Final Year Projects 2021
Batch-17ES

MEHRAN UNIVERSITY
OF ENGINEERING & TECHNOLOGY
JAMSHORO, PAKISTAN

Department of Electronic Engineering
Mehran University of Engineering & Technology
Jamshoro Pakistan
Compiled by: Engr. Qudsia Memon
Edited by: Dr. Attiya Baqai
Prof. Dr. Arbab Nighat

Message from Dean FEECE

These past years have seen an interesting development in institution building in the country and amongst all institutions, the bedrock has been the education institutions that impart practical, technical, and research-based knowledge. Electronics and ICT (Information and Communication Technologies) in general have a direct and great impact on our life. Electronic Engineering artifacts have played and continue to play a major role in the evolution of mankind and culture. It is an increasingly important engineering discipline that significantly affects the other disciplines of Engineering.

I am delighted to learn that Department of Electronic Engineering, as an innovative and forward-looking department, achieved laurels for imparting quality education with practical skills that has been at the forefront in the country and its graduates have risen to positions of great eminence. The success of the department owes much to collaborative efforts involving faculty, administration, students, students' alumni, and the community.

It is a matter of immense pleasure and happiness to see that students have made such remarkable projects such as Unmanned Aerial Vehicle Based Weeds Detection using Image Processing, Development of binary classifier for railway track surface faults detection using solar powered vehicle, Deep Learning based multi-fault detection system for 3-Phase Induction Motor, Design and Progression Analysis of Neuro Rehabilitation System using Machine Learning, Design & Development of Wheeled Type Pipeline Inspection Robot, Three-Dimensional Augmented Reality capture and display system secured funding under the NGIRI 2021- IGNITE.

On this occasion, I would like to felicitate and express utmost appreciation to the Chairperson of the Electronics department, FYP Committee, all the faculty members and students for having kept up the standard of the department. The exhibition is indeed a matter of celebration for the university as well as for the country. The crux of the matter is that I am proud of department of Electronics Engineering and its performance.

Prof. Dr. Mukhtiar Ali Unar

Dean FEECE

Message from Chairperson

The field of electronic Engineering has witnessed overwhelming importance in almost every sphere of our lives and in fact it is the driving force behind the development of world's information technology. It has made revolutionary changes the way people interact with the outside world. It has deeply penetrated in every field of our existence.

Being one of the most dynamic and active departments in terms of arranging numerous curricular, extracurricular, and technical Workshops and webinars in the time of Covid-19 too. The Department of Electronic Engineering envisages to be nationally recognized for high quality academic programs and research through focused activities and excellence of its faculty, staff, graduates, and facilities.
This department aspires that its graduates be able to face the challenges diverse areas ranging from information Technology, robotics to healthcare.

To develop and encourage a competitive environment; Electronics Engineering department has organized Project Exhibition, a platform to showcase final year students' projects since almost a decade. That not only polishes the technical skills of those who participate but also becomes an inspiration for students of other departments.

This time around, final year students of (17ES) of Electronic Engineering Department have put in their invaluable efforts and technical expertise in designing real life application-oriented projects. These projects are mainly focused on today's societal needs such as Autonomous Farming Robot, Multi- Language voice control IOT home automation and smart billing, Complete Blood Count test by end-to-end, Interactive wind shield Head-up-Display for automotive, SCADA based smart power plant etc.

Indeed, the provision of sound technical environment to the students bore fruits when three of our FYP groups shortlisted in Lab2Market event project exhibition at Sino-Pak Center for Artificial Intelligence (SPCAI), Pak-Austria Fachhochschule: Institute of Applied Sciences and Technology and one group won 2nd prize. Another group from our FYP got nominated for the Public Choice Award under 180 Seconds of your Research Studies 2021, organized by EEE Department and E3S2 Club and supported by IEEE RAS Malaysia, IEEE UTP Student Branch, IEEE SPS Malaysia and IEEE KL-Subsection.

It is a pleasure for me to look ahead to a future for our graduating students that is brighter than ever. I would like to express my gratitude to all faculty members who aptly played their part in mentoring and guiding students at every level.

Prof. Dr. Arbab Nighat
Chairperson
Department of Electronic Engineering

FYP Committee Members

S.No.#	Names	Designation
1.	Dr. Attiya Baqai	Convener
2.	Engr. Mehboob Khuwaja	Member
3.	Engr. Khuhed Memon	Member
4.	Dr. Shoaib Rehman Soomro	Member
5.	Engr. Qudsia Memon	Secretary

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Training/ Workshops Sessions by Final Year Project Committee

S. No	Training/ Workshops Sessions	Instructor	Date of Conduct
1.	OBE based FYP	Dr. Shoaib Soomro	10-12-2020
2.	Prospect Funding opportunities for FYP	Dr. Attiya Baqai	17-1-2021
3.	Academic Writing Techniques/Strategies and Plagiarism policy awareness (Turnitin)	Dr. Farida Memon	25-2-2021
4.	Research paper writing Review paper writing	Dr. Attiya Baqai	17-8-2021
5.	Mendeley (Referencing Tool)	Dr. Attiya Baqai	17-8-2021
6.	Latex (Thesis Writing Tool)	Prof. Dr. Wajiha Shah	24-8-2021

Achievements by Students

Projects in Collaboration with Industries:

The following Final Year Project (FYP) groups are interlinked with industry:

1. Unmanned Aerial Vehicle Based Weeds Detection using Image Processing Supervisor: Dr. Arbab Nighat, Dr. Farida Memon/ Dr. Fahad Students: Ms. Tazeen Liaquat 17ES09 (Group Leader), Ms. Rabia Baladi 17ES75, Mr. Dial Das 17ES77 in collaboration with Sindh Agriculture University, Tandojam.
2. Development of binary classifier for railway track surface faults detection using solar powered vehicle Supervisors: Prof. Dr. B.S Chowdhry, Engr. Ali Akbar Shah Students: Mr. Rafique Ahmed 17ES03 (Group Leader), Mr. Abdul Bari Nizamani 17ES33 in collaboration with NCRA Condition Monitoring Systems Lab and Pakistan Railways.
3. Deep Learning based multi-fault detection system for 3-Phase Induction Motor Supervisor: Prof. Dr. Bhawani Shankar Chowdhry, Engr. Dileep Kumar Soothar Students: Ms. Fazeela Rattar 17ES05 (Group Leader), Mr. Abdul Wahid 17ES69, Mr. Junaid Ahmed 17ES73 in collaboration with NCRA Condition Monitoring Systems Lab and Pakistan Railways.
4. Design and Progression Analysis of Neuro Rehabilitation System using Machine Learning Supervisors: Dr. Attiya Baqai, Dr Tahira Nihal. Students: Ms. Maliha Talpur 17ES31 (Group Leader), Mr. Saad Rehman 17ES65, Mr. Madan Lal 17ES4 in collaboration with Institute of Physical Therapy and Rehabilitation Sciences.
5. Design and Implementation of digital incentive spirometer for monitoring lungs health status Supervisors: Dr. Attiya Baqai, Engr. Burhan Aslam/ Mr. Usama Bin Yar Mr. Ahsan Rashid 17ES26 (Group Leader), Mr. Sheeraz Hussain 17ES18, Mr. Hamza Soomro 17ES02 in collaboration with Artificial Limbs & Appliance Center, Department of Orthotics & Prosthetics Rawalpindi (Pakistan).

It is a matter of great pleasure and pride for the department and the University that students, through their diligence and hard work applied for research funding of their projects and remained successful. Successfully winning a research grant authenticates the vitality and importance off their research work. Following are some of the highlights.
The following Final Year Project (FYP) groups secured a research grant through National Grassroots ICT Research Initiative (IGNITE):

1. Unmanned Aerial Vehicle Based Weeds Detection using Image Processing. Supervisor: Prof. Dr. Arbab Nighat
2. Development of binary classifier for railway track surface faults detection using solar powered vehicle. Supervisor: Prof. Dr. Bhawani Shankar Chowdhry
3. Deep Learning based multi-fault detection system for 3-Phase Induction Motor. Supervisor: Prof. Dr. Bhawani Shankar Chowdhry
4. Design and Progression Analysis of Neuro Rehabilitation System using Machine Learning. Supervisor: Dr. Attiya Baqai
5. Design & Development of Wheeled Type Pipeline Inspection Robot. Supervisor: Prof. Dr. Arbab Nighat
6. Three-Dimensional Augmented Reality capture and display system. Supervisor: Dr. Shoaib Rehman Soomro

Other Achievements:

1. Research paper presented: Ahsan Rashid, Sheeraz Hussain, Hamza Soomro, Burhan Aslam, Attiya Baqai, Usama Yar, "Design and Implementation of Digital Spirometer for monitoring lungs health status", International Marmara Scientific Research and Innovation Congress 21-22 August 2021, Turkey Istanbul.
2. Research paper published: Zeeshan Ahmed, Shahbaz Qamar Panhwar, Attiya Baqai, Fahim Aziz Umrani, Munawar Ahmed, Arbaaz Khan (2021). "Deep learning based automated detection of intraretinal cystoid fluid. International Journal of Imaging Systems and Technology (IF=2.00), by Wiley Publishers, October 2021 https://doi.org/10.1002/ima.22662
3. FYP presented: Design and progression analysis of neuro rehabilitation system using machine learning" team members: Maliha Talpur (17ES31), Madan Lal (17ES45) and Saad Rehman (17ES65) Supervisor: Dr. Attiya Baqai, Co- Supervisor: Dr. Tahira Nihal (Bhittai Institute of Physical Therapy and Rehabilitation sciences, Mirpurkhas) won 2nd Prize with cash award of 75000/ Rs in the 3rd and final round of Lab2Market event project exhibition at National Artificial Intelligence Forum (NAIF), Sino-Pak Center for Artificial Intelligence (SPCAI), Pak-Austria Fachhochschule: Institute of Applied Sciences and Technology, Haripur, Mang KPK on 2nd September 2021.
4. FYP Presented: Autonomous Farming Robot Supervisor: Dr. Farida Memon, Engr. Bharat Lal Students: Mr. Abdullah 17ES74 (Group Leader), Ms. Bisma Shakeel 17ES108, Mr. Saeed Ahmed 17ES48 project's video selected under UG category in 180 Seconds of your research studies 180 SRS 2021 in Malaysia held on 25th October 2021 also winner for the Public Choice Award under 180 Seconds of your Research Studies 2021 under UG category, organized by EEE Department and E3S2 Club and supported by IEEE RAS Malaysia, IEEE UTP Student Branch, IEEE SPS Malaysia and IEEE KL-Subsection

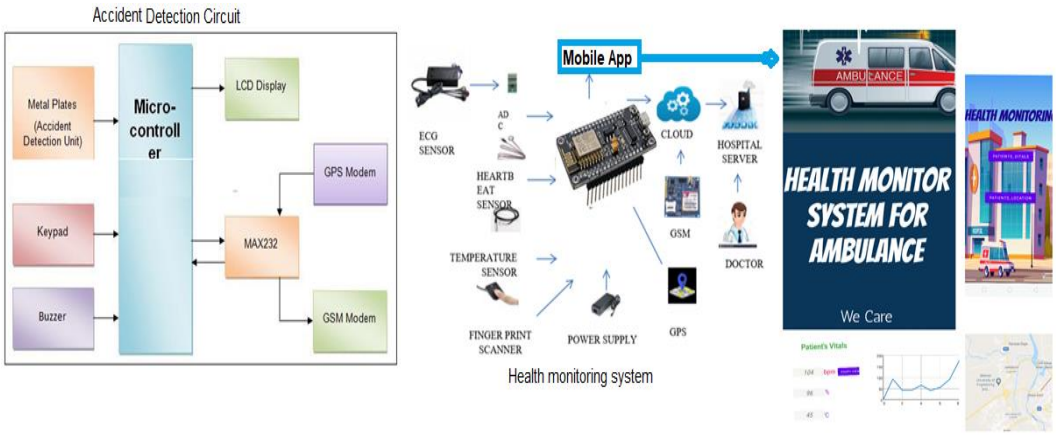
Accident Detection & Health Monitoring System for Ambulance

Abstract:

Statistically, many people especially those in road accidents or due to other causes of health dangers, lose their lives or have less chance of survival while on the way to hospitals, due to mishap of health care by experts. A patient of road accident or any other health condition, must be brought as soon as possible to the expert in hospital to increase the chances of survival for him/her. Considering the current heavy traffic conditions in Major cities of Pakistan, emergency situations like road accidents, cardiac arrests, asthma, heart attack, etc., require an urgent attention for its patients, so ambulances should be serviced with proper tools and trained helpers to achieve the proper care for everyone. Many People have untimely deaths because of lack of treatment in ambulance. The main time-consuming factor is knowing about the accident or any other incident like heart attack, asthma, when it occurs somewhere. This is very tricky and depends on the condition of patient and mentality of others to make proper decisions/judgements. To overcome this time loss, we have designed an 'Accident detector circuit' which would be fitted in every vehicle to inform the nearest hospital of the accident in an instance using GPS and GSM systems. So that an ambulance may be arranged in no time. The basic equipment present inside most of the ambulances are emergency medical kit, two types of stretchers, defibrillator, portable oxygen cylinder, glucometer, ECG, and ventilator. Our system aims at collecting and sending the patient's information when brought into the ambulance to the hospital prior to the ambulance reaching the hospital so that the suitable arrangements can be made at the hospital for better and efficient treatment of the patient. Our prototype of health monitoring system (HMS) for ambulance will continuously monitor the patient's vitals or health parameters (like Heartbeat, SPO2 level, Temperature, ECG, Glucose etc.,) using various sensors, and transmit the data through 'Mobile App' to the nearest hospital where Doctor can examine patient's condition online and set proper conditions in advance, while suggesting emergency treatment to the helper present in ambulance. To know the location of the ambulance carrying the patient we have used GPS, so if doctor have suspicions about the survival of patient, he/she can administer the helper present in the ambulance to do the necessary treatment to keep patient's vitals stable till he/she reaches the hospital. The system takes values from sensors and sends that data in real time to the google Firebase from where the data can be accessed by the doctor easily in mobile app with negligible latency.

Group Members: 17ES08
17ES76
17ES64

Supervisor: Engr. Shakila Memon
Co- Supervisor: Engr. Khuhed Memon



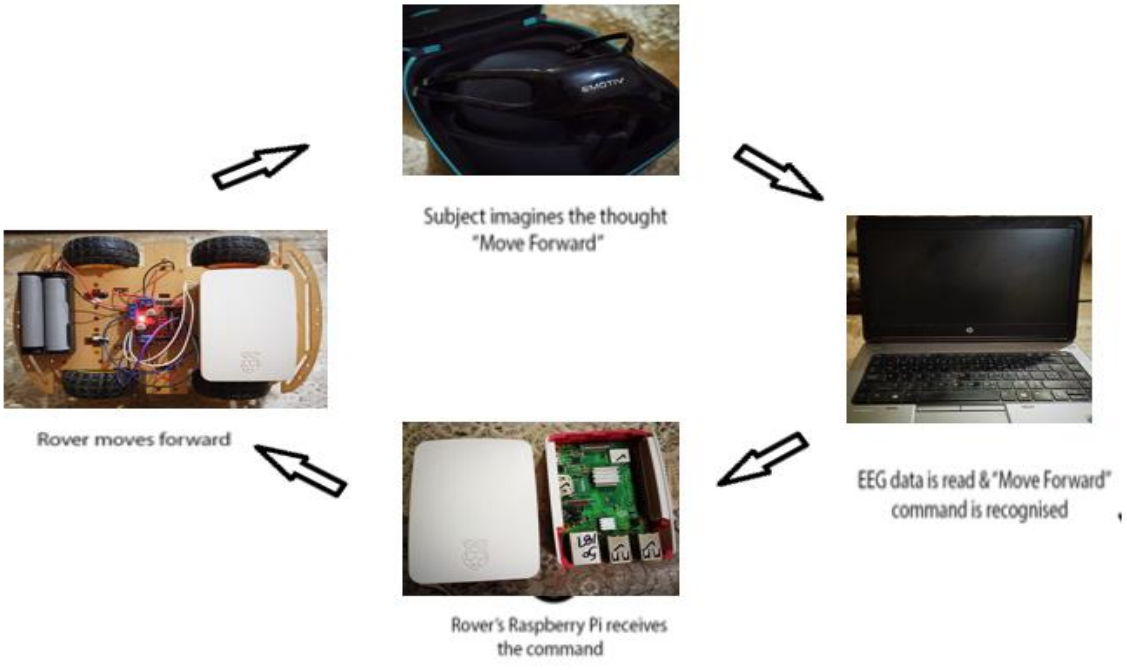
Human Car Interface (HCI) using Brain Activity

Abstract:

Nowadays, the world becomes more advanced in technology, and very complicated tasks, operations can be executed by different modern techniques. Still there is a deficiency of assistance in the mobility of the handicapped population in the present age, despite superior technology that can execute complex jobs. Numerous solutions have been proposed to overcome this issue, one of them is the use of bio-electronic devices. These devices establish interference between the human body and computers using bio-signals. One of them is EEG (Electroencephalogram) device that detects electrical activity in your brain using electrodes. Our project aims to develop an embedded system to control a toy car using electrical activity detected from brain. We accomplished this using an EEG device, which took humanoid brain signals and transmit them to the car, causing it to drive in all four directions (left, right forward and backward). This technique is non-invasive, portable. We have used Emotiv Insight for BCI (brain-computer interface), that boast advanced electronics that are fully optimized to produce clean and amplified signal that can be used to control the car. Our applied method is effective, and the result demonstrate that the car can easily be controlled with high accuracy while being less stressful on the user.

Group Members: 17ES37
17ES39
17ES61

Supervisor: Engr. Mehboob Khuwaja
External Co-supervisor: Dr. Munsif Jatoi



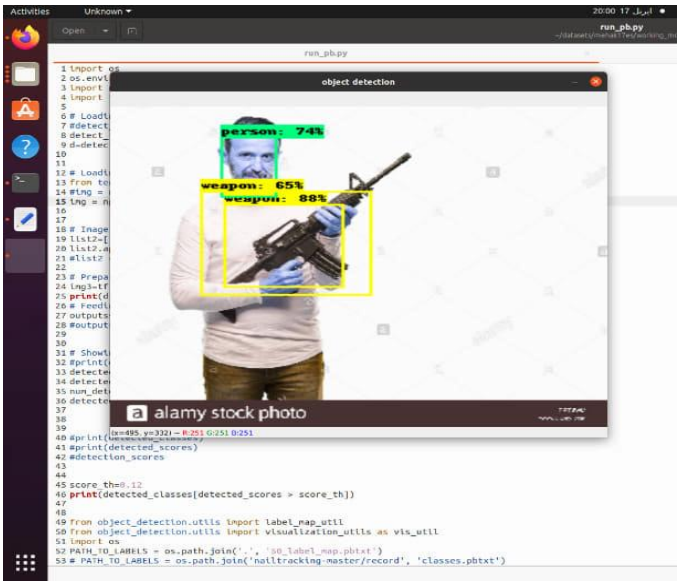
AI Based Warfield Arm Robot Using Machine Learning

Abstract

The primary intentions behind the undertaking are to reconnaissance/spy on war places, data from the foes line locales, this robot has a camera to discover and observe the bombs and people in the surrounding, an object detection trained system to detect an object at some range, a face recognition algorithm trained to recognize the foes and a gun attached to it for target killing the person after recognition. It accommodates and saves the existence of warriors and people groups. The robot which creates for the safeguard office will help people and save our lives. Because we will be knowing the foes data before the adversaries get carried out. The fundamental benefit of this operative robot is a camera for showing the current footage and detecting the object, recognizing the objects and person and shooting the target on the spot through a gun. The camera keeps monitoring the image or recordings and sends the data to the controller if it detects an object, if the detected object is weapon it buzzers an alarm, and again starts monitoring and if it is a person recognized it compares that person for similarity ratio according to the Siamese if it gets the person similar it shoots the person on the spot. These robots are exceptionally valuable these days and the future. It diminishes the work and hazard of people groups and helps them from various perspectives. These government operative robots are controlled through versatile options. We have used machine learning algorithms for its functionating on jetson nano controller for making it more efficient in processing speed and working. This Framework is simply a portable robot decreasing the human lives risk by performing such tasks which are being performed by soldiers currently.

Group Member: 17ES13
17ES57
17ES50

Supervisor: Engr. Tufail Waseer
Co-supervisor: Engr. Komal Khuwaja



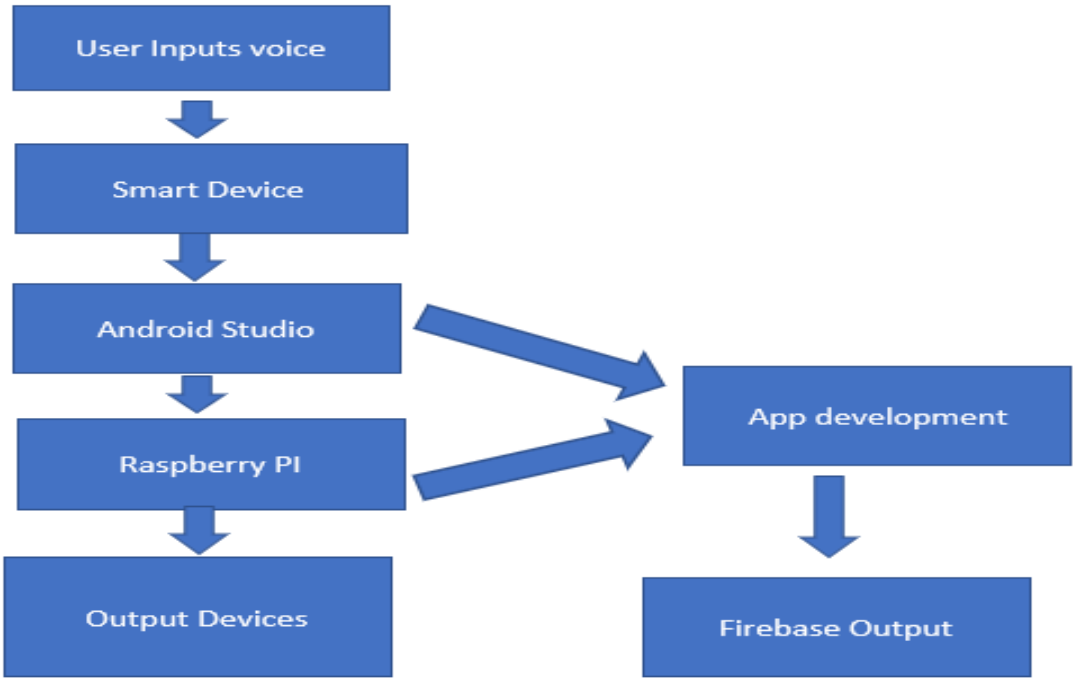
Multi Language Voice-Controlled IOT Based Home Automation System and Smart Billing

Abstract:

With the advent of technology, the lifestyle of people in the world is changing, additionally with the emergence of Internet of things, it adds more to the comforts of mankind. However, people are still turning their devices on by moving around the home and activating the switch manually, and most of the people being unconscious of the consumption and operation of devices. In this area of energy crisis, we are being irresponsible. With that much of technology around, dream of setting up the Home Automation system comes true. Hence, putting an end to miserable life of manually switching and traditional billing system by coming up with the idea of controlling home appliances remotely without moving from their position. Home automation system with the aid of Internet Of things (IOT) will accept voice commands through Google Assistant (API) in multiple languages such as English and Urdu, additionally if in case of absence of Android Device, Consumers can make the use of User Interface (UI) designed by Android Software Development Kit as well to facilitate themselves in controlling the home appliances to keep an eye on operation and statistical parameters of device in home, the proposed system is supposed to keep the track of consumption of power and timings for which it has remained active as well by the aid of relational database.

Group Members: 17ES66
17ES32
17ES78

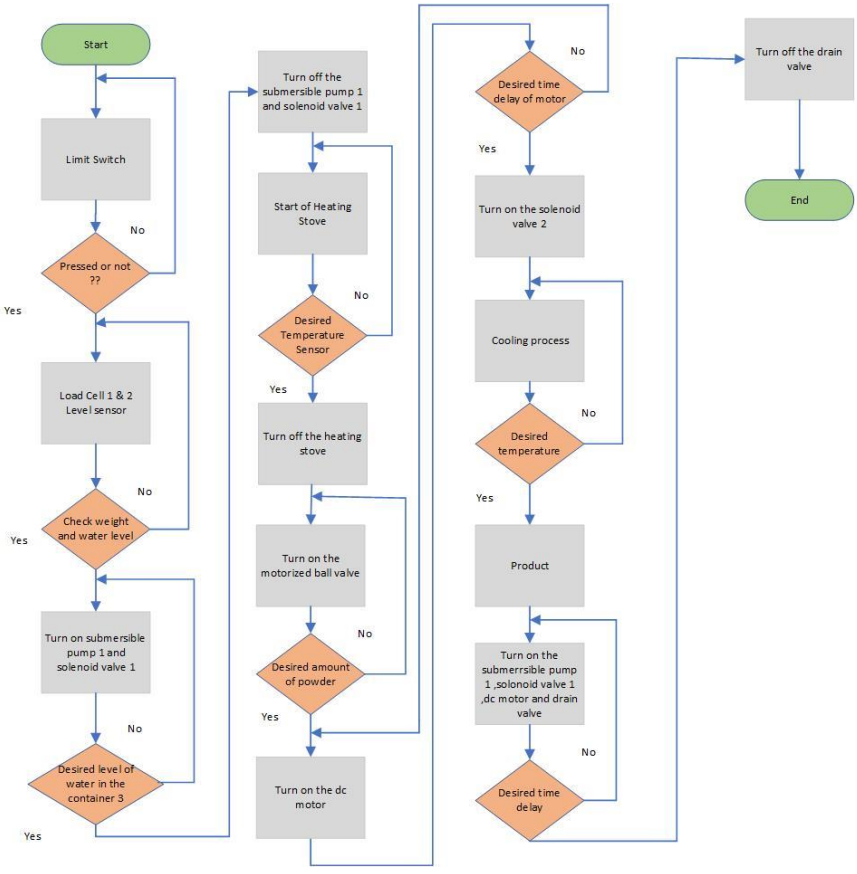
Supervisor: Prof. Dr. Wajiha Shah



Design and Implementation of Automatic Filling and Mixing System

Abstract

This research paper is intended to design, monitor, and implement an automatically mixing and filling mechanism in any industrial process. **Methods/Statistical Analysis:** The prototype presented involves a process of filling the different quantities (water and jelly powder) in the main tank and then mixing different quantities and that system is automated through a very reliable industry controller that is PLC. To operate, monitor, and control the different parameters of the system locally or remotely Human-machine Interface (HMI) is used as part of SCADA. The prototype designed gives a simple controlling & monitoring i.e., data acquisition of liquid level, Temperature Level, and weight of quantities with the help of PLCS71200. **Findings:** The mechanical design system is initially built to support a large number of regulating parameters; additionally, a console panel is built to manually operate and indicate the condition of actuators. PLC interfacing and programming with electrical components (level detector circuit, temperature sensor, loadcell, water pump, DC Motor, heater, solenoid valve, and so on) is completed at the last stage to achieve an efficient and rapid automatic process. The hardware prototype is embedded with several electronic and electrical devices such as sensors, pumps, motors, valves, heater, and the software (TIA Portal V15.1 to program the PLC s7-1200). It directly interacts with devices and more through HMI software using Ethernet. The final designed system is verified and validated with an actual solution, and it was discovered that this design provides accuracy, better efficiency, and high production in less time than a manual system, more flexibility, timesaving, and user friendly. **Applications:** The applications can be of in homes, restaurants any other places where filling and mixings take part just like in a jelly product, used as food. **Conclusion:** Error-free mechanism, high productivity in less time, and quick actuation make it useful for a variety of industrial application manufacturing products deal with control and monitoring mechanisms, such as in sugar mills, food factories, and milk factories.



Group Members: 17ES27
17ES51
17ES52

Supervisor: Dr. Irfan Ahmed Halepoto

IOT based Greenhouse Monitoring and Controlling

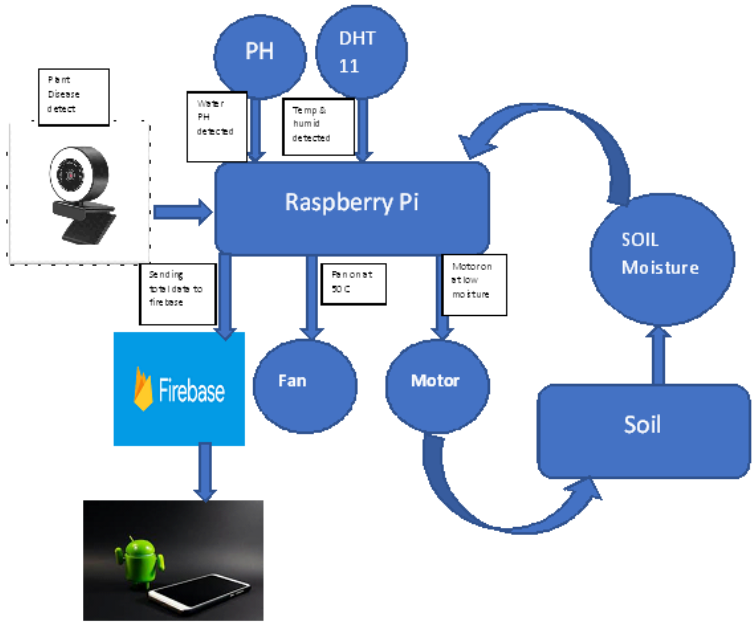
Abstract

The Population of our country is increasing at an alarming rate. Similarly, the demand of Agricultural crops is also growing rapidly. Indubitably, agriculture is also backbone of our country's economy. On the other hand, Pakistan is third the most water scarce country due to inappropriate cropping methods in agriculture sector. Therefore, it requires the most efficient cropping patterns so that it can be enhanced food production to meet demands of country's demands. The production of crops is mainly affected the yielding of crops due to plant diseases and adverse impacts of climate change. Therefore, "IOT based Greenhouse Monitoring and Controlling" automation will be conducive for agriculture and so that it can monitor and control the environmental parameters and can maximize the yielding of crop production. The production of crops is mainly affected the yielding of crops due to plant diseases and adverse impacts of climate change.

Previously, farmers were using conventional methods to predict random environmental parameters for monitoring the temperature, humidity, moisture, and Ph of soil whereas cropping the crops were manually performed in which most of water is being wasted through water pump losses which caused discomfort to the farmers, and it creates complexity and time consumption a lot as they are bound to visit Greenhouse every day manually. Moreover, it became complex to detect plant diseases at the early stages. Hence, it minimized the production of crops. IOT based green house is designed to monitor, control and cotton crop disease detection. For instance, environmental parameters such as humidity, moisture, temperature, and Ph of soil in the green house. These environmental parameters will be monitored real time data and will be displayed on Android Application. However, controlling actuators including cooling fan, exhausting fan, water pump and light will be automatically controlled by Raspberry pi an accordance with threshold values meanwhile manually it will be controlled with the help of android application. Additionally, cotton crop disease detection will be performed along with displaying disease on Android application.

Group Member: 17ES46
17ES42
17ES40

Supervisor: Engr. Komal Khuwaja
Co-supervisor: Engr. Shoaib Khaskheli



Interactive Windshield Head-Up-Display for Automotive

Abstract:

An automotive head-up display (HUD) is a display medium which provides the digital information in-front of the user or driver without causing any deviation from their direct view. The early head-up-displays were primarily developed for military aviation to project flight information in front of the pilot. However, with the recent development in optics, electronics and multimedia applications, the HUD have found its way into variety of applications including automotive interactive information systems. In this project, we present a high luminant and transparent interactive HUD display enabled by the micro-structured retroreflective surface. The high brightness is supported by exploiting the narrow angle scattering property of the retroreflective surfaces while the transparency is achieved by using a transparent glass screen at 45 degrees. The interaction with the displayed content is provided by using leap motion sensor. The interactive user interface is developed in Unity3D. Our experimental setup is demonstrated using the commercial retroreflective fabric and DLP multimedia projector. The developed system is tested in a regular car in outdoor settings. Our results high perceived brightness of the display within the viewing angle of ±10 degrees. Transmission efficiency of the developed prototype was >60%.

Group Members: 17ES15
17ES67
17ES49

Supervisor: Dr. Shoaib Rehman Soomro

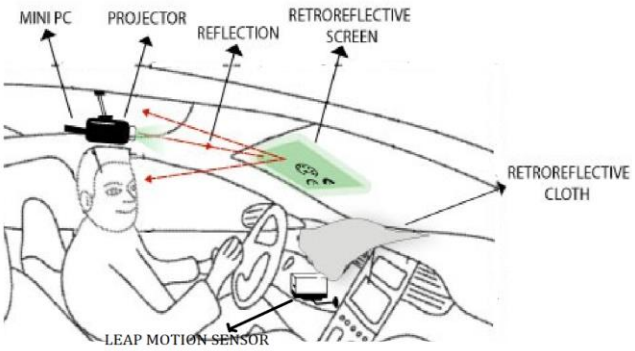


Figure 1: Conceptual Design of system

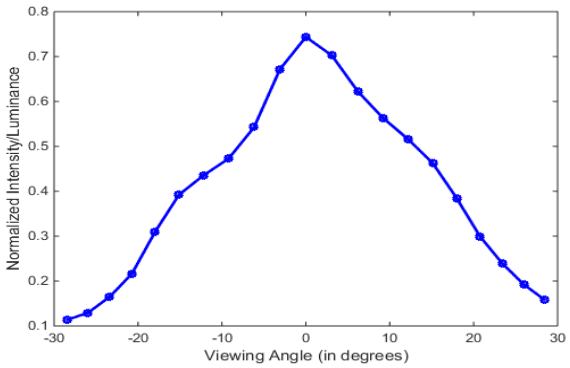


Figure 2: Graph of viewing angle of system

3-Dimensional Augmented Reality Capture and Display System

Abstract:

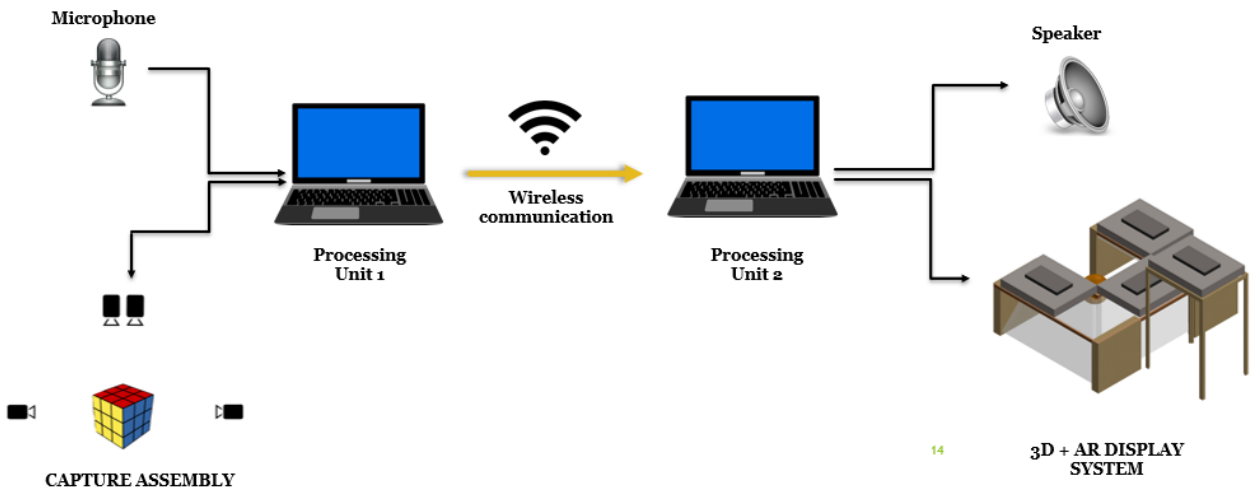
Augmented Reality (AR) is one of the emerging techniques due to the nature of three-dimensional vision being more involving and interactive for any individual. The AR systems are demonstrated for variety of use scenarios and a considerable work is done in this field to provide the AR capture and display systems of high optical quality. However, the indigenous development of AR systems is very limited in Pakistan due to higher costs associated with the optics of such systems.

In this project, we propose a low-cost integrated 3D augmented reality system made by the locally available components with the features of both 3D image capture and Multiview 3D display. The proposed system allows creation of environment of an observer/user that can help to view and analyze any real object/person standing at the remote place. The display sub-system provides three different views of the scene/object including front stereo-3D view and two side-views. A semi-reflective mirror based optical setup is developed to provide the notion of see-through display to demonstrate AR. On the other hand, the capture subsystem consists of four-camera capturing the front stereo-views and two side-views. The capture and display modules placed at two different physical locations are further connected through internet.

The display is tested for different viewing configurations, and different display parameters, such as viewing angle, polarization maintainability, stereo crosstalk, brightness equalization, frame rate and reflection, transmission and loss of light through the semi-reflective screen. The reflection of light towards the viewer was found to be 54.6% while 35.1% of the light passed through the semi-reflective mirror and the remaining 10.3% of light was lost. The stereo crosstalk was negligible (less than 5%) in 3D front view. The frame rates were good at lower resolutions of the transmitted frame but decreased as the resolution increased. The viewing angle was stable at ±20˚from the center of the display.

Group Member: 17ES24
17ES70
17ES62

Supervisor: Dr. Shoaib Rehman Soomro
Co-Supervisor: Engr. Khurram Shaikh



Deep Learning based multi-fault detection system for 3-Phase induction motor

Abstract:

Three phase Induction Motors (IMs) are working in the various types of economic fields such as machine tools, petrochemicals facilities, textile mills, power plants. IMs are used in various practices due to their simple structure, low prices, and their versatility. However, large usage of three-phase induction motors without maintenance causes unexpected failure. Which ultimately lead to major failure, economical loss, and even threat to human safety. One of the major failures in IMs is the bearing fault which happens because of less lubrication of bearing, improper design of bearing or default in manufacturing which causes tragic damage. Another major fault is broken rotor bar (BRB) which produces air-gap field in rotor. To resolve these issues this project proposes a condition monitoring system that can effectively diagnose (BRB) fault in three phase induction motor. The proposed system extracts the features using non-invasive current sensors which are connected with myRIO board. The data acquisition system (DAQ) is designed using myRIO and LabVIEW and data stored in CSV files. The organized dataset is fed to the Deep Learning (DL) model, the model train itself using the data and finally the real-time data is used to test the models and classify whether the motor is induced with (BRB) fault or not. The myRIO board provides faster data processing as it is almost ten times faster than the standard micro-controllers and microprocessor owing to FPGA capabilities in it. DL has been in limelight owing to its capabilities such as high accuracy, upgradability, and feature learning even from raw input data. This proposed system provides effective and non-invasive fault detection system of IMs with high performance owing to DL algorithms.

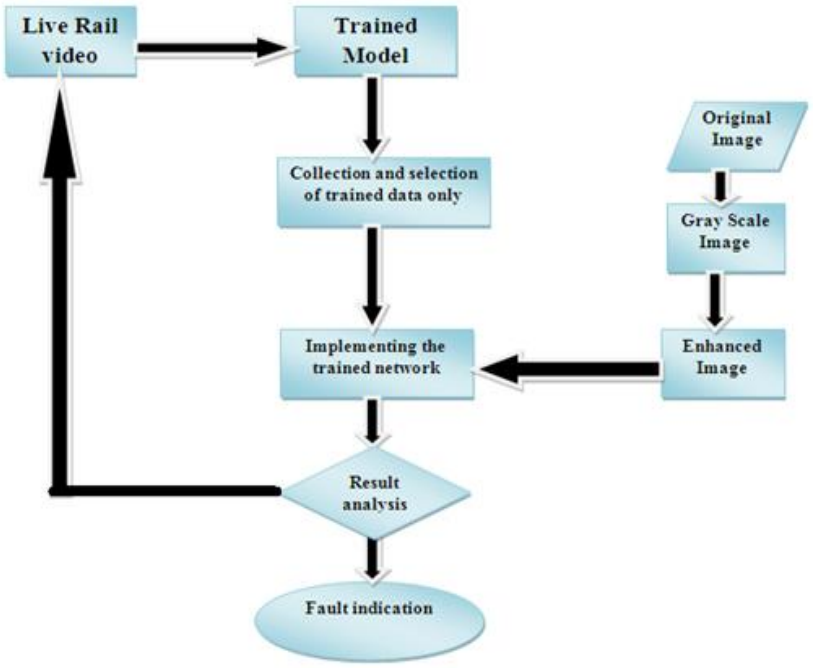
Group Members: 17ES05
17ES69
17ES73

Supervisor: Prof. Dr. Bhawani Shankar Chowdhry
Co-Supervisor: Engr. Dileep Kumar Soother

Development of Binary Classifier for Railway Track Surface Faults Detection Using Solar Powered Vehicle

Abstract:

Transportation is a crucial feature of modern society because it improves mobility, which seems to be a leading determinant of a society's success. Rail transportation, like all other modes of transportation, has gained importance over the years. Railways are by far the most widespread mode of transportation because they are speedy and reliable. It is the cornerstone of any community. In the year 2019, over 100 train accidents were caused in Pakistan due to a lack of maintenance. Train derailment, track mechanical failure, such as broken rails, are most likely causes for railway accidents, which are frequently caused due to lack of railway track condition monitoring. Track surface defects, such as squats, could be recognized, serving as a stimulant for the track to fracture and eventually break. Traditional visual inspection methodologies are in-efficient for recognizing squats hence more modern state-of-the-art artificial intelligence algorithms are required for it. With the development of a novel frame for holding a raspberry pi V2 camera mounted on a track recording vehicle (TRV), which negates the luminous impact and image cropping problems since it only concentrates on the railway track, the research facilitates efficient real-time fault detection in railway tracks. The camera is interfaced with Raspberry pi and trained with machine learning techniques i.e., the binary classifier (logistic regression) for fault detection. Binary Classifier simultaneously solves the problem of image classification and recognition which enhances its efficiency for fault analysis in railway tracks. Moreover, the binary classifier also utilizes an image processing technique i.e., canny edge detection (eliminates the dark field luminous effect in images) which makes the training process credible and shortly. Dataset consists of two categories titled test and train. Train and test folders consist of 120 and 28 images respectively and there are two classes in both folders. Each class comprises images of two tags i.e., healthy, and faulty. Every image is bound to have a pixel of 200x200 to undervalue the training time of the algorithm. Binary Classifier attains a precision of 89% for fault detection in the railroad. The outcomes exhibit that the used strategy for fault detection is efficient, valid, and precise than formerly utilized strategies like visual inspection methods.



Group Members: 17ES03
17ES33

Supervisor: Prof. Dr. Bhawani Shankar Chowdhry
Co-Supervisor: Engr. Ali Akber Shah

Design and Progression Analysis of Neuro Rehabilitation System Using Machine Learning

Abstract:

Neuro rehabilitation is a complex medical process designed to help to treat patients with neurological diseases. It aims to increase function, reduce debilitating symptoms, and improve a patient's quality of life. The incidence of many neurologic diseases is rising partly. As a result, more survivors are emerging with most exhibiting life altering impairments that require neurorehabilitation**.** Moreover, Physiotherapy treatment is expensive plus traveling and frequent visits to the physiotherapy centers and hospitals are not feasible for everyone and time consuming too. In this revolutionary era of technology, most of the Doctors are still relying on Manual Muscle Testing (MMT) or manual instruments like goniometer. Therefore, we have designed the Neuro Rehabilitation System comprising of wearable intelligent device which is home convenient, less complex, less costly and less time consuming. This home-based automated Neuro Rehabilitation system utilizes two sensors namely EMG and IMU to collect the data of patients and classify set of exercises by implementing machine learning model to assess patient task-oriented rehabilitation exercises and predicts how each set of exercise can be performed with certain accuracy. Moreover, this designed ML model is deployed on microcontroller by implementing TinyML which has enabled the processing of ML algorithm on ultra-Low-Power (ULP~ 1mW) IoT devices, thus allowed us to create smart, intelligent and low-cost embedded neuro rehabilitation device for medical application. Moreover, this device also measures the parameters i.e Range of Motion (ROM), Muscle Strength and time required to perform certain exercise by patients. To make exercises more fun, we have also developed 3D model for human arm which displays the above parameters in 3D environment.

Group Members: 17ES31
17ES45
17ES65

Supervisor: Dr. Attiya Baqai (Associate Professor)
External Co Supervisor: Dr. Tahira Nihal (Bhittai Institute, Mirpurkhas)

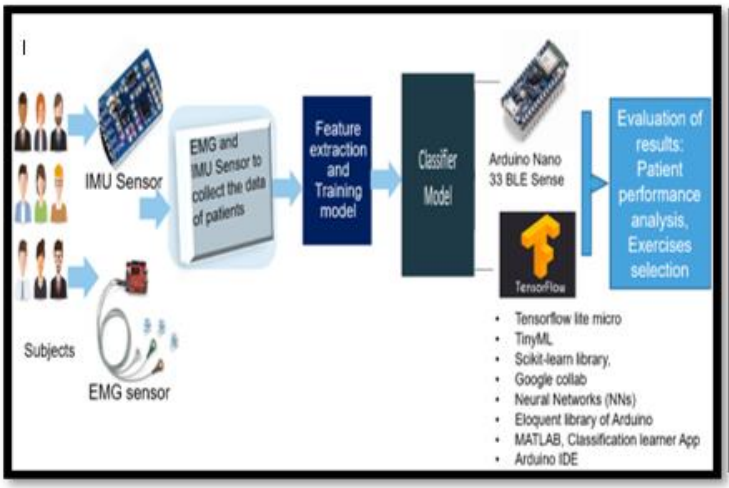


Fig 1. Project Methodology

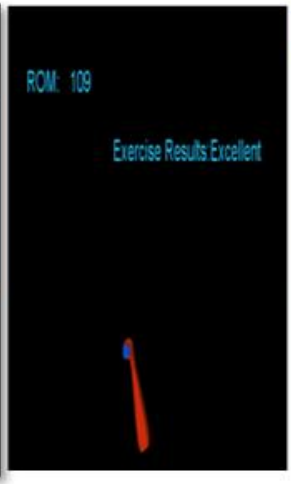


Fig 2. 3D analysis of exercises performed.

Fig 3. Designed Bluetooth App with output.

Design and Development of Wheeled Type Pipeline Inspection Robot

Abstract:

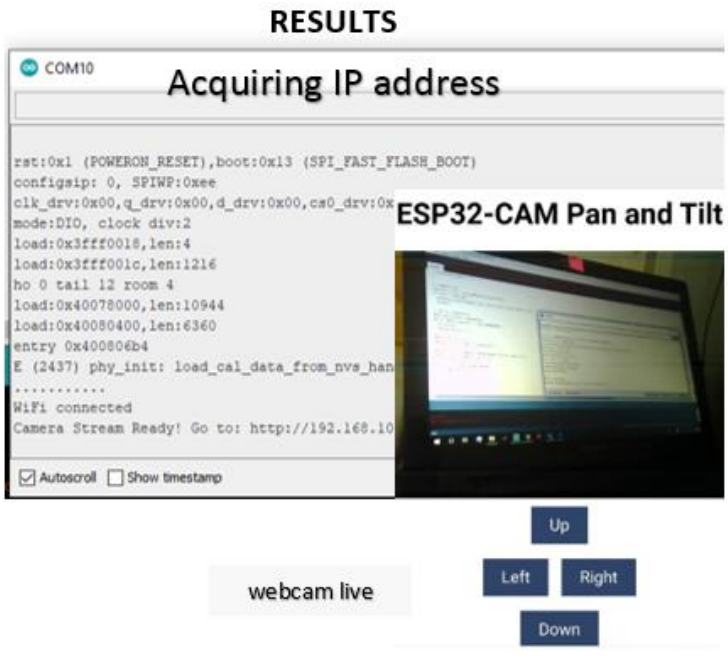
This project proposes the design and development of a wheeled type pipeline inspection robot which is used to check interior condition of pipelines and locate damage in places invisible or inaccessible to humans. It helps determine whether pipelines are in working condition or not. The inspection is a maintenance process which is required at industries for safe and secure production or transport of goods and avoid business downtime or industrial disaster due to undetected damage in the pipelines

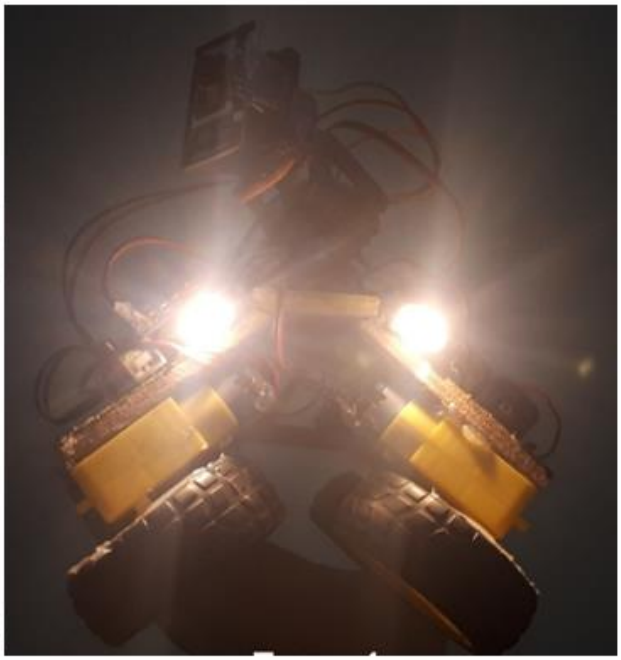
There are many types of wired and wireless pipeline inspection robots such as a wall-pressed type robot, a magnetic wheeled type robot, a caterpillar style legged robot and a wheeled type robot. For this project a wheeled type wireless design is chosen for its versatile motion and low friction.

This project aims towards developing a wireless wheeled prototype model for a minimum of 9-12 inches diameter pipe capable of horizontal, sharp "T" turn and low incline movements which will provide real time feedback of a pipeline interior in two dimensions from 0-180 degrees along X and Y axis using a camera sensor. Two 1.1w LEDs of 80lm are used for luminescence inside the pipes and the robot is controlled using an android app with the results being observed over Wi-Fi using acquired IP address.

Group Members: 17ES25
17ES71
17ES63

Supervisor: Prof. Dr. Arbab Nighat
Co-Supervisor: Engr. Kehkashan Memon





Smart Concrete Strength Measurement Device

Abstract:

The compressive strength is an overall measure of concrete quality. Generally, UTM (Universal Testing Machine) is used to find the strength of concrete. For that standard cubes or cylinder are cast and tested at different curing ages (i.e., 7, 14, 28, 90 days). This is a time-consuming process and wastes lots of materials and produces environmental pollution. Therefore, urgent need for a smart system that can reduce material wastage and give reliable results based on machine learning. This project aims to design the raspberry pi based smart device that can measure the compressive strength of concrete mix based on ANN (Artificial Neural Network). This system is able to measure the fixed compressive strength of concrete by varying different proportions of its ingredients (i.e. cement, coarse aggregates fine aggregates, and water). For that, historical concrete mix data from the Concrete and Structural Laboratory of Mehran UET Jamshoro was collected and sorted out as per ANN requirements. The ANN-based algorithm was trained, tested, and validated on historical data with high accuracy. Finally, a hardware prototype device (Raspberry pi with keypad and LCD) in which trained data and algorithm was implemented. The system was connected to a cloud storage network to gather data and have easy accessibility. This device will help the construction industry to make a quick decision about projects and save material wastage.

Group Member: 17ES06
17ES10
17ES102

Supervisor: Engr. Bharat Lal
External Co-supervisors: Dr. Fareed Memon
Engr. Shankar Lal

Smart Wastewater Treatment Plant Using DCS

Abstract:

The world is suffering from an eminent water crisis. However, pure drinking water is the fundamental need of every human being. Besides, health of a human being is a major concern which directly linked to what we drink or eat. Subsequently, the demand of pure and safe drinking water is rising with passing days due to the shortage of clean water. Whereas, lack of water purification resources, especially in remote areas of Pakistan. Thus, we design a smart waste-water treatment plant such as removing contaminants from the drain water to produce cautious drinking water. The designed prototype works on Distributed control system that is a computerized control system utilized in a plant usually with many control loops, in which automated controllers are distributed all over the system to enhance the efficiency meanwhile minimizing human efforts. “Smart waste-water treatment plant using DCS”, is equipped with Arduino interfaced with LABVIEW, which controls and monitor the overall operation of the system. Particularly, water level in a specified tank and the flow rate of that water is monitored and measured respectively during run while, maintaining the quality (PH) of final product. The concept of DCS increases reliability, reduces maintenance and operational cost by localizing control functions near the process plant, with remote monitoring and supervision. This system can be implemented in small as well as large industries.

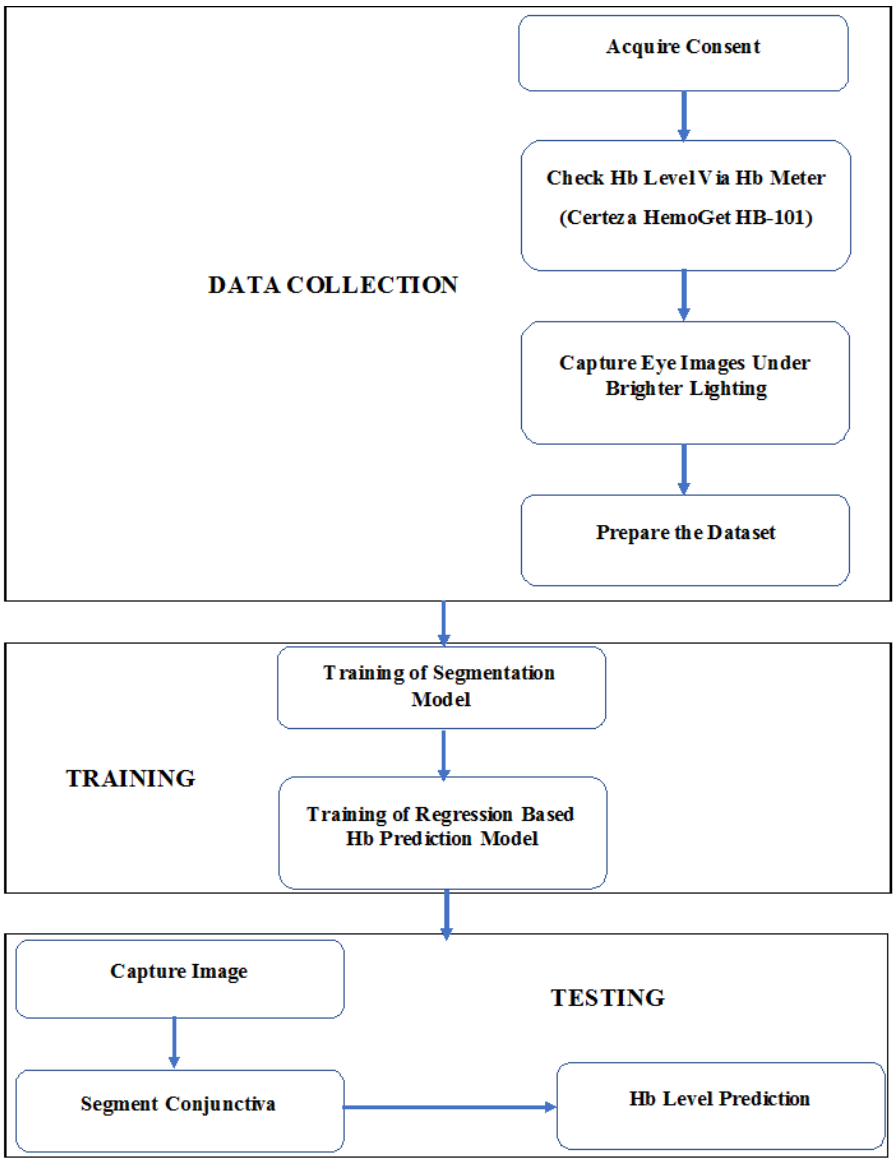
Group Members: 17ES55
17ES60
17ES54

Supervisor: Engr. Qudsia Memon
Co-Supervisor: Engr. Bharat Lal

Non-invasive method for Blood Hemoglobin Detection using Conjunctiva Images

Abstract:

The Hb (hemoglobin) is the main component of the blood. It is a protein in red blood cell which provide oxygen throughout the body. Its monetarizing is very important to know the physiological conditions. As low Hb level indicates anemia and high Hb level indicates polycythemia. Previously it is diagnosed by invasive method which is painful and risky for the anemic patient as he is already suffering from lack of blood. This project proposes non-intrusive method which is free of needle that gives comfort to the patient and help to avoid the spreading of serious diseases like HIV and AIDs that can be easily spread by the needle. This project introduces the segmentation-based Mask RCNN and regression model for the diagnosis of blood diseases. The segmentation-based Mask RCNN and regression model allows us to use more complex sets to extract many features in comparison with traditional approach. This project will result in a comfortable and portable point of care diagnostic tool through which on time identification of deficiency or efficiency of Hb level will be possible. This research work is done by segmentation of the conjunctiva region for non-invasive anemia detection applications using segmentation-based Mask RCNN and regression model.



Group Members: 17ES144
17ES106
17ES28

Supervisor: Engr. Sara Qadeer
External Co-Supervisor: Engr. Sanaullah Mehran Ujjan

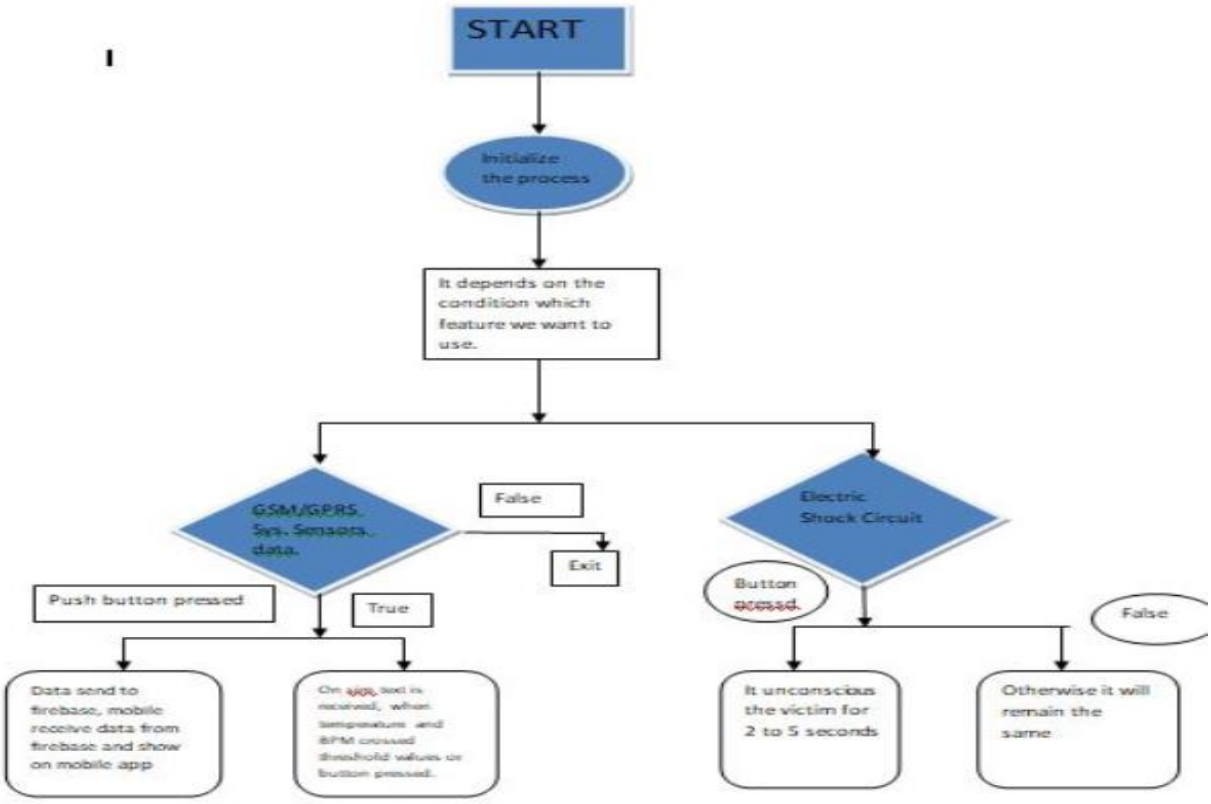
Design and Implementation of Smart Shoes for Security and Health Care Application

Abstract:

Now a day's human violation has been increased and peoples are facing security issues such as harassment, kidnapping, and other related insecurity problem, there is lack of electronic sensing system to protect and monitor human beings to overcome security problems. In this study, we have developed a smart sensing system in form of "Smart Shoes" that can be helpful to make them safe and secure. The designed system is integrated with some modules that can help to communicate and defend their selves in dangerous situations. The research work is divided into two sections *first* consist of a microcontroller (ESP 8266), GSM module (sim800I), GPS (NEO6M-V2), heartbeat (MAX30100), temperature sensor (DS18B20), and vibration sensor (SW-420) which is a trigger to communicate with Global System Communication (GSM) and Global positioning system (GPS) for mobile when a person is a dangerous situation. The second section; is designed for the defense oneself application by giving electric shocks to the attackers. These "Anti-harassment shoes" are designed and interfaced as a portable and wireless system that can be connected via a Wi-Fi hotspot to a mobile phone.

Group Members: 17ES20
17ES22
17ES38

Supervisor: Dr. Khalil ur Rehman Daayo
Co-supervisor: Engr Qurban Ali Memon



Virtual Reality Based Wireless Telepresence Platform

Abstract:

In this modern era of 21st century there are different ways of communication by means of electronics technology but still demand for interactive digital communication exists. In digital communication system from past till today we started journey from digital telephony to telepresence technology respectively. Now days the yearning for deep social interactive communication is possible through telepresence technology with aid of modern virtual reality approach. In this project design and development of virtual reality based wireless telepresence platform is proposed and a working prototype is designed which has comparable features related to DORA (Dexterous Observational Roving automation) telepresence platform, University of Pennsylvania. A wireless roving platform is designed to complete remote inspection demand, stereoscopic frame is obtained by using two cameras of same resolution which promote idea of VR technology, this kind of technique is used to achieve telepresence where instead of physical existence of user at remote location, the remote location itself is observed through sensory effects at the place where the user is located. Pan tilt mechanism is installed to provide two-degree freedom control of pitching and yawing movement for observing remote environment. As a telepresence robot this project has applications in remote inspection where the condition of location is not sufficient to visit physically such as contaminated building. A telepresence robot can be used to help an employee whose disability or location prevents from traveling, still have a physical presence in the office by means of virtual reality. A telepresence robot is beneficial in remote healthcare consultancy, visits patients, guide staff and confer with other medical practitioners. This project is highly encouraged in domain of security systems where physical guards can be replaced with telepresence robot.

Group Members: 17ES04
17ES58

Supervisor: Engr. Aamir Patoli
Co-Supervisor: Engr. Kamran Kazi

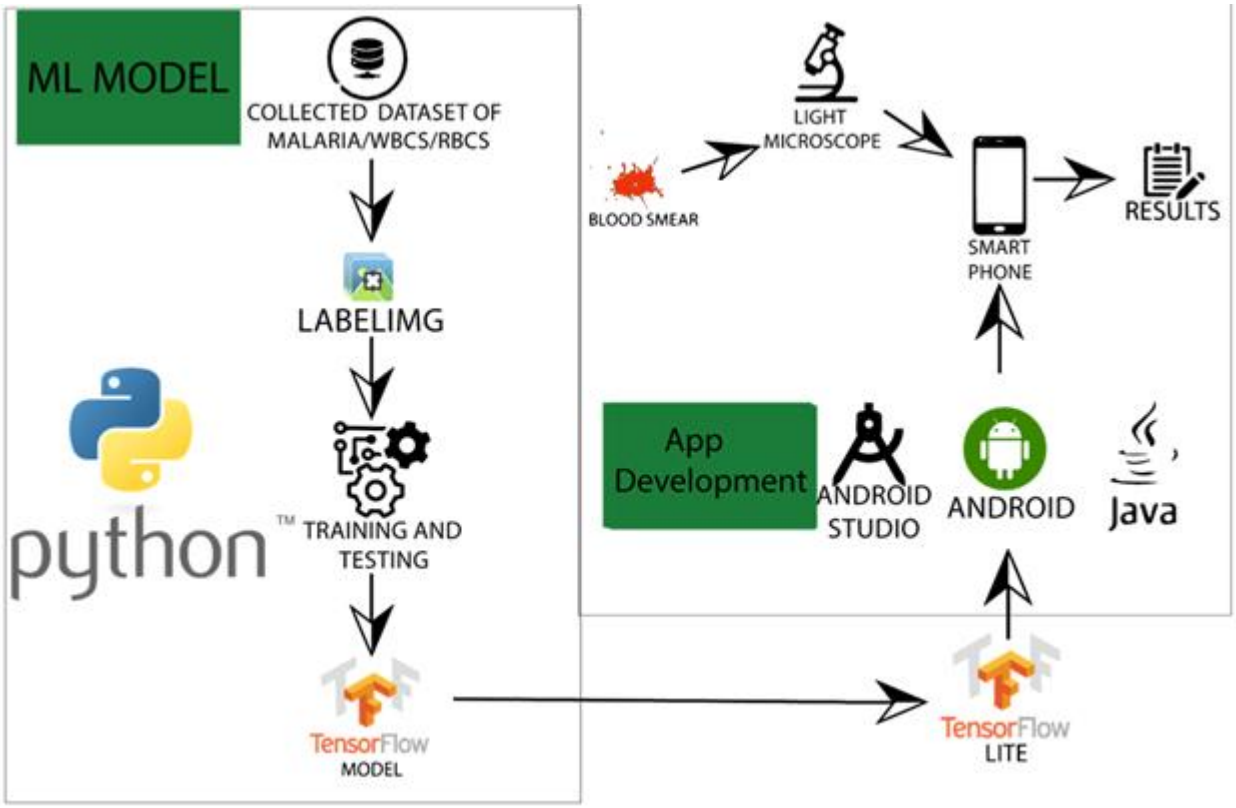
Development of an ML based Android App for disease detection using Blood Smear Slides

Abstract:

The advent of Artificial Intelligence has revolutionized every walk of life including Business, Health Care, Robotics, Education & gaming. The meticulous use of AI's capabilities to solve complex problems in the field of Medical Science can be of stupendous service to humanity. Precise, brisk & economical diagnosis of diseases can help save lives. In under-developed regions of the world, including Africa & Asia, Vector-borne diseases, Like Malaria, pose a very serious threat to human lives. In this research, have developed a standalone android application that works with a very economical portable microscope connected via micro-USB. A TENSORFLOW ML model is trained on a dataset of 400 Microscopic images of Infected blood slides. The model is converted into TENSORFLOW LITE version which is embedded within the app is capable of Malaria diagnosis in addition to providing RBCs, WBCs & Platelets count, from the blood slide's image captured using the microscope in real time. The inferences provided by the developed app require a fraction of second for computation, with adequate efficiency & extremely low cost. The average inference time on a smartphone, Google Pixel 3 with snapdragon 845 & 4GB of RAM was found to be ~235 milliseconds, with an average accuracy of 84.44%.

Group Members: 17ES59
17ES81
17ES53

Supervisor: Engr. Khuhed Memon
Co Supervisor: Engr. Komal Khuwaja
External Co Supervisor: Dr. Musab Khan



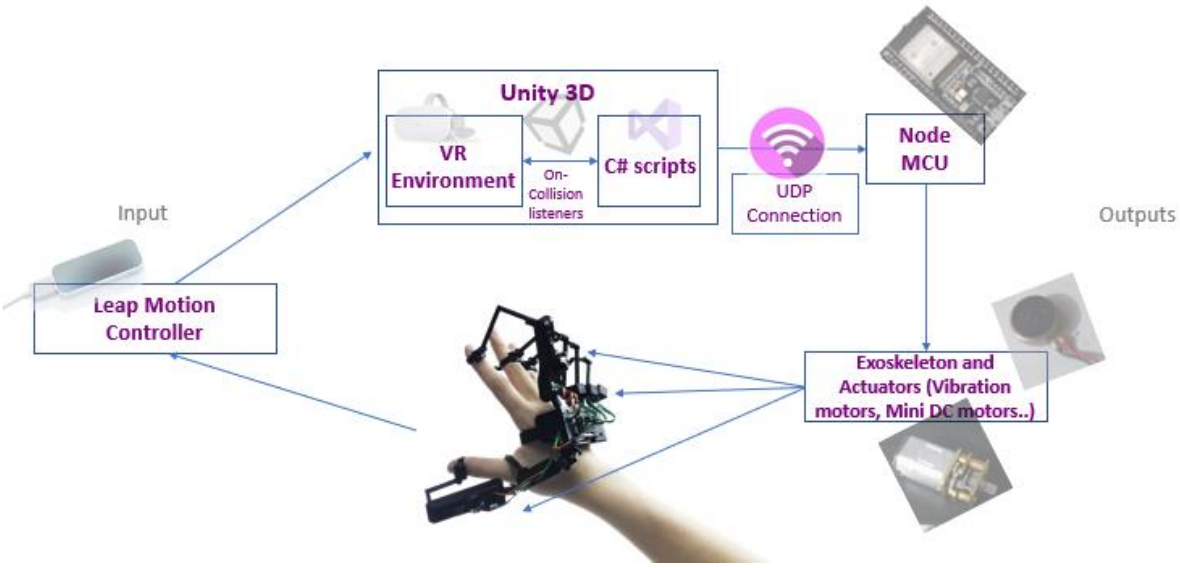
Haptic and Forced Feedback Enabled by Exo-Skeleton Based Glove for VR Applications

Abstract:

The immersive world of Virtual Reality is being used across the globe. Since the last decade, a lot of work has been done to improve the immersiveness of the virtual world by creating devices that give haptic and forced feedback to users that are quite like real-world feedbacks. Previously done work in this area mostly includes solutions that target either the haptic feedback or forced feedback. Some final products for attaining the said task are present in the market but they cost a lot. In this thesis, we have proposed a cost-effective exoskeleton-based glove that provides both feedbacks hence enriching the experience of VR applications. The dimensions of the glove are balanced with the optimal layout. Vibration motors are used to provide haptic feedback, that helps the user to feel and determine the texture of a virtual object. The exoskeleton is 3D printed with Polylactic Acid (PLA) filament, a very inexpensive and environmentally friendly material. It helps mimic the force that is exerted by objects on human fingers while grasping them, that is forced feedback. Hand engrossment in virtual reality is done by a Leap Motion controller, that provides real-time hand tracking. Whenever the users interact with a virtual object, the unity colliders send UDP packets to NodeMCU, that activate the corresponding actuators on preset configurations thus providing realistic feedback. The performance of the device is evaluated on a questionnaire that is filled by users after experiencing the immersiveness with and without the glove where it proves to be an effective Human-Computer Interface (HCI) for VR applications. However, there is still room for improvement.

Group Members: 17ES01
17ES82

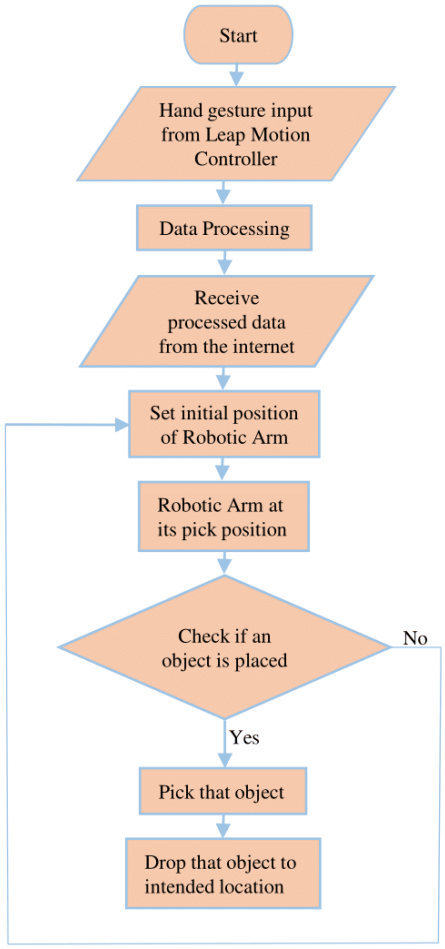
Supervisor: Engr. Khuhed Memon
Co-Supervisor: Engr. Burhan Aslam



Hand Gesture Controlled Robotic Arm

Abstract:

Robot plays an important role in making our lives easier and effortless. Robots not only work with more efficiency, accuracy, and precision but also, they can perform complex tasks which never have been done by human. Robotic arms have many applications in the sphere of space, military, agriculture, medical, and industry. The importance of this paper is to provide a relationship between human and machine through the interaction of human hand and robotic arm. This idea tends to the concept of the robotic arm, which is the same as the human hand, with more precise gestures. The arm consists of six degrees of freedom (DOF) and an end effector that can interact with the real world. The robotic arm structure adopts inverse kinematics and torque balance principle. Now the obligations for the controller arise and in the process they have been solved by the leap motion sensor which acquiring the data of elbow, wrist and finger movements and they are then directed wirelessly to the robotic arm to replicate the movements. As before work, robotic arm was controlled by the keypad or joystick which required a lot of practices and calculations to manipulate the robotic arm to reach its desired position and angle. The exploitation of the leap motion results in explicit acquiring for hand gestures and provides set of points. This innovation enables more perceptive six DOF control with an end effector. The results showed the reduction in the complexity approach and gain in control accuracy.



Group Members: 17ES41
17ES29
17ES30

Supervisor: Engr. Kamran Kazi
Co-Supervisor: Engr. Shoaib Khaskheli

Design and Implementation of Digital Incentive Spirometer for Monitoring Lungs Health Status

Abstract:

In a modern lifestyle, populated air adversely affected on human health that became cause of lung diseases. The obstructive pulmonary diseases Chronic Obstructive Pulmonary Disease (COPD) affect 600 million people all over the world. Obstructive diseases are serious global health problems due to Asthma almost 300 million individuals are affected. In a current situation, Covid-19 also affects the performance of lung condition. The respiratory problem must be diagnosed earlier because it became cause of higher death rate. A digital spirometer measures lung condition and breathing condition. Spirometry test is an effective way to diagnose various respiratory diseases and the subjects can identify their problem related to lungs by using lung parameters such as FEV1 (Forced Expiratory Volume in the first second), FVC (Forced Vital Capacity) and FEV1/FVC. The main objective of this project is to design and develop a spirometer which must be cost effective and functional. The proposed spirometer has four main constituents spirometer prototype, Circuitry, android phone, and android app. The spirometer prototype includes a differential pressure sensor and a venturi tube through which the patient blows. Air pressures convert into millivolt through pressure sensor which goes into microcontroller for the conversion. We programmed the microcontroller to obtain the lung parameters. The microcontroller shared this data via Wi-Fi to an android app. The calculated parameters can also be shared with the doctor. Our motivation behind designing this device is that in Pakistan spirometers are hardly locally made, and the digital spirometers are rarely used in many hospitals. Our effort is to make it locally as well as commercialize it after validation of our results.

Group Members: 17ES26
17ES18
17ES02

Supervisor: Dr. Attiya Baqai
Co- Supervisor: Engr. Burhan Aslam
External Co-Supervisor: Mr. Usama Bin Yar

Figure 2 Real Time Hardware

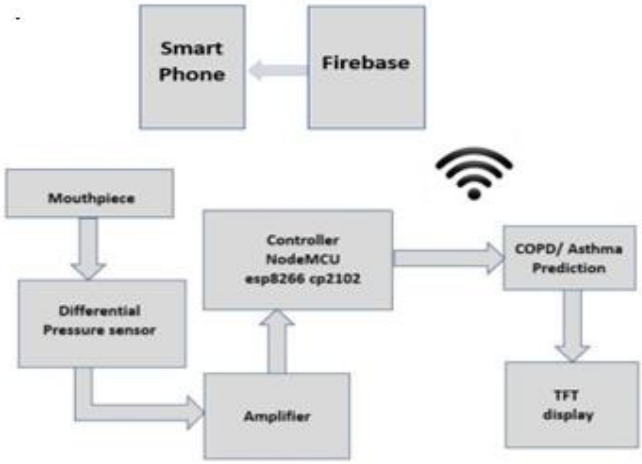


Figure 1 Digital Spirometer Design Block Diagram

Figure 3 ASHspiro App

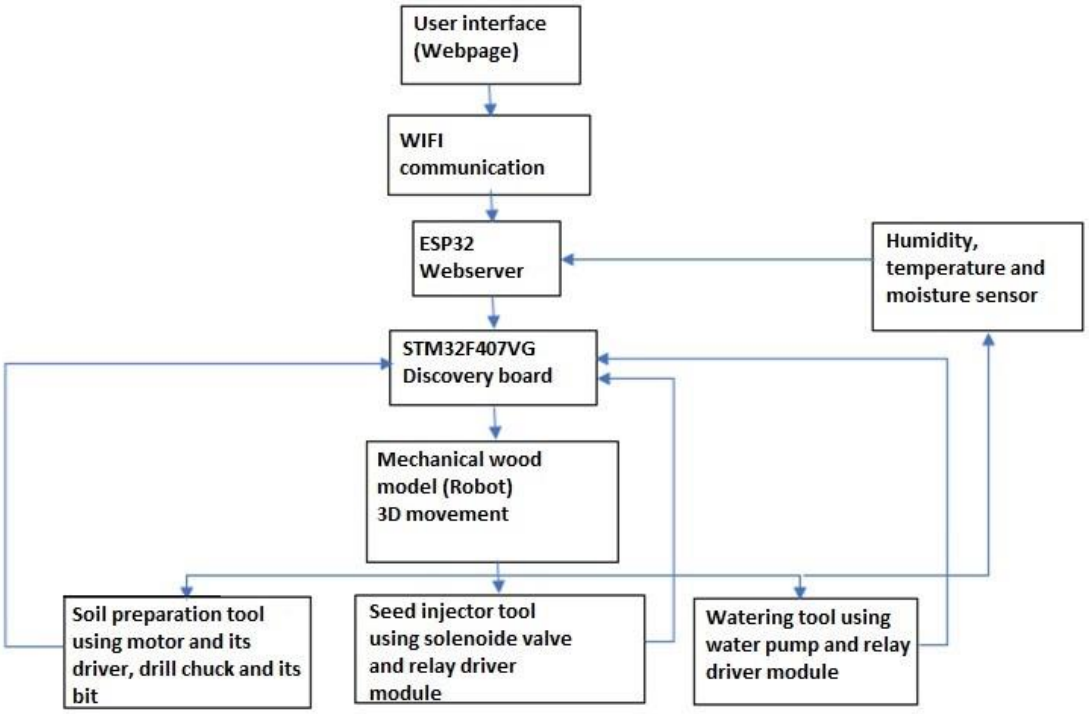
Autonomous Farming Robot

Abstract:

Pakistan's farming industry has significant problems, including low yields and inefficient use of essential resources such as water, fertilizer, and pesticides. In this era of modern technology, conventional methods of farming are unable to fulfil the agricultural demands in its respective time. Smart Farming is developing towards digitalized and data-driven operations, advanced decision support systems, smart analyses, and planning, among others. Agriculture is a perfect niche for innovations in the sphere of robotics. In this research microcontroller-based Autonomous Farming Robot is developed, that would allow farmers to use resources such as water and seeds more effectively and efficiently. Robot structure is modeled in AutoCAD software and has been constructed using wood and steel pipes. Further, different components like sensors, stepper motors and its drivers, DC motor and its driver, solenoid valve, water pump and relay module have been mounted on the robot structure and interfaced with ARM microcontroller. Three-dimensional movement inside the robot is added using stepper motor, so that robot can cover a large area and thus speed of work will be enhanced. In addition, a Web based Graphical User Interface (GUI) is designed using webserver controller, which would provide a graphical assistance to users so that they can monitor the sensor data and operate the robot wirelessly with their own desired strategy of plantation. The project has been tested using coriander seeds on the soil bed and from the experimental results, it is found that designed system can execute complex tasks such as precise distribution of seeds, soil bed preparation, watering and monitoring agricultural parameters like temperature, humidity, and moisture appropriately.

Group members: 17ES74
17ES108
17ES48

Supervisor: Dr. Farida Memon
Co-Supervisor: Engr. Bharat Lal



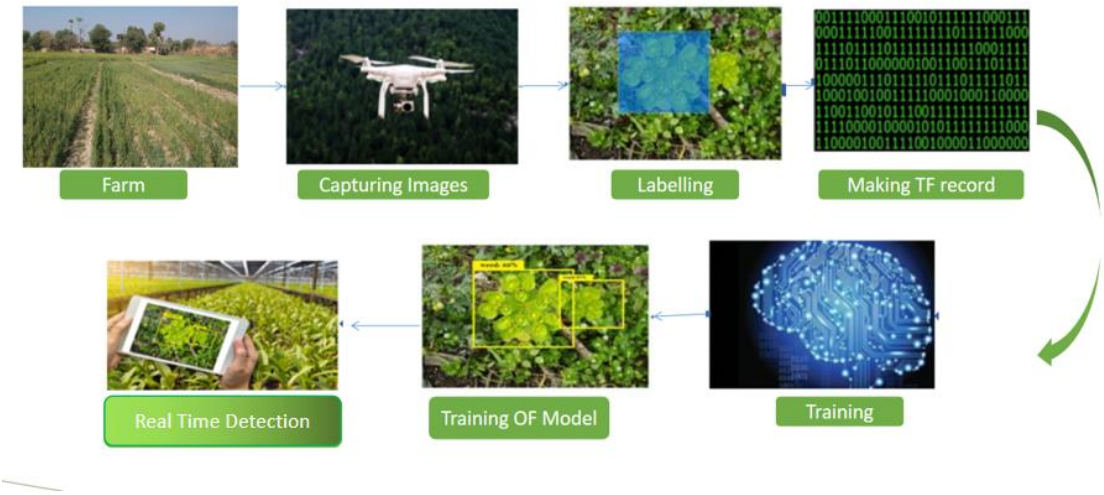
UAV (Unmanned Aerial Vehicle) based Weeds Detection Using Image Processing

Abstract:

This project presents the deep learning-based approach to detect the weeds present in wheat and cotton crop using UAV(Unmanned Aerial Vehicle).Weeds are the byproduct in any crop which consumes 80% of nutrient thus reducing the production of crop either it is wheat crop,cotton crop or any other so it is very much necessary to removing out those weeds earlier so that they did not harm the crop and first step to perform is to detect those weeds at right time so that we save other area to be weed and thus can save crop production.This project consists of a system, A drone which continuously monitors the whole field and which shows the live streaming of weed that is going to be detect.It will be advance method to detect the weeds .Three specific types of weeds are identified and selected to perform the supervised learning. The ssd_mobilenet_v2 model used to train the mode. The proposed system is efficient enough to detect the three types of weed Sun Spurge, Field bind weed, and Jungle Rice.

Group Members: 17ES09
17ES75
17ES77

Supervisor: Prof. Dr. Arbab Nighat
Co-Supervisor: Dr. Farida Memon
External Co-Supervisor: Dr. Fahad (Sindh Agriculture University)



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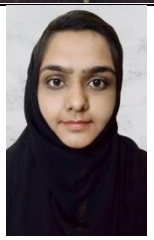
	Mr. Abdul Sami Memon 17ES37 17es37@students.muet.edu.pk		Ms. Munaza Zahoor 17ES38 17es38@students.muet.edu.pk
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