

Smart Home Automated Control System Using Android Application Based on Arduino

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Abstract:

Smart Home System (SHS) is a dwelling incorporating a communications network that connects the electrical appliances and services allowing them to be remotely controlled, monitored or accessed. SHS includes different approaches to achieve multiple objectives range from enhancing comfort in daily life to enabling a more independent life for elderly and handicapped people. In this paper, the main four fields for SHS which are, home automation and remote monitoring, environmental monitoring, including humidity, temperature, fault tracking and management and finally the health monitoring has been considered. The system design is based on the Microcontroller MIKRO C software; multiple passive and active sensors and also a wireless internet services which is used in different monitoring and control processes. This paper presents the hardware implementation of a multiple-form control system for house automation and combines both hardware and software technologies. The system results show that it can be classified as a comfortable, secure, private, economic and safe system in addition to its great flexibility and reliability.

Index Terms: Android Applications, Arduino Card, Security, Bluetooth, Android.

I INTRODUCTION

Smart home is an emerging concept that attracts the synergy of several areas of science and engineering. A lot of research has been going on for more than a decade now in order to increase the power efficiency at the consumer level of the power management systems. Smart Home is the term commonly used to define a residence that integrates technology and services through home networking to enhance power efficiency and improve the quality of living.

Smart house is not a new term for science society but is still far more away from people's vision and audition. This is because although recent various works has been done in designing the general overview of the possible remote access approaches for control-ling devices or in cases simulating the smart house itself and designing the main server the design and implementation of an off-the-shelf smart house remote control application has been limited to simply the computer applications and just in cases mobile and web applications development.

Smart home appears "intelligent" because its computer systems can monitor many aspects of daily living. Smart house can also provide a remote interface to home appliances or the automation system itself, via telephone line, wireless trans- mission or the internet and android application, to provide control and monitoring via a smart phone or web browser. The growing numbers of elderly population and increasing life expectancy have brought enormous challenges to many aspects of human life, especially in health and healthcare. According to the United Nations online database.

This paper presents smart house controlled by various micro controller systems. The designed system consists of five parts which are connected to both Mikro c and Arduino software. The first sub-system in SHS is a while review on the system. The second sub-system is the security systems that includes a fire alarm system used in announcing the outbreak of a fire and working to extinguish it remotely, and burglar alarm system that signals the occurrence of a burglary. The third sub-system is lighting control system (energy saving) which includes the internal house lighting, and the ceil lighting outside the house.

II SHS (SMART HOME SYSTEM) OVERVIEW

Smart home appliance is an interface between the remote control with its mobile or remote control and a home reliever. For each device, in order to accomplish this interface design process was taken using the micro controller and Arduino for controlling some application in the home manually by using a remote control and automatically through different sensors. Each system application will be discussed. The block diagram of complete SHS is shown in figure-1. We use a different types of micro controllers which are (PIC30f4013-PIC 16f627A- PIC12f652- PIC18f, Arduino), secondary connectivity between remote or smut phone and micro controller is established through (RF wireless and Bluetooth) modules. The two previous modules can be connected either to micro controller or Arduino. A specific android application has been designed such that different home electronic devices can be controlled using a smart phone remotely.

SMART APPLIANCES MODULE

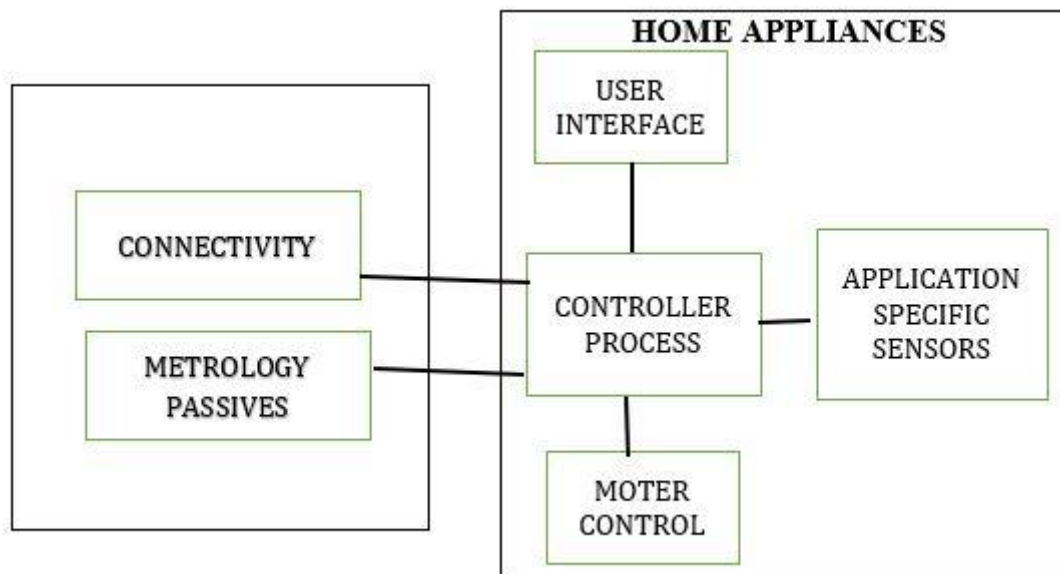
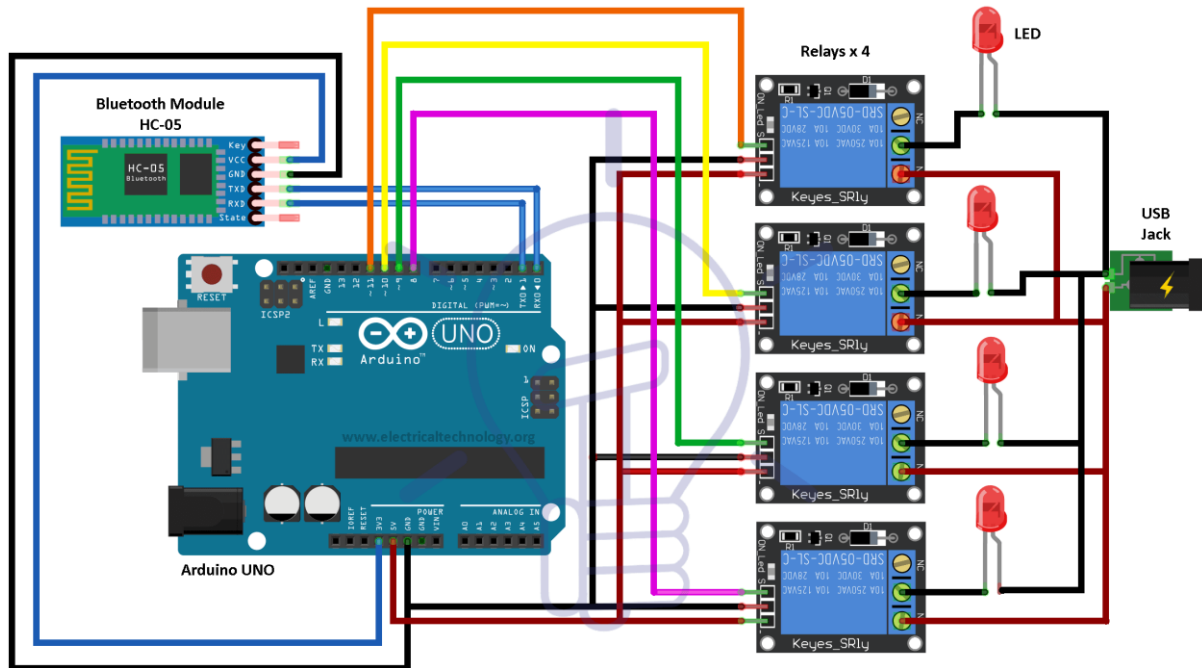


Fig-1 Block Diagram of Complete SHS

III SMART HOME AUTOMATION SYSTEM (SHAS)

Automation (such as home automation and industrial automation etc) has become important in today’s world as it helps to complete a task with lesser human assistance and in a smarter way. Houses are becoming smarter and developed these days with the help of automation devices. Home electrical appliances are using remote-controlled switches rather than conventional switches. In today’s world, most

of the people have access to smartphones and its use have become very popular and essential in our lives. We can use smartphones to control the household appliances with just one click or one message. With the help of controllers and communication devices home appliances can be remotely controlled. In this project, we will use the Arduino UNO board for the development of Smart Home Automation project with the HC-05 Bluetooth module which is remotely controlled by a smartphone. It can be really helpful for the paralyzed people who cannot do their work on their own and such devices can become a great help for these people.



Smart Home Automation System Project

Fig-2 SMART HOME AUTOMATION SYSTEM

3.1 Microcontroller

A microcontroller (MCU) is a small computer on a single integrated circuit that is designed to control specific tasks within electronic systems. It combines the functions of a central processing unit (CPU), memory, and input/output interfaces, all on a single chip.

PIC microcontroller can be used as the „brain to control a large variety of products, in order to control large devices. It is necessary to interface or connect them to the microcontroller. We have used PIC16F877 which is 8 bit, RISC type, 40 pin IC. This PIC will differ from other PICs because of the features like 10 bit, 8 channels inbuilt ADC, inbuilt PWM, one 8 bit USART, three timers.

3.2 Arduino Board

Arduino is a tool for making computers sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board.

IV ARDUINO UNO

Arduino is an open-source platform which is used to develop electronics projects. It can be easily programmed, erased and reprogrammed at any instant of the time. There are many Arduino boards

available in the market like Arduino UNO, Arduino Nano, Arduino Mega, Arduino lily pad, etc. with having different specification according to their use. In this project, we are going to use Arduino UNO to control home appliances automatically. It has ATmega328 microcontroller IC on it which runs on 16MHz clock speed. It is a powerful which can work on USART, I2C and SPI communication protocols. This board is usually programmed using software Arduino IDE using a micro USB cable. ATmega328 comes with preprogrammed onboard boot loader which makes it easier to upload the code without the help on external hardware. It has vast application in making electronics projects or products. The C and C++ language is used to program the board which is very easy to learn and use. Arduino IDE makes it much easier to program.

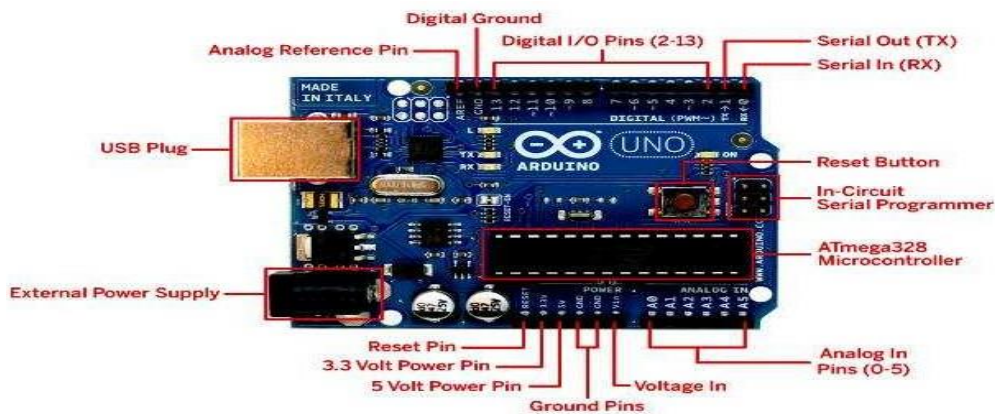


Fig.3 SCHEMATIC ARDUINO UNO FRONT

4.1 Android

A Smart phone is a mobile phone based on a mobile operating system, with more advanced computing capability and connectivity than a feature phone. Android is a software stack for mobile devices that includes an operating system, middle-ware and key applications. Android, by simple definition, is an operating system for many mobile phones. Android is mainly based on Linux operating system which uses java- like languages for running applications. The main purpose of using android is to send the control signals from smart phone through Bluetooth.

4.2 Bluetooth

Bluetooth was selected as our way of communicating mobile with a central system. Bluetooth module receives the data serially in RS232 format from controller and sends it to wireless network. For interfacing it with microcontroller we need to build the circuit because Bluetooth module understands data in RS232 standard. in TTL format. So we need to design circuit to make these two compatible with each other. Bluetooth module we are using is LM400 from LM technology. LM400 is designed to provide Bluetooth 2.0+EDR function on small form factor.

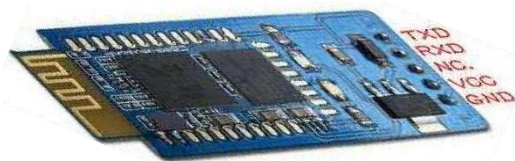


Fig.4 BLUETOOTH MODULE

V SMART HOME SECURITY SYSTEMS

A simple and compact security alarm system to protect your home/shop and valuables. The circuit is built around a tiny microcontroller chip PIC12F675. Besides, a ready-made Passive Infrared (PIR) module is integrated with the alarm system for reliable human-motion detection. The built-in passive infrared sensor detects human movement by sensing temperature changes over the scene, and works even in the total darkness. Human body heat moving across the scene will trigger the PIR sensor, and the trigger signal will be sent to the control circuit instantly. As the output of the alarm system can be connected to external lamps or alarm sirens, these devices will be instantly activated upon the detected motion.

Also we use the Arduino for security application so it can provide both control and integration of security systems and also the potential for central locking of all perimeter doors and windows. Security cameras can be controlled, allowing the user to observe activity around a house or business right from a monitor or touch panel. Security systems can include motion sensors that will detect any kind of unauthorized movement and notify the user through the security system or via cell phone.

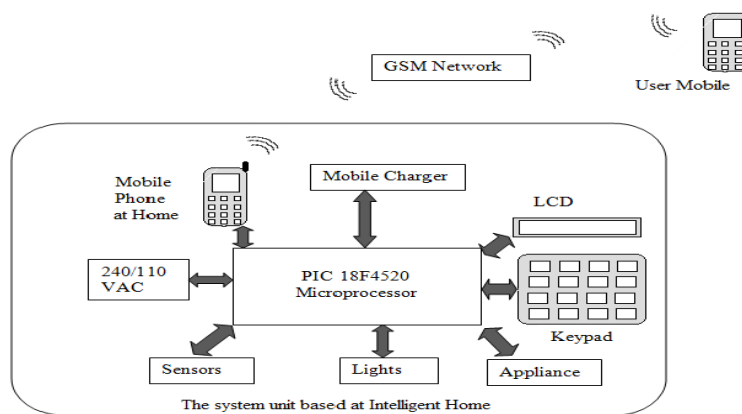


Fig. 5 ARCHITECTURE OF INTELLIGENT HOME SYSTEM



Fig.6 SHS ALERT MESSAGE

VI SMART HOME LIGHTING CONTROL SYSTEMS

At this section user will be able to control the light in SHS by two different ways by smart phone or by PIR sensor automatically if we talk about using smart phone it will be on/off option or dimmer. Dimmer are devices used to vary the brightness of a light, by decreasing or increasing the RMS voltage. It is possible to vary the intensity of light and speed of fan by using a number of types of dimmers. Modern dimmers are built from silicon controlled rectifier (SCR) instead of variable resistor, because they have higher efficiency. Since silicon controlled rectifier switches between a low resistance “ON” state and a high resistance “OFF” state, it dissipates very little power compared

with the controlled load. Dimmer circuit is based on SCR control circuit which is used in lightning control and fan speed control. This section mainly discusses about the hardware construction of main control board. Arduino UNO is chosen due to its capability to perform the both serial and USB features to establish the Bluetooth and USB connection to the android application.



Fig.7 SMART HOME LIGHTING CONTROL SYSTEMS

The application is designed in Android version 2.2 (Froyo) with API level 8. The application is designed in low API level so that the devices with higher version are compatible with it. Figure-6 illustrates the android GUI tested on smart phone.

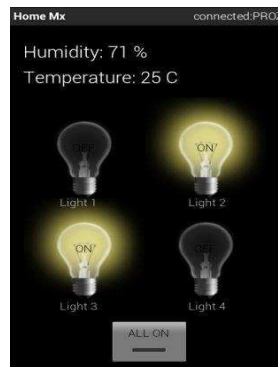


Fig.8 ANDROID MAIN CONTROL GUI

VII SHS REMOTE CONTROL SYSTEM

Currently one of the existing issues that are associated to smart home applications are the fact that in a home with all sorts of automated application, there will be too many remote controls or monitoring terminal, if the user installed a range of proprietary applications from different providers. There is also the fact that the access range to remotely control these devices are limited by either length of cables or wireless network coverage in a personal area network. It is a widely known fact that an important example of wireless technology application is the mobile phone technology. So; we use RF wireless module with a remote control of pic16f & Bluetooth module with the smart phone.



Fig. 9 OUTSIDE LIGHT SENSOR

VII SMART HOME TEMPERATURE SENSING SYSTEM FOR AIR CONDITIONER

At this section we will control the home temperature automatically by using a special temperature sensor which is the LM35 sensor is used. It has an output voltage that is proportional to the Celsius temperature. It has low self-heating capability, suitable for remote applications, low cost due to wafer level trimming, operates from 4 to 30v, low impedance output in this case.



Fig.10 OUTSIDE TEMPERATURE SENSOR

CONCLUSIONS

In this paper the design and implementation of a control and monitor system for smart house has been established. Smart house system (SHS) consists of many sub-systems that controlled by Microcontroller software as a main controlling system. Also, SHS was supported by remote control system as a sub-controlling system. The system is also connected to a wireless Bluetooth technique to monitor and control the electronic house equipment's from anywhere in the world using both Arduino and micro controller.

REFERENCES

1. Hsien-Tang Lin "Implementing Smart Homes with Open Source Solutions" International Journal of Smart Home Vol. 7, No. 4, July, 2013.pp 289-295.
2. Rosslin John Robles¹ and Tai-hoon Kim¹ "Applications, Systems and Methods in Smart Home Technology: A Review" International Journal of Advanced Science and Technology Vol. 15, February, 2010.pp 37-47.
3. Sook-Ling Chua and Stephen Marsland and Hans W. Guesgen "Behaviour Recognition in Smart Homes Sook" Proceedings of the Twenty-Second International Joint Conference on Artificial Intelligence 2011.
4. Gowthami, Dr. Adiline macriga "Smart Home Monitoring and Controlling System Using Android Phone" International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 3, Issue 11, November 2013.
5. Saisakul Chernbumroong, Anthony S. Atkins, and Hongnian Yu "Perception of Smart Home Technologies to Assist Elderly People" 4th International conference on software, Knowledge information manage and applications (SKIMA 2010).
6. Christian Reinisch, Mario J. Kofler, Wolfgang Kastner "ThinkHome: A Smart Home as Digital Ecosystem" 4th IEEE International Conference on Digital Ecosystems and Technologies (IEEE DEST 2010).