

## Review Paper on Home Automation System using Raspberry Pi

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**Abstract**—Home Automation refers to the branch of automation that deals with the methods dedicated to the reduction of human efforts and involvement in achieving tasks. The main objective of these Home Automation systems(HAS) using internet of things(IoT) is to inhibit automatic and electronic control of household features activity and appliances. This paper deals with the wide range connectivity and energy efficient control of the home appliances in a user-friendly manner. These features of connectivity, scalability, power saving can be achieved by the use of Raspberry Pi, which acts as an interface between the hardware and the software of the entire system which can be connected to number of peripherals using USB ports or HDMI port and GPIO, it can be connected to the internet using the Ethernet port or by Wi-Fi connectivity.

**Keywords:** Home automation system(HAS), Wi-Fi connectivity, Internet of Things(IoT), Raspberry Pi.

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### 1. Introduction

Home automation refers to the application of computer and information technology for control of home appliances easily and reducing the power consumption or the power wastage associated with the manual system. Its application varies from a simple remote control of lighting to complex micro-controller based networks involving varying degrees of intelligence and automation. Home automation results in convenience, energy efficiency, and safety benefits leading to improved quality of life. Its futuristic, energy efficient, control over the appliances from any location. So, concerning size, power, and price of the Raspberry Pi is qualified for a house-controller. The additional hardware and software requirements can be achieved by already existing hardware modules and open source software.

There are many keys and products available, starting from some dollars and ending somewhere in a multi-digit sector. Very popular in Germany are the cheaper Intertechno, ELRO, and similar systems or the FS20 / Homematic system. While the cheaper and the FS20 systems are uni-directional, these system works bi-directional. Of course, there are actors and sensors for all types of systems, but

Homematic is the only system where you get a feedback or can request a state.

If you have an FS20 switch-actor, you “just” can switch it on or off. You won’t get a success or response (i.e. “switched on” or “switched off”) and furthermore you cannot request a state (i.e. “is it switched on?” or “is it switched off?”). Within a Homematic based system, you can request a state of a switch per default and also get a response after an action. The varieties of home automation system improve the quality of resident’s life by facilitating a flexible, comfortable, healthy safe environment.

### 2. Literature Survey

In the paper Vinay Sagar and K N, Kusuma S M, "Home Automation Using Internet OF things", International Research Journal of Engineering and Technology (IRJET), Volume: 2, Issue :03 June -2015, pp 1965 – 1970; they have written about the project of HAS using IoT wherein they have used Intel Galileo Microcontroller. They have used Wi-Fi as a medium for internet connectivity. They have even created experimental setup of HAS where they have controlled two lights, a cooler, and alarm for a gas leak.

They have even connected gas, light, temperature, and a motion sensor and they have set a threshold for each sensor's reading using which they control the appliances.

For example- A cooler will turn on when the room temperature exceeds the set threshold and in turn reduces the room temperature. As a frontend part, they have created a HTML-based Web server page using which the user can handle the entire system. [2]

Whereas, only switching on and off the appliances is just not enough for reducing the power consumption of the system.

Ahmed Elshafee and Karim AlaaHamed, "Design and Implementation of a Wi-Fi based Home Automation System International Journal of Computer, Electrical Automation, Control and Information Engineering Vol:6,No:8,2012,pp 1074 - 1080is Arduino based distributed HAS system which consists of a server,hardware and interface modules. Server controls hardware, one interface module and can be easily configured to handle more hardware interface module. The hardware interface module controls its alarms and actuators. The web server software is developed using ASP.net technology. They have used Wi-Fi as a medium for internet connectivity.[3]

In this setup mode user, can create a basic macro involving simple triggers and to customize the macros to perform complex series of events. Macros can be activated manually or as a reaction for certain trigger light motion sensors and surveillance cameras. [3]

Since they have used Arduino as the base of the system while adding more hardware interface modules we require number of Arduino chipset to be installed in the system which results in the increases of complexity and the overall cost of the system and also eventually increase the power consumption of the entire system.

Shaiju paul, Ashlin Anthony and Aswathy B, "Android based Home Automation Using Raspberry Pi, IJCAT - International Journal of Computing and Technology, Volume 1,Issue 1, February 2014, pp 143 - 147.is very close to the paper we are introducing. They have created Home the HAS wherein they have simply connected the home appliances to the Raspberry Pi using relay circuit and they have used an android application for a user interface.[4]. Their system consists of mainly three components a Wi-Fi module, Raspberry Pi board, Relay circuit. Wi-Fi is used as a communication channel between android phone and the Raspberry Pi board. They have hidden the complexity of the notions involved in the HAS by including them in a simple, but comprehensive set of related concepts. [4]

In this paper, they have not used sensors due to which the project doesn't provide the base for an automated

system.Only switching on and off the appliances is just not enough for reducing the power consumption of the system.

Home automation using Raspberry Pi Monika M Patel a, Mehul A Jajal and Dixita B vataliya. In this paper, they have used a Raspberry pi model B as their processor, a Wi-Fi dongle for their internet connectivity, a relay circuit for connecting appliances to the system and WebIOPi for IoT framework. Their relay circuit operates at a 5-12V output. WebIOPi is an integrated IoT framework for Raspberry Pi. The system in this paper, when turned on, will first check the current situation of rooms and change in the state of lights. This system provides the user with remote control of various lights and appliances within their home.[9]

In this system, the sensors are not used which gives us the information about the conditional intensity with which the appliances should work. They are not using the Android based application which is the current trending topic. Also, they are not manipulating the intensity with which the appliances will work, which could have reduced the power consumption greatly.

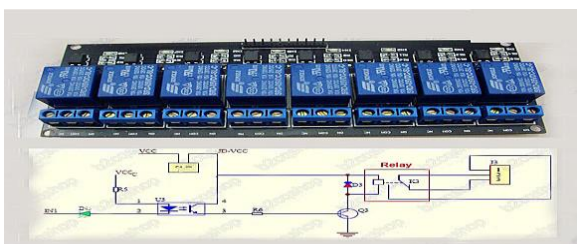
### 3. Features of Raspberry Pi in comparison to other latest technology

FEATURES	RASPBERRY PI	ARDUINO
IDE	SCRATCH	ARDUINO-IDE
MEMORY	512MB	0.002MB
RAM	256MB	2KBYTE
CLOCK SPEED	700Mhz	16Mhz
ON BOARD NETWORK	10/100 WIRED ETHERNET RJ45, Wi-Fi,BLUETOOTH	NONE
SYSTEM ON CHIP	BCM2835	SAM3X8E
INPUT VOLTAGE	5V	7-10V

The Raspberry Pi debuted in February 2012. The group behind the computer's development - the Raspberry Pi Foundation.The Raspberry Pi is believed to be an ideal learning tool, in that it is cheap to make, easy to replace and needs only a keyboard and a TV to run. These same strengths also make it an ideal product to jumpstart computing in the developing world. [7]. As for the specifications, the Raspberry Pi is a computer powered by the Broadcom BCM2835 system-on-a-chip (SoC). This SoC includes a 32-bit ARM1176JZFS processor, clocked at 700MHz, and a Videocore IV GPU. It also has 256MB of RAM in a POP package above the SoC. The Raspberry Pi is powered by a 5V micro USB AC charger or at least 4 AA batteries.[8]The biggest dissimilarity between something

like the Arduino and the Raspberry Pi is in the intended usage. The Arduino is meant to be used as a development board with microcontrollers that will be programmed and then integrated into larger machines or electronics and allowed to run on their own. On the other hand, the Raspberry Pi is meant to be used as a concluding product and operate as a traditional desktop computer.[8]

• **Relay circuit -**



A Relay is electrically operated switches, which allow low power circuits to switch a relatively high voltage or current on/off. For a relay to operate a suitable pull in and holding current should be passed through its coil. Relay coils are designed to operate from a particular voltage often 5V or 12V. The job of relay driver circuit is to provide the essential current energize the relay coil, when a LOGIC 1 is written on the PORT PIN thus turning on the relay. The relay is turn off by writing LOGIC 0 on the port pin. In our system, eight relays are used for device control. [9]

Paper Title	Authors	Month/Year of Publishing	Technology Used	Remarks	Extractive/ Abstractive
Home Automation Using Internet OF things	Vinay Sagar K N, Kusuma S M	June -2015	Galileo micro controller, HTML, Wi-Fi	Inadequate features to reduce power consumption.	Extractive
Design and Implementation of a Wi-Fi based Home Automation System,	Ahmed Elshafee, Karim AlaaHamed	2012	Arduino board, ASP.net, Wi-Fi.	Complexity increases with the expansion of system.	Extractive
"Android based Home Automation Using Raspberry Pi	Shaijupaul, Ashlin Anthony, Aswathy B	February -2014	Android, Raspberry Pi, Wi-Fi.	Doesn't provide sufficient base for an automated system.	Extractive
Home automation using Raspberry Pi	Monika M Patel, Mehul A Jajal, Dixita B vataliya	2015.	Remote Control, Raspberry Pi, Wi-fi.	System is not user-friendly.	Extractive

Fig 2. Comparison Table

• **Discussion**

For a complete HAS, the interconnectivity of all the appliances is essential as well as automatically changing its mode depending on the external atmosphere is a key feature of the HAS. Using the comparison table of the other references as shown in fig2, this paper implicates the complete automation of the home appliances involving all

the flaws of the other published papers which include wide range connectivity, convenient user interface, energy efficient system, cost effective installation, and efficiency.

These flaws can be overtaken by using a Raspberry Pi as a system processor, Android based application as a user interface, Internet as the mode of connection between Home environment and a Remote environment. Wi-Fi will be used

as a mode for accessing Internet, Relay circuit is used to connect the Home appliances like lights, fans etc. and sensors like heat sensor, light sensor etc. to the raspberry pi. Our system also gives power managing mode to the user which when switched on will make all the appliances

connected to the system to consume a minimum amount of energy and thus reduce the power consumption by entire home.

#### 4. Proposed System

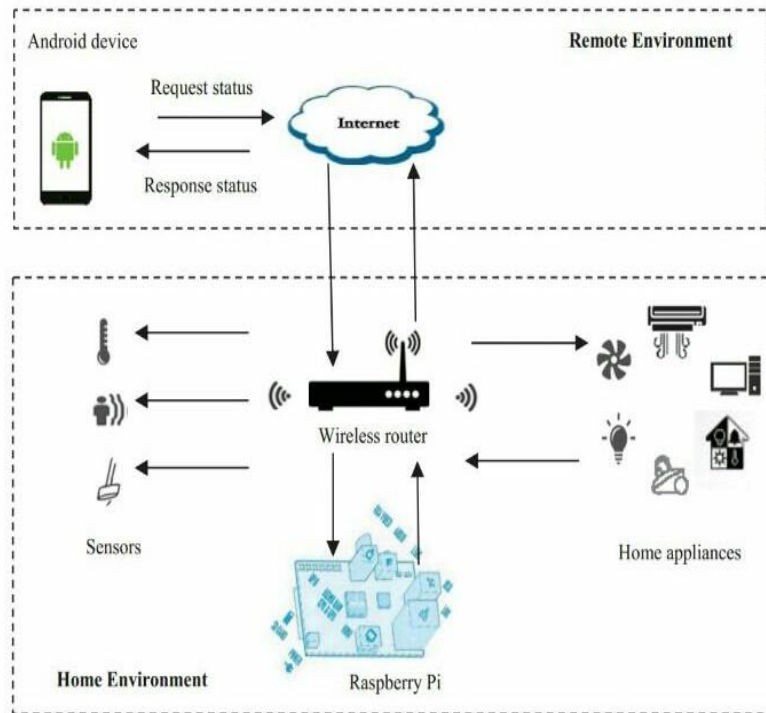


Fig.1 Workflow of Home Automation System

Fig1 shows the following phase wise implementation -

**Phase 1-** In this phase, the main objective is to control the power switch of basic appliances using an android application. In which the Raspberry Pi will play as the main interface provider between the hardware and the application. This system is just the basic skeleton of our project.

**Phase2-** In this phase, the system will be introduced with the sensors which will check and keep a record of atmospheric change and would adjust the entire home system automatically.

**Phase 3-** This phase is the most important phase of this project in which an energy saver mode is to be introduced on just one click in the application. The main objective of this mode is to save the energy consumption of the entire system which includes adjusting the appliances in such a way that it uses less power depending on the change in climate and disabling the unwanted features of the Raspberry Pi so that the system would be more power efficient and cost effective.

#### 5. Conclusion

These kinds of Home Automation System are required because a human can make mistakes and forget to switch off the appliances when in no use and in this case, they are

useful in order to utilize the power effectively and also in a secured manner.

This system can be proved as a future of artificial intelligence and a powerful and a dependable system through which the goal of energy saving and efficient use of the energy resources can be achieved soon.

Raspberry Pi being an intelligent platform using which multiple appliances can be connected to each other and can be controlled from a longer range of distance because the connection which is to be used would be through the internet. Due to which appliances, can be accessible easily.

Home Automation system is a leading step towards the increase in the technological advancement in the industry of appliances and another method by which the human errors can be avoided and the energy consumption can be reduced.

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