

Solar Based Automated Pumping System for Small Fields

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Abstract- Agriculture for small fields technology is changing rapidly. Farm machinery, farm building and production facilities are constantly being improved. Agriculture for small fields applications which is done by photovoltaic (PV) solutions. These applications are a mix of individual installations and systems installed by utility companies when they have found that a PV solution is the best solution for remote agricultural need such as water pumping for small fields or livestock. A solar powered water pumping system is made up of two basic components. These are PV panels and pumps. The smallest element of a PV panel is the solar cell. Each solar cell has two or more specially prepared layers of semiconductor material that produce direct current (DC) electricity when exposed to light. This DC current is collected by the wiring in the panel. It is then supplied either to a DC pump, which in turn pumps water whenever the sun shines, or stored in batteries for later use by the pump.

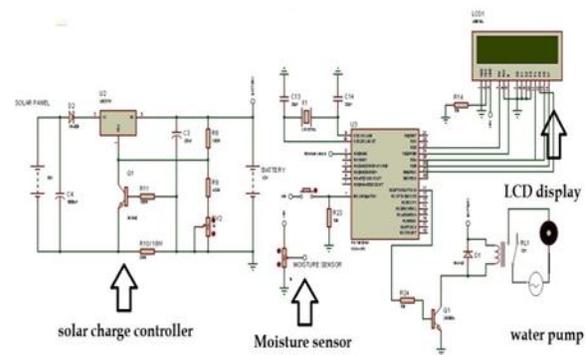
Index terms- SBAPS solar based automatic pumping system, .RES renewable energy sources.

INTRODUCTION

SBAPS is most widely used in agriculture. Agriculture is the major source of income in a country like India. Till today, most of the irrigation systems are operated manually resulting in over irrigation & water wastage most of the times. It is usually designed for ensuring the proper level of water for growing up the small plants all through the season. Even when the farmers are away, these automatic pumping for small fields systems always ensure the proper level of water in the sites. In addition, it provides maximum water usage efficiency by monitoring soil moistures at optimum level. With the development of technology in water saving irrigation and automation, automatic pumping is going to be more popular in the small fields. Thus the

problem related to agricultural productivity for small fields, poor performance and decreased availability of water. This problem can be solved by using the automatic pumping for small fields systems.

Circuit diagram:



Explanation of circuit diagram:

Pumping to small fields is nothing but a slow and regular application of water and nutrients moving down drop-by-drop directly to the root zone of the plants through low-discharge emitters and plastic pipes. This irrigation system is today's need of the hour as the natural water resources which are gift to the mankind have become scarce, and that are now not unlimited and free forever. But, the world's water resources are now fast moving back on track. After one completes the study of inter relationship between crops, soil, water and climatic conditions, one will find pumping to small fields system as a suitable system capable of delivering exact quantity of water at the root zone of the plants.

This system ensures that the plants do not endure from the strain or stress of less and over watering. The advantages of using this system are that for every drop of water used, we get more crop, better quality, early maturity, higher yield. Moreover, this system

saves labor cost and water up to 70%. The working of this irrigation system covers over 40 crops spanning across 500 acres.

The main intension of this project is to develop a pumping system in the field of agriculture.

The required components are: 89S52 series microcontroller, Op-Amp, Relay, water pump, Diodes, Voltage Regulator, Capacitors, Resistors, Lcd display.

The power supply will be 12V. By using a bridge rectifier this AC is converted to DC, then it is regulated to 5v using a voltage regulator which is used for the operation of the microcontroller.

When the sensor arrangement senses the moisture of the soil, it sends the signal to the microcontroller by using a comparator. Here, comparator acts as an interface between the sensing arrangement and the microcontroller. Sensing arrangement is made by using two stiff metallic rods placed into the field at a distance. Once the microcontroller receives the signal it generates the output that drives a relay and prompts the motor to pump water to the plants. The status of the water pump and soil is displayed on LCD which is interfaced to the microcontroller.

Thus, this automatic pumping to small fields system depends on the output of the humidity sensors. Whenever there is a need of excess water in the desired fields, then it is impossible to use sensor technology.

Explanation of each component:

Solar panel:



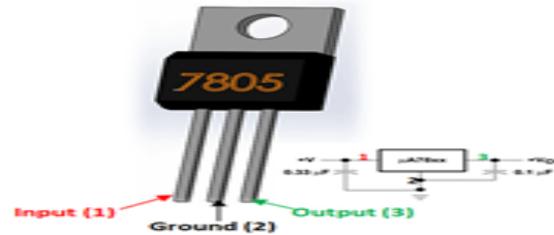
Photovoltaic solar panels absorb sunlight as a source of energy to generate electricity. A photovoltaic (PV) module is a packaged, connected assembly of typically 6x10 photovoltaic solar cells. Photovoltaic modules constitute the photovoltaic array of a photovoltaic system that generates and supplies solar electricity in commercial.

Lead acid battery



The lead acid battery is mainly used to store the charges. In the fully charged state, the negative plate consists of lead, and the positive plate lead dioxide, with the electrolyte of concentrated sulfuric acid, which stores most of the chemical energy. The electrical energy produced by a discharging lead–acid battery can be attributed to the energy released when the strong chemical bonds of water (H₂O) molecules are formed from H⁺ ions of the acid and O²⁻ ions of PbO₂. Conversely, during charging the battery acts as a water-splitting device, and in the charged state the chemical energy of the battery is mostly stored in the acid.

7805 voltage regulator:



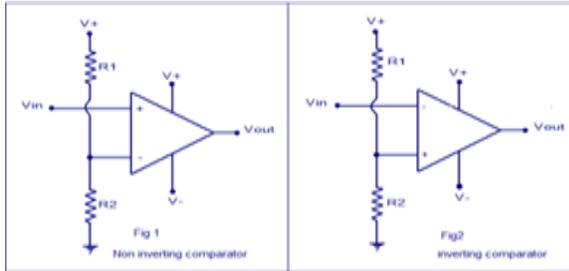
The most commonly used regulator IC's, the 7805 Voltage Regulator IC. A regulated power supply is very much essential for several electronic devices due to the semiconductor material employed in them have a fixed rate of current as well as voltage. The device may get damaged if there is any deviation from the fixed rate. The voltage provided by batteries are typically 1.2V, 3.7V, 9V and 12V.

Soil moisture sensor:



Soil moisture sensors measure the volumetric water content in soil. Since the direct gravimetric measurement of free soil moisture requires removing, drying, and weighting of a sample, soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance, dielectric constant, or interaction with neutrons, as a proxy for the moisture content.

Comparator:



In electronics, a comparator is a device that compares two voltages or currents and outputs a digital signal indicating which is larger. It has two analog input terminals and one binary digital output. The output is ideal. A comparator consists of a specialized high-gain differential amplifier. They are commonly used in devices that measure and digitize analog signals, such as analog-to-digital converters (ADCs), as well as relaxation oscillator.

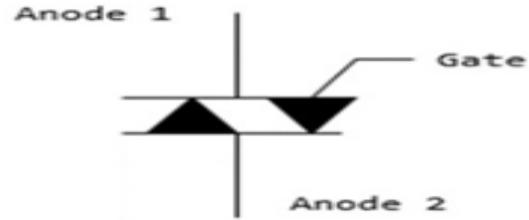
Microcontroller (89S52):



Microcontrollers are used in automatically controlled products and devices, such as automobile engine control systems, implantable medical devices, remote controls, office machines, appliances, power tools, toys and other embedded systems. By reducing the size and cost compared to a design that uses a separate microprocessor, memory, and input/output devices, microcontrollers make it economical to digitally control even more devices and processes. Mixed signal microcontrollers are common, integrating analog components needed to control non-digital electronic systems. In the context of the internet of things, microcontrollers are an economical

and popular means of data collection, sensing and actuating the physical world as edge devices.

TRIAC:



TRIAC, from triode for alternating current, is a generic trademark for a three terminal electronic component that conducts current in either direction when triggered. Its formal name is bidirectional triode thyristor or bilateral triode thyristor. A thyristor is analogous to a relay in that a small voltage induced current can control a much larger voltage and current. The illustration on the right shows the circuit symbol for a TRIAC where A1 is Anode 1, A2 is Anode 2, and G is Gate. Anode 1 and Anode 2 are normally termed Main Terminal 1 (MT1) and Main Terminal 2 (MT2) respectively. Submersible water pump:



A submersible pump (or sub pump, electric submersible pump (ESP)) is a device which has a hermetically sealed motor close-coupled to the pump body. The whole assembly is submerged in the fluid to be pumped. The main advantage of this type of pump is that it prevents pump cavitation, a problem associated with a high elevation difference between pump and the fluid surface. Submersible pumps push fluid to the surface as opposed to jet pumps having to pull fluids. Submersibles are more efficient than jet pumps.

LCD display:



LCDs are used in a wide range of applications, including LCD televisions, computer monitors, instrument panels, aircraft cockpit displays, and indoor and outdoor signage. Small LCD screens are common in portable consumer devices such as digital cameras, watches, calculators, and mobile telephones, including smartphones. LCD screens are also used on consumer electronics products such as DVD players, video game devices and clocks.

Advantages:

- One of most advantage is the saving.
- There is no need worry about of forgetting of water and coming back from vacation to find crispy, yellow grass.
- Drip can be positioned so water is more effectively targeted where it is needed, underground tubes deliver water directly to roots
- Free from pollution.

Disadvantages:

- Underground pests may damage the water delivery system.
- Initial cost is more.

Applications:

- It can be used in agriculture field and drip irrigation system.
- It can be used to provide water in nursery planting.
- Pound water management and water transfer.

CONCLUSION

Our project is based on RES. The potential of solar pumps is so huge that it can become the single largest application for solar in the country. With government support, market initiative and awareness in people the future of sun driven water pumps looks bright. Solar-based products have a huge market in the remote areas, where they can easily replace costly diesel and kerosene. Solar pumps are a feasible solution to social, environmental and economic problems in emerging markets. And in a country like India where a vast population is dependent on agriculture, the usage of solar equipments like pumps may plays an important role in country's economy.

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