"IMPLEMENTATION OF SOLAR PANEL BASED DAY AND NIGHT BATTERY CHARGER"

PROJECT REPORT

Submitted by

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in partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

IN

ELECTRONICS AND COMMUNICATION

ENGINEERING

KUMARAGURU COLLEGE OF TECHNOLOGY

COIMBATORE - 641 049

(An Autonomous Institution Affiliated to Anna University,

Chennai)

APRIL 2017

KUMARAGURU COLLEGE OF TECHNOLOGY

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BONAFIDE CERTIFICATE

Certified that this project report titled **"IMPLEMENTATION OF SOLAR PANEL BASED DAY AND BATTERY CHARGER"** is the bonafide work of **"DEEPIKA.U, DHIVYA PRABHA.M, DIVYA.R, GEETHA.S"** who carried out the project work under my supervision.

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ACKNOWLEDGEMENT

ABSTRACT

The increasing power demand and low power generation initiates ideas to generate power in various ways. One most used method for power generation is by using solar panels during day time. But this doesn't provide solution for power generation at night. It provides the solution for power loss during day and night. The power generation during daytime is done using solar panel and during night the power is generated using IR and pyro electric sensor. This project will give a comparative study on power generation by both the sensors. It will focus on factors such as efficiency, driving capacity and stability.

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LIST OF ABBREVATIONS

CSP	Concentrating Solar Power
PV	Photo Voltaic
LED	Light Emitting Diode
LDR	Light Dependent Resistor
LCD	Liquid Crystal Display
DC	Direct Current
EMF	Electro Motive Force
CMOS	Complementry Metal Oxide Semiconductor
PIC	Peripheral Interface Controller
IR	Infra-Red
PCB	Printed Circuit Board
ADC	Analog to Digital Converter

CHAPTER 1

INTRODUCTION

The objective of this project is to control solar panel cover OPEN/CLOSE depending upon the sun light. Nowadays power demand has increased due to this power failure happens many time. This project is designed to provide the solution for this power loss day and night. This project is designed with LDR, amplifier, ADC, Infrared, microcontroller, driver circuit along with motor and limit switches.

Solar panel consists of number of silicon cells, when sun light falls on this panel it generates the voltage signals then these voltage signals are given to changing circuit. Depending on the panel board size the generated voltage amount is increased. Naturally suns direction varies per hour. Infrared circuit is used to produce energy when night mode activated.

Solar energy is the light and radiant heat from the Sun that influences Earth's climate and weather and sustains life. Solar power is sometimes used as a synonym for solar energy or more specifically to refer to electricity generated from solar radiation. Since ancient times, solar energy has been harnessed for human use through a range of technologies. Solar radiation along with secondary solar resources such as wind and wave power, hydroelectricity and biomass account for most of the available flow of renewable energy on Earth.

Solar energy technologies can provide electrical generation by heat engine or photovoltaic means, space heating and cooling in active and passive solar buildings; potable water via distillation and disinfection, day lighting, hot water, thermal energy for cooking, and high temperature process heat for industrial purposes.

Sunlight can be converted into electricity using photovoltaic (PV), concentrating solar power (CSP), and various experimental technologies. PV has mainly been used to power small and medium-sized applications, from the calculator powered by a single solar cell to off-grid homes powered by a photovoltaic array.

The term "photovoltaic" comes from the Greek (*phos*) meaning "light", and "voltaic", meaning electrical, from the name of the Italian physicist Volta, after whom a unit of electrical potential, the volt, is named.

A solar cell, or photovoltaic cell (PV), is a device that converts light into direct current using the photoelectric effect. The first solar cell was constructed by Charles Fritts in the 1880s. Although the prototype selenium cells converted less than 1% of incident light into electricity, both Ernst Werner von Siemens and James Clerk Maxwell recognized the importance of this discovery.

CHAPTER 2

HARDWARE DESCRIPTION

2.1.BLOCK DIAGRAM:
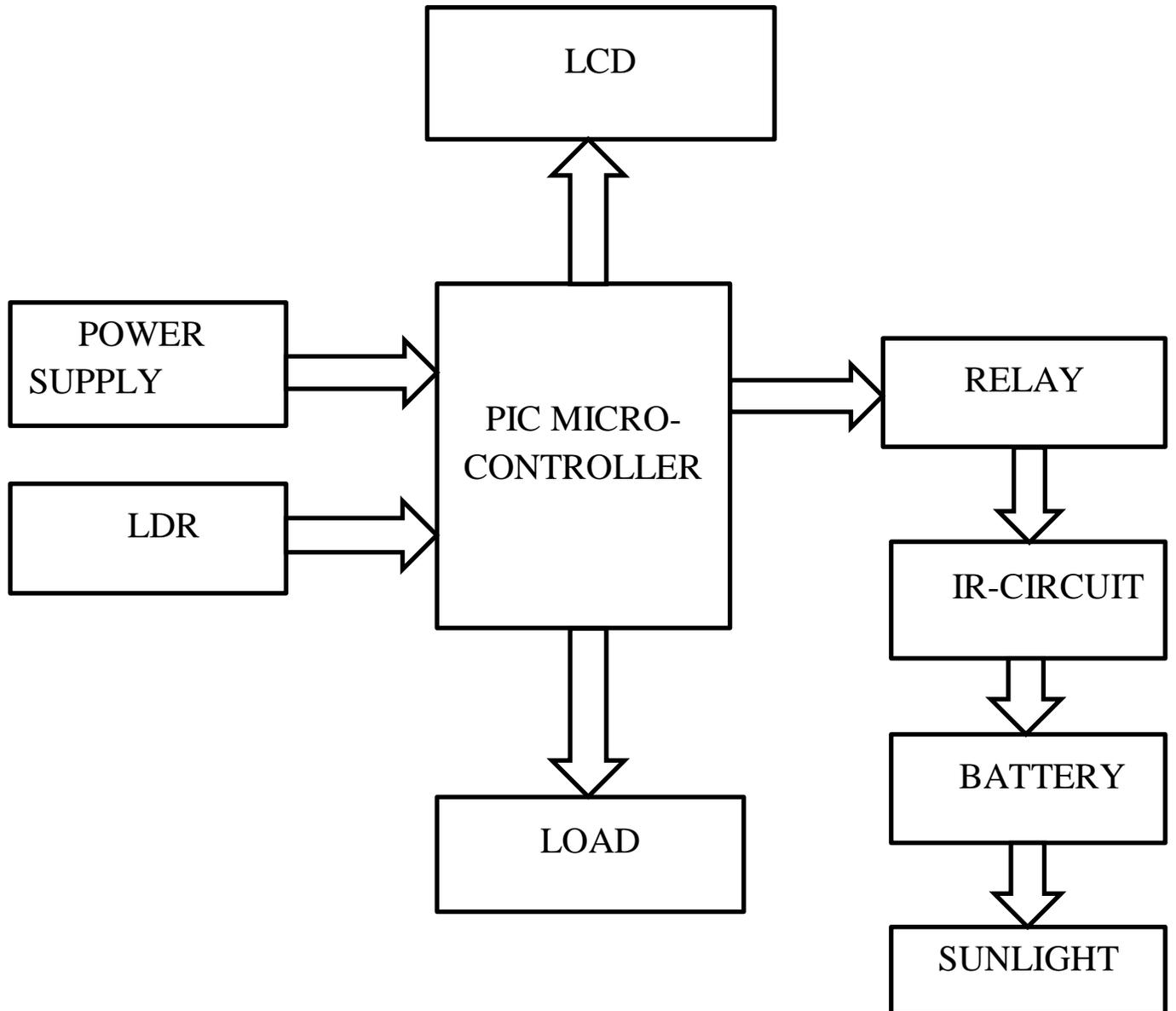
Fig 2.1.Block Diagram

2.2 CIRCUIT DIAGRAM
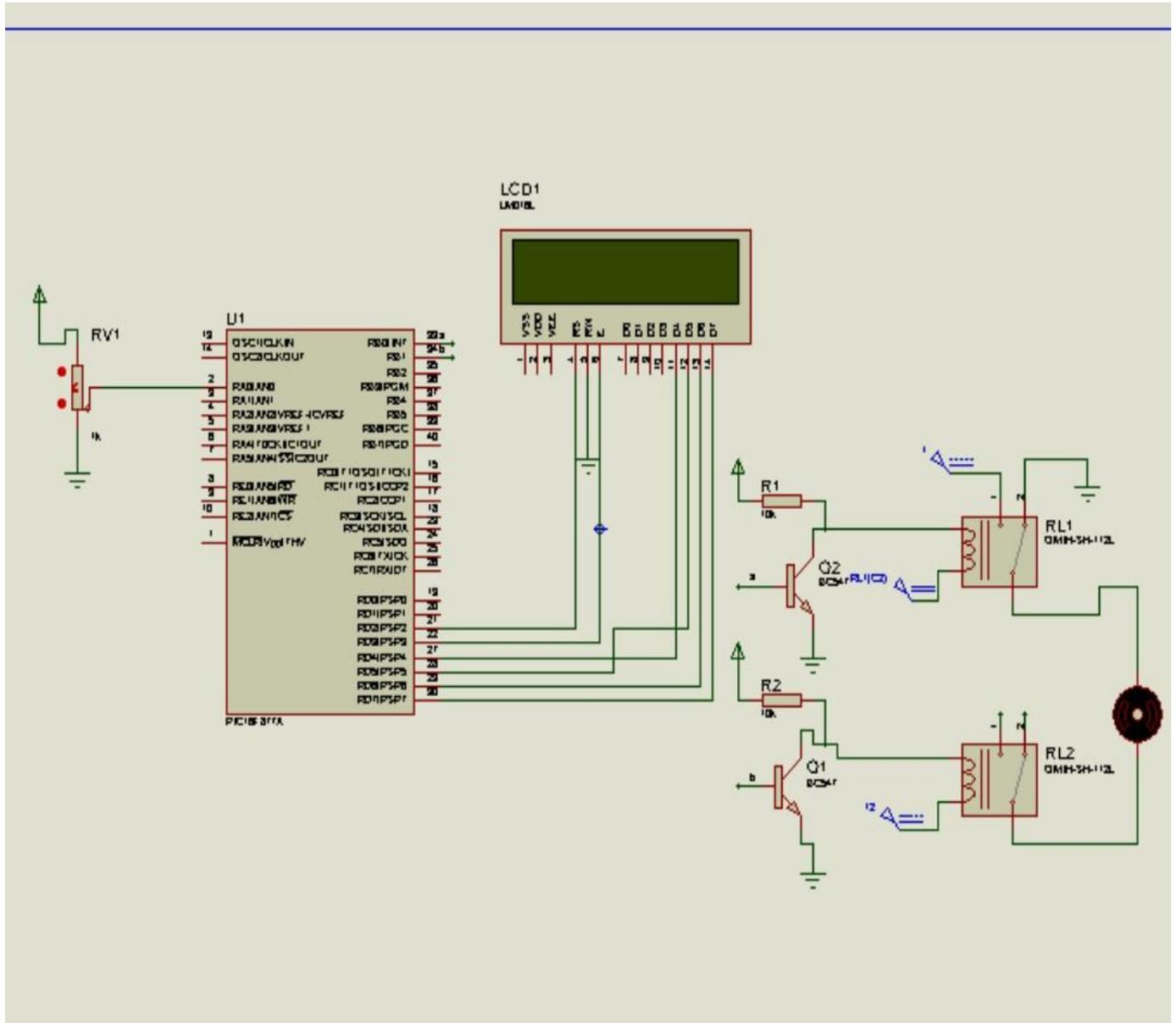
Fig2.2 Circuit Diagram

This advance innovative of solar based battery charging project is used for without main power doing with advance innovative method. Micro controller is used to control the overall unit in the project. LDR is designed with divider circuit and connected to the controller .The controller monitor the lighting source from the LDR and Activating power saving mode operation depending upon the output of LDR circuit. The Relay is used to switch battery saving mode operation .when LDR is go low the controller switch the relay and power receive from IR(infrared) to battery unit and also when LDR outputs goes high power is automatically received from direct sun light.

In home appliances purpose have connected the dc to ac converter board for light and other power sources. LCD(liquid crystal display)is display the current processes and also we can see the which source from battery will charging.

2.3 LIST OF COMPONENTS:

- Battery
- Power supply
- PIC Microcontroller
- DC Motor
- Relay
- IR grid
- Solar Panel
- LCD Display
- LDR Sensor

2.3.1 BATTERY

The battery is use to run the embedded modules without any need AC voltages. A battery produces direct current (DC) electricity .This is the 12v battery of rechargeable method. we can use continuously to use of any load and save energy from the solar panel. Battery is a device used to store the energy charged and discharged.12v DC battery with 1.3mA is used to store the charge and in addition to an another DC battery of 12v with 1.7mA is used to store the discharged energy

Fig 2.3.1 Battery

Batteries convert chemical energy directly to electrical energy. A battery consists of some number of voltaic cells. Each cell consists of two half-cells connected in series by a conductive electrolyte containing anions and cations. One half-cell includes electrolyte and the negative electrode, the electrode to which anions (negatively charged ions) migrate; the other half-cell includes electrolyte and the positive electrode to which cations (positively charged ions) migrate. Redox reactions power the battery. Cations are reduced (electrons are added) at the cathode during charging, while anions are oxidized (electrons are

removed) at the anode during charging. During discharge, the process is reversed. The electrodes do not touch each other, but are electrically connected by the electrolyte. Some cells use different electrolytes for each half-cell. A separator allows ions to flow between half-cells, but prevents mixing of the electrolytes.

Each half-cell has an electromotive force (or emf), determined by its ability to drive electric current from the interior to the exterior of the cell. The net emf of the cell is the difference between the emfs of its half-cells. Thus, if the electrodes have emfs and then the net emf is ; in other words, the net emf is the difference between the reduction potentials of the half-reactions.

The electrical driving force or across the terminals of a cell is known as the *terminal voltage (difference)* and is measured in volts. The terminal voltage of a cell that is neither charging nor discharging is called the open-circuit voltage and equals the emf of the cell. Because of internal resistance, the terminal voltage of a cell that is discharging is smaller in magnitude than the open-circuit voltage and the terminal voltage of a cell that is charging exceeds the open-circuit voltage. An ideal cell has negligible internal resistance, so it would maintain a constant terminal voltage of until exhausted, then dropping to zero. If such a cell maintained 1.5 volts and stored a charge of one coulomb then on complete discharge it would perform 1.5 joules of work. In actual cells, the internal resistance increases under discharge and the open circuit voltage also decreases under discharge. If the voltage and resistance are plotted against time, the resulting graphs typically are a curve; the shape of the curve varies according to the chemistry and internal arrangement employed.

The voltage developed across a cell's terminals depends on the energy release of the chemical reactions of its electrodes and electrolyte. Alkaline and zinc–carbon cells have different chemistries, but approximately the same emf of 1.5

volts; likewise NiCd and NiMH cells have different chemistries, but approximately the same emf of 1.2 volts. The high electrochemical potential changes in the reactions of lithium compounds give lithium cells emfs of 3 volts or more.

2.3.2. PIC MICROCONTROLLER

Microcontroller is heart of the system. It has number of features and its controlled over all process .we can write code and load the controller for control real time application processes. The microcontroller that has been used for this project is from PIC series. PIC microcontroller is the first RISC based microcontroller fabricated in CMOS (complementary metal oxide semiconductor) that uses separate bus for instruction and data allowing simultaneous access of program and data memory.

The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a small pin count. The main advantage of CMOS is that it has immunity to noise than other fabrication techniques.

Various microcontrollers offer different kinds of memories. EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. Technology that is used in pic16F877 is flash technology, so that data is retained even when the power is switched off. Easy Programming and Erasing are other features of PIC 16F877.

SPECIAL FEATURES OF PIC MICROCONTROLLER:

CORE FEATURES:

- High-performance RISC CPU
- Only 35 single word instructions to learn
- All single cycle instructions except for program branches which are two cycle
- Operating speed: DC - 20 MHz clock input DC - 200 ns instruction cycle
- Up to 8K x 14 words of Flash Program Memory, Up to 368 x 8 bytes of Data Memory (RAM),Up to 256 x 8 bytes of EEPROM data memory
- Pin out compatible to the PIC16C73/74/76/77
- Interrupt capability (up to 14 internal/external
- Eight level deep hardware stack
- Direct, indirect, and relative addressing modes
- Power-on Reset (POR)
- Power-up Timer (PWRT) and Oscillator Start-up Timer (OST)
- Watchdog Timer (WDT) with its own on-chip RC Oscillator for reliable operation
- Programmable code-protection
- Power saving SLEEP mode
- Selectable oscillator options
- Low-power, high-speed CMOS EPROM/EEPROM technology
- Fully static design
- In-Circuit Serial Programming (ICSP) via two pins
- Only single 5V source needed for programming capability
- In-Circuit Debugging via two pins
- Processor read/write access to program memory

- Wide operating voltage range: 2.5V to 5.5V

- High Sink/Source Current: 25 mA

- Commercial and Industrial temperature ranges

- Low-power consumption:

  2mA typical @ 5V, 4 MHz

  20mA typical @ 3V, 32 kHz

  1mA typical standby current

PERIPHERAL FEATURES:

- Timer0: 8-bit timer/counter with 8-bit prescaler
- Timer1: 16-bit timer/counter with prescaler, can be incremented during sleep
- via external crystal/clock
- Timer2: 8-bit timer/counter with 8-bit period register, presale and postscaler
- Two Capture, Compare, PWM modules
- Capture is 16-bit, max resolution is 12.5 ns,
- PWM max. resolution is 10-bit
- 10-bit multi-channel Analog-to-Digital converter
- Synchronous Serial Port (SSP) with SPI. (Master Mode) and I2C. (Master/Slave)
- Universal Synchronous Asynchronous Receiver Transmitter (USART/SCI) with
- 9- bit address detection.
- Brown-out detection circuitry for Brown-out Reset (BOR)
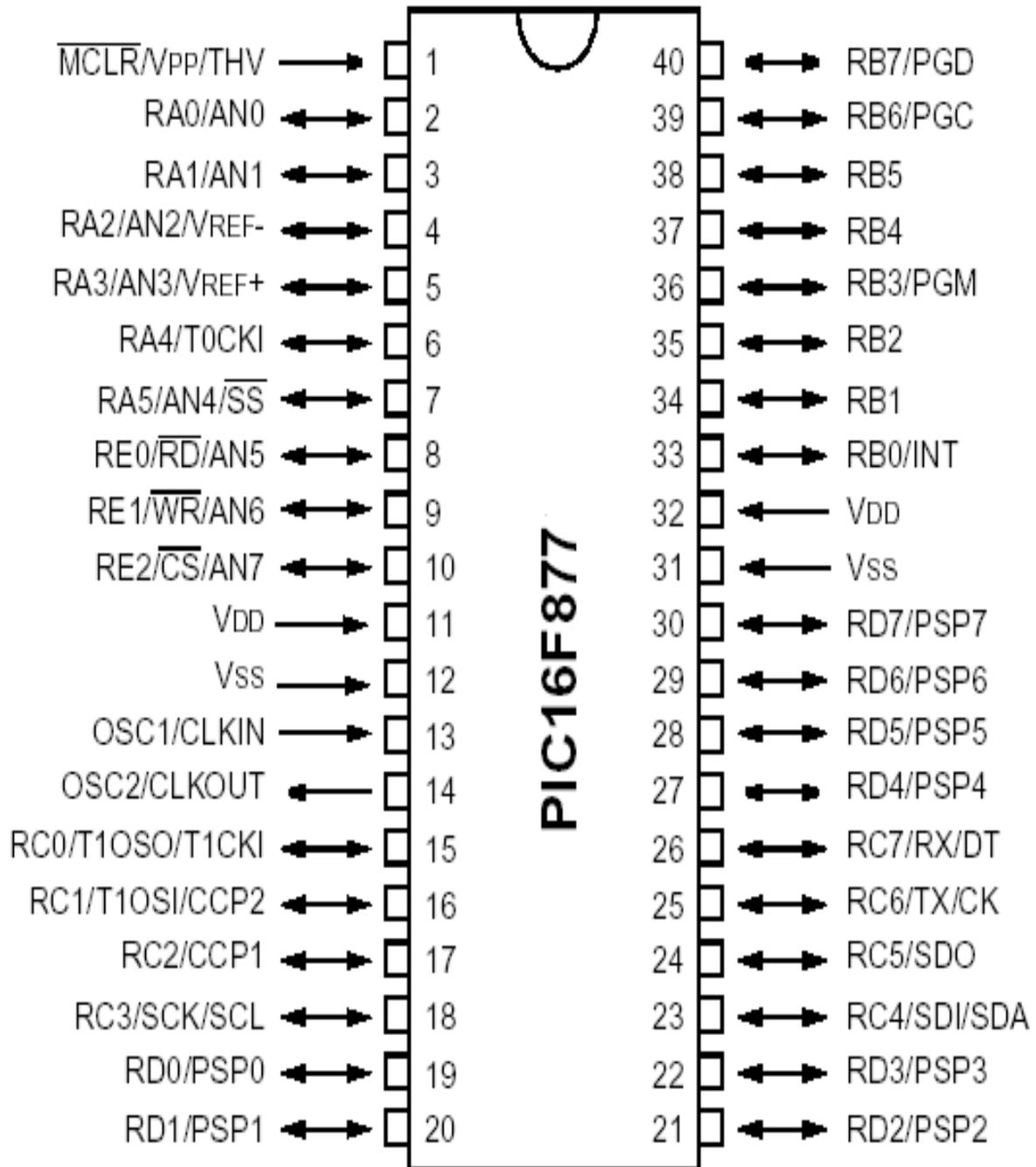
Fig 2.3.2 Pic microcontroller pin diagram

2.3.3. DC MOTOR

A DC Motor is an rotating electrical machine that converts direct current electrical energy into mechanical energy. he principle of working of a DC motor is that "whenever a current carrying conductor is placed in a magnetic field, it experiences a mechanical force". The most common types of rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic; to periodically change the direction of current flow in part of the motor. A DC motor speed can be controlled over a wide range using either a variable supply voltage or by changing the strength of current in its field windings. The stator is a permanent magnet and provides a constant magnetic field. The armature, which is the rotating part, is a simple coil. The armature is connected to a DC power source through a pair of commutator rings .DC Motor is used over AC motor because D.C wound field motors are constructed with brushes and a commutator, which add to the maintenance, limit the speed and usually reduce the life expectancy of brushed D.C. motors. A.C. induction motors do not use brushes; they are very rugged and have long life expectancies. The final basic difference is speed control .It is mainly used in the industrial applications.
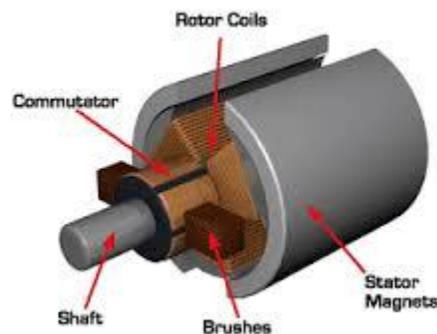
Fig 2.3.3 Dc motor

2.3.4 RELAY

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid state relays. Relays are used where it is necessary to control a circuit by a separate low –power signal or several circuits must be controlled by one signal.
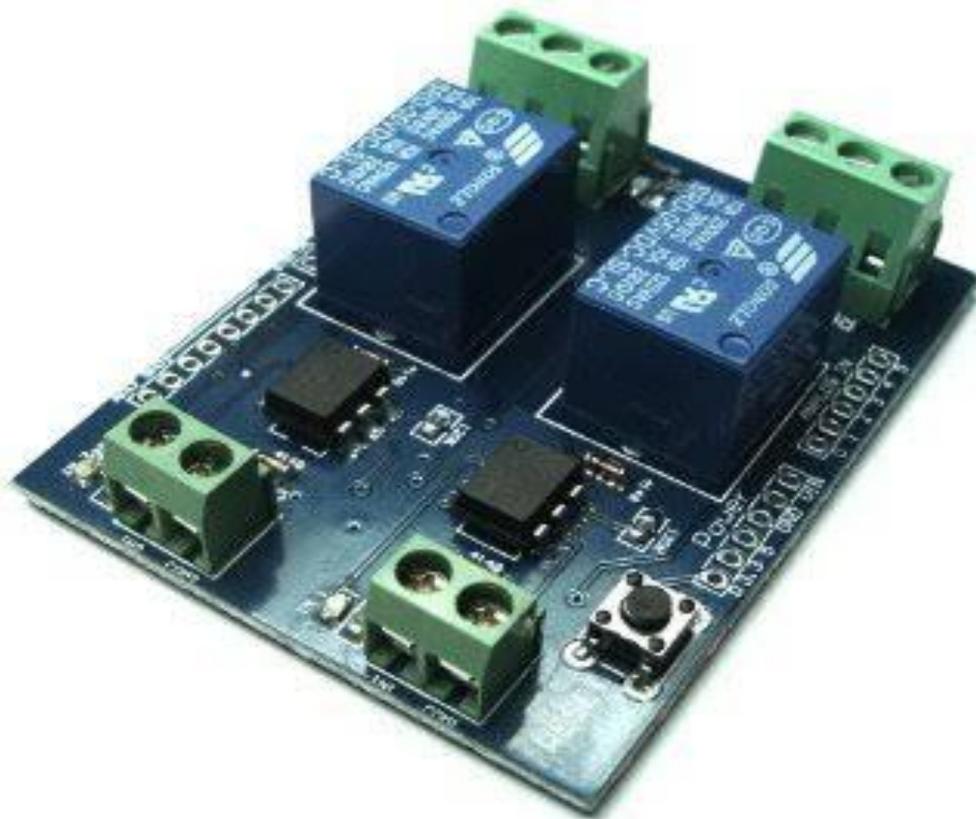
Fig 2.3.4 Relay

Relays are mainly used to open and close circuits electromechanically or electronically. Relays control one electrical circuit by opening and closing contacts in another circuit.

This circuit is designed to control the load. The load may be motor or any other load. The load is turned ON and OFF through relay. The relay ON and OFF is controlled by the pair of switching transistors (BC 547).

The relay is connected in the Q2 transistor collector terminal. A Relay is nothing but electromagnetic switching device which consists of three pins. They are Common, Normally close (NC) and normally open (NO). (NC) and normally open (NO).
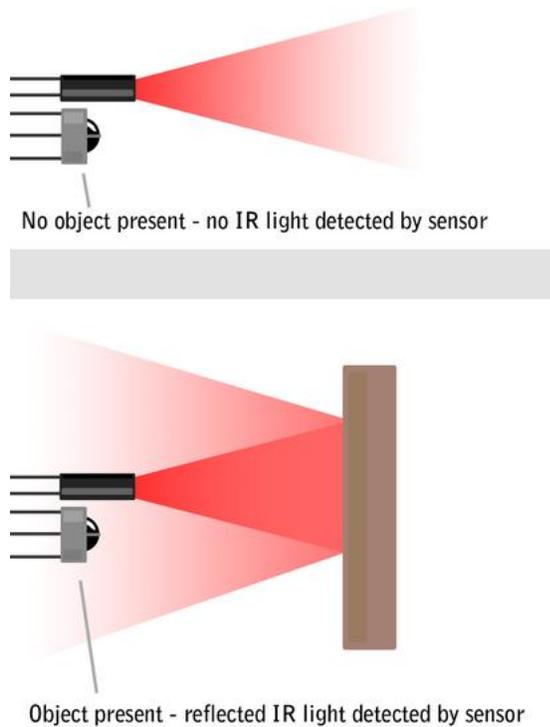
2.3.5 INFRARED SENSOR

IR sensor is an electronic device that emits in order to sense some aspects of ten surroundings. Infrared transmitter is one type of LED which emits infrared rays generally called as IR Transmitter. The transmitted signal is given to IR transmitter whenever the signal is high, the IR transmitter LED is conducting it passes the IR rays and rays are converted to electrical energy.

IR Sensors work by using a specific light sensor to detect a select light wavelength in the Infra-Red (IR) spectrum. By using an LED which produces light at the same wavelength as what the sensor is looking for, you can look at the intensity of the received light. When an object is close to the sensor, the light from the LED bounces off the object and into the light sensor. This results in a large jump in the intensity, which we already know can be detected using a threshold.

Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiation are invisible to our eyes, that can be detected by an infrared sensor. The emitter is simply an IR LED and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as the emitted by the IR LED.

We have already discussed how a light sensor works. IR Sensors work by using a specific light sensor to detect a select light wavelength in the Infra-Red (IR) spectrum. By using an LED which produces light at the same wavelength as what

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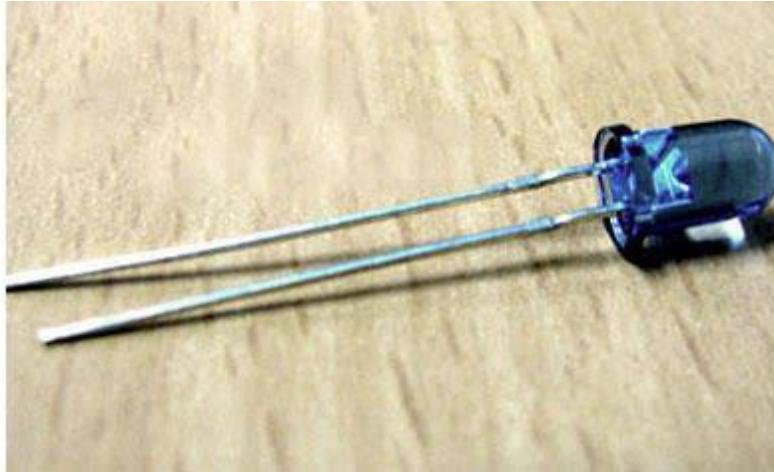
No object present - no IR light detected by sensor

Object present - reflected IR light detected by sensor

Fig 2.3.5.a) IR detection

Fig 2.3.5.b) IR Sensor

2.3.6 SOLAR PANEL

Solar Panel is a panel designed to absorb the sun's rays as a source of energy for generating electricity or heating. A solar cell, or photovoltaic cell (PV), is a device that converts light into direct current using the photoelectric effect. The first solar cell was constructed by Charles Fritts in the 1880s. Although the prototype selenium cells converted less than 1% of incident light into electricity, both Ernst Werner von Siemens and James Clerk Maxwell recognized the importance of this discovery.

The term "photovoltaic" comes from the Greek (*phos*) meaning "light", and "voltaic", meaning electrical, from the name of the Italian physicist Volta, after a unit of electrical potential, the volt, is named.

Solar power is the conversion of sunlight into electricity, either directly using photovoltaic (PV), or indirectly using concentrated solar power. Concentrated solar power systems use lenses or mirrors and tracking systems to focus a large area of sunlight into a small beam.

A Photovoltaic module of a packaged, connected assembly of typically 6*10 photovoltaic solar cells .PV module constitutes the Photovoltaic array of a photovoltaic system that generates and supplies solar electricity .Each module is rated by its DC output power under standard test conditions and typically ranges from 100 to 365 watts. The most common application of solar panels is solar water heating systems.

Fig 2.3.6 Solar panel

2.3.7 LCD DISPLAY

LCD is liquid crystal display for display the current status of the details. LCD displays are one of the most sophisticated display devices used . Once interfacing it, it will be the easiest and very reliable output device used . More, LCD displays can be used to test the outputs.

LCD accepts two types of signals, one is data, and another is control. These signals are recognized by the LCD module from status of the RS pin. Now data can be read also from the LCD display, by pulling the R/W pin high. As soon as the E pin

is pulsed, LCD display reads data at the falling edge of the pulse and executes it, same for the case of transmission.

LCD display takes a time of 39-43μS to place a character or execute a command. Except for clearing display and to seek cursor to home position it takes 1.53ms to 1.64ms. Any attempt to send any data before this interval may lead to failure to read data or execution of the current data in some devices. Some devices compensate the speed by storing the incoming data to some temporary registers.

Most of the LCD Displays available in the market are 16X2 (That means, the LCD displays are capable of displaying 2 lines each having 16 Characters a), 20X4 LCD Displays (4 lines, 20 characters). It has 14 pins. It uses 8lines for parallel data plus 3 control signals, 2 connections to power, one more for contrast adjustment and two connections for LED back light.

Pin Number	Symbol	Function
1	Vss	Ground Terminal
2	Vcc	Positive Supply
3	Vdd	Contrast adjustment
4	RS	Register Select; 0→Instruction Register, 1→Data Register
5	R/W	Read/write Signal; 1→Read, 0→ Write
6	E	Enable; Falling edge
7	DB0	Bi-directional data bus, data transfer is performed once, thru DB0 to DB7, in the case of interface data length is 8-bits; and twice, through DB4 to DB7 in the case of interface data length is 4-bits. Upper four bits first then
8	DB1	
9	DB2	
10	DB3	

| 11	DB4	lower four bits.
12	DB5	
13	DB6	
14	DB7	
15	LED-(K)	Back light LED cathode terminal
16	LED+(A)	Back Light LED anode terminal

Table 2.3.7 PIN Configuration

LCD displays have two RAMs, naming DDRAM and CGRAM. DDRAM registers in which position which character in the ASCII chart would be displayed. Each byte of DDRAM represents each unique position on the LCD display. The LCD controller reads the information from the DDRAM and displays it on the LCD screen. CGRAM allows user to define their custom characters. For that purpose, address space for first 16 ASCII characters are reserved for users. After CGRAM has been setup to display characters, user can easily display their custom characters on the LCD screen.

 DATA/SIGNALS/EXECUTION OF LCD:

Now that was all about the signals and the hardware. Let us come to data, signals and execution. LCD accepts two types of signals, one is data, and another is control. These signals are recognized by the LCD module from status of the RS pin. Now data can be read also from the LCD display, by pulling the R/W pin high. As soon as the E pin is pulsed, LCD display reads data at the falling edge of the pulse and executes it, same for the case of transmission.

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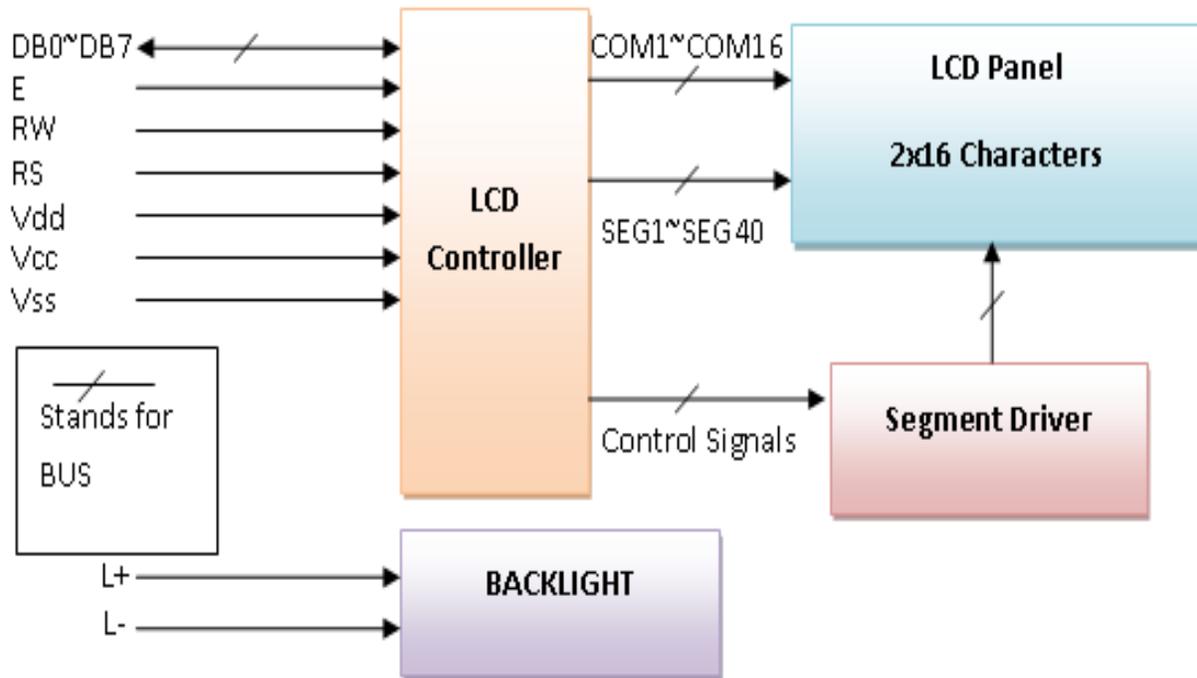
Fig 2.3.7 Block diagram of LCD Display

LCD Initialization

We are pretty familiar how to send data. But before displaying characters on the LCD display, it must be configured first. To configure an LCD display, four command words must be sent to LCD in either 4 bit mode, or in 8 bit mode. The commands are:

1. Function set

2. Display On/Off control

3. Entry mode set

4. Display Clear.

Displaying Custom Characters

All these character display modules got the feature to create 8 user defined characters (ASCII Codes 0…7) in addition to the ROM fixed codes.

1.) The command "CG RAM Address Set" defines the ASCII code (Bit 3, 4, 5) and the dot line (Bit 0, 1, 2) of the new character. Example demonstrates creating ASCII code "00H".

2.) Doing 8 times the write command "Data Write" defines line by line the new character. 8th byte stands for the cursor line.

3.) The new defined character can be used as a "normal" ASCII code (0…7); use with "DD RAM Address Set" and "Data Write".

2.3.8 LDR

A photoresistor or light-dependent resistor (LDR) or photocell is a light-controlled variable resistor. The resistance of a photoresistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photoresistor can be applied in light-sensitive detector circuits, and light- and dark-activated switching circuits

A photo resistor is made of a high resistance semiconductor. In the dark, a photoresistor can have a resistance as high as a few mega ohms (MΩ), while in the light, a photoresistor can have a resistance as low as a few hundred ohms. If incident light on a photoresistor exceeds a certain frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons (and their hole partners) conduct electricity, thereby lowering resistance. The resistance range and sensitivity of a photo resistor can substantially differ among dissimilar devices. Moreover, unique photo resistors may react substantially differently to photons within certain wavelength bands.

A photoelectric device can be either intrinsic or extrinsic. An intrinsic semiconductor has its own charge carriers and is not an efficient semiconductor, for example, silicon. In intrinsic devices the only available electrons are in the valence band, and hence the photon must have enough energy to excite the electron across the entire bandgap. Extrinsic devices have impurities, also called dopants, added whose ground state energy is closer to the conduction band; since the electrons do not have as far to jump, lower energy photons (that is, longer wavelengths and lower frequencies) are sufficient to trigger the device. If a sample of silicon has some of its atoms replaced by phosphorus atoms (impurities), there will be extra electrons available for conduction. This is an example of an extrinsic semiconductor.

Photoresistors are less light-sensitive devices than photodiodes or phototransistors: the two latter components are true semiconductor devices, while a photoresist or is a passive component and do not have a PN-junction. The photoresistivity of any photo resistor may vary widely depending on ambient temperature, making them unsuitable for applications requiring precise measurement of or sensitivity to light.

Photoresistors also exhibit a certain degree of latency between exposure to light and the subsequent decrease in resistance, usually around 10 milliseconds. The lag time when going from lit to dark environments is even greater, often as long as one second. This property makes them unsuitable for sensing rapidly flashing lights, but is sometimes used to smooth the response of audio signal compression.
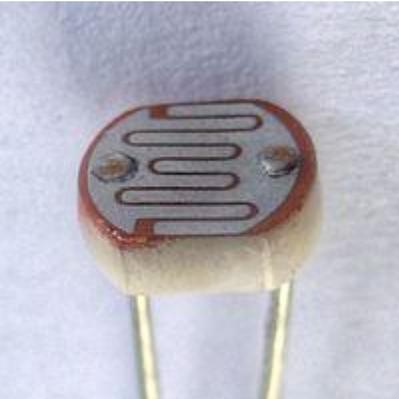
Fig 2.3.8.a) LDR diagram

Symbol for photo resistor
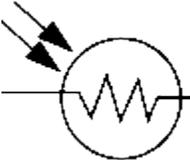
Fig 2.3.8.b) Photo resistor diagram

The internal components of a photoelectric control for a typical American streetlight. The photoresistor is facing rightwards, and controls whether current

flows through the heater which opens the main power contacts. At night, the heater cools, closing the power contacts, energizing the street light.

Photo resistors come in many types. Inexpensive cadmium supplied cells can be found in many consumer items such as camera light meters, street lights, clock radios, alarm devices, night lights, outdoor clocks, solar street lamps and solar road studs, etc.

They are also used in some dynamic compressors together with a small incandescent or neon lamp, or light-emitting diode to control gain reduction. A common usage of this application can be found in many guitar amplifiers that incorporate an onboard tremolo effect, as the oscillating light patterns control the level of signal running through the amp circuit.The use of CdS and CdSe photo resistors is severely restricted in Europe due to the RoHS ban on cadmium.

Lead sulphide (PbS) and indium anti monad (InSb) LDRs (light-dependent resistors) are used for the mid-infrared spectral region. Ge:Cu photoconductors are among the best far-infrared detectors available, and are used for infrared astronomy and infrared spectroscopy.

2.4 WORKING PRINCIPLE:

The LDR is fixed on the solar panel. LDR is nothing but Light Dependent Resistor which varies the resistance depending on the light fall. The varied resistance is converted into voltage signal. Then the voltage signal is given to ADC.

ADC is nothing but analog to digital converter which receives the LDR voltage signal and converts the input analog signal to corresponding digital signal. Here the microcontroller is the flash type reprogrammable microcontroller received digital signals from the ADC. This signal is varied as per the sun light. The microcontroller displays the corresponding information on the LCD display and activates the driver circuit for motor rotation. The motor is attached with the cover plate for open and close. The limit is specified by using limit switch.
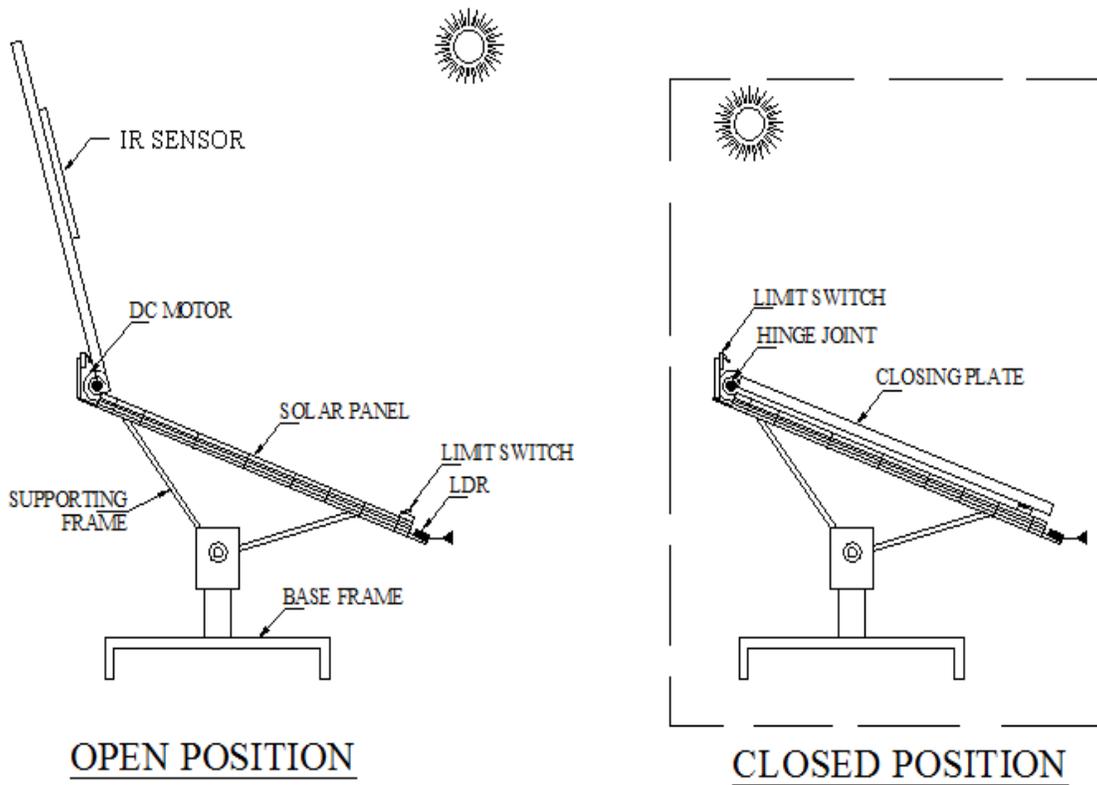
Fig 2.4. Implementation Diagram

2.5 ADVANTAGES AND APPLICATIONS

APPLICATIONS:

- ➢ Used for household appliances.

- ➢ Used in streetlight.

- ➢ Used for battery charging.

ADVANTAGES:

- ➢ Renewable source.

- ➢ Reduce energy expenditure.

- ➢ During night time the charge conserved will be $1/5^{th}$ of the energy conserved during daytime.

- ➢ It is easy to design and manufacture as all the components are easily available

- ➢ It is portable and can be placed anywhere.

- ➢ It has low cost of manufacturing.

- ➢ Micro controller can be reprogrammed if any modification is required

- ➢ Power consumption is less.

CHAPTER 3

SOFTWARE DESCRIPTION

SOTWARE USED:

- ➢ MPLABC32
- ➢ HI-TECH C COMPILER

3.1 MPLABC32:

MPLAB is a proprietary freeware integrated development environment for the development of embedded applications on PIC and ds PIC microcontrollers, and is developed by Microchip Technology.

MPLAB X is the latest edition of MPLAB, and is developed on the Net Beans platform. MPLAB and MPLAB X support project management, code editing, debugging and programming of Microchip 8-bit, 16-bit and 32-bit PIC microcontrollers.

MPLAB is designed to work with MPLAB-certified devices such as the MPLAB ICD 3 and MPLAB REAL ICE, for programming and debugging PIC microcontrollers using a personal computer. PIC Kit programmers are also supported by MPLAB.

MPLAB 8.X:

MPLAB 8.X is the last version of the legacy MPLAB IDE technology, custom built by Microchip Technology in Microsoft Visual C++. MPLAB supports project management, editing, debugging and programming of Microchip 8-bit, 16-bit and 32-bit PIC microcontrollers. MPLAB only works on Microsoft Windows.

MPLAB is still available from Microchip's archives, but is not recommended for new projects.

MPLAB supports the following compilers:

➢ MPLAB MPASM Assembler
➢ MPLAB ASM30 Assembler
➢ MPLAB C Compiler for PIC18
➢ MPLAB C Compiler for PIC24 and dsPIC DSCs
➢ MPLAB C Compiler for PIC32
➢ HI-TECH C

MPLAB X:

MPLAB X is the latest version of the MPLAB IDE built by Microchip Technology, and is based on the open-source Net Beans platform. MPLAB X supports editing, debugging and programming of Microchip 8-bit, 16-bit and 32-bit PIC microcontrollers.

MPLAB X is the first version of the IDE to include cross-platform support for Mac OS X and Linux operating systems, in addition to Microsoft Windows.

MPLAB X supports the following compilers:

➢ MPLAB XC8 — C compiler for 8-bit PIC devices.
➢ MPLAB XC16 — C compiler for 16-bit PIC devices.
➢ MPLAB XC32 — C/C++ compiler for 32-bit PIC devices.
➢ HI-TECH C — C compiler for 8-bit PIC devices.
➢ SDCC — open-source C compiler.

3.2 HI-TECH C COMPILER:

HI-TECH C for Z80/Z180 offers a complete ANSI C embedded complier package with a full development system for language C and assembler.

HI-TECH C supports the 64K memory model for the base Z80,plus the expanded memory on the Z180 and 64180, or even user-defined banked memory on any other Z80 device, allowing a megabyte of program memory. Interrupt functions can be defined entirely in c, including mode 2 vectors, and I/O ports are mapped as C variable with the port qualifier.

COMPILER FEATURES:

➢ ANSI C, supporting all standard data types

➢ Unlimited number of source files

➢ Multiple optimization levels

➢ Comprehensive library with source code

➢ Floating point support (32-bit)

➢ Mixed C and assembler programming

➢ Listings showing generated assembler

➢ Optimizing assembler

➢ Full linker, with overlaying of vocal variables to minimize RAM usage

➢ Remote source-level debugger for low-cost in-target debugging included at no extra cost.

EMBEDDED DEVELOPMENT ENVIRONMENT:

HI-TECH C for Z80/Z180 be run entirely from the HI-TECH Professional Development environment. This environment allows you to manage all of your Z80 projects. You can compile, assemble and link your embedded application with a single step.

Optionally, the compiler may be run directly from the command line, allowing you to compile, assemble and link using one command. Processors Supported: HI-TECH C compiler supports all the Z80/Z180 microcontroller families.

CHAPTER 4
RESULT
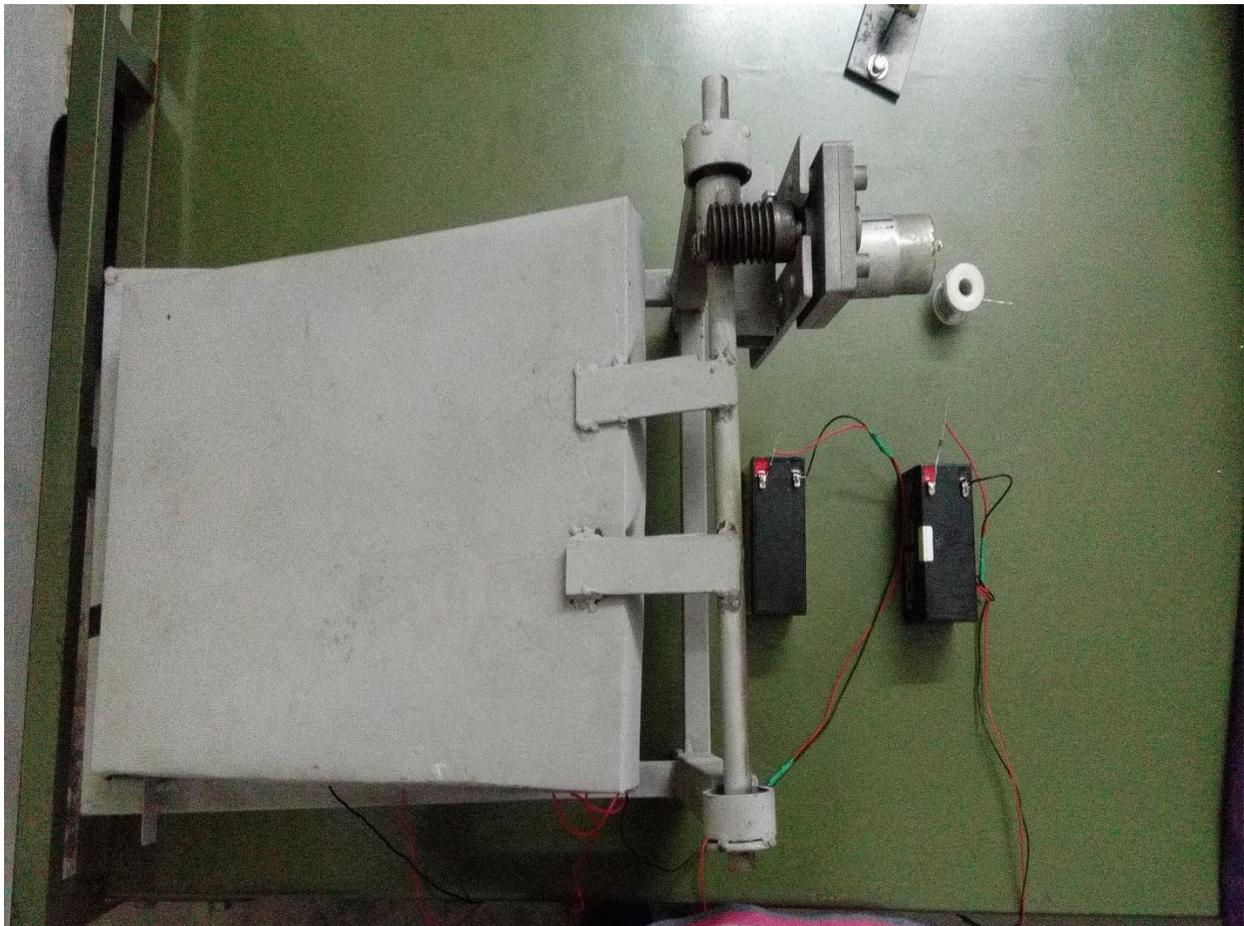
4.1. CHARGING USING SOLAR PANEL:

A 12V battery is half drained (7V) and connected to the solar panel and charged for two hours . Then the charge of the battery is measured using analog multimeter. For two hours the battery is charged up to 2V.

Fig 4.1.Charging using solar panel

4.2. CHARGING USING IR GRID:

           A half drained 12V battery (7V) is connected to the IR grid and charged. Power supply to the IR grid is given from the battery charged using solar panel. The IR grid is charged for two hours and the charge of the battery is measured. It is increased to 9.2V from 7V.

Fig4.2 charging using IR grid

TYPE OF CHARGING	BEFORE CHARGING	AFTER CHARGING
Solar panel	7V	9V(2 Hours)
IR grid	7V	9.2V(2 Hours)

CHAPTER 6
CONCLUSION AND FUTURE SCOPE

CONCLUSION:

It is inferred and concluded that solar panel can conserve power effectively during both day and night time. The night time power conservation is effective because the input power taken by the IR is less when compared to the output obtained.

FUTURE SCOPE:

This project can be further developed by increasing the efficiency of the system by increasing the output obtained at the IR. The efficiency of the IR can be increased by increasing the standard of the IR used and also by using different types of sensors like moonlight sensors and pyro electric sensors.

CHAPTER 7
REFERENCES

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