Solar Based Irrigation System

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Abstract — **This paper gives the embedded system for automatic irrigation using the soil moisture sensor based on solar power with GSM module. Solar energy is best way for the irrigation purpose to overcome energy crisis . The solar panel will extract energy from the sun and convert into electrical energy which is stored in the battery. Automatic irrigation using solar energy can be efficiently used for the proper management in irrigation. Proper irrigation increases fertility rate of the field and can get maximum production of yields and the quality of the crop by improving management of water during critical plant growth stages. The benefit of solar based automatic irrigation using soil moisture in the field get continuous flow of water and plant grows rapidly. The proper management of water helps to get rid off from the scarcity of water . The GSM (Global System of Mobile Communication) module used to send the message on the registered SIM to check the status of pump ON/OFF . If the automated system is not working then pump can also be operated manually. The manual operation can be done through the manual switching system. Another benefit of the manual operation is that it can also be used to pump the water supply for other purpose besides irrigating the field. The soil moisture sensor measures the soil resistivity or volumetric moisture content of soil in terms of voltage.**

Keywords: Solar power, Auto irrigation, Energy sensor, Soil, Moisture sensor, Water pump, Panel, PIC microcontroller.

I. INTRODUCTION

Agriculture sector is a main source of income in a country. Till today, most of the irrigation systems are operated manually resulting in excess of irrigation and water wastage most of the times. These outdated techniques can be replaced by automated techniques of farm irrigation. The decreasing cost of solar panel encourages its use in various sectors, including irrigation system for farming. An automated irrigation system uses solar panel which drives water pumps to pump water from water source (bore -well) to storage tank and the outlet valve of tank is regulated automatically by using GSM, controller and sensors. This technique minimizes the use of water for irrigation purpose.

The shedding to farm can be given depending upon the need of the surrounding temperature as deliberate by humidity sensor. Thus, the problems related to agricultural productivity, poor performance and decreased availability of water for agriculture can be solved by using the proposed solar based automated irrigation.

II. LITERATURE REVIEW

The paper [1], In GSM based Automated Irrigation organized using Raingun Irrigation System by R.Suresh,S.Gopinath, K.Govindaraju, T.Devika, N.Suthanthira Vanitha system is automated microcontroller based rain gun irrigation system. Irrigation is done only when it becomes compulsory to water the fields thus saving large quantity of water. Applications are developed on android platform using apparatus from android SDK in java programming language. The GPRS feature of mobile phone is used for proving solutions related to problems irrigation control. Enough amount of water can be given to the fields. The system sends message using GSM. The android application is designed to overcome irrigation harms such as under irrigation and over irrigation which causes leaching and other losses in soil quality. Rain gun technique is more proficient as compared with drip system. It leads to less soil erosion and less wind erosion. Yields are improved with decrease in water and labor requirements. The conventional power supply is used to run the whole automated system which is less proficient and more expensive compared

to the solar power-based system in long run. If smaller area is to be covered then the proposed system is not economical.

The paper[2] In Automated Wireless Watering System (AWWS) via Chetana A.Kestikar, Rutuja M.Bhavsar, the system is facilitated by providing PC control and mobile control for monitoring and scheming water activity. Also, the wiring confusion is reduced. The system is divided into two parts, one is software and the other is the hardware components on the site/field. The GUI interface is developed on .NET programming language. Programming is used to send message to GSM modem on site through PC and vice versa.

In physical mode system will work as traditional watering system. The client decides when to start and stop watering. In automatic mode, once the system is started, the client need not pay attention to stopping of the system. The watering will be determined according to moisture levels. The client can initiate the system by sending message to the microcontroller via the GSM modem through the program. This message being received by the microcontroller will instigate moisture sensors, water level indicator. Again, the power supply used to run the whole system is conservative and thus less economical.

The paper[3], In Solar Powered Smart Irrigation System via S.Harishankar,R.Satish Kumar, Sudharsan K.P, U.Vignesh, T.Viveknath , the solar energy from solar panels is utilized to pump water automatically from bore well directly into a ground level storage tank. Apart from the conventional techniques, the system makes efficient use of renewable energy. For the irrigation module to be automatic, the water outlet valve of the tank is controlled by soil moisture sensing circuit. The soil moisture sensor placed in field converts moisture content of soil into equivalent voltage. The obtained equivalent voltage is given to microcontroller circuit which has a reference voltage that can be adjusted by farmer as per different moisture levels corresponding to different crops. The amount of water requisite of soil is proportional to the difference of equivalent voltage and reference voltage. A control signal is given to stepper motor having angle of rotation proportional to the difference in voltage. The cross section area of the valve controlling flow of water is controlled by stepper motor and hence the amount of water flow is proportional to moisture difference. Solar energy is harnessed using solar panel PVL-68 that generates 53W at small operating cell temperature.

The paper[4], In Smart Irrigation System Autonomous Monitoring and Controlling of Water Pump by Using Photovoltaic Energy via Dhana Lakshmi.N, Gomathi K.S , the power supply for whole system is taken from renewable photovoltaic cells energy; it reduces the price of power. The water supply, temperature and pH value of the soil are monitored autonomously. The water level in fields is sensed by using floating ball sensor and the pH value by using pH sensor. The low level analog signals from sensors are converted to digital signalby using IC ADC0808. This digital signal is fed to AMTEL microcontroller 89s52. The microcontroller will monitor the sensed values and sends the status to user's cell phone via GSM module. For low water level in field, the temperature level goes high and temperature level on achieving certain threshold will switch the pumping motor ON. The hydrogen content in field is monitored by using pH sensor since every crop has a predefined pH value. The fertilizer smattering motor is switched ON after the pH value goes below the required pH value. Both pumping and smatter motor goes OFF automatically after soil has achieved required water level and pH value. The motors are operated and controlled by using GSM module through user's mobile or manually.

The paper[5], Modern Solar Powered Irrigation System by Using ARM proposed via Basava Sidramappa Dhanne, Sachin Kedare, Shiva Sidramappa Dhanne, the design methodology of automated irrigation system in this paper includes the components, solar panel, arm processor, sensors, dc motors, relay, and battery. The main stress is laid on generating power supply by harnessing solar energy and reducing power consumption for irrigation purpose. The dc current is generated via using solar panel. This dc power is stored in a battery so as to operate the pump even during the night time. The farmer sends a text message via mobile phone so as to check the level of water storage tank and condition of moisture in filed. If mission is complete then GSM

module sends the message, watering is complete to the consumer. If the mission is not complete then GSM module sends the message, watering not completed, lagging resources also the state of charge of battery is sensed by charge sensor and send to ARM processor. The good thing about this work is that it also gives information about watering resources i.e., whether resources are lagging or not.

III. METHODOLOGY

This device consists of a solar panel, which is the main source of energy and is provided to the charging controller to extract controlled power from the solar panel at different irradiation, as well as maintaining the correct charging voltage and current to charge the battery and increase its life. Conservation of water in farmland is managed using a soil moisture sensor microcontroller. The boost converter is used to convert DC to DC power to increase the solar panel's output power because if solar panel receives less light then boost converter gives higher voltage compared to input voltage. Boost converter is a power supply in the switch mode that contains a diode and a transistor with one energy storage part, the capacitor. Filters are used to decrease ripple output voltage.

The automatic irrigation system was proposed to continuously sense the of soil moisture and temperature level of the soil. The system responds appropriately by watering the soil with the exact amount of water required and then shuts down the water supply when the required amount of soil moisture is achieved. The reference amount of soil moisture is already fed to the microcontroller beforehand. This reference soil moisture content was made to be adjustable for the three most common soil types (sandy, loamy and clayey soils). The moisture sensors and temperature sensors were designed using probes made from corrosion resistant material which can be stuck into soil sample. Voltage levels corresponding to the wet and dry status of the soil sample were computed by measuring the resistance between the moisture probes and matching them to output voltage of a comparator circuit.

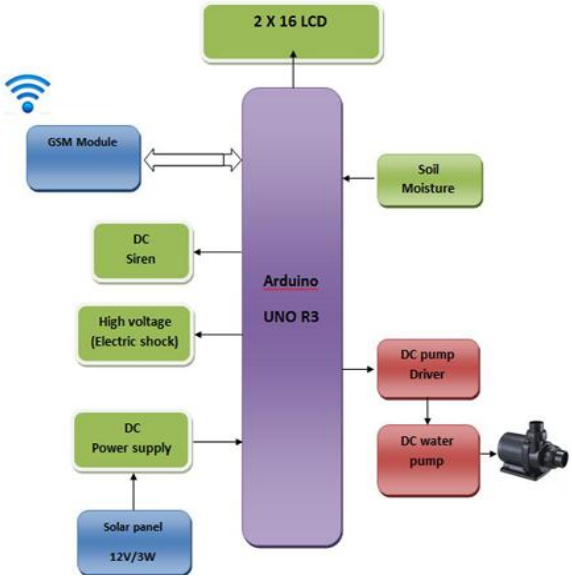

Figure 1: Block Diagram

In the above fig (1) has soil moisture sensor will sense the moisture of the soil and gives some pulse to converter module. Converter module takes the output (analog pulse) of the sensor and gives the analog output which is fed to Arduino input. Float switch is connected to the Arduino through other analog input port which is used to measure water tank level. Arduino is connected to several output devices like display (LCD), water pump, LED indicator. LCD display the status of the circuit which is in running condition. The extra output of
the Arduino is connected to the two indicators LED1 & LED2. LED1 indicates the moisture status & LED2 indicates the water tank level. Extra output is connected to the relay module. The one output of the relay module is connected to the battery positive terminal through the motor. Battery negative terminal is directly connected to the pump. The battery is connected to the solar panel through the solar charger circuit. Terminal is directly connected to the pump. The battery is connected to the solar panel through the solar charger circuit. To avoid grazing of animals to the field and protect the yielding crops from the animals we used a fencing method. it is method of giving a very little amount of shock to the animal so that the animals must be far from the field. The fields can be protected from birds also by adding a technique called bird repeller which works when birds come near to the field we are indicated with the sound of siren. this method prevents from animals and birds.

The soil moisture sensors will be placed inside the field, and it is connected to the microcontroller. The moisture sensor will be continuously sensing the moisture content of the soil and sending information to the microcontroller, where moisture content value will be compared with the predefined level (Threshold). Whenever the moisture level becomes less than the predefined level, microcontroller will send a command to activate the water pump and at the same time microcontroller will activate GSM module, which will send a feedback message to user, stating that the "Pump on". Then motor starts supplying water to the field; simultaneously the moisture sensor will be sensing the moisture content and sending the data to the microcontroller. When the field is getting enough water supply then the moisture level of the field will start increasing, this increase in the moisture content again will be compared with a predefined moisture level. When it reaches the predefined moisture level, pump will automatically off. Again, GSM module will send feedback message stating that "Pump off". This water pump also works manually by pressing the key.

IV. RESULTS

It is observed that, in India, during the month June October session high rainfall takes place and during April to June and December to February, the rainfall is moderate.

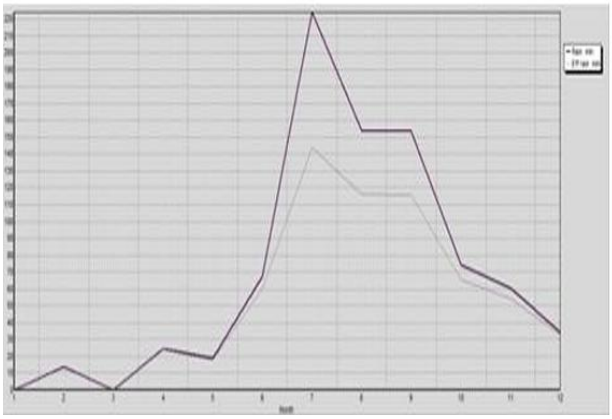

Fig.2. Rainfall and Effective rainfall during the cultivation period

So most of the need of irrigation is during month December-February and April-June, but due to lack of water, amount of water for cannot be maintained in field, so there is need for saving the water and manpower. This scenario is implemented in this work considering following cases.

Motor ON/OFF Conditions

A. Initial stage- Irrigation ON

Case 1 – In this, we take the values from field sensor like soil moisture, temperature & humidity. If the input values are abnormal then motor starts.

Case 2 – When the temperature, humidity and moisture are normal during this case, the pre-set value and field sensors value are equal so motor will automatically turn off.

Case 3 – Either from temperature moisture and humidity is abnormal. In this case, if any one of the field sensor remains abnormal then pre-set value will not match with field sensor value, so motor will remains ON.

V. ADVANTAGES

1. his system is inexpensive in terms of hardware component and power consumption.
2. This system helps in saving of water and electricity.
3. This will be useful in large agricultural areas.
4. This system helps in reducing the labor problem.
5. System can be swapped into manual mode whenever required.
6. It is convenient in all climatic conditions and all sorts of irrigation.

VI. CONCLUSION

In conclusion, This paper is the better solution for the farmers. After implementing this paper in the field there are several benefits for the farmers. By using the automatic irrigation system, it optimizes the usage of water, maximizes the productivity of crops and reduces the human intervention in the field. It will enhance the revenue of the farmers, thus encouraging the farming and at the same time giving a solution for energy crisis. It is easy to implement and eco-friendly solution for irrigating fields.

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