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Eco Friendly Modern Agriculture Machinery Control and Monitoring with IoT

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Abstract

In this paper the proposed smart controls and monitoring methodologies of agricultural machines using IoT platform leads agriculture to user-friendly to the agriculturist. The irrigation systems can works with electricity power supply cuts or supply the electricity at any time, so accuracy is important to irrigation systems. We can switch ON the pump using mobile globally, when the electricity is fed from distribution line. Overflow of water demolishes the crops and farmers are affected many times due to heavy rain in winter as well as heavy temperature rises in summer. An IoT based irrigation module sprays water as micro drops, when the plant really needs water, which reduces water consumption. The data of used water, temperature, humidity, weather speed, Electrical parameters such as voltage, current, power consumption and amount for the power consumption are monitored by mobile itself. The IoT based low voltage electrical fencing is controlled by mobile itself, which can be ON and OFF at anytime from anywhere globally. It is low power consumption fencing. The farmers can monitor their lands by drone video which is controlled by mobile and that drone is used to fertilization as well as irrigation purpose. A separate website with individual account of farmers is used to sell their vegetables their own and it builds friendly ecommerce. All farmers can monitored their agricultural land with all weather data in the same web page. All these features incorporated makes the monitoring very easy to control the agriculture land and machines operated by the farmers and workers.

Keywords*: Thingspeaks, IPcam, Node MCU, Dji F450 drone, DH11, Mission planner*

Introduction

In future agriculture will leads the word, but till now most of the works in agriculture done by manually and it leads unwanted man work and time waste. To rectify these problems the proposed smart control system for agriculture city to control all machines by mobile or computer globally with continuous monitoring system. The proposed system is used to control and monitoring the agricultural machines using IoT platform with mobile. The smart irrigation system, temperature, humidity and smart electric fencing are controlled and monitoring by mobile itself with the thing speak IoT platform.

An IoT based irrigation module sprays water as micro drops, when the plant really needs water, which reduces water consumption. The data of used water, temperature, humidity, weather speed, Electrical parameters such as voltage, current, power consumption and amount for the power consumption are monitor by mobile itself. The IoT based low voltage electrical fencing is controlled by mobile itself, which can on and off at anytime from anywhere globally. It is also low power consumption fencing. The formers can monitor them lands by drone video which is controlled by mobile and that drone is used to fertilization or irrigation purpose. In this product we are going to design the smart and global control of agricultural machines and to monitor weather, IPcam & Soil Moisture. Arduino, IPcam, and Blynk are the software tools used for this system and programming done by Arduino IDE by embedded C language. Arduino Uno R3, Esp8266, Dth11 Temperature Sensor, Moisture Sensor, Dji F450 Drone are the hardware used. The proposed module will make very easy to monitoring and control the agriculture land and machines operating to the farmers and workers. A separate website with individual account of farmers is used to sell their vegetables their own and it builds friendly ecommerce. All formers also can monitor them agriculture land with all weather data in the same web page.

C. Arun, et al [1] implanted Agriculture management using wireless sensor networks-a survey. A study on smart irrigation systems for agriculture using IoT analyzed in [3]. IoT enabled analysis of irrigation rosters

in the Indus basin irrigation system Laura García [4] introduced "IoT -based smart irrigation systems with overview on the recent trends on sensors and IoT systems for irrigation in precision agriculture. Ighodaro et.al [5] proposed development of climate-smart agriculture and smallholder farmers. Sungheetha [6] designed real time monitoring and fire detection using internet of things and cloud based drones. J.Arumai Ruban et al discussed the study of smart farming techniques in drip irrigation using IoT in [7]. An IOT based smart irrigation system using soil moisture and weather prediction is analyzed in [8]. Evapotranspiration-based irrigation system for mustard green crop cultivation using public weather forecast is presented in [9]. Arduino based smart irrigation system for home gardening is illustrated in [10]. IoT enabled smart farming and irrigation system is designed in [11]. R.R.Thirrunavukkarasu et.al [12] analysed smart irrigation and crop protection using arduino.

Smart Irrigation with Nano Drops Cooling System

In this paper, smart controlling and monitoring systems for irrigation and cooling system is proposed. Smart irrigation system with nano sprayer cooling system shows figure 1 for better understanding of the proposed work. This block diagram consists of moisture sensor, arduino UNO, 5V relay module, water pump, nono drop sprayer and arduino nano. The power supply is given to the arduino UNO as well as to relay. The moisture sensor placed in many places in farm land to sense the moisture level. Sensor sends the signal to the arduino UNO when the moisture level reaches below pre sent value and pump is ON by relay module.

The DHT 11 sensor also placed in different places of farm land to sense the humidity level of atmosphere. It sends the signal to arduino nano when the humidity reaches below pre-set value and nono water sprayer ON by relay module. The reverse is done when the moisture and humidity reaches above pre-set value and it leads to save the water and avoid unwanted irrigation to the crops.

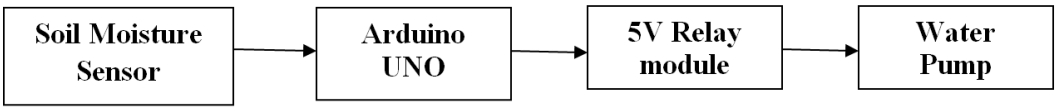

Figure.1. Block diagram of proposed Smart irrigation system

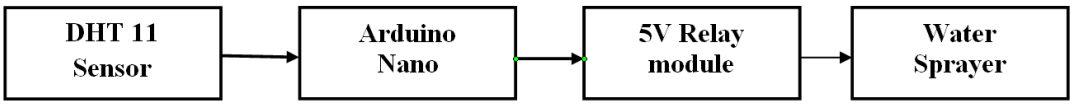

Figure.2. Block diagram of spray cooling system

Figure 3. Nanodrop spray cooling system

Arduino Uno and Nano

In our project arduino controller is used to control the pumps to automatic irrigation. The nano-drops water spray system of also controlled by ardunionano controller. The Arduino UNO is an open-source

microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The Arduino Uno R3 is a microcontroller is used in our project to control the functions of all equipment's like pumps, soil moisture sensor for smart irrigation. In this system soil moisture sensed by sensor and it goes below the pre-set value and arduino sense as moisture level is low and it ON the pump of nono drop spray system. Moisture level goes above the pre-set value and arduino sense as moisture level is high and it OFF the pump of nono drop spray system.

Figure.4 Arduino Uno

Soil Moisture Sensor

In our project we were designed fully water spray system with arduino. For this automated system we used moisture sensors, which are placed in different places of agricultural land and used to sense the moisture level and ON/FF the pumps and nono drop spray system. This spray system used for cooling the crops to protect from high temperature with the help of DHD 11 sensor.

Figure.5. Soil moisture sensor

DHT 11 sensors are placed with particular uniform distance and used to sense the humidity level in air and it send the signal to arduino nano when humidity is below the pre-set value, which leads the spray system ON and nano drops sprayed to crops.

Figure.6. DHT11 sensor

Relay Module

The 5V relay modules are used in this proposed system to control the water pumps and nano drop sprayer, which is ON whenever the signal is come from the arduino UNO and Arduino nano for ON the irrigation system and cooling system for the crops. One relay module connected between the arduino and water pump another one relay connected between the arduino and cooling spray system.

Figure.7. 5V Relay Module

Pumps

ESPs are pumps made of dynamic pump stages or centrifugal pump stages. It gives the internal schematic of a single-stage centrifugal pump. It is used to spray the water to the crops.

Figure.8. Pump module

Weather Monitoring System using IoT

The proposed IoT based monitoring system used to monitor the moisture, temperature, humidity in air through the mobile or PC from home itself with ThingSpeak and ESP 8266. BME 280 sensor is fixed with Dji F450 drone to sense the atmospheric condition and sends all datas to the ThingSpeak cloud. The agriculturist monitors the land weather datas from home itself through mobile. The same drone can used as delivery purpose in E-Commerce system in which farmers had separate account webpage to sell their vegetables to customers through online shop and this same page is used to monitor the weather conditions and live video of our land. A node MCU is used to send the sensor values to cloud and the drone is controlled through the APM2.8 flight controller. The block diagram of weather monitoring system show in figure 9.

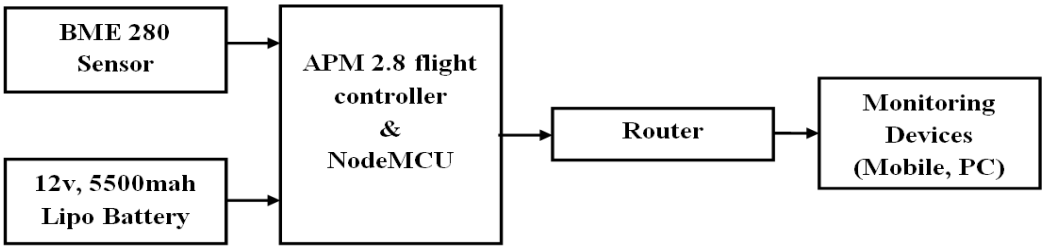

Figure.9. Weather monitoring system

BME 280 Sensor

BME 280 Sensor used to sense the analog temperature, pressure, humidity and altitude value of our atmosphere. Its maximum value up to 10oto 80o temperature measurable. Its humidity measurable level is up to 100% andthe pressure measurable value is maximum 1100 hpa. This sensor connected to node MCU to send the datas of atmosphere condition to mobile or PC.

Figure.10. BME 280 sensor

Lipo Battery

12V, 5500mah lipo battery used as power supply to the flight controller and NodeMCU which is present in the weather monitoring system. It is rechargeable battery module.

Figure.11. Lipo Battery

APM 2.8 flight controller

APM 2.8 flight controller is used as a driver of Dji F450 drone which is used to monitor the agricultural land weather conditions.

Table 1. Table 1. APM2.8 flight controller parameters

S.No	Parameter	Type & Range
1	Input Voltage (V):	12-16 V.
2	Processor	ATMEGA2560 and ATMEGA32U-2
3	Gyrometer	3-Axis

Node MCU

In this proposed system, ESP 8266 is used to communicate the all sensors in the Dji F450 drone with ThingSpeak cloud. it has inbuilt WiFi board.

Figure.12. Node MCU

Monitoring System

The datas of weather conditions and live video of agricultural land is displaced in the monitoring devices such as mobile or PC through the ThingSpeak cloud.ThingSpeak is an IoT analytics platform that allows

collect, visualize and analyse live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by sensors devices to ThingSpeak. A separate account created for individual farmers to their own land monitoring system.

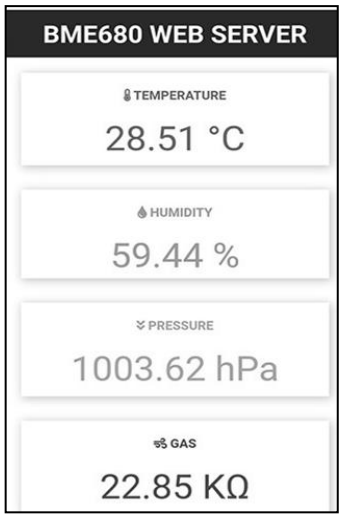

Fig.13. Weather monitoring display

Simulations and Prototype Module

Tinkercad simulation tool is used simulate the circuit modules for weather monitoring system and irrigation system with hardware components. It is a 3D design tool for embedded and simple electrical circuits.

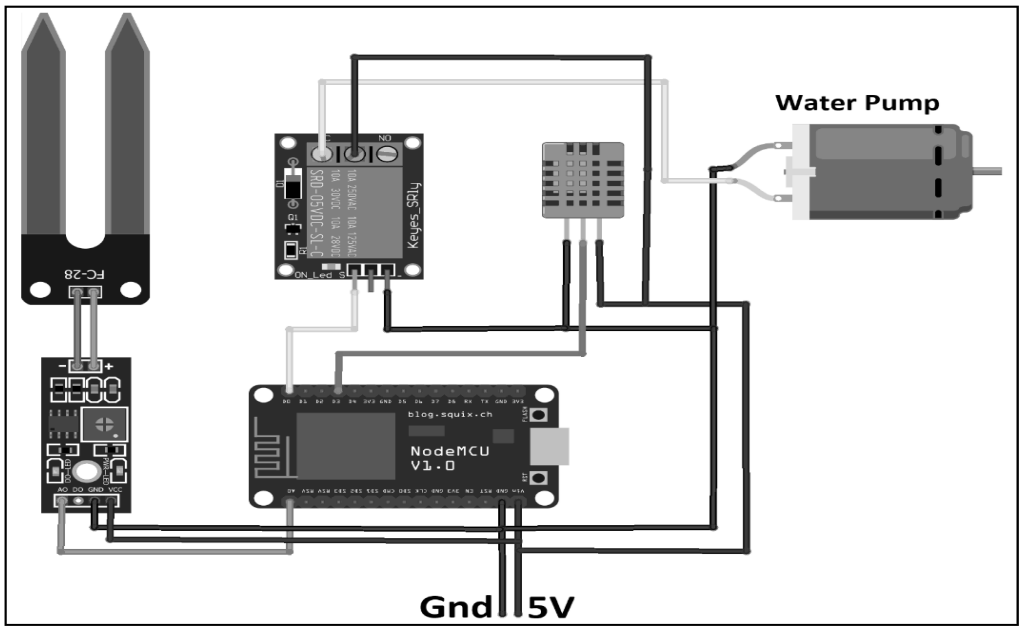

Figure.14. Smart irrigation and Nano drop cooling system

In the above simulation circuit the moisture sensor and DH11 humidity sensors are input to the nodeMCU and Water pump with sprayer si output from the node MCU. A +5V supply given to the ESP 8266 and relay module is used to ON / OFF the pumps.

The moiture sensor signal pin is connected to analog pin A_0 of arduino to sense the moisture level and common pin of relay is connected to the +5V Vin pin of arduino. The NC pin is connected to the water pump and sprayer supply pin and ground is commenly connected from arduino UNO ground.Simlarly in node MCU,

moiture sensor signal pin is connected to Analog pin and DHT 11 signal pin is connected to D_2 and D0 pin is connected to relay signal pin finally relay NC pin connected to the pumps and sprayer.

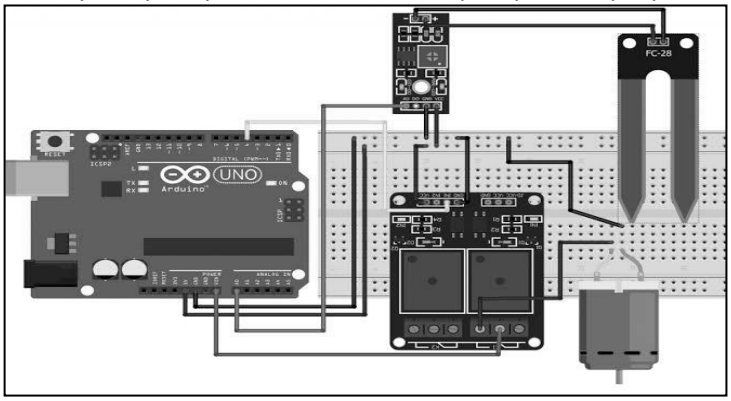

Figure.15. Smart irrigation system with ardunio UNO

Figure.16. Prototype module of agriculture machinery control and monitoring system with IoT

Figure.17. Mission planner for drone path monitoring system

Softwares used and Programming

In proposed agriculture machinery control and monitoring system with IoT all hardware components are working based on the programming for that arduino IDE and ThingSpeak cloud are used for programming. The Embedded C language is used for coding of the proposed system.

Code for Smart irrigation system

```
int Relay = 13;
int sensor = 8;
intval;
void setup ()
{
pinMode(13,OUTPUT);
pinMode(8,INPUT);
 }
void loop () {
val = digitalRead(8);
if(val == LOW)
 {
        digitalWrite(13,LOW);
 }
else
 {
digitalWrite(13,HIGH);
 }
delay(400);
}
```

In similar manner code for smart cooliing sprayer system and code for weather monitoring drone with BME 280 can be programmed and be utilised.

Conclusion

Thus the Eco friendly modern agriculture machinery control and monitoring with IoT is implemented with two modules one is pump with spray cooling system in ground and weather monitoring drone with driver module. This research facilitates efficient auto irrigation and cooling system for crops and smart global monitoring system of agricultural land through mobile or PC. Since this proposed system incorporated with different devices like soil moisture sensor, DHT11, Node MCU, Arduino UNO, arduinonano,APM 2.8 flight controller,Dji F450 drone, relay module, BME 280 and thingSpeakIoT cloud etc., so it will be easy to handle it also saves time of irrigation and surviving of land and crops. The formers can monitor them lands by drone video which is controlled by mobile and that drone is used to fertilization or irrigation purpose. A separate website with individual account of farmers is used to sell their vegetables their own and it builds friendly ecommerce. All formers also can monitor them agriculture land with all weather data in the same web page. These all features make very easy to monitoring and control the agriculture land and machines operating to the farmers and workers.

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