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Agriculture Using Mqtt Protocol

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Abstract

Increase in technology the environment of agriculture is also increasing. The level of production is ongoing fast. There are various factors that affect agriculture growth. The climate change, humidity, soil, change in temperature and more frequent extreme events decreases the production or damages agriculture. Multiple challenges have to be faced in coming years.

Farmers are nowadays working and creating advancement technology named as "Smart Farm". Various Technologies like AI (Artificial Intelligence), Big data IOT (Internet of Things) and ML (Machine Learning), Cloud Computing and many others are involved in various sectors.

It is proven that Internet of Things (IOT) helps to grow the value of many areas of farming in various sectors such as from growing crops to forestry. The factors which is most important are

- *Sensing Soil Moisture*
- *Water usage controlling*
- *Whether Reporting*
- *Temperature sensing*

These factors include in IOT which is needful and precise information for growing crops, make ease in agriculture. The aim of this project is to introduce new factor for agriculture business and better crop production named MQTT (Message Queuing Telemetry Tracking) protocol.

Keywords*: Light Detecting Resistor (LDR), CC3200, Soil Moisture, 4 channel Relay modules, 6V to 9V DC*

I.INTRODUCTION

Modern agriculture takes place with growth of technology and data as well as collaboration among researches and farmers across public and private sector. It is possible for farmers to remain up-to-date in climate change, humidity, soil, change in temperature and more frequent extreme events. We know that how IOT is the mainstream phenomenon of agriculture. In this project we have used equipment such as CC3200 by Texas Instruments, Light Detecting Resistor (LDR), Soil Moisture Sensor by Spark Fun, 4 channel Relay modules, 6V – 9V DC Water pump. The main factor is MQTT (Message Queuing Telemetry Tracking Protocol).

What is MQTT protocol?

MQTT stands for Message Queuing Telemetry Tracking Protocol. It is an open ISO and OASIS standard. It is a light weight network protocol which is used for transportation of messages among the devices. This protocol runs on a TCP/IP protocol. It is designed for connecting remote locations. It is used to define two types of network entities:

1. A message brokers

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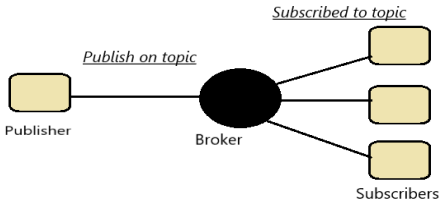
2. A number of clients.

An MQTT client is a device that runs on MQTT library and connects to an MQTT broker over a network. MQTT sends connection information in plain text format. It does not include any measures for security of a device.



Features of MQTT protocol are as follows :

1. Low code footprint
2. Less power consumption
3. Less bandwidth consumption
4. Less latency

The benefits of MQTT include:

Low code footprint: By using this protocol a device need only few lines of code in order to run the system.

Minimized data packets: MQTT is a device which is energy-efficient, it works so fast when a little CPU is joined to it.

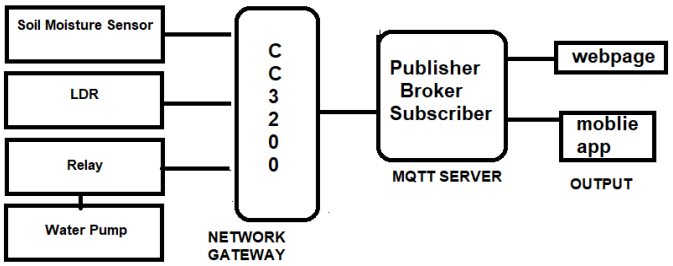
Speed: The MQTT protocol works on the basis of real time data and it doesn't delay in gathering and storing of information in the database.

Easy implementation: MQTT has an ease for implementation as it already has libraries in programming languages such as Elixir and Python.

Last will and testament: It allow a backup facility such that if a client unexpectedly disconnects any of the device than all the instructions are send to the subscribers in order to get out of the problem to a situation.

Automatic messages: Each sector is having one retained message so that a client can automatically receive a message when he/she subscribes i.e. it just acts like social media pinned post.

II. SYSTEM DESIGN AND WORKING PRINCIPLE



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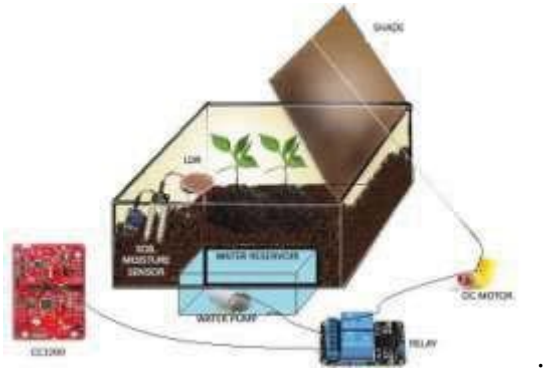
The given block diagram, shows that the architecture of the model in the project. Farmer can control the water pump with the controller i.e. ON/OFF and CC3200 by using MQTT protocol. Soil Moisture Sensor is connected to CC3200 which is further connected to the MQTT server for getting the output. The data is sent to farmers which is measured by Soil Moisture Sensor via MQTT server. This project is being divided into two sections. Section one includes of CC3200, Sensors used, Relay, Water pump and the other section MQTT server and the output in the form of data displayed. There is a network gateway between relay and soil moisture sensor connected through wire to CC3200.

In the first section there is testing and checking through this network gateway. While in the other section the data sent through this network gateway (CC3200, Soil moisture Sensor, LDR, Water pump) is sent to the farmer who has subscribed via MQTT server[10 11]. Therefore, the farmer can have the data which is sensed by the sensor directly to the him i.e. we can see various topics which has subscribed. In the final the data goes to IBM Watson cloud and the data can be accessed.

If there is higher intensity of light or rainfall the shade[1 2] will automatically collapse and if there is drought like condition the water pump will automatically start. In this way the project is useful for farmers to have more production of crop and have good business



III. EQUIPMENT

CC3200: Texas Instrument has launched a Launchpad named as CC3200. It is a first microcontroller in which a chip with on chip interest is inserted[3 4]. The Embedded memory of CC3200 has a RAM up to 256 KB. It is a 32-bit channel memory access. It has 8-bit parallel camera interface[6 7]. It consists of a 1 Watchdog Timer. It has WIFI and internet protocols present inside the ROM.

Light Detecting Resistor (LDR): LDR is a light sensitive device which is used to amount the power of light. Whenever it is a dark then the resistance is very high but as the light is exposed its resistance falls heavily. It allows to sense various light circuits. Thus, it works on based on its resistance.

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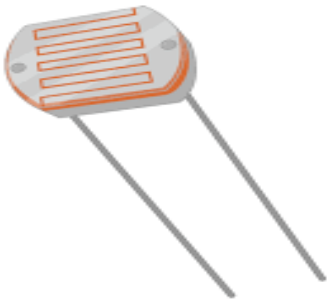

Soil Moisture Sensor: Soil Moisture Sensor made by the Spark Fun, is used to amount the gratify of the water present in the soil[8 9]. Whenever there is a deficiency of water then the unit output is set to complex level, and vice versa. This sensor works at 5V, 20mA.

Four Channel Relay module: Channel Relay module is used to initiate various components in which big amount of current is used with the help of small amount of current. The PCB color of Relay module is blue. This device has a good-interference, optical coupling isolation. Microcontroller controls the four-channel relay module.

6V - 9V DC Water Pump: It works on a voltage from 6V to 9V DC. It has a maximum head range of 3 meter while suck range is 2 meters. It works on current ranging between 0.5 to 0.7 A. It works with the liquids up to 80 degrees C. It has a maximum flow rate of 1-3L/min.

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IV. METHODOLOGY

We have designed this system in order to collect the data with the help of various sensors which helps to send the fetched data to various users, so that the users are able to access the data whenever they want. The moisture of soil, water pump status, fertility of the soil, etc. can be checked by the users whenever required. This project is used to get an idea about the fertility of soil, water content, and other components of the farming. In the above project, we have used CC3200 which acts as a gateway server which is used to connect the internet. In this system we have used various sensors, soil moisture sensor is one of them which is used to measure both analogue and digital values which helps in our project. It also acts as a four-channel relay model of the project. All the data collected goes in the MQTT protocol.

V. Conclusion

With the help of this project, we had tried to make a simple agriculture system using MQTT protocol, water pump controller, shade controller based on the soil moisture sensor, LDR and CC3200. The soil moisture sensor with high precision provides the analogue reading, so that it is to measure the soil moisture value. In this project, we finally have displayed all the information about soil moisture value and the water pump level state in the mobile app and webpages. With the help of this, the idea of modernisation of farming is straightforward, reasonable and operational.

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