Voice Controlled IOT based Agricultural Field Monitoring and Control with ESP8266 and Google NT

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Abstract: India is a country where *modernization of the farming process is one of the critical process, as they has to import ample amount of agricultural products from foreign countries to fulfill the demand of 1.2 billion populations. Agro field has experience various types of technical and architectural advancement in last few decades which has considerably had an impact on improvement of productivity of Agro products. Yet agriculture is facing problems like improper health of soil, long distance monitoring and control as required by the plant. Traditionally, Indian farmers have adopted manual observation based technique which led to over and under use of pesticide and watering and other demerits which results into factors like improper growth of plant, decrease in productivity and loss of quality. The proposed system is made to overcome against lacunas and have control over the irrigation and monitoring of the agricultural field using IOT based tech. Also proposed system is about having control of actuators via voice control with Google assistance of our smart phone. Proposed system result shows that we can observe, monitor and can have control over it via voice that to from any where in the world.*

Keywords: ***I****rrigation Control, Internet of Thing, Agricultural Field Monitoring, ESP8266.*

I. INTRODUCTION

Internet of things (IoT), is a cloud of interconnected physical devices, which can communicate with each other over the Internet. Sensing, monitoring, controlling devices and Actuators which are actually the physical devices are unable to communicate with each other even if they are connected using internet, unless they are connected to each other via any kind of IOT gateway. This entire framework is called as IoT Framework or Infrastructure. As an example Home Lighting and ventilation System, where all the control switches are been connected to the main controller which is connected to the internet. The smart Agriculture field, connected with IoT gateway systems, could be said as connected field, which can support a wide range of devices from diverse agricultural device manufacturers. This connected field can give data in more intelligent and precicse way to the observer. Agriculture field advancement has a greatest challenge for the countries with such popullation, so new technologies have to be adopted. We have implemented a novel methodology of physical parameter monitoring, data display, data integration to the cloud, alert generation and predicting the future values with the help of Adafruit Website. We have used temperature sensor, CO2 sensor, light sensor and the moisture sensor. The sensing elements are installed to various points in agricultural field i.e connected field which collects the data, and thus data is mitigated into the cloud with the help of IoT gateway (Adafruit).So user can have a real time data visualization, with the help of Adafruit server user can predict the future parameter values. The user can monitor the valves of light intensity, CO2 level, moisture, temperature and humidity and can visalize the result and so he can have control over the agriculture field by using a MQTT, by sending commands. MQTT is known for way to have communication between two or more machines where channel is created to subscribe the srever, server could be "io.adafruit" or any MQTT gateway server. This method of data monitoring of remote location offers the real time monitoring and voice controlling service via mobiles, tabs, or laptops. This provides the flexible for the data visualization, data understanding, and the predictive analysis provides alerts for the upcoming situations in futures so we could be ready to have them. The framework is settled in 3 sections.Where section 2 contains the related work, section 3 is about the proposed work, section 4 covers the voice control system working, section 5 covers the implementation and result analysis. At the end finally we have concluded with future work in section 6.

II. METHODOLOGY

Monitoring of soil moisture and groundwater levels using ultrasonic waves to predict slope failures, [1] ultrasonic waves is used to predict the failure of slope in case of heavy rainfall, and they have used a method of monitoring of soil moisture. Optimal sensor placement strategy for environmental monitoring using Wireless Sensor Networks, [2] wireless sensor having a network is used to find the optimal sensor with a proper placement method for the observing environmental changes. The realization of precision agriculture monitoring system based on wireless sensor network, [3] has used wireless sensor networks to design the monitoring of agriculture, also here the proposed system is a real time control and montoring of environmental stats of temperature, humidity, soil moisture, Carbon dioxide and the light intensity. Precision

agriculture monitoring system related to WSN, [4] proposes that WSNs has a important role in decision making, monitoring of agricultural field and optimization of agricultural resources. WSNs also help to know the real time data related to the agricultural field and the crops nature and condition , so that one is ready to face the future conditions related to their agricultural field.

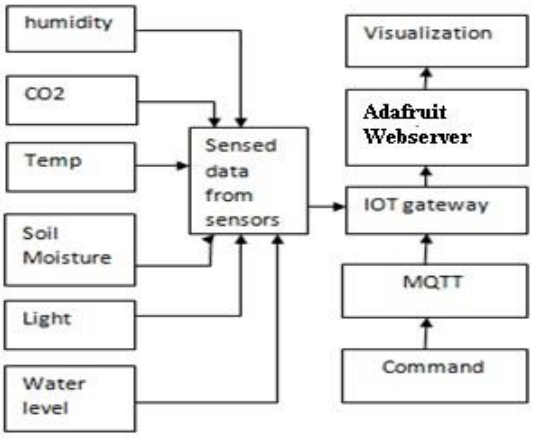

Fig. 1: System Architecture

As we can see in the System architecture diagram the sensors are connected to IOT gateway which is Adafruit in our case. This Adafruit server is used to visualize the date on display like Smartphone and laptop. The MQTT support send and receive data at lowest possible size and easily. The command with help of smartphone can be given to actuate the relays. As the date has been uploaded to a IOT server the one can see it from any where he want and at any time he want. This helps to control and monitor the agriculture field in more smart way. Here actuating command to relay can not only give by buttons but can also be given by our voice.

III. PROPOSED WORK

We propose a Novel IoT sensor network for monitoring the environmental parameter in an agriculture field. Mitigating this data to the cloud through a secured IoT hub (Adafruit), and then run and predictive analysis and the machine learning on the gathered data. The proposed system overcome the limitations of traditional GPRS based system through protocols like MQTT, secured HTTP, which not only ensured that the data is safe and secured, also high grade of security is provided to date as whole commuinication is given authorized secured data layer. Here system comes with range of bandwidth, therefore the client level solution can be run either on the mobile, PC or on the tabletWe can have required data of connected field in real time and also can actuate the motor, fans, lights in real time. This provides the flexible for the data visualization, data understanding, and the predictive analysis .

The 4G broadband connectivity is compatible to our system which does not have any limitation of bandwidth, which is experienced for the GPRS based system. At the same time the MQTT protocol itself free, the cost of operation for controlling method is zero in comparison to that of GSM based system, where each SMS's cost a value which is determined by the tariff of the service provider. Architecture of system is composed of sensors like (temperature, CO2, moisture, and the light), which are installed in the agriculture field at appropriate places. These sensors are been used to collect data of environmental para like CO2, moisture, light, and tempertaure. The sensed data is mitigated into the cloud through an IoT gateway (Adafruit); io.adafruit gives a real time data visualization. We here are using a communication protocol MQTT which is a light weighted, by using which we are having control over the irrigation in the form of controlling the relay.

IV. VOICE OPERATION

Google assistance is a great platform to interface with world verbally provided by company like Google. In this proposed work we have make use of Google Assistant to give command to relay circuit through ESP8266 WIFI module. The Google account is linked with Adafruit server for this process. Whenever we want to turn ON the motor we will give command to Google assistance as "Turn on the motor" it will turn ON the relay where the motor is connected. Once the relay is ON it will confirm that motor is turned on as " Ok I am turning on the motor", which help us to know that the task is in process or done. The Google Assistant is a serach platform mainly used by people for searching content on Google; here we are utilizing its hidden ability for field of agriculture.

Fig. 2 : Google Assistance command and response

To do so we have to connect our Google account with both Adafruit IOT server and Google assistance. As we cannot program Google assistance to respond like we want, here we have use an app called IFTTT to collaborate Google assistance and Adafruit work together. So this system can be used to control all agricultural appliances with our voice from anywhere in this world with our smartphone itself. This system give voice security like no one can give, as Google assistance works with only individual voice only. It does not operate on duplicate voice command.

V. IMPLEMENTATION AND RESULT ANAYSIS

User can analyze the output in the Adafruit, which will give the graphical notations of all the values**.** IO**.** Adafruit is an internet of things server based website or application and is open source. Adafruit can also acts as an application programming interface in order to store and retrieve the data using the HTTP protocol over the internet or via a Local area. We can see the indicator of value of temperature, light, soil moisture and the CO2 in Fig 5.

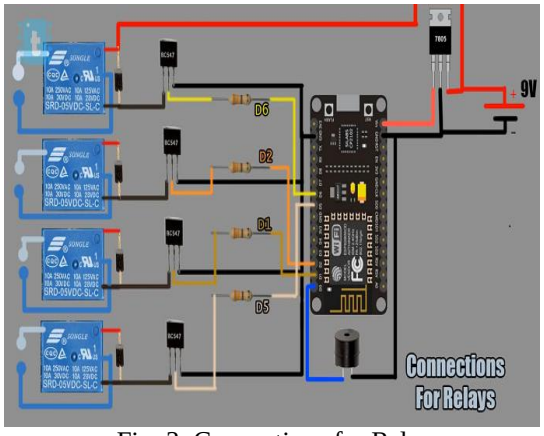

Fig. 3: Connections for Relay

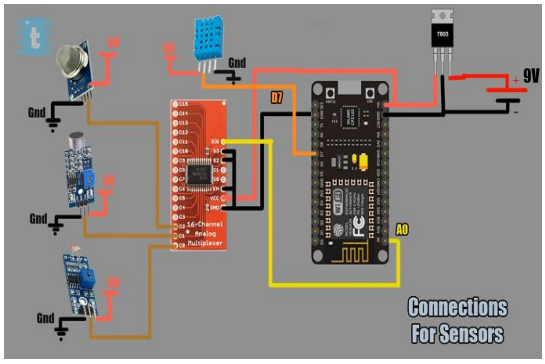

Fig. 4 : Connections for Sensor

A real time data visualization can be analyzed in the thing speak, which is an IOT hub. The figure 5 helps us to know the real time data of sensor.

VI. CONCLUSION AND FUTURE WORK

Crop productivity advancement haves a major concern in our country, along with architectural advancement the technological failures should be taken care to improve the crop productivity to support and sustain the need for ever green population of our country. Agriculture field have witnessed various sensor operated network in past to have good productivity. Yet those system dosent offer predictive data analysis as well as command with voice to actuate the actuator through mobile and laptops. However most of the technology does not offer on the data mining technique and predictive analysis, which limits the data usage to accurate state of the field and crop.

We propose a novel technology by means of which gathered data from physical sensing devices is mitigated in the cloud, where a machine learning technique could in real time produce not only the alerts corresponding to the current state of the environment and the crop but also provide predictive data of them.

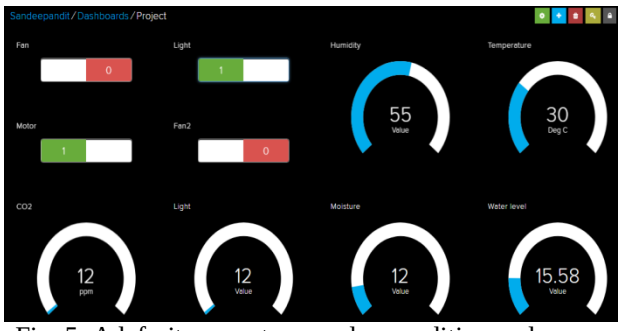

Fig. 5: Adafruit server to see relay condition and sensor readings

The IOT based architecture also offers real time realization and analysis of data which can be used across the globe in coordination with the parameter which is to be monitored via other parts of the globe to understand the abnormal behavior of the similar kind of the crop. Also system has a very optimal latency for controlling the system as well as high packet delivery rates and accuracy for mitigating the data. Voice operated system will give more enhancement as once can operate the relay sitting at home or office with his voice and without touching even his smartphone. The voice operation with google assistance not only provide free voice service but also provide security as only owner voice is recognized by google and not others. As future is of voice command agriculture system should also get an opportunity get participate in world of voice actuated system.

VII. REFERENCES

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