Digital Door Lock System using MQTT on ESP8266

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Abstract:
A review on the home automation system used in IoT and its drawbacks based on the literature survey conducted. Embedded operating systems have been an important part of today’s mobile world. Home automation is considered to be an important part of the near future. Here we are going to devise a firmware which will basically be dedicated to the applications of home automation in the field of security. For this purpose we are going to use a microcontroller, ESP8266 manufactured by Espressif. This microcontroller is Wi-fi enabled and will thus contribute to our goal of a wireless security application. For the software part we’re going to use the Standard Development Kit (SDK) that is provided with the microcontroller. This SDK will use C/C++. We will not be using any standard software that will be given with the microcontroller, but instead we plan on writing the software right from scratch. The firmware that we will write for the microcontroller will have a primary goal of supporting the MQTT (Message Queue Telemetry Transport) protocol, which is a protocol used in the Internet of Things, and thus can be conducive to creating the security application using the firmware that we write. For this purpose we will be using the basic MQTT libraries and brokers.

Keywords: IoT (Internet of Things), ESP8266, MQTT Protocol, Mosquito Broker

I. INTRODUCTION

Home Automation has been an emerging technology in the field of Internet of Things (IoT). It is used in many aspects of everyday life. It has a wide variety of applications that aim at automating the everyday activities to make a person’s life easier. Some of these applications include home assistants, smart washing machines, smart plugs, android bulbs. Amongst these applications, automated home security is an emerging field. This is a popular field because of its extreme flexibility, heterogeneity and cost effectiveness. Research is being conducted in this field by many individuals. To improve home security, we are employing the use of wireless technology. Keeping all these things in mind, we aim at building a system which aims at providing wireless home security employing an alarm system. Nowadays, inexpensive home security measures are becoming popular. For this reason we aim at building a system which employs inexpensive and easily available apparatus. This, combined with our lightweight components will make a fault tolerant and flexible system...

II. HISTORY & BACKGROUND

The Various technology have been developed in the field of Internet Of Things (IOT) for providing security, automation to the devices used in day to day life to make is easier for consumer.[1] Many related work have been found during the project work where various application have been built for security purpose like using connection between mobile devices using Bluetooth as medium of data exchange, controlling door lock system using short range mobile application.[2] Image recognition for face verification, speech control electronic devices.[2] The purpose of using mobile application because mobile is a device available with every individual and works as a personal assistant which can be useful in providing notification to the user in short time and immediate actions can be taken by user. During survey, some applications were developed to use image recognition for opening and closing the door based on the image recognition. Some papers also used speech processing for detecting that a particular user is familiar or stranger. The majority of papers found using Bluetooth as a medium because of the short range, cost efficient and difficult to access by external agent because attacker needs to be in the short range of Bluetooth. Message Encryption was the major problem found in the IoT system application. This may be the cause of easy access to the system using which the attacker gains control of the whole system. Implementing encryption on messages transmitted over network will help us in preventing any unauthorized access to message which contains confidential data or keys, authentication messages. It has been found that due to lack of authentication the attacker can easily intercept the messages sent over internet and can monitor the packets. This unfortunately provides leak to the necessary data. Using embedded system is the major purpose in this security system because we need a dedicated system whose sole purpose should be providing security to the door lock system. [4] ESP8266 has customized firmware which can be flashed and user can develop as per his/her requirement. ESP 8266 comes with built in Wi-Fi that helps user to access it within the limited range of system and very difficult for outside personal to gain access to it.

III. AN OVERVIEW OF HOMESecurity MODEL

Based on available solutions and research work carried over the years in the field of home security. As the figure below shows that the block diagram contains two major input which is authorized entry and unauthorized entry.
The system detects any movement using sensors and informs the microcontroller which enables alarm system. Various devices can be connected to this system so that centrally controlled security system can be implemented. But since the processing of microcontroller is very much limited as compared to actual computers, it becomes difficult to provide services to all the processes effectively.

IV. PROPOSED DOOR LOCK SYSTEM

The flowchart below describes about the flow of execution of the system. The proposed system has many advantages. Firstly it has replaced the traditional HTTP protocol with MQTT protocol. Also the proposed system has been implemented with customized firmware on ESP8266 which has option of using any other available firmware. Whenever any user get entry inside the house, the system starts the timer alarm, during which the user has to enter the key which is authenticated. If the person fails to provide the key to the system, then the system starts alarming and a notification is sent to the owners regarding the breach. [3] The purpose of using a mosquito broker because the broker acts like a router which accepts all the MQTT protocol transmitted packets, filter out unnecessary packet header and transmit. The MQTT server is helps to transfer messages between MQTT clients and server hosted. The notification provided to the user can be using system generated message or any application used in android/ios smart phones. The proposed system will be developed using C/C++ language due to easy handling of message stacks and has built in library for MQTT protocol and availability of limited storage.[3] The communication between ESP8266 and reed switch is using WiFi because of the limited range of WiFi which has the advantage of short range.

Figure 1. Block Diagram of proposed solution

Figure 2. Flowchart of system execution
**V. MQTT PROTOCOL**

MQTT is Message Queuing Telemetry Transport protocol. It uses TCP transport layer protocol to send the messages over the network. MQTT protocol is a broker based pub/sub protocol. Broker is a main part of the protocol which contains topics. Each client can be a publisher that send message to the broker to a specific topic and subscriber that receive automatic message every time. Server has to publish data and client has to subscribe the particular topic to get that data. Now if client side has two devices like laptop and mobile phone and both have subscribed temperature topic then whatever the data of temperature sensed that sends through broker to these two devices.

**VI. MOSQUITTO BROKER**

The counterpart to a MQTT client is the MQTT broker, which is the heart of any publish/subscribe protocol. Depending on the concrete implementation, a broker can handle up to thousands of concurrently connected MQTT clients. The broker is primarily responsible for receiving all messages, filtering them, decide who is interested in it and then sending the message to all subscribed clients. It also holds the session of all persisted clients including subscriptions and missed messages. Another responsibility of the broker is the authentication and authorization of clients. And at most of the times a broker is also extensible, which allows to easily integrate custom authentication, authorization and integration into backend systems. Especially the integration is an important aspect, because often the broker is the component, which is directly exposed on the internet and handles a lot of clients and then passes messages along to downstream analyzing and processing systems.

**VII. FUTURE SCOPE**

The proposed solution is designed based on the present condition the problems faced in home security currently. The next step for improvising the system would to provide high level encryption to the packets transmitted over the IoT. Also replacing key authentication by speech authentication which would require high level of speech processing. Today’s mobile application implements face detection in various camera application, using this technology we can develop application which takes image and send it to the ESP which detects person as valid or invalid and report to the owner of the house. Such technology is expected in coming future. Iot has been a developing technology and not only in home automation but further development is expected in IoT market.

**VIII. CONCLUSION**

Today’s growing technology in field of IoT has resulted in need of an efficient system for home security and also considering the demand of end consumer and manufacturer, we have implemented the system which is very much fast, cost effective in terms of hardware and development cost. In this paper we have tried to implement ESP8266 with MQTT protocol in Internet of Things (IoT) to provide security to user. The implementation is based on user convenience and to overcome some of the drawbacks of the previous existing digital door lock systems.