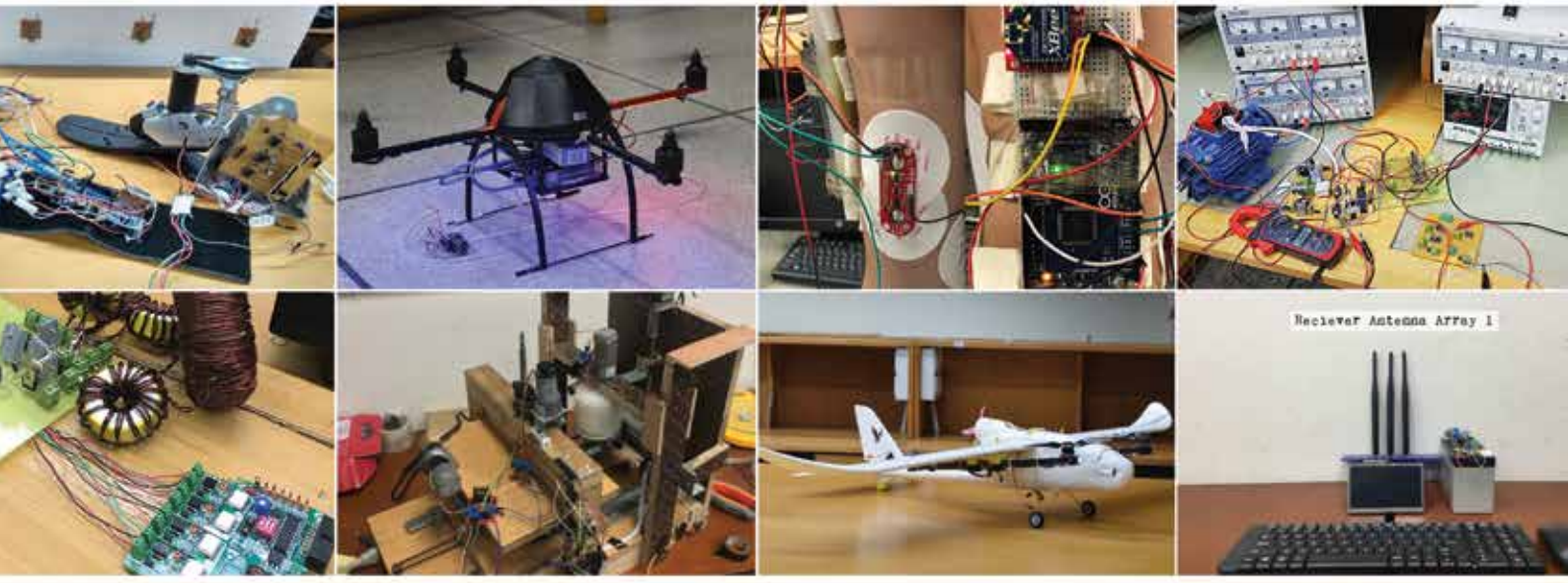
LUMS | Department of Electrical Engineering



SENIOR YEAR
DESIGN PROJECTS 2018

Syed Babar Ali School of Science and Engineering

INTRODUCTION

The Syed Babar Ali School of Science and Engineering (SBASSE) at LUMS, initiated in 2008, is the first private research school for Science and Engineering in Pakistan with a vision to carry out world-class, multidisciplinary education and research. Modeled on some of the leading universities of the world, the school aims to be a paradigm shift for science and engineering education in the country.

The Electrical Engineering (EE) programme at SBASSE is designed to enable students to be well-prepared to contribute to the rapidly changing and expanding needs of technology. The EE curriculum provides students with a strong foundation due to an emphasis on basic sciences and the development of excellent engineering skills through carefully planned core and elective courses. EE students also learn through a combination of design and lab work. The EE curriculum covers the essential breadth and depth needed for contemporary professional practice. Four important concentration areas have been identified:

- Communications, Signals and Systems
- Electronics and Embedded Systems
- Devices, Optics and Electromagnetics
- Modern Power and Energy Systems

In the final year of undergraduate studies students are involved in a year long Capstone Project to demonstrate their practical knowledge. This handbook consists of a brief description of the final year projects for the session 2017–18. This effort is coordinated by Dr. Ahmad Kamal Nasir, Dr. Adeel Pasha supported by Mr. Affan Anwar and Engr. Uzair Ahmed.

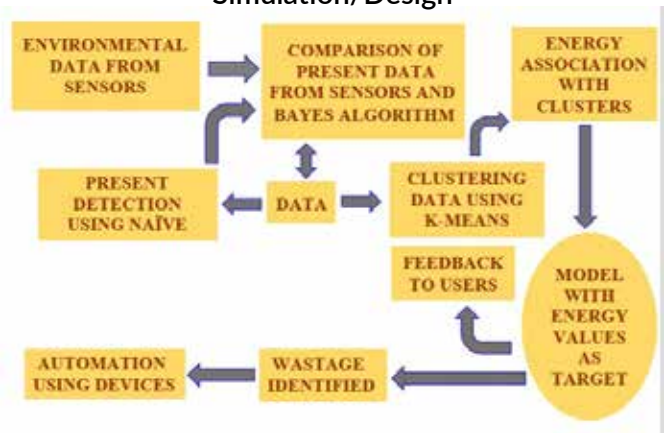
TITLE Towards Energy and Resource Efficient Buildings Through Consumer Behavior Changes using Internet of Things

Advisor: Dr. Naveed ul Hassan

Danish Amjad

Syed Muhammad Ali

Simulation/Design



HIGHLIGHTS

- Develop and install low cost nodes that relay environmental data
- Data obtained is analysed and machine learning techniques are applied in order to determine the underlying energy consumption behaviour of the user
- Identification of energy wastage and provision of feedback system

TITLE Bio Sensor for Point of Care Operations

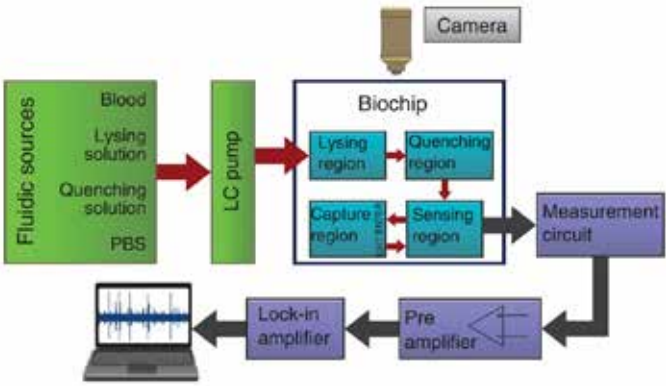
Advisor: Dr. Nauman Zaffar Butt
Co-Advisor Dr. Farasat Munir

Alyzeh Fahim

Sheikh M. Asher Iqbal

Wajahat Rafiq Baig

Simulation/Design



HIGHLIGHTS

- Design of a microfluidic biochip for point-of-care impedance-based cell counting
- Extraction of the desired signal from the biochip using signal processing techniques
- Analysis of the obtained results by comparison with earlier studies

TITLE PV System for Remote Applications

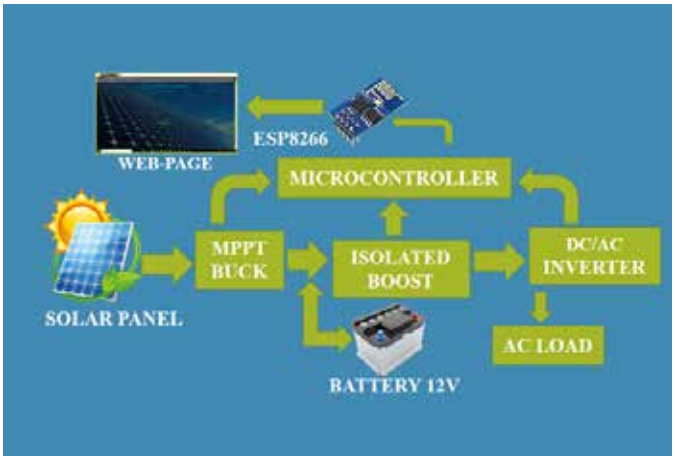
Advisor: Dr. Hassan Abbas Khan

Syed M. Ali Mehdi

Ali Mustajab Naqvi

Adil Ihsan

Simulation/Design



HIGHLIGHTS

- MPPT Buck Converter, using MPPT algorithm to extract maximum power to charge a battery
- Isolated Boost Converter to boost voltage from 12V DC to 315V DC
- SPWM inverter to produce a final 220V RMS AC voltage
- WI-FI monitoring using ESP 8266 module to monitor and control the various stages of the system

TITLE VFD for Reciprocating Compressor in Energy Constraint Systems

Advisor: Mr. Nauman Ahmad Zaffar
Co-Advisor: Dr. Hassan Abbas Khan

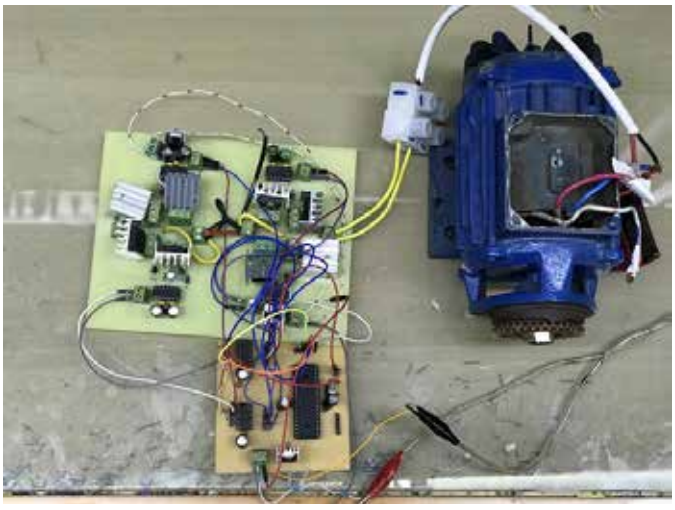
M. Ahmad Baig

M. Mohsin Tahir

Abdullah Azhar

Usman Amjad

Simulation/Design



HIGHLIGHTS

- To reduce the inrush current drawn by reciprocating compressor upon starting by linearly increasing the voltage and frequency
- To operate the compressor at lower power rating
- To ensure the working of refrigerators on common household Uninterrupted Power Supply (UPS)

TITLE Solid State Transformers

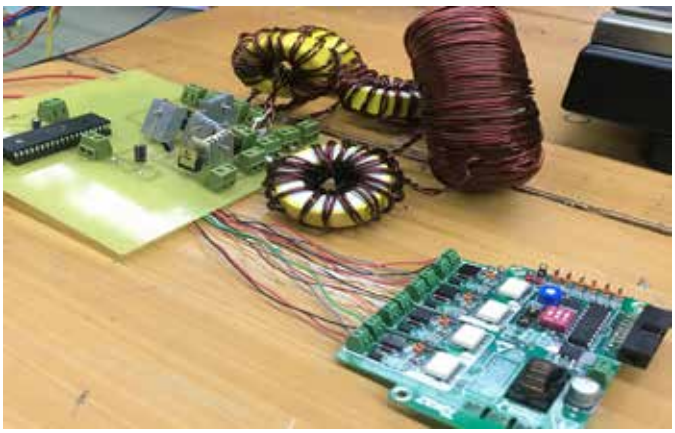
Advisor: Mr. Nauman Ahmad Zaffar
Co-Advisor: Dr. Abubakr Muhammad

Hira Akbar

Bisma Rehman

M. Abdullah

Taha Moaz



Simulation / Design (Diagram)

HIGHLIGHTS

- Single phase single stage AC-AC Boost converter
- Voltage regulation using feedback control loop
- Voltage Boost from as low as 120 VRMS to 220 VRMS
- Power Handling capability of 1000W

TITLE Development of Portable ECG Device to Predict CHF

Advisor: Dr. Muhammad Awais Bin Altaf
Co-Advisor: Dr. Farasat Munir

M. Fuaad Zameer

Sannan Ahmed

Simulation/Design

HIGHLIGHTS

- Development of algorithm similar to Pantompkins for predicting Atrial fibrillation through a device
- Development of a portable device which runs on the earlier algorithm
- Cost-effective for cardiac patients and allow focused and precise diagnosis of atrial fibrillation

TITLE Smart Meters with Power Analysis Capabilities

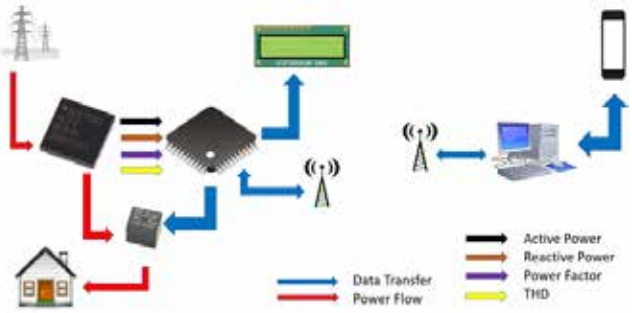
Advisor: Dr. Adeel Ahmad Pasha
Co-Advisor: Mr.Nauman Ahmad Zaffar

Umair Zakir Abowath

M.Tahir Raza

Qasim Sardar

Hamza Hassan Farooqi



Simulation/Design

HIGHLIGHTS

- Real Time Operation by measuring Power Consumption and Power Quality and communicating with the Utility Company through GSM in real time
- Soft UPS, an emergency UPS service provided by the utility company itself during load shedding hours that does not have drawbacks of a conventional UPS
- Multiple payment methods along with dynamic pricing

TITLE Call Center Simulation in NS-3 and Node.js

Advisor: Dr. Tariq Jadoon

M. Shamaas

Ammarah Azmat

Zarmeen Khan

Hira Tariq

Simulation/Design

HIGHLIGHTS

- Erlang C, Erlang X and Optimized Call Center Model Simulation in NS-3.26
- Comparison of performance metrics with Real Call Center Records
- Call Center implementation using HTTPS Server, RTC Peer Connection and Socket.io in Node.js

TITLE Wi-Fi Sensing

Advisor: Dr. Momin Uppal
Co-Advisor: Dr. Muhammad Tahir

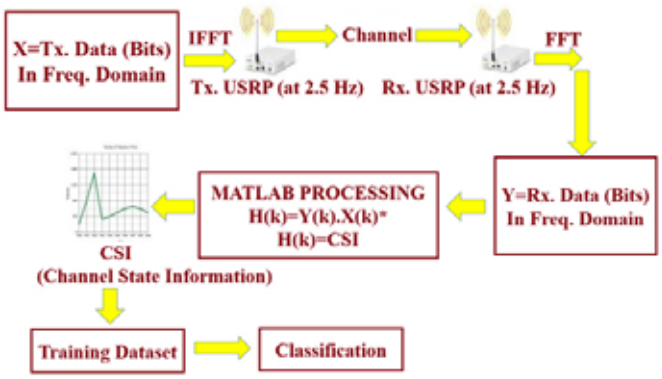
Saad Afzal

Hashim Saeed

Saad Qureshi

Airas Akhtar

Simulation/Design



HIGHLIGHTS

- Using Ambient Wi-Fi to detect the operation of different household appliances including Microwave, Celling/Pedestal Fan and Washing Machine etc.
- Detecting the behaviour of a car driver by processing Wi-Fi signals
- Classification of these devices is done using Machine Learning Algorithms

TITLE Metal Detection Using RF Sensing

Advisor: Dr. Farasat Munir; Dr. Momin Uppal
Co-Advisor: Dr. Muhammad Tahir

Abuzar Ahmad Qureshi

Abdullah Aleem

M. Saad Chughtai

Simulation/Design

HIGHLIGHTS

- Leveraging Wi-Fi signals to detect metal
- Performing different experiments for data collection
- Training and machine learning

TITLE RF & Solar Energy Harvesting using Inkjet Printed Organic Solar Cells.

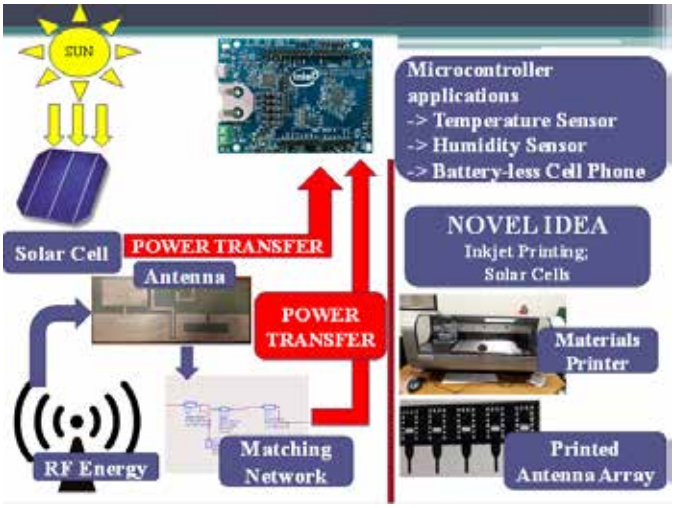
Advisor: Dr. Wasif Tanveer

M. Shahmeer Javed

Hamza Ali

Arooma Amir

Simulation/Design



HIGHLIGHTS

- Autonomous and Self Sustaining module using RF (Radio Frequency) and Solar Energy Harvesting. This is done through integration of a 3-band RF antenna and mono-crystalline solar cells
- NOVEL idea of printing Organic Solar Cells (OSCs) using Dimatix Inkjet Printer
- Selection of inks and experimental techniques to optimise parameters like power transfer, efficiency and cost effectiveness

TITLE Smart Home Automation: Smart Mirror

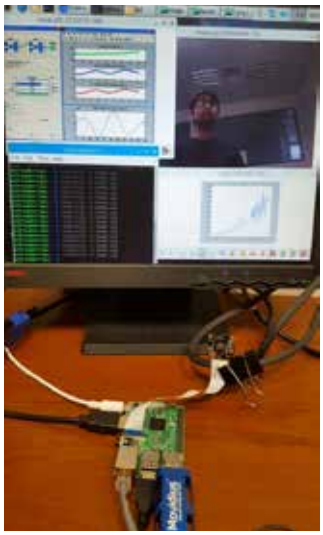
Advisor: Dr. Wasif Tanveer

Syed Ali Mannan Tirmizi

Arslan Ahmad Langrial

Ahmad Sohail

Simulation/Design



HIGHLIGHTS

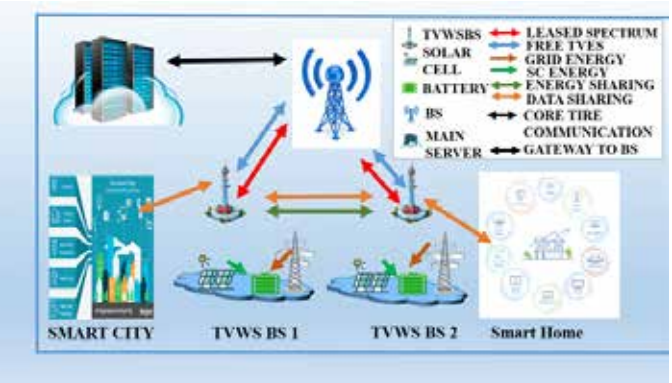
- Using Neural Compute Stick on retrained Algorithms for computing and facial/object recognition/ detection
- Setting up a limited network of sensors to obtain data in runtime and analyse consumption patterns via Machine Learning
- Building Smart Mirror to display related data based on user preferences

TITLE Cognitive Radio and TV White Space

Advisor: Dr. Naveed ul Hassan

Khalid Ismail

Simulation/Design



HIGHLIGHTS

- Spectrum and Energy Cost Minimising of Two Cooperating Base Stations in Cognitive Radio Network
- Quantitative Assessment of TVWS in Pakistan
- Developing various techniques to increase the efficiency of the utilisation of TVWS using cognitive radio

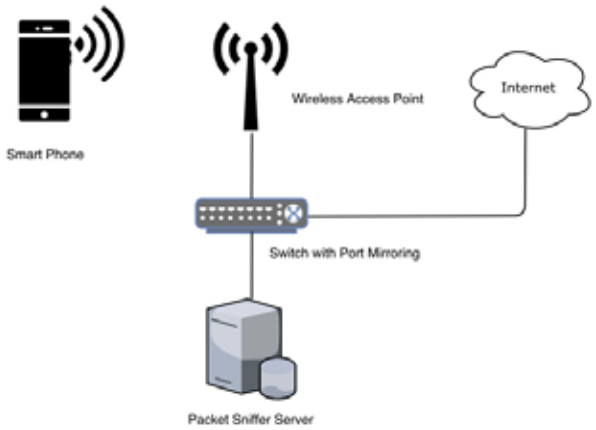
TITLE Network Traffic Fingerprinting

Advisor: Dr. Muhammad Fareed Zaffar
Co-Advisor: Dr. Tariq Jadoon

M. Junaid Raza

Ayesha Basit Alvi

Simulation/Design



HIGHLIGHTS

- Collection of Data from ISP and extraction of information without decryption
- User's Application Activity Fingerprinting with Machine Learning methods
- User Actions Fingerprinting with Machine Learning methods

TITLE Water Sample Collection Using An Aerial Drone

Advisor: Dr. Abubakr Muhammad
Co-Advisor: Dr. Muhammad Tahir

Yasir Noor

Mehr-un-Nisa Arif Kitchlew

Iqra Razzaq

Simulation/Design

HIGHLIGHTS

- Autonomous precision height control of drone
- Water sample collection using a submersible pump suction mechanism
- Integration and development of an embedded control system interfaced with ROS (Robot Operating System) Environment

TITLE IOT Based Home Automation

Advisor: Dr. Jahangir Ikram
Co-Advisor: Dr. Naveed Arshad

Asadullah Awan

M. Zauraiz Asmar

Umar Farooq

Abdur Rafay Javaid

Simulation/Design

HIGHLIGHTS

- The project focuses on home automation via internet which allow users to control and monitor home appliances from anywhere in the world.
- Controlling platform is the webpage. Each user has unique account on the website which contains the list of all appliances that have been installed.
- The user can see/monitor the status of the appliances and change the status (i-e turn them off or on etc.).

TITLE Performance Analysis and Injury Prediction using Cricket Bowling Action

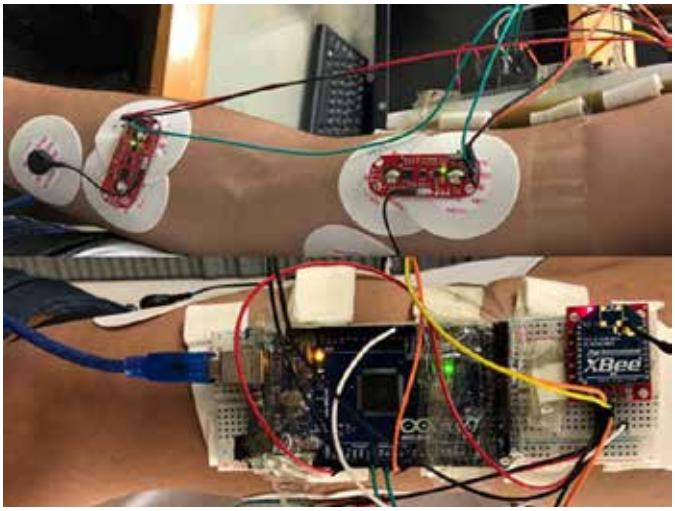
Advisor: Dr. Nadeem Khan
Co-Advisor: Dr. Ahmad Kamal; Dr M. Awais

Hayyan Ghani

Shaikh Hammad Ashraf

Omair Ahmad Shaikh

Simulation/Design



HIGHLIGHTS

- Detect muscle fatigue in EMG using amplitude analysis and identify fatigue using frequency domain analysis.
- Extend the scope of this project to the areas of clinical research, ergonomics biomedical physiology Develop a feasible model for the industry that provides a scientific method for data acquisition and future prediction of muscle fatigue and subsequent injury
- Make datasets of healthy and injured bowlers provided by the PCB and associate features with each of them in order to predict the risk of injury using machine learning techniques

TITLE DC UPS for Domestic Applications

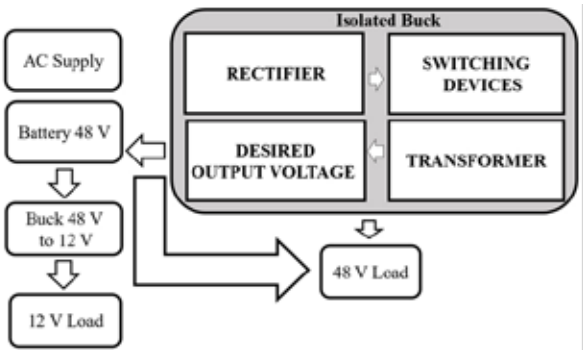
Advisor: Dr. Hassan Abbas khan

M. Junaid Khan

Rafay Fawad

M. Abdullah Siddiqui

Simulation/Design



HIGHLIGHTS

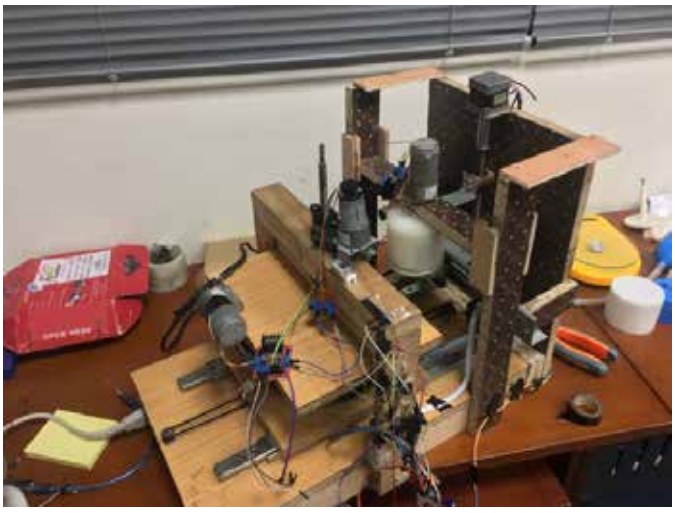
- Isolated Buck Converter to convert mains AC supply to 48 V DC
- Simple Buck Converter to supply the 12 V DC loads
- Battery charging and discharging

TITLE Easy-Chapati

Advisor: Dr. Wasif Tanveer

M. Furqan Ahmed

Simulation/Design



HIGHLIGHTS

- A dispensing unit for controlled injection of flour and water into the system
- A kneading unit for uniform mixing of the ingredients
- A cooking unit for flattening and cooking of the Chapati

TITLE Vision Based Autonomous UAV System

Advisor: Dr. Wasif Tanveer Khan
Co-Advisor: Dr. Murtaza Taj

Hafiz Ahmad Raza

Ameer Hamza

Simulation/Design

HIGHLIGHTS

- Fully autonomous systems capable of vertical take-off and landing at remote location
- Real-time Object Detection and Localization using Computer Vision techniques
- Dynamic Path Planning and Obstacle Avoidance for Real World Operations

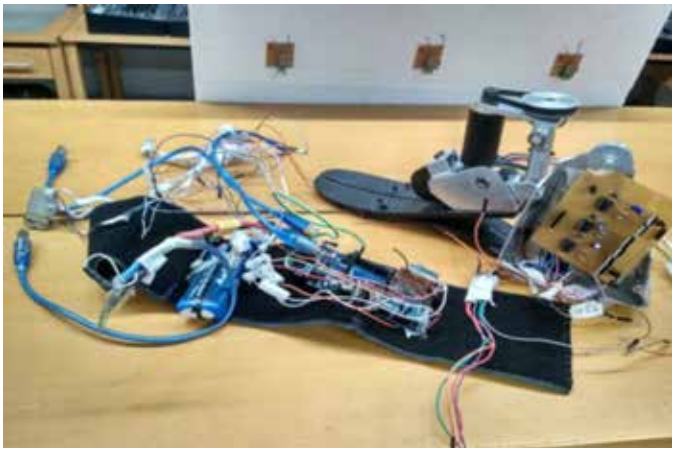
TITLE Active Ankle Prosthesis for Below Knee Amputees

Advisor: Dr. Muhammad Tahir


Seyyam Nasir


Hafiz M. Haris

Simulation/Design



HIGHLIGHTS

- Walking speed estimation in real time using wearable sensors
- Gait prediction in real time and results display on a android mobile application
- Prosthesis execution according to predicted gait

TITLE Beacon-Based Indoor Navigation for BVID

Advisor: Dr. Wasif Tanveer
Co-Advisor: Dr. Azer Raza


Momina Ayaz


Maira Afzal


Neha Mazhar


Attique Tahir

Simulation/Design

HIGHLIGHTS

- Indoor navigation way finding system for the blind or visually impaired people
- Uses Estimote Bluetooth proximity beacons to locate user in a location and determine routes to the desired location
- App interface with audio output to guide users to desired location

TITLE Dynamic Obstacle Avoidance in UAVs

Advisor: Dr. Abubakr Muhammad

Ateeq ur Rehman Baig

Simulation/Design

HIGHLIGHTS

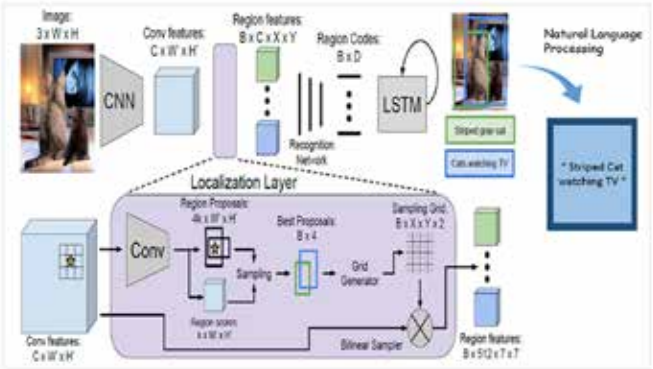
- Fully autonomous VTOL UAV system
- Dynamic Obstacle Avoidance
- Fully autonomous mission completion with zero human involvement

TITLE SamajhAI: Assistance System for Visually Impaired People – Prototype

Advisor: Dr. Murtaza Taj
Co-Advisor: Dr. Tariq Jadoon

Ahmedyar Humayun

Osama Qureshi



Simulation/Design

HIGHLIGHTS

- Dense Image Captioning using Deep Neural Network model, trained on Visual Genome dataset
- Natural Language Processing to generate single coherent summary of image

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