Solar System In Agriculture

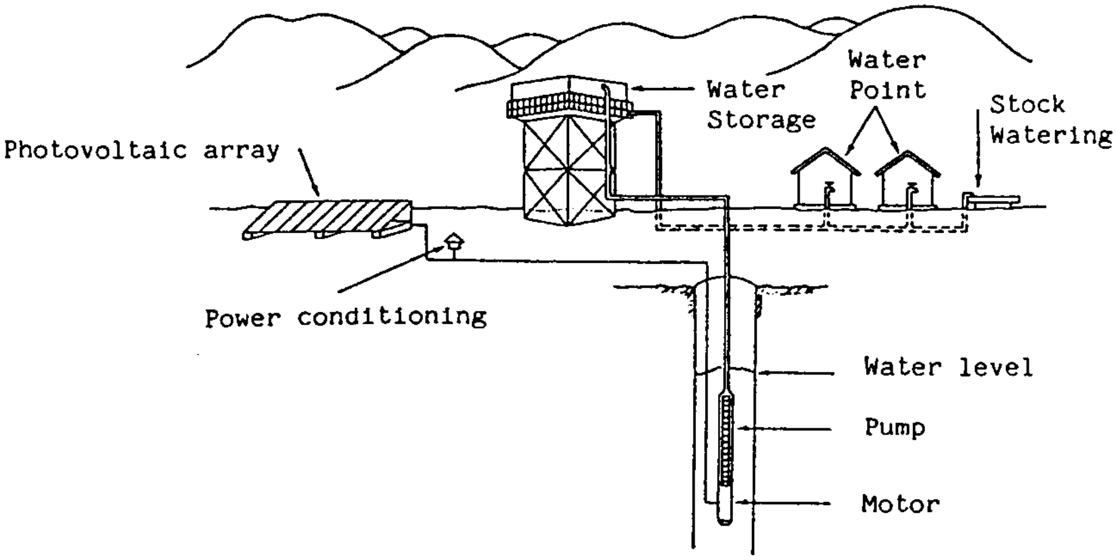
ABSTRACT

Agricultural technology is changing rapidly. Farm machinery, Farm building and production facilities are constantly being improved. Agricultural applications suitable for photovoltaic (PV) solutions are numerous. These applications are a mix of individual installations and systems installed by utility companies when they have found that a PV solution is the best solution for remote agricultural need such as water pumping for crops or livestock. A solar powered water pumping system is made up of two basic components. These are PV panels and pumps. The smallest element of a PV panel is the solar cell. Each solar cell has two or more specially prepared layers of semiconductor material that produce direct current (DC) electricity when exposed to light. This DC current is collected by the wiring in the panel. It is then supplied either to a DC pump, which in turn pumps water whenever the sun shines, or stored in batteries for later use by the pump. The aim of this article is to explain how solar powered water pumping system works and what the differences with the other energy sources are.

INTRODUCTION

1.1 CONCEPT OF SOLAR SYSTEM IN AGRICULTURE:-

Energy is a key ingredient for the overall development of an economy. India has been endowed with abundant renewable solar energy resource. India is large country and the rate of electrification has not kept pace with the expanding population, urbanization and industrialization and has resulted in the increasing deficit between demand and supply of electricity. This has not only resulted in under electrification but also put heavy pressure on the governments to keep pace with demand for electricity. People not served by the power grid have to rely on fossil fuels like kerosene and diesel for the poor people in rural areas.



(Figure 1.2: solar Water pumping system)

Wherever the rural areas have been brought under power grid the erratic and unreliable power Supply has not helped the farmers and the need for an uninterrupted power supply especially during the critical farming period has been a major area of concern. India receives a solar energy equivalent of 5,000 trillion KWh/year with a daily average solar energy incidence of 4-7 KWh/m2. This is considerably more than the total energy consumption of the country. Further, most parts of the country experience 250-300 sunny days in a year, which makes solar energy a viable option in these areas. Decentralized renewable energy system, which relies on locally available resources, could provide the solution to the rural energy problem, particularly in remote areas where grid extension is not a viable proposition.

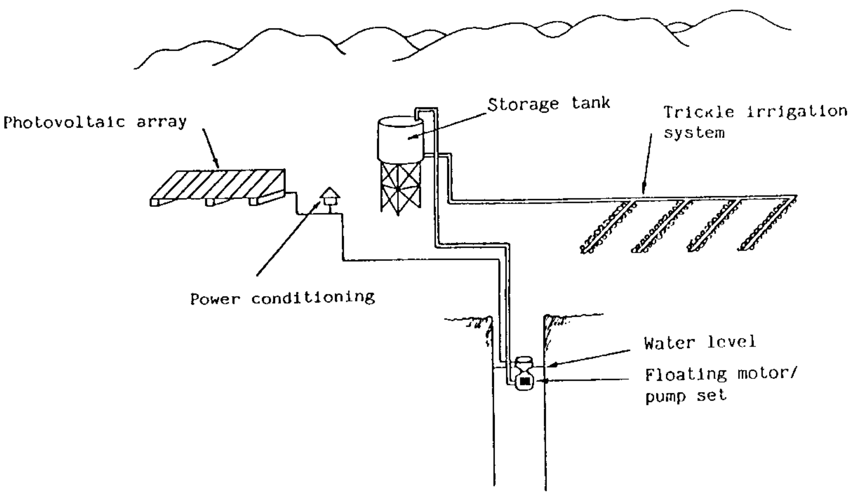


Figure 2: Solar Irrigation System

Solar energy, with its virtually infinite potential and free availability represents a nonpolluting and inexhaustible energy source which can be developed to meet the energy need of mankind in a major way. The high cost, fast depleting tested kits are available to retrofit the most pole most pole mounting applications.

1.2 BASIC BLOCK DIAGRAM OF SOLAR SYSTEM IN AGRICULTURE

Block diagram:

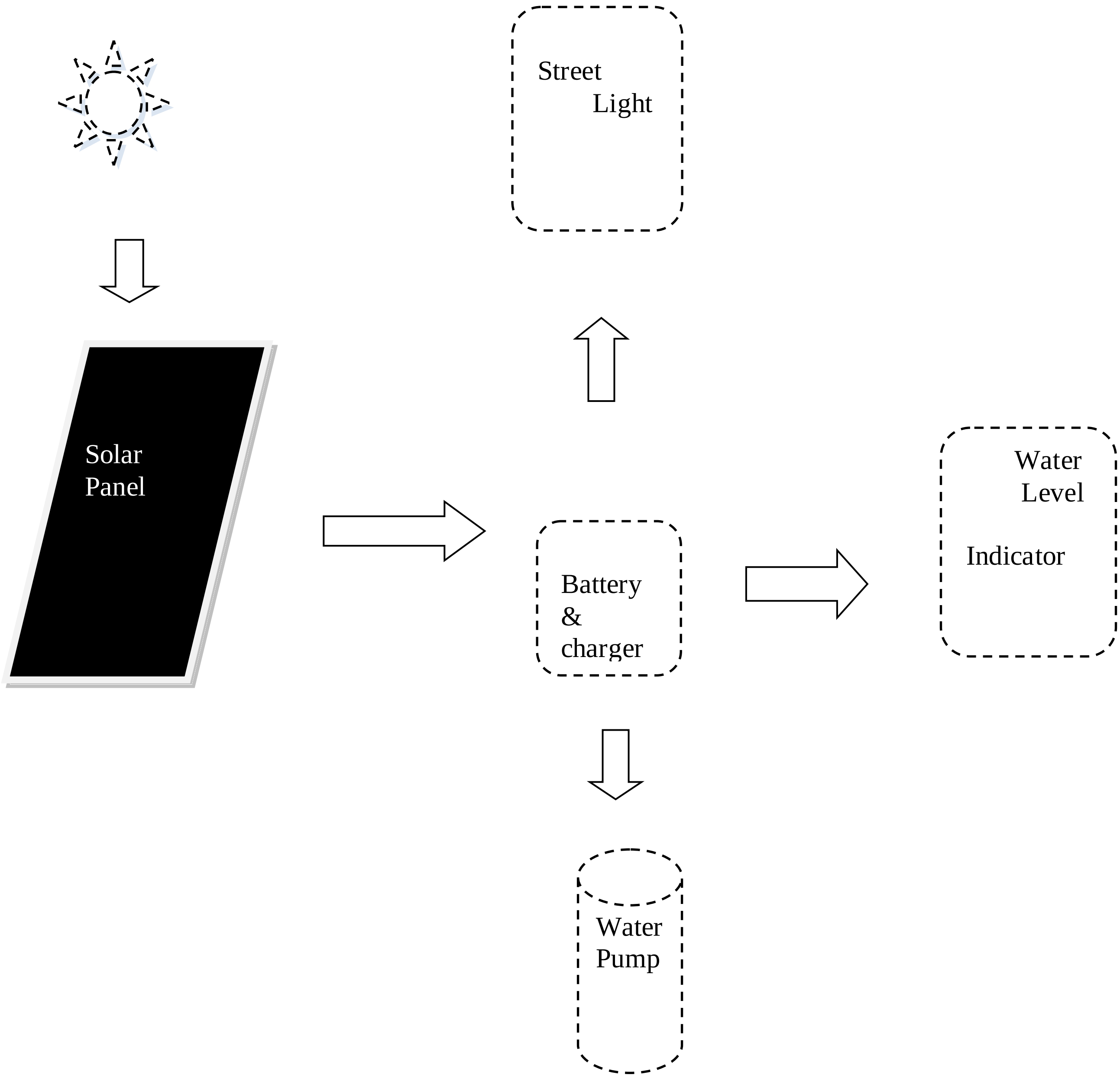


Fig1.2 block diagram of solar system in agriculture

1.2.1 Working of block diagram:-

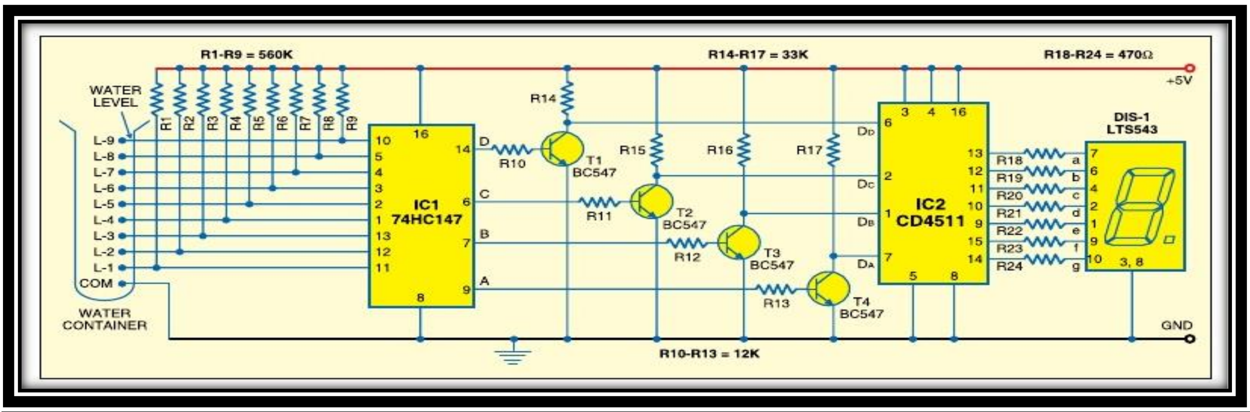
The solar system in agriculture very useful for our country. Now see the fig1.2 of block diagram of solar system in agriculture.

Now see the working of in block diagram.

When sun light falls on panel in solar panel made by silicon and germanium. It is convert photon energy to electric energy. So the solar cell converts in electrical energy in dc system. And also USB battery in hole day battery charge use dc supply in street light and water level indicator and water pump in agriculture system.

CIRCUIT DIAGRAM

WATER LEVEL INDICATOR CIRCUIT:-



(Fig: 2.2-circuit diagram of the numeric water-level indicator with display)

Working of circuit

The Numeric Water Level Indicator employs a simple mechanism to detect and indicate the water level in a tank or any other container. The level sensing is done by a set of nine probes which are placed at nine different levels on the tank walls (with probe9 to probe1 placed in decreasing order of height; COM probe is placed on the base of the tank).Basically, level9 represents the "tank full" condition while COM represents the "tank empty" condition.

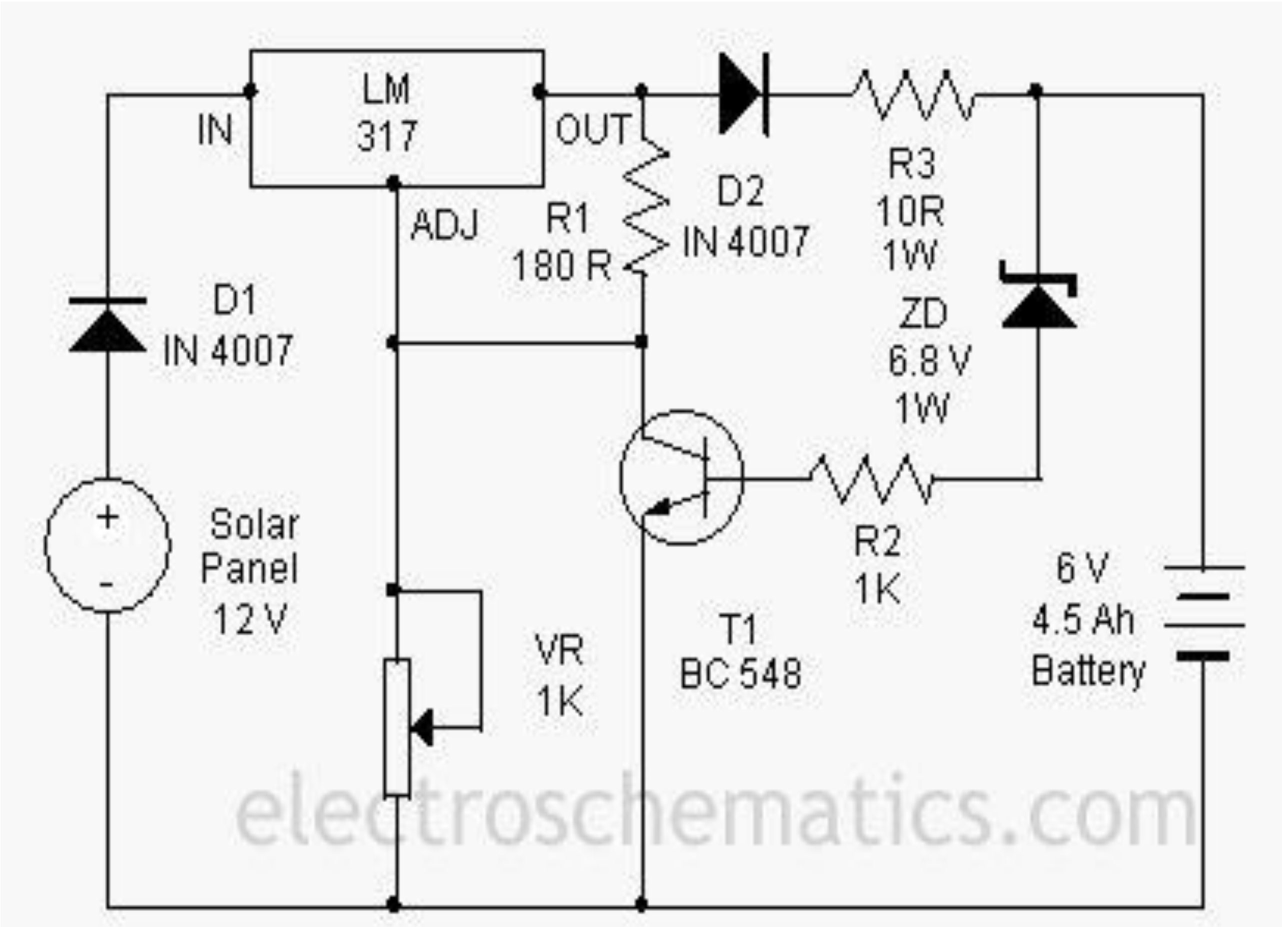
When the tank is empty, all the inputs to the priority encoder IC1 remain high; as a result its output also remains high. Since these outputs are inverted and fed as inputs to the decoder driver CD4511 (IC2), all inputs to IC2 are low. The seven segment display correspondingly shows a '0', indicating that the tank is empty.

For example, when the water reacheslevel1 (but is below level2), pin11 (A0) of IC1 is pulled to ground and the out-put generated at pin9 (Y0) of IC1 also becomes low. After inversion, the bits fed to the input pins of IC2 are 0001(DCBA). Hence, the corresponding digit displayed by the seven segment display is a ‘1’. The same mechanism applies to the detection

N of all the other levels.

When the tank is full, all inputs to IC1 become low and all its outputs also go low .This causes all the inputs to IC2to go high and hence the display shows a ‘9’, thereby indicating a “tank full” condition.

BATTERY CHARGER CIRCUIT DIAGRAM:-



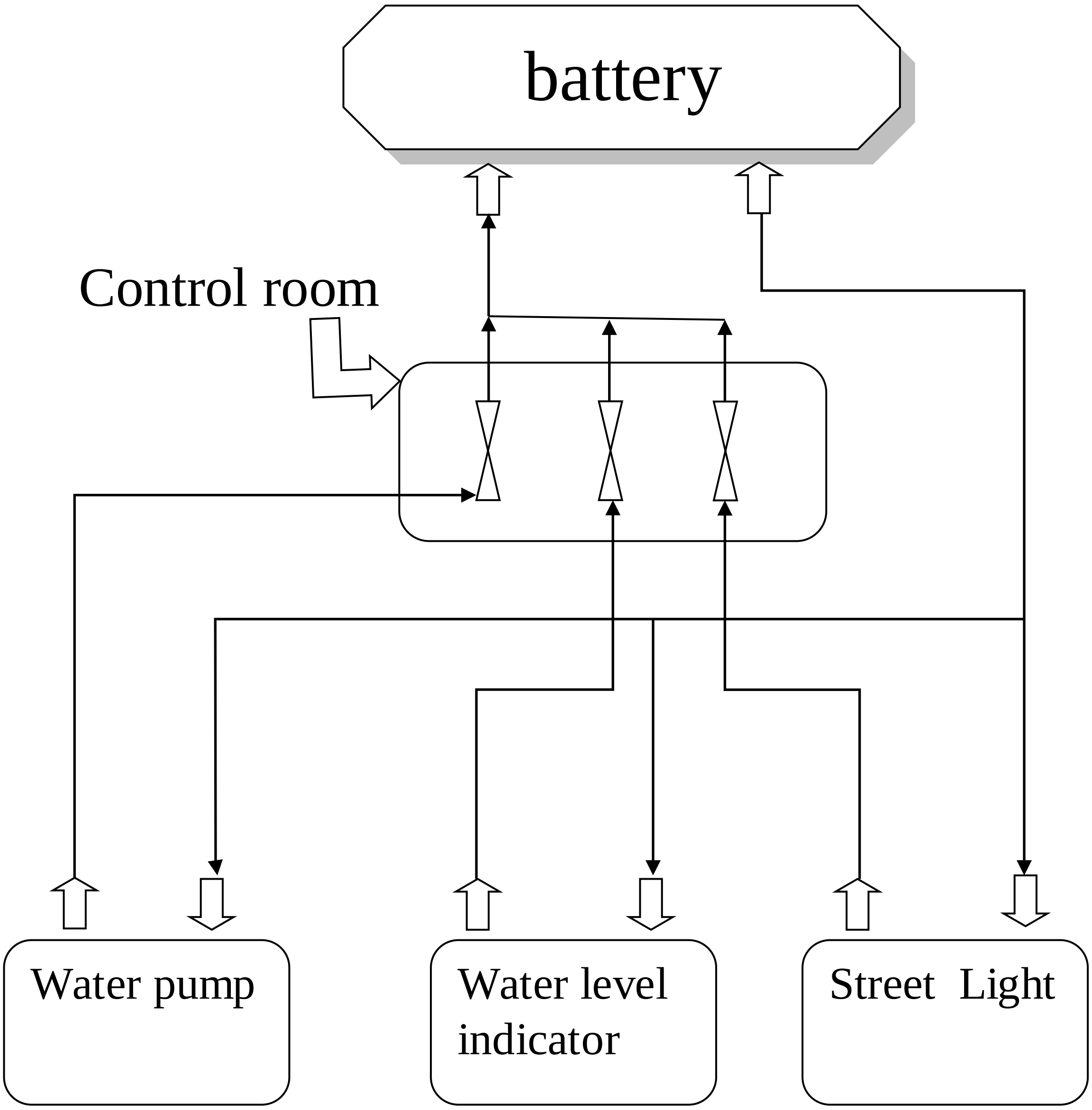
Solar Charger with Current regulation and Cut off

❖ WORKIND PRINCIPAL OF BATTERY CHARGER

The circuit uses a 12 volt solar panel and a variable voltage regulator IC LM 317. The solar panel consists of solar cells each rated at 1.2 volts. 12 volt DC is available from the panel to charge the battery. Charging current passes through D1 to the voltage regulator IC LM 317. By adjusting its Adjust pin, output voltage and current can be regulated.

VR is placed between the adjust pin and ground to provide an output voltage of 9 volts to the battery. Resistor R3 Restrict the charging current and diode D2 prevents discharge of current from the battery. Transistor T1 and Zener diode ZD act as a cut off switch when the battery is full. Normally T1 is off and battery gets charging current. When the terminal voltage of the battery rises above 6.8 volts, Zener conducts and provides base current to T1. It then turns on grounding the output of LM 317 to stop charging.

Switching & connection



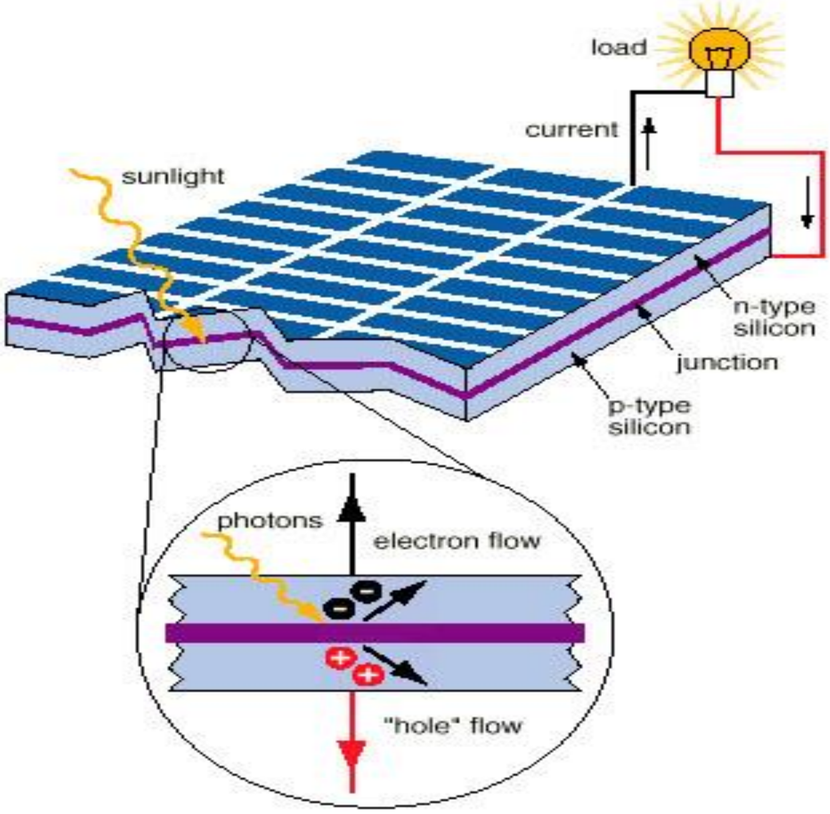
LISTOF COMPONENTS

❖ COMPONENTS OF WATER LEVEL INDICATOR

SR NO.	COMPONENT	UNIT
1.	Solar cell	NO.1
2.	Resister	
	R1 to R9=560k	N0.9
	R10 to R13=12k	No.4
	R14 to R17=33k	No.4
	R18 to R24=470Ω	No.7
	R1=180	No.1
	R2=1k	No.1
	R3=10R,1w	No.1
3.	Variable resister	
	1k	No.1
4.	IC	
	IC1=74HC147	No.1
	IC2=CD4511	No.1
	IC3=LM317	
5.	Transistor	
	BC 574	No.4
	BC 548	No.1
6.	LED display	
	LTS543	No.1
7.	D.C. series motor	No.1
8.	6V battery	No.1
9.	Diode	
	IN 4007	No.2
10.	Zener diode	
	ZD 6V,1W	No.1
11.	LED	No.1

2.1.3 INTRODUCTION OF COMPONENT

1. solar cell



(Fig, 2.3. Solar Cells)

Photovoltaic offer consumers the ability to generate electricity in a clean, quiet and reliable way. Photovoltaic systems are comprised of photovoltaic cells, devices that convert light energy directly into electricity. Because the source of light is usually the sun, they are often called solar cells. The word photovoltaic comes from “photo,” meaning light, and “voltaic,” which refers to producing electricity. Therefore, the photovoltaic processes “producing electricity directly from sunlight.” Photovoltaic are often referred to as PV.PV systems are being installed by Texans who already have grid-supplied electricity but want to begin to live more independently or who are concerned about the environment. For some applications where small amounts of electricity are required, like emergency call boxes, PV systems are often cost justified even when grid electricity is not very far away. When applications require larger amounts of electricity and are located away from existing power lines, photovoltaic systems can in many cases offer the least expensive, most viable option. In use today on street lights, gate openers and other low power tasks, photovoltaic are gaining popularity in Texas and around the world as their price declines and efficiency increases.

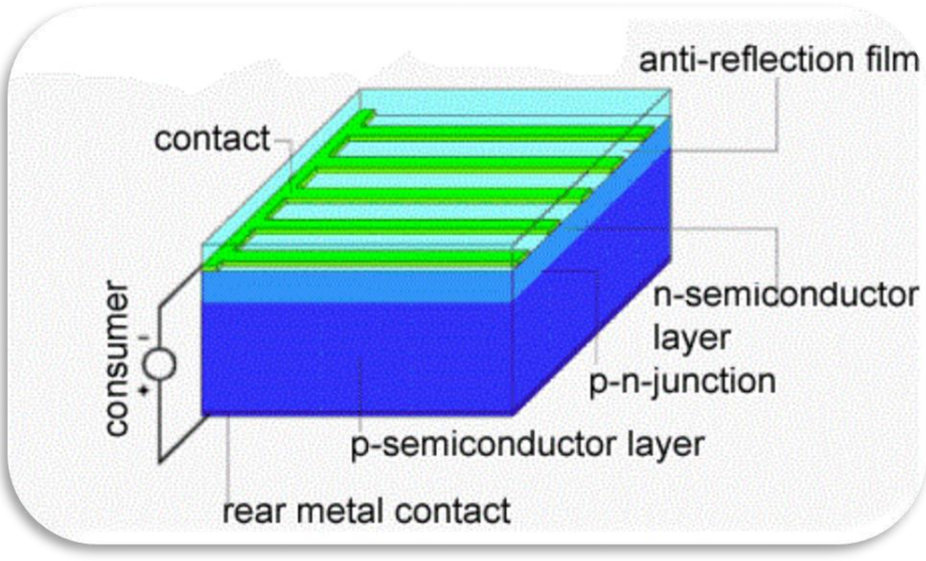
You've probably seen calculators with solar cells -- devices that never need batteries and in some cases don't even have an off button. As long as there's enough light, they seem to work forever. You may also have seen larger solar panels, perhaps on emergency road signs, call boxes, and buoys and even in parking lots to power the lights.

Although these larger panels aren't as common as solar-powered calculators, they're out there and not that hard to spot if you know where to look. In fact, **photovoltaic** -- which were once used almost exclusively in space, powering satellites' electrical systems as far back as 1958 -- are being used more and more in less exotic ways. The technology continues to pop up in new devices all the time, from sunglasses to electric vehicle charging stations.

The hope for a "solar revolution" has been floating around for decades -- the idea that one day we'll all use free electricity from the sun. This is a seductive promise, because on a bright, sunny day, the sun's rays give off approximately 1,000 watts of energy per square meter of the planet's surface. If we could collect all of that energy, we could easily power our homes and offices for free.

In this article, we will examine solar cells to learn how they convert the sun's energy directly into electricity. In the process, you will learn why we're getting closer to using the sun's energy on a daily basis, and why we still have more research to do before the process becomes cost-effective.

❖ Converting Photons to Electrons



(Fig 2.3-Solar cell)

The solar cells that you see on calculators and satellites are also called photovoltaic (PV) cells, which as the name implies (photo meaning "light" and voltaic meaning "electricity"), convert sunlight directly into electricity. A module is a group of cells connected electrically and packaged into a frame (more commonly known as a solar panel), which can then be grouped into larger solar arrays, like the one operating at Nellie Air Force Base in Nevada.

Photovoltaic cells are made of special materials called semiconductors such as silicon, which is currently used most commonly. Basically, when light strikes the cell, a certain portion of it is absorbed within the semiconductor material. This means that the energy of the absorbed light is transferred to the semiconductor. The energy knocks electrons loose, allowing them to flow freely.

PV cells also all have one or more electric field that acts to force electrons freed by light absorption to flow in a certain direction. This flow of electrons is a current, and by placing metal contacts on the top and bottom of the PV cell, we can draw that current off for external use, say, to power a calculator. This current, together with the cell's voltage (which is a result of its built-in electric field or fields), defines the power (or wattage) that the solar cell can produce.

That's the basic process, but there's really much more to it. On the next page, let's take a deeper look into one example of a PV cell: the single-crystal silicon cell.

- **Energy Loss in a Solar Cell**

Visible light is only part of the electromagnetic spectrum. Electromagnetic radiation is not monochromatic -- it's made up of a range of different wavelengths, and therefore energy levels.

Light can be separated into different wavelengths, which we can see in the form of a rainbow. Since the light that hits our cell has photons of a wide range of energies, it turns out that some of them won't have enough energy to alter an electron-hole pair. They'll simply pass through the cell as if it were transparent. Still other photons have too much energy. Only a certain amount of energy, measured in electron volts (eve) and defined by our cell material (about 1.1 eV for crystalline silicon), is required to knock an electron loose. We call this the band gap energy of a material. If a photon has more energy than the required amount, then the extra energy is lost. (That is, unless a photon has twice the required energy, and can create more than one electron-hole pair, but this effect is not significant.) These two effects alone can account for the loss of about 70 percent of the radiation energy incident on our cell.

Why can't we choose a material with a really low band gap, so we can use more of the photons? Unfortunately, our band gap also determines the strength (voltage) of our electric field, and if it's too low, then what we make up in extra current (by absorbing more photons), we lose by having a small voltage. Remember that power is voltage times current. The optimal band gap, balancing these two effects, is around 1.4 eV for a cell made from a single material.

We have other losses as well. Our electrons have to flow from one side of the cell to the other through an external circuit. We can cover the bottom with a metal, allowing for good conduction, but if we completely cover the top, then photons can't get through the opaque conductor and we lose all of our current (in some cells, transparent conductors are used on the top surface, but not in all). If we put our contacts only at the sides of our cell, then the electrons have to travel an extremely long distance to reach the contacts. Remember, silicon is a semiconductor -- it's not nearly as good as a metal for transporting current. Its internal resistance (called series resistance) is fairly high, and high resistance means high losses. To minimize these losses, cells are typically covered by a metallic contact grid that shortens the distance that electrons have to travel while covering only a small part of the cell surface. Even so, some photons are blocked by the grid, which can't be too small or else its own resistance will be too high.

Now that we know how a solar cell operates, let's see what it takes to power a house with the technology.

ADVANTAGES AND DISADVANTAGES APPLICATION

Advantage

» It does not require electric power.
» Easy to operate and maintains.
» No fuel cost- uses abundantly available free sun light.
» Long operating life.
» Highly reliable and durable free performance.
» environment friendly, no noise, no pollution.
» Saving of conventional diesel fuel.
» one time investment, no running cost

Disadvantage

» Solar energy is not available throughout the year.
» This system is less usable in cloudy or rainy weather.
» This technology is new approach so traditionally people are not
Accepted easily at the cost of the conventional oven

Application

» It is mostly use in the farm.
» It is used in industries or factory which is far away from the city.
» It is used in tube well.
» It can also use in small battery less solar toy.

Cost of project material

SR NO.	COMPONENT	UNIT	COST
1.	Solar cell	No.1	1800
2.	Resister		
	R1 to R9=560k	N0.9	20
	R10 to R13=12k	No.4	10
	R14 to R17=33k	No.4	10
	R18 to R24=470Ω	No.7	15
	R1=180	No.1	5
	R2=1k	No.1	5
	R3=10R,1w	No.1	5
3.	Variable resister		
	1k	No.1	10
4.	IC		
	IC1=74HC147	No.1	20
	IC2=CD4511	No.1	20
	IC3=LM317		15
5.	Transistor		
	BC 574	No.4	10
	BC 548	No.1	10
6.	LED display		
	LTS543	No.1	20
7.	D.C. series motor	No.1	200
8.	6V battery	No.1	150
9.	Diode		
	IN 4007	No.2	10
10.	Zener diode		
	ZD 6V,1W	No.1	15
	Total cost	2200	

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