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Future Smart Home with Internet of Things

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Abstract— **This paper gives an analysis of applications in the home based on the Internet of Things (IoT)s, The internet of things (IoT) has a variety of application areas, including smart homes. Due to advancements in smart, linked technologies such as the Internet of Things, smart home infrastructure is becoming more interwoven into our daily lives (IoT). Smart homes are characterized by the use of internet-connected technology such as smartphones, remote sensors, and other IoT devices to enable remote administration and monitoring of household appliances.**

Keywords— **Smart Home, IoT security, Electronic Product Code Technology, Cyber Attacks**

I. INTRODUCTION

After the Internet and mobile communication networks, the Internet of Things is the third wave of information technology, characterized by greater integration and intelligence. Electronic product code (EPC) Technology [1] and International Telecommunication Union research work was crucial in the development of the Internet of Things. (ITU). The internet of things talks about the scope of the internet which is going to be expanded, beyond computing and computer devices being connected. Some of the applications of IoT at home are door locks, smart gardening, smart heating, smart security, personal assistants, smart city[11] etc.

IoT is a network system in both wireless and wired link that consists of many software and hardware entities such as e-commerce, healthcare and medical system, agriculture management, energy management home automation, logistic department etc.[4] Fig.1 shows the concept of IoT at home, it shows how IoT controls and operates the physical appliances and various things via the internet.

It has been stated by various noble authors that IoT has become a reality, networking will become even more complex, with virtually every computing element or household object becoming part of a large interconnected system that would lead to more and more to vulnerable to cyber-attacks and physical threats, as a result, concern towards security is increasing, as a result, the Internet of Things Security Foundation (IoTSF) was launched on September 23, 2015.

Its mission is to promote knowledge and test practices for the security of the IoT. Researchers are doing various explorations in this field.

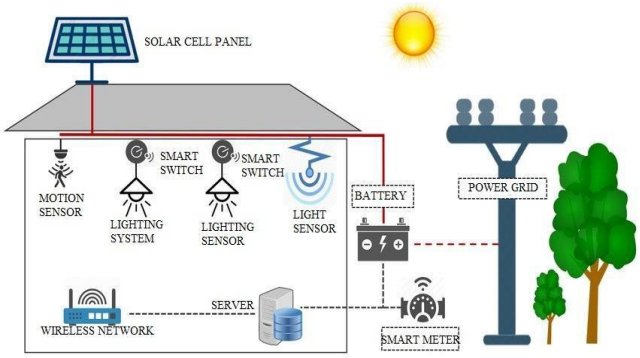

Fig. 1 Concept of IoT at Home

II. OBJECTIVE

The main objective of this paper is to compare various controller boards that we can use for our hardware projects. The two most popular among them are Arduino and Raspberry Pi. In this paper, it is shown how Raspberry Pi is better than any other technology and how it is used in IoT in-home infrastructure, in this paper descriptive knowledge and comparison are given. Some features like family, usage and features processor used are explained in brief.

III. SMART HOME ARCHITECTURE

The fibre optic network's interconnection allows us to create a network for home air conditioning and other smart appliances by linking the family's communication network. Intelligent interactive terminals, smart plugs, and smart appliances, among other things, may be used to form a network of smart appliances in the house. We achieve household appliances that automatically gather, analyze, and manage electrical data, as well as effective operation and energy management.[3] The system may control house and other services remotely by phone, cell phone, Internet, and other ways, which is an IoT application.

We also perform automatic water collection and management, as well as smoke detection, gas leak detection, anti-theft, emergency help, and other home security services, using intelligent interactive interfaces. Some other applications to explore in IoT are gas meters, and support and property management centre cell master network of IoT architecture.

It also allows for the regulated one-way exchange of home security information and other services. Fig 2 shows the structure of a smart home, it shows how all the equipment is interconnected to the network

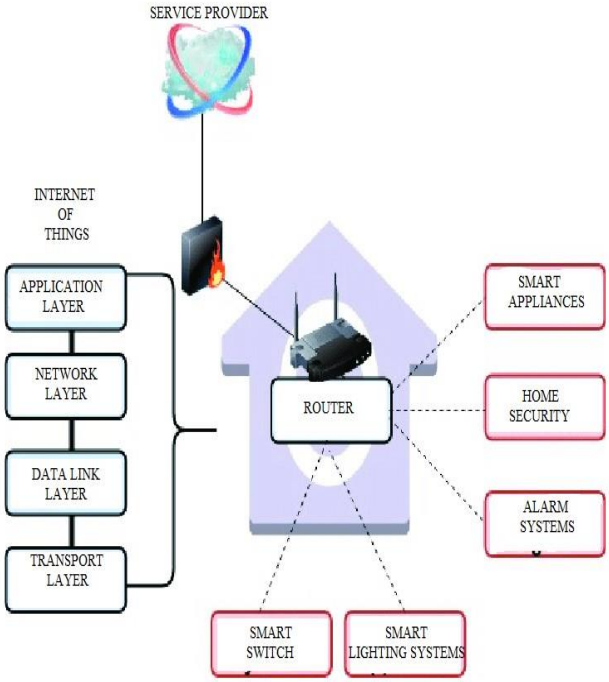

Fig. 2 Smart Home Architecture

Protocols used in Smart Home

A smart home protocol, also known as a building automation protocol, is a special language that devices use to interact with each other. These communication signals trigger desired actions, i.e. adjusting your thermostat or turning your lights on or off. Some Zigbee, 6LoWPAN, Thread, and Bluetooth LE, among the home automation techniques discussed, show the most potential for IoT-enabled home automation. Whereas Zigbee and 6LoWPAN are popular because of their ease of use and compatibility, Bluetooth and Thread promise stronger integration shortly. Here's how smart home product managers and developers can benefit from including these protocols in their solutions:

- Zigbee: It enables a wide range of product adaptations as well as scalability. The procedure of integration and certification is simple, and Zigbee provides for backward compatibility with older devices. Furthermore, the protocol includes built-in security features, removing the need for product creators to take additional procedures.[6]

- 6LoWPAN: Ideal for battery-powered temperature, smoke, and other sensors, as well as operating domestic appliances like washing machines. This technology is one of the greatest smart home technologies because of its extremely low energy consumption.

- Bluetooth: Bluetooth home automation will be widely used once the mesh technology is launched, even though it is not very useful in its current state. Within local private networks, product planners will be able to build and implement smart home solutions that are both autonomous and interdependent.

- Thread: For cooperative smart home development, a large number of hardware and software suppliers have backed the endeavour. Because of its widespread acceptance, smart home developers can expect faster framework upgrades, improved security, and lower energy consumption.

- Raspberry Pi: The Raspberry Pi is a credit card-sized computer that connects to a computer monitor or television and runs on a standard keyboard and mouse. It's a powerful method for detection that educates Scratch and Python programming to people of all ages. It can do everything a desktop computer does, including accessing the internet and watching high-definition videos, as well as creating spreadsheets, word editing, and playing games.[8]

Home Automation Protocols – Comparison

VARIABLE	**ZIGBEE**	**6LoWPAN**	**BLUETOOTH**	**RASPBERRY Pi**
TOPOLOGY	MESH	STAR	SCATTERNET	STAR
AREA COVERAGE	WIDE	WIDE	WIDE	WIDE
FREQUENCY BAND	2.4-2.6 GHz	2.4 GHz	2.4 GHz	400 MHz
DATA BANDWIDTH	LOW	HIGH	LOW	LOW
POWER-EFFICIENT	YES	NO	YES	YES
ALLIANCE	ZIGBEE ALLIANCE	Wi-Fi ALLIANCE	BLUETOOTH SIG	T^3ALLIANCE

Raspberry Pi is the most powerful protocol among all the protocols and now we will see how it is used in the home automation system.

IV. Web-based Raspberry Pi Home Automation

Along with wearables and robotics, the Internet of Things is the most popular technology today. The idea is simple: internet-connected devices in your house (or wherever they are) may speak with one another. Sensors are typically used to transmit data to the internet with this technology. Consider a sensor in your garden that sends data such as temperature, humidity, and soil purity to the internet, where you can access it from anywhere on the globe. Consider home automation systems, which allow you to utilize a web interface or a Smartphone application to operate items in your homes, such as lights, door locks, and air conditioning. Many technologies, such as standalone

lightweight IoT networks and protocols, are being developed around this concept. Here, I'll teach you how to build a web-based Raspberry Pi home automation system that allows you to operate any equipment in your home using standard HTTP protocols from anywhere around the globe. Fig. 3 shows the Raspberry Pi home automation system based on the Internet of Things.

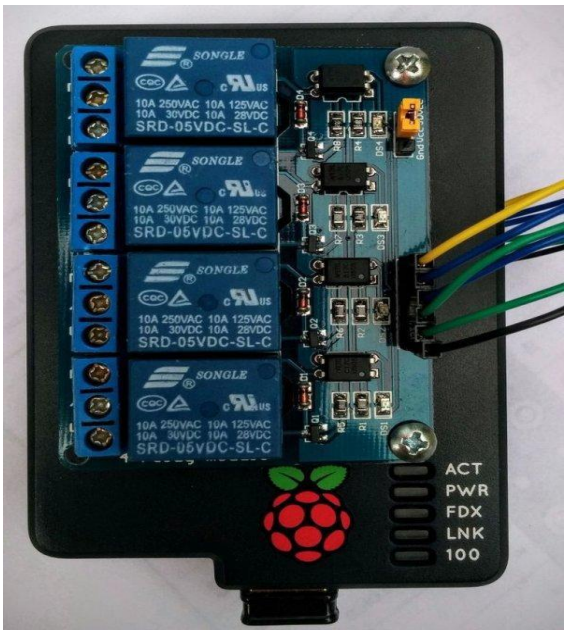

Fig. 3 Raspberry Pi home automation system

Working of web-based Automation

The entire system setup is made up of two parts: the server and the client. The web interface is the server, which contains buttons and UI (user interface) that allow you to turn devices on and off. PHP files, HTML files, and a .txt file are all there (to store data). The server typically saves information about the page's button presses (ON/OFF) in an a.txt file. Maker Pro IoT Implementation is an example of this UI. The main.html file is a simple HTML page that contains two buttons. The execution of a PHP programme called button.php is triggered by pressing the buttons. This programme acts as an API (application programming interface) for storing data in the buttonStatus.txt text file. The information is in the form of a string: "ON" if the ON button is pressed, and "OFF" if the OFF button is pressed. As a result, the current state of the button is saved in the text file buttonStatus.txt.

A Raspberry Pi with a relay circuit linked to its GPIO pin serves as the client. The Pi runs a Python programme that uses urllib2 to "publish" a URL link. That is, the Pi scans the contents of a URL link regularly. Another PHP file called buttonStatus.php is used as the URL connection here. The contents of the text file buttonStatus.txt are read using this PHP file as an API.[10] This PHP service supports as an API to read the contents of the text file buttonStatus.txt. After reading the data, the Python programme determines whether the string retrieved is "ON" or "OFF," and then uses the GPIO pin to turn on or off the relay.

Preparing the HTML files

The server side of the system must first be configured. You may utilize the file manager service to drop these files onto your server and operate your IoT systems from anywhere in the globe if you have your own domain. main.html, button.php, buttonStatus.php, and buttonStatus.txt are the files to upload to your server. Extract the files from the Maker Pro - Raspberry Pi home automation system instruction.

The Python software raspbi.py is the one that should be copied to your Raspberry Pi. If you're still not familiar with HTML or PHP, don't worry. This project will only require a basic mastery of the two languages, as well as some time spent on a few tutorials — HTML for beginners, PHP for beginners, and code reading. The HTML file contains a simple user interface with two buttons. When a button is pressed, a PHP programme is launched, which writes a string to a .txt file depending on which button was pressed.

The .txt file contains data on the most recent button status. If you don't have a domain, you can use xampp to replicate one in your local network or over Wi-Fi. It's fairly straightforward. The following are the instructions for utilizing it: Windows Xampp Web Server Emulator and Linux Xampp Web Server Emulator You can use your PC as a local web server using xampp. The IoT solutions, on the other hand, are limited to a control range that is limited to your home Wi-Fi network. In the /htdocs/xampp directory, place the HTML, PHP, and.txt files.

Relay Circuit

A simple relay circuit will be built to turn an appliance on and off. It is made up of a BC547 transistor that serves as a switch. When the transistor receives a voltage at its base from the Raspberry Pi's GPIO pin, it activates the relay.

To protect the transistor from reverse voltages caused by the relay coil, an A1N4001 diode is utilised. The circuit can be powered either by the Raspberry Pi's 5V supply or by an external battery. Make the connections for the Raspberry Pi home automation system using the schematic and pinout diagram below.Fig.4 shows the relay circuit

Set-up Raspberry-Pi

Use Installing the OS for Raspberry Pi if you have a brand-new Raspberry Pi and need help loading the OS into the SD card. Raspbian is Pi's default operating system. Use the terminal command "startx" to access Pi's GUI. For wireless connectivity, you can use an Edimax or any other company Wi-Fi dongle and the Wi-Fi config application on your Pi's desktop to scan and connect to a Wi-Fi network.

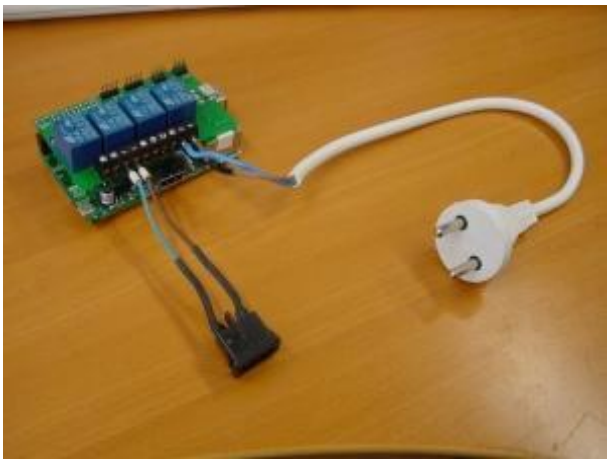

Fig. 4 Relay circuit

The Raspberry Pi is used to run a Python software called raspbi.py continuously. Copy this file to your Pi. Before running this file, open it with "nano raspbi.py" and replace the link under "response=urllib2.urlopen('http://maker.pro/education/button Status.php')" with your own URL generated with xampp or your own domain using "sudo python raspbi.py." The programme will be started as a result of this. Using SSH, you can operate the Raspberry Pi without a monitor. If you know your Pi's IP address, you can use SSH (Secure Shell) to control it remotely from a PC on the same home network To find your Pi's IP address, use the "ifconfig" command. To start the SSH service, type sudo /etc/init.d/ssh start. Then, from a remote PC, open the terminal with putty software (for Windows) and run "sudo ssh ipaddress -l pi.". "ipaddress" should be substituted with the Pi's actual IP address, which should be between 192.168.1.1 and 192.168.1.254. The Raspberry Pi should be connected to the relay circuit. GPIO pins 5 and 6 (GND) must be connected to the circuit as shown in the design. Please remember that the Raspberry Pi enters safe mode by shorting pins 5 and 6 together. To avoid booting into safe mode, please use any other GPIO other than 5 by changing the Python application. This system may be customised to allow you to control anything in your home from anywhere on the planet. It can also be used to collect data from sensors and see it from any site. MQTT and thing Speak APIs can be used to standardize the communication protocol for a large number of devices and sensors.

V. CONCLUSIONS

On a broad level, the Raspberry Pi's performance is compared to that of various prominent boards and development platforms in terms of computational power, size, and overall costs. According to the results of the investigation, Udoo has the highest performance among the IoT hardware platforms studied, but its price is relatively costly. On the other hand, detailed analyses of the Raspberry Pi have revealed that it is the ideal platform for interfacing with a wide range of devices and with support for a broad selection of input and output peripherals, it has been used in a diverse range of products as an ultra-cheap yet serviceable computer board, as well as network communication. To put it another way, the Raspberry Pi brings the benefits of a PC to the world of sensor networks, making it the ideal platform for interacting with a wide range of external peripherals. It is easy to set it up for remote communication by connecting it to Wi-Fi and giving Internet access, which makes the Raspberry Pi ideal for IoT applications. Thus, the Raspberry Pi's interest lies in its versatility and limitless application alternatives, allowing end-users to customize it according to their specific demands and budgets. Even if the stated platforms differ significantly in terms of optimal use cases, energy requirements, operating systems, and so on, it should be emphasized that they may all be used as IoT hardware components in a relatively sequential manner. The decision between the two will be based on the project's requirements.

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