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Smart Irrigation System Based on Arduino UNO Board

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ABSTRACT

In this paper, Smart Irrigation System [SIS] is designed using arduino UNO along with GSM module and sun tracking solar system. This system is very comfortable and cost effective for the people in rural areas. This system is used to deal with the demand of economical irrigation system. In this smart irrigation system, the status of the submersible pump can be monitored with the help of cell phone. The design of smart irrigation system [SIS] mainly depends on arduino UNO board. Here, the communication between arduino UNO board and the cell phone is wireless. The smart irrigation system is flexible. Since, the minimum changes in its core can allow the variety of devices to be controlled. The smart irrigation system plays a major role for the people in rural areas.

Keywords : Arduino UNO, GSM Module, Soil Moisture Sensor, Submersible pump, Liquid crystal display (LCD), Polycrystalline type Solar Panel, Light Dependent Resistor (LDR), PWM charger controller, Single Pole Double Throw (SPDT) relay.

I. INTRODUCTION

In this Modern World, everything relay on smart technology, because of increase in efficiency, maximum capability, minimum cost and decrease in waste. The Smart irrigation system [SIS] is the advanced form of traditional irrigation system. The waste produced from smart irrigation system is very low due to minimum consumption of resources. Here, the water supply is based on seasonal variations, soil characteristics, weather conditions and plant to reduce the excess flow of water. The major problem of agriculture is lack of water. To overcome this problem, SIS is used, with the help of smart irrigation system, almost 80% of water can be saved when compared to traditional irrigation. In addition to the wastage of water, another disadvantage of traditional irrigation is introducing the water directly to the plants, because of this the soil undergoes high stress from the variation in soil moisture. SIS is already implemented in some countries like America, China, Egypt, Portugal and Sweden. Recently, India has been started to implement SIS by using various methods.

II. LITERATURE SURVEY

A. Irrigation system using RF module:

In India, agriculture plays an important role for development in food production. In our country, agriculture are depends on the monsoons which is not sufficient source of water. So the irrigation is used in

agriculture field. In Irrigation system, depending upon the soil type, water is provided to plant. In this method, automatic irrigation system based on ARMs and RF module. All the system will be setup using ARM and RF module. The most important factor of this system is RF module which is used to send and receiving the message to the controller. This system used three nodes which communicate each other and irrigate paddy field automatically. The aim of this project is to modernizing agriculture technology by programming components and built the necessary component for the system. The system is real time based and extracts the exact condition of paddy field. There is one central node used which to control other node. The main function of RF module is to pass the message to the node and operate the system.

B. Irrigation system using solar photovoltaic water pump

Irrigation is a well-established procedure on many farms and is practiced on various levels around the world. It allows diversification of crops, while increasing crop yields. However, typical irrigation systems consume a great amount of conventional energy through the use of electric motors and generators powered by fuel. Photovoltaic energy can find many applications in agriculture, providing electrical energy in various cases, particularly in areas without an electric grid. In this method the description of photovoltaic irrigation system, is presented. Photovoltaic water pumping system is one of the best alternative methods for irrigation. The variation of spatial and temporal distribution of available water for irrigation makes significant demand on water conservation techniques. Hence solar powered Automated Irrigation System provides a sustainable solution to enhance water use efficiency in the agricultural fields using renewable energy system removes workmanship that is needed for flooding irrigation. The use of this photo-irrigation system will be able to contribute to the socio-economic development. It is the proposed solution for the energy crisis for the Indian farmers. This system conserves electricity by reducing the usage of grid power and easy to implement and environment friendly solution for irrigating fields.

C. Irrigation system using humidity sensor

The main aim of this method is to provide information about automatic irrigation to the plants which helps in saving money and water. The entire system is controlled using ATMEGA 328 microcontroller which is giving the interrupt signal to the motor. Temperature sensor and humidity sensor are connected to internal ports of micro controller via comparator, whenever there is a fluctuation in temperature and humidity of the environment these sensors senses the change in temperature and humidity and gives an interrupt signal to the micro-controller and thus the motor is activated, along with this buzzer is used to indicate that pump is on.

III. Methodology

A. System architecture

In smart irrigation system, Arduino is used for controlling the SIS. Here, soil moisture sensor is used to monitor the moisture level of the soil continuously and arduino is used to send SMS if the moisture level of the soil is low.

Here, Submersible pump is controlled by using relay and GSM Module TTL SIM 800L is used with Liquid Crystal Display (LCD). The probe which is connected to the soil moisture sensor is used to sense the moisture level of the soil. The soil sensor circuit is connected to the digital pin D7 of arduino and an LED.

i. LED ON= Presence of moisture in soil
ii. LED OFF= Absence of moisture in soil

Transistor BC547 is used to operate the relay and it is connected to the digital pin D11 of arduino. GSM module is used to transmit the messages via SMS to the users. In addition to the GSM module, the LCD display is used to display the status and messages of the system. LCD data pins of D4 to D7 are directly connected to the arduino pins of 16-19. The 4-bit mode in LCD is operated by using the LCD and library which is inbuilt in arduino.

B. Solar tracking system:

This system consists of arduino UNO broad, 2 resistors, 2 LDR and one servomotor. A servomotor is used to rotate the solar panel towards the source of light.

The purpose of the solar tracking system is to consume the maximum energy from the sun and it is more efficient.

This system contains servomotor which can rotate approximately 180 degrees and it is controlled by using servo library in arduino's PWM outputs. Depending upon the intensity of light, the resistance of 2 LDR is changed and it is connected to the arduino board.

C. Charger Controller

The conduction of power is the major role of solar charger controller the charging process of the battery is managed by solar charger controller. The commonly used solar charger controller is pulse with modulation (PWM) and maximum power point tracking (MPPT) there performance depends upon the use of the system. PWM charger controller is used in this system. When compared to MPPT charger controller PWM charger controller is cost efficient. Here, direct connection from the solar array to the battery bank is controlled by PWM solar charger controller in this way PWM charger controller is used in the system. At the time of bulk charging the array output voltage is "PULLED DOWN" to the battery voltage. Since, there is continuous connection from the array to the battery bank. During day time the deep cycle batteries cannot be overcharged because the reverse flow of the power is not possible to the solar panels overnight. Lighting and load control are the additional capabilities in few charger controllers.

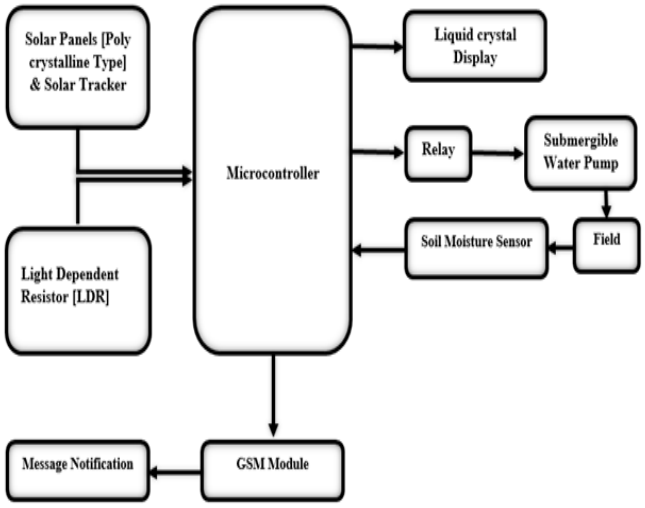

Fig 1 : Block diagram

In smart irrigation system, the AC submersible pump is driven with the use of inverter. The main parts of the oscillator are R3, R4, C1, C2, T2 and T3 are used along with MOSFET each trproduces inverting square waves. The values of R1, R2, R3, R4, C1 and C2 determine the frequency range. T1 and T4 act has power MOSFET's and they used to enhance the inverting signal from the oscillator. The amplified signal is increased by step-up transformer with its center tap connected to12V DC.

Comparison of smart irrigation system with traditional irrigation system:

Traditional system			Smart irrigation system		
Fixed cost	Diesel engine price	45000 TK	Fixed cost	Smart irrigation system	3000 TK
	Pump Price	5000 TK		Submersible Single phase AC Pump Price	150000 TK
	Engine Oil	1000 TK		Solar Panel	240000 TK
	Installation cost	500Tk		Battery	15000 TK
Variable Cost	Maintenance Cost (daily Basis) Fuel cost per Cost	500 TK 80 TK	Variable Cost	Fuel cost & Maintenance Cost	0 TK

Traditional irrigation means, supply of water to the plant zone by pumped water surface like pond, rivers, channels and underground water through earth and channels or pipes with gravitational force.

The smart irrigation system means, supply of water through sub surface or surface pipes directly to the roots zone of a plant based on requirement without wasting the water resources.

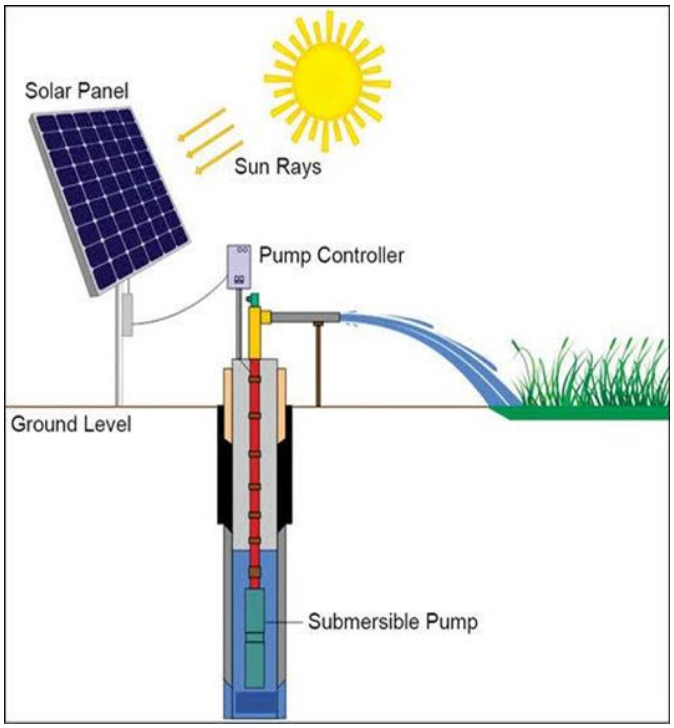

Fig 2 : Solar tracking system

IV. RESULTS AND DISCUSSION

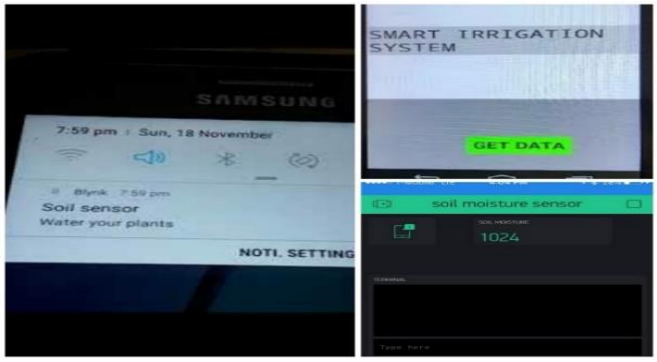

Fig 3 : SMS notification

In traditional irrigation the need of water is more when compared to smart irrigation system, traditional irrigation method fails in area like mountains and hilly regions but in smart irrigation it is easy to serve water in all corners, over flooding and over irrigation in traditional method can be neglected in modern methods. Crops like cotton needs minimum water for normal growth if we provide excess water to the plant it can be highly affected or leads to damage.

Smart irrigation method is very useful in high or low elevation there is no need of maintenance for a long period of time, this system does not need the support of power grid due to usage of solar panel. The proposed system ensures the optimized use of water and electricity, the smart irrigation system keeps the farmer updated about the pump through phone via SMS regularly. Since, the system sufficiently utilizes the water resource it is most suitable for dry areas, where there is inadequate rainfall.

Hence, this smart irrigation system is predicted to be more helpful to modern agriculture.

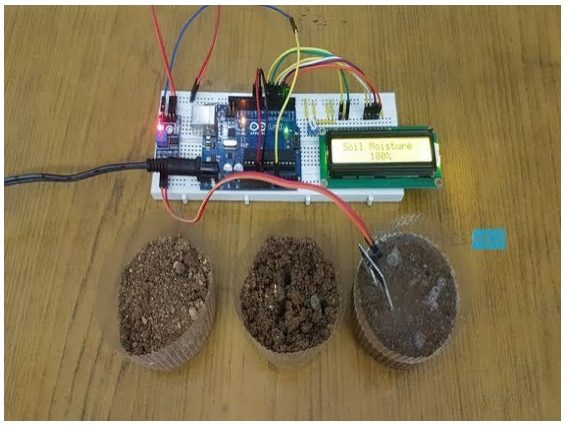

Fig 4 : Soil moisture testing

V. CONCLUSION

The SIS system is used to maintain the sustainability of water resource the system is economical and versatile. Smart irrigation increases annual income and reduces the likelihood of poverty significantly. Household using concrete canal river diversion had higher cropping income per household than those using other irrigation method. It minimizes leaching of nutrients. The microcontroller based SIS monitors and controls all the activities efficiently. This SIS model is used to modernize the agriculture industry at a mass scale with optimum expenditure. Using this system one can save man power, water to improve production and ultimately profit.

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