A Comparative Analysis on Smart Home System to Control, Monitor and Secure Home,based on technologies like GSM,IOT,Bluetooth and PIC Microcontroller with ZigBee Modulation

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***Abstract*— In this busy life schedule everyone wants to get some comfort and secure life as well. Home Automation used to control home appliances remotely to reduce efforts. Home security system is beneficial to secure your home from fire and trespass. Wireless smart home system plays a vital role in human life and increases popularity due to its flexibility, portability and low cost installation charges. Smart home system is very beneficial in everyday life as it reduces human workload, save electricity and reduces worries about home security for working peoples. Main focus in automation is to control light ON/OFF status, fan speed and other home appliances remotely. Home security includes services like gas leakage and trace pass protection. This system is very beneficial for old ages and handicapped people as well for working people, it is a blessing as it alert the person if any nasty situation raised at home in their absence. Though there are various technologies used but in every technology mobile plays important role, to automate home appliances or to get alert in risky situations. Attractive GUI can be used for smart home system, accessible with smart phones, tablet, laptop and PC. A comparative study of smart home system based on technologies like GSM, Bluetooth, IOT and PIC Microcontroller with ZigBee modulation is discussed here.**

Keywords*— *Home Automation; Security; GSM; Bluetooth; IOT; ZigBee; PIC microcontroller ; Smart phone

I. INTRODUCTION

A smart home system, includes very smart features to make life easy. In smart home automation you can control home appliances using your smart mobiles. Main motto behind the idea of smart home system is to reduce human efforts, electricity consumption, and to help old aged people and children. As wireless communication technique growing, it allows us to access or handle home appliances remotely. At the security point of view if any intruder try to enter forcefully then there is a antitheft system which raise the alarm and notify owner so that owner can take further action immediately. Another risky major issue is gas leakage in home. LPG gas is a flammable gas. So in this case also system will raise an alarm and notify user.

Home automation and security can be done with many technologies like GSM, Bluetooth and IOT. In GSM technology home appliances can be controlled by sending messages to system. Bluetooth technology uses smart phones with an android application. Whereas IOT that is internet of things is somewhat a very big area. IOT can be defined as inter-networking of physical devices, buildings and other items embedded with electronics, software, sensors and internet connectivity. Using server created over Wi-Fi for communication, sensors like gas leakage sensor, motion sensor for intruder and smartphone, tablet or laptop as a GUI it is possible to automate and secure home with IOT very effectively. Smart home system based on PIC microcontroller is very low cost and efficient controller. System uses ZigBee which is short range wireless communication module. Smoke sensor used for security purpose. If smoke is detected then alert SMS is send to user.

GSM is a wireless mobile Communication system and can be used for communication over the network. IOT i.e. Internet of Things is basically a network in which all physical devices are connected with each other and can communicate with each other.

GSM based smart home system is fully dependent on mobile network signal and send commands in form of SMS whereas in IOT based smart home system sensors plays very vital role and appliances can communicate with the help of IOT enabled devices.

IOT based smart home system with some modification may be a solution to other technology problem. It is a platform independent and hence system has no distance limitations like in Bluetooth based system [2]. IOT enabled device can be used. In this system devices can communicate with each other over the network as IOT enabled device has inbuilt Wi-Fi communication module. PIC microcontroller has no inbuilt communication module so ZigBee is used as an external communication module in system [4].

In this paper, we discussed smart home system to control, monitor and secure Home based different technologies.

Section II, describes the working of smart home system based on technologies like GSM, Bluetooth, IOT and Microcontroller respectively. In Section III, we describe some general features of smart home system. Section IV, contains comparative analysis of all technologies based smart home system. Finally in section V, we conclude our paper by considering all major outline of paper and future work.

II. LITERATURE SURVEY

A. GSM Based Home Automation,Safety And Security Using Android Mobile Phone

In this paper author developed a module which having two parts, hardware and software. Hardware architecture is built with 8 bit microcontroller, GSM phone with GSM module, relay module and sensors. Software part consist programming for Arduino and developed an Android application for smart phone. GSM modem can be used for communication between home owner and system to execute commands or to get alerts from systems in form of SMS. After GSM modem receives command in form of SMS, it will be executed by microcontroller to change the status of appliances as ON/OFF. For the home security purpose sensors are used like MQ2, MQ7 and ultrasonic sensor [1]. As MQ2 and MQ7 are gas sensors, in case of any nasty situation microcontroller raises an alarm and sent SMS through GSM modem to GSM phone [1].

B. Bluetooth Based Home Automation and Security Using ARM9

According to author, Bluetooth is very low cost, flexible and having suitable capability. In this system, Wince 6.0 Operating system is used for ARM9 devices [2]. GUI is developed using Visual Basics .net to automate home appliances. For ARM 7 and ARM 9, MDK (Microcontroller Development Kit)–ARM is used as software development environment. MDK-ARM specially designed for microcontroller applications. With micro controller devices and MDK-ARM, you can use sensors and actuators you require. This includes temperature and light sensors. GUI which is programmed in VB .net is used to send the commands to microcontroller with the help of Bluetooth. Based on received commands microcontroller will take action on appliances. Control is given for only authorized person and output of a security system is in form of LED [2].

C. IOT Based Smart Security and Home Automation System

In this paper, author built an IOT based smart and wireless home automation and security system. Author used TI-CC3200 Launchpad board embedded with micro-controller and onboard Wi-Fi shield which will be used for home automation purpose. PIR motion sensor is also used to detect the intruder [3].

If any intruder trying to enter in home in absence of owner, motion sensor sense and send SMS to owner. Then owner can send command from his mobile to turn ON lights of house and to raise an alarm so that intruder get warned. Home automation system is explained with an example as suppose owner is absence at home and guest come then owner can get a video call. After seeing that person he can disabled the security system and give commands to ON/OFF lights, fan or other home appliances too from his mobile. If someone leaves home then also owner will get to know with the help of video calling. So after that he can change the status of home appliances and enable home security system. Here appliances are connected to mains supply through a relay so that can be easily controlled with the help of microcontroller [3].

D. Design and Installation of Home Automation And Security System Using microcontroller And Zigbee modulation

Author describes, smart home system based on microcontroller with ZigBee module and GSM network [4]. Voice recognition system is used to receive the commands. Microcontroller is used as central processing unit. ZigBee is used for communication [5]. Relays are used to control home appliances. Smoke sensor generate signals when smoke is detected. PIC controller sends data to RS 232 about smoke sensor [4]. One port of GSM module is connected to RS232 to send alert message to user in case of fire hazards [4].

III. FEATURES OF SMART HOME SYSTEM

Smart home are becoming very popular in recent years. It plays a very important role in everyone's life. Fig.1, shows worldwide market for smart home service [8]. There are so many features and benefits of smart home system which includes:

A. Reduce human efforts

Home automation reduces human efforts, as authorized family members can access home appliances from everywhere.

B. Helps old aged and handicapped people

- If any old aged or handicapped person present in family and everyone from that family is working then smart home system is like a blessing for them. If any risky situation arises with old aged or handicapped person then family will get to know immediately and can take further action.
- If handicapped or old aged person is unable to walk then also he/she can access home appliances due to home automation system.

C. Save Electricity

Main aim for home automation is SAVE ELECTRICITY [6]. Everyone should use electricity as per need. As in home automation, control of home appliances is in everyone's hand then can control use of electricity as per requirement.

D. Very user friendly

- It is very easy to use and robust system.
- No need to give extra training to access the system.
- Automation and security is important for everyone and plays a vital role.

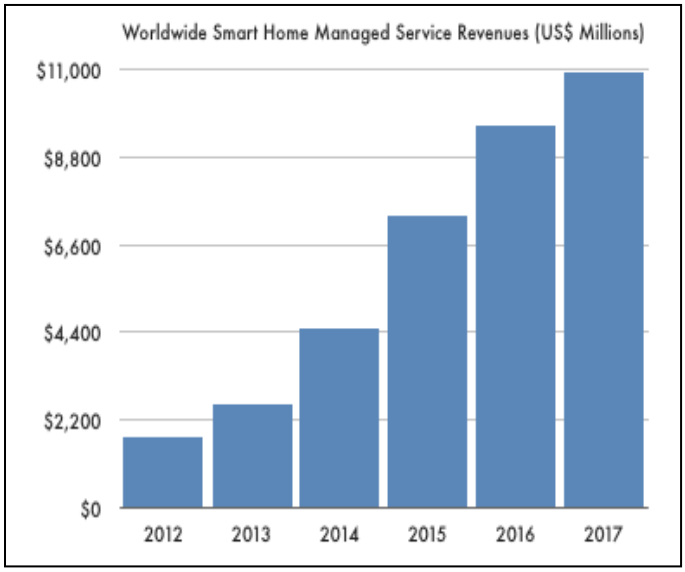

Fig. 1. Worldwide smart home service market

IV. COMPARATIVE ANALYISIS

From above surveyed paper, every smart home system is a wireless system. Android phone plays a very important role in all types of system [6]. In GSM based home automation, system allows to send commands to control home appliances and get alert in form SMS. For GSM home security also SMS is used as Communication Bridge between owner and system [1]. Bluetooth having 2400 HZ frequency and range of 100 meter for connectivity with 3Mbps speed [2]. As compare to other technologies used for smart home system, Bluetooth have distance limitation. Bluetooth based smart home system will not work beyond 100 meters [2]. As there is distance limitation in Bluetooth based smart home system but it will work properly and efficiently within the range. Bluetooth based system is very low cost and easy to use. The basic concept used in IOT (Internet of Things) is to connect and monitor things remotely using Internet. From above survey, we can say that IOT is best suited technology for home automation. This system is low cost with minimum set of equipment used [3]. Home appliances can be controlled by user even if he is not present at home. For home automation user need data connection on his mobile to operate the system remotely [6]. As compared to above technologies every system has its own feature but provides both services, automation and security. IOT and GSM based smart home system can be accessed remotely and using data connection [1,3]. A computer, laptop or smart phones can be used as a GUI to give commands to system. All loads are connected to central system, so easily accessible and manageable.

TABLE I. COMPARATIVE SUMMARY

Technology	Feature	Disadvantage
GSM	Access home appliances and control home security by sending and receiving commands in form of SMSs. MQ2 and MQ7 sensors used to sense gas leakage.	Delays in sending commands in case of weak mobile network.
Bluetooth	For Bluetooth technology android based GUI is developed to help owner to communicate with his smart home.	Bluetooth have a range limitation of 100 meter so cannot access system outside range.
IOT	Sensors and IOT enabled devices used to satisfy the smart home conditions.	In case of sensor failure whole system will collapse because lots of dependency on sensors.
PIC Microcontrpller with ZigBee	Voice based commands are accepted. Relays are used to control home appliances and microcontroller is central processing unit	Low end controller. No inbuilt communicatio n module.

V. CONCLUSION

From all above papers surveyed we can conclude that, every author come with different technology and concept for smart home system. With these different technologies, different algorithms, flowcharts were also implemented. Every technology has some advantages and disadvantages too. The main purpose of smart home system is to smoothen the life of old aged and handicapped people and to save electricity. Now a days the services provided by smart home systems are affordable to everyone. So popularity rate of using smart home system increases day by day. Smart home services provide security more rather that automation. Smart home system reduces your stress by ensuring you to provide security to your home even if you are not present there. In future people may come up with in built home automation and security system in their dream home. Smart home system will become everyone's need.

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