AGROIoT-IoT Assisted Farming

Ms.Nishigandha P. Chandugade[1], Mr. Rohit V. Kadam[2]
[1]Dept of Computer Science and Engineering
[1]KLS GIT Belagavi

Abstract*- This paper proposes monitoring and control system for agricultural parameters based on IoT and android to overcome the problems faced in monitoring different parameters in daily farming activities. In this paper a system is developed which consists of different sensors to monitor different agricultural parameters such as temperature, moisture, Humidity and rainfall levels. The system is so developed that it can be visualized from any part of the world using a web browser or android application. The proposed system involves development of hardware as well as software to monitor and control different agricultural parameters. The Light weight messaging protocols such as MQTT is used so that it perfectly suits IoT framework. In addition to monitoring certain activities it can be controlled through the internet such as irrigation, temperature stabilization systems and so on. Thus the proposed system forms complete IoT framework for agricultural operations.*

Keywords- IoT, MQTT, Sensors, Android Application, Agricultural parameters, AgroIoT.

I. INTRODUCTION

India is the land of villages. This being said the major occupation of majority of villages in India is agriculture. Near about 70% people are dependent upon agriculture. With recent advancements in engineering and technology, there also have been changes in agricultural technology and practices. Though there are advancements people still follow old practices due to the lack of money and high cost of technically advanced agricultural equipment's.

Farmers in India perform agriculture mostly with manual operation. The pain involved in doing each and every operation has to be reduced by the way of introducing simple technology which is not only user friendly to farmers but also is economical for farmers to adopt. This paper deals with the concept of IOT assisted agriculture. In this system the sensor will sense the vital parameters of the environment. The sensors are connected to the microcontroller. This system involves connected monitoring, control of agricultural parameters using Internet of things and Android.

The proposed system is not only unidirectional it is bidirectional, it means the system monitor different agriculture parameter and also it control different agricultural equipment's such as irrigation control(motor), light control, temperature control

II. LITERATURE REVIEW

Before starting the paper a number of research papers were studied extensively to find if such system exists and what are the current drawbacks. The details literature review helps us to focus on the problem more effectively and develop an efficient solution.

G. Sandhi et al., in [1] have proposed visually guided operations in green-houses. A vision system to operate in a greenhouse environment designed for tomato cultivation is explained. Here in this work they are used two PAL color cameras. The signal sent by the cameras is processed by a graphic workstation using a bit-slice microprocessor card for fast image processing.

K. Rangan et al., in [2] have discussed An Embedded Systems Approach to Monitor Green House. They are used an embedded system approach to monitor and control the greenhouse parameters. They are measuring humidity, temperature, pH of the water, soil wetness and light intensity by sensors. The message will be sent to the owner through GSM. The disadvantage of this work is few parameters are measured and the message will not be in local language. So the uneducated people cannot be able to use this system.
Wei Ai et al., in [3] have proposed Green House Environment Monitor Technology Implementation Based on Android Mobile Platform. China is a large agricultural nation. And agriculture is the foundation of national economy. They have implemented a technology which uses mobile phone as monitoring terminal, monitoring greenhouse environment explained. In this system they used two sensors-temperature and humidity sensors. Sensors are cable type. GPRS is used to send messages. Wireless sensor network is an emerging field that can be used to monitor and control the agricultural parameters in order to make intelligent automated system in greenhouse.

Akshay et al., in [4] have proposed Wireless sensing and control for precision Greenhouse management they used a CPU for monitoring and a ZigBee with PIC microcontroller to establish a wireless communication between two distant locations. The range of the ZigBee is limited. Their main purpose is to monitor and control only the temperature and humidity.

Aji Hanggoro et al., in [5] have discussed Green House Monitoring and Controlling Using Android Mobile Application .The new system developed to test the indoor humidity. Complete system is designed to monitor and control the humidity inside the greenhouse. The software used is an android phone, connected using WIFI to a central server which connected via serial communication to microcontroller and humidity sensor.

S.Thenmozhiet al., in [6] have discussed Greenhouse Management Using Embedded System and ZigBee Technology. The controlling process takes place by both manual and automatic manner. ZigBee wireless network will send status to the control room. And there we can control the activities through PC.M.K.

III. OBJECTIVES

The main objective of the project is to develop an efficient solution for monitoring and automation of different agricultural tasks by implementing internet connected **monitoring, control** of different parameters using **Internet of things and Android**. The objective is to **implement Internet connected farming** making it easier for farmer to monitor and control agricultural tasks. The primary objectives of the project are outlined as below:

- To develop a system for monitoring of various agricultural parameters such as temperature, humidity, Soil moisture and rainfall using and hardware based system
- To connect the system to the internet so that the different parameters can be monitored from anywhere over the world.
- To develop an android application which can be used to visualize and monitor all the parameters mentioned above.
- To implement efficient IOT protocols such as MQTT so that system is responsive and fast.
- To develop a cloud based solution so that the system is scalable at any instant of time.
- To make the system economical and adaptable.

IV. METHODOLOGY

The system is divided into different modules for the purpose of simplification. The methodology for approaching towards the completion of the system is given in steps below, which are completed as we move ahead with this system.

A. Market study and literature review:

The current practices to monitor greenhouse elements are studied in deep before arriving at the problem definition. The literature review over this field is also studied in deep to outline the current research work on this field

B. The hardware interfacing:

The appropriate microcontroller is selected in this phase and hardware is interfaced to monitor different parameters. This includes interfacing various sensors such as temperature sensor to monitor temperature, Humidity sensor to monitor humidity, moisture sensor to monitor the soil moisture levels and rainfall sensor to monitor rainfall

C. Programming the microcontroller:

After interfacing the sensors the microcontroller is programmed to get the data from the interfaced sensors. The data is formatted properly to be used for further applications.

D. Connecting to internet:

In this phase the data monitored through different sensors is pushed to the internet or a server hosted on internet. The server handles all the data and can be accessed anywhere from the world using internet.

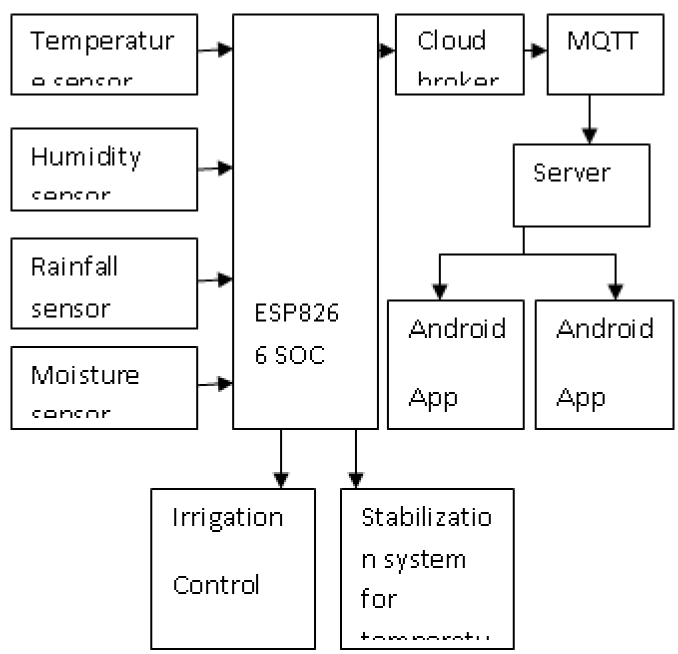

Fig. 1 Architecture diagram

E. MQTT and PAHO:

In this phase the cloud based MQTT broker is implemented as data transfer protocol to establish the communication between the developed hardware and the software. Since the broker is hosted on cloud it can easily scale up in future.

F. Development of android application:

This system also involves development of android application which can help farmers to monitor the agricultural parameters right on their cell phone using the android application. The android application is so developed that it pulls data from the server and displays it to the farmer. The Android application developed is also provided with features to manually control the equipment's.

G. Assembly and testing:

In this phase the entire system is assembled, tested and optimized for reliability.
The architecture diagram of the system is fig.1.

V. HARDWARE USED

A. The Node MCU ESP8266 SOC board:

NodeMCU is an open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi SoCfrom Espressif Systems, and hardware which is based on the ESP-12 module. The term "NodeMCU" by default refers to the firmware rather than the dev kits. The firmware uses the Lua scripting language. It is based on the eLua project, and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson, and spiffs [10].

B. DHT 11 Temperature Humidity sensor:

The DHT11 humidity and temperature sensor makes it really easy to add humidity and temperature data to your DIY electronics projects. It's perfect for remote weather stations, home environmental control systems, and farm or garden monitoring systems [12].

Here are the ranges and accuracy of the DHT11:

- Humidity Range: 20-29% RH
- Humidity Accuracy: ±5% RH
- Temperature Range: 9-50 ºC
- Temperature Accuracy: ±2% ºC
- Operating Voltage: 3V to 5.5V

The DHT11 measures temperature with a surface mounted NTC temperature sensor (thermistor) built into the unit [10].

C. Soil moisture sensor:

The Soil Moisture Sensor uses capacitance to measure dielectric permittivity of the surrounding medium. In soil, dielectric permittivity is a function of the water content. The sensor creates a voltage proportional to the dielectric permittivity, and therefore the water content of the soil [10].
The Soil Moisture Sensor is pretty straightforward when it comes to hookup. You need to supply VCC and GND. We recommend not powering the sensor constantly to prevent oxidation of the probes (more on this in a bit). You will get a SIG out, which will be between almost VCC and GND, depending on the amount of water in the soil. The two probes are acting as a variable resistor – more water in the soil means better conductivity and results in a lower resistance and a higher SIG out. Your analog readings will vary depending on what voltage you use for Vcc as well as the resolution of your ADC pins.

E. Raindrop Module:

The rain sensor module is an easy tool for rain detection. It can be used as a switch when raindrop falls through the raining board and also for measuring rainfall intensity. The module features, a rain board and the control board that is separate for more convenience, power indicator LED and an adjustable sensitivity though a potentiometer.

This module allows you measure moisture via analog output pins and it provides a digital output when a threshold of moisture is exceeded. The module is based on the LM393 op amp. It includes the electronics module and a printed circuit board (control board) that "collects" the rain drops [11].

VI. FRAMEWORK

A. MQTT Framework:

MQTT stands for MQ Telemetry Transport [10]. It is a publish/subscribe, extremely simple and lightweight messaging protocol, designed for constrained devices and low-bandwidth, high-latency or unreliable networks. The design principles are to minimize network bandwidth and device resource requirements whilst also attempting to ensure reliability and some degree of assurance of delivery. These principles also turn out to make the protocol ideal of the emerging "machine-to-machine" (M2M) or "Internet of Things" world of connected devices, and for mobile applications where bandwidth and battery power are at a premium.

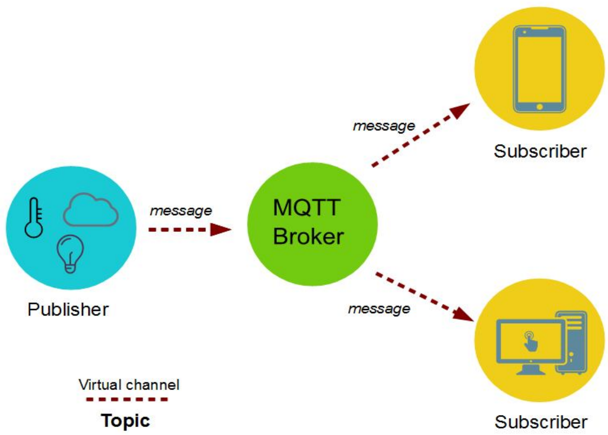

Fig. 2 MQTT block diagram

VII. SCREENSHOT

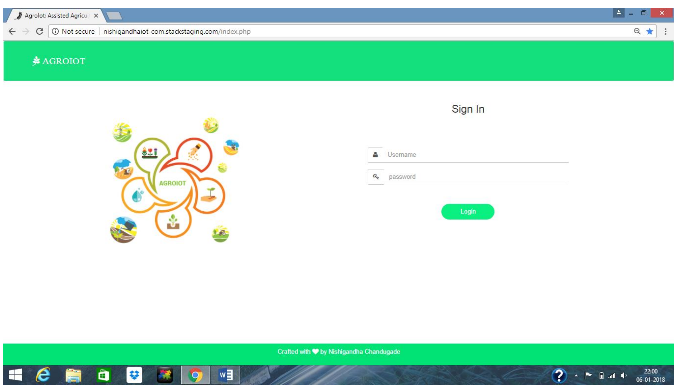

Fig. 3 Login Page

In login page the user can login with the correct user name and password, after login the page is redirected to the next page.

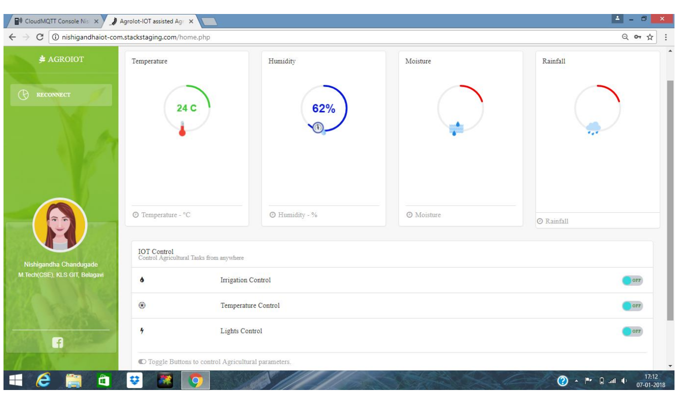

Fig. 4 Data Received From Sensors

This is the main page where the data sensed by sensor is update here, after connecting it to internet. Also from this web page we can handle the farming device such as motor and temperature control device.

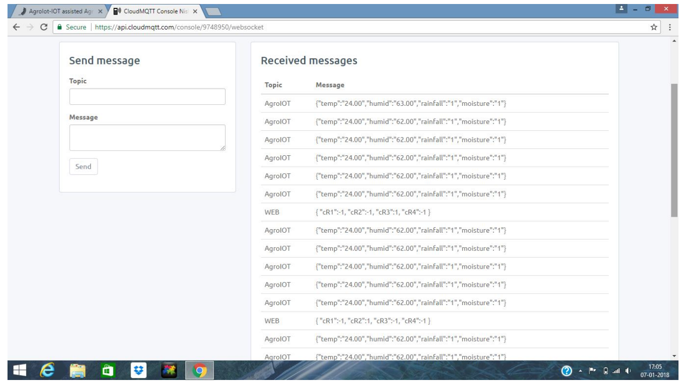

Fig. 5 Commands Received By MQTT

Fig. 6 Splash Screen of Android App

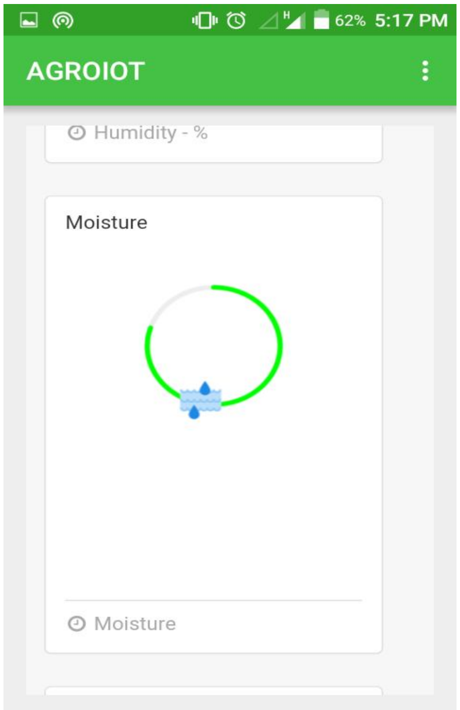

Fig. 7 Moisture Sensor Reading

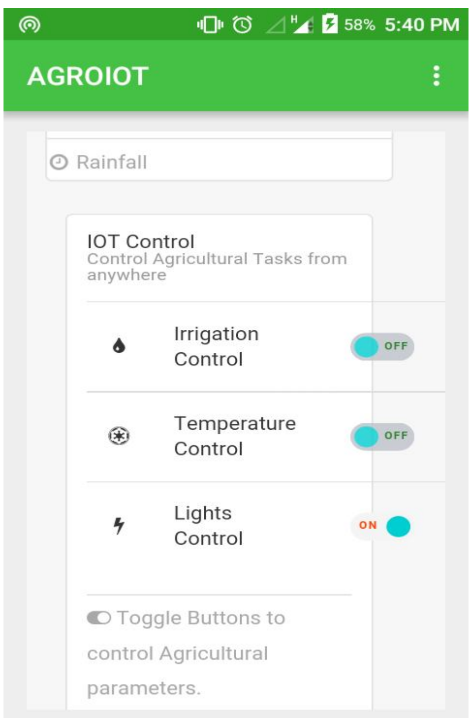

Fig. 7 IOT Control

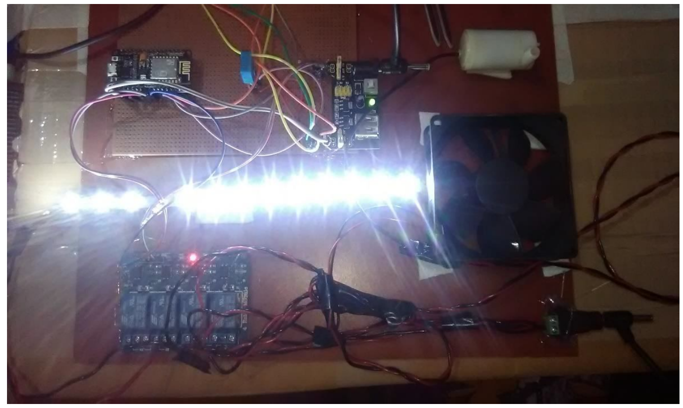

Fig. 8 Light Control System after Sending ON Command

VIII. FLOWCHART

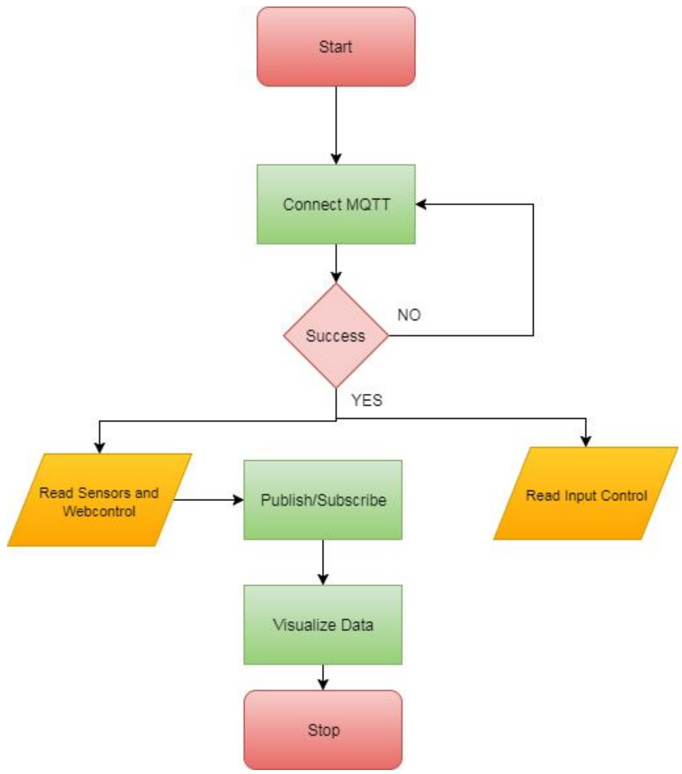

Fig. 9 Flow Chart of the system

IX. CONCLUSION

The implementation of an AGROIOT-IOT assisted farming is successfully discussed. The components used for the implementation of proposed system provide efficient output. The interfaces established between different components provide an effective communication across the overall working of the system. The various records collected by the proposed system are helpful for real-time monitoring and control of agricultural parameter and weather conditions.

X. FUTURE SCOPE

In future, certain changes can be made as per the requirements of the system. The system can be improved by adding sensor to detect PH and nutrient level of the soil. System can be improved by making potential changes in the hardware setup.

RFERENCES

[1] G. Sandhi et al. "Visually Guided Operation in Green-House", Intelligent Robots and Systems '90. 'Towards a New Frontier of Applications', Proceedings. IROS '90. IEEE International Workshop on, July 1990.

[2] K. Rangan et al. "An Embedded Systems Approach to Monitor Green-House", Recent Advances in Space Technology Services and Climate Change (RSTSCC), 2010.

[3] Wei Ai et al., "Green House Environment Monitor Technology Implementation Based on Android Mobile Platform", Artificial Intelligence, Management Science and Electronic Commerce (AIMSEC), 2011 2nd International Conference on, August 2011.

[4] C. Akshay et al., "Wireless Sensing and Control for Precision Green House Management", Sensing Technology (ICST), 2012 Sixth International Conference, December 2010.

[5] Aji Hanggoro et al., "Green House Controlling and Monitoring Using Android Mobile Application", QiR (Quality in Research), 2013 International Conference, June 2013.

[6] Thenmozhiet al., "Green House Management Using Embedded System and ZigBee Technology", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering, February 2014.

[7] Gayatri et al., "Providing Smart Agricultural Solutions to Farmers for better yielding using IOT", Technological Innovation in ICT for Agriculture and Rural Development (TIAR), 2015 IEEE, July 2015.

[8] P. S. Asolkaret al., "An Effective Method of Controlling the Greenhouse and Crop Monitoring Using GSM", Computing Communication Control and Automation (ICCUBEA), 2015 International Conference, February 2015.

[9] Vishwanath Naik et al. "IOT Based Green-House Monitoring System", International Journal of Electronics and Communication Engineering & Technology (IJECET), June 2015.

[10] http://www.openhacks.com/uploadsproductos/rain_sensor_module.pdf

[11] http://www.circuitbasics.com/how-to-set-up-the-dht11-humidity-sensor-on-an-arduino/