Optimization of a solar water pumping system in varying weather conditions by a new hybrid method

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ABSTRACT: This project focuses on the design and implementation of water pump control in the field using solar energy. This works on the principle of photovoltaics. Solar panel converts the solar energy into electrical energy which is stored in the lead-acid battery. The embedded board MPLAB is used for programming, which in turn controls the switching of the motors. The solar water pump operates as a soft real time system, where the response time of the system is not crucial. The dc motors turn on or off at different time intervals. A toggle/push button switch will turn on or off of the system which reduces the manual effort of the user. The field can be divided into different slots based on the requirement of the user. Quantity of water supplied to the crops can be varied based on the different types of crops. The power generated by solar panels is used to draw water from the tank. This technique can be used for irrigation in fields.

Keywords-Renewable energy; pumping water; technical optimization; autonomous system.

Introduction

The design and installation of solar-powered water pump control in the field are the main objectives of this project. The photovoltaic principle underlies this. Lead-acid batteries are used to store electrical energy that is produced by solar panels. Programming is done on the embedded board LPC 2148, which internally manages the motor switching. The solar water pump functions as a soft real-time system, meaning that the system's response time is not essential. The dc motors operate at various intervals of time. The system can be turned on or off with the push of a button, requiring less human effort from the user. Depending on the needs of the user, the field might be divided into various slots. Depending on the type of crop, a varying amount of water can be delivered to the crop. The water tank is drained using the power produced by the solar panels. Field irrigation can be accomplished using this technique.Our study focuses on automating and using energy sparingly to maximize the effectiveness of solar water pumps. Currently, the PM-Kusum Yojana has erected over 3.5 lac solar panels, while the state of Maharashtra has installed 1 lac.

Literature survey

This section covers a summary of different approaches to fixing the problems with the current irrigation system. The remedies are as follows:
A PV system is the best solution for remote agriculture for purposes like water pumping for crops. Using wireless communication technology like Zigbee helps increase the security of the PV system. The Zigbee technology uses wireless communication to link neighboring wireless nodes . It may be fixed in a natural setting that a control room could observe. This system was created using solar panels, sensors, inverters, solar pumping motors, and Zigbee modules .The technique used in photovoltaic water pumping systems involves feeding the motor with energy generated by the panel through a converter with two power stages: a DC/DC stage to boost panel voltage and a DC/AC three-phase inverter to convert DC voltage to three-phase AC voltage. In comparison to other types of motors, the three-phase induction motor is employed because of its high level of resilience, low cost, higher efficiency, and low maintenance cost. It uses a single PV panel to power weak water pumps.Another option is to use a photovoltaic array to power an induction motor with vector control that is connected to a centrifugal hydraulic pump. The centrifugal pump is fed by a voltage source inverter and is operated by an induction motor. It employs an induction motor, which requires less upkeep than a DC motor

Need of project

Now a days depletion of conventional power generating sources is one of the major concern faced on a global level but demand is increasing rapidly Considering the growing energy demand & frequent load shedding issues, we need to save & integrate every possible sources of power for improvement & reliability of grid

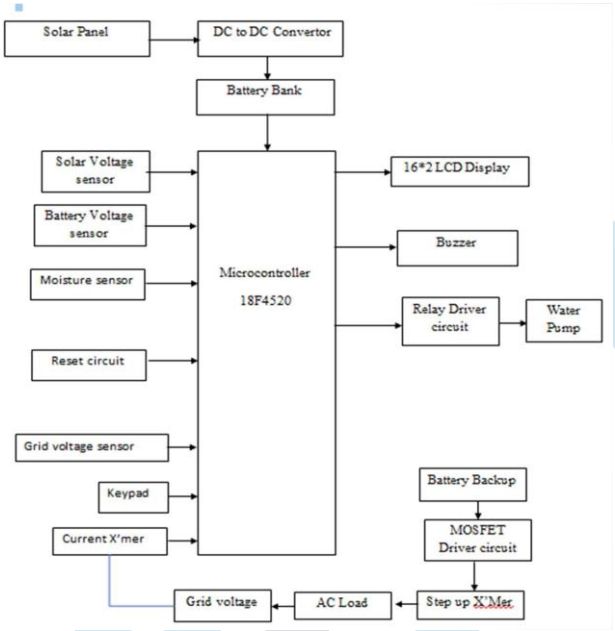
Aim and objective of project

◊ We identified that various solar pumps which are installed for farmers, residential and commercial purposes use solar energy for their daily work most of the times when pump is not in operation the energy generated by solar panel gets wasted.

◊ We aim to develop a prototype which will deliver this excess energy to home/ grid/ standalone system.

◊ This prototype will monitor all parameters, will share the details of abnormalities, manual, automatic & remote operation, alarming.

System Development



Working

Solar panel converts solar energy into electricity.
This variable DC is converted into the pure DC using a filter capacitor. This fixed 12V DC sent to the battery for charging the battery. Diode (D2) is used to protect the solar panel from the reverse voltage of the battery. 12V DC dropped up to 5V DC, this 5V DC sent to the microcontroller to measure the solar voltage and display it on the LCD Display. When '0' sent by the microcontroller to the ground terminal of LED. LED will glow, transistor (BC547) becomes ON. Then ground terminal of transistor shifts at the gate terminal
MOSFET.12V DC is applied to the gate terminal of MOSFET.MOSFET will turn ON, battery starts charging with 12 V DC Supply. 12V DC dropped up to 5V DC this 5V DC is given to the microcontroller. Microcontroller will measure the battery voltage and display it on the LCD display. Then 12V DC voltage is filtered out and removes the voltage spikes using the capacitors. By using regulator IC LM7805 we will get constant 5V DC voltage at the output terminal of regulator IC. This voltage dropped up to the level so that LED will turn ON without damaging the LED.

Application

1. Can be implemented in existing solar water pumps.
2. After a few modifications we can use the model as a microgrid.
3. Net metering at our end

Advantage

1. Safe operation
2. Power saving
3. Improvisation in grid reliability & stability
4. Remote operation

Conclusion

n this project, we propose a simple but efficient, low-cost, power-efficient embedded system for solar-based off-grid irrigation by orienting the solar panel towards the sun to provide the necessary power source in remote areas or in the irrigation field where it is

not possible to provide change through a stable current supply.Since the increase in price per unit increase in power output of a photovoltaic system is greater than that for a diesel, gasoline, or electric system, photovoltaic power is more cost competitive when the irrigation system with which it operates has a low total dynamic head. For this reason, photovoltaic power is more cost-competitive when used to power a micro irrigation system as compared to an overhead sprinkler system. Photovoltaic power for irrigation is cost-competitive with traditional energy sources for small, remote applications if the total system design and utilization timing are carefully considered and organized to use the solar energy as efficiently as possible.
we have designed a model for better optimization of solar water pumps to improve the system efficiency, better energy utilization and other benefits like secondary income source to farmers which will help economically as well as it will help to maintained grid stability.We can also achieve safe and remote operation to save human efforts, improve human safety and saving of time and energy.

Reference

1. Implementation of a High efficiency and low cost Converter for a Photovoltaic Water Pumping System João Victor M. Caracas, Luis Felipe M. Teixeira, Guilherme de C. Farias, Luiz A. de S. Ribeiro, Institute of Electrical Energy Federal University of Maranhao Sao Luis, Brazil
2. Optimization and Control of a Photovoltaic Powered Water Pumping System A. Chikh, IEEE and A. Chandra, IEEE.
3. Distillate control to reduce electricity consumption in a solar multi effect plant Lidia Roca, Luis J. Yebra CIEMAT Plataforma Solar de Almer´ıa, Tabernas, Almer´ıa, Spain.
4. Supplementary Load Frequency Control by Use of a Number of Both Electric Vehicles and Heat Pump Water Heaters Taisuke Masuta, Student Member, IEEE, and Akihiko Yokoyama, Member, IEEE.