A

PROJECT REPORT

on

"SOLAR BASED ELECTRICAL FENCING"

By

RANDHIRE DEVYANI DATTATRAY

Under the Guidance of

Prof. Aishwarya Pawar

Department of Physics

KARMAVEER SHANTARAM BAPU KONDAJI WAVARE (K.S.K.W)
ARTS, SCIENCE AND COMMERCE COLLAGE,
CIDCO, NASHIK-422008

2021-2022

MARATHA VIDHYA PRASARAK SAMAJ's

Karmveer Shantarambapu Kondaji Wavare

Arts, Commerce & Science College, Cidco, Nashik - 422008

NAAC Re-Accredites 'A' Grade (CGPA 3.20)

Certificate

This is to certify that the project entitled
Solar Based Electrical Fencing
has been successfully completed by
Randhire Devyani Dattatray
Seat no:
During the academic year 2021-22
forfulfilment of M.Sc-II(Physics)degree

Prof.Aishwarya Pawar
(Project Guide)

Dr. A. B.Gawande
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(Internal Examiner)

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Acknowledgement

In the accomplishment of this project successfully, many people have best owned upon me their blessing and the heart pledged support, this time I am utilizing to thank all the people who have been concerned with this project.

I would like to thanks to our Head of Department, **Dr. A. B. Gawande**, Department of Physics and Electronics, Karmveer Shantarambapu Kondaji Wavare Arts, Science and Commerce College, Uttamnagar, CIDCO, Nashik. For providing me such a great environment and laboratory with all facilities like instrumentation and chemicals. Whose valuable guidance has been helped me to patch this project as great achievement and also her best suggestions and instructions have served me as the major contributor towards the completion of this project.

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Name of Student

RANDHIRE DEVYANI D.

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ABSTRACT

An electric fence is an effective first perimeter protector and has steadily gained popularity in Kenya in the past few years despite the fact the electric fencing concept is not understood by many. The principle of operation of an electric fence was studied and the various fence components discussed. The phenomena associated with electric fences like interference with communication channels and ways of minimizing them were also discussed. The process of planning, designing an electric fence and installing its various components was explained.

Electric fence implementation in Kenya was studied by observing the voltage, power and material requirements of these fencing systems. The International Electric Fencing Standards and Regulations were also studied and reference made to those applied in Kenya. With Namelok and Kimana fences as a case study, the effectiveness, challenges in implementation, disadvantages and advantages of electric fencing were discussed. Based on the discussions, various recommendations were given on ways to increase effectiveness and encourage use of electric fences.

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. The electric fence is very versatile and one of its functions was in providing effective security solutions implemented in many applications. Some of the typical installations are as listed below

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

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 barriers. The mental barrier is accomplished by introducing an electric shock through the fence wire that both repels the animals and makes them less likely to contact the fence again. However in security systems, the electric shock 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 PROBLEM STATEMENT

Security is very essential in each home especially in these times where cases of burglary and theft have risen off the charts. Though it is the duty of the police in our country to ensure the safety of all citizens, it is also one's duty to cater and make sure that his/her home is safe for the family. 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 Microcontroller Atmega328 and IC CD4047

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1.4 PROJECT SCOPE

Scope

Most institutions and individuals in Kenya who use electric fences try to set them up as cheaply as possible. They also often do not carry out regular maintenance. There is no proper training for fence installation and maintenance personnel in Kenya. As a result, most of the electric fences set up are not very effective, do not meet the required standards and are very expensive to maintain. All research on electric fencing done in Kenya has been on its effectiveness in ending human wildlife conflicts.

The research was carried out by collecting information from electric fence users, installing companies and potential users. Most of the technical information available about electric fencing was provided by the equipment sales agents. This was very limiting given that proper understanding of fences is required so as to set up an effective fence. Factors that determine the final fence system design include the animals to be controlled, level of security required. Most of the companies with electric fence installations were unwilling to give any information about their fences.

1.5 PROJECT JUSTIFICATION

The readily available security systems solutions in the market are very expensive. Besides the security group of companies, the likes of G4S, KK security and Wells Fargo have completely taken over the market and hence they tend to offer home security systems but at a ridiculously high price. This project is hence aimed at providing a cheaper alternative of a self-built security systems that I still as efficient as the others.

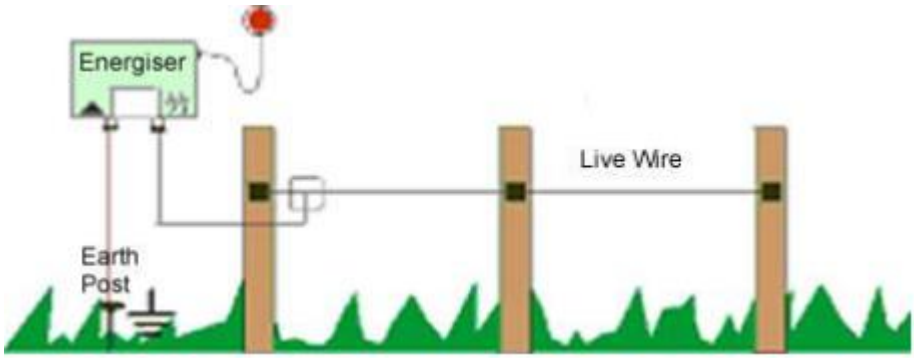
CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

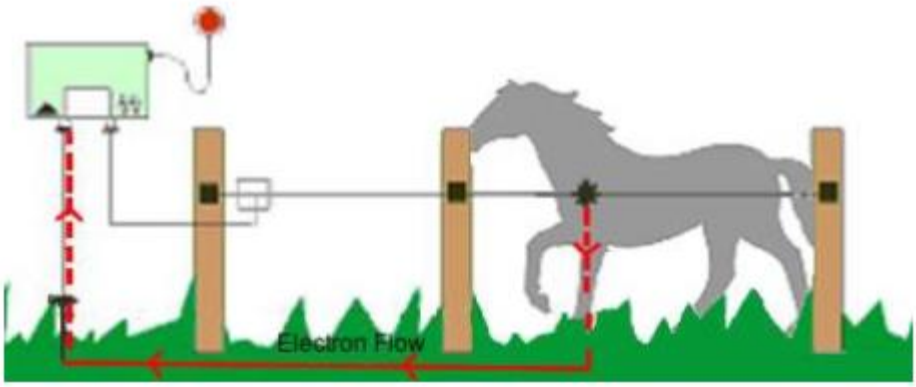
An electric fence is made up of an open electrical circuit comprising of two arms as shown below:

a) The first arm is the fence connected to the fence energizer. This section is usually insulated from any other conductive material like the ground, leaves, grass and trees by plastic insulators or an air gap of at least 3cm.

b) The second arm is the ground itself that is connected to the Earth terminal of the energizer by way of a metal rod or earth stake/post. This forms OPEN electrical circuit as shown below waiting for a person or animal to close the circuit.

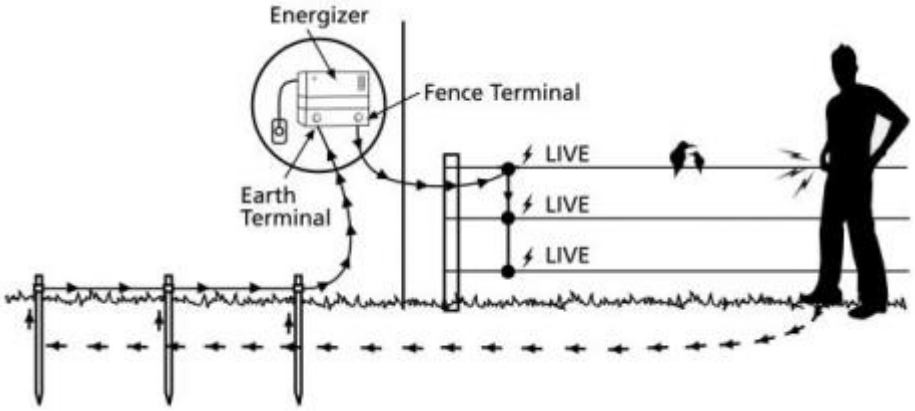


Taking an example of a horse, the electrical circuit is then CLOSED when the horse comes into contact with both the live fence and the ground at the same time. This forms a short circuit allowing the electricity to flow from the animal and back to the energizer via the earth metal rod giving the animal an electrical shock as it touches the wire.



The voltage being sent through the wires is usually very high but the current or amperage is low.

Electric fence energizers output high voltages of around 8kV but very low amperage around 120mA. Also the output is made safe in that the electrical energy is released in pulses once every 1/300th second. The reason for the pulsating current is that if the wires are touched and deliver shock, then whatever touches it has a chance to withdraw or remove itself. [4]The person or animal has to be in direct contact with the ground to feel the shocking sensation. This is why a bird resting on the wire will not receive a shock since it is not touching the ground so the circuit isn't completed. Another case is when a person wearing insulated footwear will only receive a very small shock because all the current cannot pass through the insulated soles as shown below:



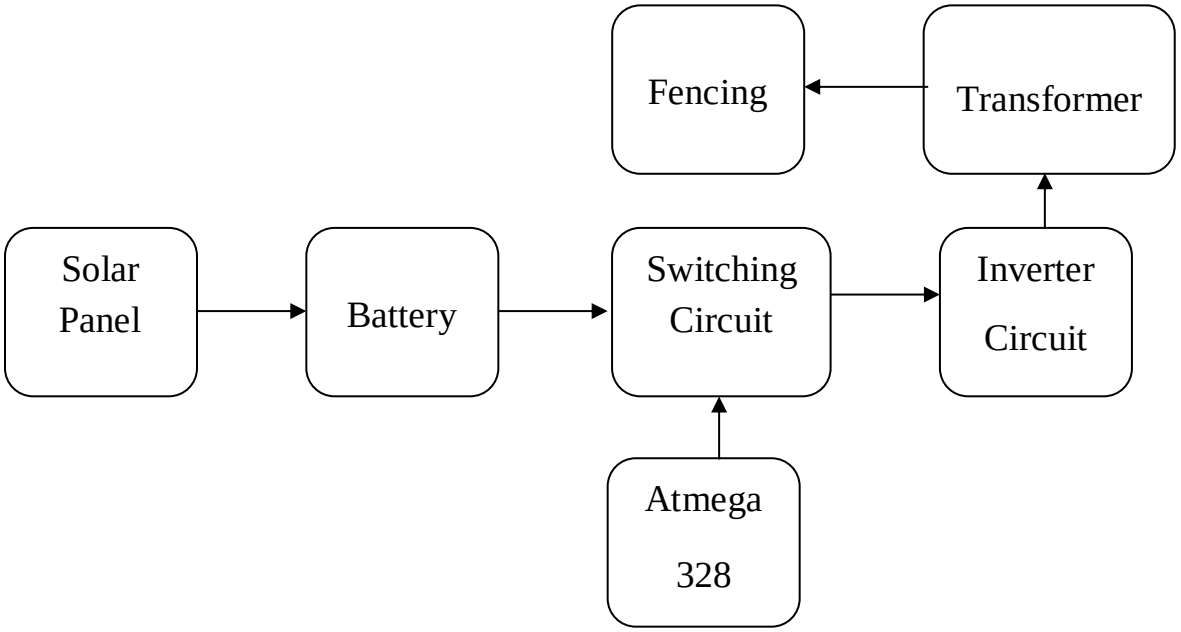
There are two types of fences:

I. Permanent electric fences: Permanent electric fences are preferred since they provide a long-term fencing solution. Compared to other fences like barbed wire, woven wire and rail fence, permanent power fence systems are economical, easy to install and operate, and require less maintenance, due to minimal physical contact with animals.

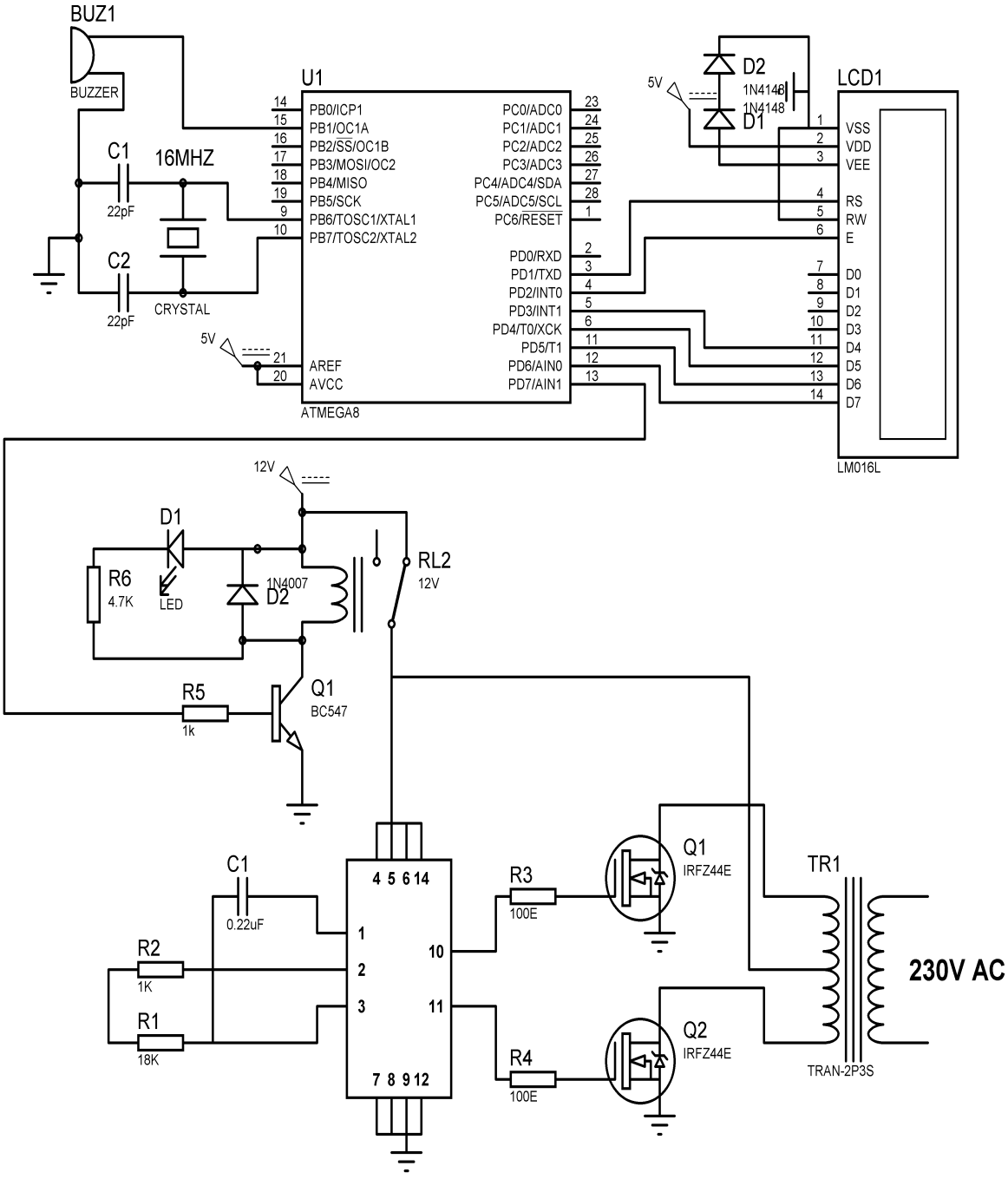
II. Temporary/Portable electric fences: Portable electric fences provide flexibility in pasture management and are ideal for short-term animal control or rotational grazing. Easily transported, constructed and maintained, portable fences are an effective temporary fencing solution for a range of animals and situations.

CHAPTER 3: DESIGN AND IMPLEMENTATION

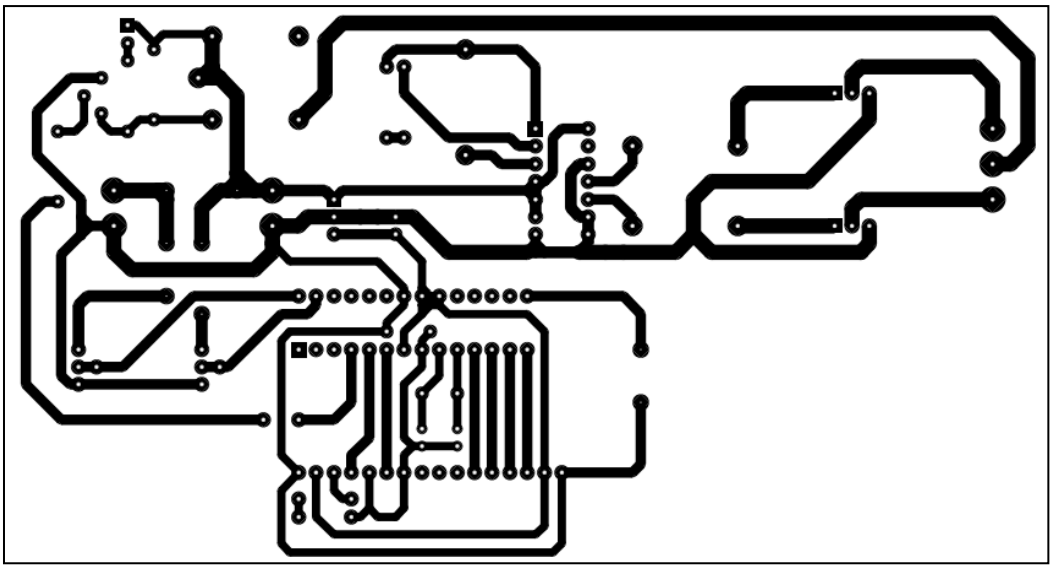
3.1Block Diagram



3.2 Circuit Diagram



3.3 PCB Layout



3.4 HARDWARE DISCRIPTION

The main purpose of this project is to convert sunlight into AC voltage hence this task is dine in three steps as follows.

Step one: - main take is to convert the DC voltage to AC voltage but for that first we need DC voltage. This voltage is get form the Sun light by using solar plate. Hence by using solar plate we charge the battery, and after charging we use this power in next step.

Step Two: -after charging of this battery next to invert this DC power into AC hence inverter circuit is used. The inverter circuit is built around IC CD4047 which is wired as astablemultivibrator. The operating frequency of astable multivibrator is set to 50Hz.The power MOSFETs IRFZ44 are directly driven by the Q and Q' output of CD4047.The power MOSFETs are connected in Push Pull configuration (Power amplifier). The MOSFETs will switch according to the pulse from CD4047 astablemultivibrator. Thus an AC voltage is transferred to the primary of transformer.

Step Three: - after getting AC voltage having frequency 50 Hz at the primary of transformer; it is stepped up to 230V.The transformer used here is an ordinary step down transformer which is connected in inverted manner. That is, the primary of a 230V to 12V-0-12V step down transformer can be treated as secondary for this inverter project.If you would like to get 110V AC, choose 110V to 12V-0-12V step down transformer in reversed way. (That is primary as secondary and secondary as primary).

Atmega328 microcontroller is used hear to monitor the voltage level of battery and solar panel on 16X2 LCD Display. Also it control the state of Relay to on and off fencing for a particular time interval.

CHAPTER 4: EQUIPMENT AND COMPONENTS OF AN ELECTRIC FENCE

An electric fence consists of various components namely the Fence (posts, wires, insulators and gates), Electronics (controller, insulated cables and switches) and Grounding system (groundrods, clamps and wiring).

4.1 The Fence

Electric fence circuit materials include insulators, posts, wires, and gates. Other miscellaneous materials include insulated wire tensioners, digital voltmeters for system checking, lightning protection devices, indicator lights for distance monitoring of fence circuit, cutout switches for isolation of fence sections, insulated spring handles for simple gates etc.

4.1.1 Insulators

An electric fence uses uninsulated wire thus all points of contact between the electrified wires and any point of possible grounding is always insulated to prevent leakage or shorting out the fence. Electrical current can pass through an air gap (arcing) in order to make its way to ground, if doing so is the path of least resistance. The higher the power being supplied, the larger the possible arcing gaps thus the thicker the required insulators. Poor insulation results in poor shock intensity or only a very short length of fence being energized due to heavy energy losses. Many materials that are considered to be insulators behave unexpectedly at high voltages; Plastics can carbonize and become conductive, Timber holds moisture that can allow current to flow, Surfaces conduct electricity because of moisture. Thus only purpose made insulators should be used.

The required length of insulator depends on the type of post used; metallic posts require insulators that are wider than the post. Environmental conditions such as amount of rain expected as well as relative humidity also need to be taken into account; for areas that experience high relative humidity at least 2.54cm should be added to the insulators used. Fences require an insulator for each live wire on every post, at tie-off points and all other points of possible grounding.

High quality insulators when utilized eliminate nuisance alarms from environmental contamination.

All purpose made electric fence insulators have voltage limits above 20kV, way much higher than the fenceline voltages of about 10kV, and a life expectancy of at least ten years. Thus insulator selection is more based on position than quality. Plastic and porcelain insulators are the most commonly used. **Porcelain** insulators generally have a longer life span but are more expensive and can crack due to poor installation, mechanical vandalism and changes in temperature. **Plastic** insulators are easy to use, are relatively inexpensive and come in many styles for different applications. UV stabilized plastic is used since common plastic allows leakage under high voltages.

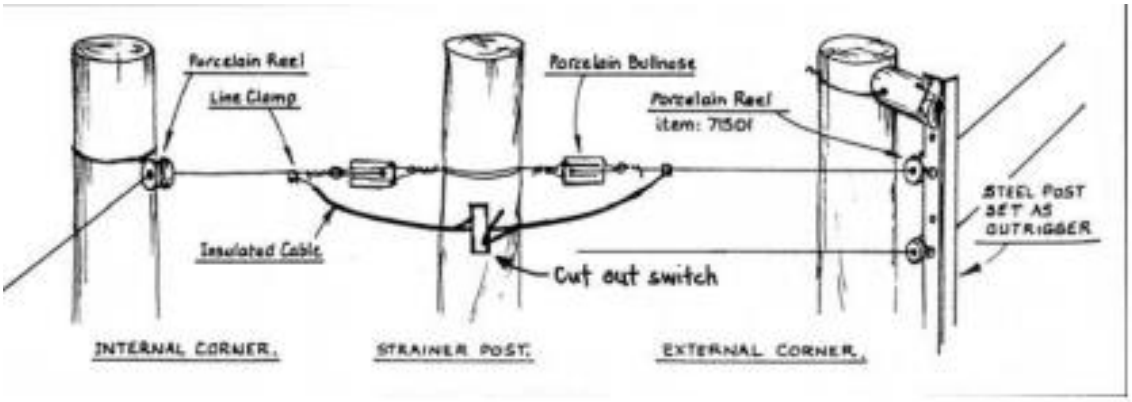


Figure 4.1: Common Ways of Insulating an Electric Fence

Being reusable and not requiring accurate nailing to prevent damage.

Offset Insulators are a special kind of line post insulators used to offset an electrified wire from the main nonelectric fence to ensure that the animals contact it first. This prolongs life of a nonelectric animal control fence. fence changes direction or at tie-off points. They are made of porcelain, high grade plastic or steel reinforced plastic tubing and are usually wire-tied to the post.

4.1.2 Posts

Straining posts are used to tension line wires of a fence. Contour posts are used to hold a fence in a depression or valley. A turning post is used when the fenceline changes direction and the internal angle is greater than ninety degrees. Wood posts are strong, rigid, highly visible and provide a psychological barrier. Steel posts are strong, rigid, provide a physical barrier and are ideal for a broken hill country terrain. Fiberglass posts are low cost, lightweight and flexible, need no maintenance or additional insulation and are easy to install. Stake or Droppers or Battens can be made of wood, plastic or fiberglass. They are usually 2m long and can be used with all types of fence posts. They maintain wire spacing and increase fence visibility. Droppers should be inserted at right angles to a slope in order to maintain the height of the fence and wire spacing. For portable fences, lightweight metal, timber or plastic-coated metal stakes and fiberglass stakes or posts are used since there is usually no sustained direct pressure from animals leaning against an electric fence. The height of a standalone fence depends on the animals to be controlled and the depth to which the posts or stakes have to be sunk into ground; this depends on soil texture and whether the post is to be set in concrete. When fence posts are positioned too close together and a wire is strained, it could break the insulators or knock posts out of the ground. Hence posts should be spread apart far enough for the fence to have such elasticity that the wire just bends and pops back like a rubber band instead of breaking.

Fence Post Lengths for Permanent Electric Fences Set In Concrete
When not set in concrete, the lengths of the posts lengths specified in Table 5.1 should be increased by 300mm and set 300mm deeper in the ground. Posts are usually spaced farther apart in level terrain but in uneven terrain, they are positioned wherever there is a high or low place. On hillsides, posts are usually installed perpendicular to the slope. This keeps the wire at the proper height and prevents it from binding on insulators or clips.

Fence height (m)	Posts	Stakes	Struts
Section Length (m)	Section Length (m)	Section Length (m)	
0.6 0.8 0.9 1.05 1.15	1.45 1.65 1.75 1.85 2.00	1.20 1.40 1.50 1.60 1.75	1.30 1.50 1.60 1.70 1.80

Figure 4.2: Post spacing

4.1.3 Wires

Any unwanted current flowing in the fence wires should always be minimized. Thus short circuits, faulty insulators and overgrown vegetation must be removed to ensure that the wires carry current as a result of an animal or intruder contacting the fence. Conducting wires can be either single or multi-stranded and range in diameters. Proper wire sizing helps to avoid problems of restricting electrical flow which would reduce the shock intensity. Synthetic webbing and rope-like fencing materials woven with fine conducting wires, usually of stainless steel, are particularly useful for areas requiring additional visibility and for temporary fencing.

Leadout Fence Section

A leadout is the supply wire that connects the fence controller to a fence some distance removed from the utility. The leadout wire can be of coated steel, aluminium or an aluminium alloy. The Zinc or aluminium coating protects steel conductors against corrosion. The arrangement in which the number and size of wires on the leadout section are equal to those on the main fence is the most effective since it ensures a low voltage drop both along the leadout and where the main fence starts. The length of the leadout and that of the fence being energized determine the gauge of the wire used. A single leadout wire does not properly supply a multistrand fence when the leadout and fence are very long (over 5km) since the pulse action of the current traveling in the wire causes surge impedance. Thus several standard gauge wires are preferred over one large wire of equivalent resistance since it cannot handle the pulse in the same manner. On long fences, wire matching helps to reduce a pulse or surge problem. The Double insulated cable is usually used in buildings and under gates since ordinary house cable is only rated for 600kV and may cause leakage to earth.

4.2 Types of Electric Fence Wires

There are many categories of electric fence wires like the spring-steel wire, multi-strand cable wire, aluminium wire, polywire, electric mesh netting wire, polythene tape wire but the most commonly used are the high and medium tensile steel wires.

I. Medium-Tensile Steel Wire

Along with aluminium wires, medium-tensile steel wires have the smallest diameters (about 2mm) and are used on temporary fencing where ease of handling and little tension are required. These wires are less suitable for long permanent fences especially where more than one wire is required due to the small diameter. They have a yield point at which they stretch plastically. When this point is reached before the stretched wire breaks, then the fence does not retain its tension over long periods and requires a large number of support stakes and posts to prevent sagging.

II. High-Tensile Steel Wire

This wire has high carbon content, does not have a yield point and when tensioned does not stretch or slacken therefore less likely to cause a fault. However, it is more brittle and may fracture during tensioning. It is only be used on permanent fencing because of the fracturing hazard.

4.3 Gates

Where a gate is required on an electric fence, the circuit must be continued either over the gate or under the gate. A gate can also be electrified without causing any inconvenience to users. Passing the fence circuit under the gate is the simplest method but requires good insulation and mechanical protection of the wire. When by-passing a gateway it is essential to use high quality double-insulated underground cable encased in a high density polythene pipe because ordinary insulated wire is liable to corrode over time when underground.

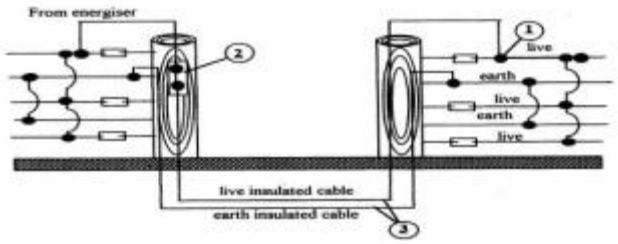


Figure 4.3: Gateway with Underground Circuit

The underground cable (3) is buried at least 300mm below the surface to protect it from mechanical damage. The ends of the pipe are bent downwards to avoid rainwater entry. Joint clamps (1) are used for all wire connections or joints. Cut out switch (2) is best installed on the controller side of the gateway for easy isolation

4.4 IC Atmega 328

Introduction

The Atmel ATmega328A is a low-power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, the ATmega8A achieves throughputs close to 1MIPS per MHz. This empowers system designer to optimize the device for power consumption versus processing speed.

Features

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

• Advanced RISC Architecture

– 130 Powerful Instructions - Most Single-clock Cycle Execution

– 32 x 8 General Purpose Working Registers

– Fully Static Operation

– Up to 16MIPS Throughput at 16MHz

– On-chip 2-cycle Multiplier

• High Endurance Non-volatile Memory segments

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

– 512Bytes EEPROM

– 1KByte Internal SRAM

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

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

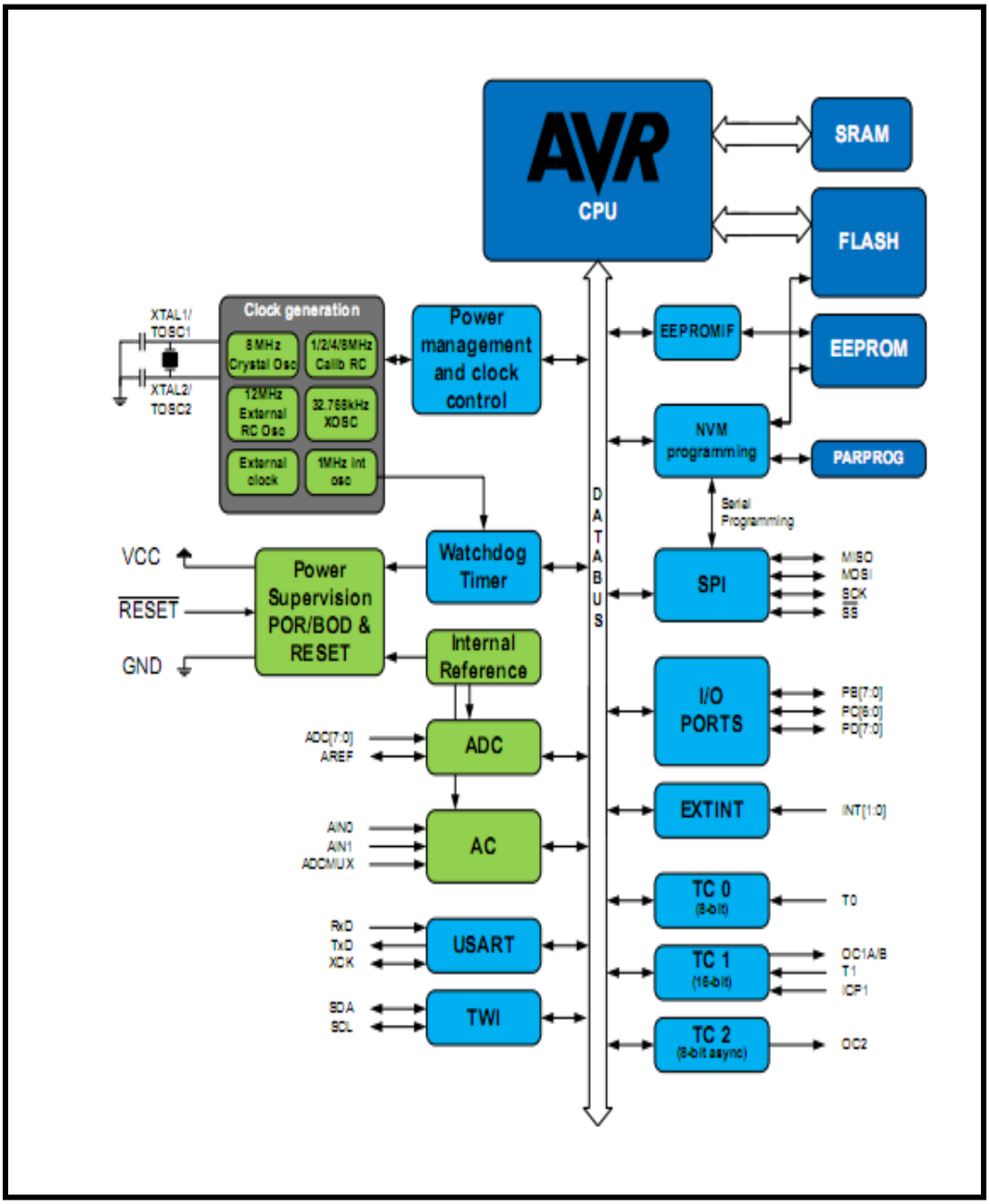
– Optional Boot Code Section with Independent Lock Bits

  • In-System Programming by On-chip Boot Program

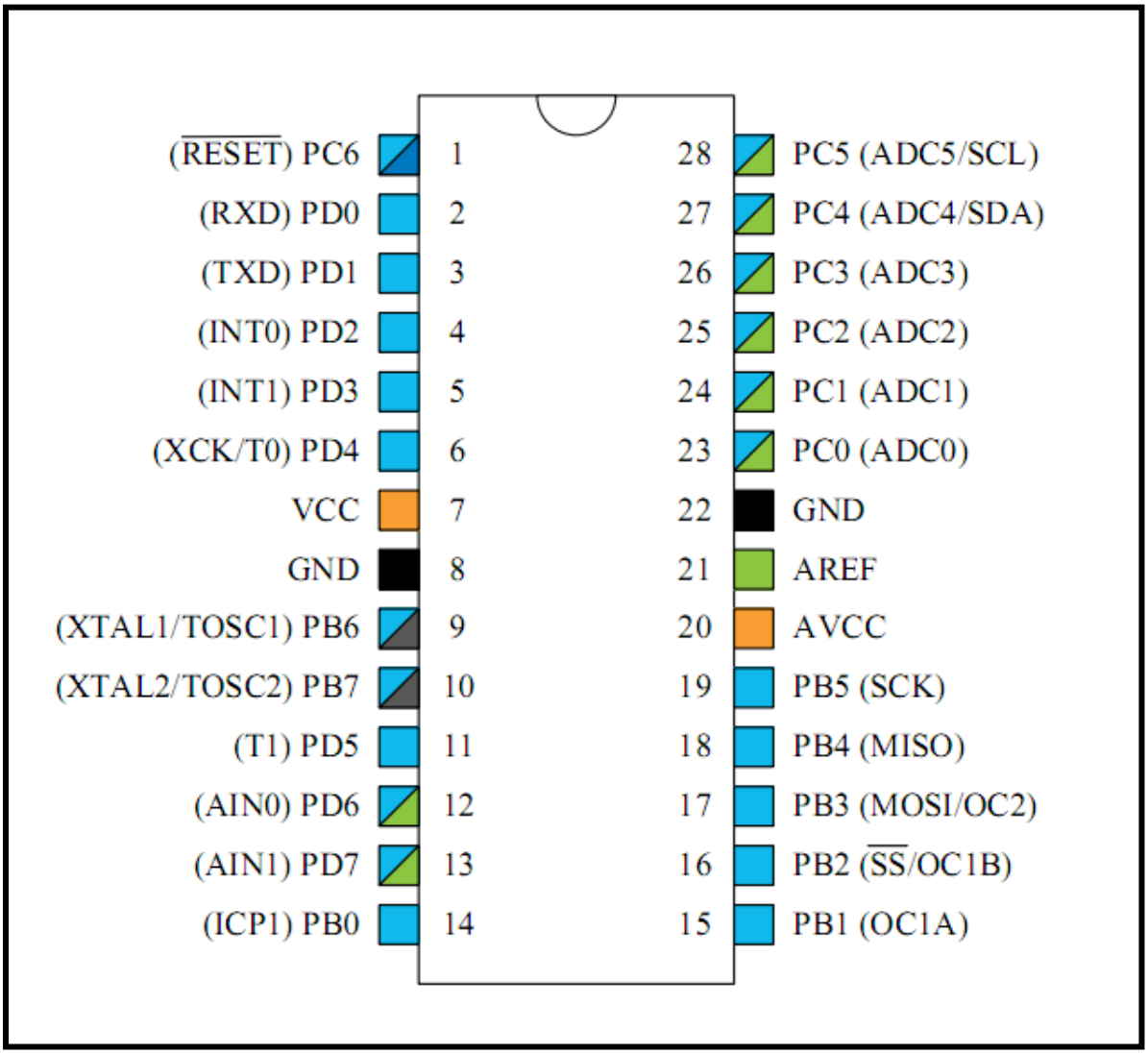
  • True Read-While-Write Operation

– Programming Lock for Software Security

Block Diagram



Pin Diagram



Pin Descriptions

VCC

Digital supply voltage

GND

Ground

Port B (PB7:PB0) – XTAL1/XTAL2/TOSC1/TOSC2

Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock is not running. Depending on the clock selection fuse settings, PB6 can be used as input to the inverting Oscillator amplifier and input to the internal clock operating circuit. Depending on the clock selection fuse settings, PB7 can be used as output from the inverting Oscillator amplifier. If the Internal Calibrated RC Oscillator is used as chip clock source, PB7:6 is used as TOSC2:1 input for the Asynchronous Timer/Counter2 if the AS2 bit in ASSR is set. The various special features of Port B are elaborated in Alternate Functions of Port B and System Clock and Clock Options.

Port C (PC5:PC0)

Port C is a 7-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port C output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tri-stated when a reset condition becomes active, even if the clock is not running.

PC6/RESET

If the RSTDISBL Fuse is programmed, PC6 is used as an I/O pin. Note that the electrical characteristics of PC6 differ from those of the other pins of Port C. If the RSTDISBL Fuse is un-programmed, PC6 is used as a Reset input. A low level on this pin for longer than the minimum pulse length will generate a Reset, even if the clock is not running. The minimum pulse length is given in Table 30-5. Shorter pulses are not guaranteed to generate a Reset. The various special features of Port C are elaborated in Alternate Functions of Port C.

Port D (PD7:PD0)

Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active, even if the clock is not running. Port D also serves the functions of various special features of the ATmega8A as listed in Alternate Functions of Port D.

RESET

Reset input. A low level on this pin for longer than the minimum pulse length will generate a reset, even if the clock is not running. The minimum pulse length is given in Table 30-5. Shorter pulses are not guaranteed to generate a reset.

AVCC

AVCC is the supply voltage pin for the A/D Converter, Port C (3:0), and ADC (7:6). It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter. Note that Port C (5:4) use digital supply voltage, VCC.

AREF

AREF is the analog reference pin for the A/D Converter.

ADC7:6 (TQFP and QFN/MLF Package Only)

In the TQFP and QFN/MLF package, ADC7:6 serve as analog inputs to the A/D converter. These pins are powered from the analog supply and serve as 10-bit ADC channels.

4.5 Liquid Crystal Display

Introduction

LCD is a type of display used in digital watches and many portable computers. LCD displays utilize to sheets of polarizing material with a liquid crystal solution between them. An electric current passed through the liquid causes the crystals to align so that light cannot pass through them. LCD technology has advanced very rapidly since its initial inception over a decade ago for use in laptop computers. Technical achievement has resulted in brighter displace, higher resolutions, reduce response times and cheaper manufacturing process. The liquid crystals can be manipulated through an applied electric voltage so that light is allowed to pass or is blocked. By carefully controlling where and what wavelength (color) of light is allowed to pass, the LCD monitor is able to display images. A back light provides LCD monitor's brightness. Just as there are many varieties of solids and liquids, there is also a variety of liquid crystal substances. Depending on the temperature and particular nature of a substance, liquid crystals can be in one of several distinct phases. Over the years many improvements have been made to LCD to help enhance resolution, image, sharpness and response times. One of the latest such advancements is TFT or Thin Film Transistor. TFT-LCD's make use of a very thin transistor that is applied to glass during acts as switch allowing control of light at the pixel level, greatly enhancing image sharpness and resolution. This has been particularly important for improving LCD's ability to display small-sized fonts and image clearly. LCD interfacing with 8051 is a real-world application. In recent years the LCD is finding widespread use replacing LEDs (seven segment LEDs or other multi segment LEDs).

This is due to following reasons:

- ★ The declining prices of LCDs.
- ★ Incorporation of a refreshing controller into the LCD, thereby relieving the CPU to keep displaying the data.
- ★ Ease of programming for characters and graphics.

Pin diagram :

Most of the LCD modules conform to a standard interface specification. A 14pin access is provided having eight data lines, three control lines and three power lines. The connections are laid out in one of the two common configurations, either two rows of seven pins, or a single row of 14 pins. One of the, pins are numbered on the LCD's print circuit board (PCB), but if not, it is quite easy to locate pin1. Since this pin is connected to ground, it often has a thicker PCB track, connected to it, and it is generally connected to metalwork at same point.

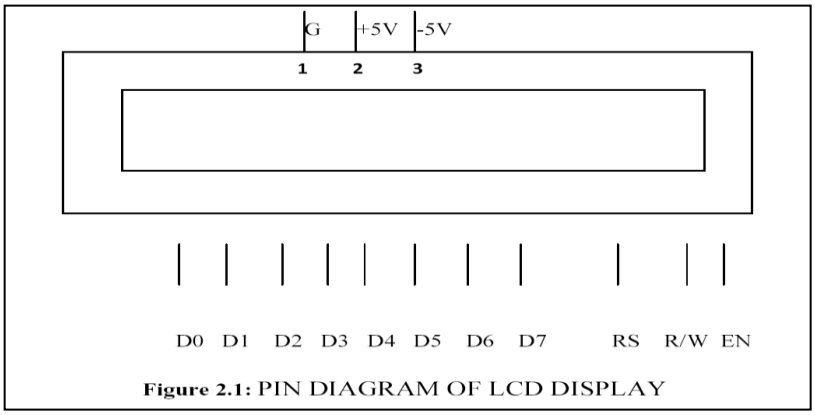


Figure 2.1: PIN DIAGRAM OF LCD DISPLAY

Pin descriptions

Vcc, Vss and Vee

While Vcc and Vss provide +5V and ground respectively, Vee is used for controlling LCD contrast.

RS, register select

```There are two very important registers inside the LCD. The RS pin is used for their selection as follows.

**a)** If RS=0, the instruction command code register is selected, allowing the user to send a command such as clear display, cursor at home, etc.,

**b)** If RS=1 the data register is selected, allowing the user to send data to be displayed on the LCD.

### R/W, read/write

R/W input allows the user to write information to the LCD or read information from it. R/W=1 when reading; R/W=0 when writing.

### EN, Enable

The enable pin is used by the LCD to latch information presented to its data pins. When data is supplied to data pins, a high-to-low pulse must be applied to this pin in order for the LCD to latch in the data present at the data pins. This pulse must be a minimum of 450ns wide.

### D0-D7

The 8-bit data pins, D0-D7, are used to send information to the LCD or read the contents of the LCD's internal registers. To display letters and numbers, we send ASCII codes for the letters A-Z, a-z, and numbers 0-9 to
```

these pins while making RS=1. We also use RS=0 to check the busy flag bit to see if the LCD is ready to receive information. The busy flag is D7 and can be read when R/W=1 and RS=0, as follows:

If R/W=1, RS=0. When D7=1 (busy flag=1), the LCD is busy taking care of internal operations and will not accept any information.

Basic Commands Of LCD

Set Cursor Move Direction:
04h – Shift cursor to the left
06h – Shift cursor to the right
80h – force cursor to the beginning of the first line
C0h – force cursor to the beginning of second line
02h – return home

Enable Display/Cursor:
0Ch - Turn Display On, cursor off
0ah - Turn Cursor On, Display off
08h - Cursor off, Display off
0eh/0fh- display on, cursor blinking

Shift Display:
18h – 1Ch - Display Shift to left, right respectively

Set Interface Length:
38h – Initialize LCD as 2 lines, 5*7 matrix

Reading Data back is used in this application, which requires data to be moved back and forth on the LCD. The "Busy Flag" is polled to determine whether the last instruction that has been sent has completed processing. Before we send commands or data to the LCD module, the Module must be initialized. For eight bit mode, this is done using the following series of operations:

- ★ Wait more than 15 ms after power is applied.
- ★ Write 0x030 to LCD and wait 5 ms for the instruction to complete
- ★ Write 0x030 to LCD and wait 160 µs for instruction to complete
- ★ Write 0x030 AGAIN to LCD and wait 160 µs or Poll the Busy Flag

- ★ Set the Operating Characteristics of the LCD
- ★ Write "Set Interface Length"
- ★ Write 0x010 to turn off the Display
- ★ Write 0x001 to Clear the Display
- ★ Write "Set Cursor Move Direction" Setting Cursor Behavior Bits
- ★ Write "Enable Display/Cursor" & enable Display and Optional Cursor.

4.6 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.

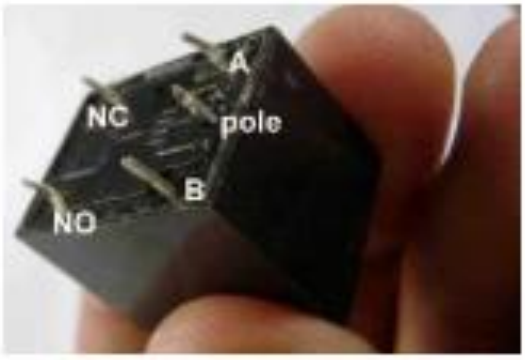


Figure 2.19 Electromagnetic or mechanical relay

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.

4.6.1 Functions of a Relay Switch

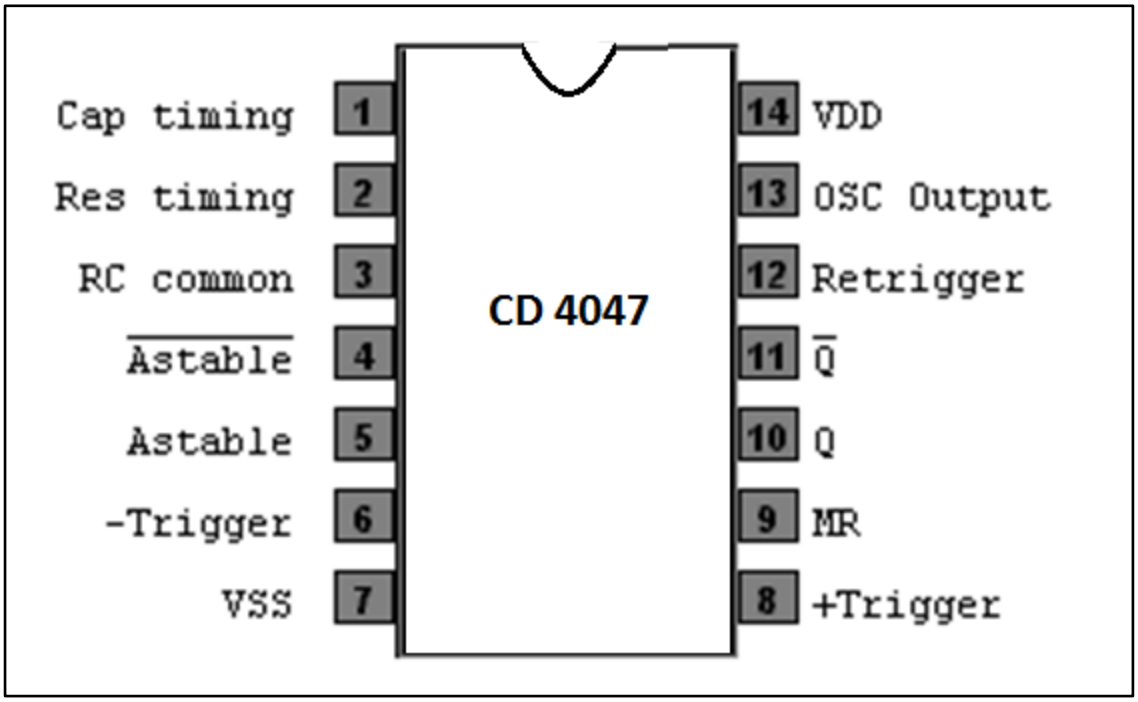
The primary functions of a relay are as follows:
a) Separating different load circuits for multi-pole relays.
b) Interfacing power circuits and electronic circuits.
c) It performs several switching functions e.g. delay, signal conditioning.
d) Separating DC circuits from AC circuits.

4.6.2 Applications of Relay

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

1. Computer interfaces.
2. Air conditioning and heating
3. Automotive electrics
4. Control of motors and solenoids
5. Electric power control
6. Production and test equipment
7. Lighting control

4.7 CD4047



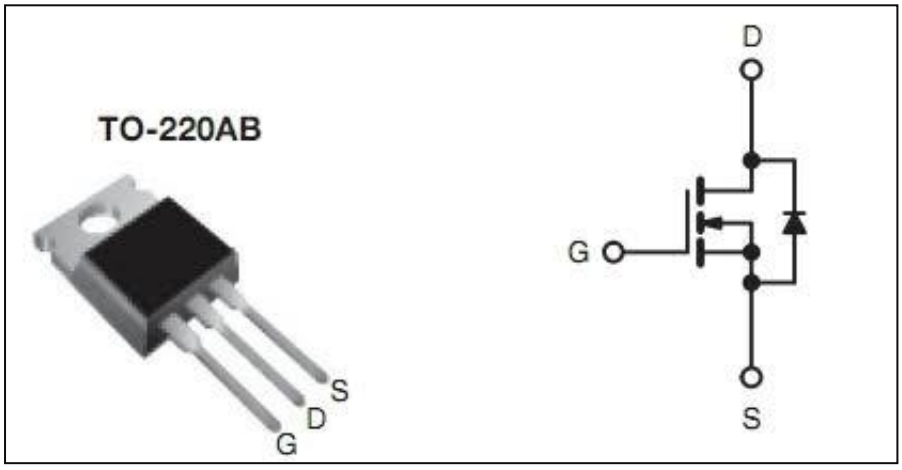
CD4047BMS consists of a getableastablemultivibrator with logic techniques incorporated to permit positive or negative edge triggeredmonostablemultivibrator action with retriggering and external countingoptions.Inputs include +TRIGGER, -TRIGGER, ASTABLE, ASTABLE,RETRIGGER, and EXTERNAL RESET. Buffered outputs are Q, Q,and OSCILLATOR. In all modes of operation, an external capacitormust be connected between C-Timing and RC-Common terminals, andan external resistor must be connected between the R-Timing and RC-Common terminals.

Astable operation is enabled by a high level on the ASTABLE input or alow level on the ASTABLE input, or both. The period of the square waveat the Q and Q Outputs in this mode of operation is a function of theexternal components employed. “True” input pulses on the ASTABLEinput or “Complement” pulses on the ASTABLE input allow the circuit tobe used as a getablemultivibrator. The OSCILLATOR output period willbe half of the Q terminal output in the astable mode. However, a 50%duty cycle is not guaranteed at this output.

The CD4047BMS triggers in the monostable mode when a positivegoing edge occurs on the +TRIGGER input while the -TRIGGER is heldlow. Input pulses may be of any duration relative to the output pulse.If retrigger capability is desired, the RETRIGGER input is pulsed. Theretriggerable mode of operation is limited to positive going edge. TheCD4047BMS will retrigger as long as the RETRIGGER input is high,with or without transitions. An external countdown option can be implemented by coupling “Q” toan external “N” counter and resetting the counter with trigger pulse. Thecounter output pulse is fed back to the ASTABLE input and has duration equal to N times the period of the multivibrator.

A high level on the EXTERNAL RESET input assures no output pulseduring an “ON” power condition. This input can also be activated to terminate the output pulse at any time. For monostable operation, whenever VDD is applied, an internal power on reset circuit will clock the Qoutput low within one output period (tM).

4.8 IRFZ44



Advanced HEXFET® Power MOSFETs from International Rectifier utilize advanced processing techniques to achieve extremely low on-resistance per silicon area. This benefit combined with the fast switching speed and ruggedized device design that HEXFET power MOSFETs are well known for, provides the designer with an extremely efficient and reliable device for use in a wide variety of applications. The TO-220 package is universally preferred for all commercial-industrial applications at power dissipation levels to approximately 50 watts. The low thermal resistance and low package cost of the TO-220 contribute to its wide acceptance throughout the industry.

4.8.1 Features:

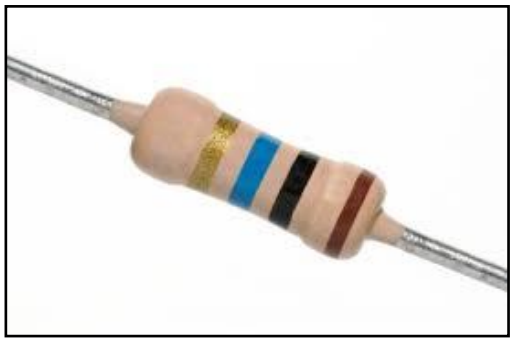
- ★ Advanced Process Technology
- ★ Ultra Low On-Resistance
- ★ Dynamic dv/dt Rating
- ★ 175°C Operating Temperature
- ★ Fast Switching
- ★ Fully Avalanche Rated

4.9 Resistor:

A resistor is a passive two-terminal electrical component that implements resistance as a circuit element. Resistors act to reduce current flow, and, at the same time, act to lower voltage levels within circuits. In electronic circuits resistors are used to limit current flow, to adjust signal levels, bias active elements, terminate transmission lines among other uses. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for generators. Resistors can have fixed resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity.

Resistors are common elements of electrical networks and elec-tronic circuits and are ubiquitous in electronic equipment. Practical resistors as discrete components can be composed of various compounds and forms. Resistors are also implementedwithin integrated circuits.

The electrical function of a resistor is specified by its resistance: common commercial resistors are manufactured over a range of more than nine orders of magnitude. The nominal value of the resistance will fall within a manufacturing tolerance.



4.9.1 Resistors are of two types

Fixed Resistor:

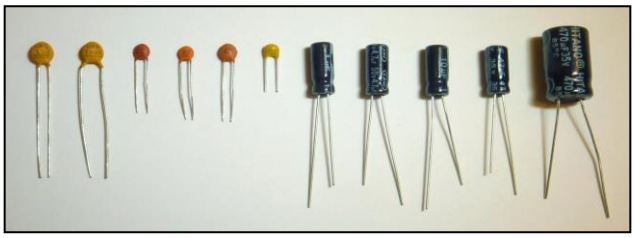
- ★ Having a fixed value of resistance

Variable Resistor:

- ★ Whose value of resistance can be changed for example if we have a resistor of 5K then the value of resistance will vary from 0 to 5KΩ.
- ★ Value of resistance can be calculated with the help of multimeter or with the colour code that is visible on the resistor.

4.10 Capacitor:-

A capacitor (originally known as a condenser) is a passi-ve two-terminal electrical component used to store energy electro statically in an electric field. The forms of practical capacitors vary widely, but all contain at least two electrical conductors (plates) separated by a dielectric (i.e. insulator). The conductors can be thin films, foils or sintered beads of metal or conductive electrolyte, etc. The "non-conducting" dielectric acts to increase the capacitor's charge capacity. A dielectric can be glass, ceramic, plastic film, air, vacuums, paper, mica, oxide layer etc. Capacitors are widely used as parts of electrical circuits in many common electrical devices. Unlike a resistor, an ideal capacitor does not dissipate energy. Instead, a capacitor stores energy in the form of an electrostatic between its plates.



A capacitor (formerly known as a condenser and prior to that known as a permittor) is a passive two-terminal electrical compo-nent that stores electric energy in an electric field. The forms, styles, and materials of practical capacitors vary widely, but all contain at least two electrical conductors (called "plates") separated by an insulating layer (called the dielectric). Capacitors are widely used as parts of electrical circuits in many common electrical devices.

Capacitors, together with resistors, inductors, and memristors, belong to the group of "passive components" used in electronic equipment. Although, in absolute figures, the most common capacitors are integrated capacitors (e.g. in DRAMs or flash memory structures), this article is concentrated on the various styles of capacitors as discrete components.

Small capacitors are used in electronic devices to couple signals between stages of amplifiers, as components of electric filters and tuned circuits, or as parts of power supply systems to smooth rectified current. Larger capacitors are used for energy storage in such applications as strobe lights, as parts of some types of electric motors, or for power factor correction in AC power distribution systems. Standard capacitors have a fixed value of capacitance, but adjustable capacitors are frequently used in tuned circuits. Different types are used depending on required capacitance, working voltage, current handling capacity, and other properties.

CHAPTER 5: SOLAR PANELS AND POWER

Solar power and solar panels are getting a lot of attention as part of the solution to our energy crisis. Solar energy, also called photovoltaic energy, is undergoing rapid changes thanks to massive investment in research and development. This article will discuss the basic makeup of photovoltaic in hopefully easy-to-understand terms.

Solar Cells

A solar panel is made of several photovoltaic cells. The cells are very thin, about 1/100th of an inch thick and usually 3 to 4 inches square. These cells convert sunlight to energy by the photovoltaic effect (we will discuss this effect in detail in a later article). These cells do not require fuel and have a standard lifetime of 20-30 years.

Solar Panels & Modules

Photovoltaic (PV) cells are assembled together to create a solar module. The module is what you are used to seeing as a panel. It has anywhere from 2 to 200 cells assembled together, encased in tempered glass and aluminum to make them weather resistant.

Tying Them Together

Like batteries, cells can be combined in series or in parallel to create larger and more specific voltages and amperages. For instance, four 1-volt/1-amp cells in series will combine for 4 volts, but the amperage will stay at 1 amp. By contrast, four 1-volt/1-amp cells in parallel will maintain 1 volt but have 4 amps of output. You can multiply the amperage by the wattage (in the example above 4 x 1) to get the watts generated. A watt is a measure of energy (think of a 40-watt light bulb).

Sizes and Shapes

Modules can be made in a many sizes and shapes to fit their application. Panels come in standard rectangular, triangular, foldable, and even thin-film rolls. This means they can be used in a wide variety of applications, from boats and rv's to electric cars and space stations.

The Solar Array

Modules are combined to create solar arrays. An array is a group of modules assembled together and designed to meet a certain electrical load. You've probably seen most arrays mounted on the rooftops of homes. These arrays are designed to generate a certain amount of electricity over the course of a year.

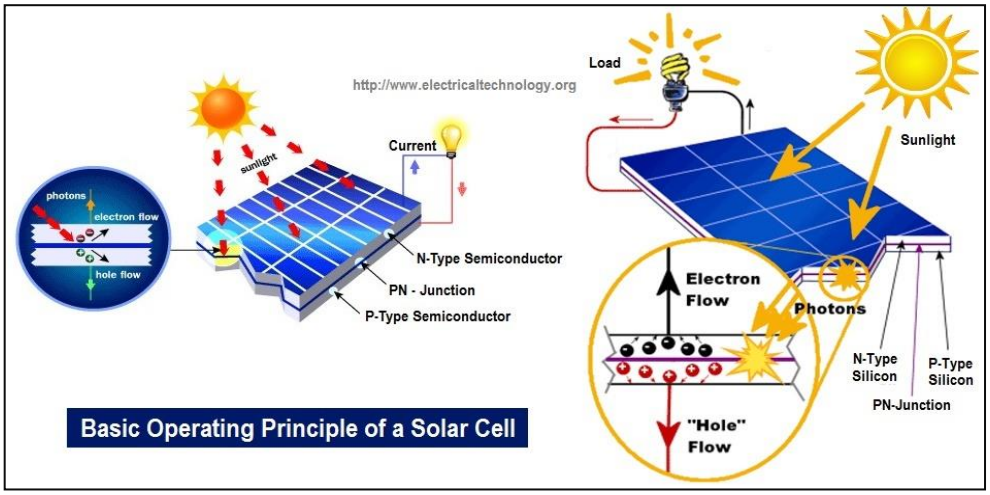
Efficiencies

Generally solar modules convert about 10-15% of the energy that strikes them into electricity. This means that for every 100 units of energy that actually hit the panel, only 15 of them actually enter the home as electricity. This is the biggest area of research now, as scientists recognize that significant advancements in solar efficiency will lead to cheaper solar energy.

AC vs DC

Panels generate direct current (DC) electricity. Think of a garden hose that is simply turned on produces water in a steady stream. Most household electronics and the electrical power grid are designed to take alternating current (AC) power. Now imagine that the water of coming out of the garden hose is being turned off and on so quickly that it has a "pulse". This is done because AC power travels over long distances much more efficiently.

This means however, that the electricity coming out of the solar array must be converted to AC if it is going into your home. This is done with an inverter, which takes the DC power and makes AC power. The power is then ready to service your home, an electrical grid, or a device. Some devices (certain lights, batteries, special devices) use DC power and therefore do not need an inverter.



CHAPTER 6: ANALYSIS

6.1 Standards, Requirements and Regulations

Any electric fence set up in Kenya is required to meet standards and follow the regulations set by the Kenya Bureau of Standards. These fencing requirements are intended to ensure safe and effective operation of the fences. Deviation from these requirements often leads to a less efficient fence with a shorter lifespan and increased possibility of interference with communication systems. These factors often in turn lead to additional maintenance costs for the fence owner.

6.1.1 Installation Requirements

Electric security fences and their auxiliary equipment should be installed, operated and maintained in such a way that the risk of people accidentally receiving an electric shock and interference with communications lines or devices is minimized.

Use of materials that minimize the galvanic effect between dissimilar metals is recommended. When an electric fence is installed along a public road or in an urban area, the installer is required to install the electrified wires or articles in such a position that people cannot inadvertently come in contact with them. Electric fences should be installed clear of any obstructions like vegetation and telephone

6.1.2 Safety Requirements and Regulations

Little is known about the physiological effect of electric shock pulses on animals. Safety requirements depend on the type of property being protected and the dangers faced.

- Electric fence constructions which are likely to lead to entanglement of animals or persons should be avoided.
- An electric fence should not be supplied from more than one controller or from independent circuits of the same controller at one time since when the pulses are too close together, they may be hazardous to animals, people and the fence controllers.

CHAPTER 7: SOURCE CODE

```
#include <LiquidCrystal.h>
LiquidCrystal lcd(3, 4, 5, 6, 7, 8);
void setup() {
  lcd.begin(16, 2);
  lcd.print("   Solar Based  ");
  lcd.setCursor(0, 1);
  lcd.print(" Elect. Fencing ");
  pinMode(9, OUTPUT);
  pinMode(2, OUTPUT);
}
void loop() {
  int ADCvalue = analogRead(A4);
  int ADCvalue1 = analogRead(A5);
  float voltage = ADCvalue * (12.0 / 1023.0);
  float voltage1 = ADCvalue1 * (24.0 / 1023.0);
  lcd.clear();
  lcd.setCursor(0, 0);
  lcd.print("BAT Volt: ");
  lcd.print(voltage);
  lcd.print("V");
  lcd.setCursor(0, 1);
  lcd.print("Solar Volt: ");
  lcd.print(voltage1);
  lcd.print("V");
  digitalWrite(9, LOW);
  digitalWrite(2, HIGH);
  delay(1000);
  digitalWrite(9, HIGH);
  digitalWrite(2, LOW);
  delay(1000);
}
```

CHAPTER 8 : HARDWARE BILLING

Sr. No.	Component Name	Quantity	Cost
1	Solar panel	1	1150Rs
2	Battery	1	1000Rs
3	Microcontroller	1	300Rs
4	CD4047IC	1	150Rs
5	Transformer	1	500Rs
6	LCD Display 16x2	1	250Rs
7	Relay	1	25Rs
8	IRFZ44	1	80Rs
9	Buzzer	1	10Rs
10	Resistor	6	20Rs
11	Capacitor	4	35Rs
12	Diode	2	10Rs
13	PCB	1	100RS

CHAPTER 9 : APPLICATION AND ADVANTAGES

ADVANTAGES

- ★ Solar energy has always helped in educing global warming and greenhouse effect.

- ★ Also use of solar energy helps in saving money many people have started using solar based devices
- ★ A solar inverter helps in converting the Direct current into batteries or alternative current. This helps people who use limited amount of electricity.

CONCLUSION

- ★ Due to sun power there is no need to charge invertors battery from other power supply.
- ★ Except bulkiness it is portable so can be easily movable.

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