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Home Automation System using Android Application

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ABSTRACT

Automation of the surrounding environment of modern-day human beings puts forward an efficient yet user effective way of increasing productivity and reducing time consumption. This project aims to achieve a simple model of a home automation system, that aims to interact with the surrounding electrical appliances in one's house with the help of a mobile application. The main interactions will be catered using an MQTT broker, with the addition that the server processes itself will be taken care of, using Raspberry pi.

Keywords- Home-automation, Raspberry Pi, mobile application, Appliance

I. Introduction

Given the differences between the current times and the scenario about a decade ago, we can unanimously agree that technology has taken a front seat in intervening with human-lifestyle making it ever so comfortable and convenient. Having that information in hindsight we can presume that today's homes require sophisticated control paired with ease of use and high security. This fact has definitely revolutionized the sector of home automation in trying to come up with creative yet simple to user interfaces between humans and appliances. Utilizing this opportunity of automated household tasks, mobile phones (a commonly found commodity within most homes) have entered the picture. With a very simple interface and use of local network connecting appliances within the house, these can be used as a tool to move a step forward in this direction.

II LITERATURE REVIEW

1. Home automation usingXBee

A system proposition which is specialized for pre-existing houses despite of its eligibility to be extended to new houses. The main idea is that the target persons, particularly the elderly, are living at home most of the time. Since the end users are constantly residing in their dwelling, the web server mode and the GSM mode aren't efficient while the conventional Bluetooth system that operates at 10m may not cover all the domicile area. The concept of this project is to use wireless communication using Xbee. Transceivers that achieve the total control between the remote-control tool and the master main board. The latter is based on microcontroller commanding relays that toggle the current states of the appliance's switches [1]

2. Communication Using RaspberryPi

The Raspberry Pi's Ethernet port is main gateway for communication with other devices. It is auto-sensing which means that it may be connected to a router or directly to another computer (without the need for a crossover cable) [5, 6]. The model B has a standard RJ45 Ethernetportwhilemodel Adoesn't,butcanbeconnected to a wired network by an USB Ethernet adapter. USB Ethernet adapter has two-speed mode, 10 Mb/s and 100 Mb/s(TableIV).Withacableconnected,theRaspberryPi willautomaticallyreceivethedetailsitneedstoaccessthe Internet when it loads its operating system through the Dynamic Host Configuration Protocol(DHCP).[2]

3. Secured Hashingalgorithm

In cryptography, SHA-1 is a cryptographic hash function planned by the National Security Agency and made available by the NIST as a U.S. Federal data Processing Standard. SHA stands for "secure hash algorithm". The three SHA algorithms are designed in a different way and are well-known as SHA0, SHA1, and SHA2. SHA-1 is very similar to SHA-0, but corrects the fault in the original SHA hash specification that led to important weaknesses. The SHA-0 algorithm was not implemented by many applications. On the other hand, SHA-2 significantly differs from the SHA-1. SHA-1 is the very often used of the existing SHA hash functions, and is working in several widely-used security applications and protocols [3]

4. Message Queue Telemetry Transport(MQTT)

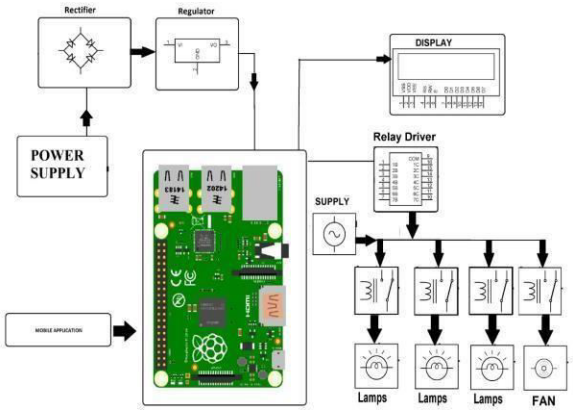
Message Queue Telemetry Transport (MQTT) is a Machine-to-Machine (M2M) / "Internet of Things" connectivity protocol. MQTT is selected because it is a lightweight messaging protocol. MQTT send and receive messages in a very small size. MQTT use publish and subscribe concept to send and receive message, it is client and server based. Server which is better known as the broker receives a message from a client, it can be data message publish or subscribe. MQTT is not a new protocol, created by Dr. Andy Stanford-Clark from IBM and Arlen Nipper from Arcom (now Eurotech) in 1999 [4]

III IMPLEMENTATION

Our proposed project aims to simplify the process of automating the household using a user-friendly mobile application. With the wide range of technological implementations that we have discussed previously, we can observe a pattern with the already present models. As mentioned,homeautomationsystemspredominantlywork with a very tedious user interface which not only affects the quality of usage for many people, added with the fact that many of these systems run via a web application proves as a tedious task due to the lack of portability and grueling difficulty prompting many users to avoid using thisautomationsystem.Assemblingconclusionsfromsuch a dataset we, through this project have tried to make a mobile application catering to these inconveniences, thus making it more user friendly with an interactiveGUI.

The pedestal of this project, stands on implementing a simple home automation system using Node MCU board and integrating with Raspberry Pi. The Node MCU board servesasthebasicconnectinginterfacebetweentheserver, user and the appliances. An effective communication between all the three being is established using the MQTT messaging protocol. This effectively is a publishes-subscriber type of message relaying protocol that fits perfectly for this system implementation. This protocol is mainly dominated by the subscribers (who subscribe to certain topics) and publishers, who essentially are the resources for the information (topics). The information is relayed between them using a broker who acts as a mediator for effective communication. For the ease of implementation,wehereuseRaspberryPiinitsownasthe brokerprovidingitasaneffectivemediatorforinformation transfer.

The devices are equipped to be smart devices that are detectable to other devices when connected over a local network. Taking into account that most homes have a Wi-Fi router for general use, we can utilize this to our advantage. During the process of implementation, we set our local network to be this Wi-Fi since any device set within a reasonable distance from the router, in the house can access it. After the initial connection between our mobile application and the smart device has been set up, we can easily use this to control these devices.



Architectural design

LIST OF MODULES

Our proposed system is made up of these following modules:

Module 1: User authentication
Module 2: Setting up the network
Module 3: Setting up rooms
Module 4: Scope
- 4.1 Addingrooms
- 4.2 Adding childdevices
- 4.3 Interrupt handling using priority handling

MODULE 1: USERAUTHENTICATION

The project, as mentioned above makes use of a mobile application for device handling and all other functionalities. However, also means that higher levels of security measures must be taken against any breaches. Thus, to comply with safety procedures and requirements, the user is asked to make an account using credentials (either over Google, Facebook or providing a username / phone number and password credentials). Upon receiving this request, the server automatically reads the external IP address (mapped to the Wi-Fi router) and also provides a 16-digit authentication key to the user. These above measures are provided to make sure only authenticated users can access this application and control for the household devices, protecting against any possible theft or burglary.

MODULE 2: SETTING UP A NETWORK AND DEVICE

The domain of this home automation system spans over the scope of the house currently being occupied by the user. Since this project runs on a more local network level, we make use of a common Wi-Fi router network for setting up the initial system. The user at the time of user authentication provides an external IP address mapped to the Wi-Fi router. This is taken as a default local network for the detection of the devices. Every smart device (lights, fans, air conditioners, fridge, etc.) must be connected to this common Wi-Fi network to be detected. During the initial set-up, the devices after being connected over Wi-Fi are set into a discoverable mode, which means the mobile application will be able to detect the presence of this device (in the same manner as a device being detected over a Bluetooth network for pairing) and thus be able to establish a connection. Once connected, the device remains connected regardless and in case the mobile application gets disconnected when leaving the premises of the house, the device will just automatically get connected to the same, once the Wi-Fi is re-connected automatically when entering back into the range of therouter.

MODULE 3: SETTING UP ROOMS

In this project implementation we move ahead to see that the application, in its current stage provides an existent household structure with 4 rooms. The rooms namely living room, kitchen, bedroom and dining room are mapped to a room id for identification purposes. Once a room has been chosen by the user for setup purposes, they can map and connect individual electrical smart devices over local network. In this manner, every device will not only be identifiable and accessible using a unique device ID, it will also be accessible using a room ID. This allows the user to perform mass functions, including turning off/on all the devices all together and not have to independently control every action. An added feature to this, is that it allows the user to exactly know which particular room, does an appliance belong to and thus take appropriate measures even when they are present in different room.

MODULE 4.1: ADDING ROOMS

This module in the future prospect, when implemented would deal with the additional features of allowing the user to add other rooms to the structure than just the ones that are provided in the basic mobile application. A user would be able to customize their home automation system accordingly to their desires and would no longer need to conform to the original basic layout plan. Each room, once added and confirmed will be given a unique room ID, that will be mapped to all the internal devices within the room. This not only makes it more user friendly but more accessible in the practical world since, no home is alike. It would give them more control over the setup and make it more efficient and structured. In its due coursethe project may be able to expand on the possibilities on providing a graphic layout of the room set up making it more adaptable to people who prefer having a more visual GUI.

MODULE 4.2: SETTING UP CHILD DEVICES

Another feature that can be sought out is, having varying levels of access and administration to provide effortless implementation. Taking into account that most families consist of not just one person, it seems to be tedious if another family member would have to go and acquire the main user's mobile phone to access and control devices within a certain room. This can be handled by dividing the levels of access, namely into a parent and child. The user who would set up the initial home automation system would be, by default named and categorized as the parent. Once a parent authentication has been set up, the parent user would then be subsequently be provided with a way to add other devices to the network, namely the child device. This can either be done using a referral method where the parent user will have a sharable link, that they can provide to the other mobile devices, which once clicked, would need to authenticated by an authentication code (temporary) sent to the parent user's mobile application, which when provided will successfully add the required device to the network.The other method that can be used would be having a QR code that is scannable by the other mobile devices. To ensure further security, the parent user gets notified every time a child user has been added to the network. In this way a secure home network could be created without any interruptions from outside interference. In any case, if a device has been added, that the parent user doesn't recognize then they can simply choose to remove the user as per convenience.

MODULE 4.3: INTERRUPT HANDLING

This particular aspect comes into question when we implement different user modules as discussed above (parent and child). In this case, even though numerous issues are resolved, it also brings forth some other issues that need to be dealt with. The major issue arises when a number of users are trying to access and control the same device with either the same or different instruction. This leads to interrupts and thus hinders the progress that was created with the addition of various level users. This issue however can be taken care of by assigning levels of priority. This can be understood in a way that if one user wishes to control a device with an instruction, and at the same time is in a conflicting scenario with another user, the server that receives these requests, compares the levels of priorities of both or all devices present within the conflicting spectrum. Then once the server has decided upon the device with higher priority, it executes the instruction pertaining to that device. This priority order will be decided upon by the parent and main user. By default, the authority and priority of the parent user is taken as the highest.

IV. CONCLUSION

In this paper, we proposed a simple yet effective and user-friendly home automation system pertaining to the interest of users allowing them to enjoy more control over their home, yet have the utmost comfortability of a seamless GUI user interface. This project aims at taking the already existing technology and expand on it by putting forward a mobile application at the user's end. The designed system provides effective communication between devices and with the user using Raspberry Pi integrated with the principles of MQTT messaging protocol. It stores and relays data in form of a publisher-subscriber platform and proves apt to be integrated with our daily lives, owing to the portability and ease. Leaving ahead a possibility of carving out a wider horizon of functionalities, this project aims to help integrate and innovate the most personal aspects of human life. With such an innovation, it aims to improve and build on the relationship linking modern technology and basic human life and patterns.

V. REFERENCES

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