Mobile Phone Based Home Security System

Submitted in partial fulfillment of the Degree of

Bachelor of Technology

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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY,

WAKNAGHAT

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Certificate

This is to certify that project report entitled "**Mobile phone based home security system**" submitted by **Nipun Puri, Adiya Khandelwal and Sharad Rastogi** in partial fulfillment for the award of degree of Bachelor of Technology in Electronics and Communication Engineering to Jaypee University of Information Technology, Waknaghat, Solan has been carried out under my supervision.

This work has not been submitted partially or fully to any other University or Institute for the award of this or any other degree or diploma.

Signature of Supervisor ....
Name of Supervisor ....PARDEEP GARG....
Designation ....LECTURER....
Date ....02-06-2012....

Acknowledgement

As we conclude our project with the grace of God, we look back to thank: for all the help, guidance and support lent us, throughout the course of our endeavor. First and foremost, we thank laudable Mr. Pardeep garg, our project guide, who has always encouraged us to put in our best efforts and deliver a quality and professional output. His methodology of working over the basics and laying a strong foundation has taught us that output is not the end of project. We really thank him for his time and efforts. We also thank Mr. Pramod for guiding us throughout our lab work and providing us an immense support. Apart from these, countless events, countless people and several incidents have made a contribution to this project that is indescribable.

Name of Students:	**Signature of Students:**
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Aditya Khandelwal	....
Sharad Rastogi	....

Date: 2-6-2012

List of Symbols

S.No.	Symbols	Meaning
1	Ω	Ohm
2	τ	Time Response
3	Φ_Q	Heat Flux
4	ρ	Density
5	λ	Thermal Conductivity
6	C_p	Specific Heat Capacity

Summary

Engineering is not only a theoretical study but it is a implementation of all we study for creating something new and making things more easy and useful through practical study. It is an art which can be gained with systematic study, observation and practice. In the college curriculum we usually get the theoretical knowledge of industries, and processes and to implement that knowledge we have developed a GSM based home security system.

Whenever we are away from home there is a threat of theft, fire or gas leak. These issues can cause a lot of damage in one's life. To make them easily preventable we have included three different types of sensors in our circuit, Intrusion detection, LPG detector and fire detector. LPG cylinders are commonly used in our kitchens and are also used in heating systems in some cold areas. Chances of leakage are high and its consequences, deadly. The gas sensor detects if there is a LPG leak in our kitchen, the leakage is instantly reported via cell phone so the user is informed irrespective of wherever they are.

Thefts are increasing a lot these days especially in cities. Many times the whole family leaves their home unattended just for a couple of hours only to return and discover that their possessions have been stolen. The intrusion detector can be installed on doors and windows so that if anyone tries to break in the owner is immediately informed on his cell phone. This can also be programmed to call the police station, building's security in charge. It can also be used in offices, where some place have a restricted entry.

One of the most dangerous and easily avoidable accident at home is fire. Fire always takes time to spread from one room to another, but by the time it is detected it is always too late. Best way to control fire is to detect it as early as possible. For this we have used a heat sensor circuit, which can be installed at various places in the house. So that a minor fire can be detected before it becomes a beastly burning inferno.

Chapter 1

Introduction

While deciding about the major project, the main consideration was to make something that would be practically useful and could be utilized in our daily lives as well as various diverse fields. Theft and accidents have increased a lot in today's world and security is a prime concern in our day-today life but not everyone can afford a costly security system. We have tried to make a cheap and effective security system. The Microcontroller based Home Security System can be adopted at home and office as it has various types of Sensors. In our Project we have a LPG gas sensor, fire sensor & intrusion detection sensors. LPG gas sensor can detect various kinds of gas. Fire sensor detects fire by measuring a change in the temperature. In intrusion detection the intruder sensor reacts to light and physical movements. These sensors are connected to a comparator circuit. The system is fully controlled by the 8 bit microcontroller AT89C52 which has a 8Kbytes of ROM. This connects the sensors to the cell phone.

Today cell phone has become an integral part of our life and cell phone network has become pretty dependable in India, both cities and rural areas. Through this security system we can get security alert on our mobile phone in case of any incident say LPG leak, theft, and fire irrespective of where we are.

1.1 Features

Our home security system has various features to safeguard someone's home or workplace. They are:

- LPG gas sensing
- Theft sensing
- Fire sensing
- Remote alert

1.2 Block Diargam

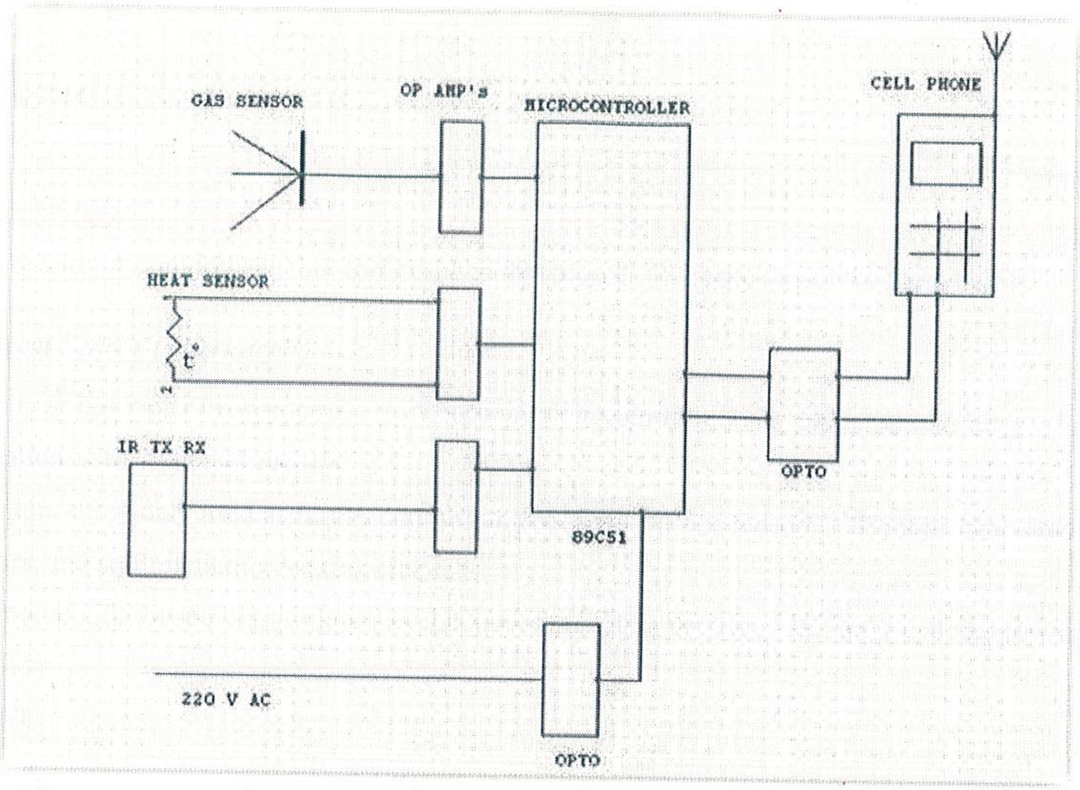


FIGURE 1.1 Block Diagram

Chapter 2

Background Material

2.1 Components

There are various components that were used in this project. We have described them below.

2.1.1 Heat Sensor (Thermistor)

A thermistor is a type of resistor with resistance varying according to its temperature. The word is a combination of thermal and resistor.

Thermistors are widely used as inrush current limiters, temperature sensors, self resetting overcorrect protectors, and self regulating heating elements.

Assuming, as a first-order approximation, that the relationship between resistance and temperature is linear, then:

$\Delta R = k\Delta T$

where

ΔR = change in resistance

ΔT = change in temperature

k = first-order temperature coefficient of resistance.

2.1.2 Obstacle Sensor

An Obstacle Sensor are a pair of Infra Red light sensors and they sense any object which comes in the path of ther IR rays.

2.1.3 Operational Amplifier

An operational amplifier, often called an op-amp, is a DC-coupled high-gain electronic voltage amplifier with differential inputs and usually a single output. Typically the output of the op-amp is controlled either by negative feedback, which largely determines the magnitude of its output voltage gain, or by positive feedback, which facilitates regenerative gain and oscillation. High input impedance at the input terminals and low output impedance are important typical characteristics.

Basically, the Op-Amp is nothing more than a differential amplifier that amplifies the difference between two inputs. One input has a positive effect on the output signal, the other input has a negative effect on the output. The component circuit symbol is:

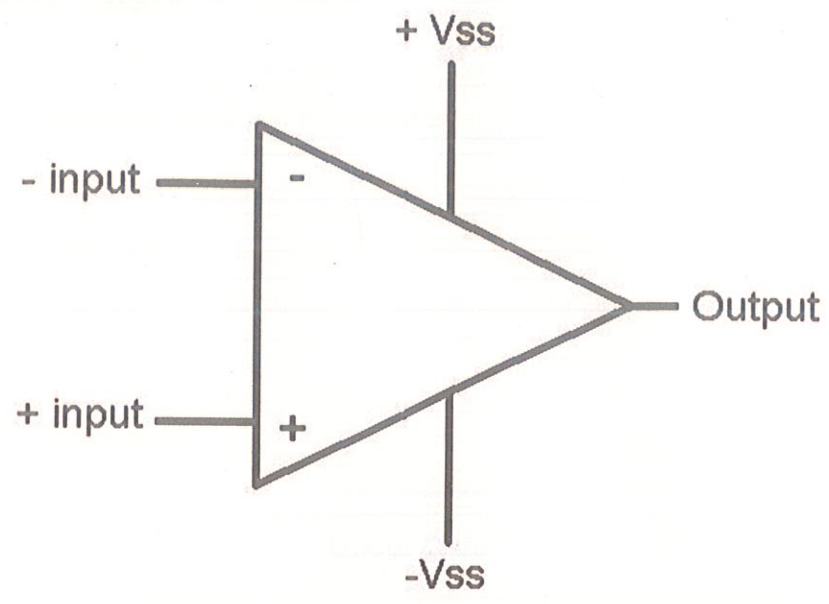


FIGURE 2.1 Operational Amplifier[1]

For clarity, the power supply terminals to the amplifier chip are not usually shown, except on detailed circuit diagrams. The Op-Amp requires two power supplies; a positive voltage supply and a negative voltage supply, both with respect to our circuit ground connection.

The theoretically perfect Op-Amp has an infinite voltage gain, an infinite bandwidth and infinite input impedances. In this way it just senses an input voltage level without actually interfering with that voltage in any way. The perfect Op-Amp also has zero-Ohm output impedance. It may therefore be used to drive heavy (in electronic terms) circuits.

2.1.4 Resistor

Example: 

Function:

Resistors restrict the flow of electric current, for example a resistor is placed in series with a light-emitting diode (LED) to limit the current passing through the LED.

Resistor values - the resistor colour code

Resistance is measured in ohms, the symbol for ohm is an omega Ω.

1 Ωis quite small so resistor values are often given in kΩ and MΩ.

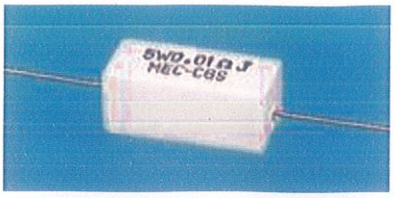
1 kΩ = 1000 Ω, 1 MΩ = 1000000 Ω.

Resistor values are normally shown using coloured bands.

Each colour represents a number as shown in the table.

The Resistor Colour Code	
Colour	Number
	0
Brown	1
Red	2
Orange	3
Yellow	4
Green	5
Blue	6
Violet	7
Grey	8
White	9

TABLE 2.1 Resistor color code



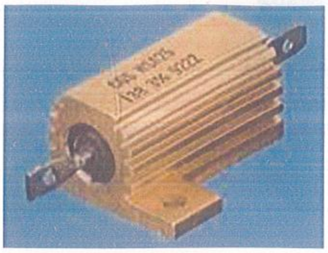


FIGURE 2.2 High power resistors

(5W top, 25W bottom)

Power Ratings of Resistors

Electrical energy is converted to heat when current flows through a resistor. Usually the effect is negligible, but if the resistance is low (or the voltage across the resistor high) a large current may pass making the resistor become noticeably warm. The resistor must be able to withstand the heating effect and resistors have power ratings to show this.

Power ratings of resistors are rarely quoted in parts lists because for most circuits the standard power ratings of 0.25W or 0.5W are suitable. For the rare cases where a higher power is required it should be clearly specified in the parts list, these will be circuits using **low value resistors** (less than about 300Ω) or **high voltages** (more than 15V).

The power, P, developed in a resistor is given by:

$P = I^2 \times R$ where: P = power developed in the resistor in watts (W)

or I = current through the resistor in amps (A)

$P = V^2 / R$ R = resistance of the resistor in ohms (Ω)

V = voltage across the resistor in volts (V)

Examples:

A 470Ω resistor with 10V across it, needs a power rating $P = V^2/R = 10^2/470 = 0.21$W.

In this case a standard 0.25W resistor would be suitable.

A 27Ω resistor with 10V across it, needs a power rating $P = V^2/R = 10^2/27 = 3.7W$.

A high power resistor with a rating of 5W would be suitable.

Variable Resistor

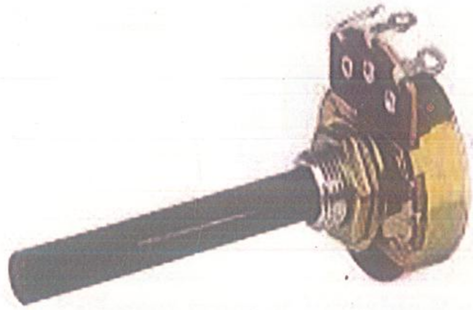


FIGURE 2.3 Variable Resistor [11]

Variable resistors consist of a resistance track with connections at both ends and a wiper which moves along the track as you turn the spindle. The track may be made from carbon, cermet (ceramic and metal mixture) or a coil of wire (for low resistances). The track is usually rotary but straight track versions, usually called sliders, are also available.

Variable resistors may be used as a rheostat with two connections (the wiper and just one end of the track) or as a potentiometer with all three connections in use. Miniature versions called presets are made for setting up circuits which will not require further adjustment.

Variable resistors are often called potentiometers in books and catalogues. They are specified by their maximum resistance, linear or logarithmic track, and their physical size. The standard spindle diameter is 6mm.

The resistance and type of track are marked on the body.

4K7 LIN means 4.7 kΩ linear track. 1M LOG means 1 MΩ logarithmic track.

Some variable resistors are designed to be mounted directly on the circuit board, but most are for mounting through a hole drilled in the case containing the circuit with stranded wire connecting their terminals to the circuit board.

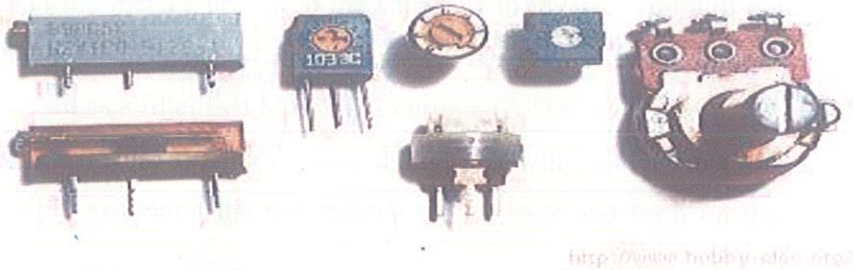


FIGURE 2.4 Different types of Variable Resistors[11]

2.1.5 Capacitor

The capacitor's function is to store electricity, or electrical energy. The capacitor also functions as a filter, passing alternating current (AC), and blocking direct current (DC). This symbol ⊣⊢ is used to indicate a capacitor in a circuit diagram.

The capacitor is constructed with two electrode plates facing each other, but separated by an insulator. When DC voltage is applied to the capacitor, *an electric charge* is stored on each electrode. While the capacitor is charging up, current flows. The current will stop flowing when the capacitor has fully charged.

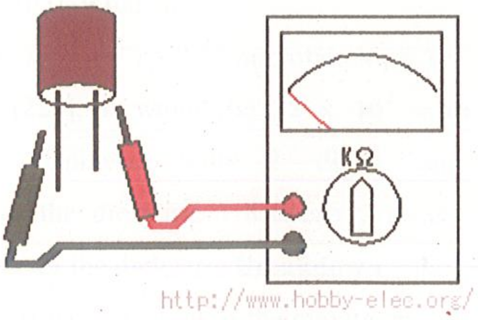


FIGURE 2.5 Capacitor [11]

When a circuit tester, such as an analog meter set to measure resistance, is connected to a 10 microfarad (μF) electrolytic capacitor, a current will flow, but only for a moment. You can confirm that the meter's needle moves off of zero, but returns to zero right away.

When you connect the meter's probes to the capacitor in reverse, you will note that current once again flows for a moment. Once again, when the capacitor has fully charged, the current stops flowing. So the capacitor can be used as a filter that blocks DC current. (A "DC cut" filter.)

However, in the case of alternating current, the current will be allowed to pass. Alternating current is similar to repeatedly switching the test meter's probes back and forth on the capacitor. Current flows every time the probes are switched.

The value of a capacitor (the capacitance), is designated in units called the Farad(F). The capacitance of a capacitor is generally very small, so units such as the microfarad (10^{-6}F), nanofarad (10^{-9}F), and picofarad (10^{-12}F) are used.

Recently, an new capacitor with very high capacitance has been developed. The Electric Double Layer capacitor has capacitance designated in Farad units. These are known as "Super Capacitors."

Sometimes, a three-digit code is used to indicate the value of a capacitor. There are two ways in which the capacitance can be written. One uses letters and numbers, the other uses only numbers. In either case, there are only three characters used. [10n] and [103] denote the same value of capacitance. The method used differs depending on the capacitor supplier. In the case that the value is displayed with the three-digit code, the 1st and 2nd digits from the left show the 1st figure and the 2nd figure, and the 3rd digit is a multiplier which determines how many zeros are to be added to the capacitance. Picofarad (pF) units are written this way.

For example, when the code is [103], it indicates

10×10^3, or 10,000pF = 10 nanofarad(nF) = 0.01 microfarad(μF).

If the code happened to be [224], it would be 22×10^4 = or 220,000pF = 220nF = 0.22μF. Values under 100pF are displayed with 2 digits only. eg, 47 would be 47pF. The capacitor has an insulator(the dielectric) between 2 sheets of electrodes. Different kinds of capacitors use different materials for the dielectric **Breakdown voltage.**

When using a capacitor, you must pay attention to the maximum voltage which can be used. This is the "breakdown voltage." The breakdown voltage depends on the kind of capacitor being used. You must be especially careful with electrolytic capacitors because the breakdown voltage is comparatively low. The breakdown voltage of electrolytic capacitors is displayed as Working Voltage. The breakdown voltage is the voltage that when exceeded will cause the dielectric (insulator) inside the capacitor to break down and conduct. When this happens, the failure can be catastrophic.

Electrolytic Capacitors (Electrochemical type capacitors).

Aluminum is used for the electrodes by using a thin oxidization membrane. Large values of capacitance can be obtained in comparison with the size of the capacitor, because the dielectric used is very thin. The most important characteristic of electrolytic capacitors is that they have polarity. They have a positive and a negative electrode [Polarized]. This means that it is very important which way round they are connected. If the capacitor is subjected to voltage exceeding its working voltage, or if it is connected with incorrect polarity, it may burst. It is extremely dangerous, because it can quite literally explode. Make absolutely no mistakes. Generally, in the circuit diagram, the positive side is indicated by a "+" (plus) symbol.

Electrolytic capacitors range in value from about 1μF to thousands of μF. Mainly this type of capacitor is

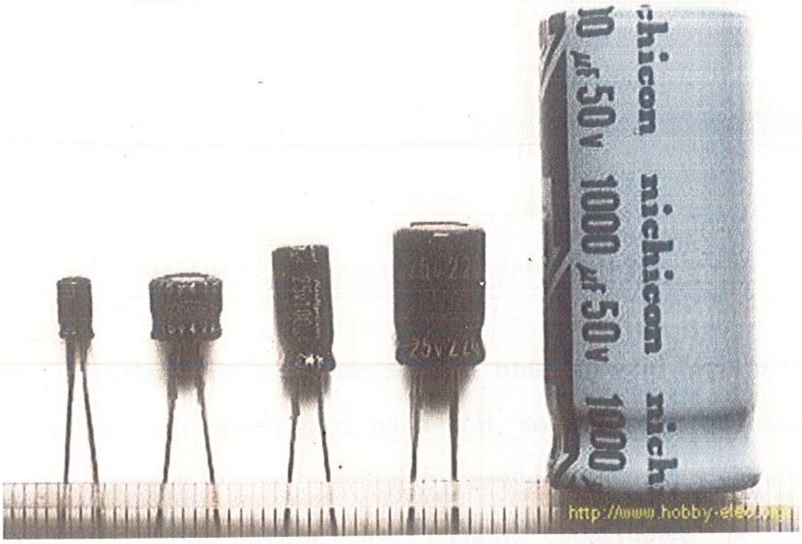


FIGURE 2.6 Electrolytic Capacitors [11]

used as a ripple filter in a power supply circuit, or as a filter to bypass low frequency signals, etc. Because this type of capacitor is comparatively similar to the nature of a coil in construction, it isn't possible to use for high-frequency circuits. (It is said that the frequency characteristic is bad.)

The Figure 2.6 is an example of the different values of electrolytic capacitors in which the capacitance and voltage differ, from the left to right:

1μF (50V) [diameter 5 mm, high 12 mm]

47μF (16V) [diameter 6 mm, high 5 mm]

100μF (25V) [diameter 5 mm, high 11 mm]
220μF (25V) [diameter 8 mm, high 12 mm]
1000μF (50V) [diameter 18 mm, high 40 mm].
The size of the capacitor sometimes depends on the manufacturer. So the sizes shown here are just examples.

Ceramic Capacitors

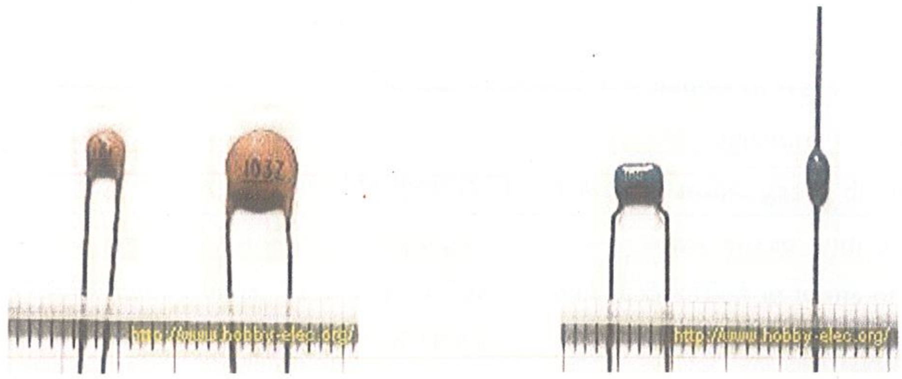


FIGURE 2.7 Ceramic Capacitors [11]

Ceramic capacitors are constructed with materials such as titanium acid barium used as the dielectric. Internally, these capacitors are not constructed as a coil, so they can be used in high frequency applications. Typically, they are used in circuits which bypass high frequency signals to ground.
These capacitors have the shape of a disk. Their capacitance is comparatively small. The capacitor on the left is a 100pF capacitor with a diameter of about 3 mm. The capacitor on the right side is printed with 103, so 10 x 10^3pF becomes 0.01 μF. The diameter of the disk is about 6 mm.
Ceramic capacitors have no polarity.
Ceramic capacitors should not be used for analog circuits, because they can distort the signal.

2.1.6 Gas Sensor

Gas sensors interact with a gas to initiate the measurement of its concentration. The gas sensor then provides output to a gas instrument to display the measurements. Common gases measured by gas sensors include ammonia, aerosols, arsine, bromine, carbon dioxide, carbon monoxide, chlorine, chlorine dioxide, diborane, dust, fluorine, germane, halocarbons or refrigerants, hydrocarbons, hydrogen, hydrogen chloride, hydrogen cyanide, hydrogen fluoride, hydrogen selenide, hydrogen sulfide, mercury vapor, nitrogen dioxide, nitrogen oxides, nitric oxide, organic solvents, oxygen, ozone, phosphine, silane, sulfur dioxide, and water vapor.

Important measurement specifications to consider when looking for gas sensors include the response time, the distance, and the flow rate. The response time is the amount of time required from the initial contact with the gas to the sensors processing of the signal. Distance is the maximum distance from the leak or gas source that the sensor can detect gases. The flow rate is the necessary flow rate of air or gas across the gas sensor to produce a signal.

Gas sensors can output a measurement of the gases detected in a number of ways. These include percent LEL, percent volume, trace, leakage, consumption, density, and signature or spectra. The lower explosive limit (LEL) or lower flammable limit (LFL) of a combustible gas is defined as the smallest amount of the gas that will support a self-propagating flame when mixed with air (or oxygen) and ignited. In gas-detection systems, the amount of gas present is specified in terms of % LEL: 0% LEL being a combustible gas-free atmosphere and 100% LEL being an atmosphere in which the gas is at its lower flammable limit. The relationship between % LEL and % by volume differs from gas to gas. Also called volume percent or percent by volume, percent volume is typically only used for mixtures of liquids. Percent by volume is simply the volume of the solute divided by the sum of the volumes of the other components multiplied by 100%. Trace gas sensors given in units of concentration: ppm. Leakage is given as a flow rate like ml/min. Consumption may also be called respiration. Given in units of ml/L/hr. Density measurements are given in units of density: mg/m^3. A signature or spectra measurement is a spectral signature of the gases present; the output is often a chromatogram.

Common outputs from gas sensors include analog voltage, pulse signals, analog currents and switch or relays. Operating parameters to consider for gas sensors include operating temperature and operating humidity.

FIGURE 2.8 Gas sensor

2.1.6 Voltage Regulator

A voltage regulator is an electrical regulator designed to automatically maintain a constant voltage level.

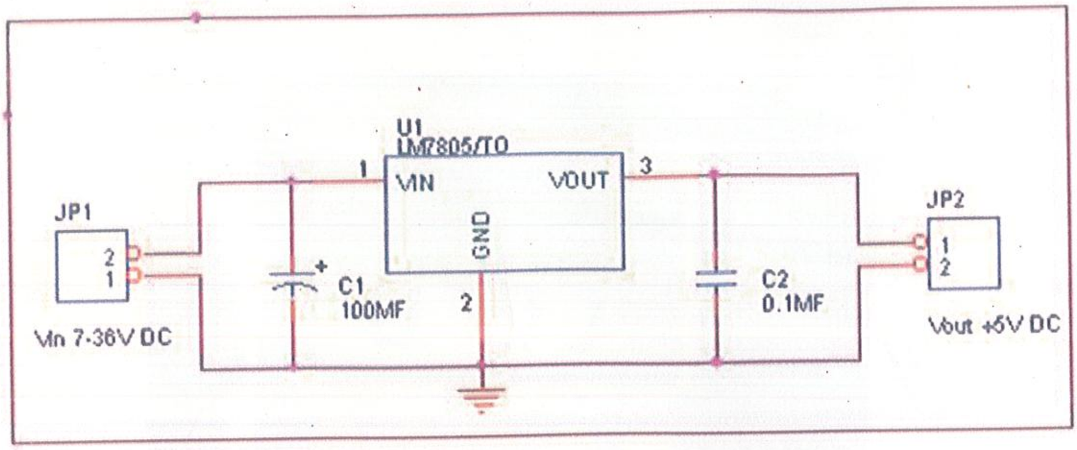


FIGURE 2.9 Circuit of power supply

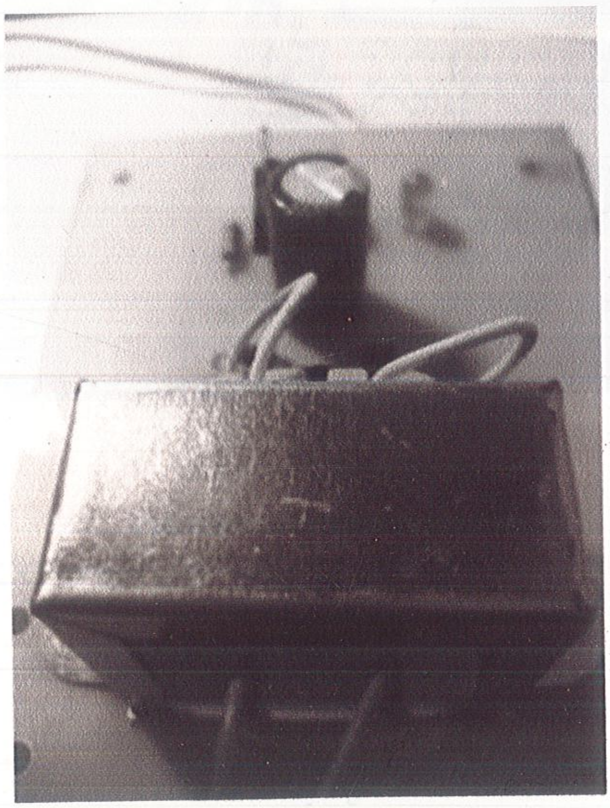


FIGURE 2.10 Power Supply

s

FIGURE 2.11 Multimeter

Output DC voltage of 5V after adjusting the variable resistance

Transformer

A transformer is a device that transfers electrical energy from one circuit to another through inductively coupled conductors of the transformer's coils. A varying current in the first or *primary* winding creates a varying magnetic flux in the transformer's core and thus a varying magnetic field through the *secondary* winding. This varying magnetic field induces a varying electromotive force (EMF), or "voltage", in the secondary winding. This effect is called inductive coupling.[3]

FIGURE 2.12 Transformer

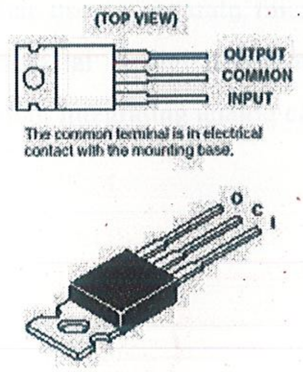


FIGURE 2.13 LM7805

2.1.7 Microcontroller

A microcontroller (also microcontroller unit, MCU or μC) is a small computer on a single integrated circuit consisting of a relatively simple CPU combined with support functions such as a crystal oscillator, timers, watchdog, serial and analog I/O etc. Program memory in the form of NOR flash or OTP ROM is also often included on chip, as well as a, typically small, read/write memory.

Microcontrollers are designed for small or dedicated applications. Thus, in contrast to the microprocessors used in personal computers and other high-performance or general purpose applications, simplicity is emphasized. Some microcontrollers may operate at clock frequencies as low as 32kHz, as this is adequate for many typical applications, enabling low power consumption (mill watts or microwatts). They will generally have the ability to retain functionality while waiting for an event such as a button press or other interrupt; power consumption while sleeping (CPU clock and most peripherals off) may be just Nano watts, making many of them well suited for long lasting battery applications. Other microcontrollers may serve performance-critical roles, where they may need to act more like a Digital signal processor (DSP), using higher clock speeds and not needing such very low powered operation.

Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, remote controls, office machines, appliances, power tools, and toys. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes. Mixed signal microcontrollers are common, integrating analog components needed to control non-digital electronic systems.[4]

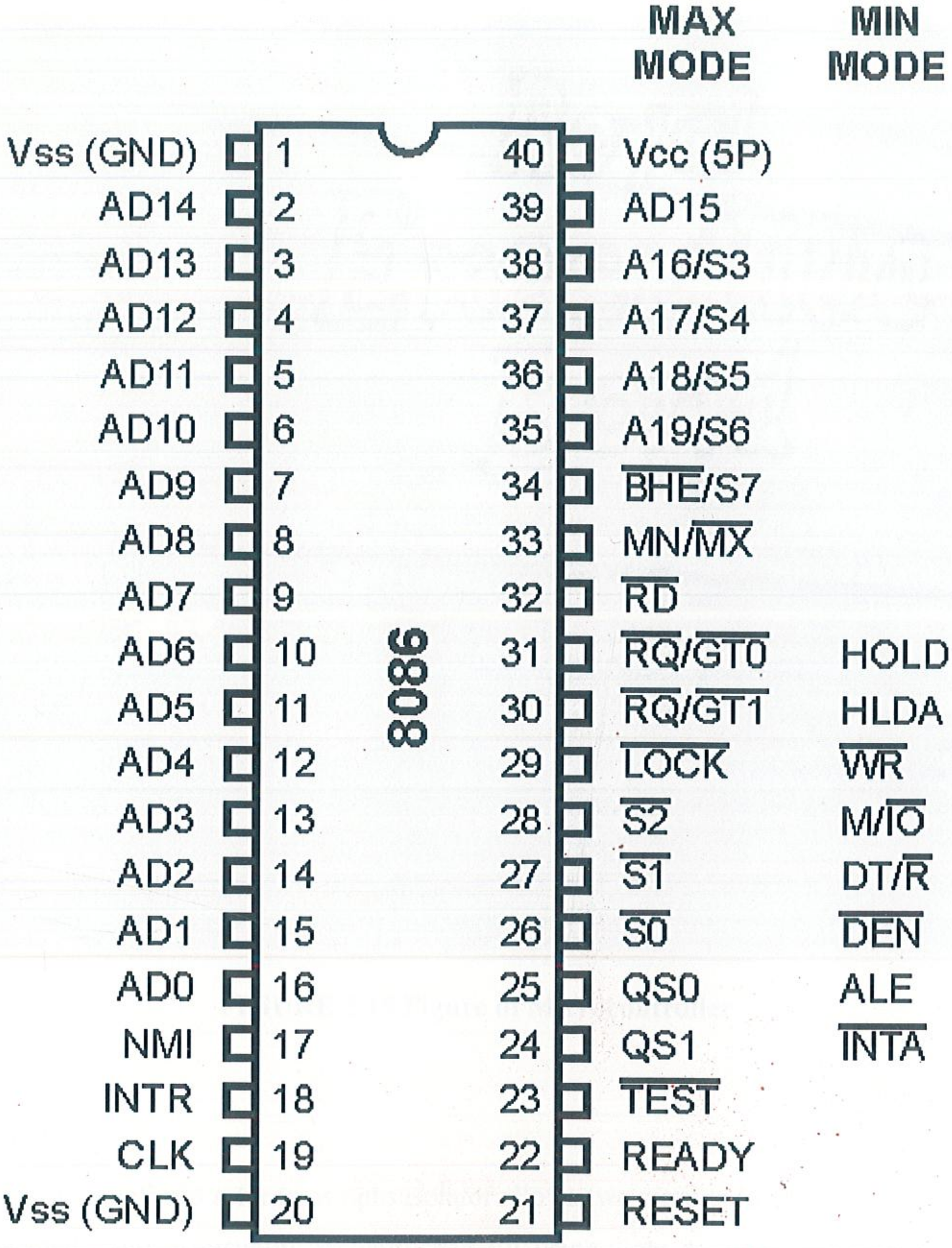


FIGURE 2.14 Pin Diagram Of microcontroller[5]

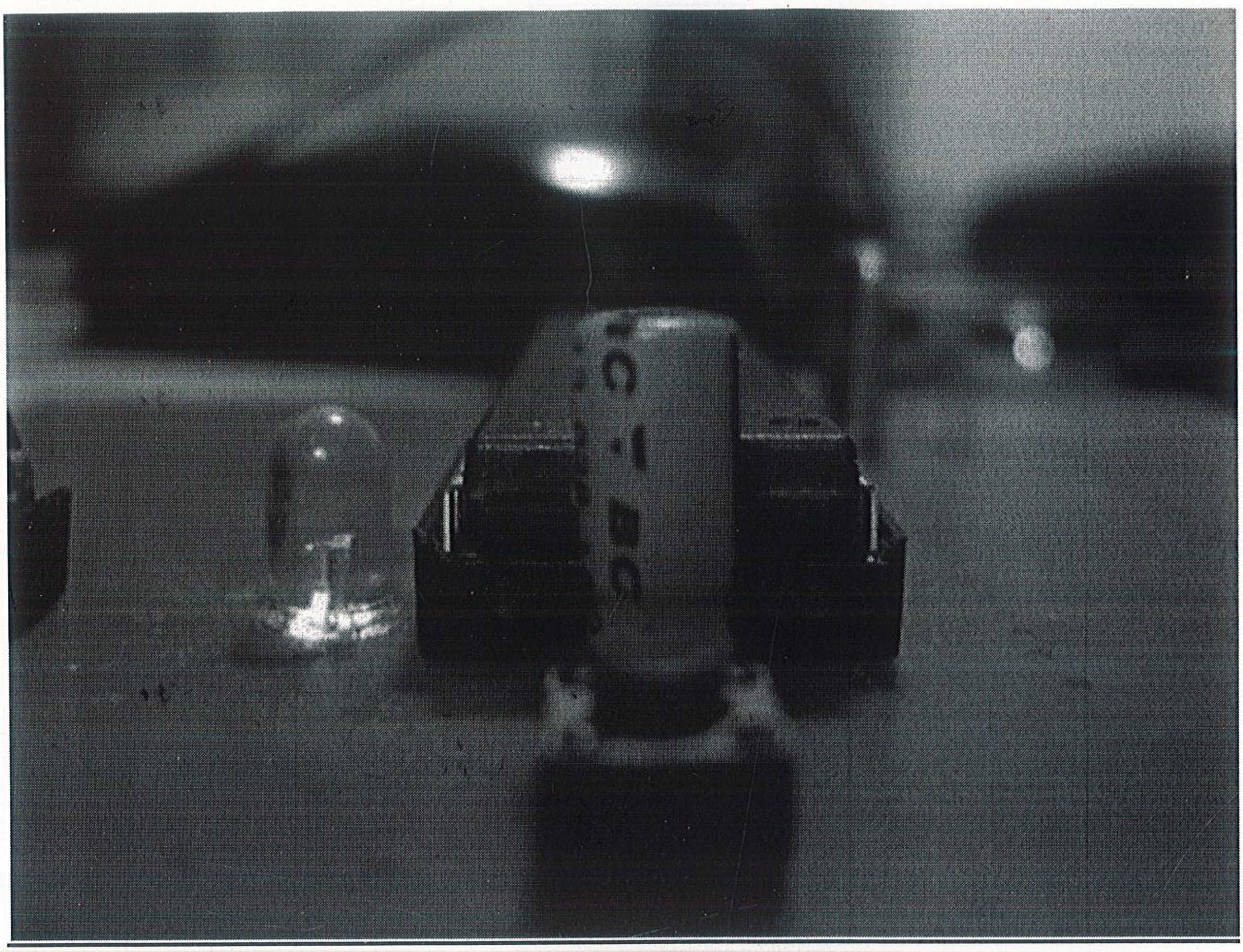


FIGURE 2.15 Figure of Microcontroller

2.1.8 Optocoupler

An Optocoupler or sometimes refer to as opto isolator allows two circuits to exchange signals yet remain electrically isolated. This is usually accomplished by using light to relay the signal. The standard Optocoupler circuits design uses a LED shining on a phototransistor-usually it is an n-p-n transistor and not p-n-p. The signal is applied to the LED, which then shines on the transistor in the IC.

The light is proportional to the signal, so the signal is thus transferred to the phototransistor. Optocoupler may also comes in few module such as the SCR, photodiodes, TRIAC of other semiconductor switch as an output, and incandescent lamps, neon bulbs or other light source. The most commonly used optocoupler which is the combination of LED and phototransistor is used here.

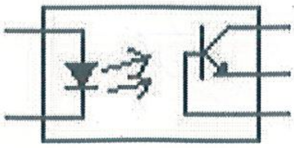


FIGURE 2.16 Schematic of Optocoupler

The Optocoupler usually found in switch mode power supply circuit in much electronic equipment. It is connected in between the primary and secondary section of power supplies.

Chapter 3

Work Description

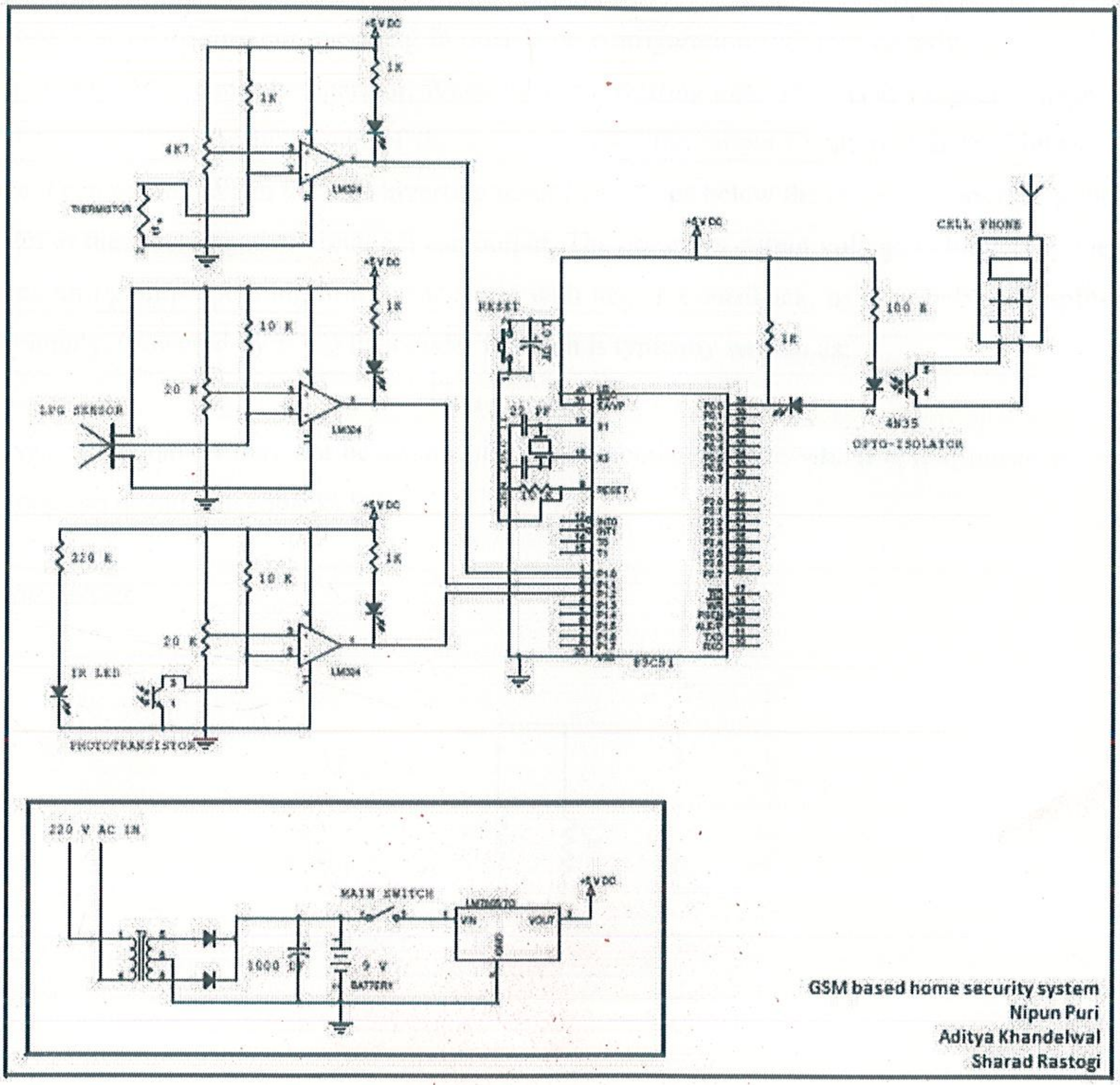


FIGURE 3.1 Circuit Diagram of Home Security System

3.1 Comparator circuit

All the circuits designed are based on a general Comparator circuit design. A comparator circuit basically compares two voltages or current and switches its output to indicate which is larger. An operational amplifier (op-amp) has a well balanced difference input and a very high gain. This parallels the characteristics of comparators and can be substituted in applications with low-performance requirements. In theory, a standard op-amp operating in open-loop configuration (without negative feedback) may be used as a low-performance comparator. When the non-inverting input (V+) is at a higher voltage than the inverting input (V-), the high gain of the op-amp causes the output to saturate at the highest positive voltage it can output. When the non-inverting input (V+) drops below the inverting input (V-), the output saturates at the most negative voltage it can output. The op-amp's output voltage is limited by the supply voltage. An op-amp operating in a linear mode with negative feedback, using a balanced, split-voltage power supply, (powered by ± V_S) its transfer function is typically written as:

$$V_{out} = A_o(V_1 - V_2)$$

However, this equation may not be applicable to a comparator circuit which is non-linear and operates open-loop (no negative feedback).[6]

3.2 Heat Sensor

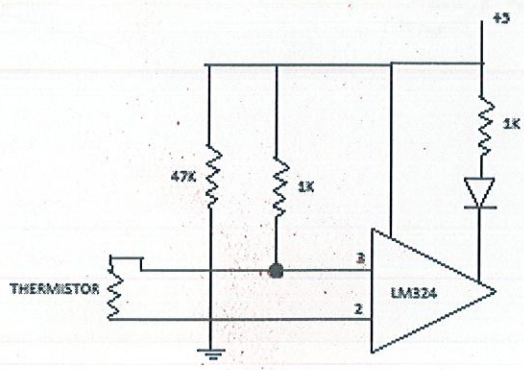


FIGURE 3.2 Circuit Diagram of Heat Sensor

A **heat flux sensor** is a commonly used name for a transducer generating a signal that is proportional to the local heat flux. This heat flux can have different origins; in principle convective-, radiative- as well as conductive heat can be measured. Heat flux sensors are known under different names, such as heat flux transducers, heat flux gauges, heat flux plates. In SI units heat flux is measured in watts per square meter. A heat flux sensor should measure the local heat flux in one direction. The result is expressed in watts per square meter. The calculation is done according to:

$$\phi_q = \frac{V_{\text{sen}}}{E_{\text{sen}}}$$

Where V_{sen} is the sensor output and E_{sen} is the calibration constant, specific for the sensor.

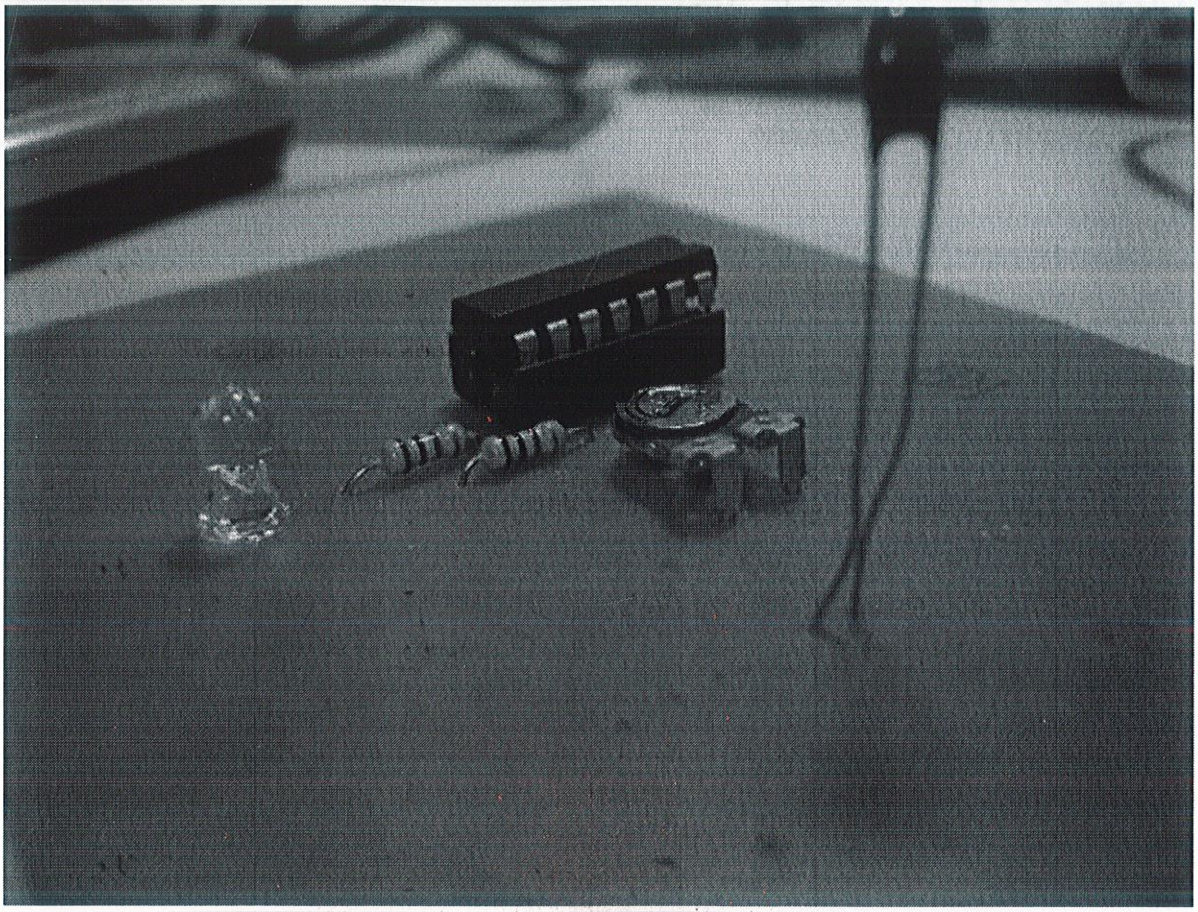


FIGURE 3.3(a) Figure of heat sensor circuit

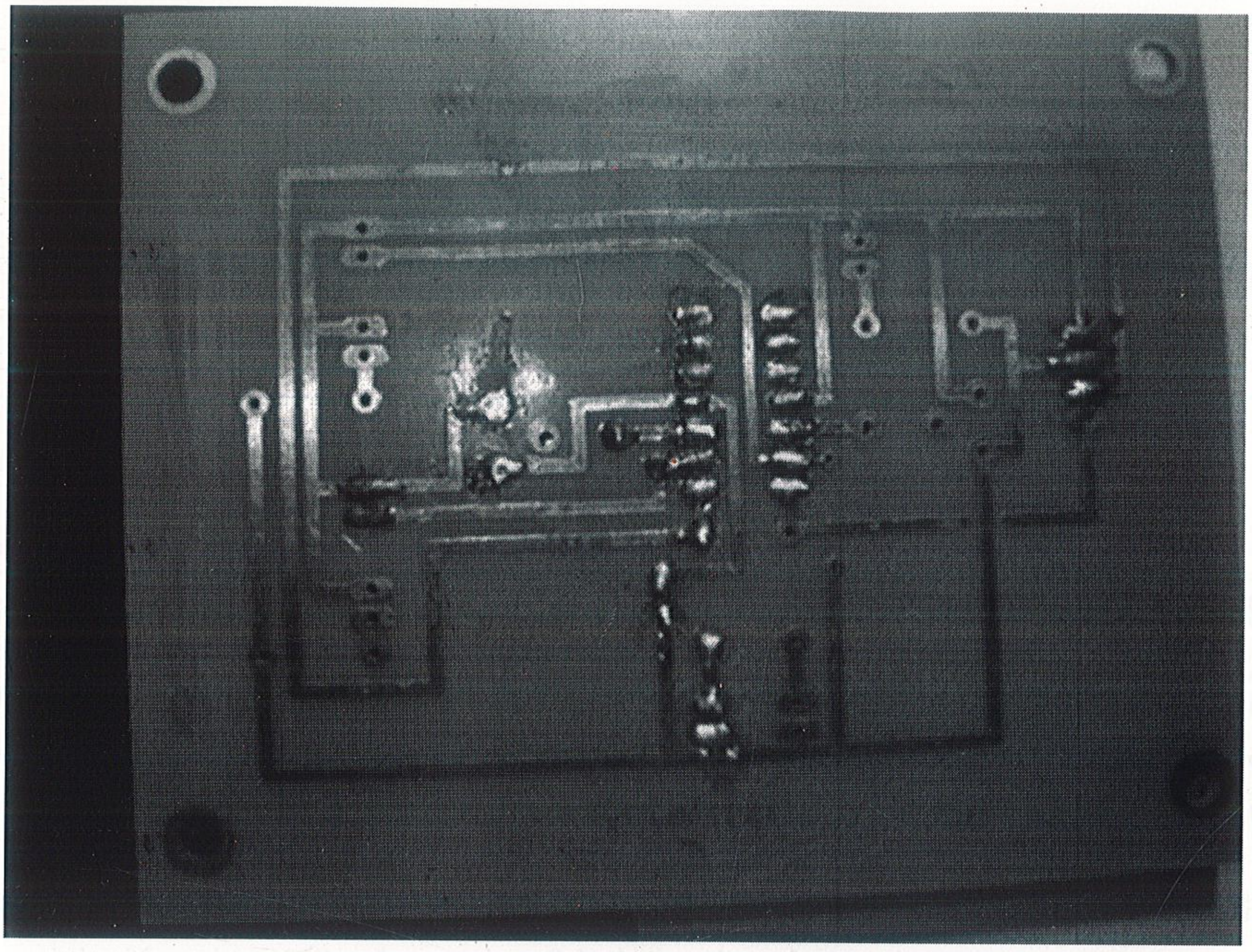


FIGURE 3.3(b) Figure of Heat sensor PCB

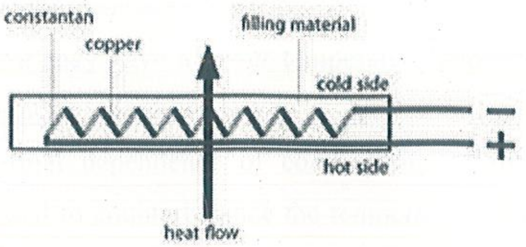


FIGURE 3.4 Internal diagram of heat flux sensor[3]

3.2.1 General characteristics of a heat flux sensor

As shown before in the figure above, heat flux sensors generally have the shape of a flat plate and a sensitivity in the direction perpendicular to the sensor surface.

Usually a number of thermocouples connected in series called thermopiles are used. General advantages of thermopiles are their stability, low ohmic value (which implies little pickup of electromagnetic disturbances), good signal-noise ratio and the fact that zero input gives zero output. Disadvantageous is the low sensitivity.

For better understanding of heat flux sensor behavior, it can be modeled as a simple electrical circuit consisting of a resistance, *R*, and a capacitor, *C*. In this way it can be seen that one can attribute a thermal resistance R_{sen}, a thermal capacity C_{sen} and also a response time τ_{sen} to the sensor.

Usually, the thermal resistance and the thermal capacity of the entire heat flux sensor are equal to those of the filling material. Stretching the analogy with the electric circuit further, one arrives at the following expression for the response time:

$$\tau_{sen} = R_{sen} C_{sen} = \frac{d^2 \rho C_p}{\lambda}$$

In which d is the sensor thickness, ρ the density, C_p the specific heat capacity and λ the thermal conductivity. From this formula one can conclude that material properties of the filling material and dimensions are determining the response time. As a rule of thumb, the response time is proportional to the thickness to the power of two.

Other parameters that are determining sensor properties are the electrical characteristics of the thermocouple. The temperature dependence of the thermocouple causes the temperature dependence and the non-linearity of the heat flux sensor. The non linearity at a certain temperature is in fact the derivative of the temperature dependence at that temperature.

However, a well designed sensor may have a lower temperature dependence and better linearity than expected. There are two ways of achieving this:

As a first possibility, the thermal dependence of conductivity of the filling material and of the thermocouple material can be used to counterbalance the temperature dependence of the voltage that is generated by the thermopile. Another possibility to minimize the temperature dependence of a heat flux sensor, is to use a resistance network with an incorporated thermistor. The temperature dependence of the thermistor will balance the temperature dependence of the thermopile. Another factor that determines heat flux sensor behavior is the construction of the sensor. In particular some designs have a strongly nonuniform sensitivity. Others even exhibit sensitivity to lateral fluxes. The sensor schematically given in the above figure would for example also be sensitive to heat flows from left to right. This type of behavior will not cause problems as long as fluxes are uniform and in one direction only.

3.3 Infrared Transceiver

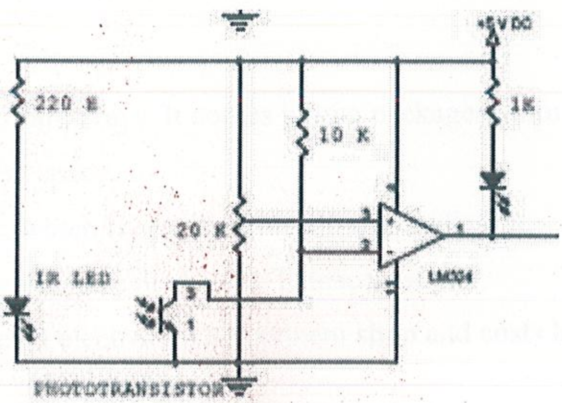


FIGURE 3.5 Circuit Diagram of IR Transceiver

3.3.1 Overview

This sensor can be used to detect reflecting silver/white strip, obstacle detection, flame detection, etc. These sensors are primary requirement of any simple line follower robo-car.

3.3.2 Principle

IR LED emits infrared radiation. This radiation illuminates the surface in front of LED. Surface reflects the infrared light. Depending on reflectivity of the surface, amount of light reflected varies. This reflected light is made incident on reverse biased IR sensor. When photons are incident on reverse biased junction of this diode, electron-hole pairs are generated, which results in reverse leakage current. Amount of electron-hole pairs generated depends on intensity of incident IR radiation. More intense radiation results in more reverse leakage current. This current can be passed through a resistor so as to get proportional voltage. Thus as intensity of incident rays varies, voltage across resistor will vary accordingly.

This voltage can then be given to OPAMP based comparator. Output of the comparator can be read by uC. Alternatively, you can use on-chip ADC in AVR microcontroller to measure this voltage and perform comparison in software.

3.3.3 IR LED and IR sensor

IR LED is used as a source of infrared rays. It comes in two packages 3mm or 5mm.

3mm is better as it is requires less space.

IR sensor is nothing but a diode, which is sensitive for infrared radiation.

This infrared transmitter and receiver is called as IR Transceiver pair.

It can be obtained from any decent electronics component shop and costs less than 10Rs. Following snap shows 5mm IR pairs.

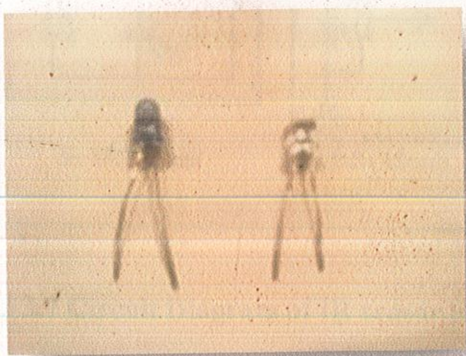


FIGURE 3.6 IR Transceiver Pair

Colour of IR transmitter and receiver is different. However you may come across pairs which appear exactly same or even has opposite colours than shown in above pic and it is not possible to distinguish between Transceiver visually. In case you will have to take help of multimeter to distinguish between them.

Here is how you can distinguish between IR Transceiver using DMM :

- Connect cathode of one LED to +ve terminal of DMM.
- Connect anode of the same LED to common terminal of DMM (means connect LED such that It gets reverse biased by DMM).
- Set DMM to measure resistance upto 2M Ohm.
- Check the reading.
- Repeat above procedure with second LED.
- In above process, when you get the reading of the few hundred Kilo Ohms on DMM, then it indicated that LED that you are testing is IR sensor. In case of IR transmitter DMM will not show any reading.

While buying an IR sensor, make sure that its reverse resistance in ambient light is below 1000K. If it is more than this value, then it will not be able to generate sufficient voltage across external resistor and hence will be less sensitive to small variation in incident light.

The circuit diagram :

Circuit diagram for IR sensor module is very simple and straight forward.

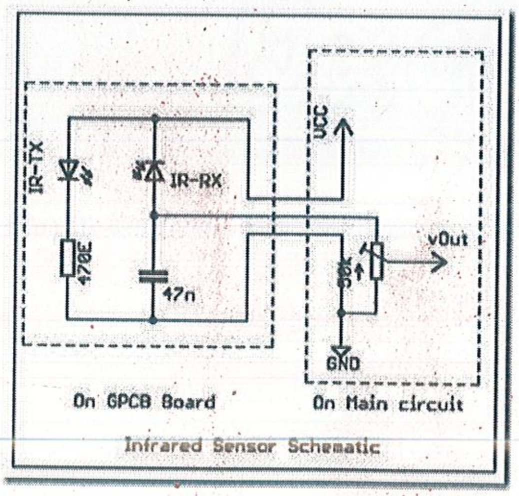


FIGURE 3.7 Circuit Diagram of IR sensor module[4]

Circuit is divided into two sections. IR Tx and IR Rx are to be soldered on small general purpose Grid PCB. From this module, take out 3 wires of sufficiently long length (say 1 ft). Then, as shown above, connect them to VCC, preset and to ground on main board. By adjusting preset, you can adjust sensitivity of the sensor. VCC should be connected to 5V supply.

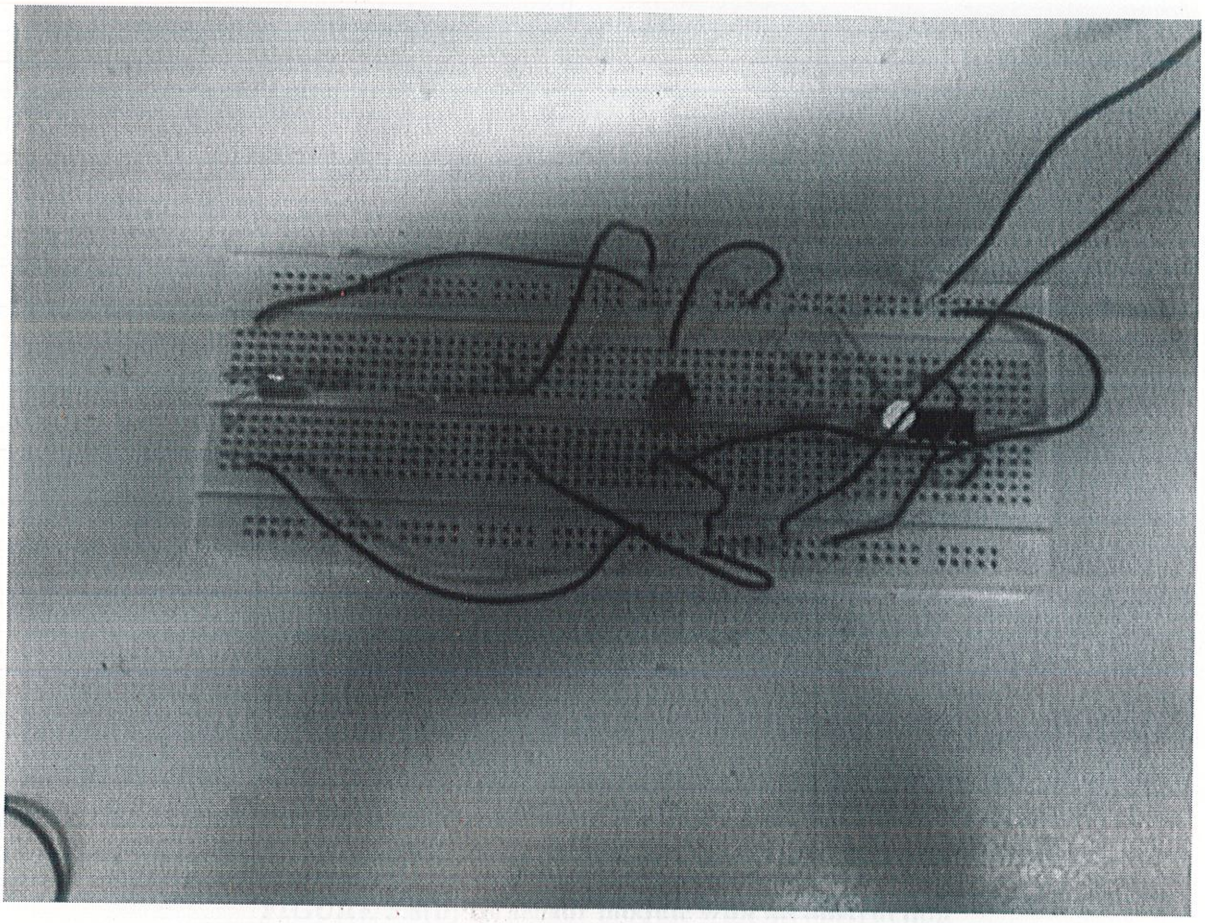


FIGURE 3.8(a) IR sensor module constructed on bread board

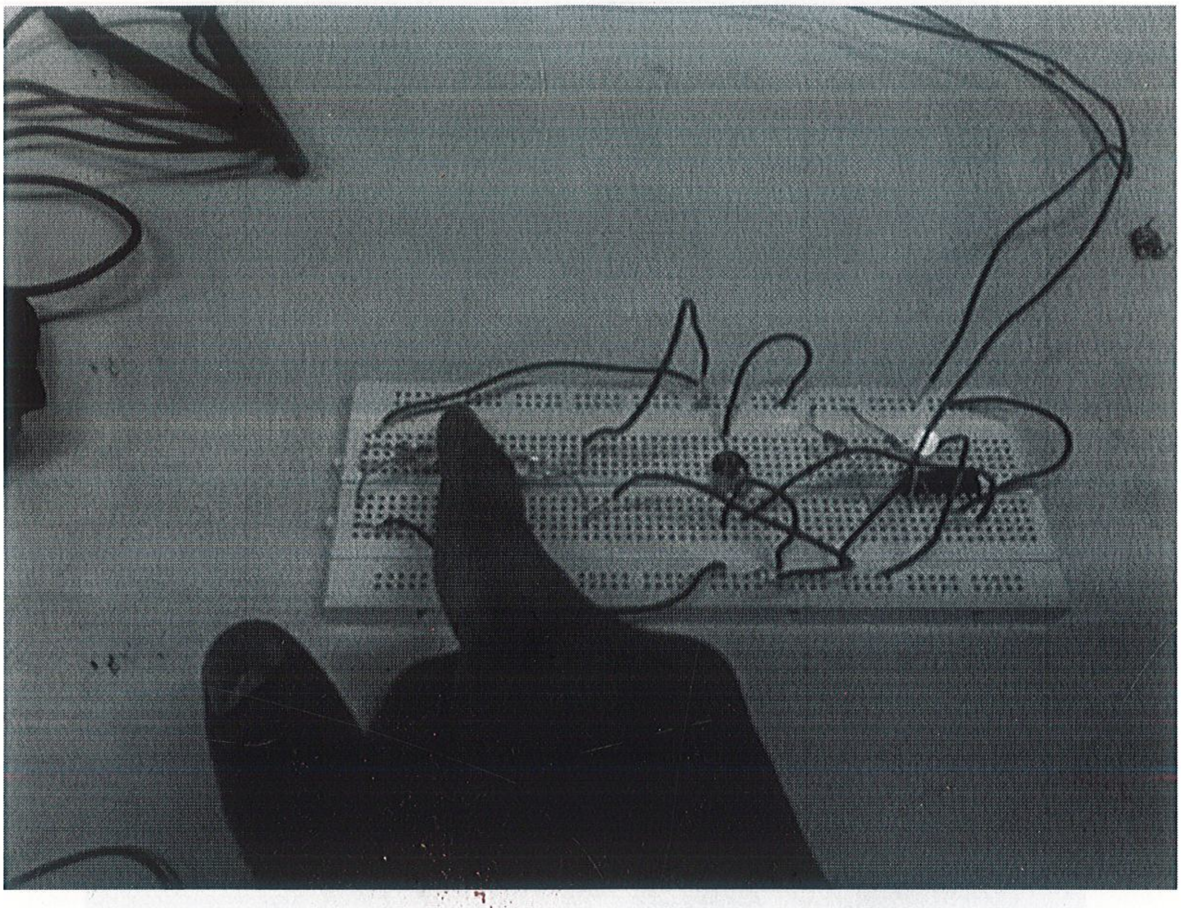


FIGURE 3.8(b) IR sensor module with an obstruction
Notice the LED turns on when the IR Transceiver pair has an obstruction between it

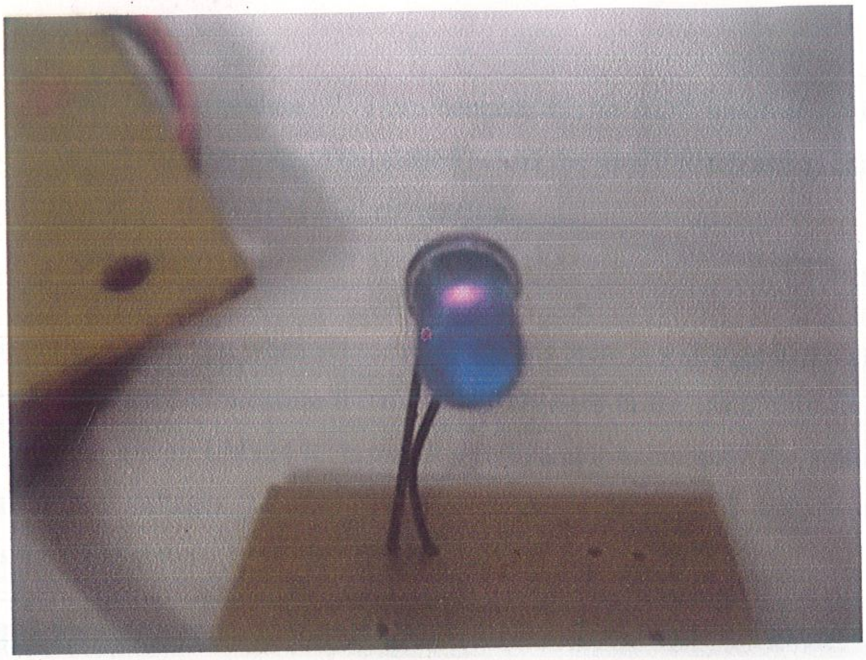


FIGURE 3.9(a) IR sensor module on a PCB
Notice IR light can be seen on a digital camera

FIGURE 3.9(b) IR sensor module on a PCB

NOTE :

Vout is the output from sensor module. You can connect this to ADC input of AVR microcontroller. Now using ADC, you can read the voltage developed across the movable tap and grounded pin of preset. Alternatively you can also use OPAMP based comparator.

3.4 Gas sensor

Gas sensor is based on the fact that when sensor sense the gas there is a change in the internal resistance. The gas sensor circuit is used to measure the resistance changes in the metal thin film when the gas is passed through it. In our circuit LM324 IC is use as a comparator to compare the voltage across the film with different reference voltages. Comparator gives negative or positive voltage at the output and according to this the LED glows.

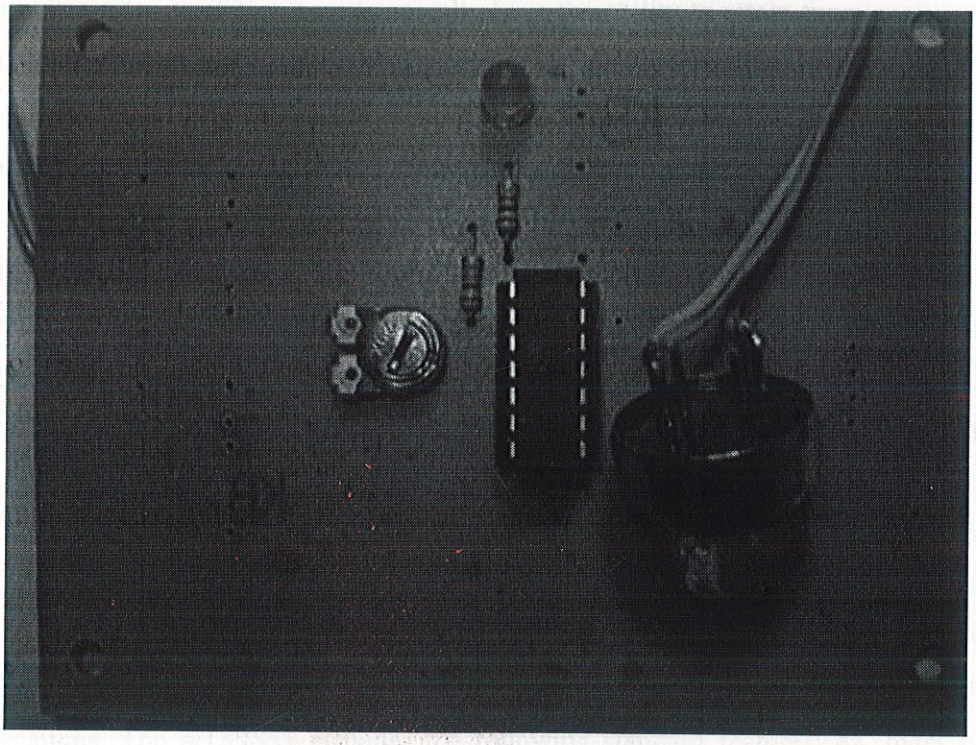


FIGURE 3.10 Gas sensor circuit

3.5 Microcontroller

The controller is used to do all the programming. A microcontroller (also MCU or μC) is a functional computer system-on-a-chip. It contains a processor core, memory, and programmable input/output peripherals. Microcontrollers include an integrated CPU, memory (a small amount of RAM, program memory, or both) and peripherals capable of input and output. It emphasizes high integration, in contrast to a microprocessor which only contains a CPU (the kind used in a PC). In addition to the usual arithmetic and logic elements of a general purpose microprocessor, the microcontroller integrates additional elements such as read-write memory for data storage, read-only memory for program storage, Flash memory for permanent data storage, peripherals, and input/output interfaces. At clock speeds of as little as 32KHz, microcontrollers often operate at very low speed compared to microprocessors, but this is adequate for typical applications. They consume relatively little power (milliwatts or even microwatts), and will generally have the ability to retain functionality while waiting for an event such as a button press or interrupt. Power consumption while sleeping (CPU clock and peripherals disabled) may be just nanowatts, making them ideal for low power and long lasting battery applications. Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, remote controls, office machines, appliances, power tools, and toys. By reducing the size, cost, and power consumption compared to a design using a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to electronically control many more processes. The AT89S51 is a low-power, high-performance CMOS 8-bit microcontroller with 4K bytes of In-System Programmable Flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-Standard 80C51 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with In-System Programmable Flash on a monolithic chip, the Atmel AT89S51 is a powerful microcontroller which provides a highly-flexible and cost-effective solution to many embedded control applications. The AT89S51 provides the following standard features: 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, two 16-bit timer/counters, a Five vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S51 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 external interrupt or hardware reset.[7]

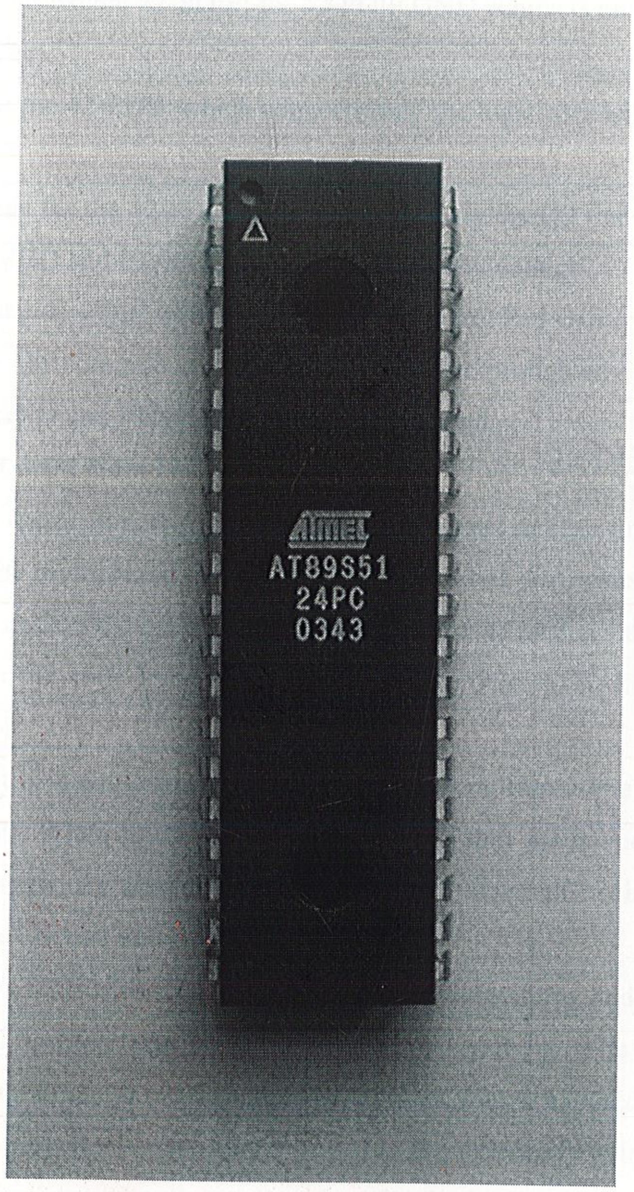


FIGURE 3.11 AT89S51

3.5.1 Pin Description

VCC - Supply voltage (all packages except 42-PDIP).

GND - Ground (all packages except 42-PDIP; for 42-PDIP GND connects only the logic core and the embedded program memory).

VDD - Supply voltage for the 42-PDIP which connects only the logic core and the embedded program memory.

PWRVDD - Supply voltage for the 42-PDIP which connects only the I/O Pad Drivers. The application board must connect both VDD and PWRVDD to the board supply voltage.

PWRGND - Ground for the 42-PDIP which connects only the I/O Pad Drivers. PWRGND and GND are weakly connected through the common silicon substrate, but not through any metal link. The application board must connect both GND and PWRGND to the board 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 can 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 pull-ups. Port 0 also receives the code bytes during Flash programming and outputs the code bytes during program verification. External pull-ups are required during program verification.

Port 1 - Port 1 is an 8-bit bi-directional I/O port with internal pull-ups. 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 pull-ups and can be used as inputs. As inputs, Port 1 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups.

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 pull-ups. 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 pull-ups and can be used as inputs. As inputs, Port 2 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups. Port 2 emits the high-order address byte during fetches from external program memory and during accesses to external data memory that uses 16-bit addresses (MOVX @ DPTR). In this application, Port 2 uses strong internal pull-ups when emitting 1s. During accesses to external data memory that uses 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 pull-ups. 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 pull-ups and can be used as inputs. As inputs, Port 3 pins that are externally being pulled low will source current (IIL) because of the pull-ups. Port 3 receives some control signals for Flash programming and verification. Port 3 also serves the functions of various special features of the AT89S51, as shown in the following table.

RST - Reset input. A high on this pin for two machine cycles while the oscillator is running resets the device. This pin drives High for 98 oscillator periods after the Watchdog times out. The DISRTO bit in SFR AUXR (address 8EH) can be used to disable this feature. In the default state of bit DISRTO, the RESET HIGH out feature is enabled.

ALE/PROG - Address Latch Enable (ALE) is an output pulse for latching the low byte of the address during accesses to external memory. This pin is also the program pulse input (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 timing 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 during 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.

PSEN - Program Store Enable (PSEN) is the read strobe to external program memory. When the AT89S51 is executing code from external program memory, PSEN is activated twice each machine cycle, except that two PSEN activations are skipped during each access to external data memory.

EA/VPP - External Access Enable. 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, EA will be internally latched on reset. EA should be strapped to VCC for internal program executions.

This pin also receives the 12-volt programming enable voltage (VPP) during Flash programming.

XTAL1 - Input to the inverting oscillator amplifier and input to the internal clock operating circuit.

XTAL2 - Output from the inverting oscillator amplifier.

Chapter 4

Process Undertaken

4.1 Soldering

Soldering is a process in which two or more metal items are joined together by melting and flowing a filler metal into the joint, the filler metal having a relatively low melting point. Soft soldering is characterized by the melting point of the filler metal, which is below 400 °C (800 °F). The filler metal used in the process is called solder.

Soldering is distinguished from brazing by use of a lower melting-temperature filler metal; it is distinguished from welding by the base metals not being melted during the joining process. In a soldering process, heat is applied to the parts to be joined, causing the solder to melt and be drawn into the joint by capillary action and to bond to the materials to be joined by wetting action. After the metal cools, the resulting joints are not as strong as the base metal, but have adequate strength, electrical conductivity, and water-tightness for many uses. Soldering is an ancient technique mentioned in the Bible and there is evidence that it was employed up to 5000 years ago in Mesopotamia.

4.1.1 Applications

One of the most frequent application of soldering is assembling electronic components to printed circuit boards (PCBs). Another common application is making permanent but reversible connections between copper pipes in plumbing systems. Joints in sheet metal objects such as food cans, roof flashing, rain gutters and automobile radiators have also historically been soldered, and occasionally still are. Jewelry components are assembled and repaired by soldering. Small mechanical parts are often soldered as well. Soldering is also used to join lead came and copper foil in stained glass work. Soldering can also be used to effect a semi-permanent patch for a leak in a container cooking vessel.[8]

FIGURE 4.1 Solder used in soldering

4.2 Printed circuit board

4.2.1 Introduction

A printed circuit board, or PCB, is used to mechanically support and electrically connect electronic components using conductive pathways, tracks or signal traced from copper sheets laminated onto a non-conductive substrate. It is also referred to as printed wiring board (PWB) or etched wiring board. Printed circuit boards are used in virtually all but the simplest commercially produced electronic devices.

A PCB populated with electronic components is called a printed circuit assembly (PCA), printed circuit board assembly or PCB Assembly (PCBA). In informal use the term "PCB" is used both for bare and assembled boards, the context clarifying the meaning

4.2.2 Manufacturing

Conducting layers are typically made of thin copper foil. Insulating layers dielectric is typically laminated together with epoxy resin. The board is typically coated with a solder mask that is green in color. Other colors that are normally available are blue, black, white and red. There are quite a few different dielectrics that can be chosen to provide different insulating values depending on the requirements of the circuit. Some of these dielectrics are polytetrafluoroethylene (Teflon), FR-4, FR-1, CEM-1 or CEM-3. Well known prepreg materials used in the PCB industry are FR-2 (Phenol cotton paper), FR-3 (Cotton paper and epoxy), FR-4 (Woven glass and epoxy), FR-5 (Woven glass and epoxy), FR-6 (Matte glass and polyester), G-10 (Woven glass and epoxy), CEM-1 (Cotton paper and epoxy), CEM-2 (Cotton paper and epoxy), CEM-3 (Non-woven glass and epoxy), CEM-4 (Woven glass and epoxy), CEM-5 (Woven glass and polyester). Thermal expansion is an important consideration especially with ball grid array (BGA) and naked die technologies, and glass fiber offers the best dimensional stability.

FR-4 is by far the most common material used today. The board with copper on it is called "copper-clad laminate".

Copper foil thickness can be specified in ounces per square foot or micrometers. One ounce per square foot is 1.344 mils or 34 micrometers [9].

4.2.3 Etching

The vast majority of printed circuit boards are made by bonding a layer of copper over the entire substrate, sometimes on both sides, (creating a "blank PCB") then removing unwanted copper after applying a temporary mask (e.g., by etching), leaving only the desired copper traces. A few PCBs are made by adding traces to the bare substrate (or a substrate with a very thin layer of copper) usually by a complex process of multipleelectroplating steps. The PCB manufacturing method primarily depends on whether it is for production volume or sample/prototype quantities. Double-sided boards or multi-layer boards use plated-through holes, called vias, to connect traces on opposite sides of the substrate.

Various methods

- Silk screen printing–the main commercial method.
- Figureic methods–used when fine linewidths are required.
- ***Laser-printed resist: Laser-print onto transparency film, heat-transfer with an iron or modified laminator onto bare laminate, touch up with a marker, then etch.*** This is the method we have used in our project.
- Vinyl film and resist, non-washable marker, some other methods. Labor-intensive, only suitable for single boards.

Chapter 5

Conclusion

It is a security system for homes and offices, and it is developed to make offices and,especially, homes much more secure. Although there are existing security systems for homes, it differs from them in many ways.

First, it combines different security techniques, such as sensors. Then, it provides warning from mobile phone system.

The home security system has lots of beneficial effects on society. Its social impact will be very important, because people far away from their home need not to be worried about it. People will be able to get their home security status from their mobile phone. In the time of emergency they will be warned by the system by a phone call. The home security system is a low-cost security system, and it is really easy to make a home secure with it. What you need to make your home secure with home security system is only three different types of sensors(fire, intrusion, gas), a modem.

The system we have developed is an experimental platform; we have successfully implemented and tested all the main functions that our system was intended to meet. In its commercial release, the system may lead to great achievements in home and office security and prevention of different dangerous situations such as fire and theft.

5.1 Future scope

This is just a home security warning mechanism. Fire extinguisher robots can be made to extinguish fires. The intrusion detection system can be programmed to call the police or install security systems such as electrified doors, safety nets can be installed.

In further release of the home security system, cameras can be added and be accessible through computers. Also we can extended to transmit camera view of home to the users via their mobile phones and other mobile devices like PDA

References

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[3] http://developer.intel.com/design/

[4] http://www.hardware-bastelkiste.de/pict/cpu/dip8086.gif

[5] Malmstadt, Enke and Crouch, Electronics and Instrumentation for Scientists, The Benjamin/Cummings Publishing Company, Inc., 1981, ISBN 0-8053-6917-1, Chapter 5.

[6] http://en.wikipedia.org/wiki/File:Generalhfsensor.png

[7] http://developer.intel.com/design/usb`

[8] http://en.wikipedia.org/wiki/Soldering

[9] http://en.wikipedia.org/wiki/Printed_circuit_board

[10]http://en.wikipedia.org/wiki/Etching

[11] http://www.hobby-elec.com

Appendix

Coding

```
ORG ooh
        clr p2.o
        setb p2.1
        MOV Po,#oFFH
        MOV P1,#oFFH
        MOV Ro,#o96H
START:        MOV R1,#oo3H


ADI:   JNB P1.o,ADI2
       JMP CALLING

ADI2:  JNB P1.1,ADI3
       JMP CALLING

ADI3:  JB P1.2,ADI4
       JMP CALLING

ADI5:  JMP ADI


CALLING:

       clr p2.1

       setb p2.o

       CALL DELAY
       CALL DELAY

       CLR Po.o
       CALL DELAY
       SETB Po.o
       CALL DELAY

       CLR Po.o
       CALL DELAY
       SETB Po.o
       CALL DELAY
```

```
XXX1:DJNZ Ro,XXX
        JMP XX

XXX:  CALL DELAY

JMP XXX1

XX:    DJNZ R1,CALLING

JMP    START

delay:

    h1: mov r4,#1o
    h2: mov r3, #1oo
    h3: djnz r3, h3
      djnz r4, h2
        djnz r5, h1

      ret

END
```

Softwares used

EAGLEcad for circuit designing .We first make schematic in it.This in turn creates lay out of PCB.

Keil for compiling. Microcontroller understands hex files. But as hex files are very complicated therefore we make use of the software keil. Programming in keil makes use of C or Assembly language which are easily programmable. Keil on its own converts these files to hex files.

Proload After the formation of hex file we need to insert this hex file into the micro controller so that it executes the program written in the keil. For this purpose we make use of proload.