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Home Automation using IOT and Mobile App

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Abstract - *This paper presents an idea or a concept for home automation using voice recognition. Today, home automation industry is growing widely; this is powered by the need to provide systems which provides support for aged and physically handicapped people, especially people who lives alone. Smart home or home automation can be said as the residential extension of building automation, it also involves the automation and controlling of lightings, ACs, ventilation and security which also includes home appliances such as dryers/washers, ovens or refrigerators/freezers which uses WiFi for monitoring via remote. Home automation must have compliance with all the household standards and ease of use. This paper focuses on flexible, cost friendly wireless home automation system which would be based on an Android App. The app will be working with the help of Voice Recognition also Internet of Things. The App would be featuring the process of voice recognition that would be taking commands from user in order to control different home appliances that would be connected via IOT.*

Key Words: Internet of Things, IOT, Home Automation, Voice Recognition, Speech Recognition, IOT, Mobile Application

1. INTRODUCTION

As the mobile devices are continuously increasing in its popularity and also for its smooth functionality the demand for advanced and responsive mobile applications is increasing day by day in people's daily routine. Web services utilization is the most open and also practical way for providing remote service access or enabling the applications to make them communicate with each other. Busy and most engaged families also individuals with physical limitations are the people who represent an attractive market for home automation including networking.

Because of rapid development in internet and internet of things, we all are highly integrated at an uneven scale. Internet Of Things often abbreviated as IOT refers to the interconnection of different devices or any appliances through any possible mode. [1]

The other idea used in this app is speech recognition. As speech has been one of the best means of communication between all individuals and will always be. The problem of communication with computer led to a heavy research on speech recognition before this the communication between user and computer was simple click method which was suitable for a limited process but researchers wanted a more enhanced communication for the betterment of the people and break the small thin barrier between user and computer. This similar method of speech recognition will be used in this app to control the home appliances with the user's voice.

2. EARLY HISTORY

Home automation system is a kind of automation systems, which are used specifically for controlling the home appliances and devices mechanically (in some cases remotely) with the help of variety of control systems [2]. The home automation systems are used for controlling the indoor & outdoor lights, heat, ventilation, air conditioning in

the house, to lock or open the doors & gates, to control electrical & electronic appliances and so on using various control systems with appropriate sensors [2][3].

Early home automation began with labour-saving machines. In 1900s,self-contained electric or gas powered home appliances came into existence with the introduction of electric power distribution resulting to the introduction of washing machines (1904), water heaters(1889), refrigerators, sewing machines, dishwashers, and also clothes dryers.[4]

The first general purpose home automation network technology, X10 was developed in 1975.It was considered as a communication protocol for electronic devices. For the purpose of signaling and control, it primarily make use of electric power transmission wiring, here the signals will provide brief radio frequency bursts of digital data, and remains most widely available.

3. RELATED WORK

Smart home is not a new term for science society however, it is still far more away from people's vision and audition.The field of home automation is growing exponentially as the electronic based technologies are converging day by day. Variety of smart systems have been constructed where the control is through Bluetooth, internet, short message service (SMS) etc. Bluetooth system is one of the best wireless system and also most of the current laptop/notebook, tablets and cellphones have in-built adaptor which results in reducing the cost of system indirectly. As it limits the control to within the range of Bluetooth environment while on the other hand most of the systems are not too possible to be implemented as a cost-friendly solution.

1.The **Wi-Fi based home automation system** makes use of a Personal Computer (PC) (with inbuilt Wi-Fi card) which is based on web server that manages the connected home devices. Here the users can manage and also can control the system locally (LAN) or remotely (internet). Wide range of home automation devices are supported by system such as power management components and security components. An identical type of

Architecture is implemented where the actions are coordinated by the home agent running on a PC. Other some papers also represented internet controlled systems which consists of dedicated web server, database and a web page for interconnecting and managing the devices.[5]

2. These systems utilizes PC which results into a direct increase in cost and power consumption. On the other side, the development and hosting of the web page will also result in extra costs.

2. EnOcean:

EnOcean - Smart. Green. Wireless. Energy harvesting wireless technology often abbreviated as EnOcean which enables the maintenance-less sensor solutions which delivers data to intelligent networks in building architectures and IOT. The company EnOcean works specifically in the field of IOT and home automation. It is patented energy harvesting wireless technology. EnOcean makes and markets energy harvesting wireless modules for use in buildings, smart home and also in industrial applications as well as for the Internet Of Things (IOT). [5]

4. SYSTEM DESIGN

4.1 PROPOSED SYSTEM ARCHITECTURE

As shown in the design, a low cost smart home system for remotely controlling also for monitoring the smart home environment is represented. A summary of the proposed system architecture is shown in Figure 1.[5]

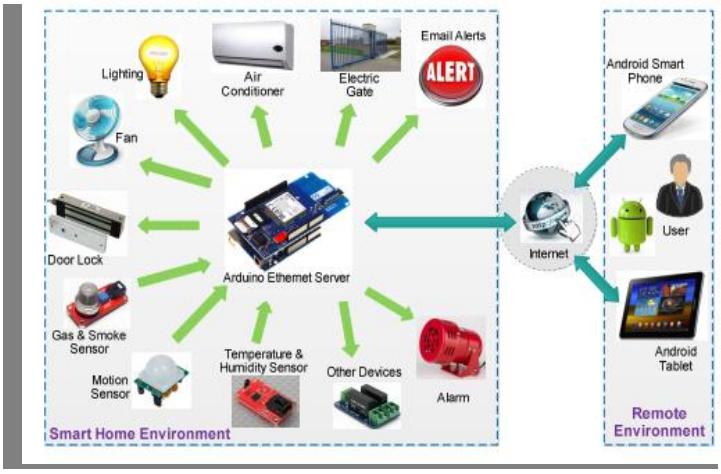
The system consists of an app which is developed using Android platform and by using Arduino Ethernet based

micro web-server. The Arduino micro-controller acts as a main controller that hosts and performs the actions which are necessary to be carried out. [5][6]

The master controller that has the Arduino Ethernet micro web server running consists of Arduino Mega 2560 and Arduino Ethernet Shield with other hardware such as the siren, nRF24L01+ radio module, which is used to communicate and coordinate actions with the other sensor nodes within the home environment and the Bluetooth module [6].

All the actuators/relays and sensors are directly interconnected to the main controller. Using the smart home app, from a remote location it is possible to control and monitor the smart home environment. The app will communicate with the micro web-server via the internet. Any internet connection via Wi-Fi or 3G/4G network can be used on the user device.[7]

This all automation and controlling of the home appliances and the alert systems can be done just with the human's voice using the voice/speech recognition.



4.2 Software development of the Android platform app

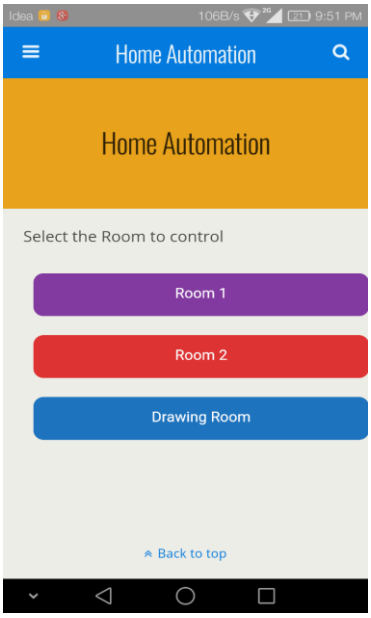
There are several platforms for developing smart phone applications such as Windows Mobile, Symbian, iOS and Android.

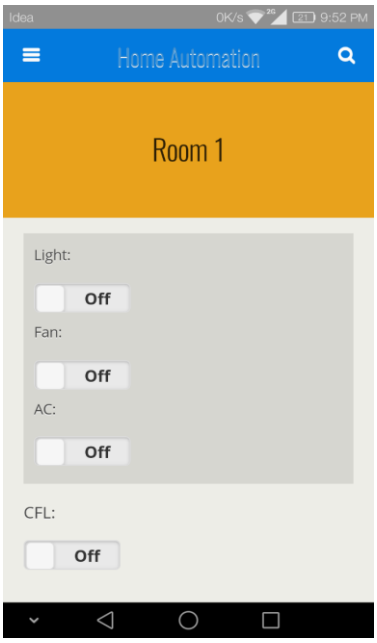
In the proposed system, the Android platform app is developed as most of the phones and handy devices support Android OS. Java programming language using the Android Software Development Kit (SDK) has been used for the development and implementation of the smart home app.

The SDK includes a complete set of development tools such as debugger, libraries, and a handset emulator with documentation, sample code and tutorials. Eclipse (running on Windows 7 development platform), which is the officially supported integrated development environment (IDE) has been used on in conjunction with the Android Development Tools (ADT) Plug-in to develop the smart home app. [8][9]

The designed app for the smart home system provides the following functionalities to the user:

- Device control and monitoring.
- Scheduling tasks and setting automatic control of the smart home environment.
- Password change option.
- Supports voice activation for switching functions.[9]





5. PROPOSED METHODOLOGY

In today's world everyone has shortage of time and in this era of technology there should be a mobile app that could be used to control the home appliances with the help of speech recognition.

This project will use the home appliances and will be powered with the Bluetooth and the WiFi making an interconnectivity between the devices and creating an internet of things.

In this project the Arduino Mega 2560 and the Arduino Ethernet [9] shield have been used to implement the smart home micro web-server.

Arduino is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. The Arduino Mega 2560 [10] microcontroller board is based on the ATmega256 having 54 digital input/output pins. The Ethernet is interfaced to the Arduino via the Arduino SPI pins. Low voltage switching relays were used to integrate the devices with the Arduino for demonstrating the switching functionality

In this proposed project a mobile app is created and it includes all the features of controlling the home appliances with the help of speech recognition and interconnectivity of devices. [8][9]

The mobile app that is created, contains all the commands like switching on/off the AC, Fan, Washing machine, etc.

Thus this concept basically contains the smart appliances in a home that can be controlled by WiFi and Bluetooth and connected wirelessly with the mobile phones.

The mobile app in the mobile phone will be containing the options to give different commands to the appliances and controlling it with our mobile app. [10]

The main page of the app will be having the login page that will be used to authenticate the user using the IP Address and the password.

After successful login the user will be able to control all the appliances with the mobile app and the voice recognition. [11]

There will be switches provided in the app to control the devices and the appliances of the home and these switches can be customized manually or using voice by the user. [12]

6. CONCLUSIONS

In this paper, an internet based smart home system that can be controlled remotely upon user authentication is proposed and implemented. The Android based smart home app communicates with the micro web-server via internet using the REST fully based web service. Any android supported device can be used to install the smart home app, and control and monitor the smart home environment. A low cost smart home system has been developed which does not require a PC as all processing is handled by the microcontroller. The system also uses the Google speech recognition engine thus eliminating the need for an external voice recognition module. Prospective future works include incorporating SMS and call alerts, and reducing the wiring changes for installing the proposed system in pre-existing houses by creating a wireless network within the home environment for controlling and monitoring the smart home environment.

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