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Solar Powered Smart Sprinkling System

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Abstract: ***The main objective of this prototype is to provide motor ON or OFF information to the farmers, which helps in saving water quantity and money. The entire prototype is controlled by using Arduino UNO microcontroller, which gives interrupt signal to the motor pump. Soil moisture sensor is connected to digital port through analog and digital comparator. Whenever there is a fluctuation in soil moisture sensor senses the changes happening in soil and send interrupt signal to the arduino and thus the motor pump is activated or deactivated depend upon the changes happening in the soil. Along with this, mobile phone is used to indicate the motor pump condition through GSM Module and the whole prototype will function by implementing Solar Panel and Rechargeable battery.***

Keyword: Arduino Uno, DC Motor, GSM Module, Mobile, Moisture sensor, Rechargeable Battery, Solar panel.

I. INTRODUCTION

Irrigation means delivering water to the growing plants in a proper or disciplined manner. Water wastage is a major problem in agricultural land. Sometimes the excess amount of water is given to the fields. To overcome this problem various methods are available to save water from agricultural fields. Ditch irrigation, Drip irrigation, Terraced irrigation, Sprinkler irrigation and Rotary irrigation are the methods. In this prototype we used Sprinkler irrigation as a main concept which is used to control the flow of water to the field. Usually farmers manually control the motor by observing the soil. This manually controlling irrigation systems will not give the proper level of water in the land. Solar Powered Smart Sprinkling system is intended for sustaining the suitable level of water [1]. Even when the farmers are not near to the field, solar powered smart sprinkling system always ensure the proper level of water in the field. Soil moisture sensor senses the moisture level of the soil.

Whenever the soil get dry then sensor senses low moisture level and spontaneously switches on the water pump through relay to supply water to the plants in the field. As the plant gets enough water the sensor senses enough wetness in soil and send signal to arduino. The water pump will spontaneously get stopped, simultaneously the arduino sends signal to GSM and the user gets necessary message about the motor conditions through mobile phone.

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II. BLOCK DIAGRAM

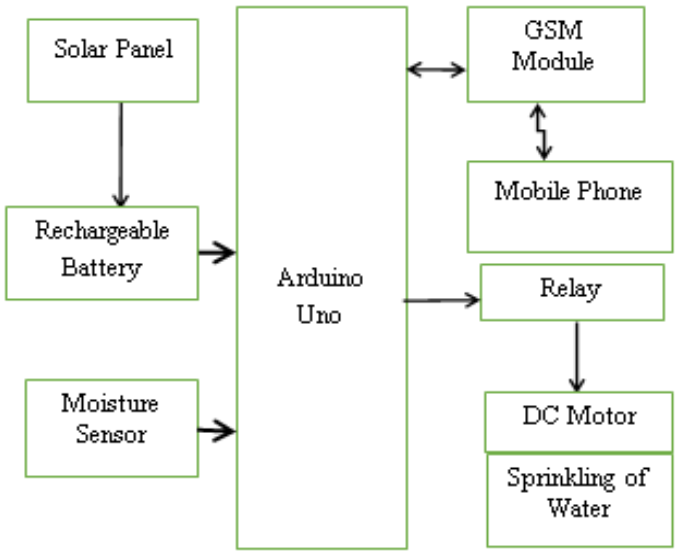


Fig. 1. Block diagram of Solar Powered Sprinkling System

The above figure is block diagram of Solar Powered Smart Sprinkling system. The Blocks consist of nine blocks.The moisture sensor consists of two electrical probes which is used to measure moisture content of the soil in the field and will send a message to the user's phone to inform the state of irrigation via GSM module. DC motor is used in this prototype to pass water to the plants in the field and it is controlled by arduino. Relay will switch ON or OFF the motor that depends on the condition of the moisture in soil. The full prototype will work by rechargeable battery and this battery is charged by solar panel.

III. WORKING PRINCIPLE

The deficiency of the water in the field is sensed by soil moisture sensor. Whenever there is need of water in the field, the high signal trigger on the output pin of the sensor and given to the microcontroller. Then the arduino sends high signal to relay and relay turn ON the motor until the field becomes wet simultaneously user will receive SMS from GSM module about the status of moisture. Whenever there is a need of optimum level of water in the field the user can turn ON the motor. The above process will work until the Power supply is ON.

IV. BLOCK DIAGRAM DESCRIPTION

A. Arduino Uno

Arduino is a microcontroller. The main IC used in arduino is Atmel microcontroller chips. Arduino is much advance than 8051 microcontroller and PIC microcontroller. We can write code by using C programming language.

The microcontroller used for this prototype is arduino uno.

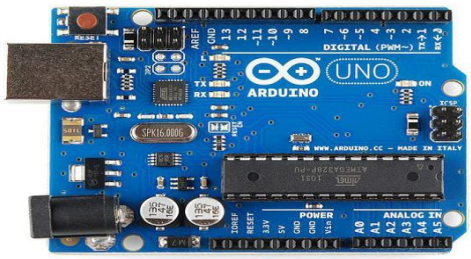


Fig. 2. Arduino board

B. Solar Panel

The below figure shows the diagram of solar panel. A solar panel is a collection of solar cells which can be used to generate electricity through photo voltaic effect. These cells are arranged in a grid pattern on the surface of solar panels. Most of the solar panels are made up of crystalline silicon cells [1].

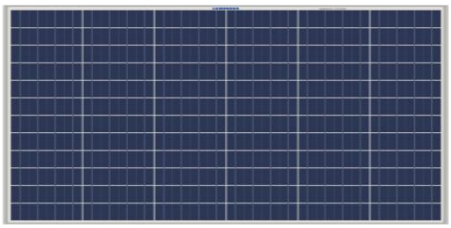


Fig. 3. Solar panel

C. Battery

A battery is a grouping of two or more electro substance cells. These cells mass energy in the form of substance energy and this is converted into electrical energy when connected to an electrical circuit in which an electrical current can flow [2]. Rechargeable batteries require substance reactions in direction to function. One response occurs in or nearby the anode and one or more responses occur in or nearby the cathode. In all cases, the feedback at the anode produces extra electrons in a process called oxidation, and the response at the cathode uses the further electrons during a method known as reduction. This is how the rechargeable battery works.

D. Soil Moisture Sensor

Soil moisture sensors are used for measuring the volumetric water content of soil. YL69 wetness detecting probe is used to sense the wetness here. Image of YL69 sensing probe is shown in below figure. Yl38 module is shown in below diagram. It is an only channel operational amplifier based on LM393 IC. This module just equates the output voltage of the sensing probe with a mention voltage and differences its voltage appropriately for the microcontroller to read. Main advantages of YL138 module is it the results will be accurate.

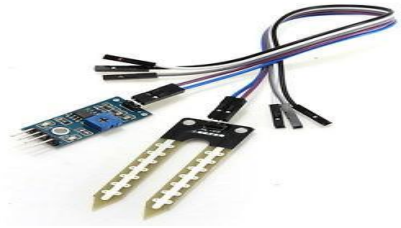


Fig. 4. Soil moisture sensor

E. Relay module

In this prototype we have used 12V DC relay. The below figure shows the diagram of relay module. A relay is an electromagnetic switch operated by a moderately low electric current that can turn on or off a much high electric current. The key operation of the relays are it can switch a low-power signal. It is also used in places where only one signal can be used to control a lot of circuits.



Fig. 5. Relay module

F. DC Motor

In this system we have used 12V DC motor pump. A DC motor is an electro mechanical device which converts electrical energy into mechanical energy [3]. The working of DC motor is based on the principle that when a current carrying conductor is placed in a magnetic field, the conductor experiences a mechanical force. A DC motor is constructed with stator, rotor, yoke, poles, commutator, carbon brushes and field windings.

G. GSM Module

The below figure shows GSM module. GSM/GPRS module, used in many mobile phones and PDA. In this system we used GSM SIM900A module [4].

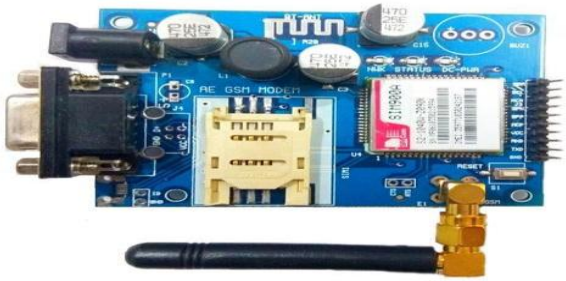


Fig. 6. GSM Module

H. Mobile: Mobile telephone a portable device for connecting to a network in order to send and receive message, voice, video, or other data [5].

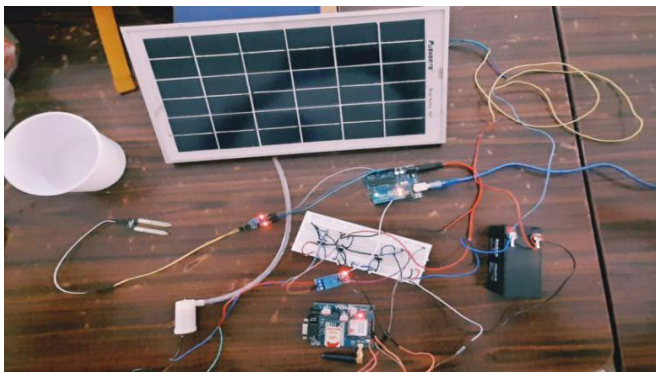


Fig. 7. Final image of Smart Sprinkling System

V. FLOWCHART

The flow chart of the prototype is show in below figure. The first four blocks is about the status of the prototype fifth block is condition block it tells if the system in ON switch on the motor and send SMS to the user that the system in working under user control. If the system is OFF the sixth block indicates that the device if OFF. Hence the system will not work.

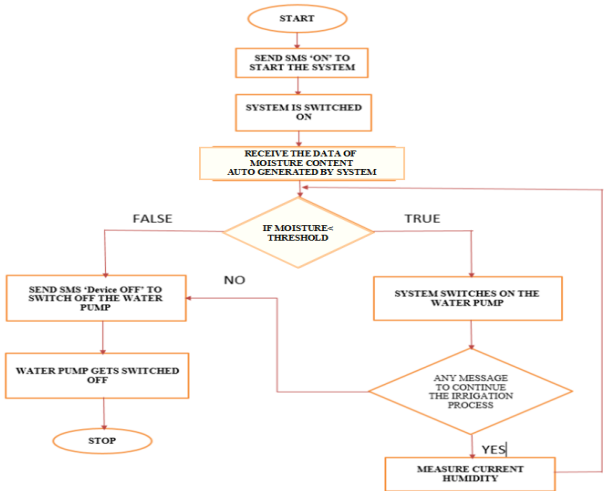


Fig. 8. Design Flowchart

VI. RESULT AND DISCUSSION

The implementation of this prototype is working without any errors. We have observed that this system water measurement is easier than the surface irrigation system and under electromagnetic interference also the prototype is working. The area between the fields remains dry and gets water only from rainfall, this lag is due to inaccuracy of moisture sensor. This Solar Powered Smart Sprinkling System prototype supports aggressive water management for the fields.

VII. CONCLUSION

By using hardware and Software knowledge, we developed the Solar Powered Smart Sprinkling System. The result of our design has met our expectation in which every component is working well. Our Solar Powered Smart Sprinkling System is easy to use comparatively cheap in that case that by receiving SMS we can find the status of motor and moisture. This system saves the valuable time of the farmers free from worrying about the field and helps to increase the production of the crops because this system provides the defined amount of water to the particular fields.

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AUTHORS PROFILE



Dr Sidharthan V is Assistant Professor, Department of Electronics, Sri Ramakrishna College of Arts and Science, Coimbatore. Has a decade of teaching experience and produced one research candidate under VLSI System Design. Recently finished Doctorate from the Bharathiar University. The area of interest includes VLSI System Design, Communication Systems.



Mr Guru prasanna A pursing final year of Master of Science in Electronics and Communication System in Sri Ramakrishna college of Arts and Science, Nava India, Coimbatore. I am working part time employee in Pactron Company as a PCB design engineer.



Mr Shankar raman V pursuing final year of Master of Science in Electronics and Communication System in Sri Ramakrishna College of Arts and science, Nava inda, Coimbatore. We have made a prototype titles solar powered smart sprinkling system which was funded by our college and we worked for six months to complete prototype. I have worked as part time in PCB Design Company for one month.