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IOT Based Smart Home Monitoring System Using Raspberry Pi

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Abstract— One of the most dynamic and exciting developments in information and communication technology is the advent of the Internet of Things (IoT). Automation can make work more smart and easy. This paper is focused on five different techniques such as home automation system using software defined networking (SDN) based firewall, by using Near Field Communication (NFC), client – server based home automation system, home automation using Zigbee wireless sensor communication technique and home automation technique with real time E-metering using E-controller etc. Even though, some issues arising in every method which are critically analyzed in this paper to improve these issues. The paper has proposed a new home automation technique with the use of IOT, so as to reduce the existing problems and make home automation more smart and secure.
Keywords— Internet of Things (IOT), Home automation system

I. INTRODUCTION

IoT can be considered as a situation or time where more things are connected to internet than human beings. Things represent the physical objects which are provided with unique identification numbers and their purpose is to collect and transmit the data. The author proposed a system has been focused on five different techniques and systems such as, A software-defined networking (SDN)-based firewall platform is capable of detecting horizontal port scans [1]. Home automation using Near Field Communication (NFC) is also proposed. This NFC is used as the central system to automate home environment for a user by locking and unlocking doors, lighting, air conditioning as NFC helps in providing energy efficiency and required security [2].Client – server based home automation system involves Client-Server interaction and user gets the notification without any distance criteria, the application considered as brightness adjustment of light by connecting the client to sensor [3]. The author also proposes a system that has complete functions, low price, comfortable environment control and so on [4]. Home automation technique with real time E-metering using E-controller is proposed [5]. These systems are also used to conceive the home automation system more secure and smart.

This paper presents, Home automation by IOT in which a method is defined that uses Raspberry Pi to control and manage home appliances anytime anywhere. This system performs its task with the help of the sensors which help in controlling the state of the devices.

II. BACKGROUND

A home automation system is a technological solution that enables automating the bulk of electronic, electrical and technology-based tasks within a home. It uses a combination of hardware and software technologies that enable control and management over appliances and devices within a home. In software-defined networking (SDN)-based firewall, the platform is capable of detecting horizontal port scans. Horizontal port scans cannot be detected by a local firewall because the attacker only tries to establish one connection to each host, and can only be identified if data from multiple networks are combined [1]. NFC is used as the central system to automate home environment for a user by locking and unlocking doors, lighting, air conditioning, switching on/off fans as NFC helps in providing energy efficiency and required security [2]. In the client server based home automation system, Client-Server service and device friendly approach used in typical home automation workflow consists of 4 stages. The user environment by sensing, reporting the events to a centralized entity, centralized entity analyses and triggers the workflow, workflow will execute and update user by any interactive channels [3]. In zigbee wireless sensor network, the network in the home is used to collect the data information. The embedded home gateway is the link between the perception layer and the network layer. It is responsible for the data acquisition and processing of the perception layer [4]. Home automation with real time E-metering using E-Controller is suitable for power consumption in system and efficiency experiments with size factor. E-controller is represented by combining embedded technology with IoT [5].

Previous Work Done

Sajad Shirali-Shahreza et al (2018) [1] proposed a SDN based firewall system, in which Current SDN implementations do not provide access to packet-level information, which is essential for network security applications, due to performance limitations. The platform uses FleXight, and proposed new channel.

Vagdevi P. et al (2017) [2] proposed home automation using NFC, it is the type of remote innovation including an arrangement of conventions, which build up radio recurrence correspondence between the two gadgets inside a short closeness of 10 cm or less.

Brundha S.M.et al (2017) [3] proposed a client server based home automation method which involves Client-Server interaction and user gets the notification without any distance criteria.

Xiaobo Mao et al. (2017) [4] proposed a zigbee wireless sensor network in which ZigBee coordinator is responsible for the establishment and maintenance of the ZigBee wireless network, receiving control commands from the home gatewayand forwarding them to other ZigBee devices.

Rohit Bhilare (2015) [5] proposed an E-metering usingE-controller which is a bundle of embedded system and software stack, which is the most popular procedure for Web development using in the world . Remote login and monitoring by building a distributed Web control system build in web application.

III. EXISTING METHODOLOGIES

A. Software Defined networking based firewall:

In the proposed framework, firewall can be break down into two components: 1) the enforcer and 2) the mastermind. The enforcer is a packet processor that examines a packet and either drops it. The enforcer is simple enough that can be run on a home network gateway that connects the home to the Internet. The mastermind, is responsible for analyzing packets, identifying anomalies, and deciding how to handle them. Mastermind lies in the cloud and managed by a third party. It is represented by-

$\rho SYN = \rho FIN = 1$ and $\rho No-Rule = 0.01$ Where, ρSYN, ρFIN, $\rho No-Rule$- Sampling parameters

B. Near Field Communication based home automation system:

The circuit board has a NFC reader implanted on it. The board additionally includes a microcontroller, light sensor, temperature sensor, LCD, transfers and GSM modem. The NFC card comprises of a tag which is predefined with a one of a kind pin number or a key. The programming prerequisites include Philips Flash utility – A programming utility to peruse, compose, identify, eradicate and check BIOS chips, Keil ARM programming A programming device to fabricate implanted C program and DocLight – A re-enacting, breaking down and testing apparatus for serial correspondence.

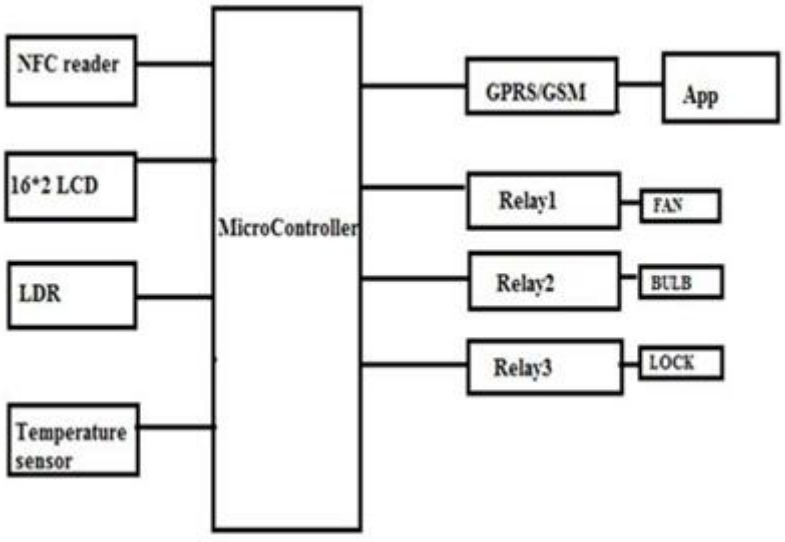

Fig 1: Block Diagram of NFC system

C. Client Server based home automation system:

1) **Client-Server Interaction:** The Client and Server are provided with internet based on SSID (service set identifier) and password, once the SSID and the password match they are active and ready to operate.
2) **Role of Host Server for Notification at user end:** When the activation happens, client makes a request to server for notification. The Host server is created with hosting official site.

3) **Role of Instapush Application:** The application need to be installed on the user mobile so during installation, authentication token is being provided. PHP files are developed by creating events in the Instapush official site.
4) **PHP files of the application:** The PHP file contain the application id, authentication id which invokes the message that need to be sent to the user.

D. Zigbee wireless sensor communication technique:

Application layer users use mobile clients (Android mobile phones, tablet PCs) or personal computers as the client, use a variety of means to access the Linux cloud server and obtain all kinds of information in the smart home. The network layer is mainly composed of Linux cloud server platform, which analyse and processes the user's home data. The perception layer relies on the ZigBee wireless sensor network in the home to collect the data information. The embedded home gateway is the link between the perception layer and the network layer.

$$x_{t+1}^{(i)} = r_1^{(i)} x_t^{(i)} (1 - x_t^{(i)})$$
$$x_{t+1}^{(i)'} = r_2^{(i)} x_t^{(i)} (1 - x_t^{(i)'})$$

Where, i - parameter shared by the server

E. E-metering using E-controller:

The system along with web application is controlling smart devices in home and also all billing features from web application working as a cloud application. According to the technology a user can login and check usage of electricity real time as well as control the devices. There are various energy provides like BEST, TATA Power, MSEB, Reliance etc. Heart of the project is Microcontroller C8051F340 which is high speed microcontroller SMD device. It contains a server which is having a web application working as a cloud application connected to the microcontroller.

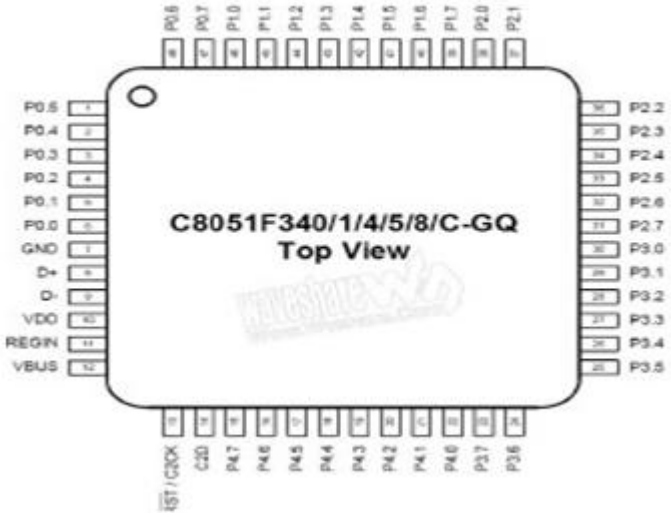

Fig 2: Pin diagram of controller

IV. ANALYSIS AND DISCUSSION

The SDN based home automation system is scalable and can be used by many home users, and provides a practical approach to implement the idea of having a remote controller helping local firewalls by aggregating data from different home networks. Horizontal port scan detection system on the real-world ISP traffic can be implemented to detect all attackers [1].

Near Field communication system operates 3 types of modes:

1. **Card emulation mode** – NFC empowered gadgets act like a contactless savvy card. Advanced cells with NFC label work in same mode and can be utilized to make payments or ticketing.
2. **Reader/Writer mode** – NFC empowered gadget as a reader peruses data from electronic labels. It begins the correspondence by producing an attractive field.
3. **Distributed mode** – Two NFC gadgets can trade information on the other hand. Each of these gadgets supports both initiator and target mode. The information trade here happens gradually because of the

administration of complex convention [2].

The Client and Server are provided with internet based on SSID (service set identifier) and password, once the SSID and the password match they are active and ready to operate, client constantly monitors the sensor value and then posts the data attained to the server. Server gets the data from different sensors. The client can request for data from server if required [3].

Zigbee wireless sensor communication technique uses the Z-stack protocol stack, and the version number is zstack- cc2530-2.5.1a. It is a concrete implementation of the ZigBee protocol, and only needs to use the underlying code to write it in the application layer. The user makes multitasking programming through invoking the coherent osal provided by the API [4].

The system along with web application is controlling smart devices in home and also all billing features from web application working as a cloud application. The main purpose of the project is to design energy consumption meter and control, monitor system for all service providers. A user can login and check usage of electricity and control the home appliances.

Proposed Methods and Techniques	**Contents**	
	Advantages	**Disadvantages**
Software defined networking based technique	It does not need any additional device, as it only needs a home gateway that supports FleXam.	It will have minimal impact in terms of bandwidth.
Using Near Field Communication	The system provides usability, adaptability, also more security and safety.	The system crashes due to any damage in interconnection.
Client-Server based home Automation	Facial features of the detected face are compared with the trained images in the database.	Compatibility problem in which controlling all aspects of home automation from one centralized platform is important, but not all systems are compatible with one another.
Zigbee wireless sensor communication technique	The system increases human-computer interaction and comfort monitoring of the devices.	It system is poor and the user's comfort is not much consideration.
Real time E-metering using E- controller	System provides comfort and efficiency to the consumers.	System is able to eliminate the serial communication in case of any difficult situation.

TABLE 1: Comparison between different schemes

IV. PROPOSED METHODOLOGY

IoT stands for Internet of Things, which means accessing and controlling daily usable equipments and devices using Internet. The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. The proposed method consists of Raspberry pi which has inbuilt camera and USB ports for connecting various devices. SD card has been inserted for storing the results. Power supply is provided to the Raspberry Pi through the micro USB port of the device. The I/O devices such as Keyboard, Mouse, and Monitor are connected to the Raspberry Pi using an USB ports for performing different operations. The proposed system also consists of Driver Motor, Wi-Fi module and various sensors connected to it. Relay Driver, Fire sensor, PIR sensors and Buzzer can be connected to the Raspberry Pi. The whole system can be composed of two parts: Client and Server. Here, server is the web interface, consisting of Buttons and User interface that will allow you to put on various devices ON or OFF. It consists of PHP file, HTML files and .txt file to store the data. The server usually stores information regarding the button press on the page held on .txt file. The client side consists of Raspberry Pi with a relay circuit and driver motor. The system works on client server connection and interaction. The system has Wi-Fi module which acts as an interface between the client and the server. The server contains the Buttons which can be controlled by the client with the help of Wi-Fi module and the Web based app. The Web based app or Android app can be designed as per the

requirement. The module contains UI which is responsible for the control of the model. The client will provide the operations to be performed by the Wi-Fi module and the server will perform the specified operations. Various sensors are connected that are required for performing various operations. Relay driver is connected to Raspberry Pi which is responsible for controlling the status of the doors, whether the door is open or close. Camera connected to the Raspberry Pi can detect the motion with the help of PIR motion sensor. Fire sensor is also installed due to which the problem of fire can be resolved by turning it ON. A Buzzer is provided for audio and other operations. In this way the Home Automation can be performed using Raspberry Pi.

Diagrammatic representation of proposed method is shown as follows:

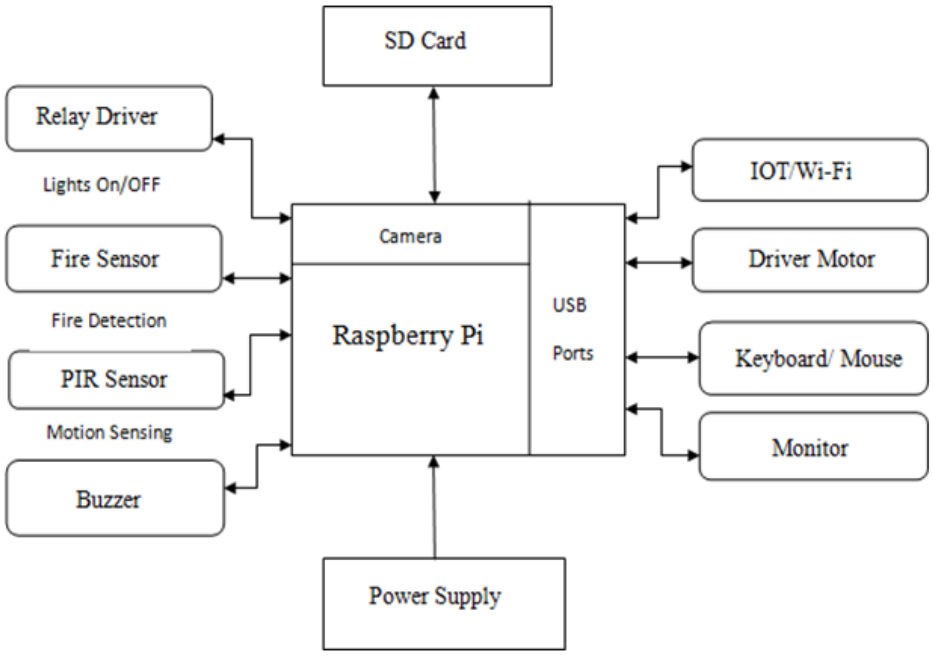

Fig 4: Flowchart of proposed method

V. ACKNOLEDGMENT AND POSSIBKLE PRSULT

Home automation is Automation technology which makes the work more efficient in all views related to home. The proposed method gives a low cost solution and Home automation done using IOT system which uses cell phone devices to control and analyse the basic home functions and features automatically through online.

VI. CONCLUSION

The paper has analysed the five different techniques such as SDN based home automation system, Home automation by Near Field Communication technique, client-server basedhome automation system, Homeautomation system using Zigbee wireless sensor communication technique, Home automation by real time E-metering. The unsolved issues of these methods are focused in the system. The proposed method help to solve the problems related to home automation at lower cost considering the above unsolved issues.

VII. FUTURE SCOPE

From observations of the proposed method the future work will include the implementation of the home automation system using IOT. Afterwards the system may include smart parking and also the use of Artificial Intelligence can be done.

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