A Novel Prototype for Home Automation Using Internet of Things

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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. Advancement in technologies have made homes more convenient, efficient and even more secure. Introducing the Raspberry Pi to the world of home automation provides numerous customizations to turn a regular home into a smart home. Raspberry Pi provides a low cost platform for interconnecting electrical/electronic devices in home via the internet network. The main objective of this project work is to design a smart home which can be controlled and monitored by the Raspberry Pi via the Internet of Things (IoT). This project 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. Installing Raspbian Operating System (OS), a code can be developed for loads to ON and OFF separately by using python programming language. An android mobile application (app) is used where we can be able to see the status of appliances virtually and control them by changing the buttons provided in that app.

Index Terms: Raspberry Pi, Internet of Things (IoT), Relay, Home appliances, Firebase, Android app.

I. INTRODUCTION

Internet of Things today is a famous research topic to enhance the convenience of life, connecting most sensors and appliances can be a good solution. Suppose that all the home appliances are connected to the network and already on demand identifies by the central home server, all the states of the appliances can be monitored remotely. However, not all current home appliances can be connected to the network. Most of the appliances are turned on/off based on the mechanical switch. In addition, different home appliances provide different functions and services. Hence, how to connect these different home appliances to the network for remote control becomes an important issue.

If the home appliance is controlled and monitored, it means that the appliance is powered on and already connected to the network. In opposition, to save the power and reduce the cost the appliance should be turn off if iy is noy used, Since most of current appliances today are not equipped the intelligent power module, to directly turn on or power on thr appliance via using wire or wireless signal is too difficult.

Today, Internet of Things (IoT) is proposed to make all the things connected by network. Suppose that the devices equip the Internet connection module for information exchanging based on network. All the powered devices will be treated as the network devices and exchange the data between device and controller. In addition, based on IoT concept, the control server or the management system can automatically identify each individual device. However, until now, most home appliances are not the "Home IoT" type devices. Therefore, how to establish a home IoT environment for the existed home appliances should be considered.

II. IDENTIFICATION AND RESEARCH

Homes of the 21st century will become more and more self-controlled and automated due to the comfort it provides, especially when employed in a private home. A home automation system is a means that allow users to control electric appliances of varying kind. Many

existing, well-established home automation systems are based on wired communication. This does not pose a problem until the system is planned well in advance and installed during the physical construction of the building. But for already existing buildings the implementation cost goes very high. In contrast, Wireless systems can be of great help for automation systems. With the advancement of wireless technologies such as Wi-Fi, cloud networks in the recent past, wireless systems are used every day and everywhere. Some of the existing methods are:

a. Bluetooth Based Home Automation
b. Wireless Home Automation System Using Zigbee.

Bluetooth Based Home Automation:

The main design element is a standalone embedded system board ARM7 LPC2148 at home. Home devices are connected to the ARM7 and ARM9 with Bluetooth device. Appliances in the house are connected to the IN/OUT ports of the embedded system board and their status is passed to the ARM7. For authorized person to access home appliances we have to develop an authentication to the system. The device with low cost and scalable to less change to the core is much important.
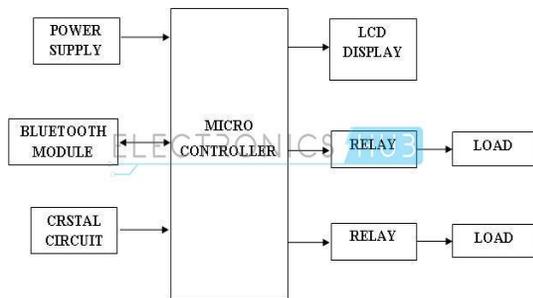

Figure: 1 Wireless Home Automation System Using Zigbee

The high technology centers on recognition of voice commands and uses low-power RF Zigbee wireless communication modules which are relatively of low cost. The home automation system is supposed to control all slights and electrical appliances in a house or office using voice commands. The system has been tested and verified. The verification tests included voice identification response test, indoor ZigBee communication test. The tests involved a mix of 11 male and female subjects with various Indian languages. 7 different voice commands were sent by each person. Thus the test involved sending a total of 77 commands and 80.05% of these commands were recognized correctly.
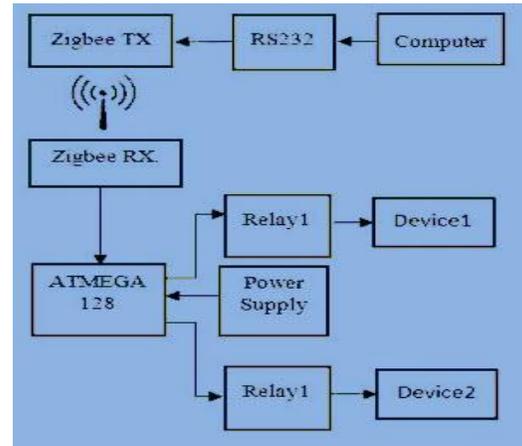
By using these methods, we can control home appliances for certain distance. In order to overcome this problem we have come with a solution, that is IoT based home automation using Raspberry Pi.

III. BLOCK DIAGRAM OF PROPOSED MODEL

Firebase:
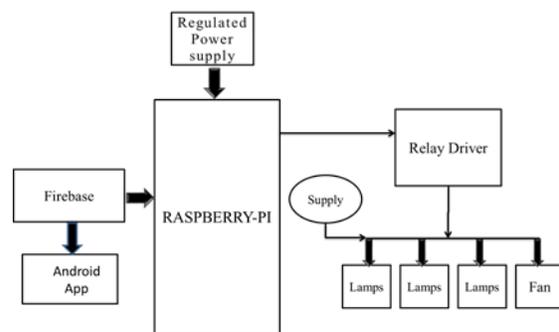
Firebase is a mobile and web application development platform. Firebase provides a real-time database and backend as a service. The service provides application

developers an API that allows application data to be synchronized across clients and stored on Firebase's cloud. The company provides client libraries that enable integration with Android, iOS, JavaScript, Java, Objective C, swift and Node.js applications. The database is also accessible through a REST API and bindings for several JavaScript frameworks such as Angular, React, Ember.js and Backbone.js. The REST API uses the Server-Sent Events protocol, which is an API for creating HTTP connections for receiving push notifications from a server. Developers using the real time database can secure their data by using the company's server-side-enforced security rules.

Android app:

A mobile app is a computer program designed to run on a mobile device such as a phone/tablet or watch. Mobile applications often stand in contrast to desktop applications that run on desktop computers, and with web applications which run in mobile web browsers rather than directly on the mobile device. The term "app" is a shortening of the term "software application".

Raspberry Pi:

Raspberry Pi of model 3B consists of Broadcom BCM2387, 1.2GHz Quad-Core ARM CortexA53, 1 GB RAM, 64 bit CPU, 4 USB ports, 4 pole Stereo output and Composite video port, Full size HDMI.

Relay:

A relay is an electrically operated switch. Relay driver consists of relay(5V DC coil), BC337 NPN transistor, Diode, 1 K resistor.

To control our appliances using raspberry pi through firebase and an app, the app could be user interface to ON and OFF the appliances in a smart way.

A.   Referred Work

Wireless Home Automation system (WHAS) using IoT is a system that uses computers or mobile devices to control basic home functions and features automatically through internet from anywhere around the world, an automated home is sometimes called a smart home. It is meant to save the electric power and human energy. The home automation system differs from other system by allowing the user to operate the

system from anywhere around the world through internet connection.
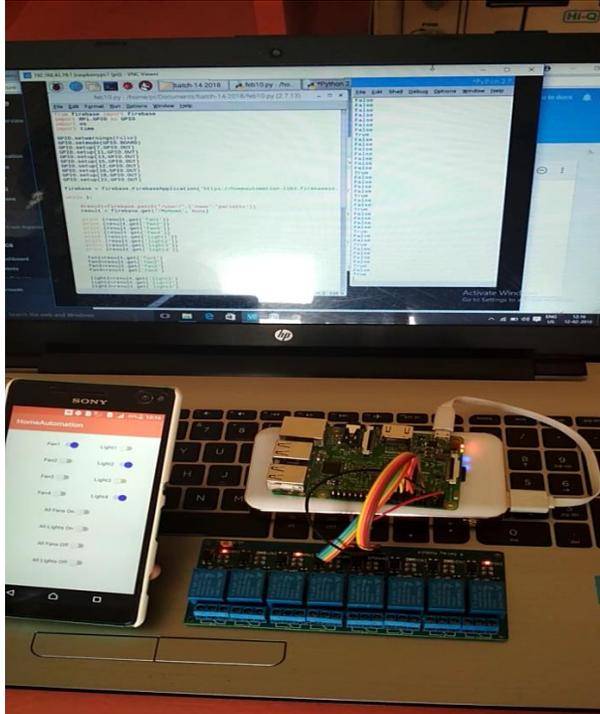
B.   Software used

Android Studio is the official integrated development environment (IDE) for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development. It is available for download on Windows, macOS, and Linux based operating systems. It is a replacement for the Eclipse Andeoid Development Tools (ADT) as primary IDE for native Android application development. Features of Android Studio are:

- Gradle-based build support
- Android-specific refactoring and quick fixes
- Lint tools to catch performance, usability, version compatibility and other problems
- ProGuard integration and app-signing capabilities
- Template-based wizards to create common Android designs and components
- A rich layout editor that allows users to drag-and-drop UI components, option to preview layouts on multiple screen configurations
- Support for building Android Wear apps
- Built-in support for Google Cloud Platform, enabling integration with Firebase Cloud Messaging (Earlier 'Google Cloud Messaging') and Google App Engine
- Android Virtual Device (Emulator) to run and debug apps in the Android Studio

IV.   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 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 reached.

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