



A Smart Control System of Home Appliances Using SMS

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Abstract: Smart Control System is a leading Fire Safety Security and Electrical systems in which SMS based home appliance control system is capable of controlling appliances from any place where GSM service is available. SMS is a telecommunications protocol that allows the sending of short text messages (160 characters) to and from terminal equipment. The aim and objectives of this project is to help the users of home appliances optimize the usage of electricity remotely using short message service (SMS). Many users of electricity forget to turn off their bulbs and other electrical appliances may be as a result of power failure before they left home thereby leaving the light turned on continuously. The prototype was successfully developed and met the above stated objectives. At first stage, the program initializes all variables and ports, then it initializes GSM, after which a decision parameter determines whether there is any SMS or not. If there is any SMS available in the GSM module, the microcontroller reads that SMS and compares the password with the pre-set password. If the password matches, it reads the command given in the SMS, decode the command and turns ON/OFF the home appliances according to the accuracy of the command. In conclusion, the system could provide better performance by intelligently sending notification upon power failure, provide a flexible function by supporting both manual and automatic control as well as provide an option for the user to control the appliance through web-based system. The programming language used to implement this project is Microsoft visual basic 6.0 because of its efficiency and user's friendly ability.

Keywords: SMS, home appliance, control, system

1. Introduction

Nowadays most of the people from any places at any time are connected with the mobile phone and want to get easy access to technology through their cell phones. With the development of the electronics technology in the last two decades, a new concept called Smart Home has become prevalent and through this concept people have been trying to control and secure their home appliances remotely by using SMS with low cost. GSM based remote control management is a subject of creating interest which has found application in different zones. Many works are going on in this field all over the world. (Tan, Lee & Mok, 2007) developed an automatic power meter reading system to send the power consumed reading to e-billing system at authorized office. The system works by integrating the GSM modem that was embedded with digital kWh power meter. It utilizes the GSM network to send power usage reading using SMS to the authorized office.

The authorized office collect and manage the received SMS message contained in the meter reading to generate the billing cost and send back the cost to the respective consumer through SMS. Authors (Seravidis, 2003) developed a system for acquiring water level and temperature status via SMS by utilizing PIC 16F877 and MPLAB IDE software for programming. The paper was designed to detect level and temperature of the water in a pool. The system functions when the level of water and the temperature in pool exceed the desired limits. At the same time the PIC circuit will automatically interface to the mobile phone and send the alert message to the user. Furthermore, (Lock, 2008), developed a remote and security control system via SMS to control the switch for lamp, door and alarm system using Visual Basic 6.0 to develop the software. Visual Basic was chosen because it can easily communicate between computer and mobile phone.

Statement of the Problem

The problem associated with the existing

system, at the present time, people use electrical energy as one of the main source of power of energy to operate any electrical device or appliance. Most of the people turn on the light for 24 hours per day when they are away from home. Leaving the light turned on continuously, lead to energy waste. Thus this paper is proposed to develop a system is to facilitate the home owner to optimize usage of electricity remotely using SMS. Light turned on continuously and it lead to energy waste. Thus this research is carried out to provide a mechanism through the development of a prototype to provide a service to the home owner to optimize the usage of electricity through remote control using SMS services.

Literature Review

Now-a-days there is huge advancement in communication sector, almost everyone has access to mobile phone(s) and thus the world has indeed become a global village. At any given moment, any person across the world can be contacted with the help of a mobile phone. Mobile phones can not only be used for the calling and sending SMS but also new ideas can be generated and techniques can be developed from it that can further enhance its capabilities. There are huge technological advancements in wireless communication like Infra-red and Bluetooth which mostly took place in the recent years showing that further improvements are on the horizon to make our lives easier and comfortable. Having wireless control of almost all the things in a person's life is a growing interest and many systems are developed providing such controls. With the inception of home automation labor saving machines were first priority of inventors. Self-contained electric or gas powered home appliances became viable in the 1900s with the introduction of electric power distribution and led to the introduction of water heaters in 1889 later washing machines in 1904 followed by refrigerators, sewing machines, dishwashers, and clothes dryers. In recent history i.e. 1975 X10 the first general purpose home automation network technology was developed, which is a communication

protocol for electronic devices. It primarily uses electric power transmission wiring for signaling and control, where the signals involve brief radio frequency bursts of digital data and remains the most widely available. By 1978, X10 products included a 16 channel command console, a lamp module, and an appliance module. Soon after came the wall switch module and the first X10 timer . In a research by ABI in United states 1.5 million home automation systems were installed by 2012. Here our main objective is to design a system that will enable us to have a complete control of the interface on which it is based (Serasidis, 2003).

In recent years, there has been a growing interest among consumers in the smart home concept. Smart homes contain multiple, connected devices such as home entertainment consoles, security systems, lighting, access control systems and surveillance. Intelligent home automation system is incorporated into smart homes to provide comfort, convenience, and security to home owners. Home automation system represents and reports the status of the connected devices in an intuitive, user-friendly interface allowing the user to interact and control various devices with the touch of a few buttons. Some of the major communication technologies used by today's home automation system include Bluetooth, WiMAX and Wireless LAN (Wi-Fi), Zigbee, and Global System for Mobile Communication (GSM).

All GSM is one of the most widely used cellular technologies in the world. With increase in the number of GSM subscribers, research and development is heavily supported in further investigating the GSM implementation. In 2009, Das, Sanaullah, et. al. developed a cell phone based remote management and control system for home appliances. However, a few limitations for the system include not being able to control multiple appliances concurrently and the home automations system could not verify the status of the appliances. ElKamchouchi and ElShafee presented the design and prototype implementation of basic home automation system based on SMS technology using

AT89C55 Atmel microcontroller. The microcontroller acts as the bridge between the GSM network and sensors of the home automation system. Further researches have been conducted to analyze the performance of other home automation control system. Internet and wireless communications have also been utilized in parallel with GSM for home automations (Ahmed, 2009).

Among the cellular technologies, GSM network is preferred for the communication between the home appliances and the user due to its wide spread coverage which makes the whole system online for almost all the time. Another advantage of using the GSM network in home automation is its high security infrastructure, which provides maximum reliability whereby other people cannot monitor the information sent or received. Hence, this research work implements SMS based control for home appliances using the GSM architecture without accessing the local network (Mohd et al, 2010).

Related Works

The introduction of Internet of things (IoT) and other wireless technologies fueled many researches in HA. Several wireless communication technologies that can support some form of remote sensing and control, remote data transfer and monitoring such as Wireless Fidelity (Wi-Fi), Radio Frequency Identification (RFID), Bluetooth, mobile telephony (GSM) have been used to actualize various unending levels of intelligence in homes.

Yan and Shi (2013), examined the feasibility of Bluetooth technology in HASs using Android smartphones without the Internet control. Devices were connected to a Bluetooth sub-controller, accessed and controlled by the smartphone via a mobile application using built-in Bluetooth connectivity but this technology is geographically limited in application.

Park (2012), proposed a mobile Internet Protocol (IP) based architecture and succeeded in the design of a smart home security and automation without any actual building and testing. Recent researchers have also used Web services, Simple Object Access

Protocol (SOAP) and Representational State Transfer (REST) as an interoperable application layer to remotely access home automation systems.

Ciubotaru-Petrescu, et al (2006), designed and implemented SMS based control for monitoring systems. Their paper has three modules viz: sensing unit for monitoring the complex applications, processing unit that is a microcontroller and a communication module that uses a General Packet Radio Service (GPRS) modem or cell phone via serial port RS-232. The SMS is used for status reporting such as power failure. If their system can be used for industrial purposes, then surely, it also has domestic applications. Conte and Scaradozzi (2003) have again viewed HASs as Multiple Agent Systems (MAS).

Methodology

GSM hardware tests are run in order to check the hardware support. The system will call GSM modem and it will get activated after activation the Modem will check for hardware support. If the hardware is missing or some other hardware problem there will be error, resulting in communication failure and the application will be terminated. If the hardware responds then the serial port will be opened for communication and GSM hardware will allow transmission of SMS. The system will then connect and after connection establishment, the system will be able to detect intrusion and will alert user about the breach and similarly the system will update status of appliances by receiving SMS from the pre-defined cell number. SMS will be silently ignored if cell number is unauthorized.

Research Approach

This research work implements fuzzy logic. Fuzzy logic starts and builds on a set of user-supplied human language rules. The fuzzy systems convert these rules for their mathematical equivalents. This simplifies the job of the system designer and the computers, and results in much more accurate representations of the way systems behave in the real world. In additional benefits of fuzzy

logic include its simplicity and its flexibility. Fuzzy logic can handle problems with imprecise and incomplete data, and it can model nonlinear functions of arbitrary complexity.” If you don't have a good plant model, or if the system is changing, then fuzzy will produce a better solution than conventional control techniques”. You can create a fuzzy logic system to match any set of input-output data. Fuzzy logic models called fuzzy inference systems, consist of a number of conditional “if - then” rules. For the designer who understands the system, these rules are easy to write, and as many rules as the necessary can be supplied to describe the system adequately (although typically only a moderate number of rules are needed. The real-time sending of a batch of short messages service(SMS) is a typical application in value added service of mobile. In order to improve the sending efficiency and real-time performance of SMS, a short message real-time parallel sending algorithm based on thread is proposed in the paper.

System Operating Principles

The HACS is made up of two subsystems namely: appliances control unit which is responsible for ubiquitous access of appliances and security alert subsystem also responsible for security intrusion detection. In this paper the microcontroller with Universal Asynchronous

Receiver/Transmitter (UART) circuit is interfaced with an AT command supporting GSM modem. The user at a remote place sends SMS through the use of the HACS text-based mobile application to the mobile to control the home appliances. The microcontroller decodes the received message and does the required action. The protocol used for the communication between the two is AT command. The microcontroller pulls the SMS received by phone, decodes it, recognizes the Mobile number and then switches on the relays attached to its port to control the appliances. After successful operation, the controller sends status feedback to the user. Figure 2 below Shows the Model of the HACS.

Step-1: The initial state of the system is shown in output. The power switch is off and no message is sent to the system. Hence, all of the appliances are switched off.

Step-2: When an SMS (Password Command = 12341111) is sent for all switched ON command then all the appliances are switched ON.

Step-3: When water level goes to under the empty level in water tank then the GSM system sends an SMS to the user as “Tank Empty”. Then user may send an SMS to turn ON the water pump as well as when water tank is full the water pump will automatically be turned OFF as shown in the following results.

The design of different units is described below:

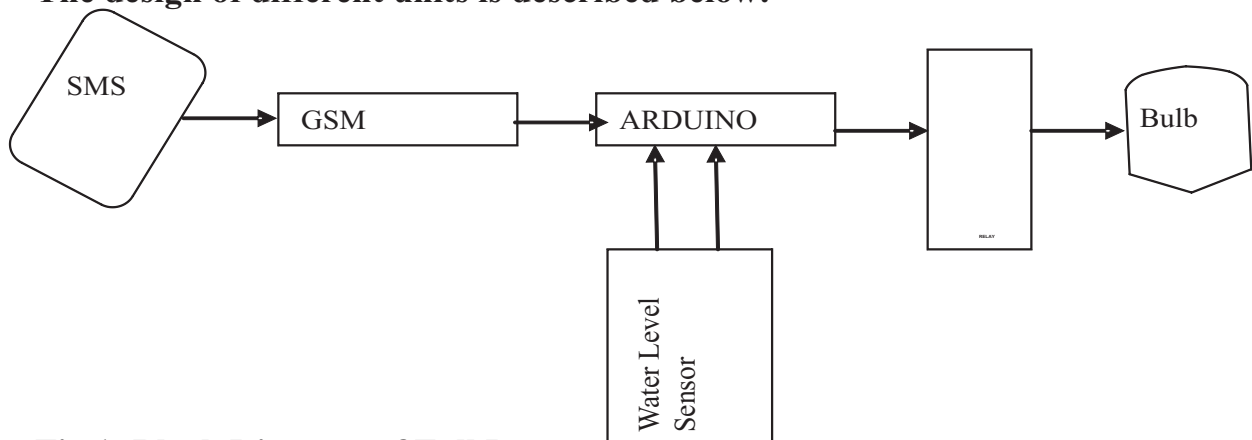


Fig.1: Block Diagram of Full Paper

Results and Discussion

Results

All the designed units have been interconnected in the board and the developed software has been uploaded into the Arduino microcontroller. A prototype model of the home has also been developed. The developed system has been made intelligent and automatic by the developed software program. The program has been developed using Arduino IDE.

The paper is aimed to design and implement a GSM based wireless control of house hold electrical appliances. After doing different tests and programming different codes, eventually the obliged outcome is put forward. It is a fast and efficient approach to control the devices. This equipment works anywhere with a great gathering of sign. At last the obliged result is attained with GSM module Sim900A based outline for effective

and compelling result. The paper “A smart control system of home appliances using SMS.” has been successfully designed and tested. Integrating features of all the hardware components used have developed it. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced IC’s and with the help of growing technology the paper has been successfully implemented. Embedded systems are emerging as a technology with high potential. In the past decades microprocessor based embedded system ruled the market. The last decade witnessed the revolution of Microcontroller based embedded systems. With regards to the requirements gathered the manual work and the complexity in counting can be achieved with the help of electronic devices.

Interface

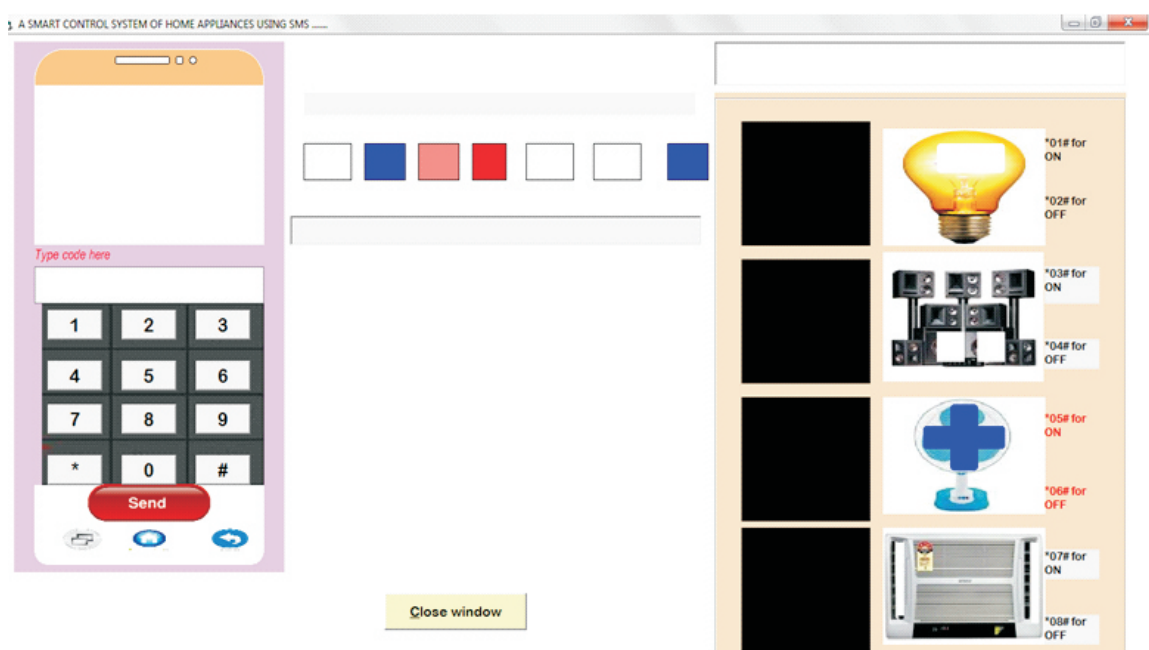


Figure 4.1: Smart Control System of Home Appliances using SMS Page

Discussion of Results

At first, the program initializes all variables and ports. Then it initializes GSM. After that a decision parameter determines whether there is any SMS or not. If there is any SMS available in the GSM module, the microcontroller reads that SMS and compares

the password with the pre-set password. If the password matches, it reads the command given in the SMS, decode the command and turns ON/OFF the home appliances according to the command. An example SMS to turn first two appliances ON and another two appliances OFF is 12341100 (password- 1234). It will work if the password

is correct either it ignores the SMS. From the decision point if there is no SMS, it goes to another decision point which determines whether the water tank is empty or not. If the tank is empty it sends SMS to the user prompting that the tank is empty through the GSM module. Otherwise it will go back to the first decision point. In this way this process will be continued until the system is switched off or power disconnected.

Conclusion

The prototype was successfully developed and met the three stated objectives. The system can automatically switch ON and OFF the extension and lamp remotely using SMS. The integration of software and hardware has performed a good task in producing the SMS system. However, there are several weaknesses had been identified which can be further improved in the future such as the system could provide better performance by intelligently send notification upon power failure, provide a flexible function by supporting both manual and automatic control as well as provide an option for the user to control the appliance through web-based system. In addition, the system is very practical when the user is away from home due to it can control the electrical home appliances remotely as long as the mobile phone gets the coverage.

Recommendation

Following are the recommendation for future in this project; One of the places that automation can have a big impact is in our home. Now there is more to it than speakers in every room and movie distribution. Let's look at a few ideas that could be turned into projects. Future will be of Automation of all products. Each and every product will be smart devices that we use daily and that will be controlled through a smart chip called microcontrollers. Each and Every home appliances will be controlled either by PC or hand held devices like PDA or mobile handsets. Some examples of it are when you want you can switch on/off Fan of your home by mobile handset or PC. Smart Grid: Home

automation technologies are viewed as integral additions to the Smart grid. The ability to control lighting, appliances, HVAC as well as Smart applications (load shedding, demand response, real-time power usage and price reporting) will become vital as Smart Grid initiatives are rolled. Garage Door; with help of automation you can open the garage door when you left home.

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