Smart Home Android Application Using Zigbee Technology

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***Abstract*—Living in a fast moving world of automation people want the comfort to access all their home appliances remotely, smart home is an emerging technology in this field. This paper proposes a design for smart home control system which allow people to control their home appliances by using a smart phone(android) application and provide security when user is away from home. The smart devices are controlled using a DCU(Data concentrator Unit) which is embedded with ZigBee technology(IEEE 802.15.4) to communicate with devices. The potential increase in electric bills or damage to home can be averted by using the smart android application, by controlling home devices by sending appropriate messages through GSM(Global System for Mobile communications).**

Keywords—Smart home,Android phone,DCU,ZigBee,GSM

I. INTRODUCTION

Smart home uses 'home automation' technology to provide the users with 'intelligent' response and information by monitoring and controlling many devices of home. For example, we can switch on/off the lights, fans, oven etc when the user is away from home by just a single click in his/her smart phone.

Home automation is becoming more popular for the purpose of safety, security and human convenience .Home automation uses microprocessor based intelligence to integrate and monitor home appliances, in this paper it is referred as DCU.[2]

Data Concentrator Unit is the intermediate device embedded with ARM processor in order to communicate between the home devices and the android phone.DCU is also embedded with ZigBee protocol which is a low cost, low power communication protocol.

This system uses android phone, mobile internet, GSM, DCU, ZigBee network etc.[2]

A smart home consists of three main parts:

1) Network: The network is used for connecting the home automation to DCU and it is usually through GSM
2) DCU: Data Concentrator Unit is used to manage the smart devices
3) Home Automation: These are the devices which controls the physical environment.

II. RELATED WORK

Smart home is not a new term in the information technology, it exists since 1990's.Various smart home systems have been proposed via Bluetooth, Wi-Fi, Short Message Service(SMS), Internet, Voice Based.

A. Bluetooth based systems

Bluetooth based systems have good capabilities and are built in most of the laptops and cell phones which decreases the cost of the system. However the Bluetooth range is limited and the system works within that range only and also the power consumption is more.

B. Wi-Fi based sysytems

Wi-Fi based systems uses a PC based web service that manages the home devices. Using this system the user can manage and control the devices locally or remotely. But these systems uses PC which leads to high cost and power consumption.[3]

C. SMS based systems

In SMS based systems we use GSM for communication. The devices are controlled by sending a message to the controller, this incurs more cost.

D. Voice based systems

In these systems user speaks a voice command through a microphone which is processed and sent to the controller. The microcontroller extracts the information from the signal and performs the action respectively. This also incurs increase in cost and power consumption.

E. Internet based systems

Internet based features allows the user to control devices from any part of the world remotely if the user has an access to the internet connection.

The existing android applications provided by various smart home system providers such as Samsung Smart home system, Toyoma smart homes costs high due to the complicated hardware and the complex user interface used to satisfy the luxury needs. Our proposed project provides a good and simple user interface for user friendly interaction with the smart devices with a relatively low cost when compared to the

existing systems which costs more than 1,000 dollars. Hence our proposed system is affordable to a common man providing safety, security and convenience to everyone.

III. PROPOSED WORK

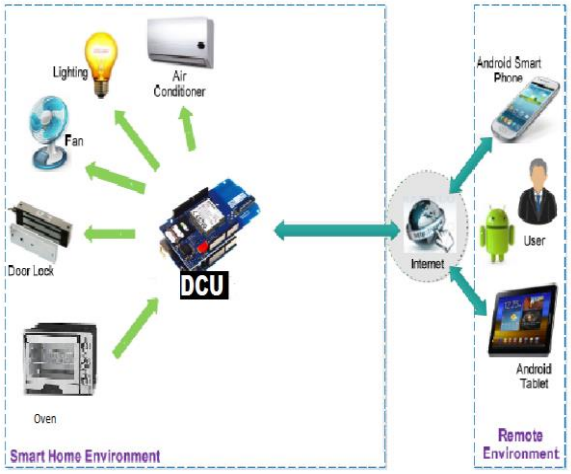

Fig. 1. Overview of the smart home system

Figure 1 depicts the overall architecture of smart home system. The main components are described below:

A. *Home Devices*

A smart device is an ordinary device with a sophisticated computer installed to provide more functionality that monitors many aspects of daily routine.

Smart home devices include:

- Micro Oven used in kitchen which can be set to start when user is away from home to provide preheating.
- Lighting control system can be used to control home lights to turn on or off remotely.
- Fans or Air conditioners can be turned on to make the home environment cooler remotely before the user arrives.

B. *Data Concentrator Unit*

The DCU acts as an intermediate device between the home devices and the smart phone.DCU is used to generate proper mechanism in order to control the appliances. Update, emergency messages are sent and received through DCU in order to control and co ordinate the appliances whenever required.

DCU is provided with a 32bit ARM processor(speed up to 1GHz),128MB-256MB DRAM, Serial ports ZigBee 2.4GHz module, GPRS dual/quad band, battery backup with an internal charger.

The DCU is identified by a static IP(Internet Protocol) address using which the android phone setup a connection with it.

C. *ZigBee*

ZigBee is a wireless communication standard based on IEE 802.15.4.It is a short range, low power, low cost and two way wireless communication topology used to communicate between home appliances and the DCU.

It has a wide area of applications such as Smart home automation, agricultural and industrial monitoring, sensor applications and other control areas like medical, consumer electronics.

The main features of ZigBee are:[1]

- Low Power: One pair of batteries can last up to the life time of the home appliances which is an outstanding advantage of using ZigBee technology.
- Low Cost: It is a simple protocol whose chip cost around just two dollars.
- Short latency: The response rate is much high, thus saving energy.
- Network flexibility and Large capacity: It can support up to 65,536 nodes and supports automatic reconfiguration in mesh topology.
- Low rate: ZigBee works in lower rate of 20 ~250kbps to meet low speed transmission of data by the appliances.
- High security: ZigBee provides three security models to prevent illegal access and provides encryption standards.

Smart home networking has the following characteristics:

1) Less amount of data to transfer with low speed.
2) Variety of devices used in home forms a large network.
3) Real time information with less delay.
4) Low cost.
5) Faster response.

All the above characteristics can be satisfactorily provided using ZigBee.

D. *GSM*

Global system for mobile communication.
Almost all part of the world is under the coverage of GSM network, hence forth the user can interact with home automation system from any part of the world. [4]

The DCU is provided with a SIM(Subscriber Identity Module)which interacts with the users phone using GSM network.

E. *Android Phone*

It is a sotware system which provides the user interface to control the smart devices.Sockets can be implemented to make the syatem interactable to the DCU.

The smart phone establishes the connection to the DCU by using its static IP address through GSM.

The following flowchart (fig 2) provides an overview of the flow of control from smart phone to the smart devices through the DCU. It is a two way communication where in the DCU provides the updated information regarding the devices whenever the user connects to it. On receiving a command from the user it updates the device status accordingly and performs appropriate action.

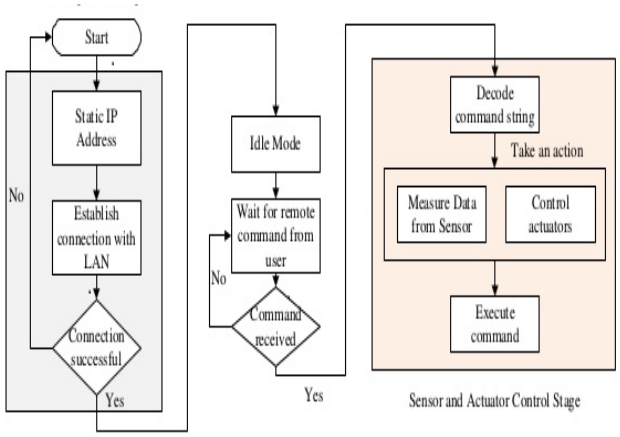

Fig. 2. Flow of control in the system

IV. CONCLUSION AND FUTURE WORK

This paper presents low cost wireless based home automation system which can be controlled remotely through an android application through just a click.

The proposed architecture includes the GSM technology for wireless communication and ZigBee technology for communication among smart devices.

In future GPS technology can be used to automate the system whenever the user nears to the home in order to provide more convenience. The system can be enhanced to provide more security by automating door lock systems and motion sensors.

In the near future more and more people will prefer home automation systems so as to have more security, safety, cost effective and an improved quality of life style.

REFERENCES

[1] Dongmei Yan, and Zhiguang Dan "ZigBee-based Smart Home System Design" 201O 3rd International Conference on Advanced Computer Theory and Engineering(ICACTE)

[2] Faisal Baig, Saira Beg and Muhammad Fahad Khan " Zigbee Based Home Appliances Controlling Through Spoken Commands Using Handheld Devices".International Journal of Smart Home Vol. 7, No. 1, January, 2013.

[3] Shiu Kumar" Ubiquitous smart home system using android application" International Journal of Computer Networks & Communications (IJCNC) Vol.6, No.1, January 2014.

[4] G.M. Sultan Mahmud Rana1, Abdullah Al Mamun Khan2, Mohammad Nazmul Hoque3, Abu Farzan Mitul4" Design and Implementation of a GSM Based remote home security and appliance control system "Proceedings of 2013 2nd International Conference on Advances in Electrical Engineering (ICAEE 2013)19-21 December, 2013, Dhaka, Bangladesh