Title:

Formation Control of Homogeneous Robots

Advisor: Dr. Muhammad Tahir

Abstract:

This is an era of whirlwind advancement in science and technology. An exhaustive research work is taking place these days to work out efficient and sophisticated systems in order to ease human life. Swarm Robotics is an example, an idea inspired by swarm of insects. Robots in a group develop greater efficiency since they aid one another and avoid loop holes. In our project, a robotic team, comprising a master and two slaves, has been developed. The team has been enabled to co-ordinate and reach navigational goals, avoid hurdles, thereby maintaining a formation, by integration of formation and navigational behaviors. Once stationed as a fully developed system, the robotic team may be employed as agents to provide surveillance, aid in fire extinguishing, land mine detection, for agricultural purposes and other humanitarian causes.

Group Members

- Laajverd Abidi   (2012-EE-007)
- Afeerah Javed Khan   (2012-EE-012)
- Chaudhary Ahmed Sharif   (2012-EE-030)

Title:

Gesture Controlled Smart Wheelchair

Advisor: Dr. Muhammad Tahir

Abstract:

Many disabled people of our society suffer from mobility issues and fatigue problems in operating the ordinary wheelchairs. Keeping in view the problems faced by such partially disabled persons, the aim of this project is to make a gesture controlled wheelchair which would be easy to operate and safe to drive because of its obstacle avoidance feature. The aim is accomplished using a microcontroller programmed in such a way that drives the wheelchair intelligently based on environment perception and user's input. The system proposed uses a low cost accelerometer module to take users input in order to control the wheelchair. The hand gestures are recognized according to the angle given by the accelerometer module which is fed to the controller which then decides the motion of the wheelchair. The ultrasonic sensors integrated on the wheelchair grant it additional features such as obstacle avoidance, edge detection etc. The microcontroller serves as the core of the system as it takes inputs from different modules and then decides the input to the motors of the wheelchair by changing the PWMS generated at its pins. The possible movements given by the user's gesture are forward, backward, left, right and stop and user could rely on the wheelchair in avoiding obstacles and edges.

Group Members

- Rimsha Touqeer   (2012-EE-073)
- Fareeha Arshad   (2012-EE-068)
- Safa Ashraf   (2012-EE-067)
- Saba Maqsood   (2012-EE-137)

Title:

Portable Cardiac Monitoring System

Advisor: Mr. Umer Shahid

Abstract:

There exists a demand for Cardiac Monitoring system as current implementations are in their underdeveloped stages, high in cost and inaccessible to the vast majority in Pakistan. Cardiac monitoring involves monitoring of heart activity. The system design aims to provide solutions to the problems encountered in acquiring low voltage signals from the body, providing remote transmission of ECG data and also storing it on an SD card for long term monitoring purposes.

Modern Cardiac monitoring systems consist of Electrocardiography (ECG). A number of electrodes are connected at different parts of body. The electric pulses generated by the electrodes are sent to the monitor which makes a graph depending on heart rhythm of the patient. In hospital, the ECG techniques used, are versatile but the equipment is highly immobile and expensive. The need of an equipment for scenarios where heart monitoring has to be carried out at some remote place is rising. Such an equipment will find its benefit for heart monitoring at homes without having to go to hospitals at relatively lower cost. Being versatile and compact, the equipment could be made portable and could be set up in no time.

Group Members

- Muhammad Hamid   (2012-EE-159)
- Muhammad Usman   (2012-EE-154)
- Abdullah Zafar   (2012-EE-165)
- Allah Yar Khan   (2012-EE-160)

Title:

Load Monitoring and Fault Analysis of 11kV Line Distribution Transformer with Remote Access

Advisor: Arsalan Abdul Rahim

Abstract:

In Pakistan there is no proper mechanism designed to monitor HV side of distribution transformers. When a person periodically visits a transformer site and record the important parameters of interest. Such a method of monitoring does not provide the information about the times of overload operation or over heating of the 11Kv feeders. Today power utilities are monitoring 11Kv feeders manually and extra high voltage systems by using Partial Discharge Monitoring in combination with Supervisory Control and Data Acquisition (SCADA) system but extending such a system for distribution transformers is not an economic proposition.

Monitoring distribution transformers is altogether a different problem compared to power transformers. Implementing this system aims to solve these complexities in an economical and efficient manner. Our system is mainly based on the high computational power of Texas Instrument᾽s TM4C1294 microcontroller. For the acquisition of the required data we have used sensors; i.e. CT for current, PT for voltages and Hall effect sensors. These mentioned parameters are stored for processing using a 12-bit built in analog to digital converter. This data is further transmitted to a central database system on the internet using Ethernet communication. Also an alert mechanism is set up which sends E-mail and SMS alerts to the supervisory personnel in case of abnormal operation based on configurable set of policies and instructions. A back-up system for logging is also provided using an SD Card interfaced to the controller. Most importantly all these tasks are done in real-time. Further a back-up power supply is also installed for monitoring in times of load shedding. This compact system will help utilities to make decisions regarding the installation of new distribution transformers, maintenance or upgradation of the existing ones, and to identify any problems before any catastrophic failure.

Group Members

- Syed Waqar Ali   (2012-EE-169)
- Arsalan Naseer Khan   (2012-EE-175)
- Zartar Gulzar   (2012-EE-135)

Title:

Hybrid Electric Bike with Plug-in Charging Unit

Advisor: Arsalan A Rahim

Abstract:

Self-charging E-bike seems to be a fantasy at first but we are working on it to introduce a concept which then can be applied to motor bikes, E-rickshaws or electric cars. Our first goal is to build an E-bike which can be charged easily and can be utilized for routine tasks within a city. For this, we are using a BLDC Hub motor which is assembled in rear wheel of a bicycle. The reason to use this type of motor is efficiency, no mechanical assembly as motor is already assembled in the hub of wheel. To drive this motor we have designed a three phase variable frequency motor drive. The hardware includes three phase inverter, MOSFET gate drive, fly back converter for power supply of ICs (it converts 36V to 15V). The main addition to this bike is a Hybrid module. When the user is pedaling the bike, the motor acts as a generator and this electrical energy is used to replenish the charge to batteries. This module uses a rectifier and a boost converter with feedback to maintain the charging voltage. Also we have designed a 36V 10A onboard battery charger which can recharge batteries anywhere by just plugging into any 220VAC socket. Also we have used a customized display to display some important parameters of the bike including speed, battery, load and some inappropriate conditions.

Group Members

- Abdul Wahab   (2012-EE-105)
- Hafiz Ahmad   (2012-EE-127)
- Zaigham Aslam   (2012-EE-111)
- Muhammad Nabeel Khan   (2012-EE-116)

Title:

Array Integrated Converter (AIC) using HERIC Topology with GRID sharing at DC level (battery) for Isolated loads

Advisor: Mr. Arsalan A. Rahim

Abstract:

Array Integrated Converter converts DC input voltage (either from solar or some DC source) to AC sinusoidal voltage output. It consists of single phase H bridge inverter to convert that DC source into ac output and then transformer to step up the voltage up to 360V and then rectifier to convert that 360V ac to 360V dc which is used to derive HERIC (Highly Efficient Reliable Inverter Concept) which is more efficient than usual inverter and it give output which is fed to the filter to get sinusoidal ac voltage. We have used Sinusoidal Pulse Width Modulation (SPWM) technique with TM4C123GXL microcontroller and gate drive circuit which drives the MOSFETs of H Bridge inverter and HERIC. Moreover transformer that has been there to step up the voltage also has auxiliary winding which is fed from the battery and two MOSFETs which keep on switching the battery voltage (taken from GRID) through the transformer winding and keeps the flux through transformer constant if in some case dc input voltage from the source gets low

Group Members

- Muhammad Zawar Hasan   (2012-EE-102)
- Muhammad Zain Ghazanfar   (2012-EE-095)

Title:

Pneumatically Controlled Pick, Identify and Place Robotic Arm with Conveyor Belt Using PLC.

Advisor: Dr. Tahir Izhar

Abstract:

A lot of research has been done on industrial automation; with the aim to reduce human interaction with repetitive processes in industry; to minimize the possibility of human error. Pick and Place robotic arm is a result of these researches which sorts objects on the basis of specific properties along the assembly line in industries. In our project; we are making complete physically working robotic arm and a conveyor as a model of assembly line. We are using industrial oriented approach which includes the use of pneumatic system and PLC. Pneumatic system is extensively used in industry along with electrical system and all the industrial automation is done using PLC. The robotic arm is interfaced with a conveyor belt, on which objects will move. On conveyor belt, there will be objects of different materials; metallic and non-metallic. For these objects, different designated locations will be made. We will control the conveyor belt and robotic arm using PLC. When an object will come in front of a sensor on conveyor belt, the motor of the conveyer belt will start and take the object at the end of conveyor belt. The sensor attached at the end of belt will stop the conveyor motor and trigger the arm to do its job; which will pick the object from the conveyor belt; identifies it and places it on the designated place based on its material. Our objective is to make such a system which is efficient than a human & which can work continuously without wasting time.

Group Members

- Muhammad Bahzad   (2012-EE-118)
- M. Tahir Iqbal   (2012-EE-107)
- H.M. Asaad Areeb   (2012-EE-098)
- Amaar Liaqat   (2012-EE-083)

Title:

Automated Solar Based Smart Irrigation System

Advisor: Dr. Tahir Izhar

Abstract:

Pakistan is situated in sunny belt and its global solar insolation falling on horizontal is between 450-650 $\frac{\text{watt}}{\text{m}^2-\text{day}}$. This range of $\frac{\text{watt}}{\text{m}^2-\text{day}}$ amounts to about 1500-3000 annual sun shine hours and 1.9-2.3 MWh/m2-year. This project intends to utilize this immense potential to serve water pumping needs of Punjab Province. In this project solar system is designed to pump water at 37 m³/hour from 60 feet of head. These constraints cover water needs of many crops like wheat and above 90% areas of Punjab Province. Selection of submersible pump is made by calculating hydraulic energy demand of any crop and according to the pump curves. Three phase 4 HP motor is used for driving multistage submersible pump and is feed from PV source rated at 1.35 times of minimum input power required for motor. VFD is used for DC to AC conversion, to cope with starting current problems and provide operational stability. Due to advancement in VFDs and soft starters solar pumping has become most economical solar application. Pump keeps on pumping water throughout the day when sufficient irradiance is available and water is stored in reservoir. The benefit of this technique is we avoid electrical storage which reduces cost of system considerably. Once reservoir is filled with required amount of water, water level sensor placed in it detects this and microcontroller commands the solenoid valve of particular patch of field to open automatically, as per watering schedule, for calculated time. Watering schedule is the input to the system which governs how much water is to be provided to crop on what date. System is capable of providing information regarding water pumping and distribution to fields using GSM SIM900D through text message.

Group Members

- Muhammad Umar Zaman   (2012-EE-039)
- Muhammad Umer   (2012-EE-017)
- Tehseen Haider   (2012-EE-057)
- Zubair Ghaffar   (2012-EE-059)

Title:

Solar Powered Electric Fence with GSM Module and Location of Intrusion Detection

Advisor: Prof. DR. Tahir Izhar

Abstract:

In this project we intend to develop an eco-friendly solar powered electric fence to protect our perimeters more effectively and efficiently. An energizer powered by Solar Panel converts an input voltage of 12V to high voltage pulse of range of about 10KV. Our system provides security in two different ways. First, it gives a painful shock to the person/animal who is trying to intrude in our area. Second, it keeps the owner updated of working state of the fence. If someone touches the fence, the user will receive a message containing information about the intrusion as well its location. Arduino (AT 2560) and GSM module (SIM 900D) are, collectively, the heart of intrusion location detection system. Arduino takes input from the Ultrasonic (US) sensors used in different zones of the fence installed. Ultrasonic sensors continuously emit high frequency sound waves. If some object happens to comes in their range, waves are reflected back and the object is detected. Arduino then invokes a burned function to trigger the GSM (Global System for Mobile Communications). GSM digitizes and compresses data, then sends it to the desired individual through TDMA (variation of time division multiple access) indicating the affected zone in which someone has trespassed. This system has varied applications in agricultural, industrial and military sectors. But due to increased crime rate they are also becoming popular in domestic sectors.

Group Members

- Muhammad Shahid   (2012-EE-043)
- Sadeed Ahmed   (2012-EE-041)
- Umar Ijaz   (2012-EE-040)
- Muhammad Usman   (2012-EE-046)

Title:

Solar Electric Car Using NI myRIO FPGA

Advisor: Dr. Syed Abdul Rahman Kashif

Abstract:

Due to the growing energy crisis, engineers all over the world are burning midnight oil to develop such efficient systems which are based on renewable energy to cater the need of energy produced by conventional systems such as fuel, gas, etc that are cost inefficient. Extensive research is being done on the renewable energy systems that could displace the need of conventional and costly energy resources. One of the topics of interest now a days in all over the world is to develop vehicles based on renewable energy sources mainly solar energy source. The idea is to get rid of cost inefficient conventional fuel or gas engines that require day to day costly maintenance and adds to growing world pollution which in turn is causing global warming. The proposed project is to develop an efficient car that could run on batteries energized by either a solar source or DC power supply. The success of this project relies on high and efficient power handling capability of the system developed. NI myRIO FPGA is used in this project due to its efficient high power handling capability. The project achieves the best inversion efficiency from DC to AC using space vector modulation PWM inverter and achieves the least THD for the smooth working of 4 hp induction motor installed on the car. Efficient speed control mechanism of the solar electric car using space vector modulation PWM technique is another challenging work successfully done in this project. The final display of this project is a real time solar car with a sitting capacity of 2 persons, efficiently running on the roads and being controlled by graphical user system running on LABVIEW software.

Group Members

- Waqar Akram   (2012-EE-228)
- Naveed Akhtar   (2012-EE-211)
- Mubashar Safdar   (2012-EE-173)
- Usman Idrees   (2012-EE-174)

Title:

Design and Implementation of Space Vector Modulation based Multilevel Inverter on myRIO FPGA.

Advisor: Dr. Syed Abdul Rahman Kashif

Abstract:

D.C. motors have been used widely during the last century in applications where variable-speed operation was needed, because its flux and torque can be controlled easily by means of changing the field and the armature currents respectively. Due to the remarkable advantages, induction motors are superseding DC motors in the industry applications. The efficient control of induction machine is most desired element in implementation of process control in industry. Space vector pulse width modulation based control can improve performance in induction motor drives because it utilizes the source more effectively. Recently the use of multilevel inverters for industrial motor drives has gained more and more spotlight. This is due to many advantages of multilevel inverters over the simple two level inverters. These advantages include low stress on the blocking switches due to which we can extract more power and build higher voltage inverters using the same low rating components. Space vector PWM for multilevel inverters (MLI) needs to be explored for industrial motor drives. MLIs result in extremely low harmonic distortion (THD) in voltage and current, and produces a common mode voltage hence reducing the stress on motor. The proposed project has been evaluated in simulations of induction motor control and National instruments myRIO FPGA platform has been used to validate its effectiveness. Due to high computational power of myRIO FPGA over other DSP platforms, it can be used for an efficient control of the induction motor in industrial application. This project will also show the potential of using myRIO FPGA module in the field of power electronics for inverter control along with graphical interface of the LabVIEW over a tablet for motor control process.

Group Members

- Abdul Moiz Waris   (2012-EE-217)
- Muhammad Nadeem   (2012-EE-218)
- Abdul Aleem   (2012-EE-222)
- Mussab Jarral   (2012-EE-246)

Title:

Energy Meter Test Setup & Analysis of Micro Smart Grid for UET Lahore Network

Advisor: Dr. Syed Abdul Rahman Kashif

Abstract:

The objective of the project is to develop a test bench for three-phase smart industrial meters using LabView graphical interface and myDAQ (Data Acquisition Device) along with 60 kV High Voltage Measuring Unit (For High Voltage Testing). The DAQ system will record all three phase parameters in real time required to implement IEC 60521 standards. The product will deliver high-precision measurements of three-phase currents, voltages, harmonics analysis, Fast Fourier Transformation (FFT) analysis, total harmonic distortion, power factor, active and reactive powers, as well as calculations of other desired values. Smart meters are tested with linear and non-linear load for defined period of time and myDAQ system is fast enough to measure even small glitches in waveforms and record them using the graphical interface of the LabView. The test bench will provide industrial grade testing facility for smart as well as conventional digital and electromagnetic meters and will evaluate the performance of meters according to industrial standards using LabView and myDAQ system.

Along with Project includes the development of Simulation of UET Lahore power system network in **Power System Simulator for Engineering (PSSE)** and perform PSSE analytical capabilities (load flow, contingency analysis etc.) on the network. The Single Line Diagram of the UET Network is developed in AutoCAD.

Group Members

- Ahmad Ali Wajid   (2012-EE-023)
- M. Humayun Minhas   (2012-EE-025)
- Haitem Tanveer   (2012-EE-029)
- Harris Nazir   (2012-EE-052)

Title:

Micro Grid (Smart Generation with Automated Distribution and Monitoring)

Advisor: Dr. Syed Abdul Rahman Kashif

Abstract:

The main goal of this project is the development of an efficient power system with smart generation, automated distribution and monitoring for integration with national grid or its use as a standalone system. In smart generation, electricity generated by some renewable means such as solar must be converted to a form that can be integrated with the utility with maximum efficiency by involving DC to DC and DC to AC conversion until a refined AC of 50Hz is produced. In the development of this smart system, firstly, physical solar tracking is done to have the maximum light intensity on solar panel plate. Then, maximum power is transferred from solar panels to batteries using buck converter with feedback achieving Maximum Power Point Tracking (MPPT). After that, battery potential is boosted to higher level via push pull switching at high frequency using Ferrite core Chopper. Boosted DC is then converted to AC using single phase inverter and depending upon the sharing with grid or use as a standalone system, either Sine wave or Sine PWM output of 50Hz are obtained. Sharing of inverter AC with national grid and automated load shifting is performed. All of the control and monitoring is done using FPGA based microcontroller NI myRIO-1900. Central control is achieved by displaying monitoring and control parameters on an android aided tablet using NI Data Dashboard application and Wi-Fi router of the FPGA as communication channel. In Pakistan, this project can be deployed to make a building self-dependent in meeting its electrical needs and energy crisis can be solved. Industries and people living in remote areas can be benefited. Also mutual sharing of power with national grid can greatly boom the country's energy reservoirs and remove extra burden on power system by applying smart localized micro-grid techniques.

Group Members

- Syed Muhammad Ali Shah   (2012-EE-148)
- Umair Bin Toheed Chughtai   (2012-EE-022)
- Waqar Aslam   (2012-EE-180)
- Madiha Raza   (2012-EE-142)

Title:

Automation of Water Pumping and Tank Maintenance using SCADA

Advisor: Dr. Umer Tabreez Shami

Abstract:

One of the most dominant issue nowadays is the suitability and availability of water resources. Measurement of water level is an essential job for industrial and domestic perspective. Therefore, water controlling system has achieved potential significance in certain application. Recently a large number of monitoring systems integrated with water level detection have become popular. The most common method of controlling water level is to start the water pump when the reservoir is empty and turn it off when it is about to full. This is not an adequate water controlling method. Besides, water level controlling systems are commonly used in monitoring of water levels, reservoirs and dams etc. Usually, such types of systems provide graphical or pictorial view of current water level and also continuous indication.

Certain other functionalities can also be implemented such as automatic control and audio and visual alerts at pre-set levels. Proper monitoring is needed to ensure water sustainability actually being reached, with disbursement linked to sensing and automation. Such programmatic approach entails microcontroller based automated water level sensing and controlling. Therefore, this project aims to devise a water pumping control and remote monitoring system. The operator can monitor the functionality of the entire system on SCADA screen and alarm reports assist in locating faults. Speed and direction of the motor as set on the JAVA interface/PC will be send over wireless communication channel to the Arduino which generates PWM gating signals of required frequency for the inverter. Thus the speed and direction of the three phase induction water pump is controlled. This contributes to a significant increase in maintenance efficiency.

Group Members

- Mutahar Zahid   (2012-EE-220)
- Saad Masood   (2012-EE-226)
- Malik Abdur Rehman Zameer   (2012-EE-229)
- Muhammad Aqeel Shams   (2012-EE-227)

Title:

Single Phase Multilevel Inverter with Variable Frequency for Induction Motor Control

Advisor: Dr. Umar Tabrez Shami

Abstract:

This thesis presents simulation and hardware implementation of a diode clamped multilevel inverter. Such inverter are under consideration in research now a days. The multilevel inverter provides a convenient method to eliminate selective harmonics. Multi-Level Inverter technology has been developed in the area of high-power medium-voltage energy scheme, because of their advantages such as devices of lower rating can be used thereby enabling the schemes to be used for high voltage applications. The Multilevel we have used is Single phase three level inverter .We are using AT89S51 microcontroller to generate pulses to control the MOSFET's. It is a low power high performance CMOS 8 bit micro controller. The AT89S51 provides the following standard features: 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, two 16-bit timer/counters. The inverter part is a 3 level single phase inverter with a variable frequency operation which is controlled from micro controller launch pad. We have used pulse transformer in the driver circuit. The topology used for this inverter is three level diode clamped inverter. Controlling an a.c. induction motor by the technique of sinewave-weighted pulse-width modulation (PWM) switching gives the benefits of smooth torque at low speeds, and also complete speed control from zero up to the nominal rated speed of the motor. This thesis presents the need of Speed Control in Induction Motors. Out of the various methods of controlling Induction motors, V/f Control has proven to be the most versatile. The advantages we have gained from this is low THD, elimination of selective harmonics and lower switching frequencies. We also did the Fourier transform of our output signal to see the spectrum and magnitude of harmonics. Experimental setup has been designed, implemented and tested for practical validation.

Group Members

- Talha Saeed   (2012-EE-231)
- Khurram Shafiq   (2012-EE-232)
- Abu Bakar Abid Jathol   (2012-EE-248)
- Asad Ali   (2012-EE-251)

Title:

SCADA System Automation of Electric Distribution

Advisor: Dr. Umar Tabrez Shami

Abstract:

Automation of a multi-story building, factory or any other small scale power consumption area is useful for its efficient operation. Also data can be stored in a database for later analysis on how to improve power consumption and faults can be alerted within seconds. Keeping this in mind we created a model of automation of electric distribution using SCADA (supervisory control and data acquisition). There are 3 consumption areas Area1, Area2 and Area3. Area1 is controlled by a SCADA software running on a laptop, similarly Area2 and Area3 are controlled by another SCADA software running on another laptop. A third laptop is also placed for controlling all the three areas wirelessly through internet using sockets class in java, thus acting as a master remote control. SCADA software is coded in java. Communication between the consumption Areas and SCADA software on laptop is carried through microcontrollers Arduino and Tiva TM4C123G. ADC (Analog to digital) modules of both microcontrollers are used for taking input from measuring devices installed in the consumption areas and this data is send to laptops by USB data cable through UART module on the microcontrollers.

Group Members
- Hamza Wain   (2012-EE-233)
- Salman Shoukat   (2012-EE-234)
- Hamza Mehmood   (2012-EE-239)
- Muhammad Waqar Aslam   (2012-EE-249)

Title:

Closed-loop V/f control of induction motor using space vector modulation on STM32F4

Advisor: Dr. Syed Abdul Rahman Kashif

Abstract:

Induction motor is the most widely used electrical machine in industrial applications. Dynamic response of an induction motor has to be improved to optimize its energy consumption and to obtain the desired torque-speed response. Constant Volts/Hertz algorithm enables us to run motor at its rated torque and variable speed simultaneously. In short we can obtain the desired dynamic response of induction motor using V/f control. The basic theme behind V/f control is to keep the magnetic flux of the machine constant at all operating points to obtain the electromagnetic torque independent of the frequency as well as to avoid core saturation of the motor due to low frequency operation at high voltage. V/f control necessitates the variation of voltage amplitude and power frequency simultaneously. Space vector modulation (SVM) is the most advance PWM technique to dynamically vary the voltage and frequency using a 3-phase inverter. In space vector modulation, a reference voltage vector rotating at the desired electrical frequency and having desired magnitude is sampled at high frequency to approximate its circular trajectory. Closer the sampled trajectory of voltage vector to the circular one, closer will be the phase currents to the sinusoidal resulting in less losses. Closed-loop control enables us to precisely control the speed of the motor independent of the slip. The present speed of the motor is compared with the input speed and error is fed to the PI controller to generate the actuating signal having the rate of change corresponding to the parameters of the PI controller. This helps to 'smooth' the dynamic response of the machine no matter how much jerky is the input speed signal.

Group Members

- Muhammad Nouman Sadiq   (2012-EE-019)
- Zubair Hafeez   (2012-EE-028)
- Nabeel Khalid Bhatti   (2012-EE-047)
- Zahid Masood   (2011-EE-180)

Title:

Design and Implementation of Three Phase (Space Vector Modulation Based) Direct Matrix Converter

Advisor: Dr. Syed Abdul Rahman Kashif

Abstract:

The matrix converter is an array of controlled semiconductor switches that connects directly the three-phase source to the three-phase load. The main advantage of MCs is the absence of bulky reactive elements, which are subject to ageing, and reduce the system reliability, it is the good alternative of conventional variable frequency drive. The Matrix Converter uses bidirectional fully controlled switches for direct conversion from ac to ac. It is a single stage converter that requires only nine bidirectional switches for three phase to three phase conversion. The nine bidirectional switches are arranged so that any of the input phase can be connected to any of the output phase. Space Vector Modulation technique can be considered the best solution for the possibility to achieve the highest voltage transfer ratio, to optimize the switching pattern, to reduce output voltage and input current harmonics. In the project we direct three phase AC to 3-by-3 matrix arrangement pattern of MOSFETs, biased by set of nine optocouplers, to get three phase AC output of desired frequency and voltage level. There are several advantages of Direct matrix Converter: No Dc Link (reactive energy storage element capacitor), higher lifetime of converter, Regenerative, Bidirectional power flow, High Efficiency, more than 90%, Fully controlled output frequency, Low switching losses, Fully Controlled Output Voltage, Four quadrant operation. There are several applications of Direct matrix Converter: Variable Frequency Drive, Direct Torque Control of induction motor and permanent magnet synchronous motor, Speed control of AC machines, Wind generation systems, Pumps, Fans, Paper and Textile mills, elevators, electric vehicles, subway transportation, home appliances, robotics, steel and cement mills, etc.

Group Members

- Hafiz Usman Butt   (2012-EE-221)
- Muhammad Nabil Tahir   (2012-EE-212)
- Mansoor Zahid   (2012-EE-237)
- Syed Saad Atif   (2012-EE-112)

Title:

Smart Energy Metering with Automatic Control

Advisor: Dr. Asghar Saqib

Abstract:

The project covers three main fields: monitoring (measurement and comparison), load control and protection. The main objective of our project is to devise a control room of two buildings where we have the complete system to monitor and compare the current, voltage and power consumption of both the buildings. In the control room, in addition to the measurement of these quantities, we have the control of the loads connected to the system such that if the load connected to any of the two buildings exceeds a certain limit, we can shut down the loads using a microcontroller and the associated tripping circuit. Similarly, if there arises a short circuit fault in our system, we can immediately trip our relays and circuit breakers in order to protect the loads.

Control equipment consists of Arduino Mega 2560 microcontroller and tripping circuit is an electromechanical relay mainly HRSS-4H-S-12V, these are connected through opto-coupler. Supply from WAPDA is stepped down using a potential transformer (220V/12V), after proper rectification, is fed to control circuit which monitors and controls the load connected to the system.

Group Members

- Sheharyar Hassan   (2012-EE-147)
- Waqas Farooq   (2012-EE-167)
- Kiran Akram   (2012-EE-141)
- Maida Mahboob   (2012-EE-075)

[Abstract]

Title:

Prototype Model of Thermal Power Plant Using Solar Energy

Advisor: Dr. Asghar Saqib

Abstract:

Nowadays Pakistan is facing the worst ever energy crisis of its history. Neither we have enough power plants to fulfill our contemporary energy demand nor do we have much revenue for importing highly expensive crude oil which, unfortunately, we have been using for the past few years for the operation of our existing power plants. Meanwhile our fuel resources are limited, we cannot rely on these resources for the generation of electricity. So, the need of the hour is to somehow shift the momentum from these pricy and depleting resources to low cost, non-exhaustive natural resources in order to assuage the outages which have exacerbated our economy.

Our project comprises of the design and prototype model of solar thermal power plant for which we have used parabolic trough to focus sunlight for the generation of steam which in turn is used to run turbine and generator. Electricity generation using parabolic troughs is cheap keeping in view the cost of climate change impact. We have used single axis tracking of the sun to maximize electricity generation. In our project, we have used water as a heat transfer medium and Steel sheet for the concentrator. The total electricity generation is approx. 80 Watt.

Parabolic trough thermal solar power plants (PTSPP) are being used for commercial, utility-grade purposes for more than three and a half decades. In USA, more than 350MW of parabolic trough thermal power plants have been operating in California since 1980s. The long operating history of PTSPP means that operation and maintenance costs are predictable and well understood [1].

Parabolic trough is the only proven CSP technology that has been continuously operating for over 30 years with performance and reliability characteristics completely understood [1]. Thus, there is a huge room in Pakistan for the commercial use of parabolic trough solar power plants for energy production and we should make use of them in solving our energy crisis.

[1] http://www.renewable-energysources.com

Group Members

- Hafiz Muhammad Faizan   (2012-EE-163)
- Maaz Nisar   (2012-EE-164)
- Muhammad Mubeen   (2012-EE-171)
- Mandip Chauhan   (2012-EE-182)

Title:

Protection of Power Distribution System using Auto Re-closer and Sectionalizer along with GSM module and Micro-controller

Advisor: Dr. Muhammad Asghar Saqib

Abstract:

In electric power distribution, an auto-recloser is a circuit breaker equipped with a mechanism that can automatically close the breaker after a predetermined transient fault time which was opened due to a fault. It is intended to restore the Power Distribution System after any transient fault without long time outage. Re-closer has been programmed with certain number of attempts to withstand faults. There is central as well as distributed control. Using sectionalizer and auto-recloser we are identifying faulty phase, fault type, and in case of permanent fault GSM installed with central control unit, will communicate with focal persons about the condition of the system. Only central control has privilege to control partial load shedding of the system and display system record on LCD as well. Its integration with sectionalizer and micro-controller based distance relay mechanism not only improves continuity but also gives privilege to set system under partial load shedding in case of maintenance of equipment or to protect the system in case of overloading and in identification of faulty zone in patrolling the distribution line

Group Members

- Amjad Iqbal   (2012-EE-027)
- Muhammad Azeem   (2012-EE-242)
- Saqib Mehmood   (2012- R/2011-EE-113)
- Muhammad Rafique   (2012-EE-178)

Title:

Implementation of Security and Intelligent Parking of an Organization using NFC

Advisor: Dr. Zubair Ahmed Khan

Abstract:

Keeping in view the current alarming situations in our country, we need to take a step and secure every organization from any unwanted happenings. Schools, colleges and universities need special attention regarding security. We are implementing a "security and intelligent parking system" which could be implemented in any organization. Every person of the organization will have an identity card, say university card, which would be used to uniquely identify each person at the entrance. Near Field Communication (NFC) is used for this purpose. A remote database is implemented, which could be located at the control room of the organization, to confirm whether the person belongs to the organization or not. If the person doesn't exist in the database, an alarm will be initiated. The control room will have the facility to add/remove a person to/from database in case any modification is needed. If the person belongs to the organization, then he/she would be allowed to enter through the entrance. If someone is using the car/vehicle at entrance, he/she will be additionally facilitated with parking facilities. A screen is displayed at entrance of the parking area which shows the addresses of available empty parking lots. Not only that, he/she will receive a message through mobile phone which will guide him/her about nearest possible empty parking space. In this way, the driver does not have worry about searching the empty parking lots. This will not only save time but will also regulate the traffic. Status of the parking area is obtained and updated by the weight sensors. The database is keeping track of each person by storing the entrance and exit time. It will help the organization to regulate the discipline, rules and regulations of each person.

NFC could be implemented for the metro system in our country. Each person will use his/her card at entrance and exit of the metro station. Time and place will be noted down at entrance and exit. Comparing departure and arrival places, fare could be deducted from the card accordingly. The objectives of the project are to:

- Enhance security of an organization.
- Regulate the traffic by engineering intelligent Parking system.
- Maintain the discipline, rules & regulations of the organization by keeping track of every person's entrance & exit time.

Group Members

- Basharat Hussain   (2012-EE-255)
- Mustafa Haider   (2012-EE-122)
- Fiasal Saleem   (2012-EE-021)
- M. Bilal Maqsood   (2012-EE-026)

Title:

Porting Control Systems on Internet Using Embedded Web Server

Advisor: Prof. Dr. Khalid Mehmood Ul Hassan

Abstract:

In the vast wilderness of technology, control systems have taken a preeminent position. From simple kitchen wares to rocket sciences and space shuttles, everything is surrounded with automated marvels of technology. There are home automation systems (HAS), heating, ventilation and air-conditioning system (HVAC), responsive surveillance systems etc. which lie under the domain of control systems. Porting anything on the internet means that it's being made available on the global network of computers. Twenty first century has seen a tremendous breakthrough in the field of networking. Internet has made almost everything connected and made the utopian concept of global village, an amazing reality. This project basically deals with the concept of 'internetworking' of physical resource collectors and control units or otherwise known as Internet of Things (IoT).

We have made a mesh network of sensors and connected it to an embedded TCP/IP server to demonstrate the idea. We connected some control appliances, sensors and a surveillance camera to the server and forwarded the port of the server on the internet. User interface was provided in a desktop app and an android app to connect to the server in both LAN and WAN mode. Different nodes of the network were connected using 802.11 b/g/n WiFi protocol. Many security procedures have also been deployed to eradicate any possibility of breach.

Group Members

- Saqib Ahmed   (2012-EE-181)
- Abdul Haleem Malik   (2012-EE-247)
- Haseeb-ur-Rehman   (2012-EE-109)
- Muhammad Urshyan   (2012-EE-149)

Title:

Controlling Mouse Cursor using Eye Ball Movement

Advisor: Prof. Dr. Khalid Mehmood Ul Hassan

Abstract:

Control is indeed a revolutionary field of science and a lot of research has been focused on forming a digitally automate world having all protocols controlled via Microprocessors with great accuracy, perfection and efficiency nullifying human error. Controlling the Mouse Cursor using Eye Ball Movement requires, firstly, detection of face, tracking of eye balls using template matching, storing consecutive camera captured frames having eye ball's positions and via comparing this data, provides an error signal used as an input for mouse cursor's positioning. This error signal fed to the drivers and hence location of the cursor is updated accordingly. Previous work in this field incorporates EOG sensors mounted around the human eye taking signal from eye muscle movement and varying cursor's location accordingly. This technique was not suitable as it does not remain autonomous. Moreover it does not ensure efficient human to machine interfacing. The proposed methodology of eye balls tracking is a gateway to "Human-Machine Interfacing" which is the supreme outcome of the Control world.

This project integrates the useful information extracted from camera captured frames focusing the eye-ball position for accurate maneuver detection. Furthermore, instead of determining the movement of eye-ball using sensors and feeding the result for cursor's positioning, a direct link is developed between Machine's hardware and Human's eye. This technique leads to a more directive communication minimizing the Hardware requirement. This technique is most efficient as increasing the number of frames per second considerably enhances the precision and monitors extremely small positional changes creating a perfect and swift response accordingly. Once the aberrant behavior was detected, it was notified to the Microcontroller creating error signal and feeding it to the mouse cursor's driver.

Group Members

- Shahid Waseem   (2012-EE-114)
- Husnain Maqsood   (2012-EE-097)
- Samad Nawaz Khan   (2012-EE-113)
- Ayesha Rana   (2012-EE-207)

Title:

Internet of Things- Smartphone Based Surveillance System and Control

Advisor: Dr. Khalid Mahmood ul Hasan

Abstract:

In today's world, surveillance is becoming a major concern. Everyone wants to keep an eye on assets and locations of their interest. CCTV and PC based systems are used to serve this purpose. But a low cost solution is not available for a person to control the systems from a remote location. Now-a-days mobile phone has become a basic electronic gadget and the simplest way to communicate with anyone at any time as we can communicate over wide areas utilizing cellular technology. By keeping this technological facility of mobile phone in mind, this project depicts a design wherein a user at a remote location can monitor and control appliances and surveillance devices through his/her mobile phone. In this system there are server and client ends. A mobile application is developed at the client end which can send requests to view images through webcam at any time instant, control desired load and take actions accordingly at the location of interest. In case of an intruder, the GSM module will send a notification to client so that an immediate action can be taken.

Group Members

- Zujajah Masud   (2012-EE-005)
- Sara Afzal Baig   (2012-EE-009)
- Ujiara Ahmad   (2012-EE-014)
- Sabahat Kiran   (2012-EE-015)

Title:

Wi-Fi Based Live Video Streaming Robot Controlled Using Android App

Advisor: Dr. Khalid Mahmood ul Hassan

Abstract:

The research falls under the category of automated robots for surveillance and security purposes in wide areas (e.g. airports and museums) and buildings, and monitoring of safety equipment. The goal is to provide safety like man, only without the need of the presence of man at the spot himself. Android app controlled patrolling robot can move to monitor the restricted zones and can provide a live view through the camera of any mobile attached to it, by using Wi-Fi system. This is beneficial in increasing efficiency of the security systems as the mobile robot helps in reducing the number of devices required to cover a given amount of area. The robot also has a feature of transmitting audio to the destination it is at, which increases its tentative applications. An Arduino microcontroller is used to control the movement of the robot using DC motors and servo motor for camera rotation. Arduino gets the signals from the Bluetooth module installed in the robot hardware. Live video streaming to the android app is being done via Wi-Fi using Raspberry-Pi2 microcontroller. This is accomplished by building a server on the Raspberry-Pi2 board and then using the URL of the server to stream live video to our app with minimal delay.

We choose this Wi-Fi based project to be worked on mainly because of the advantages it would bring to people. These advantages include data transport in ultra-low cost, the biggest connectivity range, i.e. using local area networks with access point we can connect to any place in the world, and a greater versatility providing many different configurations. This way we have the possibility to interact with any device that is connected somehow to the network.

The objectives of this project are:
  i.   To develop an easily controllable robot for live surveillance.
  ii. To develop an Android Application as mobile GUI for monitoring and controlling the robot.
  iii. To conclude a way for live video streaming with zero delay.
  iv. To optimize the hardware of the robot to meet multiple applications on large scale as well as small scale.

Group Members

- Sumaiya Kidwai   (2012-EE-138)
- H. Maliha Shabbir   (2012-EE-208)
- Ariba Sami   (2012-EE-199)
- Sana Khalid   (2012-EE-069)

Department of Electrical Engineering
University of Engineering and Technology, Lahore

Title:

Traffic Sign Detection and Recognition by a Robot in Motion

Advisor: Dr. Kashif Javed

Abstract:

In our project, we present the prototype of an autonomous vehicle which is capable of detecting and recognizing the traffic signs in real street-view video through the camera that is mounted at the top of the car. The automatic traffic sign detection and recognition system (TSDR) provides an additional level of assistance to the driver, leading to increase passengers, road users and vehicles safety. As part of Advanced Driving Assistance Systems, traffic sign recognition (TSR) has drawn considerable research attention due to its challenging nature as a computer vision problem. It is usually tackled in three stages:

   i. Detection

   ii. Feature Extraction

   iii. Classification

We propose a road sign detection and recognition algorithm for an embedded application. The algorithm is developed by using the Hue Saturation Value (HSV) color space to segment the road signs color (red) and the regions of interest (ROI) in order to locate and determine the shape of the road sign (circular and triangular) in real street-view video. After that, the feature that is present in the traffic sign is extracted by drawing a bounding rectangle. The feature is then classified using Support Vector Machine (SVM). For classification, we have used LibSVM. The classifier is trained by using a dataset that is constructed using real life images of traffic signs. This system is then used to control the motion of the vehicle.

Group Members

- Fizza Tariq   (2012-EE-001)
- Fatima Tariq   (2012-EE-004)
- Fatima Nasir   (2012-EE-076)
- Mahwish Khalid   (2012-EE-077)

Title:

Real Time Localization and Tracking of an Acoustic Source via a Mobile Vehicle

Advisor: Dr. Kashif Javed

Abstract:

The prime incentive behind this project is to devise a counter-terrorism solution to help law enforcement agencies track events of interest and to better respond to terrorist activities. Among the long list of possible terrorist activities the sporadic gunshot, target killing, suicide bombing, remote control bombings are events of national importance. Our solution currently focuses on the problems of target killing and sporadic gunshot. Monitoring and tracking such kind of terrorist activities (target killing, sporadic gunshots) requires detection, tracking and localization of events of interest. We have employed acoustic sensors for the purpose of detecting the event of interest, while intelligent camera node is used for the purpose of tracking the shooter in real-time. Once an event of interest (EOI) has been identified, our system starts an intelligent and automated response. So our goal is to identify, localize and then track the acoustic source using acoustic sensors and a camera node. We have used threshold based detection i.e. an event of interest is triggered each time the acoustic level crosses a certain threshold to eliminate false detections due to noise. Then we cross correlate the acoustic signatures captured by each of the three microphones, arranged in an equilateral tringle, to find the delay index and the time delay from which we then calculate source angle to localize the source using its acoustic signature. Then we pan the motorized camera through that specific angle and inform the camera node via serial port to track the acoustic source. The camera node then runs TLD algorithm to track the source in the camera frame. The camera node, in collaboration with the motor-control block, controls the motorized camera to help track the target efficiently in the ϕ-plane.

Group Members

- Farhat Abbas   (2012-EE-081)
- Mohsin Shan   (2012-EE-082)
- Sheikh Abdul Rasheed   (2012-EE-099)
- Asadullah Khan   (2012-EE-080)

Department of Electrical Engineering
University of Engineering and Technology, Lahore

Title:

Robot Control through Speech Commands

Advisor: Dr. Kashif Javed

Abstract:

Speech has always been the finest source of communication among humans. In near future, we will be communicating with robots as well. In this project, we have developed a robot that performs basic operations of a car as we speak to it. Our project uses Machine Learning to build a speaker-independent system. We collected speech data from 48 different students aged 18-27 years of both genders. We used Mel Frequency Cepstral Coefficients (MFCCs) as the features of speech in our modelling phase. The design of our algorithm is efficient so that the response time of the whole system is 300ms on raspberry pi 2. The system is working with 90% accuracy. Our project finds its applications in Personal Robots, home automation, wheel chairs and every other area where we are happy to get things done just by saying it.

Group Members

- Asad Ullah Khan   (2012-EE106)
- Atif Ali   (2012-EE-042)
- Mohamed Khalid   (2012-EE-194)
- Muhammad Islam   (2012-EE-020)

Title:

Face Recognition Based Attendance System

Advisor: Dr. Kashif Javed

Abstract:

Currently there are very few attendance systems which provide efficient use of classroom time. We are developing a Face Recognition Based Attendance System which will be accurate, time efficient and be part of the development of smart classrooms. To realize this system, many parameters had to be decided. Tests were run to decide which pre-processing techniques to use on the training and captured images. Fisher Face algorithm was found to be the most robust for our application and will be the method we will use for face recognition from now on in our real-time attendance system. Training sets for each of the volunteer students were finalized to have images at all possible distances that a student can sit at in a sample classroom as well as images in varying light conditions found in classrooms. A graphical user interface was developed for a teacher to input certain parameters such as the number of times attendance will be taken during a class. A model will be trained for each class which will be sent to the module in the classroom for face recognition to take place. In real time, while a teacher is taking his or her class, pictures will be taken of the class at certain intervals. The students in those images will have their faces detected and then recognized. Their attendance will be updated according to the amount of time they were present. A TCP connection is made with a server in the main office from where class information can be taken and updated attendance can be sent once the class is finished.

Group Members

- Rida Fatima   (2012-EE-078)
- Ramla Ijaz   (2012-EE-196)
- Saadia Ahmad   (2012-EE-197)
- Farwa Batool   (2012-EE-198)

Title:

Energy Conservation and Management in Smart Homes

Advisor: Dr. Omer Waqar

Abstract:

Home automation has become widely popular all over the world but this is prone to energy resources' wastage. Some ways should be devised to cope with this problem. So, our project has major focus on making the objects of daily use; Internet connected, Smartphone-accessible and responsive. The proposed Smart Home system is capable of optimizing energy consumption by making connected devices intelligent as they analyze consumer data to interpret consumer behavior and make decisions with minimum human intervention. It is a Master-Slave node system with a Client-Server model. All the nodes report to and are handled by main node i.e. Energy Management System (E.M.S.), using ZigBee as communication protocol, in star topology to send commands from main node to all other nodes in the network; because Zigbee modules have an exceptional battery life and consume very less power. Main node generates commands by collecting data from sensors and internet. Commands are according to the standard frame format defined in Zigbee Cluster library which is used in the public profiles produced by the ZigBee Alliance, so that any functionality can be added normally to existing system following the same format; and to speed up the development and standardization of the public profiles. We have implemented ZCL HA profile and SEP 2.0 profile so that variety of protocols such as zigbee, wifi etc can be supported in same network.

A Graphical User Interface will allow users to remotely interact with different appliances and plans of their house, in order to make life more comfortable and be aware of their energy consumptions.

Group Members

- Mahrukh Zubair   (2012-EE-074)
- Rohma Khalid   (2012-EE-144)
- Sabahat Jabbar   (2012-EE-200)
- Ayesha Tariq   (2012-EE-203)

Title:

AMI Based Smart Energy Meter

Advisor: Dr. Suhail Aftab Qureshi

Abstract:

To keep pace with the increased necessity of advanced metering infrastructure and near real time two way communication between the Power Distribution Companies and the consumers, a data communication technique has been devised and it should be implemented This work presents advanced energy meter based on a single phase energy meter , a microcontroller, and a GSM module to develop an automated system by which monthly power consumption will be calculated accurately and at the same time the resulting unit will be sent to a remote receiver for further calculation and an updated data also be received by the consumers about any information using AMI technology. The current procedure of collecting the reading of energy consumption is a procedure completely dependent on human effort. And there is no doubt that human reading is time consuming, costly and may fault be calculated. This introduces the current scenario and future aspects of smart grid technology. Smart grid is based on digital technology application. Today's power grid system is not able to identify the hacker attack but smart grid technology enables to identify the hacker attack and respond it, in affected areas real time information between the users and the production side enables to isolate that affected part and redirect the power flow around damage area. By assimilation of AMI smart meter technology with power grid using GSM protocol we will get communication infrastructure that provides remote control of power system components and optimal control of the power system. Deploying an Advanced Metering Infrastructure (AMI) is a fundamental early step to grid modernization. AMI provides the framework for meeting one of the Modern Grid's Principal. Automatic Meter Reading system (AMI) continuously monitors the energy meter and sends data on request of service provider through SMS. It saves huge human labor. The data received from an energy meter has been stored in database server which was located at electricity Board station through SMS gate way for further processing by energy provider.

Group Members

- Farhan Farrukh   (2012-EE-045)
- Hasaan Baig   (2012-EE-055)
- Hamza Iftikhar   (2012-EE-088)
- Imran Arif   (2012-EE-123)

Title:

Smart Monitoring and Control of Distribution Transformers through Android Application

Advisor: Prof. Dr. Suhail Aftab Qureshi

Abstract:

Monitoring and Control of Distribution Transformers makes reliable and safe operation of transformers and also to cope up under or over voltages and currents conditions that can disturb the smooth and safe operation of transformer. Therefore, Smart Monitoring and Control system has been introduced equipped with latest and fast components RPI2, GSM Modem, CT & PT, Data Logging & Android Application. Monitoring is acquisition of data of transformer parameters like voltage, currents & temperature after 15sec continuously. While in control, shut down of transformers will be done from control room to avoid faults in case of parameter deviation from their expected value. The whole mechanism include the step down of transformer parameters like voltages and currents by CT's & VT's to a value required by ADC module using Super Diode Circuitry. There is SPI mechanism established between ADC module and Rpi2 to feed analog data in digital form to compare parameter values with standard values while UART mechanism between GSM and Rpi2 for 2-way communication i.e. from transformer to control room and vice versa to send data to a predefined number in GSM modem. When any parameter varies, Rpi2 detects that variation and communicates with GSM modem via UART and GSM will send sms to a predefined number. When any parameter of transformer exceeds its safe limit, a specific code sent by android application will activate the relay and transformer will get tripped. In safe conditions, the transformer can be re-activated simply by pressing a single button on android application. The idea behind this project is to reduce human effort while making surety of safe and smooth operation of transformer with acquisition of its parameters like voltages, currents and temperature instant by instant say after 15 sec.

Group Members

- Numan Ashraf   (2012-EE-119)
- Sharjeel Munawar   (2012-EE-096)
- Gohar Rasool   (2012-EE-110)
- Abdul Wahab   (2012-EE-103)

Title:

Characterization of Power Line Network Using Low Cost Network Analyzer

Advisor: Dr. Inam Ilahi Rana

Abstract:

A low cost, low frequency network analyzer is made by interfacing Rigol oscilloscope with laptop using LabView software. It works from 10KHz to 30MHz.An input is applied to a circuit under test(CUT).Its input and output is displayed on oscilloscope whose data is then transferred to laptop where this data is processed and bode plot of CUT is plotted. It can also calculate S-parameters (scattering parameters that shows relation between incident and reflected waveforms).Results given by our network analyzer are verified using Winspice and by doing numerical calculations.

One application of this analyzer is that it can be used to characterize a power line. This is done by connecting two high pass filters and power line is connected between these two filters so that power line signal (50 Hz,220V) will not affect our DDS(direct digital synthesizer) signal generator through which signal is applied to line and behaviour of power line is observed using our analyzer. This behaviour is observed for 90-500 KHz as our power line communication frequency is in this range

Group Members

- Nayab Zahra   (2012-EE-006)
- Hafiza Rimsha Rauf   (2012-EE-132)
- Sadia Riaz   (2012-EE-139)
- Aamina Batool   (2012-EE-134)

Title:

Design and Development of CUDA GPU-Based High Performance Protein Sequence Search Engine

Advisor: Dr. Naeem Ayyaz

Abstract:

LUMSProTWeb is a top-down protein search engine implemented in the .NET framework as a web application. The application is deployed on a high performance GPU server for performance gains. Algorithms are refactored and NVIDIA's CUDA toolkit is used for implementing the core search routines of the search engine. The rationale of the project derives from the fact that most of the publically available proteomics search tools are neither open source nor open architecture; ours will be both. Secondly, the search performance of the other available search engines is at best suboptimal for Top-Down Proteomics (TDP) due to the high complexity data from next generation mass spectrometers. The rather novel TDP approach provides an accurate characterization of large proteins as compared to the conventional Bottom-Up Proteomics approach. LUMSProTWeb is a GPU based application for optimal computation of high complexity data by execution of thousands of threads in parallel. It stands to fill the critical gap in the availability of open source platforms for TDP data analysis. A salient objective of this project therefore is to implement LUMSProT using .NET framework as a web API using Model-View-Controller (MVC) architecture, based on industrial standards with open architecture and availability of source code on GitHub.

Group Members

- Abdul Rehman Basharat   (2012-EE-150)
- Urwa Muaz   (2012-EE-168)
- Taha Tahir   (2012-EE-176)
- Yasir Anwar   (2012-EE-241)

Title:

Automated Vision Based Path Guider for Blind People

Advisor: Dr. Mohammad Naeem Ayyaz

Abstract:

The number of cases of visual impairment in Pakistan is expected to be 3,320,000 out of an estimated population of 213 million people in year 2020. Most of them cannot be treated. Therefore, various mechanisms have been devised to ease their movement. There can be both wearable devices and portable devices for easing the mobility of blind people. The common mobility of visually impaired people is carried out by a traditional white cane which is a portable assistive technology and keeps at least one hand of the user constantly busy. Moreover, the white cane cannot provide protection from all levels of obstacles. To solve these issues we have devised a wearable device, a belt, which will not only provide hands-free interaction with the surroundings but will also maximize the protection from different levels of obstacles. Automated devices have already been introduced in the world using various technologies such as GSM, GPS, and RFID. We, in our project, are making use of image processing mainly due to the wish of making future extensions in our project such as classifying the objects and letting the users know the type of obstacles encountered by them. By doing this, we wish to provide them with a better imagination of the world around them. Currently, the user will be given voice commands guiding them in their mobility. Moreover, we are incorporating vibrators as well with the device to act as a backup signal. Our aim is to provide a sense of safety and protection to the visually impaired.

Group Members

- Amina Riaz   (2012-EE-131)
- Aiman Siddiqi   (2012-EE-140)
- Shakeel Ahmad   (2012-EE-024)

Title:

Load Shedding Management with Priority Based Smart Management and Power Flow Study on PSS/E

Advisor: Dr. Naeem Ayyaz

Abstract:

Load shedding of electricity is the most common of all the problems faced in our country.   The long-term solution of this issue may take several years and success is not guaranteed since ever-increasing demand can hardly meet the supply. The most adverse consequence of this setback is that every industrial, commercial and residential process which is dependent on electricity stops for a while, though power is provided by some other sources later. This momentary shut-down affects the efficiency, economics and life of expensive machinery to great extent. Some manufacturing processes, once stopped, may take several hours to maintain their stability.

Our goal is to make such a system in which the uncertain and unscheduled load-shedding will be controlled efficiently. Since short falls demand nothing other than the disconnecting of load, we will establish priority based load removal system so that the most important of all the appliances and processes may not get disturbed, but only in case of severe power failure.

According to our proposal, instead of tripping one or two feeders from distribution sub-station in case of shortfall, all the feeders are subjected to a load reduction by equal distribution of the amount of load. We have performed a PSS/E based power flow study at FESCO Old Thermal Grid which is a 132 kV distribution substation. We have concluded that by enforcing equal amount of load reduction to all the feeders improves the voltage profile. In addition to this, the stress on the distribution lines and transformers is also reduced.

After the successful verification of our proposed scheme, we designed a priority based switching device for the utility. Dividing the whole load of a utility in four groups, the user can set which group should trip first in case of load reduction signal. The device intelligently measures the amount of current taken by each group and trips the required load groups when needed. The grid, user and device are connected to each other by GSM based communication network. The user receives a text message a few seconds before the tripping of a certain load group.

Our proposal has far-reaching consequences. It not only ensures the running of most necessary residential loads in case of short falls, but also provides equal distribution of power in distribution lines and transformers. This system can be further extended to industrial loads and more efficient communication network with online billing and energy metering.

Group Members

- Awais Ali   (2012-EE-146)
- Muhammad Khan   (2012-EE-153)
- Muhammad Taimour   (2012-EE-177)
- Rajitha Rajapaksha   (2012-EE-193)

Title:

Design and Implementation of Heliostat Field Using STM32F4 Discovery Board

Advisor: Dr. Ubaid Ullah Fayyaz

Abstract:

As the demand of electricity is increasing day by day, so we need Renewable Energy resources to overcome energy shortage. In countries like Pakistan Sun is a large source of Energy and through which we can generate electricity. Solar Panels and Steam turbines are used to produce electricity through Solar Power. For producing electricity through Steam turbines, it is required to collect solar power on single target so that sufficient heat is produced to run steam turbines. In this project we are reflecting Sun light on a Central Receiver through mirrors. The device required to do so is called Heliostat. Heliostat is a combination of two words Helios and stat. Helios is Greek word use for sun and stat word use for stationary. A heliostat is a device which contains a mirror, usually a plain mirror and this mirror can move in dual axis. This mirror tracks the sun and then reflects its radiations towards a predefined target. This target can be any object or direction, distant from heliostat device. To do this work, the reflected surface of the mirror should be in a direction that when the sun's radiation touches the surface of the mirror then after the reflection these reflected rays hit the predefined target. In most cases the target is stationary. For reflection, the mirror surface should be kept perpendicular to the bisector of the angle between the target and sun's direction. A practical heliostat system consists of many heliostat mirrors and one receiving tower. The project comprise of both hardware and software. Hardware includes the modification of the existing structure to more portable, reliable, cheaper, extendable and efficient mode. This project makes the heliostat system ready to use anywhere any time. Software makes the hardware user friendly according to customers' demands and also supports the system to be fully automated with the help of RTC module through which time and date is automatically taken. It includes extensibility, which means that it supports the increase in number of heliostat units which give rise to the heliostat field.

Group Members

- Muhammad Kamran   (2012-EE-049)
- Talha Shafqat   (2012-EE-089)
- Tehreem Fatima   (2012-EE-003)
- Sumbul Saleem   (2012-EE-011)

Title:

Voltage Sag Mitigation Using PWM Switched Autotransformer and PI Controller in Closed Loop

Advisor: Mr. Habib Wajid

Abstract:

This project presents a novel voltage control scheme that can compensate for voltage sags and swells in the power system. Sensitive loads require an uninterruptible supply of voltage and are particularly prone to voltage sags defined according to IEEE standards as the reduction in RMS voltage from 10 to 90 percent of its nominal value and having a duration of 0.5 cycles to 1 minute. The problem has been addressed using the technique proposed by Thangellamudi Devaraju in his research paper "Understanding of voltage sag mitigation using PWM switched autotransformer through MATLAB Simulation" in the journal namely "World Journal of Modelling and Simulation", Vol. 8 (2012) No. 2, pp. 154-160; objectives being to redo the simulations and implementation on hardware for the very first time. In this technique, during the times of voltage dips or swells, the source voltage is made to pass through an IGBT connected in AC voltage controller configuration which chops the sine wave according to a certain value of duty cycle decided after comparing the measured voltage with the desired value. This chopped sine wave is then fed to an autotransformer which essentially doubles the voltage at its output. A filter at the output gets rid of the harmonics in the chopped wave and produces a pure sinusoidal waveform of required magnitude at the load. It is evident from the description that the technique is simple in terms of algorithm, inexpensive due to less number of components being utilized and has a very quick response during the abnormal conditions.

Group Members

- Muhammad Aftab Ahmad   (2012-EE-021)
- Muhammad Usman   (2012-EE-117)
- Muhammad Saad Malik   (2012-EE-152)
- Rizwan Khalid   (2012-EE-188)

Title:

Speed Control of BLDC Motor using Hall Effect Sensors and BEMF and Torque Ripple Comparison

Advisor: Dr. Abdul Rahman Kashif

Abstract:

The project is speed control of BLDC motor using Hall Effect sensors and back emf measurement and torque ripple comparison. Speed and position control of BLDC has many applications and accuracy of speed control matters in many cases like BLDC driven spindle for CNC machining, BLDC as actuators for robotic hand and many more. Similarly lower noise of BLDC is an attractive feature in many applications like BLDC driven blower for HVAC systems and their lower noise makes them suitable for heating and cooling systems of homes. BLDC motor needs continuous feedback of the rotor position for which different methods can be used, Sensor based methods are normally used for the position and speed feedback but they require some extra cost and in many application they cannot be used. Sensor less methods need separate starting mechanism and have problems at lower speed. The comparison of these methods will be helpful in deciding which technique to use for speed control of the motor depending upon the application the motor is implemented in. The feedback of continuous rotor position is obtained from Hall sensor and from back emf. The position feedback is fed to the STM board (stm32f407) integrated with Matlab Simulink. Six inverter pulses are generated through controller and fed to the inverter which aligns the stator's magnetic field accordingly. Comparison of the both techniques is done at the end and emphasis is given to torque ripple comparison.

Group Members
- Rubab Abbas   (2012-EE-066)
- Khalida Rasheed   (2012-EE-071)
- Asifa   (2012-EE-204)
- Fareeha Robail   (2012-EE-207)

Title:

Harmonic Reduction Method for a Single-Phase DC-AC Converter without an Output Filter

Advisor: Dr. Syed Abdul Rahman Kashif

Abstract:

DC cannot be converted into pure AC due to generation of harmonics during conversion which lead to various technical faults. Harmonics can be generated either at the source or at the load. Many techniques are developed for their removal at the respective generation sites. To block harmonics, conventional method is the use of passive filters designed for specific frequencies. The passive filters are mainly composed of inductors and capacitors and are more prone to retardation by external factors. When a new harmonic appears at the output, its source has to be figured out to done to design the filter at that particular frequency and at the generation site. The active filters, although are efficient as compared to passive yet, increase the size of the system. We aim to remove the physical existence of filter by implementing a logical filter inside the embedded control system, reducing both the system size and power losses. In our project, we have canceled the harmonics in the output by injection of mirror harmonics that were equal in magnitude but opposite in phase. At hardware level, we have a single phase square wave inverter preceded by a buck-boost converter. DC is amplified through buck-boost converter which produces rectified sine wave. This when fed to the inverter produces sine wave at the output. Sample of the output voltage is taken and then, analyzed. It contains harmonics generated by every possible source. However, we considered major harmonics (with higher distortion factor) i.e. 3rd and 5th harmonic. Their mirrors were injected into the reference sine wave used for the modulation of the switch of the converter. This reduced distortion in the waveform to a great extent, making it a better approximation of the pure sine wave. Using this technique, lower order harmonics were cancelled and THD is reduced below 5%.

Group Members

- Noor-ul-Huda   (2012-EE-070)
- Ayesha Asif   (2012-EE-072)
- Hamna Ahmad   (2012-EE-201)
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Title:

Design and Implementation of Asynchronous link between Renewable Energy Resource and National Grid

Advisor: Mr. Muhammad Bilal

Abstract:

Distribution grid integration has become one of the most innovative subjects of research topics today. "Smart Grid" generally refers to a class of technology designed to modernize the existing utility distribution system to improve the efficiency on the power network and energy use in homes and business.

With the increase in the demand of the energy, the production of more energy is required. For the production of the energy now a day's renewable energy resources are being extensively used. Renewable sources of energies like wind, solar, hydro-plant, fossil fuel plants are now a day becoming popular. In the challenge of integrating such different technologies the inclusion of power electronics converters, as an interface between the generator systems and the net, has permitted the development of power control strategies that extends their capability to interact with the grid under faulty scenarios.
 In all these applications the grid voltage synchronization capability has gained lately a great importance, as a good synchronization under balanced and unbalanced is needed. There are two different scenarios: one is before connecting an inverter to the grid and the other is during the operation. If the inverter is not synchronised with the grid or another power source it is to be connected to, then large transient currents may appear at the time of connection, which may damage the equipment. During the normal operation, the inverter needs to be synchronised with the source it is connected to so that the system can work properly. In both cases, the grid
information is needed accurately and in a timely manner.

Group Members

- Jameel Ahmad   (2012-EE-190)
- Muhammad Umair Zafar   (2012-EE-183)
- Muhammad Yasir Sarwar   (2012-EE-189)
- Mustafa Faiz   (2012-EE-184)

Title:

Implementation of Microcontroller Based Admittance Relay for the Protection of Transmission Line

Advisor: Mr. Muhammad Bilal

Abstract:

The problem of combining fast fault clearance with selective tripping of plant is a key aim for the protection of power systems. To meet these requirements, high speed protection systems for transmission and primary distribution circuits that are suitable for use with the automatic reclose of circuit breakers are under continuous development and are very widely applied. Distance protection, in its basic form, is a non-unit system of protection offering considerable economic and technical advantages. Unlike phase and neutral overcurrent protection, the key advantage of distance protection is that its fault coverage of the protected circuit is virtually independent of source impedance variations. During load fault conditions, high voltage power systems and loads can suffer from extreme peak currents. Fuses, circuit breakers, contactors and solid-state opening switches are used to isolate the fault from the power system and stop the flow of power. In most cases this approach works well. However, for expensive and sensitive loads, the result of a fault may lead to significant damage leading to critical system downtime. In this case, any mechanical based opening switch would be far too slow to prevent damage. Distance relaying techniques have attracted considerable attention for the protection of transmission lines. With digital technology being ever increasingly adopted in power substations, more particularly in the protection field, distance relays have experienced some improvements. The trip/no trip decision has been improved, compared to electromechanical solid state relays. This paper presents the design and operation technique for protection of short transmission lines using microprocessor-based distance relay.

Group Members

- Nasir Ali   (2012-EE-090)
- Syed Asad Zulfiqar   (2012-EE-091)
- Arslan Mahmood   (2012-EE-092)
- Muhammad Ahtisham   (2012-EE-223)

Title:

XBee Based Power System Parameters Monitoring Unit with Remote Power System and Power Quality Analysis

Advisor: Mr. Habib Wajid

Abstract:

Our project is related to the quality of the power flowing in a particular section of a power system. Lack of energy to a terrible level is an alarming situation in Pakistan. Also the present system is an old fashioned and a non-automated one to much extent. Due to which the load shedding and other random problems that occur in the system need a constant and a remote check on the system. That's something our project is related to.

Our goal is to fetch the data of three phase power system from various points on the load side of the system and display it on a local LCD exactly at the point of examination. And to analyze it more comprehensively and in a detailed plus an authorized manner, let us look at the steps of the whole process briefly. In the first step, we fetch the data from the secondary of a distribution transformer, display it on the local display. The next step is to transmit this data to some remote receiving end so that it can be processed and analyzed. For this purpose, we have various options like GSM, Ethernet or some locally transmitting device. We are employing Xbees-S1 for this purpose. The transmitted data is then logged into the computer. After this step, the last step comes into account where the logged data is processed using the tools available in LabVIEW. This step includes different analysis like current and voltage analysis, FFT analysis, harmonic analysis, phasor and sequence component analysis.

We are developing a GUI for representation of this data to the user where he can observe it and take necessary precautions in case of any abnormal condition. We will further try to make multiple analyzers so that we can collect and analyze the data from various points in the power system. By this multiple node analysis, we will also be able to have a complete fault analysis of the system under study. Hence a check and balance on the power theft will also be implemented. Furthermore, in the future extensions, we plan to make our units standalone energy units using the solar penal and battery system. This project has a large scope in the power system as it can notify the user in case of any malfunction so that the problem can be rectified in time.

Group Members

- M. Zain Asif   (2012-EE-151)
- Sajid Hussain   (2012-EE-156)
- Shahzaib Anjum   (2012-EE-157)
- Hafiz M. Zohaib   (2012-EE-172)

Title:

Power Theft Identification in Distribution Lines Using Differential Power Measurement

Advisor: Dr.Haroon Babri

Abstract:

Electrical power theft identification system is used to detect an illegal tapping on the distribution lines. This system can be implemented in the distribution network of the electrical power supply system. Already existed systems are not able to detect the exact location of tapping. This system identifies the tapped electrical line. This is a real system. We can have an additional meter reading facility within the same cost and same technique. This system will protect the distribution network from power theft. Science has fascinated human life to such extent that imagining a world without it is hardly possible. If science has benefited human life then on the other hand it is also a reason of many immoral activities. A common crime that directly affects the economy of a nation is power theft. The aim of this project is to find out such theft in distribution lines. As it is difficult to implement this type of systems however in future there is a raising scope of this type of systems .In this project we have implemented the differential protection scheme of transformers .In this scheme two current transformers are connected at both ends of the load. If there is no theft then the secondary current of both the current transformers will be same. By using this principle one current transformer is connected at the starting end of the distributor and the other current transformers are connected to the different legal loads. If the vector sum of currents of all the current transformers connected to loads is equal to the current in the main current transformer then there will be no power theft. However if there is a difference in the currents then there will be power theft.

Group Members

- Abdul Manan   (2012-EE-035)
- Shaheryar Ali   (2012-EE-037)
- Shafqat Hassan Raza   (2012-EE-054)