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Security aware Intelligent Automation Using Internet of Things (IOT)

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Abstract: The IoT provide felicitous way out for a wide range of applications. Iot has the abeyant to reduce device downtime through remote provision. Internet of Things played a very important role to connect the physical and virtual objects or things based on existing and evolving interoperability information and communication technology in the world. Today it is the most thrust area of research. As we know the term invented by Kevin Asthon, many applications like smart health, smart grid, smart automobiles, smart industries are of IoT. This paper explains on security and privacy of IoT with their different characteristics.. Many algorithms have already been proposed and implemented for the security and privacy of data in IoT. This paper proposes an algorithm for security what make sense out of data analytics and visualization. The IoT can correctly identify peak times for instilling supplies for various devices for their smooth and continuous operation.

Keywords: Internet of things, security, network, sensor, privacy.

1. Introduction

The Internet of things is the global infrastructure for information society. It is the practical perspective which meets all the requirements to us. According to Wikipedia IoT is defined as "It is the network of devices such as vehicles, and home appliances that contain electronics , software, actuators and connectivity which allow these things to connect , interact and exchange data. Many researchers has given different and broad definitions of Internet of things. Iot devices used energy harvested batteries. Sensors and Actuators are the pillars of IoT. Sensors are physical devices which converts the energy and actuators are working in the reverse direction of a sensor. It takes electrical input into physical action like electric motor a hydraulic system and pneumatic systems. There are different types of sensors and actuators depending upon the working of environment. Sensors in Iot which sense something from environment, also analog by nature. Huge amount of data generates from the sensors. The paradigm of IoT is in different blocks i.e. Iot devices, Gateway, Edge devices. Edge devices has to be more bigger than Gateway and used to remove the duplicate data also gateway devices might be in proper proportion. Gateway often may not be good choice to send data to Internet.

2. Security and integrity are the key issues in Internet of Things (IoT)

Security and integrity are the key issues in Internet of Things (IoT) which is still the domain of research as number of interconnecting devices are increasing.

- The IoT devices needs to be equipped with the secured and higher strength based key exchange so that the overall communication can be trust aware.
- There is need to intend and implement the algorithms for higher security and dynamic key exchange in IoT infrastructure.
- The multi-level hybrid key based algorithms can be used to impose the higher degree of integrity and security in IoT.

S.N.	Security Requirements	Security Challenges
1	Confidentiality	COMPUTATIONAL LIMITATIONS
2	Authentication	MEMORY LIMITATIONS
3	Integrity	ENERGY LIMITATIONS
4	Broad network access	DYNAMIC SECURITY UPDATES
5	Data Freshness	TAMPER-RESISTANT PACKAGES
6	Self Healing	MOBILITY
7	Fault Tolerance	SCALABILITY
8	Resiliency	COMMUNICATIONS MEDIA
9	Authorization	THE MULTIPLICITY OF DEVICES
10	Non-Repudiation	A DYNAMIC NETWORK TOPOLOGY
11	Availability	A MULTI-PROTOCOL NETWORK

Table 1 Security Requirements and Challenges of Internet of Things

The IoT communication can be made secure and trust aware with the implementation of multilevel hybrid key exchange using hash functions and self-devised algorithms.

2.1 Introduction

Appliance automation is one of the significant developing advances that can change the way people live in the world [1]. The appliance automation has enhanced the quality of people's life by allowing clients to have a comfortable lifestyle [2]. In the past, controlling of the appliances was done using computers with internet, which was bulky and had no mobility [3]. Most of the appliance automation systems available in market use different wireless communication like Bluetooth, Zigbee, Wi-Fi and Global System for Mobile Communication (GSM) [4]. The appliances can be turned on/off using a remote control instead of going to the switchboard. In Appliances control, the person uses the mobile phone keypad buttons to control the appliances using Dual Tone Multi-Frequency. Also, control of appliances can be done from a remote area using radio frequency or Internet [5].

The internet of things (IoT) is the system that enables the devices to communicate, monitor and control remotely over any network [6]. Smartphones are perfect in giving a user interface in appliance automation system, because of their mobility and their extensive variety of capabilities. Within the house, offices or industries, the user might not want to go to a central control panel, or not even to the laptop, but use the phone that is usually placed in close proximity to the user. When far from these places, the user might want to monitor the appliances or even turn on or off each appliance before reaching to his home or office [7],[8].

Related Work

A lot of research work is carried out in Appliance Automation which is discussed below. PIC remote-controlled device using a telephone to control appliances was designed in [9]. This system did not support wireless technology. Bluetooth based Home automation was developed in [7], but the system did not support mobile technology and was controlled within few meters. Wireless Zigbee Home Automation system was designed in [8]

using 89C51 microcontroller and H2007 as the voice recognition unit. And this system was used to compare different voice commands stored in the controller to control the appliances at a short distance. Home Automation system using GSM was designed in [10]. This system worked on Arduino Uno for controlling the appliances through relays with GSM technology. SMS based control for monitoring systems was designed and implemented in [11], [12] using a microcontroller and a GPRS modem. This system is costly for the client as it becomes costly to communicate using SMS. Home Automation using Raspberry Pi was developed in [13], [14], [15] to interface with the external world. They utilized Webiopi which is a web application to control the Raspberry Pi's (General Purpose Input Output) GPIO. The control of appliances was within the network and provided high security and did not support voice mode.

Many varieties of appliance automation systems are available, the current system has got a number of restrictions. As of now, appliance automation systems are executed with a lot of hardware. The establishment and support of the present system is a troublesome task. It likewise forces an enormous establishment cost on the client. In most of the appliance automation, Control of appliances was within the network, close proximity or in form of SMS. Also, only one mode was available to clients to control the appliances. In this paper, we have designed and developed a Wireless browser to control and monitor the appliances using Raspberry Pi 3 in two modes namely touch mode and voice mode within the home network or anywhere in the world. We have developed a webpage for touch mode and voice mode so that users can control the electrical appliances through a smartphone over the internet. Also, the appliances can be turned on or off automatically depending on the conditions set by the client.

Hardware Description

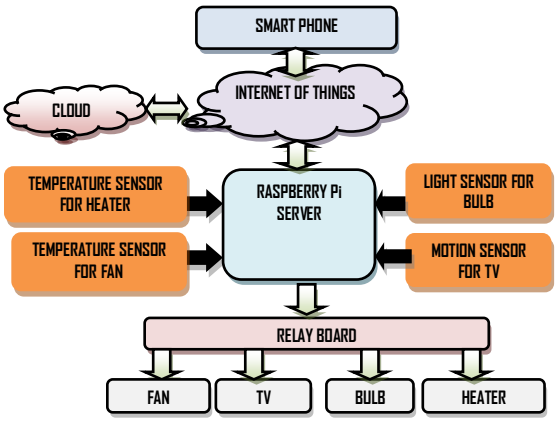

Fig 1: Block Diagram of IoT Based Appliance Automation Using Raspberry Pi

The model is designed using Raspberry Pi 3 with relay boards, sensors, and appliances as hardware components. Raspberry Pi GPIO Pins can be controlled via smartphone using the technology called the Internet of Things (IoT) using HTML and Python programs. The controls are transmitted from smartphone wirelessly to the Raspberry Pi GPIO Pins which are further processed and given to appropriate appliances via relay boards. A login page would be provided for only the authorized users to have access to the webpage. The web interface has buttons assigned to the user through which the appliances can be controlled individually. Also, if the user desires to use voice mode he can further choose the voice commands to control the appliances. Also, the appliances will automatically turn on or off depending on the conditions set by the user using sensors which are discussed below.

A. Circuit Diagram of Iot based Appliance Automation

The circuit diagram consists of a Raspberry Pi 3, 8-bit relay board along with four appliances. Raspberry Pi is interfaced to the external world by using Webiopi, which is a web application that allows controlling the Raspberry Pi's GPIO. The relay board is connected to GPIO Pins of Raspberry Pi 3 (Pin 4 for TV, Pin 17 for the fan, Pin 22 for the bulb, Pin 27 for heater), Pin 2 to 5V and Pin 6 to gnd. The appliances are connected to the

output of the relay board. The power required by the relay to turn on the appliances is fed by an external power source (220V-240V at 50Hz). The Raspberry Pi acts as a server to receive inputs from users via webpage using webiopi and accordingly gives outputs to the relay board to turn on or turn off the appliances. Also, there is additional Pin 25 & Pin 24 which controls the turn on and off of all appliances using a single button that is available on the webpage. The relay used is an active low relay, which turns on the appliances when logic 0 and turns off the appliances when logic 1.

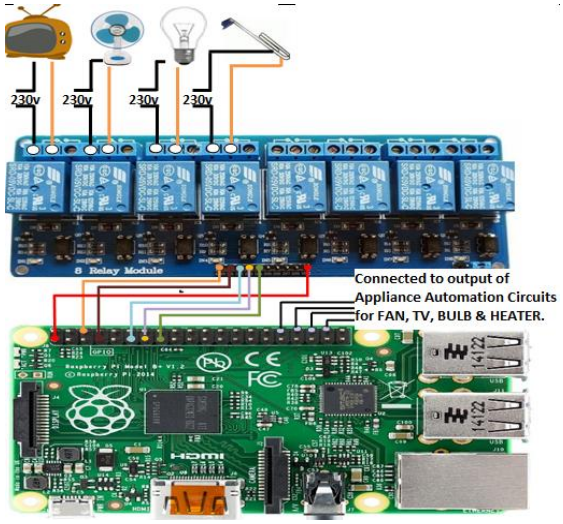

Fig 2: Circuit diagram of IoT Based Appliance Automation Using Raspberry Pi

Software Description

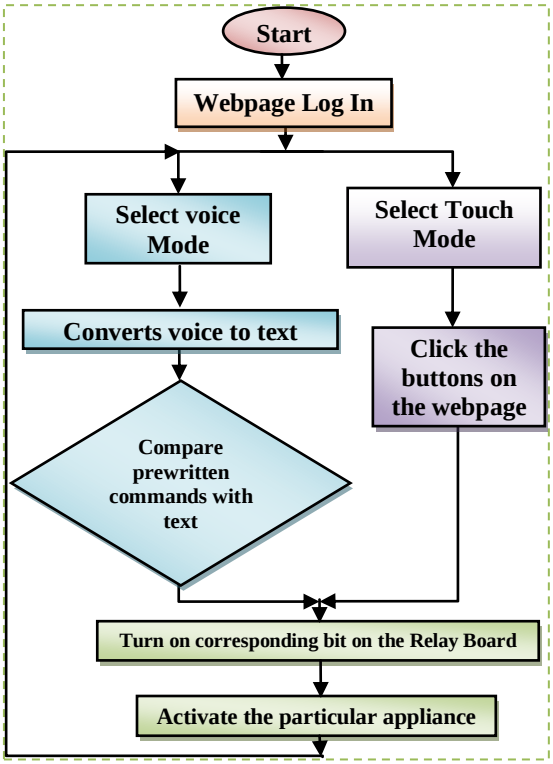

Fig 3: Flowchart for IoT Based Appliance Automation using Raspberry Pi

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The flowchart describes two modes for controlling the appliances using touch mode and voice mode. In Touch mode, individual appliances can be turned on or off by clicking on the respective buttons on the smartphone. In Voice Mode, the user can tap over the microphone symbol on the smartphone and say the predefined voice commands. The smartphone converts the voice commands to text. Raspberry Pi receives the incoming text and compares with predefined text and performs the respective task.

Result and Discussion

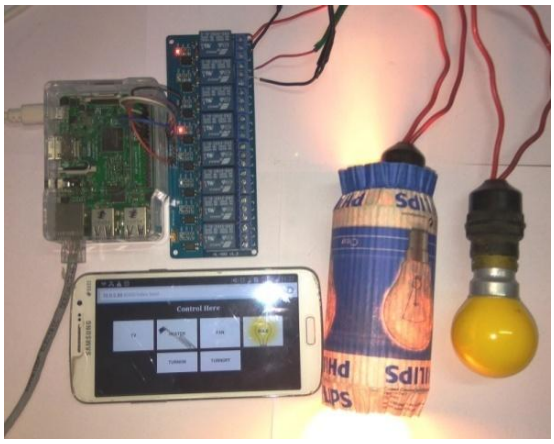

Fig 4: Raspberry Pi interfaced with relay board and appliances

The fig. 4 shows the interfacing of Raspberry Pi with the relay board and the appliances. The client can control the appliances through the webpage using touch mode or voice mode.

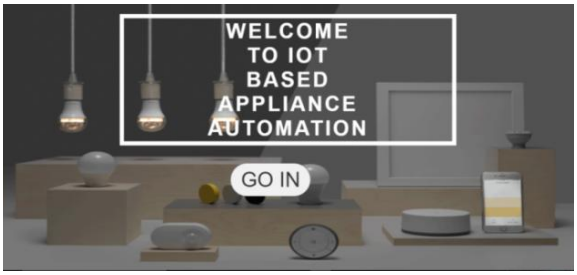

Fig 5: Web page designed using HTML, JavaScript and CSS for Clients

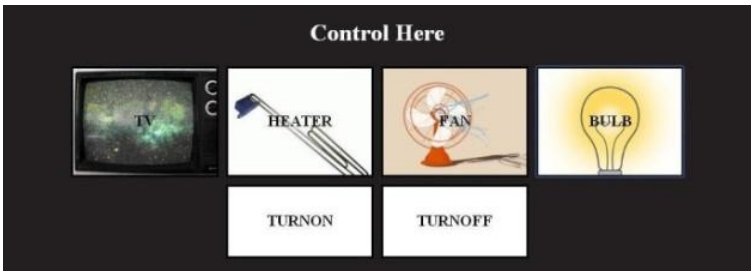

Fig 6: Control page designed for the Appliances

Conclusions

In this paper, automation system for any application has been proposed using Raspberry Pi module and operated using Android Application. Different Electrical appliances may be used by giving command and touching . By this

devices can be operated and seen. We can also used Aurdino instead of Raspeberry. It can also helps to the senior citizen in the absence of other family members. The database can be maintained whatever devices we used and it proves cheaper in cost.

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