International Journal on Recent Researches in Science, Engineering & Technology (IJRRSET)
A Journal Established in early 2000 as National journal and upgraded to International journal in 2013 and is in existence for the last 10 years. It is run by Retired Professors from NIT, Trichy. Journal Indexed in JIR, DIIF and SJIF.
ISSN (Print) : 2347-6729
ISSN (Online) : 2348-3105
JIR IF : 2.54
SJIF IF : 4.334
Cosmos: 5.395
Research Paper
Available online at: www.jrrset.com
UGC Approved Journal No: 45483
Volume 5, Issue93 Pages 24-28

SOLAR WATER PUMP CONTROL WITH FOUR DIFFERENT TIME SLOTS FOR POWER SAVING APPLICATIONS

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Abstract The solar energy is converted into electrical energy by photo-voltaic cells. This energy is stored in batteries during the day time for it to be utilized to run water pump for agriculture. This project deals with a controlled charging mechanism with protections for over charge, deep discharge and under voltage of the battery. The project is designed to operate water pump at four different time slots. It overcomes the difficulties of switching the pump ON/OFF manually. This proposed system has an inbuilt real time clock (RTC) to keep tracking the time and thus to switch ON/OFF the pump accordingly. This project consisting of a real-time clock (RTC) is interfaced to a microcontroller of the 8051 family. While the set time equals to the real time, then microcontroller gives command to the corresponding relay to turn on the load, and then another command to switch off as programmed by the user. Multiple on/off time entry is the biggest advantage with this project. A matrix keypad helps entering different time slots. A 7-sement display is interfaced to the microcontroller to display time. In this project, a solar panel is used to charge a battery. A set of op-amps are used as comparators to continuously monitor panel voltage, load current, etc.
Keywords: solar energy, photo-voltaic cells, water pump, continuity test, battery, efficiently.

1. INTRODUCTION

A solar powered pumping system method needs to take proper account of the fact that demand for irrigation system water varies throughout the year. Solar-powered systems are being preferred for use in developing countries instead of other forms of alternative energy because they are extremely durable and can also exhibit long-term economic benefits. Solar powered water pumping systems can be the most appropriate solution for grid-isolated rural locations in poor countries where the levels of solar radiation are extremely high. Solar powered water pumping systems (SPPS) can cater to basic needs of the public like provide drinking water, water for irrigation etc without the need for any kind of fuel or extensive maintenance. A large-scale SPPS can serve well over 240 people at a time.

The Solar panel serves as the main power source that provides the energy to charge a battery. A separate circuitry is also added to control the charging and current transmission constant. In the proposed system, when the battery is charged long enough, it drives the water pump, i.e. the load, for a proper timing. As it can be clearly seen from the block diagram that the load is connected to a relay in-between which actually triggers the load. There is one additional feature in the setup. This additional feature allows us to set the timing in order to control the ON/OFF time of the

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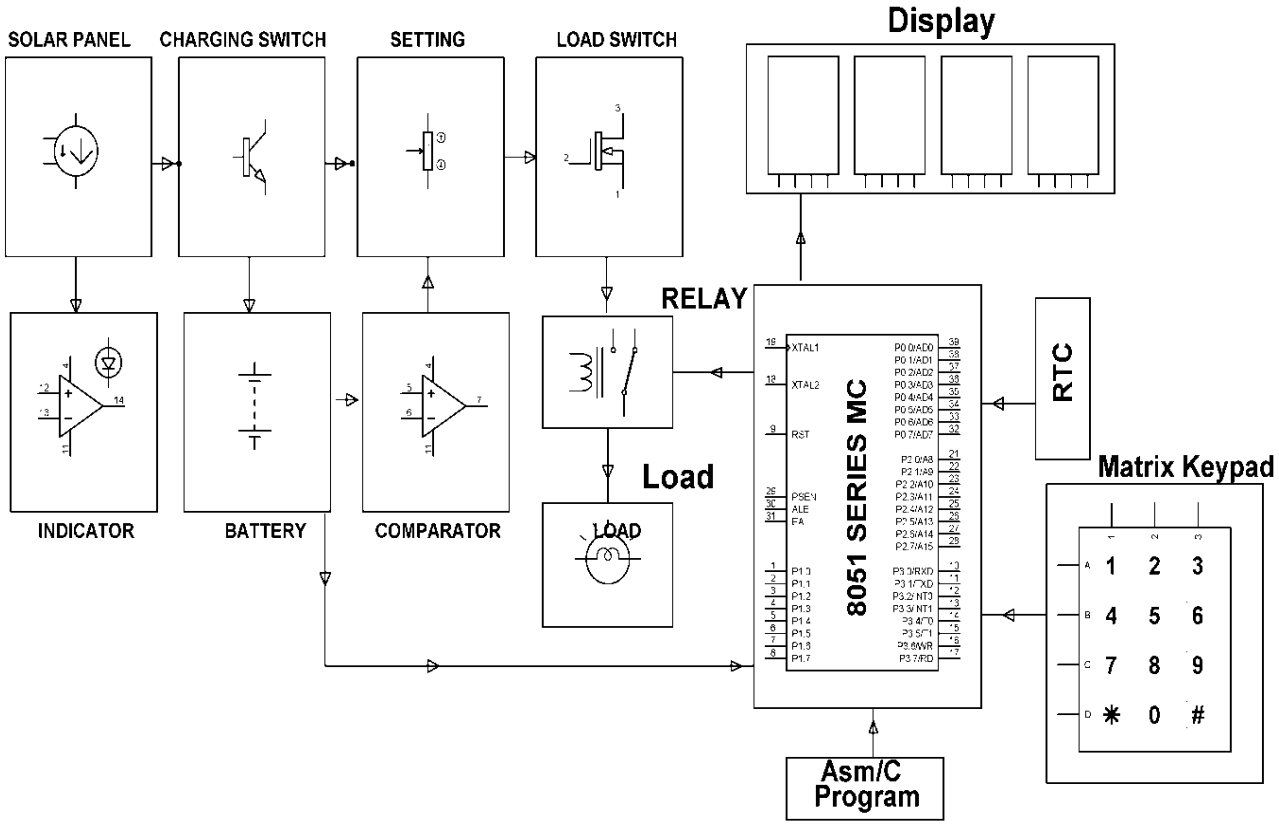
water pump. In this way the solar energy can be harnessed more efficiently. This can be done by interfacing a RTC (Real time Clock) to the microcontroller in order to control the timing.

1.1 Block Diagram:



1.2 HARDWARE IMPLEMANTATIONS:

1. LED
2. PUSHBUTTONS
3. RESISTOR
4. CAPACITOR
5. PHOTOVOLTAIC CELLS/SOLAR CELLS
6. BATTERY
7. COMPARATOR
8. 8051 SERIES MICROCONTROLLER
9. 7-SEGMENT DISPLAY
10. RTC
11. KEYPAD
12. RELAY
13. DIODES
14. REGULATOR
15. MOTOR
16. SOLAR PANEL
17. OP-AMPS
18. MOSFET
19. BATTERY

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2. HARDWARE TESTING:

2.1 CONTINUITY TEST:

In electronics, a continuity test is the checking of an electric circuit to see if current flows (that it is in fact a complete circuit). A continuity test is performed by placing a small voltage (wired in series with an LED or noise-producing component such as a piezoelectric speaker) across the chosen path. If electron flow is inhibited by broken conductors, damaged components, or excessive resistance, the circuit is "open".

This test is the performed just after the hardware soldering and configuration has been completed. This test aims at finding any electrical open paths in the circuit after the soldering. Many a times, the electrical continuity in the circuit is lost due to improper soldering, wrong and rough handling of the PCB, improper usage of the soldering iron, component failures and presence of bugs in the circuit diagram. We use a multi meter to perform this test. We keep the multi meter in buzzer mode and connect the ground terminal of the multi meter to the ground. We connect both the terminals across the path that needs to be checked. If there is continuation then you will hear the beep sound.

2.2 POWER ON TEST:

This test is performed to check whether the voltage at different terminals is according to the requirement or not. We take a multi meter and put it in voltage mode. First of all check the voltage across the battery terminal whether it is fully charged or not, the battery used in this project is 6V, so touch the ‘red terminal’ of battery with ‘red probe’ of multi meter and touch ‘black terminal’ of battery with ‘black probe’ of multi meter, if 6V is being displayed on multi meter screen then we can proceed for next steps.

Now we have to check whether the LEDs are in working condition or not, Red LED or IR LED or Photo diode has got one ‘longer leg’ and one ‘shorter leg’. Longer leg is positive terminal of LED and shorter leg is negative terminal.

Now keep the multi meter in ‘buzzer mode or continuity mode’ and touch ‘red probe’ of multi meter to the ‘longer leg’ of LED and ‘black probe’ of multi meter to the ‘shorter leg’ of LED, if LED glows in such case that means it’s working.

3.0 ADVANTAGES AND DISADVANTAGES

ADVANTAGES

- Energy is saved.
- Reliable and long life.
- Produces water when it’s needed most.
- Low labor and maintenance costs.
- No fuel costs.
- Easy to remove, transport and store.
- Non-polluting

DISADVANTAGES

- The biggest disadvantage of solar energy is that it’s not constant. To produce solar electricity there must be sunlight. So energy must be stored or sourced elsewhere at night.
- Beyond daily fluctuations, solar production decreases over winter months when there are less sunlight hours and sun radiation is less intense.
- Solar electricity storage technology has not reached its potential yet.
- While there are many solar drip feed batteries available, these are currently costly and bulky, and more appropriate to small scale home solar panels than large solar farms.

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4.0 APPLICATIONS

- Industrial machinery
- Agricultural motors
- Water pumps
- House hold items like ovens, AC, refrigerators etc.,

4.1 FUTURE SCOPE:

With advancements in technology, the systems can be made more user-friendly. The proposed system can be further enhanced by deploying a GSM model. The user can control the motor pump from a remote location using his mobile phone. The user can also get the water level indication of the reservoir and overhead storage tank on his mobile phone. These technologies are already available in the market, though presently they are not so popular. Furthermore, to check the appropriateness of the soil, the system can be fitted with sensors like; Humidity sensor, pH sensor, Temperature sensors etc which can provide the user with information about the soil conditions via an SMS on his mobile phone.

- Number of channels can be increased
- Can be modified with the use of a data logger and a graphical LCD panel
- A speaking voice alarm could be used instead of the normal buzzer.
- Modems, cellular phones or satellite terminal
- Energy storage device
- Time bound administration of fertilizers,
- A multi-controller system can be developed

5.0 CONCLUSION

It can be concluded that Photovoltaic systems are designed to supply water and irrigation in areas where there is scarcity of electricity. Their main advantages over hand pumps are their practically zero maintenance, long useful life, no fuel requirement, no contamination, and comparatively easier installation. Also since sun is used as the energy source output coincides with the amount of solar radiation.

Thus compared to diesel powered pumping systems, the cost turns out to be 64.2% in case of solar PV pumping system for duration of 10years. Solar pumps are available to pump from anywhere in the range of up to 200m head and with outputs of u to 250m³/day. Such high is the solar PV water pumping for irrigation (9 to 70 million solar PV pump sets), that at least 255 billion lit/year of diesel can be saved

The Peak demand is around twice the average demand during the irrigation system seasons. Thus this indicates that the solar pumps for irrigation remain under-utilized for most part of the year. The selected irrigation system should be such that it minimizes the water losses without putting additional pressure on the water head.

5.1 RESULT

Thus the solar energy is used by the water pumps by simply converting the solar energy into electrical energy by photo-voltaic cells. The electrical energy is stored in the battery which is used to run the water pumps for agriculture. The project is designed to operate water pump at four different time slots. This helps in overcoming the difficulties of switching on/off manually.

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- The Microcontroller based irrigation system will prove to be real time feedback control systems which will monitors and controls all the activities of irrigation system efficiently.
- The present proposal is a model to modernize the agriculture industries on a small scale with optimum expenditure.
- Using this system, one can save manpower, water to improve production and ultimately profit.

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