DESIGN AND DEVELOPMENT OF PROTOTYPE OF SMART FARM FENCE FOR PROTECTION FROM WILD ANIMALS

FINAL YEAR MAJOR PROJECT

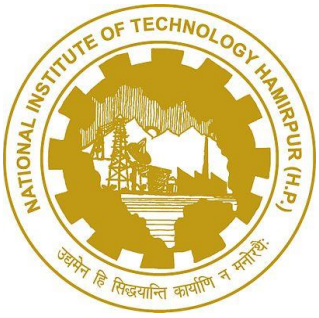
SUBMITTED BY: -

SUKH SAGAR (14276)

GIRIRAJ SWAMI (14261)

SANDEEP JANGIR (14290)

KAILASH KUMAWAT (14291)



DEPARTMENT OF ELECTRICAL ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY

HAMIRPUR (HP)-177005, INDIA

Project report submitted in partial fulfillment of the requirements for the award of the degree of B.Tech, NIT Hamirpur.

Date of Submission: Dec. 13, 2017

DESIGN AND DEVELOPMENT OF PROTOTYPE OF SMART FARM FENCE FOR PROTECTION FROM WILD ANIMALS

REPORT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

BACHELOR OF TECHNOLOGY

In Electrical & Electronics Engineering

Under the guidance of

Dr. R. K. Jarial

DEPARTMENT OF ELECTRICAL ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY, HAMIRPUR, (2017)

SUBMITTED BY:

-

SUKH SAGAR (14276)

GIRIRAJ SWAMI (14261)

SANDEEP JANGEER (14290)

KAILASH KUMAWAT (14291)

NATIONAL INSTITUTE OF TECHNOLOGY

HAMIRPUR (HP)

CANDIDATE'S DECLARATION

We hereby declare that the work which is being presented in the Project report title "Design And Development Of Prototype Of Smart Farm Fence For Protection From Wild Animals" in partial fulfillment of the requirements for the award of the Degree of Bachelor of Technology and submitted in the Electrical Department, National Institute of Technology Hamirpur, is an authentic record of our own work carried out during the period from January to December 2017 under the supervision of Dr. R. K. Jarial, Associate Professor, Electrical Engineering Department, NIT Hamirpur. The matter presented in this project report has not been submitted by us for the award of any other degree of this or any other Institute/University.

Sukh Sagar (14276)

Giriraj Swami (14261)

Sandeep Jangir (14290)

Date: December 13, 2017 **Kailash Kumawat (14291)**

This is to certify that the above statement made by the candidates is correct to the best of my knowledge.

Dr. Zakir Hussain **Dr. R. K. Jarial**

Head, EEE Dept. **Signature of Supervisor**

The project Viva-Voce Examination of the candidates has been held on……..

Signature of External Examiner

ACKNOWLEDGEMENT

We would like to express our deepest appreciation to all those who provided us the possibility to complete our major project. A special gratitude, we give to our project supervisor, Dr. R. K. Jarial, Associate Professor, Electrical Engineering Department, NIT Hamirpur (H.P.) whose contribution in suggestions and encouragement helped us to coordinate in the project. We would like to thank him for all guidance given by him without which this project couldn't have been completed.

We would like to thank all the faculty and staff members of Electrical Engineering department of NIT Hamirpur, who gave us opportunity to complete the major project in such a wonderful working environment, and helping us in achieving the desired goal.

Sukh Sagar (14276)

Giriraj Swami (14261)

Date: **Sandeep Jangir (14290)**

NIT Hamirpur **Kailash Kumawat (14291)**

ABSTRACT

India, with gigantic diversified agricultural lands has different crops ranging from tomato to wheat. But a big part of the crops is destroyed due to animal menace and hence a protection is required to save the crops from animal. Solar Fencing Perimeter Protection is the modern day need to the growing security threat in denying, detecting while having the inbuilt capability to serve as deterrent. In this project, we design and implement Fencing Perimeter Protection for agriculture and farm houses. It is the modern day need to the growing security threat in denying, detecting while having the inbuilt capability to serve as deterrent. It works on Solar Energy with backup facility to run uninterruptedly during the nights as well as cloudy days. When any object is sensed by wire connected to pull switch, the pulse generator immediately generate a specific high frequency pulsed wave and sent it to micro controller, then the controller activate the energizer which generate high voltage spike for a very short duration And also send signal to the authorized person through the GSM modem, and it is interfaced with the controller. At the same time buzzer and light will on. In normal conditions fence remains inactive hence there is no power loss that is the main advantage of this type of fence. The authorized person can sent message through GSM to operate motor also. Solar Powered Fence is scientific Fence and works on Solar Energy with backup facility to run uninterruptedly during the nights as well as cloudy days to control motor using GSM.

KEYWORDS: GSM modem, sensor, fence, agriculture

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND

Electric fences began to be implemented ever since the early 1930s and they were used to control livestock in the United States of America and New Zealand. An ignition coil of a car was used to build the first electric fence in the year 1936-1937 by an inventor called Bill Gallagher. Agriculture in India is the broadest economic sector and plays a significant role in the overall socio-economic factor of India. The increasing news articles in television and newspaper on wild animals raiding agricultural crops shows that these animals can destroy a farmer's livelihood. In such areas Electric fencing system can be employed in which the animals experience a high voltage low current shock for a very short time. Because of the small magnitude of current there is no threat to the animal's life at the same time the large magnitude voltage scares away the animals. Electric fences are constructed to form both psychological and mental barriers.

Some of the typical installation of electric fence are as listed below:-

a) Military bases, borders and high security installations
b) Industrial sites and factories
c) Remote ware houses and builder's yards
d) Cellular phones antenna sites
e) Electricity transformer substation and electricity pylons
f) Housing estates
g) Private houses
h) Car lots
i) Rental storage facilities

Electric fences are mostly used in agriculture. Whereas standard fences are constructed to just form a physical barrier, electric fences are constructed to form both psychological and mental barrier. The mental barrier is accomplished by introducing an electric shock though the fence wire that both replace the animals and makes them less likely to contact the fence again. However in security systems, the electric shocks is meant to keep intruders out and is usually accompanied by an alarm system which is triggered when an intruder is detected and has been shocked already and this is what this project is aiming to achieve.

1.2 LITRATURE REVIEW-

As stated by Sukumar, 2003; Osborn & Hill, 2005, electric fences are mostly used in agriculture. Whereas standard fences are constructed to just form a physical barrier. There are several projects and initiatives on the mitigation of problems of damage of crops conflict taking place around the globe. Traditional methods are used- shouting, beating, burning bamboo, bursting fire crackers.

In the paper [10] presented by 'Suraj Dilip Chinchole , Sampada Milind Jadhav2 , Prof. R.K. Admane' in june 2017 they describe how low cost energizer can be developed. Even poor former can adopt this energizer. In paper publish by NABARD [9] they do various experiment in the Himanchal Pradesh. In his paper they calculate that approx. 229.09 crore (RS) crop damage in the Himanchal Pradesh. They do cost benefit analysis of solar fence and they found that it is best solution for monkey menace in the economic range of former.

1.2 PROBLEM STATEMENT

Present fence which is used by farmer is physical barrier (ex-Barbed wire) which require strong pole and wire. It is hard to sustain against big animal and group of wild animal break the fence and destroy the livelihood of a farmer. In case of big farm it was hard to identify the location of intruder. By that's reason farmer have to patrol in his field in night even after using fence. Electric fence are constructed to form both physical as well as mental barrier. It also provide protection from crop theft. This project will guide users through building a security system that isn't complex as such but will do the job.

1.3 OBJECTIVES

The objectives of this project is to build an automated electric fence where the generation of shock and the alarm system are controlled by a micro-controller when an animal (or unauthorized person) tries to enter in field then a recorded voice is played, and high intensity light (only in night) is focused on the animal by locating his location in the field.

1.4 PROJECT WORK

This project entails the following-

1) Designing an electric fence energizer that is essentially a high voltage pulse generator and linking it to the fence.

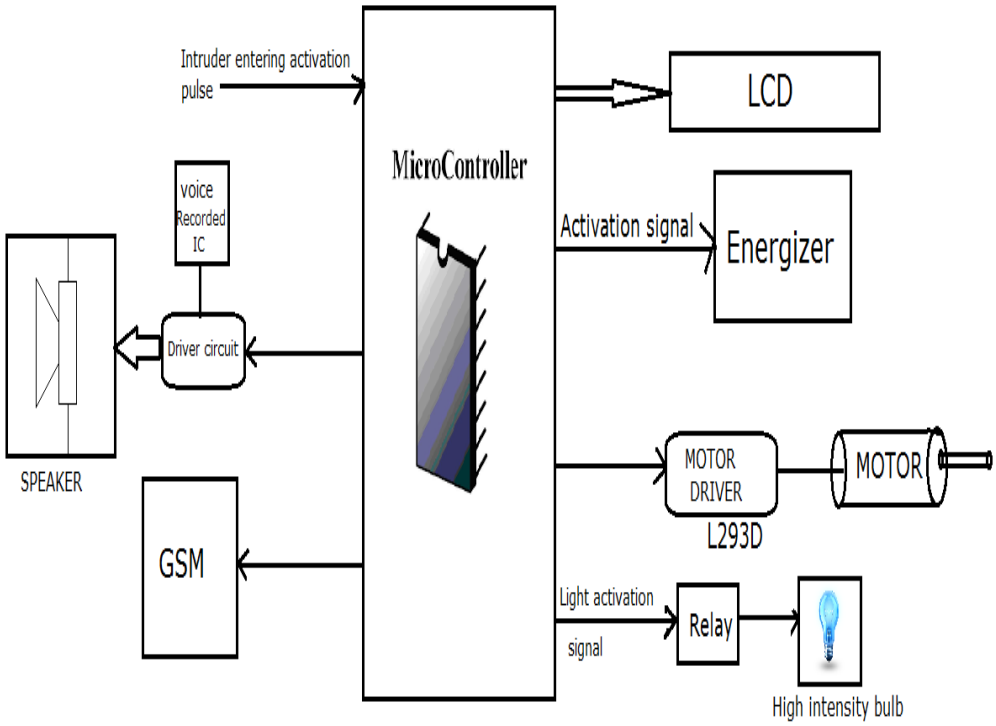
2) Design a 555 timer pulse generator to detect the location of intruder.

3) Interfacing the microcontroller with the torch and alarm system together with the necessary Arduino program that will enable the microcontroller to execute its function.

CHAPTER 2

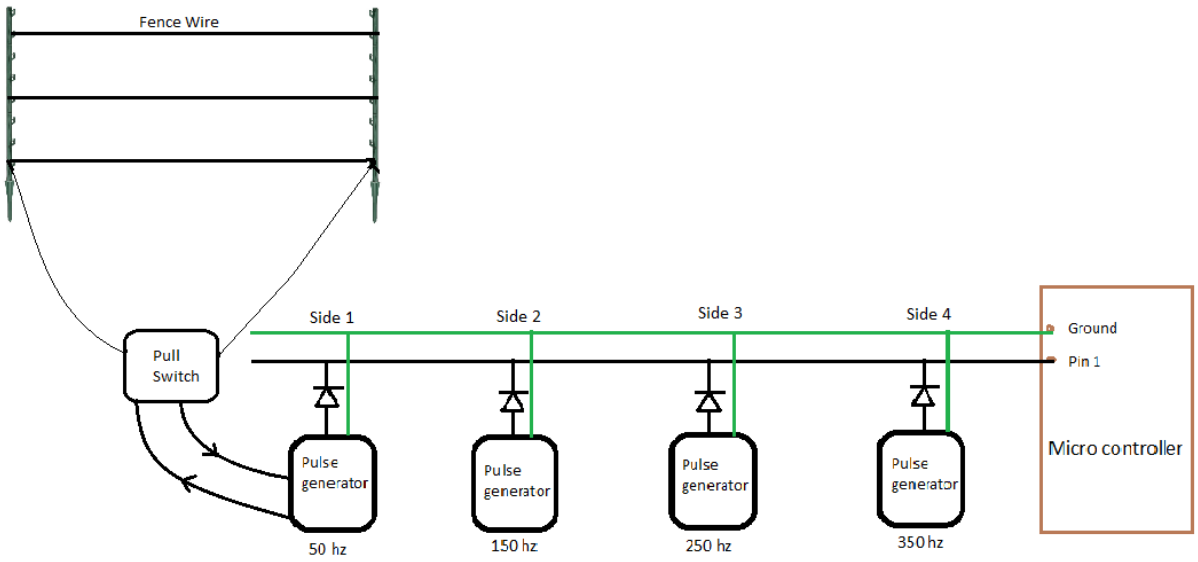
WORKING

Block diagram:

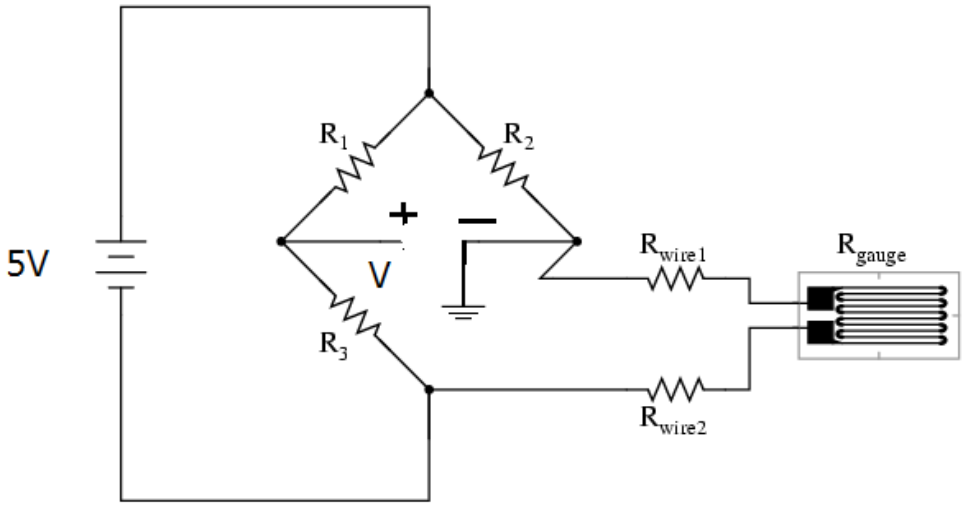


Here block diagram shows how all the component are connected with Arduino mega. The functioning of all component and project is listed below.

2.1 Sensing of an animal: Following circuit is used to sense the intruder. When any intruder try to enter in the field then wire will be pushed by the intruder and with help of push button pulse generator will be activate. Pulse generator will send pulse of particular frequency which is sensed by Arduino. Pulse generator fitted on different pole will generate different frequency pulse. In this way we can sense the location of intruder.



2. When an intruder tries to enter in field forcibly then a pressure will come in fence wire that pressure transfer to pole. At the bottom of pole we have fixed strain gauge whose resistance change with pressure. That change in resistance is detected by whetstone balance bridge circuit. When an intruder tries to enter field then bridge become unbalance and a voltage is sensed at null point. This voltage is as a trigger circuit for pulse generator.

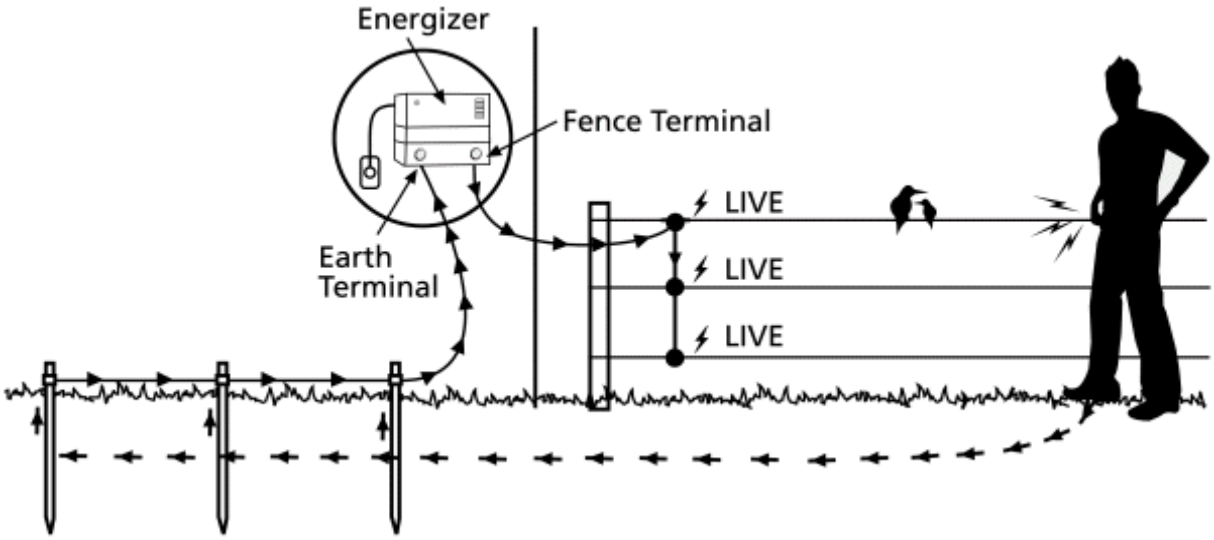


2.2 Detecting position of an intruder in the field: To focus light (at night) on an animal it is necessary to find out its location on the boundary of field. For that alternate pole of the field carry a strain gauge circuit with a pulse generator which generate a pulse of particular frequency (each different) when trigger is activated. Each pulse generator output is connected with a common

wire which is finally connected with microcontroller which detects frequency. By detecting frequency we can know at which pole location intruder are trying to enter in field.

2.3 Auxiliary equipment control by microcontroller: There are various auxiliary equipment attached with microcontroller. Following auxiliary equipment can be seen in detail in chapter **3.**

1. Energizer: when an intruder tries to enter in the fields then microcontroller sense it and ON the energizer to give a painful (but not lethal) shock to the animal.



2**. Motor**: Motor is fitted at a center pole of the field which contains a high intensity bulb as well as a speaker. When an intruder tries to enter in fields then high intensity light is focused on the intruder in night and recorded voice of farmer is played so that intruder assume that farmer is present in his field and it get away from the field. Motor is used to rotate the bulb and speaker so that single bulb can cover 360 degree space.

3**. GSM**: GSM is used to send message to farmer. By GSM farmer will be updated what is happening in his field. Ex. If wire breaks, an intruder struck in the fence, security system is working or not.

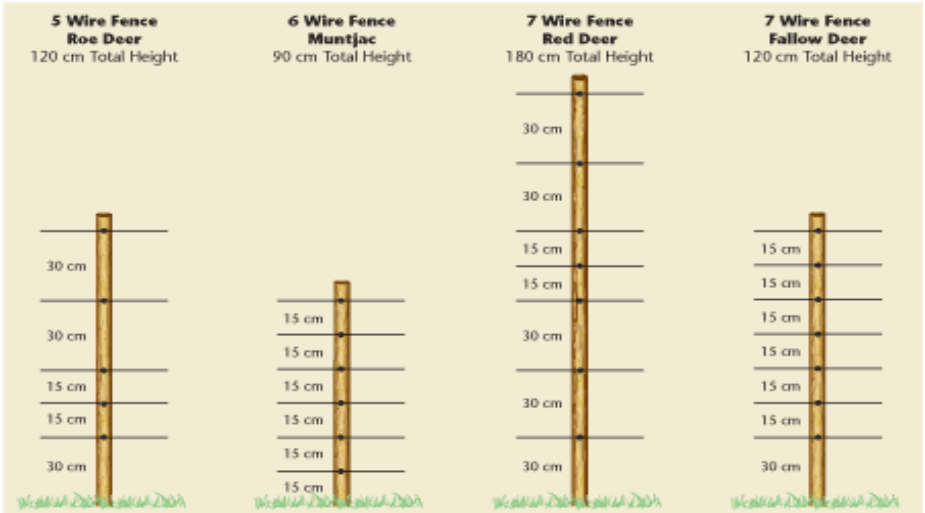
4. **High intensity bulb:** it is seen that wild animal feel frightened whenever a high intensity light is exposed on them suddenly in the night. So using this principal we have designed this system which focus light on the animal. It is controlled by microcontroller. It's blinking and duration of ON period is controlled by microcontroller. Many times high intensity light alone sufficient to keep away to wild animal from the field.

5. **Buzzer:** Here we are using buzzer at the place of speaker. The role of speaker is to play recorded voice of either a man or dog. By this way animal will feel presence of animal or dog in the field, so animal will not try to enter in the field. Speaker is fitted on the motor. So motor will rotate toward animal before being played. So high intensity voice in desired direction can be played.

2.4 Power supply: For power supply we are using a 12V battery which can be charge by either solar panel or ac main supply (if available at field). For other auxiliary equipment (ex. motor, bulb, controller) converter is used which convert 12v to desired voltage level.

2.5 Equipment used in project:

1. **Pole**: pole can used of wood or stone pillar. It height depend upon field requirement and type of animal attack. Pole material also depend on what strength of the pole is required and on the farmer expenditure. For high strength pole of strength pole of composite material available in the market can be used.



Space between two poles is 5-10 meter.

2. **Electric fence wire:**

Most electric fences use 14 or 17 gauge wire depending on the length of the fence and what animal is being contained or repelled.

Steel Wire

Galvanized steel wire will last the lifetime of the fence and is the most commonly used wire.

Features and Benefits

1) Steel wire is a basic, economic wire
2) Carries charge long distance, extensions
3) Can use with any type of charger

Ideal Uses

- Semi-permanent fencing
- Permanent fencing
- Perimeter fencing

Note: Steel wire can be used with any type of charger and when connected properly to like wire extensions, this wire can carry a charge for very long distances.

Aluminum Wire

Aluminum wire is the best for carrying a charge. Aluminum conducts electricity four times better than steel wire. While it will cost more, aluminum wire does not rust like un-galvanized steel wire.

Features and Benefits

- Long-lasting
- Permanent fencing
- Lifetime warranty, will not rust

Ideal Uses

- Carries charge 4x better than steel
- Perimeter fencing

Component use for prototype design:

Component	Quantity	Price	Specification
LCD(liquid crystal gas)	1	250	16x2 LCD
Pulse generator	4	400	Variable IC-555 pulse generator
Arduino Mega	1	750	-
Motor	1	200	Unipolar,5v stepper

High intensity bulb	1	50	-
Buzzer	1	30	5v
Battery	1	450	4.5Ah,6V
Energizer	1	170	1500V pulse of 3ms
Solar panel	1	1000	12V,10W
Resistor box	1	50	-
Capacitor box	1	50	-
GSM	1	700	A6,GPS,GPRS
Total	-	3650	

Rating of battery:

Current taken by Auxiliary equipment-

GSM	100 ma
Motor	500 ma
Bulb	100 ma
Speaker	200 ma
Microcontroller	400 ma
sensing and pulse generator circuit	100 ma
Electric fence	300 ma

Approx. 4.5AH, 12V will be sufficient to give power for one day.

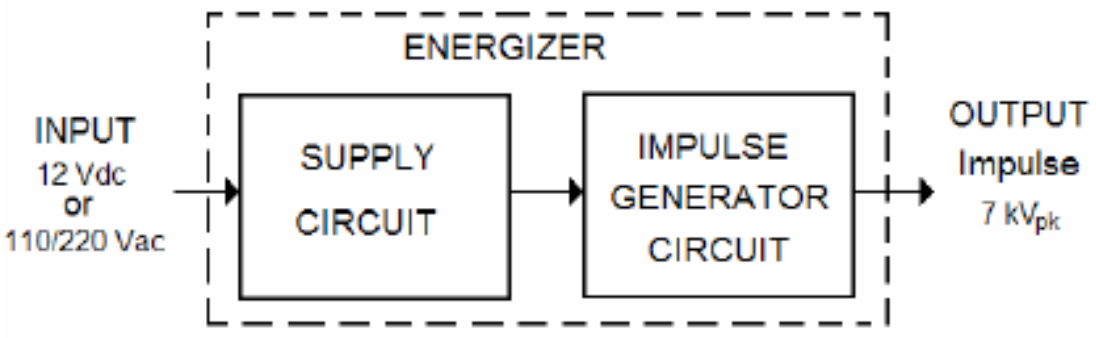
CHAPTER 3

DESCRIPTION OF PROJECT

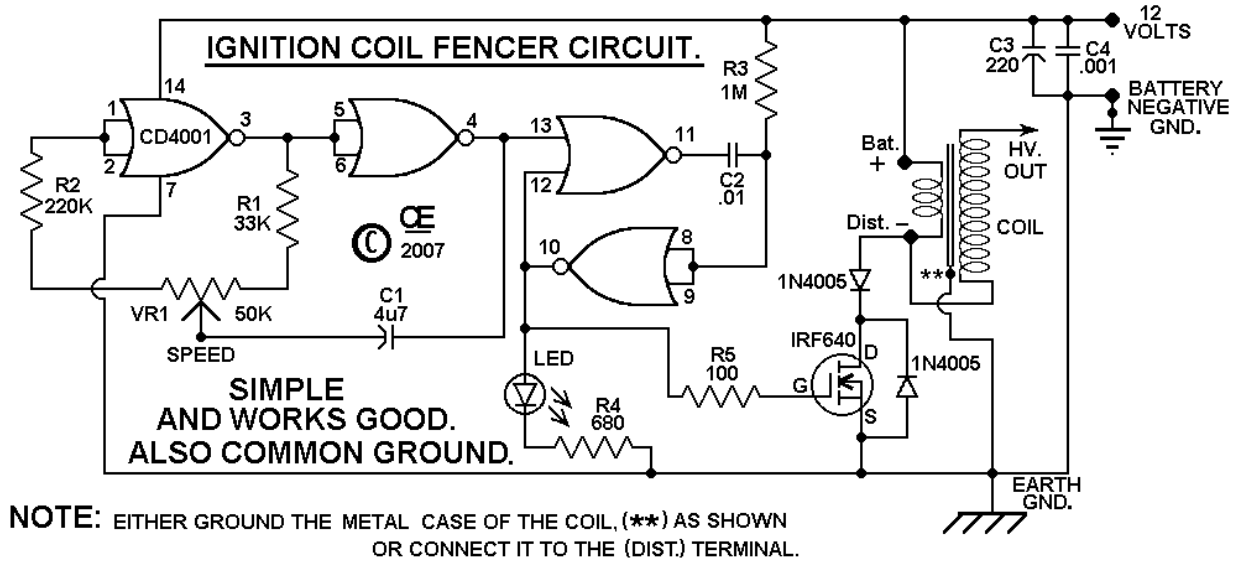
3.1 ENERGIZER-

An energizer is a high voltage pulsed power supply that consists of two functional sub-units which are energy storage unit and switching unit. The energy storage unit stores electrical energy which is then released by switching unit during the output pulse. Design of an energizer for a non-lethal electric fencing system involves requirements of high output voltage, low output current, controllable pulse duration over various pulse rates and control over release of electrical energy during output pulse. In addition to that, the system must be power efficient and capable enough to store huge amount of energy so that it can work without an input source

for several hours if employed in a remote area. Other requirements for energizer design are compactness and reliability.

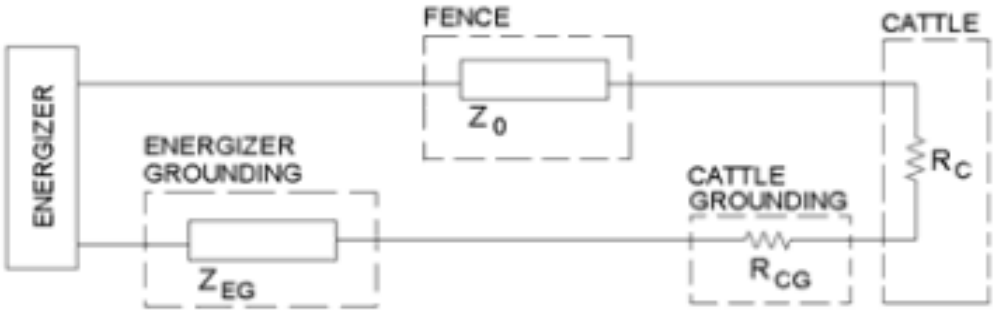


Circuit diagram of energizer-



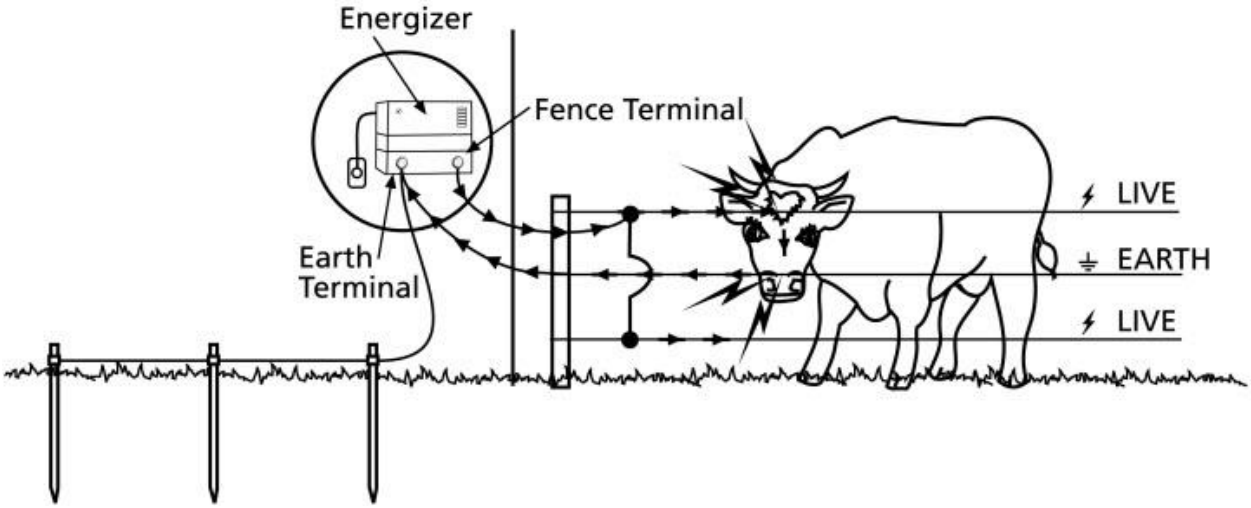
Operation-

The current flow on the fence when the cattle touch the wire the circuit is closed and the electric impulse current generated by the Energizer flows through the body. In practical experiences is evidenced that the cattle doesn't transpose the fence for a peak voltage higher than 2 kV to 5 kV measured where cattle touches the wire. For a fence with this peak voltage the livestock experiments a panic sensation and don't return to touch the wire. The simplified electric circuit for the fence circuit. This circuit was modeled from results obtained through measurements in a real fence. The Z0 is the characteristic impedance of the fence line and were in some cases the conductor capacitive and inductive reactance is more expressive than the conductor resistance. This impedance may be calculated in the same way that for a power line. In this study was observed that the reflection phenomenon is important to calculate the peak voltage in the fence because this effect can boost the peak voltage value in the system. The reduced voltage produced by faults in insulators produce reflections in the fence line that reduces the peak voltage on the fence.

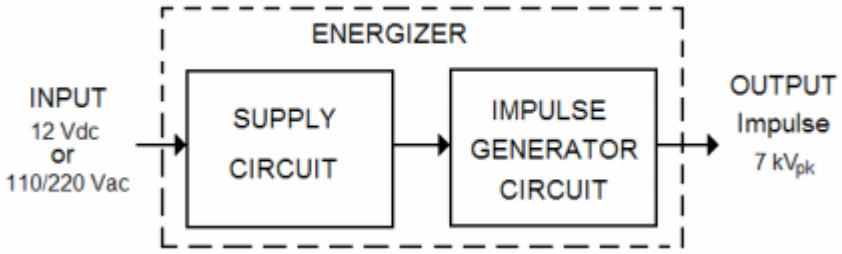


This electric circuit modeled is very useful to estimate the peak value of voltage and the dissipated energy in the cattle in the worst case – the end of the fence. It was evidenced that the energizer grounding and the fence line impedance need to be projected appropriated because they are the main design parameters and causes a reduction of the peak voltage in the cattle body who touches the fence at the end. It was observed too that the grounding of the hoofs of cattle is expressive comparing to the cattle body resistance. This voltage divider

reduces the voltage and energy in the cattle body. The main grounding will depend in soil resistivity and in some cases a grounding wire in the fence will be necessary, even in small fences with few kilometers.



Rating-



Input voltage = 220V AC or 12V DC

Supply frequency = 50/60 Hz

Output Voltage pulse= it depends on intruders as follow-

For pet animals-

Beef Cattle	2,000 - 3,000 V	Bulls require a higher voltage as more aggressive.
Dairy Cattle	2,000 V	If kept separately, calves and heifers require lower wires and less spacing.
Horses	2,000 - 3,000 V	Intelligent, learn quickly, easy to control. A fence made of politape, wire or rope is less likely to injure if a spooked horse tries to run through it.
Llamas	4,000 - 5,000 V	Thick coats insulate from electric shocks so require higher voltage.
Deer and Elk	4,000 - 5,000 V	Spook easily and jump higher than most other animals. Above head height, electric high tensile fence recommended. Space wires close enough to prevent stepping through or heads between wires.
Sheep	4,000 - 5,000 V	Wool insulates from electric shocks so require higher voltage.
Goats	4,000 - 5,000 V	Some species have thick insulating coats requiring higher voltage. Tend to test fences - space wires low to ground and high enough to prevent being jumped.
Pigs	2,000 V	Start wires close to ground as rooting animal and finish at nose level.
Pets	700 - 1,000 V	Start wires close to ground.

For wild animals-

Wild Hogs	5,000 V	Aggressive and persistent. Deter from rooting by starting wires close to ground.
Wolves and Coyotes	4,000 - 5,000 V	Very thick, insulating fur requires high voltage. Can dig to reach prey so place first wire low to the ground.
Bears	5,000 V	Thick, insulating fur requires high voltage. Bait fences to train avoidance.
Deer and Elk	4,000 - 5,000 V	Move quickly and often run through fences unseen so make fence highly visible.
Small Nuisance Animals	1,000 - 2,000 V	Start wires close to ground as small and most species prone to digging.

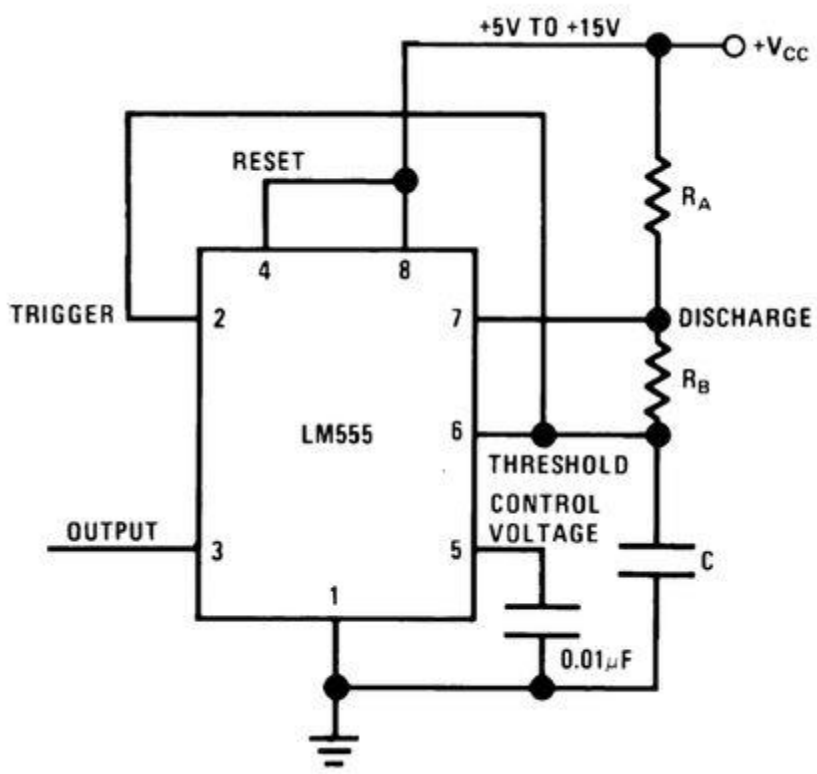
These data for voltage level according to STAFIX. https://www.stafix.com/en/node/14195

3.2 Pulse Generator

A **pulse generator** is either an electronic circuit *or* a piece of electronic test equipment used to generate rectangular pulses. Pulse generators are used primarily for working with digital circuits, related function generators are used primarily for analog circuits.

A cardiac pulse generator is a device having a power source and electronic circuitry that produce output stimuli. Functionally, at its simplest, current sourced by the device's battery travels through a connecting pathway to stimulate the heart and then flows back into the pacemaker to complete the circuit.

Circuit diagram-



Component- 1. 555 IC

2. Capacitor

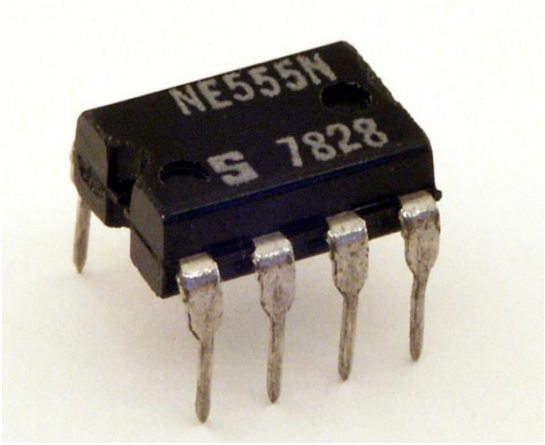
3. Resistor

4. Power supply

1. 555 timer IC-

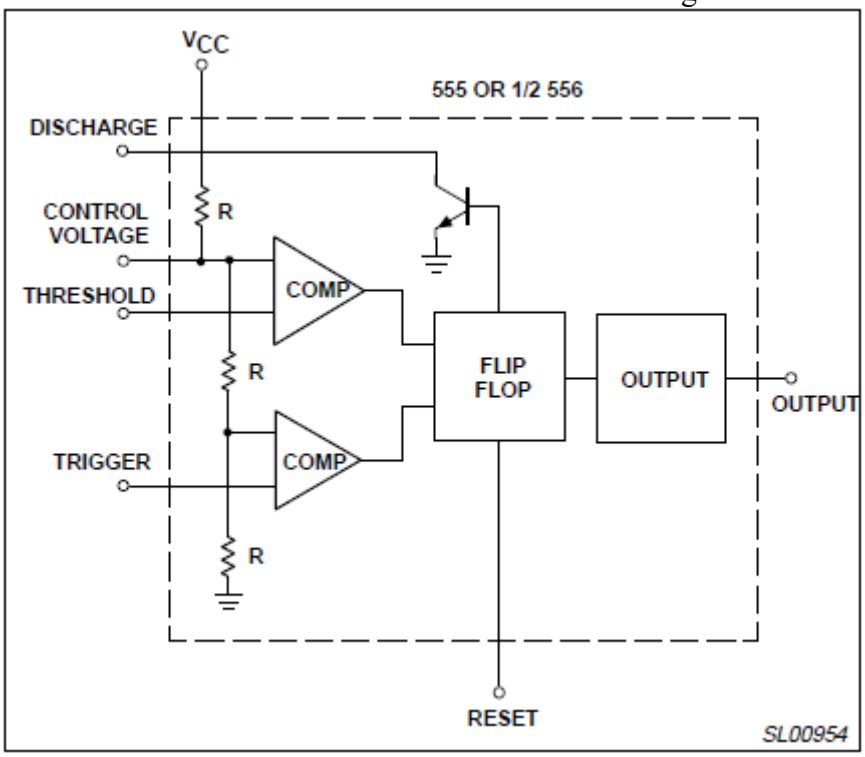
Philips Semiconductors introduced the 555 IC timer that was a unique functional building block that enjoyed unprecedented popularity. The timer's success is mainly to several inherent characteristics foremost of which are; versatility, stability and low cost. The simplicity of the timer, in conjunction with its ability to produce long time delays in a variety of applications, has lured many designers from mechanical timers, op amps, and various discrete circuits into the ever increasing ranks of timer users. The 555 timer IC is an integrated circuit (chip) used in a variety of timer, pulse generation, and oscillator applications. The 555 can be also be used to provide time delays, as an oscillator, and as

a flip-flop element Derivatives provide up to four timing circuits in one package. The image below shows the NE555 timer.



Description-

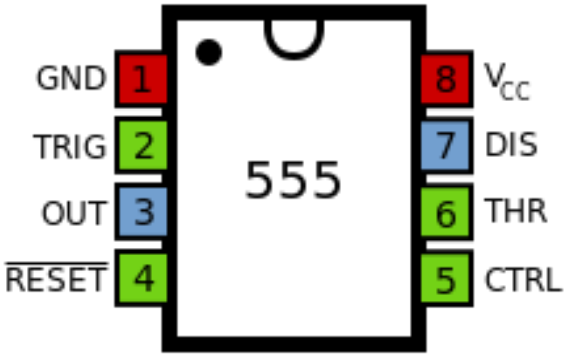
The 555 timer consists of two voltage comparators, a bistable flip-flop(R-S flip-flop), a discharge transistor, and a resistor divider network. To understand the basic concept of the timer let's first examine the timer in block form in Figure.



Timer Functional Block Diagram

The resistive divider network is used to set the comparator levels. Since the three resistors are equal in value, the threshold comparator is referenced internally at 2/3 of supply voltage level and the trigger comparator is referenced at 1/3 of supply voltage. The outputs of the comparators are tied to the bi stable flip-flop. When the trigger voltage is dropped below 1/3 of the supply, the comparator changes its state and sets the flip-flop driving the output to a high state. The threshold pin normally monitors the voltage of the capacitor in the RC timing network, When the capacitor voltage exceeds 2/3 of the supply, the threshold comparator resets the flip-flop which in turn drives the output to a comparator resets the flip-flop which in turn drives the output to a low state. When the output is in a low state, the discharge transistor is "on", thereby discharging the external timing capacitor. Once the capacitor is discharged, the timer will await another trigger pulse, the timing cycle having been completed.

Here is the pin-out diagram for the 555 timer



Pin 1: **Grounded Terminal:** All the voltages are measured with respect to the Ground terminal.

Pin 2: Trigger Terminal: The trigger pin is used to feed the trigger input, then the 555 IC is set up as a mono stable multi-vibrator. This pin is an inverting input of a comparator and is responsible for the transition of flip-flop from set to reset. The output of the timer depends on the amplitude of the external trigger pulse applied to this pin. A negative pulse with a dc level greater than Vcc/3 is applied to this terminal. In the negative edge, as the trigger passes through Vcc/3, the output of the lower comparator becomes high and the complimentary of Q becomes zero. Thus the 555 IC output gets a high voltage, and thus a quasi-stable state.

Pin 3: Output Terminal: Output of the timer is available at this pin. There are two ways in which a load can be connected to the output terminal. One way is to connect between output pin (pin 3) and ground pin (pin 1) or between pin 3 and supply pin (pin 8). The load connected between output and ground supply pin is called the *normally on load* and that connected between output and ground pin is called the ***normally off load***.

Pin 4: Reset Terminal: Whenever the timer IC is to be reset or disabled, a negative pulse is applied to pin 4, and thus is named as reset terminal. The output is reset irrespective of the input condition. When this pin is not to be used for reset purpose, it should be connected to + V_{CC} to avoid any possibility of false triggering.

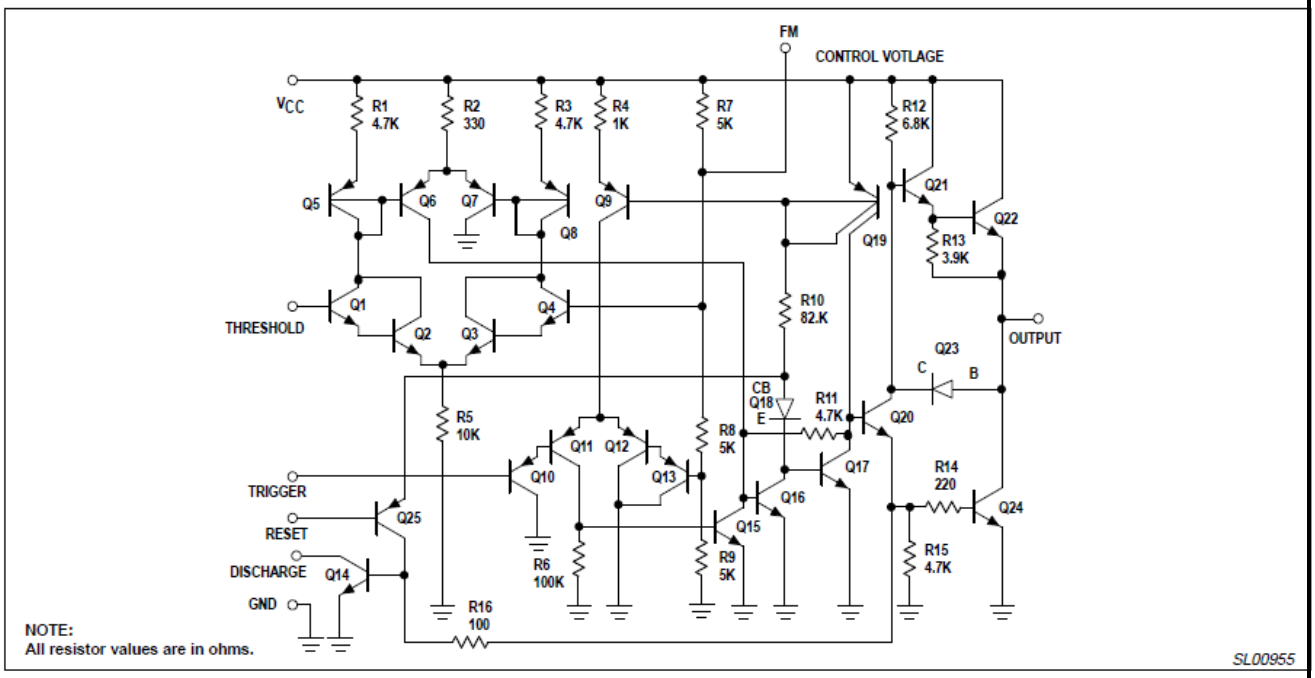
Pin 5: Control Voltage Terminal: The threshold and trigger levels are controlled using this pin. The pulse width of the output waveform is determined by connecting a POT or bringing in an external voltage to this pin. The external voltage applied to this pin can also be used to modulate the output waveform. Thus, the amount of voltage applied in this terminal will decide when the comparator is to be switched, and thus changes the pulse width of the output. When this pin is not used, it should be bypassed to ground through a 0.01 micro Farad to avoid any noise problem.

Pin 6: **Threshold Terminal:** This is the non-inverting input terminal of comparator 1, which compares the voltage applied to the terminal with a reference voltage of 2/3 V_{CC}. The amplitude of voltage applied to this terminal is responsible for the set state of flip-flop. When the voltage applied in this terminal is greater than 2/3Vcc, the upper comparator switches to +Vsat and the output gets reset.

Pin 7: **Discharge Terminal:** This pin is connected internally to the collector of transistor and mostly a capacitor is connected between this terminal and ground. It is called discharge terminal because when transistor saturates, capacitor discharges through the transistor. When the transistor is cut-off, the capacitor charges at a rate determined by the external resistor and capacitor.

Pin 8: Supply Terminal: A supply voltage of + 5 V to + 18 V is applied to this terminal with respect to ground (pin 1) [9].

Timer Circuitry



Schematic of 555 Dual Timer

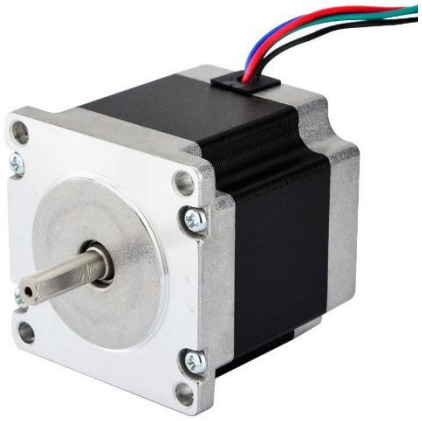
The timer is composed of five distinct circuits: two voltage comparators; a resistive voltage divider reference; a bistable flip-flop; a discharge transistor; and an output stage that is the "totem-pole" design for sink or source capability. Q10-Q13 comprise a Darlington differential pair which serves as a trigger comparator. Starting with a positive voltage on the trigger, Q10 and Q11 turn on when the voltage at Pin 2 is moved below one third of the supply voltage. The voltage level is derived from a resistive divider chain consisting of R7, R8 and R9. All three resistors are of equal value (5kW). At 15V supply, the triggering level would be 5V. When Q10 and Q11 turn on, they provide a base drive for Q15, turning it on. Q16 and Q17 form a bistable flip-flop. When Q15 is saturated, Q16 is "off" and Q17 is saturated. Q16 and Q17 will remain in these states even if the trigger is removed and Q15 is turned "off". While Q17 is saturated, Q20 and Q14 are turned off.
The output structure of the timer is a "totem-pole" design, with Q22 and Q24 being large geometry transistors capable of providing 200mA with a 15V supply. While Q20 is "off", base drive is provided for Q22 by Q21, thus providing a high output. For the duration that the output is in a high state, the discharge transistor is "off". Since the collector of Q14 is typically connected to the external timing capacitor, C, while Q14 is off, the timing capacitor now can charge through the timing resistor, RA.

The capacitor voltage is monitored by the threshold comparator (Q1-Q4) which is a Darlington differential pair. When the capacitor voltage reaches two thirds of the supply voltage, the current is directed from Q3 and Q4 thru Q1 and Q2. Amplification of the current change is provided by Q5 and Q6. Q5-Q6 and Q7-Q8 comprise a diode-biased amplifier. The

amplified current change from Q6 now provides a base drive for Q16 which is part of the bistable flip-flop, to change states. In doing so, the output is driven "low", and Q14, the discharge transistor, is turned "on", shorting the timing capacitor to ground.

3.3 MOTOR-

Stepper motor- A stepper motor is an electromechanical device which converts electrical pulses into discrete mechanical movements. The shaft or spindle of a stepper motor rotates in discrete step increments when electrical command pulses are applied to it in the proper sequence. The motors rotation has several direct relationships to these applied input pulses. The sequence of the applied pulses is directly related to the direction of motor shafts rotation. The speed of the motor shafts rotation is directly related to the frequency of the input pulses and the length of rotation is directly related to the number of input pulses applied.



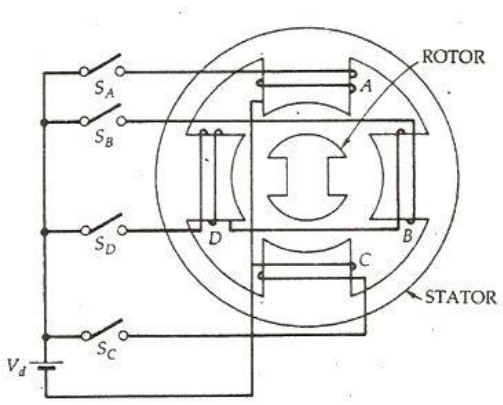
Open Loop Operation - One of the most significant advantages of a stepper motor is its ability to be accurately controlled in an open loop system. Open loop control means no feedback information about position is needed. This type of control eliminates the need for expensive sensing and feedback devices such as optical encoders. Your position is known simply by keeping track of the input step pulses. Stepper Motor Types There are three basic stepper motor types. They are:

• Variable-reluctance

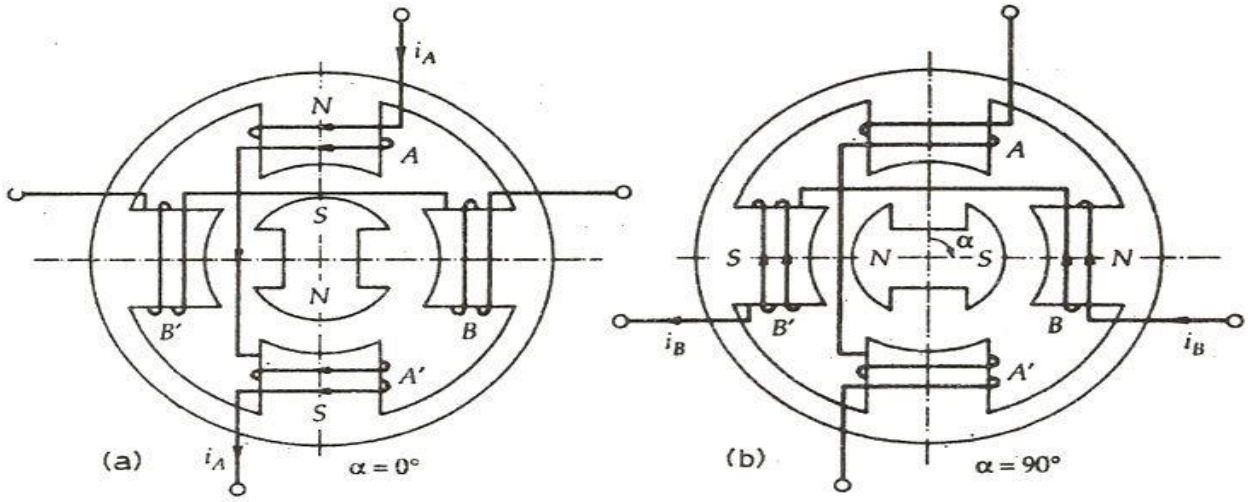
• Permanent-magnet

• Hybrid Variable-reluctance (VR)

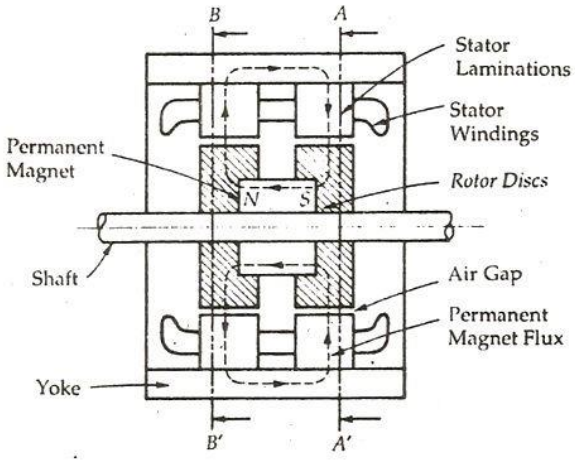
Variable-reluctance: This type of stepper motor has been around for a long time. It is probably the easiest to understand from a structural point of view. Figure 1 shows a cross section of a typical V.R. stepper motor. This type of motor consists of a soft iron multi-toothed rotor and a wound stator. When the stator windings are energized with DC current the poles become magnetized. Rotation occurs when the rotor teeth are attracted to the energized stator poles.



Permanent Magnet (PM) Often referred to as a "tin can" or "can stock" motor the permanent magnet step motor is a low cost and low resolution type motor with typical step angles of 7.5° to 15°. (48 – 24 steps/revolution) PM motors as the. Name implies have permanent magnets added to the motor structure. The rotor no longer has teeth as with the VR motor. Instead the rotor is magnetized with alternating north and south poles situated in a straight line parallel to the rotor shaft. These magnetized rotor poles provide an increased magnetic flux intensity and because of this the PM motor exhibits improved torque characteristics when compared with the VR type.



Hybrid (HB) The hybrid stepper motor is more expensive than the PM stepper motor but provides better performance with respect to step resolution, torque and speed. Typical step angles for the HB stepper motor range from 3.6° to 0.9° (100 – 400 steps per revolution). The hybrid stepper motor combines the best features of both the PM and VR type stepper motors. The rotor is multi-toothed like the VR motor and contains an axially magnetized concentric magnet around its shaft. The teeth on the rotor provide an even better path which helps guide the magnetic flux to preferred locations in the airgap. This further increases the detent, holding and dynamic torque characteristics of the motor when compared with both the VR and PM types. The two most commonly used types of stepper motors are the permanent magnet and the hybrid types. If a designer is not sure which type will best fit his applications requirements he should first evaluate the PM type as it is normally several times less expensive. If not then the hybrid motor may be the right choice.



Size and Power: - In addition to being classified by their step angle stepper motors are also classified according to frame sizes which correspond to the diameter of the body of the motor. For instance a size 11 stepper motor has a body diameter of approximately 1.1 inches. Likewise a size 23 stepper motor has a body diameter of 2.3 inches (58 mm), etc. The body length may however, vary from motor to motor within the same frame size classification. As a general rule the available torque output from a motor of a particular frame size will increase with increased body length. Power levels for IC-driven stepper motors typically range from below a watt for very small motors up to 10 – 20 watts for larger motors. The maximum power dissipation level or thermal limits of the motor are seldom clearly stated in the motor manufacturer's data. To determine this we must apply the relationship P=V × I. For example, a size 23 step motor may be rated at 6V and 1A per phase. Therefore, with two phases energized the motor has a rated power dissipation of 12 watts. It is normal practice to rate a stepper motor at the power dissipation level where the motor case rises 65°C above the ambient in still air. Therefore, if the motor can be mounted to a heatsink it is often possible to increase the allowable power dissipation level. This is important as the

motor is designed to be and should be used at its maximum power dissipation, to be efficient from a size/output power/cost point of view.

Operation-Stepper motors operate differently from DC brush motors, which rotate when voltage is applied to their terminals. Stepper motors, on the other hand, effectively have multiple toothed electromagnets arranged around a central gear-shaped piece of iron. The electromagnets are energized by an external control circuit, for example a microcontroller.
To make the motor shaft turn, first one electromagnet is given power, which makes the gear's teeth magnetically attracted to the electromagnet's teeth. The point when the gear's teeth are thus aligned to the first electromagnet, they are slightly offset from the next electromagnet. So when the next electromagnet is turned ON and the first is turned OFF, the gear rotates slightly to align with the next one and from there the process is repeated. Each of those slight rotations is called a step, with an integer number of steps making a full rotation. In that way, the motor can be turned by a precise. Stepper motor doesn't rotate continuously, they rotate in steps. There are 4 coils with 90^{o} angle between each other fixed on the stator. The stepper motor connections are determined by the way the coils are interconnected. In stepper motor, the coils are not connected together. The motor has 90^{o} rotation step with the coils being energized in a cyclic order, determining the shaft rotation direction. The working of this motor is shown by operating the switch. The coils are activated in series in 1 sec intervals. The shaft rotates 90^{o} each time the next coil is activated. Its low speed torque will vary directly with current.

3.4 Microcontroller (Arduino)-

A microcontroller is a computer-on-a-chip, or, if you prefer, a single-chip computer. *Micro* suggests that the device is small, and *controller* tells you that the device might be used to control objects, processes, or events. Another term to describe a microcontroller is *embedded controller,* because the microcontroller and its support circuits are often built into, or embedded in, the devices they control.

You can find microcontrollers in all kinds of things these days. Any device that measures, stores, controls, calculates, or displays information is a candidate for putting a microcontroller inside. The largest single use for microcontrollers is in automobiles—just about every car manufactured today includes at least one microcontroller for engine control, and often more to control additional systems in the car. In desktop computers, you can find microcontrollers inside keyboards, modems, printers, and other peripherals. In test equipment, microcontrollers make it easy to add features such as the ability to store measurements, to create and store user routines, and to display messages and waveforms. Consumer products that use microcontrollers include cameras, video recorders, compact-disk players, and ovens. And these are just a few examples.

A microcontroller is similar to the microprocessor inside a personal computer. Examples of microprocessors include Intel's 8086, Motorola's 68000, and Zilog's Z80. Both microprocessors and microcontrollers contain a central processing unit, or CPU. The CPU executes instructions that perform the basic logic, math, and data-moving functions of a computer. To make a complete computer, a microprocessor requires memory for storing data and programs, and input/output (I/O) interfaces for connecting external devices like keyboards and displays.

In contrast, a microcontroller is a single-chip computer because it contains memory and I/O interfaces in addition to the CPU. Because the amount of memory and interfaces that can fit on a single chip is limited, microcontrollers tend to be used in smaller systems that require little more than the microcontroller and a few support components. Examples of popular microcontrollers are Intel's 8052 (including the 8052-BASIC, which is the focus of this book), Motorola's 68HC11, and Zilog's Z8.

3.4.1 Types of Microcontrollers

Microcontrollers can be classified according to the following

a) Number of Bits

The bits in microcontroller are 8-bits, 16-bits and 32-bits microcontroller.

In 8-bit microcontroller, the point when the internal bus is 8-bit then the ALU is performs the arithmetic and logic operations. The examples of 8-bit microcontrollers are Intel 8031/8051, PIC1x and Motorola MC68HC11 families.

The 16-bit microcontroller performs greater precision and performance as compared to 8-bit. For example 8 bit microcontrollers can only use 8 bits, resulting in a final range of 0×00 – 0xFF (0-255) for every cycle. In contrast, 16 bit microcontrollers with its 16 bit data width has a range of 0×0000 – 0xFFFF (0-65535) for every cycle. A longer timer most extreme worth can likely prove to be useful in certain applications and circuits. It can automatically operate on two 16 bit numbers. Some examples of 16-bit microcontroller are 16-bit MCUs are extended 8051XA, PIC2x, Intel 8096 and Motorola MC68HC12 families.

The 32-bit microcontroller uses the 32-bit instructions to perform the arithmetic and logic operations. These are used in automatically controlled devices including implantable medical devices, engine control systems, office machines, appliances and other types of embedded systems. Some examples are Intel/Atmel 251 family, PIC3x.

b) Memory Devices

The memory devices are divided into two types, they are

- Embedded memory microcontroller
- External memory microcontroller

- Embedded memory microcontroller: When an embedded system has a microcontroller unit that has all the functional blocks available on a chip is called an embedded microcontroller. For example, 8051 having program & data memory, I/O ports, serial communication, counters and timers and interrupts on the chip is an embedded microcontroller.
- External Memory Microcontroller: When an embedded system has a microcontroller unit that has not all the functional blocks available on a chip is called an external memory microcontroller. For example, 8031 has no program memory on the chip is an external memory microcontroller.

c) Instruction set

ISC: CISC is a Complex Instruction Set Computer. It allows the programmer to use one instruction in place of many simpler instructions.

RISC: The RISC is stands for Reduced Instruction set Computer, this type of instruction sets reduces the design of microprocessor for industry standards. It allows each instruction to operate on any register or use any addressing mode and simultaneous access of program and data.

Example for CISC and RISC:

CISC:	Mov AX, 4	RISC:	Mov AX, 0
	Mov BX, 2		Mov BX, 4
	ADD BX, AX		Mov CX, 2
		Begin	ADD AX, BX
		Loop	Begin

From above example, RISC systems shorten execution time by reducing the clock cycles per instruction and CISC systems shorten execution time by reducing the number of instructions per program. The RISC gives a better execution than the CISC.

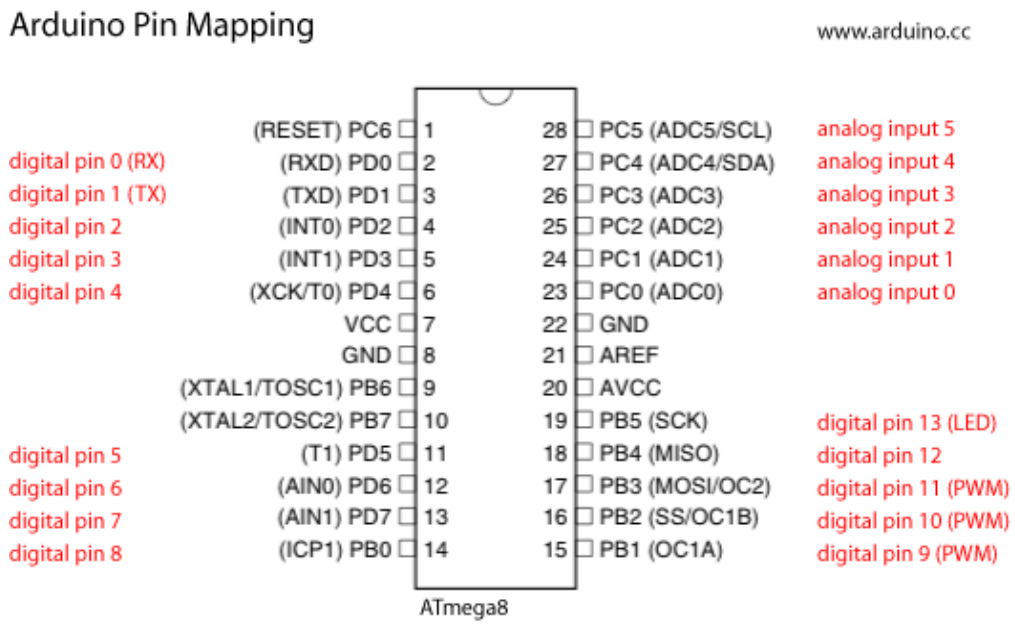
d) Memory Architecture

Memory architecture of microcontroller are two types, they are namely:

- Harvard memory architecture microcontroller
- Princeton memory architecture microcontroller

Harvard Memory Architecture Microcontroller: The point when a microcontroller unit has a dissimilar memory address space for the program and data memory, the microcontroller has Harvard memory architecture in the processor.

Princeton Memory Architecture Microcontroller: The point when a microcontroller has a common memory address for the program memory and data memory, the microcontroller has Princeton memory architecture in the processor.



Arduino Pin Mapping

3.5 ARDUINO

Arduino is a tool for making computers that can detect and control more of the physical world than compared to a desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board. Arduino can be used to develop interactive objects, taking inputs from a variety of switches and sensors, and controlling a variety of lights, motors etc. Arduino

projects can be stand-alone, or they can communicate with software running on your computer (e.g. Flash, Processing, MaxMSP.) The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free. The Arduino programming language is an implementation of Wiring, a similar physical computing platform, which is based on the Processing multimedia programming environment.

The Arduino environment has been designed to be easy to use for beginners who have no software or electronics experience. With Arduino, you can build objects that can respond to and/or control light, sound, touch, and movement. Arduino has been used to create an amazing variety of things, including musical instruments, robots, light sculptures, games, interactive furniture, and even interactive clothing.

Arduino is famously known for its hardware, but you also need software to program that hardware. Both the hardware and the software are called "Arduino." The combination enables you to create projects that sense and control the physical world. The software is free, open source, and cross-platform. The boards are inexpensive to buy, or you can build your own (the hardware designs are also open source). In addition, there is an active and supportive Arduino community that is accessible worldwide through the Arduino forums and the wiki (known as the Arduino Playground)

3.5.1 Arduino Software

Software programs, called *sketches*, are created on a computer using the Arduino integrated development environment (IDE). The IDE enables you to write and edit code and convert this code into instructions that Arduino hardware understands. The IDE also transfers those instructions to the Arduino board (a process called *uploading*).

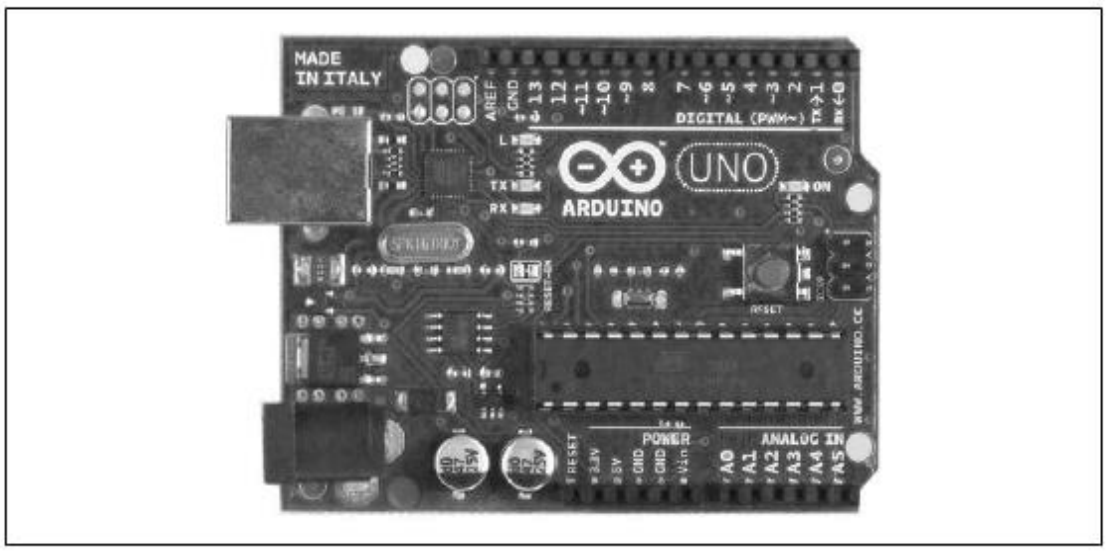
```
// the setup function runs once when you press reset or power the board
void setup() {
  // initialize digital pin 13 as an output.
  pinMode(13, OUTPUT);
}

// the loop function runs over and over again forever
```

```
void loop() {
  digitalWrite(13, HIGH);   // turn the LED on (HIGH is the voltage level)
  delay(1000);              // wait for a second
  digitalWrite(13, LOW);    // turn the LED off by making the voltage LOW
  delay(1000);              // wait for a second
}
```

3.5.2 Arduino Hardware

The Arduino board is where the code you write is executed. The board can only control and respond to electricity, so specific components are attached to it to enable it to interact with the real world. These components can be sensors, which convert some aspect of the physical world to electricity so that the board can sense it, or actuators, which get electricity from the board and convert it into something that changes the world. Examples of sensors include switches, accelerometers, and ultrasound distance sensors. Actuators are things like lights and LEDs, speakers, motors, and displays. There are a variety of official boards that you can use with Arduino software and a wide range of Arduino-compatible boards produced by members of the community. The most popular boards contain a USB connector that is used to provide power and connectivity for uploading your software onto the board. The figure 2.9 shows a basic a basic board, the Arduino Uno.



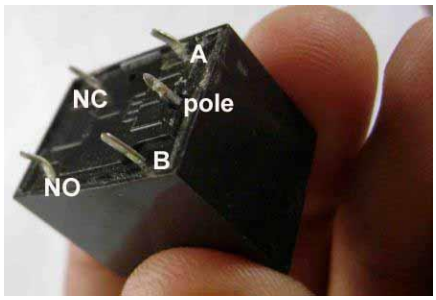
Basic Board: Arduino Uno

3.6 RELAY SWITCH

Relays switches that are electro magnetically operated where an actuating current on isolated load circuits or contacts. It is hence an electrically operated switch that makes it possible for one circuit to be switched on by another circuit that is separate.

Galvanic isolation is where functional parts of an electrical system are isolated to prevent flow of current prohibiting any conduction path.

Current flowing through the coil of the relay generates a magnetic field that attracts and pulls lever and changes the switch contacts. Since the current in the coil can be on or off, relays have two switch positions and they are double throw.



Electromagnetic or mechanical relay

The connections on the relay are usually labeled COM (POLE), NC and NO as shown in the diagram above.

COM/POLE= Common, NC and NO always connect to this, it is the moving part of the switch.

NC = Normally Closed, COM/POLE is connected to this when the relay coil is not magnetized.

NO = Normally Open, COM/POLE is connected to this when the relay coil is MAGNETIZED and vice versa.

3.6.1 Functions of a Relay Switch

The primary functions of a relay are as follows:

a) Separating different load circuits for multi-pole relays.
b) Interfacing power circuits and electronic circuits.
c) It performs several switching functions e.g. delay, signal conditioning.
d) Separating DC circuits from AC circuits.

3.6.2 Applications of Relay

Relays have got so many applications. The following are some of the applications:

i. Computer interfaces.
ii. Air conditioning and heating.
iii. Automotive electrics.
iv. Control of motors and solenoids.
v. Electric power control.
vi. Production and test equipment.
vii. Lighting control.

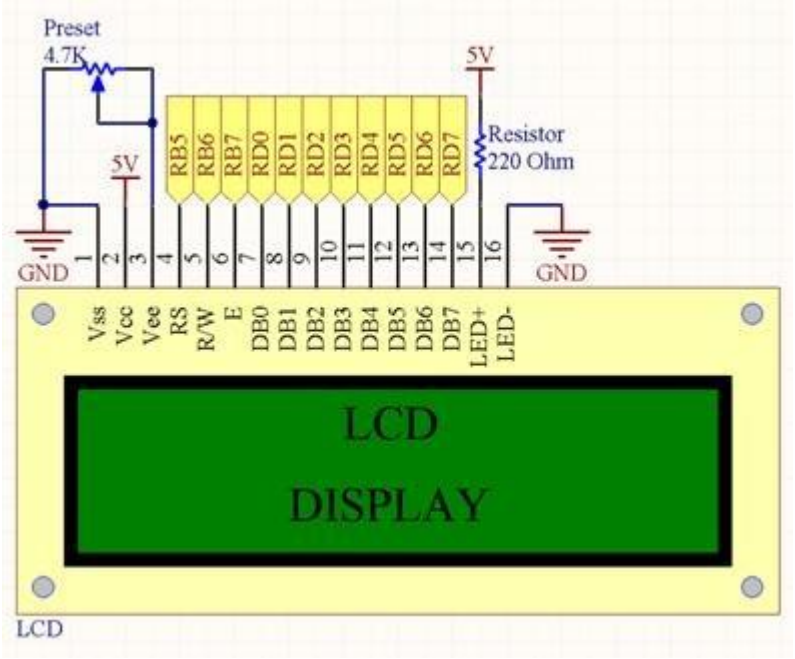
3.7 LCD (Liquid Cristal Display)-

A liquid crystal display or LCD draws its definition from its name itself. It is combination of two states of matter, the solid and the liquid. LCD uses a liquid crystal to produce a visible image. Liquid crystal displays are super-thin technology display screen that are generally used in laptop computer screen, TVs, cell phones and portable video games. LCD's

technologies allow displays to be much thinner when compared to cathode ray tube (CRT) technology.

An LCD is either made up of an active matrix display grid or a passive display grid. Most of the Smartphone's with LCD display technology uses active matrix display, but some of the older displays still make use of the passive display grid designs. Most of the electronic devices mainly depend on liquid crystal display technology for their display. The liquid has a unique advantage of having low power consumption than the LED or cathode ray tube.

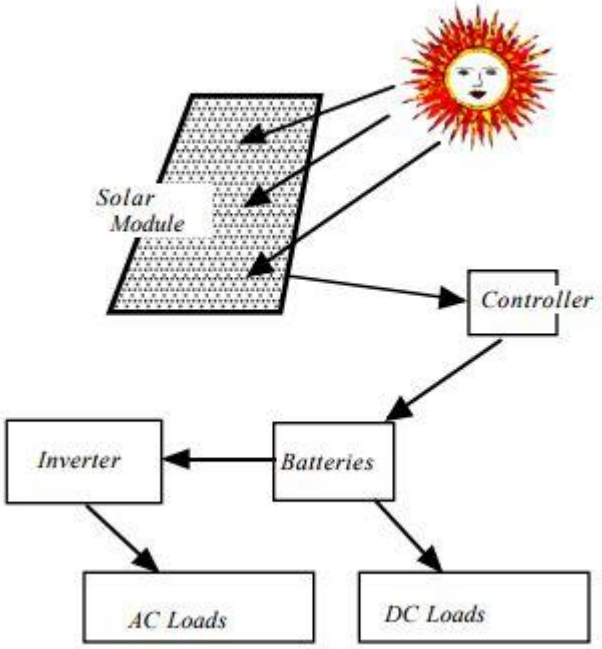
Liquid crystal display screen works on the principle of blocking light rather than emitting light. LCD's requires backlight as they do not emits light by them. We always use devices which are made up of LCD's displays which are replacing the use of cathode ray tube. Cathode ray tube draws more power compared to LCD's and are also heavier and bigger.



3.8 Solar Panel-

Solar power is arguably the cleanest, most reliable form of renewable energy available, and it can be used in several forms to help power your home or business like either directly as thermal energy (heat) or through the use of photovoltaic cells in solar panels and transparent photovoltaic device to generate energy.

Solar-powered photovoltaic (PV) panels convert the sun's rays into electricity by exciting electrons in silicon cells using the photons of light from the sun. This electricity can then be used to supply renewable energy to your home or business.



Solar photovoltaic cells: Photovoltaic cells made from silicon that transform incoming sunlight into electricity rather than heat. (”Photovoltaic” means electricity from light — photo = light, voltaic = electricity.)

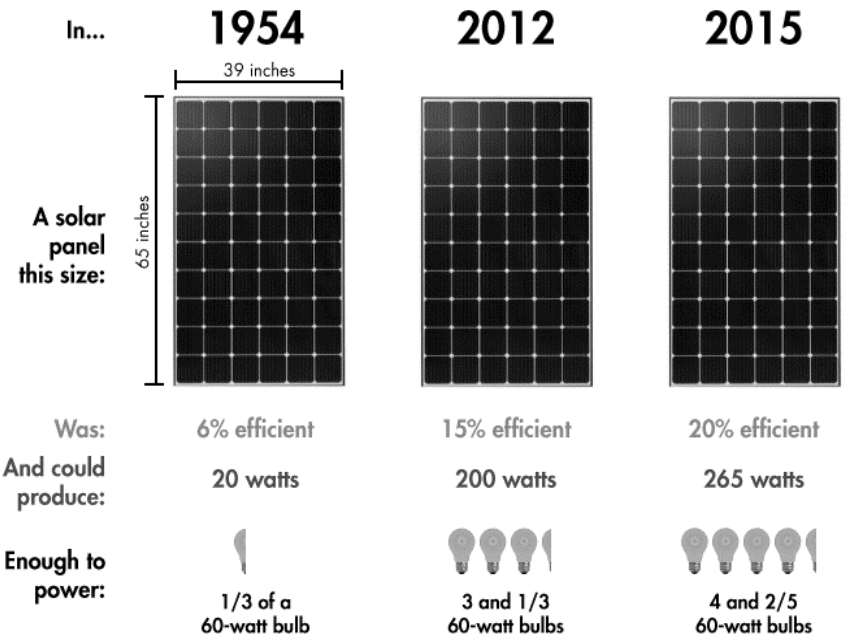
Photovoltaic effect in modern times though is in solid-state devices, mainly in photodiodes. When sunlight or other sufficiently energetic light is incident upon the photodiode, the electrons present in the valence band absorb energy and, being excited, jump to the conduction band and become free. These excited electrons diffuse, and some reach the rectifying junction (usually a p-n junction) where they are accelerated into a different material by a built-in potential (Galvani potential). This generates an electromotive force, and thus some of the light energy is converted into electric energy. The photovoltaic effect can also occur when two photons are absorbed simultaneously in a process called two-photon photovoltaic effect. And these cell can also be used in Array of multiple cells. These cells then construct a complete solar panel.

Solar panel

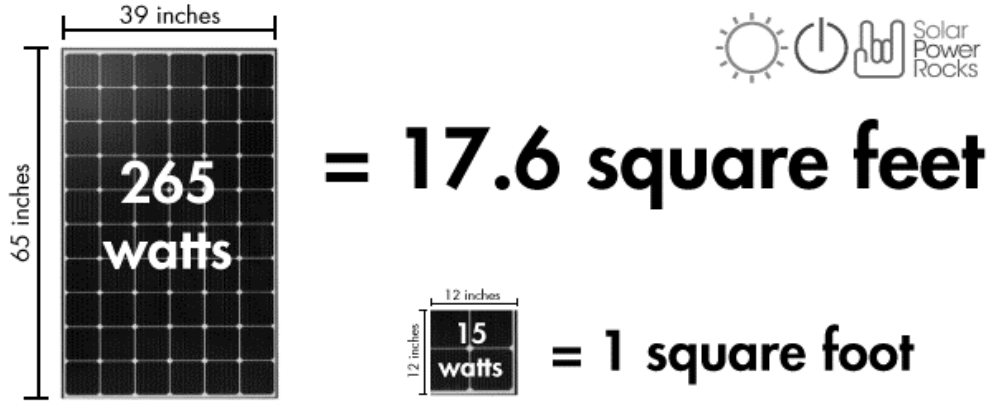
Solar panels, also known as modules, contain photovoltaic cells made from silicon that transform incoming sunlight into electricity rather than heat. (”Photovoltaic” means electricity from light — photo = light, voltaic = electricity.)

Photovoltaic (PV) module is a packaged, connect assembly of typically 6x10 photovoltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial and residential applications. Each module is rated by its DC output power under standard test conditions (STC), and typically ranges from 100 to 365 Watts (W).

Power Characteristics:



Size of the panel:



Pricing:

Type	Power (W)	Module Voltage	cost	Cost pew watt
Monocrystalline	50W	12	2387	47.74
Monocrystalline	110W	12	4934	44.85
Monocrystalline	220W	12/24	9869	44.84
Polycrystalline	5W	12	395	79.28
Polycrystalline	10W	12	668	66.84
Polycrystalline	50W	12	2247	44.94
Polycrystalline	100	12	3278	32.78
Polycrystalline	250	24	7166	28.66

3.9 GSM (Global System for Mobile Communication)-

Probably the most useful thing to know about the Global System for Mobile communications (GSM) is that it is an international standard. If you travel in Europe and many other parts of the world, GSM is the only type of cellular service available. Originally, the acronym GSM stood for Group Special Mobile, a group formed by the Conference of European Posts and Telegraphs (CEPT) in 1982 to research the merits of a European standard for mobile telecommunications. Commercial service using the GSM system did not actually start until 1991. Instead of using analog service, GSM was developed as a digital system using TDMA technology.

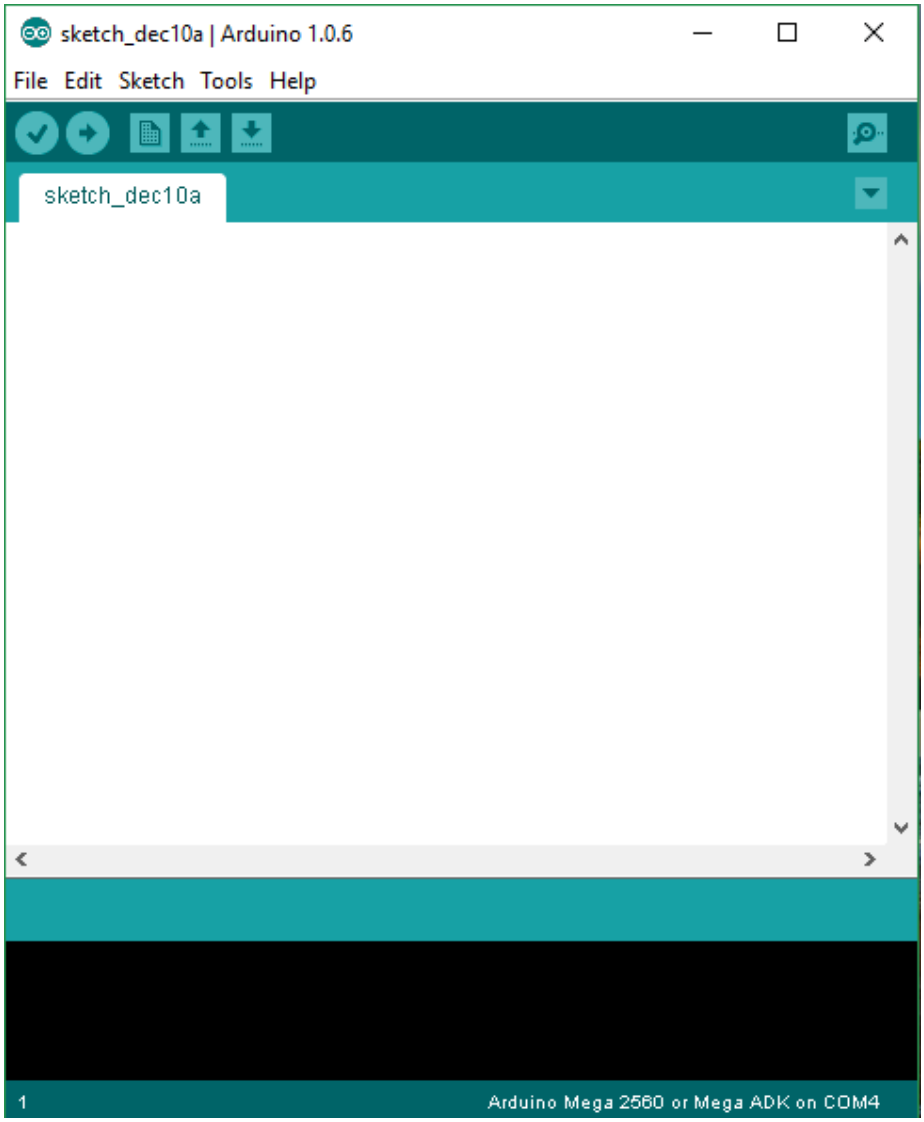
CHAPTER 4

SOFTWARE

4.1 Software Used-

Arduino IDE-

Software programs, called *sketches*, are created on a computer using the Arduino integrated development environment (IDE). The IDE enables you to write and edit code and convert this code into instructions that Arduino hardware understands. The IDE also transfers those instructions to the Arduino board (a process called *uploading*).



4.2 Basic Commands-

For GSM- AT+CMGS="MOBILE NO."

AT+CPMS=?

AT+CMGF=1

For Stepper Motor- #include <Stepper.h>

```
Stepper myStepper(stepsPerRevolution, 8, 9, 10, 11);

 // read the sensor value:
 int sensorReading = analogRead(A0);
 // map it to a range from 0 to 100:
 int motorSpeed = map(sensorReading, 0, 1023, 0, 100);
 // set the motor speed:
 if (motorSpeed > 0) {
   myStepper.setSpeed(motorSpeed);
   // step 1/100 of a revolution:
   myStepper.step(stepsPerRevolution / 100);
```

For Energizer-

```
state = inState;  //
 digitalWrite(LED_1, state);  // Set the LED
 digitalWrite(RELAY_1, !(state));  // Set the Relay
 Serial.print("State is now: ");  // Prints the current state
 Serial.println(state);
```

For LCD-

```
#include <LiquidCrystal.h>

// set up the LCD's number of columns and rows:
 lcd.begin(16, 2);
 // Print a message to the LCD.
 lcd.print("hello, world!");
```

4.3 Flow Chart-

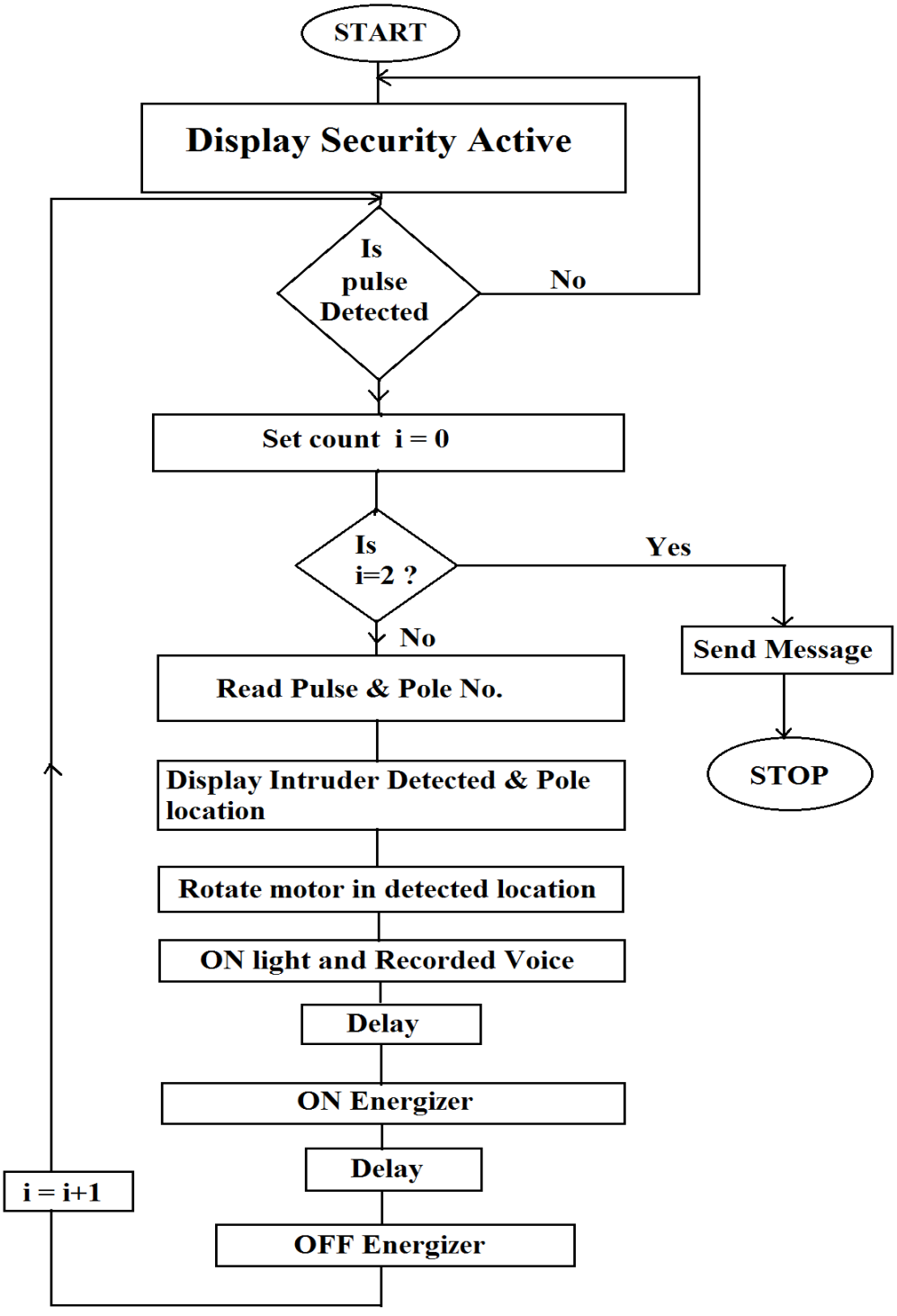


Fig. - Flow Diagram of Smart Electric Fence

4.4 Code-

```
// the setup function runs once when you press reset or power the board
void setup() {
  // initialize digital pin 13 as an output.
  pinMode(13, OUTPUT);
}

// the loop function runs over and over again forever
void loop() {
  digitalWrite(13, HIGH);   // turn the LED on (HIGH is the voltage level)
  delay(1000);              // wait for a second
  digitalWrite(13, LOW);    // turn the LED off by making the voltage LOW
  delay(1000);              // wait for a second
}
```

CHAPTER 5

FINENCIAL ANALYSIS

Following analysis and experiment is done by NABARD (National bank of agricultural and rural development) in HIMANCHAL PRADESH.

The Department of Agriculture and Department of Horticulture Government of Himachal Pradesh has estimated the damages due to monkey and other wild animals to agriculture and fruit crops in the state. Total area affected by monkey menace and other animals is 1.56 lakh hectare and value of damages is Rs.229.09 crores as given in Table.

Table 3: Damages to crops due to monkey menace and wild animals

Land use	Affected Area (Ha)	% of Total Affected area	Value (RS. crore)
Field crops	126372	80.70	184.27
Fruit crops	30213	19.30	44.82
Total	156585	100.00	229.09

Affected area Includes abandoned area of 19,563 hectare

Above effected are good market for this project. (Include data of other state in available)

Table 4: District-wise Potential for investment in Solar Fencing

District	Area(ha)	District	Area(ha)
Kangra	34245	Hamirpur	10257
Una	29348	Solan	8012
chamba	21457	Sirmour	7288
Bilaspur	14925	Kullu	2963
Mandi	13919	Kinnaur	350
Shimla	13757	Other	45
Total			156585

Cost and Economics

Unit cost has been worked out for 5 different models by NABARD on 1 Acre, 2.5 Acre, 5 Acre, 10 Acre and 20 Acre. Higher area models are suitable for group of farmers. Unit cost of these models is given in table-

Model	Protected Area	Perimeter for fencing	Unit cost	Cost per running meter
	Acre	meter	Rs.	Rs.
Model 1	1	300	161907	540
Model 2	2.5	500	210793	422
Model 3	5	700	259679	371
Model 4	10	1000	407716	408
Model 5	20	1400	505489	361

The average cost per running meter of 7 rows fence comes to Rs.396/Meter.

Area to be protected	Acre	1.00
Fence Length (Perimeter)	Meter	300
Fence Height above ground level	Meter	2.14 (7 ft)
Number of wire rows / strands	Number	7
Spacing between wire rows	Meter	0.30 (1 ft)
Pole to Pole distance	Meter	5
Total Pole Height	Meter	2.74 (8.5 ft)

(Above + Below Ground level (1.5 ft.))

Technical Specification for above Model and its cost-

Sr. No.	Name of items	Specification	Quantity	amount (₹)
I	**Fencing work**			
A	**The Electrical Unit**			
1	Energizer	Input Voltage: 12V DC, Input Current: 500MA, Output Voltage: 6.0 KV - 10.0 KV, Pulse Interval: 1.2 Second, Pulse Duration: 0.3 m Second, Output energy: 2.5 Joules	1	10000
2	Fence voltage alarm		1	1000
3	Solar PV module	72 Wp	1	5500
4	Battery	80 Ah	1	5500
5	Hooter	320 DB	1	500
6	Lightening diverter	Copper	2	2500
7	Mounting box	Mild steel with powder coating	1	3000
8	Module mounting structure with pole	Mild steel with powder coating	1	1500
9	Cables and hardware	2-Core copper flexible cable (Mtrs)	5	30
B	Fence			
1	HT wire	ACSR Conductor wire, 2.59 mm (12 gauge), TATA make or equivalent	2200	5.5
2	Corner/end post	MS with Galvanized, 40x 40 Sq.mm Pipe, 8.5 Feet with PP Insulator riveting	8	640
3	Support post	MS with Galvanized, 25x 25 Sq.mm Pipe, 8.5 Feet with PP Insulator riveting	22	390
4	Intermediate post	MS with galvanized, 25x 25 Sq.mm Pipe, 8.5 Feet with PP Insulator riveting	60	390
5	Support poles bolts	Mild steel	22	25
6	Corner poles/end insulators	Poly propylene	56	7

7	Intermediate pole insulators	Pole propylene	420	7
8	Corner pole hooks	SS	56	392
9	Wire tighter	MS	21	525
10	Joint clams	GI	21	147
11	Double insulated cable single core	ACSR wire, 2.0 mm dia.	50	1250
12	Earth kits (galvanizing)	Copper	6	4200
13	Warning sign boards	PVC	30	2250
C	**Gates**			
1	4 ft. wide gate 1 leaf		1	32350
D	**Instrument/tools**			
1	Digital multi meter	Range up to - 20000KV	1	7500
2	Xenon flash tube		1	3000
3	Neon tester		1	2500
4	Tool kit (wire tighter handle twist in tool, pliers, double ended spanner for joining clamp tightening)		1	1000
	Total fencing work			140346
E	**Transportation with transit insurance**			7017
II	**Civil work**			
1	Excavation for Poles :- 0.45mx0.60mx0.60m (CuM)	0.162	14.58	2187
2	Providing and laying cement concrete for Post (Cum)		14.58	11664
	Total civil work			13851
	Grand total (I+II)			154197
III	**Installation and commissioning**			7710
	Total			161907
	Cost per meter of fence length			540

CHAPTER 6

CONCLUSION, APPLICATION & SCOPE

Conclusion-

Thus we are concluded the solar electric fencing prototype is designed and developed successfully. The project shows that the proposed system is simple and efficient one. We are save cost in order to implement this project for security purpose as well as less time consume. The authorized person get message from GSM, when any intruder is stuck in electric fence. Pulse generate sends pulse to the controller. Now controller read the pulse and detect the location of intruder and send signal to relay drive. Though relay driver the buzzer will on and light will glow. This is the solution to the protection of agriculture areas from robberies, interruption and creatures.

Applications-

a) Military bases, borders and high security installations.
b) Industrial sites and factories.
c) Remote warehouses and builders yards.
d) Cellular phone antenna sites.
e) Electricity transformer, sub-stations and electricity pylons.
f) Housing Estates.
g) Private Houses.
h) Car lots.
i) Rental storage facilities
j) Orchards/fruit trees
k) Sheds/storage areas
l) Chicken coops
m) Dog kennels
n) Gardens

Future Scope-

Camera is interfaced with the fencing system. Snapshot of the person and text messages are send to the authorized person who tried to get inside land. We can also improve sensing system by using strain gauge and latest sensor to sense the intruder more accurate. We can make smarter this system by applying image processing.

References-

[1] https://www.stafix.com/en/node/14195
[2] http://gyti.techpedia.in/project-detail/optimum-cost-electric-fence/890
[3]https://www.nabard.org/demo/auth/writereaddata/ModelBankProject/1302170923merged_document_9.pdf

[4] https://am.gallagher.com/au/in-practice/an-introduction-to-electric-fencing

[5] https://www.kencove.com/fence/97_How+an+Electric+Fence+Works_resource.php

[6] https://dir.indiamart.com/impcat/electric-fence.html

[7] https://www.lowes.com/pl/Electric-fencing-Animal-pet-care/4294402538

[8] Dr. G.Prasanthi 1, M.Harinarayana, "Design of Converter for Solar Power Fencing System for an Agriculture Field" in proc.ijareeie.2014.03.

[9] Experiment conducted by NABARD and solar fence proposed in himachal Pradesh, "solar power fencing for crop protection from monkey menace and domestic / Wild animals in himachal pradesh",
[10] Suraj Dilip Chinchole1 , Sampada Milind Jadhav2 , Prof. R.K. Admane, "SOLAR BASED ELECTRONIC FENCING", June 2017.
[11] Maryam Minhas*, Tanveer Abbas, Reeja Iqbal and Fatima Munir, "An Electric Fence Energizer Based on Marx Generator", October 2016.
[12] Marcelo Giovanni B. De Martino Fernando S. dos Reis Guilherme A. D. Dias, "AN ELECTRIC FENCE ENERGIZER DESIGN METHOD", July 2002.