IOT BASED MODERN IRRIGATION SYSTEM

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Abstract -- Agriculture plays a vital role in the development of our country with rich agricultural backgrounds. In India, about 70% of the population depends on farming and one third of the nation's capital comes from farming. Issues concerning agriculture always hinder the development of the country. The only solution to this problem is to adopt smart agriculture. The main aim of this project is to develop a low cost solution for the continuous monitoring and to enable smart irrigation of the agricultural field using Internet of things (IoT) technologies. In this work, a system is developed to monitor the field condition using sensors and to automate the irrigation process based on the sensor data. The proposed system will monitor the various parameters availing in the field.9

Keywords- IoT, Arduino, soil moisture, temperature, humidity, water level.

I. INTRODUCTION

Agriculture is the main backbone of India's Economical growth. The most important barrier that arises in traditional farming is the climatic change. Effects of climatic change include heavy rainfall, intense storm, heat waves, less rainfall, etc. Due to these factors, the productivity decreases to a major extent. Unfortunately, many farmers still use the traditional methods of farming, which results in a lower yield of crops and fruits. To boost the productivity and to minimize the barriers in agriculture field, there is a need to use innovative technology and techniques like Internet of Things.

Prachi Patil (2014) proposed a method of automating the irrigation process using Peripheral Interface Controller (PIC16F877A) and Global System for Mobile (GSM SIM300) modem. The system monitors the soil moisture condition of the farm and controls the soil moisture by switching ON/OFF the water pump. Once the moisture reaches a particular level, the system takes appropriate steps to regulate or even stop the water flow. The proposed system also monitors the water level in the water source so that if the water level becomes very low, it switches off the motor to prevent damage to the motor due to dry run. The status of the field in terms of moisture level, water level and motor state are communicated to the farmer in the form of messages using GSM Modem. Owing to the use of GSM modem, the cost of this proposed method increases and the reliability of GSM messages is low. Also the use of single moisture sensor is not sufficient t for automating the agricultural process.

Rajalakshmi.P et al., 2016 proposed the monitoring and automation of agriculture by using moisture, temperature, light and humidity sensors and Micro controller. The data from the sensors are sent to the web server using wireless transmission and JavaScript Object Notation (JSON) format, which is formerly used for data encoding to maintain the server database. The notifications are sent to the farmer's mobile periodically and the farmer will be able to monitor the field conditions from anywhere. The parameters used here are soil moisture sensor, temperature and humidity sensor DHT11, Light Dependent Resistor (LDR) used as the light sensor and web server – NRF24L01 used for transmitter and receiver. Automation of irrigation system data was stored in Structured Query Language (MySQL)database using Personal Home Page (PHP)script. However the cost of this proposed system is high compared to the other methods.

Now a day, Internet of Things (IoT) is widely applied to the industrial problems, enabling the industries to compete with the challenges they face and do to a smart monitoring of the work process, power levels, etc. Nikesh Gondchawar (2016) tried to achieve smart agriculture using automation and Internet of Things (IoT) technologies. This proposed method includes smart irrigation based on accurate real time field data and uses Global Positioning System (GPS) based remote controlled robot that performs operation like weeding, spraying, moisture sensing, etc. All the operations are performed by interfacing the necessary sensors, Zig-Bee modules, camera and actuators with the Raspberry Pi. The proposed method is useful for larger farms because of the installation cost involved and is not suitable for smaller forms and green houses.

Prathibha SR et al., 2017 made use of the evolving IOT technology (Internet of Things)to automate and enable smart agriculture. As environmental factor plays a vital role in deciding the yield of crops, this work involves the monitoring of atmospheric temperature and humidity in the agricultural field through sensors using CC3200 single chip controller. The Wireless Sensor Network collects the data from different sensors and sends it to the main server using wireless protocol. Camera interfaced with CC3200 is used to capture the images of

the field and the pictures are sent through Multimedia Messaging Service (MMS) to farmers mobile. It gives the information about the temperature, humidity of the air in agricultural field through Multimedia Messaging Service to the farmer through General Packet Radio Services (GPRS).

In this proposed work, an IoT based irrigation system has been proposed that has a wide area of application like open Farm, greenhouse farming, etc. In open farming, irrigation, water level, etc. can be managed with this system, whereas in greenhouse farming, temperature control, moisture control, humidity, etc can be managed this system. The system could be extended to small home gardens as well.

Objectives:

The following are the main objectives of this work,

- o A simple and easy to install and configurable system.
- o Providing with the necessary information to the farmer and to avoid irrigation at the wrong time of day like reducing runoff from overwatering saturated soils.
- o To turn the motor ON and OFF remotely, thus minimizing the need of labor.
- o To save time and to eliminate the human errors.

II. PROPOSED SYSTEM MODEL:

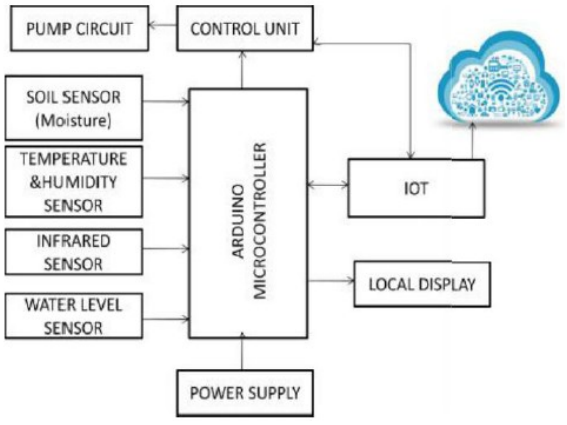

Fig1: Block diagram of proposed system

Arduino forms the heart of this proposed method to monitor the field condition and to take the necessary control action. Temperature, humidity, water level, soil moisture and obstacle sensor are used to sense the at mospheric conditions prevailing in the agricultural land and the sensed values are given to Arduino. The sensed value are sent to the IoT cloud using the ESP8266 Wifi module and are populated by the THINGSPEAK free cloud network.

The THINGSPEAK network is used to maintain a complete database of data collected from the field over time. Based on the historical data collected over time, the farmer could judge the weather conditions and can switch o n the water pump. The relay circuit connected to the Arduino enables the remote controlling of water pump by the farmer.

III. SYSTEM DESIGN: ARDUINO:

Arduino being a open-source microcontroller development board is widely used for simple and cost effective automation purposes. In this work, Arduinois used to read the sensor values, communicate the sensed data to IoT Cloud using ESP8266 Module and to control the water pump and motors. The Arduino reads the sensed value of Temperature (LM35) Sensor, Humidity sensor (DHT11), Moisture Sensor, water level sensor, etc in round robin method and calibrates the data. The calibrated data is sent to the IoT server using the ESP8266 module. Further it switches ON/OFF the water pump based on the control signal sent from the IoT server.

SUPPLY BOARD:

The proposed work utilize s +5 V, +12 V DC power supplies and hence a power supply circuit is used for the prototyping model. The supply voltage of 230V AC is given to a step-down transformer and is stepped down to 12V AC, which is later converted to 12V DC using the rectifier circuit. The output of rectifier still contains some ripples. To remove the ripples and to obtain a smoothed DC power, filter circuits are used. The Voltgae regulators are used t o further regulate the output DC voltage to the desired level of +5V and +12 V. Figure 2 gives the designed power supply circuit.

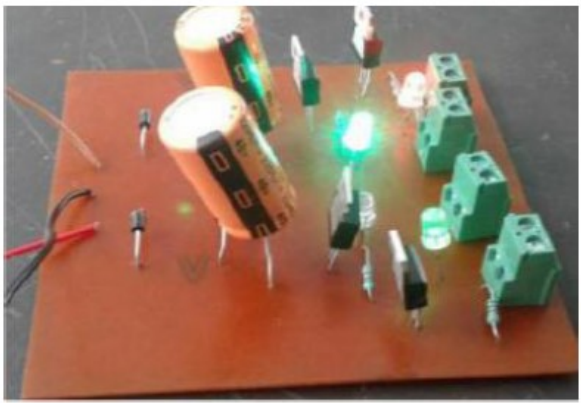

Fig2: Power supply board

LCD Display

LCD display is used as a local display unit to display the field parameters . JHD162A display controller, which is a monochrome LCD module is used in this work. The LCD displays the informations like sensed parameter values that prevails in the field, status of water level, water pumb status etc. Figure shows the diagrammatic representation of the LCD module interfaced with the Arduino. project is built using Arduino nano and DHT11 Humidity and Temperature Sensor. The program will make the Arduino to automatically read the data from the sensor and display it as Humidity and Temperature on the LCD Display.

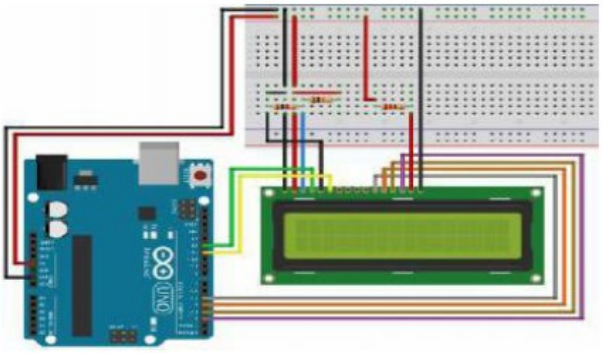

Fig3: Interfacing lcd to arduino

ULTRASONIC SENSOR:

Ultrasonic sensor is used to measure the water level in the tank or well in this work. It measures the water level by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. Water level is measured based on the time taken by the ultrasonic waves to get reflected from the water level. Figure gives the schematic of the used ultrasonic sensor.

Fig4: Ultrasonic sensor

HUMIDITY SENSOR:

Humidity sensors work by detecting changes that alter electrical currents or temperature in the air. There are three basic types of humidity sensors: capacitive, resistive and thermal. The ratio of moisture in the air to the highest amount of moisture at a particular air temperature is called relative humidity. A simple

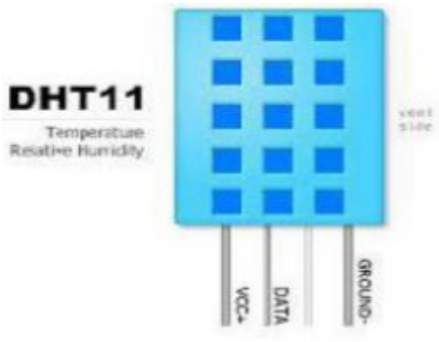

Fig5: Humidity sensor

INFRARED SENSOR:

An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. It is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion. The IR waves emitted by the LED reflect from an object and are caught by the receiver. The receiver has intimated to theft detected or not in analog format.

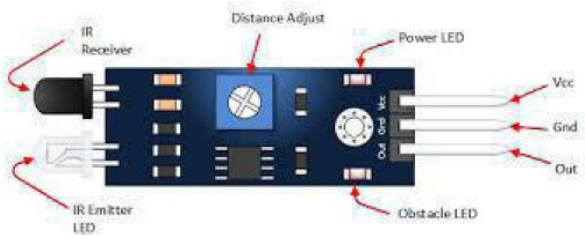

Fig6: Infrared sensor

SOIL MOISTURE SENSOR:

Soil moisture sensor is used for establishing moisture content in the field. The soil moisture sensor consists of two probes which are used to measure the volumetric content of the water. The two probes allow the current to pass through the soil and then it gets the resistance value to measure the moisture value. When there is more water, the soil will conduct more electricity which means that there will be less resistance. Therefore, the moisture level will be higher. Dry soil conducts electricity poorly, so when there will be less water, then the soil will conduct less electricity which means that there will be more resistance. Therefore, the moisture level will be lower.

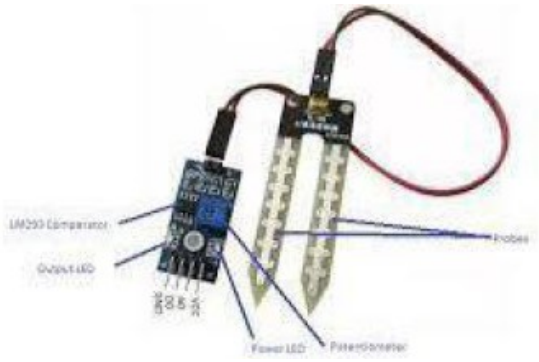

Fig7: Soilmoisture sensor

Wifi Controller:

The ESP8266 is a low-cost Wi-Fi chip. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. ESP8266 has an1 MB of built-in flash, allowing for single-chip devices capable of connecting to Wi-Fi. Almost limitless fountain of information available for theESP8266 and amazing

community support provides the use of ESP8266 in this work.

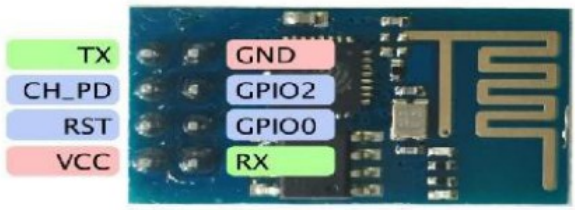

Fig8: ESP8266 Wi-Fi module

THINGSPEAK:

Thing Speak is a platform providing various services exclusively targeted for building IoT applications. It offers the capabilities of real-time data collection, visualizing the collected data in the form of charts, ability to create plug-in and apps for collaborating with web services, social network and other APIs. The core element of Thing Speak is a 'Thing Speak Channel'. A channel stores the data that we send to Thing Speak and comprises of the below elements:

- 8 fields for storing data of any type – These can be used to store the data from a sensor or from an embedded device.
- 3 location fields – Can be used to store the latitude, longitude and the elevation. These are very useful for tracking a moving device.
- 1 status field – A short message to describe the data stored in the channel.

PUMPING CIRCUIT:

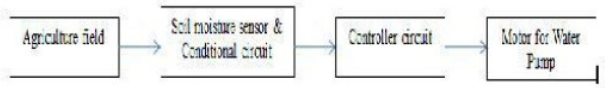

Fig9: Block diagram of pumping circuit

The proposed system will monitor the various parameters availing in the field uses the soil moisture condition, of the farm and controls the soil moisture by monitoring the level of water in the water source and accordingly switching the motor ON/OFF for irrigation purposes. The proposed system also monitors the water in the water source so that if the water level becomes very low, it switches off the motor to prevent the damage of motor due to dry run.

IV. RESULTS:

The hardware connection of water level ,soil moisture, humidity, temperature and IR sensors was done using Arduino Breadboard implementation of both the circuits was successfully done . The ESP8266 wi-fi module was interfaced with Arduino and serial transmission of data was stored successful.

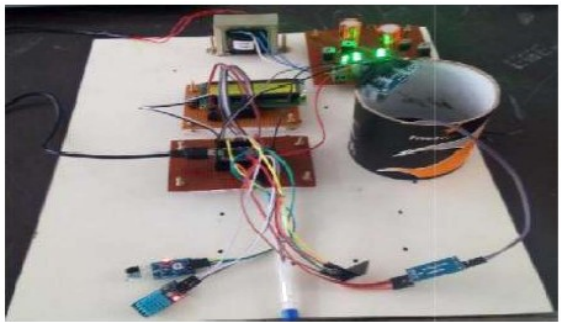

Fig10:Sensors connection diagram

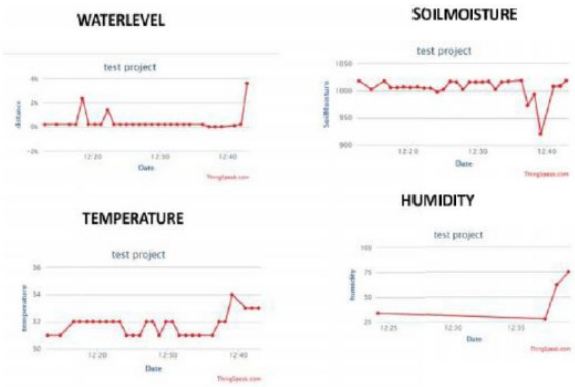

Fig11:ThingSpeak display

V. Conclusion:

In the concept of the IOT, the server should send the commands to the actuators of the fields, so the actuators of fields can take appropriate decisions The smart irrigation module can be modified according to the specific need of different crops. This data can be stored on the server.

VI. Innovation:

This system Camera is interfaced with Arduino to capture images of field and send that pictures through MMS to farmers mo bile using Wi-Fi.

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