

Design of Smart Home Area Networks

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Abstract

Rapid growth of various high-tech tools and equipments makes our jobs done comfortable and sophisticated. The mobile phone is the inseparable part of human lives today. With the help of mobile phones human can do many works related to their civil life. At today's advanced technology the mobile phone have become smart. With the help of this smart gadget we can make our home smarter one. Some products are commercially available in market which allows home appliances controlling through internet, GSM, Bluetooth, RFID, and Wi-Fi wireless technologies. The main purpose of this work is to design an advanced electrical devices monitoring and controlling at home or offices remotely using android mobile. The controlling of electrical appliances is done wirelessly through Android smart phone using the GSM feature present in it. Here in this project the Android smart phone is used as a remote control for operating the electrical appliances.

Key words: GSM, Gas Cylinder, ARM-7.

I. INTRODUCTION

In Home automation systems there are collections of interconnected devices for controlling various functions within a house. Mobile devices are ideal in providing a user interface in a home automation system, due to their portability and their wide range of capabilities. Within the house, the user might not want to go to a central control panel, or not even to the laptop, but use the phone that is usually placed in closer proximity to the user. When far from the house, the user might want to

check its current status or even schedule actions for his return. But it lacks the true sense of real mobility, security and some limited range of connectivity. We proposed a new technology so that the ordinary services of the mobile phones can be used to communicate with and control the home appliances. Here, the switch board of our regular use is replacing by Android mobile application which will communicate with ARM microcontroller and the android based smart phone. The home appliances monitoring and controlling is done wirelessly through Android smart phone and also using PLCC module. Android is a healthy array of connectivity options, including Wi-Fi, Bluetooth, GSM and wireless data over a cellular connection. The advantage of controlling mechanism is the devices controlling and monitoring is available in two modes one from Mobile Phone and GSM devices. The important part of this technique is that the appliances can be controlled using power line carrier communication module network and produce required output. Here all the devices which are to be controlled are connected to the ARM-7 LPC2148 Microcontroller.

II. LITERATURE REVIEW:

There are two other relevant projects to monitor elderly using sensor networks and integrating home automation, but they do not explore user interface design [5] [6]. In Mainardi's work [7], the project is designed for people with manual dexterity and mobility impairments, but it could be widely used. The idea is to have a portable touch screen device with the proposed interface. Another work presented the use of touch screen devices

combined with voice control, allowing the interaction of people with limitations in their upper and/or lower limbs, replacing the standard devices (mouse and keyboard) [8]. The voice control systems in the state of the art are suitable for interactions with menu screens. Some works present systems based on a hardware-software co-design that allows speaker-independent speech recognition at an accuracy rate of 95%, without voice training [9]. Other works present solutions of image processing for interacting without traditional interaction. A gesture-based control system was developed to simplify the home automation interaction to people with mobility impairments in the Intelligent Sweet Home project [10]. Another solution was developed to replace hand interaction using head movements and mouth position [11]. Through serial communication and infrared, the system controls appliances.

III. NEW CHALLENGES:



Figure- 1. Image of Android application for device controlling system

Android is an open source platform. Neither developers nor handset manufacturers pay royalties or license fees to develop for the platform. The underlying operating system of Android is licensed under GNU General Public. The Android framework is distributed under the Apache Software License (ASL/Apache2), which allows for the distribution of both open and closed source derivations of the source code. Commercial developers (handset manufacturers especially) can choose to enhance the platform without having to

provide their improvements to the open source community. Instead, developers can profit from enhancements such as handset-specific improvements and redistribute their work under whatever licensing they want. Android application developers have the ability to distribute their applications under whatever licensing scheme they prefer. Developers can write open source freeware or traditional licensed applications for profit and everything in between.

In today's world every house and building has properly installed electricity lines. By using the existing AC power lines as a medium to transfer the information, it becomes easy to connect the houses with a high speed network access point without installing new wirings. This technology has been in wide use since 1950 and was mainly used by the grid stations to transmit information at high speed. Now a days this technology is finding wide use in building/home automation as it avoids the need of extra wiring. The data collected from different sensors is transmitted on these power lines thereby also reducing the maintenance cost of the additional wiring. In some countries this technology is also used to provide Internet connection.

Intelligent information appliance is the main direction of development in the appliance control field. Intelligent appliance network has small amount and low speed of data transmission using GSM; there are many appliances in family and it needs more network capacity.

Network Connectivity

It supports wireless communications using:

- GSM mobile-phone technology
- 3G
- Edge
- 802.11 Wi-Fi networks

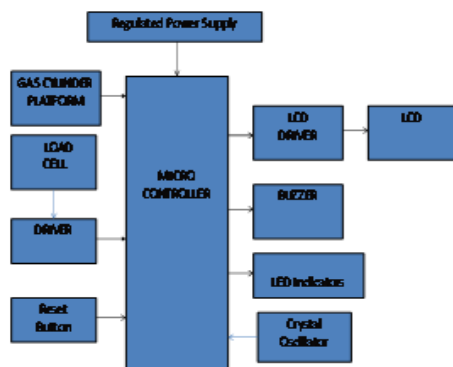
IV. METHODOLOGY:

We have presented a system that can be interconnected with the electrical devices and

Arm-7 microcontroller using GSM communicating network. The communication device used for the communication over the power lines is a MODEM, commonly known as Power Line MODEM (PLM). It works as both transmitter and receiver, i.e., it transmits and receives data over the power lines.

The design of a wireless LPG leakage monitoring system is proposed for home safety. This system detects the leakage of the LPG and alerts the consumer about the leak, activating the alarm. The additional advantage of the system is that it continuously monitors the level of the LPG present in the cylinder using load sensor and if the gas level reaches below the threshold limit of gas the information displayed in the LCD display. The device ensures safety and prevents suffocation and explosion due to gas leakage. This project is implemented using PIC controller and simulated using keil software.

In this prototype, gas leakage detection has been given a highest priority. MQ6 placed in the vicinity of the Gas cylinder. In the advent of leakage, the resistance of the sensor decreases increasing its conductivity. Corresponding pulse is fed to microcontroller and simultaneously switches on the buzzer. Also a logic high pulse (+5V) is given as an interrupt to INT0 pin of Microcontroller. LPG gas leakage found will be displayed on LCD. LCD continuously monitors the weight of the gas in cylinder and displays.



Block diagram

V. RELATED WORK:

The portable Electrical devices controlling system using android mobile, relay, TRIAC switches for controlling devices, GSM receiver module, ARM-7 (LPC2148) micro-controllers and PLCC modules for communication between two sections. The microcontroller (ARM-7 LPC2148) takes the input from Android application when the user selects the devices using android application and using wireless Bluetooth connectivity. At the receiver section PLCC modules receives data and controls electrical appliances like lights, fans using relay, TRIAC switches.

a. ARM-7 LPC2148 Microcontroller:

In the presented paper Home automation system we used ARM-7 microcontroller which is RISC microprocessor architecture from Advanced RISC Machines Ltd. The ARM7 architecture is made up of a core CPU plus a range of system peripherals which can be added to a CPU core to give a complete system on a chip. It offers several architectural extensions which address specific market needs, encompassing fast multiply and innovative embedded ICE support.



Fig.2 ARM-7 LPC2148Microcontroller

b. GSM module

The SIM900 is a complete Quad-band GSM/GPRS solution in a SMT module which can be embedded in the customer applications. Featuring an industry-standard interface, the SIM900 delivers GSM/GPRS 850/900/1800/1900MHz performance for voice, SMS, Data, and Fax in a small form configuration of 24mm x 24mm x 3 mm, SIM900 can fit almost all the space requirements in your

M2M application, especially for slim and compact demand of design.



Fig3. PLCC module

c. Relay and TRIAC:

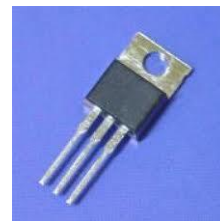
A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism, but other operating principles are also used. Relays find applications where it is necessary to control a circuit by a low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits, repeating the signal coming in from one circuit and re-transmitting it to another. Relays found extensive use in telephone exchanges and early computers to perform logical operations.

A type of relay that can handle the high power required to directly drive an electric motor is called a contactor. Solid-state relays control power circuits with no moving parts, instead using a semiconductor device triggered by light to perform switching. Relays with calibrated operating characteristics and sometimes multiple operating coils are used to protect electrical circuits from overload or faults; in modern electric power systems these functions are performed by digital instruments still called "protection relays".



Fig.4. Relay

A Triac and optically isolated Diac (Triac driver) based circuit controls the intensity of the high voltage 230volts lamp. This system also employs a zero crossing detector for smooth operation of lamp intensity. This project consists of a Microcontroller that takes input from speech recognition module and processes the request. Then it processes the data and takes necessary action on the lamp. The optical isolation system safeguards the microcontroller-based system from high voltages.



VI. RESULTS

The main aim of the prototype development is to reduce electricity wastage. GSM module is used for receiving short message service (SMS) from user's mobile phone that automatically enable the controller to take any further action such as to switch ON and OFF the home appliances such as light, air-conditioner etc.

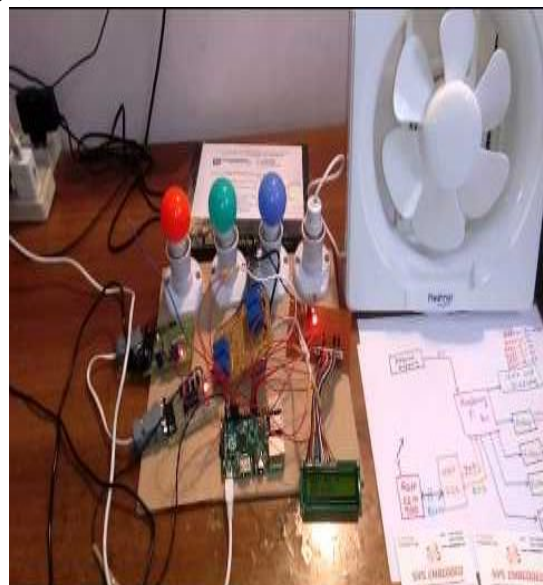


Fig.5 GSM-based home appliance control for smart home system.

The system is integrated with microcontroller and GSM network interface using embedded C language. Micro C software was utilized to accomplish the integration. The system is activated when user sends the SMS to controller at home. Upon receiving the SMS command, the microcontroller unit then automatically controls the electrical home appliances by switching ON or OFF the device according to the user direction. In other words, it reads message from the mobile phone and responds to control the devices according to the received message. The prototype has been successfully developed and it could provide an effective mechanism in utilizing the energy source efficiently.

VII. CONCLUSION:

In the presented paper provides survey on an advanced home automation system using Mobile and GSM communication. In Particular it's helpful to identify the aspects of a product that people are happy. The paper provides highly advanced IC's like ARM-7 Microcontrollers, Relays and TRIAC switches, GSM module communication technology with the help of growing technology, the project has been surveyed successfully with a unique idea.

The idea of the advanced home automation can also be extended for future using GPRS module. GPRS module can be used to monitor and control the appliances of multiple devices like lights, fans, coolers etc using predefined web link. It can also be extended using driver circuits for controlling intensities, speed levels for lights and fans devices. Usage of Wireless Wi-Fi network, through which the devices can also be controlled using voice application and also touch application from android mobile.

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