"IOT based Home Automation and Security System"

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Abstract: With the rising power of innovation, we can finish things at a substantially faster rate. We have at the touch of a button access to large amounts of information due to the capability of computers and the Internet. Not only technology has given us more information, but also has given us the ability to communicate, organize, and manage our time. Smartphones are handheld faster processing devices that are becoming more popular as the means by which everyone manages personal information, accesses and enters corporate data, and mines the richness of the web. The aim of this paper is to design the secure Home automation system which is accessed from global position. In this proposed system raspberry pi is used as gateway between web dashboard and actual system devices as well as sensors. For faster communication point of view in this system MQTT protocol is used which access the sensors data and devices from anywhere in the world. Sensors and devices are communicating to the raspberry pi through the wired connection.

Keywords: MQTT, Raspberry pi, COAP, IOT, Home Automation.

1. INTRODUCTION

From the last decade, the home automation has seen a rapid introduction of network enabled digital devices. These technology offers new opportunities to increase the connectivity of devices for the purpose of home automation Moreover, with the rapid expansion of the Internet, there is the added potential for the remote control and monitoring of such network enabled devices. However, the adoption of home automation systems has been slow. Automation is the use of machines, control systems and information technologies to optimize productivity in the production of goods and delivery of services. Home automation is the residential extension of building automation. It is automation of the home, housework or household activity. Home automation may include centralized control of lighting, HVAC (heating, ventilation and air conditioning), appliances, security locks of gates and doors and other systems, to provide improved convenience, comfort, energy efficiency and security. Home automation for the elderly and disabled can provide increased quality of life for persons who might otherwise require caregivers or institutional care.

The popularity of home automation has been increasing greatly in recent years due to much higher affordability and simplicity through smartphone and tablet connectivity. The concept of the "Internet of Things" is associated with the popularization of home automation. A home automation system integrates electrical devices in a house with each other[1]. The techniques employed in home automation contain elements those are in building automation as well as the control of domestic activities, such as home entertainment systems, houseplant and yard watering, pet feeding, changing the ambiance "scenes" for different events (such as dinners or parties). Devices may be connected through a computer network to allow control by a personal computer, and may allow global access through the internet. This integration of information technologies with the home automation, systems and appliances are able to communicate in an integrated manner which results in convenience, energy efficiency, and safety benefits. In this given system raspberry pi is middleware between actual user interface and embedded system through the wired [2]. Other side use message queue telemetry transfer protocol (MQTT) protocol use for maintains communication between user and actual embedded system [3,4]. Raspberry pi having built in SSL layer security for data encryption. For maintaining device independence in this complete system web interface used. Here webpage are used to visualize the result and access the connected device.

2. DESIGN AND IMPLEMENTATION

Proposed system scenario we created home automation and security using raspberry pi through the MQTT protocol. Various sensors are connected to the raspberry pi through wired. Using MQTT protocol user accesses the devices and views the result. Dashboard is nothing but the web environment from where display sensor reading and access the home devices. The whole project divided into the 3 part embedded system, middleware network, web environment or dashboard.
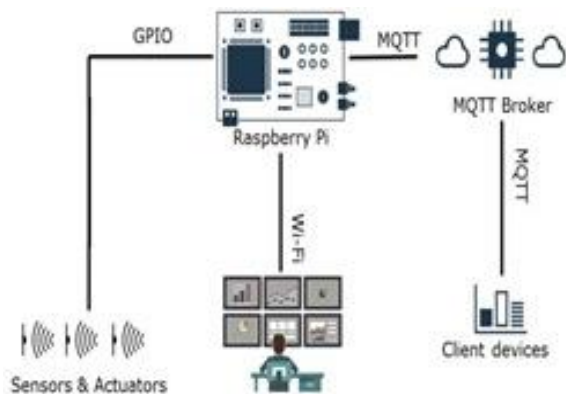
Fig.1 Home Automation Overview

Raspberry pi use as an interface between devices and web dashboard through wireless connection. In this proposed system we used temperature and humidity sensor, LPG and smoke detection sensor with alarm system, Motion detection sensors. We use relay board for connecting the actuators. Raspberry pi having built in wireless feature so user can handle the system on local connection also.

Second part of the system is network connection. For connecting and maintaining the network communication there are number of IOT protocols like HTTP, COAP and MQTT. In this proposed system we use MQTT protocol. Factors for selecting the protocol is light weight, fast, consuming less power, Security, etc. MQTT stands for Message Queue Telemetry Transfer protocol. It is specially used when low bandwidth required. MQTT is faster than HTTP and COAP. It is a machine to machine protocol.

TABLE 1 Comparison between COAP & MQTT

Factors	COAP	MQTT
Architecture	Client approach	Publish-subscribe
Bandwidth	Higher than MQTT	Low
Power consuming	less than HTTP	5 times less than COAP
Security	SSL not providing security	SSL Providing encryption

MQTT having three component publishers, Broker and Subscriber. In MQTT process receiving and sending data is secure and correct.
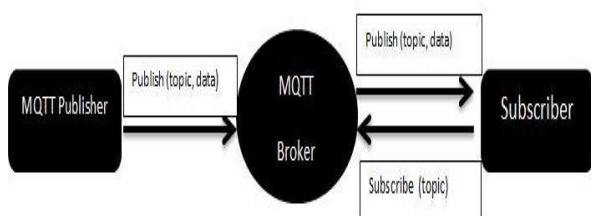
If user want check or access any information it send the request to the broker and then request pass to the publisher then publisher process and send the correct response to the broker then broker publish to the all subscriber who are subscribe the specified topic.

In MQTT Publisher publish the topic and data MQTT broker publish that data to the client which are registered that topic. In Proposed system we use mosquitto broker which publish the topic. Third part of this system is visualizing the data for considering the device independency factor we use web environment. We create web dashboard from where user can access the devices and sensors status. HTML, CSS, JavaScript, AJAX are used to build the web dashboard. The MQTT customer speaks with each other through the MQTT merchant. The work of MQTT specialist is forward the to all the customer aside from distributer of the message. In MQTT, to send the message there is have to make a theme and after that distribute message utilizing that subject. MQTT representative forward these messages to just those customers who subscribed to that point. In our venture, we are utilizing Paho-python library to distribute the sensor's perusing and gets charges from web Application. What's more, utilizing, JavaScript MQTT customer library to subscribe MQTT subject on Web Application.

3. METHODOLOGY

Aim of the proposed system is to access the home devices and sensors status from any corner of the world using secure protocol suit. The raspberry pi act as a gateway in between devices and user interface. Raspberry control the complete system all sensors status monitoring by raspberry pi and give update about the home environment using temperature and humidity sensors same as motion detector detect the motion and manage the devices automatically. In proposed system user also access devices using local network. MQTT protocol maintain the connection between actual system to the web dashboard.
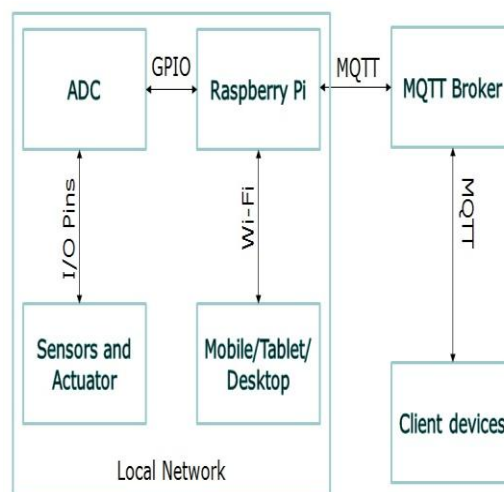

Fig.2 MQTT Architecture

Fig.3. Home Automation Architecture

Raspberry pi act as an computer which is connected to the home network connection and update the sensors status on dashboard. In this system we used DHT11 type temperature & humidity sensor, MQ-2 gas sensor, HC-SR501 PIR sensor, 5mp camera for designing secure home environment.

4. SOFTWARE AND HARDWARE SPECIFICATION

I. Raspberry pi
In proposed system we use raspberry pi 3 B module which having built in WiFi, Bluetooth, SSL layer security with 1GB DDR2 type RAM and 1.2GHz Quad-Core processor. It support USB and Ethernet Connection. It used Raspbian OS.

II. Sensors

A.   DHT11 –temperature & humidity
This sensor used for checking environment temperature as well as humidity. It works on 3 to 5V power supply. This sensor measure the air and generate the digital signal and send through the data pin. It having 4 pins VCC, ground, data pin and no connection.

B.   MQ-2 gas sensor
Gas sensor used for security purpose MQ-2 type sensor having total 6 pins it works on 5v power supply. It generate analog output.

C.   HC-SR501 PIR sensor
It is a passive infrared or motion detector which work on 5v to 20v DC power supply. It detecting the motion in between 3 to 7m.

D.   Raspberry pi camera board
It is a 5mp camera resolution with 2592*1944pixel static image and 1080p video capturing. The camera is only able to capture the image and video.

III. Programming language
Python is very much popular language. In proposed system sensors monitoring and reading the status we used python programming language because it is an powerfull, Multipurpose, easy to use as well as Inbuilt in raspbian OS.

IV. Scripting Languages:
For making interactive user interface we used several scripting technology like HTML, CSS, Javascript, MQTT.

V. LIGHTTPD Server:
LIGHTTPD is a open source web server. In this system we use this server to run the web portal. It having low memory footprint, faster response, secured and effective management of CPU load. It support PHP, Python, Perl, Ruby, Lua languages.

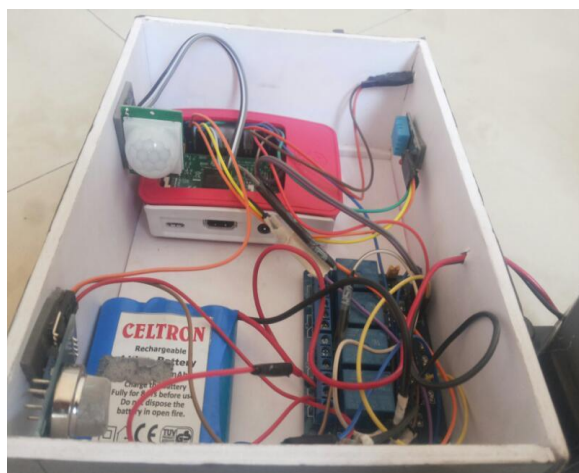## 5. EXPERIMENTAL SETUP

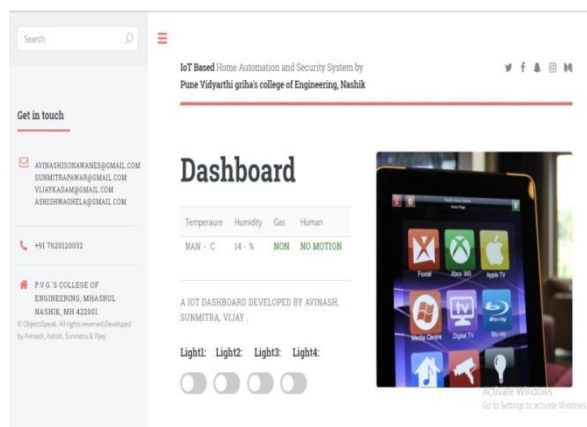Fig.4. Model of automation

Fig.5. Sensors and Actuator

Fig.6. Operating Dashboard

6. CONCLUSION

In this given research we have try to connected the simply human life to smarter technical world. we have design the

secure and fast access and responsive home automation system which is access by global position as well as we design web GUI for maintaining platform independence and run on low configuration. MQTT protocol more better and secure than the other protocol like COAP, HTTP etc. This proposed system we use and deploying in number of other areas which is covered in IOT. We have try to overcome the dis-advantages related IOTTechnology.

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