set and pin out. The on -chip Flash allows the program memory to be reprogrammed in -system or by a conventional nonvolatile memory programmer. By combining a versatile 8 -bit CPU with Flash on a monolithic chip, the Phillips AT89C51 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications.

The AT89C51 is designed with static logic for operation down to zero frequency and supports two Software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port and interrupt system to continue functioning. The Power - down Mode saves the RAM contents but freezes the oscillator disabling all other chip functions until the next Hardware reset.

4.1.6 PIN DIAGRAM OF MICROCONTROLLER

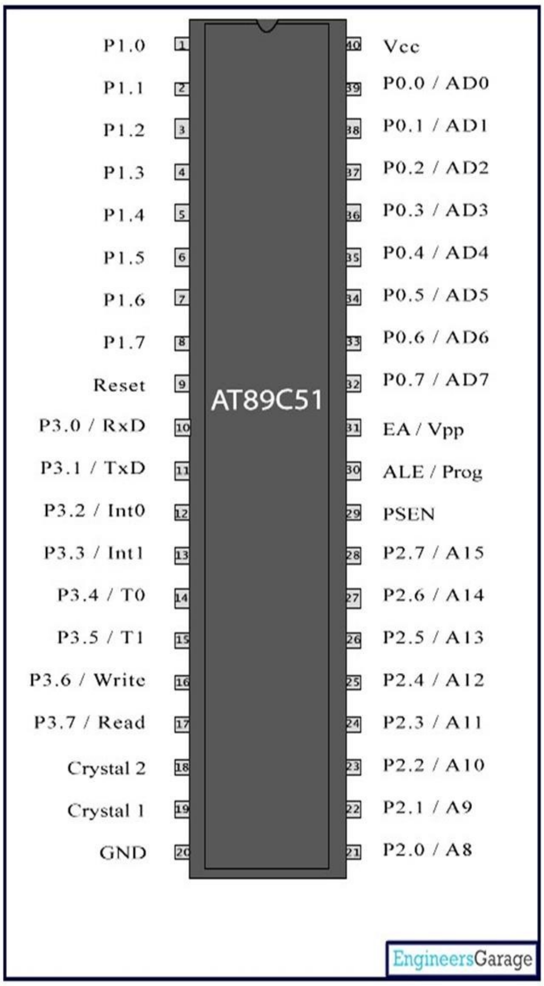


Figure 4.5: PIN DIAGRAM OF MICROCONTROLLER

4.2 ARCHITECHTURE OF 89c51

4.2.1 Features of 89C51

Following is the features of 89C51 microcontroller as per the datasheet given by Phillips- Compatible with MCS-51TM Products

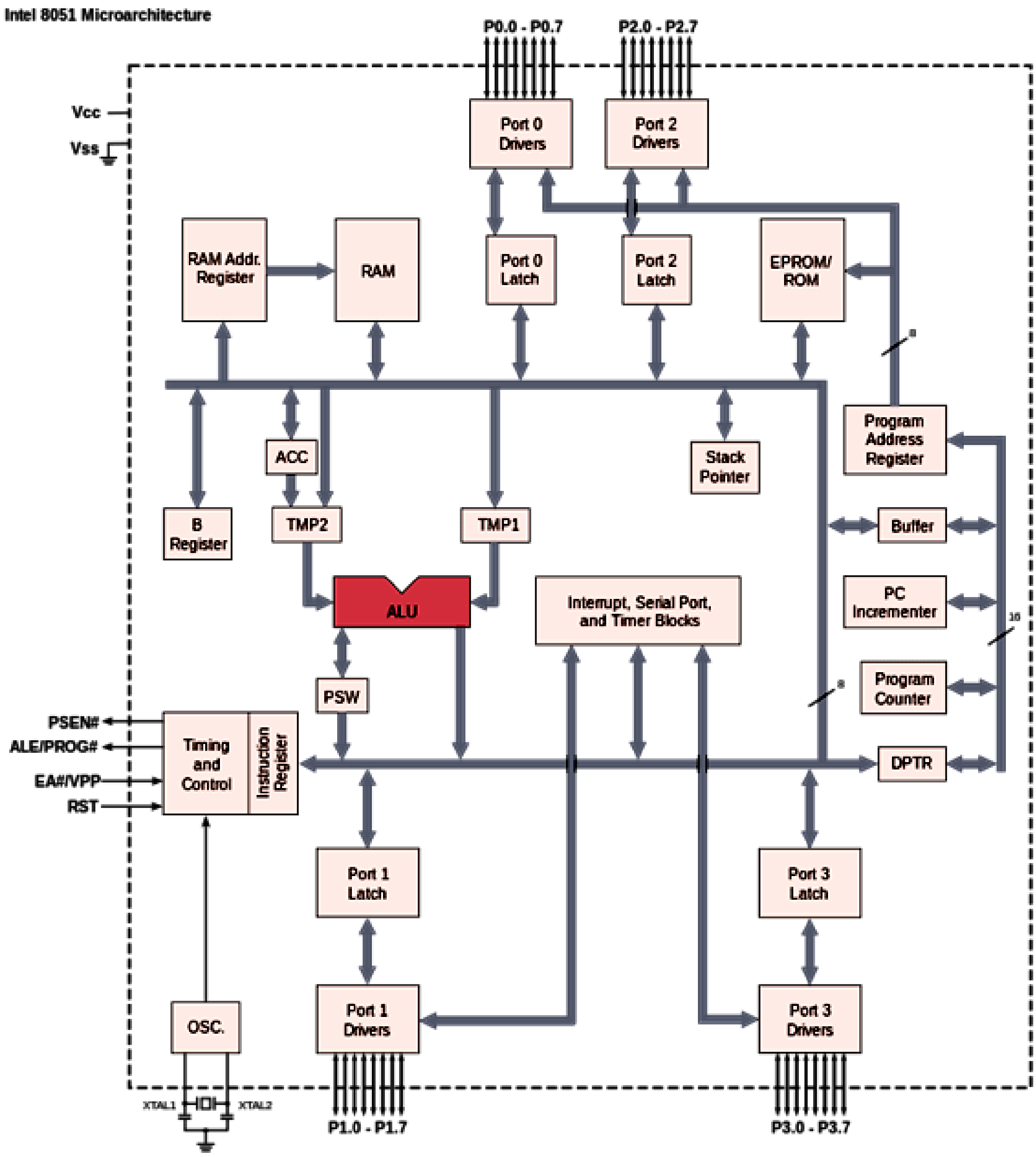


Figure 4.6: Architechture of 89c51

- 4K Bytes of In -System Reprogrammable Flash Memory Endurance: 1,000 Write/Erase Cycles
- Fully Static Operation: 0 Hz to 24 MHz
- Three -level Program Memory Lock
- 128 x 8 -bit Internal RAM
- 32 Programmable I/O Lines
- Two I6 -bit Timer/Counters
- Six Interrupt Sources
- Programmable Serial Channel
- Low -power Idle and Power -down Modes

4.2.2 LCD 16 * 2

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special and even custom characters (unlike in seven segments), animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The command register stores the command instructions given to the LCD. A command is an instruction given to LCD to do a predefined task like initializing it, clearing its screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD. Click to learn more about internal structure of a LCD.

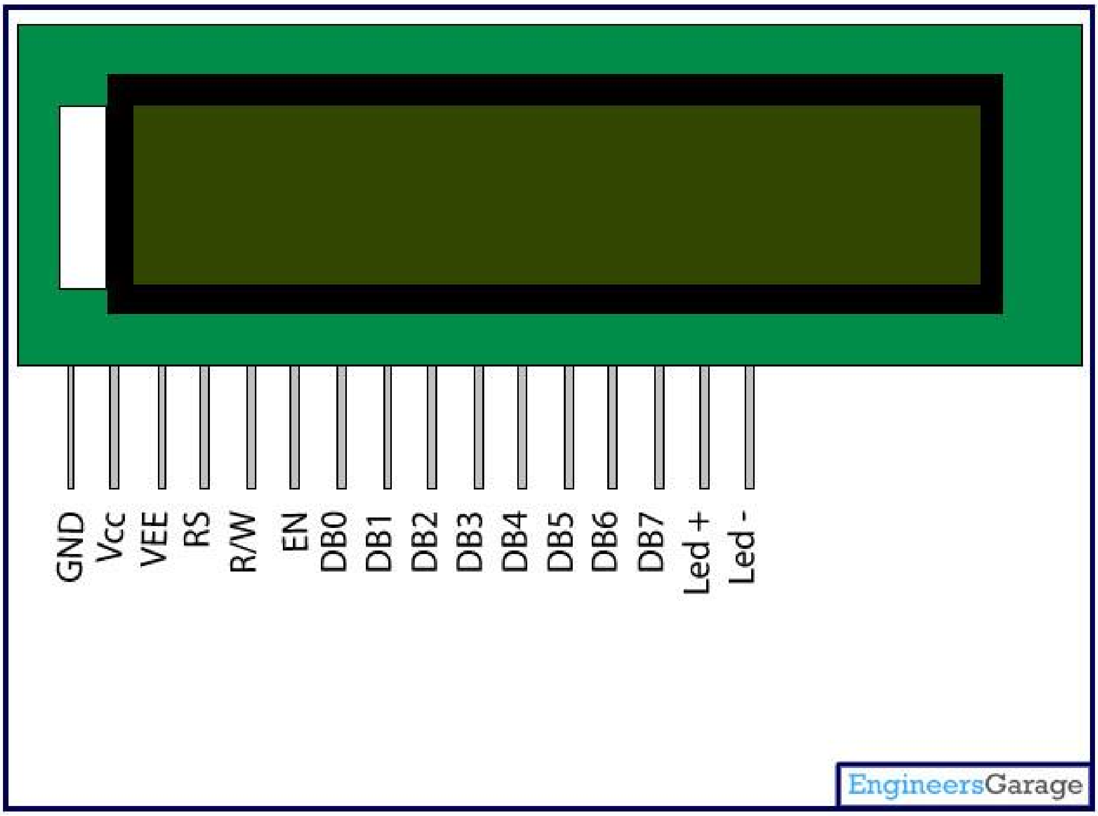


Figure 4.7: LCD

4.2.3 Pin Discription:

Pin No	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	Vcc
3	Contrast adjustment; through a variable resistor	VEE
4	Selects command register when low;and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB0
8	DB1	
9	DB2	
10	DB3	
11	DB4	
12	DB5	
13	DB6	
14	DB7	
15	Backlight VCC (5V)	Led+
16	Backlight Ground (0V)	Led-

4.2.4 Light Emitting Diode

A Light emitting diode (LED) is essentially a pn junction diode. When carriers are injected across a forward-biased junction, it emits incoherent light. Most of the commercial LEDs are realized using a highly doped n and a p Junction.

To understand the principle, let's consider an unbiased pn+ junction n .The depletion region extends mainly into the p-side. There is a potential barrier from Ec on the n-side to the Ec on the p-side, called the built-in voltage, V0. This potential barrier prevents the excess free electrons on the n+ side from diffusing into the p side. When a Voltage V is applied across the junction, the built-in potential is reduced from V0 to V0 – V. This allows the electrons from the n+ side to get injected into the p-side. Since electrons are the minority carriers in the p-side, this process is called minority carrier injection. But the whole injection from the p side to n+ side is very less and so the current is primarily due to the flow of electrons into the p-side.

These electrons injected into the p-side recombine with the holes. This recombination results in spontaneous emission of photons (light). This effect is called injection electroluminescence. These photons should be allowed to escape from the device without being reabsorbed.

4.2.5 The recombination can be classified into the following two kinds

i.Direct recombination:

ii.Indirect recombination Direct Recombination:

- **Direct recombination**:

  In direct band gap materials, the minimum energy of the conduction band lies directly above the maximum energy of the valence band in momentum space energy. In this material, free electrons at the bottom of the conduction band can recombine directly with free holes at the top of the valence band, as the momentum of the two particles is the same. This transition from conduction band to valence band involves photon emission (takes care of the principle of energy conservation). This is known as direct recombination. Direct recombination occurs spontaneously. GA As is an example of a direct band-gap material.

- **Indirect Recombination:**

  In the indirect band gap materials, the minimum energy in the conduction band is shifted by a k- vector relative to the valence band. The k-vector difference represents a difference in momentum. Due to this difference in momentum, the probability of direct electron hole recombination is less.

  In these materials, additional dopants (impurities) are added which form very shallow donor states. These donor states capture the free electrons locally; provides the necessary momentum shift for recombination. These donor states serve as the recombination centers. This is called indirect (non-radiative) Recombination.

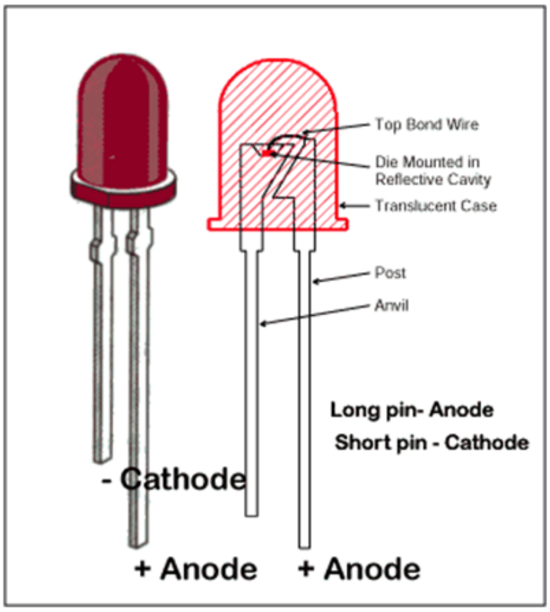


Figure 4.8: LED(Light Emitting Diode)

Chapter 5

PCB Designing

5.0.1 Step no 1

Prepare a layout of the circuit on any commonly used PCB designing software. A layout is a design which interconnects the components according to the schematic Diagram (circuit diagram). Take a mirror image print of the layout on the OHP sheet using a laser printer. Make sure that the design is correct with proper placement of the components.

5.0.2 Step no 2

Cut the copper board according to the size of layout. A copper board is the base of a PCB, it can be single layer, double layer or multi layer board. Single layer copper board has copper on one side of the PCB, they are used to make single layer PCBs, it is widely used by hobbyist or in the small circuits. A double layer copper board consists of copper on both the sides of the PCB. These boards are generally used by the industries. A multilayer board has multiple layers of copper; they are quite costly and mainly used for complex circuitries like mother board of PC.

5.0.3 Step no 3

Rub the copper side of PCB using steel wool. This removes the top oxide layer of copper as well as the photo resists layer if any.

Figure 5.1: PCB Cutting Process

5.0.4 Step no 4

Place the OHP sheet (wax paper) which has the printed layout on the PCB sheet. Make sure that the printed/mirror side should be placed on the copper side of PCB.

5.0.5 Step no 5

Put a white paper on the OHP sheet and start ironing. The heat applied by the electric iron causes the ink of the traces on the OHP sheet to stick on the copper plate exactly in the same way it is printed on the OHP sheet. This means that the copper sheet will now have the layout of the PCB printed on it. Allow the PCB plate to cool down and slowly remove the OHP sheet. Since it is manual process it may happen that the layout doesn't comes properly on PCB or some of the tracks are broken in between. Use the permanent marker and complete the tracks properly.

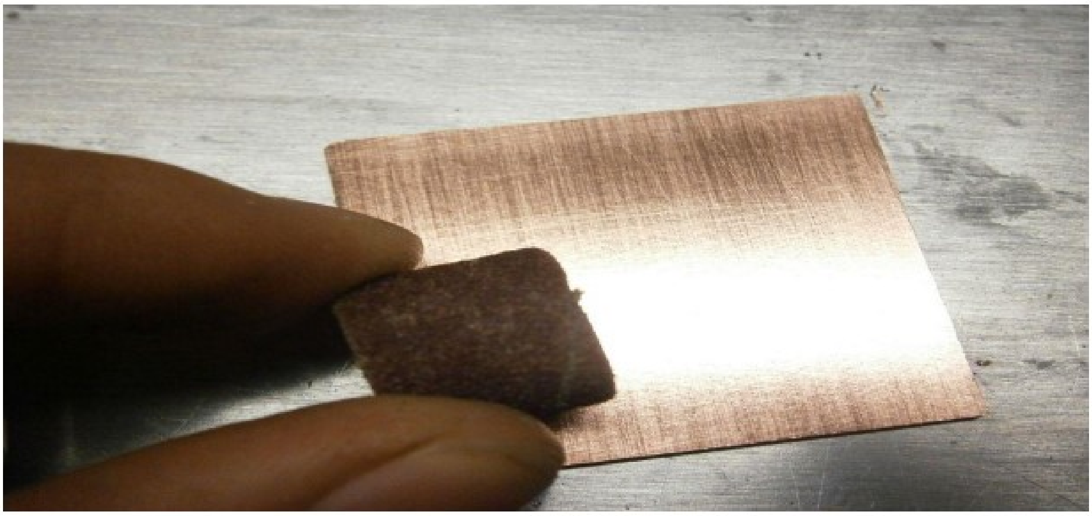


Figure 5.2: PCB Cleaning Process

5.0.6 Step no 6

Now the layout is printed on PCB. The area covered by ink is known as the masked area and the unwanted copper, not covered by the ink is known as unmasked area. Now make a solution of ferric chloride. Take a plastic box and fill it up with some water.Dissolve 2-3 tea spoon of ferric chloride power in the water. Dip the PCB into the Etching solution (Ferric chloride solution, Fecl3) for approximately 30 mins. The Fecl3 reacts with the unmasked copper and removes the unwanted copper from the PCB. This process is called as Etching. Use pliers to take out the PCB and check if the entire unmasked area has been etched or not. In case it is not etched leave it for some more time in the solution.

5.0.7 Step no 7

Take out the PCB wash it in cold water and remove the ink by rubbing it with steel wool. The remaining area which has not been etched is the conductive copper tracks which connect the components as per the circuit diagram.

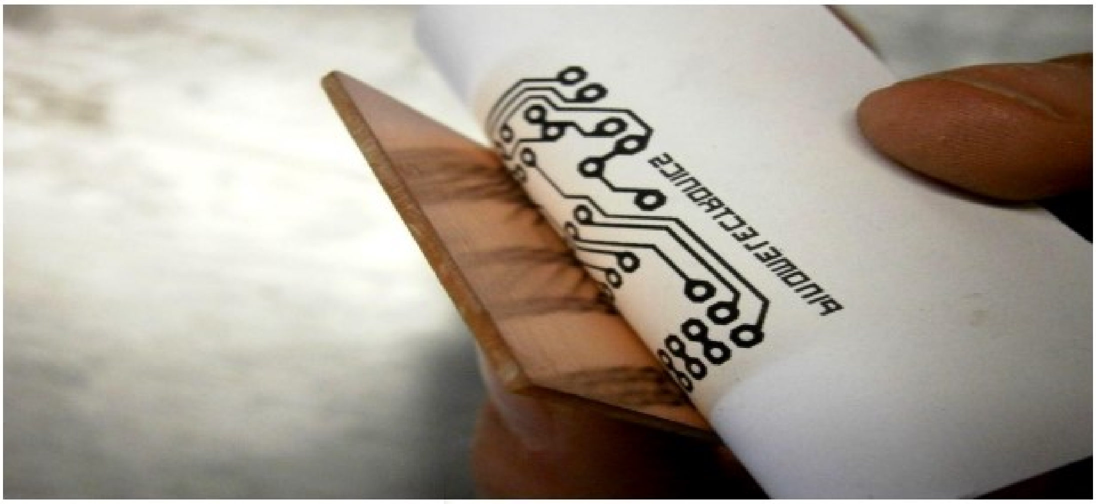


Figure 5.3: PCB Printing Process

Figure 5.4: Printing Layout Process

Chapter 6

SOFTWARE DISCRIPTION

6.0.1 C Language Basics

6.0.2 C Language Introduction

C is a procedural programming language. It was initially developed by Dennis Ritchie between 1969 and 1973. It was mainly developed as a system programming language to write operating system. The main features of C language include low-level access to memory, simple set of keywords, and clean style, these features make C language suitable for system programming like operating system or compiler development. Many later languages have borrowed syntax/features directly or indirectly from C language. Like syntax of Java, PHP, JavaScript and many other languages is mainly based on C language. C++ is nearly a superset of C language (There are few programs that may compile in C, but not in C++).

6.0.3 Begining with C language Program

6.0.4 Finding a Compiler:

Before we start C programming, we need to have a compiler to compile and run our programs. There are certain online compilers like https://ide.geeksforgeeks.org/, http://ideone.com/ or http://codepad.org/ that can be used to start C without installing a compiler.

6.0.5

Windows: There are many compilers available freely for compilation of C programs like Code Blocks and Dev-CPP. We strongly recommend Code Blocks.

6.0.6

Linux: For Linux, gcc comes bundled with the linux, Code Blocks can also be used with Linux.

6.0.7 Writing first program: Following is first program in C

```
#include <stdio.h>
int main(void)
{
printf("Anoop Chauhan");
return 0;
```

- Output:

  Let us analyze the program line by line.

- Line 1 In a C program, all lines that start with are processed by preprocessor which is a program invoked by the compiler. In a very basic term, preprocessor takes a C program and produces another C program. The produced program has no lines starting, all such lines are processed by the preprocessor. In the above example, preprocessor copies the preprocessed code of stdio.h to our file. The .h files are called header files in C. These header files generally contain declaration of functions. We need stdio.h for the function printf() used in the program.

- Line 2 : There must to be starting point from where execution of compiled C program begins. In C, the execution typically begins with first line of main(). The void written in brackets indicates that the main doesn't take any parameter (See this for more details). main() can be written to take parameters also. We will be covering that in future posts. The int written before main indicates return type of main(). The value returned by main indicates status of program termination. See this post for more details on return type.

- Line 3 and 6 : In C language, a pair of curly brackets define a scope and mainly used in functions and control statements like if, else, loops. All functions must start and end with curly brackets.
- Line 4 : is a standard library function to print something on standard output. The semicolon at the end of printf indicates line termination. In C, semicolon is always used to indicate end of statement.
- Line 5 : The return statement returns the value from main(). The returned value may be used by operating system to know termination status of your program. The value 0 typically means successful termination.

6.1 Keil compiler

6.1.1 C51 C Compiler

- In 2004, MATLAB had around one million users across industry and academia. MATLAB users come from various backgrounds of engineering, science, and economics. The Keil C51 C Compiler for the 8051 microcontroller is the most popular 8051 C compiler in the world. It provides more features than any other 8051 C compiler available today. The C51 Compiler allows you to write 8051 microcontroller applications in C that, once compiled, have the efficiency and speed of assembly language. Language extensions in the C51 Compiler give you full access to all resources of the 8051. The C51 Compiler translates C source files into relocatable object modules which contain full symbolic information for debugging with the µVision Debugger or an in-circuit emulator. In addition to the object file, the compiler generates a listing file which may optionally include symbol table and cross reference information.

Chapter 7

SCOPE OF PROJECT

- The handicapped passenger, school student, senior citizen and pregnant women are not able to cross the bridge while moving from one platform to another due to crowd and rush of people at bridge where they are unable to cross comfortably.

- Another problem is of the track crack detection, wherein the motorman does not come to know about the crack thereby leading to accident.

- The workers who are working in tunnels are not aware about the trains which are coming from both side, and due absence of communication with the train they are prone to accidents.

- Saving of power is very important for developing nation like India where there is acute power shortage and hence it very much important to save power in trains/tunnels, like for example unnecessarily the lights and fans are continuously ON in trains and light being ON in tunnels

Chapter 8

LITERATURE SURVEY

8.0.1 Refered Paper 1

- ## Beneficiaries

It will be beneficial for the passenger who travels by train and option the train as a first priority public transport. The passengers who belong in to the senior citizen category,handicapped passenger, school student will have a relief while travelling through a train and they can travel without hampering their safety. There will be a time saving as well as power saving and the individual life can be protected by reducing the density of the crowd in railways.

Abstract: Local trains are the lifeline of the people to travel from one place to the another and it is one of the most cheapest, convenient and easiest mode of transport. Being on the top most priority mode of transport still there are various problems faced by Indian Railway for transporting millions of people daily from one place to another at reasonable cost and without hampering the safety of passengers. The train are not working 24*7 instead it is working for 20*6 and one day is the half day mega block, in order to make train work 24*7 and make passengers more feasible to travel this project should be implemented. If the proposed application will implement, then it will not only be beneficial to the passengers but also to our Indian government.

8.0.2 Refered Paper 2

- **Background**

Abstract: Indian Railways (reporting mark IR) is a state owned national transporter, and responsible for rail transport in India. It is owned and operated by the Government of India through the Ministry of Railways.As we know, the Railways provide the cheapest and most convenient mode of passenger transport for both long distance and suburban traffic.Although Indian Railways have progressed a lot, both quantitatively and qualitatively,during the last few years, the system is still facing with a number of problems which require attention. The first passenger train in India ran between Bombay (Bori Bunder) and Thane on 16 April 1853. The 14-carriage train was hauled by three steam locomotives:Sahib, Sindh, and Sultan. This was also the first railway bridge in India. Mumbai Suburban Railway consists of exclusive inner suburban railway lines augmented by commuter rail on main lines serving outlying suburbs to serve the Mumbai Metropolitan Region. Spread over 465 kilometres (289 mi), the suburban railway operates 2,342 train services and carries more than 7.5 million commuters daily.By annual ridership (2.64 billion), the Mumbai Suburban Railway is one of the busiest commuter rail systems in the world and it has some of the most severe overcrowding in the world. IR carried 8.107 billion passengers (more than 22 million passengers per day), transported 1.101 billion tons of freight, and had 7,216 stations.

8.0.3 Refered Paper 3

- ## Research

Abstract:

- Track crack and overhead wire break detection sensors are available in market but it is very costly and Indian Railway are not able invest that much cost as per Indian railway geographical areas.We are proposing the IoT based technique using TTL logic based detection for Railway safety and Security.

- Our proposal is low cost and provides ease to Indian Railway, as it is completely automatic since control is Railway Platform with Tunnels safety and security via IoT using RF technique.

- On October 13.2017 the train services on Kalyan-CST route of Central Railway remain affected after overhead wire broke between Thakurli and Kalyan railway stations on Friday evening. The railway sources said that incident occurred at around 6.50pm on up line after which services on both up and down lines were stopped for the repair work till 8pm. The incident has delayed local as well as long distance trains on the route.

- 21 January 2017 – The Kuneru train derailment occurred when the 18448 Jagdalpur–Bhubaneswar Hirakhand Express derailed near Kuneru, Vizianagaram, killing 41 and injuring 68.

- 7 March 2017 – The 2017 Bhopal–Ujjain Passenger train bombing occurred when a bomb exploded on the Bhopal–Ujjain Passengerat Jabri railway station, injuring 10. This was the first strike in India by the Islamic State.

- 30 March 2017 - Eight coaches of Mahakaushal Express derailed near Uttar Pradesh's Kulpahar, injuring 52.

- 15 April 2017 – The Meerut–Lucknow Rajya Rani Express derailed 8 coaches near Rampur; injuring at least 24.[139]

- 19 August 2017 – The 18478 Puri–Haridwar Kalinga Utkal Express derailed in Khatauli, Muzaffarnagar, Uttar Pradesh. Killing at least 23 and leaving around 97 injured.

- 23 August 2017 – Auraiya train derailment occurred when the Kaifiyat Express (12225) derailed between Pata and Achalda railway stations around 02:40 am (IST). Around 100 people were injured.

- 6 May 2016 – The Chennai Central–Thiruvananthapuram Central Superfast Express and a suburban train had a side collision near Pattabiram, injuring 7.

- 20 November 2016 – The Pukhrayan train derailment occurred when the 19321 Indore–Rajendra Nagar Express derailed 14 coaches at Pukhrayan, approximately 60 km (37 mi) from Kanpur, killing 150 and injuring 26

Chapter 9

FLOWCHART

9.0.1 Flowchart of Intelligent Railway Security System with Energy Conservation

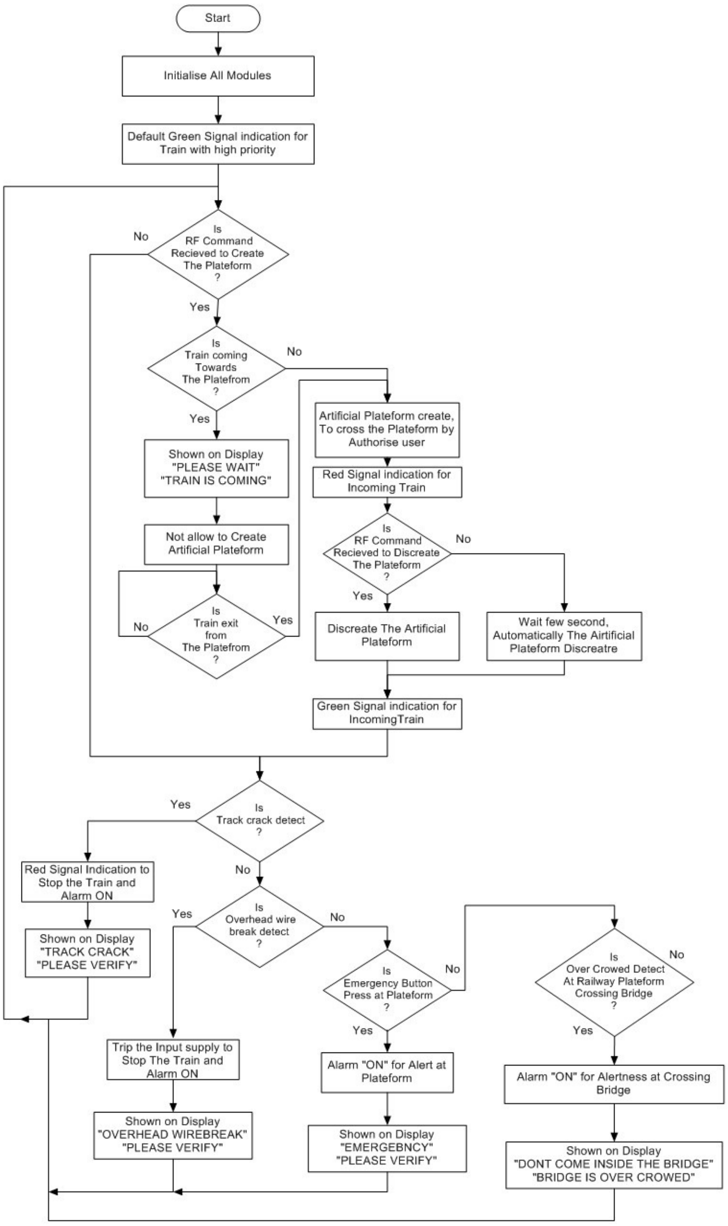


Figure 9.1: Flowchart of Intelligent Railway Security System with Energy Conservation

Chapter 10

METHODOLOGY

10.0.1 Gathering Information

- Track crack detection- basically the rail is always grounded that means at initial time the voltage across rail track is 0 volts.so we are tapping a wire on one station and second wire on second station we are giving these wires as input to the micro controller if there is no crack in the track between two stations the voltage across both the wires from each station should be 0 votls. But if there is a crack between the track then one of the wire from station is raised high and other is low. these signal are compared and they are given to microcontroller and micro controller gives output and sends message through gsm module to thevoperator .as soon as the track crack is detected the signal next to crack is converted to red and the siren is started.

- Overhead wire crack detection- basically the overhead wire is always 25000volts.so we are stepping down the volage to 5v and tapping a wire on one station and second wire on second station we are giving these wires as input to the micro controller if there is no crack in the overhead wire between two stations the voltage across both the wires from each station should be 5 votls.But if there is a crack between the overhead wire then one of the wire from station is raised high and other is low. these signal are compared and they are given to microcontroller and micro controller gives output and sends message through gsm module to the operator about the break as well as it will trip off the supply between wire of two poles.

- Labour Security System:- suppose if some labour is working inside the Tunnel and train is coming but they are busy in their work So situation might be dangerous to their life. So here we are providing security to the labour. There is a sensor 1 km away from a tunnel to detect the train and if sensor sense the train it automatically inform the workers with the help of siren or displaying massage that the train is coming clear the route or stop the work.

- Power saving:-Most of the time inside the tunnel light is ON unnecessary.So there is a wastage of power .So we are design a system such a way that light gets ON inside the tunnel when the train get passes through the tunnel. So there are two sensor placed at the entry and exit of the tunnel. As the sensor sense the train the light inside the tunnel gets ON on the timer basis.

- Smart communication system in the tunnel:-Basically inside the tunnel there is no signals or range for communication. So walky talky communication between the motorman in the train as well as watch guard becomes difficult. to overcome this problem we are using the rail as a medium for communication between engine and guard van. so if the guard wants to convey a message of alart then there are switches in his van regarding particular caution so if guard want to communicate with motorman about safety.he will press a switch representing particular message the message will be transmitted by using rail as a medium towards motor men.similarly for motor men also.

10.0.2 Proper Planning

- The handicapped passenger, school student, senior citizen and pregnant women are not able to cross the bridge while moving from one platform to another due to crowd and rush of people at bridge where they are unable to cross comfortably.

- Another problem is of the track crack detection, wherein the motorman does not come to know about the crack thereby leading to accident.

- The workers who are working in tunnels are not aware about the trains which are coming from both side, and due absence of communication with the train they are prone to accidents.

- Saving of power is very important for developing nation like India where there is acute power shortage and hence it very much important to save power in trains/tunnels, like for example unnecessarily the lights and fans are continuously ON in trains and light being ON in tunnels.

- One of the problem is of the overhead wire because of some issue the overhead wire breaks and it leads to the accidents and major of the people die because of sure severe accidents.

- There are so much crowd and rush on the bridge and therefore the passengers falls ,there is no such system which will measure the density of the crowd and it will not allow the people to enter in to the bridge and there is a lack of emergency rescue button because if people face any sort of harm or if they are in trouble there is no such a facility provided so that they can take help from the control room.

10.0.3 Status and Plane of Action

- The handicapped passenger, school student, senior citizen and pregnant women are not able to cross the bridge while moving from one platform to another due to crowd and rush of people at bridge where they are unable to cross comfortably.

- Another problem is of the track crack detection, wherein the motorman does not come to know about the crack thereby leading to accident.

- The workers who are working in tunnels are not aware about the trains which are coming from both side, and due absence of communication with the train they are prone to accidents.

- Saving of power is very important for developing nation like India where there is acute power shortage and hence it very much important to save power in trains/tunnels, like for example unnecessarily the lights and fans are continuously ON in trains and light being ON in tunnels.

- One of the problem is of the overhead wire because of some issue the overhead wire breaks and it leads to the accidents and major of the people die because of sure severe accidents.
- There are so much crowd and rush on the bridge and therefore the passengers falls,there is no such system which will measure the density of the crowd and it will notallow the people to enter in to the bridge and there is a lack of emergency rescue button because if people face any sort of harm or if they are in trouble there is no such a facility provided so that they can take help from the control room.

Chapter 11

PCB LAYOUT

11.0.1 Fig (i)

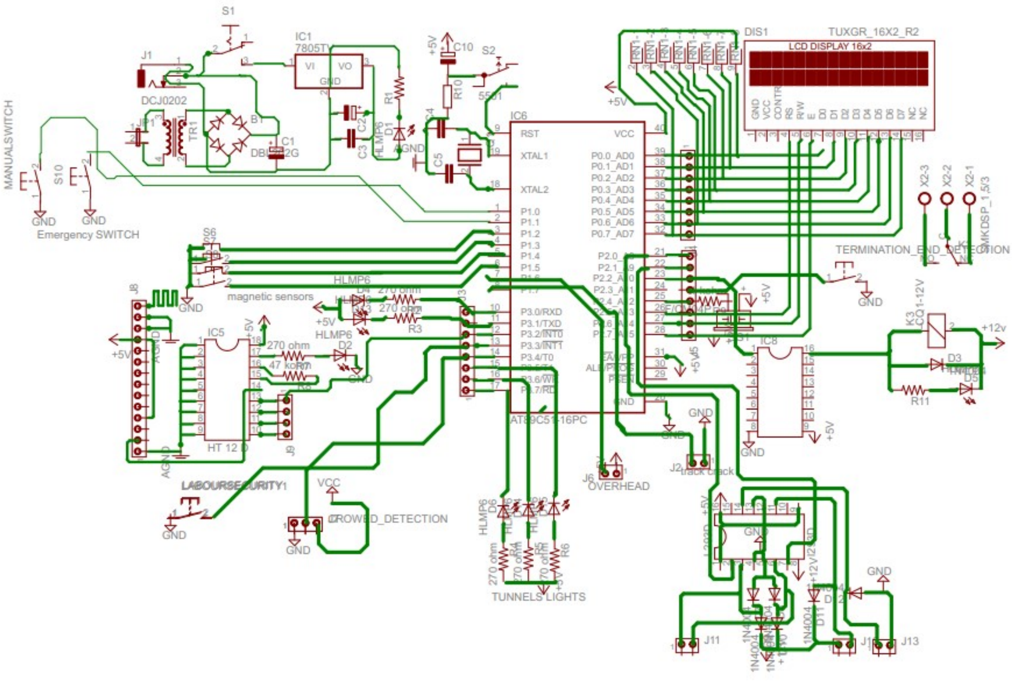


Figure 11.1: PCB Layout

11.0.2 Fig (ii)

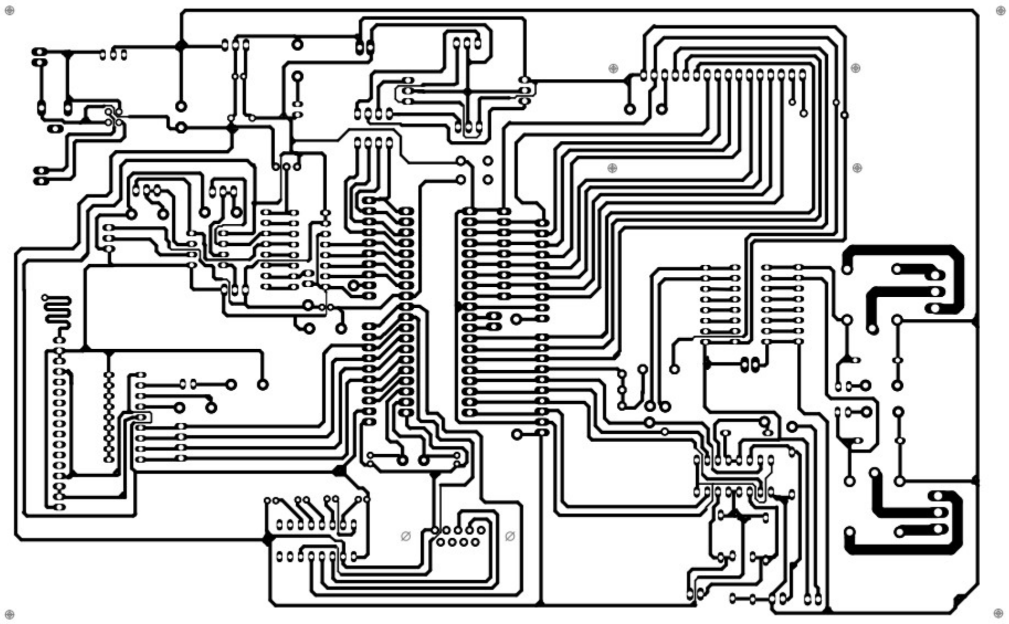


Figure 11.2: Final PCB Output

Chapter 12

SOURCE CODE

12.0.1 INTELLIGENT RAILWAY SECURITY SYSTEM WITH ENERGY CONSERVATION PROGRAMMING

C: > Users > Anoop > Desktop > New folder > C code.c

```c
#include<Hdd.h>

uchar cnt=0;
uint t=0;
bit send = 0,manual_sw_tnl_light_flage=0,left_flag=0,tunnel_exit_sensor_flage=0,tunnel_enter_sensor_flage=0,ir_labour_enter_flag=0,ir_labour_exit_flag=0;
bit lcdstr_flag=0,tunnel_enter_flag=0,gate_open_flag=0,gate_close_flag=0;

bit handicpd_plt_crt_flage=0,handicpd_plt_brk_flage=0,PROCESS_FLAG=0;
bit timer_street_light_flag=0,go_slow_flage=0;

//sbit tunnel_enter_sensor      = P1^2;
sbit manual_sw_tnl_light        = P1^0;   //variable name indicate position of motor not operation
sbit emergency_button         = P1^1;
sbit train_enter_sensor         = P1^2; //variable name indicate position of motor not operation
sbit train_exit_sensor          = P1^3;
sbit tunnel_enter_sensor      = P1^4;
sbit tunnel_exit_sensor         = P1^5;
//sbit green_signal                   = P1^6;//Anoop
//sbit red_signal                     = P1^7;Ashish
sbit brk_tract_snsr             = P1^7;//Prathamesh
sbit overhead_wire              = P1^6;//Zeeshan



sbit green_signal                 = P3^0;//Anoop
sbit red_signal                   = P3^1;//Ashish

//sbit brk_tract_snsr           = P3^0;//Prathamesh
//sbit overhead_wire                = P3^1;//Zeeshan



/*Int0 & int 1 for rf reciver
sbit red_signal                   = P3^2;*/
sbit ir_labour_enter            = P3^3;

sbit ir_sensor_crowed_detect= P3^4;
sbit tunnel_light_2             = P3^5;
```

Figure 12.1: 1

```
C: > Users > Anoop > Desktop > New folder > C code.c
sbit tunnel_light_3            = P3^6;
sbit tunnel_light_4            = P3^7;


sbit motor_1_open                          = P2^0;
sbit motor_1_close                         = P2^1;
sbit power_25000w_led_indicator = P2^2;
sbit stn_termination_end              = P2^3;
sbit buzzer                                    = P2^4;

//-------------------main hardware configuration------------------//
void crowed_monitor();
void gate_crossing();
void beep();
void delay_ms1(unsigned int c1) //for 11.059Mhz
{
    unsigned int c2;
    for(;c1>0;--c1)
        for(c2=0;c2<115;++c2)
//          for(c3=0;c3<10;++c3)
                ;
}
void emergency_help();
void timer_initialise();
void manaul_sw_tunnel_light();
void auto_tunnel_control();
void track_break_detect();
void overhead_wire_break();
void plateform_create_discreate();
void plateform_end_detection();
void main()
{
//  init_serial();
    init_lcd();
        power_25000w_led_indicator=1;
    lcdstr("INTELGT. RAILWAY");
    lcdcmd(0xc0);
    lcdstr("SECURITY SYSTEM ");
```

Figure 12.2: 2

C: > Users > Anoop > Desktop > New folder > C code.c

```c

    delay(65000);
    left_flag=0;
    manual_sw_tnl_light_flage=0;
    manual_sw_tnl_light       =1;     //variable name indicate position of motor not operation
  tunnel_exit_sensor        =1;
  tunnel_enter_sensor       =1;
    ir_labour_enter                     =1;

  buzzer                      =1;
    ir_sensor_crowed_detect     =1;//for Ashish active high ir module
  tunnel_light_2            =1;
    tunnel_light_3            =1;
    tunnel_light_4            =1;
    brk_tract_snsr                  =1;
    overhead_wire             =0;
    power_25000w_led_indicator=1;
    ir_labour_enter           =1;
    emergency_button                =1;
    train_exit_sensor=1;

    lcdstr_flag=0;

    tunnel_enter_flag=0;
    /*railway plateform varible*/
    timer_initialise();
    handicpd_plt_crt_flage=0;
    handicpd_plt_brk_flage=0;
    cnt=0;
    motor_1_open    =0;
    motor_1_close   =0;
//motor_2_open      =0;
//motor_2_close     =0;
    red_signal      =1;
    green_signal    =0;
    PROCESS_FLAG    =0;
    brk_tract_snsr  =1;      //cng frn 1 to 0
    overhead_wire   =0;     //0 to 1
```

Figure 12.3: 3

C: > Users > Anoop > Desktop > New folder > C code.c

```c
    stn_termination_end =1;

    /*---------------railway plateform end----------------*/
    while(1)
    {
        manaul_sw_tunnel_light();
        auto_tunnel_control();
        track_break_detect();
        overhead_wire_break();
        crowed_monitor();
        //gate_crossing();
        plateform_create_discreate();
        plateform_end_detection();
        emergency_help();
    }
}

void plateform_end_detection()
{
    if(stn_termination_end==0)
    {
            lcdstr_flag=0;
            lcdcmd(0x01);
            lcdcmd(0x80);
            lcdstr("PLATFRM TERMNTD.");
            lcdcmd(0xc0);
            lcdstr("PLS STOP TRAIN");
            delay_ms1(500);
            delay_ms1(500);
            buzzer=0;
            delay_ms1(500);
            delay_ms1(500);
          while(1);
    }
    else
    {}
}
```

Figure 12.4: 4

C: > Users > Anoop > Desktop > New folder > C code.c

```
void auto_tunnel_control()
{
        if(ir_labour_enter==0)
        {
            delay_ms1(50);
            ir_labour_enter_flag=1;
        }
        if(ir_labour_enter_flag==1)
        {
            lcdstr_flag=0;
            lcdcmd(0x01);
            lcdcmd(0x80);
            lcdstr("TRAIN IS COMING");
            lcdcmd(0xc0);
            lcdstr("STOP WORK");
            delay_ms1(500);
            delay_ms1(500);
            buzzer=0;//on
            delay_ms1(500);
            delay_ms1(500);
            tunnel_exit_sensor_flage=0;
        }
        else
        {
//          lcdcmd(0x01);
//          lcdcmd(0x80);
//          lcdstr("TRAIN GOES OUT");
//          lcdcmd(0xc0);
//          lcdstr("START WORK");
//          delay_ms1(500);
//          delay_ms1(500);
//          //buzzer=0;
//          delay_ms1(500);
//          delay_ms1(500);
        }
        if(ir_labour_enter_flag==1)
        {
            if(tunnel_enter_sensor==0)//ms for tunnel enter detect
```

Figure 12.5: 5

C: > Users > Anoop > Desktop > New folder > C code.c

```c
            {
                tunnel_exit_sensor_flage=0;
                ir_labour_enter_flag=0;
                tunnel_enter_flag=1;//
                lcdcmd(0x01);
                lcdcmd(0x80);
                lcdstr("WEL COME TO");
                lcdcmd(0xc0);
                lcdstr("LONAVALA TUNNEL");
                delay_ms1(500);
                if(manual_sw_tnl_light_flage==0)
                {
                    tunnel_enter_sensor_flage=1;//to set manual switch flag,checks whther manual sw is on or off
                }
            }
            else
            {}
        }
        if(tunnel_enter_sensor_flage==1)
        {
//          tunnel_light_1 =0;          //all tunnel should be ON
            tunnel_light_2 =0;
            tunnel_light_3 =0;
            tunnel_light_4 =0;

        }
        if(tunnel_enter_flag==1)
        {
            if(tunnel_exit_sensor==0)
            {
                tunnel_enter_flag=0;
                tunnel_exit_sensor_flage=1;
                tunnel_enter_sensor_flage=0;
                ir_labour_enter_flag=0;    //after train exit tunnel continou work
                if(manual_sw_tnl_light_flage==0) //manaul sw is off& train exit from tunnel then only light off
                {
//                  tunnel_light_1 =1;          //all tunnel should be OFF
                    tunnel_light_2 =1;
```

Figure 12.6: 6

C: > Users > Anoop > Desktop > New folder > code.c

```c
                    tunnel_light_3 =1;
                    tunnel_light_4 =1;
                }
            }
        }
        if(tunnel_exit_sensor_flage==1)
        {
            lcdcmd(0x01);
            lcdcmd(0x80);
            lcdstr("TRAIN GOES OUT");
            lcdcmd(0xc0);
            lcdstr("START WORK");
            delay_ms1(500);
            delay_ms1(500);
            buzzer=1;
            delay_ms1(500);
            delay_ms1(500);
            cnt++;
            if(cnt==5)
            {
                cnt=0;
                lcdstr_flag=1;
                tunnel_exit_sensor_flage=0;
                lcdcmd(0x01);
            }
        }
        if(lcdstr_flag)
        {
            lcdcmd(0x80);
            lcdstr("HAPPY JOURNEY");
            lcdcmd(0xc0);
            lcdstr("KEEP SMILE");
            delay_ms1(500);
            delay_ms1(500);
        }

}
// void gate_crossing()
```

Figure 12.7: 7

C: > Users > Anoop > Desktop > New folder > C code.c

```
// {
//  if( bfr_gate_mgnt_snsr ==0 && afr_gate_mgnt_snsr==1)
//      {
//          gate_close_flag=1;
//          gate_open_flag=0;
//          lcdcmd(0x01);
//          delay_ms1(50);
//      }
//      if( bfr_gate_mgnt_snsr ==1 && afr_gate_mgnt_snsr==0)
//      {
//          gate_close_flag=0;
//          gate_open_flag=1;
//          lcdcmd(0x01);
//          delay_ms1(50);
//      }
//      if(gate_close_flag==1 && gate_open_flag==0)
//      {
//          lcdcmd(0x80) ;
//          lcdstr("CROSSING GATE");
//          lcdcmd(0xC0) ;
//          lcdstr("    CLOSE    ");
//          delay_ms1(500);
//          delay_ms1(500);
//          delay_ms1(500);
//          buzzer=0;
// //           gate_open=1;                        //opn
// //           gate_close=0;

//          motor_1_open=1;
//          motor_1_close=0;
//          //delay_ms1(5000);
//          delay_ms1(500);
//          delay_ms1(500);
//          delay_ms1(500);
//          motor_1_open=0;
//          motor_1_close=0;
// //           gate_open=0;                        //stop
// //           gate_close=0;
```

Figure 12.8: 8

C: > Users > Anoop > Desktop > New folder > C code.c

```
//
//          //delay_ms1(1000);
//          buzzer=1;
//          gate_close_flag=0;
//      }
//      if(gate_close_flag==0 && gate_open_flag==1)
//      {

//          delay_ms1(50);
//          lcdcmd(0x80) ;
//          lcdstr("CROSSING GATE");
//          lcdcmd(0xC0) ;
//          lcdstr("    OPEN    ");
//          delay_ms1(50);
//          buzzer=0;
// //           gate_open=0;
// //           gate_close=1;
//          motor_1_open=0;
//          motor_1_close=1;
//          //delay_ms1(5000);
//          delay_ms1(500);
//          delay_ms1(500);
//          delay_ms1(500);
//          delay_ms1(500);
//          motor_1_open=0;
//          motor_1_close=0;
// //           gate_open=0;
// //           gate_close=0;
//          delay_ms1(500);
//
//          //delay_ms1(1000);
//          buzzer=1;
//          gate_open_flag=0;
//      }

// }
//void beep()
//{
```

Figure 12.9: 9

C: > Users > Anoop > Desktop > New folder > C code.c

```
//      buzzer=0;
//      delay_ms1(500);
//  //  delay_ms1(500);
//      buzzer=1;
//}
void overhead_wire_break()
{
    if( overhead_wire ==1)       //please uncomment for overhead wire
    {
//      buzzer=0;
//      clear_disp();
//      lcdcmd(0x80) ;
//      lcdstr("OVRHD WIRE BREAK");
//      lcdcmd(0xC0) ;
//      lcdstr("PLEASE VERIFY   ");
        delay_ms1(500);
//      while(1);
    }
    else
    {
        power_25000w_led_indicator=0;
        buzzer=0;
        lcdcmd(0x01) ;
        lcdcmd(0x80) ;
        lcdstr("OVRHD WIRE BREAK");
        lcdcmd(0xC0) ;
        lcdstr("PLEASE VERIFY   ");
        delay_ms1(500);
        delay_ms1(500);
//      transmit_string("AT+CMGS=\"09773719818\"\r\n");     //deepak vit
//      //transmit_string("AT+CMGS=\"08898126556\"\r\n");   //for testing
//      delay(100);
//      transmit_string("OVRHD WIRE BREAK PLEASE VERIFY\r\n");
//      delay(100);
//      delay(100);
//      txdata(0x1a);
        delay(100);
        while(1);
```

Figure 12.10: 10

```
C: > Users > Anoop > Desktop > New folder > C code.c
    }
}
void track_break_detect()
{
    if( brk_tract_snsr ==0)
    {
//      buzzer=0;
//      clear_disp();
//      lcdcmd(0x80) ;
//      lcdstr("TRACK IS BREAK   ");
//      lcdcmd(0xC0) ;
//      lcdstr("PLEASE VERIFY    ");
        delay_ms1(500);
//      while(1);

    }
    else
    {
        buzzer=0;
        lcdcmd(0x01) ;
        lcdcmd(0x80) ;
        lcdstr("TRACK IS BREAK   ");
        lcdcmd(0xC0) ;
        lcdstr("PLEASE VERIFY    ");
        delay_ms1(500);
        red_signal=0;
        delay_ms1(500);
//      transmit_string("AT+CMGS=\"09967684142\"\r\n");     //Anoop vit
//      //transmit_string("AT+CMGS=\"07900062626\"\r\n");
//      delay(100);
//      transmit_string("TRACK IS BREAK PLEASE VERIFY\r\n");
//      delay(100);
//      delay(100);
//      txdata(0x1a);
        delay(100);
        green_signal=1;
        while(1);

```

Figure 12.11: 11

C: > Users > Anoop > Desktop > New folder > C code.c

```c
        
    }
}

void emergency_help()
{
    if(emergency_button==0)
    {
        buzzer=0;
        lcdcmd(0x01) ;
        lcdcmd(0x80) ;
        lcdstr("EMRGNCY @ PLTFRM");
        lcdcmd(0xC0) ;
        lcdstr("PLEASE VERIFY");
        delay_ms1(500);
        while(1);
    }
    else
    {}
}
void crowed_monitor()
{
    if(ir_sensor_crowed_detect==0)
    {
        buzzer=0;
        lcdcmd(0x80) ;
        lcdstr("BRIDGE OVR CROWD");
        lcdcmd(0xC0) ;
        lcdstr("PLS DONT COME IN");
        delay_ms1(500);
        while(1);
    }
    else
    {}
}

void manaul_sw_tunnel_light()
{
```

Figure 12.12: 12

C: > Users > Anoop > Desktop > New folder > C code.c

```c
    if(manual_sw_tnl_light==0)  //if labor is working
    {
        delay_ms1(10);
        if(manual_sw_tnl_light==0)  //if labor is working
        {
            manual_sw_tnl_light_flage=~manual_sw_tnl_light_flage;
        }
    }
    if(manual_sw_tnl_light_flage==1)    //manual switch for labors,lights on
    {
//      tunnel_light_1 =0;         //all tunnel should be ON
        tunnel_light_2 =0;
        tunnel_light_3 =0;
        tunnel_light_4 =0;
    }
    else if(manual_sw_tnl_light_flage==0&& tunnel_exit_sensor==1 &&tunnel_enter_sensor_flage==0)//labours making light off
    {
//      tunnel_light_1 =1;         //all tunnel should be OFF
        tunnel_light_2 =1;
        tunnel_light_3 =1;
        tunnel_light_4 =1;
    }
}
void plateform_create_discreate()
{
    if(handicpd_plt_crt_flage==0 && handicpd_plt_brk_flage==0 &&PROCESS_FLAG==0)//train is cmg
    {
        if(train_enter_sensor==0)
        {
            IE=0;                   //disable intterrup fot platform create
            green_signal=0;
            red_signal=1;
            lcdcmd(0x01);
            lcdcmd(0x80);
            lcdstr("TRAIN IS COMING");
            lcdcmd(0xc0);
            lcdstr("PLEASE WAIT");
            delay_ms1(500);
```

Figure 12.13: 13

C: > Users > Anoop > Desktop > New folder > C code.c

```c
            delay_ms1(500);

        }
        else if(train_exit_sensor==0)
        {
            IE=0x83;                        //enable intterrup fot platform create
            green_signal=0;
            red_signal=1;
            lcdcmd(0x01);
            lcdcmd(0x80);
            lcdstr("WL CM RLW.PLTFRM");
            lcdcmd(0xC0);
            lcdstr("DNT CRS RL LINE");
            delay_ms1(500);
            delay_ms1(500);
        }
        else
        {
//              green_signal=0;
//              red_signal=1;
//              lcdcmd(0x01);
//              lcdcmd(0x80);
//              lcdstr(" WEL COME TO ");
//              lcdcmd(0xc0);
//              lcdstr("VASHI STATION");
//              delay_ms1(500);
//              delay_ms1(500);
        }
    }
    if(handicpd_plt_crt_flage==1 && handicpd_plt_brk_flage==0)   //train is not cmg
    {
        green_signal=1;
        red_signal=0;           //TRAIN STOP
        lcdcmd(0x01);
        lcdcmd(0x80);
        lcdstr("ACCESS GRANTED");
        lcdcmd(0xc0);
        lcdstr("PLTFRM CREATED");
```

Figure 12.14: 14

C: > Users > Anoop > Desktop > New folder > C code.c

```c
        motor_1_open=1;                 //CREATE PLATFORM
        motor_1_close=0;

//          motor_2_open=0;                 //CLOSE  IF PLATFORM CREAT FROM BOTH SIDE
//          motor_2_close=1;

        delay_ms1(500);                 //DELAY
        delay_ms1(500);
        delay_ms1(500);
        delay_ms1(500);
        delay_ms1(500);
        delay_ms1(500);

        motor_1_open=0;                 //stop  MOTOR_1
        motor_1_close=0;

//          motor_2_open=0;                 //STOP  MOTOR_2
//          motor_2_close=0;

        buzzer=0;
        delay_ms1(500);
        delay_ms1(500);
        buzzer=1;
        lcdcmd(0x01);
        lcdcmd(0x80);
        lcdstr("HAPPY JOURNEY");
        lcdcmd(0xc0);
        lcdstr("  KEEP SMILE");
        handicpd_plt_crt_flage=0;
        TR0=1;
    }
    if(handicpd_plt_crt_flage==0 && handicpd_plt_brk_flage==1)   //train is not cmg
    {
        red_signal=1;
        green_signal=0;         //TRAIN STOP
        lcdcmd(0x01);
        lcdcmd(0x80);
        lcdstr("THANK YOU");
```

Figure 12.15: 15

C: > Users > Anoop > Desktop > New folder > code.c

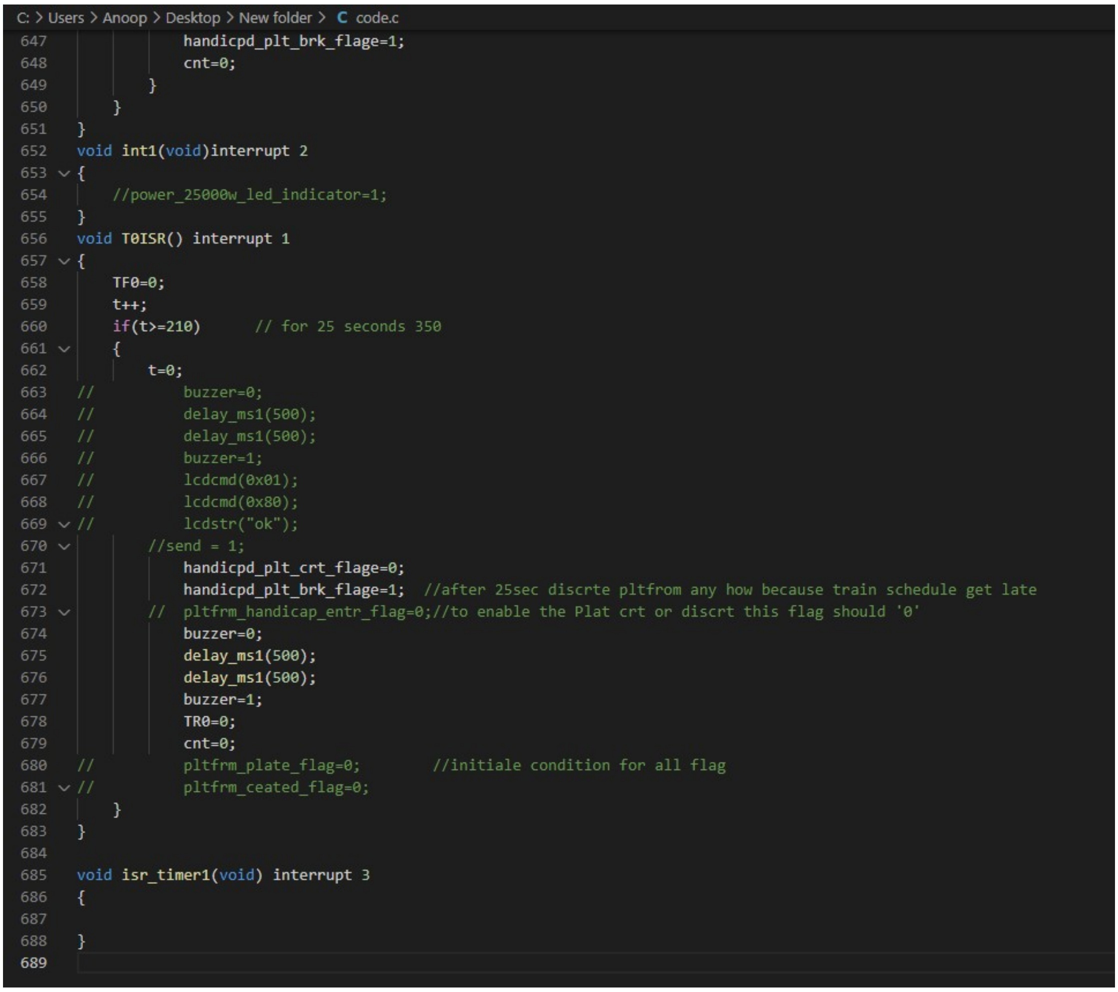
```
            lcdcmd(0xc0);
            lcdstr("PLTFRM DISCRTED");


            motor_1_open=0;                 //CREATE PLATFORM
            motor_1_close=1;

    //          motor_2_open=1;                 //CLOSE  IF PLATFORM CREAT FROM BOTH SIDE
    //          motor_2_close=0;

            delay_ms1(500);                 //DELAY
            delay_ms1(500);
            delay_ms1(500);
            delay_ms1(500);
            delay_ms1(500);
            delay_ms1(500);

            motor_1_open=0;                 //stop  MOTOR_1
            motor_1_close=0;

    //          motor_2_open=0;                 //STOP  MOTOR_2
    //          motor_2_close=0;

            buzzer=0;
            delay_ms1(500);
            delay_ms1(500);
            buzzer=1;
            lcdcmd(0x01);
            lcdcmd(0x80);
            lcdstr("HAPPY JOURNEY");
            lcdcmd(0xc0);
            lcdstr("  KEEP SMILE");
            //handicpd_plt_crt_flage=0;
            handicpd_plt_brk_flage=0;
            PROCESS_FLAG=0;
            TR0=0;
        }
    }
```

Figure 12.16: 16

C: > Users > Anoop > Desktop > New folder > C code.c

```c

void timer_initialise()
{

    IE = 0x83;   //////////////////ea=1&t0=1,int0=1////////1000 0011 of ie register//////////
    TCON|=0x00001010b;  //falling edge
    TMOD|=0x01; //////////////timer0 & mode1 & timer1 mode1
    TH0=0x00;  //////////////72msec////////////////
    TL0=0x00;
//  TH1=0xfc;  //////////////200usec////////////////
//  TL1=0x65;

}
void int0(void)interrupt 0
{

    buzzer=0;                 //new added
    delay_ms1(1000);
    buzzer=1;

    if(train_enter_sensor==0)         //train is coming  please wait
    {
        handicpd_plt_crt_flage=0;  //handcapped request access
        handicpd_plt_brk_flage=0;
    }
    else
    {
        cnt++;
        if(cnt==1)
        {
            handicpd_plt_crt_flage=1;   //train is not cmg
            handicpd_plt_brk_flage=0;
            PROCESS_FLAG=1;
        }
        else if(cnt==2)
        {
            handicpd_plt_crt_flage=0;   //train is not cmg
            handicpd_plt_brk_flage=1;
```

Figure 12.17: 17



C: > Users > Anoop > Desktop > New folder > C code.c

```c
                handicpd_plt_brk_flage=1;
                cnt=0;
            }
        }
}
void int1(void)interrupt 2
{
    //power_25000w_led_indicator=1;
}
void T0ISR() interrupt 1
{
    TF0=0;
    t++;
    if(t>=210)      // for 25 seconds 350
    {
        t=0;
//          buzzer=0;
//          delay_ms1(500);
//          delay_ms1(500);
//          buzzer=1;
//          lcdcmd(0x01);
//          lcdcmd(0x80);
//          lcdstr("ok");
        //send = 1;
            handicpd_plt_crt_flage=0;
            handicpd_plt_brk_flage=1;  //after 25sec discrte pltfrom any how because train schedule get late
        //  pltfrm_handicap_entr_flag=0;//to enable the Plat crt or discrt this flag should '0'
            buzzer=0;
            delay_ms1(500);
            delay_ms1(500);
            buzzer=1;
            TR0=0;
            cnt=0;
//          pltfrm_plate_flag=0;        //initiale condition for all flag
//          pltfrm_ceated_flag=0;
    }
}

void isr_timer1(void) interrupt 3
{

}
```

Figure 12.18: 18

lcd.c × code.c ●

C: > Users > Anoop > Desktop > New folder > lcd.c

```c
#include<Hdd.h>

sbit rs = P2^5;
sbit rw = P2^6;
sbit en = P2^7;
#define lcd P0


void  delay(uint del)
{
uint i;
for (i=0;i<del;i++);
}

void lcdcmd(uchar dat)
{
lcd = dat;
rs = 0;
rw = 0;
en = 1;
delay(100);
en  = 0;
}

void lcdstr(uchar *str)
{
unsigned char i;
for (i=0;str[i]!=0;i++)
lcd_dat (str[i]);
}

void lcd_dat(uchar dat)
{
lcd = dat;
rs =1;
rw=0;
en = 1;
delay(100);
en  = 0;
}

void init_lcd()
{
lcdcmd(0x38);
delay(1000);
lcdcmd(0x38);
delay(1000);
lcdcmd(0x38);
delay(1000);
lcdcmd(0x0c);
delay(1000);
lcdcmd(0x01);
delay(1000);
}
```

Figure 12.19: 19

Chapter 13

ADVANTAGES, DISADVANTAGES, APPLICATION, FUTURE SCOPE AND CONCLUSION

13.1 Advantages:

- The handicapped passenger, senior citizen, pregnant women and school students can travel without any harm.
- Labours life are secured and safe.
- Power saving can be maximized up to the extent.
- Emergency rescue button helps to rescue one's life.
- Automated Systems and low cost
- One time investment.
- Accidents can be prevented.
- Trains schedule is unaffected.

13.2 Disadvantage And Overcome:

- For wireless communication we are using Radio frequency(RF) Transmitter and receiver module.
- The range of RF module(100M) is shorter and can not be used for long distance ,but can be overcome by using Long range of transreciever Module, Repeaters or GSM technology.

GSM

13.3 Application:

- To all stations
- At all the railway crossing
- To all railways (including mail, express,local)

13.4 FUTURE SCOPE:

- This project can be advanced by including GPS system in RFID ticketing to see the current location of the individuals.
- MOBILE PLATFORM can be advanced by using new materials for the construction of it so that it is lighter to move and easier to control.

13.5 ACKNOWLEDGMENT

- We acknowledge this project to all the individuals who travel by train everyday in extreme crowd.We intend to give them some relief by our small project.

13.6 CONCLUSION:

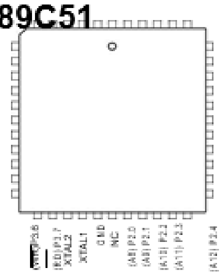
- Thus we conclude that this project can be impleted in future in INDIA. If it is imolemented it will a great relief in crowd management in on INDIAN platforms and thus help us in becoming a technically advanced nation.

Chapter 14

DATASHEET

8-bit Microcontroller with 4K Bytes Flash

AT89C51



Features

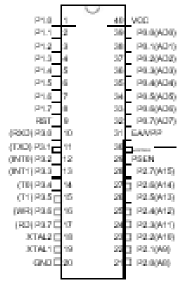
- Compatible with MCS-51™ Products
- 4K Bytes of In-System Reprogrammable Flash Memory
  – Endurance: 1,000 Write/Erase Cycles
- Fully Static Operation: 0 Hz to 24 MHz
- Three-level Program Memory Lock
- 128 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Two 16-bit Timer/Counters
- Six Interrupt Sources
- Programmable Serial Channel
- Low-power Idle and Power-down Modes

Description

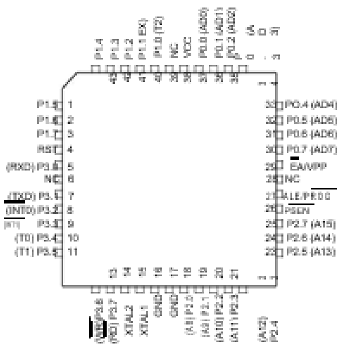
The AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conven-tional nonvolatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C51 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications.

Pin Configurations

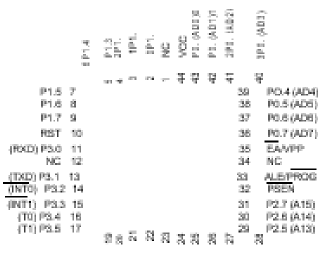
PDIP



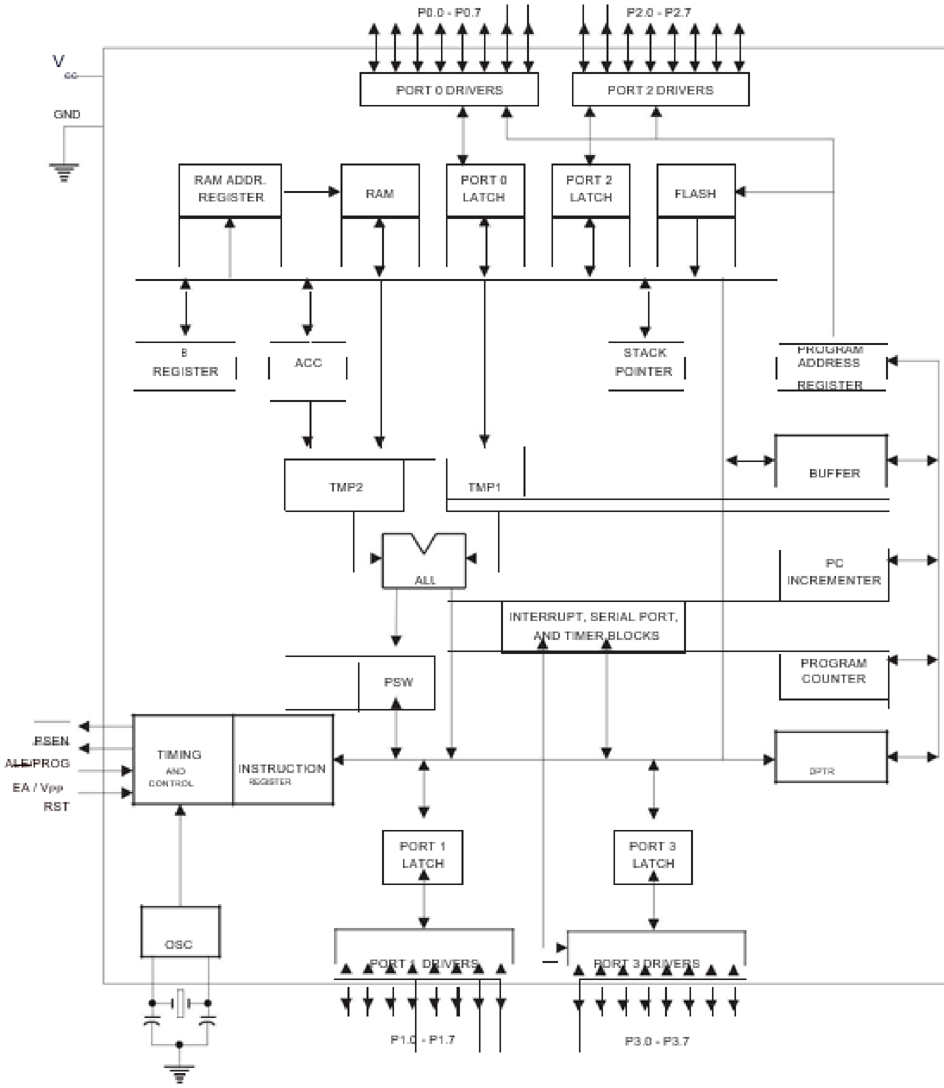
PQFP/TQFP



PLCC



Block Diagram



The AT89C51 provides the following standard features: 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, two 16-bit timer/counters, a five vector two-level interrupt architecture, 1 full duplex serial port, on-chip oscillator and clock circuitry. In addition, the AT89C51 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port and interrupt system to continue functioning. The Power-down Mode saves the RAM contents but freezes the oscillator disabling all other chip functions until the next hardware reset.

Pin Description

VCC

Supply voltage.

GND

Ground.

Port 0

Port 0 is an 8-bit open-drain bi-directional I/O port. As an output port, each pin can sink eight TTL inputs. When 1s are written to port 0 pins, the pins can be used as high-impedance inputs.

Port 0 may also be configured to be the multiplexed low-order address/data bus during accesses to external program and data memory. In this mode P0 has internal pullups.

Port 0 also receives the code bytes during Flash programming, and outputs the code bytes during program verification. External pullups are required during program verification.

Port 1

Port 1 is an 8-bit bi-directional I/O port with internal pullups. The Port 1 output buffers can sink/source four TTL inputs. When 1s are written to Port 1 pins they are pulled high by the internal pullups and can be used as inputs. As inputs, Port 1 pins that are externally being pulled low will source current (I_{IL}) because of the internal pullups.

Port 1 also receives the low-order address bytes during Flash programming and verification.

Port 2

Port 2 is an 8-bit bi-directional I/O port with internal pullups. The Port 2 output buffers can sink/source four TTL inputs. When 1s are written to Port 2 pins they are pulled high by the internal pullups and can be used as inputs. As inputs, Port 2 pins that are externally being pulled low will source current (I_{IL}) because of the internal pullups.

Port 2 emits the high-order address byte during fetches from external program memory and during accesses to external data memory that use 16-bit addresses (MOVX @ DPTR). In this application, it uses strong internal pullups when emitting 1s. During accesses to external data memory that use 8-bit addresses (MOVX @ RI), Port 2 emits the contents of the P2 Special Function Register.

Port 2 also receives the high-order address bits and some control signals during Flash programming and verification.

Port 3

Port 3 is an 8-bit bi-directional I/O port with internal pullups. The Port 3 output buffers can sink/source four TTL inputs. When 1s are written to Port 3 pins they are pulled high by the internal pullups and can be used as inputs. As inputs, Port 3 pins that are externally being pulled low will source current (I_{IL}) because of the pullups.

Port 3 also serves the functions of various special features of the AT89C51 as listed below:

Port Pin	Alternate Functions
P3.0	RXD (serial input port)
P3.1	TXD (serial output port)
P3.2	$\overline{\text{INT0}}$ (epxternal interrupt 0)
P3.3	$\overline{\text{INT1}}$ (external interrupt 1)
P3.4	T0 (timer 0 external input)
P3.5	T1 (timer 1 external input)
P3.6	$\overline{\text{WR}}$ (external data memory write strobe)
P3.7	$\overline{\text{RD}}$ (external data memory read strobe)

Port 3 also receives some control signals for Flash programming and verification.

RST

Reset input. A high on this pin for two machine cycles while the oscillator is running resets the device.

ALE/$\overline{\text{PROG}}$

Address Latch Enable output pulse for latching the low byte of the address during accesses to external memory. This pin is also the program pulse input ($\overline{\text{PROG}}$) during Flash programming.

In normal operation ALE is emitted at a constant rate of 1/6 the oscillator frequency, and may be used for external tim-ing or clocking purposes. Note, however, that one ALE pulse is skipped during each access to external Data Memory.

If desired, ALE operation can be disabled by setting bit 0 of SFR location 8EH. With the bit set, ALE is active only dur-ing a MOVX or MOVC instruction. Otherwise, the pin is weakly pulled high. Setting the ALE-disable bit has no effect if the microcontroller is in external execution mode.

$\overline{\text{PSEN}}$

Program Store Enable is the read strobe to external program memory.

When the AT89C51 is executing code from external program memory, $\overline{\text{PSEN}}$ is activated twice each machine cycle, except that two $\overline{\text{PSEN}}$ activations are skipped during each access to external data memory.

$\overline{\text{EA}}$/VPP

External Access Enable. $\overline{\text{EA}}$ must be strapped to GND in order to enable the device to fetch code from external program memory locations starting at 0000H up to FFFFH. Note, however, that if lock bit 1 is programmed, $\overline{\text{EA}}$ will be internally latched on reset.

$\overline{\text{EA}}$ should be strapped to V_{CC} for internal program executions.

This pin also receives the 12-volt programming enable voltage (V_{PP}) during Flash programming, for parts that require 12-volt V_{PP}.

XTAL1

Input to the inverting oscillator amplifier and input to the internal clock operating circuit.

XTAL2

Output from the inverting oscillator amplifier.

Oscillator Characteristics

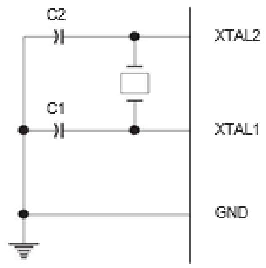
XTAL1 and XTAL2 are the input and output, respectively, of an inverting amplifier which can be configured for use as an on-chip oscillator, as shown in Figure 1. Either a quartz crystal or ceramic resonator may be used. To drive the device from an external clock source, XTAL2 should be left unconnected while XTAL1 is driven as shown in Figure 2. There are no requirements on the duty cycle of the external clock signal, since the input to the internal clocking circuitry is through a divide-by-two flip-flop, but minimum and maxi-mum voltage high and low time specifications must be observed.

Idle Mode

In idle mode, the CPU puts itself to sleep while all the on-chip peripherals remain active. The mode is invoked by software. The content of the on-chip RAM and all the special functions registers remain unchanged during this mode. The idle mode can be terminated by any enabled interrupt or by a hardware reset.

It should be noted that when idle is terminated by a hard ware reset, the device normally resumes program execution, from where it left off, up to two machine cycles before the internal reset algorithm takes control. On-chip hardware inhibits access to internal RAM in this event, but access to the port pins is not inhibited. To eliminate the possibility of an unexpected write to a port pin when Idle is terminated by reset, the instruction following the one that invokes Idle should not be one that writes to a port pin or to external memory.

Figure 1. Oscillator Connections

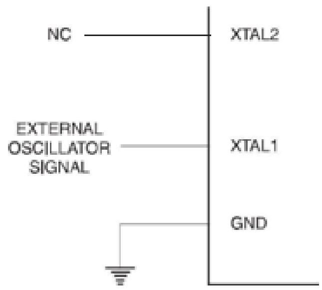


Note: C1, C2 = 30 pF ± 10 pF for Crystals
= 40 pF ± 10 pF for Ceramic Resonators

Status of External Pins During Idle and Power-down Modes

Mode	Program Memory	ALE	$\overline{\text{PSEN}}$	PORT0	PORT1	PORT2	PORT3
Idle	Internal	1	1	Data	Data	Data	Data
Idle	External	1	1	Float	Data	Address	Data
Power-down	Internal	0	0	Data	Data	Data	Data
Power-down	External	0	0	Float	Data	Data	Data

Figure 2. External Clock Drive Configuration



Power-down Mode

In the power-down mode, the oscillator is stopped, and the instruction that invokes power-down is the last instruction executed. The on-chip RAM and Special Function Registers retain their values until the power-down mode is terminated. The only exit from power-down is a hardware reset. Reset redefines the SFRs but does not change the on-chip RAM. The reset should not be activated before V_{CC} is restored to its normal operating level and must be held active long enough to allow the oscillator to restart and stabilize.

Program Memory Lock Bits

On the chip are three lock bits which can be left unprogrammed (U) or can be programmed (P) to obtain the additional features listed in the table below.

When lock bit 1 is programmed, the logic level at the $\overline{EA}$ pin is sampled and latched during reset. If the device is pow-ered up without a reset, the latch initializes to a random value, and holds that value until reset is activated. It is nec-essary that the latched value of EA be in agreement with the current logic level at that pin in order for the device to function properly.

Lock Bit Protection Modes

Program Lock Bits				
	LB1	LB2	LB3	Protection Type
1	U	U	U	No program lock features
2	P	U	U	MOVC instructions executed from external program memory are disabled from fetching code bytes from internal memory, EA is sampled and latched on reset, and further programming of the Flash is disabled
3	P	P	U	Same as mode 2, also verify is disabled
4	P	P	P	Same as mode 3, also external execution is disabled

Programming the Flash

The AT89C51 is normally shipped with the on-chip Flash memory array in the erased state (that is, contents = FFH) and ready to be programmed. The programming interface accepts either a high-voltage (12-volt) or a low-voltage (V_{CC}) program enable signal. The low-voltage programming mode provides a convenient way to program the AT89C51 inside the user's system, while the high-voltage programming mode is compatible with conventional third-party Flash or EPROM programmers.

The AT89C51 is shipped with either the high-voltage or low-voltage programming mode enabled. The respective top-side marking and device signature codes are listed in the following table.

	VPP = 12V	VPP = 5V
Top-side Mark	AT89C51 xxxx yyww	AT89C51 xxxx-5 yyww
Signature	(030H) = 1EH (031H) = 51H (032H) =F FH	(030H) = 1EH (031H) = 51H (032H) = 05H

The AT89C51 code memory array is programmed byte-by-byte in either programming mode. *To program any non-blank byte in the on-chip Flash Memory, the entire memory must be erased using the Chip Erase Mode.*

Programming Algorithm: Before programming the AT89C51, the address, data and control signals should be set up according to the Flash programming mode table and Figure 3 and Figure 4. To program the AT89C51, take the following steps.

10. Input the desired memory location on the address lines.
11. Input the appropriate data byte on the data lines.
12. Activate the correct combination of control signals.
13. Raise $\overline{EA}$/VPP to 12V for the high-voltage program-ming mode.
14. Pulse ALE/$\overline{PROG}$ once to program a byte in the Flash array or the lock bits. The byte-write cycle is self-timed and typically takes no more than 1.5 ms. Repeat steps 1 through 5, changing the address and data for the entire array or until the end of the object file is reached.

$\overline{\text{Data}}$ Polling: The AT89C51 features $\overline{\text{Data}}$ Polling to indicate the end of a write cycle. During a write cycle, an attempted read of the last byte written will result in the com-plement of the written datum on PO.7. Once the write cycle has been completed, true data are valid on all outputs, and the next cycle may begin. Data Polling may begin any time after a write cycle has been initiated.

Ready/$\overline{\text{Busy}}$: The progress of byte programming can also be monitored by the RDY/$\overline{BSY}$ output signal. P3.4 is pulled low after ALE goes high during programming to indicate BUSY. P3.4 is pulled high again when programming is done to indicate READY.

Program Verify: If lock bits LB1 and LB2 have not been programmed, the programmed code data can be read back via the address and data lines for verification. The lock bits cannot be verified directly. Verification of the lock bits is achieved by observing that their features are enabled.

Chip Erase: The entire Flash array is erased electrically by using the proper combination of control signals and by holding ALE/$\overline{PROG}$ low for 10 ms. The code array is written with all "1"s. The chip erase operation must be executed before the code memory can be re-programmed.

Reading the Signature Bytes: The signature bytes are read by the same procedure as a normal verification of locations 030H, 031H, and 032H, except that P3.6 and P3.7 must be pulled to a logic low. The values returned are as follows.

(030H) = 1EH indicates manufactured by Atmel
(031H) = 51H indicates 89C51
(032H) = FFH indicates 12V programming
(032H) = 05H indicates 5V programming

Programming Interface

Every code byte in the Flash array can be written and the entire array can be erased by using the appropriate combination of control signals. The write operation cycle is self-timed and once initiated, will automatically time itself to completion.

All major programming vendors offer worldwide support for the Atmel microcontroller series. Please contact your local programming vendor for the appropriate software revision.

Flash Programming Modes

Mode		RST	PSEN	ALE/PROG	EA/VPP	P2.6	P2.7	P3.6	P3.7
Write Code Data		H	L		H/12V	L	H	H	H
Read Code Data		H	L	H	H	L	L	H	H
Write Lock	Bit - 1	H	L		H/12V	H	H	H	H
	Bit - 2	H	L		H/12V	H	H	L	L
	Bit - 3	H	L		H/12V	H	L	H	L
Chip Erase		H	L	(1)	H/12V	H	L	L	L
Read Signature Byte		H	L	H	H	L	L	L	L

Note: 1. Chip Erase requires a 10 ms $\overline{\text{PROG}}$ pulse.

Figure 3. Programming the Flash

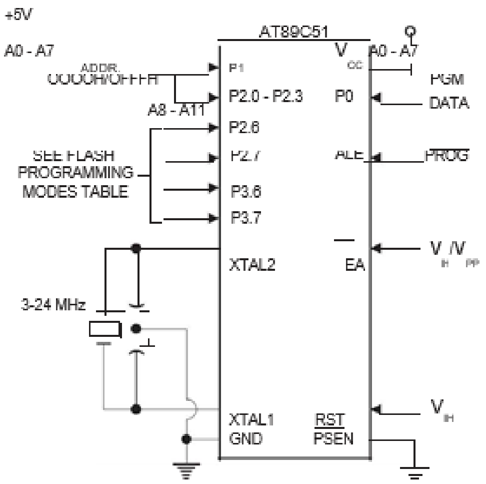
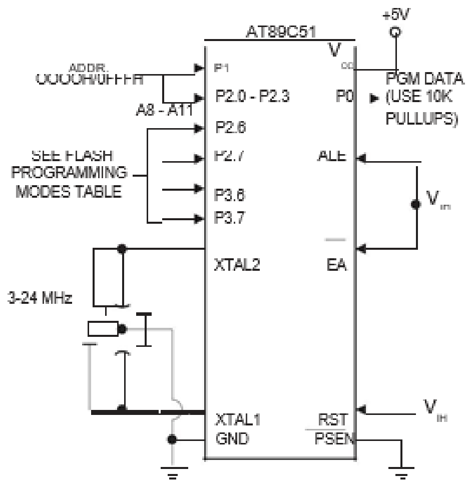
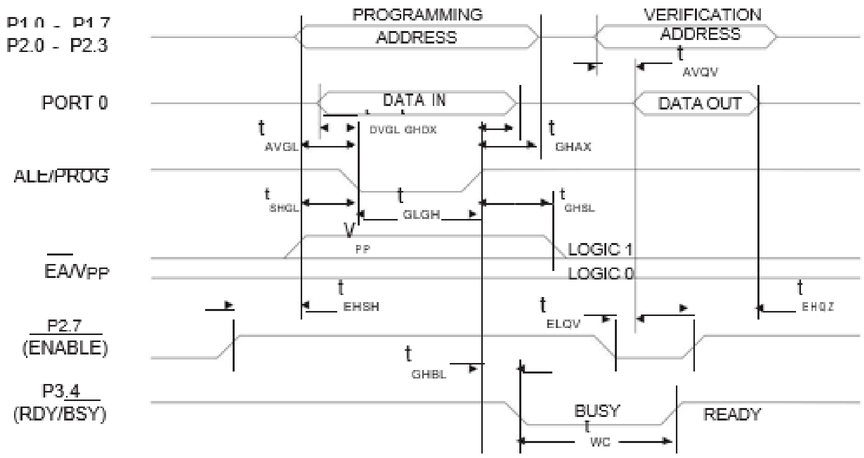


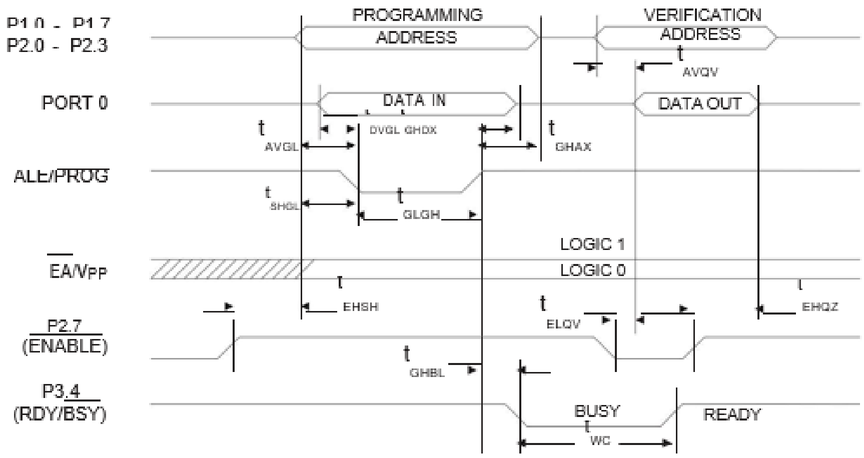
Figure 4. Verifying the Flash



Flash Programming and Verification Waveforms - High-voltage Mode (VPP = 12V)



Flash Programming and Verification Waveforms - Low-voltage Mode (VPP = 5V)



Flash Programming and Verification Characteristics

T_A = 0°C to 70°C, V_{CC} = 5.0 ± 10%

Symbol	Parameter	Min	Max	Units
VPP(1)	Programming Enable Voltage	11.5	12.5	V
IPP(1)	Programming Enable Current		1.0	mA
$1/t_{CLCL}$	Oscillator Frequency	3	24	MHz
t_{AVGL}	Address Setup to $\overline{PROG}$ Low	$48t_{CLCL}$		
t_{GHAX}	Address Hold after $\overline{PROG}$	$48t_{CLCL}$		
t_{DVGL}	Data Setup to $\overline{PROG}$ Low	$48t_{CLCL}$		
t_{GHDX}	Data Hold after $\overline{PROG}$	$48t_{CLCL}$		
t_{EHSH}	P2.7 ($\overline{ENABLE}$) High to VPP	$48t_{CLCL}$		
t_{SHGL}	VPP Setup to $\overline{PROG}$ Low	10		µs
t_{GHSL}(1)	VPP Hold after $\overline{PROG}$	10		µs
t_{GLGH}	$\overline{PROG}$ Width	1	110	µs
t_{AVQV}	Address to Data Valid		$48t_{CLCL}$	
t_{ELQV}	$\overline{ENABLE}$ Low to Data Valid		$48t_{CLCL}$	
t_{EHQZ}	Data Float after $\overline{ENABLE}$	0	$48t_{CLCL}$	
t_{GHBL}	$\overline{PROG}$ High to BUSY Low		1.0	µs
t_{WC}	Byte Write Cycle Time		2.0	ms

Note: 1. Only used in 12-volt programming mode.

Absolute Maximum Ratings*

Operating Temperature	-55°C to +125°C
Storage Temperature	-65°C to +150°C
Voltage on Any Pin with Respect to Ground	-1.0V to +7.0V
Maximum Operating Voltage	6.6V
DC Output Current	15.0 mA

*NOTICE: Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

DC Characteristics

T_A = -40°C to 85°C, V_{CC} = 5.0V ± 20% (unless otherwise noted)

Symbol	Parameter	Condition	Min	Max	Units
V_{IL}	Input Low-voltage	(Except $\overline{EA}$)	-0.5	0.2 V_{CC} - 0.1	V
V_{IL1}	Input Low-voltage ($\overline{EA}$)		-0.5	0.2 V_{CC} - 0.3	V
V_{IH}	Input High-voltage	(Except XTAL1, RST)	0.2 V_{CC} + 0.9	V_{CC} + 0.5	V
V_{IH1}	Input High-voltage	(XTAL1, RST)	0.7 V_{CC}	V_{CC} + 0.5	V
V_{OL}	Output Low-voltage(1) (Ports 1,2,3)	I_{OL} = 1.6 mA		0.45	V
V_{OL1}	Output Low-voltage(1) (Port 0, ALE, PSEN)	I_{OL} = 3.2 mA		0.45	V
V_{OH}	Output High-voltage (Ports 1,2,3, ALE, PSEN)	I_{OH} = -60 µA, V_{CC} = 5V ± 10%	2.4		V
		I_{OH} = -25 µA	0.75 V_{CC}		V
		I_{OH} = -10 µA	0.9 V_{CC}		V
V_{OH1}	Output High-voltage (Port 0 in External Bus Mode)	I_{OH} = -800 µA, V_{CC} = 5V ± 10%	2.4		V
		I_{OH} = -300 µA	0.75 V_{CC}		V
		I_{OH} = -80 µA	0.9 V_{CC}		V
I_{IL}	Logical 0 Input Current (Ports 1,2,3)	V_{IN} = 0.45V		-50	µA
I_{TL}	Logical 1 to 0 Transition Current (Ports 1,2,3)	V_{IN} = 2V, VCC = 5V ± 10%		-650	µA
I_{LI}	Input Leakage Current (Port 0, $\overline{EA}$)	0.45 < V_{IN} < V_{CC}		±10	µA
RRST	Reset Pull-down Resistor		50	300	KΩ
C_{IO}	Pin Capacitance	Test Freq. = 1 MHz, T_A = 25°C		10	pF
I_{CC}	Power Supply Current	Active Mode, 12 MHz		20	mA
		Idle Mode, 12 MHz		5	mA
	Power-down Mode(2)	V_{CC} = 6V		100	µA
		V_{CC} = 3V		40	µA

Notes: 1. Under steady state (non-transient) conditions, I_{OL} must be externally limited as follows:
Maximum I_{OL} per port pin: 10 mA
Maximum I_{OL} per 8-bit port: Port 0: 26 mA
Ports 1, 2, 3: 15 mA
Maximum total I_{OL} for all output pins: 71 mA
If I_{OL} exceeds the test condition, V_{OL} may exceed the related specification. Pins are not guaranteed to sink current greater than the listed test conditions.
2. Minimum V_{CC} for Power-down is 2V.

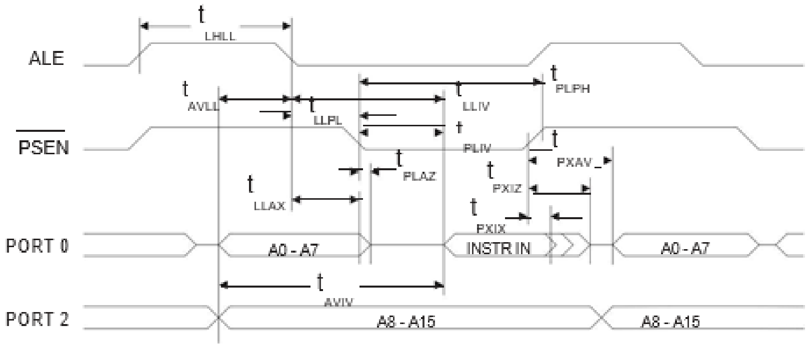
AC Characteristics

Under operating conditions, load capacitance for Port 0, ALE/$\overline{PROG}$, and $\overline{PSEN}$ = 100 pF; load capacitance for all other outputs = 80 pF.

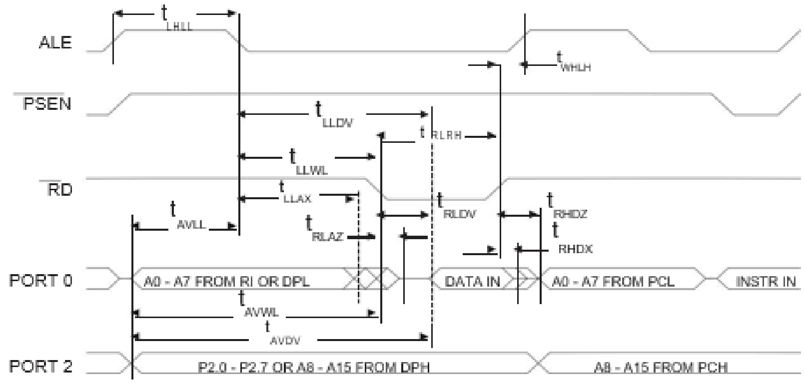
External Program and Data Memory Characteristics

Symbol	Parameter	12 MHz Oscillator		16 to 24 MHz Oscillator		Units
		Min	Max	Min	Max	
$1/t_{CLCL}$	Oscillator Frequency			0	24	MHz
t_{LHLL}	ALE Pulse Width	127		2tCLCL-40		ns
t_{AVLL}	Address Valid to ALE Low	43		t_{CLCL}-13		ns
t_{LLAX}	Address Hold after ALE Low	48		tCLCL-20		ns
t_{LLIV}	ALE Low to Valid Instruction In		233		4tCLCL-65	ns
t_{LLPL}	ALE Low to $\overline{PSEN}$ Low	43		t_{CLCL}-13		ns
t_{PLPH}	$\overline{PSEN}$ Pulse Width	205		3tCLCL-20		ns
t_{PLIV}	$\overline{PSEN}$ Low to Valid Instruction In		145		3tCLCL-45	ns
t_{PXIX}	Input Instruction Hold after $\overline{PSEN}$	0		0		ns
t_{PXIZ}	Input Instruction Float after $\overline{PSEN}$		59		tCLCL-10	ns
t_{PXAV}	PSEN to Address Valid	75		t_{CLCL}-8		ns
t_{AVIV}	Address to Valid Instruction In		312		5tCLCL-55	ns
t_{PLAZ}	$\overline{PSEN}$ Low to Address Float		10		10	ns
t_{RLRH}	$\overline{RD}$ Pulse Width	400		6tCLCL-100		ns
t_{WLWH}	$\overline{WR}$ Pulse Width	400		6tCLCL-100		ns
t_{RLDV}	$\overline{RD}$ Low to Valid Data In		252		5tCLCL-90	ns
t_{RHDX}	Data Hold after $\overline{RD}$	0		0		ns
t_{RHDZ}	Data Float after $\overline{RD}$		97		2tCLCL-28	ns
t_{LLDV}	ALE Low to Valid Data In		517		8tCLCL-150	ns
t_{AVDV}	Address to Valid Data In		585		9tCLCL-165	ns
t_{LLWL}	ALE Low to $\overline{RD}$ or $\overline{WR}$ Low	200	300	3tCLCL-50	3tCLCL+50	ns
t_{AVWL}	Address to $\overline{RD}$ or $\overline{WR}$ Low	203		4tCLCL-75		ns
t_{QVWX}	Data Valid to $\overline{WR}$ Transition	23		tCLCL-20		ns
t_{QVWH}	Data Valid to $\overline{WR}$ High	433		7tCLCL-120		ns
t_{WHQX}	Data Hold after $\overline{WR}$	33		tCLCL-20		ns
t_{RLAZ}	$\overline{RD}$ Low to Address Float		0		0	ns
t_{WHLH}	$\overline{RD}$ or $\overline{WR}$ High to ALE High	43	123	tCLCL-20	tCLCL+25	ns

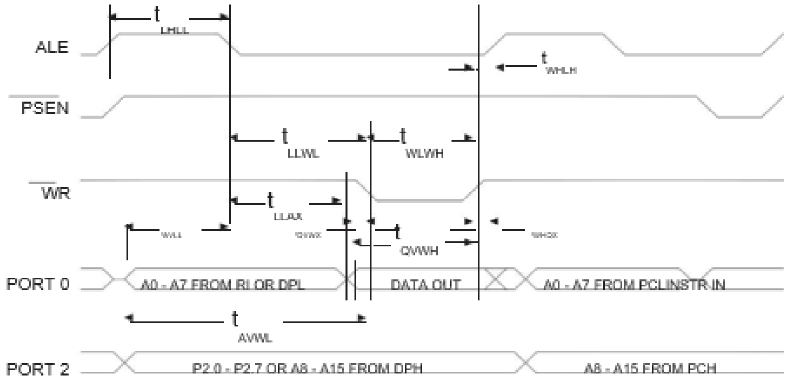
External Program Memory Read Cycle



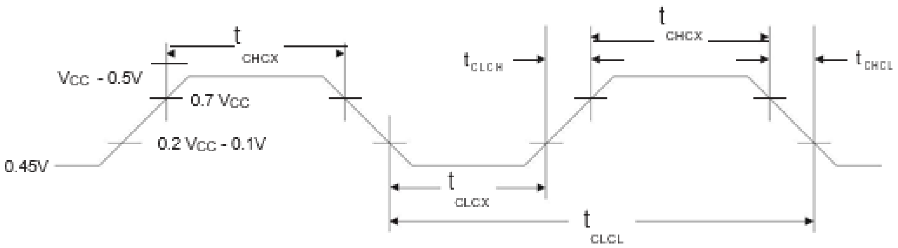
External Data Memory Read Cycle



External Data Memory Write Cycle



External Clock Drive Waveforms



External Clock Drive

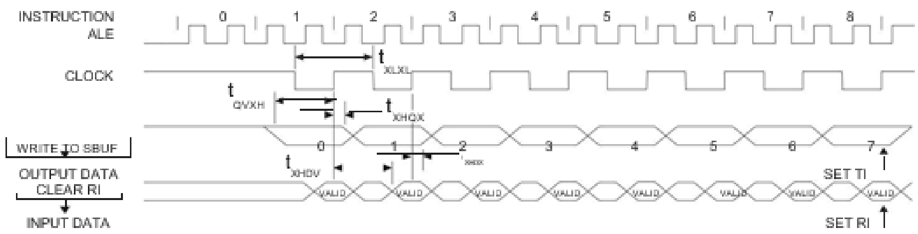
Symbol	Parameter	Min	Max	Units
$1/t_{CLCL}$	Oscillator Frequency	0	24	MHz
t_{CLCL}	Clock Period	41.6		ns
t_{CHCX}	High Time	15		ns
t_{CLCX}	Low Time	15		ns
t_{CLCH}	Rise Time		20	ns
t_{CHCL}	Fall Time		20	ns

Serial Port Timing: Shift Register Mode Test Conditions

(V_{CC} = 5.0 V ± 20%; Load Capacitance = 80 pF)

Symbol	Parameter	12 MHz Osc		Variable Oscillator		Units
		Min	Max	Min	Max	
t_{XLXL}	Serial Port Clock Cycle Time	1.0		$12t_{CLCL}$		µs
t_{QVXH}	Output Data Setup to Clock Rising Edge	700		$10t_{CLCL}$-133		ns
t_{XHQX}	Output Data Hold after Clock Rising Edge	50		$2t_{CLCL}$-117		Ns
t_{XHDX}	Input Data Hold after Clock Rising Edge	0		0		Ns
t_{XHDV}	Clock Rising Edge to Input Data Valid		700		$10t_{CLCL}$-133	Ns

Shift Register Mode Timing Waveforms



AC Testing Input/Output Waveforms(1)

Note: 1. AC Inputs during testing are driven at VCC - 0.5V for a logic 1 and 0.45V for a logic 0. Timing measurements are made at V_{IH} min. for a logic 1 and V_{IL} max. for a logic 0.

Float Waveforms(1)

Note: 1. For timing purposes, a port pin is no longer floating when a 100 mV change from load voltage occurs. A port pin begins to float when 100 mV change from the loaded V_{OH}/V_{OL} level occurs.

Ordering Information

Speed (MHz)	Power Supply	Ordering Code	Package	Operation Range
12	5V ± 20%	AT89C51-12AC	44A	Commercial
		AT89C51-12JC	44J	(0° C to 70° C)
		AT89C51-12PC	40P6	
		AT89C51-12QC	44Q	
		AT89C51-12AI	44A	Industrial
		AT89C51-12JI	44J	(-40° C to 85° C)
		AT89C51-12PI	40P6	
		AT89C51-12QI	44Q	
16	5V ± 20%	AT89C51-16AC	44A	Commercial
		AT89C51-16JC	44J	(0° C to 70° C)
		AT89C51-16PC	40P6	
		AT89C51-16QC	44Q	
		AT89C51-16AI	44A	Industrial
		AT89C51-16JI	44J	(-40° C to 85° C)
		AT89C51-16PI	40P6	
		AT89C51-16QI	44Q	
20	5V ± 20%	AT89C51-20AC	44A	Commercial
		AT89C51-20JC	44J	(0° C to 70° C)
		AT89C51-20PC	40P6	
		AT89C51-20QC	44Q	
		AT89C51-20AI	44A	Industrial
		AT89C51-20JI	44J	(-40° C to 85° C)
		AT89C51-20PI	40P6	
		AT89C51-20QI	44Q	
24	5V ± 20%	AT89C51-24AC	44A	Commercial
		AT89C51-24JC	44J	(0° C to 70° C)
		AT89C51-24PC	40P6	
		AT89C51-24QC	44Q	
		AT89C51-24AI	44A	Industrial
		AT89C51-24JI	44J	(-40° C to 85° C)
		AT89C51-24PI	40P6	
		AT89C51-24QI	44Q	

Package Type	
44A	44-lead, Thin Plastic Gull Wing Quad Flatpack (TQFP)
44J	44-lead, Plastic J-leaded Chip Carrier (PLCC)
40P6	40-lead, 0.600" Wide, Plastic Dual Inline Package (PDIP)
44Q	44-lead, Plastic Gull Wing Quad Flatpack (PQFP)

Chapter 15

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- 21 January 2017 – The Kuneru train derailment occurred when the 18448 Jagdalpur–Bhubaneswar Hirakhand Express derailed near Kuneru , Vizianagaram , killing 41 and injuring 68.
- 7 March 2017 – The 2017 Bhopal–Ujjain Passenger train bombing occurred when a bomb exploded on the Bhopal–Ujjain Passengerat Jabri railway station , injuring 10.This was the first strike in India by the Islamic State.
- 30 March 2017 - Eight coaches of Mahakaushal Express derailed near Uttar Pradesh 39;s Kulpahar, injuring 52.
- 15 April 2017 – The Meerut–Lucknow Rajya Rani Express derailed 8 coaches near Rampur; injuring at least 24.
- 19 August 2017 – The 18478 Puri–Haridwar Kalinga Utkal Express derailed in Khatauli, Muzaffarnagar, Uttar Pradesh. Killing at least 23 and leaving around 97 injured.