IoT BASED SMART IRRIGATION SYSTEM

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ABSTRACT- The main objective of this paper is to develop an IoT based smart irrigation system which is used to irrigate the agricultural fields. Here the agricultural lands are irrigated automatically without the presence of farmer at the fields, which mainly focuses to reduce the wastage of water. It saves time, low maintenance, cost effective and efficient irrigation process. Raspberry pi is used in design of this prototype which makes system easy for operating. The system also consists of sensors which measure the moisture of soil, temperature and humidity. These measured sensor values are given to Raspberry Pi which establish a communication link with IoT (Internet of Things) and intimated to the farmer through internet. Raspberry Pi is connected to Relay which controls the submersible motor pump.

***Key words*: IOT, Gateway, DHT, RELAY**

I. INTRODUCTION

In India, agriculture plays an important role in development of the country. Generally, agriculture depends on the rain and monsoons which are not sufficient water sources. So, the irrigation process should be employed in the field of agriculture, but irrigation is also a time-consuming process. The main objective of this paper is to overcome these challenges. To make the irrigation smarter we will make a fusion of traditional farming and modern technologies. The main purpose of this system is to control the farming fields based on the environmental factors like soil moisture, temperature and humidity. The plants are watered with the use of devices like Raspberry-Pi and soil moisture, temperature and humidity sensors.

The Internet of Things is a network which is consists of all physical devices data analysis such as vehicles, machines, home appliances and sensors and APIs to communicate and transfer data over the internet. There are several IoT applications in farming such as collecting the information of temperature, humidity etc. this data can be used for smart irrigation techniques, which improve the quality and quantity in production, minimize risk and waste. IoT system architecture is a simple view consists of 3 phases

1. Devices (sensors, machines, etc.)
2. The Gateway
3. Cloud

Devices include networked electronic, electrical and mechanical things, such as sensors those use protocols such as proprietary protocols to connect to the Gateway. The Gateway consists of sensors data analysis systems called the Gateways that provide functionality, such as processing of the data, providing secure connection to the cloud, analytics or computing.[1] The cloud phase includes various database systems that store the sensors data.The cloud phase is most cloud-based IoT system features an event organizing and communication with the users and handles communication with all the phases.

II. DESIGN AND IMPLEMENTATION

The block diagram of the prototype is shown in Fig. 1 and Fig. 2. The main components are Raspberry-Pi module, sensors, relay, motor, power supply and Wi-Fi connection.

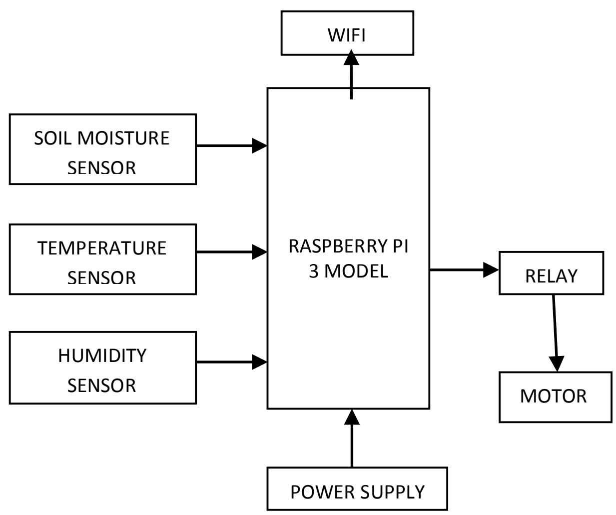


Fig. 1 Smart irrigation system (Block diagram)

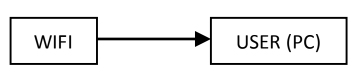


Fig. 2 Monitoring Unit

III. SENSORS

Sensors are the electronic devices which convert the physical parameters such as temperature, moisture, humidity into the electrical signal. The system shown in the Fig. 1 consists of

A. Soil moisture sensor

This sensor measures the volumetric water content i.e. moisture content present in soil. [2] When the moisture content is present in soil, the sensed value is high otherwise low. It operates at voltage of 5V and <20mA current, interface type is analog. Working temperature is of 10ºC to 30ºC.

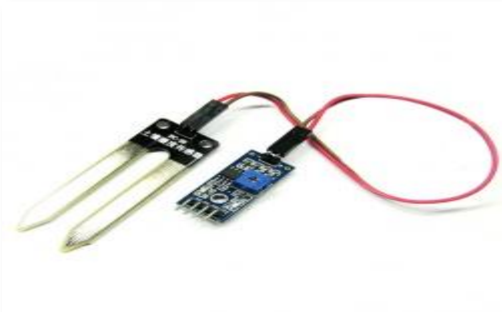


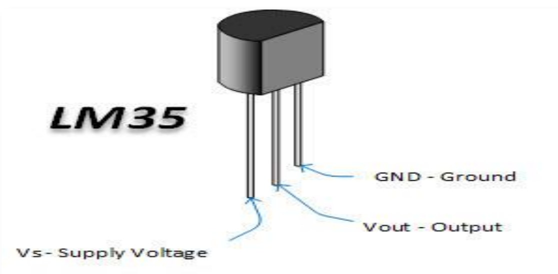
Fig 3 . SOIL MOISTURE SENSOR

B. Temperature sensor

This sensor measures the temperature (in °C) which is an electric output. LM35 temperature sensor is used in this prototype. The scale factor is .01V/°C. [2] Input voltage is +5V for typical applications. LM35 can measure the temperature range from -55°C to 150°C.

Fig4.Temperature Sensor

C. Humidity sensor



DHT11 sensor measures the humidity content present in the field. The sensor can measures the humidity from 20%RH to 90%RH with an accuracy of ±1°C and ±1%. Its operating voltage is 3.5V to 5.5V, resolution for humidity is 8-bit.

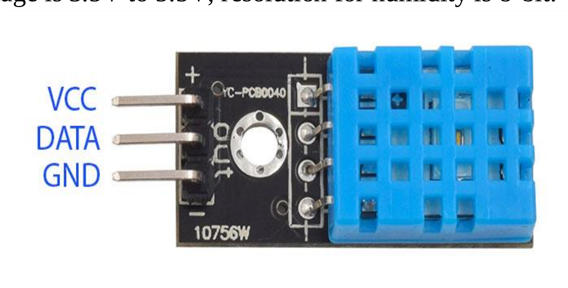


Fig.5HUMIDITY SENSOR

IV. FUNCTIONAL COMPONENTS

A. Raspberry -Pi

The Raspberry-Pi is a credit card sized minicomputer without any peripheral devices like mouse, keyboard, etc.[1] It has a many components for connecting to other devices, like USB ports, an Ethernet port, an SD card slot, Wi-Fi ports, and more. It's a Broadcom BCM2837, ARM cortex A53, 1.2GHZ 64bit processor. Storage is of microSD card of capacity 1GB. GPU of 400 MHz Dual Core VideoCore IV with 1080p30 H.264 high-profile decodes. Several ports such as HDMI for audio, four USB 2.0 ports, 3.5mm Composite Video and Audio jack, DSI Display Port, CSI Camera port and 40pin GPIO.

Wireless communication can be done using 802.11n Wi-Fi wireless networking. Bluetooth of version 4.1 wireless technology. 10/100BASE-T Ethernet (RJ-45 connector). Operating voltage is of 5V DC and operating current is 2.5Amps. The operating systems for Raspberry-Pi are NOOBS, raspbian several third party operating systems are XBian, RISC OS, pinet, Libreelec, etc.

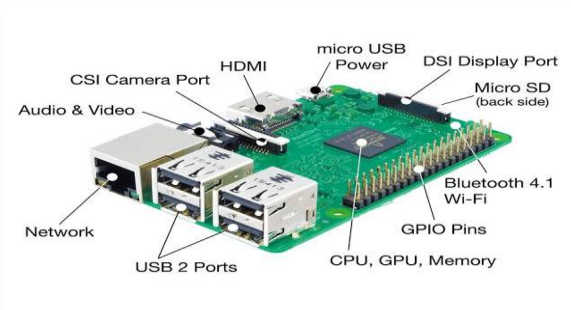


Fig. 6 RASPBERRY-PI 3

B. RELAY

A Relay is a switch. Current which flows through the coil of the relay creates a magnetic field which changes the switch contacts. [3] The coil current can be ON or OFF so relay have two switching positions and they are double thrown (changeover) switches.

Fig. 7 RELAY

C. MOTOR

Submersible pump is a device which has completely sealed motor and closely-coupled to the pump body. The whole arrangement must be submerged in the water to be pumped out. Submersible pump pushes the water to the ground surface. [3] We have used a low cost, mini Submersible Pump Motor which operates at voltage of 2.5V to 12V. It can pump up to 120 liters per hour and its current consumption is low i.e. 220mA.

Fig. 8 SUBMERSIBLE PUMP

V. PROPOSED METHODOLOGY

Raspberry-Pi is the main controlling part of the system. In this prototype sensors and relay are interfaced with Raspberry-Pi module. The Raspberry Pi cannot directly drive the relay. It has only 0V, 5V or 3.3 V. It needs 12V to drive the relay. In this we used a driver circuit which provides 12V amplitude to drive the relay. Now when the power supply is ON the soil moisture sensor senses the moisture content in the soil continuously, similarly the LM35 and DHT11 sensors checks the temperature and humidity. If the soil moisture content is low, the motor which is connected to the relay will turn ON the motor, otherwise motor is OFF. The climatic conditions and status of the field can be observed by farmer through the webpage.

VI. RESULT

The sensors data is stored in the cloud of IoT and the farmer or user can view the data in their PC or mobile through the webpage. The periodic view of sensors data which consists of parameters like temperature, humidity, soil moisture are show in Fig. 8, Fig. 9, Fig. 10. The climatic conditions at the agricultural field which were shown to the farmer are as follows.

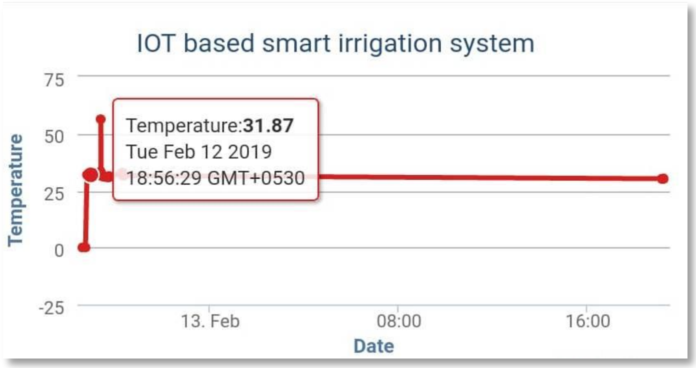


Fig. 9 Temperature

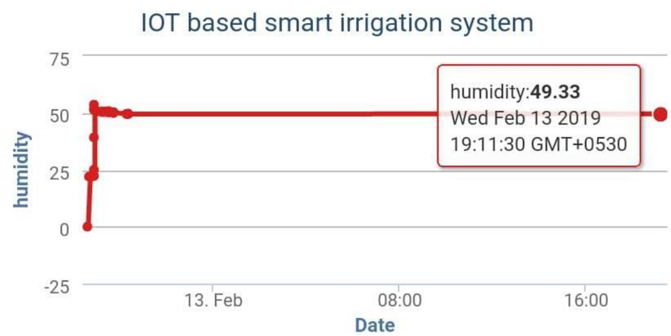


Fig. 10 Humidity

Moisture content present in the soil is shown in Fig.11.

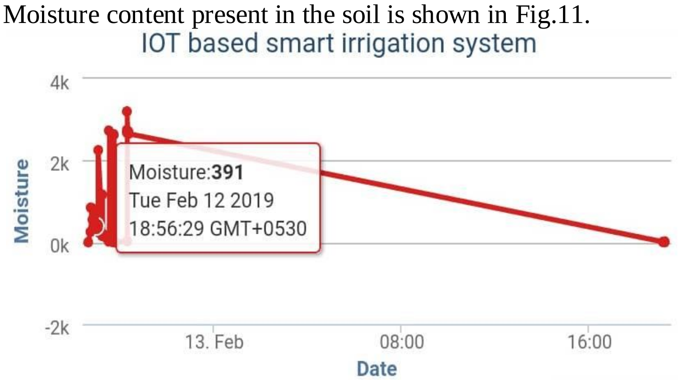


Fig. 11 soil moisture content

Watering of plants occurred or not can be also observed if the motor is in ON condition the displays 1 otherwise 0. The time and date of the complete process can also be observed.

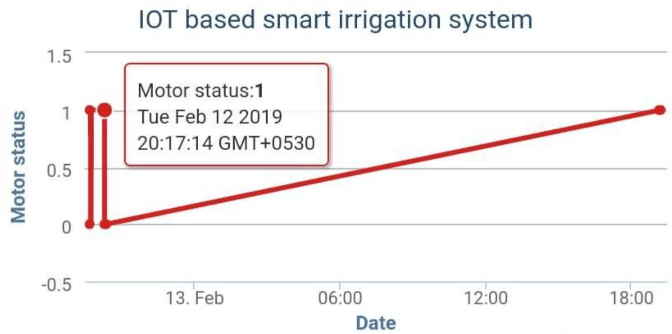


Fig. 12 Motor status

VII. CONCLUSION

This paper involves a technique of monitoring and controlling the irrigation process. The smart irrigation system is of low cost and feasible for optimizing water resources. Farmer can also check their field status from anywhere in the world. Embedded system and computerized irrigation of agriculture gives a solution to assist web page precise irrigation control that permits maximize their productivity and saves the water.

VIII. FUTURE SCOPE

Rain sensors can be used so that farmer can know when it rains and prevent form overwatering in the field. Rain water storing can be done and that water can be used for irrigation. Buzzers can be used so that it gives siren if floods, any intrusion occur etc. We can include many more water quality sensors that could increase production. Water level sensor can be used to detect the water level present in the stored water. We can interface LCD screen to the Raspberry-Pi in order to display the current status of the soil moisture content and temperature levels, percentage of water utilized to water the plant, duration of time for which the water pump is ON, etc. latest version of the raspberry pi can be used for more efficient results.

VII. REFERENCES

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AUTHOR

Mr. K.Chandra Sekhar is Currently working as an Assistant Professor in Raghu Institute of Technology in the Department of ECE. His area of Interests includes VLSI, Embedded, IOT, Coding Theory and Communications.