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Research Paper

IOT Based Automated Horticulture for Farmers

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ABSTRACT:
India is the crop growing based country. Our ancient publics entirely depended on the farming realizing. Agriculture is a cause of living of mainstream Indians and has great control on the economy of the country. In dry zones or in situation of lacking rainfall, irrigation comes to be difficult. So, it wants to be involuntary for correct produce and measured at all for farmer protection. Horticulture is a sub-sector of agriculture which plays significant role in economy, human nutrition, gender mainstreaming and employment. Horticultural commodities include fruits, vegetables, flowers, spices and condiments, which have grown steadily and turn into a major segment in agricultural trade. The objective of Horticulture system is to keep measure on food security and the aim of automatic irrigation control system is to minimize the efforts of the human operator (gardener) in Horticulture activities.Over the years, monitoring soil moisture levels of farmlands has been performed manually. This is often time-consuming and inefficient, necessitating a solution that is efficient in controlling and monitoring soil moisture conditions. This work therefore proposes an Internet of Things IOT-based soil moisture monitor that observes soil moisture level using an ESP32 consist of inbuilt Wi-Fi module to send data from the board to the user's cell phone or laptop. The soil moisture monitor works by observing the water level of the soil and alerts the farmer when the predefined threshold rate of the moisture sensor goes above or below, thus indicating overwatering or underwatering.This control system is built around Arduino programmed using embedded C language.This process also involves sending data from the sensor to the cloud and then to the database server. Evaluation of the proposed soil moisture monitor using Thingspeak shows that the system is dynamic and efficient as it ensures water is not wasted. It is also cost effective as it eliminates the huge budget for hiring farm workers.

KEYWORD: *Arduino IDE, DHT11 sensor, Soil moisture sensor, Relay, LCD, DC Pump motor.*

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I. INTRODUCTION:

Horticulture commodities; e.g., especially vegetables such as red chili, red onion, tomatoes, potato are essential agricultural produces in the food supply needs in Indonesia[1].These commodities are a significant issue because of frequent price fluctuations in the Indonesian market. The success of horticulture cultivation is highly dependent on climate and environmental factors such as local microclimate, groundwater content, the temperature of the growth environment, humidity, and light intensity[2].Thus, it is essential to develop technologies that can solve these problems and ensure the horticulture in Indonesia becomes more productive both in quality and quantity[3].Previously, several studies have been presented in which they applied I0T-based technique for improving farming[4].However, a study of I0T-based horticulture that fits with Indonesia condition[5].In the Existing System, people used to check and verify the moisture content in the fields manually[6].This is very difficult and risk process to check the condition in the mid-night. Even though the climate is good the humidity is unknown, so in the previous system we have some disadvantages. Different sensors such as soil moisture, DHT11 are connected to Arduino microcontroller's input pins within this device[7].The sensed sensor values are displayed in LCD. If the sensed value exceeds the threshold values set in the system, the relay circuit automatically switches the pump ON / OFF and it is connected to the driver circuit which helps to switch the voltage[8].By using this device, the farmer can at any time access the details of the field conditions[9].

II. RELATED WORKS

Many methodology such as Design of IOT-based Monitoring System for Intelligence Indoor Micro-Climate Horticulture Farming in Indonesia, IOT based Horticulture Monitoring System, Smart Agriculture, IOT based smart sensors agriculture, IOT Based Smart Agriculture Monitoring System,An Efficient Water Optimization for Horticulture Crops usingiot,Sensor based Automated Irrigation System,Design and Implementation of Automatic Plant Watering System has been proposed by many authors and the detailed explanation about these methods is as follows.

Emil Robert Kaburuana(2019)proposed the micro-climate is very closely related to habitat and important for organisms on a micro scale. Light intensity, soil moisture, soil temperature, air temperature, soil acidity, wind direction, and CO2 level are micro-climate factors that are very influential in aquaculture productivity[10].

Monika Rabka, Dion Mariyanayagam, Dr PanchamShukla(2021)proposed the Remote monitoring and control of these farms is the obvious next step in trying to tackle the issues at hand. This is where the Internet of Things (IoT) comes into the fold. IoT is a network of Internet-connected devices that collect user-accessible data using sensors and processors and transfer it over wired or wireless networks.Controlled-EnvironmentAgriculture will help make farmers' daily work more manageable by reducing the amount of time needed for physical monitoring[11].

Dr.N.Suma, Sandra Rhea Samson, S.Saranya(2017)propose the Monitoring the environmental factors is not the complete solution to increase the yield of crops. There are a number of other factors that decrease productivity to a greater extent. Hence automation must be implemented in agriculture to overcome these problems. So, in order to provide solutions to all such problems, it is necessary to develop an integrated system which will take care of all factors affecting productivity in every stage[12] .

Dr. Balakrishna K propose the It transformed from the natural irrigation technique which was followed by the farmers to the automatic irrigation which for sure has benefitted in the less wastage of water and lessens the hard work of the farmers in farms. Controlling of remotely located irrigation water pumps for an agricultural site without going and visiting the site[13].

Karan Kansara, Vishal Zaveri, Shreyans Shah, SandipDelwadkar and KaushalJani was propsed in Sensor based Automated Irrigation System with IOT mentioned about using sensor based irrigation in which the irrigation will take place whenever there is a change in temperature and humidity of the surroundings. The flow of water is managed by solenoid valve. The two mobile are connected using GSM. The GSM and microcontroller are connected using MAX232. When moisture of the soil become low moisture sensor sense it and send signal to microcontroller, then the microcontroller gives the signal to mobile and it activate the buzzer. This buzzer indicates that valve needs to be opened by pressing the button in the called function signals are sent back to microcontroller. Microcontroller used can increase System Life and lower the power Consumption. There system is just limited to the automation of irrigation system and lacks in extra ordinary features[14].

By Observing above Methodologies there are some drawbacks such as while using Arduino it is expensive and it requires another microcontroller for WIFI purpose and memory purpose[15].

III. MATERIALS AND METHODS

Requirements:

The proposed prototype requires the following Hardware:

ESP32 microcontroller, Soil moisture sensor, pH sensor,DHT11 sensor, LDR sensor,Relay,DC pump,I2C, 16*2 LCD..The specifications of these hardware is presented in table 1:

S.NO:	Hardware Names	Specifications
1	ESP32	It is Single or Dual-core 32-bit LX6 Microprocessor with clock frequency up to 240MHz.
2	Soil moisture sensor	This sensor measures the volumetric content of water inside the soil and gives us the moisture level as output.
3	pH sensor	The pH sensor output is 4-20 mA with a three wire configuration.
4	LDR sensor	Light Resistance: 50-100 K Ohms Application: Photo resistor
5	DHT11 sensor	Measurement range: 20-95%RH; 0-50C Resolution: 8bit(temperature), 8bit(humidity)
6	Relay	Voltage: Max. 30VDC Current: Max. 1A
7	DC pump	Power source: Dc12V Max Flow Rate: 4.7 LPM
8	I2C Adapter	Data on the I2C-bus can be transferred at rates of up to 100 Kbit/s in the standard-mode, up to 400 kbit/s.
9	16*2 LCD display	The outline size of 80.0*36.0 mm and VA size of 66.0*16.0 mm and the maximum thickness is 13.2mm.

Table 1:Hardware Specifications

The algorithm of the proposed model is developed in Embedded C and simulated on Arduino IDE. Arduino IDE is an open source platform which is used to program the microcontroller to perform some specific task. In this work, we are using Arduino IDE software version 1.0.6.

Software Details:

- Arduino IDE software:

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS and Linux. The environment is written in C and based on Processing and other open-source software. This software can be used with any Arduino board.

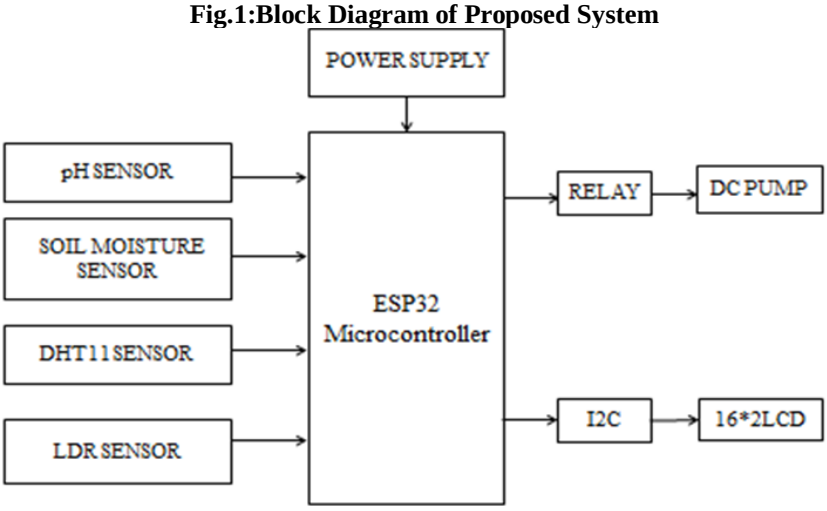
- Embedded C:

Embedded C is a set of language extensions of C programming language. It includes a number of features not available in normal C, such as fixed point arithmetic, named address spaces, and basics I/O hardware addressing. Embedded C uses most of the syntax and semantics of standard C.

Proposed model:

This Horticulture system using IOT system is powered by ESP32 Microcontroller, it consists of Temperature sensor, Moisture sensor, LDR sensor, pH Sensor. When the IOT based Horticulture monitoring system starts it checks the light intensity, water quality, humidity, temperatureand moisture level.

Fig.1:Block Diagram of Proposed System



If the temperature, humidity goes above the level, and light intensity values, and the soil moisture content areupload it to cloud. This all is displayed on the LCD display module. This all is also seen in IOT where it shows information of Humidity, Temperature, Moisture, light intensity and water quality.

IV. Experimental Results

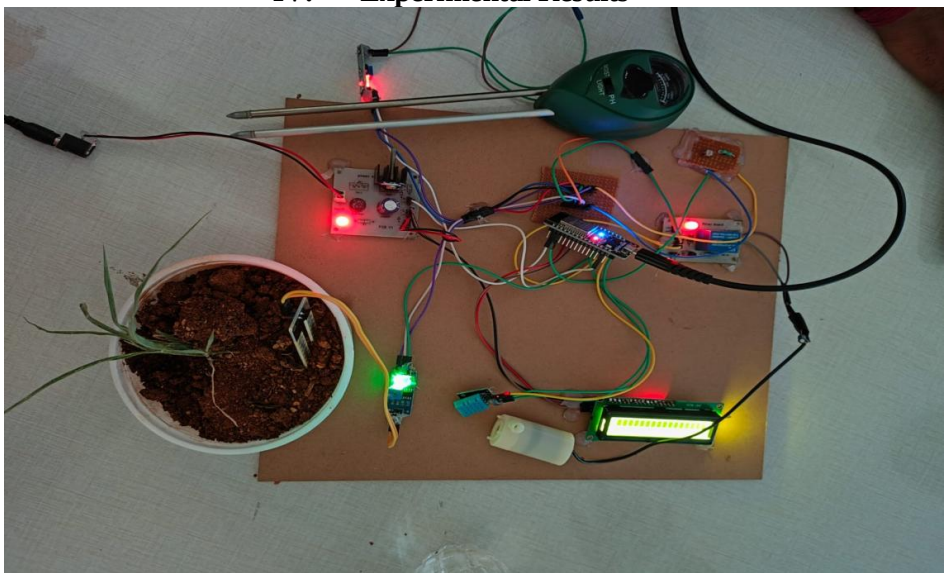


Fig.2: Proposed prototype

In this study,monitoring system for the micro-climate horticulture system is presented. An electronic sensors board is implemented to monitor air, water, and soil condition at the horticulture site. The results are collected into a monitoring database. This database is also be integrated with the IOT, which consists of weather data at the horticulture area. This study limitation is only on the design and development of monitoring system.Sensors sense the level of water if it goes down, it automatically starts to pump the water.

The data visible in the LCD will be sent to server. The output of Thingspeak shows the Temperature values Vs Date, Humidity values Vs Date, Light Intensity Vs Date , motor ON/OFF Vs Date, pH Vs Date. If the soil moisture is wet then motor automatically switches OFF and if the soil moisture is dry then motor automatically switches ON.

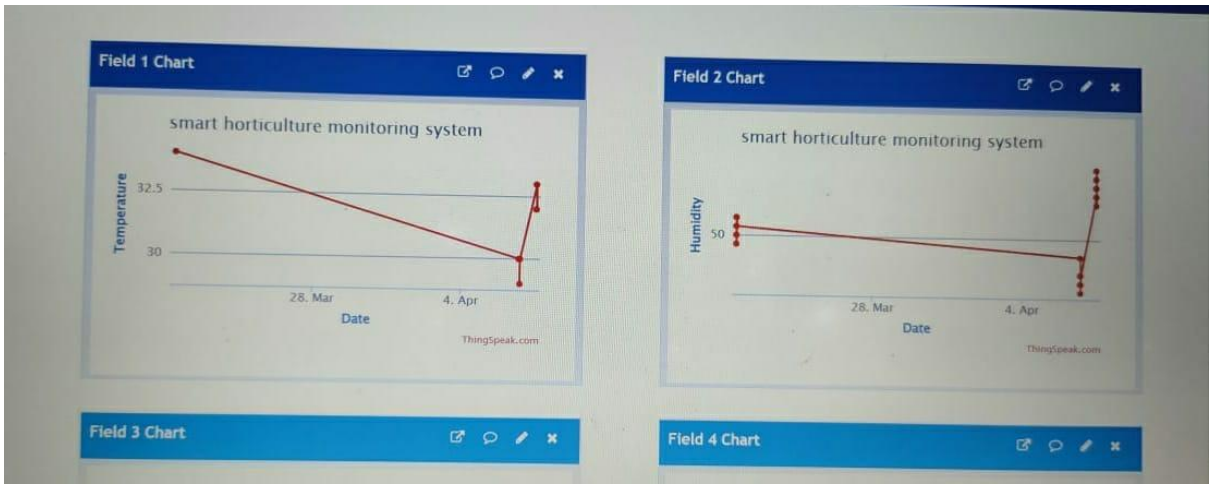


Fig.3:Temperature graph values and Humidity graph values

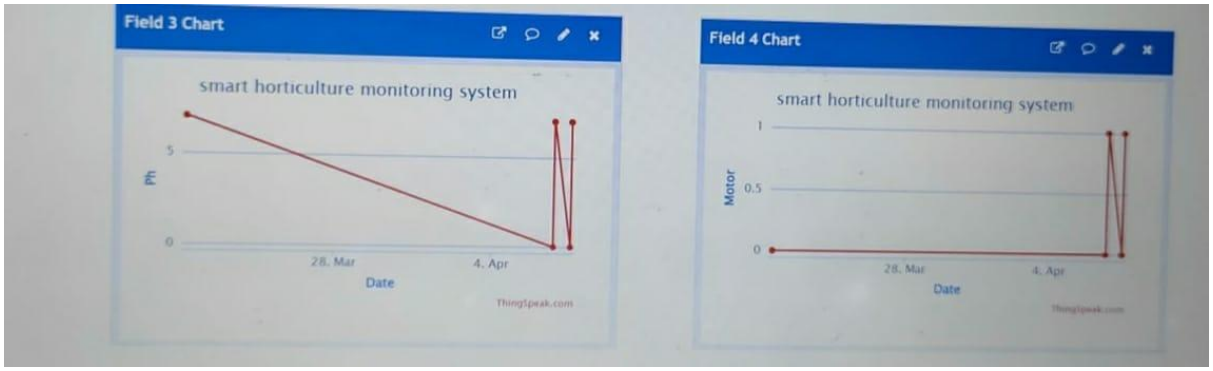


Fig.4: pH Sensor graphvaluesand Motor graph values

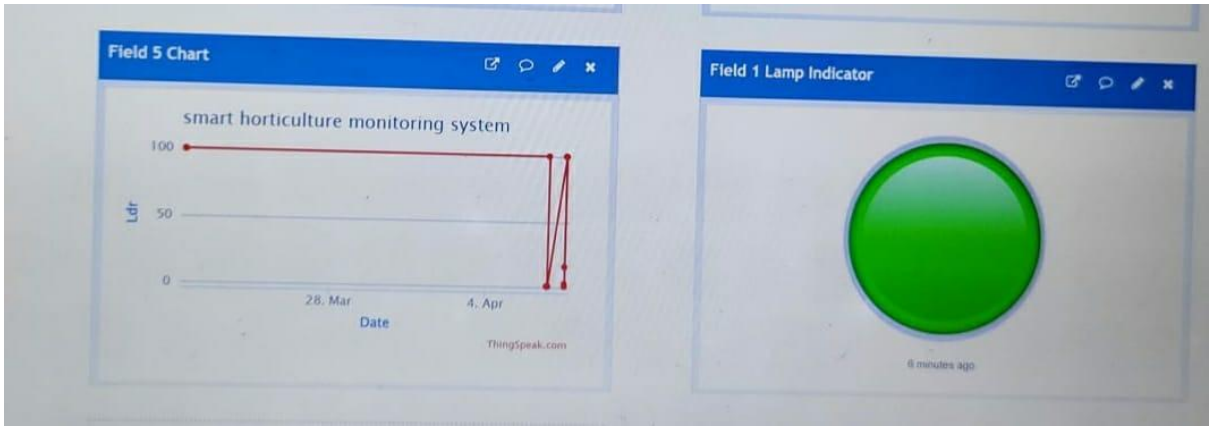


Fig.5: LDR Sensor graph values and Lamp indicator if motor is ON

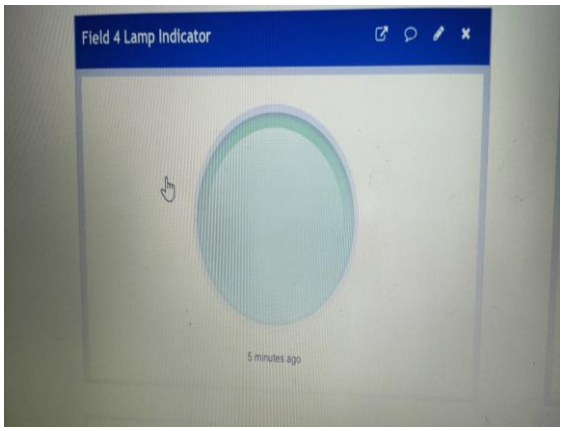


Fig.6:Lamp indicator if motor is OFF

FUTURE SCOPE

In Future we can use the advance Sensor which we get correct Accurate value, we can added some more sensors and added the devices to find out the diseases in plants. In High temperature we can connect the cooler or fan are like some devices to controller the temperature with automatic.

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