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IOT based Crop Monitoring System

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Abstract: ***The main backbone of India is Agriculture. There are many aspects that influence the yield of the crop. The major aspects that impact are soil moisture, weather conditions and proper maintenance and fencing to the field. If the fencing is not done properly, the probability of the field getting attacked by animal is more. In order to avoid the above situation, we are implementing PIR sensor for detection of movements and accordingly there would be a buzzer sound when the movement is detected. Along with this, we monitor the soil moisture level by which motor get on and off accordingly. There are few circumstances in which the crop gets hold of fire when it is ripe totally. To overcome this dangerous situation, we have implemented flame sensor along with GSM module to send alert message to the respective person when the crop gets hold of fire.***
Keywords: Scientech IOT gateway, PIR, Soil moisture, Fire Sensor, GSM module.

I. INTRODUCTION

In INDIA, the farming is done in old methods. Most of the farming and agriculture activities are done based on predictions which does not give the expected output. Due to this, the farmers will have to bear more losses and sometimes they take away their lives by suicide. To increase the growth of crops many factors should be monitored such as soil moisture and fencing and these cannot be ignored.

In order to avoid the loss in agriculture sector, we come up with an idea of IOT based crop monitoring system. This system provides an easy way of monitoring the crop which is easily affordable for every farmer and avoids hazardous situation because there is probability for a person to get shock while operating the motor. In overall sense, we strive to reduce the risk of losing the crop from hands and avert loss of life.

II. EXISTED METHOD

Aneith Kumar [1] proposes an Automatic Irrigation and Fire Detection System. This paper is mainly focused on water problem and fire accident in the agriculture land. Three types of sensors they are soil moisture sensor, Humidity and Fire detection sensor. Each sensor takes into account the different parameters of the soil.

The whole sensor circuits are interfaced with microcontroller MSP430.

Vikhram. B [2] proposed the Animal Detection System in Farm areas. The main aim of this project is to protect the crops from damaged caused by animal as well as divert the animal without any harm. Animal Detection System is used to detect the presence of animal and offer a warning. In this project we are used PIR and ultrasonic sensors to detect the movement of the animal and send signal to the controller. It diverts the animal by providing sound and signal further, this signal is transmitted to GSM and which gives an alert to farmers.

Rameshbabu.R [3] proposed Smart Crop Protection System with Image Capture over IOT. The main aim of this project is to protect the crop from damage caused by animals. The camera continuously monitors the fields. If any animal is found, it provides the real-time image of the field over the internet.

Which can be viewed by using web browser on devices like computer mobile and also it alerts the surrounding people through the buzzer sound. The whole sensor circuits are interfaced with raspberry pi.

S.Srinath [4] proposed GSM based Automatic Irrigation Control System. This system is smart irrigation techniques using internet of things (IOT). In this system sensors are placed in the agriculture field, measures the soil moisture value, water level in the tank and well-water through mobile data communication network. The web servers use intelligent software to analyze the data and act according to the result obtained to perform desired action.

Devendra. S [5] proposed Automated Irrigation System using Wireless Sensor Network. The system supports water management decision, used for monitoring the whole system using GSM module. The system continuously monitors the water level in the tank and provide accurate amount of water required for plant or crop. The system checks the temperature and humidity of soil to retain the nutrient composition of the soil managed for growth of plant.

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III. PROPOSED METHOD

In the proposed system, IOT based crop monitoring system is done where sensors are used to collect all the information in the agriculture field. In our proposed work, three sensors are used such as soil moisture, PIR and Flame sensor. The three sensors are connected to the IOT gateway. Also, the data is stored in the cloud by using IOT server. This project mainly works on serial communication between arduino nano and raspberry pi. The below diagram shows the IOT based crop monitoring system.

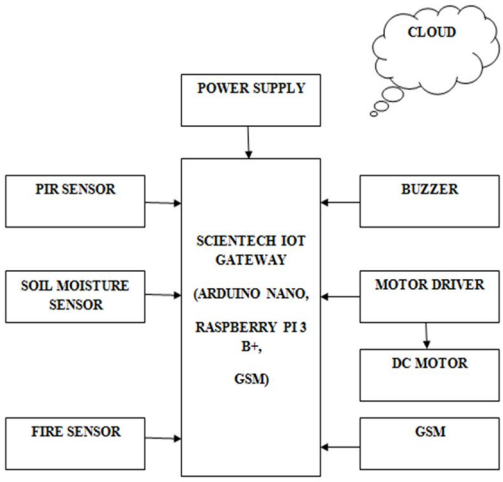


Fig: IOT based crop protection system

A. *IOT Gateway*



Fig: IOT Gateway

Scientech which is an Industrial sensor Gateway with powerful OS embedded Linux/Windows in it and it also supports wireless Zigbee, Bluetooth Low Energy (BLE), 6LoWPAN & IEEE 802.15.4 MAC to communicate with Sensors Network and other end reliable communication channels Wi-Fi, Ethernet, GSM to connect the cloud and it can also be used as stand-alone private cloud server by running MQTT Broker and local Database with small feature and rich Web servers. Arduino nano, Raspberry pi 3B+ and GSM are present in the IOT Gateway. It runs directly on 230V AC, so no need to add any regulator circuit to the system. There are multiple options by which you can communicate with the gateway, such as Bluetooth, Wi-Fi, GSM, and Ethernet. The gateway has external connectors available for Ethernet, USB, HDMI output, and Sensors. There are Five Connectors available for sensors in the gateway and each connector is name uniquely in alphabetical manner they are A, B, C, D, E. 8 Analog Inputs, 7 Digital Inputs/Output pins are available for sensor connections. The pin connection is also shown in below Table.

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Port connection	Arduino pin
A1	+5V
A2	A1
A3	D2
A4	A0
A5	Gnd
B1	+5V
B2	A3
B3	D3
B4	A2
B5	Gnd
C1	+5V
C2	A5
C3	D4
C4	A4
C5	Gnd
D1	+5V
D2	D7
D3	D5
D4	A6
D5	Gnd
E1	+5V
E2	D8
E3	D6
E4	A7
E5	Gnd

Fig: Pin connection

B. PIR Sensor



Fig: PIR sensor

Passive Infrared Sensor (PIR) is an electronic sensor that is used to measures infrared light radiating from objects in its field of view. It is a motion detector. PIR sensor is used to detect the movement of animals are present in the crop. If any animal is detected, it produces the buzzer sound without any harm to the animals. The PIR sensor detection range around 20feet (6 meters) and the detection angle should be 120 degrees. The frequency range of buzzer sound should be 15-22 kHz.

Frequency range of hearing for humans and selected animals		
animal	frequency (hertz)	
	low	high
humans	20	20,000
cats	100	32,000
dogs	40	46,000
horses	31	40,000
elephants	16	12,000
cattle	16	40,000
bats	1,000	150,000
grasshoppers and locusts	100	50,000
rodents	1,000	100,000
whales and dolphins	70	150,000
seals and sea lions	200	55,000

Fig: Hearing Range

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C. Soil Moisture Sensor

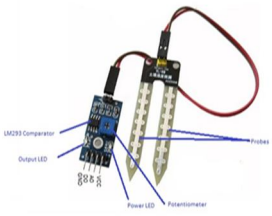


Fig: Soil moisture sensor

Soil moisture sensor is one of the important parameters used in automatic irrigation systems in the current scenario. The soil moisture sensors are usually placed in the soil below the crops. The sensor is used to measure the moisture level of the soil. When the soil is having low moisture level, the module output is at high level (motor is on), else the output is at low level (motor is off).

D. Flame Sensor



Fig: Flame Sensor

Flame sensor is used to detecting heat. When there is a presence of high temperatures, the device gets activated and gives the appropriated output. The output may be either buzzer sound or it will send the message signal to the farmer by using GSM module. Flame sensor is used to detect the source of the wavelength in the range of 760nm-1100nm and the detection angle should be 60 degrees.

IV. FLOW DIAGRAM

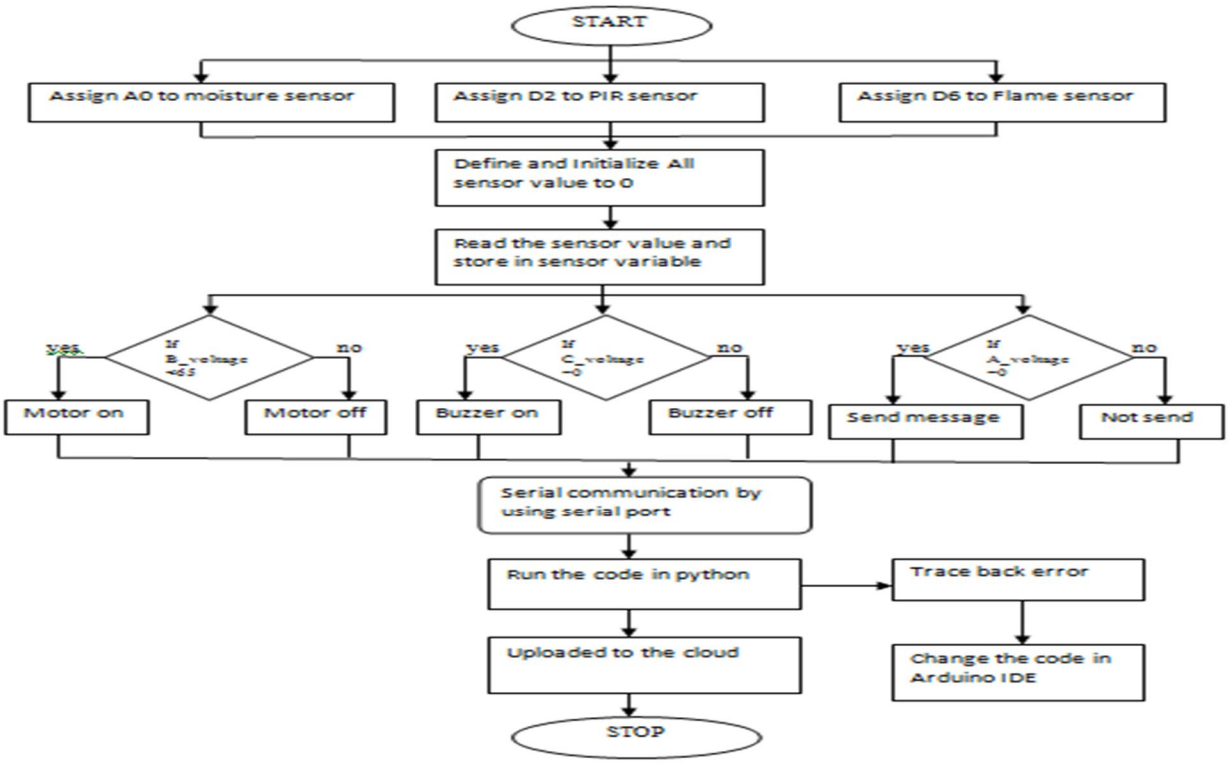


Fig: flow chart

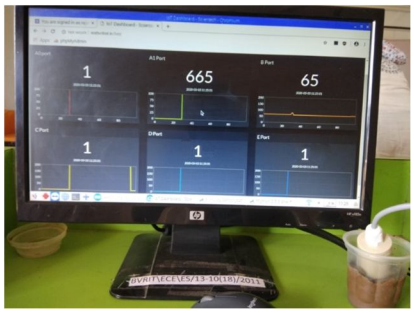
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1) STAGE1 Assign analog pin A2 to soil moisture sensor. Assign digital pin D4 to PIR and Assign digital pin D2 to flame sensor.
2) STAGE 2 define and initialize all sensor value to 0 i.e. int Sensor Value=0
3) STAGE 3 Read SensorPin and store value in Sensorvalue variable
4) STAGE 4 if sensor value is greater than 65, the motor is off. If the sensor value is less than 65, the motor is on
5) STAGE5 if the sensor value is high, buzzer will be on. If the sensor value is less, buzzer will be off.
6) STAGE6 if the sensor value is high, the message will be sent to the user by using GSM module. If the sensor value is less, the message will not send to the user.
7) STAGE7 serial communicate between arduino nano and raspberry pi by using serial port
8) STAGE8 if any trace back error is occurred in the python shell again go to the arduino code and change the program and the process is continuous. If there is no trace back error in the python shell, the data is stored in the cloud.

V. RESULT



Fig: Prototype of our project



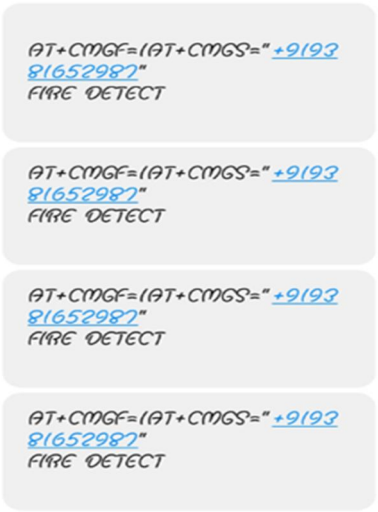


Fig: the output is shown in serial monitor and mobile phone.

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VI. FUTURE SCOPE

The future scope of this project could be including the camera for more secured for the crop by using image processing and the data is send to the cloud, and also use mobile application and voice speaker. This would make the predicting and analysing processes more accurate. It also includes making different data mining algorithms suitable for data analysis in agriculture.

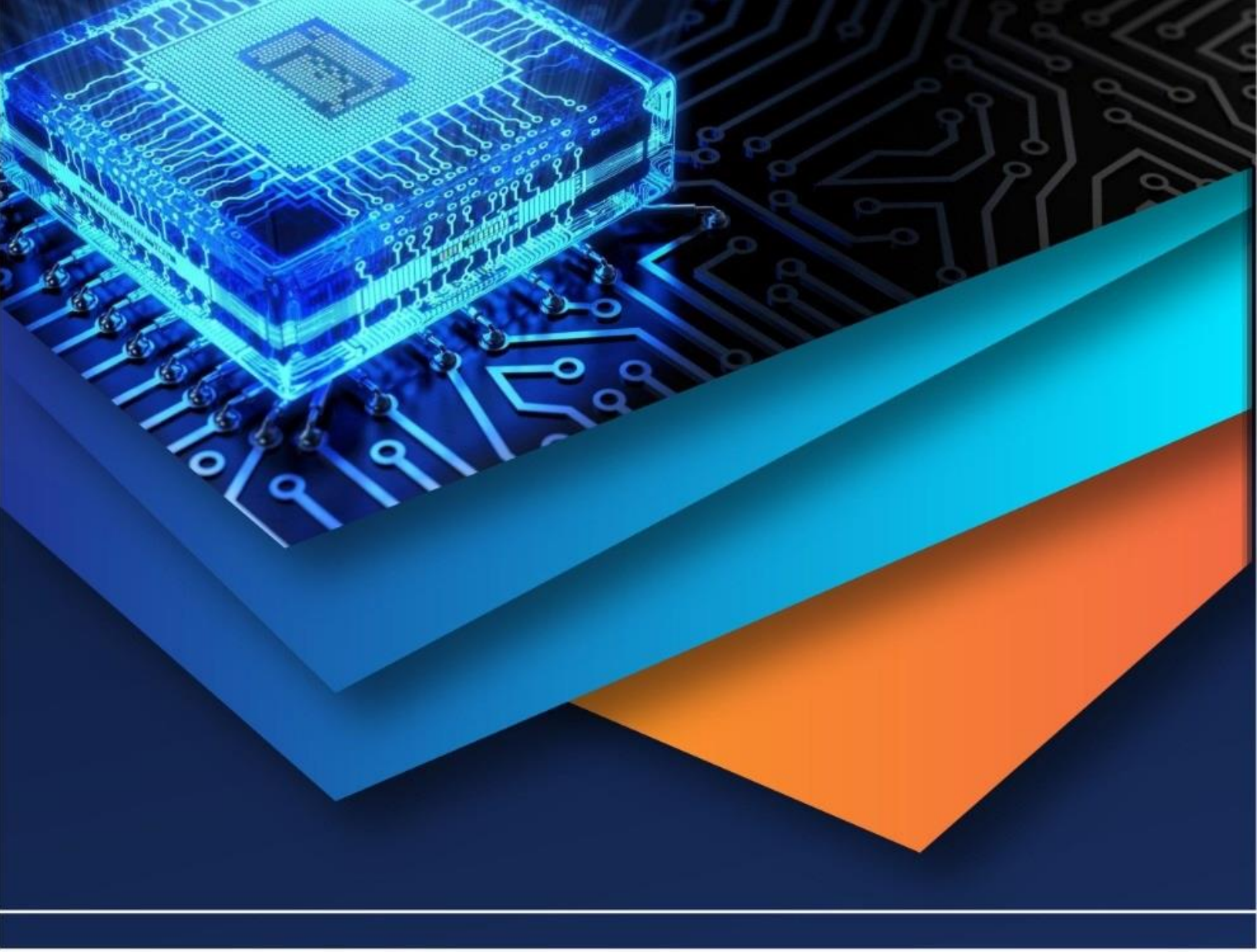
VII. CONCLUSION

The main objective for creating this IOT based crop monitoring system is to make it more Innovative, user friendly and cost effective than the existing systems. Measuring three parameters namely soil moisture, PIR and fire. The primary applications for this project are for farmers and gardeners who do not have enough time to yield. This project will help farmers in protecting their yield. The famers are facing major problems in their agriculture fields, because they have no proper idea about when the current situation. The PIR sensor used to protect the field from animals and birds. PIR sensor is used to sense the animals and it gives the sound, So that wild animals will not enter into the farm. It will run away. Moisture sensor is used to sense the moisture level of the plant/crop. If the moisture level is found to be below the threshold level, and it produce the water through the motor. fir sensor is used to sense the fire, when the fire is detected, The GSM module sends information to the farmer to know about the field condition. The farmers can able to monitor the field conditions from anywhere.IOT builder helps in real time sampling of soil, PIR and fire and hence the data acquired can be further used for analysing the crop. We have also taken many readings of the soil, PIR and fire for various days at different times of the day. Data on the cloud also helps the agriculturists in improving the yield.

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