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Android Smart Phone Operated Intelligent Home

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Abstract:

In this paper mainly aims in making of Home Automation techniques to design and implement a remotely controlled, energy-efficient and highly scalable Smart Home with basic features that safeguard the residents' comfort and security. As a central controller, we used a PIC microcontroller that communicates with an Android application, our user interface. Energy can be effectively conserved if we can control the home electrical appliances like lights, fans, refrigerators, AC, TV's etc. The energy conversation is very important in the current scenario and should be done to a maximum extent where ever it is possible. The main purpose of this paper is to design an advanced electrical devices controlling at home or offices remotely using Bluetooth wireless technology and android mobile operating systems. The controlling of electrical appliances is done wirelessly through Android smart phone using the Bluetooth 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:

Android, Bluetooth module, Electromagnetic Relays, PIC 16F73, LED indicators.

I. INTRODUCTION:

Due to an environment of the building appliances control system, the device selection mainly considerate the economy and stability. First, the house intelligent switch control system should be Adapted to several types of voltage, and the stability and safety should be guaranteed as well. Second, the system should have a strong anti-jamming capability and fast communication efficiency. Last, with long hours' work, any other electrical interferences and radio radiation should be kept away.

Automation has created a bigger hype in the electronics. The major reason for this hype is automation provides greater advantages like accuracy, energy conversation, reliability and more over the automated systems do not require any human attention. Any one of the requirements stated above demands for the design of an automated device. Our house network brings together both wireless Zigbee and wired X10 technologies, thus making it a cost-efficient hybrid system. Events can be programmed to be triggered under specific conditions, and this can have a great role in reducing the total energy consumed by some appliances. On the other hand, the system can suggest smart task scheduling. The scheduling algorithm we present is a heuristic for the Resource-constrained-scheduling problem (RCPSP) with hybrid objective function merging both resource-leveling and weighted completion time considerations. In nowadays, we must make use of various high-tech tools and equipments to get our jobs done and make our life comfortable. And the mobile phone is the inseparable part of human lives today. With the help of mobile phones human can done many works related to their civil life. At today's repaired technology the mobile phone is also become smart one. With the help of this smart gadget we can make our home smart one. Some products are commercially available in market which allows home appliances controlling through internet, GSM, Bluetooth, RFID, and Wi-Fi wireless technologies. 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 PIC microcontroller and the android based smart phone. The home appliances' controlling is done wirelessly through Android smart phone and also using Bluetooth wireless connectivity, Android is a healthy array of connectivity options, including Wi-Fi, Bluetooth, GSM and wireless data over a cellular connection.

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The advantage of controlling mechanism is the devices controlling using android application based on wireless Bluetooth communication. The important part of this technique is that the appliances run on single processing controller and produce required output. Here all the devices which are to be controlled are connected to the PIC Microcontroller.

II. RELATED WORK:

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; there are many appliances in family and it needs more network capacity.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 License Version 2 (GPLv2), a strong "copy left" license where any third-party improvements must continue to fall under the open source licensing agreement terms. 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.

Figure- 1.Android operating system for controlling electrical appliances

Android is a multi-process system, in which each application (and parts of the system) runs in its own process. Most security between applications and the system is enforced at the process level through standard Linux facilities, such as user and group IDs that are assigned to applications. Additional finer-grained security features are provided through a "permission" mechanism that enforces restrictions on the specific operations that a particular process can perform, and per-URI permissions for granting ad-hoc access to specific pieces of data. The officially supported programming language on the Android platform is Java.

We can also use XML as the descriptor file as well as the user interface of an application is based on that. As the Linux kernel of the Android platform is based upon an ARM processor architecture it would also be possible to write code in C or other languages and compile it to ARM native code. : The first step is to create a simple Android Application using Eclipse IDE. Follow the option File -> New -> Project and finally select Android New Application wizard from the wizard list. Now name your application as HelloWorld using the wizard window as follows:

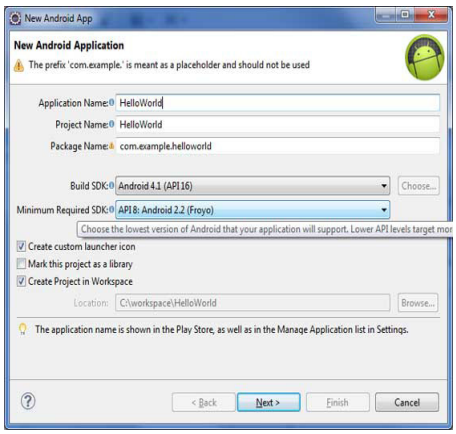

Figure- 2. Creating an Android Application

II. PROPOSED METHODOLOGY:

In the proposed model we are presented a system that can be interconnected with the electrical devices and a PIC 16F73 microcontroller using android application. The Bluetooth wireless connectivity provides the communication mechanism between the user mobile end and the PIC microcontroller system interfaced with the electrical appliances.

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A central controller (our PIC board) receives user commands to execute. On the user side, a mobile device provides interface with the system as a whole through a user-friendly application. The mobile device can be either wired to the central controller (through USB cable for instance), or communicates with it wirelessly. The data received by the Bluetooth module from Android smart phone is fed as input to the AVR microcontroller. The controller acts accordingly on the Relays to switch connected electrical appliances.Bluetooth is an open standard specification for a radio frequency (RF)-based, short-range connectivity technology that promises to change the face of computing and wireless communication. It is designed to be an inexpensive, wireless networking system for all classes of portable devices, such as laptops, PDAs (personal digital assistants), and mobile phones.

It also will enable wireless connections for desktop computers, making connections between monitors, printers, keyboards, and the CPU cable-free. Here the devices to be controlled are interfaced to PIC microcontroller unit through switches like Relay, TRIAC, and the system processes them and performs appropriate action on the devices. This project finds its applications in industrial environment, home automation and for any other commercial purposes. The block diagram below shows the design of Android-based home-appliance control that is implemented by using PIC microcontroller. This circuit consists of some major blocks like power supply, Bluetooth module, microcontroller, relay driver and loads, which are explained below.

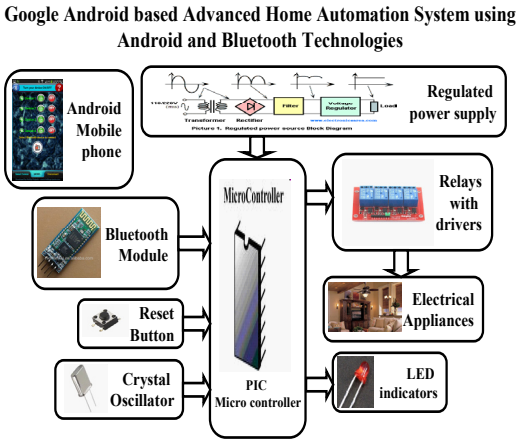

Figure- 3.Block diagram of Advanced Home Automation System using Android and Bluetooth Technologies

The presented application is a low cost solution for electrical appliances controlling using android application with wireless Bluetooth connectivity feature. The present system uses an onboard mini computer named as PIC 16F73 microcontroller which consists of number of input and output ports.

The input and output port of the micro controller are interfaced with different input and output modules depending on the requirements. The proposed solution can be used in other types of application, where the information needed is requested rarely and at irregular period of time (when requested).

In this proposed system, Bluetooth wireless connectivity and load controllers in the home are connected to an I/O control module like PIC microcontroller board which has the capability to communicate with a user-controlled device. At the user controlling side, the smart phone or tablet with an android-application-based GUI-controller allows the user to send the desired control signals such as switching a lamp off and on, room temperature maintenance, etc.

Building of this android-based home automation is a simple concept as you can implement this in your home by using cost-effective products like microcontroller and electrical appliances using switches like relays, TRAICS. So we can study brief interfacing information about using of Bluetooth communication to control home appliances.

III. HARDWARE DESIGN OF PORTABLE DEVICE:

The portable Electrical devices controlling system using android mobile, relay switches for controlling devices, Bluetooth receiver module, PIC micro-controller. The microcontroller (PIC16F73) takes the input from Android mobile based application with wireless Bluetooth connectivity when the user selects the devices using android application the PIC microcontroller acts accordingly on the electrical appliances using Relay switches.

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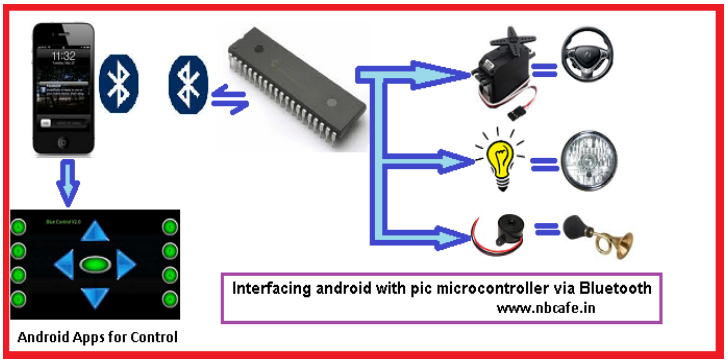

Figure- 4.Interfacing diagram of proposed model

a. PIC Microcontroller:

This project makes use of an onboard computer, which is commonly termed as micro controller. It acts as heart of the project. This onboard computer can efficiently communicate with the output and input modules which are being used. The controller is provided with some internal memory to hold the code. This memory is used to dump some set of assembly instructions into the controller. And the functioning of the controller is dependent on these assembly instructions.

In the Proposed Home automation system we used the microcontroller PIC which stands for Peripheral Interface Controller given by Microchip Technology to identify its single-chip microcontrollers. PIC microcontrollers are very successful in 8-bit microcontrollers. This project makes use of an onboard mini computer, which is usually termed as micro controller. It acts as heart of the project. This onboard computer can efficiently communicate with the output and input modules which are being used.

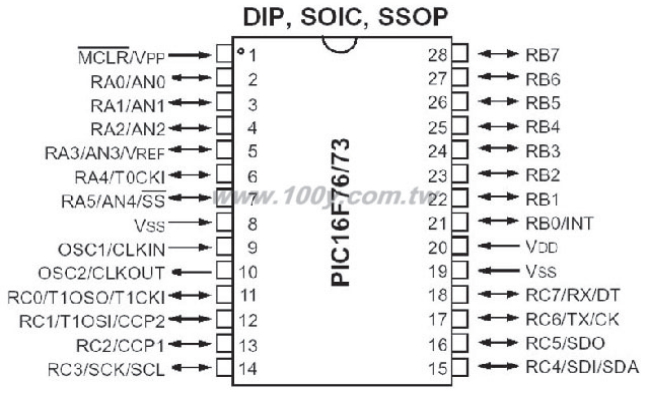

Figure- 5.Pin diagram of PIC Microcontroller

The controller contains some internal memory to store the program code. This memory is also used to dump some set of assembly instructions into the controller and these help for the functioning of the controller. The crystal oscillator speed that can be connected to the PIC microcontroller ranges from up to 20Mhz. Using the CCS C compiler usually 20Mhz oscillator will be used. The cost of the microcontroller is also very cheaper. The 20 MHz crystal oscillator should be connected with about 22pF capacitor. There are 3 input/output ports on PIC microcontroller namely port A port B port C port D and port E. Every single port has different based functionality. Most of them can be used as general I/O ports. The microcontroller uses Harvard architecture which separates both Program and Variable (data) memory interface. This facilitates fetching of an instruction and the operation on data/accessing of variables simultaneously.

Fig 6. Microcontroller

b. Bluetooth Module:

Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz) from fixed and mobile devices, and building personal area networks (PANs). Invented by telecom vendorEricsson in 1994 it was originally conceived as a wireless alternative to RS-232 data cables. It can connect several devices, overcoming problems of synchronization. The module's host and slave, the host and slave pairing communication from the machine and from the machine or between the host and the host can not communicate, communication function and computers, mobile phones and other Bluetooth pairing purchase default slave , requires that the host needs to be indicated. Bluetooth serial module is used for converting serial port to Bluetooth. These modules have two modes: master and slaver device. The device named after even number is defined to be master or slaver when out of factory and can't be changed to the other mode.

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But for the device named after odd number, users can set the work mode (master or slaver) of the device by AT commands.

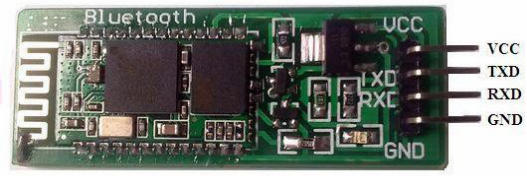

Fig 7. Bluetooth Receiver module

c. Relay:

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".

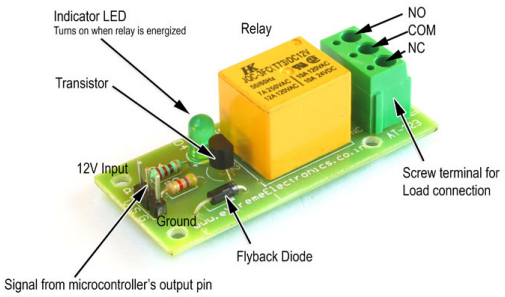

Fig. 8. Relay

d. LED indictaor:

A light-emitting diode (LED) is a semiconductor light source. LED's are used as indicator lamps in many devices, and are increasingly used for lighting. The structure of the LED light is completely different than that of the light bulb. Amazingly, the LED has a simple and strong structure with semiconductor material which determines the LED's color. The LED is based on the semiconductor diode. When a diode is forward biased (switched on), electrons are able to recombine with holes within the device, releasing energy in the form of photons. This effect is called electroluminescence and the color of the light (corresponding to the energy of the photon) is determined by the energy gap of the semiconductor. LED's present many advantages over incandescent light sources including lower energy consumption, longer lifetime, improved robustness, smaller size, faster switching, and greater durability and reliability.

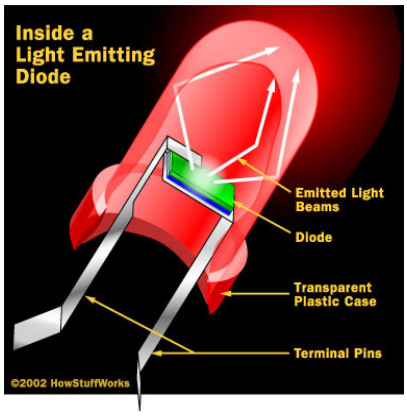

Fig. 9. LED indictaor

IV CONCLUSION:

The existing implementation of an advanced home automation system using android smart phone and Bluetooth wireless technologies is an Integrating feature of all the hardware components has been used and developed in it. The Presence of each and every module has been reasoned out and placed very carefully. Hence the contributing to the best working unit for an automation of electrical devices has been designed perfectly. Secondly, using highly advanced IC's like PIC Microcontroller, Relay modules, Bluetooth receiver and Android operating system with the help of growing technology, the project has been successfully implemented with a unique idea. Thus the project has been successfully designed and tested.This project can be extended using GPRS module.

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GPRS module can be used to monitor and control the appliances of multiple devices like lights, fans, coolers etc using predefined weblink. The project can also be extended using driver circuits for controlling intensities, speed levels for lights and fans devices. The project can be extended using wireless Wi-Fi network using which the devices can also be controlled using voice application and also touch application from android mobile and also from PC.

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