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EXPERT SYSTEM FOR AGRICULTURE USING IoT

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Abstract – *Agriculture is the primary occupation in our country for ages. But now due to the migration of people from rural to urban, there is a reduce of cultivation in agriculture. So, to overcome this problem we go for smart agriculture techniques using IoT. This project includes various features like monitoring the field using sensors like Soil moisture, temperature and Humidity sensing, Light dependency resistor Sensor and proper irrigation facilities. It makes use of wireless sensor networks for monitoring the soil properties and environmental factors continuously. Sensor nodes are deployed at a location on the farm. Monitoring these parameters is through the internet services and the operations are performed by interfacing sensors, GPRS and Wi-Fi with Arduino. This concept is created as a product and given to the farmer's welfare.*

Key Words: Field monitoring , Sensors, Arduino, Work Flow, Crop details, IoT technology.

1. INTRODUCTION

Nowadays, Indian Agriculture productivity is very less compared to world standard due to use obsolete farming technology. The world is trending into new technologies and implementations it is a necessary goal to trend up in agriculture also. Many types of research are done in the field of agriculture. Most projects signify the use of a wireless sensor network collect data from different sensors deployed at various nodes and send it through the wireless protocol. The collected data provides information about various environmental factors. 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 a solution to all such problems, it is necessary to develop an integrated system that will take care of all factors affecting productivity in every stage. But complete automation in agriculture is not achieved due to various issues. Though it is implemented in the research level it is not given to the farmers as a product to get benefitted from the resources. Hence this paper deals about developing smart agriculture using IoT and given to the farmers.

1.1 LITERARURE SURVEY

The existing method and one of the oldest ways in agriculture is the manual method of checking the parameters. [1]It focuses on developing devices and tools to manage, display and alert the users using the advantages of a wireless sensor network system. [2]It aims at making agriculture smart using automation and IoT technologies.

The highlighting features are smart GPS based remote-controlled robots to perform tasks like weeding, spraying, moisture sensing, human detection and keeping vigilance. [3]The cloud computing devices that can create a whole computing system from sensors to tools that observe data from agricultural field images and from human actors on the ground and accurately feed the data into the repositories along with the location as GPS coordinates.[4]This idea proposes a novel methodology for smart farming by linking a smart sensing system and a smart irrigator system through wireless communication technology.[5]It proposes a low cost and efficient wireless sensor network technique acquire the soil moisture and temperature from various locations of the farm and as per the need of crop controller to take the decision whether the irrigation is enabled or not.

2. PROPOSED SYSTEM

In the farm field, various sensors are deployed in the field like temperature and humidity sensor, a moisture sensor, an LDR sensor, and a Ph sensor. The data collected from these sensors that are connected to the Arduino UNO and GSM Shield and Wi-Fi.

In the Monitoring section, the received data is verified with the threshold values. If the data exceeds the threshold value the GSM shield sends an SMS alert to the farmer. This alert is sent as a message to the farmer and get alerted after sensing. The values are generated in the web server and the farmer gets a detailed description of the value using a mobile application.

The Arduino UNO is started, automatically an alert must be sent to the user. This is processed by sending a message to the user through the GSM module and Wi-Fi. Other parameters like temperature, humidity, soil moisture, PH sensor, and the LDR sensors show the threshold value. The mobile app consist of four fields like about us, contact, crop detail and field monitoring.

3. HARDWARE USED

ARDUINO UNO R3

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 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.

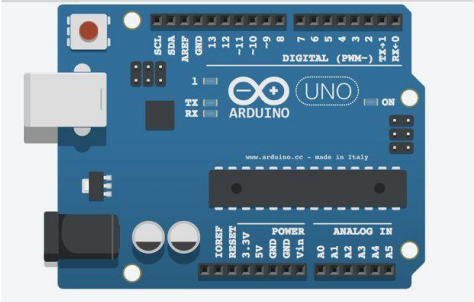

Fig 1: Arduino Uno

It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega8U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer.

The Arduino Uno can be programmed with the Arduino software (download). Select "Arduino Uno from the Tools > Board menu. It communicates using the original STK500 protocol (reference, C header files).

GSM/GPRS MODULE

The GPRS/GSM Shield is compatible with all boards that have the same form factor (and pinout) as a standard Arduino Board. The GPRS/GSM Shield is configured and controlled via its UART using simple AT commands. Based on the SIM900 module from SIMCOM, it is like a cell phone.

GSM Modem can accept any GSM network operator SIM and it can act just like a mobile phone with its own unique phone number. The necessity to use this is it can use the RS-232 protocol which can be easily connected to the controller. It can be used like a phone where it can send and receive SMS and make a call.

Fig 2: GSM Shield Sim900a

The GSM modem is connected to the controller through RS232. The SMS is sent through the terminal to the number using AT Commands. "AT-Attention" commands that are used by the controller to control the GSM to perform the desired function. It also has reverse voltage protection and LED notifications. It is operated in 900/1800 MHz.

ESP8266 MODULE

The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arduino device and get about as much Wi-Fi-ability as a Wi-Fi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing.

SOIL MOISTURE SENSOR

The soil moisture sensor is a sensor that senses the moisture content of the soil. The sensor has both the analog and the digital output. The digital output is fixed and the analog output threshold can be varied. It works on the principle of an open and short circuit. The output is high or low indicated by the LED. When the soil is dry, the current will not pass through it and so it will act as an open circuit. Hence the output is said to be maximum.

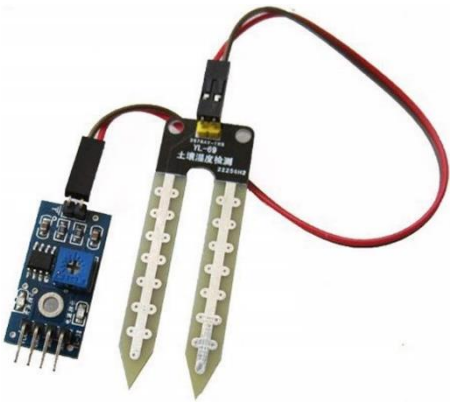

Fig 3: Soil Moisture sensor

When the soil is wet, the current will pass from one terminal to the other and the circuit is said to be short and the output will be zero. The sensor is platinum coated to make the efficiency high. The range of sensing is also high. It is anti-rust and so the sensor has a long life which will afford the farmer at a minimum cost.

TEMPERATURE AND HUMIDITY SENSOR

Humidity Sensor is one of the most important devices that has been widely in consumer, industrial, biomedical, and environmental etc. applications for measuring and monitoring Humidity. Irrigation techniques like drip irrigation need accurate moisture content for plants. Also, the moisture in the soil plays an important role in the proper growth of the plant. Other areas where humidity control is required for indoor vegetation.

Fig 4: DHT11 sensor

A temperature sensor is often a resistance temperature detector or thermocouple that measures temperature through an electrical signal. A thermocouple is made from two dissimilar metals that generate an electrical voltage in proportion to the changes in temperature. A thermistor is actually a variable resistor that changes its resistance with the change of the temperature. These sensors are made by sintering of semi conductive materials such as ceramics or polymers in order to provide larger changes in the resistance with just small changes in temperature

LIGHT DEPENDENT RESISTOR SENSOR

A Light Dependent Resistor (LDR) is also called a photoresistor. It is basically a photocell that works on the principle of photoconductivity. A Light Dependent Resistor (LDR) is also called a photoresistor or cadmium sulphide (CdS) cell. It is also called a photoconductor. It is basically a photocell that works on the principle of photoconductivity.

Fig 5: LDR sensor

The passive component is basically a resistor whose resistance value decreases when the intensity of light decreases. This optoelectronic device is mostly used in the light varying sensor circuit, and light and dark activated switching circuits. Some of its applications include camera light meters, street lights, clock radios, light beam alarms, reflective smoke alarms, and outdoor clocks.

PH SENSOR

PH probes measure pH by measuring the voltage or potential difference of the solution in which it is dipped. So, to make electricity flow through the test solution. The pH meter measures the difference in electrical potential between a pH electrode and a reference electrode, and so the pH meter is sometimes referred to as a "potentiometric pH meter".

Fig 6: PH sensor

The difference in electrical potential relates to the acidity or pH of the solution. The pH meter is used in many applications ranging from laboratory experimentation to quality control.

4. SOFTWARE USED

ARDUINO IDE

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to the Arduino board.

The mobile application was developed using third party software.

5. RESULTS AND DISCUSSION

The hardware is interfaced with all the sensors in the board. The hardware components include the Arduino UNO, GPRS\GSM module and all the sensors interfaced. The board is inserted with a SIM card which is used to communicate with the user and the recorded values.

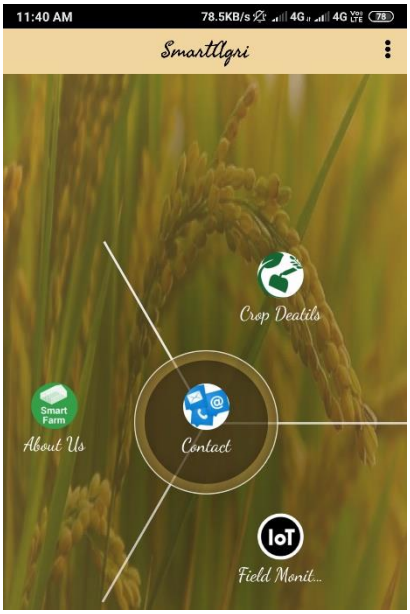

Fig 7: Home Screen

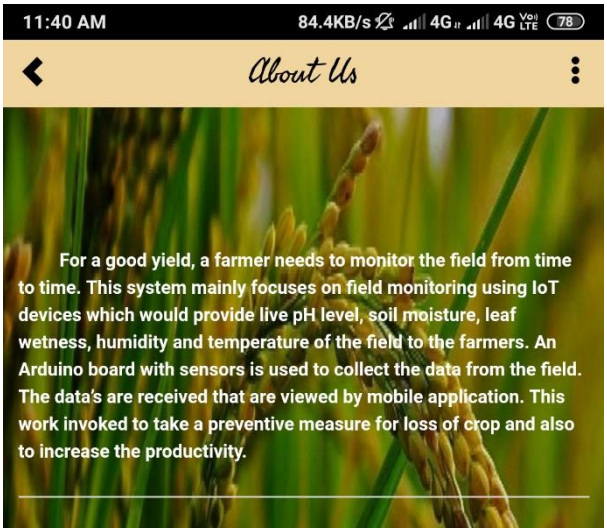

Fig 8: About us

- The About us page consist of information about the proposed and developer details.

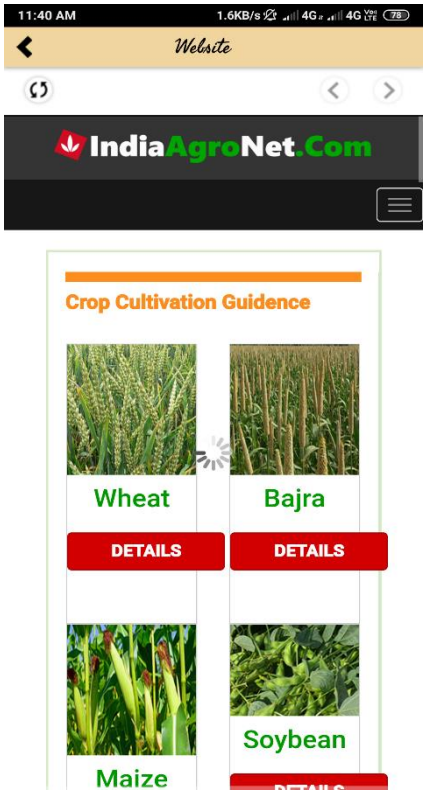

Fig 9: Crop Details

- The Crop Details page consist of the information about all the crop and their growing and its requirements.

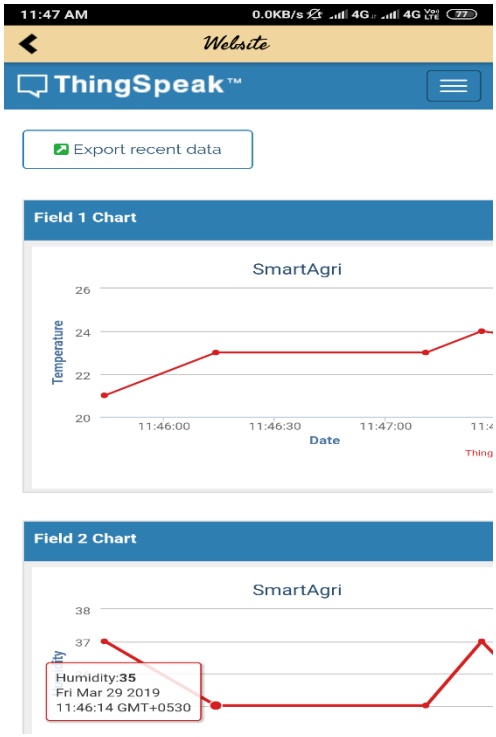

Fig 10: Field Monitoring

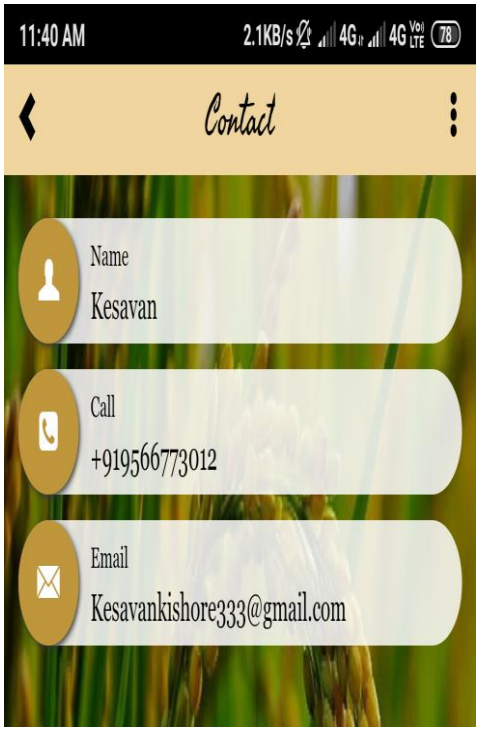

Fig 11: Contact Details

6. CONCLUSIONS

Internet of Things is far and wide castoff in relating devices and gathering statistics. This agriculture monitoring system serves as a reliable and efficient system and corrective action can be taken. Wireless monitoring of field reduces the human power and it also allows user to see accurate changes in crop yield.

It is cheaper in cost and consumes less power. The smart agriculture system has been designed and synthesized. The developed system is more efficient and beneficial for farmers. It gives the information about the temperature, humidity of the air in agricultural field, light dependency of the field and moisture content of soil through an mobile application to the farmer from any location. The application of such system in the field can definitely help to advance the harvest of the crops and global production.

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