Solar In Agriculture

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Abstract-
We're using Non-renewable sources of energy in excess mount for our needs. As this type of minerals like coal etc. are exhausting so we have to depend on the renewable sources of energy like solar, wind, etc. For smaller application it is better to use renewable energy. As this project is based on water pump and required AC supply. So for this particular application we are using solar panels to charge the DC battery and the power from the battery can be used for this application. This project is an innovative solution to operate a machine / motor / liquid pumps for a small duration. If a machine is to be operated for ten minutes, and should be switched off after the duration, it is too difficult and many times we forget to switch it off the system after the prescribed time. This project provides the facility of automatic switch off after the requited time duration. This is achieved by using the pic microcontroller. Four push-to-on switches are connected to one port of the microcontroller. These four switches are to provide four different fixed time constants. A LCD is connected to the microcontroller to display the status of the pump. Contrast of the LCD can adjust by using a preset which is connected to it. A transistor is used to drive the relay during the active time period. 5V double pole – double through relay is used to control the AC liquid pump. LED indication is provided for visual identification of the relay / load status. A switching diode is connected across the relay to neutralize the reverse EMF.

Keywords: Solar cell, IC, Transistor, D.C. Series Motor, Battery.

Published in IJIRMPS (E-ISSN: 2349-7300), Volume 12, Issue 2, March- April 2024

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1. INTRODUCTION

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

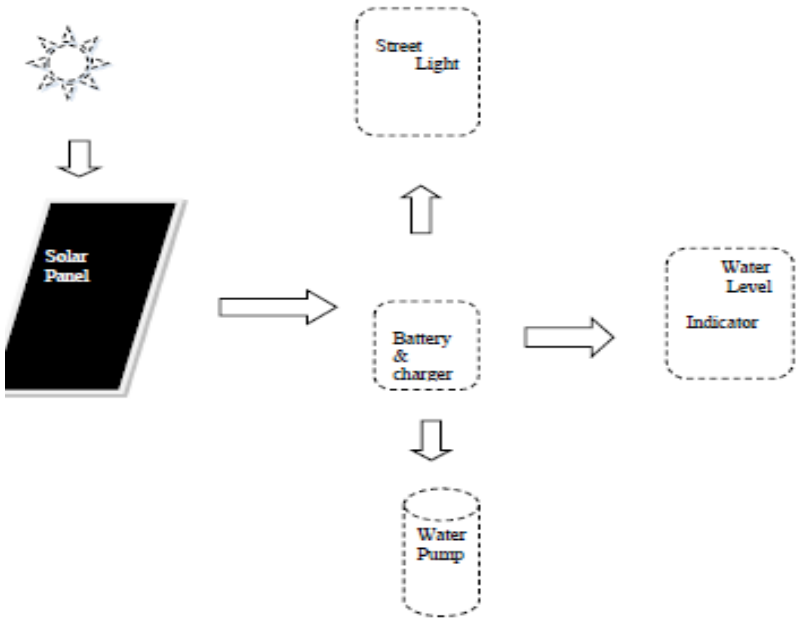
Wherever the rural areas have been brought under power grid the erratic and unreliable power Supply has not helped the farmers and the need for an uninterrupted power supply especially during the critical farming period has been a major area of concern. India receives a solar energy equivalent of 5,000 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.

Solar energy, with its virtually infinite potential and free availability represents a non-polluting 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.

2. LITERATURE SURVEY

Bardi et al. looked at the possibility of farmers switching from fossil fuels to renewable green energy sources, which may enhance the quality and quantity of food processed on a wide range of farms. It may also provide electricity for agricultural equipment, such as road haulage, as well as field research. Only a few agricultural equipment operators are now aware of the problems posed by the depletion of fossil fuels and global warming. The root of the climate change problem is this. Unless farmers' attitudes change, the issue will continue to worsen. Growers should also employ energy-saving equipment for growing crops and utilize the PV system to optimize land, since it is cost-effective and can be used for a variety of purposes[8].
Dupraz et al. investigated the best methods for converting solar radiation into both energy and agriculture. It's also known as photovoltaic (PV) or agro-photovoltaic (APV) farming, and it's a natural answer to agriculture's lack of renewable energy. This system was set up to enhance the mild shadow of the crops by raising the solar panels to a height of 2 meters above the ground. Climate conditions, sufficient water availability, and energy supply are all variables that influence agricultural growth. As a result, contemporary technology must be combined with innovative economic efficiency farming methods and the effective use of limited land resources with minimum environmental impact to maximize agricultural output and improve land usage. The solar panel's DC energy is transferred to the battery. The converter receives this DC feed from the battery and converts it to AC power. AC electricity is utilized to operate the ventilation systems in the greenhouse in order to generate heat or control temperature[9].
Maher et al. proposed a greenhouse model with a fuzzy-based management system to maintain the indoor greenhouse environment using induction motors, heating systems, and other components for ventilation, heating, humidification, and dehumidification applications for long-term greenhouse agricultural production with efficient climate control for increased yield. Their research has shown that both the fuzzy controller and the PV generator may be used in greenhouses to save energy and lower the cost of agricultural output[10].

3. BLOCKDIAGRAM



4. PROBLEM STATEMENT

Conventional irrigation method wastes a lot of water, leading to a high cost of electricity to run the pump set for irrigation. Automation can help save water, electricity as well as human efforts. Irrigation plant evolution has gone through several stages, in which the original irrigation system has many shortcomings

because they do not save much water and human energy. Therefore, the introduction of automation can help to overcome these shortcomings and prepare a way to save water.

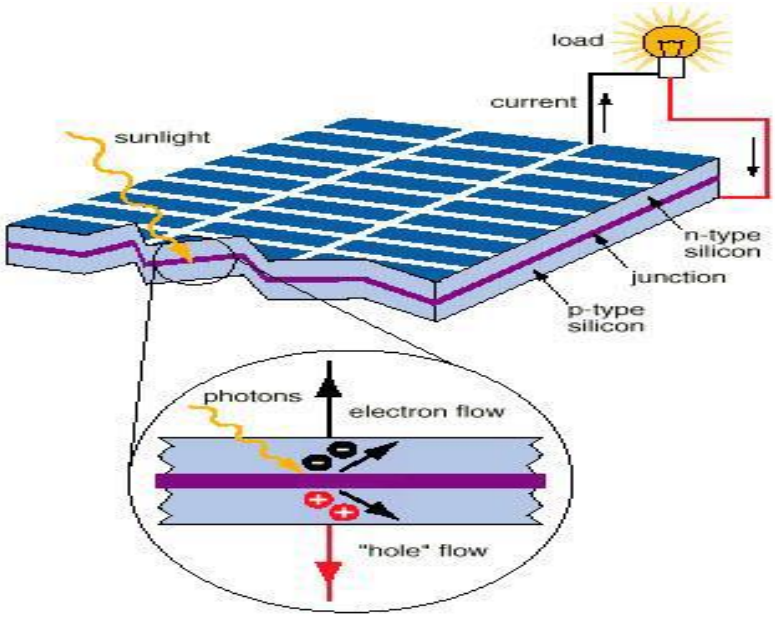
COMPONENTS USED IN CIRCUIT

1. Solar cell
2. Resistors
3. Variable Resistor
4. IC
5. Transistor
6 D.C. Motor
7. Diode
8. Zener diode
9. LED

1. Solar cell

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.

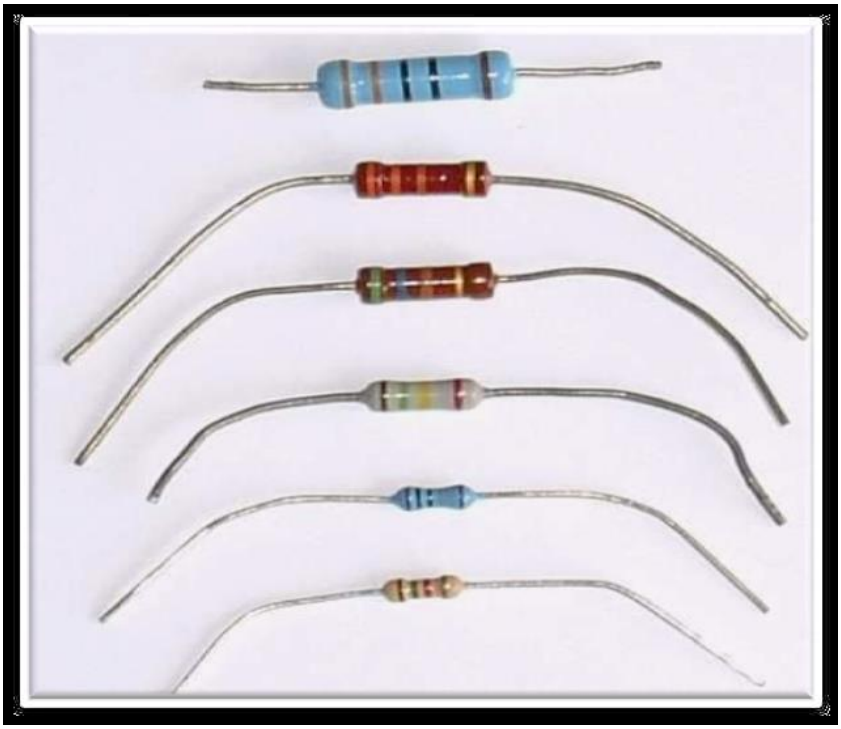


2. Resistors

The most basic role of resistors is current limiting i.e, precisely controlling the quantity of electrical current that is going to flow through a device or a conductor. Resistors can also be used as voltage divider, in other

words they can be used to generate any voltage from an initial bigger voltage by dividing it. They are also used as pull-up resistors in electronic logic circuits to ensure that inputs to logic systems settle at expected logic levels if external devices are d is connected or high-impedance. They may also be used at the interface between two different types of logic devices, possibly operating at different power supply voltages.

The resistor is one of the most diverse and easiest of all the electrical components you will find in your average radio or TV set. This is because it has been around for many years and plays such a vital role that it will continue to in many new shapes and sizes to come. Today there are many different resistors in circulation, all of which will be explained shortly but for now let's go over some of the most important details.

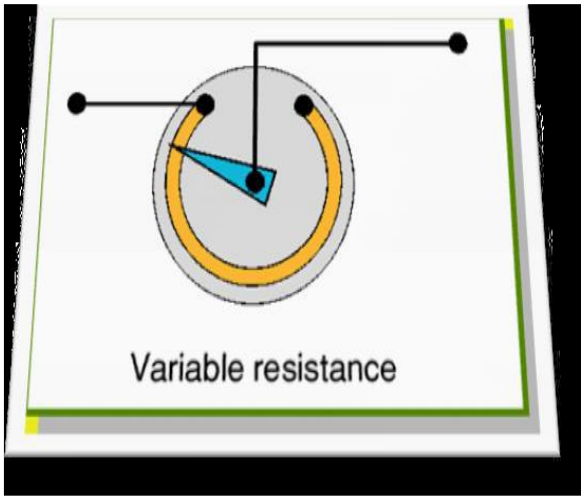


3. Variable Resistor

Variable resistor is a potentiometer with only two connecting wires instead of three. However, although the actual component is the same, it does a very different job. The pot allows us to control the potential passed through a circuit. The variable resistance lets us adjust the resistance between two points in circuit.

Variable resistors are often called potentiometers, or. pots. For short,because one very common use for them is as an adjustable voltage divider. For many years they were often called .volume controls, because another very common use was in adjusting the audio volume produced by amplifiers, radio and TV receivers.

Yet another early name for essentially the same component when it was used simply as a variable resistance was rheostat. Meaning a device to set the flow.(of current). Pots are made in a variety of physical forms, and with the actual resistance element made from different materials. Some pots are made for frequent manual adjustment via a control knob, while others are designed to be adjusted only occasi only with a screwdriver or similar tool, for fine tuning of circuit performance. The latter type are usually called preset. Pots or trim pots.



4. IC

IC1= 74HC147:

The 74HC147 priority encoder accepts data from nine active LOW inputs (A0 to A8) and provides a binary representation on the four active LOW outputs (Y0 to Y3). Apriority is assigned to each input so that when two or more inputs are simultaneously active, the input with the highest priority is represented on the output, with the input line A8having the highest priority

IC3=LM317

The LM317 is an adjustable 3-terminal positive voltage regulator capable of supplying 100mA over a 1.2V to 37V output range. It is exceptionally easy to use and requires only two external resistors to set the output voltage. Further, both line and load regulation is better than standard fixed regulators. Also, the LM317 is available packaged in a standard TO-92transistor package which is easy to use.

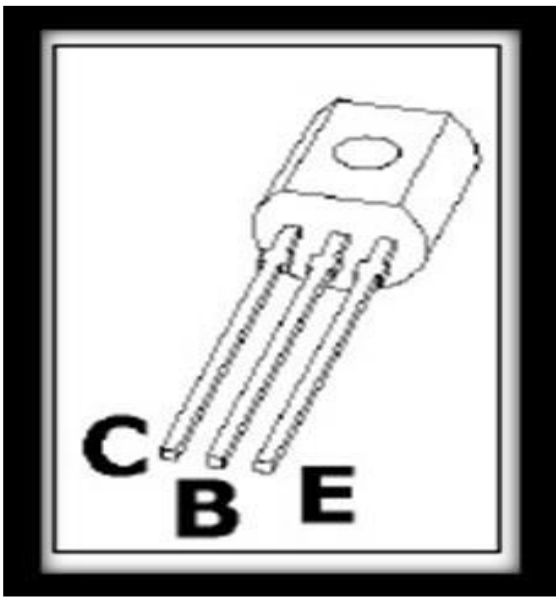
In addition to higher performance than fixed regulators, the LM317 offers full overload protection. Included on the chip are current limit, thermal overload protection and safe area protection. All overload protection circuitry remains fully function eleven if the adjustment terminal is disconnected.

5. Transistor

Transistors are classified as either NPN or PNP according to the arrangement of their N and P materials. Their basic construction and chemical treatment is implied by their names, "NPN" or "PNP." That is, an NPN transistor is formed by introducing a thin region of P-type material between two regions of N-type material. On the other hand, a PNP transistor is formed by introducing a thin region of N-type material between two regions of P-type material. Transistors constructed in this manner have two PN junctions, as shown in figure 2-2. One PN junction is between the emitter and the base; the other PN junction is between

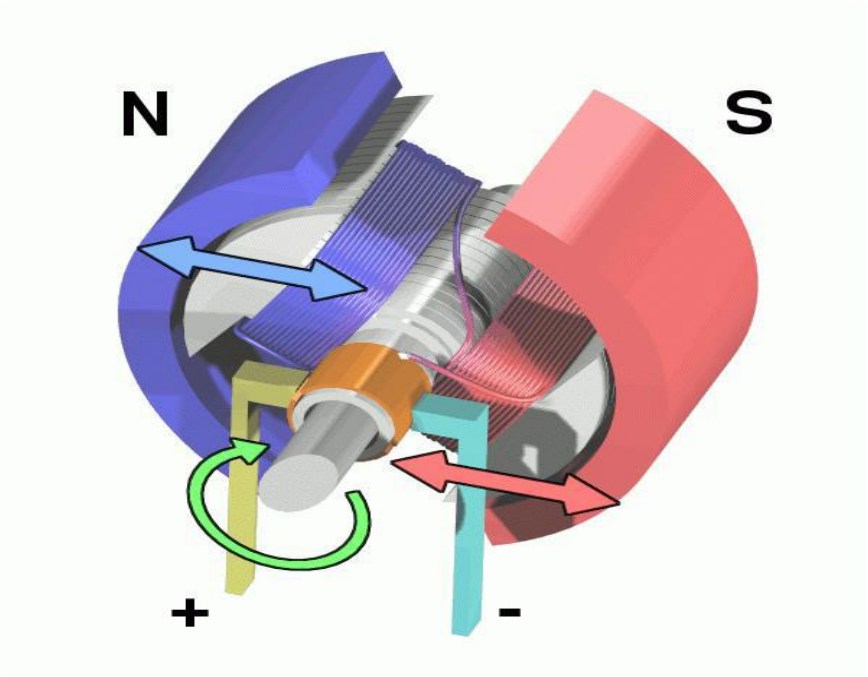
the collector and the base. The two junctions share one section of semiconductor material so that the transistor actually consists of three elements.

Since the majority and minority current carriers are different for N and P materials, it stands to reason that the internal operation of the NPN and PNP transistors will also be different. The theory of operation of the NPN and PNP transistors will be discussed separately in the next few paragraphs. Any additional information about the PN junction will be given as the theory of transistor operation is developed.



7. D.C. Motor

D. C. motors are seldom used in ordinary applications because all electric supply companies furnish alternating current However, for special applications such as in steel mills, mines and electric trains, it is advantageous to convert alternating current into direct current in order to use d.c. motors. The reason is that speed/torque characteristics of d.c. motors are much more superior to that of a.c. motors. Therefore, it is not surprising to note that for industrial drives, d.c. motors are as popular as 3-phase induction motors. Like d.c. generators, d.c. motors are also of three types viz., series-wound, shunt-wound and compound wound. The use of a particular motor depends upon the mechanical load it has to drive.

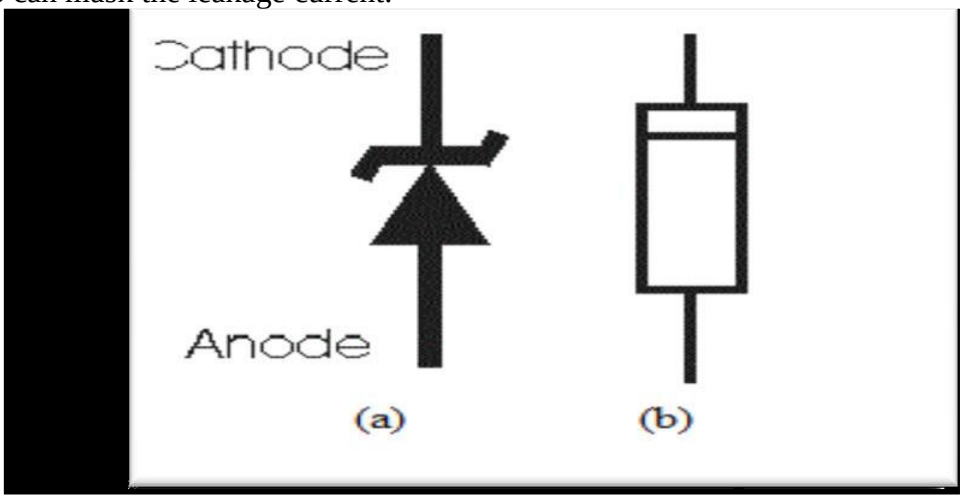


8. Zener diode

Zener diodes are used to maintain a fixed voltage. They are designed to 'breakdown' in a reliable and non-destructive way so that they can be used **in reverse** to maintain a fixed voltage Zener diodes are a special type of semiconductor diode-- devices that allow current to flow in one direction only --that also allow current to flow in the opposite direction, but only when exposed to enough voltage. And while that sounds a bit esoteric, they're actually among the handiest components ever to cross an engineer's bench, providing great solutions to a number of common needs in circuit design.

In what follows, we'll show you how (and when) to use a Zener, for applications including simple reference voltages, clamping signals to specific voltage ranges, and easing the load on a voltage regulator.

It was noted earlier that the reverse-bias saturation current of general-purpose junction diode is so small that it ordinarily is masked by currents associated with high-resistance conducting paths across the junction. But currents associated with other phenomena occurring in what is a very complex physical junction environment also can mask the leakage current.



9. LED

Light-emitting diodes or Leeds. Are now very widely used in almost every area of electronics mainly as indicator and display devices. In effect solid state lamps. They're very well suited for such uses, because they are physically quite rugged and hence much more reliable than filament-type incandescent lamps. They also run much cooler and are

Much more efficient, requiring far less electrical power input for the same amount of light output. Other common uses for LEDs are as a source of either visible or infra-red light, as a carrier for data and other information over short line of sight. Distances A LED is basically just a specialized type of P-N junction diode, made from a thin chip of fairly heavily doped

Semiconductor material.

When it is forward biased to reduce the potential barrier provided by the junction's narrow depletion layer, electrons from the semiconductor's conduction band can combine with holes from the valence band, releasing sufficient energy to produce photons of light. Because of the thin chip a reasonable number of these photons can leave it and radiate away as its light output. Unlike diodes made for detection and power rectification, which are generally made from either germanium or silicon, LEDs are made from compound semiconductor materials such as gallium arsenide (Gas), gallium phosphide (Gap), gallium arsenide-phosphate (Gasp), silicon carbide (Sic) and gallium indium nitride (Gain). The exact choice of semiconductor determines the wavelength of peak emission of photons. And hence the colour of the light emitted, in the case of visible light LEDs. It can also determine the electro optical conversion efficiency, and\ hence the light output.

5. Working

Working of circuit

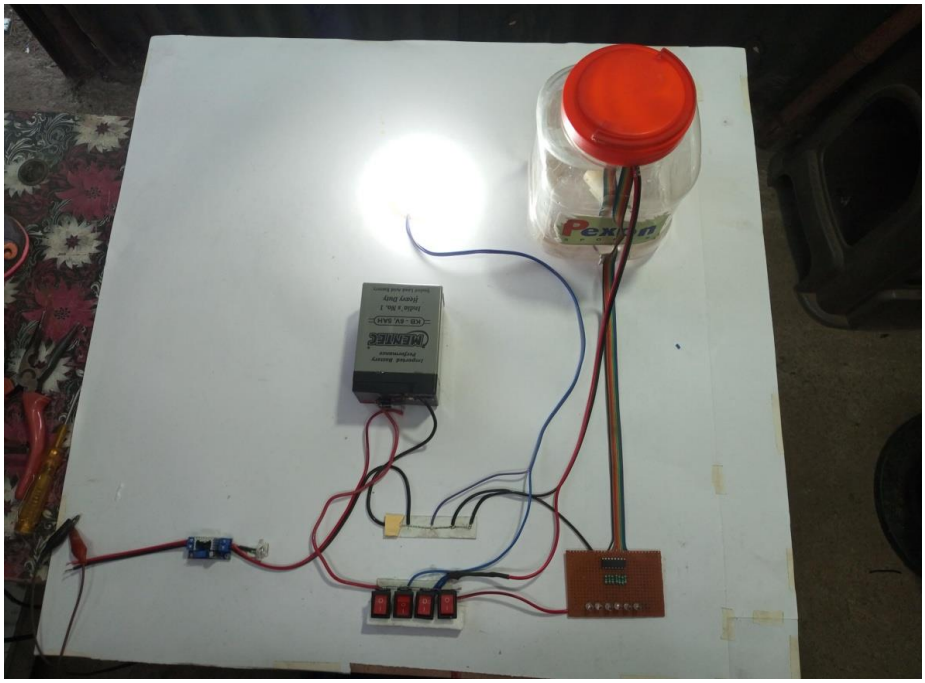
The Numeric Water Level Indicator employs a simple mechanism to detect and indicate the water level in a tank or any other container. The level sensing is done by a set of nine probes which are placed at nine different levels on the tank walls (with probe9 to probe1 placed in decreasing order of height; 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



6. Advantages

1) It does not require electric power.
2) Easy to operate and maintains.
3) No fuel cost- uses abundantly available free sun light.
4) Long operating life.
5) Highly reliable and durable free performance.
6) Environment friendly, no noise, no pollution.
7) Saving of conventional diesel fuel.
8) One time investment, no running cost

7. Result

In the Solar in Agriculture project, we have generated electrical energy with the help of solar panels and have told that through electrical energy we can run pumps and motor lights etc. in our fields. In this, we have used a 6 volt battery and a pump. Also, we have used a water level indicator. We have used a battery circuit for battery charging. Along with this, we have used LED for power battery bank so that we can get light through LED when the light goes off. In this project, we have generated power through totally renewable energy which is very useful for our future and it will also be used in electricity generation in future.

8. Conclusion

This paper suggests that solar energy may offer a long-term solution to many of the world's current issues, including climate change, energy shortages, atmospheric conservation, and drought. Despite this, farmers believe that the initial cost of solar water pump systems is more than the cost of a diesel water re-circulating pump, but neither system considers production or maintenance expenses. The PV collection of solar water pump systems, which may be utilized to generate power if irrigation is not required, is one of the most essential features. Solar water pumping devices can efficiently meet the needs of marginal farmers in the landholding system for irrigation water. Pump sets are installed every year in India due to increasing fuel costs on a regular basis. The solar water pump system allows for better use in order to decrease fuel consumption. Solar water pumps have been available in different designs for over three decades, therefore they are not a new idea. Using up to 30% of the world's available energy will need expensive money to continue to utilize more of the power production. It claims that certain expenses are imposed on society and the environment based on the periodicity of the energy market and thermal power plants. Based on the above, we conclude that the solar pumping system is more feasible than the diesel engine pumping method

for watering India's agriculture. Solar water pumps are not more expensive on an economic level if solar energy is utilized continuously, but their capital expenses are considerable.

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