Dual Power Generation Using Solar And Wind Energy For Auto Irrigation

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Abstract: The main motive behind the project is to develop a hybrid power system using solar and wind energy. As primary fuels are depleting day by day, solar and wind energy are highly used in many industries for power generation. Energy generated from these sources is considered a technological option for generating clean and green energy. The major emphasis of this project is to generate energy from renewable sources and to provide this energy for irrigation purposes The. uninterrupted power supply can be provided by the means of the hybrid energy system. This system involves the integration of two energy systems that will give continuous power supply. The objective of our project is to reduce this manual involvement by the farmer by using an automated irrigation system whose purpose is to enhance water use for crops. Even if the farmland has a water-pump, manual involvement by farmers is required to turn the pump on/off when needed. This project is intended to cultivate an automatic irrigation system which controls the pump motor ON/OFF on sensing the moisture content of the soil.

I. INTRODUCTION

As we know energy is the basic requirement for any development. Due to the rapid increase in cost and environmental concern it is important to discuss the various methods and processes for the generation of power by renewable energy sources. Thus producing electricity with the use of renewable resources like Wind and Solar has been taken up in this project. A Windmill, which rotates when there is enough wind, generates electricity owing to magnetic coupling between the rotating and stationary coil. A windmill is being used in this project. Silicon-based wafers which are cascaded together to form a Solar Panel is being used in this project to generate electricity. The Windmill, when there is enough wind to drive it, generates power to charge a battery. Similarly, the Solar Panels are mounted in the direction which exposes to maximum sunlight to generate energy enough to charge the battery. Since both of them simultaneously can work in favourable natural conditions, both can charge the battery at a faster pace than they would have individually. Thus, this project is an example of how natural resources can be efficiently harnessed to produce electricity at a faster pace and cheaper rate. This electrical power can utilize for various purposes. In this project, we are using electricity for automatic irrigation purpose. To assist farmers in growing plants, we are introducing a low-cost microcontroller-based automated irrigation system using soil moisture sensors. The sensors will monitor the changing conditions of moisture levels according to weather conditions. Concerning changing conditions of soil moisture, they will be able to schedule the proper timing for water supply. Automated irrigation systems can increase crop yields, save water usage, energy, and labor costs as compared with manual systems.

II. DESIGN AND IMPLEMENTATION

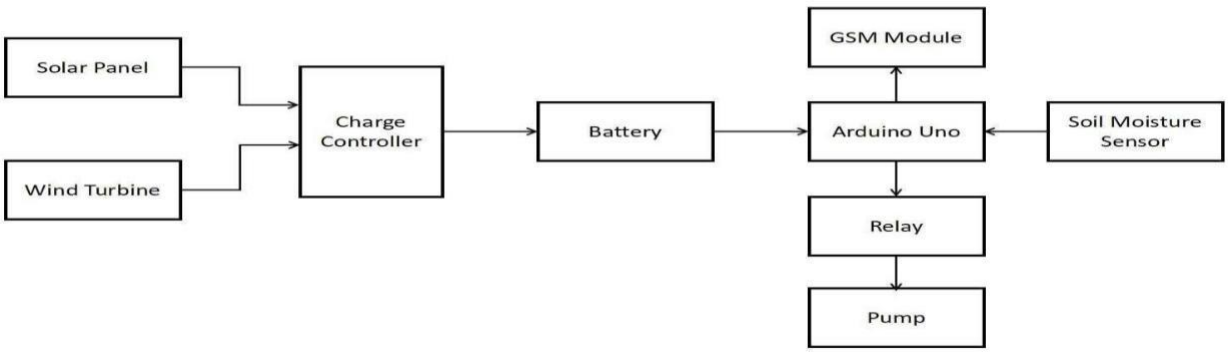

FIG 1: BLOCK DIAGRAM

III. IMPLEMENTATION:

STAGE 1 OF DESIGN-

SOLAR PANEL:

Maximum power : 10W

Voltage at max. power : 17V

Current at max. power : 0.59A

Open circuit voltage : 21V

Short circuit current : 0.62A

WIND TURBINE:

Wind turbine is that system which extracts energy from wind by rotation of blades of the wind turbine. In this project we have used the vertical type wind turbine.

STAGE 2 OF DESIGN-

CHARGE CONTROLLER

The basic functions of Charge controller is:

- Low voltage protection.
- Over voltage protection.
- Battery cut off circuit.
- Back current protection.
- Over discharge protection.

Battery:

Lead acid battery

AP12-1.3 (12V/1.3Ah)

In our project we have used the lead acid battery. We have used this battery because it provides higher specific energy than other battery types.

STAGE 3 OF DESIGN-

Various modules are interfaced to the Arduino Uno,

1. Soil moisture sensor
2. Relay
3. Water pump
4. GSM module

IV. INTERFACING

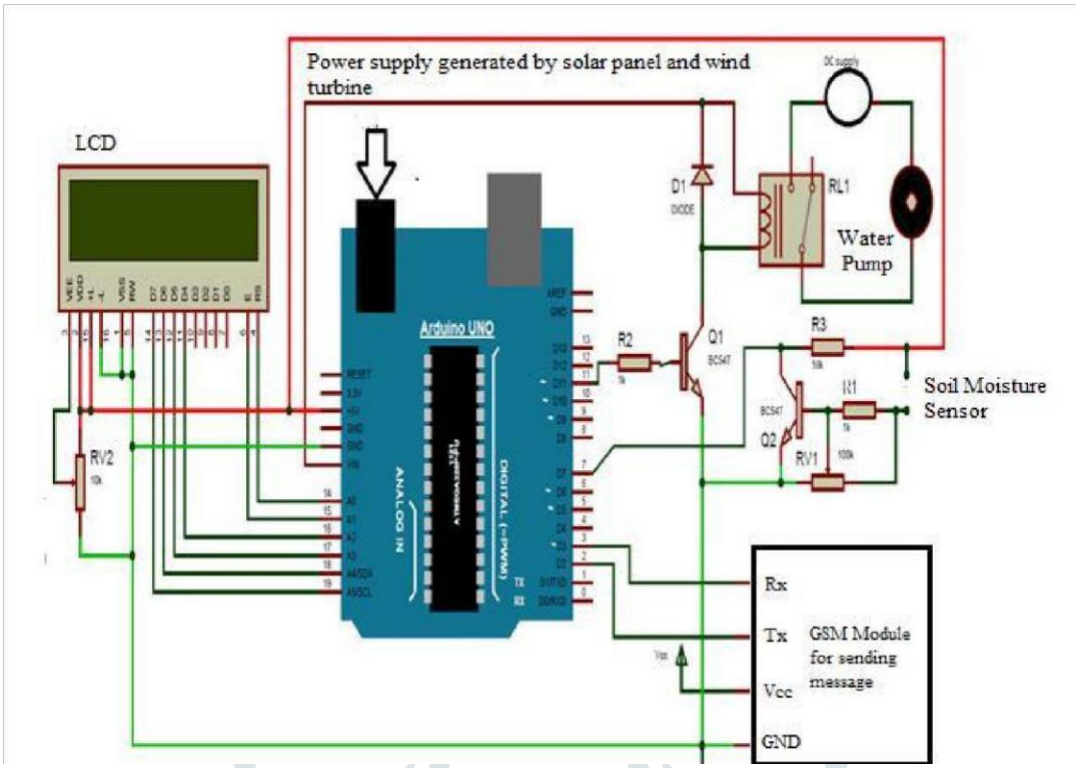

FIG 2: INTERFACING OF DIFFERENT MODULES

V. WORKING

The power is generated from the individual solar panel and windmill. These powers are supplied to the charge controller for over-voltage protection, back current protection. These controlled powers are then stored in the battery for further use. The power is supplied to Arduino UNO through the battery which is used for auto irrigation. Arduino is used for controlling the whole process and the GSM module is used for sending alert messages to the user on his Cell phone. The soil moisture sensor is connected to one of the input ports of Arduino. If moisture is present in the soil then there is conduction between the two probes of Soil Moisture sensor and due to this conduction, transistor Q2 remains in on state and Arduino Pin D7 remains Low. When Arduino reads the LOW signal at D7, then it sends SMS to the user about "Soil Moisture is Normal. The motor turned OFF" and water pump remains in Off state. Now if there is no Moisture in soil then Transistor Q2 becomes Off and Pin D7 becomes High. Then Arduino reads the Pin D7 and turns On the water motor and also sends a message to the user about "Low Soil Moisture detected. The motor turned ON". The motor will automatically turn off when there is sufficient moisture in the soil.

VI. CALCULATIONS

The total power generated by this system may be given as the addition of the power generated by the solar PV panel and power generated by the wind turbine.

Mathematically it can be represented as,

PT=NW*PW+NS*PS

Where,

PT is the total power generated

PW is the power generated by wind turbines

PS is the power generated by solar panels

NW is the no of wind turbine

NS is the no of solar panels used

A) Calculations for wind energy

The power generated by wind energy is given by,

Power = (density of air * swept area * velocity cubed)/2

PW = 1⁄2. ρ (A) (V3)

Where,

P is power in watts (W) ρ is the air density in kilograms

per cubic meter (kg/m3)

A is the swept area by air in square meters (m2) V

is the wind speed in meters per second (m/s).

Let V= 15 m/s

ρ= 1.23 kg/m3

A= π*r2

= 3.141*(.5)2

= 0.7854 m2

PW = (1.23*0.7854*153)/2

= 1630 W

B) Calculations for solar energy

To determine the size of PV modules, the required energy consumption must be estimated. Therefore, the power is calculated as

PS = As*r*H*PR Where,

r = Solar panel yields or Efficiency

As = area of single PV panel (m2)

H = Annual average solar radiation on tilted panels.

PR = Performance ratio, coefficient for losses.

Let H = 5.17 kw/m2

PR = 0.75 default value As

= 0.25*0.30

= 0.75 m2 r

=16%

PS = (5.17*0.75*0.75*0.16)

= 465.3W

VII. RESULT

Depending upon the sun's intensity and whether there is enough wind or not, power is generated from solar panels and windmill. The amount of power generated from these sources depends on environmental conditions. Here we have used the Arduino UNO for controlling the irrigation system. Depending upon the soil moisture, if the moisture is present in the soil then there is conduction between two probes of soil moisture sensor and due to this Arduino reads the LOW signal, and the water pump remains OFF. If there is no moisture present in the soil then there is no conduction between the probes and due to this Arduino reads the HIGH signal and the water pump turns ON. The water pump will be automatically turned off when sufficient moisture will be there in the soil. The whole above information about the output of the soil moisture sensor, whether the water pump is turned on or off is sent to the user.

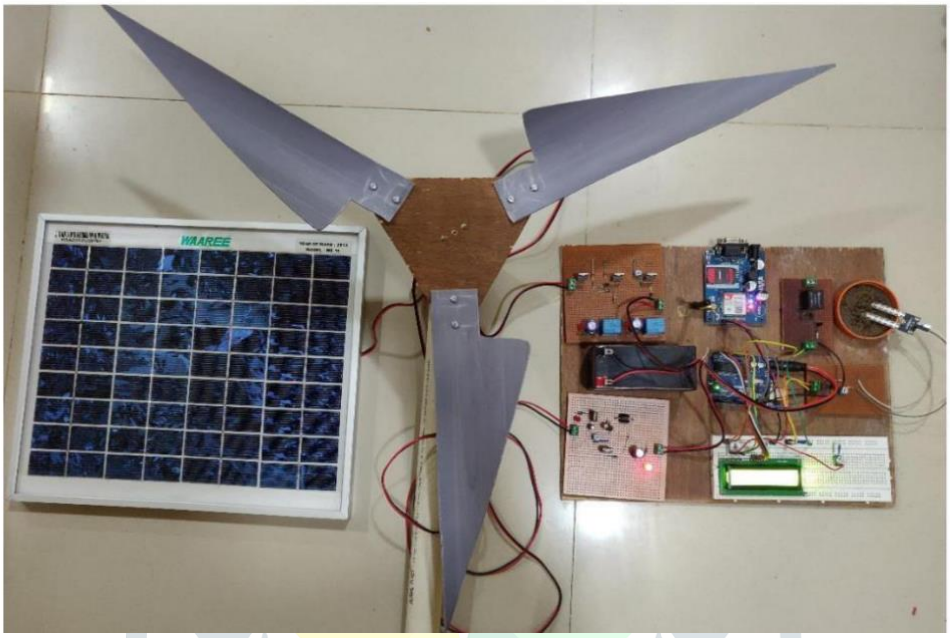

FIG 5: WORKING MODEL

VIII.CONCLUSION AND FUTURE SCOPE

CONCLUSION

The hybrid power generation system is a good and effective solution for power generation than conventional energy resources. It has greater efficiency. People should motivate to use of non-conventional energy resources. It is highly safe for the environment as it does not produce any emission and a harmful waste product like conventional energy resources. It is a cost-effective solution for the generation of energy. It only needs an initial investment. It has also long-life span. We can conclude that it is a good, reliable and affordable solution for electricity generation. We can design this model considering low cost, reliability, alternate source of electric power. As the proposed model is automatically controlled, it will help the farmers to properly irrigate their fields. The model always ensures a sufficient level of water in the soil. Thus, this system avoids over-irrigation, under irrigation, topsoil erosion and reduce the wastage of water. To overcome the necessity of electricity and ease the irrigation system for our farmers, the proposed model can be a suitable alternative.

FUTURE SCOPE

- By using an inverter in the model, the system can be used for various applications which require AC power supply.
- In metropolitan cities, implementing a wind turbine is not possible. In this case, rather than using wind turbines, we can use other power generating sources like piezoelectric material, biomass energy.

IX. REFERENCES

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