Smart Watering System using IoT

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***Abstract*— As India's population is increasing day by day after 25-30 years there will be significant issue of food, therefore the development of agriculture is important .Today the farmers area unit has shortage of rains and inadequency of water. In the present era the greatest problem faced by world is water scarcity and agriculture being a demanding occupation consumes plenty of water , therefore a system is required to use the water efficiently. The main objective of this work is to develop a smart and automated watering system for plants. Automated systems have less manual operations, relaibily, flexibility and are accurate. The field of internet of things had a significant transformation to extend things from the data generated from devices to objects in the physical space.**

I. INTRODUCTION

INIDA'S major source of income is from agriculture sector and 70% of people depend on the agriculture, most of the irrigation systems uses traditional methods which are operated manually. Two scare and valuable resources of irrigation that is water and energy are not efficiently utilized by the current irrigation system. Todays advanced society has turned into a digital world through the contribution of technology , now we are leaving in such an era where technology is studied to improve our life style. Hence to make life simpler and convenient "SMART WATERING SYSTEM" had been introduced. A model of controlling irrigation facilitates to help millions of people.

Smart watering system can be defined as the science of artificial application of water to the soil depending on the soil moisture content. With the advent of open source arduino boards along with the moisture sensor, it is viable to create devices that can monitor the soil moisture content and accordingly irrigating the fields or the land scape when needed. The proposed system makes use of microcontroller ATMEGA328P on arduino uno platform and IOT which enables farmers to remotely monitor the status of water level in the soil by knowing the sensor values thereby, making the farmers work much easier as they can concentrate on other farm activities.

II. LITERATURE SURVEY

INDIA is one of the scare water resources in 13 countries in the world, due to low utilization of water resources our country is facing the risk of overheating. In order to effectively scale back the impact of inadequate water resources on INDIA's economy from fashionable agricultural cultivation and management prospective, inline with essential principles of web ,with device technology, this paper proposes exactitude agriculture irrigation system, and focuses on the hardware design ,specification and code method management of the irrigation system.

The newer scenario of decreasing water tables, drying up of rivers and tanks, unpredictable environment present an urgent need of proper utilization of water. To cope up with this use of temperature and moisture sensor at suitable locations for monitoring of crops is implemented in [1]. An algorithm developed with threshold values of temperature and soil moisture can be programmed into a microcontroller-based gateway to control water quantity [2]. After the research in the agricultural field, researchers found that the yield of agriculture is decreasing day by day. However, use of technology in the field of agriculture plays important role in increasing the production as well as in reducing the extra man power efforts. Some of the research attempts are done for betterment of farmers which provides the systems that use technologies helpful for increasing the agricultural yield [3]. The use of remote switching and monitoring of irrigation system using smart phones to address the need of automatic control of the water is presented. The data about soil moisture, temperature and humidity is sent to the smart phone for the user to make the decision. [4]. In the studies related to wireless sensor network, researchers measured soil related parameters such as temperature and humidity. Sensors were placed below the soil which communicates with relay nodes by the use of effective communication protocol providing very low duty cycle and hence increasing the life time of soil monitoring system. The system was developed using microcontroller, sensors while the transmission was done by hourly sampling and buffering the data, transmit it and provide the necessary water [5] .

III. SOFTWARE AND HARDWARE REQUIREMENTS

A. EMBEDDED C

Embedded C is a set of language extensions for the c programming language by the c standard committee to address commonality issues that exists between c extensions for different embedded system. Historically embedded c programming requires non standard extensions to the c language in order to support exotic features such as fixed point arithmetic, multiple distinct memory banks and basic input output operations.

Two salient features of embedded programming are

- Code speed
- Code size

Code speed is governed by the processing power ,timing constraints, whereas code size is governed by available program memory and use of programming language. Goal of embedded system programming is to get maximum features in minimum space and minimum time.

B. SOIL MOISTURE SENSOR

Soil moisture sensors are used for measuring the water content of the soil. The soil moisture sensor uses capacitance to measure dielectric permitivity of the surrounding medium in soil, dielectric permittivity is a function of the water content .The sensor creates a voltage proptional to the dielectric permittivity, and therefore the water content of soil. The sensor averages the water content over the entire length of the sensor. There is a two centimeter zone of influence with respect to the flat surface of the sensor , but it has little or no sensitivity at the extreme edges. The soil moisture sensor is used to measure the loss of the moisture over time due to evoparation and plant uptake, evaluate optimum soil moisture contents for various species of plants, monitor the soil moisture content to control irrigation .

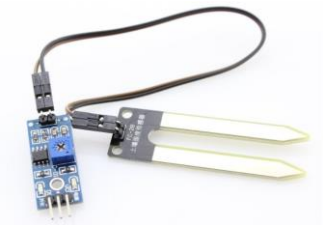

Fig1:Soil moisture sensor

C. ARDUINO UNO

Arduino is an open-source computer hardware and software device. It also designs and manufactures µc based kits for building digital devices and interactive objects that can sense and control objects with many devices.

The main reason for choosing this device arduino uno is that controller board based on the ATmega328 consists of 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button and Flash Memory 32 KB of which 0.5 KB used by boot loader SRAM 2 KB EEPROM 1 KB Clock Speed 16 MHz.

Fig2:Arduino uno

D. RELAY

Relay board module is used for controlling higher current loads from microcontroller development board, PC parallel or arduino uno. This board has one onboard relay which can switch upto 7 amps. Relay's terminals (C,NC,NO) are accessible through screw terminals which makes wiring up the board very easy. The relay is safely driven by transistor BC547 hence input device, such as arduino, is protected from realy circuit. There is free wheeling diode which will further protect microcontroller from relay kick back.

Fig3:Single channel relay

E. GSM MODULE

Gsm module is a specialized type of module which accepts a sim card, and opartes over a subscription to a mobile operator, just like a mobile phone. Gsm module can perform the following operations:

- Receive, send or delete sms messages in a sim.
- Read, add, search phone book entries of the sim.
- Make, receive or reject a voice call.

The module needs a AT commands, for interacting with processor or controller, which are communicated through serial communication. These commands are sent by the controller/processor. The module sends back result after it receives a command. Different AT commands supported by the module can be sent by processor/controller/computer to interact with GSM cellular network.

Fig4:GSM module

IV. PROPOSED SYSTEM

This prototype monitors the amount of soil moisture. A predefined range of soil moisture is set, and can be varied with soil type or crop type. In case the moisture of the soil deviates from the specified range, the watering system is turned on/off. Whenever system swiched on/off, a message is sent to the user via GSM module updating the status of water pump and soil moisture, it will activate the irrigation system, pumping water for the plants.

The block diagram of smart irrigation system is represented in Fig5. It consists of a arduino uno (ATmega328) which is the brain of the system. The soil moisture sensor is connected to the input pin of the controller. The water pump, gsm module and the relay are coupled with the output pins. Sensors are placed inside the soil, these sensors uses two probes which sense the moisture level in the soil. Moisture level readings are sent to the arduino controller. Soil sensor is analog, the analog signals are converted into digital form from an inbuilt ADC present in arduino controller. Arduino now alerts the motor to supply the required amount of water to the soil. The motor is programmed to rotate, the rotating platform is attached on the motor to provide a base moment of pipe. If the soil is dry the moisture sensor values will be high, so the pump is turned on using a relay and switched off when the values reaches threshold.

This system integrates a GSM module with arduino where the moisture value measured by the sensor and status of the pump(ON/OFF) is collected. The farmer will be intimated about the current field condition and this information is displayed on a web page along with the control buttons to turn on or turn off the water pump remotely. So that the farmer can access the details about the condition of the field anywhere, anytime.

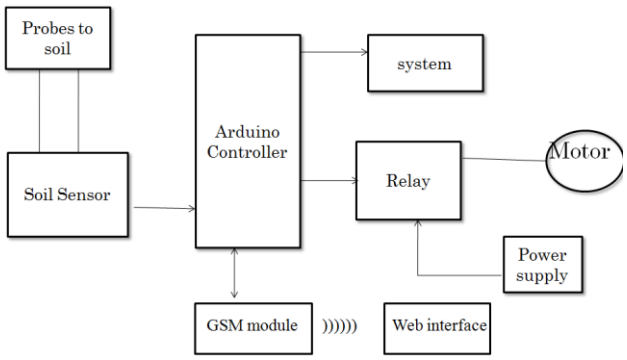

Fig5: Block diagram of smart watering system

V. ADVANTAGES

This technology is an efficient automated irrigation systems and it is a valuable tool for conserving water planning and irrigation scheduling which is extendable to other similar agricultural crops. Moisture level of the soil is measured. So that, we can provide water as per requirement of the soil .It prevents water clogging of soil. Valves are controlled in our system. Therefore labour is not required for valve controlling. The message is sent to users mobile so he can understand the moisture level and user can handle the situation at distant location.

VI. RESULT

The smart irrigation system was tested on a garden plant. The plant's water requirement is 600-800mm a day. In the Arduino code, the moisture range was set as 300-700 (which delineates the corresponding resistance value in digital format). Moreover this system proves to be cost effective and proficient in conserving water and reducing its wastage.

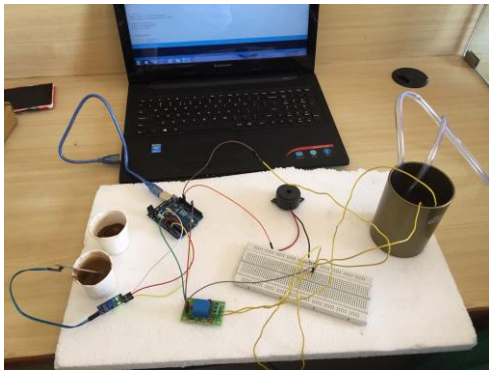

Fig6:Experimental setup

VII. CONCLUSION

The proposed system can be used to switch on/off the water pump according to the soil moisture levels there by automating the process of irrigation, which is one of the time consuming activities. The system uses information from the soil moisture sensor to irrigate soil which helps to prevent over irrigation or under irrigation of soil there by avoiding crop damage. The farm owner can monitor the process online through a website. From this system it can be concluded that there can be considerable development in farming with the use of iot.

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