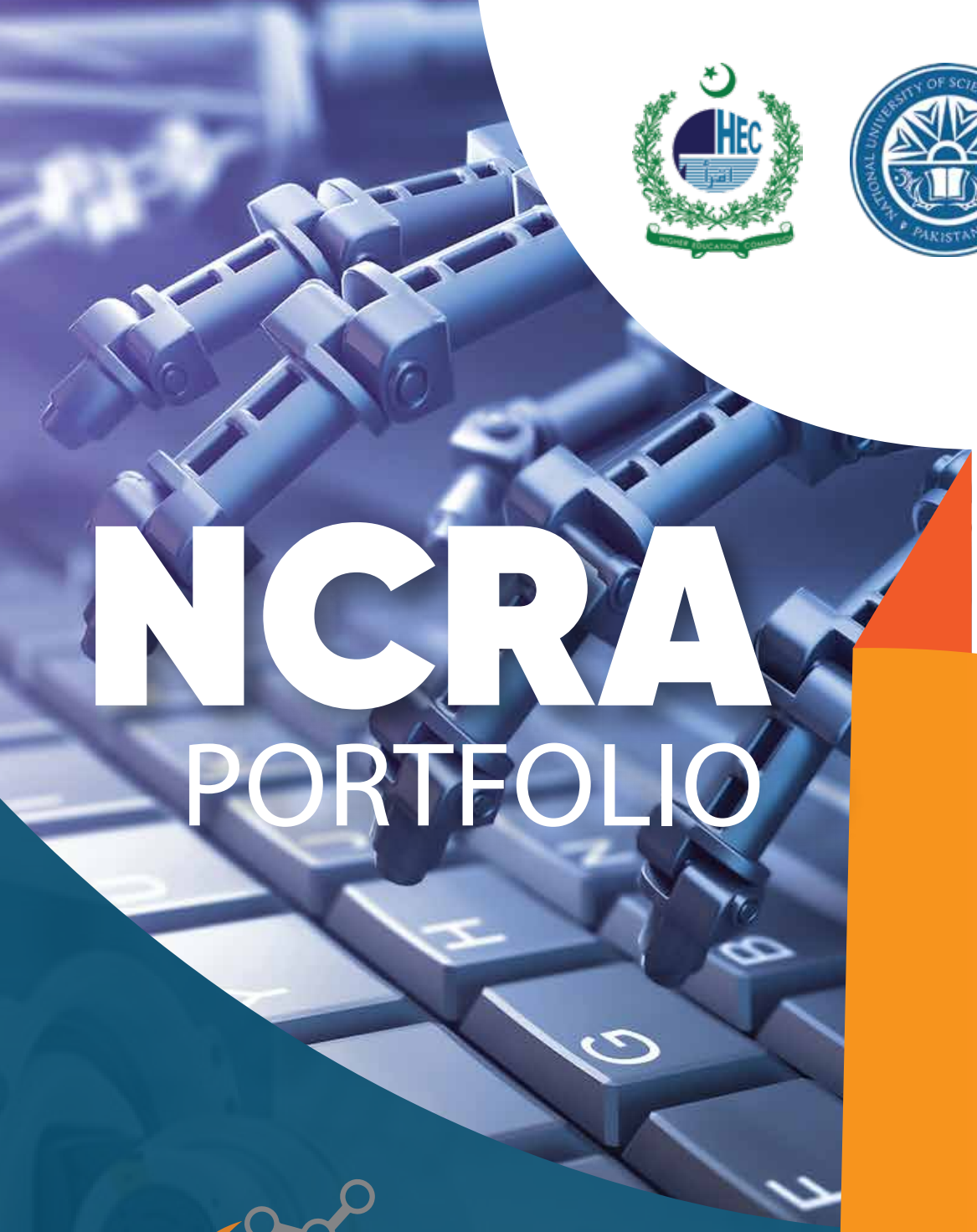


NCRA
PORTFOLIO

NCRA

NATIONAL CENTRE OF
ROBOTICS & AUTOMATION

NUST College of Electrical & Mechanical Engineering (E&ME), Rawalpindi
University of Engineering and Technology (UET), Lahore
University of Central Punjab (UCP), Lahore
Information Technology University (ITU), Lahore
Air University (AU), Islamabad
Lahore University of Management Sciences (LUMS), Lahore
National University of Emerging and Computer Sciences (FAST-NUCES), Islamabad
University of Engineering and Technology Taxila (UET), Taxila
NED University of Engineering and Technology (NEDUET), Karachi
Mehran University of Engineering and Technology (MUET), Jamshoro
University of Engineering and Technology Peshawar (UET) Peshawar
Balochistan University of IT, Engineering & Management Sciences (BUITEMS), Quetta
Mirpur University of Science and Technology (MUST), Mirpur, Azad Kashmir

NCRA PORTFOLIO

National Centre of Robotics & Automation

Message from Project Director

"It is indeed a great pleasure and pride for me to lead the National Centre of Robotics and Automation in the capacity of Central Director.

The world is on the verge of an exciting new era, with great new innovations in robotics and automation and NCRA is ready to make its contribution to Pakistan. We take pride in imagining the impossible and then looking for ways to make it possible. At NCRA researchers build the future by developing innovative technologies and conducting research that furthers the field of robotics & automation and its applications.

We realize that it's just the beginning and we have much more to explore and achieve. We are thankful to our stakeholders, who have entrusted us with ambitious projects and it's our privilege to work under the guidance of the Higher Education Commission Pakistan.

NCRA is working under the umbrella of a National Steering Committee of highly motivated and learned individuals, besides that we are blessed to have a Scientific and Industrial Advisory Board of leading international experts.

I am so proud of my team, colleagues, labs, start-ups, and industry leaders for putting in the work to transform Fiction into Fruition. We aim to transform tomorrow for the betterment of humankind!". As we begin the next phase of our work, we look forward to a future in which robotics & automation empowers local people and enhances industrial output. It's our way of contributing to society and creating a better tomorrow for Pakistan."

Dr. Umar Shahbaz Khan
Project Director NCRA
NUST College of E&ME

NCRA PORTFOLIO

National Centre of Robotics & Automation

Introduction

NCRA is a PSDP project worth 1.295 Bn under the umbrella of HEC. The National Centre of Robotics and Automation is a consortium of 11 labs over 13 Universities of Pakistan with its Centre headquarter at NUST College of E&ME. The Centre proposes to become the leading hub of visualize thinking, design, innovate, and commercialize to transfer knowledge to our economy in the area of Robotics and Automation, to facilitate the researchers in the field of Robotics and Automation, help them establish and grow Automation industry towards Industry 4.0 and seek solutions to the indigenous problems through Robotics and Automation.

Vision

Enabling highly skilled experts to ensue an ecosystem focused towards indigenous technology development using Robotics & Automation in pursuance of making Pakistan one of the technologically advanced nations of the world.

Mission

In fulfillment of NCRA vision, facilitate a consortium of experts across the country to promote Research and Development in the fields of Robotics and Automation. Subsequently, promoting Knowledge-Economy, achieving Technology Indigenization, developing highly skilled HR, and fulfilling SDGs.

Objectives

The Centre aspires four scientific objectives:

1. Build national capacity to carry out R&D in the emerging field of Robotics and Automation by solving at least a small number of 'hard' problems identified and mutually agreed by a scientific committee comprising local and international experts
2. Solve local problems and take solutions to market through technology commercialization and licensing
3. Provide high-value shared services to academia, startups and industrial partners
4. Human Resource Development in Robotics and Automation

Secretariat

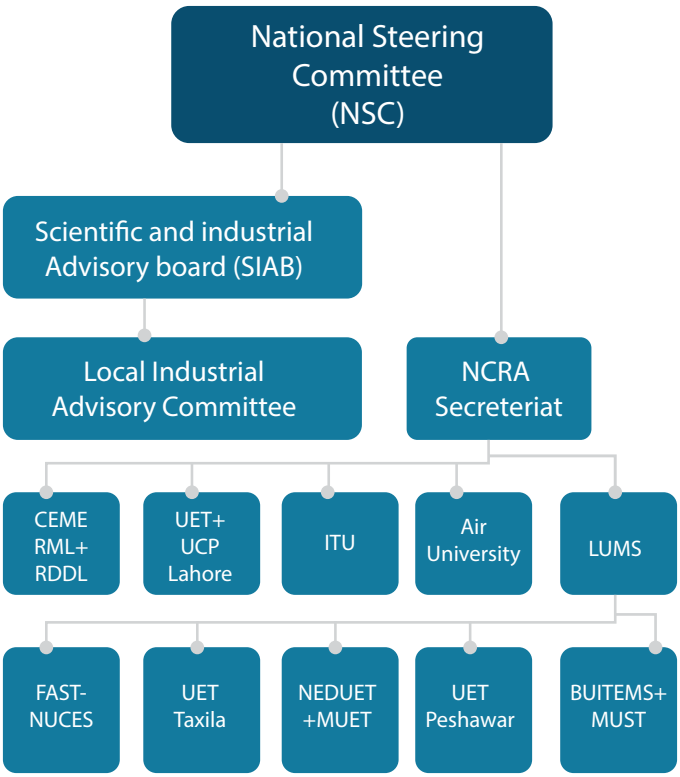
Secretariat of the Centre is housed at NUST, College of Electrical and Mechanical Engineering, Rawalpindi, Centre is responsible for the following tasks:

- Assist the National Steering Committee in ensuring seamless cooperation among different university Labs
- Regularly generate management reports on the activities of the Centre and the associated costs incurred
- Host the six-monthly meetings of the National Steering Committee and providing all necessary facilitation to the NSC for carrying out its activities
- Organize, with support from the National Steering Committee, a Robotics & Automation Conference and Lab2Market Event to showcase NCRA Research at the National level and support individual Universities in creating smaller regional quarterly Lab2Market Events as well as liaise with various entrepreneurial platforms within the country to ensure close collaboration with the eco-system
- Project the activities and achievements of the National Centre of Robotics and Automation in the National and International Media as well as Social Media Platforms for maximum impact and visibility
- Support individual Labs in identifying areas of research where scientists and engineers involved in the Centre may be able to contribute, and which may help the Centre become more sustainable in the long run
- Support individual Labs in identifying sources, whether international or local, from where the funding may be secured for the continuous working of the Centre

Overview

Robotics and automation could have the power to spur unprecedented economic growth and productivity. Over the next few years, every organization will be utilizing a digital workforce (automated robots) as an integral resource. The National Centre of Robotics and Automation is geared towards R&D and Human Resource Development in the areas of Robotics, Automation and allied fields and their practical applications. It is aimed at playing a significant role in Vision 2025 program of the government which has identified these areas as vital to the development of the country. Moreover, the network established by this Centre would enable and empower startups in the areas of Robotics and Automation to come up with solutions to the local problems of Pakistan. In addition to the industry of Pakistan in its drive towards the Industry 4.0 concept. The Centre is comprised of a laboratory in each host university.

Hierarchy



National Steering Committee

A National Steering Committee (NSC) and Scientific and Industrial Advisory Board (SIAB) shall look after and provide oversight to the management and operations of the National Centre of Robotics and Automation during and after the completion of project. The purpose of the National Steering Committee is to provide constructive and timely feedback to the Centre to help it improve its performance.

Members of the National Steering Committee

1. Dr. Shaista Sohail, ED, HEC
2. Barkan Saeed, Chairman, P@SHA
3. AVM Asif Maqsood, DG AvRID, PAC Kamra
4. Asim Shahryar Husain,CEO, Ignite
5. Mr. Raja Sabri Khan, CEO, Integrated Dynamics (Pvt) Ltd
6. Mr. Tafseer Ahmed DG, ICCC
7. Dr. Naveed Iqbal, COO,Teresol (Pvt)Ltd
8. Dr. Gul Mohammad Laghari, Chief S&T, Planning Comission
9. Prof. Dr. Syed Riaz Akbar, Director, Institute Of Mechatronics Engg.

Scientific and Industrial Advisory Board

A Scientific and Industrial Advisory Board (SIAB) has constituted to help and oversee the development of a research agenda for the NCRA and the broader allied Robotics community in the country at large. SIAB ensures fresh ideas and inclusion of locally relevant research possibilities on NCRA's research agenda. The Scientific Advisory Board is also responsible for organizing a formal anonymous International Peer Review of the Centre every 3-years. Each member of the Board has been selected for three (3) years. NSC can replace a member, whose tenure is ending or is not willing to continue as a member, through majority voting.

Members of Scientific and Industrial Advisory Board (SIAB)

1. Mr. Imtiaz Rastgar – Pakistan

Imtiaz Ali Rastgar is an entrepreneur and founding chairperson of Rastgar Group. Imtiaz Rastgar is a manufacturing specialist and a consultant for marketing and exports. He is one of the best-known entrepreneurs in the engineering sector of Pakistan.

Imtiaz Rastgar has participated in the inception of the various trade bodies e.g. Islamabad Chamber of Commerce & Industry, PAAPAM (Pakistan Association of Automobile Parts & Accessories Manufacturers), QPSP (Quality & Productivity Society of Pakistan), PFA (Pakistan Foundry Association), TiE (The Indus Entrepreneurs) Islamabad Chapter.

2. Mr. Nasir Javed – USA

Mr.Nasir Javed is the elected chairperson of IEEE (Institute of electrical & electronic engineers). He also provided his services as a renowned Mentor, Investor and as a technology advisor for Al & Robotics. Mr Javaid is also a founding charter member of The Indus Entrepreneurs (TIE), Southern California since 1997. Princeton technology Designs, Manufactures, Markets and Distributes SSD, Memory (Princeton original modules) and provides EMS to customers. Princeton products have been sold in over 57 countries around the world.

3. Dr. Takeo Kanade - USA/Japan

Takeo Kanade is a computer scientist and one of the world's foremost researchers in computer vision. He is U.A. and Helen Whitaker Professor at Carnegie Mellon University. He has approximately 300 peer-reviewed academic publications and holds around 20 patents.

4. Dr. Keum Shik Hong – South Korea

Dr. Hong is associated with School of Mechanical Engineering at Pusan National University (PNU), South Korea. In 2009, under the auspices of the World Class University Program, he established the Department of Cogno-Mechatronics Engineering, PNU. His current research interests include brain-computer interface, nonlinear systems theory, adaptive control, distributed parameter systems, autonomous systems, and innovative control applications in brain engineering

5. Dr. Karsten Berns – Germany

Dr. Berns is a senior professor at the University of Kaiserslautern Germany. His present research activities are realization of reliable, complex autonomous robotic systems. The main application area is off-road robotics, in which autonomous or semi-autonomous vehicles like small trucks, excavators, harvesters, tractors, and rescue robots are under development

6. Dr. Matthias Harders – Austria

He is a senior professor at the University of Innsbruck, Austria where he leads the Interactive Graphics and Simulation group. Matthias Harders is lecturer and senior researcher at the Computer Vision Lab of ETH Zurich, and leader of the Virtual Reality in Medicine Group. His current research focuses virtual and augmented reality, haptic interaction, and biomedical simulation.

7. Dr. Tao Yue – Norway

Tao Yue is a chief research scientist of Simula Research Laboratory, Oslo, Norway, where she is leading the expertise area of Model Based Engineering (MBE) . She is also affiliated to University of Oslo as an Associate Professor. Her present research area is software engineering, with specific interested in requirements engineering, requirements-based testing, model-based product line engineering, model-based system engineering, model-based testing and empirical software engineering.

8. Dr. Hui Xie – China

Hui Xie is a senior professor in the State Key Laboratory of Robotics and Systems, School of Mechatronics Engineering at Harbin Institute of Technology (HIT) China. His current research interests include micro/nanorobotics, micro/nanomanipulation and characterization, bio-inspired small/-soft robots and swimming microrobots

9. Dr. Manoj Karkee – USA

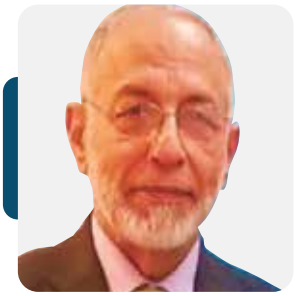
He is an Associate Professor at Washington State University (USA). Dr. Karkee's work is in the BSysE Agricultural Automation Engineering research emphasis area. He is primarily interested in Automated and autonomous agricultural machinery systems, field robotics, and machine intelligence for production agriculture; and in Agricultural systems modeling, simulation, and control

10. Dr. Willaim Melek – England

William Melek is a Professor in the Department of Mechanical and Mechatronics Engineering at the University of Waterloo. He also serves as the Director of the Laboratory of Computational Intelligence and Automation, and the Director of RoboHub.

Local Industrial Advisory Committee (LIAC)

LIAC provides feedback on the products being developed at the NCRA labs. The committee comprises of leading Pakistani industrialists having vast experience in product development. Through the inputs of the committee the Labs are able to produce products having high commercialization potential.



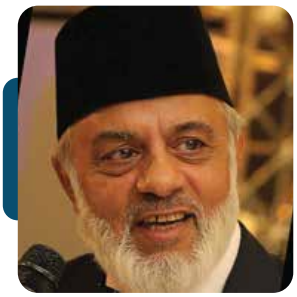
Mr. Imtiaz Rastgar
Founder
Rastgar Industries

Mr. Shoaib Farooqui
Managing Partner
Maqbool Enterprises (Pvt) Ltd

Mr Asad Ikram
Senior Consultant
National Radio Telecom Corporation of Pakistan

Mr. Sohail P. Ahmad
Advisor
Bolan Casting Limited

Mr. Zaafir Waheed
Chief Executive Officer
AEDesign (Pvt) Ltd



Dr. Haroon Javed Qureshi
CEO & Founder
East west Infinity (Pvt) Ltd

Introduction of Labs

1. Robot Maker Lab (RML)- NUST College of E&ME

Dr. Amir Hamza
Principal Investigator
NUST College of E&ME

Dr. Anas Bin Aqeel
Co-Principal Investigator
NUST College of E&ME

Dr. Hamid Jabbar
Co-Principal Investigator NUST College of E&ME

The Robot Maker Lab is equipped with the state of the art rapid prototyping, machining and fabrication facilities for robot parts. It is a shared facility between all NCRA Labs and acts as a centralized robot manufacturing facility to support NCRA Labs, start-ups, academia and industry. RML provides following manufacturing services

- Laser Cutting
- 3D Printing and Scanning
- CNC Manufacturing
- Composite Material Manufacturing
- PCB circuit design and fabrication

ROBOTMAKERLAB

Domains

The main objective of this laboratory is to provide manufacturing facilities in the field of robotics for the researchers and industries in Pakistan. The facility is focused on manufacturing of robotics components and tools with its breakdown into two major sub-projects/modules as follows:

- Manufacturing of mechanical parts
- Manufacturing of electrical parts

2. Human Centered Robotics Lab (UET Lahore + UCP Lahore)

The Human-Centered Robotics Lab aims to indigenously design and develop integrated robotic systems, based on smart sensing and actuation, to seamlessly interact with humans, actively learn from them and eventually create an effective collaborative environment.

University of Engineering and Technology (UET) Lahore

Dr. Ali Raza
Principal Investigator
University of Engineering & Technology, Lahore

Dr. Muhammad Ahsan
Co-Principal Investigator
University of Engineering & Technology, Lahore

Dr. Mohsin Rizwan
Co-Principal Investigator
University of Engineering & Technology, Lahore

Hafiz Dr. Farhan Maqbool
Co-Principal Investigator
UET Lahore
(Faisalabad Campus)

Currently, we are developing collaborative robots, upper-body exoskeletons and lower-body active prostheses at the University of Engineering and Technology (UET), Lahore, and lower-limb orthoses/exoskeletons at the University of Central Punjab(UCP), Lahore.

Domains:

Collaborative robots (CoBots)

CoBots allow safe physical interaction and synergistically share workspace with other robots and human co-workers. These robots can be efficiently programmed by means of physical stimuli and percepts without extensive reconfigurability of their hardware or software components. The lab is indigenously developing a 7-DOF collaborative robot for typical industrial applications. Its design has been systematically evolved from the successful realization of its smaller versions: 3-DOF planar writing manipulator followed 5-DOF non-planar manipulator for pick-and-place task. The collaborative feature has been introduced by means of impedance control scheme as well as exploiting redundancy for added compliance. The final product, a 7-DOF collaborative manipulator, is expected to meet the modern needs of national industry.

Exoskeletons

The lab is developing both passive and active upper-limb exoskeletons for assisting repetitive industrial tasks. The passive type is in the form of a fully functional gravity compensator, whereas an active exoskeleton that amplifies power along multiple direction, is being currently developed using 4-DOF powered actuators.

University of Central Punjab (UCP) Lahore

Dr. Muhammad Kashif
Principal Investigator
University of Central Punjab,
Lahore, Pakistan

Active orthoses for the disabled population:

The goal of this lab is to make modern assistive devices, such as powered exoskeletons, accessible to the disabled people living in countries with severe financial constraints like Pakistan. Moreover, design changes in the conventional braces for polio patients have been made to improve their performance. Several prototypes and designs have been developed and tested on patients.

The lab has the distinction of developing Pakistan's 1st exoskeleton for the paraplegic patients. This robotic-skeleton externally attaches to the human body and provides support and strength to the paralyzed body. The structure is equipped with sensors and motors to accomplish normal walking function.

3.Industrial Monitoring and Automation Lab – ITU, Lahore

Dr. Tauseef Tauqeer
Principal Investigator
Information Technology
University Lahore

Dr. Rehan Hafiz
Co-Principal Investigator
Information Technology
University Lahore

Dr. Usman Younis
Co-Principal Investigator
Information Technology
University Lahore

The industrial monitoring and automation laboratory is to solve the commercial and public sector industrial problems. The scope is to develop real-time health monitoring of induction motors which are the workhorse of industrial units, industrial unit state/performance prediction systems, real-time monitoring and analysis of effective power consumption, identify the performance and recommend design improvements in induction motors, and finally developing capability to perform industrial energy audit

Domains

Domains of the Lab have been identified as following:

- Energy Monitoring and Control System
- Industrial Health Monitoring and Performance Prediction
- Motor Characterization and Improvement Facility

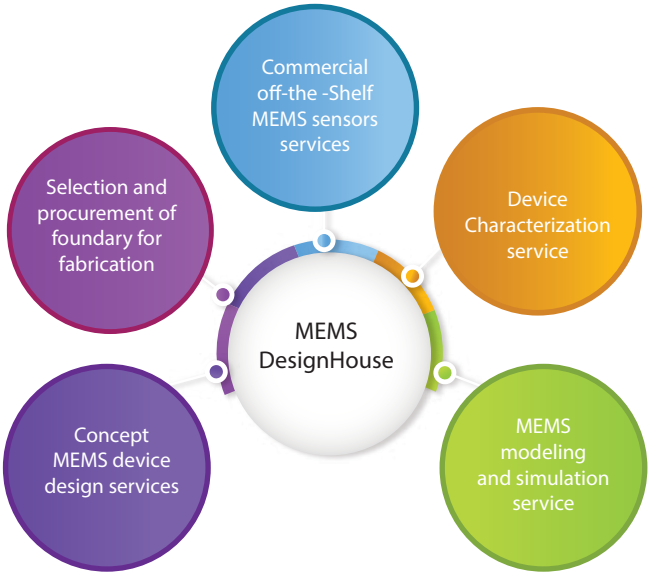
4. MEMS Sensor Design and Testing Lab – Air University

Dr. Rana Iqtidar Shakoor
Principal Investigator
Air University, Islamabad

Dr. Shafaat Ahmed Bazaz
Co-Principal Investigator
Sir Syed CASE Institute of
Technology, Islamabad

Dr. Muhammad Mubasher Saleem
Co-Principal Investigator
NUST College of
E&ME, Rawalpindi

The main working of the proposed lab is based on the fabless prototyping approach that is being followed by many universities and research institutes across the world having no in-house fabrication facility. The devices designed at AU-MEMS design and test lab will be sent to some commercial fabrication facilities in USA and Europe. This fabless approach is ideally suited for Pakistani institutions with design expertise but lack of in-house fabrication capabilities due to very high costs involved. The MEMS sensors and actuators developed at the lab and duly validated with respect to performance parameters will be made available to MEMS developers (both nationally and internationally) through open source cell library which is very similar to the concept of "cell libraries" in traditional VLSI design industry. This will enhance the visibility of our work in the field of MEMS and will give confidence to the potential customers to trust our MEMS development capabilities.



Domains

The Lab will work on the following domains of MEMS devices, which currently don't exist in Pakistan.

- Modeling & Simulation: MEMS design tool INTELLISUITE & MEMSPro will be used for the device modeling & simulation.
- Fabrication: The Lab will focus on prototype fabrication through external resources. This approach is ideally suited for Pakistani institutions where we lack of in-house processing capabilities and required HR for the establishment of Chip Fabrication facility.
- Testing: The Lab will serve as a world class test facility which can be utilized for the broad range of the MEMS devices.

5.Agricultural Robotics Lab – LUMS

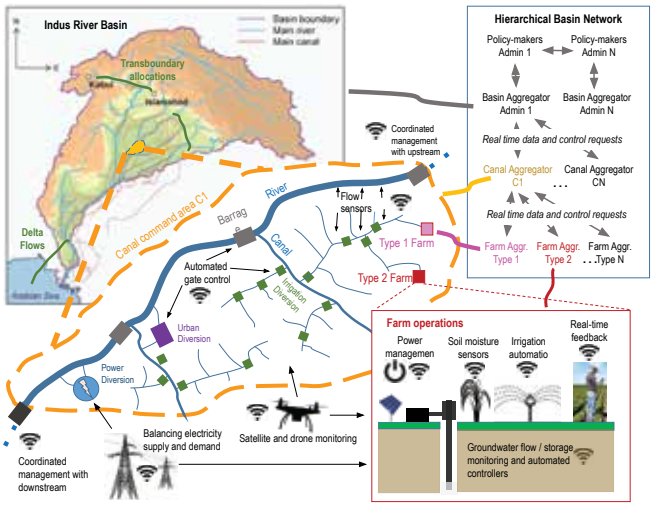
Dr. Abubakr Muhammad
Principal Investigator
Lahore University of Management Sciences

Dr. Mian Muhammad Awais
Co-Principal Investigator
Lahore University of Management Sciences

Dr. Murtaza Taj
Co-Principal Investigator
Lahore University of Management Sciences

Dr. Hassan Jaleel
Co-Principal Investigator
Lahore University of Management Sciences

The proposed lab aims to setup a state of the art national precision agriculture facility, with a focus on agricultural robotics and automation, and a clear path from scientific problem solving to technology roll-out for each theme. The goal is to promote and demonstrate the use of automation driven technologies to assist Pakistani farmers in improving production process and increasing efficiency by efficient utilization of water, enhancing the crop monitoring and yield prediction capabilities and reducing the harmful impacts of agricultural inputs.



Domains

The Lab is focusing on the following domains.

- Achieving high water efficiency: Due to the growing water demands of industry and urban centres, the cumulative effect on our water resources has become so large that water has become an existential threat to our food security, provincial harmony and international relations increasing water efficiency at the farm gate is the one of the main purposes of the lab

- Improving crop monitoring services: The Focus is to enhance the crop monitoring and yield prediction capabilities of government organizations and private industry by working out the right combinations of manual monitoring, in-situ sensors, satellite remote sensing, UAVs and other airborne sensing platforms

- Lowering environmental impacts of Agricultural: Reduction in the negative impacts of agricultural activity and enhancement in eco-friendly sectors in agriculture

6. UAV Dependability Lab – FAST NUCES, Islamabad

Dr. Muhammad Uzair Khan
Principal Investigator
FAST-National University of Computer & Emerging Sciences, Islamabad

Dr. Atif Aftab Ahmed Jilani
Co-Principal Investigator
FAST-National University of Computer & Emerging Sciences, Islamabad

Dr. Muhammad Usman
Co-Principal Investigator
FAST-National University of Computer & Emerging Sciences, Islamabad

Automated UAV testing is an emerging and active area of research with a number of works recently published. The lab will focus on three application areas, SiL(Software-in-loop), HiL(Hardware-in-the-loop) and adaption of these technologies to civil domains. Most of the research produced at the proposed lab will be applicable to both military and civil UAS(Unmanned Aircraft System). The Lab is also working in close collaboration with Aviation Design Institute at Pakistan Aeronautical Complex, Kamra. The lab will also establish research collaborations with leading international academic organizations.

7. Swarm Robotics Lab – UET Taxila

Dr. Muhammad Haroon Yousaf
Principal Investigator
UET Taxila

Dr. Naveed Khan Baloch
Co-Principal Investigator
UET Taxila

Dr. Waqar Ahmad
Co-Principal Investigator
UET Taxila

From Pakistan's perspective, multi-agent robotic systems can be of immense relevance and significance in a multitude of applications. The most crucial aspect of Swarm Robotics Lab at UET Taxila would be to develop scalable and application-agnostic solutions supported by the multi-agent robotic system optimally. The lab aims to achieve this using state-of-the-art swarm intelligence algorithms. Swarm Robotics Lab consists of three core areas of expertise, i.e., Swarm Intelligence, Artificial Intelligence (AI) and Computer Vision, and Decentralized Communication. The Swarm Robotics Lab has each one of these core areas as sub-labs.

SWARM ROBOTICS LAB

Domains

The Swarm Robotics Lab is working on the following domains.

- Disaster Management: From our national perspective, multi-agent robotic systems and their need are significant in natural disasters that generally affect vast geographical areas. Noteworthy are geophysical and hydrological disasters such as earthquakes and floods, respectively. The swarm of ground, aerial, and marine robots may engage for multi-dimensional applications in affected areas.

- Monitoring and Surveillance: Swarm Robotics Lab is also investigating different solutions for ground/aerial monitoring and surveillance of certain areas. To be specific, the lab is looking for prototypes for aerial object recognition, anomaly detection, behavior analysis, and intelligent surveillance systems.

- Stem Education: With the implementation and integration of Next-STEM robots with our mainstream swarm of robots, the lab aims to provide an excellent opportunity for the educators and students to have hands-on experience on a versatile robotic kit that will help them learn concepts of different engineering and research fields. SRL has developed a low-cost 2D miniature robotic platform with multiple add-on options of the onboard computer and different sensors with multiple applications, especially in transforming simulation-based testing to prototype-testing of robotics algorithms.

8. Robot Design and Development Lab - NUST College of E&ME

Dr. JAVAID IQBAL
Principal Investigator
NUST College of E &ME

Dr. Nasir Rashid
Co-Principal Investigator
NUST College of E &ME

Dr. Mohsin Islam Tiwana
Co-Principal Investigator
NUST College of E &ME

Dr. Tahir Habib Nawaz
Co-Principal Investigator
NUST College of E&ME

The primary objective of the "Robot Design & Development Lab" is to provide a fusion Centre where real world (preferably local) problems are picked, given to a multidisciplinary team, and lead till commercialization. Secondary objectives include, but not limited to, human resource development and providing a platform where industry, startups, and academia can collaborate.

Based on the strength of the department, the lab will focus towards the robotics domains of Prosthesis, Unmanned Ground Vehicles and Agricultural robotics. The proposed lab will carry out cutting edge research, provide training/solutions to the local industry as well as assist startups to develop robotic applications.

Domains

Following are main application domains of the Robot Design and Development Lab

- Prosthesis: Amputation is one of the most dreadful kind of trauma which changes human life forever, the Lab is focused on indigenization of low cost EMG based prosthesis.

- Unmanned Ground Vehicles: Focusing on development of indigenous cost effective UGV's for commercial and military use.

- Agriculture Robotics: The aim is to create opportunity for innovators and entrepreneurs to bring ideas that can help to integrate information system, current mobile network, and sensor/actuators equipped automated machines and mobile platforms to bring a system that can revolutionize precision agriculture in Pakistan.

9. Haptics, Human-Robotics and Condition Monitoring Lab - (NEDUET + MUET)

NED University of Engineering & Technology, Karachi

Dr. Riaz Uddin
Principal Investigator
NED University of Engineering & Technology, Karachi.

Human-Robot Interaction (also called HAPTICS) serves countless uses in social, medical educational, rehabilitation, entertainment and defense applications etc. Lab will perform research activities in Human- Robot Interaction/Haptics for the design, development and control of Haptic Teleoperation Systems, Haptic Interfaces/simulators, development and fabrication of Haptic/robotic devices, assistive and wearable robots with force feedbacks etc.

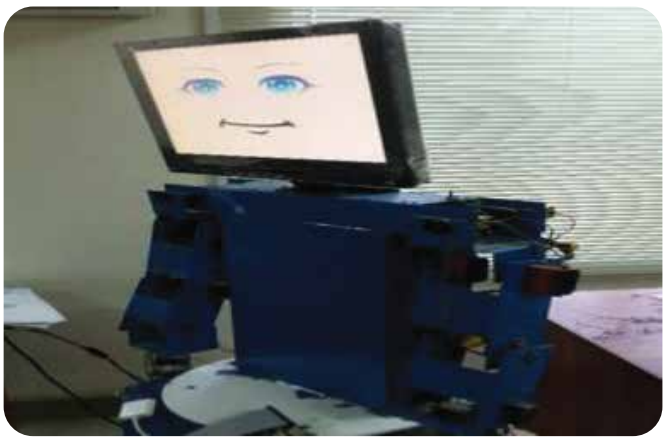
Domains

- Haptic Teleoperation System for Disaster Management:

  The main research objective of this domain is to design and develop a Haptic Interaction/Teleoperation System for dealing with the remote environment especially for the case of Disaster Management such as Earthquake, fire, flood, terrorist attack etc.

- Design and Development of Haptic Education/Assistive Robots:

  The primary objective is to design of STEM based Education in Schools using Haptic Educational Robots. In addition, assistive robots will be developed with haptic feedback for rehabilitation purposes, which is also the current research area of this proposed lab. The education and rehabilitation robot design will also benefit the community working on this domain



Condition Monitoring Lab
Mehran University of Engineering and technology, Jamshoro

Prof. Dr. Bhawani Shankar Chowdhry
Principal Investigator
Mehran University of Engineering & technology(MUET), Jamshoro

Prof. Dr. Tanweer Hussain
Co-Principal Investigator
Mehran University of Engineering & technology(MUET), Jamshoro

Condition Monitoring (CM) is the use of advanced technologies to determine the condition of equipment and predict its failure. This in turn should inform Predictive Maintenance (PM) or Reliability-Centred maintenance (RCM).

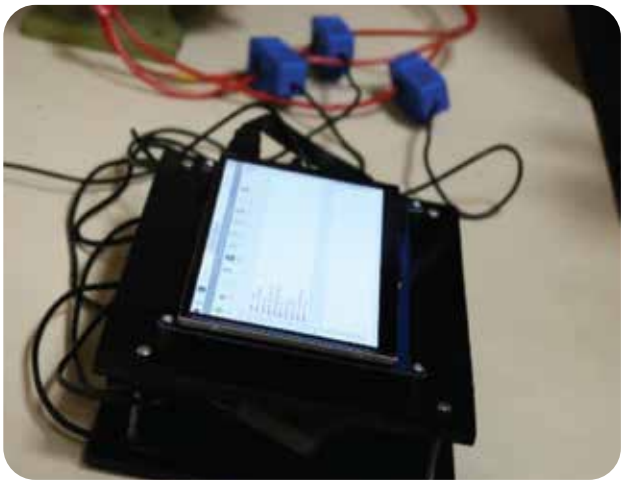
Our road and railway infrastructure would be the key target areas for this research lab. Solutions built in this lab would be provided and deployed on the Railway engines and Railway lines for better maintenance approach in the long run.

Also, the Road infrastructure will be monitored in the same fashion using automated condition monitoring techniques and all the data can be mapped to one control Centre where operators would be taking care of real time system changes.

Domains

- Railway/Road Infrastructure Condition Monitoring using IRT: To evaluate emerging non-invasive NDT (non-destructive testing) approaches/technologies (i.e. IRT) for their ability to detect in real-time and/or quantify promptly various types of defects or damages for equipment condition monitoring.

- Railway Rolling Component Condition Monitoring: Main Objective of this work is to develop standalone cost-effective indigenous systems to acquire data, analyze it, produce alarms, and make decisions autonomously as per the given set of healthy/unhealthy set of rules for Railway Condition Monitoring Systems.



10. Control, Automotive & Robotics Lab –(BUITEMS + MUST)

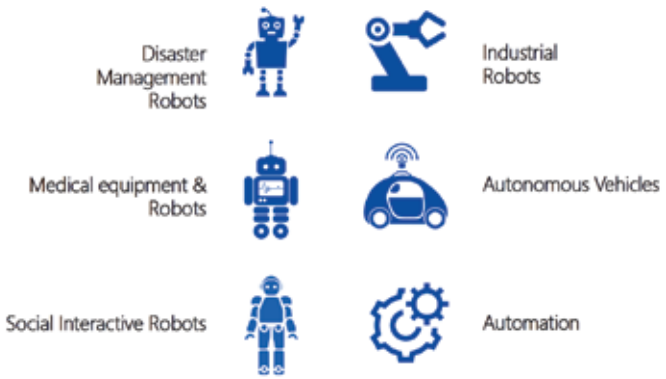
Balochistan University of IT, Engineering & Management Sciences (BUITEMS)

Dr. Anayat Ullah
Principal Investigator
Associate Professor,
BUITEMS, Quetta

Dr. Bakhtiar Kasi
Co – Principal Investigator
Associate Professor,
BUITEMS, Quetta

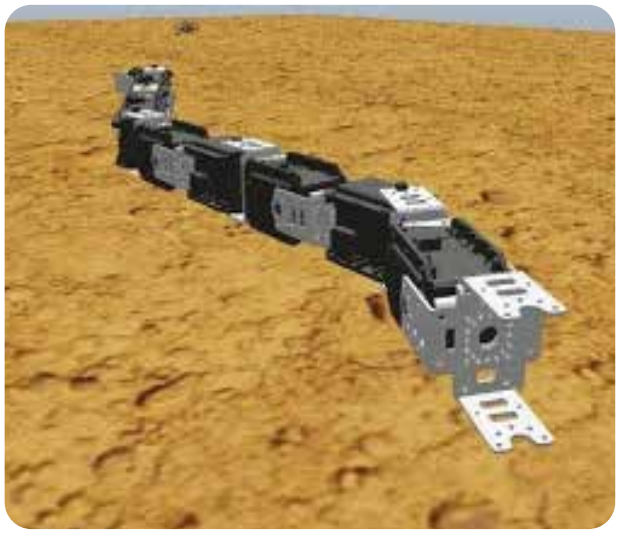
Dr. Abdul Wahid Tareen
Co -Principal Investigator
Assistant Professor,
BUITEMS, Quetta

The lab is situated at Balochistan University of IT, Engineering & Management Sciences (BUITEMS), Quetta. The aim of the lab is to solve pressing problems of Pakistan and particularly Balochistan using Robotics and Artificial Intelligence. BUITEMS AI & Robotics Research team has been working on Evolutionary Robotics, Artificially Intelligent Robotics, Deep Learning, Search & Rescue Robotics, Social Robotics, Textile based Robotic Sensors, Data Mining & Analytics.



Domains

- Search and Rescue Robot: Hyper-redundant snake-robot that uses state of the art reinforcement learning algorithms to maneuver in complex environments such as collapsed buildings and coal mines to identify human survivors. Can be used for espionage.



- Social Mobile Autonomous Robot – SMART: Social robots can interact with humans to provide information and guidance. They have multiple applications including being stationed at Airports, Universities and Public gatherings, we are focusing on its food serving application. Future versions will include local language understanding.

Mirpur University of Science and Technology (MUST)

Dr. Faisal Riaz
Co-Principal Investigator
Mirpur University of Science and Technology

The Control, Automotive and Robotics (CAR) Lab aims to develop autonomy level 4 autonomous vehicle and autonomous industrial loader for the transportation of freight from one point to another. This solution will prove its worth in industrial applications of Pakistan as well as in the international market. CAR lab will develop intelligent self-driving solutions utilizing advanced machine learning and deep learning techniques. This lab will be equipped with advanced facilities which help to support the development of autonomous vehicles. Moreover, the developed functionalities will be tested on a customized test track.

The main aims of this lab are to promote, develop and apply scientific research in Pakistan. This lab will conduct high quality original scientific research in self driven logistic vehicles for industrial applications.

Domains

Autonomous Vehicles: The human driven vehicles cause deadly accidents due to mistakes of drivers and we have proposed solution to introduce a human inspired autonomous vehicle which can drive themselves without any human intervention, employing inbuilt software, sensors, and communication systems. This vehicle is going to make a revolution in the industrial sector in Pakistan as well as in the international market through collaboration.

11. Advanced Robotics and Automation Lab – UET, Peshawar

Dr. Muhammad Tahir Khan
Principal Investigator
UET Peshawar

Dr.Izhar ul Haq
Co-Principal Investigator
UET Peshawar

Dr. Muhammad Akmal
Co-Principal Investigator
UET Peshawar

Dr. Sheraz Ali Khan
Co-Principal Investigator
UET Peshawar

Advanced Robotics & Automation Lab aims to work on two key research areas
a) Prosthesis and orthosis
b) Agriculture machinery & robotics
to establish a state of the art research Centre. The lab will make significant impact on Pakistan's GDP by developing indigenously solutions in the field of prosthetic and orthotic devices and automated/intelligent agricultural machinery& robotics. According to the statistics from many rehabilitation Centres including Pakistan institute of Prosthetic and Orthotic Sciences (PIPOS) there are approximately 1.1 million amputees in Pakistan. Considering the prevailing security situation in the country, this number is likely to increase. The recent floods and earthquakes have also contributed to the number of amputees. The cost of prosthetic limbs available in the international market is extremely high making them unaffordable for amputees in developing countries.

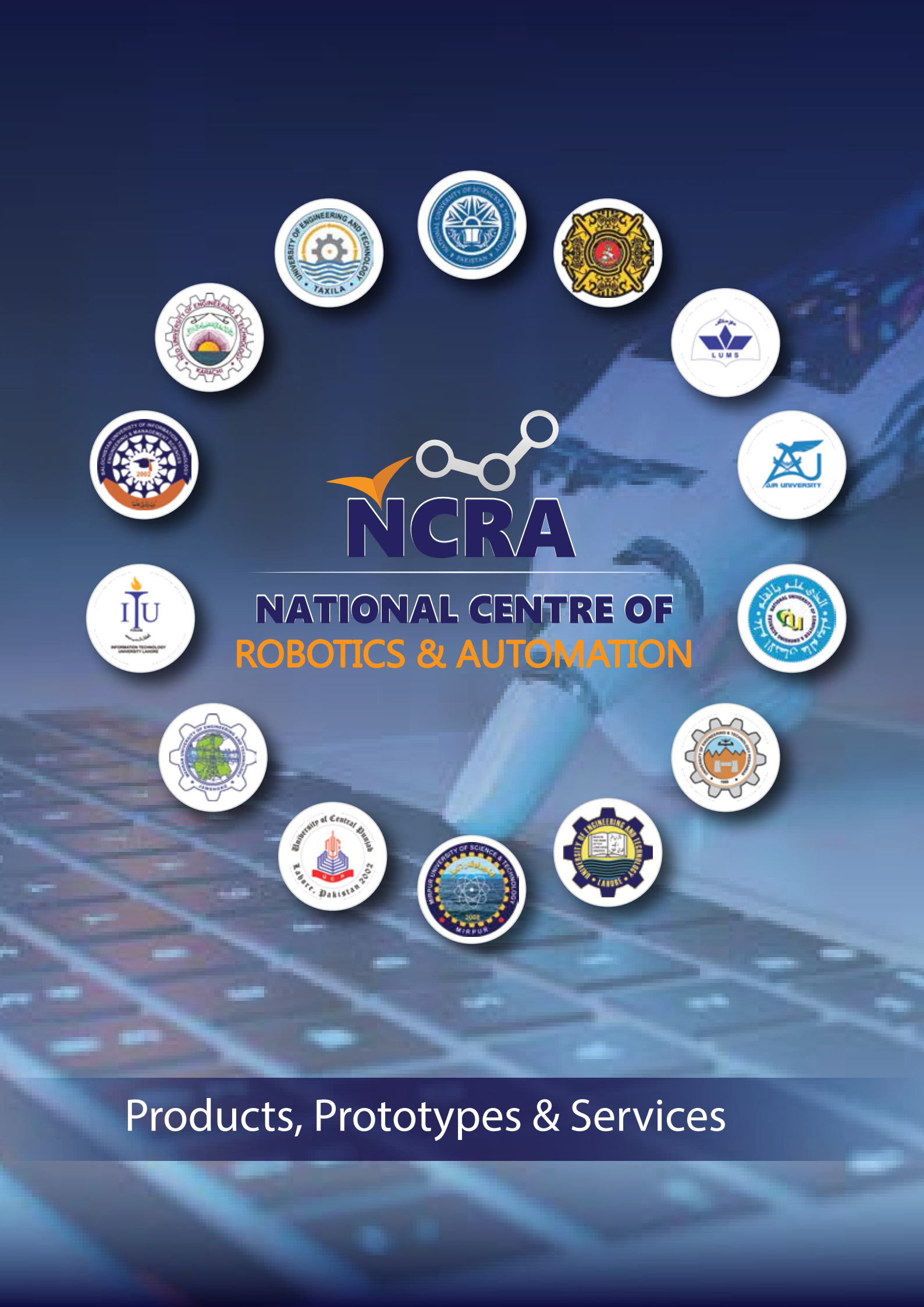
Similarly, agriculture constitutes the largest sector of our economy. The most important problem of agriculture is its low yield per hectare for almost every major crop. Whereas, other countries of the world are getting higher yield per hectare due to use of automation in agriculture.

Domains

- Automation in Prosthesis and Orthosis: To indigenously design and develop intelligent prosthetic and orthotic devices to facilitate amputees by providing low cost solutions in partnership with rehabilitation Centres including Pakistan Institute of Prosthetic and Orthotic Sciences (PIPOS).
- Automation in agriculture machinery & robotics: To develop advanced and affordable spray systems that employ intelligent techniques to automatically match spray outputs to crop structures during application of pesticides and fertilizers on agriculture crops.

Summary of KPIs

Sr.#	Input	Output	Targets	Progress	%age achieved
1.	Equipment, Research Funds, HR	Journal Publications	30	138	460%
2.		Conference Publications	45	125	277%
3.		Non-PSDP Research Funds from external sources	PKR 150 M	361.04 Mn	240%
4.		Industrial Project Funding	PKR 75 M	135.18 Mn	180%
5.		Startups (New Jobs)	20(100)	20	100%
6.		Products	24	107 (Products are being worked on)	445%
7.		Trained Professionals	180	2104	1170%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Products, Prototypes & Services

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EARTH AUGER

Earth Auger can reduce the time taken for plantation and reduce the workload on the person by making their task a lot easy. Finding alternative ways with greater efficiency in planting on large scale. Where a person can dig and plant about 3 trees in an hour, the Power Drill can dig a hole in minutes. The mechanism is simple with no complexities, is easy to use, lightweight so can be carried easily, and no technical knowledge is required to operate it. The mechanism includes a drill, just as the name shows, fixed right under a wheelbarrow. A generator powers the drill and the speed of the drill can be changed according to the users will. It can be utilized in areas where ground is hard and digging by hand is challenging. Depending upon the hardness of the soil, the drill can be accelerated accordingly. The project offers three preset (high, medium, low) drilling speeds that can be varied according to the porosity of the soil.

FEATURES

- It increase the efficiency of human resources in terms of financial turnover.
- It can drill faster which manual labor will take great amount of time.
- Economic and readily available equipment.

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NCRA PORTFOLIO

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SPRAYER DRONE

FEATURES

- Uniform spraying
- Consuming less water, time, and spraying liquid
- Payload capacity - 12 kg/liter
- 7 km RX/TX Range with DJI Controller
- Saves 80% water and 75% time
- Autonomous and Manual mission modes

Teams of researchers at NUST own a 16L and 10L aerial spraying unit respectively. They are testing the effectiveness, efficiency, and efficacy of this aerial spraying unit. The aerial spraying system has been assembled locally while most of the hardware and equipment is imported from China. These aerial spraying units can take-off, land, and fly manually, on GPS-on mode, or autonomously on a pre-defined path given by the pilot through the mobile phone application connected to the remote controller of the aerial spraying unit. The aerial spraying unit was tested on spraying nutrition, pesticide, insecticide, and herbicide on cotton crop, sugarcane crop, citrus orchard, guava orchards, maize crop, and to kill wild weeds on land before construction. The result of the spray was satisfactory in all crops, especially at the Maize crop, sugarcane crop.

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LAND ROVER DEFENDER JEEP
ENGINE TEST BENCH

FEATURES

- Portability
- Secure mounting of equipment
- 360 degree rotation of LCD
- Extended Diagnostic cable
- Locking mechanism of Wheels
- UPS supply included
- Circuit Breaker Safety

Empirical calibration and validation steps are replaced by predefined procedures, which can be fully or partially automated. Automated procedures can be performed in much shorter time: Error prone tasks can be done more dependably and even complex and critical tasks become reproducible. Mathematical optimization algorithms and environment models support effective automation.

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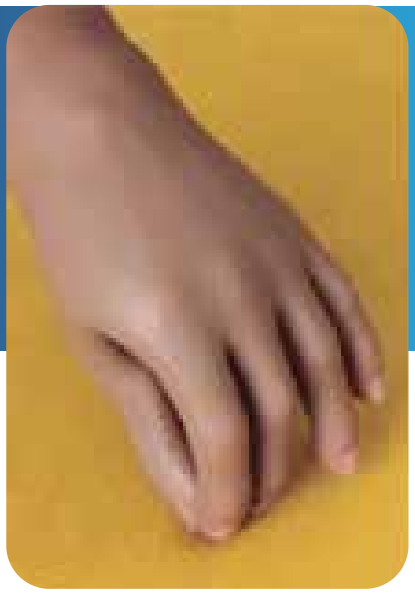
MYOBIONICS PROSTHETIC GRIPPER



FEATURES

- Affordable
- Lightweight
- Rechargeable
- Reliable & Robust
- Skin matching glove
- Japanese Mabuchi Motor
- Built-in Battery Management
- Dedicated software calibration

The primary aim at myobionics is to develop prosthesis that transform the lives of amputees by helping them regain their confidence and sense of independence while performing daily tasks. Controlled in the similar way to other myo-electric hands, (EMG sensor measure muscle flex), when the muscle contracts it sends a signal to the hand to perform the desired movement i.e open and close

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MASK HOLDER
EAR EASE

Wearing masks can be really annoying for the Ears, to ease up the stress on ears, NCRA has developed a 3D printed mask holder that can be used in multiple sizes. It can be used in Schools, Offices, Public Areas, Operation theatre, ICU, Hospital Emergency Wards and Corona Wards.

FEATURES

- Reduce Ear pain
- Multiple Sizes
- Soft material
- Suitable for use in
  - Schools
  - Public Places
  - Hospitals
- 3D Printed Design

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ORTHOTIC INSOLE

FEATURES

- Treatment for leg length discrepancy
- Provides stability for high arch foot profiles
- Relieves chronic pain caused by plantar fasciitis
- Correction of foot and leg pronation angles in flatfooted people

The purpose of the orthotic insoles is to help support the feet and improves foot posture while also relieving the patient of any chronic foot or leg pain. Since a person foot profile varies, custom insoles are developed while taking into consideration all the features of the foot profile like foot size, weight, and foot arch and pronation angle to make the insoles that best suit your need. The insoles are made of highly flexible and durable Thermoplastic Polyurethane (TPU)

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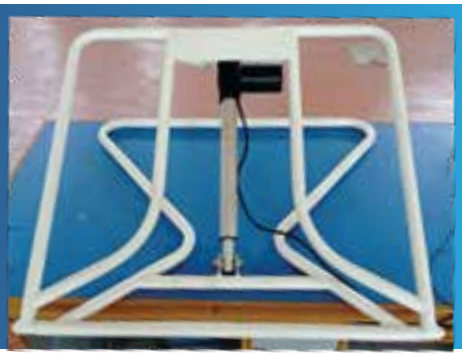
RECLINER BED



FEATURES

- RF remote control
- Simple and easy to operate
- Light weight and highly portable
- Perfect for post surgery recovery

Recliner bed is a smart, cost-effective and convenient alternative to expensive electric beds and bulky hospitals. It regains mobility and independence at home and wherever you go as the is portable, any bed can be made adjustable with the portable recliner bed.

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SOLAR PANEL CLEANING ROBOT

FEATURES

- Increases efficiency to 30%
- Clean Solar Panel at a speed of 5 sec per meter
- Fully automated
- Low maintenance cost

is natural. The accumulated dust on the surface of PV solar panel can reduce the system efficiency by up to 50%. Main environmental factors that affects efficiency of panel are dust, bird dropping, snow, pollen and sea salt. For this design, develop and manufacture a solar panel cleaning robot. One or two workers will easily operate the robot. Ensure the increase in efficiency of the solar panel.

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LIVE LINE WASHING ROBOT

FEATURES

- Control Mode: Wired
- Turret Rotation: 360 Degrees
- Power: 12V Battery
- Joy Stick Control

Accumulation of dust on surface of the panels of solar voltaic (PV) system

Power transmission poles have insulators that isolate transmission lines. Due to humidity and dust accumulation, the insulators have chances of getting short and sometimes, arcs are seen due to high voltages. To avoid any hazard, insulators are cleaned periodically using high-pressure ionized water jet. For this purpose, a person must climb the power poles

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FIRE FIGHTING ROBOT

FEATURES

- Control Mode: Wireless
- Drive Options: Wheels/Track
- Range: 300m in Line of Sight
- Travelling Speed: 8 km/hr.
- Turret Rotation: 360 Degrees
- Battery Backup 1.5 hrs.
- Camera Feedback 2 Cameras
- Payload: 45 KGs

During fire hazards specifically in oil fields, fire fighters face the problem of damage control and access into affected areas. For this purpose, an automated vehicle can be used with a motorized monitor and can be operated from a distance by the fire fighter to monitor and extinguish the fire.

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FACE APP

FEATURES

- Capacity of 10,000 faces
- Recognition time less than 1 sec
- Recognition Accuracy 99%
- Masked Facial Recognition
- Multiple Camera Integration
- Security Solution
- Attendance System
- Masked Facial Recognition

Face Recognition based Attendance and Management System is indigiounously developed device. This device uses state of art deep learning technology to recognize faces. Facial Recognition device has an accuracy of 99%. It can uniquely identify about 10,000 different faces. Its recognition time less than 1 second. This device is managed through integrated database management system to control the operation of device and use it for attendance purpose. Device also possesses the ability to recognize people wearing masks. Masked Facial Recognition has an accuracy of 99%.

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RESPIRATORY HOOD

FEATURES

- Battery Operated
- Simple and easy to operate
- Light weight and highly portable
- Minimise the risk of infection
- Spare parts are easily replaceable and available in market

Respiratory Hood consists of a fabric hood with a plastic visor to protect the face and delivers clean air through an Air filter using a fan mounted on the wearer's belt. The aim is to develop something simple yet effective which can provide protection and minimize the risk of infection for people working in public areas, medical staff.

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TELE-OPERATED DECONTAMINATION ROBOT

FEATURES

- Control Mode: Wireless
- Drive Options: Wheels/Track
- Range: 300m in Line of Sight
- Travelling Speed: 8 km/hr
- Turret Rotation: 360 Degrees
- Battery Backup 1.5 hrs
- Camera Feedback 2 Cameras
- Spray Fluid Tank: 16 ltrs

A Tele-Operated Decontamination Robot is being proposed which will be wirelessly operated and can spray the disinfectant while the operator is at a standoff safe distance.

Recognising the need to adopt preventive measures as the world sails through unchanted waters of COVID-19, scientists at the Robot Design and Development Lab of NCRA have indigenously developed Teleoperated UGV for decontamination. It is designed with the exclusive feature of finding its course through hard terrains to decontaminate localities without physical human intervention.

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UV LIGHT AIR PURIFIER

FEATURES

- Wall Mounted
- Simple and easy to operate
- Light weight and highly portable
- Safe to use even in the presence of patients and Staff
- Spare parts are easily replaceable and available in market
- One-hour exposure will lead to about 80% reduction of bacterial growth in the air

UV Light Air Purifier is a device that uses short-wave ultraviolet light (UV-C light) to inactivate airborne pathogens and micro-organisms like mold, and bacteria. It can be used in Schools, Offices, Public Areas, Operation theatre, ICU, Hospital Emergency Wards and Corona Wards.

SPECIFICATIONS

- 2 x TUV T8 Lamps
- Electrical Power 36W per lamp
- Total power consumption = 140W
- Current: 0.44A per lamp
- UV-C Radiation at 100 hr: 15W/Lamp
- Variable air flow control
- Power source: 220 V AC
- Dimensions LxWxH(cm): 130x25x25
- Weight: 16kg

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FRUIT MATIQS

FEATURES

- Wavelength Range: 200-1050nm
- Spectral Sampling: 3nm
- Battery Life: >1500 scans
- PC Interface: SD Card
- Working Temperature: 00C-300C
- Weight: 1.14Kg
- Dimension: 240x160x63 mm
- Battery: Rechargeable 20000 mAh
- Display: 7-inch Touch Display

The fruit maturity meter used near-infrared (NIR) spectroscopy to non-destructively estimate quality metrics such as dry matter, total soluble solids (TSS or brix) and titratable acidity. It has a wide range of applications, determining optimal harvest timing, to providing an objective analysis of produce quality of fruit in packing houses.

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VERSATILE TERRAIN ARTICULATED MOBILE UNMANNED GROUND VEHICLE (UGV)

FEATURES

Mobility

- Reconfigurable according to the terrain
- Articulated flipper arms provide high mob
- Obstacle avoidance
- Negotiate rough terrain
- Travelling speed – up to 5 km/hr
- Climb Inclinations – up to 45o
- Climb up stairs easily

Performance

- N-board camera for surveillance
- Live video feedback which can be recorded
- Range up to 1 km

Modern Armies of the world are focused towards the safety of their soldiers in the current arms conflicts. Pakistan Army engaged in the conflict against war on terror is also concerned about this aspect and looking for the sol in the form of some Unmanned Platform with can provide surveillance capability while being op from remote loc. One of the examples of such sys (Chaos UGV) being used in the US Army.

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TRACKED RE- CONFIGURABLE ROBOT

FEATURES

Mobility

- Negotiate rough terrain
- Roll over rubble
- Navigates through narrow passag-
- es
- Travelling speed – up to 8 km/hr
- Climb Inclinations – up to 45o
- Climb up stairs – up to 35o

Performance

- Carried on to a vehicle for travelling long distances
- Can be developed by 2 x per in 10 minutes time.

Life of soldiers has always been of paramount important for the military command. Modern army command have always been looking for the options through which they can engage the target from a distant location without endangering lives of their soldiers, especially in unknown environment. During the display of projects in college of EME, suggestion was given to develop an unmanned vehicle which can engage the target while being con from a distant location to be used in close quarter battle in unknown environment.

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THROWBOT WITH EYE

FEATURES

Mobility

- Negotiate rough terrain
- Roll over rubble
- Navigates through narrow passag-
- es
- Climb Inclinations – up to 45o

Performance

- Indoor Range (NLOS) – 30m
- Indoor Range (NLOS) – 100m
- Speed – 6 km/hr
- Drop Height – 10ft
- Run Time – 35 min

Life of soldiers has always been of paramount importance for the military command. Modern army command have always been looking for the options through which they can scan the target area from a distant location without endangering lives of their soldiers. During the display of projects in college of EME, suggestion was given to develop a throw-able vehicle which can examine a confined environment before law enforcement or military personnel enter.

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IED DISPOSAL TRACKED ROBOT

FEATURES

Mobility

- Negotiate rough terrain
- Roll over rubble
- Navigates through narrow passag-
- es
- Travelling speed – up to 5 km/hr
- Climb Inclinations – up to 30°
- Climb up stairs – up to 30°

Portability

- Carried by a single person
- Can be deployed in 10 minutes time

Surveillance

- On-board camera for surveillance

Live video feedback which can be

- recorded

Range up to 1 km

-

Modern Armies of the world are focused towards the safety of their soldiers in the current arms conflicts. Pakistan Army engaged in the conflict against war on terror is also concerned about this aspect and looking for the sol in the form of some Unmanned Platform with can provide surveillance capability while being op from remote location. Moreover, the platform should be light in weight which can be carried by a single soldier. An IHD was arranged at the CIEDO, Engineers Department GHQ to discuss the options for dev such piece of equipment. Department of Mechatronics, college of E&ME was part of IHD and also showcased the existing projects being carried out at the department.

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FLEXFREE BRACE

An affordable stance-control kneean-kle-foot orthosis (KAFO)

- The lightest and cheapest stance-control orthosis on the market
- No more walking with locked-knee joint
- Low maintenance, fewer parts with no electronic components
- Modular, assemble pre-fabricated joint into your existing KAFO

MOVE FAST AND BREAK THINGS

Customized joint designs for more active users

Human-centered robotics lab, UCP, 1 Khayaban-e-Jinnah, Johar Town Lahore
042-35880007
bmct.lab@gmail.com

PROSTHETIC DEVICES FOR LOWER-LIMB AMPUTEES

FEATURES

- Variants: Knee; Ankle-Foot
- Operating Mode: Active
- Range of Motion: 0-110° (Knee);
- 25-45° (Ankle-Foot)
- Max. Amputee Weight: 100 Kg
- Walking Speeds: Variable
- Stumble Recovery
- Manual Extension Locks
- Facilitates Symmetrical Weight
- Distribution and Natural Gait

Why Walk with Crutches, when You can be More Natural!

The lab has developed low-cost Active Prosthetic Devices that can replace the amputated limbs of the disabled personnel. The developed prosthesis has two variants; a Knee for Transfemoral Amputees, and an Ankle-Foot for Transtibial Amputees.

A state-of-the-art control framework is used to operate the devices in a continuous manner for different walking speeds i.e., slow, normal, fast, etc. Besides, these devices are equipped with multiple sensors for more intuitive and smooth control.

The robust mechanical structure of the prosthetic devices are controlled by a BLDC motor, which takes away any worries of replacing the motor or its brushes in the near future. Moreover, these devices come along with a Carbon Fibre Foot and a Prosthetic Foot Shell to give the appearance of a natural human leg.

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ROBOTIC MANIPULATORS (Conventional and Collaborative)

FEATURES

- Degree of Freedom: 5, 7
- Payload: 2-5 kg
- Reach: 800 - 1000 mm
- Open-source control interface
- Low backlash drives using strain wave gears
- Conventional and Collaborative modes available

Our commercial manipulator product line consists of indigenously designed and developed affordable industrial-grade manipulators for easy installation and fast deployment in general purpose robotic arm applications. Available in two different levels of dexterity, in conventional 5-DOF and collaborative 7-DOF versions, it offers sub-millimeter positioning accuracy and repeatability with enhanced compliance built upon impedance control scheme. Computer based open-source python interface implements controller with several built-in libraries for task-specific motion control and also features full customization of trajectory generation and path planning.
The manipulator joint drive unit integrates frameless and brushless DC motor, a high precision and low backlash strainwave gears and high-resolution optical encoder for fast and accurate actuation. Hollow shaft motors provide enough diameter to route bulk of shielded wiring through the interior of manipulator without incurring electromagnetic interference. Detachable joints allow efficient and cost-effective repair, maintenance and retrofitment. The product design ensures that our manipulator meet industry standard durability, safety and performance.

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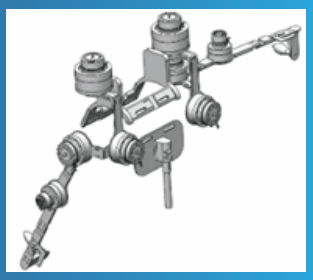
UPPER LIMB EXOSKELETON



FEATURES

Exoskeleton

- Degree of freedom (DoF) = 3-4 per arm
- Payload = 3-5 kg
- Max. joint velocity = 35 RPM
- Control Approach = Positon and force control

Gravity Compensator

- Payload = Customizable
- Range of Motion = -45° to 45°

Exoskeleton is a wearable mobile machine used to augment the human power and reduce muscle fatigue during repetitive tasks. This powered exoskeleton consists of 3-4 degree of freedom per arm and its each joint has a Brushless DC (BLDC) motor, a position encoder and a harmonic drive system. A force/torque sensor is attached to its end-effector. This exoskeleton has application in industry to pick and place heavy objects and avoid muscle fatigue in repetitive tasks and can also be used for rehabilitation purposes.

Gravity compensator has been developed to counterbalance the gravitational forces generated by heavy loads. This compensator comprises only of passive components (i.e. mechanical links and spring mechanism). It provides compensation against weight of work-piece and/or body weight. It is inexpensive and suitable for repetitive industrial tasks like load-lifting and providing support in hand drill machine, etc.

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SMART MONITORING AND CONTROL SYSTEM

FEATURES

- 10x DI, 10x DO, 4x AI, 4xAO, 4x PWM
- Measurement of line Pressure,
- Motor Vibration and Water FLow
- Geo tagging of each site
- On site and Off site monitoring
- Chlorinator operation and chlorinator tank level indication
- Three phase voltage and current measurement
- Apparent, Real, Reactive Power measurement
- Frequency measurement (Optional harmonic analysis)
- Remotely monitored and control along with scheduling features
- Web Connectivity (Supported HTTP and MQTT Protocol)
- The web application
-

A complete automation solution for three phase motor which is capable of real time energy monitoring, scheduled and remote operations. System is integrated with cloud storage where all parameters are logged and reports are generated for in-depth analyses and efficient management decision.

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3Ø-CONDITION MONITOR

FEATURES

- Eight RJ45 connection ports for 3 PTs, CTs, vibration, and temperature sensors
- Input current per pin up to 40 mA
- Input voltage per pin up to 5 V
- Wireless connectivity for
- ubiquitous deployment
- Real-time monitoring and signal relaying

IoT based compact 3 Phase signal monitoring unit (SMU) which implements the stand alone as well distributed monitoring of the electrical systems. Various sensors such as Pts, CTS, vibration, and temperature are connected to the eight Rj45 connectors of SMU, and real-time measurements are relayed to Central Panel to present the real-time operation of electrical systems.

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THERMASENSE

FEATURES

- Real time monitoring
- Wireless communication
- Up to 16 sensors support
- Cloud interfacing / data logging History and alarms
- Graphical data display
- All universal inputs have 12-bit ADC
- which supports NTC thermistors K type
- For sensors voltage input 5V and current input up to 20 mA is required
- Operating frequency 50Hz
- Dry contact input for insertion

ThermaSense is an IoT based wireless, self-contained multi-point temperature monitoring system that attaches to your electrical enclosures such as electrical cabinets, panels. The reporting can be provided on your personal computers via cloud integration. ThermaSense provides an IoT based alternative to the costly IR camera-based thermography.

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LOCATION OF THINGS (LOT)

FEATURES

- Power supply: PoE(48V), DC(9V) and Micro USB(5V)
- Protocol: MQTT (TCP/SSL) and HTTP/HTTPS
- Network: Ethernet and WIFI
- User can modify the gateway parameters on the web UI.
- 300 devices can be scanned per second
- Users will easy to get the data from iBeacon

LoT enables the automatic identification of objects and has diverse applications in asset management such as livestock tracking, warehouse and store checkout automation, theft prevention, and supply chain streamlining. The localization platform aims to use minimal tracking recourses to optimize the accuracy.

Beacons used to track the location and monitor the activity of employees in an indoor facility that is helpful in efficient resource utilization and better customer experiences. Also, helpful to implement the recommendation of WHO to maintain a minimum safe distance between employees due to COVID-19.

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SMOG-SENSE
SS-001

FEATURES

- Real-time air quality and weather updates
- Hourly information for multiple types of pollutants PM2.5, PM10, PM1.0, CO, NO2, O3 and SO2.
- Hourly and daily air quality and weather reporting.
- SMOGSENSE Box helps you to give health recommendations to reduce your exposure to harmful air pollution.
- Check the Data, at any time using our SMOGSENSE Mobile App.
- Immediately alerts when pollutants such as SO2, NO2, CO, O3 are at dangerous levels.

Mitigating the impact of air pollution on communities and workers is a key priority for environmental professionals and industrial hygienists. Air pollution is an invisible threat to everyone's health. Track key local pollutants like PM2.5, PM10, NO2, CO, SO2 and ozone sensors on a bright, easy-to-read LCD screen.

SMOGSENSE is easy to set up and operate and accurately measure ambient air for construction, remediation, urban environments, smart cities, and national networks – for compliance, non-compliance, and special purpose air monitoring. The SMOGSENSE app gives you live air quality data and gives helpful health recommendations to reduce your exposure to harmful air pollution.

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VX 3V VIBRATION TRANSMITTER

FEATURES

- Measured Vibration:
- Vibration/Velocity/Displacement
- Frequency Response: 0-1500 Hz
- Output: 0-3.3 V DC, 3 Wire Output
- Range: ± 3g House Material:
- Aluminum Operating Temperature:
- -40 to 85 C Package Alignment
- Error: ±1 Degrees Interaxis
- Alignment Error: ±0.1 Degrees
  Cross-Axis Sensitivity: ±1 % Noise
- Density: 150 – 300 µg/√Hz rms
  Sensor Resonant Frequency: 5.5
- kHz Output Swing low: 0.1 V
- Output Swing high: 2.8 V Power
- Supply: 5VDC

IMAL is offering industrial grade "Vibration Monitor" for high-frequency condition monitoring. Our designed vibration monitor measures the vibration in 3-axes using our robust and precise accelerometers. The system can be configured for complete cloud connectivity for real-time monitoring. Vx3-V Vibration transmitter is an integrated transmitter, installed directly on the bearing cover of various rotary machines and devices, widely used in various thermal power plants, cement plants, machine plants, blower plants, and paper plants, coal mine machines, aimed to achieve high accuracy vibration measurement in the industrial applications.

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SMARTQ

FEATURES

- Cloud Integration
- Portability
- No Overhead
- Host Mode
- Authentication
- Authorization
- Guest Mode
- Get Informed
- HR Service Analysis
- QR Code Based Ticketing
- Schedule Visits
- Customer Relationship

SmartQ is a step towards technological enforcement of Social Distancing, keeping the business going. For businesses, it avoids rush hours and long queues and provides capacity and resource management for customers. It allows them to schedule the appointment and take advantage of the waiting time.

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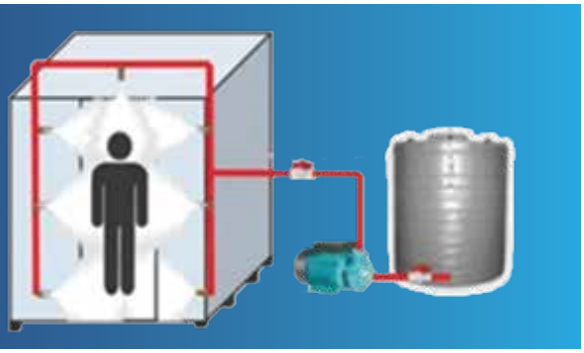
SANITIZING SPRAY GATE/TUNNEL



FEATURES

- Tunnel Size W x H x L (4 ft x 7 ft x 5 ft)
- Water Pump 12Vdc
- Integrated LED Light
- Storage Tank (Min Capacity 200 L)
- Console Box (For Pump and Adapter)
- Mist Nozzles
- Motion Sensor
- Body Temperature Detection
- Count No. of persons pass through gate
- Cloud Data Logging

Sanitizing Spray Gate/Tunnel is a sanitizing tunnel that sprays any sanitizing substance both in a concentrated or in a ready-to-use diluted formula. iMAL offered this project as a tested, safe and effective method to sanitize people. The tunnel detects the presence of a person and automatically sprays the sanitizing substance.

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WATER QUALITY AND WATER FLOW SENSOR

FEATURES

- Measurement of key chemical parameters i.e pH, dissolved oxygen, electrical conductivity, oxidation-reduction potential
- Measurement of key physical parameters i.e temperature and turbidity
- Flow meter for closed channels/conduits
- Ultrasonic sensors for water level measurement in open channels
- Wi-Fi based remote telemetry
- Real time dashboard
- Can be packages as fixed installation or a floating
- sampler with GPS location tagging.

The system's objective is to enable real-time hydrological measurements for achieving high efficiency in irrigation systems and address the lack of data availability in improving water management. Our product can monitor water quality parameters, level, and flow at both open channels and closed conduits. The collected data is wirelessly transmitted to the server. The prototype is tested in drain water to estimate its feasibility in a hazardous environment. Moreover, a field experiment of the floating-type system was performed in an open-channel freshwater stream, where the floater covered 4.3 Km length of the stream for a duration of almost 100 minutes.

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LUMS

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TALKING FIELDS
A FARMER'S TOOL

FEATURES

- Satellite based crop health images
- Crop health charts
- Weather forecast for 5 days
- Guidelines for paradoxical agriculture
- 3 languages (English, Urdu,
- German)
- Password less login

Talking fields is an android application developed for farmers to improve crop management. The main purpose of the application is to provide farmers a tool which they can use to keep the tracks of their crops health, weather conditions and to make farmers aware of the paradoxical agriculture techniques.

Satellite based health images provided every 5 days will help farmers to detect the weak crop location in the field very efficiently. They can keep track of the fields remotely. The seasonal time series charts will give the information about the condition of a field over time.

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Camera Based Trash Monitoring in Waterbodies

FEATURES

- Configurable for cloud and edge computing
- Wi-Fi connectivity
- IP64 enclosure
- On board IR illuminators for night vision
- Less than 5-watt power consumption

Rivers and canals flowing through cities are often used illegally for dumping trash. This contaminates fresh water channels which eventually reach agricultural fields and causes degradation of soil.

Our product, aimed to address this challenge, is an IoT based system to measure the quantity of trash that passes through a location in real time. This data can be used to deploy other counter measures against this problem. Product consists of camera nodes that are connected to a server.

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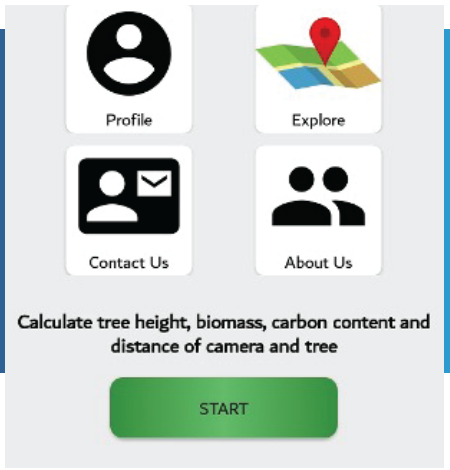
FOREST HEALTH MONITORING APPLICATION



FEATURES

- Single vision camera-based height and width measurement of trees
- Easy cropping of target tree image
- Cloud computing and storing of data
- Convolutional Neural Network (CNN) based tree identification, segmentation and height estimation

It is an android based application for finding tree height and its diameter at breast height, using distance method. The data is then used to assess biomass and carbon content of the tree and calculate total biomass of the whole forest area. This data is ultimately used for estimation of carbon sequestration required to stave off global warming.

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SMART FIELD FOR INNOVATIVE AGRICULTURAL PRACTICES

FEATURES

- Soil Moisture sensors
  Moveable sensor platform with following sensors
  - LIDAR 3D mapper
  - Multispectral camera
  - GPS RTK
- Weather station with ability to measure
  - Rainfall
  - Humidity
  - Temperature
  - Wind speed and direction
- High speed internet connectivity

LUMS field is a state of the art, closed-loop, model agricultural farm for precision agriculture. It is established to study the efficiency of Paradoxical Agriculture (assisted by precision agriculture tools) in improving the crop yields, soil health, and lives of the farmer community, compared with the orthodox agricultural practices. Another aim of the field is to study the time required by the PQNK agricultural technique to reclaim land damaged by conventional agriculture methods.

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OPTICAL INSPECTOR FOR COCKPIT

FEATURES

- Compatible with ARINC 661 compliant tools for developing CDS
- Supports system-level and system integration level testing of CDS
- Supports CDS testing in SIL and Automated visual inspection using computer vision
- Automated test case generation
- Automated test case execution
- Automated test evaluation
-
-

An optical inspector is a tool developed to test multi-functional displays used in the Cockpit Display Systems (CDS) of an aircraft. The tool uses computer vision and artificial intelligence techniques to identify the faults in the display of various CDS elements. The tool complies with the ARINC 661 standard for CDS.

A common practice by the aircraft vendors is to test the information displayed on CDS by manually executing different aircraft flight scenarios and manually verifying the correctness of information displayed on CDS according to these scenarios. Testing in this way is a very time consuming and laborious task. The tool alleviates the manual effort by automating the CDS testing.

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COVERAGE ANALYZER

FEATURES

- A coverage measurement tool for safety-critical systems
- Comply with MISRA C standard
- Supports source code highlighting
- Generates coverage overview using graphs and charts
- Supports multiple coverage criteria including MC/DC criterion Generates coverage analysis reports

A tool is developed to analyze the coverage of code written in C programming language. The tool compiles with the MISRA C standard that defines codeing guide-lines to develop safety critical systems.

One of the main testing activity for the testing safety-critical systems is to analyze the code coverage. The manual inspection of code coverage is a very labour-intensive and time-consuming. The purpose of the tool is to assist a tester in analyzing the coverage of code automatically.

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TEST DATA GENERATOR FOR MC/DC

FEATURES

- A generic tool that supports the testing of diverse applications
- Automated test data generation
- Supports coverage-based testing i.e., MC/DC criterion
- Supports system-level testing
- Scalable, robust, and cross-platform tool

An automated test data generation tool is developed that uses computational intelligence techniques and system models. The tool generates test data according to the MC/DC criterion.

To test safety-critical systems, achieving MC/DC is recommended by international safety standards, e.g., DO-178C. For this purpose, the generation of test data manually is not practical due to the huge number of possible values. The tool automates the test data generation to achieve the MC/DC criterion.

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SURGICAL SUTURE ATTACHMENT FORCE MEASUREMENT DEVICE

FEATURES

- Suture Size: 3/0 – 9/0
- Force Measurement: 0.2N – 7N
- Operating Mechanism: Tactile Sensor (FSR)
- User Input: Keypad
- Output Panel: On-board Printer, Status
- indicating LEDs & OLED Display
  Sample Placement: Surgical Needle
- Gripper & Suture Gripper

Surgical Suture is a therapeutic device used after an injury or surgery to join human body tissues together. A low-cost, smart and efficient design of attachment force tester using a tactile sensor based on Force Sensing Resistor (FSR) technology is proposed.

In Pakistan, there are huge numbers of hospital and medical training centers performing surgeries. Most of them buy suture from different quality brand suppliers. This new proposed machine would help surgical companies to expand their surgical activities in the form of low-cost equipment, easy maintenance and up-gradation services.

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NED VENTILATOR

FEATURES

- Modes of Ventilation: 9 Modes
- Ventilation Type: Invasive & Non-invasive
- Alarm Volume: 50 – 80 dB
- Weight: 30 Kg (Ventilator + Compressor)
- User Display: Touch Display & Button Panel
  Power Source: AC (Wall plugin), DC (Adapter)
- Operating Environment: 15-30˚C Temperature, 1 atm Pressure, 25-75% humidity
- Patients: Adult & Pediatric

Ventilators are very critical in current COVID-19 pandemic. Therefore, it is needed to develop rapidly ventilators in considerable quantity that are reliable and stable during different modes (of operation) to provide ventilation to the patient in different critical conditions via Mandatory Ventilation modes (CMV/ AC/ SIMV) and Pressure support modes PSM mode (BiPAP/ CPAP). In this regard, the team of Haptics, Human-Robotics and Condition Monitoring Lab (affiliated with NCRA) of NED University of Engineering and Technology, Karachi developed an indigenous basic ICU-ventilator naming NED-ventilator, whose design is based on desired mixture of controlled-compressed air/ oxygen switching. The state-of the art design has obtained provisional approval for serial production from PEC/DRAP. The design is following the European/UK govt. standards and is able to be not only effectively used in COVID-19 but also for other ICU requirements for the patients.

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HAPTICS TELE -OPERATION

FEATURES

- Haptics Teleoperation applications like Medical, Exploration, Drilling and much more
- The Handshake task deploys a Master device and Slave device, the slave mimics the movements of Master device
- The teleoperation can be performed using both LAN and WAN

Teleoperation system consists of a human operator, a teleoperator system and an environment. While the human operator controls the master device, the communication channel transfers force and position/velocity information, and the slave device manipulates the environment for different remote applications. The application for tele-presence includes application in medical field like minimal invasive surgeries, exploration in hard to reach and non-human friendly areas like deep sea and Mars, drilling, drawing and many other fields. The current major contribution of lab in the Haptics domain is the development of a handshake algorithm on WAN.

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TRACTION MOTOR FAULT DETECTION SYSTEM

FEATURES

- Real-time condition monitoring
- Effective and Early fault detection
- Low power requirements
- Wireless Monitoring
- Portable Monitoring System

INTRODUCTION:

An Early fault detection system for traction motors is being proposed which will allow to effectively monitor the condition of traction motors using vibration data. The condition monitoring system can also be remotely monitored through IoT.

Traction motors in locomotives suddenly fail owing to various rough operating conditions, researchers at the Condition Monitoring Systems Lab of NCRA are indigenously developing an early fault detection system for traction motors which will assist in avoiding unplanned halt in operation of train due to failure of traction motors in locomotives. It is designed with the exclusive features including effective fault diagnosis, real-time fault detection, and wireless monitoring.

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WIRELESS INERTIAL MEASUREMENT UNIT

INTRODUCTION:

This is a continuation of the track surface monitoring as discussed earlier. In this work, we have adopted Wireless Sensor Networks (WSN) to overcome problems of the safety of the structure by analyzing them precisely using structural health monitoring techniques. This emphasis on the development of an IOT based smart instrumentation for analyzing the health of the structure based on the accelerometer (ADXL320) and Node MCU. This is based on the work accepted for publication in the Journal of Wireless Personal Communication titled "Development of IOT Based Smart Instrumentation for the Real-Time Structural Health Monitoring" (In press)

APPLICATIONS

The product is aimed to determine the track faults in real-time using a wireless medium of communication. The entire data and the track can be monitored remotely, in real-time by using an online cloud platform named Thing speak.

SPECIFICATIONS:

The developed device is based on the mentioned below specifications:

Low-Cost Solution: The developed prototype is an indigenous and low solution for railway condition monitoring.

Wireless Communication: The developed prototype is an IoT enabled device.

Built-in Power: The device has a built-in battery that has a backup of 7 hours.

Low Latency: The device is a low delay rate making it perfect for real-time measurements.

Rugged nature: The device is tough and can withstand the harshness of the railway condition monitoring.

Accuracy: The device performed very well in determining the track damages making it a reliable solution for the real-time – railway condition monitoring.

Power Efficient: The device consume low power.

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AXLE BASED ACCELERATION -WIRELESS (ABA-W)

FEATURES

- Portability
- Cost efficient
- Compact in size
- Smart road condition monitoring
- Inspection of severity of damaged road
- Power efficient.

Road deterioration remains a major problem especially in Pakistan resulting human casualties and financial losses such as mechanical strain for vehicles, increasing the need for repairs and fuel consumption of vehicles. Hence; the product is designed to prevent road accidents and vehicle damages on roads. The prototype consists of Node MCU (with built in WIFI) and GY-61 ADXL335 accelerometer provides acceleration and speed of vehicle and an android application mapped with Google Map is designed to collect location coordinates of vehicle. This data is then sent to Firebase database using WIFI module for analysis. The prototype deployed on the wheel axle of van follows Axle Based Acceleration (ABA) method. The Fuzzy C-means clustering algorithm (unsupervised linear clustering algorithm) analyzes the acceleration, speed and GPS coordinates of vehicle for road condition monitoring and provides predicted road bumps' location coordinates. Fuzzy Partition Co-efficient technique is used to determine the optimal number of clusters. The predicted location coordinates are then specified in the android application which will be used by drivers for getting alerts.

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HANDHELD TRACK RECORDING VEHICLE

FEATURES

- Control Mode: Wireless/Cloud
- Drive Options: Rail Track
- Backup: 5hrs on a single charge
- Travelling Speed: 3 km/hr
- Algorithms: Wavelet Transformation and Canny Edge Detector
- Video Resolution: 480p
- Controller: Raspberry Pi 3 B +

Usually, railway accidents are caused by train derailment, the mechanical failure of tracks, such as broken rails often caused by lack of railway condition monitoring. Such monitoring could identify track surface faults, for e.g: squats, that act as a catalyst for the track to crack and ultimately break. The developed prototype enables real-time identification of railway track faults using image processing techniques such as Canny edge detection and 2D discrete wavelet transformation. The Canny edge detection outperforms traditional track damage detection techniques including Axle Based Acceleration using Inertial Measurement Units and is as reliable as Fiber Bragg Grating. The Canny edge detection employed can identify squats in real-time owing to its specific threshold amplitude using a camera module mounted on a specially designed handheld Track Recording Vehicle (TRV). The 2D discrete wavelet transformation validates the insinuation of the Canny edge detector regarding track damage and furthermore determines damage severity, by applying high sub band frequency filter. The entire algorithm works on a Raspberry Pi 3 B+ utilizing an OpenCV API. When tested using an actual rail track, the algorithm proved reliable at determining track surface damage in real-time. Although wavelet transformation performs better than Canny edge detection in terms of determining the severity of track surface damage, it has processing overheads that become a bottleneck in real-time. To overcome this deficiency a very effective two-stage process has been developed.

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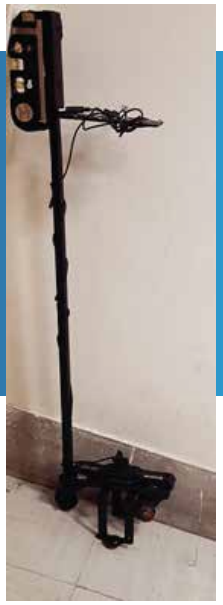
SQUAT DETECTOR STICK (SDS)



FEATURES

- Control Mode: Wired
- Drive Options: On Rail Track
- Camera Focal length: 3cm
- Latency: 0.0213 sec
- Damage Analyzing: Canny Edge and Wavelet transformation
- Processing Mode: Workstation
- Camera Resolution: 5MP, 1080p
- Additional Feature: Tilt analyzer

DMS is acronym for Damage Measuring Stick. It is a smart stick equipped with a 5MP, 1080p camera that uses image processing algorithms like Wavelet transformation and Canny Edge Detector for analyzing and determining the track damage.

It is design for any labor to analyze the track damage like a professional maintenance engineer. The filter parameters are kept in such a way that it detects those tracks which require immediate concern. Furthermore, the efficiency of this DMS is validated from Sonatest Railscan 125.

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NCRA PORTFOLIO

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WIRELESSLY OPERATED TRV

FEATURES

- Control Mode: Wireless/Cloud
- Drive Options: Rail Track
- Range: 24 km
- Traveling Speed: 8 km/hr
- Turret Rotation: 180 Degrees
- Battery Backup: 3 hrs
- Sensory Feedback: Accelerometer
- Battery: 70 amp-hours

Wirelessly operated TRV is designed based on the Cloud networking platform. The developed system has less latency, more accuracy and has an ability to detect sophisticated track surface faults like Squats and turn out frogs that are hard to determine using visual inspection techniques.

The system cost less around $1000 and its designed on the rigid steel frame. The wheels of the system are designed in such a way that they damp the readings for the joint gap making these wheels novel for the detection of the track faults. The entire analysis is done using Inertial Measurement Units, which are able to analyze the track faults using Fast Fourier Transform.

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SOCIAL MOBILE AUTOMONOUS ROBOT

FEATURES

- Control Mode: Autonomous
- Drive Options: Wheels
- Application: Assistance
- Range: Area Mapped during Setup

INTRODUCTION:

Humans are instinctively anxious when interacting with unknown objects, and robots are no exception. In situations where humans have to interact with robots, they should be able to interact in natural language and should be socially aware. Our Social Bot is capable of communicating in contextual natural language. It is an assistive bot that provides relevant information with regards to query. Individual asking is identified, and replies are contextually related to identified personne

APPLICATIONS:

- Crime Monitoring & Citizen Assistance
- Customer Service Representative
- Airport Assistance
- Event & Seminar Assistance
- Waiter at Restaurants
- Control Mode: Autonomous

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SNAKE ROBOT

FEATURES

- Control Mode: Autonomous
- Application: Search and Rescue, Oil and Gas industry, Defense

Adaptive algorithms are being used for motion planning, object detection, mapping and localization

INTRODUCTION:

Snake robots have the unique ability to navigate around uneven terrains, pipes, holes, and explore small spaces owing to their small structure and agility. It can also be used to, autonomously build a 3D map of an unknown environment whilst identifying and localizing different objects.

APPLICATIONS:

Search and Rescue: In the case of natural disasters such as earthquakes or floods, this autonomous robot helps the response team by navigating under rabble or water and identifying survivors.
Industrial Application: It can move or climb through pipes for inspection, drilling, or welding.
Defense Application: It can be used for security and tactical surveillance.

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EMO 3.0

Dual seat Self -Driven Car

FEATURES

- Self-Driving Auto-Pilot
- 360 Degree Field of View (FoV) using 3D LiDAR
- High Resolution Cameras
- Vehicle-2-Infrastrure Communication
- Object and Event Detection and Response
- Passenger Communication System
- Electric Vehicle
- Auto Accident Reporting
- Emotions Inspired Collision Avoidance
- ISO 262602 Standard Compliance

EMO 3.0 (super pro) is an acronym for dual seat emotion enabled autonomous vehicle indigenously built by SelfTech. The basic purpose of EMO is to design truly human inspired autonomous vehicle, which makes decisions using both cognitive and emotional cues. It is equipped with advanced auto-pilot and multi-purpose sensors i.e. 3D LiDAR and high definition cameras. Customized autopilot has been designed for the EMO to perform multiple functions without human intervention.

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AUTOMATON SIMPLE

FEATURES

- Advanced Self-Driving Auto-Pilot
- 360 degrees field of view using 2D LIDAR
- High resolution cameras
- Object and event detection and response
- Autonomously goods delivery
- 450 Kgs Weight Capacity
- User friendly interaction interface Auto-accident reporting
- Customized operation design
- domain
- ISO 26262 standard compliance
-

Automaton Simple is a human inspired autonomous industrial loader. The autonomy level 4 electric self-driving industrial loader has been developed for the transportation of freight from one point to another. It is equipped with autopilot and multi-purpose sensors i.e. long and short-range sonars and cameras. Customized autopilot has been designed for the loader to perform multiple functions without human intervention. Automaton can carry load from one point to another. The power source of the loader is 48v (4 dry-cell batteries), can operate 3 hours in the field

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PRECISION AGRICULTURAL SPRAYER

FEATURES

- No. of nozzles: 6
- Swath size: 4.35m
- Pump: Positive displacement pump
- Operation modes: manual/automatic
- Add on features: GPS sensor, vision sensor, HMI
- Boom length: 3
- Tank size: 300 liters
- Spray angle: 80o

A Precision Agricultural Sprayer is being developed which will be tractor-mounted and can spray pesticides uniformly supporting varying tractor speeds. The onboard visionbased control system will detect and recognize plants and weeds in real -time for targeted spraying. The sprayer system can be used for both sensor-based variable rate application on variety of crops such as tobacco, maize and vegetables.

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BIONIC HAND FOR TRANS-RADIAL AMPUTEES

FEATURES

- Five Individual Powered Fingers
- Manually Rotated Thumb for Multi-Grasping
- 7 Gripping and Grasping options
- Weight up to 500 g
- Up to 800 grip patterns on a single battery charge

Advanced Robotics & Automation Lab, UET Peshawar has indigenously developed, low-cost, light weight and userfriendly active hand for trans-radial amputees of developing countries including Pakistan to restore their Activities of daily livings (ADLs). The developed product requires minimal training of amputee for its operation due to state-of-the-art intelligent control architecture. With the developed product various grasp and grips patterns can be achieved including power, precision, finger-point, tripod and key grip.

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INTELLIGENT PROSTHETIC KNEE FOR LOWER LIMB AMPUTEES

Advanced Robotics & Automation Lab, UET Peshawar has developed low cost state-of-the-art electronically controlled intelligent transfemoral knee joint to facilitate lower limb amputees by equipping them with technologically advanced prosthetic devices to assist them in contributing towards socio-economic growth of the country. The developed prosthesis utilizes various sensing mechanism coupled with computational intelligence to control the resistance of knee joint in real time resulting in several advantages including increased awareness to amputee about position of prosthesis in real time, better balance, ability to climb stairs, walk on ramps, less concentration on mechanics of walking and more importantly lesser amount of input energy from amputee in operating these devices subsequently less fatigue of amputees.

FEATURES

- Control Mode: Passive
- Flexion Angel: 120°
- Speed Adaptive
- Intelligent Stance & Swing Phase Control
- Enhanced Stability
- Stumble Recovery
- Battery Backup: 6 Hrs.

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MULTI-CROP PRECISION SEED PLANTER

FEATURES

- Multi-crop plantation
- High Speed & precise Planting
- Seed Singulation
- Adjustable Seed-Seed Dist.
- Adjustable Depth Control
- Variable rate seed application
- Increased Productivity

A multi-crop precision seed planter is being developed to achieve maximum crop yield. The Seed drop mechanism will be electrically controlled with enhanced assurance level of required seed to seed distance at required depth. Variable rate seed drop method will be applied to increase maximum utilization of land according to its yield properties. R&D efforts are also put into seed planter to increase crop yield by incorporating various furrow opener designs, seed depth control and soil covering mechanism.

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LASER CUTTING

FEATURES

- 1 KW fiber laser for sheet metal and tube structures
- Sheet Bed Size: 3000mm x 1500mm
- Tube: 20mm – 200mm Materials: CS, SS, MS, Alumi-num, Brass
- Contactless Cutting
- High Speed
- Accuracy, Precision & Repeatability

Robot Maker Lab (RML) offers one shop for all your production metal parts. Our state of the art laser cutting machines are capable of manufacturing complex, ergonomically pleasing and functional sheet and tube cut products as per requirement.

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3D PRINTING AND SCANNING

FEATURES

- Rapid Prototyping
- Reverse Engineering
  Print size up to 500mmx-500mmx500mm
- Materials: PLA, ABS, PET, PETT, Nylon
- Fused Filament Fabrication
- Stereo lithography using Photo solidification

Robot Makers Lab offers 3D printing and 3D scanning services. Printing center is equipped with high-performance professional FDM and SLA 3D printers. In addition a high resolution 3D laser scanner is also available.

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PCB DESIGNING
AND MANUFACTURING

FEATURES

- Double sided PCB Manufacturing
- Optimized PCB Designing CNC Drilling and Auto Soldering
- Automatic SMD Component Mounting
- Min Track size: 8ml, min hole size: 16ml

Robot Maker Lab offers services of PCB designing, manufacturing and stuffing (PCB assembly) up to 2 layers. Salient features of PCB Setup are as follows:

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CNC MANUFACTURING

FEATURES

- 5 Axis Machining Centre
- Mini CNC Lathe Machine
- Mini CNC Milling Machine
- High Accuracy & Tolerance
- Low volume & complex geometries

Robot Maker Lab is equipped with 5 axes CNC Machining Centre as well as other smaller instruments for precision machining jobs.

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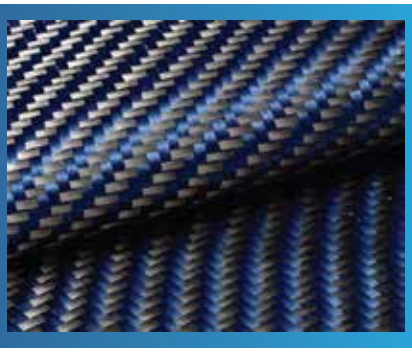
COMPOSITE MATERIAL MANUFACTURING



FEATURES

- Light Weight Structures
- CNC Pattern and Mold
- High Volume Fraction Materials: Carbon Fiber, Glass Fiber, Kevlar
- Process: Hand layup, Vacuum Infusion, Oven

Robot Maker Lab offers state of the art composite material manufacturing services.

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INJECTION MOLDING

FEATURES

- High Output Production
- Cost Savings
- Precision, Efficiency & Strength
- Use multiple types of Plastic
- Light weight products

Robot Maker Lab offers the services of Injection Molding for the production of wide range of complex plastic components, and can benefit wide range of OEMs across many different industries. Injection molding facility offers the following benefits:

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TRAININGS

FEATURES

- Computer Aided Design and Manufacturing
- Rapid Prototyping
  CNC Machining
- Microcontroller & Sensors
- Internet of Things

Robot Maker Lab provides services of Professional Trainings for academia and start-ups under the supervision of highly qualified and skilled Engineers.

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ARDUINO

BASED TRAINING KIT

FEATURES

- Arduino UNO
- Relay Module
- MPU6050 (Accelerometer, Gyroscope)
- RFID Module
- LCD (16x2)
- Bread Board
- Sensor (Vibration, Obstacle, Temperature and Ultrasonic)
- Servo and stepper Motor

From concept to design, through prototype to production, RML Design and Manufacturing Services can support every aspect of your electronic and embedded design process in the realm of PCB. As specialists, we provide full turnkey product development and medium to high-volume manufacturing services. From electronic component procurement to PCB design and layout, through Fabrication and Assembly of PCB, we boast our expertise in terms of perfection in engineering and manufacturing PCBs for our esteemed customers.

Please contact us for your queries about our service and expertise regarding your requirement.

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NCRA Social Media

We've embraced the digital realm to share our journey with a global audience. Across various social media platforms, our dedicated page and channel serves as a vibrant hub where we unveil the cutting-edge advancements emerging from our partner R&D labs.

Please visit our YouTube channel to discover more:

https://www.youtube.com/@NCRA-NUST

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