MQTT & IOT Based Control and Monitoring of Smart Green House

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Abstract: - Internet of Things (IOT) is the backbone of the change in the today's growing technological era. Basically, in the real world the things having sensor capability, sufficient power supply and connectivity to internet makes field like IOT possible. For such rapid growing technology, it is the necessity to have very light, inexpensive and minimum bandwidth protocol like Message Queuing Telemetry Transport (MQTT) Protocol. Such non-established protocol it is easy for the clients to publish or/and subscribe the desire topic through the host acting as server of the network also known to be the broker. The Wi-Fi enabled ESP8266 & Atmega328 board interfaces with LM35, LDR sensor, DHT11 sensor, Soil moisture sensor and Gas Sensor which monitor the temperature, ambient light inside green house respectively, humidity, and soil moisture. Collected data form sensor is in Analog data format and Atmega328 microcontroller unit will fetch the data and convert it and process it into the digital format. Therefore, collected data form specific node will send to IOT server where it can view and analyses by an expert. MQTT server like broker also provides the facility of monitoring through the dashboard. By analyzing the system will get the temperature, humidity and light intensity level with the respective update. According to the light intensity level the brightness of greenhouse & other parameters are controlled By Node. In this system we implement the idea for the smart Green house monitoring system.

Keywords:- MQTT,IOT,Atmega328,Wi-Fi, Sensor.

I. INTRODUCTION

With the rapid growth of the national economy, modern agriculture has been developing rapidly. The research and application of controlled agriculture are being paid more and more attention especially that the greenhouse project has become one of the important parts of the high-efficiency factory-agriculture [2].

The development of technology, the old farming methods cannot meet the needs of social development. So we have to update and transform the traditional agricultural technical. Greenhouse agriculture has become a major trend in the development of high-tech agriculture. Greenhouse agriculture needs to control the environmental factors to obtain the optimum growth conditions for the crop. Thus it can extend the production season to get the optimum yield. Currently, artificial management is the major way to detect and control the environment factors, wastes lots of manpower and relatively large of monitoring error, affecting the growth of crops. Providing suitable environment for the growth of crops, the system is based on the wireless sensor detection technology and embedded technology to achieve the intelligent control of greenhouse environment [1].

This project intrudes a kind of agriculture greenhouse monitoring system which are based on Wi-Fi and the main objective of the system is to control the climate condition as per the crop data sheet, the sensor are design for collecting information about the climate of green house like temp, pressure, light, humidity and CO2.whith the help of system will decide the action the about the control like fan control, curtain control and sprinkler [3].

II. PROBLEM DEFINING

With the development of technology, the old farming methods cannot meet the needs of social development. So we have to update and transform the traditional agricultural technical. Greenhouse agriculture has become a major trend in the development of high-tech agriculture. Greenhouse agriculture needs to control the environmental factors to obtain the optimum growth conditions for the crop. Thus it can extend the production season to get the optimum yield.

Currently, artificial management is the major way to detect and control the environment factors, wastes lots of manpower and relatively large of monitoring error, affecting the growth of crops. Providing suitable environment for the growth of crops, the system is based on the wireless sensor detection technology and embedded technology to achieve the intelligent control of greenhouse environment. To meet the requirements in real-time, reliability and sustainability for crop-growth environment monitoring in greenhouse precision agriculture, to Design smart agriculture greenhouse using IOT based gateway which is based on Wi-Fi and embedded technologies.

III. OPEN ISSUE

Zigbee has short communication range between 10 to 100 meter but effectively 10mtr. Data is transferring with 250KPS speed. Zigbee is less secure, compared with Wi-Fi. Replacement cost will be high if any problem occurs [1][3].

A Sensor Network may require a lot of additional wiring to be installed around the house to allow sensors to work - unless the sensors used are wireless. Using wireless makes sensor devices much more expensive. Retrofitting an existing home rather than a new build could cause a lot of upheaval for the period of the installation [4].

CAN Bus are high software expenditure, Undesirable interaction more probable and Danger of incomplete technology for the customer. The data transfer capacity of the CAN Bus is 200kbps [2].

Bluetooth is a technology that allows devices to communicate and share data over short distances approx 8 to 10 meter. The rate of data transfer between Bluetooth devices is about 3 Mbps. Bluetooth devices work with the 2.4 GHz radio band, which is the same unlicensed frequency used by many other wireless devices. If many devices in the same area are all using the same stretch of bandwidth, it can lead to overall network problems, as the signals collide and information has to be resent [4].

Wired sensor technology is not portable. It is required cable connection.Wired sensor network restriction between the body movements. Interface of malty device that share channel. The units must be plugged into power outlets and network ports in order to function. Moving units takes time, energy and, potentially, information- technology personnel. These hard-wired requirements can make arranging personnel, furniture and equipment difficult. Moves of equipment or employees may require running additional network cabling, installing new electrical outlets and reconfiguring network-port structures [4][5].

IV.PROBLEM SOLUTION

Iinsidious weather of any Green house is maintained by several of parameters like ambient light inside green house, humidity, soil moisture, temperature and CO2. After implementing this system these parameters are measured by different sensors like LDR, DHT11, Soil moisture sensors, LM35 and Gas Sensor. This data will be collected from the sensor in analog data format. So Atmega328 microcontroller unit will fetch this data convert it into digital format and process it. The collected data from that particular node will be sent to IOT server where it can be view and analyse by experts. MQTT server like broker also provides the facility of monitoring through the dashboard. By analysing the system will get the temperature, humidity and light intensity level with the respective update. According to the light intensity level the brightness of greenhouse & other parameters are controlled By Node. In this system we implement the idea for the smart Green house monitoring system is will help to collect better and exact data from greenhouse and it will also reduce men power as it can be monitored by any remote locations where user have internet connection. To send this data to internet gateway we will use ESP8266 which is operating on IEEE 802.11(Wi-Fi) Standard.IOT server will be implemented on PHP based framework. We can place this type of more than one node in different part of green house and measure different parameters at different locations for better management of it.

V.FOUNDATION OF BASIC THEORY

Internet of Things basically helps in automation. It helps to connect with physical object around us. Electronic device like microcontroller embedded within physical object behaves like a real object and starts communicating. According to study number of things connected to internet will exceed no .of people on earth in near future. Cisco Internet Business Solution Group analyses that total connected things will reach 50 billion in 2020. Basically fundamental goal of IOT is to connect everything around us and enable seamless communication between them with very minimum human intervention. It focuses connection anytime, anywhere with anything [8].

The system is needed which can automatically capture the data and transfer it to the internet without any human to machine interaction. These things are provided with the unique identifiers which can be read using Atmega328 microcontroller unit and ESP8266 module with the help of sensors. The thing in the internet of thing can be a person with a heart monitor implant, a farm animal with a biochip transponder, an automobile that has built in sensors to alert the driver when the pressure is low or any other manmade object that has a unique IP address with the ability to be connected to the network for the transfer of the data. There is a major participation of wireless technology MQTT and the internet in the making of IOT. One of the basic things needed to sense the object in the environment is Atmega328 microcontroller unit. Sensing can be possible by assigning each object a unique identifier and then connected to the internet, for smart processing by the transfer of information. IPv6 is playing a very important role in the development of IOT, by using its huge address space one can easily assign an IP address to everything on this planet and could transfer the data over network.IOT is one of the upcoming concepts of technological innovation in the field of networks which will help not only in the industrial development but also in the day to day life of a human being, hence now days IOT is being the research emphasis topic for the researchers and for the enterprises. The typical scenario of IOT is shown in figure 1[8].

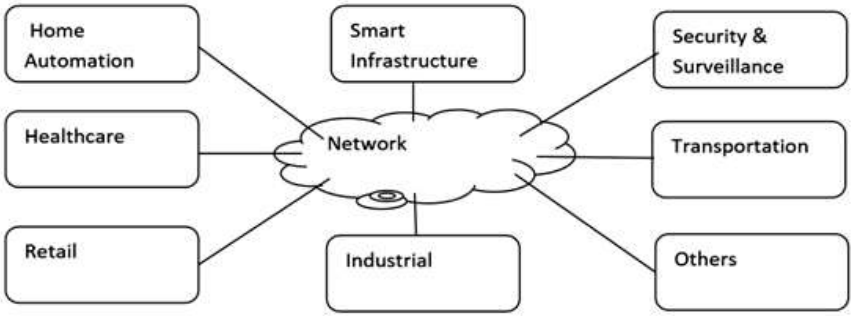

Figure 1: Internet of Things Application

The General Security Features of IOT

Table 1 shows some representative examples of challenges in both classes. Security should be enforced in IOT throughout the development and operational lifecycle of all IOT devices and hubs [10]. There are different mechanisms to ensure security, some of which are given below:

- The software running on all IOT devices should be authorized.
- When an IOT device is turned on, it should first authenticate itself into the network before collecting or sending data.
- Since the IOT devices have limited computation and memory capabilities, firewalling is necessary in IOT network to filter packets directed to the devices.

- The updates and patches on the device should be installed in a way that additional bandwidth is not consumed.

Table 1: General IOT Security Challenges [10]

Class Challenges	Class Challenges
Technological	Challenges related to wireless technologies, scalability, energy, and distributed nature of IOT
Security	Challenges to ensure security by authentication, confidentiality, end to-end security, integrity etc.

MQTT (Message Queue Telemetry Transport)

Currently, the most widely adopted protocols in the IOT and an M2M field is MQTT. Connectivity clearly plays an important role in IOT, and the efficient handling of mobility is crucial for the overall performance of any IOT application. To achieve stable and reliable communications, the crucial aspects to be considered are: (a) links can be frequently modified or broken without control, (b) channels can suffer from interferences, (c) nodes can become isolated, and (d) the service offered may not be available at any time. The presence of one or several of these factors has negative effects on the quality of the information transmission, producing: data loss, fail to access a service, and bad overall performances [6].

Table 2: Deference between MQTT and HTTP [12]

Features	MQTT	HTTP
Full Form	Message Queue Telemetry Transport	Hyper Text Transfer Protocol
Design Methodology	The protocol is data centric.	The protocol is document centric.
Architecture	It has publish/subscribe architecture. Here devices can publish any topics and can also subscribe for any topics for any updates.	It has request/response architecture.
Complexity	simple	more complex
Data security	YES	NO, hence HTTPS is used to provide data security.
Upper layer protocol .	It runs over TCP	It runs over UDP.
message size .	small, it is binary with 2Byte header	Large, it is in ASCII format.
Service levels	3	1
Libraries	30KB C, 100KB Java	Large
Port number	Port number 1883 80 or 8080	80 or 8080
Data distribution	1 to 0/1/N	one to one only
Service kevel	QOS	All message get same level of service
Networking	Ethernet,3G,WIFI	Zigbee, Bluetooth, RF
Min message size	2 byte	1 byte
Max message size	<24 MB	<128 byte
Mode	Asynchronous	Synchronous

Introduction of MQTT Protocol

MQTT stands for MQ- Telemetry Transports

It is nice slit with publish and scribe system. You can publish and receive messages as clients and it make really easy establish communication between multiple devices. It is simple messaging protocol Design for constrained devices and with Low bandwidth. So it is perfect solution for Internet of thing application [11].

MQTT basic concepts

Publish/Subscribe

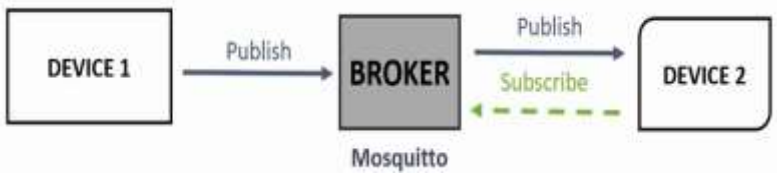

Figure 2: Publish/Subscribe with MQTT Broker [11]

Publish/Subscribe system means that device can publish messages to other devices or your devices can subscribe to particular topic to receives those messages [11].

For examples Device 1 publishes on a topic. Device 2 is subscribes to same topic in which device 1 is publishing so Device 2 Receives the message. Messages are Information that you want to exchanged between your devices whether its command or data.

Topics

Topics are the way you registers Interest for incoming message or how is Specify where your want to publish your messages. Topic are represented with string separated by "/" slashed indicate the topic level.

- Topic level separator : Home/Office/Lamp

MQTT Broker

The Broker primarily responsible to receives all the messages, Filter the message, decides who's interesting in it and then publish the message to all subscribers. There are several brokers we can use. We are going to use Mosquito [11].

Overall System Architecture

Collected data form sensor is in Analog data format and Atmega328 microcontroller unit will fetch the data and convert it and process it into the digital format. Therefore, collected data form specific node will send to MQTT Broker. MQTT Broker provided acknowledgement to client.IOT server where it can view and analyses by an expert. MQTT server like broker also provides the facility of monitoring through the dashboard. By analyzing the system will get the temperature, humidity and light intensity level with the respective update. According to the light intensity level the brightness of greenhouse & other parameters are controlled By Node. In this system we implement the idea for the smart Green house monitoring system.

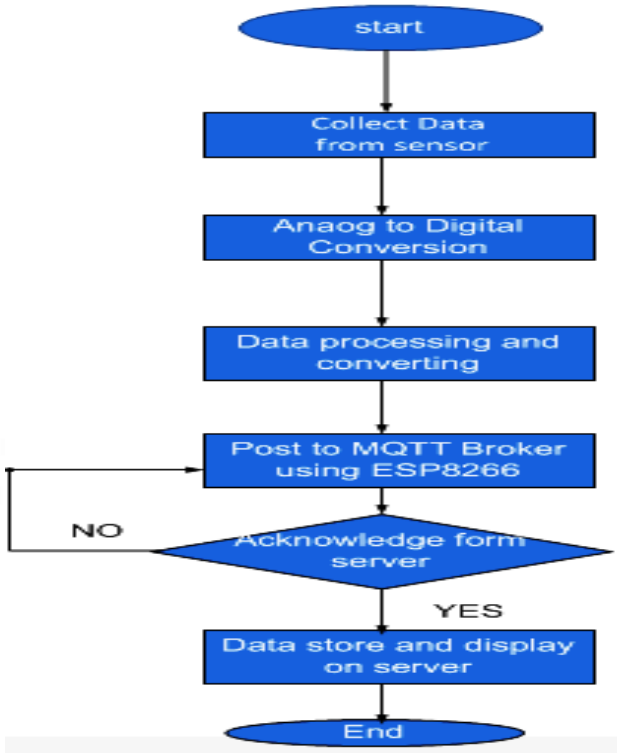

Figure 3: Overall System Architecture

Proposed System

Collected data form sensor is in Analog data format and Atmega328 microcontroller unit will fetch the data and convert it and process it into the digital format. Therefore, collected data form specific node will sent to IOT server using ESP8266.

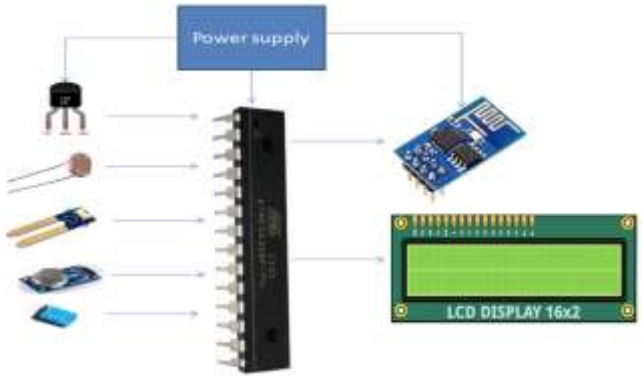

Figure 4: Node Block Diagram

The System Contain Following Component:

1.ATmega328 AVR microcontroller	2.Power Supply	3. Adjustable Voltage Regulator using LM117
4. 16 MHz Crystal Capacitor	5. Push Button Switch	6. 16*2 LCD Display
7. LED	8. LDR	9. DHT11
10.Soil moisture sensors	11.LM35	12.MQ-7 Gas sensor

System Block Diagram

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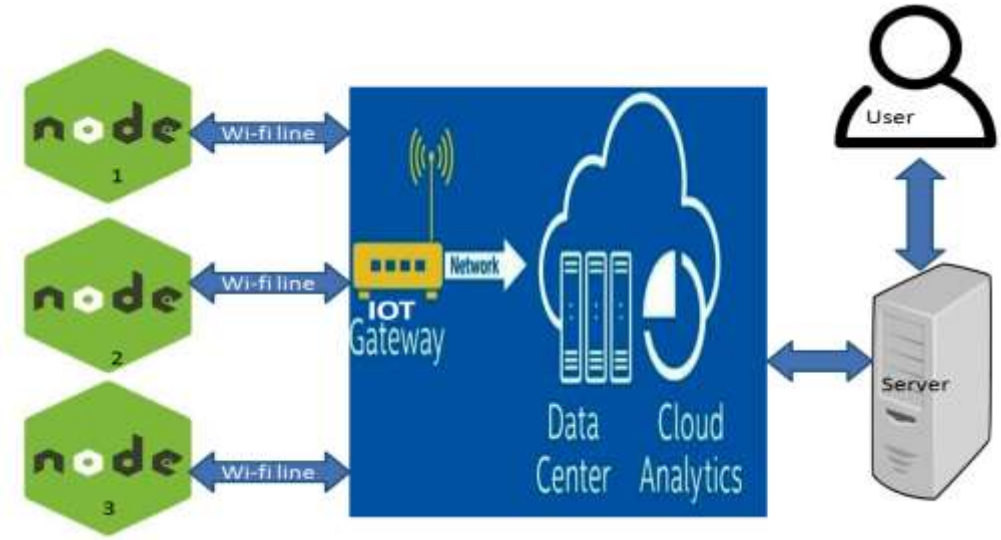

Figure 5: System Block Diagram

IV. CONCLUSIONS

In this project has proposed IOT solution for realizing real-time web-based solution aimed for monitoring & controlling temperature, ambient light inside green house respectively, humidity, and soil moisture values in the agricultural drying process. The focus was on reliable delivery of data from sensors to end user devices using broker-based publish/subscribe messaging protocol MQTT, which main characteristics are low overhead, asynchronous communication, low complexity and low power. Using this protocol limitations resulting from constrained networks in rural areas are avoided. In proposed model the client producing data (publisher) sends data to the server which forwards data to end user devices. Also, the architecture of web-based application aimed at showing results collected from sensors is presented. Thus MQTT protocol is very easy to implement which provides some degree of guaranty about delivery of messages. The Ardunio facilitates good user interface and creates simple device communication using MQTT protocol. As per the requirements the more number of the peripheries can be easily integrated to the system with a little change in its core by means of which a low cost, low power consumption system can be designed and implemented.

ACKNOWLEDGMENT

I take this opportunity to convey my profound gratitude to my guide Prof. Nilesh. L. Rudani, Asst. Professor, S.K. Patel college of Engineering, Visnagar for his valuable guidance and I am thankful to all those who helped me directly or indirectly.

I would like to give my special thanks to Dr. Kehul. A. Shah, Head, Electronics and Communication Department, SPCE, Visnagar and other faculty members to provide me precious suggestions during the project. By the divine grace of god and motivation from my family, I have been able to manage the things.

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