NEAR EAST UNIVERSITY

Faculty of Engineering

Department of Electrical and Electronic Engineering

Moisture Detector

Graduation Project
EE- 400

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ABSTRACT

Moisture detector's usage is for signaling moisture breakthroughs in moist mediums such as soil or cotton. They are placed into the moist mediums and react to very low moisture content hence; they do not require the presence of condensate droplets. After the cause of the high moisture is removed. The moisture detectors will be on the OFF state unless there is moisture.

This project presents an electronic moisture detector; this detector can be used efficiently in a various real-life applications including agricultural irrigation system, where time economizing obtained using these electronic devices.

Integrated circuits considered as one of the important element to those electronic devices, since they operate depending upon logic functions. This project has mentioned a detailed description for this element and other elements.

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INTRODUCTION

Generally, a detector physically is a device for the detection or demodulation of signals, usually there is an alarm speaker connected to the output of the detector which converts electrical signals to sound, this sound is usually considered as low frequency sound, there are many types of the detector upon the case that is desired.

Mainly this project has covered four chapters related with project field; they will be described in details as follows:

In chapter one there are detailed explanations to most used electronic components, where the electronic engineer has to deal with them carefully since now he/she is dealing with polarities that if they are not taken in consideration, we will face troubles that causes damages to those polar components.

At the beginning of this chapter resistors and capacitors were described in this project in detailed form, simple explanations with there diagrams providence, and how their values could be obtained from their shapes and colors. Here tables and equations were offered for the simplification of the reading process.

Semiconductors were provided as a second stage of this chapter were two sections of this newly discovered material explained, Intrinsic and Extrinsic Semiconductors, and Purity and Perfection of a Semiconductor.

Where under the semiconductors materials integrated circuits and diodes can be mentioned since they are semiconductors with different practical functions. Potentiometer is mentioned with its types, wire wound type and Rotary type, are explained. Photocells are also described in details where it used in the line-activated circuits. Ferrite aerial is mentioned also, and it is consist of a coil (or coils) of wire on a piece of ferrite.

At the end of this chapter switches, loudspeaker and some other devises were mentioned in details.

In chapter two a real life example of a moisture detector is introduced, where here there is a microcontroller is connected to a motor that operates it depending upon the moisture level in the soil, in such a case a watering process is gained automatically.

In chapter three this project moisture detector is mentioned as it is study and search example with a simple circuit implementation, verifying using two probes immersed with the test medium whether there is moisture in the mediums or not, and this is triggered by a low frequency alarm.

In chapter four that includes modifications that has been occurred during the implementation of the circuit such as placing some light emitting diodes, reducing the noise of the output frequency and adjusting the volume to a certain desired level.

The aims of this project are:

- To have a hand-on experience with electronic projects.
- To design, build and implement a moisture detector.
- To investigate areas of used applications.

At last the main results that have been achieved while the modification part. Firstly is reducing the noise (filtering) by adding capacitors in parallel in certain places in the circuit for limiting the output frequency.

Secondly, and the other result is adjusting the volume to wanted levels by adding resistors in series with output.

Chapter 1

Electronic Components

1.1 Overview

This chapter covers explanations for most commonly used electronic circuit's components such as (Resistors, Capacitors, Semiconductors, Integrated circuits, and Diodes), and some other devices, where each of the mentioned components has its own properties (shapes, colors, values, units) and so on. Safety guidelines for electronic project are also described in this chapter. Now starting with little detail about each of the mentioned component:

1.2 Resistors

The resistor is the simplest, most basic electronic component. In an electronic circuit, the resistor opposes the flow of electrical current through itself. It accomplishes this by absorbing some of the electrical energy applied to it, and then dissipating that energy as heat. By doing this, the resistor provides a means of limiting or controlling the amount of electrical current that can pass through a given circuit.

Resistors, such as the Figure 1.1, have two ratings, or values, associated with them. First, of course is the resistance value itself. This is measured in units called *ohms* and symbolized by the Greek letter Omega (Ω).

The second rating is the amount of power the resistor can dissipate as heat without itself overheating and burning up. Typical power ratings for modern resistors in most applications are ½ watt and ¼ watt, which are the two sizes shown in Figure 1.1. High-power applications can require high-power resistors of 1, 2, 5, or 10 watts, or even higher.

Figure 1.1 Resistors

A general rule of thumb is to always select a resistor whose power rating is at least double the amount of power it will be expected to handle. That way, it will be able to dissipate any heat it generates very quickly, and will operate at normal temperatures. For purposes of physical comparison, the larger resistor in Figure 1.1 is rated at ½ watt; its body is a cylinder 3/8" long and 1/8" in diameter. The smaller resistor, rated at ¼ watt, is of the same shape but is only 1/4" long and 1/16" in diameter.

The traditional construction of ordinary, low-power resistors is as a solid cylinder of a carbon composition material. This material is of an easily-controlled content, and has a well-known resistance to the flow of electrical current. The carbon cylinder is molded around a pair of wire leads at either end to provide electrical connections. The length and diameter of the cylinder are controlled in order to define the resistance value of the resistor the longer the cylinder, the greater the resistance; the greater the diameter, the less the resistance. At the same time, the larger the cylinder, the more power it can dissipate as heat. Thus, the combination of the two determines both the final resistance and the power rating.

A newer, more precise method is shown Figure 1.2. The manufacturer coats a cylindrical ceramic core with a uniform layer of resistance material, with a ring or cap of conducting material over each end. Instead of varying the thickness or length of the resistance material along the middle of the ceramic core, the manufacturer cuts a spiral groove around the resistor body. By changing the angle of the spiral cut, the manufacturer can very accurately adjust the length and width of the spiral stripe, and therefore the resistance of the unit.

The wire leads are formed with small end cups that just fit over the end caps of the resistor, and can be bonded to the end caps. With either construction method, the new resistor is coated with an insulating material such as phenolic or ceramic, and is marked to indicate the value of the newly finished resistor.

High-power resistors are typically constructed of a resistance wire (made of nichrome or some similar material) that offers resistance to the flow of electricity, but

Figure 1.2 Precise resistor's picture

Can still handle large currents and can withstand high temperatures. The resistance wire is wrapped around a ceramic core and is simply bonded to the external connection points. These resistors are physically large so they can dissipate significant amounts of heat, and they are designed to be able to continue operating at high temperatures.

These resistors do not fall under the rule of selecting a power rating of double the expected power dissipation. That is not practical with power dissipations of 20 or 50 watts or more. So these resistors are built to withstand the high temperatures that they will produce in normal operation, and are always given plenty of physical distance from other components so they can still dissipate all that heat harmlessly. Regardless of power rating, all resistors are represented by the schematic symbol shown in the Figure 1.3. It can be drawn either horizontally or vertically, according to how it best fits in the overall diagram.

1.2.1 Reading the Color Cods of a Resistor

In Figure 1.4 is an image of a ½-watt resistor. Due to variations in monitor resolution, it may not be precisely to scale, but it is close enough to make the point. You can see that there are four colored stripes painted around the body of this resistor, and that they are grouped closer to one end (the top) than to the other.

To someone who knows the color code, these stripes are enough to identify this as a 470Ω, 5% resistor. Imagine putting all of that in numbers on something that small! Or worse, on a ¼- watt resistor, which is even smaller. The use of colored stripes, or bands, allows small components to be accurately marked in a way that can be read at a glance, without difficulty or any great possibility of error. In addition, the stripes are easy to paint onto the body of the resistor, and so do not add unreasonably to the cost of manufacturing the resistors. Starting with the color band or stripe closest to one end of

Figure 1.3 Schematic symbol

Figure 1.4 ½-Watt resistors

The resistor, the bands have the following significance: The first two bands give the two significant digits of the resistance value. The third gives a decimal multiplier which is some power of 10, and generally simply defines how many zeroes to add after the significant digits. The fourth band identifies the tolerance rating of the resistor.

If the fourth band is missing, it indicates the original default tolerance of 20%. The bands may take on colors according to the following Figure 1.5 and Table 1.1.

1.3 Capacitors

It is known that an electrical current can only flow through a closed circuit. Thus, if we break or cut a wire in a circuit, that circuit is opened up, and can no longer carry a current. But we know that there will be a small electrical field between the broken ends. The Figure 1.6 shows two metal plates, placed close to each other but not touching.

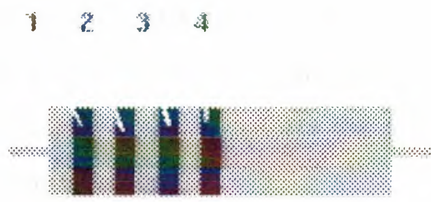


Figure 1.5

Table 1.1 Resistor's colors values

Color	Significant Digits (1 and 2)	Multiplier (3)	Tolerance (4)
Black	0	1	
Brown	1	10	
Red	2	100	
Orange	3	1000	
Yellow	4	10,000	
Green	5	100,000	
Blue	6	1,000,000	
Violet	7		
Grey	8		
White	9		
Gold		0.1	5%
Silver		0.01	10%
(None)			20%

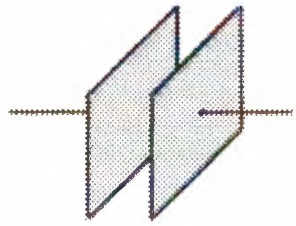


Figure 1.6 Metal plates

A wire is connected to each plate as shown, so that this construction may be made part of an electrical circuit. As shown here, these plates still represent nothing more than an open circuit. A wide one to be sure, but an open circuit nevertheless.

Now suppose we apply a fixed voltage across the plates of our construction, as shown in Figure 1.7. The battery attempts to push electrons onto the negative plate, and pull electrons from the positive plate. Because of the large surface area between the two plates, the battery is actually able to do this. This action in turn produces an electric field between the two plates, and actually distorts the motions of the electrons in the molecules of air in between the two plates.

Our construction has been given an electric charge, such that it now holds a voltage equal to the battery voltage. If we were to disconnect the battery, we would find that this structure continues to hold its charge until something comes along to connect the two plates directly together and allow the structure to discharge itself. Because this structure has the capacity to hold an electrical charge, it is known as a capacitor. How

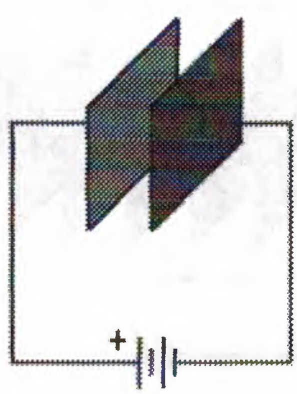


Figure 1.7 Fixed voltage applied to the plates

Much of a charge it can hold is determined by the area of the two plates and the distance between them. Large plates close together show a high capacity; smaller plates kept further apart show a lower capacity.

Even the cut ends of the wire we described at the top of this page show some capacity to hold a charge, although that capacity is so small as to be negligible for practical purposes.

The electric field between capacitor plates gives this component an interesting and useful property: it resists any change in voltage applied across its terminals. It will draw or release energy in the form of an electric current, thus storing energy in its electric field, in its effort to oppose any change. As a result, the voltage across a capacitor cannot change instantaneously; it must change gradually as it overcomes this property of the capacitor.

A practical capacitor is not limited to two plates. As shown the Figure 1.8, it is quite possible to place a number of plates in parallel and then connect alternate plates together. In addition, it is not necessary for the insulating material between plates to be air.

Any insulating material will work, and some insulators have the effect of massively increasing the capacity of the resulting device to hold an electric charge. This ability is known generally as capacitance, and capacitors are rated according to their capacitance.

It is also unnecessary for the capacitor plates to be flat. Consider Figure 1.9, which shows two "plates" of metal foil, interleaved with pieces of waxed paper. This assembly can be rolled up to form a cylinder, with the edges of the foil extending from

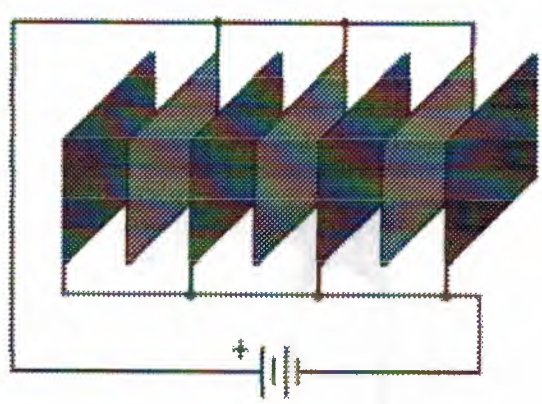


Figure 1.8 Multi-plates capacitor

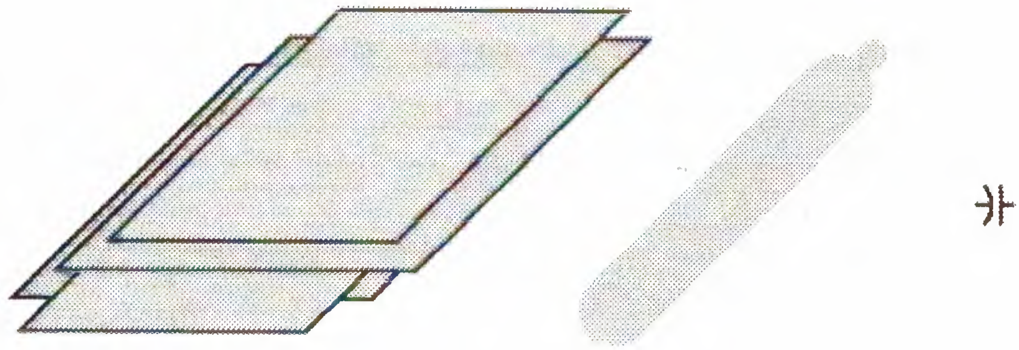


Figure 1.9 Plates of metal foil

Either ends so they can be connected to the actual capacitor leads. The resulting package is small, light, rugged, and easy to use. It is also typically large enough to have its capacitance value printed on it numerically, although some small ones do still use color codes.

The schematic symbol for a capacitor, shown in Figure 1.9 to the right of the rolled foil illustration represents the two plates. The curved line specifically represents the outer foil when the capacitor is rolled into a cylinder as most of them are. This can become important when we start dealing with stray signals which might interfere with the desired behavior of a circuit (such as the "buzz" or "hum" you often hear in an AM radio when it is placed near flourescent lighting). In these cases, the outer foil can sometimes act as a shield against such interference.

An alternate construction for capacitors is shown in Figure 1.10. We start with a disc of a ceramic material. Such discs can be manufactured to very accurate thickness

Figure 1.10 Alternate constructions for capacitors

And diameter, for easily-controlled results. Both sides of the disc are coated with solder, which is compounded of tin and lead.

These coatings form the plates of the capacitor. Then, wire leads are bonded to the solder plates to form the structure shown in Figure 1.10.

The completed construction is then dipped into another ceramic bath, to coat the entire structure with an insulating cover and to provide some additional mechanical protection. The capacitor ratings are then printed on one side of the ceramic coating, as shown in Figure 1.10.

Modern construction methods allow these capacitors to be made with accurate values and well-known characteristics. Also, different types of ceramic can be used in order to control such factors as how the capacitor behaves as the temperature and applied voltage change. This can be very important in critical circuits.

1.3.1 Reading the Values of a Capacitor

The basic unit of capacitance is the farad, named after British physics and chemist Michael Faraday (1791 - 1867) [1]. For you physics types, the basic equation for capacitance shown below.

$$C = q/V \qquad (1)$$

Where:

- C is the capacitance in farads.
- Q is the accumulated charge in coulombs.
- V is the voltage difference between the capacitor plates.

Verbally, a capacitance of one farad will exhibit a voltage difference of one volt when an electrical charge of one coulomb is moved from one plate to the other through capacitance. To help put this in perspective; one ampere of current represents one coulomb of charge passing a given point in an electrical circuit in one second.

In practical terms, the farad (f) represents an extremely large amount of capacitance. Real-world circuits require capacitance values very much smaller.

Therefore, we use Micro-farads (µf) and Pico-farads (pf) to represent practical capacitance values. The use of the micro- and Pico- prefixes is standard. $1\ \mu f = 1 \times 10^{-6}$ f and $1\ pf = 1 \times 10^{-6}\ \mu f$. Sometimes you will see the designation µµf in place of pf; they have the same meaning.

Like resistors, capacitors are generally manufactured with values to two significant digits. Also, small capacitors for general purposes have practical values greater than

1 pf and less than 1 μf. As a result, a useful convention has developed in reading capacitance values. If a capacitor is marked "47," its value is 47 pf. If it is marked .047, its value is .047 μf. Thus, whole numbers express capacitance values in Pico-farads while decimal fractions express values in micro-farads. Any capacitor manufactured with a value of 1 μf or greater is physically large enough to be clearly marked with its actual value.

A newer nomenclature has developed, where three numbers are printed on the body of the capacitor. The third digit in this case works like the multiplier band on a resistor; it tells the number of zeros to tack onto the end of the two significant digits. Thus, if you see a capacitor marked "151," it is not a precision component. Rather, it is an ordinary capacitor with a capacitance of 150 pf. In this nomenclature, all values are given in Pico-farads.

Therefore you might well see a capacitor marked 684, which would mean 680000 pf, or 0.68 μf.

1.4 Semiconductors

Metal conducts electricity; rubber does not. Gold conducts electricity; Styrofoam does not. Most materials fall easily into one category or the other. Everyone knows, for example, that if you want a good wire you are going to make it out of copper, not plastic. But there is a whole group of materials that fall in between. Their conductivity is in between metals and insulators. And their conductivity can be modified transiently, by shining a light on them or injecting charges. They are known as semiconductors, and they first became interesting to physicists in the late 1920s [2]. At first no one could figure out how they worked. Scientists once thought that certain atoms simply held onto their electrons more strongly than others. But as physicists got a better understanding of what an atom looked like, they understood what was really going on.

Different kinds of atoms have different numbers of electrons swarming around them. These electrons can only sit in specific places around the atom. It is sort of like rows of seats in a theater-in-the-round, a few electrons get to sit in the first row around the stage, and when that is filled the next electrons sit in the next row and so on. Electrons in a filled row stay put just as in a theater it is harder to get out when you have got people sitting on each side of you. In an insulator, every row is completely filled. Consequently the electrons rarely move. No moving electrons mean no electricity can pass through.

But if you are sitting in the back row of a movie theater and the seats are not full, you could easily get up, switch seats, may be even decide to check out a different movie in the next theater. In a metal, the last row is not filled with electrons. The outer electrons have little loyalty to the atom they are with and readily wander off in search of other atoms. This translates too many moving electrons, which means metals can easily conduct electricity.

They reside somewhere in the middle. They are mostly made of atoms that don't conduct electricity, but they have a handful of atoms with loose electrons. Under certain circumstances by changing things like temperature or how much energy is injected these loose electrons will start a flowing current.

That means that depending on what you do, semiconductors can transiently conduct more or less electricity. It is just that property that transistors exploit.

1.4.1 Intrinsic and Extrinsic Semiconductors

An intrinsic semiconductor is one which is pure enough that impurities do not appreciably affect its electrical behavior. In this case, all carriers are created by thermally or optically exciting electrons from the full valence band into the empty conduction band. Thus equal numbers of electrons and holes are present in an intrinsic semiconductor. Electrons and holes flow in opposite directions in an electric field, though they contribute to current in the same direction since they are oppositely charged. Hole current and electron current are not necessarily equal in an intrinsic semiconductor, however, because electrons and holes have different effictive masses (crystalline analogues to free inertial masses).

The concentration of carriers is strongly dependent on the temperature. At low temperatures, the valence band is completely full, making the material an insulator. Increasing the temperature leads to an increase in the number of carriers and a corresponding increase in conductivity. This principle is used in thermistor. This behavior contrasts sharply with that of most metals, which tend to become less conductive at higher temperatures due to increased phonon scattering. An extrinsic semiconductor is one that has been doped with impurities to modify the number and type of free charge carriers.

1.4.2 Purity and Perfection of a Semiconductor Materials

Semiconductors with predictable, reliable electronic properties are difficult to mass-produce because of the required chemical purity, and the perfection of the crystal structure, which are needed to make devices. Because the presence of impurities in very small proportions can have such big effects on the properties of the material, the level of chemical purity needed is extremely high. Techniques for achieving such high purity include zone refining, in which part of a solid crystal is melted. Impurities tend to concentrate in the melted region, leaving the solid material more pure. A high degree of crystalline perfection is also required, since faults in crystal structure such as dislocations, twins, and stacking faults, create energy levels in the band gap, interfering with the electronic properties of the material. Faults like these are a major cause of defective devices in production processes. The larger the crystal, the harder it is to achieve the necessary purity and perfection; current mass production processes use six-inch diameter crystals which are grown as cylinders and sliced into wafers.

1.5 Integrated Circuits

Another name for a chip, an integrated circuit (IC) is a small electronic device made out of a semiconductors material. The first integrated circuit was developed in the 1950s by Jack Kilby of Texas instrument and Robert Noyce of Fairchild Semiconductor [3]. Integrated circuits are used for a variety of devices, including microprocessors, audio and video equipment, and automobiles. Integrated circuits are often classified by the number of transistors and other electronic components.

An integrated circuit (IC) is a thin chip consisting of thousands or millions of interconnected semiconductor devices, mainly transistors, as well as passive components like resistors. As of present days, typical chips are of size 1 cm^2 or smaller, but larger ones exist as well.

Among the most advanced integrated circuits are the microprocessors, which drive everything from computers to cellular phones to digital microwave ovens. Digital memory chips are another family of integrated circuits that are crucially important in modern society.

The integrated circuit was made possible by mid-20th-century [4], technology advancements in semiconductor device fabrication and experimental discoveries that showed that semiconductor devices could perform the functions performed by vacuum tubes at the time. The integration of large numbers of tiny transistors onto a small chip was an enormous improvement to the manual assembly of finger-sized vacuum tubes. The integrated circuit's small size, reliability, fast switching speeds, low power consumption, mass production capability, and ease of adding complexity quickly pushed vacuum tubes into obsolescence.

Only a half century after their development was initiated, integrated circuits have become ubiquitous. Computers, cellular phones, and other digital appliances are now inextricable parts of the structure of modern societies. Indeed, many scholars believe that the digital revolution brought about by integrated circuits was one of the most significant occurrences in the history of mankind.

1.5.1 Significance

Integrated circuits can be classified into analog, digital and mixed signal (both analog and digital on the same chip).

Digital integrated circuits can contain anything from one to millions of logic gates, flip-flops, multiplexers, etc. in a few square millimeters. The small size of these circuits allows high speed, low power dissipation, and reduced manufacturing cost compared with board-level integration.

The growth of complexity of integrated circuits follows a trend called "Moore's Law", first observed by Gordon Moore of Intel. Moore's Law in its modern interpretation states that the number of transistors in an integrated circuit doubles every two years. By the year 2000 the largest integrated circuits contained hundreds of millions of transistors [5], and the trend shows no sign of slowing down.

The integrated circuit is one of the most important inventions of the 20th century [6]. Modern computing, communications, manufacturing, and transportation systems, including the Internet, all depend on its existence.

1.6 Diodes

A diode, or "rectifier," is any device through which electricity can flow in only one direction. The first diodes were crystals used as rectifiers in home radio kits. A weak radio signal was fed into the crystal through a very fine wire called a cat's whisker. The crystal removed the high frequency radio carrier signal, allowing the part of the signal with the audio information to come through loud and clear. The crystal was filled with impurities, making some sections more resistant to electrical flow than others. Using the radio required positioning the cat's whiskers over the right kind of impurity to get electricity to flow through the crystal to the output below it.

At the time, though, no one really understood about the impurities -- then in 1939 Russell Ohl accidentally discovered that it was the boundary between sections of different purity that made the crystal work [7]. Now that the way they work is understood, manufacturers make crystal diodes that work much more consistently than the ones in those original radio kits.

A crystal diode is made of two different types of semiconductors right next to each other. One side is easy for electrons to travel through; one side is much tougher. It's something like trying to swim through a pool filled with water and then a pool filled with mud: swimming through water is easy; swimming through mud is next to impossible. To an electron some semiconductors seem like water, some like mud.

One side of the semiconductor boundary is like mud, one like water. If you try to get electricity to move from the mud side to the water side, there is no problem. The electrons just jump across the boundary, forming a current. But try to make electricity go the other way and nothing will happen. Electrons that didn't have to work hard to travel around the water side just do not have enough energy to make it into the mud side. (In real life, there are always a few electrons that can trickle in the wrong direction, but not enough to make a big difference.)

This boundary has turned out to be crucial for our daily lives. Diodes change the alternating current that comes from your wall outlet into the direct current that most appliances need. And transistors need two such boundaries to work.

1.7 Potentiometer

These are available in a number of different types, but the circuit in the book requires carbon type that is available from virtually any electronic component retailer. Wire wound type are electrically suitable, but are often physically rather large and more expensive and are not recommended. Rotary types are preferable to slider types as the latter are usually much more difficult to mount. It is important to connect the potentiometer correctly in most cases as other-wise, for example, advancing a volume control might give a decrease in volume rather than increase. Potentiometer are available with a linear law (Lin = linear abbreviated type) or with a logarithmic law (log. Type), and circuit will work if the wrong type is used (provided it has the right value of course). However, if we take a volume control as a simple example, a logarithmic type would normally be utilized in this application, and using this type of potentiometer gives an apparently smooth and easily controlled increase in volume as the control is advanced. If a linear type is used there is an apparent sudden increase in volume as control is advanced from zero, with very little apparent change in volume over the major part of the control's adjustment range. It is possible to set the volume at desired level, but the volume-level is comparatively difficult to control accurately. Thus it is advisable to use potentiometer of the type specified in the appropriate component list [8].

1.8 Photocell

The photocell used in the line-activated circuits is an RPY58A which is small cadmium sulphide photo-resistor, and physically is flat, about 5mm square, and has the tow lead out wires coming from one edge. It looks very much like a small ceramic plate capacitor, in fact.

Like an ordinary resistor, a cadmium sulphide photo cell is not polarized component and can be connected in to circuit either way round. The light-sensitive surface of the component is the one having a gold pattern surface and not the one to which the two leadout wires can be clearly seen to connect [9].

1.9 Ferrite Aerial

The radio receiver projects use medium wave ferrite aerial, and a suitable type is the Denco MW5FR. Like all ferrite aerial, this consist of a coil (or coils) of wire on a piece of ferrite. In case of the MW5FR the piece of the ferrite is rod measuring about 127mm x 9.5mm and there are two coils on a paper former which is supplied on to the rod. The two coils are a large (tuned) winding and smaller (coupling) winding. They are wound using wires of different colors so that it easy to determine which leadouts come from which winding. The coils are wound using litz wire (a number of enameled copper wires twisted together and given an overall layer of insulation as well), and of the leadout wires are ready-tinned with solder so that they should fit into the breadboard without too much difficulty.

It is not essential to use Denco aerial, and the circuits have also been tested using an ambit MWC22 aerial coil on an ambit 140mm X 9.5mm ferrite rod. How ever this aerial coil has tag connections rather than leadout wires, and leads must either be soldered to the tags or connected using a small crocodile clips. The circuit should work properly using any other standard medium-wave ferrite aerial provided the aerial coils have the small coupling winding.

The ferrite aerial can simply on the workbench or at the rear of breadboard assembly if a unit long. Alternatively the aerial can be mounted on the board assembly using either a "p" style cable grip capable taking a 9.5mm diameter cable (or ferrite rod in this case of course), or special mounting clips left loose, bear in mind that ferrite is a very hard and brittle material, and that if the aerial is dropped it is quit likely that the ferrite rod will break. Also bear in mind that the aerial will not operate properly if it is laid on a metal surface and that some plastic laminates used for bench and table tops have a layer of metal foil on their underside [10].

1.10 Switches

By this point in your life, you have activated switches countless of millions of times, mostly without even thinking about it. Every key you press on a keyboard, microwave, telephone, etc. you are activating a type of switch. Not to mention, every time you turn on or off your car, or the car's blinker, defroster, radio and windshield wiper, or hit the snooze button on your alarm clock.

Even if you are somewhat familiar with switches, this section will help you to better understand the many types that are available and how to implement them into your project. However, because the switch is such a basic component, this section may be best suited to the beginner.

1.10.1 The Basics of a Switch

A switch is in its simplest form, is just a wire that gets connected or disconnected when some mechanical force is applied. The mechanical force can be anything from a person activating it by force (such as pressing a button on a keyboard), or the weight of water pressing on it (pressure switch), magnetic force from a fixed magnet or electromagnet.

Some switches have normally connected wires (called normally closed) and others are disconnected until the mechanical force is applied (normally open).

Most switches stay in one state (open or closed) until a mechanical force is applied in the reverse direction. An example of this is a light switch. Once turned on (closed), it stays on until turned off, without an outside force holding it on the whole time.

Other switches stay in their other-than-normal state only while the mechanical force is applied. Many switches of this second type are referred to as button. They are only turned on or off for as long as the mechanical force is applied. A spring or other mechanism internally returns them to their normal state. This may also be referred to as momentary ON or momentary OFF, with the moment being the activation of the button switch by mechanical force.

Now showing some of the most common switches:

1.10.2 Toggle Switch

This is multi-pole and multi-position miniature toggle switch. It is wide variety of actuator and termination of options shown in Figure 1.11.

1.10.3 Other Most Common Type of Switches

1- SPST

This is the most basic type of switch. SPST stands for Single Pole, Single Throw. NOTE: Pole refers to the number of switches there are in a switch assembly. Throw refers to the positions that each switch has to go to. If you look at Figure 1.12 a, this will make more sense. For instance, a rotary switch can be called a Single Pole, Six Throw type of switch as there is only one input but six different possible outputs with this type.

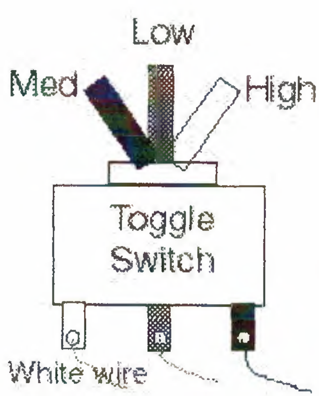


Figure 1.11 Toggle switch

2- SPDT

SPDT switches have one switch inside of the assembly, but have two options for the switch position look at Figure 1.12 b.

3- DPST

DPST switches basically have two switches in the assembly that can either be turned on or off together look at Figure 1.12 c.

4- DPDT

DPDT, as you may have guessed by now, stands for Double Pole, Double Throw. This is basically two DPST switches that are in one package that get operated at the same time look at Figure 1.12 d.

1.11 Loudspeakers

Loudspeakers are output transducers which convert an electrical signal to sound. Usually they are called 'speakers'. They require a driver circuit, such as a 555 astable or an audio amplifier, to provide a signal. There is a wide range available, but for many electronics projects a 300mW miniature loudspeaker is ideal. This type is about 70mm diameter and it is usually available with resistances of 8Ω and 64Ω. If a project specifies a 64Ω speaker you must use this higher resistance to prevent damage to the driving circuit, a circuit symbol and a photograph shown in Figure 1.13.

(a) SPST Switch

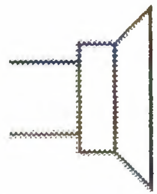
(b) SPDT Switch

(c) DPST Switch

(d) DPDT Switch

Figure 1.12 Switches diagrams

Photograph of a loudspeaker



Circuit symbol

Figure 1.13

Most circuits used to drive loudspeakers produce an audio (AC) signal which is combined with a constant DC signal. The DC will make a large current flow through the speaker due to its low resistance, possibly damaging both the speaker and the driving circuit.

To prevent this happening a large value electrolytic capacitor is connected in series with the speaker, this blocks DC but passes audio (AC) signals. See capacitor coupling shown in Figure 1.14.

Loudspeakers may be connected either way round except in stereo circuits when the (+) and (-) markings on their terminals must be observed to ensure the two speakers are in phase.

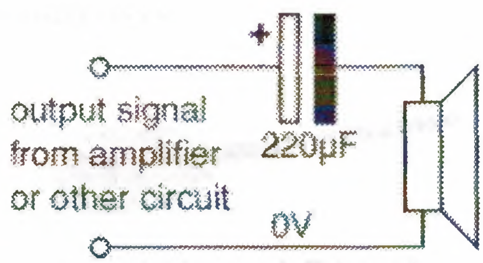


Figure 1.14 Capacitor in series to block DC

Correct polarity must always be observed for large speakers in cabinets because the cabinet may contain a small circuit (a 'crossover network') which diverts the high frequency signals to a small speaker (a 'tweeter') because the large main speaker is poor at reproducing them.

Miniature loudspeakers can also be used as a microphone and they work surprisingly well, certainly well enough for speech in an intercom system for example

A somewhat higher impedance of more than 80 ohms does not seem to be available. Except where noted otherwise, the use of the low impedance loud speaker such as 8 ohms type is not recommended.

Loudspeakers should be treated carefully since the diaphragm is easily damaged, and you should always hold a loudspeaker by magnet housing at the rear of the component.

1.12 Battery Clips and Holders

The standard battery clip fits a 9V PP3 battery and many battery holders such as the 6 × AA cell holder shown in Figure 1.15. Battery holders are also available with wires attached, with pins for PCB mounting, or as a complete box with lid, switch and wires.

Many small electronic projects use a 9V PP3 battery but if you wish to use the project for long periods a better choice is a battery holder with 6 AA cells. This has the same voltage but a much longer battery life and it will work out cheaper in the long run. Larger battery clips fit 9V PP9 batteries but these are rarely used now.

1.13 Safety Guidelines

Some electrical and electronic safety guidelines are used pertaining engineers to take care about them [11].

1. Turn off power and unplug from the wall before working on electric or electronic circuits, except when absolutely necessary.

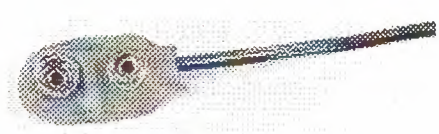


Figure 1.15 6 × AA Cell holder

2. Complete all your wiring and check it carefully before turning on the power supply.

3. When a setup or circuit is to be reconfigured or rewired, turn the power supply off. It is also a good practice to disconnect it from the power supply.

4. When you are done with an experiment, turn off the power supply first before disassembling the circuit.

5. Do not work on electrical equipment in a wet area or when touching an object that may provide a hazardous earth ground path.

6. Turn off power and unplug equipment before checking or replacing fuses. Locate and correct the cause of a blown fuse or tripped circuit breaker before replacing the fuse or resetting the circuit breaker.

7. Immediately report and do not use defective cords and plugs. Inspect cabling for defects such as frayed wiring, loose connections, or cracked insulation.

8. Remove metal jewelry, watches, rings, etc., before working on electrical circuits.

9. Always check the electrical ratings of equipment you use and be sure you use that equipment within its ratings.

10. Never overload circuits.

11. Never leave unprotected systems unattended.

12. Never place containers of liquid on electrical systems.

13. Never defeat the purpose of a fuse or circuit breaker. Never install a fuse of higher amperage rating than that specifically listed for your circuit.

14. Make sure equipment chassis or cabinets are grounded. Never cut off or defeat the ground connection on a plug.

15. Safely discharge capacitors in equipment before working on the circuits. Why? Because, large capacitors found in many laser flash lamps and other systems are capable of storing lethal amounts of electrical energy and pose a serious danger even if the power source has been disconnected.

16. When shifting probes in a live/active circuit, be sure to shift using only one hand: It is best to keep the other hand off other surfaces and behind your back.

17. If you are working on a design project and you plan to work with voltages equal to or above 50 volts, notify your instructor and obtain their approval before proceeding.

1.14 Summary

This chapter covered background information on electronic circuit components. In addition safety guidelines for hardware electronic project were presented.

Chapter 2

Garden Plant Moisture Detector

2.1 Overview

This chapter presents a moisture detector that recognizes the water level in the garden soil, and this for making the watering operation processing automatically.

This devise used to maintain the soil moisture level, so the plants can grow healthy. The soil moisture value from the sensor is processed by microcontroller to activate the watering valve. If the soil moisture level is below from the expected value, then the watering valve will be active. However, if the soil moisture level is higher than the expected value, the watering valve will be off. The expected soil moisture level can be controlled by arranging the value of Pot VR1. The LCD (Liquid Crystal Display) will display the soil moisture level and the expected level. The main part of this electronic gardener is a microcontroller chip 8051. This chip used as LCD driver, ADC driver and valve driver, as they shown in Figure 2.1.

2.2 Hardware Description

The soil moisture sensor 200SS is used, which have an output range from zero cb to 200 cb (centibar). This sensor must be operated with square wave signal, which generated by the timer circuit using LM555 and 7404. The sensor circuit is like a voltage divider circuit, so the resistance of the sensor is equal to the soil moisture value. Because the reading from the sensor is only valid when the bias signal from the timer circuit reaches the peak amplitude, it must use the sample and hold component LF398 to keep the value until next reading cycle.

To convert the analog signal to digital signal, MAX114 is used, which have 4 inputs channel and 8 bits output. The soil moisture level goes to the first channel, while the expected value goes to the second channel. The other channels can be connected to other sensors in different areas, so we can control the soil moisture in many areas. However, of course the sensors must be placed far enough from the others.

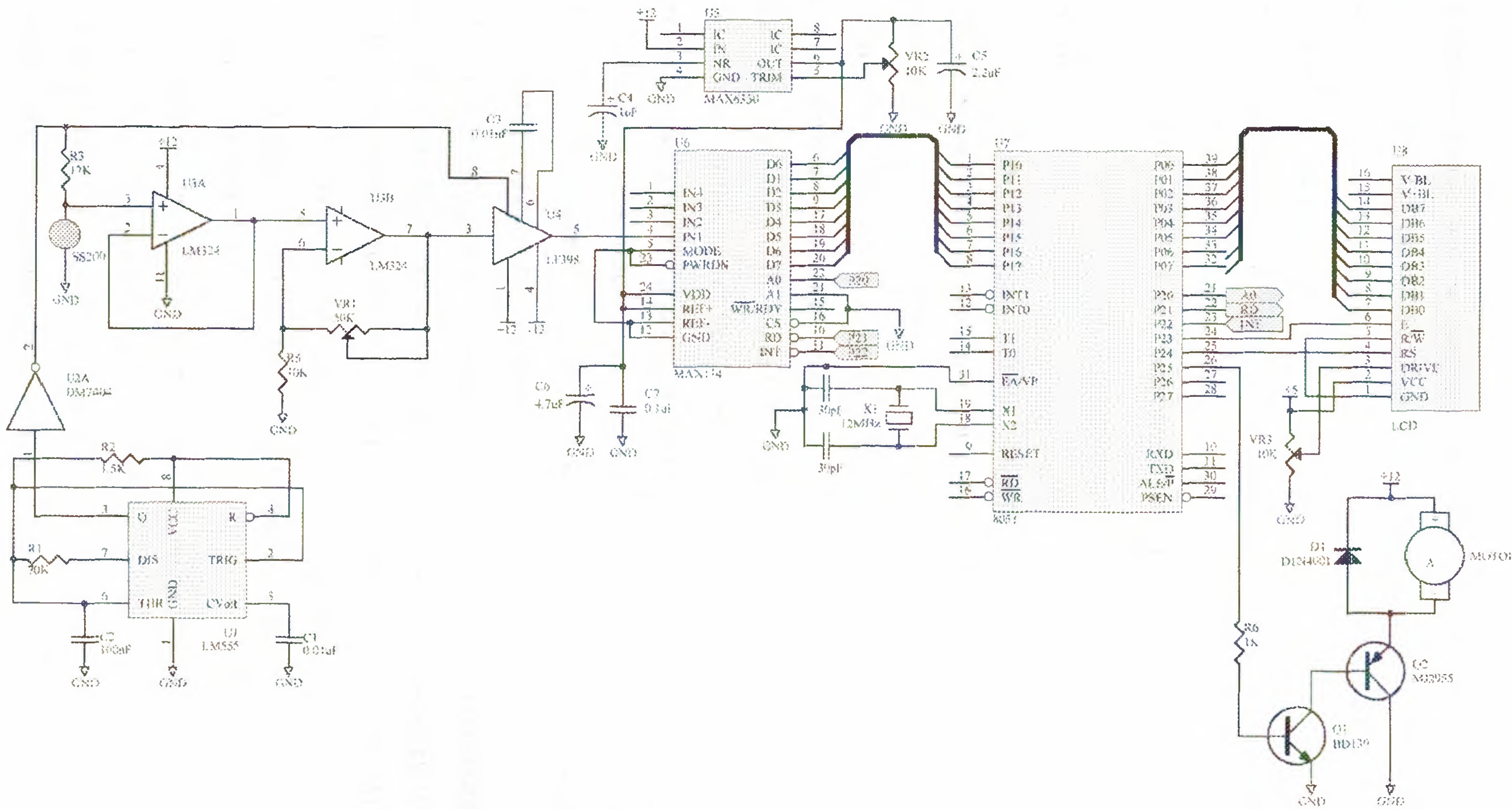


Figure 2.1 A Circuit's diagram [12]

The microcontroller chip drive the ADC chip by sending low signal to CS and RD pin of the MAX114 and get the digital data from DB0-DB7 pins after the INT pin goes low.

These digital signals will be converted to decimal format, then send to the LCD. Because the function of the LCD is only to display data, so the RW pin can be connected to ground. While the other control pins (i.e. EN and RS pins) are controlled by the microcontroller.

The microcontroller will compare the expected soil moisture value with the sensor reading and determine whether the watering valve is active or not, where circuit diagram shown in Figure 2.1 and components given in Table 2.1.

2.3 Analysis

This chapter provides basic common concepts between this plant moisture detector and the project moisture detector since they have the same operating logic which is the moisture level.

In this section there will be providence to the main analysis of this chapter and the differences between mentioned moisture detector in this chapter and main project moisture detector which is the subject of the next chapter.

Firstly, here in this circuit that performs a real life example of a moisture detector where mainly can be used for accomplishing watering process automatically in a garden or in any planted areas, where mainly this circuit has a microcontroller that control the water valve when programmed moisture level is available. This microcontroller and the other chips are programmed by assembly language

Therefore in such practical watering process, there will be economizing to the time and getting a very good quality planting as well, since it is controlled to the best soil moisture level. Detailed hardware description is viewed in (Section 2.3) of this chapter.

Secondly, this moisture detector has no big difference with this project moisture detector, since both of them operate with common medium's environments which it is mainly the moisture with all its types.

It is mentioned in the next chapter that this project moisture detector deals with under graduated electronic engineers, where they can acquire the idea of the moisture level detector completely, simply and easily.

Finally, these two chapters have covered two common electronic operating system examples, where one of them has covered a real life example which is described in this chapter. And the other example is a study and search example which is covered by the next chapter of this project.

2.4 Parts List

Table 2.1

Part Label	Part Description
U1	LM555 Timer
U2	7404 Not Gate
U3	LM324 Operational Amplifier
U4	LF398 Sample And Hold
U5	MAX6350 Voltage Reference
U6	MAX114 Analog to Digital Converter
U7	8051 Microcontroller
U8	M1632 Liquid Crystal Display
Q1	BD139
Q2	MJ2955
C1	0.01uF
C2	100nF
C3	0.01uF
C4	1uF
C5	2.2uF
C6	4.7uF
C7	0.1uF
D1	D1N4001
R1	70K
R2	1.5K
R3	17K
R4	10K
R5	1K
VR1	Pot 50K
VR2	Pot 10K
VR3	Pot 10K

2.5 Summary

This chapter presented an example of moisture detector that resembles the detector that it is built in this project. In the next chapter this project moisture detector will be explained.

Chapter 3

Moisture Detector

3.1 Overview

This chapter describes my project the moisture detector. The detector verifies whether there is moisture in the mediums or not, that is notified by triggering a low frequency alarm.

This moisture detector verifies whether there is any kind of moisture that exist in the mediums or not, and this is done by having two probes immersed in medium material. This circuit normally produces a low frequency audio output having a fundamental frequency of only few Hertz, but the operating frequency rises considerably if a couple of probes are placed in water. A more modest increase in pitch is produced if the probes are placed in some thing damp, such as fairly moist soil.

A practical application for a unit such as this is as a soil moisture indicator to show whether or not a plant needs watering by giving an indication of moisture at root level.

3.2 Hardware Description

The circuit diagram of the unit is shown in Figure 3.1 and the components are given in Table 3.1.

The circuit is little more than a low frequency oscillator based on IC1 and driving a loudspeaker LS1 via C2. The frequency at which IC1 oscillates can be considerably boosted by switching on Tr1 so the R3 is effectively connected from the input of IC1 to the negative supply rail. As the circuit stands though, Tr1 is cut off and passes no significant current.

With probes placed on water there will be fairly low resistance between them and heavy base current will flow into Tr1 so that this device is biased hard into conduction and the frequency IC1 is taken to its maximum figure. It should perhaps be pointed out that pure water does in fact have a very high resistance, but most source of water (rain, tap water, etc.) contain significant amount of purities which produces a much lower resistance.

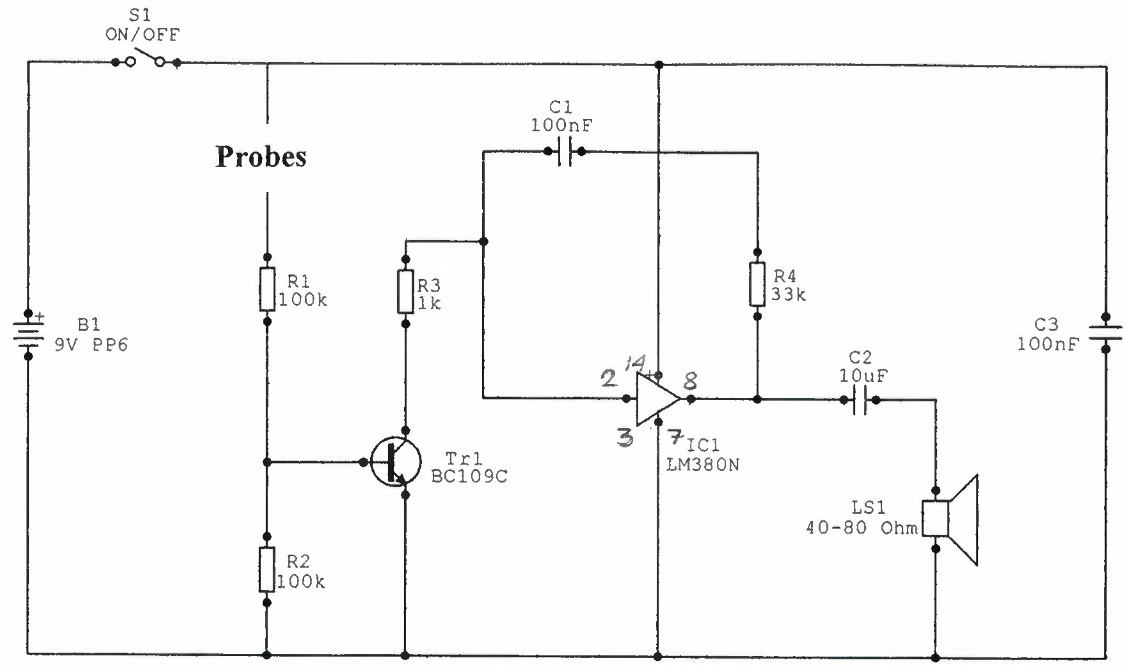


Figure 3.1 Circuit's diagram [10]

If the probes are placed in some thing that has only modest moisture content there, will be a much higher resistance between them, but Tr1 will still be biased into conduction to certain extent and there will be a significant increase in the operating frequency of the unit. Thus, Tr1 is not simply switched fully on or fully off, and intermediate states (and output frequencies from the unit) can be produced. The probes can simply consist of two-piece of a single strand PVC-insulated wire with a small length of insulation (say about 5 mm) removed from the ends. If the unit is to be used as a soil moisture indicator, the two probes must be mounted together so that they are a fixed distance apart. A spacing of about 200 mm is suitable. The spacing is important as it affects the sensitivity of the unit. If the unit seems to be oversensitive, incidentally, removing some of the exposed at the end of each probe is the easiest way of correcting this. Similarly, a lack of sensitivity can be corrected by removing some of the insulation at the end of each probe to leave a greater length of exposed wire.

3.3 Part List

List of the components shown in Table 3.1

Table 3.1 Part list

Part Label	Part Description
R1	100 K (Brown, Black, Yellow, Gold)
R2	100 K (Brown, Black, Yellow, Gold)
R3	1 K (Brown, Black, Red, Gold)
R4	33 K (Orange, Orenge, Orenge, Gold)
C1	100 nF Polyester (Brown, Black, Yellow, Black, red)
C2	10 μF 25V electrolytic
C3	100 nF Polyester (Brown, Black, Yellow, Black, red)
IC1	LM380N
Tr1	BC109C
S1	SPST Miniature Toggle Type
B1	PP6 Sise 9 Volt and Connector to Suit
LS1	Miniature Type Having an Impedance in the Range 40 to 80 ohms

3.4 How the Circuit Works

Firstly, at the start of analyzing the circuit of my project which provides a moisture detector that detects the existence of the moisture in the mediums, of course relatively with there types there will be multiple volume levels of the low frequency alarm.

This circuit has a power source of (9 DC Vs battery), that means this circuit gives to the reader an idea of a simple moisture detector that resembles the ones which are used at the plant's watering systems which might be sourced by (12 DC Vs – 24 DC Vs), of course both are working with mutual logic.

Secondly, initiating with (9 DC Vs battery) considering that the toggle switch at the short circuit state (ON), then the current of this battery will go from plus pole (+) to minus pole (-), passing through the on case switch and then through the medium used in the test, here the current will be able to be conducted through the medium when the moisture is available, how it occurs as it is known that the moisture is water or other liquid diffused in a small quantity as vapors, and water has chemical composite that allow to the electrical current to pass through it with certain conductivity, this goes the current to the parallel resistors first of R1 (100 KΩ) and second of R2 (100 KΩ) where transistor connected across the connection point of the two resistors, of course the current will be reduced in the resistors with the relation of Ohm's low.

$$I = V / R \qquad (1)$$

Where:

- V: is the voltage across the resistor terminals in volts.
- I: is the current passing through the resistor in amperes.
- R: is the resistance in ohms.

The power in the resistors that absorbed it from the electrical current will be dissipated as heat energy through their bodies known by the power loss equation.

$$P = I^2 * R \qquad (2)$$

Where:

- P: is the power loss in watts.
- I: is the current passing through the resistor in amperes.
- R: is the resistance in ohms.

Now as the continuation of the traveled electrical current, when it is at the transistor region where the purpose of this transistor firstly is to make current control to the forward devices in the circuit, and secondly is to make amplification to the electrical current.

Then this current is passing though R3 (1 KΩ), where the process that happens in this resistor will be the same as the first two parallel resistors R1 and R2 as shown in the Figure 3.1.

This current now is passing through the branch of C1 (100 nF), IC1 (LM380N) and R4 (33 KΩ), starting with C1 in this branch, this capacitor will be charged with voltage since it a storing device, thus the voltage entering to this branch will be decreased with certain factor as some of it will be absorbed by the capacitor.

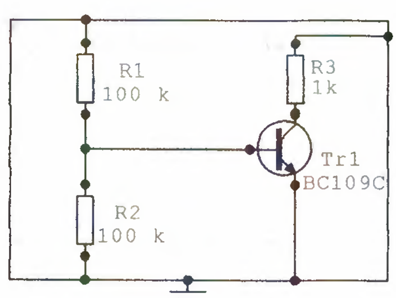


Figure 3.1 First part of the circuit

This capacitor is connected in parallel with IC1 (integrated circuit) that works upon the logic functions mainly (AND, OR, and NOT). Where this IC1 in this circuit has 14 pins and the connection of them is that first pin is an input and the fourteenth pin is an input as well to the IC1, the third pin is grounded and the seventh one grounded as well, finally the eighth pin is an output.

The same capacitor is connected in series with the fourth resistor R4 (33 KΩ) and the whole mentioned branch that its output is connected in series with C2 (10 μF) as storage device as well, that means the output's voltage of that branch will be reduced as shown in Figure 3.2. Finally this current enters the loudspeaker LS1 of a resistance range of (40 – 80) ohms, where here an important process occurs which it is the current transformation from its time domain to its frequency domain takes place hence a low frequency alarm is being come out. The whole circuit is connected in parallel with third capacitor C3 (100 nF).

3.5 Summary

This chapter covered a simple design of a moisture detector, which can operate in any damp medium; the output low frequency is alternated depending on moisture level in a certain medium that is connected to the detector. This chapter provided also a detailed explanation on how the detector circuit works from input to output. In the next chapter the implementation of my project moisture detector will be presented. Results and modifications are described in details for the circuit components that make vital changes to the output.

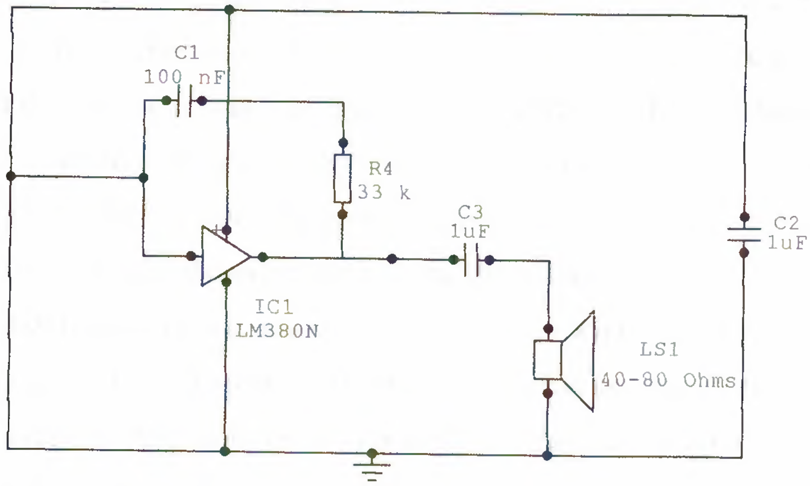


Figure 3.2 Second part of the circuit

Chapter 4

Implementation of the Moisture Detector

4.1 Overview

This chapter provides the specifications of this moisture detector which was mentioned in chapter three. Results and modifications are described as well, such as reduction of noise, adjusting the volume to lower or higher level, placing some LEDs (light emitting diodes) to show the device status (ON or OFF) and finally making simple housing packet to the circuit to be put inside as better scene.

4.2 Modifications

This section provides the reader the modifications that were added to this project as follows:

4.2.1 Light Emitting Diodes

Two light-emitting diodes (LEDs) are employed in the project, and these are both small types (3 mm or 0.125 in), but the TIL209 is a red device and the TIL211 is a green device. Many component suppliers do not use type numbers for the LEDs and simply describe them as LED of a certain color, diameter and shape (the TIL209 and TIL211 are both type incidentally).

With most LED circuits, including those described here, from the electrical viewpoint the size, color, and shape of the LED is not important and with exception of a few special types such as infra-red and multi-color type types any LED can be used. For circuit that use both types it is not even essential to use LEDs of different colors, but a two- current display will probably be clearer than one having LEDs of the same color.

There are various way used to show which LED lead-out wire is the anode (+) and which is the cathode (-), one of the most common being to have one lead-out wire shorter than shorter than the other, usually the shorter lead-out wire is cathode one (-), but unfortunately this is not always the case, and sometimes different method of identification is used. With some LEDs there is no obvious way of telling which lead-out wire is which as they seem to be symmetrical if the manufacturer's or retailer's data is not available, or does not make it clear lead-out wire is which, you can simply try each LED either way round.

If the device is wrongly connected it will fail to light but is unlikely to sustain any damage, and it will merely be necessary to reverse the polarity of the device in order to make the circuit function correctly.

And now viewing some general detailed information about light emitting diodes,

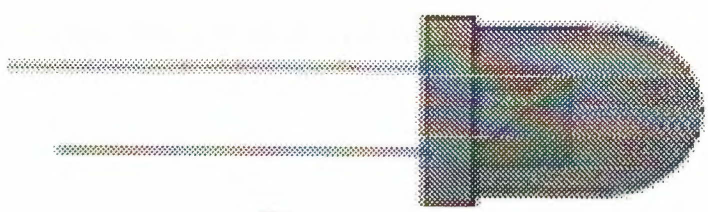
1- Function

LEDs emit light when an electric current passes through them an example of a light emitting diode and its circuit symbol are shown Figure 4.1.

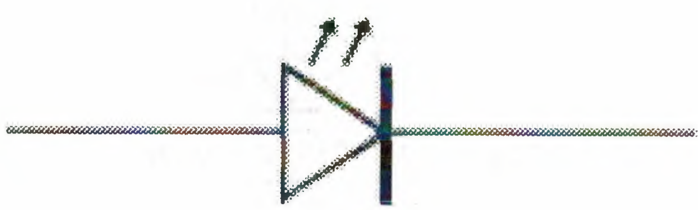
2- Connecting and Soldering

LEDs must be connected the correct way round, the diagram shown in Figure 4.1 may be labeled **(a)** or **(+)** for anode and **(k)** or **(-)** for cathode (it really is k, not c, for cathode). The cathode is the short lead and there may be a slight flat on the body of round LEDs. If you can see inside the LED the cathode is the larger electrode (but this is not an official identification method).

LEDs can be damaged by heat when soldering, but the risk is small unless you are very slow. No special precautions are needed for soldering most LEDs.



An example of light emitting diode



A circuit symbol of a light emitting diode

Figure 4.1

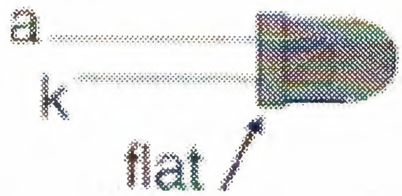


Figure 4.2 Light emitting diode diagram

3- Connecting LEDs in Series

If it is desired to have several LEDs on at the same time it may be possible to connect them in series. This prolongs battery life by lighting several LEDs with the same current as just one LED.

All the LEDs connected in series pass the same current so it is best if they are all the same type. The power supply must have sufficient voltage to provide about 2V for each LED (4V for blue and white) plus at least another 2V for the resistor. To work out a value for the resistor you must add up all the LED voltages and use this for V_L circuit diagram shown in Figure 4.3.

4- Sizes, Shapes and Viewing Angles of LEDs

LEDs are available in a wide variety of sizes and shapes. The 'standard' LED has a round cross-section of 5mm diameter and this is probably the best type for general use, but 3mm round LEDs are also popular as mentioned in section 4.1.

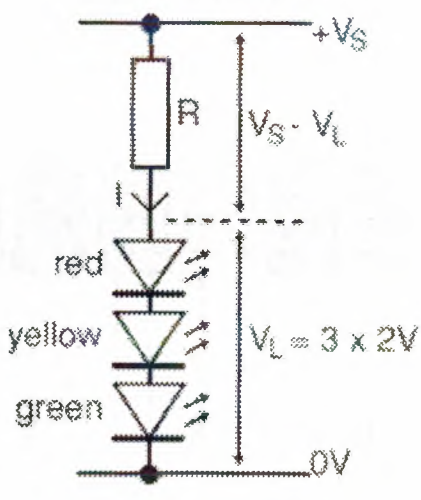


Figure 4.3 Circuit diagram

Round cross-section LEDs are frequently used and they are very easy to install on boxes by drilling a hole of the LED diameter, adding a spot of glue will help to hold the LED if necessary. LED clips are also available to secure LEDs in holes shown in Figure 4.4. Other cross-section shapes include square, rectangular and triangular.

As well as a variety of colors, sizes and shapes, LEDs also vary in their viewing angle. This tells you how much the beam of light spreads out. Standard LEDs have a viewing angle of 60° but others have a narrow beam of 30° or less.

5- Colors of LEDs

LEDs are available in red, orange, amber, yellow, green, blue, and white. Blue and white LEDs are much more expensive than the other colors as show in Figure 4.5.

The color of an LED is determined by the semiconductor material, not by the coloring of the 'package' (the plastic body).

LEDs of all colors are available in uncolored packages which may be diffused (milky) or clear (often described as 'water clear'). The colored packages are also available as diffused (the standard type) or transparent.

Figure 4.4 LED Clip

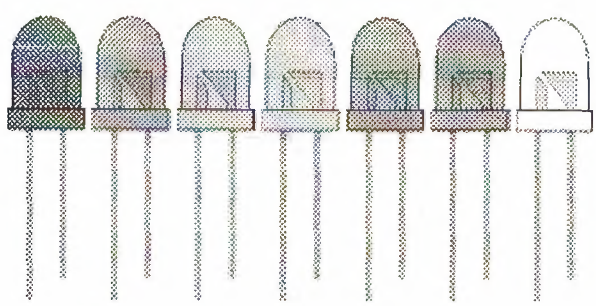


Figure 4.5 Colors of LEDs

4.2.2 Reduction of Noise

This section explains how noise could be eliminated from an electronic circuit, where for this purpose capacitors are used, where that can be connected in parallel with some other capacitors as shown in Figure 4.7.

In such a way the output low frequency will be limited to the best form that is needed. That value of the capacitor was reached using a variable capacitor and adjusting it to the best value. Mainly in this branch shown in Figure 4.7, the voltage is reduced and filtered as well, that is why noise is eliminated and much more sensitive output is reached.

4.2.3 Adjusting the Output Volume

This section explains how output volume could be controlled, for reaching this desire resistors are placed in a certain places in the circuit with series connection and mostly these places can be decided by making changes in the output resistances (increasing and decreasing their values), of course in this project situation as the output is a low frequency thus, getting higher volume of that output can be done by reducing the series resistance to that output and vice versa.

For more practical and accurate results, variable resistance could be placed in series with output speaker. This change is shown in Figure 4.8.

4.1.4 Simple Cover Packet (Housing)

This packet has been made for getting better scene to the circuit, it is a carton made packet Figure 4.9 shows a picture of the circuit in the cover packet.

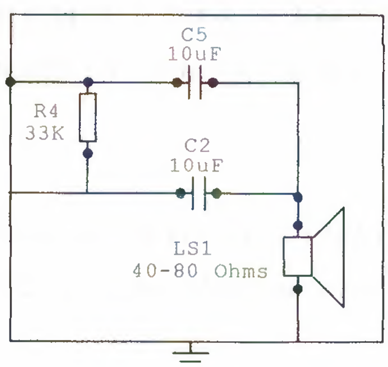


Figure 4.7 Modified portion of the circuit

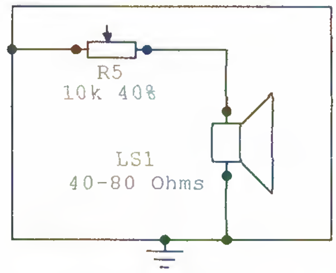


Figure 4.8 Modified portion of the circuit

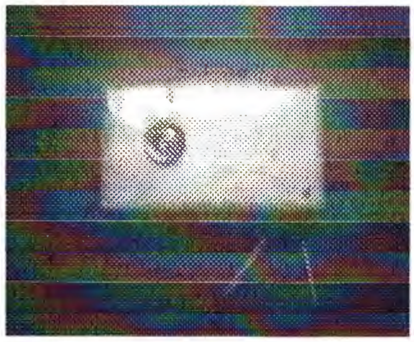


Figure 4.8 Picture of the circuit in the cover packet

4.3 Results

The section provides which moist mediums that are used in testing part of the circuit, those were two moist mediums, one is moist planting soil and the other is normal moist cotton. As it recognized the alarm were slightly more in normal moist cotton, and this is because of their formation material that it depends on the particles formation of those mediums since the soil particles is closer together than the cotton particles.

Here in this section there are most important notices that have been reached during the modification's part of the project. Starting with light emitting diode's results, these are considered as important results for electronic engineer.

1-Testing a LED

An electronic engineer should never connect a LED directly to a battery or power supply, it will be destroyed almost instantly because too much current will pass through and burn it out.

LEDs must have a resistor in series to limit the current to a safe value, for quick testing purposes a 1k resistor is suitable for most LEDs if your supply voltage is 12V or less. Remember to connect the LED the correct way round. Shown in Figure 4.9.

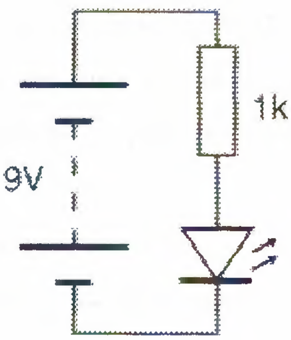


Figure 4.9 A LED connection's diagram

2- Avoid connecting LEDs in parallel

Connecting several LEDs in parallel with just one resistor shared between them is generally not a good idea.

If the LEDs require slightly different voltages only the lowest voltage LED will light and it may be destroyed by the larger current flowing through it. Although identical LEDs can be successfully connected in parallel with one resistor this rarely offers any useful benefit because resistors are very cheap and the current used is the same as connecting the LEDs individually. If LEDs are in parallel each one should have its own resistor.

3- Filtering and Volume Adjusting

As results of the experiments during the modification part it is being recognized that a capacitor can be use for filtering purpose since the output frequency can be limited to a desired level. Resistors can be used for adjusting the output volume, by increasing the resistance value, volume is decreased frequently, and vice versa.

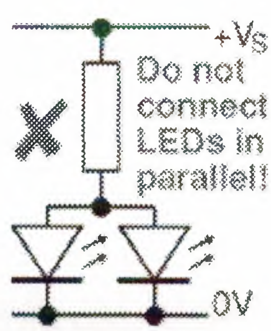


Figure 4.10 wrong case LEDs connection

4.4 Specification

Mainly this project moisture detector resembles the watering system since it operates with existence of the moisture (water or other liquid diffused in a small quantity as vapor, or within a solid, or condensed on a surface).

4.5 Summary

This chapter provided the main modifications and results that have been made on this project circuit in details. A specification has been viewed as well.

CONCLUSION

Electronic fields are considered as a real revolution in the world. As we did see in the project chapters, that we can create something useful, practical and vital to the people life using those microprocessor.

Another important example for that revolution is the computer, since it was at the beginning as big as a room with very low efficiency, but it is completely different than now days one, and that because of reducing the mother board size of a computer by hundreds of microprocessor and electronic components.

Moisture detectors are considered one of those important devices that make vital key role to the people's life, as in our case moisture Detector can economize people's times by operating certain functions automatically as were mentioned in the project chapters.

Since this project deals with under graduated electrical and electronic engineers, an electronic devise was provided in a simple manner to be much understandable to the students.

The aims of this project were:

- To have a hand-on experience with electronic project.

  This aim was accomplished by the search of this project and having mostly detailed ideas about electronic world.

- To design, build and implement a moisture detector.

  This aim was accomplished by having practical experience of implementing moisture detectors.

- To investigate areas of used applications.

  This aim was accomplished by referring to many references and having real-life applications to this project moisture detector.

One important concept that the student has to know about the capacitor, that it has an important role in electrical and electronic field since it can be used as filters where the outputs frequencies can be limited to a certain desired levels.

References

[1] Faraday, Michael, British physics and chemist (1791 – 1861), "http://www.google.com/electronic components the capacitor.htm".

[2] "http://www.google.com/semiconductors.htm".

[3] Jack, kilby, taxas instrument and Ropert, Noyce, of Fairchild semiconductor, "http://www.google.com/integrated circuit.htm".

[4] "http://www.google.com/integrated circuit.htm".

[5] "http://www.google.com/integrated circuit.htm".

[6] "http://www.google.com/integrated circuit.htm".

[7] "Russe, Ohl, 1939, http://www.google.com/diods.htm".

[8] "http://www.google.com/safty guidlines.htm".

[9] "http://www.google.com/garden plant moisture detector.htm".

[10] "Khashman, Adnan, Hand-out of electronic project, Moisture detector".