

Solar Based Automatic Irrigation for an Agronomical Enclosure

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ABSTRACT: Nowadays, electricity is being widely used in the case of agricultural field so that more energy is required and leads to waste of power source. To supervise the work in the field, human power is also required. Control and monitoring of environmental parameters inside a agronomical field, so as to ensure continuous maintenance of favorable crop atmosphere is the objective of the work presented in this paper. This system is working under solar energy. The objective is achieved through the use of internet based technology. The system is also integrated with mobile telephony to monitor the soil moisture. Here we used AT-mega 328P is used to control the overall system. To sense the moisture content in the soil, soil moisture sensor is used. Solar panel is used to convert light energy into electrical energy which act as a power resource for this system.

KEYWORDS: AT-mega 328P, Soil moisture sensor, Mobile Telephony, Solar panel

I. INTRODUCTION

A proper method has to be implemented for the irrigation system because of lack of rain and scarcity of water in soil. Agricultural field always needs and depends on the water level of the soil. But continuous extraction of water from soil reduces the moisture level of soil to avoid this problem planned irrigation system should be followed. And improper use of water leads to wastage of significant amount of water. For this purpose, automatic plant irrigation system is designed using moisture sensor and solar energy. The proposed system derives power from sunlight through photo-voltaic cells. Hence, the system cannot depend on the electricity. In this proposed model by using sunlight energy, power the irrigation pump. The circuit comprises of soil moisture sensor are inserted in the soil to sense whether the soil is wet or dry. An AT-mega 328P microcontroller is used to control the whole system. When the moisture level of the soil is low then the sensor detects the soil condition and gives condition to the relay unit connected to the switch of the motor. It will ON in dry condition and switch off the motor when the soil is in wet condition. The moisture level of the soil is sensed by the sensor inserted into the soil which gives signal to the microcontroller whether the land needs water or not. The signal from the sensor received through the output of the comparator and it is preceded with instruction from the program stored in the microcontroller. When the soil is dry motor ON and in wet condition motor is OFF. This condition of motor ON and OFF is displayed on a 16X2 LCD. Photovoltaic cell is a system converts light energy into electricity. Photovoltaic cell is otherwise known as "solar cells". This is used in simple and complicated application. The simplest system of photo voltaic cells is small calculators and wrist watches in everyday usage. Most complicated system that provide electricity for pumping water, powering communications equipment, lights to the homes and running our appliances. The PV cells which takes sunlight and convert it into electricity this is kept as a small grid. Solar electric panels more commonly referred to as photovoltaic, or PV, panels, it converts sunlight into electricity. The electricity is used to run appliances and electrical devices or stored in batteries to be used later. Solar Thermal Panels are used in commercial purpose to heat the water. Solar collectors are the heart of most active solar thermal energy systems. The collector absorbs the sun's light energy and converts it into heat energy. This thermal energy used to heat water for commercial and residential purposes and conserve the electricity power. Solar buildings technologies are useful to the buildings which uses more power to run man applications. Solar thermal collectors are the main component of active solar systems, and are designed to meet the specific temperature requirements and climate conditions for the different endues. Flat-

plate collectors, Evacuated- tube collectors, concentrating collectors, transpired air collectors these are some types of collectors in solar system. The proposed system uses the solar energy to ON the water pump. Here the irrigation maintained through the soil moisture sensor and solar energy. There are many plants which required minimum level of moisture. If the required level of water is not provided then the plant will die and results in low production. By irrigate the crop according to the moisture level they need, is provided by the soil moisture sensor. Due to the presence of sensor crops will irrigate properly.

II. LITERATURE SURVEY

In the paper, Environment monitoring and control of a poly house farm through internet(2008), Sameer khandekar et.,al represents the control and monitoring of environmental parameters inside a poly house farm so as to ensure continuous maintenance of favorable crop atmosphere This system uses internet based technology as it serves only for the crops inside the poly house farm. It also leads the way to integrate with mobile telephony. Using this concept, we expand the system using AT-mega328 p microcontroller for the overall function and with advancement to present technology, IoT is used. In addition, solar energy is used instead of electrical energy to overcome the energy crisis.

In Automatic irrigation system based on RF module (2014), prof.P.R.Indurkar et.,al represents the automatic irrigation system to the paddy field. Here we use this concept without using RF technology as the areas near RF cellular towers have been observed with more lightening compared to other areas. Usage of arduino over RF module overcomes this drawback.

In Solar powered automated irrigation for agriculture (Jan-March 2016) N. Prakash et.al., represents the solar based irrigation that maintains the water level in the crop field. This system uses PIC microcontroller for the overall function of the irrigation. Boost converter and inverter is used for the power supply and storage purpose which is more costlier. Even though the PIC microcontroller is cheaper, the programming in it has more difficulties. To overcome this, we use arduino which serves easier to be programmed. No boost converter and inverter is used. For the fast access internet based technology IoT is used. This system prevails cheaper hence can be used by any farmer in the crop fields such as wheat field, paddy field, sugarcane field etc.,

III. SYSTEM ANALYSIS

Our project consists of following hardware components that contain the following units AT-mega328p microcontroller, soil moisture sensor, LDR sensor, solar panel, Wi-Fi module, DC motor, 16*2 LCD display. These are shown in the figures which are given below. Fig 1 shows block diagram, fig 2 shows AT-mega328p microcontroller, fig 3 shows soil moisture sensor, fig 4 shows Wi-Fi module, fig 5 shows solar panel and fig 6 shows BLYNK software.

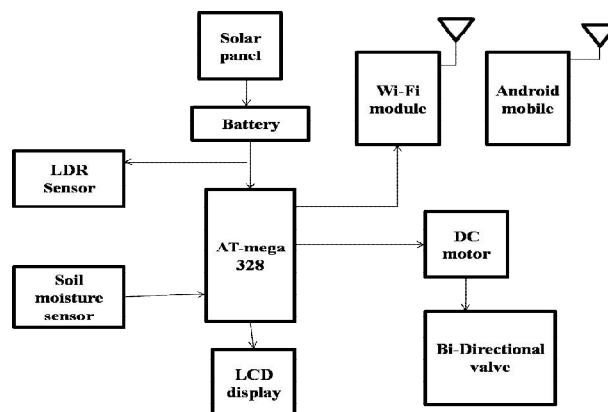


Fig 1.Block diagram

1.AT-mega328p:

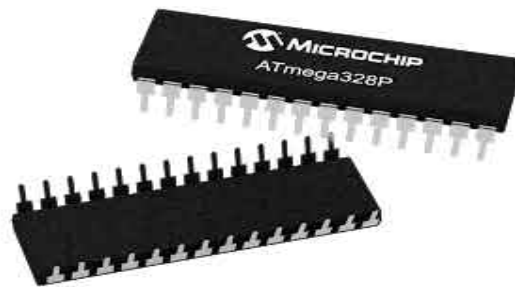


Fig 2. Microcontroller

The high-performance Microchip picoPower 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1024B EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts.

2. Soil moisture sensor

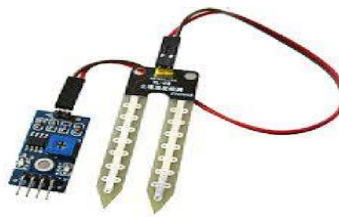


Fig 3. Soil Moisture Sensor

Soil moisture sensor measure the water content in soil. Measuring soil moisture is important in agriculture to help farmers manage their irrigation systems more efficiently. Not only are farmers able to generally use less water to grow a crop, but they are also able to increase yields and the quality of the crop by better management of soil moisture during critical plant growth stages. The module uses LM393 comparator to compare the soil moisture level with the preset threshold.

3. Light dependent resistor:

A photo resistor (or light-dependent resistor, LDR, or photocell) is a light-controlled variable resistor. The resistance of a photo resistor decreases with increasing incident light intensity; in other words, it exhibits photoconductivity. A photo resistor can be applied in light-sensitive detector circuits, and light- and dark-activated switching circuits.

A photo resistor is made of a high resistance semiconductor. In the dark, a photo resistor can have a resistance as high as several mega ohms (M Ω), while in the light, a photo resistor can have a resistance as low as a few hundred ohms. If incident light on a photo resistor exceeds a certain frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electrons (and their hole partners) conduct electricity, thereby lowering resistance. The resistance range and sensitivity of a photo resistor can substantially differ among dissimilar devices.

4. Wi-Fi module:

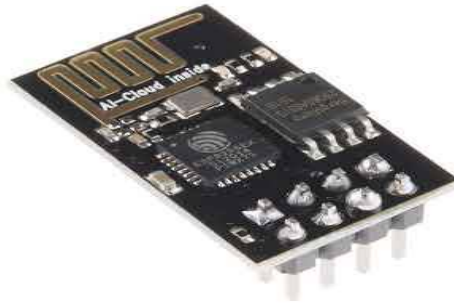


Fig 4. Wi-Fi module

The ESP8266 Wi-Fi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi-ability as a Wi-Fi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existence interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

There is an almost limitless fountain of information available for the ESP8266, all of which has been provided by amazing community support. In the Documents section below you will find many resources to aid you in using the ESP8266, even instructions on how to transforming this module into an IoT (Internet of Things) solution.

5. DC Motor

A DC motor is any of a class of rotary electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.

6. LCD Display

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

7. Solar panel

Solar panel refers to a panel designed to absorb the sun's rays as a source of energy for generating electricity or heating. A photovoltaic (PV) module is a packaged 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 and residential applications. Each module is rated by its DC output power under standard test conditions (STC), and typically ranges from 100 to 365 watts.

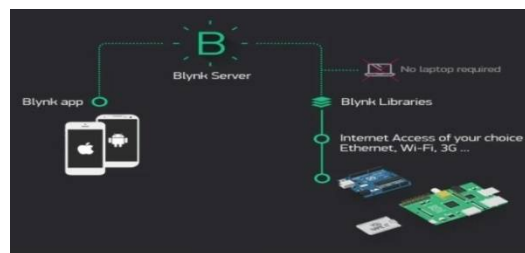


Fig 5.Solar panel

There are a few commercially available solar modules that exceed 22% efficiency and reportedly also exceeding 24%. A single solar module can produce only a limited amount of power; most installations contain multiple modules.

8. BLYNK software

BLYNK is a Platform with iOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets. It's really simple to set everything up and you'll start tinkering in less than 5 mins. BLYNK is not tied to some specific board or shield. Instead, it's supporting hardware of your choice. Whether your Arduino or Raspberry Pi is linked to the Internet over Wi-Fi, Ethernet or this new ESP8266 chip, BLYNK will get you online and ready for the Internet of Your Things. BLYNK is not just "another IoT cloud".



Blynk's architecture

Fig 6. BLYNK software

IV. WORKING PRINCIPLE

The two soil moisture sensor namely V1 and V2 senses the availability of moisture content in the soil. Two directional valves are attached to the water source. DC motor is used for the pumping and favoring of direction of water flow. Solar panel is used for the absorption of heat energy which then converts it in to electrical energy. Battery is used for the storage purpose. The soil moisture sensors are placed in the agricultural fields. The sensor senses the availability of water content in the field and indicates the unavailability. The water flow is favored in the corresponding field. The overall function of the system is performed by the AT-mega328p microcontroller. Wi-Fi module is connected to the system through which the android mobile is connected. With the BLYNK software developed in the mobile, the system status can be monitored anywhere. Thus, the automatic irrigation to the agricultural field is achieved.

V. CONCLUSION

The proposed system is beneficial to the farmers when this system is implemented. And also useful to the government with solar panel energy, solution for energy crisis is problem. When the soil needs water is indicated by the sensor by this automatic irrigation system is implemented. Then the various crops also irrigated with this system by turn on the button. According to the button pressed the irrigation system detects the moisture level of the crop. For example, Wheat, Paddy, Sugarcane crops moisture content of soil is detected and irrigated automatically. Automatic irrigation system is used to optimize the usage of water by reducing wastage and reduces the human work. The energy needed to the water pump and controlling system is given by solar panel. Solar panels which are small grid that can be produce excess energy. By using solar energy reduces the energy crisis problem. The system requires minimal maintenance and attention because they are self-starting. To further enhance the daily pumping rates tracking arrays can be implemented. This system demonstrates the feasibility and application of using solar PV to provide energy for the pumping requirements for sprinkler irrigation. Even though this system is distance dependent, this can further be extended for future scope.

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