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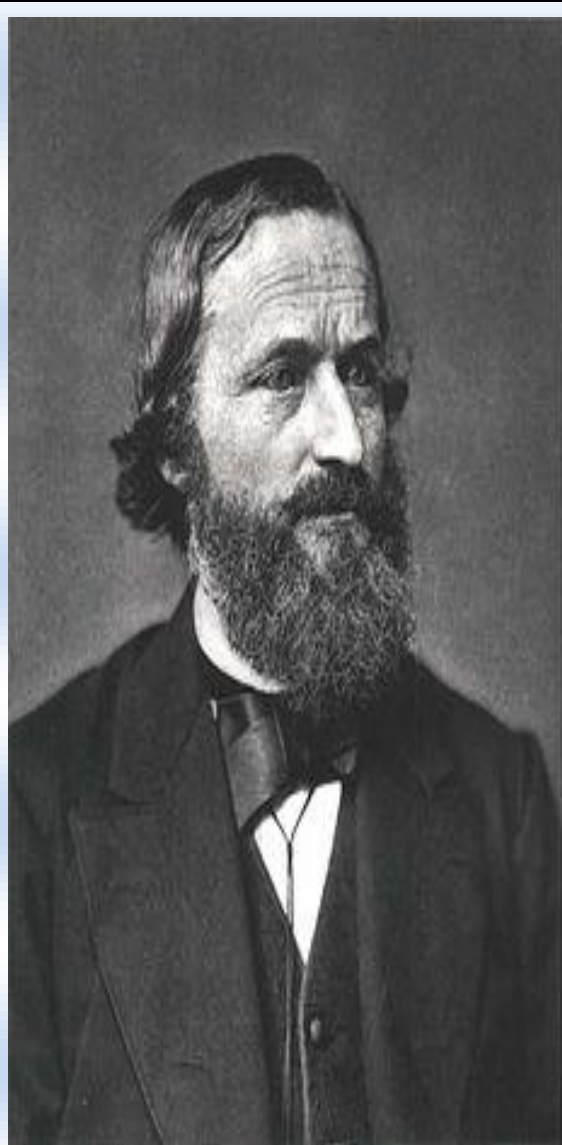
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SCIENTIST OF THE SEMESTER

MR. DATKHILE SAGAR NAMDEV¹

¹ Department of Electrical Engineering Bhivrabai Sawant Polytechnic, Wagholi



Gustav Robert Kirchhoff	
Born	12 March 1824 Königsberg, Province of East Prussia, Kingdom of Prussia (present-day Kaliningrad, Russia)
Died	17 October 1887 (aged 63) Berlin, Province of Brandenburg, Kingdom of Prussia (present-day Germany)
Residence	Prussia / German Empire
Nationality	Prussian (1824-1871) German (1871-1887)
Alma mater	University of Königsberg
Known for	Kirchhoff's circuit laws Kirchhoff's law of thermal radiation Kirchhoff's laws of spectroscopy
Awards	Rumford medal (1862) Davy Medal (1877) Matteucci Medal (1877) Janssen Medal (1887)
Scientific career	
Fields	Physics Chemistry
Institutions	University of Berlin University of Breslau University of Heidelberg
Doctoral advisor	Franz Ernst Neumann[citation needed]

Gustav Robert Kirchhoff (12 March 1824 – 17 October 1887) was a German physicist who contributed to the fundamental understanding of electrical circuits, spectroscopy, and the emission of black-body radiation by heated objects.

He coined the term black-body radiation in 1862. Several different sets of concepts are named "Kirchhoff's laws" after him, concerning such diverse subjects as black body radiation and spectroscopy, electrical circuits, and thermochemistry. The Bunsen–Kirchhoff Award for spectroscopy is named after him and his colleague, Robert Bunsen.

Gustav Kirchhoff was born on the 12th of March, 1824 in Königsberg, Prussia, the son of Friedrich Kirchhoff, a lawyer, and Johanna Henriette Wittke.^[2] His family were Lutherans in the Evangelical Church of Prussia. He graduated from the Albertus University of Königsberg in 1847 where he attended the mathematico-physical seminar directed by Carl Gustav Jacob Jacobi, Franz Ernst Neumann and Friedrich Julius Richelot. In the same year, he moved to Berlin, where he stayed until he received a professorship at Breslau. Later, in 1857, he married Clara Richelot, the daughter of his mathematics professor Richelot. The couple had five children. Clara died in 1869. He married Luise Brömmel in 1872. Kirchhoff formulated his circuit laws, which are now ubiquitous in electrical engineering, in 1845, while still a student. He completed this study as a seminar exercise; it later became his doctoral dissertation. He was called to the University of Heidelberg in 1854, where he collaborated in spectroscopic work with Robert Bunsen. In 1857 he calculated that an electric signal in a resistanceless wire travels along the wire at the speed of light.

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Mobile Train Radio Communication

RUSHIKESH KSHRIRSAGAR ¹, TARAWADE SANKET M², MR. POKHARKAR S.V.³

^{1, 2, 3} Department of Electrical Engineering Bhivrabai Sawant Polytechnic, Wagholi

Abstract

Each mobile uses a separate, temporary radio channel to talk to the cell site. The cell site talks to many mobiles at once, using one channel per mobile. Channels use a pair of frequencies for communication. One for transmitting from the cell site, the forward link, and one frequency for the cell site to receive calls from the users, the reverse link. Communication between mobile units can be either half-duplex or full-duplex. In case of half-duplex, transmit and receive communications between the mobile units are not at the same time, i.e. talking and listening cannot be done at the same time. In case of full-duplex communication, transmit and receive communication is at the same time, i.e. one can talk and listen at the same time. When communications between mobile units are within a cell, and if the same is half-duplex, then it shall require only one pair of frequency. If the same is full duplex, then requirement of frequency pair shall be two. When a mobile unit is communicating with a mobile unit outside the cell, then the requirement of frequency pair shall be one per cell for both half-duplex and full-duplex communication. Hence the system resources are utilized more if the mobile units communicate with each other in full-duplex mode.

Introduction

Mobile Communications Principles

Each mobile uses a separate, temporary radio channel to talk to the cell site. The cell site talks to many mobiles at once, using one channel per mobile. Channels use a pair of frequencies for communication. One for transmitting from the cell site, the forward link, and one frequency for the cell site to receive calls from the users, the reverse link. Communication between mobile units can be either half-duplex or full-duplex. In case of half-duplex, transmit and receive communications between the mobile units are not at the same time, i.e. talking and listening cannot be done at the same time. In case of full-duplex communication, transmit and receive communication is at the same time, i.e. one can talk and listen at the same time. When communications between mobile units are within a cell, and if the same is half-duplex, then it shall require only one pair of frequency. If the same is full duplex, then requirement of frequency pair shall be two. When a mobile unit is communicating with a mobile unit outside the cell, then the requirement of frequency pair shall be one per cell for both half-duplex and

full-duplex communication. Hence the system resources are utilized more if the mobile units communicate with each other in full-duplex mode.

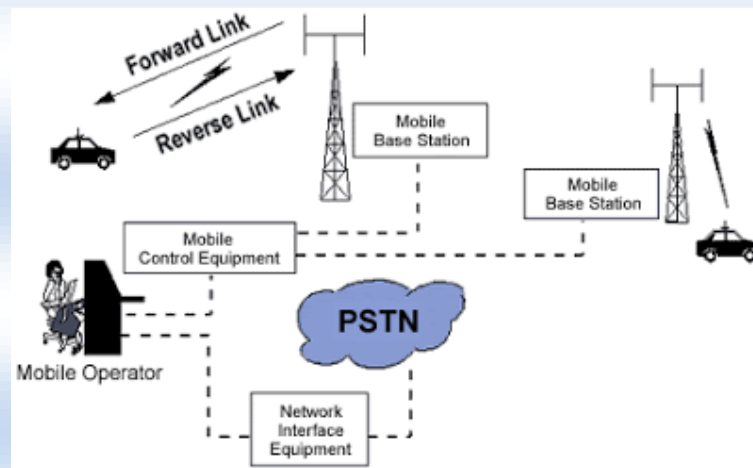


Figure: Mobile Communications Principles

Early Mobile Telephone System Architecture

Traditional mobile service was structured similar to television broadcasting. One very powerful transmitter located at the highest spot in an area would broadcast in a radius of up to fifty kilometres. The “cellular concepts” structure the mobile telephone network in a different way. Instead of using one powerful transmitter, many low-power transmitters were placed throughout a coverage area. For example, by dividing a metropolitan region into one hundred different areas (cells) with low-power transmitters using twelve conversations (channels) each, the system capacity theoretically could be increased from twelve conversations - or voice channels using one powerful transmitter- to twelve hundred conversations (channels) using one hundred low-power transmitters.

Different Type of Communication Systems

The different types of communication systems available today can be broadly classified into the following categories.

- Landline System
- Cellular System
- Satellite System The evolution of the above Systems had been broadly as a point to point system.
- Two-Way Radio System The evolution of the Two-way Systems has been both as a point to point and a point to multi point system.

Mobile Communication Evolution

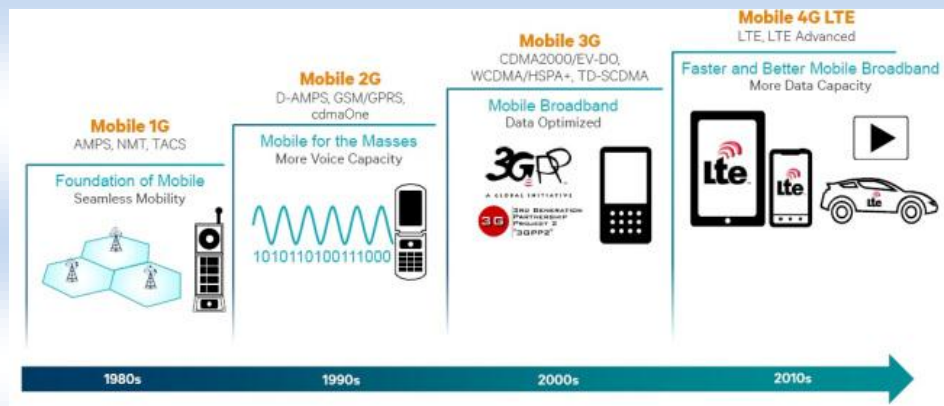
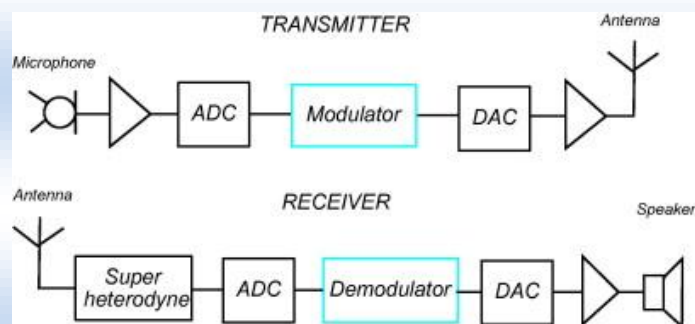


Figure: Evolution of 2-Way Radio Platform

The following diagram explains how the evolution of 2-Way radio platform has taken place



Present Day Scenario

A choice of mobile system for a setup is governed mainly by the following facts

- Coverage area
- Number of subscribers to be catered
- Frequency spectrum available
- Nature of the terrain
- Type of application i.e. voice or data or both
- Integration with other systems
- Future technological migration capability

Railways' Present-Day Requirements.

The Train Mobile System's present-day requirements are not just voice transmission, but also along with voice the system shall be capable of handling data also. Typical applications for the Modern Train Mobile System are as under.

- Text and status message transmission.
- Automatic Train operation's critical alarms.
- Train status and alarm information
- Passenger information system control
- Train passenger emergency system
- Closed circuit TV system

MPT1327 System

MPT1327 is an Open Standard for analog trunked radio networks. The British Department of Trade and Industry (DTI) developed it in year 1988. In the course of the next twelve months of development continued and resulted in MPT1343 standards. A system based on MPT1327 generally comprises of several radio channels. At least one of these channels will have been defined as the CC (Control Channel) and all the other channels are TCs (Traffic Channel). Data messages between the mobiles and the networks are exchanged on the Control Channel at 1200 bits/sec using FSK (Frequency Shift Keying). Each subscriber in a trunked radio network has a unique call number. It consists of a prefix (3digits), a fleet number (4 digits), and a subscriber number within the fleet (2 or 3 digits). After it has been entered the call number will be converted in the mobile to a 20-bit address. For the duration of the call a subscriber is exclusively allocated a traffic channel from the available trunk. Western Railway has already opted for a MPT1327 system for the Motorman and Controller communication in its Suburban Section in Mumbai Division. This system is as a part of the TMS project between Churchgate and Virar Sections. M/s Tait New Zealand has supplied the Mobile System.

Tetra Systems

TETRA stands for Terrestrial Trunked Radio, covering PMR (Professional Mobile Radio) as well as PAMR (Private Access Mobile Radio) applications. As a trunked system, it is designed to be the true follower of MPT1327. TETRA applies digital speech transmission with TDMA (burst transmission), very fast call setup times, and may use powerful encryption. TETRA is an Open Standard defined by ETSI (European Telecommunication Standards Institute). TETRA applies a modulation format called $\pi/4$ DQPSK, TDMA with 4 channels per

carrier, and a carrier spacing of 25 KHz. TETRA does not have a fixed frequency allocation as GSM. But the systems currently planned or installed in Europe assumes frequencies in the range of 380-400 MHz for public a safety communication, and 410-430 MHz for commercial systems.

GSM System

- The GSM (Global System for Mobile Communication) MoU Association, a Swiss registered Corporation, is the principle body responsible for promoting and evolving the GSM wireless platform worldwide. Today GSM is the most successful implementation of a global wireless standard using digital technology for point to point operations.
- There are over 293 members representing 120 countries/areas. The overall objective of the GSM MoU Association is “The promotion and evolution of the GSM900, GSM1800, GSM1900 systems, and the GSM platform for international roaming, for the provision of standardized services
- GSM (Global System for Mobile communication) is a digital mobile telephony system that is widely used in Europe and other parts of the world. GSM uses a variation of time division multiple access (TDMA) and is the most widely used of the three digital wireless telephony technologies (TDMA, GSM, and CDMA). GSM digitizes and compresses data, then sends it down a channel with two other streams of user data, each in its own time slot. It operates at either the 900 MHz or 1800 MHz frequency band.

Advantages

- Increase rail capacity through closer train operation
- Improved efficient and flexibility of the rail network
- Improved serviced reliability
- Increased safety
- Reduced operation and maintenance cost for the track side infrastructure

Disadvantages

- Complex system
- Initial cost is high
- Need experienced worker
- Amount of data can transmit through channel is limited

Conclusion

Mobile Communication today is a fast growing field. No one can deny its role in Modern Railway Operations. However there is a need of proper choice of technology looking into Railways' Operational needs. It is beyond doubt that incorporation of Mobile Communication into Railways will open new operational avenues, thereby reducing operational costs and increasing customer satisfaction by providing better services. This shall not only help in increasing productivity, but also help in increasing safety of operations. This is an age of communication. Indian Railways, which is a lifeline of the nation, is also geared up to take the requirements of the new millennium, which is knocking the door of this century.

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Android Based Electrical Appliances Control

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Abstract

Today we are living in 21st century where automation is playing important role in human life. Home automation allows us to control household appliances like light, door, fan, AC etc. It also provides home security and emergency system to be activated. Home automation not only refers to reduce human efforts but also energy saving and time efficiency. The main objective of home automation and security is to help handicapped and old aged people who will enable them to control home appliances and alert them in critical situations. This paper put forwards the design of home automation and security system using ARM7 LPC2148 board. The design is based on a standalone embedded system board ARM7 LPC2148 at home. Home appliances are connected to the ARM7 and communication is established between the ARM7 and ARM9 with Bluetooth device. The home appliances are connected to the input / output ports of the embedded system board and their status is passed to the ARM7. We would develop an authentication to the system for authorized person to access home appliances. The device with low cost and scalable to less modification to the core is much important. It presents the design and implementation of automation system that can monitor and control home appliances via ARM9 S3C2440A board.

Keywords: Smart Home; Smart Environment; Bluetooth Module; Embedded Systems; ARM7-MDK Kit; wince6.0; ARM9 with GUI.

Introduction

With the development of technology and the continuous improvement of people's living standard, people are in pursuit of automated, intelligent and convenient home control systems. At present, the PC is used as the remote control terminal for most home control systems; however, there are some problems in the PC monitor terminal, such as its great bulk, inconvenience to carry, high cost, limited monitoring range and so on. Therefore, it's a good choice to design a terminal based on phone. With the popularity of smart phones, particularly, the phone based on Android system is rapidly developed. At its I/O developer conference, Google showed a sneak preview of its Android Home project, which will extend the Android platform into household objects. It means that the remote control based on Android phone will become a mainstream way. After logging into the control interface, users can easily control the

lights, TVs and air conditionings anytime, anywhere, which brings great convenience to people and improves the quality of life.

Home automation Systems (HASs) represents a great research opportunity in Creating new fields in engineering, architecture and computing (Huidobro and Millan, 2004). HASs becoming popular nowadays and enter quickly in this emerging market. However, end users, especially the disabled and old aged due to their complexity and cost, do not always accept these systems. Due to the advancement of wireless technology, there are several different of connections are introduced such as GSM, WIFI, ZIGBEE, and Bluetooth. Each of the connection has their own unique specifications and applications. Among the four popular wireless connections that often implemented in HAS project, Bluetooth is being chosen with its suitable capability. Bluetooth with globally available frequencies of 2400Hz is able to provide connectivity up to 100 meters at speed of up to 3Mbps depending on the Bluetooth device class. In addition, a Bluetooth master device is able to connect up to 7 devices in a "Piconet".

Implementation

Wince 6.0

For this home automation and security system we are targeting ARM9 S3C2440A platform since it has huge market and open source. Wince6.0 is a operating system which is used for ARM9 devices that includes middleware and key applications. The Wince6.0 OS is based on WindowsCE.net 5.0Standard. The ARM9 provides the tools and APIs necessary to begin developing applications on the Wince6.0 platform.

Software Design

As discussed earlier we are developing graphical user interface (GUI) application by using visual basics .net. The application consists of main function like light controlling, Door controlling, etc. When the application starts user is first authenticated, if user is authorized he will be navigated to main screen. The main screen has a list of all functions among which user can select any one function which he want to control. After selecting a function hewould be able to see a current status of a particular device. If user wishes, he canenable ordisable intended device. The system is programmed to auto on/off lights during late night hours. If room temperature goes very high or low user can manually adjust fan/AC as per user requirement.

MDK-ARM

The MDK (microcontroller Development Kit) - ARM is a complete software development environment for ARM7™ and ARM9™processor-based devices. MDKARM is specifically designed for microcontroller applications, it is easy to learn and use, yet powerful enough for the most demanding embedded applications. MDK-ARM is available in four

editions: MDK-Lite, MDK-Basic, MDK-Standard, and MDK-Professional. All editions provide a complete C/C++ development environment and MDK-Professional includes extensive middleware libraries. The Kiel MDK board provides input and output pins that you can implement through the use of attachments called "shields". With an Micro controller devices and the „ARM MDK“, you can use whatever sensors and actuators you require to create your own accessories. This may include a LED outputs, and temperature and light sensors.

Block Diagram

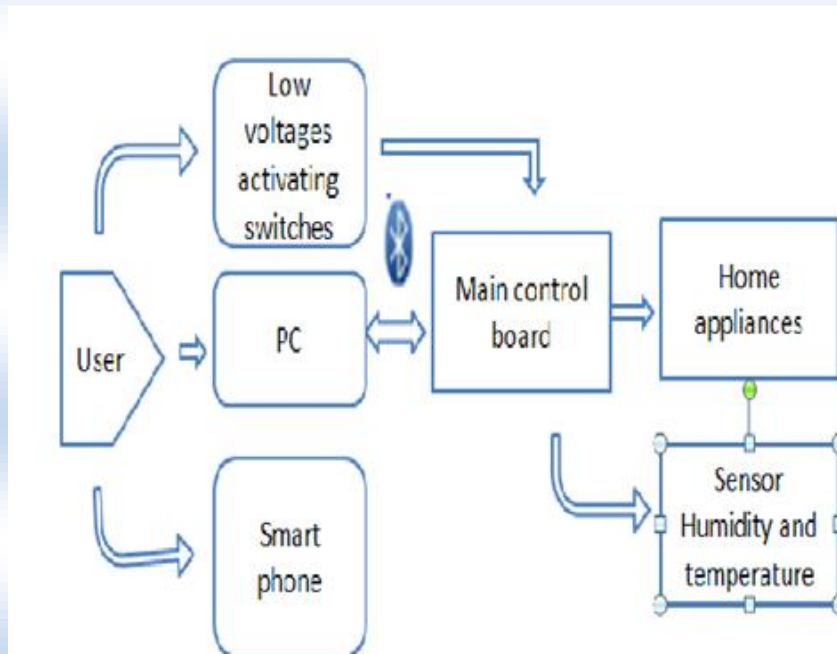


Figure:-Block Diagram

Micro Controller Device

It is the device through which application interacts with home appliance. USB Connector - It is the hardware port in the kit through which the USB device is attached to the embedded kit. Embedded Device - It consists of individual embedded kits along with respective home appliance. In this project we are implementing ARM9Wince6.0 based device control with the help of blue tooth. For this one ARM9 is required in the transmitter section. In the receiver section two devices are interfaced to microcontroller with Bluetooth module. User responsibility is to develop one application software (GUI) in ARM9 with VB.net which is used to send the commands. With the help of Bluetooth. In the receiver side Bluetooth module is interfaced to the controller to Trans receive the data from the ARM9 processor. Based on that data microcontroller will decide the devices operation like on/off the devices and lock/unlock the door.

Software Development

Graphical User Interface (GUI) Module

The most important feature of our application is to hide several processes from the user while allowing some degree of interaction with the application. By using the GUI package, we were able to customize the application to include a variety of user interface elements such as text boxes, choice groups, alert messages, lists and command buttons.

The Program Flow Chart

Upon the execution of the program, it first checks if Bluetooth is already enabled on the ARM9. If Bluetooth is enabled, the device and service discovery process will run. The software will check if there are already predefined devices stored in the ARM9smemory. If they do exist, they will be listed down for the user to select one. The program then checks to see if the selected device is in range. It will then verify if the device is a Bluetooth transceiver (ARM7-MDK board). Now if there are no devices stored in Bluetooth-enabled devices within the area. Once discovered, these devices will be displayed on the screen and also stored in memory. Once it is confirmed that the device is indeed a transceiver, the software will store the unique addresses of all the controller modules connected to it, in this case ARM7-MDK. If the address of a controller module has not been saved, then it will be designated a number i.e. MDKLAMP. Otherwise, it will be given its saved name and will prompt the user to enter the pairing password for ARM7-MDK board. Upon entering the correct password, the program stores all connected controller modules names inside the ARM9 memory, then only the Main Menu user interface will be displayed.

Applications And Future Challenges

Followings are the applications of home appliances control system based on the android Smartphone.

Lighting Appliance Control Subsystem

Household appliances also don't need to transmit large amounts of data, and its real-time requirement is not high, so take a combination of wired and wireless ways to make wiring easy. Alarm subsystem with landline phone alarm and GSM alarm has multiple protections. It can still alarm normally when the line of the landline phone is cut off. The entire system takes modular design thinking which contributes to the design clear and facilitates the user to select a different combination of modules to meet the needs of individual users. Humanized operation interface allows users to use them more conveniently. Dimming control, a more comfortable environment and a certain scene was creating. Appliance control function is not only our commonly household appliances such as microwave ovens, water dispensers, rice cookers,

television sets, but also includes garden automatic irrigation systems, fountains and other equipment. Lighting appliance control subsystem can be achieved not only a variety of romantic scenes, but also for the whole family safe. When you go out, just one lobby button, you can complete power outage, which significantly reduces the risk of fire and saves energy.

Future Challenges

This project can be further developed by integrating it with the internet to monitor your home while sitting in a remote area. By doing this, one can keep an eye on his or her home through an internet connected to the user's mobile phone or PC or laptop. This will not only improve the security of your home in this modern day world but will also assist in conservation of energy like if you left any home appliance switched on by mistake, then you can check the status of the appliance on the graphical interface made on your mobile and can switch it off using the internet connectivity.

Conclusions

By designing the Android user interface and Home information centre, home appliance control system based on the Android phone can be designed. It has combined android client, network transmission, and wireless switch, home information centre to form a complete system, and the whole system works normally. Identifying message commands and wireless encoding are the two major tasks for home information centre. Android phone have advantages such as humane interface, customizable and extendible applications and android phone is easy to carry so on. By constantly improving the control function, android phone allows us anytime, anywhere to control any device, and finally realizes the highly intelligent home.

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Photovoltaic Solar Power generation

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Abstract

Perturb and Observe (P&O) and Incremental Conductance (INC) are widely used as Maximum Power Point Tracking (MPPT) techniques in Photovoltaic (PV) systems. But, they fail under rapidly varying of sunlight levels. This paper proposes a new MPPT technique, which can make a distinction between perturbation in the reference voltage and sudden-changing of sunlight and thus optimize the PV system efficiency. This method consists on a modified INC algorithm, which is used to fine-tune the duty cycle of the DC/DC converter in order to avoid divergences of the maximum power point (MPP) when using basic INC under fast varying of luminosity levels. The proposed PV-MPPT system, which is composed by a step-up converter as the interface to feed the load, is tested by simulation within the Mat lab/Simulink software by taking into account the luminosity, the temperature and the load variation. The simulation results are satisfactory and demonstrate that the improved INC technique can track the PV maximum power at diverse operating conditions with the most excellent performance, the energy conversion efficiency is increased by approximately 5%.

Introduction

The solar energy has many advantages compared with fossil-fuel energy. It is inexhaustible, free of charge, naturalness, clean, no ecological pollution, and with modular character, which allows construction of the solar array at different power levels. On the other hand, it has an important disadvantage, which is the low efficiency of conversion of light to electrical energy. Moreover, the power harvested by a PV generator depends on a number of factors, such as the luminosity, the temperature, and the load in that it is connected. In each operating condition, there is just one and unique particular point that makes the PV array in functioning at its maximum power.

In most PV applications (stand-alone system, hybrid system and public grid connected system), it is very important to exploit the peak power provided by the photovoltaic generator. To achieve this goal, a power electronics device with an adequate MPPT technique is needed. Many of these MPPT algorithms have been published in several references. These methods vary in many aspects such as the necessary sensors, the complexity, the cost, the efficiency, the

convergence rapidity, the accurate tracking when temperature and/or luminosity vary, and equipment required for the implementation or popularity. A full analysis of 30 different MPPT algorithms can be found.

Maximum power point tracking algorithms

Classical INC technique

The INC algorithm tracks the MPP by comparing the sum of incremental conductance plus instantaneous conductance of a PV panel with zero. It is based on the fact that the slope of the curve power vs. voltage $\frac{dP}{dV} = \frac{1}{V} I_p \frac{DI}{DV} - \frac{V}{V}$ of the solar panel is zero at the MPP, positive on the left of it and negative on the right. If the slope is positive, the operating point must be moved to the right by increasing the module voltage. If it is negative, the operating point must be moved to the left by decreasing the module voltage. Finally, when the slope is null, the operating point is at the MPP and thus the algorithm stop the voltage adjustment. The accuracy and rapidity in which the algorithm tracks the MPP depends on the size of the increment of the reference voltage or of the reference of the duty cycle.

Modified INC technique

In stable conditions of fixed irradiance level and temperature, the current vs. voltage characteristic shows well that the change in voltage leads a change in current with differing sign. If perturbation in voltage leads a perturbation with same sign in current, the PV array is in sudden varying atmospheric conditions. Contrary to the traditional method, the modified INC algorithm can distinguish between these two operating conditions and thus avoid divergence in the case of the second circumstances by changing the direction of the perturbation. One can say that the new algorithm must act contrary to the old algorithm when the system functions under fast-varying conditions. This principle is explained in Fig. 7, which is given in the flowchart of the modified INC algorithm. The added part with respect to the old algorithm is indicated in yellow colour. It consists of two tests consisting in change in current and voltage with same signs. It indicates the fast-varying of sunlight.

Conclusion

In this paper, the modelling, simulation and control of a standalone photovoltaic power electricity generation system has been proposed by incorporating a power electronics converter to permit the use of the PV array at its maximal power. The proposed PVMPPPT system has been implemented under MATLAB-SIMULINK environment. A control strategy based on an

improved INC technique was developed in order to regulate the power output of a solar system, which comprises photovoltaic generation, a boost DC-DC converter that is able to step-up the load voltage. Comparing with traditional INC technique used in the past, the use of the proposed MPPT control improves the PV system performance mainly in dynamic states, thus reducing the loss of power and enhancing the tracking efficiency by five percent. The results of simulation are present. Drawbacks of this study are the slow time response at start-up in comparison to others techniques such as Sliding Mode Control and the lack of experimental work. Future work will continue by extending the principle of MPPT technique proposed on other more efficient converter topologies and taking into account the shading phenomenon in the test of developed MPPT system for an inhomogeneous illumination.

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Minimizing Penalty in Industrial Power Consumption by Engaging APFC Unit

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Abstract

In the industrial division, the numerous motoring loads are continuously running and generating the inductive load. Power consumption is increasing day by day at a very high rate. So the power factor in this operation gets lessened due to the inductive reactive power. The electricity company charges the penalty to the industrial consumers if the power factor goes below the specified limit;. By using power capacitors the required compensation can be achieved to overcome inductive reactance with the help of APFC panel. The current transformer sends a current signal which is received by the microcontroller 8051 and simultaneously the signals are fed to the various contactors to connect the capacitors in the line. Thus due to addition of the capacitor to the line, it will help in compensating the reactive power and thus maintain the power factor near to unity. This will avoid the penalty to the industrial consumers. In the conventional methods, we were using the fixed capacitor for compensation. But these led to excessive charging of the capacitors, which in turn caused the voltage surges. Thus it becomes complicated to maintain power factor near unity by on and off operation of the fixed capacitor. The contactor switched capacitors are connected and disconnected automatically eliminating the previous predicament.

Keywords: microcontroller 8051, capacitor bank, embedded technology

Introduction

In any AC system the current, and thus the power, is formed of variety of components based on the nature of the load consuming the power. These are resistive, inductive and capacitive elements. In case of a purely resistive load, for instance, electrical resistance heating, incandescent lighting, etc., the current and also the voltage are in phase i.e the current follows the voltage. While, in case of inductive loads, current lags behind the voltage i.e the current is out of phase with the voltage. Almost all of the equipment and appliances in the present day are inductive in nature (Except few purely resistive loads and synchronous motors), for instance, inductive motors of every type, electric arc, welding machines, and induction furnaces, choke coils and magnetic systems , transformers and regulators, etc. In the case of a capacitive load the current and voltage are once more out of phase however now the current leads the voltage. The

foremost common capacitive loads are the capacitors put in for the correction of power factor of the load.

Problem Statement

An electrical load that operates on alternating current requires apparent power, which consists of real power plus reactive power. Real power is the power actually consumed by the load. Reactive power is repeatedly required by the load and given back to the power source, and it is the cyclical effect that occurs when alternating current passes through a load that contains a reactive component. The real power is less than apparent power whenever reactive power is present which results in a power factor less than 1 of electrical loads. The reactive power increases the current flowing between the power source and the load, which also increases the power losses through transmission and distribution lines. This results in operational and financial losses for power companies. Therefore, power companies require their customers, especially those with large loads, to maintain their power factors above a specified amount (usually 0.90 or higher) or be subject to additional charges.

Electrical engineers involved with the generation, transmission, distribution and consumption of electrical power have an importance in the power factor of loads because power factors affect efficiencies and costs for both the electrical power industry and the consumers. If the operating costs are increased, reactive power may require the use of switches, C.B, Transformers, transmission lines with higher current capacities. In order to correct the power factor of ac loads or transmission system, there are various methods available. One of the methods is by switching the capacitors or inductor banks on or off which results in cancelling of inductive or capacitive effects of the connected loads.

Block Diagram

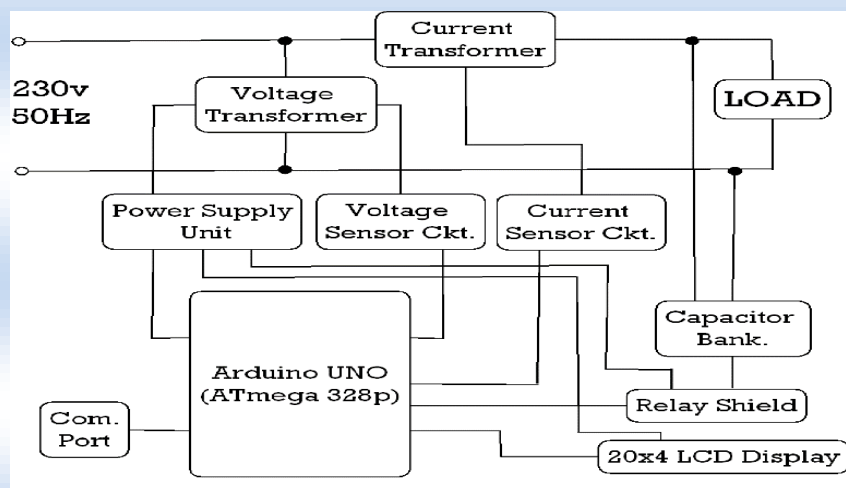


Figure: Block Diagram

Methodology

Power supply

In power supply we are using step-down transformer. The 230 V ac input supply is given to the primary of the transformer. Transformer is an electromechanical static device which transforms power from one circuit to another without changing its frequency. Due to the magnetic effect of the coil the flux induced in the primary is transferred to the secondary coil.

Rectifier

The main function of the rectifier is to convert the ac voltage to the dc output. The diode is a primary component in most of the rectifier circuits since it conducts in one direction. This property of diode convert the sinusoidal voltages with zero average value into waveforms that contains both ac and dc components (pulsating dc). It is a full wave bridge rectifier.

Voltage Regulator

The main function of the voltage regulator is to convert the variable output DC voltage into the constant DC voltage which is required for the supply for the microcontroller and zero crossing detector. Zero Crossing Detectors: The zero crossing detector circuit is an important application of the op-amp comparator circuit. It can also be called as sine to square wave convertor. It is used to spot the sinusoidal wave zero crossing from positive half cycle to negative half cycle. The reference voltage with which the input voltage is to be compared, must be made zero ($V_{ref}=0$). The input sine wave is given as an V_{in} . To measure the time difference between two waves we need to detect zero crossing of two waves. Zero crossing detector produces an output state change whenever the input crosses the reference input.

Microcontroller

Microcontroller is a IC chip that executes programs for controlling other devices or machines. Its a micro sized IC chip device which is used for control of other devices and machines, that is why it is called microcontroller. It is a microprocessor having RAM, ROM and I/O ports. 8051 microcontroller is used in automatic power factor correction panel. The microcontroller receives the load current in the line and gives the signal to the relay driver and simultaneously connects the capacitors as per the need. Relay: A relay is an electrically commanded switch. Many relays employ an electromagnet to perform a switching mechanism automatically; however, different operating principles are also utilized. Relays are used wherever it is essential to control a circuit by a weak-power signal or where numerous circuits must be controlled by unit signal. Current running through the coil of the relay generates a

magnetic field which attracts a lever and switches the switch connections. The coil current can be on or off so relays have two switch locations and utmost have double throw switch.

Relay Driver

Relay Driver is interfaced with the microcontroller output. It is used to drives the multiple relays as per the compensation required.

LCD

LCD stands for liquid crystal display. It is a flat panel display or alternative electronic visual display that uses the light modulating properties of liquid crystals. liquid crystal display is employed to indicate the present power factor. 16x2 digital displays is connected with 8051 microcontrollers. It's obtainable in an exceedingly 16 pin package with backlight; adjustment of contrast function and each dot matrix have 5×8 dot resolution.

Capacitor Bank

Capacitors can be included for compensation of power factor through a relay. A capacitor bank is a combination of different capacitors of the similar rating that are connected in series or parallel with each other to stock electrical energy. The resulting bank is then used to correct a power factor lag or phase shift in an ac power capacitor does. They are intended to store electrical energy. The most basic use of a capacitor bank for Alternating Current power supply (AC) error improvement is in industrial conditions. Where a huge number of transformers and electric motors are used. As this machine makes use of an inductive load, they are responsive to phase shifts and power factor lags in the power supply which may reduce system efficiency if left uncorrected. By including a capacitor bank in the system, the power lag can be corrected at the lowest cost possible for the company when compared to making notable changes to the company power grid or system that is supplying the equipment.

Requirements

1) Hardware requirements

- Capacitor Banks
- Transformers
- Diodes
- PCB
- 8051 Micro Controller
- LED
- Voltage Regulator
- Relays

- LCD
- Relay Driver IC
- Switches
- Resistors

2) Software Requirements

- **Embedded C language**

Embedded C language is an add-on to programming C language with some addition of header files, from a controller to controller these header files may vary. Embedded C programming depends on hardware architecture. It possesses cross development in nature. Embedded C programming is used for limited resources like RAM, ROM and I/O peripherals on an embedded controller. Embedded C programming needs some non-standard extensions for the C language which is required to support some features like fixedpoint arithmetic, multiple well-defined memory banks, and basic I/O operations. Programming of 8051 microcontrollers is first done in embedded C and then converted into Hex code and this code is dumped into microcontroller IC.

- **Compiler**

A compiler is basically a translator, a compiler is also a program which is built to transform the source code which is written by a developer in a binary code which is also known as machine language. The process of converting programs into machine language is known as compilation. An important part of the translation process is that compiler sends warnings or reports to its user about the errors present in the source program. Compilers are sometimes classified as single pass, multi-pass, load and go, debugging, optimizing. There are two parts of compilation analysis and synthesis. In the first part which is analysis it breaks up the program into its integral pieces and on the other hand in the second part which is synthesis, it builds the desired target program from the intermediate representation. Compilers translate source code into object code and this is unique for each type of computer platforms hence there are many compilers available for the same language.

Conclusion

After studying in depth and observing the aspects of the power factor it's clear that power factor is that the most important part for the utility company also as for the consumer. Utility companies get rid of from the power losses whereas the consumers are free from low power factor penalty charges. The automotive power factor correction by the use of capacitive

load banks is extremely economical because it reduces the cost by decreasing the power drawn from the supply. Other advantage is that it is automated process, hence no man power is required.

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Control of BLDC Motor Using Closed Loop Technique

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Abstract

The hardware project is designed to control the speed of a BLDC motor using closed loop control technique. BLDC motor has various application used in industries like in drilling, lathes, spinning, electric bikes etc. The speed control of the DC motors is very essential. This proposed system provides a very precise and effective speed control system. The user can enter the desired speed and the motor will run at that exact speed.

Keywords: Hall position sensors, Brushless DC motor, Microcontroller.

Introduction

Permanent-magnet excited brushless DC motors are becoming increasingly attractive in a large number of applications due to performance advantages such as reduced size and cost, reduced torque ripples, increased torque-current ratio, low noises, high efficiency, reduced maintenance and good control characteristics over a wide range in torque-speed plan. In general, Brushless DC motors such as fans are smaller in size and weight than AC fans using shaded pole or Universal motors. Since these motors have the ability to work with the available low voltage sources such as 24-V or 12-V DC supply, it makes the brushless DC motor fans convenient for use in electronic equipment, computers, mobile equipment, vehicles, and spindle drives for disk memory, because of its high reliability, efficiency, and ability to reverse rapidly. Brushless dc motors in the fractional horsepower range have been used in various types of actuators in advanced aircraft and satellite systems.

Most popular brushless DC motors are mainly three phases which are controlled and driven by full bridge transistor circuits. Together with applying permanent magnet excitation, it is necessary to obtain additional torque components. These components can be obtained due to a difference in magnetic presence in both quadrature and direct axis; therefore, reluctance torque is developed and torque null regions are reduced significantly [8, 11]. In this paper, a brushless DC motor with distributed winding and a special form of PM-rotor with special stator periphery are described. Which develop a speed control system for a BLDC motor by closed loop control technique?

Types of Control Techniques Of BLDC Motor

Though various control techniques are discussed in [8] basically two methods are available for controlling BLDC motor. They are sensor control and sensor less control. To control the machine using sensors, the present position of the rotor is required to determine the next commutation interval. Motor can also be controlled by controlling the DC bus rail voltage or by PWM method. Some designs utilize both to provide high torque at high load and high efficiency at low load. Such hybrid design also allows the control of harmonic current [9]. In case of common DC motors, the brushes automatically come into contact with the commutator of a different coil causing the motor to continue its rotation. But in case of BLDC motors the commutation is done by electronic switches which need the rotor position.

Construction and Operating Principle

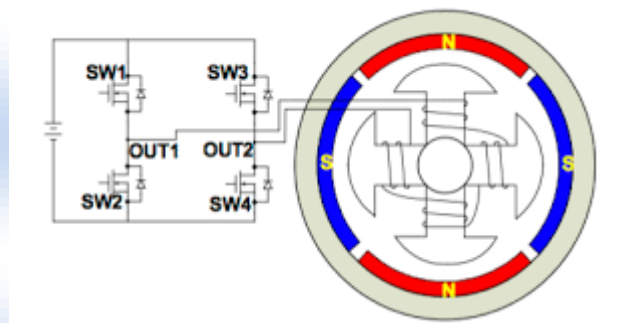


Figure: Construction

Brushless DC motors were developed from conventional brushed DC motors with the availability of solid state power semiconductors. Brushless DC motors are similar to AC synchronous motors. The major difference is that synchronous motors develop a sinusoidal back EMF, as compared to a rectangular, or trapezoidal, back EMF for brushless DC motors. Both have stator created rotating magnetic fields producing torque in a magnetic rotor.

BLDC Motor Speed Control

Pulse-width modulation (PWM) is a commonly used technique for controlling power to an electrical device, made practical by modern electronic power switches. The average value of voltage (and current) fed to the load is controlled by turning the switch between supply and load on and off at a fast pace. The longer the switch is on compared to the off periods, the higher the power supplied to the load is. The PWM switching frequency has to be much faster than what would affect the load, which is to say the device that uses the power. Typically switching's have to be done several times a minute in an electric stove, 120 Hz in a lamp dimmer, from few

kilohertz (kHz) to tens of kHz for a motor drive and well into the tens or hundreds of kHz in audio amplifiers and computer power supplies

Logical Operation of BLDC Motor

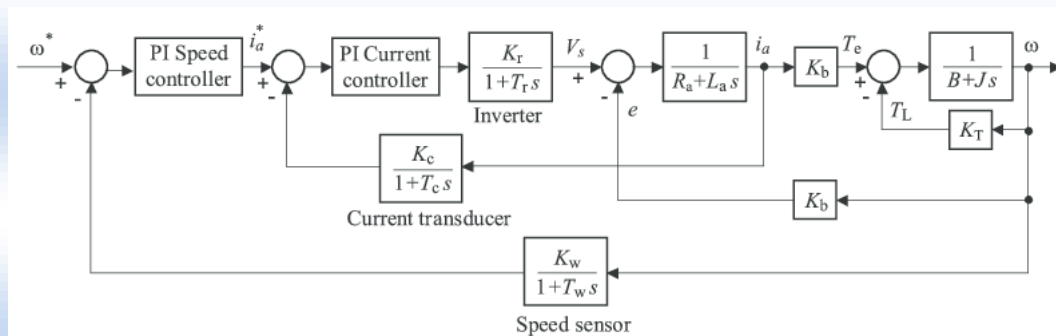


Figure: Logical Operation of BLDC Motor

While logic high during the on time duty cycle is delivered by the microcontroller to the input of the OPTO U3, The opto led glows to bring the opto transistor pin no 5 and 6 to conduct. Now 12V supply is given at the junction point of R7 and R8 and reaches the gate of the MOSFET Q1 via D4 for Q1 to conduct thus enabling the motor to get supply to run. A freewheel diode is used across the motor to conduct the charge stored in the motor during off period. During off time of the duty cycle the opto transistor does not conduct and the charge which is stored in the gate of Q1 forces Q3 to conduct while the motor stops. This ON and OFF the motor reduces the speed. The DC power is available to the motor via the MOSFET as per the PWM generated by micro controller depending upon the input given to micro controller from a keypad. As well as the speed is displayed on a liquid crystal display. To sense the speed of BLDC motor an IR LED in photo diode arrangement is used.

Simulation Results for Various PWM Pulses

The speed control technique employed here is pulse width modulation (PWM) technique. The duty cycle determines the speed of the motor. The desired speed can be obtained by changing the duty cycle. The PWM in microcontroller is used to control the duty cycle of DC motor.

$$\text{Average voltage} = D * V_{in}$$

Conclusion

The hardware for closed loop control of BLDC motor using microcontroller is designed. By using the PWM technique speed of the BLDC motor was controlled and it was made to run

at exactly entered speed. In future this hardware will be implemented in DSPACE and the speed control will be observed.

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PC Based Electrical Load Control

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Abstract

Automations in industrial, commercial or residential sectors mostly depends upon the power systems, which requires distant controlling and monitoring. By using wireless technologies, it is more efficient to implement an appropriate technology depending upon the cost, speed and distance requirements of the proposed system. For remote controlling and monitoring of various loads/appliances and a means of efficient power utilization through real-time power consumption with the help of a PC-based GUI application. The advancement of technology things are becoming simpler and easier for us. Automated systems have more advantages over manual system. PC based control systems are highly reliable, accurate and time saving systems. They provide number of features like quick data storage, transfer data and data securities. A PIC controller based controller is designed to control a number of electrical equipment. To control and monitor connected equipment through the PC.

Key words: PIC Controller, DB Connector, Relay Driver, Relays, Level Shifter IC, Resistor, Capacitor, LED, Transformer

Introduction

In today's world there is high a demand for PC based control system because of its various advantages over manual control system, PC based control systems are highly reliable, accurate and time saving systems, they provide number of features like quick data storage, data transfer and data security which help industries to work in efficient manner In this paper, a PC based system which will control various devices like Motor, Light, and Fan etc. Designed a GUI (Graphical User Interface) on the PC and which helps to give command to the system. PIC controller is used in order to receive commands from PC and accordingly control the devices connected to it. In this way this system is completely controlled by PC. Personal computers are becoming the choice to design and implement control algorithms because it is simple to write, modify and update software programs that implement a control algorithm. Currently, someone needs to manually switch of the lights on each floor and room. This system allows a single user to operate all those light fans, or other loads from a single PC.

Objectives

The main objective of this project is to control the electrical load/appliances through a personal computer (PC). This controlled system is available with proper security. In this project, we can control the electrical appliances ON/OFF by just being seated at one place using a PC.

Block Diagram

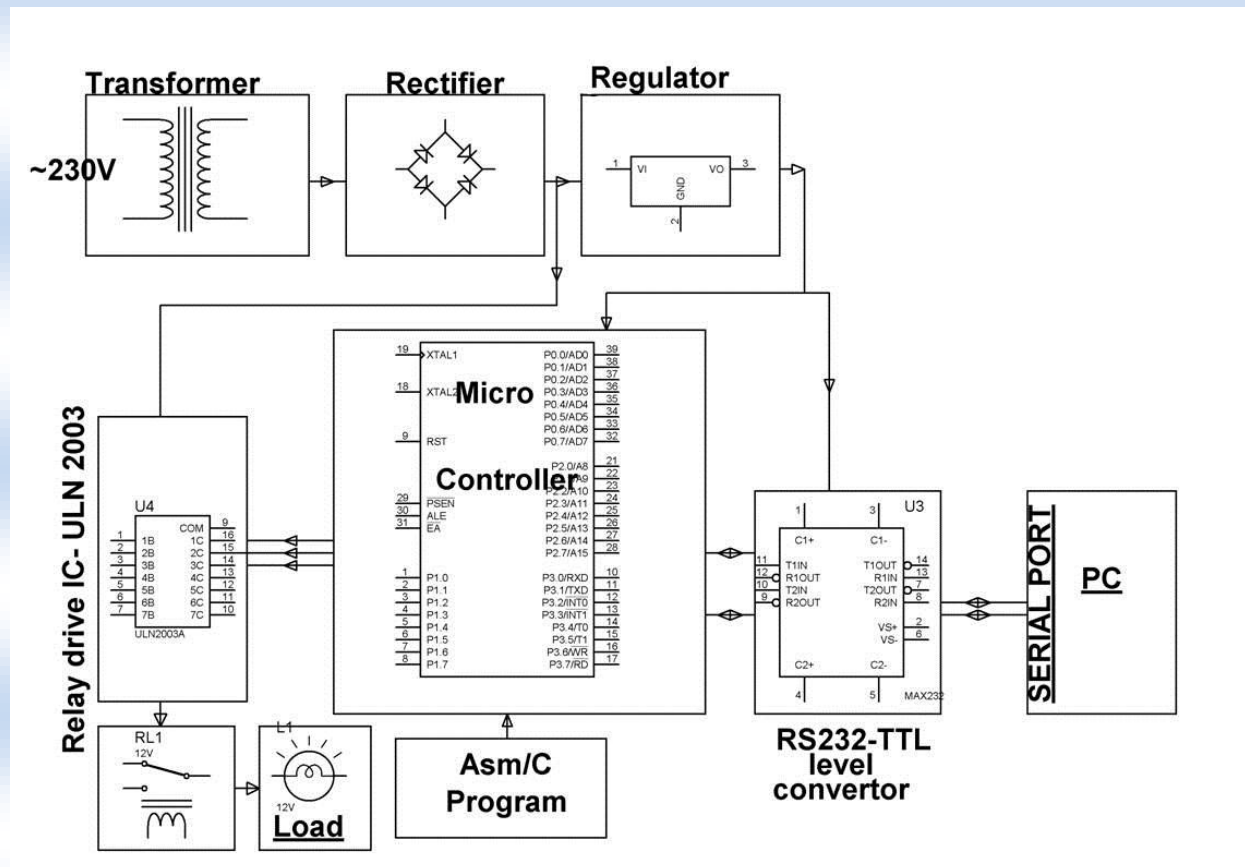


Figure: Block Diagram

Working

It is used to controlling, a number of electrical equipment using a PC. This system is used to control the software as well as hardware. The block diagram of PC controlled home appliances system as shown in fig. When the power is ON initially, all IC's & relays get resets. Once any Button is pressed by user through computer control device window (GUI), computer will send command to PIC controller with the help of standard serial communication protocol (RS 232). And through PIC microcontroller relay operation take place & according that home appliance works. The developed model is connected to four loads. By giving command to

individual appliances then they are turned on and off simultaneously. All the devices can work at a time. Any device can turn off as on as per requirement by giving appropriate command.

PIC Controller

PIC 16F877 is one of the most advanced microcontroller from Microchip. This controller is widely used for experimental and modern applications because of its low price, wide range, high quality and ease of availability. It is ideal for applications such as machine control applications, measurement devices, study purpose, and so on.

- 1) It has high performance RISC CPU.
- 2) It has ONLY 35 instructions.
- 3) All single cycle instructions except for program branches which are two cycles.
- 4) Operating speed: clock input (200MHz)

DB Connector

The DB9 connector is a analog 9-pin plug of the D-Sub connector family. This connectors contain two or more parallel rows of contacts surrounded by a characteristic Dshaped metal shell. This shell is not only provides mechanical support and ensures the correct orientation, but it may also screen against electromagnetic interference. Several methods are used to connect the system circuitry to the contacts in D-sub connectors, including crimp, solder cup, PCB solder, PCB press-fit and wire wrap connections.

Relay Driver

- 1) ULN is Relay driver application
- 2) The ULN2003 is a monolithic high voltage and high current Darlington transistor arrays.
- 3) It consists of seven NPN Darlington pairs that have high-voltage outputs with common-cathode clamp diode for switching inductive loads.

Relays

A relay is an electrical switch that uses an electromagnet to move the switch from the OFF to ON or ON to OFF position instead of a person moving the switch. It takes a relatively small amount of power to turn on a relay.

Level Shifter IC

The MAX232 is an IC that converts signals from an RS-232 serial port to signals suitable for use in TTL compatible digital logic circuits. This MAX232 is a dual driver/receiver and typically converts the RX, TX, CTS and RTS signals.

Resistor

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. Resistors act as to control current flow. In electronic circuits resistors are used to limit current flow, to adjust signal levels. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls. In power distribution systems, or as test loads for generators. Fixed resistors have resistances that only change slightly with temperature, time or operating voltage. Variable resistors can be used to adjust circuit elements.

Capacitor

A capacitor is a passive two-terminal electrical component used to store electrical energy temporarily in an electric field. The practical capacitors vary widely, but all contain at least two electrical conductors separated by a dielectric. The conductors can be thin films, conductive electrolyte, etc. The non-conducting dielectric acts to increase the capacitor's charge capacity. A dielectric can be glass, ceramic, plastic film, air, vacuums, paper, mica, oxide layer etc. Capacitors are widely used as parts of electrical circuits in many common electrical devices. Capacitor stores energy in the form of an electrostatic field between its plates.

LED

A light-emitting diode is a two-lead semiconductor light source. It is a pn-junction diode, which emits light when activated. When suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device; this can release energy in the form of photons. This effect is called electroluminescence. I.

Transformer

Transformer is an electrical device that transfers energy between two or more circuits through electromagnetic. When induction varying current in the transformer's primary winding creates a varying magnetic flux in the core and a varying magnetic field on the secondary winding. This varying magnetic field at the secondary induces a varying electromotive force

(EMF) or voltage in the secondary winding. According Faraday's Law in conjunction with high magnetic core properties, transformers can be designed to efficiently change AC voltages from one voltage level to another within power networks.

Software Description

Keil uVision4

The Keil C51 C Compiler for the 8051 microcontroller is the most popular 8051C compiler in the world. It have more features than any other 8051 C compiler. The C51 Compiler allows you to write 8051 microcontroller applications in C. That has the efficiency and speed of assembly language extensions. The C51 Compiler give you full access to all resources of the 8051. The C51 Compiler translates C source files into reloadable object modules which contain full symbolic information for debugging with the μ Vision Debugger.

Flash Magic

This software is used to burning of program in to the microcontroller with help of controller development kit. C.

Express PCB

This software is used to design PCB layout.

Conclusion

Necessity of automation is the part of our day to day life, the automated electric load which is controlled by the PC. The ability to control lighting home appliances. This proposed system is used to design and implement a control and monitor system for smart house and also used in industries to control the various loads.

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To develop *globally* competent technocrats by imparting *quality technical education* for *socio-economic* enhancement of the nation.

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M1: To nurture and maintain an environment of *high academic standard* for diploma students, encouraging higher education and entrepreneurial abilities.

M2: To deliver *quality education* by imparting basic engineering knowledge, interpersonal skills, critical thinking and creativity.

M3: To equip students with *technical skills, ethical and moral values* to meet aspirations of the society and industry to contribute sustainable development of the nation.

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