IoT Based Home Automation System using Raspberry Pi 4

T Maragatham\(^2\), P Balasubramanie\(^1\), M Vivekanandhan\(^3\)

\(^1\)Assistant Professor, Kongu Engineering College, Perundurai, Erode.
\(^2\)Professor, Department of CSE, Kongu Engineering College, Perundurai, Erode.
\(^3\)PG Scholar, Kongu Engineering College, Perundurai, Erode.

E-mail : tmaragatham@gmail.com

Abstract. This paper proposes a propelled home mechanization framework that utilizes an android application to control and screen the home apparatuses. This plan depends on the Internet of Things (IoT). In home computerization, every single home apparatus are organized together and worked without human intercession. In this framework, Raspberry Pi 4 is going to be interfaced with numerous sensors that may evaluate temperature and steaminess, light, energy, etc. Sensors were used to collect information and it would be stored in the data store and an example examination is done on the put away information which tells the client at which time the machines are typically on or off with the goal that they can be naturally controlled with no human intercession by watching the normal use design. The client moreover turns on/off remotely by means of mobile application and web-server.

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

1. Introduction

The IoT is a developing innovation that permits client to control hardware contrivances. IoT is utilized to control the home and industrial gadgets, via computerizing through the web. Raspberry Pi 4 inserted controller is interfaced with a Wireless Local Area Network (WLAN) modulator to get client orders over the web or android application.

Transfers are adjusted to switch loads. These transfers are updateable, so client can set the necessary force gracefully to the relay. In the wake of getting the client orders over the cyber world, inserted controller forms these ordinate transcriptions to work the heaps in like manner and display the framework status.

2. Related Work

In [1], creators introduced a home automation framework that has the innovation to control gadgets naturally so as to gather the wants of security, solace and productivity. Then again, voice-based advanced associate, as an example, Apple's Siri gives an entrance of area freely to the web and native networks. This examination specialize in executing a smart home technology framework through Raspberry Pi and thru Siri as an ease direct framework to mechanize home gadgets to be specific, the air cooler, entryway, window and electrical devices. Siri Proxy be introduced on the Raspberry Pi as an intermediary worker for Siri. Through building a Siri Proxy module, lots of orders for home computerization might be uniquely crafted by the client.
In[2], creators created a home automation framework utilizing Digilent chipKIT Uno32 and Arduino Uno. The disadvantage, it employments Uno 32 and Arduino Uno while it features a least capacity settled transfers.

In[3], creators proposed a crossover strategy to control the home machines. Raspberry Pi has different communication media like Ethernet port, USB port, Bluetooth and so on. It permits to control number of domestic apparatuses at the same time. Here, the Ethernet is as it were a 10/100 and the processor isn't as quick, it is time expending to download and introduce computer program and is incapable to do any complex multitasking.

In[4], the creators proposed an efficient strategy for home automation framework through world wide web and employs a lower power protocols like zigbee and wifi. In this paper[5], creators clarified around controlling the electrical apparatuses by means of keen phone by utilizing wifi as a communication convention and raspberry pi as a server. Subsequently, client can effortlessly get to the domestic apparatuses like fan, light, entryway locks etc. In[6] the authors proposed a framework that utilizes mobile application, handheld devices for providing an user interface to the end users. But the client unable to sense some of happenings such as motion detection, open-door and etc.

The authors [7] experimentally proven that the simple appliances are effectively monitored and controlled through the internet. Though it gives a better result, it takes more memory space in the cloud. The authors[8] projected a mechanism to send an alert message to the owner by using internet. The authors have given minimum level of security for the proposed methodology. In[9], authors projected a methodology to reduce the energy consumption. In[10], creators proposed a project with micro controller and raspberry pi to monitor and control light or other home appliances.

To determine a couple of issues in the above frameworks, Wi-Fi innovation ought to be utilized for a lot more extensive scope of correspondence. Sensors are used to collect data from the proposed model and an example examination can likewise be performed on the information. It turns the framework considerably extra power proficient while the system is able to naturally turn on/off apparatuses dependent on normal utilization design.

3. Proposed Model

The outline of the propounded structure is given in Figure 1. The various steps involved are explained as follows:

The framework comprises of various sensors like movement, hotness, and daylight and actuators, for example, signal, driven, LCD show, and so on. In addition to that, the structure includes a set of hardware components such as WLAN module, Rasperry pi4, temperature detector, PIR motion sensor, relay, light sensors, buzzers, RGB backlight and a set of software components like Rasperry IDE, storage, Android application and web server.

![Figure. 1 Outline of the Proposed System](image-url)
3.1 Descriptions
- It has Broadcom BCM2711 and Quad core Cortex-A72 64-bit SoC @ 1.5GHz
- It has 1, 2 and 4GB LPDDR4-3200 SDRAM.
- It also has Gigabit Ethernet
- Contains 2 USB 3.0 ports and 2 USB 2.0 ports.
- Raspberry Pi4 has a standard 40 pin GPIO header.
- 2 × micro-HDMI ports it supports 4kp60.
- 2-lane MIPI DSI display and 2-lane MIPI CSI camera port
- 4-pole stereo audio and composite video port

3.2 Sensor monitoring module
In this framework numerous sensors are created, those sensors are coordinates with Raspberry Pi 4 microcontroller. Here ESP8266 based WLAN module can be utilized. It has a coordinates TCP/IP convention stack which provides Raspberry Pi 4 embedded microcontroller get to the WLAN organize.

3.3 PIR motion sensor
A Passive Infrared Sensor (PIR) is an electronic detector that gauges infrared radiation transmitting from gadgets in its area of see. Those are often utilized in PIR-predicated dynamic pointers. These kind of sensors are generally used in home alarm systems and modified lighting enabled systems.

3.4 Light sensor
A light sensor may be a photoelectric gadget that changes over light sign (photons) into an electronic sign (electrons). There's something else completely to a light sensor at that point simply its definition. It comes with different sorts and utilized in numerous applications to discover the presence or nonexistence of a substance.

3.5 Temperature sensor
Temperature sensors are the devices that are uncommonly outlined to alter their possess characteristics depending upon the temperature of the encompassing conditions. Ordinarily a thermocouple or Resistance Temperature Finder (RTD) gives temperature estimation through an electrical signal.

3.6 Relay module
Relay acts as a switch to the electrical appliances for controlling (ON/OFF) voltages as well as streams. It has 10Ams transfer 250 watts up to 12 volts. Transfers are switches to encourage bolt and open circuits electromechanically or naturally. In existing framework the transfer utilized in a settled mode in expansion to that the power capacity is additionally low and underpins as it were restricted voltage. Within the display framework the hand-off is updateable, so engineer can increment the capacity of voltage asked by the client. When the light is ON, the client can OFF it remotely by utilizing web browser additionally in android application. When the client sends a command to the light is OFF the transfer communicates with the raspberry microcontroller to switch it OFF. This will be conceivable by utilizing the code designed within the raspberry IDE. The transfer utilized in this framework is updateable so ready to upgrade the control capacity (voltage) as per the client necessities. Consequently in future, the client can be able to automate the industrial machine.

3.7 User interface module
In this module the client can get to and screen the electrical apparatuses with the assistance of both android application and web server. Hence the net server is utilized to get to the apparatuses anyplace circular. In this manner, it acts as an interface between the user and the application. The internet server to boot utilized for putting away the signals and client records. It oversees the communication between the Raspberry Pi 4 and portable savvy gadget. In expansion to that, it is utilized to support the two-way communication between them. In our framework, web-server is formed to integrate
equipment devices, microcontroller and portable gadgets. After effective integration, client needs to enter the IP address to get to the internet server within the domestic computerization framework. In case a web-server awards authorization to access the system, then the input contains the response code which is received to authenticate the user. At the present the user is able to check and organize the domestic devices via web-server.

4. Experimental Results

In this test results the performance of proposed framework is analyzed by using a set of Quality of Service (QoS) boundaries, such as, Ethernet Throughput, WIFI Throughput and Power Draw Benchmark.

4.1 Ethernet Throughput

The Ethernet Throughput is estimated by the pace of effective conveyance of frames over a communication medium.

The above graph shows that, the Ethernet throughput of the Raspberry Pi 4 is higher than the Arduino.

4.2 WIFI Throughput

WIFI Throughput means the estimation of information rate between network gadgets inside the home or independent company organization.
While comparing the WIFI throughput between the Arduino and Raspberry Pi 4, the throughput speed is higher in Raspberry Pi 4.

### 4.3 Power Draw Benchmark

Benchmarks are utilized to gauge and evaluate the presentation of specific parts of a given framework. Here it is utilized explicitly to the presentation in combination with the power and energy utilization of calculations on a wide scope of hardware platforms.

The power usage of Raspberry Pi4 is lower when compared to Arduino.

### 5. Conclusion

In this paper the house mechanization framework was sketched out by using Raspberry Pi4 embedded controller furthermore Wi-Fi methodology also used for checking and organizing the home apparatuses which empowers the client to distantly get to the framework from anyplace around the globe. The framework is fit for computerizing the activity of the apparatuses by dissecting the ordinary utilization patter of the apparatuses by the client. The transfer is effectively updateable based on the client necessities. By utilizing this framework the client can remotely get to the domestic apparatuses all over around the world. So it spares parts of electrical vitality and diminishes the human exertion and so on.
References

1. Ana Marie. D Celebre et al 2015 Home automation using raspberry Pi through Siri enabled mobile devices Proc. Int. Conf. on Humanoid, Nanotechnology, Information Technology Communication and Control, Environment and Management (Philippines - IEEE), p 1-6.
2. ShruthiRaghavan and Girma S. Tewolde 2015 Cloud based low-cost home monitoring and automation system Proc. of ASEE Nthh. Cent. Sec.Conf American Soc. fr. Engg. Edu.
3. Kulkarni B P, Aniket V Joshi, Vaibhav V Jadhav and Akshaykumar T Dhamange 2017 IoT Based Home Automation Using Raspberry PI In. J of Inn St. In Sci. And Engg. Tech. 3 Issue 4.
4. Pavithra D and Ranjith Balakrishnan 2015 IoT based monitoring control system for home automation Proc. of Gl. Conf. on Comm. Tech.
5. Deepali Javale, Mohd Mohsin, Shreeerang Nandanwar and Mayur Shingate 2013 Home Automation and Security System Using Android ADK Int. J. of Comm. and Comp. Tech. 3 Issue 2.
6. Sirsath N. S, Dhole P. S, Mohire N. P, Naik S.C and Ratnaparkhi 2013 Home Automation using Cloud Network and Mobile Devices ITSI Trans. on Ele. and Electro. Engg.Issue :2.
7. VinaySagar K and Kusuma S 2015 Home Automation Using Internet of Things In.Rech. J. Engg and Tech 2 Issue 3 pp 1965- 1970.
8. Ravi Kishore Kodali, Vishal Jain, Suvadeep Bose and Lakshmi Boppana 2016 IoT Based Smart Security and Home Automation System Int. Con. on Comp. Comm. and Automation pp 1286-128.
9. SilviuFolea, Daniela Bordencea, Casiana Hotea and Honoriu Valean 2012 Smart home automation system using Wi-Fi low power devices IEEE In. Con.on Aut. Qly. and Tstg. Rob.
10. Pooja Patel, MiteshPatel,Vishwa Panchal, and VinitNirmal 2016 Home automation using Internet of Things Imperial J. of Inter disc. Rech. 2, Issue 5.