IOT BASED HOME AUTOMATION USING RASPBERRY PI

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ABSTRACT:

This study provides a sophisticated home mechanisation framework that uses an Android application to control and monitor the house devices. This strategy is based on the Internet of Things (IoT). Every single house gadget is arranged and operated without human intervention in home computerization. In this framework, the Raspberry Pi 4 will be linked to a variety of sensors that can measure temperature and humidity, light, energy, and so on. Sensors were used to collect information, which was then stored in the data store. An example examination is performed on the stored information, which tells the client when the machines are typically on or off, with the goal of naturally controlling them with no human intervention by watching the normal use design. The customer can also turn on and off remotely via a mobile application and a web server.

Keywords:

Internet of Things, Raspberry Pi 4, Home automation, Server, Mobile devices

INTRODUCTION:

The Internet of Things is a concept in which each gadget is identifiable on the internet. The Internet is a constantly changing thing. It all began with the "Internet of Computers." According to research reports, the number of "things" or devices connected to the Internet will skyrocket. The has the ability to improve people's lifestyles. In today's world, individuals prefer automatic systems than manual systems. The Raspberry Pi and the Relay, as well as their driving circuits, are the main components of an IoT-based home automation system. Home automation is a method that replaces human contact with programmed electronic devices in as many domestic tasks as is theoretically possible and desired. Finally, it is a system aimed at improving quality of life through the automation of household equipment that may be operated via the Internet or telephone [1].

Figure 1: Smart Home

HOME AUTOMATION & HISTORY:

The concept of home automation first appeared in the nineteenth century. The Electronic Computing Home Operator was created in April 1968 and was upgraded using a collection of surplus electronics. The X10 standard was expanded to allow transmitters and receivers to broadcast signals like "turn ON" and "turn OFF" over radio frequency. The X10 system has a number of drawbacks. With the invention of the Raspberry Pi, a little credit card-sized computer with a huge variety of peripherals and communication interfaces such as Ethernet, USB ports, and HDMI ports, home automation has become incredibly easy and exciting. Home automation comprises everything that building automation provides, such as door and window controls, climate controls, multimedia home theatre control, pet feeding, plant watering, and so on. Home automation is synonymous with 'Smart house' or 'Intelligent home'. These intelligent or smart homes are controlled by a variety of technology. GSM, WIFI, Bluetooth, Zigbee, and other technologies are utilised in home automation.

SYSTEM DESIGN:

A. The Raspberry Pi The Raspberry Pi is a line of credit card-sized single-board computers created by the Raspberry Pi Foundation in the United Kingdom to promote the teaching of basic computer science. They create free resources to teach people about computing and how to build things using computers. Raspberry Pi was created in 2006. It is possible to connect a PC monitor and a television to the Raspberry Pi. The Raspberry Pi can be connected to a mouse and keyboard. All Broadcom system-on-a-chip models have an ARM compliant central processing unit (CPU) and an on-chip graphics processing unit. The Pi 3's CPU speed ranges from 700 MHz to 1.2 GHz. On-board memory capacities range from 256 MB to 1 GB RAM. The operating system and programme memory are stored on Secure Digital (SD) cards. The majority of Raspberry Pi boards include USB ports, HDMI output, DSI port, audio jack, 40 GPIO pins, in-built Bluetooth, WIFI, and other features. [2]

The Raspberry Pi has its own operating system. Raspbian, Ubuntu Mate, Snappy Ubuntu, Pidora, Linutop, Arch Linux ARM, and more operating systems are available for the

Raspberry Pi. C++, Python, SQL, and HTSQL are among the programming languages supported by the Raspberry Pi. Arduino is programmed using C++. HTSQL (Hyper Text Structured Query Language) is used to give a web interface to databases that can be accessed using a web browser. It also supports java, java script, php, and other programming languages. [3]

The Raspberry Pi has four distinct power modes:

- In run mode, the central processor unit (CPU) and all ARM11 core functions are available and powered on.
- Standby mode - the main core clocks are turned off (the components of the CPU that process instructions are no longer active), but the core's power circuits remain operational. The core can be swiftly woken up in this mode, known as "Wait for Interrupt" (WFI), by a process that generates a particular call to the CPU called an interrupt. This interrupt will halt any existing activity and perform the request of the calling process.
- Power is turned off in the shutdown mode.
- The inactive mode, in which the core is turned off but all caches remain powered on.

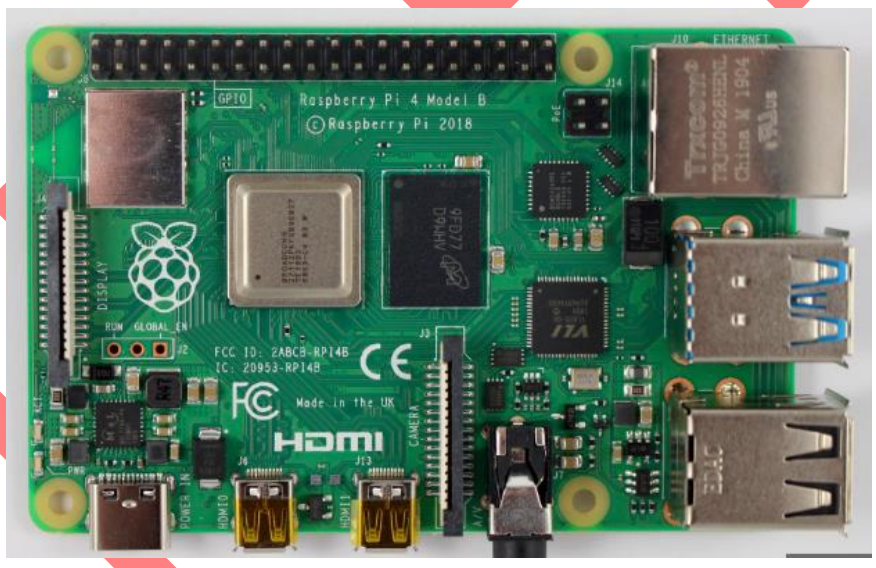

Figure 2: Raspberry Pi

B. Relay and Relay Driver Circuit

A relay is nothing more than an electromagnetic switch. A relay allows one circuit to switch another when they are physically separated. When we wish to use a low voltage circuit to switch on and off a device that requires high voltage for functioning, we use a relay. For example, a 5V supply connected to the relay is adequate to power a 230V AC mains-powered lamp. Relays are available in a variety of operating voltage configurations such as 6V, 9V, 12V, 24V, and so on. The relay is divided into two parts: input and output. When a tiny input voltage is applied to the input side, it generates a magnetic field. [4]

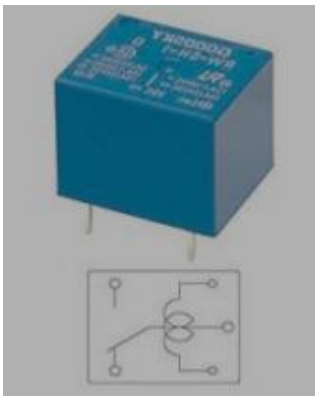

Figure 3: Relay module

C. Mobile Devices:

Mobile gadgets are nothing more than tiny computing devices. They are small enough for us to operate and grasp in our hands. They have their own operating systems as well. A mobile device can be transferred from one area to another. Smart phones, laptops, tablets, and other mobile gadgets are examples.

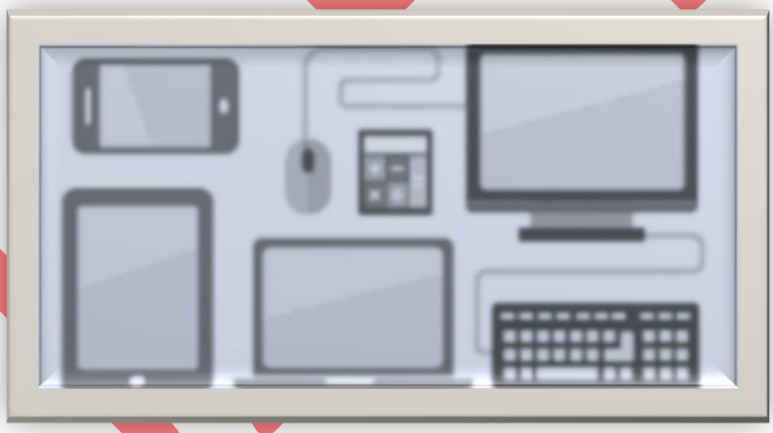

Figure 4: Mobile Devices

1. Hardware implementation:

We followed the block diagram below to create the system hardware. The entire block diagram is separated into two sections: server side and client or user side.

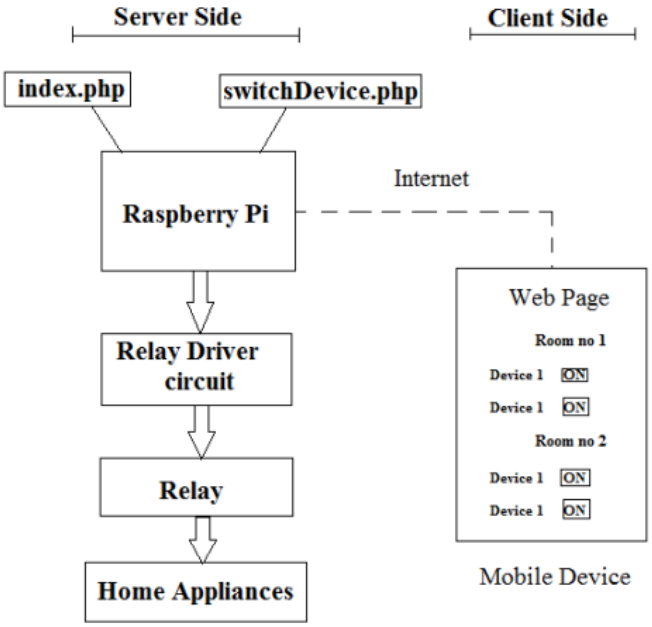

Figure 5: Block diagram of system

2. Software implementation

The PHP programming language is used. There are two PHP files produced. The first is index.php, and the second is switchDevice.php. These two files are kept on the Raspberry pi's local LAMP server. Dreamweaver programme is used to construct the web page and the UI that appears on it.

On the Raspberry Pi, the server side is completely installed. LAMP is used to build a server on the Raspberry Pi (Linux, Apache, MySQL, PHP). Two PHP files are created and saved on the Server that we built on the Raspberry Pi. The Raspberry Pi has 40 GPIO pins. These pins are used to operate household appliances. The Relay Driver Circuitry connects the relay to the Raspberry Pi's GPIO pins. The GPIO pins output 3.3V. To drive a relay, a minimum voltage of 6V is necessary, which can be achieved using relay driver circuitry. The Relay is connected to all of the home appliances. The client side is simply the user side. Users must utilise a mobile device to connect to the Raspberry Pi through the internet. Once the user connects the mobile device to the network and enters the IP address of the Raspberry Pi into the mobile device's browser, the user will be able to see a web page that provides a UI for controlling home appliances in each room. The user interface simply displays the number of rooms and household equipment in each room. It also includes toggle controls for each room's home appliances. A number of home appliances can be operated at the same time. [5]

OBJECTIVES:

1. To implement the entire process by using PHP language.

2. To design of the low cost home automation system using the IoT(Internet of Things) technology.

3. The aims to provide a speech control interface to the users to control the appliances.

REVIEW OF LITERATURE:

This paper provides a basic introduction to the Internet of Things, its applications, and possible societal advantages. IoT has piqued the interest of scientists, industry, and governments all around the world because to its potential to transform modern living. The Internet of Things is envisioned as billions of sensors linked to the internet via wireless and other communication technologies. The sensors would produce a vast amount of data, which would need to be analysed, interpreted, and used. Home Automation Systems leverage Internet of Things technology to monitor and control electrical and electronic appliances at home from any remote location using a Smartphone. The implementation of a low-cost, versatile home automation system is described.

Natural products and their derivatives are rich in new medicinal compounds (Clardy and Walsh, 2004). Plant essential oils have a wide range of applications, mostly in the health, agriculture, cosmetic, and food industries. The use of essential oils in traditional medical systems has been used from prehistoric times in human history. Researchers from all around the world are working to describe EOs' antibacterial, antiviral, antimutagenic, anticancer, antioxidant, anti-inflammatory, immunomodulatory, and antiprotozoal characteristics (Bakkali et al., 2008). The concentrations necessary to suppress the growth of target organisms are used to compare the efficacy of various EOs. For bioactivity comparison, minimum growth inhibitory concentrations (MICs), minimum lethal concentrations (MBCs or MFCs), MIC50, and LD50 values are commonly utilised. These values are obtained by the use of defined procedures. For antimicrobial susceptibility testing, for example, Clinical Laboratory Standards Institute (CLSI) methods and cell viability assessment by MTT or XTT assays are used (Bakkali et al., 2008) [6]

RESEARCH METHODOLOGY:

Books, educational and development magazines, government papers, and print and online reference materials were just a few of the secondary sources we examined to learn about the components, applications, and impacts of IOT-based home automation utilising raspberry pi. We used the PHP programming language to implement the entire process. There are two PHP files produced. The first is index.php, and the second is switch Device.php. These two files are kept on the Raspberry pi's local LAMP server. Dreamweaver programme is used to construct the web page and the UI that appears on it.

RESULT AND DISCUSSION:

The performance of the proposed framework is evaluated in this test utilising a set of Quality of Service (QoS) boundaries, such as Ethernet Throughput. [7]

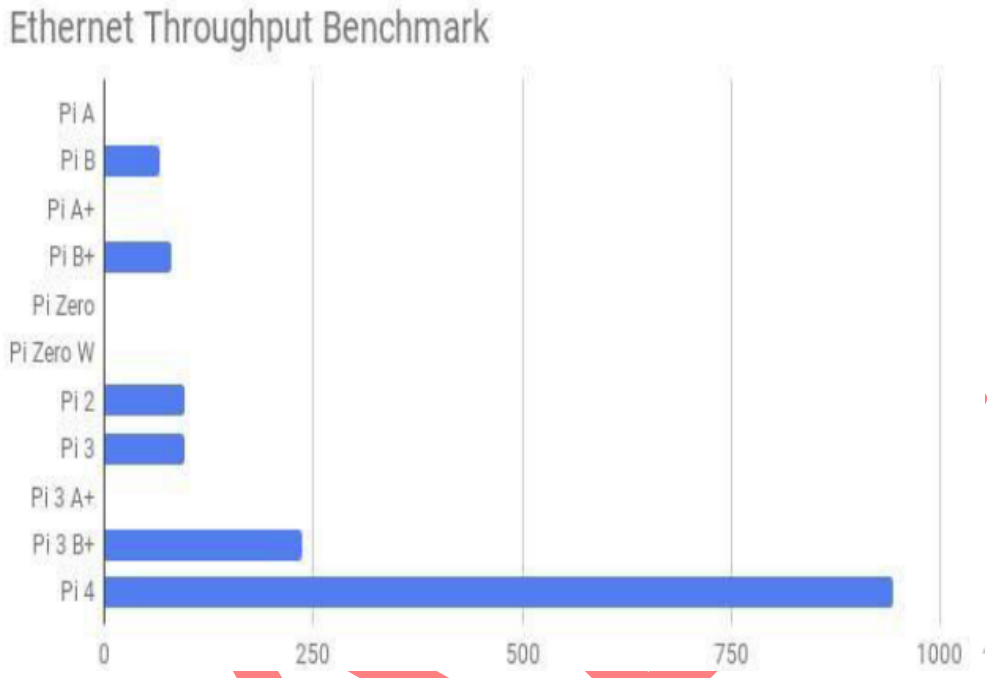

Figure 6: Raspberry Pi 4

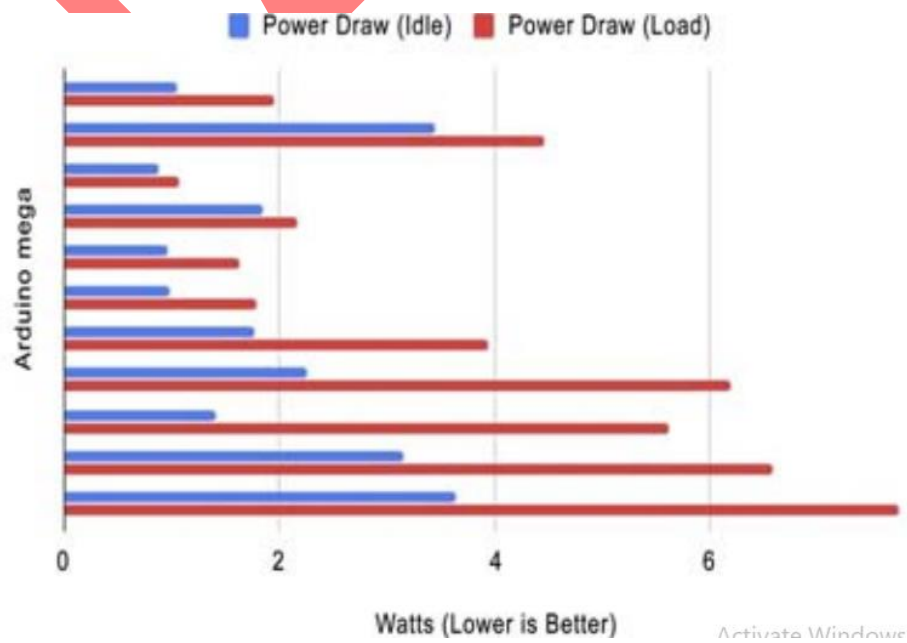

Figure 7: Arduino

When compared to Arduino, the Raspberry Pi4 consumes less electricity.

Essentially, we are creating a text file on the server and storing ON/OFF values once a user selects ON or OFF options, and every 3 seconds our PHP software stored in Raspberry Pi checks the text of this file using HTTP protocol and appropriately ON/ OFF appliances.

- **TURN ON HOME APPLIANCES:**

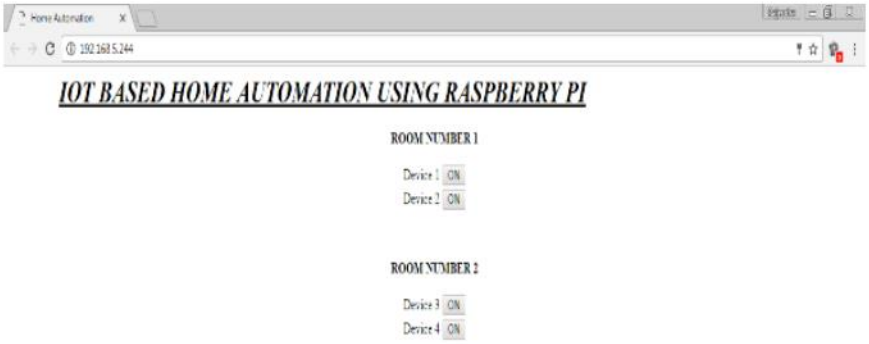

Figure 8: Web page layout to turn ON home appliances

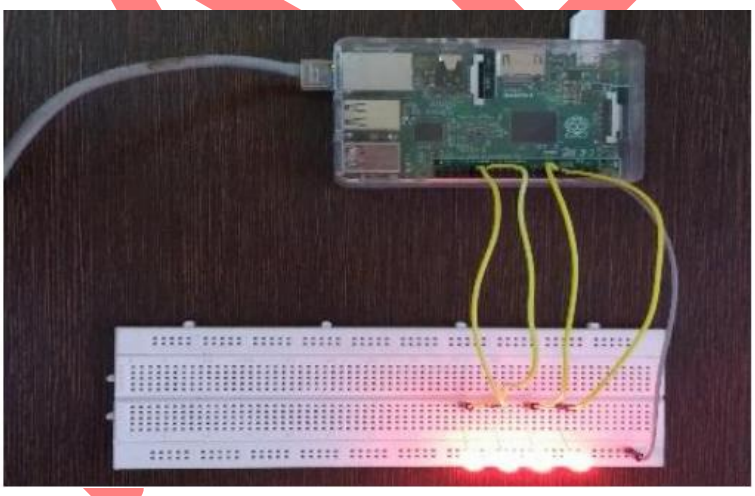

Figure 9: Output for above figure 8

Figure 9 shows what the result of figure 8 signifies when the home appliances are turned on. [8]

CONCLUSION:

In this research, the house mechanisation framework was designed using the Raspberry Pi4 embedded controller, as well as Wi-Fi methodology for testing and coordinating the home apparatuses, allowing the customer to remotely access the framework from anywhere on the planet. The framework is appropriate for computerising the activity of the apparatuses by dissecting the client's typical utilisation pattern of the apparatuses. The transfer can be effectively updated based on the needs of the client. Using this framework, the client can remotely access home apparatuses all over the world. As a result, it conserves electrical energy and reduces human effort, among other things.

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