

A Review Paper on Smart GSM Based Home Automation System

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Abstract - Home automation system is used to control the home appliances remotely. There are many home automation technologies available in market out of which the popular technologies are X10, Z-Wave, Zigbee, GSM technology, INSTEON, and EnOcean. All these technologies have its pros and cons. The proposed system is user friendly and easy to use. The system is using Global System for Mobile Communication (GSM) modem to control home appliances via Short Message Service (SMS). The AT- Commands has been used in this system to control the devices. AT89s52 microcontroller is integrated with the GSM to give baud rate of 9600 bps. For the security purpose the pattern is used that will authenticate the SMS.

Key Words: Home automation; Global System for Mobile Communication (GSM); Short Message Service (SMS); RS232 standard

1. INTRODUCTION

The home automation system is the system that allows us to operate and control all the home appliances when we are away from home. The home automation system can connect multiple devices such as home security system, lighting, access control system, air condition etc. It provides comfort, convenience and security to home owners. There are so many technologies that are used for home automation [1]. This includes X10[1], Z-Wave[1], INSTEON[1,], Zigbee[1], and EnOcean. The system is useful to elderly people and to save electricity. It connects to almost all the devices and control remotely. The user will send SMS which is received by GSM system and microcontroller is identifying the command from SMS and do actions according to command.

The all above system have some disadvantages. Some systems have device connectivity problem or some are expensive or some other may have security problem.

This paper consists of 4 sections. The section II includes the popular technologies of used in home automation. The

section III includes the proposed system. And the paper ends with the conclusion which is given in section IV.

2. EXISTING SYSTEMS

A. Zigbee

ZigBee is an IEEE 802.15 standard used in home automation technology and similar to wifi and Bluetooth technology [5,6]. This technology uses radio frequency (RF) for signaling and control. Zigbee is a mesh protocol, where devices can act as repeaters [5]. This technology gives advantage of increase in the connectivity of devices within the home. Zigbee technology is wireless so it helps to overcome the intrusive installation problem. The Zigbee standard provides 250kbps data rate which is sufficient for controlling home devices. The installation and running cost is low [7].

In this system the zigbee and wifi network are integrated with the help of common gateway. This system uses four devices as a light switch, radiator valve, and safety sensor and zigbee remote control. The system is divided into two subsystems.

1. DSM i.e. Digital Home Service Distribution and Management System: this gives the interface for control and monitoring of home devices.
2. Home gateway: this is used for managing the home automation system. It accepts mobile phone signals And activates or deactivates a LED for home devices[9].

B. X10

X10 is a versatile home automation technology that uses home's existing electrical wiring to remotely control lights, appliances, security system and much more. The X10 commands travel from X10 transmitters to X10 receivers through standard household wiring. This technology can use both methods i.e. wired power line and wireless radio communication methods. X10 is inexpensive and many devices are available. This technology provides limited control over home devices.

TABLE I. THE COMPARISON AND RATINGS

	Z-Wave	ZigBee	X10	INSTEON	EnOcean
Properties					
Released (Year)	2001	2004	1975	2005	2008
Inventor	ZenSys Corp.	ZigBee Alliance	Pico Electronics	Smartlabs Inc.	EnOcean GmbH
Standardization	Proprietary	IEEE 802.15.4	Proprietary	Proprietary	Proprietary
Primary Markets	Home Automation	Industrial Automation, Research, Home Automation, Telecommunications, Healthcare	Home Automation	Home Automation	Industrial Automation, Home Automation
Communication Mode	RF	RF	RF, Power Line	RF, Power Line	RF
System-On-Chip Solution	Yes	Yes	Yes	Yes	Yes
Encryption	128-bit AES	128-bit AES	No	No	ARC4/AES
Performance Factors					
Energy Usage	High (1)	Medium (2)	High (1)	High (1)	Nil (3)
Data Rate	~ 40 kbps (3)	>20 kbps (3)	20-200 bps (1)	~ 2000 bps (1)	125 kbps (3)
Two-way Communication	Yes (3)	Yes (3)	No (0)	Yes (3)	Yes (3)
Transmission Range	~120m (3)	~60m (2)	~30m(2)	~120m (3)	> 20m (2)
Inter-brand Operability	High (3)	Medium (2)	Low (1)	Medium (2)	Medium (2)
Number of Certified Devices	>600 (3)	<500 (2)	>500 (3)	<500 (2)	>600 (3)
Ability to work as Repeaters	Yes (3)	Yes (3)	No (0)	Yes (3)	No (0)
Ease of Installation	Easy (3)	Medium (2)	Difficult (1)	Easy (3)	Medium (2)
Performance Index	0.916	0.792	0.375	0.75	0.75
Affordability Index	0.34	0.212	1.00	0.362	0.46

Table-1:Comparison & rating [12]

C. INSTEON

INSTEON is used to integrate power line system with wireless system, was developed to replace X10 standard. It is partially compatible with X10 devices. The transmission of data occurs at 1131.65 KHz for power line devices and 904 MHz for wireless devices. It is easy to install and setup. INSTEON messages get through in less than 0.05 seconds so it activates an INSTEON-enabled switch and the lights turn on instantaneously.

D. EnOcean

EnOcean is one of the newest technologies in home automation. It is wireless sensor network technologies. It is more energy efficient than other wireless technology. Its main aim is zero energy consumption through energy harvesting [10]. The maintenance is minimal because the devices are self-powered. Radio interference is also minimal because it operates in 315 MHz band. Their sensors have been installed over in over 25,000 buildings.

E. Z-wave

Z-wave is most widely used technology in home automation systems. It offers good network reliability and stability (Fig. 2 for Z-Wave motion sensor). Z-Wave devices are compatible. The each device has a unique network ID and each network has a unique identification thus making system secure [3]. Z- Wave is mesh protocol like Zigbee so the devices can talk to one another.

Z-Wave operating frequency varies with the region; in US the frequency is 908.42MHz and in Europe 868.42. The signal range is 30 meters which can be extended by using devices as repeater [4].

3. PROPOSED SYSTEM

The proposed system is GSM based home automation system [11]. There are so many technologies but the range of the system which uses these technologies is about 120 m. The GSM technology provides wide range so that you can operate your system from any corner of the world. The home appliances are controlled and accessed by SMS. So this technology provides cost effective solutions for controlling the home appliances remotely. The system is wireless therefore it is cost-effective and easy to install. The proposed system allows user to control home devices via SMS using GSM technology. The system is able to give feedback about the condition of the home devices. And the system follows certain SMS pattern which provide authentication of user. The system consists of the following components:

1. Microcontroller
2. GSM module
3. Mobile Devices
4. Water level detector

Microcontroller: It contains home devices control system through which devices are controlled.

GSM module: It is hardware component that send and receive SMS to and from the system.

Mobile Devices: Mobile device has SIM card through which the communication takes place. Mobile user transmits SMS using GSM technology.

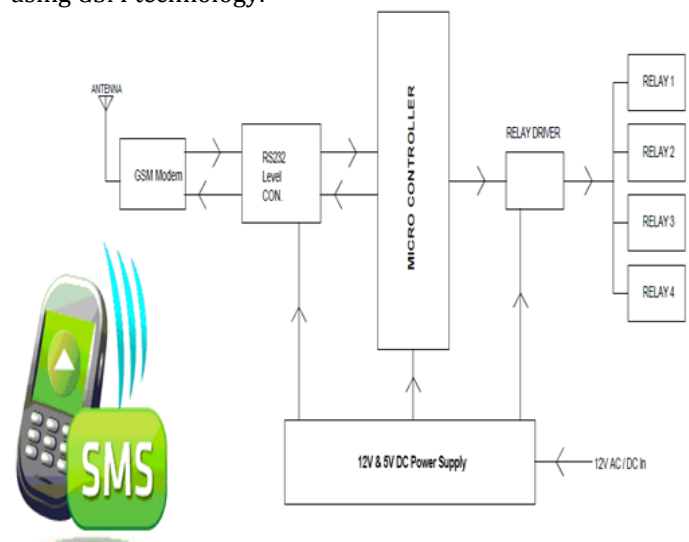


Fig - 1: Block Diagram of proposed system

Mobile device communicates with the GSM module via radio waves. The mode of communication is wireless. User transmits instruction via SMS. GSM module receives that signal. GSM module is connected to Microcontroller via port. For interfacing between GSM and Microcontroller RS232 logic converter is used. Microcontroller is main module in which home appliances control system is installed. For transmission of instruction or command the GSM technology is used.

When the user sends the instruction, it will follow particular pattern such as “@ command #”. The command starts with “@” and ends with “#”. If the SMS is in this format then only the command will be executed. After receiving the SMS the system will first check for the pattern of the SMS, if the pattern is correct then it will take action according to the instruction otherwise there will be no action against the SMS incorrect pattern.

The system is built on proteus software which is simulator software. The proposed system is doing two type of task. First it will automate the home devices and second it will send monitor the home devices and send the status of the device to the user through SMS. Both the task is accomplished by GSM technology via SMS.

The below figure shows the circuit diagram which is built on proteus software.

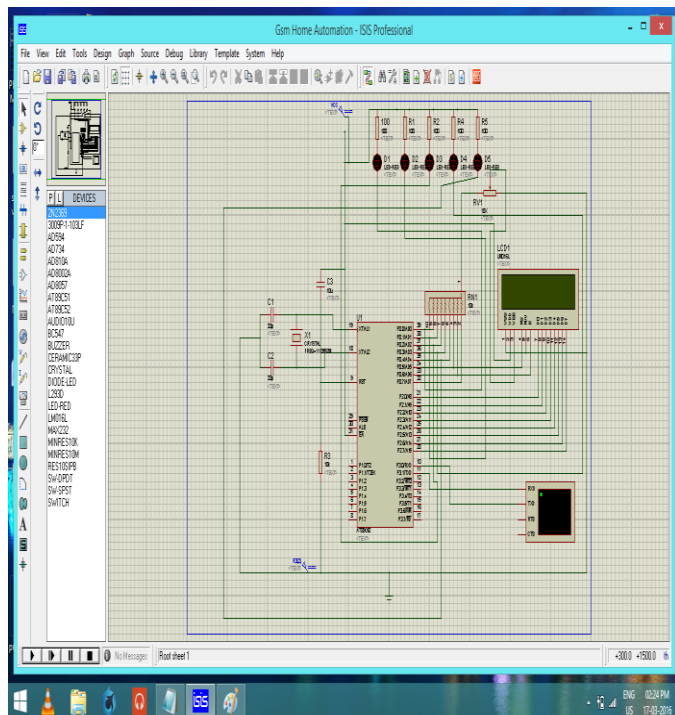


Fig -2: Circuit diagram on proteus software

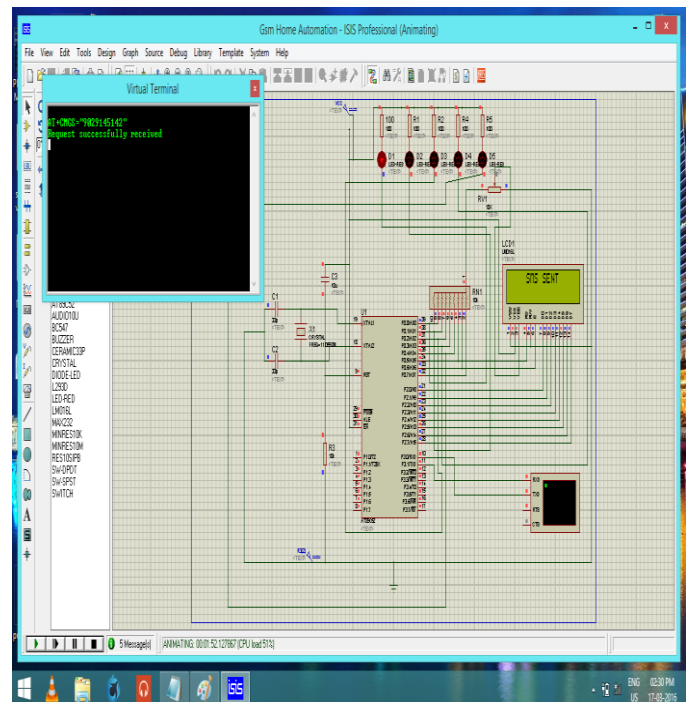


Fig - 3: Device 1 is switched ON

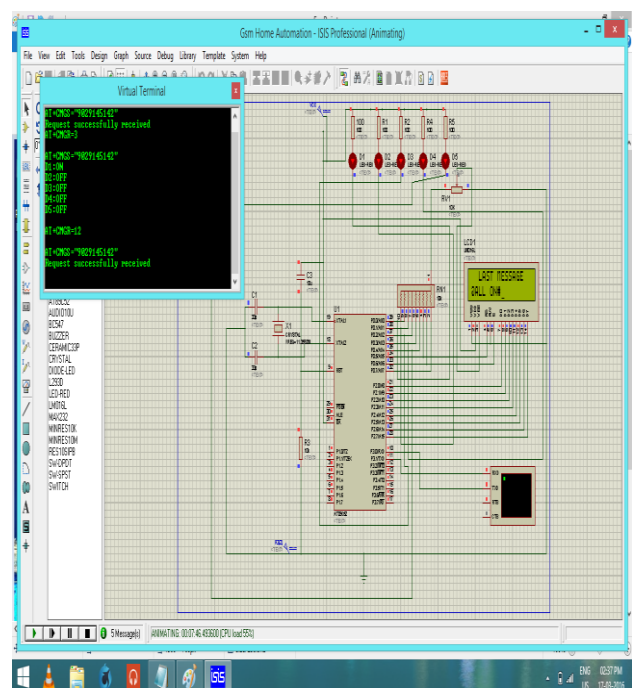


Fig - 4: All devices are switched ON

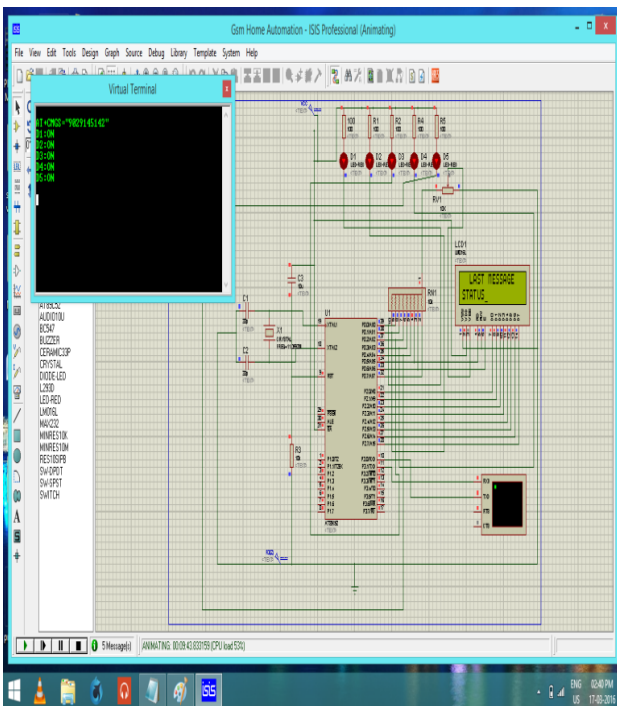


Fig - 5: Displaying status of all the devices

4. CONCLUSION AND FUTURE SCOPE

Recently, the home automation market is very promising field that is growing very fast and needs vast range of developments that can be carried out in the concept of smart home. For Home Automation there are many technologies available in market like zigbee, x-10, Insteon, EnOcean, z-wave etc. The system consists of GSM technology and microcontroller which decreases the cost of system and there are specific pattern of command which gives security against unauthorized user. The proposed system is user friendly, low cost and easy to understand. The range of GSM is global so the user can use the system from any corner of the world. It will automate the home appliances. For future work we can add many features in the system such as sensors for gas and temperature. After testing the system on proteus we will implement it on the hardware.

REFERENCES

- [1] C. Gomez and J.Paradlls, "Wireless home automation networks: A survey of architectures and technologies," IEEE Communications Magazine, vol.48(6),pp.92-101,Jun.2010
- [2] J. Walko, "Home Control," Computing & Control Engineering Journal, vol.17 (5), pp.16, 19 Oct-Nov 2006.
- [3] M. Knight, "Wireless security - How safe is Z-wave?"

Computing &Control Engineering Journal , vol.17(6), pp.18,23, Dec.-Jan. 2006

- [4] P. Amaro, R. Cortesao, J. Landeck, and P. Santos,"Implementing anAdvanced Meter Reading infrastructure using a Z-Wave compliant Wireless Sensor Network," in Proc. 2011 3rd International YouthConference on Energetics (IYCE) , pp.1-6.
- [5] Batista, N.C.; Melicio, R.; Matias, J.C.O.; Catalao, J.P.S., "ZigBee wireless area network for home automation and energy management: Field trials and installation approaches," Innovative Smart Grid Technologies (ISGT Europe), 2012 3rd IEEE PES International Conference and Exhibition on , vol, no., pp.1,5, 14-17 Oct. 2012
- [6] A. C. Olteanu, G. D Oprina, N. Tapus, and S. Zeisberg, "Enabling Mobile Devices for Home Automation Using ZigBee," in Proc. 2013 19th International Conference on Control Systems and Computer.
- [7] N. Kushiro, S. Suzuki, M. Nakata, H. Takahara and M.Inoue,"Integrated home gateway controller for home energy Management system", IEEE International Conference on Consumer Electronics, pp.386-387, 2003.
- [8] J. Ploennigs, U. Ryssel, and K. Kabitzsch, "Performance analysis of the EnOcean wireless sensor network protocol," in Proc. 2010 IEEE Conference on Emerging Technologies and Factory Automation (ETFA), pp.1-9
- [9] Khusvinder Grill, Shuang-Hua Yang, Fang Yao and XinLu "A zigbee based home automation system" IEEEtransaction on consumer electronics, vol. 55, No.2, May 2009
- [10] A. Lottis D. Hess, T. Bastert, and C. Rohrig, "Safe@home-A wireless assistance system with integrated IEEE 802.15a localisation technology", in Proc. 2013 IEEE International Conference on Intelligent Data Acquisition and advanced Computing Systems(IDAACS),pp.461-467
- [11] "Smart GSM based Home Automation System" Teymourzadeh, R.; Ahmed, S.A.; Kok Wai Chan; Mok Vee Hoon Systems, Process & Control (ICSPC), 2013 IEEE Conference on Year: 2013
- [12] Chathura Withanage, Rahul Ashok, Chau Yuen, Kevin Otto " A comparison of the popular home automatio technologies" 2014 IEEE Innovative Smart Grid Technologies -Asia (ISGT ASIA)

Websites:

- "X10 devices and standards," <http://www.x10.com>.
- "Z-Wave devices and standards," <http://www.z-wavealliance.org/>.
- "Insteon devices and standards," <http://www.insteon.com/>

- "Home automation devices, reviews and case studies,"
<http://www.vesternet.com/resources/feature-comparison>."EnOcean devices and standards,"
<http://www.enoceanalliance.org/en/home>.