Wireless Smoke Sensor Alert System

By

LIKHIT SINGLA -101320

Under the Supervision of
Dr. Satya Prakash Ghrera

May 2014

Project Report Submitted in partial fulfillment of the requirement for the Degree of
BACHELOR OF TECHNOLOGY

DEPARTMENT OF
COMPUTER SCIENCE AND INFORMATION TECHNOLOGY
JAYPEE UNIVERSITY OF INFORMATION TECNOLOGY,
WAKNAGHAT

CERTIFICATE

This is to certify that the work titled **Wireless Smoke Sensor Alert System** submitted by **LIKHIT SINGLA(101320)**partial fulfillment for the award of degree of **BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE**of Jaypee University of Information Technology, Waknaghat has been carried out under my supervision. This work has not been submitted partially or wholly to any other University or Institute for the award of this or any other degree or diploma.

Signature of the Student:

LIKHIT SINGLA(101320)

Signature of Supervisor

____

DR SATYA PRAKASH GRERA

ACKNOWLEDGEMENT

No venture can be completed without the blessing of Almighty. I consider it my bounded duty to bow to Almighty whose king blessing always inspire us on the right path of the life.

Science has caused many frontiers so has human efforts towards human research. My guide **Dr. Satya Prakash Ghrera** , Professor , Department of Computer Science and ICT, JUIT, has indeed acted as a light house showing me the need of sustained effort in the field of Cloud Computing to learn more and more. So I take this opportunity to thank him, for lending me stimulating suggestions, innovative quality guidance and creative thinking. He provides me the kind of strategies required for the completion of the task. I am grateful to him for the support, he provides me in doing thinks at my pace and for being patient for my mistakes.

Signature of the Student: ____________________

Name of Student: __LIKHIT SINGLA___

Date: _____________

TABLE OF CONTENTS

CHAPTER ONE: INTRODUCTION

CHAPTER TWO: DESIGN AND CONSTRUCTION

CHAPTER 1 :INTRODUCTION

1.1 ABSTRACT

Every year in the world, over 1400,000 residential fires result in 16,000 fatalities and 120,000 injuries. Over 50% of those fatalities occur in homes without smoke detectors. The significance of smoke detectors is evident, and the statistics substantiate the need for the most advanced smoke detectors possible.

The motivation behind the project came from brainstorming and thoughts regarding bolstering home safety. The importance of smoke detection is one of the chief safety concerns for residential (single-family) housing. Most smoke detectors on the current market are individual units sans communication or connections to other smoke detectors. Thus, only the smoke detector that sounds an alarm is the one which senses the smoke.

The solution is a wireless implementation of smoke detectors—increasing safety in terms of saving lives and property. In the incident of a fire, residents are alerted more rapidly as response time is decreased, thereby increasing the chance for survival.

1.2 METHODOLOGY

The chief goal entails designing and implementing a wireless network of smoke detectors sans the need of a central console. The idea is to set off the alarm in all of the smoke detectors in the network (i.e. in a house), thus allowing the warning to reach the entire household.

All of the smoke detectors are set off after one detector detects smoke. The smoke detector that goes off wirelessly alerts all the other smoke detectors in the network, subsequently setting off all the smoke detectors. To differentiate the originating detector and the other detectors, each detector is assigned its own distinct alarm and can also produce the exact alarm of the other detectors.

Furthermore, a Smoke threshold 200PPM is implemented with the purpose to avoid false alarms in cases of minor smoke (cooking, incense, etc.). For instance, in the case of a fire, the temperature threshold alarm is set off (with priority status that is determined by the microcontroller) after the smoke alarm to warn the residents of the fire. In cases of minor smoke, only the smoke alarm is set off, as the temperature threshold has not been reached. This serves to avoid any confusion between minor smoke and a fire. The temperature alarm functions similarly to the smoke alarm, in the sense that each detector is assigned its own temperature alarm and is also capable of producing the exact alarm of the other detectors; this allows residents to know where the fire originates. The temperature alarm sound of the detector is the same as the smoke alarm sound of the detector but at a higher volume.

Benefits

- Increased safety

- Reliability
- Wide range of coverage
- Avoid false alarms in cases of minor smoke

Features

- Wireless communication
- Wide range of coverage
- Smoke threshold

1.3SCOPE OF THE WORK

I will use liquid crystal display for displaying the message.

1.4 AIM OF THE PROJECT:

- **Uses**: This is every useful and innovative project. it is used to make system Automatic & intelligent.

1.5OBJECTIVES OF THE PROJECT

- Programming of Atmega-8
- Interfacing the programmable chip with the LCD.
- Interfacing of the RF encoder/ Decoder with the programmable chip
- Smoke Sensing Technology

Chapter 2: DESIGN AND CONSTRUCTION

2.1 COMPONENT LIST

Components			
Name	Capacity	Quantity	Code
Regulator	7805	2	
Capacitor	1000µf	4	
Capacitor	10µf	2	
Ceramic Capacitor	0.1	14	
Transformer	12V/250mA	2	
Push Button		2	
RF Transmitter/Receiver	433MHz	1/1	
Load Driver	ULN2003	2	
LCD	16*2	1	
28 Pin Base		2	
Atmega -8A		2	
Oscillator	Internal	2	
LED		2	
Resistance	0Ω	10	

Resistance	1k	2	
Smoke Sensor	MQ-2	1	
Buzzer		1	
Relay		1	

2.2 POWER SUPPLY :

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a **power supply unit** or **PSU**. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

Here in our application we need a 5v DC power supply for all electronics involved in the project. This requires step down transformer, rectifier, voltage regulator, and filter circuit for generation of 5v DC power. Here a brief description of all the components are given as follows:

2.2.1 TRANSFORMER:

A transformer is a device that transfers electrical energy from one circuit to another through inductively coupled conductors — the transformer's coils or "windings". Except for air-core transformers, the conductors are commonly wound around a single iron-rich core, or around separate but magnetically-coupled cores. A varying current in the first or "primary" winding creates a varying magnetic field in the core (or cores) of the transformer. This varying magnetic field induces a varying electromotive force (EMF) or "voltage" in the "secondary" winding. This effect is called mutual induction.

If a load is connected to the secondary circuit, electric charge will flow in the secondary winding of the transformer and transfer energy from the primary circuit to the load connected in the secondary circuit.

The secondary induced voltage V_S, of an ideal transformer, is scaled from the primary V_P by a factor equal to the ratio of the number of turns of wire in their respective windings:

$$\frac{V_S}{V_P} = \frac{N_S}{N_P}$$

By appropriate selection of the numbers of turns, a transformer thus allows an alternating voltage to be stepped up — by making N_S more than N_P — or stepped down, by making it

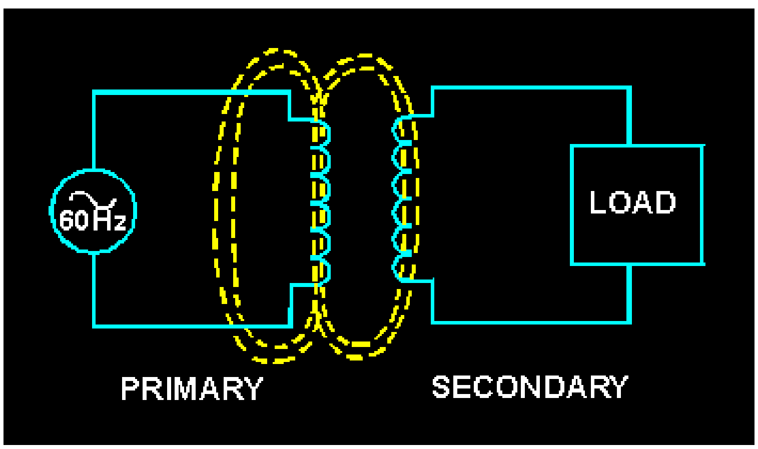
BASIC PARTS OF A TRANSFORMER

In its most basic form a transformer consists of:

- A primary coil or winding.
- A secondary coil or winding.

- A core that supports the coils or windings.

Refer to the transformer circuit in figure as you read the following explanation: The primary winding is connected to a 60-hertz ac voltage source. The magnetic field (flux) builds up (expands) and collapses (contracts) about the primary winding. The expanding and contracting magnetic field around the primary winding cuts the secondary winding and induces an alternating voltage into the winding. This voltage causes alternating current to flow through the load. The voltage may be stepped up or down depending on the design of the primary and secondary windings.



THE COMPONENTS OF A TRANSFORMER

Two coils of wire (called windings) are wound on some type of core material. In some cases the coils of wire are wound on a cylindrical or rectangular cardboard form. In effect, the core material is air and the transformer is called an AIR-CORE TRANSFORMER. Transformers used at low frequencies, such as 60 hertz and 400 hertz, require a core of low-reluctance magnetic material, usually iron. This type of transformer is called an IRON-CORE TRANSFORMER. Most power transformers are of the iron-core type. The principle parts of a transformer and their functions are:

- The CORE, which provides a path for the magnetic lines of flux.
- The PRIMARY WINDING, which receives energy from the ac source.
- The SECONDARY WINDING, which receives energy from the primary winding and delivers it to the load.
- The ENCLOSURE, which protects the above components from dirt, moisture, and mechanical damage.

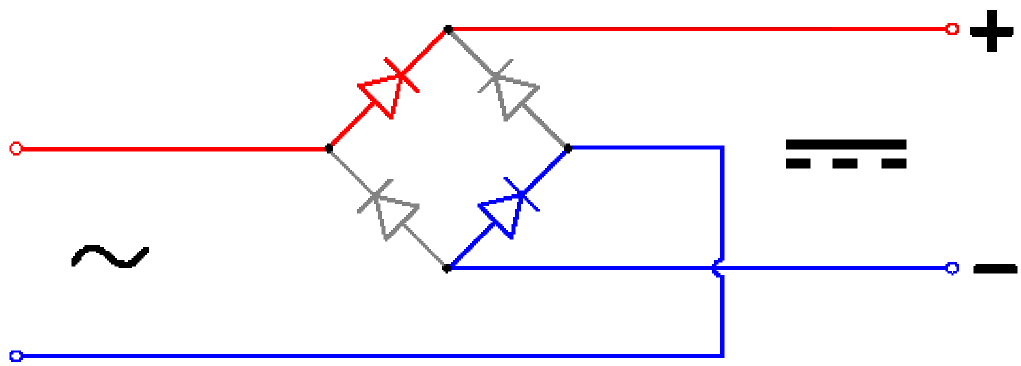
2.2.2BRIDGE RECTIFIER

A bridge rectifier makes use of four diodes in a bridge arrangement to achieve full-wave rectification. This is a widely used configuration, both with individual diodes wired as shown and with single component bridges where the diode bridge is wired internally.

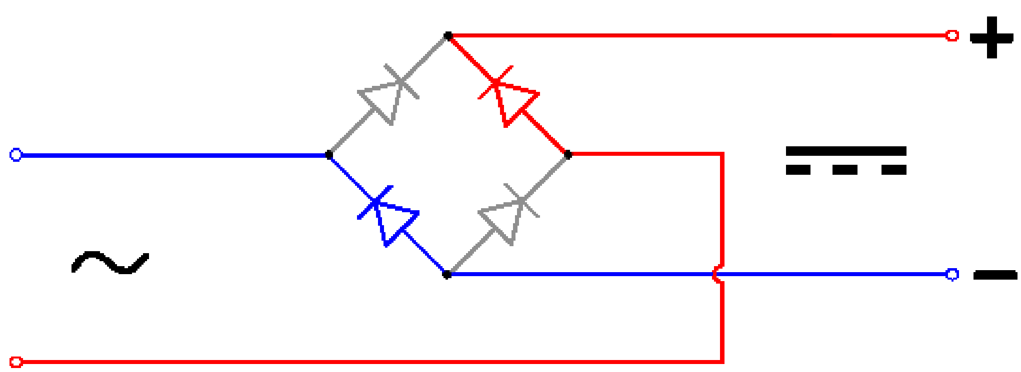
BASIC OPERATION

According to the conventional model of current flow originally established by Benjamin Franklin and still followed by most engineers today, current is *assumed* to flow through electrical conductors from the **positive** to the **negative** pole. In actuality, free electrons in a conductor nearly always flow from the **negative** to the **positive** pole. In the vast majority of applications, however, the *actual* direction of current flow is irrelevant. Therefore, in the discussion below the conventional model is retained.

In the diagrams below, when the input connected to the **left** corner of the diamond is **positive**, and the input connected to the **right** corner is **negative**, current flows from the **upper** supply terminal to the right along the **red** (positive) path to the output, and returns to the **lower** supply terminal via the **blue** (negative) path.



When the input connected to the **left** corner is **negative**, and the input connected to the **right** corner is **positive**, current flows from the **lower** supply terminal to the right along the **red** path to the output, and returns to the **upper** supply terminal via the **blue** path.

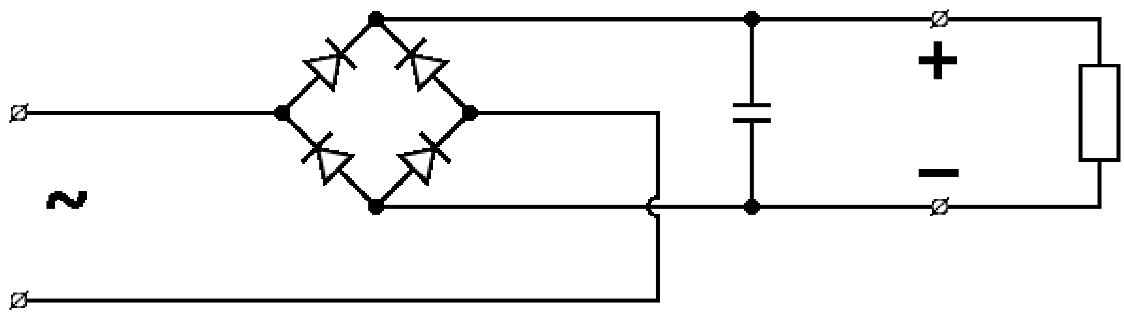


In each case, the upper right output remains positive and lower right output negative. Since this is true whether the input is AC or DC, this circuit not only produces a DC output from an AC input, it can also provide what is sometimes called "reverse polarity protection". That is, it permits normal functioning of DC-powered equipment when batteries have been installed backwards, or when the leads (wires) from a DC power source have been reversed, and protects the equipment from potential damage caused by reverse polarity.

Prior to availability of integrated electronics, such a bridge rectifier was always constructed from discrete components. Since about 1950, a single four-terminal component containing the four diodes connected in the bridge configuration became a standard commercial component and is now available with various voltage and current ratings.

2.2.3 OUTPUT SMOOTHING

For many applications, especially with single phase AC where the full-wave bridge serves to convert an AC input into a DC output, the addition of a capacitor may be desired because the bridge alone supplies an output of fixed polarity but continuously varying or "pulsating" magnitude (see diagram above).



The function of this capacitor, known as a reservoir capacitor (or smoothing capacitor) is to lessen the variation in (or 'smooth') the rectified AC output voltage waveform from the bridge. One explanation of 'smoothing' is that the capacitor provides a low impedance path to the AC component of the output, reducing the AC voltage across, and AC current through, the resistive load. In less technical terms, any drop in the output voltage and current of the bridge tends to be canceled by loss of charge in the capacitor. This charge flows out as additional current through the load. Thus the change of load current and voltage is reduced relative to what would occur without the capacitor. Increases of voltage correspondingly store excess charge in the capacitor, thus moderating the change in output voltage / current.

The simplified circuit shown has a well-deserved reputation for being dangerous, because, in some applications, the capacitor can retain a *lethal* charge after the AC power source is removed. If supplying a dangerous voltage, a practical circuit should include a reliable way to safely discharge the capacitor. If the normal load cannot be guaranteed to perform this function, perhaps because it can be disconnected, the circuit should include a bleeder resistor connected as close as practical across the capacitor. This resistor should consume a current large enough to discharge the capacitor in a reasonable time, but small enough to minimize unnecessary power waste.

Because a bleeder sets a minimum current drain, the regulation of the circuit, defined as percentage voltage change from minimum to maximum load, is improved. However in many cases the improvement is of insignificant magnitude.

The capacitor and the load resistance have a typical time constant $\tau = RC$ where C and R are the capacitance and load resistance respectively. As long as the load resistor is large enough so that this time constant is much longer than the time of one ripple cycle, the above configuration will produce a smoothed DC voltage across the load.

In some designs, a series resistor at the load side of the capacitor is added. The smoothing can then be improved by adding additional stages of capacitor–resistor pairs, often done only for sub-supplies to critical high-gain circuits that tend to be sensitive to supply voltage noise.

The idealized waveforms shown above are seen for both voltage and current when the load on the bridge is resistive. When the load includes a smoothing capacitor, both the voltage and the current waveforms will be greatly changed. While the voltage is smoothed, as described above, current will flow through the bridge only during the time when the input voltage is greater than the capacitor voltage. For example, if the load draws an average current of n Amps, and the diodes conduct for 10% of the time, the average diode current during conduction must be 10n Amps. This non-sinusoidal current leads to harmonic distortion and a poor power factor in the AC supply.

In a practical circuit, when a capacitor is directly connected to the output of a bridge, the bridge diodes must be sized to withstand the current surge that occurs when the power is turned on at the peak of the AC voltage and the capacitor is fully discharged.

Sometimes a small series resistor is included before the capacitor to limit this current, though in most applications the power supply transformer's resistance is already sufficient.

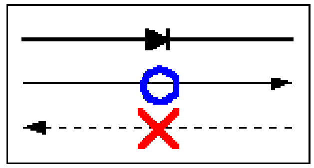
Output can also be smoothed using a choke and second capacitor. The choke tends to keep the current (rather than the voltage) more constant. Due to the relatively high cost of an effective choke compared to a resistor and capacitor this is not employed in modern equipment.

Some early console radios created the speaker's constant field with the current from the high voltage ("B +") power supply, which was then routed to the consuming circuits, (permanent magnets were then too weak for good performance) to create the speaker's constant magnetic field. The speaker field coil thus performed 2 jobs in one: it acted as a choke, filtering the power supply, and it produced the magnetic field to operate the speaker.

2.2.4 Diode

A diode is a semiconductor device which allows current to flow through it in only one direction. Although a transistor is also a semiconductor device, it does not operate the way a diode does. A diode is specifically made to allow current to flow through it in only one direction. Some ways in which the diode can be used are listed here.

- A diode can be used as a rectifier that converts AC (Alternating Current) to DC (Direct Current) for a power supply device.
- Diodes can be used to separate the signal from radio frequencies.
- Diodes can be used as an on/off switch that controls current.



Diode Symbol

This symbol  is used to indicate a diode in a circuit diagram. The meaning of the symbol is (Anode)  (Cathode).

Current flows from the anode side to the cathode side.

Although all diodes operate with the same general principle, there are different types suited to different applications. For example, the following devices are best used for the applications noted.

Voltage regulation diode(Zener Diode)

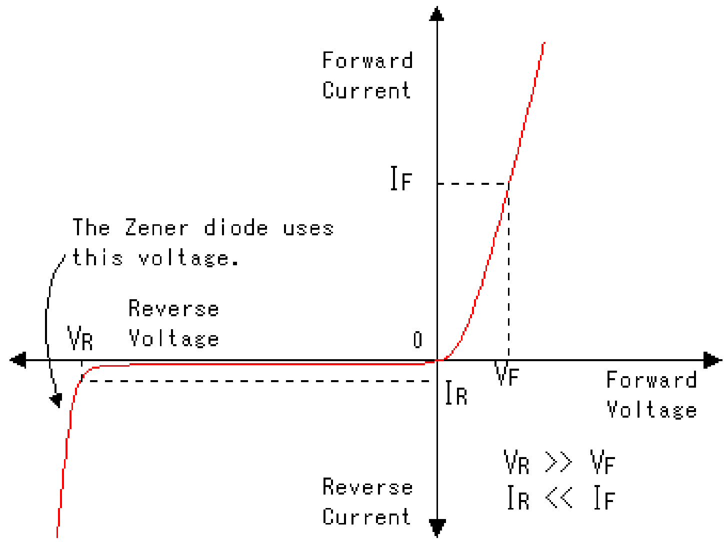
The circuit symbol is .

It is used to regulate voltage, by taking advantage of the fact that Zener diodes tend to stabilize at a certain voltage when that voltage is applied in the opposite direction.

Light emitting diode

The circuit symbol is .

This type of diode emits light when current flows through it in the forward direction. (Forward biased)



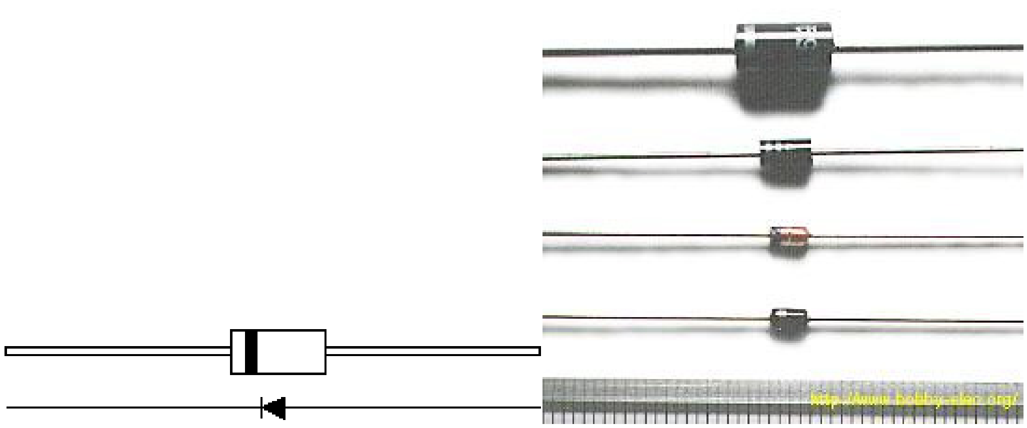
Characteristics of Diode

The graph above shows the electrical characteristics of a typical diode. When a small voltage is applied to the diode in the forward direction, current flows easily. Because the diode has a certain amount of resistance, the voltage will drop slightly as current flows through the diode. A typical diode causes a voltage drop of about 0.6 - 1V (V_F) (In the case of silicon diode, almost 0.6V)

This voltage drop needs to be taken into consideration in a circuit which uses many diodes in series. Also, the amount of current passing through the diodes must be considered.

When voltage is applied in the reverse direction through a diode, the diode will have a great resistance to current flow. Different diodes have different characteristics when reverse-biased. A given diode should be selected depending on how it will be used in the circuit. The current that will flow through a diode biased in the reverse direction will vary from several mA to just µA, which is very small.

The limiting voltages and currents permissible must be considered on a case by case basis. For example, when using diodes for rectification, part of the time they will be required to withstand a reverse voltage. If the diodes are not chosen carefully, they will break down.



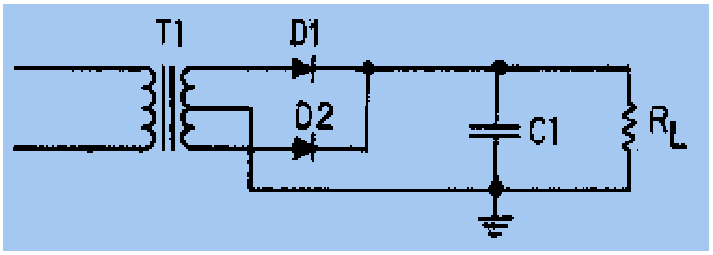
2.2.5 REGULATOR IC (78XX)

It is a three pin IC used as a voltage regulator. It converts unregulated DC current into regulated DC current.

Normally we get fixed output by connecting the voltage regulator at the output of the filtered DC (see in above diagram). It can also be used in circuits to get a low DC voltage from a high DC voltage (for example we use 7805 to get 5V from 12V). There are two types of voltage regulators 1. fixed voltage regulators (78xx, 79xx) 2. variable voltage regulators (LM317) In fixed voltage regulators there is another classification 1. +ve voltage regulators 2. -ve voltage regulators POSITIVE VOLTAGE REGULATORS This include 78xx voltage regulators. The most commonly used ones are 7805 and 7812. 7805 gives fixed 5V DC voltage if input voltage is in (7.5V, 20V).

2.2.6 The CAPACITOR FILTER

The simple capacitor filter is the most basic type of power supply filter. The application of the simple capacitor filter is very limited. It is sometimes used on extremely high-voltage, low-current power supplies for cathode ray and similar electron tubes, which require very little load current from the supply. The capacitor filter is also used where the power-supply ripple frequency is not critical; this frequency can be relatively high. The capacitor (C1) shown in figure 4-15 is a simple filter connected across the output of the rectifier in parallel with the load.

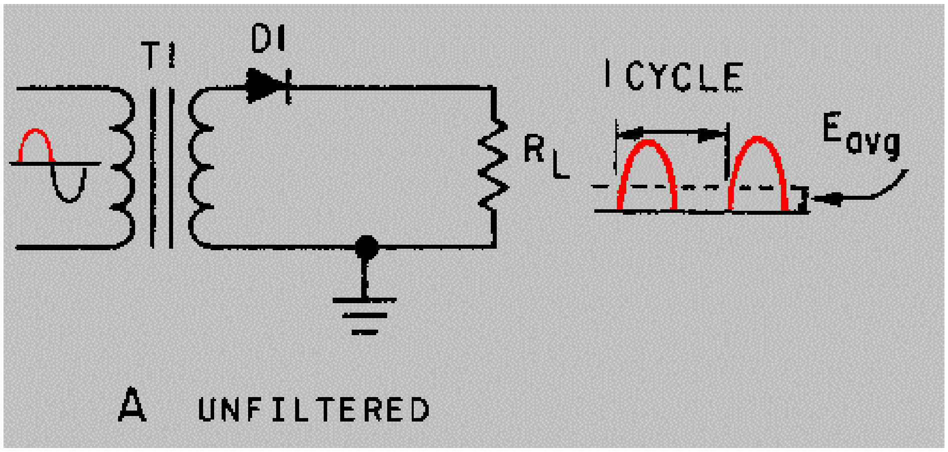


Full-wave rectifier with a capacitor filter.

When this filter is used, the RC charge time of the filter capacitor (C1) must be short and the RC discharge time must be long to eliminate ripple action. In other words, the capacitor must charge up fast, preferably with no discharge at all. Better filtering also results when the input frequency is high; therefore, the full-wave rectifier output is easier to filter than that of the half-wave rectifier because of its higher frequency.

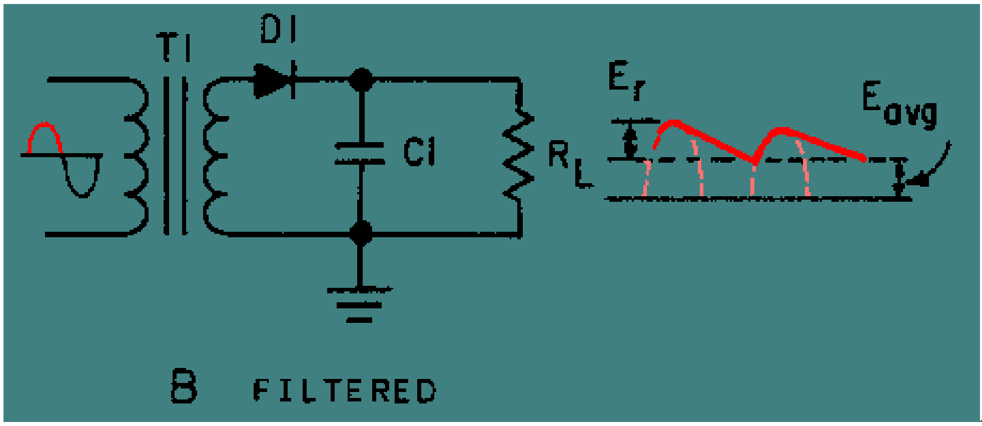
For you to have a better understanding of the effect that filtering has on E_{avg}, a comparison of a rectifier circuit with a filter and one without a filter is illustrated in views A and B of figure 4-16. The output waveforms in figure 4-16 represent the unfiltered and filtered outputs of the half-wave rectifier circuit. Current pulses flow through the load resistance (R_L) each time a diode conducts. The dashed line indicates the average value of output voltage. For the half-wave rectifier, E_{avg} is less than half (or approximately 0.318) of the peak output voltage. This value is still much less than that of the applied voltage. With no capacitor connected across the output of the rectifier circuit, the waveform in view A has a large pulsating component (ripple) compared with the average or dc component. When a capacitor is connected across the output (view B), the average value of output voltage (E_{avg}) is increased due to the filtering action of capacitor C1.

UNFILTERED



Half-wave rectifier with and without filtering.

FILTERED



D

The value of the capacitor is fairly large (several microfarads), thus it presents a relatively low reactance to the pulsating current and it stores a substantial charge.

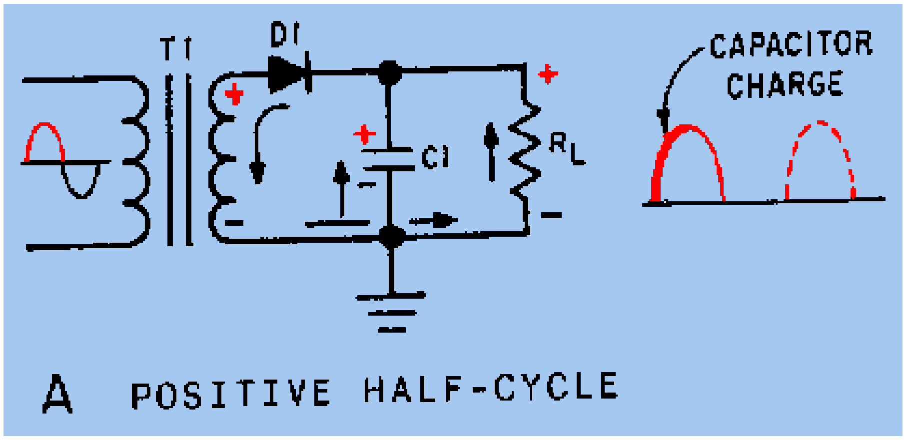
The rate of charge for the capacitor is limited only by the resistance of the conducting diode, which is relatively low. Therefore, the RC charge time of the circuit is relatively short. As a result, when the pulsating voltage is first applied to the circuit, the capacitor charges rapidly and almost reaches the peak value of the rectified voltage within the first few cycles. The capacitor attempts to charge to the peak value of the rectified voltage anytime a diode is conducting, and tends to retain its charge when the rectifier output falls to zero. (The capacitor cannot discharge immediately.) The capacitor slowly discharges through the load resistance (R_L) during the time the rectifier is non-conducting.

The rate of discharge of the capacitor is determined by the value of capacitance and the value of the load resistance. If the capacitance and load-resistance values are large, the RC discharge time for the circuit is relatively long.

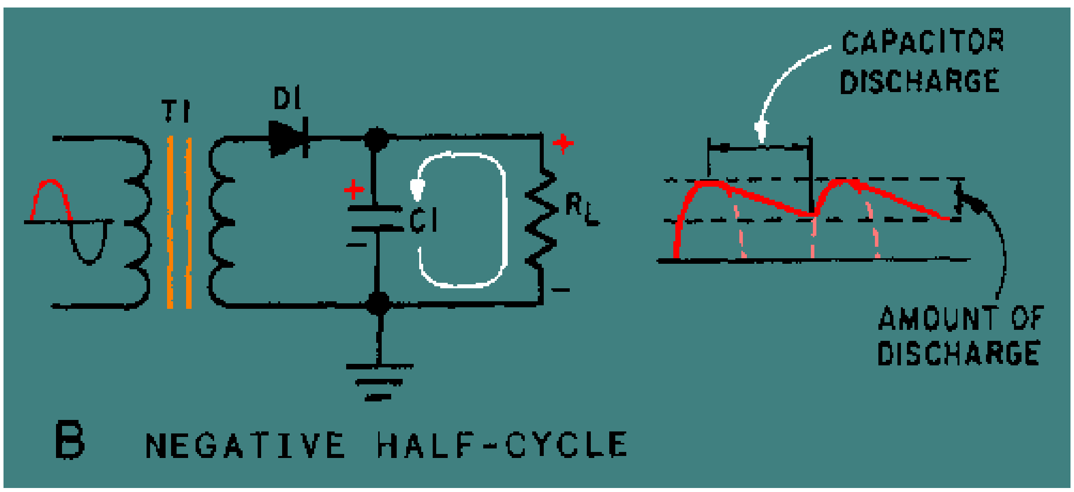
A comparison of the waveforms shown in figure 4-16 (view A and view B) illustrates that the addition of C1 to the circuit results in an increase in the average of the output voltage (E_{avg}) and a reduction in the amplitude of the ripple component (E_r) which is normally present across the load resistance.

Now, let's consider a complete cycle of operation using a half-wave rectifier, a capacitive filter (C1), and a load resistor (R_L). As shown in view A of figure 4-17, the capacitive filter (C1) is assumed to be large enough to ensure a small reactance to the pulsating rectified current. The resistance of R_L is assumed to be much greater than the reactance of C1 at the input frequency. When the circuit is energized, the diode conducts on the positive half cycle and current flows through the circuit, allowing C1 to charge. C1 will charge to approximately the peak value of the input voltage. (The charge is less than the peak value because of the voltage drop across the diode (D1)). In view A of the figure, the heavy solid line on the waveform indicates the charge on C1. As illustrated in view B, the diode cannot conduct on the negative half cycle because the anode of D1 is negative with respect to the cathode. During this interval, C1 discharges through the load resistor (R_L). The discharge of C1 produces the downward slope as indicated by the solid line on the waveform in view B. In contrast to the abrupt fall of the applied ac voltage from peak value to zero, the voltage across C1 (and thus across R_L) during the discharge period gradually decreases until the time of the next half cycle of rectifier operation. Keep in mind that for good filtering, the filter capacitor should charge up as fast as possible and discharge as little as possible.

Figure 4-17A. - Capacitor filter circuit (positive and negative half cycles). POSITIVE HALF-CYCLE



Capacitor filter circuit (positive and negative half cycles). NEGATIVE HALF-CYCLE

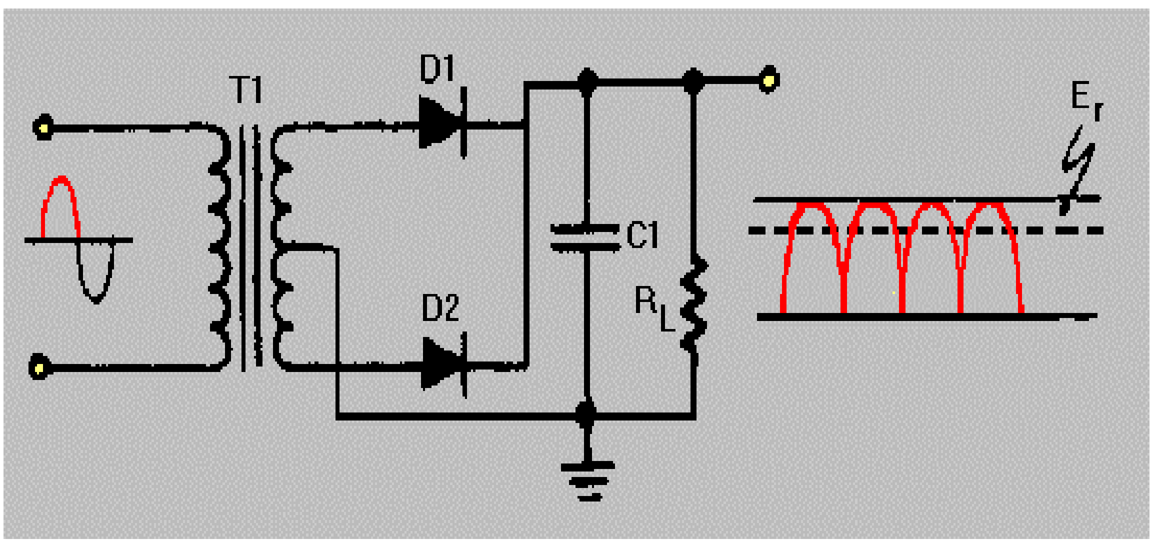


Since practical values of C1 and R_L ensure a more or less gradual decrease of the discharge voltage, a substantial charge remains on the capacitor at the time of the next half cycle of operation. As a result, no current can flow through the diode until the rising ac input voltage at the anode of the diode exceeds the voltage on the charge remaining on C1. The charge on C1 is the cathode potential of the diode. When the potential on the anode exceeds the potential on the cathode (the charge on C1), the diode again conducts, and C1 begins to charge to approximately the peak value of the applied voltage.

After the capacitor has charged to its peak value, the diode will cut off and the capacitor will start to discharge. Since the fall of the ac input voltage on the anode is considerably more rapid than the decrease on the capacitor voltage, the cathode quickly become more positive than the anode, and the diode ceases to conduct.

Operation of the simple capacitor filter using a full-wave rectifier is basically the same as that discussed for the half-wave rectifier. Referring to figure 4-18, you should notice that because one of the diodes is always conducting on. either alternation, the filter capacitor charges and discharges during each <u>half</u> cycle. (Note that each diode conducts only for that portion of time when the peak secondary voltage is greater than the charge across the capacitor.)

Full-wave rectifier (with capacitor filter).



Another thing to keep in mind is that the ripple component (E_r) of the output voltage is an ac voltage and the average output voltage (E_{avg}) is the dc component of the output. Since the filter capacitor offers relatively low impedance to ac, the majority of the ac component flows through the filter capacitor. The ac component is therefore bypassed (shunted) around the load resistance, and the entire dc component (or E_{avg}) flows through the load resistance. This statement can be clarified by using the formula for X_C in a half-wave and full-wave rectifier. First, you must establish some values for the circuit.

HALFWAVE RECTIFIER

FREQUENCY AT
RECTIFIER OUTPUT: 60 Hz

VALUE OF FILTER
CAPACITOR: 30µF

LOAD RESISTANCE: 10kΩ

$$X_C = \frac{1}{2\pi fC}$$

$$X_C = \frac{.159}{fC}$$

$$X_C = \frac{.159}{60 \times .000030}$$

$$X_C = \frac{.159}{.0018}$$

$$X_C = 88.3\Omega$$

FREQUENCY AT
RECTIFIER OUTPUT: 120Hz

VALUE OF FILTER
CAPACITOR: 30µF

LOAD RESISTANCE: 10kΩ

$$X_C = \frac{1}{2\pi fC}$$

$$X_C = \frac{.159}{fC}$$

$$X_C = \frac{.159}{120 \times .000030}$$

$$X_C = \frac{.159}{.0036}$$

$$X_C = 44.16\Omega$$

As you can see from the calculations, by doubling the frequency of the rectifier, you reduce the impedance of the capacitor by one-half. This allows the ac component to pass through the capacitor more easily. As a result, a full-wave rectifier output is much easier to filter than that of a half-wave rectifier. Remember, the smaller the X_C of the filter capacitor with respect to the load resistance, the better the filtering action. Since

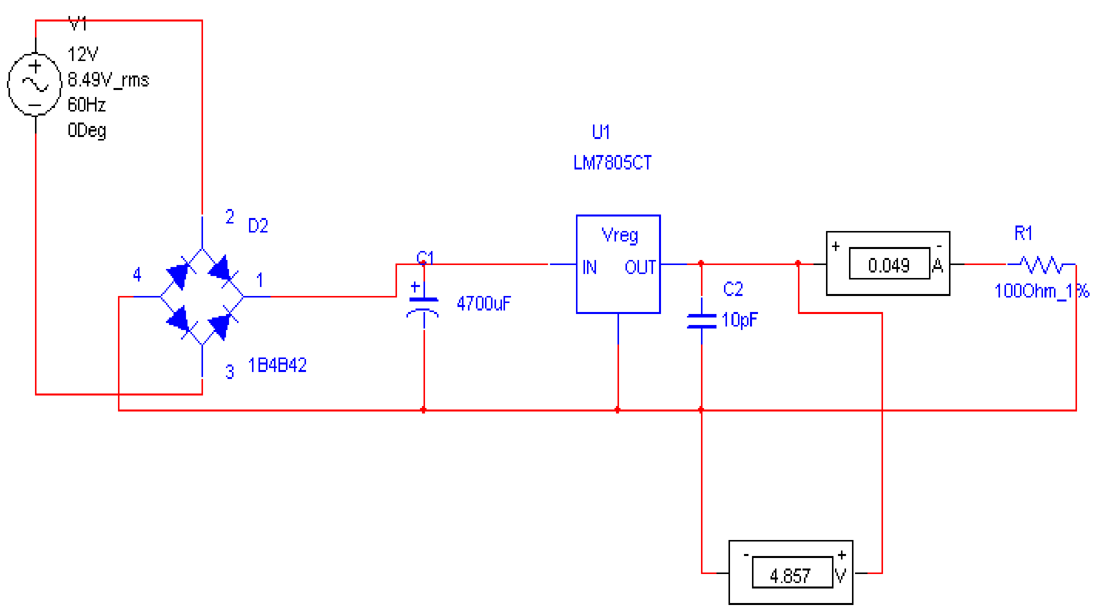
$$X_C = \frac{1}{2\pi fC}$$

the largest possible capacitor will provide the best filtering.

Remember, also, that the load resistance is an important consideration. If load resistance is made small, the load current increases, and the average value of output voltage (E_{avg}) decreases. The RC discharge time constant is a direct function of the value of the load resistance; therefore, the rate of capacitor voltage discharge is a direct function of the current through the load. The greater the load current, the more rapid the discharge of the

capacitor, and the lower the average value of output voltage. For this reason, the simple capacitive filter is seldom used with rectifier circuits that must supply a relatively large load current. Using the simple capacitive filter in conjunction with a full-wave or bridge rectifier provides improved filtering because the increased ripple frequency decreases the capacitive reactance of the filter capacitor.

2.3 CIRCUIT DIAGRAM OF POWER SUPPLY



2.4 16 x 2 CHARACTER LCD:

FEATURES

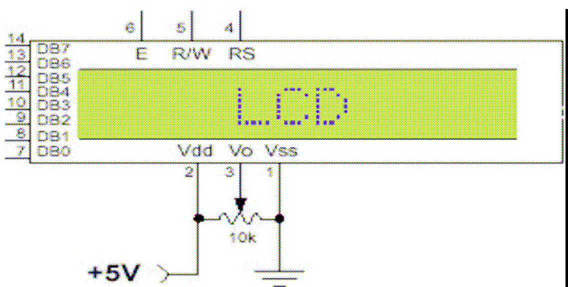
- 5 x 8 dots with cursor
- Built-in controller (KS 0066 or Equivalent)
- + 5V power supply (Also available for + 3V)
- 1/16 duty cycle
- B/L to be driven by pin 1, pin 2 or pin 15, pin 16 or A.K (LED)
- N.V. optional for + 3V power supply

PIN NUMBER SYMBOL FUNCTION

- 01 Vss GND
- 02 Vdd + 3V or + 5V
- 03 Vo Contrast Adjustment
- 04 RS H/L Register Select Signal
- 05 R/W H/L Read/Write Signal
- 06 E H → L Enable Signal
- 07 DB0 H/L Data Bus Line
- 08 DB1 H/L Data Bus Line

- 09 DB2 H/L Data Bus Line
- 10 DB3.
- H/L Data Bus Line
- 11 DB4 H/L Data Bus Line
- 12 DB5 H/L Data Bus Line
- 13 DB6 H/L Data Bus Line
- 14 DB7 H/L Data Bus Line
- 15 A/Vee + 4.2V for LED/Negative Voltage Output

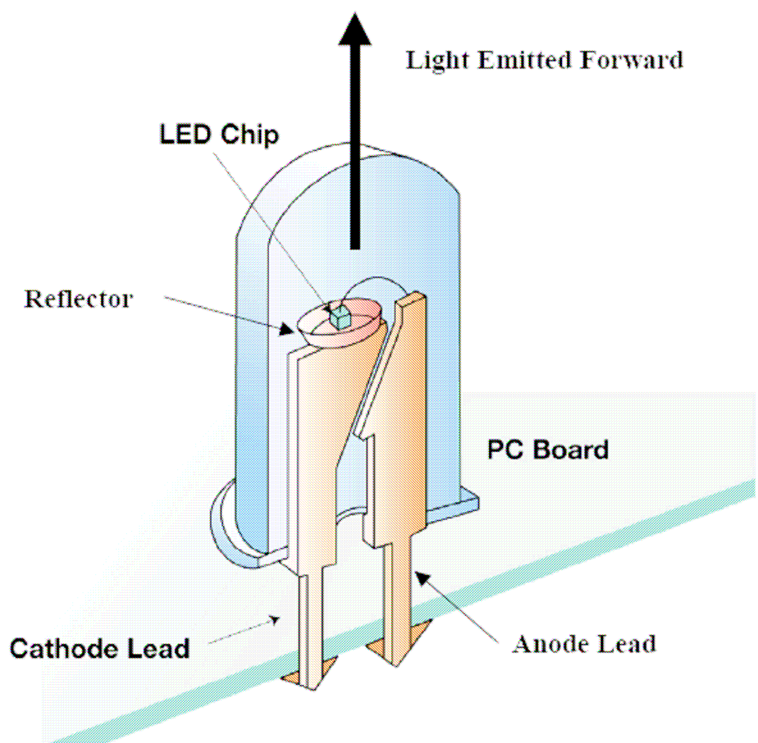
Microcontroller – LCD Interfacing



Above is the quite simple schematic. The LCD panel's *Enable* and *Register Select* is connected to the Control Port. The Control Port is an open collector / open drain output. Therefore by incorporating the two 10K external pull up resistors, the circuit is more portable for a wider range of computers, some of which may have no internal pull up resistors. I make no effort to place the Data bus into reverse direction. Therefore I had wire the *R/W* line of the LCD panel, into write mode. This will cause no bus conflicts on the data lines. As a result I cannot read back the LCD's internal Busy Flag which tells us if the LCD has accepted and finished processing the last instruction [20]. This problem is overcome by inserting known delays into my program. The 10k Potentiometer controls the contrast of the LCD panel. Nothing fancy here.

I used a power supply of 5volt. The user may select whether the LCD is to operate with a 4-bit data bus or an 8- bit data bus. If a 4-bit data bus is used, the LCD will require a total of 7 data lines. If an 8-bit data bus is used, the LCD will require a total of 11 data lines [20]. LCD with 8-bit data bus is used for this design. The three control lines are **EN**, **RS**, and **RW**. EN line must be raised/lowered before/after each instruction sent to the LCD regardless of whether that instruction is read or write text or instruction. In short, I manipulate EN when communicating with the LCD.

2.5LED



TYPICAL SPEC. OF HB LED

- 1 Watt LEDFull intensity 350mA, Maximum current 500mA

  2.8V Volt drop @ 350mA

- Watt LEDFull intensity 700mA, Maximum current 1A

  4.3V Volt drop @ 700mA

- Watt LED (multi-die package)Full intensity 700mA, Maximum current 1A

  7.1V Volt drop @ 700mA

- Watt LED (single-die)Full intensity 1.5A

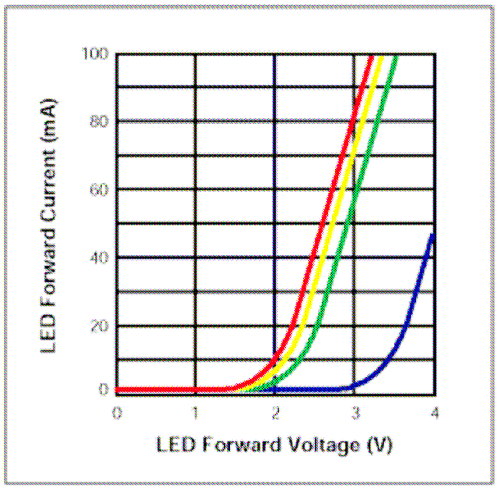
CHARACTERISTICS OF LEDs

- Forward Voltage (VF) drop across LEDDiodes are current driven!

- Wavelength variationsCrystal and junction growth defects

- Brightness variationsCrystal defects resulting formation of phonons and non-radiation energy transfer

- Temperature Junction temperatureof the device affects each of the parameters above



2.6Resistors

The resistor's function is to reduce the flow of electric current. There are two classes of resistors; fixed resistors and the variable resistors. They are also classified according to the material from which they are made. The typical resistor is made of either carbon film or metal film. There are other types as well, but these are the most common. The resistance value of the resistor is not the only thing to consider when selecting a resistor for use in a circuit. The "tolerance" and the electric power ratings of the resistor are also important. The tolerance of a resistor denotes how close it is to the actual rated resistence value. For example, a ±5% tolerance would indicate a resistor that is within ±5% of the specified resistance value.

Fixed Resistors

A fixed resistor is one in which the value of its resistance cannot change.

Carbon film resistors

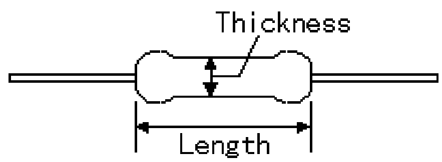
This is the most general purpose, cheap resistor. Usually the tolerance of the resistance value is ±5%. Power ratings of 1/8W, 1/4W and 1/2W are frequently used. Carbon film resistors have a disadvantage; they tend to be electrically noisy. Metal film resistors are recommended for use in analog circuits. However, I have never experienced any problems with this noise. The physical size of the different resistors is as follows.

From the top of the photograph

1/8W

1/4W

1/2W



Rough size

Rating power (W)	Thickness (mm)	Length (mm)
1/8	2	3
1/4	2	6
1/2	3	9

The physical size of the different resistors

Variable Resistors

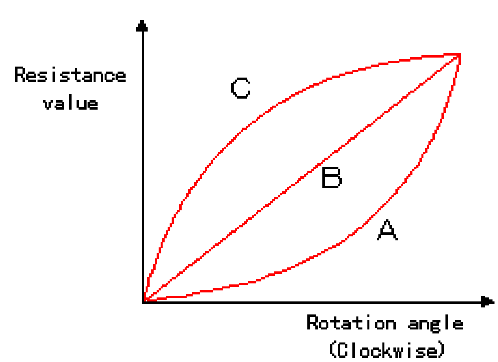
There are two general ways in which variable resistors are used. One is the variable resistor which value is easily changed, like the volume adjustment of Radio. The other is semi-fixed resistor that is not meant to be adjusted by anyone but a technician. It is used to adjust the operating condition of the circuit by the technician. Semi-fixed resistors are used to compensate for the inaccuracies of the resistors, and to fine-tune a circuit. The rotation angle of the variable resistor is usually about 300 degrees.

Some variable resistors must be turned many times to use the whole range of resistance they offer. This allows for very precise adjustments of their value.

These are called "Potentiometers" or "Trimmer Potentiometers."

Variable Resistors

In the photograph to the left, the variable resistor typically used for volume controls can e seen on the far right. Its value is very easy to adjust. The four resistors at the center of the photograph are the semi-fixed type. These ones are mounted on the printed circuit board. The two resistors on the left are the trimmer potentiometers.



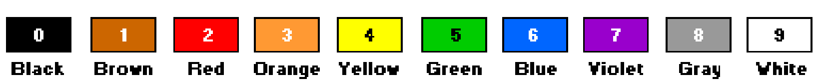
Resistance value Vs. Rotation Angle

There are three ways in which a variable resistor's value can change according to the rotation angle of its axis.

When type "A" rotates clockwise, at first, the resistance value changes slowly and then in the second half of its axis, it changes very quickly. The "A" type variable resistor is typically used for the volume control of a radio, for example. It is well suited to adjust a low sound subtly. It suits the characteristics of the ear. The ear hears low sound changes well, but isn't as sensitive to small changes in loud sounds. A larger change is needed as the volume is increased. These "A" type variable resistors are sometimes called "audio taper" potentiometers.

As for type "B", the rotation of the axis and the change of the resistance value are directly related. The rate of change is the same, or linear, throughout the sweep of the axis. This type suits a resistance value adjustment in a circuit, a balance circuit and so on.

They are sometimes called "linear taper" potentiometers. Type "C" changes exactly the opposite way to type "A". In the early stages of the rotation of the axis, the resistance value changes rapidly, and in the second half, the change occurs more slowly. This type isn't too much used. It is a special use. As for the variable resistor, most are type "A" or type "B".

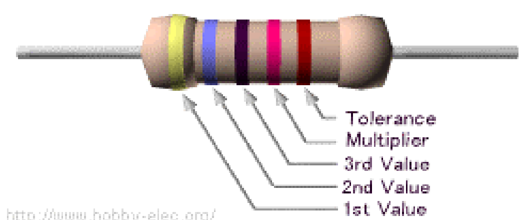


Example 1

(Brown=1),(Black=0),(Orange=3)

10×10^3 = 10k ohm

Tolerance(Gold) = ±5%



Example 2

(Yellow=4),(Violet=7),(Black=0),(Red=2)

470×10^2 = 47k ohm

Tolerance(Brown) = ±1%

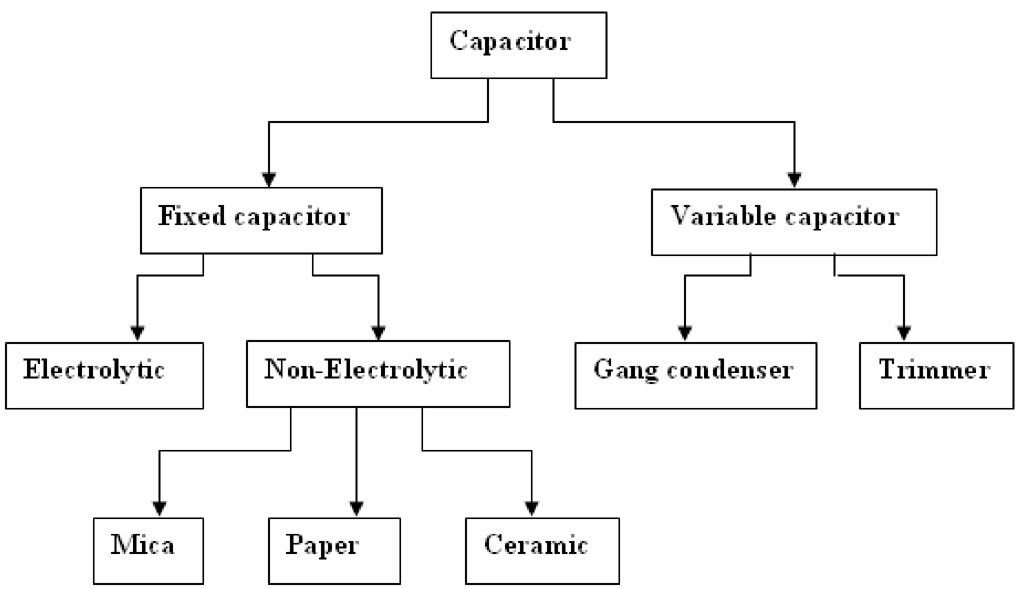
Color	**Value**	**Multiplier**	**Tolerance** (%)
Black	0	0	-
Brown	1	1	±1
Red	2	2	±2
Orange	3	3	±0.05
Yellow	4	4	-
Green	5	5	±0.5
Blue	6	6	±0.25
Violet	7	7	±0.1
Gray	8	8	-
White	9	9	-
Gold	-	-1	±5
Silver	-	-2	±10
None	-	-	±20

Resistor color code

2.7Capacitors

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 'F' 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.

Types of Capacitor



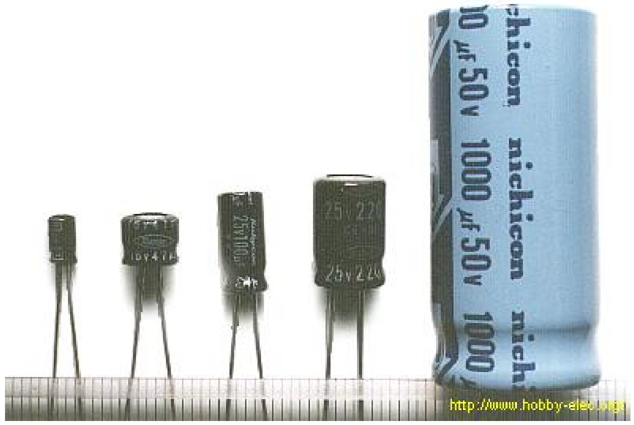
Types of Capacitor

Breakdown voltage

when using a capacitor, we 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. We 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. [Polarised] 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 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 photograph on the left is an example of the different values of electrolytic capacitors in which the capacitance and voltage differ.



Electrolytic Capacitors

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 shere on this page are just examples.

Ceramic Capacitors

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 10×10^3pF 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.

Ceramic Capacitors

Variable Capacitors

Variable capacitors are used for adjustment etc. of frequency mainly. On the left in the photograph is a "trimmer," which uses ceramic as the dielectric. Next to it on the right is one that uses polyester film for the dielectric. The pictured components are meant to be mounted on a printed circuit board.

Variable Capacitors

When adjusting the value of a variable capacitor, it is advisable to be careful. One of the component's leads is connected to the adjustment screw of the capacitor. This means that the value of the capacitor can be affected by the capacitance of the screwdriver in your hand. It is better to use a special screwdriver to adjust these components.

CHAPTER 3 : PROGRAMMER, SIMULATOR, BURNER

3.1 Programmer

When we have to learn about a new computer we have to familiarize about the machine capability we are using, and we can do it by studying the internal hardware design (devices architecture), and also to know about the size, number and the size of the registers.

A microcontroller is a single chip that contains the processor (the CPU), non-volatile memory for the program (ROM or flash), volatile memory for input and output (RAM), a clock and an I/O control unit. Also called a "computer on a chip," billions of microcontroller units (MCUs) are embedded each year in a myriad of products from toys to appliances to automobiles. For example, a single vehicle can use 70 or more microcontrollers. The following picture describes a general block diagram of microcontroller.

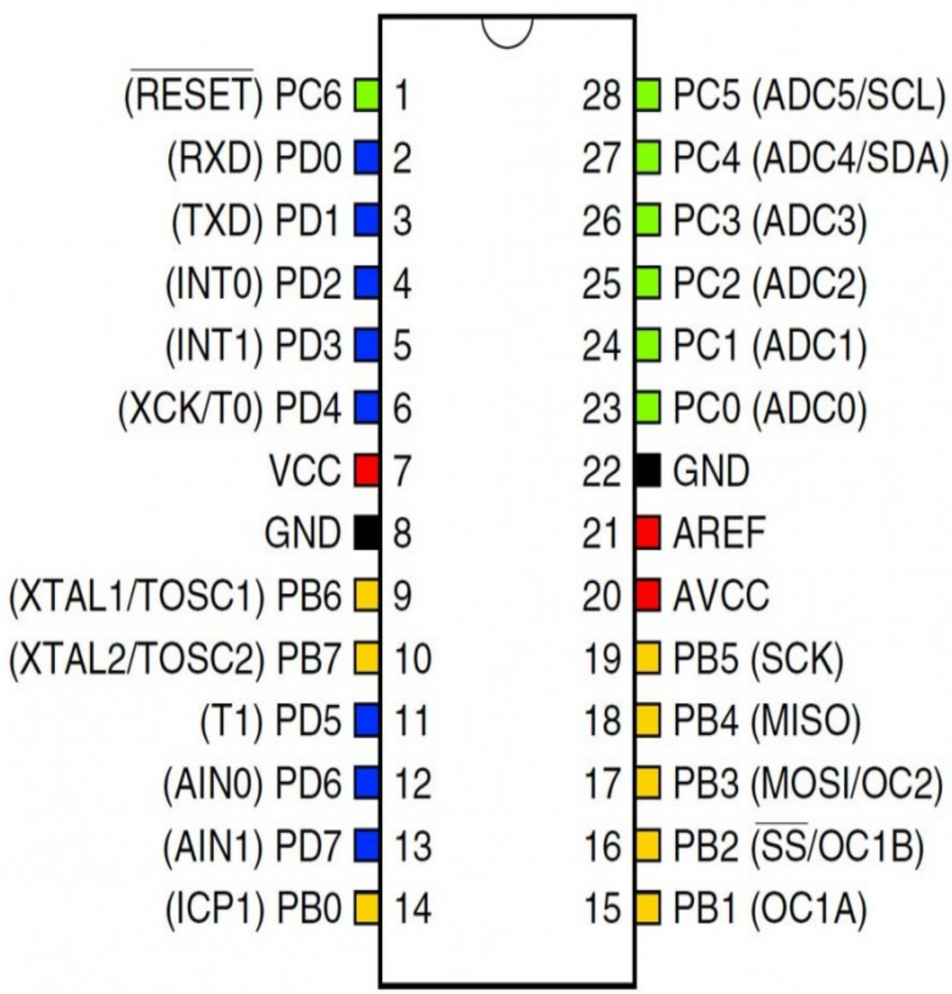
1. AVR Studio (Cross Compiler)

   The AVR Studio IDE from Atmel combines project management, make facilities, source code editing, program debugging, and complete simulation in one powerful environment. The AVR Studio development platform is easy-to-use and helping you quickly create embedded programs that work. The AVR Studio editor and debugger are integrated in a single application that provides a seamless embedded project development environment.

2. Embedded C (Programming Language)

   We use C language to develop logic for the functioning.

Microcontroller (Atmega-8A)



Features

• High-performance, Low-power Atmel®AVR® 8-bit Microcontroller

• Advanced RISC Architecture

– 130 Powerful Instructions – Most Single-clock Cycle Execution

– 32 x 8 General Purpose Working Registers

– Fully Static Operation

– Up to 16MIPS Throughput at 16MHz

– On-chip 2-cycle Multiplier

• High Endurance Non-volatile Memory segments

– 8KBytes of In-System Self-programmable Flash program memory

– 512Bytes EEPROM

– 1KByte Internal SRAM

– Write/Erase Cycles: 10,000 Flash/100,000 EEPROM

– Data retention: 20 years at 85°C/100 years at 25°C(1)

– Optional Boot Code Section with Independent Lock Bits

• In-System Programming by On-chip Boot Program

• True Read-While-Write Operation

– Programming Lock for Software Security

• Atmel QTouch® library support

– Capacitive touch buttons, sliders and wheels

– Atmel QTouch and QMatrix acquisition

– Up to 64 sense channels

• Peripheral Features

– Two 8-bit Timer/Counters with Separate Prescaler, one Compare Mode

– One 16-bit Timer/Counter with Separate Prescaler, Compare Mode, and Capture Mode

– Real Time Counter with Separate Oscillator

– Three PWM Channels

– 8-channel ADC in TQFP and QFN/MLF package

• Eight Channels 10-bit Accuracy

– 6-channel ADC in PDIP package

• Six Channels 10-bit Accuracy

– Byte-oriented Two-wire Serial Interface

– Programmable Serial USART

– Master/Slave SPI Serial Interface

– Programmable Watchdog Timer with Separate On-chip Oscillator

– On-chip Analog Comparator

• Special Microcontroller Features

– Power-on Reset and Programmable Brown-out Detection

– Internal Calibrated RC Oscillator

– External and Internal Interrupt Sources

– Five Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, and Standby

• I/O and Packages

– 23 Programmable I/O Lines

– 28-lead PDIP, 32-lead TQFP, and 32-pad QFN/MLF

• Operating Voltages

– 2.7 - 5.5V

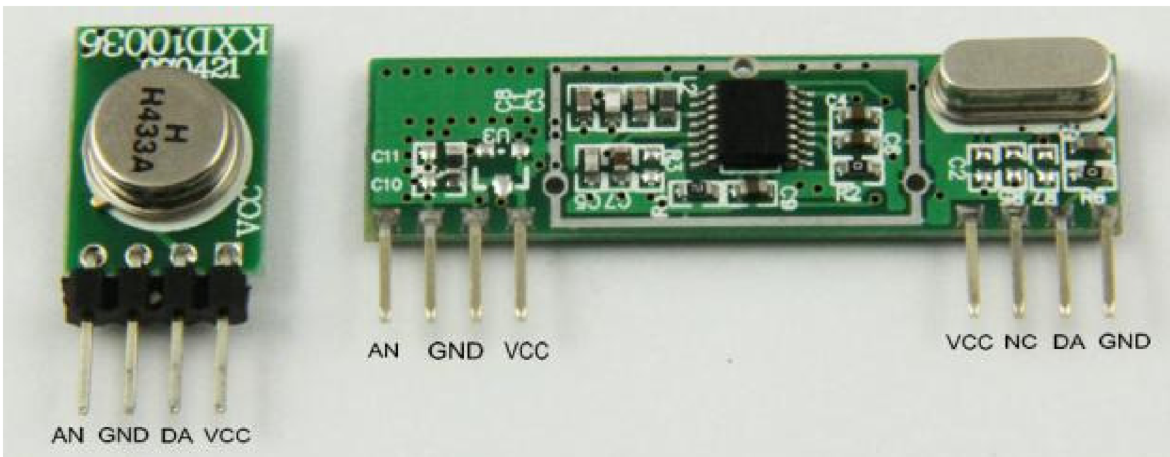
– 0 - 16MHz

• Power Consumption at 4MHz, 3V, 25°C

– Active: 3.6mA

– Idle Mode: 1.0m.

RF Module



Transmitter:

Working voltage: 3V - 12V fo max. power use 12V

Working current: max Less than 40mA max , and min 9mA

Resonance mode: (SAW)

Modulation mode: ASK

Working frequency: Eve 315MHz Or 433MHz

Transmission power: 25mW (315MHz at 12V)

Frequency error: +150kHz (max)

Velocity : less than 10Kbps

So this module will transmit up to 90m in open area .

Receiver:

Working voltage: 5.0VDC +0.5V

Working current:≤5.5mA max

Working method: OOK/ASK

Working frequency: 315MHz-433.92MHz

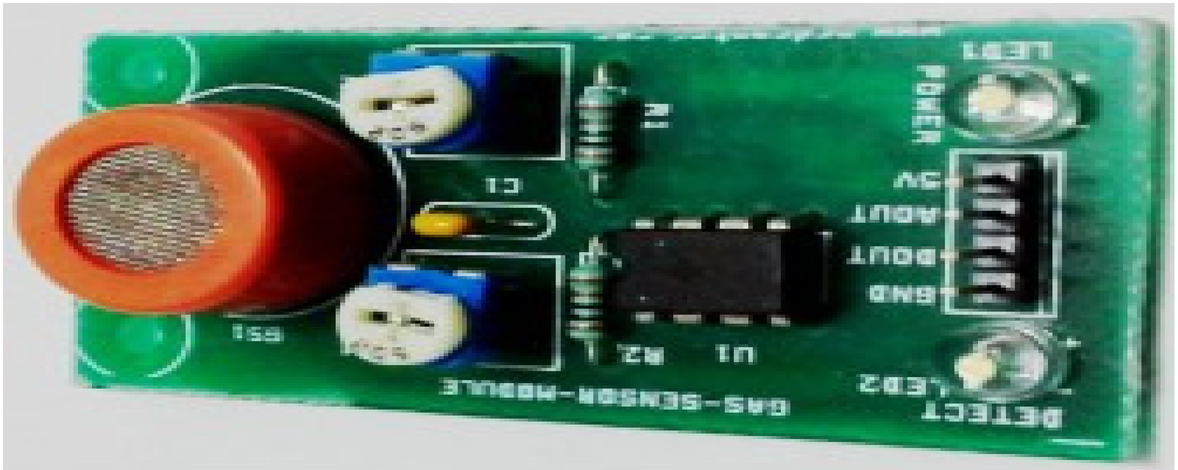
Bandwidth: 2MHz

Sensitivity: excel –100dBm (50Ω)

Transmitting velocity: <9.6Kbps (at 315MHz and -95dBm)

the use of an optional antenna will increase the effectiveness of your wireless communication. A simple wire will do the trick.

Smoke/Gas Sensor



Introduction

The onboard LPG Sensor(MQ-2) provides the Smoke contents in the air. If this found above set PPM value then it will inform the Host controller by pulling the Digital Output Pin to High and onboard status LED glow. The sensor module is mainly intended to provide a means of comparing Smoke sources and being able to set an alarm limit when the source becomes excessive.

Circuit Specification

- Supply Voltage – 5 V
- Maximum Current – 200mA

- Output voltage
    - Digital Output (5V)
    - Analog Output (0 V to 5 V – Variations)

PIN No	**PIN Information**
GND	Supply Ground
DOUT	Digital Output (TTL Level)
AOUT	Analog Output (0V to 5 V)
5V	Supply +5V

Features

- It provides smoke PPM in the air
- TTL Level Compatible
- Analog output also available to connect this with ADC

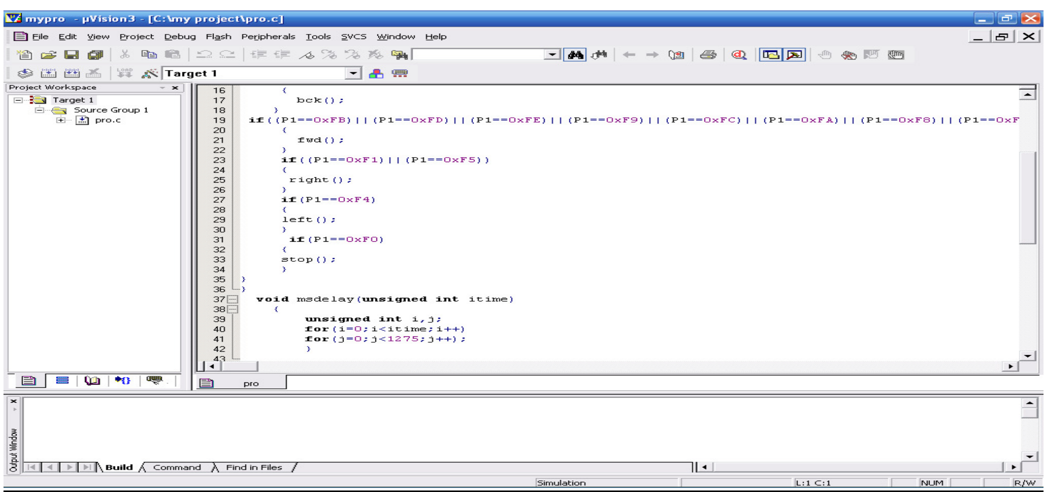
Applications

- Automotive Domain
- Security & Surveillance

- Smart Home System
- Industrial Control System

3.2 Simulator

AVR Studio is an integrated development environment used to create software to be run on embedded systems (like a microcontroller). It allows for such software to be written either in assembly or C programming languages and for that software to be simulated on a computer before being loaded onto the microcontroller. The software used is c programming



CHAPTER FOUR: RECOMMENDATION AND CONCLUSION

Conclusion

We obtained a Smoke Detection by varying the voltage applied to the non-inverting terminal of the error amplifier which gives error that is made zero by the microcontroller thus controlling the unit by detecting PPM of a smoke gas.

We have done this successfully.

Recommendation

It is highly recommended that electronic board should be constructed for this new system

References

- "AVR and embedded system" by Mazidi and Mazidi
- All datasheets from www.datasheetcatalog.com
- About ATmega8A from www.atmel.com