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MQTT PROTOCOL BASED SMART HOME AUTOMATION USING ESP8266

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Abstract—
This project offers a new move toward to organize home appliances from a Developments in Internet of Things (IoT) have enabled innovations in smart home and industrial automation, providing possibilities for devices in homes to be monitored and controlled remotely. Such solutions have resulted in energy efficiency and cost savings, as appliances are monitored and controlled by small, resource constrained embedded devices. The paper presents a design of an ESP8266 Node MCU smart home solution, using Message Queuing Telemetry Transport (MQTT). The smart home solution design utilizes an MQTT mosquito broker on Arduino, a single board computer development board. A DHT 22 sensor is interfaced with the ESP8266 micro-controller to collect sensor data for temperature and humidity.

This project uses regulated 5V, 500mA power supply. Unregulated 12V DC is used for relay. 7805 three terminal voltage regulator is used for voltage regulation. Full wave bridge rectifier is used to rectify the ac output of secondary of 230/12V step down transformer.

Index Terms-- Wi-Fi, Local Area Network, Message Queening Telemetry Transport.

I. INTRODUCTION

Home automation is developing automation systems for a home, called a smart house or smart accommodation. It consists the control and automated operations of lighting, heating, ventilation, air conditioning, and safety, as well as home appliances such as washer/dryers, ovens or freezers. Wi-Fi is used for distant monitoring and control. Home appliances, when distantly monitored and controlled through the Internet, are an important component of the IOT. Current

systems generally consist of switches and sensors connected to a central hub sometimes called a "gateway" from which the system is controlled with a user interface that is interacted either with a wall-mounted terminal, mobile phone software, tablet computer or a web interface, often but not always through Internet cloud services.

As there are so many challenging vendors, there are very few worldwide accepted industry standards and the smart home space is heavily disjointed. Well known communications protocol for products include X10, Ethernet, RS-485, 6LoWPAN, Bluetooth, Zigbee and Z-Wave, or other protocols all of which are unsuited with each other. Manufacturers often put off independent implementations by maintenance of documentation and by litigation. Nowadays home and building automation systems are heavily used. On the one hand, they provide increased flexibility, especially when employed in a independent home. The automation systems which are installed in commercial buildings not only increases comfort, but also allow central control of home appliance. Hence, they contribute to an overall reduction of cost and also to energy, which is certainly a main issue now a day.

We have used MQTT server in this project to get an efficient system as it well known for its fastness, Due to it efficiency the famous social medias like facbook messenger and whatsapp messenger also using this MQTT Server. MQTT is a machine-to-machine (M2M)/"IOT" connectivity protocol. It was designed as an extremely lightweight

publish/subscribe messaging transport. It is useful for connections with remote locations where a small code footprint is required and/or network bandwidth is at a premium. Automated activity includes the A.C. to an energy saving setting when the house is vacant and get back to the normal setting when the resident is getting ready to come back.

II. RELATED WORK

Home Automation Protocols and Technologies

There is a rich variety of protocols and technologies in the field of home automation. Some of them are standard and have been designed by international institutions, while others are proprietary and have been developed by companies. In certain cases, such protocols and technologies have been designed for wired communications, while others are aimed at creating wireless systems. Each of them presents different advantages and disadvantages depending on the deployed scenario.

Home Automation Systems for Heterogeneous Networks

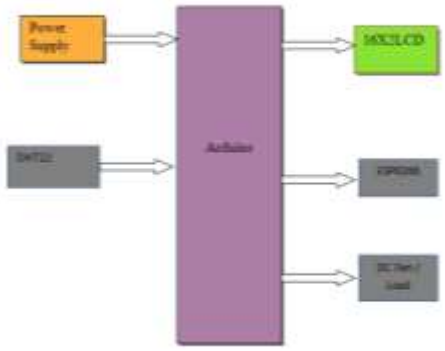
In the last few years, several academic researchers have presented a number of relevant home automation systems based on the use of multi-technology devices. For example, some authors [19] studied the problem of integrating varied wireless technologies (ZigBee, Wi-Fi, GSM/GPRS) in home automation environments. Specifically, the researchers used a LabVIEW-based PC that acted as a ZigBee coordinator for collecting data from different ambient sensors (temperature, humidity, light) and that is able to control certain actuators (e.g., lighting or irrigation). Similarly, other authors made use of a PC as ZigBee coordinator in order to create an HAS based on intelligent power outlets [41]. An example of a multi-transceiver (X10, Serial, EIB, ZigBee, Bluetooth, DTMF, CAN and GSM/GPRS/UMTS) HAS is presented in [20].

III. EXISTING METHOD

The basic concept of a smart home system is to control and monitor household appliances remotely. In [3], the authors present a laptop-based mostly wireless home automation system. The projected system consists of an associate automatic speech recognition system that identifies spoken words and converts them into text commands in MATLAB. The text commands are then transmitted to a micro-controller via a powerless RF Zigbee-based device system. The microcontroller controls the home electrical appliances via its corresponding relays. The system uses low latency ZigBee modules that are vulnerable to interference, hence signal weakening. In [4], the authors present architectures for home automation and planned a unique home automation architecture giving room to all or any of the new IoT protocols such as CoaAP, Zigbee, and Bluetooth but did not involve lightweight low bandwidth communication protocols like MQTT. In [5], the authors present a solution meant to perform home automation through SMS. A GSM network is deployed and a devices area unit is bridged employing a micro-controller and GSM module. Additionally, the solution presented focuses on security aspects within the networking and proposes a secure, reliable, and adaptable home automation system. A key downside to the proposed solution is that it requires base stations with low latency and high bandwidth.

IV. PROPOSED SYSTEM

The proposed architectural system for the NODEMCU ESP8266 smart home with MQTT. The smart home automation application would be running on the ATmega 328P controller & MQTT broker controlling various devices in real time. This architecture presents merits of being low-cost, affordable, low resource needs and open source. The proposed system design of the ESP8266 smart home using MQTT was implemented with



hardware not limited to Node MCU ESP8266 microcontroller, temperature and humidity sensor DHT22, Arduino Uno, DC fan.

Figure: Proposed System Block Diagram

The circuit schematic diagram display's step by step how to interface the DHT22 with the Node MCU ESP8266 microcontroller. The data pin of the DHT22 is connected to GPIO pin 5 (D1) of the Node MCU ESP8266. The VCC and GND of the DHT 22 are connected to the 3V3 supply voltage and GND respectively. The LED receives a signal from GPIO pin 4 (D2) of the ESP8266 board. Finally, the Arduino sketch is uploaded into the Node MCU ESP8266 microcontroller using the Arduino IDE. Figure shows the circuit schematic diagram which was used in the implementation of the prototype.

a) System Design

The intensity of light is sensed using DHT22 sensor connected to ESP8266 development board. ESP8266 development board processes the sensor data and performs actuation. It acts as a gateway for data transmission through WiFi. ESP8266 is configured as MQTT client publishing the sensor data to the MQTT broker and subscribing for the commands to control the actuation. ESP8266 module publishes the sensor data under the topic ′ esp\sense′ . It subscribes for the topic ′ esp\led′ and ′ esp\buzzer′ to receive commands to control LED and buzzer connected to the GPIOs of ESP8266. MQTT mosquitto broker is set up for ESP8266 to publish and subscribe to the application messages. Other MQTT clients such as PCs and Mobiles can connect to MQTT server through existing communication technologies such as Ethernet, 2G, 3G, WiFi etc.

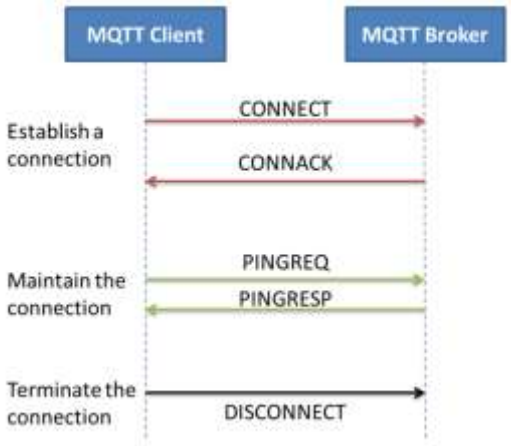


Figure: Establishing, maintaining and terminating MQTT connection

V. HARDWARE COMPONENTS

The system in this project proposes consist of consists of Embedded C, Arduino microcontroller, Temperature sensor, Moisture, Node MCU, Thing speak. The block diagram of proposed system is as follows.

VI. RESULTS

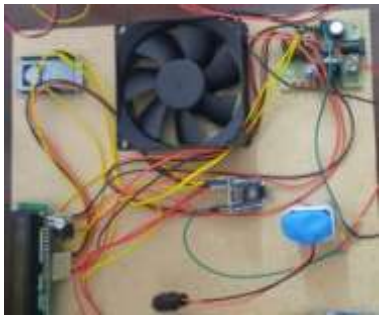


Figure: Prototype Model

VII. CONCLUSION

This project presents the design of a smart home solutions using on ESP8266 microcontroller with MQTT is presented. The smart home controls the NodeMCU ESP8266 outputs for home automation and displays sensor data on a LCD display from the sensor node made by interfacing NodeMCU ESP8266 and DHT 22 with the LED. In the design, Arduino IDE software running on Arduino and the

MQTT communication protocol facilitate communication between the NodeMCU ESP8266.

The future works of the proposed smart home system presented will involve interfacing more sensors to collect sensor data for other environmental parameters in a home setting and interfacing a lot more appliances to the sensor node to nearly the entire home setting.

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