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A Smart System to Manage and Control Home Appliances

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ABSTRACT: In 21st century the tremendous advancement of science and technology which can be used to secure the assets and the home appliances of users. Many times we leave the room without switching off lights and fans. This way we waste most valuable electricity. In this work we have designed and developed a Smart System to manage and control Home appliances in which use of electricity will be reduced. Now a days the crimes become increasing day by day. The system is designed to ensure home security also. We can control this system through sending SMS. This system has been designed using microcontroller, Ultrasonic sensor for motion detection, GSM module for sending and receiving SMS and buzzer for alarm. We constructed the circuit successfully and result was as expected. The proposed system does not require any extra apps to control appliances. It is a low cost and flexible home automation system. This is a simple and useful security system.

KEYWORDS : GSM module, AT Mega 328, SHMS, 4 Channel Relay module, GSM SIM, LCD, Faster, Home Automation, Home Security.

I. INTRODUCTION

Electricity is one of earthshaking resources in all Countries. It is the major source of power for most of the country's economic activities. Many times we do not turn off the light or fan at the time of deserting the room, thus electricity is wasted. By raising public awareness we can reduce the wastage of electricity. But it is not enforced due to carelessness. In this case we can use home automation system. The system uses a control application, at the user end to control the home appliances remotely using Wireless technology. The Smart home system controls the home appliances using an Ultrasonic sensor and a GSM module. Ultrasonic sensor detects the object and switch on the home appliances automatically when someone enters on the room and gets off after some time. GSM module controls the load just send a text message. Input from the user is transmitted serially over a GSM module, where it is received, identified and relayed to the appropriate module [1].

Major Inputs and Outputs:

- Input Signals
- SMS feedback
- ON and OFF all appliances

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We have designed it as a smart home system but there are a number of other applications of this system. It can be used by:

- Disabled people
- Home monitoring
- Lighting control
- Energy efficiency

II. RELATED WORK

Manoj Kumar, Dharmendra Patel, Sumit Monda published a paper on “Advance in GSM Based Home Automation Saving Energy in Home by Using Android Phone” Journal of Advanced Computing and Communication Technologies[3]. In this paper, it is described how to control home appliances and save energy in home. This system acts as embedded system, which can be used for controlling the appliances.

Rajeev Piyare and Seong Ro Lee published a paper on “Smart Home-Control and Monitoring System Using Smart Phone” proceedings, The 1st International Conference on Convergence and it’s Application [4]. This paper presents a low cost and flexible home control and monitoring system using an embedded micro-web server, with IP connectivity for accessing and controlling devices.

Raqibull Hasan, Mohammad Monirujjaman Khan, Asaduzzaman Ashek , Israt Jahan Rumpa published a paper on “Microcontroller Based Home Security System with GSM Technology” on Open Journal of Safety Science and Technology[1]. In this paper, design and implement of a microcontroller based home security system with GSM technology have been presented and analyzed.

III. DESIGN AND METHODOLOGY

3.1 Arduino UNO

The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started

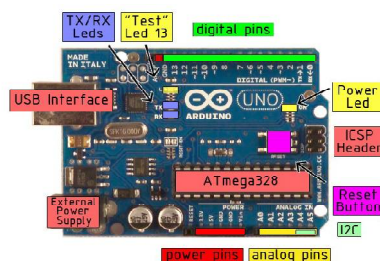


Fig 1. Arduino Uno

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Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB of which 0.5 KB used by bootloader
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz

Table 1. Configuration of Arduino UNO

3.2 SIM 900 (GSM Module)

GSM is a mobile communication modem, it stands for global system for mobile communication. It is widely used mobile communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands. GSM system was developed as a digital system using time division multiple access (TDMA) technique for communication purpose. A GSM digitizes and reduces the data, then sends it down through a channel with two different streams of client data, each in its own particular time slot. The digital system has an ability to carry 64 kbps to 120 Mbps of data rates [7].



Fig 2 . SIM900 GSM Module

3.3 Ultrasonic Sensor

An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object [5].



Fig 3. Diagram of the basic ultrasonic sensor operation

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3.4 Relay Module

Relay is an electromagnetic switch, which is controlled by small current, and used to switch ON and OFF relatively much larger current. Relay is the good example of controlling the AC (alternate current) devices, using a much smaller DC current. Relays are available in many ratings, here we used 6V operating voltage relay, which allow 7A-250VAC current to flow [8].

3.5 Buzzer

A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke [5].



Fig 5. Buzzer

3.6 Software: Arduino IDE

A program written with the IDE for Arduino is called a sketch. Sketches are saved on the development computer as text files with the file extension .ino. Arduino Software (IDE) pre-1.0 saved sketches with the extension .pde. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub *main()* into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution [3].

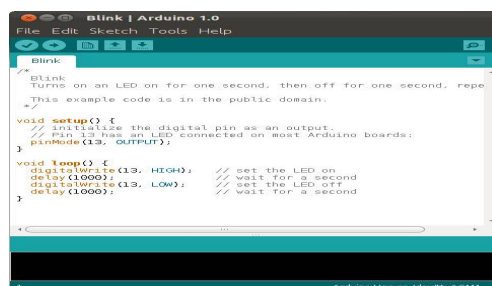


Fig 6. Arduino IDE compiler

IV. BLOCK DIAGRAM OF THE SYSTEM

The figure 7 is the simple block diagram of our system. It shows a simple sketch of the implementation of our system and the various parts involved in it. The Micro controller Device is the device through which application interacts with home appliances.

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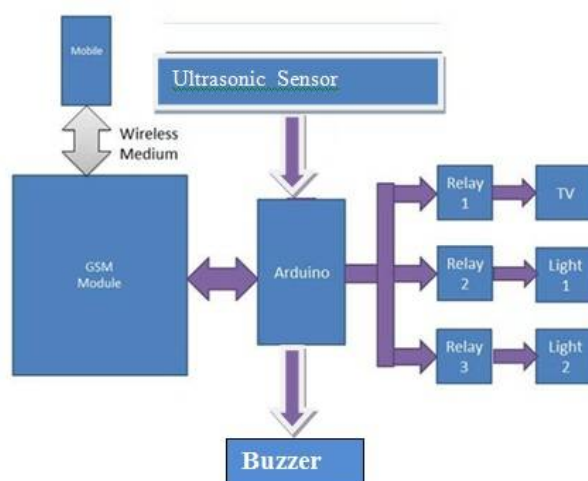


Fig 7. Block diagram of system

Mode is used for selecting either Bluetooth or GSM through which to control the appliances. The commands will be received based on the mode selection by the appropriate device from the android application.

V. EXPERIMENT THE HOME MANAGEMENT SYSTEM

5.1 Home Automation System

This system refers to an automation system. In this system we used GSM module and a microcontroller. We send a text message from our phone to control load ON or OFF. GSM module receives the signal and gives the signal to Arduino. Arduino takes a decision and given the output signal to relay module and relay module control the load as auto switching system. And our phone will send a feedback short message service text indicating the new state of the appliance, whether switched ON or OFF.

Serial No:	Message	Operation
1	#A.fan a on*	Fan A: ON
2	#A.fan a off*	Fan A:OFF
3	#A.light a on*	Light A: ON
4	#A.light a off*	Light A :OFF
5	#A. all on.	All:on
6	#A. all off.	All:off

Table 2. SMS sending command

5.2 Home Security System

For the home security system, we can use sensors which will check the distance between the two points. If some intruder passes between the two points then the distance between two points would decrease. The feedback of the distance is send back to the microcontroller. The microcontroller would send a feedback SMS to the owner through GSM SIM and will also ring an alarm [3].

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VI. CIRCUIT DIAGRAM

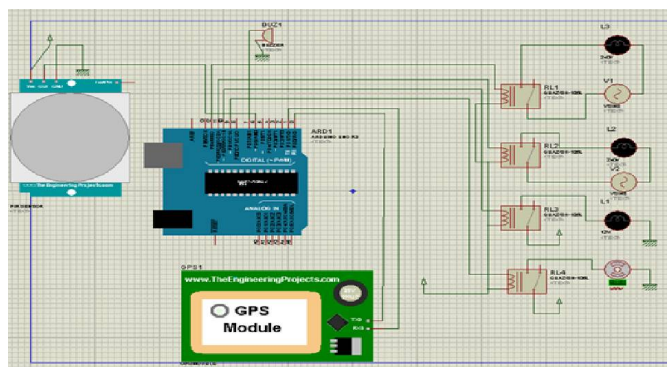


Fig 8. Smart Home Circuit diagram

Connections of this GSM based home automation circuit is quite simple, here a liquid crystal display (LCD) is used for displaying status of home appliances which is directly connected to arduino in 4-bit mode. Data pins of LCD namely RS, EN, D4, D5, D6, D7 are connected to arduino digital pin number 6, 7, 8, 9, 10, 11. And Rx and Tx pin of GSM module is directly connected at Tx and Rx pin of Arduino respectively. And GSM module is powered by using 12 volt adaptor. 5 volt SPDT 2 relays are used for controlling light and fan. And relays are connected to arduino pin number 3 and 4 through relay driver for controlling light and fan respectively [2] which is thereby connected to the GSM module for the transmission of the signal. Depending on the sensor, firstly, sensor detect the human and transmit the signal to arduino. Arduino receives the signal and gives the signal to GSM module and buzzer. Buzzer takes the signal and gives the output as sound wave and also GSM module receive the signal and convert it. Then it transmits the signal to another phone (Text Message). Secondly, GSM modules transmit the signal to Arduino. Arduino receives the signal and gives the signal to relay. Relay control the load with auto switching system [3].

VII. RESULT AND DISCUSSION

7.1 Result

The overview of the research has been shown in figure 9. This system has been designed using microcontroller AT Mega 328, Ultrasonic sensor for human detection, GSM module for sending and receiving SMS and buzzer for alarm. As a result the system activates all the security and automation system. This includes an alarming message to owner mobile phone, turn on the buzzer and turn on SMS message to owner mobile phone, turn on the LED and fan, etc. We constructed the circuit successfully and result was as expected.



Fig 9. Over view of Project

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The working of the system is divided into two parts which are home automation and security system. For the home automation we have used a mobile phone through which we can control the home appliances. This mobile phone is used to send a SMS to the GSM modem used in our system. This will read the SMS and send it to the microcontroller. The microcontroller will extract the message from the received SMS and control the relay module. The relay will turn on or off the appliances as ordered by the owner. The system has been successfully completed with overcoming some existing limitations of Smart Home Management System using present technologies. It has been found much better output from the previous projects.

7.2 Test Result

The test result of SMS sending and receiving system can be obtained by three ways. One way is using #A. all on/off*, second way is by using #A. light on/off* and the third way is using #A.fan on/off*. Receiving the SMS send from the android mobile phone and understanding and sending the commands to relay unit is described by messaging module.

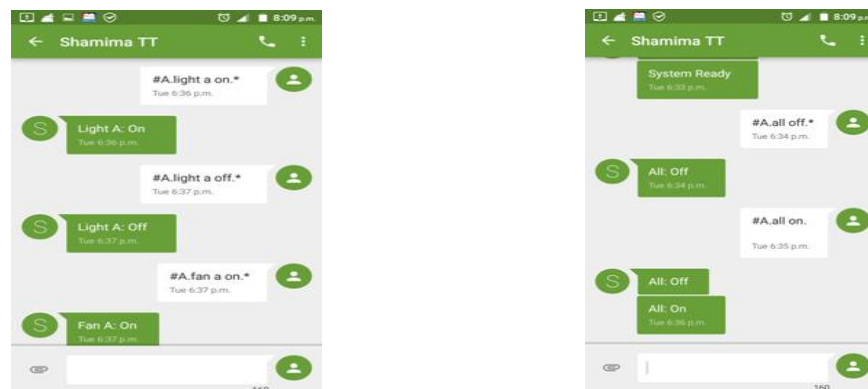


Fig 10. Screenshot SMS of mobile phone

The android application is act as a user interface, through which the user can easily control the devices. Figure 10 is the sample snapshots. The display is used to denote the commands sent by the smart phone. In figure 10 the GSM button at the top right corner is to switch to GSM mode. The ON/OFF commands near the devices will turn ON/OFF the particular device. We can also turn ON/OFF all the devices at the same time by pressing all devices ON/OFF button. The test result for the above processes is given below:

VIII. ADVANTAGES OF SYSTEM

Our system on GSM based home automation and security system which is very useful and also very economical. It provides simple and easy way to control the household appliances with a single SMS by using mobile phone. Automation system is installed carefully and is integrated under one centralized control unit which ultimately secures the people. By controlling temperature and lighting based on the programmed schedules, automation system reduces the energy bills considerably. The system has an ability to enhance the security features of the home without demanding a huge home renovation. We can operate and access the automation technology with ease due to its simple procedure that are easy to learn and implement.

IX. CONCLUSION

The research on Smart Home Management System is a GSM based home automation system save energy at home controlled by android phone which is very useful and also very economical. It provides simple and easy way to control the household appliances with a single SMS or by using an android application. Also the safety and security system can be easily installed and used in the house. The application program is tested on various Android mobile phones



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which are quite satisfactory and responses received from the community in general are encouraging. The system is intelligent enough to monitor the secure environment. In addition, the user is informed about the security breach through GSM network that provides a special opportunity whenever the user stays at far away from home. Moreover, the system provides the reliable operation within reasonable cost and removes the system complexity. Consequently, the system is also applicable for commercial purposes due to versatile ways of security and controllability.

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