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Survey on Home Automation Systems using Android Applications

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ABSTRACT: Home automation is becoming popular due to its numerous benefits. Home automation refers to the control of home appliances and domestic features by local networking or by remote control. Artificial Intelligence provides us the framework to go real-time decision and automation for Internet of Things (IoT). This paper compares technologies used while developing different home automation systems from various features standpoint. This paper focuses on concept of home automation where the monitoring and control operations are facilitating through smart devices installed in residential buildings. Heterogeneous home-automation systems and technologies considered in review with central controller based (Arduino or Raspberry pi), web based, Bluetooth-based, smart-phone based, ZigBee based, cloud-based and the Internet with performance.

KEYWORDS: Android, Raspberry-Pi, Arduino, Home Automation, IoT.

I. INTRODUCTION

Automation is the technology by which a process or procedure is performed with minimum human assistance. In control complexity it can range from simple on-off control to multi-variable high level algorithms. Home automation or domotics is building automation for a home, called a smart home or smart house. A home automation system will control lighting, climate, entertainment systems, and appliances. It may also include home security such as access control and alarm systems. When connected with the Internet, home devices are an important constituent of the Internet of Things. A home automation system typically connects controlled devices to a central hub or "gateway". The user interface for control of the system uses wall-mounted terminals, tablet or desktop computers, a mobile phone application, or a Web interface, that may also be accessible off-site through the Internet. This Smart home with the use of new technology, aims to make the domestic activities more convenient, comfortable, secure and economical. The home automation system includes main components which are:

User interface: as a monitor, computer, or Phone, for example, that can give orders to control System.

Mode of transmission: wired connections (example Ethernet) or Wireless (radio waves, infrared, Bluetooth, GSM) etc.

Central Controller: It is hardware interface that communicates with user interface by controlling domestic services Electronic devices, a lamp, an AC or a heater, which is compatible with the transmission mode, and connected to the Central control system.

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Electronic devices: A lamp, an AC or a heater, which is compatible with the transmission mode, and connected to the Central control system.

II. LITERATURE REVIEW

In this section, we will look at the available Home Automation Systems with their technology with their features, benefits and limitations they have. Figure [1] shows a Traditional Architecture of Remote Home Automation.

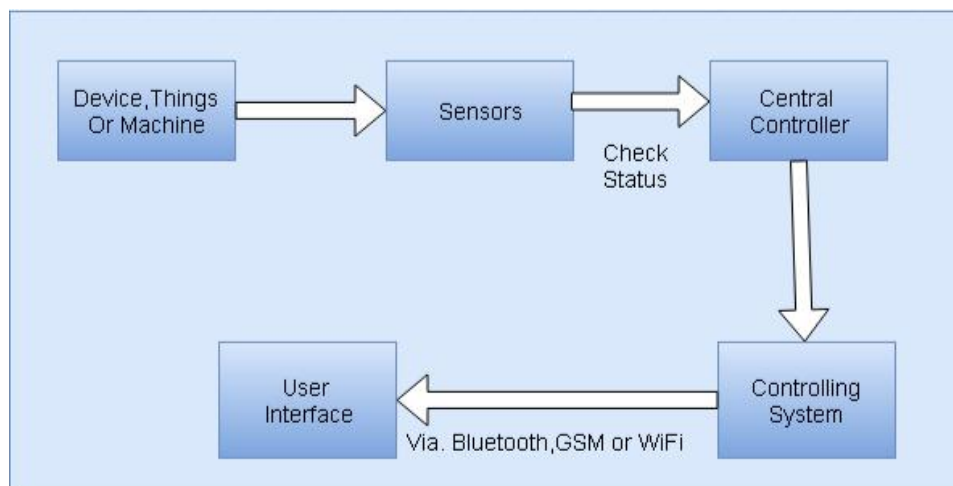


Figure 1. Traditional Model of a Home Automation System.

Home Automation Systems currently focus on Smart Phone applications as the easiest way to interface with the Smart Homes. However, this has not always been the case. It has evolved from several architectures and systems into the developed architecture it is today. In this survey following Papers were studied and the technologies were compared.

An IoT based Home Automation Using Android Application [1]. The Authors propose a low cost, secure, universally accessible, auto-configurable, remotely controlled solution. The approach discussed in the paper is efficient while controlling home appliances remotely using the Wi-Fi technology to connect system parts, satisfying user needs and requirements. Wi-Fi technology capable solution has proved to be controlled remotely, provide home security and it is low cost as compared to the previous systems.

Home Automation Using Internet of Thing [2]. In this paper the authors have focused on the process of operating or controlling various equipment, machinery, and other electrical and electronic appliances using various control systems remotely. The platform uses the IOT technology to create a network between the main server and the other electrical and electronic appliances making home a smarter place to live in. The whole network consists of a single admin which makes their model a secure one as the admin only have the authority to access all the nodes present under each user.

A virtual connection is setup between the sensors and the servers using PHP and no micro controllers are involved which help reduce the cost of this particular system.

Mobile based Home Automation using Internet of Things (IoT) [3]. In this paper, a prototype smart home automation using IoT is presented. This research work will be carried forward by integrating relays to Arduino board for controlling home appliances from a remote location in a real scenario the connection is made using Bluetooth 2.0. As

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an extension, authors propose a generic IoT framework and use cloud computing infrastructure for connecting and managing remote devices and also store sensor data. Authors plan to productize proposed home automation solution so that a greater number of people can use IoT in a smart environment.

Globally Accessible Machine Automation Using Raspberry Pi [4]. The authors have proposed a model that implements novel architecture for a home automation system is proposed using the raspberry pi board, Weaved services and electromagnetic relay. Raspberry pi micro-controller board is used to control the switches of appliances through internet. A website was created using weaved services for acquiring user input. The implemented automation system aims to provide an efficient, comfortable and flexible user interface for controlling electric appliances remotely.

Real Time Smart Home Automation based on PIC Microcontroller, Bluetooth and Android Technology [5].

In this paper, Authors have proposed a working protocol of PIC Technology based low cost, flexible and Bluetooth based solution to home automation for current and future smart home implementation. The system will facilitate users to pair any sort of Android devices with Bluetooth Sensor integrated on board to pair and control the Lights of the room. In the future, the proposed system could be enhanced via use of Arduino/AVR/ARM based Microcontroller Technology and could be integrated with advanced wireless communication mediums like ZigBee, Wi-Fi Modules to extend operating range and enhancing accuracy and robustness.

IoT Based Home Automation [6]. Authors have developed an android mobile application that is used to monitor the switches of lights for the entire and the application can be accessed at remote place using the wifi module. Thus the proposed automation system will save time and conserve energy. The implementation of home automation using IOT enabled the authors to go through various research papers and do a prosthetic literature survey. Various enterprise level automation was observed. Using android programming an application was developed which controlled the states of the lights. From that moment there was no need to touch the switch as the lights were controlled using mobile application.

Smart and Interactive Home Using Raspberry Pi [7]. The Authors conclude that the proposed Smart Home System is very cheap, fast and responsive which makes it reliable and user friendly. Also that it could be scaled easily into larger places like Universities, Industries, and Hospitals. A camera could be used to add more security to the system but adds extra cost to the system. Despite of all the advantages of Raspberry Pi it has some limitations, it requires time to power up and has a limited memory which cannot be expanded and thus it is important to keep only the program required to run and perform the specific task(s) at hand. It also requires a good Wi-Fi or Internet connection at all time for its operation.

Home Automation using Raspberry Pi controlled via an Android Application [8]. Authors have proposed a system which permits the owner or the controller, all the rights to take decisions and to regulate the home appliances with the help of an android application. It provides effortless as well as varied ways to control the devices in the house providing remote access through portable devices like android phones. Future scope was determined as implementing a smart Doorbell which uses voice and video calls between the person standing right outside the door and the owner remotely.

IoT based Home Automation by using Personal Assistant [9]. Authors have proposed a Virtual Assistant called RasPi. However there remain some areas of improvement for the Raspberry Pi (RasPi) Personal Assistant. The quality of voice recognition can be improved by better training. The Amazon Echo in comparison employs a special setup for Far-field Voice Recognition which enables the user to speak from any direction as well as from large distances from the Echo. The RasPi personal assistant employs a simple webcam for speech recording. Due to design limitations, the range and direction of users' speech is limited. Image processing could be improved as well. The Image processing algorithm used in the project has its limitations. It can only pick up fingers when there is a definite background-foreground demarcation. The authors also state that Amazon has invested considerable funds and time to develop the

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Echo and have produced a state-of-the-art product with a large number of features not covered by the RasPi Personal Assistant. The RasPi personal assistant is simply an attempt to show possible areas of improvement.

While studying all the above papers it was noted that a majority of them used Micro Controllers to monitor and control the systems efficiently. The two most prominently used are:

1)Raspberry Pi:

It is a credit-card-sized single microcontroller computer. Python as the main programming language. It is easy to learn and suitable for real world applications. There are two main types of pi first one is Model A has 256Mb RAM, one USB port and no network connection and Model B has 512Mb RAM, 2 USB ports and an Ethernet port. It has a Broadcom BCM2835 system on a chip which includes an ARM1176JZF-S 700 MHz processor, Video Core IV GPU, and an SD card. Arduino can successfully work with Raspberry Pi Computers.

2)Arduino:

It is a microcontroller board, not fully computers. In this, written codes are simply executed without any obstacle. It is an 8-bit Atmel AVR Microcontroller which comprises of 32K and 512K of onboard flash memory, 2K of RAM, runs at 8-84MHz clock speeds with voltages of 2.7V-12V. programming is done using C and carries no operating system. The code is written in the computer and then sent through USB cable for execution. Its construction simply covers digital input-output pins that are between 9-54 AND 6-12 analogue input pins. Its power consumption is less than 0.5 watt.

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III. COMPARISON TABLE

Table 1.

Sr No.	System	Communication Interface	Controller	Applications
1.	Wi-Fi based using Arduino	Wifi	Arduino	Control home appliances using android and Wi-Fi.
2.	Home Automation using IoT	Web Server and Wifi	No Controller.	Virtual Connections have been setup using PHP for controlling various electrical and electronic appliances using various control systems remotely.
3.	Mobile Based Home Automation	Bluetooth Based	Arduino	Using low cost Arduino board for controlling various electrical appliances using an Android smart phone.
4.	Machine Automation Using	Weaved Cloud Services and WiFi	Raspberry pi	Raspberry pi micro-controller board is used to control the switches of appliances through internet.
5.	Real Time Homes automation using PIC and Bluetooth	Bluetooth Network	PIC Microcontroller	Android Devices with Bluetooth Sensor integration to control local Appliances
6.	IoT Based Home Automation	Bluetooth	Arduino	The android mobile application will be used to monitor switches of lights and application can be accessed at remote place using the Wi-Fi module.
7.	Smart and Interactive Home Using Raspberry Pi	Wi-Fi /LAN	Raspberry Pi	Control the switching on or off of the home devices control the intensity, speed and temperature of the same as and when desired.

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8.	Home Automation using Raspberry Pi and Android Application	Bluetooth And Wi-Fi	Raspberry Pi	The Android Application provides for an interface to the user to Regulate Appliances, get Reminders, Alarms
9.	IoT Based Home Automation by Using Personal Assistant	Wi-Fi	Raspberry pi along with RasPi	The work helps in consumers' access to a hands-free personal assistant that uses speech or gesture commands to interact with appliances in a house

IV. CONCLUSION

Based on surveyed study the comparison of home automation systems are presented. Microcontroller, communication interface and their applications are compared. There are a number of do-it-yourself (DIY) platforms available that allow to create Home Automation system quickly and easily with low cost and high performance e.g. Raspberry pi, Arduino, other microcontrollers, etc. We have reviewed different home automation systems e.g. Bluetooth-based, Cloud Based, Internet based. However considering all the factors a conclusion can be drawn that there is a need for a framework for secure communication between internal and external entities, standardized key management is required to ensure confidentiality, tempering or reverse in smart meter and legal and strong framework for privacy of user. Also there is no system that actually integrates Virtual Assistants into Home Automation Systems to the full extent. Hence we can conclude that a system which is Secure and integrates Virtual Assistants can be developed to replace the current systems.

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