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# Smart security and Home Automation system using Internet of things

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**Abstract -** *Smart homes have become as an area of research interest in the upcoming years. Home automation gives us our own independence and complete control over our home along with effective intelligent system which controls our home in our absence in an very efficient manner. In the upcoming years all the implemented technique does not have realized Intelligent Home design in the quality aspects because everything has its own pros and cons whether we talk in of technology, efficiency etc. This paper presents a brief analysis on implemented techniques and provides a effective solution to realize home automation system which constitutes Bluetooth control via Android app development for in-house control and GSM (Global System for Mobile Communication) technology for mobile control using Arduino Development Board. To implement Intelligent Home, the need is to adapt simple, efficient and cost effective technologies.*

***Key Words*: — home automation, GSM, ZigBee, Bluetooth, AT commands, Arduino, 89C51, PIC, microcontroller, DTMF, PAN, Android**

## 1. INTRODUCTION

Home automation has been one of the most recognizable technologies that has been utilized by both industrial and private sectors of life in the 21st century. Various definitions of Home Automation have been presented and with the ever advancing technology these definitions are improving on daily basis. Home Automation as a pleasing technology that may be introduced for the new features. Home automation is a technology involving centralized & autonomous control of housing, buildings and industry, including inhabitants of a house to improve the way they spent their life in-house and hence taking the living standards to another level by introducing facilitations as efficient utilization of energy resources, improved multimedia experience and delivering health services through information technology. This technology has been advancing using incorporation of new techniques to ensure reliability and addition safety features against various sudden unanticipated scenarios. Home automation basically incorporates an electronic control of household activities like control of electrical appliances, lightning, central heating & air conditioning and security system. These features are assisted by using different types of sensors, control and communication modules. Various home automation techniques have been implemented and were presented in the form of research in recent years. All of presented techniques have their own distinct advantages over each other. In this paper we have critically analyzed techniques which are already implemented in terms of their efficiency, ease of use, robustness and cost. After analysis, we propose a solution which is efficient enough to be an ideal home automation system and comply with above mentioned factors. The project integrates a centralized automation system including control & communication features along-with security modules interfaced to each other through a main master control providing human interface. The aim can be met by integrating GSM (AT Commands) for mobile control, ZigBee for centralized control within home and Arduino Development Board for catering GSM and eliminated using Zig Bee Communication Module. The system was improved by incorporation of couple of security features along with task acknowledgment notification feature but system lacked monitoring feature (sensors). Due to ZigBee. This method results in a solution which is highly efficient, intelligent, and easy to use which could also prove a right choice for customer in terms of cost.

## 2. RELATED WORK

The rapid growth and application of control systems has not been confined to industrial use but also implemented in personal and private spaces of people all around the world. The idea of autonomous home has been one of the most desirable technologies in life of human beings and considerable improvements have been made in this field.

### 2.1 Existing Home Automation Techniques

The idea was first implemented in the form of product back in 2009 by implementing control through mobile phone based DTMF tones. It got improved when DTMF was replaced by a reliable technique of GSM implementation – SMS based Commands and wired systems inside home were usability concerns home automation was featured with nice human interface devices like Android along with implementation of multiple techniques in order to make it attractive product for consumers. In, modeling of simple home automation system implemented prototype has been discussed along with graphical results and analysis of GSM implementation. All the technologies implemented so far have assisted a fine and quality improvement in realization of intelligent homes but still there is a room for improvement and to make these control systems more efficient and cost effective.

## 3. STRUCTURE OF PROPOSED WORK

### 3.1Cloud Based Home Automation

In this work a home automation system will be developed, as illustrated in Fig 1. that uses an integration of Pachube cloud networking, mobile devices, low-cost microcontrollers, and

in-home user interfaces. From a mobile device, the user can run the mobile phone application and control the system via an Internet connection and cloud networking. From a personal computer a Visual C# based program and cloud by a forty-seven-character password. Pachube treats each unit in the house as a data point. These data points are manipulated to control the unit inside the home automation system. When a unit is turned on, a value of one is given to that action, and zero for turning off action. When a unit is brightened or dimmed a networking provides the user with an interface for control of the system. In home control is achieved via a hand held remote which uses ZigBee wireless communication to the in-home controller which is integrated with the cloud network via an internet connection.

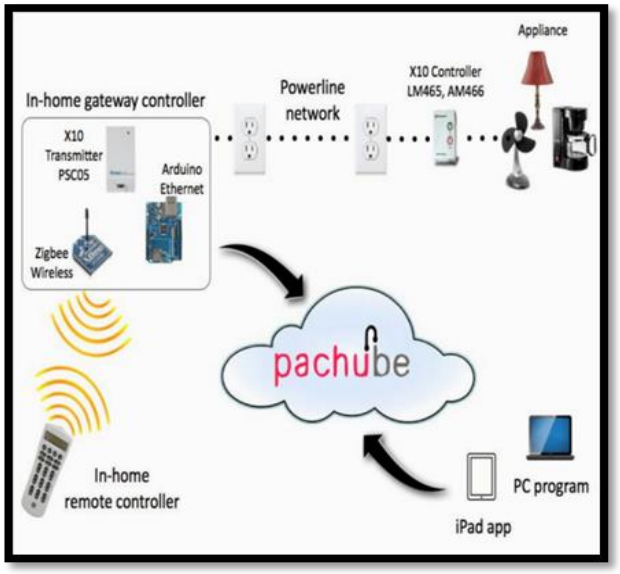


Fig.1 Cloud Based Home Automation System

## Pachube Cloud Network

Pachube is the networking cloud used in this design. Each data stream is classified by a feed identification number and secured value between the range of zero and nine is given to that action. After each unit is set to its desired action, the values are placed in a networking package and sent to the cloud

## X10 Communications

Of the many home automation systems that are currently available, two basic methods of data transmission are used among them By using the existing electrical lines within the house to transmit a binary signal that is embedded in the zero crossing point of the sinusoidal AC power supply, power line communication can send commands throughout a house to control various electronic devices. This method is widely known as X10 transmission and has been used to control devices for many years and is still commonly used in home automation systems.

## iOS Mobile Application and PC Application

The new iOS application was created by the SDK 4.3. Most of the programs in this paper were implemented using Cocoa Touch and Objective-C code. To start creating an iOS application, there are four main parts. The first part is the XIB file which contains the graphical interface. The second part is the header files; this is where all the necessary libraries are included into the project. The third part is the main files where all the code and functions needed are written to execute required tasks. The last part needed is the resource folder which contains all graphics and sounds needed. Before the application can run, source code and interface builder must be linked properly.

### 3.2 Speech Recognition Based Home Automation System

The main concept is to form a network connecting the electrical and electronic appliances in a house. The Wireless Home Automation System is an integrated system to facilitate elderly and disabled people with an easy-to-use home automation system that can be fully operated based on speech commands. The system is portable and constructed in a way that is easy to install, configured.

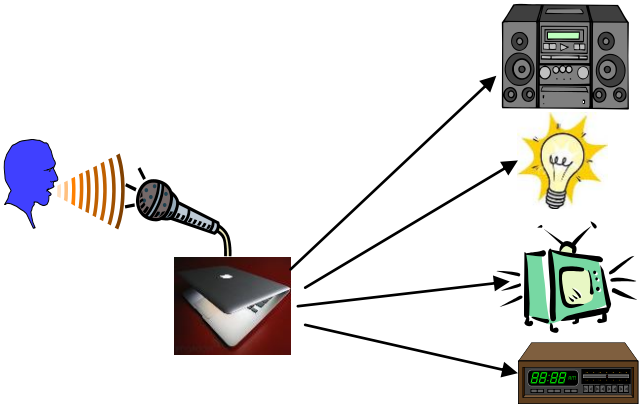

Fig. 2 Speech Recognition Based Home Automation System

The home automation system contains both a base station and a remote station. Each station will be packaged separately and have a separate PCB.

## BASE STATION

The base station will operate with a +5V power supply. This voltage will be used as the operating voltage for all of the circuit elements in the base station. The microphone in the base station will be picking up audio in a close range. The audio signal from the microphone will be input into the HM 2007 speech recognition chip. The HM 2007 chip will process the audio and determine if the commands are speech

commands and valid then it will pass the commands through microcontroller and ZigBee to remote station where the matched command operation will be performed.

**REMOTE STATION**

The remote station will operate with same +5 V power supply. The remote station microcontroller receives the digital signal commands from the base station using the ZigBee wireless protocol and performs the request function. On the basis of command signals received it will update the status of relay switches board. It also read the sensors values and update the LCD status on the remote station. The sensors unit is capable of detecting when the user enters or leaves the room by measuring the change in signals strength between the access Point and can accordingly turn on or off appliances such as lights and fans and in the meantime send its status back to base station.

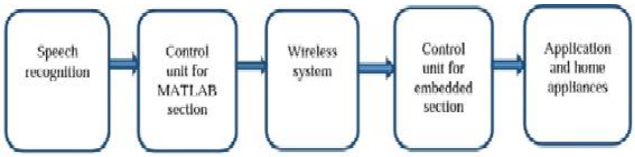


Fig. 3 System Model of Home Automation System

The proposed method is aimed at designing a voice controlled based smart home system. The system is designed in such a way that it is easy to install and use. The system has two main sections; they are Control section and embedded section. Control section uses a PC with software for speech processing and recognition. After recognition, corresponding control characters are sent through the ZigBee transceivers to the control part. Microcontroller in the control part will select the required device according to the input voice command. The devices can also be controlled from distant locations through SMS. So, a GSM module is associated with the control part. Voice recognition based Wireless Home Automation Based on ZigBee is a very useful for the adults and physically disabled persons, who are not able to do various activities efficiently when they are at home and need one's assistant to perform those tasks.

### 3.3 Home Automation using Arduino

The main part of the system consists of a Microcontroller with an Ethernet module for controlling. This Ethernet module is connected to a Wi-Fi router which gives a static IP address to it so that it can use TCP/ IP based communication with other accessing devices connected to the same router.

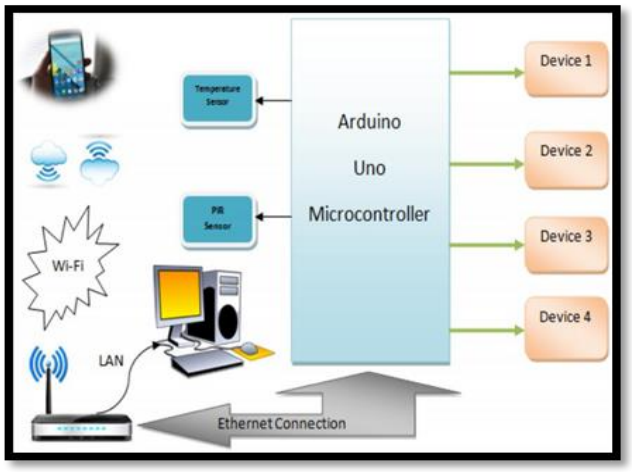


Fig.4 System Design of Home Automation System using Arduino

This module is connected to four appliances through relay devices to automatically turn on and off those devices. As the relay devices are current controlled device, current amplification is needed to support low current output of the microcontroller. Now that was a part which requires human control. To make this design more efficient an automatic system has been designed as well.

## 4. OBSERVATIONS & RESULTS

### 4.1 Comparative Analysis

A number of researches & ideas have been presented in the field of Home Automation systems to make them efficient enough to be adapted by the majority, but we are looking for an ideal system that is equally intelligent, efficient, robust and cost effective technologies.

Table-1 Communication Modules Comparative Analysis.

| Specifications | Bluetooth | ZigBee |
|---|---|---|
| Data Rate | Higher Data Rate | Low Data Rate |
| Power Consumption | High Power Consumption | Low Power Consumption |
| Max number of Cell Nodes | 8 | 65000 |
| Range | 10m | 10-100m |
| Self-Healing Network | Not Present | Present |
| Network Topology | Ad-hoc, peer to peer, star or mesh | Ad-hoc, very small networks |
| Response Time | Slow | Fast |

Bluetooth technology as evident from table I is less efficient than ZigBee technology but if we study it in terms of cost and usability Bluetooth is cheap and meet needs of home automation system. Also we have found Bluetooth technology comparatively easy to implement. Control can be made more easy and efficient if the controller used is switched to Arduino Development Board which is open source hardware with open source environment and provides an ideal interfacing scenario with Bluetooth and GSM. Evident in table III, AT commands have been found better as compared to DTMF technique in terms of security levels, acknowledgement reports, usability and reliability.

## 5. CONCLUSION

This paper presents a wireless based home automation system which can be controlled through spoken commands. In the proposed architecture, wireless component is added by GSM and for home networking ZigBee technology is used. For voice command processing an application is developed and installed in the mobile phone.

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