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Smart Field Monitoring Using IoT

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***Abstract*-**The Internet of Things is a system of physical things embedded with sensors,softwares,electronics and connectivity to allow it to perform better by exchanging information with other connected devices. IOT(Internet of Things) technique is used in agriculture.In the existing work the leaf sensor senses the temperature difference level in leaf and sends it to PIC microcontroller. The sensors communicates remotely with a reader using backscatter bistatic standards. The drawback is that there is no way for monitoring the disease in crops. The sensors are used to find the unwanted plants , disease in the crops and maintain soil moisture. The data obtained from the field is stored in cloud by using wifi module. The information will be send to farmers through mobile Android application.

***Keywords*-**IOT, sensors, wifi module, Android application

I.INTRODUCTION

The Internet of things refers to a type of network to connect anything with the Internet based on stipulated protocols through information sensing equipments to conduct information exchange and communications in order to achieve smart recognitions, positioning, tracing, monitoring, and administration An IoT ecosystem consists of web-enabled smart devices that use embedded processors, sensors and communication hardware to collect, send and act on data they acquire from their environments. IoT devices share the sensor data they collect by connecting to an IoT gateway or other edge device where data is either sent to the cloud to be analyzed or analyzed locally. Sometimes, these devices communicate with other related devices and act on the information they get from one another. The devices do most of the work without human intervention, although people can interact with the devices for instance, to set them up, give them instructions or access the data.The connectivity, networking and communication protocols used with these web-enabled devices largely depend on the specific IoT applications deployed. The main contribution of Smart Field Monitoring using IOT are The efficient way of monitoring the Agricultural field and assisting the farmers in a supportive way.The detection of Weed in the field improve the agriculture in large scale.The periodic monitoring of the field reduces the labour work in the field.Section I contains Introduction of Smart Field Monitoring,Section II contains Related works,Section III contains Proposed system of the work,Section IV contains System implementation,Section V contains Explanation of Proposed system,Section VI consists of Architecture diagram of System,Section VII tells about Algorithm used in the system,Section VIII contains Results obtained,Section IX contains Conclusion and Future scope of the Project and Section X contains References.

II.RELATED WORKS

When the temperature difference level condition exceeds the set value programmed in the microcontroller, it sends the message to the farmer.GSM is the most widely used mobile technology.GSM is operated by using a subscriber identity module[1].The implementation of a prototype sensor node and the implementation of the RFID reader .This can be used to ensure faithful irrigation of farm field Nodes need to be charged at regular intervals[3]. The leaf sensor senses the leaf by using uW-backscatter bistatic standards senses the leaf and sends the sensed value of leaf level to the concerned person through the gateway called GSM (Global System Monitoring)[2]. When the temperature difference level condition exceeds the set value programmed in the microcontroller, it sends the message to the farmer. GSM is the most widely used mobile technology. GSM is operated by using a subscriber identity module. When the optimum level is reached, the relay will turn on and the message is sent to the farmer through GSM and once the water level for leaf is reached to the sufficient level, the motor is automatically turned OFF[5].This can be used to ensure faithful irrigation of farm field.

III.PROPOSED SYSTEM

The system uses the arduino microcontroller to control the system.It gets attached to all the sensors needed to monitor the field.The power supply of 5 to 12 V is given to the Arduino microcontroller.The moisture of the field is

analyzed by the moisture sensor.The TCS3200 and TCS3210 programmable colour light-to-frequency converters that combine configurable silicon photodiodes and a current-to-frequency converter on a single monolithic CMOS integrated circuit. The WeedSeeker model 655 sensors also operate on a 12 V power supply.They are configured for a 380mm spacing to match their 380mm field view.The sensors operate at 610-760mm from the ground can have single to multiple sensors mounted cross a spray system. Depend upon moisture level the pump motor will supply water to the field. Relays are switches that open and close circuits electromechanically or electronically.

IV.SYSTEM IMPLEMENTATION

The system is implemented with the following components.

i) **Moisture sensor:**
Moisture is a term used to describe the amount of water present in soil. Water vapor, the gaseous state of water, is generally invisible to the human eye. Humidity indicates the likelihood for precipitation, dew, or fog to be present. The amount of temperature of the soil increases as the soil moisture decreases.The moisture sensor calculates dielectric permittivity of the soil to measure soil moisture.

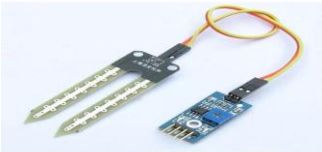

Fig.4.1 Moisture sensor

ii)Color sensor:
The TCS3200 or TCS3210 programmable colour light-to-frequency converters that combine configurable silicon photodiodes and a current-to-frequency converter on a single monolithic CMOS integrated circuit. In the TCS3200, the light-to-frequency converter reads an 8 x 8 array of photodiodes. Sixteen photodiodes have blue filters, 16 photodiodes have green filters, 16 photodiodes have red filters, and 16 photodiodes are clear with no filters. In the TCS3210, the light-to-frequency converter reads a 4 x 6 array of photodiodes. Six photodiodes have blue filters, 6 photodiodes have green filters, 6 photodiodes have red filters, and 6 photodiodes are clear with no filters. The four types (colors) of photodiodes are interdigitated to minimize the effect of non-uniformity of incident irradiance. All photodiodes of the same color are connected in parallel. Pins S2 and S3 are used to select which group of photodiodes (red, green, blue, clear) are active. Photodiodes are 110 µm x 110 µm in size and are on 134-µm centers.High-Resolution Conversion of Light Intensity to Frequency, Programmable Color and Full-Scale Output Frequency , Communicates Directly With a Microcontroller Single-Supply Operation (2.7 V to 5.5 V),Power Down Feature ,Nonlinearity Error Typically 0.2% at 50 kHz,Stable 200 ppm/°C Temperature Coefficient ,Low-Profile Lead (Pb) Free and RoHS Compliant Surface-Mount Package

Fig.4.2 Color sensor

iii)Arduino microcontroller:
The Arduino Uno is one of the most common and widely used Arduino processor boards. There are a wide variety of shields (plug in boards adding functionality). It is relatively inexpensive (about $25 - $35). The latest version as of this writing (3/2014) is Revision 3 (r3): · Revision 2 added a pull-down resistor to the 8U2 HWB line, making it easier to put into DFU (Device Firmware Update) mode · Revision 3 added o SDA and SCL pins are now brought out to the header near the AREF pin (upper left on picture). SDA and SCL are for the I2C interface o IOREF pin (middle lower on picture that allows shields to adapt to the voltage provided o Another pin not connected reserved for future use The board can be powered from the USB connector (usually up to 500ma for all electronics including shield), or from the2.1mm barrel jack using a separate power supply when you cannot connect the board to the PC's USB port.

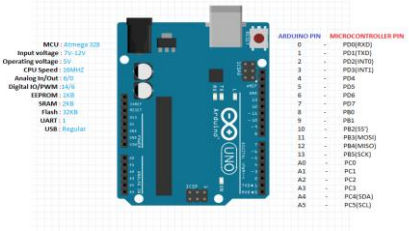

Fig.4.3 Arduino microcontroller

iv)Wifi module:
The ESP8266 WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi 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 WiFi-ability as a WiFi 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, community.This module has a powerful enough on-board processing and storage capability that allows it to be integrated with the sensors and other application specific

devices through its GPIOs with minimal development up-front and minimal loading during runtime. Its high degree of on-chip integration allows for minimal external circuitry, including the front-end module, is designed to occupy minimal PCB area. The ESP8266 supports APSD for VoIP applications and Bluetooth co-existance interfaces, it contains a self-calibrated RF allowing it to work under all operating conditions, and requires no external RF parts.

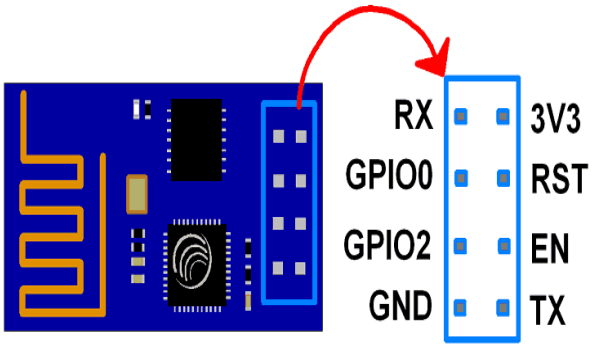

Fig.4.4 Wifi module

v)Weed Finder:

The WeedSeeker model 655 finder also operate on a 12 V power supply. They are configured for a 380mm spacing to match their 380mm field view.The finders operate at 610-760mm from the ground.The Weed finder is used to point out the unwanted plants in the field by matching the templates of the required plants,if there is any mismatch the finder assumes it as weed, and the information is sent to farmers.

vi)Pump motor:

A submersible pump (or sub pump, electric submersible pump (ESP)) is a device which has a hermetically sealed motor close-coupled to the pump body. The whole assembly is submerged in the fluid to be pumped. The main advantage of this type of pump is that it prevents pump cavitations', a problem associated with a high elevation difference between pump and the fluid surface. Small DC Submersible water pumps push fluid to the surface as opposed to jet pumps having to pull fluids. Submersibles are more efficient than jet pumps.

Fig.4.5 Pump motor

vii)Relay Driver:

The main usage of the Relay was seen in the history for transmitting and receiving the information, that was called as Morse code where the input signals used to be either 1 or 0, these change in signals were mechanically noted in terms of ON and OFF of a light bulb or a beep sound, it means those pulses of 1s and 0s are converted as mechanical ON and OFF using electromagnets. Later this was improvised and used in various applications. Let's see how this electromagnet acts as a switch and why it is named as relay.A relay is classified into many types, a standard and generally used relay is made up of electromagnets which in general used as a switch. Dictionary says that relay means the act of passing something from one thing to another, the same meaning can be applied to this device because the signal received from one side of the device controls the switching operation on the other side. So relay is a switch which controls (open and close) circuits electromechanically. The main operation of this device is to make or break contact with the help of a signal without any human involvement in order to switch it ON or OFF. It is mainly used to control a high powered circuit using a low power signal. Generally a DC signal is used to control circuit which is driven by high voltage like controlling AC home appliances with DC signals from microcontrollers.

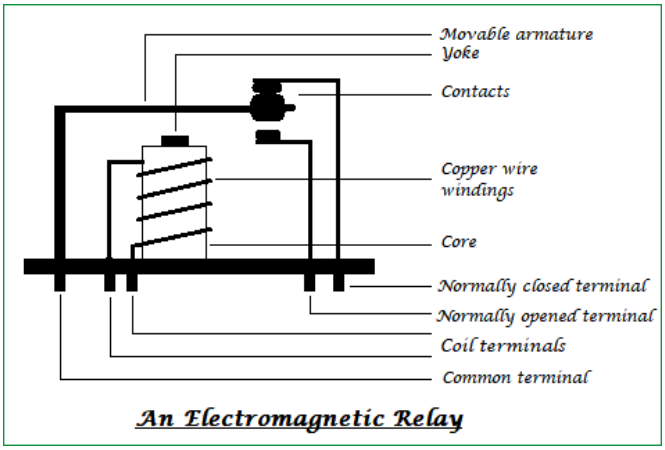

Fig.4.6 Relay driver

V.EXPLANATION

The proposed system can be explained by four functionalities respectively.They are

1. Field moisture detection
2. Leaf disease detection
3. Weed detection
4. Automatic irrigation

1.Field moisture detection:

The soil moisture is present in the soil. The Field moisture detection using moisture sensor is sent to the farmers.The SKU9527 model sensor is used to sense the moisture

level.The Soil Moisture Sensor uses capacitance to measure the water content of soil (by measuring the dielectric permittivity of the soil, which is a function of the water content)**.**

2.Leaf disease detection:
The disease in the leaf is identified by the colour sensor by sensing the leaf. The TCS3200 or TCS3210 programmable colour light-to-frequency converters that combine configurable silicon photodiodes and a current-to-frequency converter on a single monolithic CMOS integrated circuit.The information obtained will be sent to farmers.

3.Weed detection:
The WeedSeeker model 655 finder also operate on a 12 V power supply. They are configured for a 380mm spacing to match their 380mm field view.The finders operate at 610-760mm from the ground. The Weed finder is used to point out the unwanted plants in the field by matching the templates of the required plants,if there is any mismatch the finder assumes it as weed, and the information is sent to farmers.

4.Automatic irrigation:
Depend upon the moisture level the pump motor will supply water to the field. Relays are switches that open and close circuits electromechanically or electronically.

VI.ARCHITECTURAL DIAGRAM

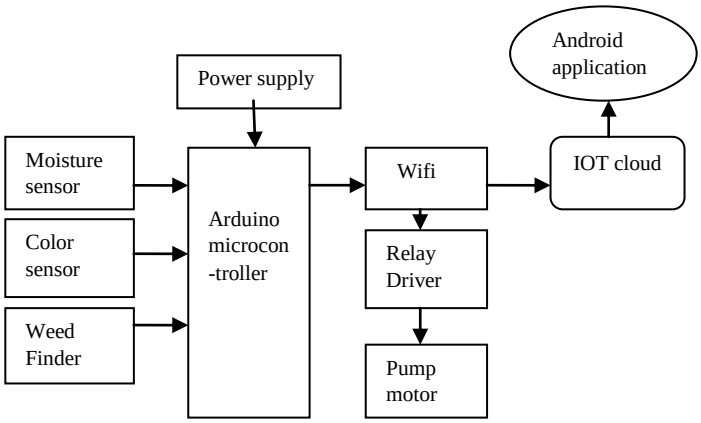

Fig.6.1 Architectural diagram

VII.ALGORITHM

MQTT is an open message protocol for machine-to-machine (M2M) or Internet of Things (IoT) communications that enables the transfer of telemetry-style data (i.e. measurements collected in remote locations) in the form of messages from devices and sensors, along unreliable or constrained networks, to a server. MQTT stands for Message Queue Telemetry Transport. As its name suggests, it's a protocol for transporting messages between two points. Sure, we've got Messenger and Skype for that; but what makes MQTT so special is its super lightweight architecture, which is ideal for scenarios where bandwidth is not optimal.The MQTT high-level architecture is primarily divided into two parts – a broker and a client. A broker acts as the heart of the architecture with capabilities of both subscriber and publisher. It is the point of contact for all clients. A broker's primary job is to queue and transmit messages from a publisher client to the subscriber client. However, it can also possess heavier capabilities (such as SSL certification, logs, database storage, etc.) based on requirements, set-up, and the broker service used.The client portion is further divided into publishers and subscribers. Since clients are the actual software components that go into the edge devices, they're engineered to be very, very lightweight, with a majority of processing of the already lightweight architecture handled by the broker.The sensors collect information about their respective parameters and send to arduino through MQTT protocol.Object detection is done by using SURF (Speed-up Robust Features) algorithm. Speeded up Robust Features is a algorithm used mostly in computer vision tasks and tied to object detection purposes. SURF fall in the category of feature descriptors by extracting key points from different regions of a given image and thus is very useful in finding similarity between images.The Weed finder uses the SURF algorithm to match templates of the plants.The mismatch of the templates indicate the prescence of weed.

VIII.RESULTS OBTAINED

The field moisture level is identified by moisture sensor by calculating accurate dielectric permittivity of the soil.The color sensor is able to analyze disease by identifying colour changes about 8% higher than previous works.The weed finder analyzes all types of weed with accuracy**.**

XI.PERFORMANCE EVALUATION

The graph describes about the data transfer in the system.MQTT refers to the telemetry style of data obtained from respective sensors.OMI refers to the Open Message Interface which helps the data transfer between controller and Cloud.The x-axis refers to the traffic load in the OMI and MQTT.The y-axis represents the number of information sent from sensor to controller and controller to cloud.The number of information is represented in bytes.The rate of MQTT messages transferred from sensors are high scale and rate of OMI message transfer is also high. The number of messages recorded by the sensors are transferred to the controller rapidly.The number of MQTT messages transferred are higher than previous works.The traffic load in the system is low when compared with other works as we use wifi module as a transport medium

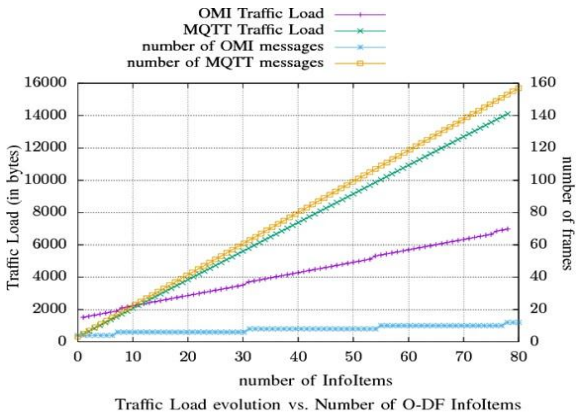

Fig.9.1Performance Evaluation

X.CONCLUSION&FUTUREWORK

The proposed work may be extended by using Raspberry-pi controller instead of arduino for better functioning.The weed finder can be used for full field by installing it in hover with weed remover blades to removes weeds.The entire system can be implemented in an unarmed vechile to monitor field in future.

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