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A DETAILED ANALYSIS OF A SOLAR WIND HYBRID POWER GENERATION SYSTEM INCORPORATING AN ENHANCED LOAD CONVERTER

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ABSTRACT

In comparison to traditional power generation techniques, renewable energy is reliable as well as efficient, clean, and environmentally friendly. Switching to renewable energy sources is the only way to alleviate the resource shortages that the world is now experiencing, particularly the lack of fuel resources. More and more people are turning to renewable energy sources like solar and wind power. The project's goal is to utilize the programming language MATLAB/Simulink to design a hybrid power producing system that is connected to the grid and uses both solar and wind energy. The geography, solar irradiance, daylight hours, temperature, wind speed, and wind direction were all considered during the model's creation. The grid-connected hybrid model includes photovoltaic cells, a maximum power point tracker (P&O), a boost converter, an inverter, a wind turbine, and a permanent magnet synchronous generator (PMSG). In addition, the hybrid system is what powers the grid. The output is measured under a range of irradiance and temperature conditions.

1.INTRODUCTION

With its support for economic expansion, welfare, and quality of life, energy is essential for human advancement and world prosperity. The ecological balance and safety of conventional energy sources are seriously compromised on a local and global scale. Renewable energy sources are a superior choice because they are clean, non-polluting, and environmentally beneficial in today's energy-demanding world. Natural energy is abundant, carbon-free and can replace fossil fuels while protecting resources for future generations. Examples of such sources are sunshine, wind, rain, waves, geothermal heat, and tides. The excessive consumption of traditional energy sources like coal, petroleum, and oil, which has resulted in resource depletion and environmental imbalances, is what is causing the rising need for electrical energy. Renewable energy sources including biomass, solar, wind, and hydroelectricity are safe, dependable, and environmentally benign. These renewable energy sources, however, are susceptible to climatic and seasonal changes, which reduces their efficiency in the summer and winter. Hybrid power generation using renewable energy is

more efficient since it combines two or more renewable energy sources to satisfy load demands. This system costs less and is more dependable, effective, and eco-friendly. The most popular renewable energy sources for generating electricity are solar and wind power. These sources have several advantages over other energy sources, including a decrease in peak demand, a reduction in reliance on a sole source, and an improvement in power quality.

2.LITERATURE SURVEY

A Review Economic viability of photovolt aic water pumping system solar energy Y honis YG

Each solar cell has prepared layers of semic onductor material produces DC. Scarcity of electricity with that high cost of diesel affect s the Water supply and irrigation. Solar ener gy for pumping water is therefore promising options in terms of conventional energy. We can conserve water by using Pv technology because we waste a lot of water when we do n't use it properly . additionally, several soci oeconomic considerations for environment g oods are made. This document is intended fo r irrigation pumping system that are inexpen sive. temperature, humidity .and soil moistur e are measured by a programmable sensor m odule , which transmits the data to am ESP3 2 microcontroller. Additionally, this docume nt explains how to set oil moisture limitation s for particular. soil types. The RTC (Real Ti me Clock) and Microcontroller circuit help o vercome the problem of manually operating the water pump.. The pump can be managed using pre – set time window .that Makes co ntrolling much simpler and more dependable than the current system by integrating GSM and a soil moisture sensor into the current .

Proceedings of the International Conference on Inventive Computing and Informatics IEEE IJETMR.co Advance in Electronic and Electric Engineering. ISSN 2231-1297, Volume 4 (2014), pg. 34

Making an automated water pumping system is the aim of this project. This technology is able to detect the amount of soil moisture and makes an intelligent judgement regarding whether to turn on or turn off the water motor based on the amount of moisture in the soil. The motor is also powered by solar energy. Where people live and work, electricity is essential. The level of affluence and living conditions of a country directly affect its use of power. Due to industrial development, an increase in the use of electrical equipment, and other factors, the demand for energy globally is rising at an alarming rate.We obtain nearly 80% of our energy from traditional fossil fuels like coal (23%) and natural gas (21%) as well as oil (36%), according to the World Energy Report. It is well recognised that eventually, all of these resources will be entirely depleted. Alternative energy sources should therefore be used to prevent an energy catastrophe in the near future. Solar power is the best alternative energy source. The most significant source of energy in the planet is solar energy. Currently, solar energy lessens the usage of fossil fuels and lowers electricity prices in addition to being a natural energy source. Solar energy is energy that is transformed into thermal or electrical energy from the sun. Making an automated water pumping system is the aim

of this project. The photovoltaic solar panel will track solar energy from the sun, generating direct current that is stored in the battery and allowing the system to sense the soil's moisture content and make an informed decision about whether to turn on or off the motor.The microcontroller kit will include a temperature sensor. Water level sensors are positioned in tanks, and moisture sensors are introduced into the ground. A photo controller is an intelligent gadget that can carry out the task when a moisture sensor detects it during operation. The water level sensor and motor are connected to the pic controller via a relay. Through a relay, the motor receives energy from the solar panel. Moreover, a battery is used to store solar energy. The controller continuously checks the moisture level and decides whether to turn the motor on or off based on that level. Using embedded C, the microcontroller

Y Kim, R G Evans; Software design for wireless sensor-based site-specific irrigation?, Computers and Electronics in Agriculture; Vol. 66; pp. 159–165; 2009

In-field sensor-based site-specific irrigation management is of benefit to producers for efficient water management. Integration of the decision making process with the controls is a viable option for determining when and where to irrigate, and how much water to apply. This research presents the design of decision support software and its integration with an in-field wireless sensor network (WSN) to implement site-specific sprinkler irrigation control via Bluetooth wireless communication. Wireless in-field sensing and control (WISC) software was designed by four major design factors that provide real-time monitoring and control of both inputs (field data) and outputs (sprinkler controls) by simple click-and-play menu using graphical user interface (GUI), and optimized to adapt changes of crop design, irrigation pattern, and field location. The WISC software provides remote access to in-field micrometeorological information from the distributed WSN and variable-rate irrigation control. An algorithm for nozzle sequencing was developed to stagger nozzle-on operations so as evenly distributed over the 60-s cycle. Sensor-based closed-loop irrigation was highly correlated to catch can water with $r^2 = 0.98$. Efficient water management plays an important role in irrigated agricultural cropping systems. Many areas of agricultural fields are effectively over- or under-irrigated due to spatial variability in water infiltration and runoff of rainfall and irrigation, crop water use and irrigation depth. Under-irrigated areas are subject to water stress, resulting in production loss, while over-irrigated areas suffer from plant disease and nutrient leaching. A wireless sensor-based irrigation control system is a potential solution to optimize water management by remotely accessing in-field soil water conditions and site-specifically controlling irrigation sprinklers. The system requires seamless integration of the system input and output components, and software design for decision support and monitoring.Sensor-based irrigation systems have been studied for many applications (Stone et al., 1985, Jacobson et al., 1989, Zazueta and Smajstrla, 1992, Meron et al., 1995, Testezlaf et al., 1997). Stone et al. (1985) presented a

computer-based monitoring system for continuous measurements of soil water potential. Zazueta and Smajstrla (1992) compared indirect estimates with direct measurement of soil moisture. Meron et al. (1995) used a control system for apple tree irrigation management using tensiometers. Testezlaf et al. (1997) used an automated irrigation control system for management of greenhouse container plants. A well-designed irrigation system is an essential requirement for a profitable and environmental friendly irrigation (Abreu and Pereira, 2002). Wireless radio frequency technology has provided opportunities to deploy wireless data communication in agricultural systems (Oksanen et al., 2004, Zhang, 2004, Lee et al., 2002). Software design for automated irrigation control has been studied by Abreu and Pereira (2002). They designed and simulated solid-set sprinkler irrigation systems by using ISADIM software that allowed to the design of a simplified layout of the irrigation system. However, their software provided limited control due to the lack of feedback in-field sensors. An automated irrigation system was proposed for remote in-field sensing and variable-rate irrigation control (Kim et al., 2008). The objective of this paper is to describe a user-friendly software design for decision support and monitoring of wireless sensor-based site-specific irrigation system. A schematic flowchart of an automated irrigation system for variable-rate irrigation is illustrated in Fig. 1. The system consists of machine conversion, localization, and mission planning. The first requirement is to convert a self-propelled irrigation machine from a conventional mechanical and hydraulic system to an electronically controllable system for individual sprinkler head control. Then, it is necessary to be able to continuously monitor the geographic location of the irrigation machine by a self-positioning system. Once the machine is controllable and accessible to its navigation, mission planning must decide when to irrigate and how much water each sprinkler head should apply at each location. This decision support process updates watering instructions according to the cart location and field soil water conditions monitored from sensors distributed across the field, and sends control signals to a nozzle controller at the irrigation machine.

W R Anis, H M B Metwally; Dynamic performance of a directly coupled PV pumping system; Solar Energy; Vol. 53; pp. 369– 377; 1994

A PV pumping system using switched reluctance motor (SRM) is thoroughly investigated in this work. This motor is supplied by a d.c. voltage through a simple switching circuit. This drive circuit is much simpler than the normal d.c./a.c. inverter required to supply the induction motor. The efficiency of this motor is considerably higher than that of the equivalent d.c. or induction motors. In addition, because of the simple construction, SRM is cheaper than these conventional drives. Because of the above advantages of the SRM, the proposed system has higher efficiency and lower cost as compared with other systems. A design example is studied in detail to explore the advantages of PV pumping systems based on this new drive. The study of the performance of the proposed system showed

that the operating efficiency of the motor is about 85% during most of its working time. The matching efficiency between the PV array and the proposed system approaches 95%. The major part of the losses takes place in the pump and the riser pipes, this loss represents one-third of the total available energy.

W Lawrance, B Wichert, D H Gridge; Simulation and performance of a photo-voltaic pumping system; Power Electronics and Drive System; Vol. 1; pp. 513-518; 1995

Electricity is one of the major parameters for making growth and development of a country. The increasing demand for energy, the continuous reduction in existing sources of fuels and the growing concern regarding environment pollution, have pushed mankind to explore new non-conventional energy, renewable energy resources such as solar energy. Solar energy is mostly available and it is a clean source of energy in the whole world. In India, most of our agriculture water requirement is fulfilled from rainwater. As per land is concerned, India has the second largest available agricultural ground in the whole world. Still the problem of electricity not resolved. Most of the users (farmers) are not getting electricity for their agriculture field. The transportation and condition of roads is also hurdling in the development of agriculture. In this paper, we are discussing about the irrigation techniques available for the users (farmers). The main objective of this paper is to provide solar operated water pump which is controlled by GSM module with solar tracking to maximize efficiency. This minimizes the human effort of users (farmers) in the remote places. Users (farmers) can control all irrigation operations through mobile device. Population wise India stands 2nd in the world. The primary source of income for most of the population is still farming in India. Current agriculture systems are operated manually which consumes huge amount of time, money and energy. In India there is huge difference between total power supply & demand to the farming. In many areas power cut down continues for more than 8hrs. The current technology uses fossil fuel in many parts of India, which creates air pollution. So, it better to use renewable source of energy government also encourages its use in various sectors, including automation irrigation system for the farming. The main objective of paper is to design GSM module based Solar operated water pump use for the farming which uses Solar panel to the drive water pump. For the maximum efficiency of solar panel we use solar tracking technology The pump is control by DOL (Direct On Line) starter and it is operated through GSM module or we can use automatic starter. So this irrigation system can be operated from anywhere. The whole irrigation system is operated by the GSM and electricity is supplied to water pump by solar energy.

A report on Solar PV Applications in India; Published by Center for Study of Science; Technology and Policy (2006-07) [6] Odeh I, Yohanis Y G, Norton B; Economic viability of photovoltaic water pumping systems; Solar Energy; 80; 2006, pp. 850-860

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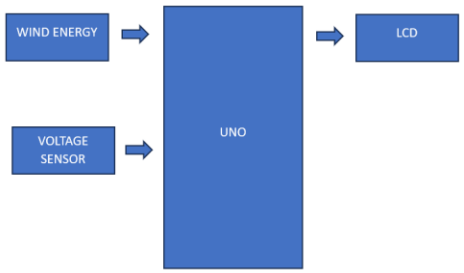
3.BLOCK DIAGRAM



BLOCK DIAGRAM DESCRIPTION

REGULATED POWER SUPPLY:

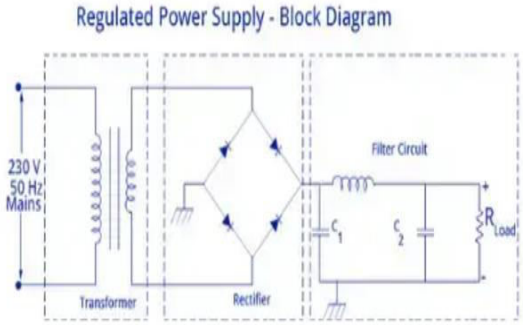


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Fig: Regulated Power Supply

Diagram

A regulated power supply provides a stable DC output by transforming variable AC input.

Component Overview: The essential components of a regulated power supply consist of a transformer, rectifier, filter, and regulator, each vital for ensuring a stable DC output.

The rectification process involves diodes transforming alternating current (AC) into direct current (DC), sometimes using full-wave rectification to optimize efficiency.

Filter Function: Filters, including capacitor and LC kinds, mitigate ripple and stabilize the DC output voltage.

Regulatory Mechanism: Regulators modulate and stabilize output voltage to safeguard against input fluctuations or load variations, crucial for a dependable power supply.

MICRO CONTROLLER

ARDUINO

The Arduino is a series of microcontroller boards designed to facilitate electrical design, prototyping, and experimentation for artists, hackers, amateurs, and even professionals. Individuals use it as the cognitive component for their robots, to create innovative digital musical instruments, or to develop a system that enables houseplants to notify you via Twitter when they want water. Arduino boards, namely the basic Arduino Uno, are constructed around an ATmega microcontroller, which functions as a comprehensive computing unit including a CPU, RAM, Flash memory, and input/output ports, all integrated into a single chip. In contrast to a Raspberry Pi, it is designed to connect various sensors, LEDs, tiny motors, speakers, servos, and similar components directly to these pins, which may read or output digital or analog voltages ranging from 0 to 5 volts. The Arduino interfaces with your computer by USB, allowing you to program it in a straightforward language (C/C++, akin to Java) using the complimentary Arduino IDE by uploading your developed code to the board. Once programmed, the Arduino may operate via a USB connection to your computer or independently without it—requiring just a power source, devoid of a keyboard or display

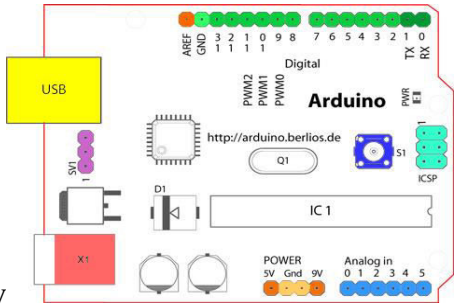

Fig: Structure of Arduino Board

SENSOR

A sensor is a device that identifies and reacts to certain stimuli from the physical world. The input may consist of light, heat, motion, moisture, pressure, or several other environmental phenomena. The output is often a signal that is either translated to a human-readable format at the sensor site or transferred electronically via a network for interpretation or further processing.

CONCLUSION

In the conclusion, the project is achieve all of the objective are : to measure solar panel parameter such as the temperature, light intensity, voltage and current. Using the temperature sensor that sense the changes in surrounding temperature, for the light intensity parameter was by using the LDR sensor, for the voltage parameter was by using the voltage divider method in order to reduce the maximum value of the solar panel to the voltage value suitable for the Arduino of power supply and lastly the current parameter was by using the current sensor module. Next, to find the best position and time for the solar power effectively energize the electricity. The data from measurement part shows that the best position of the solar panel effectively energize was the sunrise position with the highest voltage value which is14.75V at time 11.00am have been recorded. At this time the light intensity was 954 lux and the temperature was at 34.32℃. Lastly, to develop a portable device for measuring the solar energy can be achieve with developing the light in weight of the casing of the device and the neat arrangement of the electrical component inside the casin

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