International Journal of Engineering and Advanced Technology (IJEAT)
ISSN: 2249-8958 (Online), Volume-10 Issue-1, October 2020

Dual Source Self Displaying Water Pumps

Aldrin Jose, Andrew Franklin Raj A, Arunmozhi T M, Kuttiraj G, Dr. Karpagam J

Abstract: ***Energy may be a key ingredient for the development of a nation. India is a country that is profusely endued with renewable energy sources. It is an outsized nation and the rate of electrification have not unsubdued speed with the increasing people, development and industrialisation has resulted in the increasing shortage between need and supply of electricity. Individuals who are not provided the facility grid need to be dependent on fossil fuels like diesel and petrol for his or her power wants and additionally incur significant revenant expenditure. We have taken initiative to design and implement a pump which will be operated on multiple energy sources. The pump is operated by taking power from the prevailing AC grid and facility taken from the standalone electrical photovoltaic system. The pump works on renewable solar power and whenever there is a shortage of solar power, it is switched to AC grid. Additionally, to the system, a self-display unit has been put in within the pump. This unit helps the buyer to observe the motor parameters like voltage, current and frequency any time. This unit helps in reducing the value for putting in a separate meter close to the starter of the pump. This increases the compactness of the pump.***

Keywords: AC grid, Photovoltaic system, Solar energy, Self-displaying unit, Water pump.

I. INTRODUCTION

Agriculture in developing nations isn't as economical as ought to be. One in all the most issues of agriculture is water management. Even developing nations that receive an optimum quantity of water through rainfall to be economical within the field of agriculture. The initial investment of alternative energy is high. However, lets place it during a developing nation's farmers perspective, where the agricultural spaces are brought below power system the erratic associate degreed uncertain supply provide are not helpful for farmers. Therefore, need for an uninterrupted power supply particularly throughout the important cultivation period has been a serious area to discuss. India receives an alternative energy average of 5,000 trillion kWh /year and an everyday average alternative energy incidence of 4-7 kWh/m which is often significantly quite the entire energy utilization of the nation. Further, majority of the parts of the country experience 250-300 sunny days during a year, that makes alternative energy a usable choice in these regions. Decentralized renewable energy systems, that admit domestically out their resources, may give the answer to the agricultural energy drawback. Significantly in rural areas wherever grid supply isn't in a manageable proposition alternative sources with its just about infinite usage and free handiness, represent a non-polluting and unlimited energy supply.

Revised Manuscript Received on September 15, 2020.
* Correspondence Author
Aldrin Jose*, Under Graduate Student, Electrical and Electronics Engineering, KPRIET, Arasur, Kovai.
Andrew Franklin Raj A, UG Scholar, Under Graduate Student, Electrical and Electronics Engineering, KPRIET, Arasur, Kovai.
Arunmozhi T M, Under Graduate Student, Electrical and Electronics Engineering, KPRIET, Arasur, Kovai.
Kuttiraj G, Under Graduate Student, Electrical and Electronics Engineering, KPRIET, Arasur, Kovai.
Karpagam J, Assist Prof, Electrical and Electronics Engineering, KPRIET, Arasur, Kovai.

II. PROPOSED METHODOLOGY

The advantages of this system are

- High initial system cost but gives more benefit in long time.
- Low labour and maintenance costs.
- No fuel costs.
- Easy to transport, remove and store.
- Produces water during summer when it is needed most.
- Reliable and long life.
- Non-polluting.

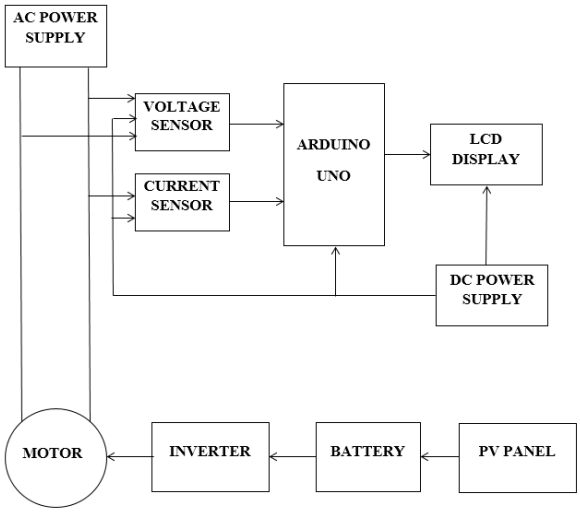

Fig. 1. Block Diagram

A. Arduino UNO

Arduino Uno is a type of microcontroller board based on the ATmega328 (datasheet). It usually has 14 digital I/O pins, six analog input pins, a 16 MHz ceramic resonator, USB connection, a power supply pin, and a reset button. It has all the required components for the functioning of the microcontroller.

It can be connected to computer through a USB cable or connect it with an AC-to-DC battery or adapter. The Arduino UNO is different from the previous boards because it does not have a FTDI USB-to-serial driver chip. Rather, it uses a Atmega16U2 (Atmega8U2 having upto version R.2) programmed as a USB-to-serial converter.

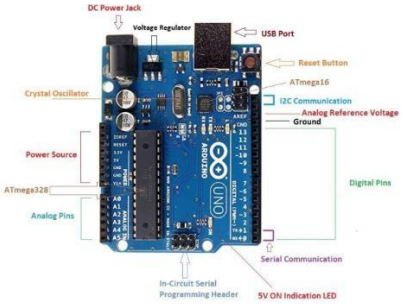

Fig. 2. Arduino UNO

B. Solar Panel

The word solar panel is employed informally to describe a photo-voltaic (PV) module. A PV system is an assembly of photo-voltaic cells arranged on a framework for installation. Photo-voltaic cells utilize daylight as a source of supply and generate electricity. A set of PV modules is named a PV Panel and many such arrangements is called an Array. Arrays of an photovoltaic system provide electricity to electrical components. Photovoltaic systems use light energy (photons) from the sun to generate electricity through the photovoltaic phenomenon. Most systems use wafer- primarily based on crystalline Silicon cells. The structural component of a system is either the topmost part or the rear part. These cells should be protected against mechanical harm as well as wet. Many systems are rigid, however semi-flexible systems support a thin-film cells are also obtainable. The panels square measure connected on electrically non-parallel one to get a optimum voltage and so are in parallel to extend photovoltaic phenomenon. The power of the system is obtained by the product of the voltage and current, therefore the electrical phenomenon of the system.

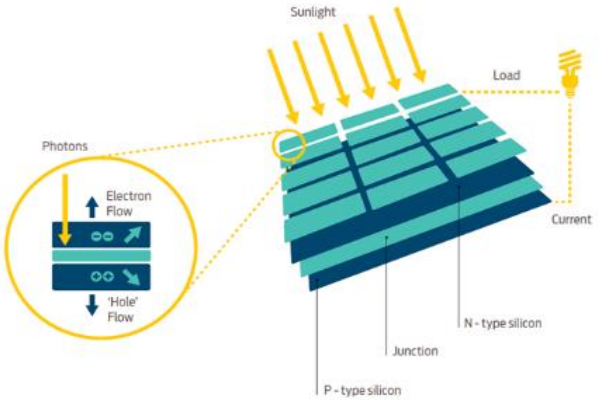

Fig. 3. Solar Panel

C. Current Sensor

Current sensing elements are employed to measure current flowing through the motor. Current sensing element function like as current transformer. This is often achieved by employing a current transformer (CT), a "donut" shaped instrument which are ribbed through the wire whose current is to be measured. A current transformer could be any type of "instrument transformer" which are outlined to supply current in its secondary that is absolutely proportional to the current flowing through the primary.

Specifications:

- Input Current : 0-30A
- Output Mode : 0-1V @ 30mA
- Frequency : 50HZ-150KHZ
- Dielectric Strength: 6000V AC/1min

Fig. 4. Current Sensor

D. Voltage Sensor

A voltage sensor is a type of sensor which are used to determine and observe the voltage across a circuit. Voltage sensors can detect both the AC voltage and DC voltage levels. The input of the sensor are the voltage and output are the switches, analog voltage signal, a current signal, an audible signal, etc.

Specifications:

- Output Signal : Analog 0-5V.
- Measurement range : 250V.
- Current (input) : 2mA.
- Dimensions : 49.5 mm x 19.4 mm.
- On-board micro-precision voltage transformer.

Fig. 5. Voltage Sensor

E. LCD Display

The Liquid Crystal Display (LCD) is a displaying unit that is used to show the motor specifications. Liquid Crystal Displays (LCDs) are used in common applications where LEDs are used.

The applications of LCD are displaying of numbers and alphanumeric characters in dotted matrix formats and display segments. When required voltage is allowed through electrodes the liquid crystal molecules will be arranged in a specific direction.

The light rays passing through the LCD could be rotated by the polarizer, this results in highlighting the inputted characters. The power supply should be +5V.

To accomplish the optimum contrast for the display, the voltage (VL) at pin 3 should be optimized correctly. This display must not be disconnected from a power connected circuit.

Fig. 6. LCD Display

F. Charge Controller

The charge controller is a device that is used to optimizing the conditioning of the charge and the storage battery is charged fully, 50% charged or discharged and controls the panel itself showing whether the panel is in functioning or idle. Added to these processes the charge controller observes the batteries charging conditions, the process to charge and the type of connected and disconnected load from its system.

Fig. 7. Charge Controller

G. Centrifugal Pump

Centrifugal Pump is a type of pump which is commonly used pump to pump water from one place to another. This is a type of pump which has a rotating impeller to pump water and other liquids through the centrifugal force. These are the undoubted pump choices exceptionally used for transferring water from one place to the desired location in many industries including agriculture, municipal (water and wastewater plants), industrial, power generation plants, petroleum, mining, chemical, pharmaceutical and many other places. Centrifugal Pumps are helpful because they are usually used to pump more litres of liquids, produce efficient flow rates (which can change with the change in the Total Dynamic Head (TDH) of the specific pipe system) and has the potential to modify its flow rates between a larger scale.

Fig. 8. Centrifugal Pump

H. Pumping Elements

The pumping element is also called as an impeller. This component is mainly used to apply pressure and suction force to transfer water to the desired location in the designated location. This type of impeller is used in a centrifugal pump containing impeller that is static on the motor by making various required changes on the pumping system.

I. Storage Battery

The storage battery is used to store the electrical power in the energy form of chemical energy. This form of energy is later used in executing electrical processes when the circuit is connected. In this project, the battery element used is 48V, 120Ah and comes to functioning when it is no supplied with solar power, or when the sun is blocked by clouds and the pump system is needed to operate. The usually used battery type used in PV system is a lead acid battery. Therefore, the battery which is used is a lead acid type of storage element, because these batteries better performance co-efficient and are well-suited for various transfers.

Specifications:

- Capacity : 120Ah
- Voltage : 12V
- Current : 9.6A
- Battery type: Lead acid battery, Dry charge
- Dimension : 410x176x245 mm

Fig. 9. Battery

J. Inverter

A inverter, is a series of circuit connections which is used to convert direct current (DC) to alternating current (AC). The input voltage, output voltage and frequency, and overall

power handling depends upon the designing of particular devices and circuitries. The inverter is not used to generate electricity; the electricity is produced from the direct current. These type of inverters can be either electronical or it can be various choices of effects (which is a rotating component) and electronical circuitries. Stationary inverters have no rotating components. Power inverter is commonly used in many practical uses like large voltage and current applications. These circuits are further modified for low voltage and current uses and these devices are known as oscillators. The circuits which convert direct current to alternating current are known as rectifiers.

Specifications:

- Capacity: 800VA
- Power: 672Watts
- Battery: 1 battery(12VDC)
- Waveform: Trapezoidal waveform

Fig. 10. Inverter

III. RESULT

Coimbatore is located on 11.05° N; 76.95° E in the region with average solar irradiance of 5.35kWh/m^2/day and diffused solar radiation exposure is 8.52 MJ/m2. The monthly average is given below,

Table- I: Monthly Average

Monthly Average (kWh/m^2/day)	
JAN	5.65
FEB	6.29
MAR	6.78
APR	6.68
MAY	6.37
JUN	5.87
JUL	5.66
AUG	5.96
SEP	6.02
OCT	5.19
NOV	4.86
DEC	5.19

The global solar intensity at 10am will increase up to mid noon. The highest solar intensity measured is 845 W/m2. During afternoons at periods due to cloudy weather intensity drops. The diffused intensity rises simultaneously. These values does not affect the. Pumping system. During 4.00pm the intensity drops its value up to 600 W/m2.

Table- II: Voltage and Current Values

Time	PV panel	
	Voltage(V)	Current(A)
9:30 AM	225	3.1
10:30 AM	225	3.1
11:30 AM	227	3.1
12:30 PM	230	3.2
1:30 PM	230	3.2
2:30 PM	230	3.2
3:30 PM	227.5	3.2
4:30 PM	225	3.1
5:30 PM	225	3.1

The above voltage and current reading were noted in the sun shining time. These recording are noted for a period of 8 hours with readings of each hour. Its recommended position is 30° south to east.

IV. CONCLUSION

Due to the expansion in cost per increment in unit power yield of a photovoltaic framework is more prominent than that of a diesel, petroleum, or electrical framework, photovoltaic system is more financially savvy when the water system framework with which it works has a low all out unique head. Consequently, photovoltaic system is more cost-serious when it is utilized to control a miniaturized scale water system framework when contrasted with an overhead sprinkler framework. Photovoltaic system for water system is price-serious with conventional vitality hotspots for little, far off applications, if the absolute framework structure and use timings are deliberately analyzed and orchestrated to utilize the sun powered vitality as effectively as could reasonably be expected. Later on, when the costs of non-renewable energy sources rise and the monetary favorable circumstances of large scale manufacturing lessens the pinnacle watt cost of the photovoltaic system, which causes photovoltaic capacity to turn out to be more price-serious and normal. The main advantages in this project are

- High initial system cost but gives more benefit in long time.
- Low labour and maintenance costs.
- No fuel costs.
- Easy to transport, remove and store.
- Produces water during summer when it is needed most.
- Reliable and long life.
- Non-polluting

Benefits to farmers:

Farmer gets a high value, high discharge pumping system for a one-time amount that is less than a third of the actual price and may be maintained at nominal cost annually.

- Minimum expense and fuel cost.
- Over long run it is more efficient.
- Enables cultivation of an extra crop.
- Helps in giving the basic defensive water system in water scant region
- Reduces work and time
- Improves agriculture productivity.
- High income and better life
- Increase in profit leads to easy payment of loans for installing the system.

REFERENCES

1. Solar Water Pump. Int. Journal of Engineering Research and Application ISSN: 2248- 9622, Vol. 7, Issue 5, (Part -3) May 2017.
2. Eker. B and Akdogan A, Protection methods of corrosion on Solar Systems, TMMOB Machinery Engineering Society, Mersin, Turkey, 2015.
3. M. Dubey, S. Sharma, and R. Saxena, "Solar PV Standalone Water Pumping System Employing PMSM Drive," Electrical Electronics and Computer Science (SCEECS), IEEE 2014.
4. Jose M Corberan, Antonio Cazorla- Marin, Javier Marchante-Avellaneda, Carla Montagud, International Journal of Low-Carbon Technologies, Volume 13, Issue 2, June 2018.
5. Luqman Maraaba, Zakariya Al-Hamouz and Mohammad Ahido,"An Efficient Stator Inter-Turn Fault Diagnosis Tool for Induction Motors", 2018.
6. Yugo Santos and Marta, "Comment on Draft Pumps for Power Papers", October 7, 2013.

AUTHORS PROFILE

Aldrin Jose, Under Graduate Student, Electrical and Electronics Engineering, KPRIET, Arasur, Kovai.

Andrew Franklin Raj A., Under Graduate Student, Electrical and Electronics Engineering, KPRIET, Arasur, Kovai.

Arunmozhi T M, Under Graduate Student, Electrical and Electronics Engineering KPRIET, Arasur, Kovai.

Kuttiraj G., Under Graduate Student, Electrical and Electronics Engineering, KPRIET, Arasur, Kovai.

Dr. Karpagam J., Professor, Electrical and Electronics Engineering, KPRIET, Arasur, Kovai. She received her M.E. and Ph.D. degrees from Anna University. She is having 18 years of teaching and research experiences, which include Power Converters, Control Techniques and Industrial Drives.