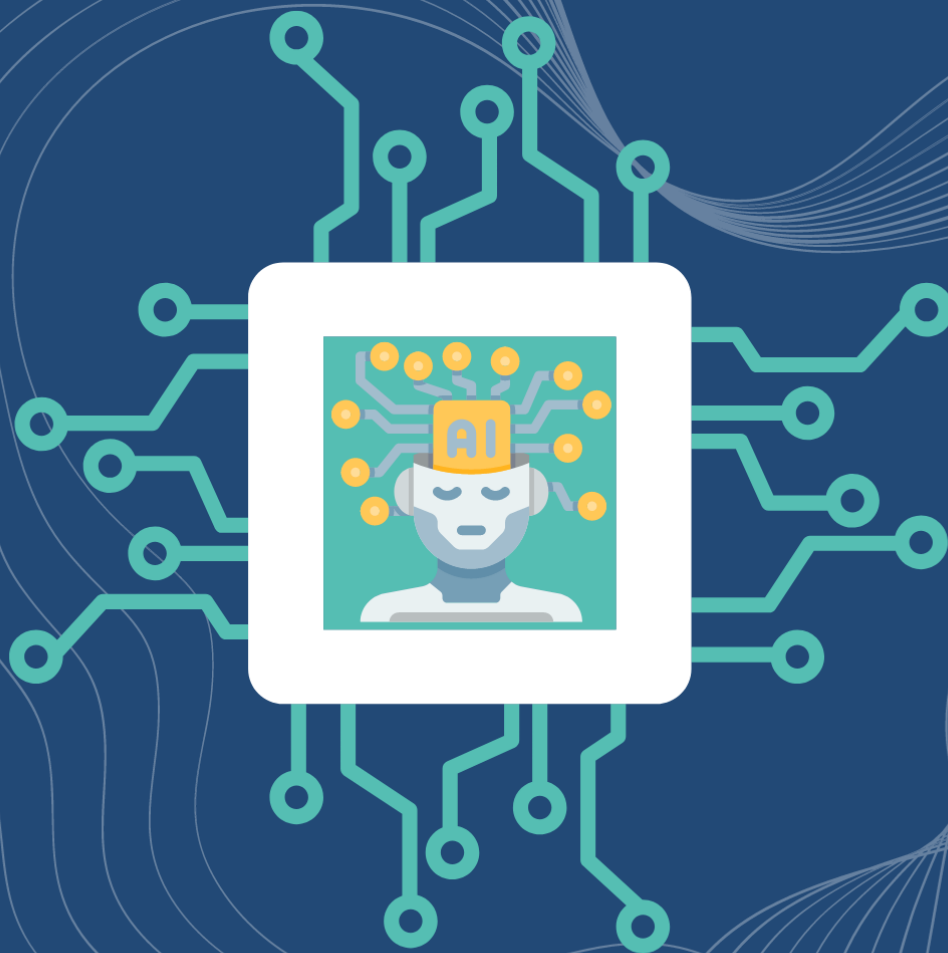


# OPEN HOUSE' 23

## ABSTRACT BOOKLET



The Future is Technology

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## Project 1

### **AUTOMATIC VOLTAGE REGULATOR FOR SYNCHRONOUS GENERATOR**

This project aims to design and implement a more accurate and hysteretic Automatic Voltage Regulator (AVR). Supply voltage in rural areas continues to be below necessary levels. This poses a serious threat to sophisticated electronic items like computers, refrigerators, and televisions. As a result, it has become crucial to guarantee that the input voltage stays within a suitable pre-specified level in both rural and certain urban areas. Locally available options currently suffer from a lack of accuracy and the problem of cycling between two output voltages, which causes surges at the output that might damage precious equipment. This study corrected both faults and included appropriate additions.

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## Project 2

### Classification of Surface EMG Signals Using Machine Learning Techniques

The final year project titled "Classification of Surface EMG Signals using Machine Learning Techniques" aims to develop an accurate and efficient algorithm that can classify surface electromyography (EMG) signals using various machine learning and deep learning techniques to validate the treatment of Chiropractic Interventions for lower back pain.

Surface EMG is a non-invasive technique that records the electrical activity of the muscle in response to a nerve's stimulation of the muscle using electrodes placed on the surface of the skin over the muscle. The signals obtained from EMG are often noisy and complex, and analyzing them requires specialized knowledge and tools. Therefore, developing an automated algorithm that can accurately classify Surface EMG signals can help in diagnosing and treatment of pain management of lower back muscle.

The dataset used in this project was provided by the New Zealand College of Chiropractic in Auckland. The involved preprocessing of data to remove noise and artifacts, extracting relevant features from the signals using empirical mode decomposition (EMD) and wavelet decomposition, and various machine learning techniques, including Long-Short Term Memory (LSTM), Light Gradient Boosting Machine (LGBM), Extreme Gradient Boosting (XGBoost), and Adaptive Boosting (Adaboost), are utilized in the proposed system to classify surface EMG signals based on their patterns and features. The system's performance is evaluated based on several metrics, such as accuracy, F1-score, precision, recall, receiver operating characteristic (ROC) curve, sensitivity, and specificity.

The results show that the proposed system achieved accuracy in classifying surface EMG signals, which indicates its potential to aid in the diagnosis and treatment of pain management of lower back muscle.

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## Project 3

### COLLABORATIVE ROBOT (COBOT)

Robots without additional sensors automatically stop when a collision is detected, which causes unneeded downtime and wear and tear on the installation. With the aid of the time-of-flight vision camera Kinect V2, a speed and separation monitoring system is examined in this paper. For continuous detection of human workers within a shared workspace, a Microsoft Kinect V2 vision camera is used. It's feasible to Calculate distances between all of Robot joints also along the Human worker with the aid of the joint angle information provided by the robot control. The robot's velocity and acceleration values are then set to safe values after the shortest distance, which also happens to be the critical distance time, is identified. The safety of human-robot interaction can be improved by real-time object or human detection and Distance-calculation, which can avoid the robot from collision with people or Objects. With the aid of VREP software and the setup, the algorithm is tested in both a virtual and actual environment. Robot speed can be adjusted in accordance with the distance people enter a shared workspace by observing the human skeleton and object recognition. Real-time object or human detection and distance calculation can avoid the robot's collision with humans or objects and increases the safety of human robot interaction.

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## Project 4

### Conversion of Combustion Engine into Electric Vehicle

The new generation are targeting for reducing exhaust gas pollution by operating in EV (electric vehicle) mode during the stop and go movement in thick traffic conditions at low engine rpm, but run on ICE (Internal Combustion engine) mode at cruising speed on highways. While new Electric Vehicle concepts are being developed internationally, existing Gasoline and Diesel powered conventional ICE vehicles will be guzzling unwanted pollutants for rest of their life, adding to the menace of global warming.

Electric motors can function in place of combustion engines to power electric vehicles. The project emphasis on calculating motor power, energy density of battery and required controller for controlling BLDC motor speed. Then components are examined. The vehicle's engine and gas kit were removed and calculated the vehicle's weight. Install a gearbox with a BLDC motor and comprehend the conversion wiring diagram. After that, component location before balancing the vehicle's weight being focused. By Following we assemble our car, convert it into an electric vehicle and give it a test drive. Finally, we focused on improving vehicle safety. Design data logger using arduino to check temperature and rpm. By combating the issue of a polluted environment and transform our car into an electric one at a reasonable cost.

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## Project 5

### **DEEP-LEARNING-BASED ACTION RECOGNITION IN BASKETBALL**

In recent years, deep learning-based methods have shown remarkable performance in action recognition tasks. In this work, we present a deep learning-based approach to recognize basketball actions using the Fast Region-based Convolutional Neural Network (Fast R-CNN) technique on the Space Jam dataset.

The proposed system comprises a preprocessing stage that extracts features from the raw video data, followed by the Fast R-CNN model that is trained to learn discriminative features from the extracted features. The Fast R-CNN model is a popular deep learning technique used for object detection and recognition, which has shown state-of-the-art performance in several computer vision tasks. The Space Jam dataset consists of basketball game video footage, and the proposed method is evaluated on this dataset using the classification accuracy metric.

The proposed system will help to get higher accuracy than the accuracy achieved in the previous implementation. The proposed system can be used for action recognition in recorded basketball game videos, which can provide valuable insights for coaches and players to improve their game strategies. The system can be extended to recognize more complex actions and applied to real-time action recognition in live basketball games with appropriate modifications.

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## Project 6

### **Design and Implementation of RISC-V Processor on FPGA with Integrated Accelerator for ML Applications**

We are currently witnessing the dawn of a new industrial revolution, characterized by the rapidly changing industrial landscape. In this revolution, RISC-V has emerged as a widely used term to describe the development of custom processors designed to meet the power and performance requirements of newer workloads for AI, ML, and IoT. RISC-V is an open standard ISA that is built on RISC principles. The primary drivers of this product include building custom processors, boosting speed, reducing costs, enhancing security, developing a platform for new students in this field, promoting innovation and skills, and competing with other companies such as Intel (x86), ARM (ARM ISA), and others.

This project presents the implementation of a RISC-V processor on FPGA with an integrated accelerator for machine learning (ML) applications. The processor used in this project is VexRiscv with ztchip accelerator. The main objective of this project is to develop a hardware system with high performance and efficiency for ML applications. To achieve this objective, the VexRiscv processor is modified to transfer tensor instructions to ztchip for accelerating ML computations. The implementation of this integrated system is carried out on an FPGA platform, which allows for flexibility and easy reconfiguration. The design is verified using debugging tools and is tested on various ML applications. The results show that the designed processor with the integrated accelerator outperforms traditional processors and accelerators in terms of both speed and energy efficiency.

Overall, the project demonstrates the feasibility and effectiveness of implementing a RISC-V ML accelerating system. This work has implications for the development of high-performance and energy-efficient RISC-V systems for various applications, particularly in the field of ML.

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## Project 7

### Digital Twin: Smart Agricultural System

A digital twin is a virtual representation of a physical object or system, used for simulation, analysis, and monitoring. It uses data from sensors and other sources to create a digital model of the object or system, allowing for the analysis of its performance, behavior, and potential issues. Digital twins can be used in a variety of industries, including manufacturing, healthcare, and urban planning, to improve efficiency, reduce downtime, and optimize processes.

For this project, we are implementing a smart agricultural system which refers to a virtual representation of a farm, its resources (such as land, crops, and equipment), and its processes (such as planting, watering, and harvesting). This digital representation is created by collecting data from sensors and using that data to create a virtual model of the farm.

The purpose of using a digital twin in a smart agricultural system is to provide a virtual representation of a farm and its processes, allowing for:

**Improved crop management:** By monitoring crop growth and soil conditions in real-time, farmers can optimize irrigation and fertilization to improve crop yield and quality.

**Predictive maintenance:** A digital twin can be used to monitor the performance of equipment and predict potential failures, allowing farmers to schedule maintenance proactively and minimize downtime.

**Better resource management:** By analyzing data from the digital twin, farmers can optimize the use of resources such as water, fertilizer, and energy, reducing costs and minimizing environmental impact.

**Enhanced decision-making:** By providing real-time data and insights, a digital twin can help farmers make more informed decisions about planting, harvesting, and resource management.

**Increased efficiency and profitability:** By improving crop management, resource utilization, and decision-making, a digital twin can help farmers increase the efficiency and profitability of their operations.

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## Project 8

### EE Managerial App

In today's digital era, mobile applications have become a vital tool for organizations to engage with their customers, clients, and stakeholders. Universities have recognized the importance of mobile apps in enhancing student engagement and communication. This thesis focuses on the development of a university department Android app to improve the communication and engagement between students and their department.

The primary objective of this thesis is to develop a comprehensive and user-friendly Android app for a university department that facilitates the students to access all the necessary information and services quickly. The app's features will include course schedules, assignment deadlines, departmental news and events. The app's user interface designed to provide a seamless and intuitive user experience for the students, making it easy to navigate and find the information they need.

Overall, this project aims to contribute to the development of an effective and user-friendly university department Android app that can enhance student engagement and communication with the department. The app's implementation can help the department to provide better services to their students and improve the overall learning experience.

It also includes printing facility for students to get any important print via wifi.

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## Project 9

### ELECTRIC CYCLE USING BLDC MOTOR

Due to day-to-day hike in petrol prices, it is troublesome to commute from one place to another. Importing an electric cycle entails a high shipment fee. A budget friendly alternative is required, keeping in mind the environmental factors and use of green energy for the project. In Pakistan, it is essential to revive the cycling culture because of its health and social benefits.

The electric cycle using a Brushless Direct Current (BLDC) motor offers a sustainable and efficient mode of transportation. This type of motor offers several advantages over traditional brushed DC motors, including increased reliability, longer lifespan, and lower maintenance requirements. The electric cycle utilizes a rechargeable battery to power the BLDC motor, which provides the necessary torque and speed for the rider to traverse a variety of terrains. The BLDC motor also offers improved energy efficiency compared to brushed DC motors, enabling the electric cycle to travel further distances on a single charge. Additionally, the BLDC motor is controlled using electronic speed controllers, allowing for precise regulation of the electric cycle's speed and power output. In conclusion, the electric cycle using a BLDC motor is a promising solution for sustainable transportation, offering riders a clean and efficient way to get around while reducing their carbon footprint.

The main purpose of this project is to design an Electronic Speed Controller (ESC). The ESC is the brain of the whole system which takes current from battery and powers the BLDC Motor. The current delivery depends on the amount of acceleration provided. The ESC is also responsible of current cut off, breaking mechanism and protection of system.

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## Project 10

### **ESTIMATING COGNITIVE WORKLOAD IN AN INTERACTIVE VIRTUAL REALITY ENVIROMENT USING EEG**

The project estimating cognitive workload in an interactive virtual reality environment using EEG is a Machine learning project. The main goal of the project is to understand the mental workload of a person by having an EEG signal as an input. Since there are various accidents caused due to stress and mental overload, we wish to determine the healthy mental capacity of an individual in order to minimize further accidents caused. With the concepts of machine learning and AI we plan to develop a machine learning model that can process the EEG signal and give us a desirable output based on dataset that we have available. We are performing the project on software such as python and MATLAB, and the major contribution of the project is using Python. We have used coding to implement our simulation project. Our project consists of three main stages, pre-processing, feature extraction, and classification. Pre-processing deals with the signals noise and peak removal by using bandpass and Butterworth filters and the result is stored in pickle format. The pre-processing is of 3 types and we can see which filters give us a more accurate result. Next stage is the feature extraction of the EEG signal. Here we have extracted 26 features of time, frequency, wavelet and complexity domain. These features are also stored in a pickle format and act as an input for the classifier. The classifier is the last step of the project that will use machine learning algorithms such as Gaussian NB, KNN, etc. These classifiers will help us to perform machine learning algorithms on which we can train and test the data. Furthermore, we will improve accuracy of classifiers to get that best output from the simulation. Until this point we have used manual feature extraction techniques on our project, we will use Deep neural networks to gain the best output from the algorithm. Finally with all this we could understand the mental workload of a person and can minimize accidents caused in the future of Pakistan.

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## Project 11

### FPGA Based 2-Qubit Quantum Entanglement Emulator

In this technological era, Moore's law is now considered as a bottles neck in the growth trends of digital electronic due to tunneling at the sub-atomic level. Quantum computers are considered as a solution to this predicament. Quantum Computers by virtue of superposition and entanglement offer computational precedence over classical computing. The project emulates the behavior of superposition via S and T gate. In addition to this two-qubit entanglement is also emulated on FPGA via CNOT, Toffoli and Fredkin's gate. Overall, this project's FPGA-based quantum emulator can help researchers better understand the behavior of quantum systems and develop more advanced quantum algorithms and applications.

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## Project 12

### FPGA IMPELMENTATION OF LIGHTWEIGHT SECURITY MECHANISM; SIMON & SPECK

The practice of protecting data's confidentiality, integrity, and authenticity from unauthorized access is known as cryptography. The significance of cryptography cannot be overstated in the digital age of today, when virtually all of our personal and business information is stored and transmitted online. Secure protection for sensitive data like bank account information, personal identification information, and confidential business data is provided by cryptography. It also helps protect critical infrastructure from cyberattacks, like financial systems and power grids. Online communication and transactions would be highly susceptible to interception and manipulation without cryptography, which would result in data breaches and a loss of trust. As a result, maintaining the privacy and security of our digital world necessitates the widespread use of cryptography.

Simon and Speck are two families of lightweight block ciphers that were designed by the National Security Agency (NSA) for use in constrained environments such as Internet of Things (IoT) devices, smart cards, and other low-power embedded systems. Simon and Speck have been optimized for performance and efficiency, while still maintaining a high level of security. These ciphers are designed to be compact, with a small memory footprint and low power consumption, making them ideal for use in resource-constrained devices.

In our project, we are going to design Simon and Speck algorithms using three different approaches i.e. Software implementation using C++, hardware implementation on FPGA, and ASIC implementation on ASIC (0.18 nm cmos technology). The aim of our project is resource efficient implementation of Simon and Speck on software, hardware, and ASICs.

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## Project 13

### **FPGA Implementation of Lightweight Security Mechanism PRESENT-80**

The use of cryptographic techniques is crucial for securing resource-constrained devices and IoT networks that often have limited computing power and memory. However, due to their resource constraints, these devices are vulnerable to attacks such as side-channel attacks and tampering. Therefore, the use of lightweight standardized cipher models has gained attention as an effective solution for achieving security in these devices while minimizing the impact on their resources. By using these techniques, it is possible to address security problems such as confidentiality and integrity of data, secure bootstrapping, and secure communication.

The PRESENT cipher is a symmetric-key block cipher that performs both encryption and decryption processes using a plaintext of 64 bits and a key size of 80 bits. The PRESENT cipher is a compact and efficient cipher that provides strong security for lightweight applications. The model design is performed by utilizing Verilog-HDL on the Xilinx 14.7 ISE platform and is implemented on a SPARTAN-6 FPGA board. The performance analysis is carried out with respect to slices, LUTs, and Flip-flops (FFs). Furthermore, the model is also designed for ASIC implementation, utilizing 0.18nm CMOS technology to measure gate count. This approach ensures an accurate assessment of the gate count and paves the way for efficient hardware implementation.

The main purpose of the project is to provide a hardware-based implementation of the PRESENT cipher that improves the security and performance of resource-constrained applications such as embedded systems, IoT devices, and smart cards with minimal resource requirements. The project's outcome can contribute to the development of lightweight security solutions that are efficient and secure while meeting the resource constraints of modern applications.

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**FPGA IMPLEMENTATION OF TIME EFFICIENT  
DEINTERLEAVING ALGORITHM**

In this work, a new deinterleaving algorithm that can be used as a part of an ESM system and its implementation by using an FPGA is studied. The function of the implemented algorithm is interpreting the complex electromagnetic military field in order to detect and determine different RADARs and their types by using incoming RADAR pulses and their PDWs. It is assumed that RADAR signals in the space are received clearly and PDW of each pulse is generated as an input to the implemented algorithm system. Clustering analysis and a new interpreting process is used to deinterleave the RADAR pulses. In order to implement the algorithm, FPGA is used for achieving a faster and more efficient system. Comparison of the new algorithm and the previous deinterleaving studies is done.

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## Project 15

### **FROM OFF-GRID TO ON-GRID UPS**

The world today we live in is facing problems of global warming and energy crisis due to increase in number of emission emitting automobiles, new industrial estates etc. Solar energy has become the most famous among the renewable's, so different techniques are used for harnessing its maximum energy. Similarly, the use of uninterruptible power supply [UPS] is also increasing due to rise of energy crisis and the existing UPS takes grid supply for charging batteries resulting in high consumer electricity bills.

The energy crisis has become a concern for undeveloped and developing countries that is most likely not going to go away with the increase in population in these regions. The need for power rises by 5% yearly in developing nations, especially Pakistan. So to overcome this problem people use UPS for load shedding which costs users extra bills as the battery is charged by WAPDA. Plus, batteries are not getting fully charged due to frequent load shedding. In addition, when these UPS devices convert alternating current (AC) to direct current (DC), half of the energy is lost during the battery charging process.

We suggested that turning these locally produced UPS into a PV-fed UPS inverter would be the most effective solution to this issue in terms of increasing their efficiency. In simple words, we can say that we will convert the existing UPS to a solar UPS/Inverter.

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## **GNSS Spoofing Detection Using Machine Learning Techniques**

In environmental, engineering, and navigation contexts, the Global Navigation Satellite System (GNSS) and related electronic technologies are becoming increasingly important. Even so, radio frequency (RF) communication can interfere with civilian GNSS transmissions.

The main aim is to make a GNSS receiver acquire and track false navigational information. Phase, energy, and fictitious signal components are used to analyse the differences between spoofing and real signal patterns. The tracking loop's correlation output is used to extract three critical characteristics: early late phase, delta, and signal level. These features can be used for spoofing detection by machine learning techniques such as K-Nearest Neighbor (KNN), Neural network, and naive Bayesian classifier. A multi-layer Neural network with feature index inputs is used to detect GNSS spoofing. According to simulation results on a software GNSS receiver, NN could achieve a sufficient detection accuracy in a short amount of time.

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## Project 17

### Hardware Implementation of Grain 128-a Cryptography on FPGA

Cryptography is an information security tactic used to protect enterprise information and communication from cyber threats through the use of codes. This practice refers to secure information and communication techniques derived from mathematical concepts and a set of rule-based calculations, called algorithms, to transform messages in ways that are hard to decipher.

A cipher algorithm is a mathematical formula designed specifically to obscure the value and content of data. Most valuable cipher algorithms use a key as part of the formula. This key is used to encrypt the data, and either that key or a complementary key is needed to decrypt the data back to a useful form.

Grain-128a cipher is used in a variety of applications that require fast and secure encryption. Some examples include wireless communication systems, smart cards, and satellite communication systems. Grain-128a is also used in some security protocols, such as the European Telecommunications Standards Institute (ETSI) standard for cryptographic algorithms.

The main Purpose of this new version of the cipher Grain-128 is that this cipher is strengthened against all known attacks and observations on the original Grain-128, and has built-in support for optional authentication. The changes are modest, keeping the basic structure of Grain-128. This gives a high confidence in Grain-128a and allows for easy updating of existing implementations. It is a reliable and effective technique for encrypting huge volumes of data since it has a 128-bit key and a 96-bit initialization vector (IV). Its design incorporates a mix of non-linear and linear operations to defend against known cipher attacks.

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## Project 18

### INTEGRATION OF ANTI-SPOOFING TECHNIQUE IN GNSS-SDR

This thesis investigates the application of the Cross Ambiguity Function (CAF) technique along with the Carrier to Noise Ratio ( $C/N_0$ ) monitoring method to mitigate spoofing attacks in GNSS-SDR systems. MATLAB serves as the principal tool for analyzing the performance of both CAF and  $C/N_0$  monitoring in detecting and countering spoofing attacks. The analysis utilizes simulated data from the Texas Spoofing Test Battery (TEXBAT), a comprehensive dataset encompassing a wide range of spoofing attacks. The research examines the incorporation of both CAF and  $C/N_0$  monitoring during the acquisition phase of the GNSS-SDR system, assessing their efficacy in identifying and alleviating various spoofing attack scenarios. The CAF technique involves comparing the received signal to an anticipated replica, while  $C/N_0$  monitoring examines the stability of the carrier to noise ratio in the received signal. The findings reveal that the combined use of CAF and  $C/N_0$  monitoring effectively detects and mitigates spoofing attacks, emphasizing the need for integrating anti-spoofing measures into GNSS-SDR systems to maintain system integrity and security. By employing CAF and  $C/N_0$  monitoring together, a more comprehensive and robust solution to tackle GNSS spoofing is achieved, ultimately enhancing overall system performance and dependability.

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## Project 19

### MULTI INPUT MULTI OUTPUT DC-DC CONVERTER

#### (MIMO)

Due to its essential role in power production, energy storage, auto-motive, traction, defense, aerospace, utility systems, portable electronic devices, systems integration, and energy efficiency systems, power electronics is leading a special sort of industrialization. Recent trends make it clear that power electronics will be essential to improving energy efficiency by addressing difficulties with global climate change and promoting a sustainable future. The converter was basically separated into four sorts. The optimum solution for both grid-connected and stand-alone applications is a DC-DC converter. The converter utilized for both energy generation and consumption is the DC-DC converter.

These power electronics converters may also come in single or multiple input and output configurations, among other options. There are several configurations of converters available, including Multi-Input Multi-Output (MIMO), Single Input Single Output (SISO), Single Input Multi-Output (SIMO), and Multi-Input Single Output (MISO) converters, to meet the needs of various applications with variable output level requirements. Multiple input sources increase energy efficiency and decrease losses. Such a converter often enables the integration of several sources that provide DC electricity directly.

A MIMO converter permits users to input data from numerous sources and uses them in various sorts of loads. The foundation of this research will be used to address the DC system's load diversity issue.

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## **NILM Based Conservation Plan of Residential Load Through AI**

Monitoring electricity consumption in the home is an important way to help reduce energy usage. Non-Intrusive Load Monitoring (NILM) techniques are a promising approach to obtain estimates of the electrical power consumption of individual appliances from aggregate measurements of voltage or current in the distribution system. In this work we discuss different learning algorithms used in the NILM literature and propose metrics for evaluating them. Work was carried on small scale in which algorithm is trained on available residential data set UK-DALE, the testing is done on selected appliances that are commonly used in household. The process initiates with the total aggregated power signal that carries overall voltage and current information. The algorithm separates each appliance energy consumption and shows the power consumed by them individually.

The process initiates with the total aggregated power signal that carries overall voltage and current information. The algorithm separates each appliance energy consumption and shows the power consumed by them individually.

Hardware part is developed as a data acquisition module for collecting data and testing it. Software part deals with Machine Learning Algorithms that dis-aggregates the total power signal and separates them individually.

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## Project 21

### NO-REFERENCE VIDEO QUALITY ASSESSMENT

Video quality assessment is conducted blindly using extracted features from multimedia content, as there is no reference available. However, using NR-based methods to evaluate video quality can be difficult since the extracted features may provide limited information. As the usage of online video traffic continues to increase annually, videos acquired or transmitted by consumers may become distorted due to technological or environmental limitations. Therefore, accurately predicting video quality is crucial. The objective of Video Quality Assessment (VQA) research is to create video quality models that generate predictions closely aligned with human judgments, irrespective of the video content or the type and severity of distortions (or combinations of distortions) that may have affected the videos. In the last decade, the number of recorded, shared, and viewed videos has grown significantly, with sharing of "in-the-moment" experiences through video becoming increasingly popular on social media platforms such as Instagram and Facebook.

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## Project 22

### OCCUPATIONAL EXOSKELETON (UPPER LIMB)

Mostly we have seen that workers in the industries work under heavy loads all by themselves without any external help, which can be harmful for their physical health. More than 50% of workers in the industries working under heavy loads retire due to back injuries or muscle injuries engaging in the lift. This mostly happens due to lack of proper helping equipment. We need to design an Occupational Exoskeleton for low budget industries that is light weight, durable and budget friendly.

Occupational Exoskeleton is device provided by high budget industries to their workers in order to make heavy lifting easy and safe for them. This device is also widely used by military personnel to lift and hold heavy machine guns but these devices are very costly and a low budget industry cannot afford these for their workers. So we need to make a low cost and budget friendly Exoskeleton to target our low budget audience.

The main purpose of the project is to build a cost effective upper limb Occupational Exoskeleton because the upper body is mainly engaged in lifting objects and working tools. So by neglecting the lower part of the body we can reduce the cost of the device by a large margin. In some of the Exoskeletons while supporting shoulder joints, elbow joints are neglected. So, our focus will be a hybrid Exoskeleton that can support both shoulder and elbow joints. Our goal is to make it as light as possible to minimize its pressure on the wearer, we would use aluminum body to achieve this goal.

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## Project 23

### **Performance Enhancement of Automatic Modulation Classification Using Deep Learning**

Machine learning has been transformed by deep learning, a potent branch of artificial intelligence. Because of its capacity for processing and learning from massive volumes of data, it has grown in popularity. Deep learning has been used in many different applications recently, such as speech recognition, image recognition, and natural language processing. It is used to identify and categorize various modulation schemes in the field of communications engineering, where it is quite successful.

The capacity of deep learning to adapt to new and unexplored contexts is another benefit of employing deep learning for modulation scheme identification. When dealing with new and untested settings, traditional approaches for modulation scheme identification are sometimes not as successful as they may be. On the other hand, deep learning models are more flexible and dependable since they can be trained on a variety of datasets and can learn to detect modulation schemes under various settings.

The main purpose of the project is to maximize the modulation schemes classification prediction for we have used different models of machine learning and deep learning to achieve the outcome. we have trained them on raw data and also features extracted from the raw data to get the accuracy at best.

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## Project 24

### Programmable AC/DC Power Supply

Every electrical and electronic appliance is designed to work perfectly at a certain input voltage. In Pakistan, household electrical and electronic appliances are designed to work properly at 220VAC, 50Hz and most of the times the voltage supplied from distribution companies are as low as 130VAC making this appliances to work under threat of low voltage supply. This low supply voltage causes these appliances to malfunction and in most cases damage them. Since the electric power supply/distribution companies are unable to provide the consistent adequate voltage. We are making this power supply to test different types of appliances to check their durability. This power supply is highly programmable and can performs a wide variety of tests on all kind of appliances to check their durability and resistance to voltage fluctuation.

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## Project 25

### **Railway Crack Detection Robot**

In the past, manual detection of cracks and discontinuities in railway tracks was not only time-consuming but also prone to inaccuracies. To address this issue, a robot was developed for the easy, accurate, and cost affective detection of such flaws.

The purpose of this project is to present the development of a railway crack detection robot using Arduino (UNO) microcontroller board, Bluetooth module, GPS module, infrared sensor for crack detection, ultrasonic sensor for train detection, LCD module, and beeper.

The robot is designed to accurately and efficiently detect cracks on railway tracks, allowing for prompt maintenance and repairs to be conducted, thereby improving the safety and reliability of train transportation.

The robot will be run by a DC battery which will be charged by a solar panel. The crack detection algorithm uses an infrared sensor to detect cracks on the railway tracks, while the ultrasonic sensor is used to detect the presence of a train in the vicinity. The GPS module is used to provide the robot's location data, which is displayed on the LCD module. The robot will provide audible and visual alerts through the beeper, when it detects cracks or trains in its path. Overall, the railway crack detection robot has the potential to improve the safety and efficiency of railway transportation by detecting cracks early and allowing for timely maintenance and repairs

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## Project 26

### Rapid Prototyping of Underwater Microturbine Fed Generator Set

As we know that due to limited resources, the shortage of electricity is increasing day by day in Pakistan. We don't have enough dams to fulfill the requirements. So, we need a solution that's is cost effective, reliable and could be long term. For this purpose, we are designing an underwater microturbine that has the potential for future electricity generation. It is a reliable source to generate electricity. It is predictable and reliable.

Micro hydro or Microhydro Power Plants is a small scale power plant which use water power as a power drive such as irrigation drain, river, or nature waterfall with a made use of its water level and a total of water debit. One of the most important components in a micro hydropower plant is a turbine. Turbine has a function to convert energy potential and kinetic energy from water to mechanic energy. There is a lot of turbine type which used in micro hydropower plants, one of those is Screw Turbine. Screw Turbine is one of the turbines which is working to an area that had the lowest head such as irrigation drain. The way work for this modeling is a pump will be drawn water in the bucket, and then water will be flowing through a pipe to water shelter, which it's installed in turbine head, collect it back to a bucket. The generator will change mechanic energy from the turbine into electric energy. To measure turbine spin and generator, it uses with a tachometer while voltmeter and ampere meter are used to measure voltage and current which generated through a generator.

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## Project 27

### **SECURE MEDICAL IMAGING DATA USING CRYPTOGRAPHY WITH CLASSIFICATION**

Medical imaging data in today's healthcare information systems is an essential part of diagnostics. Securing medical imaging data plays a critical role in the current time but today it is a complex task of maintaining data privacy so the main objective of this study is to solve this problem.

In this project firstly we secure and compress the MRI images of the brain using cryptography and Huffman compression. AES (Advanced Encryption Standard) is a symmetric-key encryption algorithm that is widely used for encrypting data. It uses a block cipher to encrypt data in fixed-size blocks of 128 bits and supports key sizes of 128, 192, and 256 bits. Huffman coding is a lossless data compression algorithm. The idea is to assign variable length codes to input characters, with the code length assigned based on the frequency of the corresponding character.

In this whole process input images are encrypted and compressed and after that images are decrypted using AES algorithm and supplied as input to the pre-trained convolutional neural networks such as Alex-net and mobilenet. The Alex net comprises 25 layers such as convolutional, batch-normalization, ReLU and max-pooling etc. The classification between the tumor and healthy images has been performed using softmax layer. MobileNet is built with depth separable convolutional layers. Each depthwise separable convolutional layer consists of a depthwise convolution and a pointwise convolution. Counting the depthwise and pointwise convolutions as separate layers, MobileNet has 28 layers.

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## Project 28

### STOCK MARKET PREDICTION USING MACHINE LEARNING

In this project we attempt to implement machine learning approach to predict stock prices. Machine learning is effectively implemented in forecasting stock prices. The objective is to predict the stock prices in order to make more informed and accurate investment decisions. We propose a stock price prediction system that integrates mathematical functions, machine learning, and other external factors for the purpose of achieving better stock prediction accuracy and issuing profitable trades. There are two types of stocks. You may know of intraday trading by the commonly used term "day trading." Intraday traders hold securities positions from at least one day to the next and often for several days to weeks or months. LSTMs are very powerful in sequence prediction problems because they're able to store past information. This is important in our case because the previous price of a stock is crucial in predicting its future price. While predicting the actual price of a stock is an uphill climb, we can build a model that will predict whether the price will go up or down.

Keywords: LSTM, CNN, ML, DL, Trade Open, Trade Close, Trade Low, Trade High

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## **SWARM UAVs**

### **Abstract**

An unmanned aerial vehicle(UAVs), commonly known as a drone, is an aircraft without any human pilot, crew, or passengers on board. UAVs are a component of an aircraft system, which includes adding a ground-based controller and a system of communications with the UAV. Swarm uavs(SUs) have unprecedented positive impact in our personal, social and business operations. SUs is a field in which large numbers of SUs are coordinated to perform a desired task. The nature of individual SUs is either heterogeneous or homogeneous SU. A significant portion of research is seen to be interested in SUs. The main aim is to develop an autonomous and intelligent system to perform swarming with synchronization and continuous communication. We develop our own algorithm which is named "Coordination Algorithm(C-Algorithm)". We design and develop our own system in which the moving UAV perform swarming; give live surveillance via camera; extinguish the fire which is a certain application of our final year project while avoiding obstacles and collisions among themselves by controlling parameters like stability, resolution, coordination, and synchronization. Our system comprises of four unmanned aerial vehicles (UAVs).These UAVs form swarm pattern of Y and Delta shape through localization which divides single machine work into multiple groups of machines. The Swarm UAVs(SUs) are comprised of one Master the decision-making node and the other 3 Slave-nodes which act accordingly to the master node in a synchronized manner. All 4 SUs are designed and developed on the same computational power to enhance ability and modification according to global application. The communication channel is Wi-Fi of range 200-220 meters, yet well-secured master only communicates to unique MAC address of slave nodes and can handle 250 bytes of data up to 20 slave nodes if attached and develop "C-Algorithm" which is specifically designed for our final year project.

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## Project 30

### SWITCHED CAPACITOR DC-DC CONVERTER FOR HVDC APPLICATION

This project focuses on the design and implementation of a switched capacitor DC-DC converter for Direct Current (DC) applications. The goal of the project is to develop a converter that can efficiently and reliably convert the voltage from a low voltage source to a high voltage level suitable for DC applications.

The converter will be designed and simulated using software tools such as Proteus and LTspice. The design will consider the specific requirements of newer DC applications, such as high voltage levels and high efficiency. The converter will also be designed to operate over a range of input and output voltages, allowing for flexibility in different applications.

The project will involve the construction and testing of a prototype converter to validate the simulation results and evaluate its performance under real-world conditions. The prototype will be tested for efficiency, voltage regulation, and stability, among other parameters.

The results of this project will contribute to the development of more efficient and reliable HVDC systems, which have numerous applications in renewable energy, electric vehicles, and other industries. The knowledge and skills gained from this project will also be valuable for future research in power electronics and DC systems.

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## Project 31

### **VIDEO DISTORTION DETECTION & CLASSIFICATION IN THE CONTEXT OF VIDEO SURVEILLANCE**

Despite the development of advanced video sensors with higher resolution, the quality of the acquired video is often affected by some distortions due to the environment, encoding and storage technologies, due to these distortions videos become useless. To remove these distortions from a video and enhance the quality of the video the first step is to detect and classify the distortion present in the video. Our main objective of this project will be to detect distortion in a video, identify the distortion type, classify distortion level and then we will classify multiple distortion.

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## Project 32

### WEARABLE KNEE RECOVERY DEVICE

Total Knee Replacement (TKR) Surgery is the most common orthopedic procedure globally spearheaded by ageing societies, and the procedure is commonly followed by a long, unengaging, often (perceived as) burdensome rehabilitation period. The rehabilitation field has barely seen changes in the past 50 years and the advent of ageing populations have only proven to worsen the already overburdened healthcare workforce.

The need for efficient, highly efficacious treatment is imperative and we believe the recent advancement of wearable technology, now as the forefront of personal health monitoring, is the key to break the field. Currently, knee problems are becoming more common and increasing more rapidly as many people suffer from permanent disability due to joint problems, orthopedics issues, muscle injuries and accidents.

To overcome this rapid problem, we are designing a wearable recovery device that will provide additional torque for the knee joints through processing the signals and the angle of the knee. Using this system, it is expected that the number of visits to hospitals as well as the number of interventions can be reduced, as well as the associated cost of care. Moreover, our design will reduce the stress in joints and provide an easy movement while mounting stairs and walking.

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## Project 33

### **Flood Detection Using Machine Learning**

In order to lessen the effects of natural disasters, it is essential to identify flooding. Machine learning has become a viable method for predicting floods thanks to the development of technology. Through the analysis of vast volumes of data, such as satellite images, weather forecasts, and historical flood records, machine learning algorithms can help in the detection of floods. The use of machine learning methods like support vector machines, decision trees, and neural networks can aid in locating flood-prone locations and predicting the intensity of the flood. Furthermore, these algorithms can be employed to identify the beginning of a flood and send out early alerts to the impacted areas. Combining these technologies will allow for the establishment of a strong flood detection system, which will considerably lessen flood damage. This abstract emphasizes how machine learning may enhance flood detection and how important it is for reducing the effects of natural disasters.

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## Project 34

### **Stability of a Two-Wheel Auto-Balancing Robot on Uneven Terrains**

This study aimed to evaluate the stability of a two-wheel auto-balancing robot on uneven terrains. The robot was tested on various terrain types, including rocky and slippery surfaces, to determine its ability to maintain balance. Results showed that the robot was able to effectively balance itself on even and uneven surfaces.

We are working to create a robot that can balance itself on two wheels. The robot will have one axle connecting the two wheels and a platform mounted on it. Additionally, there will be another platform placed above. Our job is to keep the platform balanced and stable using distance sensors, as it will otherwise not remain stable.

Initially, the goal is to simply balance the robot on its two wheels. If the platform inclines, the microcontroller will send signals to motors so that they can move forward or backward depending on the inclination direction and extent.

Additionally, the system includes shock absorbers for the suspension to improve stability on rough terrain. The project includes components such as an Arduino microcontroller board, stepper motor, gyroscope, Bluetooth module, motor drivers, shock absorbers, and wheels. The goal is to create a robot that can effectively balance itself on any surface and have potential applications in various fields.

Further improvements could be made by adjusting the control algorithms and the physical design of the robot to increase stability on challenging terrains. This research contributes to the advancement of two-wheel auto-balancing robots and their potential for practical applications.

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## Project 35

### INFLATABLE VEST FOR MOTORCYCLISTS

Motorcyclists are more vulnerable on the road and are more likely to be injured or killed. Motorcycles are hard to control, difficult for other drivers to see, and crashes often put the rider's life in danger. Dozens of motorcyclists' lives could be saved every year if airbag jackets are made compulsory to use. Along with helmet, a jacket/vest will enhance the safety of a rider.

The ultimate objective of our project is to design airbag vest/jacket for the bikers. The airbag vest helps the biker to prevent accidents, injuries and death. Vests are attached with an airbag to protect motorcycle riders against injuries. In the event of an accident the rider's airbag will inflate within milliseconds to protect rider's body from severe injuries. The airbag jacket provides extra protection to the most parts of the body including the spine, neck, collar- bone and ribs.

In this report we, with the help of electronic modules such as a microcontroller and some sensors like gyroscope and accelerometer will effectively judge when to activate the inflatable vest in order to safeguard the torso of the rider from potentially life-threatening injuries. We have designed an algorithm that takes input reading from sensors and in case of an abnormal readings, gives an output to a dc motor that in-turn opens a valve that allows the escape of CO2 from high pressure environment inside the canister to a low pressure environment which is the vest

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## Project 36

### SOUND SOURCE LOCALIZATION IN OUTDOOR ENVIRONMENT

Gunshot detection is an important issue in the field of public safety, as it can help authorities respond quickly to incidents involving firearms. Machine learning algorithms can play a crucial role in the development of effective gunshot detection systems. One of the main challenges in developing these systems is the ability to accurately distinguish between the sound of a gunshot and other similar sounds such as fireworks, car backfires, and construction noises. Machine learning calculations can be prepared on huge datasets of audio recordings to learn the features that distinguish the sound of a gunshot from other sounds. Once a model has been trained, it can be deployed in real-world scenarios to detect gunshots in real-time. The audio recordings can be analyzed in real-time to detect if a gunshot has been fired. If a gunshot is detected, the system can alert authorities, allowing for a rapid response.

The choice of the algorithm depends on the specific requirements of the application and the quality of the training data. Another important aspect of gunshot detection systems is the localization technique for finding range and direction.

One commonly used method for range estimation is Time Difference of Arrival (TDOA), which involves measuring the difference in time between the arrival of a signal at multiple reference points. With TDOA, the range can be estimated based on the time difference between the signals and the speed of the signal. Once the ranges have been estimated, the direction can be determined using information from multiple reference points. For example, triangulation can be used to calculate the location of the object by using the ranges and directions from multiple reference points. Localization using range and direction with TDOA estimation involves measuring the time difference between signals at multiple reference points to estimate the range, and then using this information to determine the direction and ultimately the location of an object or device.



## Project 37

### DRIVE TRAIN OF THE VERTICAL AXIS WIND TURBINE

In an effort to find solutions for global energy crisis, an analysis on a helical vertical axis wind turbine was conducted with the consideration of renewables and energy efficiency. This study was carried out in two steps: the realization of the analytical calculation of a helical wind turbine power output which then informed the design and construction of the gearbox. The design of the rotor blades and the generator to be used was worked out after studying several different designs. The helix blades were used, combined with a permanent magnet synchronous generator. The Vertical Axis Wind Turbine is designed to be planted at the green belt on the Srinagar Highway, where the traffic flows both ways. The micro winds from moving vehicles will act as the input for the blades to rotate and in turn produce electricity.

The project particularly aims to address its use as the electricity supply for residential properties or any other places with less ideal economic conditions. The uncomplicated and highly accessible mechanism using basic materials is to give people a viable option on their own electricity production. The gearbox is one of the components in wind turbines most prone to cause complications. The costs for maintenance and replacement of gearboxes, along with the costs caused by production losses due to non-functioning gearboxes, constitute a large share of the expenses of operating wind power plants. The report involves repeated testing of the planetary gearbox, to create a final model with the most efficient and stable electricity output.

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