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Irrigation Automation Using IoT

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Abstract - India is an agricultural country, and about 70% of the population depends on agriculture. Automation of farm activities can transform agricultural domain from being manual and static to intelligent and dynamic leading to higher production with lesser human supervision. The management of irrigation can be improved using automatic watering system. Automation of farm activities can transform agricultural domain from being manual and static to intelligent and dynamic leading to higher production with lesser human supervision. This automated irrigation system which monitors and maintains the desired soil moisture content via automatic watering. Microcontroller ATMEGA328P on Arduino platform is used to implement the control unit. The setup uses soil moisture sensors which measure the exact moisture level in soil. This value enables the system to use appropriate quantity of water which avoids over/under irrigation. IOT is used to keep the farmers updated about the status of motor. Information from the sensors is regularly updated on a webpage using WiFi module through which a farmer can check whether the water pump are ON/OFF at any given time. Also, the sensor readings are transmitted to a Thing speak channel to generate graphs for analysis.

Keywords — Automatic, efficiency, energy, time saving.

I. INTRODUCTION

In the field of agriculture, use of proper method of irrigation is important because the main reason is the lack of rains & scarcity of land reservoir water. The continuous extraction of water from earth is reducing the water level due to which lot of land is coming slowly in the zones of un-irrigated land.

Another very important reason of this is due to unplanned use of water due to which a significant amount of water goes waste. For this purpose; we use this automatic plant irrigation system. The system derives power from solar energy through photo-voltaic cells. Hence, dependency on erratic commercial power is not required. Cost effective solar power can be the answer for all our energy needs. Solar powered smart irrigation systems are the answer to the Indian farmer. This system consists of solar powered water pump along with an automatic water flow control using a moisture sensor. It is the proposed solution for the present energy crisis for the Indian farmers. This system conserves electricity by reducing the usage of grid power and conserves water by reducing water losses.The irrigation system is defined as a system that distributes water to targeted area. Basically, it is meant for agriculture purposes. The efficiency of the irrigation is based on the system used. Since antiquity, the human life is based on agriculture and the irrigation system is one of the tools that boost agriculture.

There are many other types of irrigation system all over the world but these irrigations are encountering many problems. In fact, there are few modern systems but they mostly fail in one way to another. The automation plays an important role in the world economy; therefore, engineers struggle to come out with combined automatic devices in order to create complex systems that help human in its activities so that the system automatically processes itself without any human intervention. So we would like to develop an automatic irrigation system.

Solar energy has emerged as viable source of renewable energy over the past few decades and is now used for various applications such as emergency lighting, water heaters, and industrial application. It is a cheap source of energy. Unlike hydroelectricity it does not cause national or any conflicts because sun is the only renewable source which is available to everyone. This project proposes a solar based automatic irrigation system. The main objective is to design an low cost irrigation system with the help of microcontroller. WiFi modules are used to alert farmer about the actions taken at the field. Basically, the project consists of electrical part and mechanical part. The electrical part consists of photovoltaic, which is meant to generate power and the power is stored in the rechargeable battery. The mechanical part consists of pump to pump out the water from the water source.

II. LITERATURE SURVEY

Study According to the survey conducted by the Bureau of Electrical Energy in India in 2011 there are around 18 million agricultural pump sets and around 0.5 million new connections per year is installed with average capacity 5HP. Total annual consumption in agriculture sector is 131.96 billion KWh (19% of total electricity consumption).As cited in paper [1] solar powered smart irrigation technique is the future for the farmers and a solution for energy crisis. So for

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the proposed solar powered system we are using techniques analyzed in paper [2] and [4] and modified. Sine PWM technique has been used for inverter operation for minimum harmonics as given in paper [3] which further increases the efficiency of the system. The rating of the system was calculated corresponding to the pump specifications referring to paper.

III. OBJECTIVE

The main objective of this project was to design a small scale irrigated system that would use water and electricity in more well-organized way in order to prevent excess water loss and minimize the cost of labour. The following aspects were considered in the choice of design solution:

- Installation cost.
- Water saving.
- Human intervention.
- Reliability.
- Power consumption.
- Maintenance.
- Expandability.

IV. PROPOSED SYSTEM

The system is a combination of hardware and software components. The hardware part consists of embedded system and software is the webpage designed using PHP. The webpage is hosted online and consists of a database in which readings from sensors are inserted using the hardware.

In recent days, agriculture field farmers are facing many problems in watering their plants to keep their crops green in summer season. It's because they don't have correct idea about the availability of the power. Even if the power is available, they have to wait until the pitch is properly watered. Thus this process restricts them to stop doing other deeds. But, there is a solution, i.e., automatic solar submersible pump control panel for irrigation. In the trial of solar based plant irrigation using submersible pumps, PV cells are used to generate electricity, which is stored in rechargeable batteries. These batteries produce power for the system operation. A submersible pump controller is used to pump a water from a boor well or storage water tank. Then, the water is drawn by a where the installed sprinklers water the crops or plants.

A. Moisture Sensing Section

A sensor is an electronic component, module, or subsystem whose purpose is to detect events or changes in its environment and send the information to other electronics, frequently a computer processor. A sensor is always used with other electronics, whether as simple as a light or as complex as a computer. In this system we are using three sensors that are soil, temperature, humidity sensors. The inverting input of a comparator is given to a fixed voltage through the regulated power supply and the non-inverting input of comparator is pulled down and given to moisture sensing arrangement at sensing terminal. When the soil is dry, the soil resistance between the positive supply and the non-inverting input is high resulting in voltage to the non-inverting input less than the inverting input making comparator out going logic low. This command is given to controller. In this condition the output of the controller is logic high that switches ON a relay driver transistor due to which the relay is ON and the water pump is in ON condition. Then while the soil gets sufficiently wet, the soil resistance falls making available a voltage to the non-inverting input higher than inverting input, so the output of comparator is logic high which is fed to microcontroller. In this condition microcontroller output is logic low to a transistor which stops conducting a make relay OFF and the pump stops.

V. WIFI MODULE

The **ESP8266** is a low-cost Wi-Fi chip with full TCP/IP stack and MCU (microcontroller unit) capability produced by Shanghai-based Chinese manufacturer, Espress if Systems. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections. The very low price and the fact that there were very few external components on the module which suggested that it could eventually be very inexpensive in volume. The **ESP8285** is an ESP8266 with 1 MiB of built-in flash, allowing for single-chip devices capable of connecting to Wi-Fi. In the system the record or the reading sensed by the soil moisturizer sensor, humidity sensor, temperature sensor will be sent to farmer or user through the wifi. two YL-69 soil moisture sensors taken over a period of one hour. Figure 1 depicts readings from two YL-69 soil moisture sensors one of which was inserted in over irrigated soil and the other in soil with initial moisture content 79%. The readings were taken over a period of one hour to observe the rate at which moisture content in soil is reducing when the sprinklers are off. These readings are transmitted to the website and things peak channel.

VI. SYSTEM ARCHITECTURE

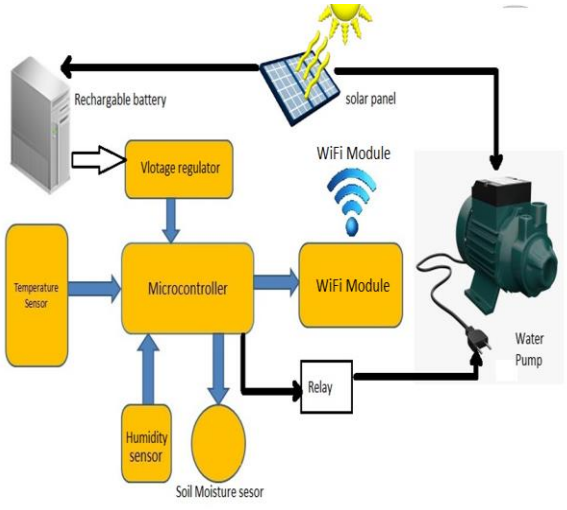

Figure 1. Block diagram of system.

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VII. FLOW CHART

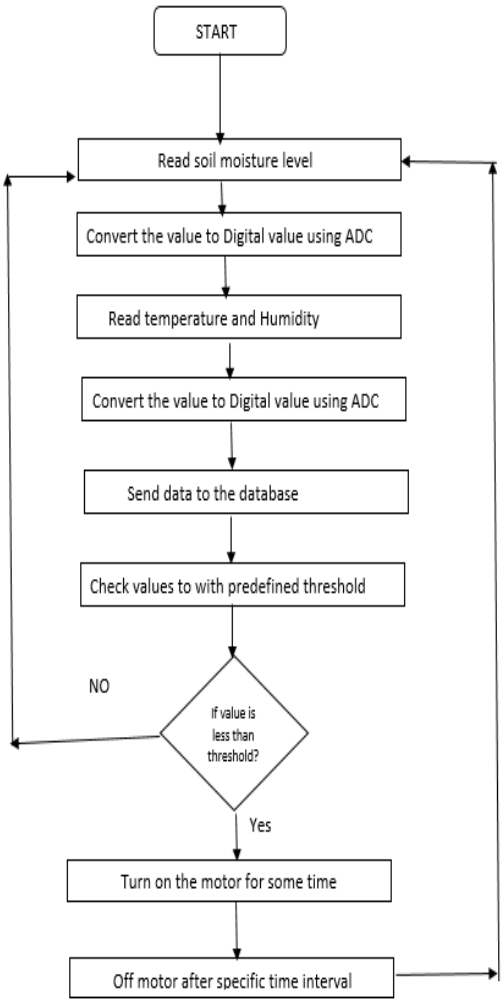

Figure 2. Flow diagram of system.

VIII. RESULT ANALYSIS

Sr No.	Moisture Status	Temperature(C)	Relative humidity	Date-Time
1	45	25	45	2018-03-22 00:41:36
2	45	25	45	2018-03-22 00:41:56
3	45	30	50	2018-03-22 00:42:10
4	45	23	23	2018-03-22 00:43:11
5	45	23	54	2018-03-22 00:44:43
6	45	23	54	2018-03-22 00:44:48
7	45	23	54	2018-03-22 00:44:49
8	45	23	54	2018-03-22 00:44:49
9	45	23	54	2018-03-22 00:44:49
10	45	23	54	2018-03-22 00:44:49
11	45	23	54	2018-03-22 00:44:49

Figure 3 :Humidity and temperature reading from sensor.

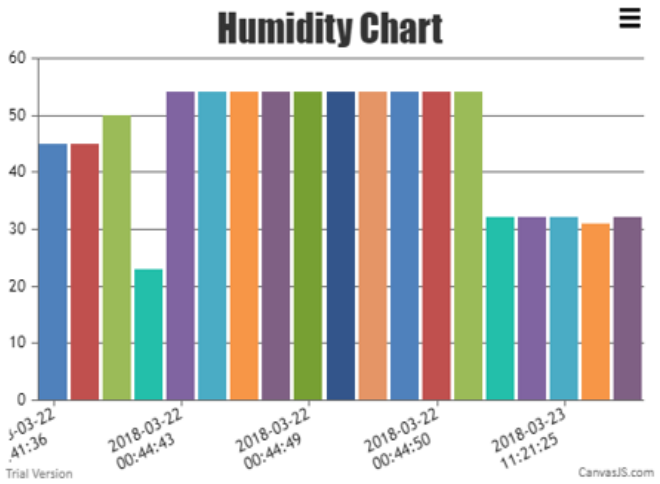

Figure 4 Graphical representation of humidity.

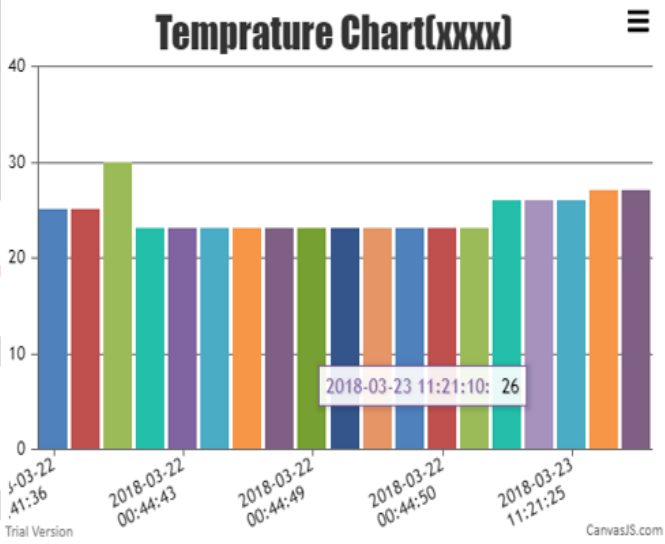

Figure 5 Graphical representation of temperature.

IX. PROJECT IMAGES

The hardware section comprises of ATMEGA 328 microcontroller, sensors, WiFi module, solar panel, relay, LCD display, photo-voltaic cell.

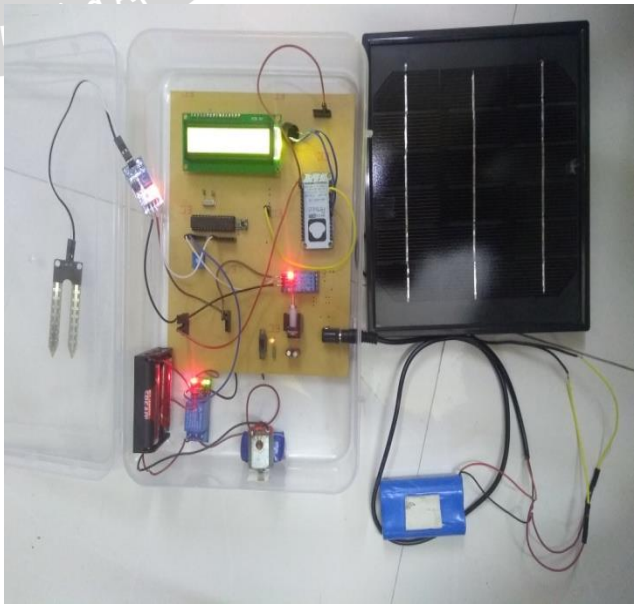

Figure 6 Hardware part

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X. ADVANTAGES OF PROJECT

Compared to more traditional systems, a water system that relies on a solar water pump motor offers many benefits, including the following Solar water pump installations are versatile and can be used for various applications:

It enables people to manage their drinking **water supply**, livestock watering, irrigation, and other residential applications.

Usually the need for water is greatest during the hot sunny days. During these peak times the pv panels also produce most power and most water will be pumped into the storage tank.

Due to the simplicity of solar powered water pump systems, this technology is reliable, and requires **little maintenance**.

- Easy installation
- Low maintenance
- Simple and reliable
- No fuel spills or costs
- Unattended operation
- Mobility option

XI. CONCLUSION

A system to monitor moisture levels in the soil was designed and the project provided an opportunity to study the existing systems, along with their features and drawbacks. The proposed system can be used to switch on/off the water sprinkler according to soil moisture levels thereby automating the process of irrigation which is one of the most time consuming activities in farming. Agriculture is one of the most water-consuming activities. The system uses information from soil moisture sensors to irrigate soil which helps to prevent over irrigation or under irrigation of soil thereby avoiding crop damage. The farm owner can monitor the process online through a website. Through this project it can be concluded that there can be considerable development in farming with the use of IOT and automation. Thus, the system is a potential solution to the problems faced in the existing manual and cumbersome process of irrigation by enabling efficient utilization of water resources.

XII. FUTURE SCOPE

- Rain gun sensor can be used .
- IR sensor can use to detect and warn any object passing in field.
- Rain water harvesting can be done and this harvesting water can be used to moisten field.

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