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Automated Solar Powered Irrigation System A Technical Review

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Abstract-

This paper discusses about the various automated irrigation techniques available to the farmer. The key objective of this paper is to provide a solar powered microcontroller based automated irrigation system. Minimization of human intervention in farm land irrigation can be done by using this automated technology. The use of moisture sensor, humidity sensor and water level sensor all together sends the signals to microcontroller which further sends the various statuses as read by the sensors to user mobile through GSM. The farmer (user) can control all irrigation operations through his android mobile device.

Keywords: Automated irrigation, GSM mobile, humidity sensor, microcontroller, moisture sensor, water level sensor.

1.INTRODUCTION

Agriculture sector is a major source of income in a country like India. Till today, most of the irrigation systems are operated manually resulting in over irrigation and water wastage most of the times. These obsolete 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 optimizes the use of water for irrigation purpose. The shedding control to farm can be given depending upon the temperature need of the surrounding as measured by humidity sensor. Thus the problems related to higher agricultural productivity, poor performance and decreased availability of water for agriculture can be solved by using the proposed solar powered automated irrigation system.

2. LITERATURE-REVIEW

In GSM based Automated Irrigation Control using Raingun Irrigation System by R.Suresh, S.Gopinath, K.Govindaraju, T.Devika, N.Suthanthira Vanitha [1], system is automated microcontroller based rain gun irrigation system. Irrigation is done only when it becomes necessary to water the fields thus saving large quantity of water. Android based mobile device is used. Applications are developed on android platform using tools from android SDK in java programming language. The GPRS feature of mobile phone is used for proving solution to irrigation control problem. Sufficient amount of water can be given to the fields. The system sends messages using GSM. The android application is designed to overcome irrigation problems such as under irrigation and over irrigation which causes leaching and other losses in soil quality. Rain gun technique is more efficient as compared with drip system. It leads to less soil erosion and less wind erosion. Yields are increased with decrease in water and labor requirements. The conventional power supply is used to run the whole automated system which is less efficient and more costly compared to the solar power based system in long run. If lower land area is to be covered then the proposed system is not economical.

In Automated Wireless Watering System (AWWS) by Chetana A.Kestikar, Rutuja M.Bhavsar [2], the system is facilitated by providing PC control and mobile control for monitoring and controlling watering activity. Also the wiring mess is reduced. The system is divided into two parts, one is PC side 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. Two modes of operation are there manual and automatic. In manual mode system will work as traditional watering system. The user decides when to start and stop watering. In automatic mode, once the system is started, the user need not pay attention to stopping of the system. The watering will be decided according to moisture levels. . The user 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 initiate moisture sensors, water level indicator. Again the power supply used to run the whole system is conventional and thus less economical.

In Solar Powered Smart Irrigation System by S.Harishankar, R.Satish Kumar, Sudharsan K.P, U.Vignesh, T.Viveknath [3], 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. The block diagram for the solar pumping module is as shown:

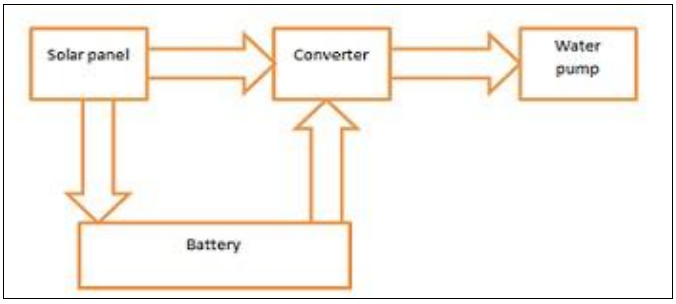

Figure1: Block diagram of [3]

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 nominal operating cell temperature.

In Smart Irrigation System Autonomous Monitoring and Controlling of Water Pump by Using Photovoltaic Energy by Dhana Lakshmi.N, Gomathi K.S [4], the power supply for whole system is taken from renewable photovoltaic cells energy; it reduces the cost 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 signal by 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 sprinkling motor is switched ON after the pH value goes below the required pH value. Both pumping and sprinkler 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.

In Modern Solar Powered Irrigation System by Using ARMproposed by Basava Sidramappa Dhanne, Sachin Kedare, Shiva Sidramappa Dhanne [5], 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 by 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 task is complete then GSM module sends the message, "watering is complete" to the user. If the task 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.

In Solar Panel Based Automatic Plant Irrigation Systemproposed by Prof. Rupali S.Sawant, Shreejit Gubre, Swathi Pillai, Monica Jain [6], the moisture sensor unit along with the processor, GSM modem and solar panel is almost same as the previous proposed works for field irrigation. The newly added feature in this work is humidity sensor module. The humidity sensor HIH4000/HSY220 manufactured by Honeywell is used to check the temperature of surrounding. For temperature range going above or below the set value needed for good growth of a crop, the microcontroller directs the shedding so as to shed the field thereby maintaining the temperature need of the crop. Thus the controlled temperature as well as controlled irrigation can be provided to the crop for healthy growth. The use of solar panel makes the whole system less costly in long run.

3.PROPOSED-SYSTEM

The overall enhanced solution to the automated irrigation problem can be described as in following manner. Drip irrigation system is to be used for saving large quantity of water from going wastage. The moisture sensor unit senses the moisture level in the soil. It gives an analog voltage to ADC which further gives a digital signal to microcontroller for generating and sending text message to the user through GSM technique, determining whether the fields need to be watered or not. The GSM and the microcontroller are connected by means of IC MAX232. The water level sensor is used to determine whether the water level in storage tank is sufficient or not for watering the fields. If water levels falls below the certain threshold then a message is sent to the user on his mobile phone reading as, "lagging resources, watering not complete otherwise the text sent is "watering complete".

The humidity sensor is to be used as discussed earlier to regulate the temperature of surrounding by means of shed as controlled by controller for healthy crop growth.

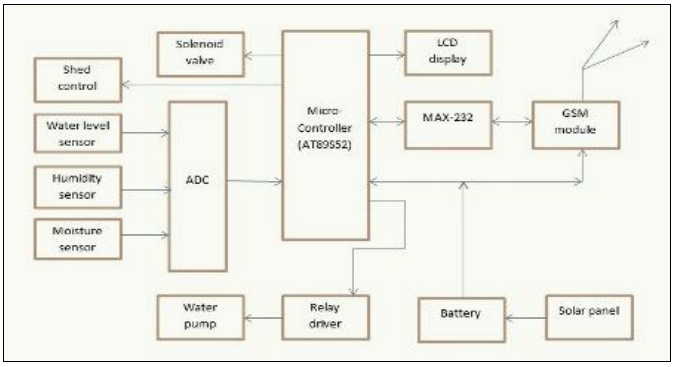

Figure 2: Block diagram of the proposed system

The control of pumping valve (pumping water to storage tank), watering valve (irrigating fields) and shed control when needed can be regulated by applications developed on the android mobile phone of the user through which the controlling signals can be sent back to the microcontroller through GSM. These applications are developed using android SDK in a java programming language.The GPRS feature of mobile phone is used as solution for irrigation control system.
Solar panels is used for harnessing photovoltaic energy so as to charge a battery which is to be used as a power supply for the microcontroller based irrigation system operating at field, thereby using renewable energy and saving grid power.

4.CONCLUSION

Agriculture sector is the backbone of our country. Due to decreased availability of water and increasing demand for higher agriculture productivity, the water saving automated irrigation technique has now emerged as a topic of high concern and immense importance. It is the precise method for farm irrigation and an important tool for accurate soil moisture control for good crop yield. Also the use of solar panels for supplying power to irrigation systems decreases the burden on grid power. The overall benefits are high and system is economical in long run.

5.REFERENCES

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