Department of Mechatronics Engineering
NUST, College of E&ME
1st INTRA NUST CONFERENCE Nov 8, 2014

DR. UMER IZHAR
The Department

- Department of mechatronics was established in 1998
- First undergraduate degree (DE 20) graduated in 2002
- Postgraduate program started in 2005
- Current Student Enrollment (PG: 66+1, UG: 337)
- Graduated till 2014: UG: 794, PG: 35
Research @ DMTS
Core Research Competencies

- Mechatronics systems
- Manned and unmanned robotic vehicles
- Upper and lower limb prosthetics
- Brain computer interface
- Automotive
- Mobile robotics
- Missile guidance
Robotics and Prosthesis Group

- **Research Focus**
  - Unmanned Vehicles
  - Prosthetic Limbs
  - Other Research Areas

- **Tracked Reconfigurable (TREC) UGV**
- **Semi Autonomous Tracked Reconfigurable (STAR) UGV**
- **Mini UGV**
- **Throwable UGV**
- **SHRIMP**
Robotics and Prosthesis Group

Tracked REConfigurable (TREC) UGV

- Wireless control
  Range up to 1 Km
- 3 Onboard Cameras Feedback
- GPS feedback
- Improved Track drive
- Improved Onboard Processor
- Light Weight
- Ruggedized Platform
- Payload Capability of 30kg

TREC UGV with G3 mounted – Live Fire

TREC UGV with camera mounted for surveillance
Robotics and Prosthesis Group

Tracked REConfigurable (TREC) UGV

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  Range up to 1 Km
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User Trial in North Waziristan
Robotics and Prosthesis Group

Tracked REConfigurable (TREC) UGV

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  Range up to 1 Km
- 3 Onboard Cameras
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- GPS feedback
- Improved Track drive
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- Payload Capability of 30kg

User Trial in North Waziristan
Robotics and Prosthesis Group

STAR UGV

- Track drive – Articulated Flipper Arms
- Wireless control range up to 1 Km
- 3 onboard cameras feedback
- GPS feedback
- Payload Capability 30kg
- Improved Onboard Processor
- Ruggedized Platform

High Mobility
Unmanned Ground Vehicle

STAR UGV - Maneuverability
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Mini UGV

- Wireless control range up to 1 Km
- 1 onboard camera feedback with night vision
- Payload capability 5kg
- Track drive
- 2 x motors with torque 10Nm
- Li-Po batterys

SMALL UNMANNED GROUND VEHICLE

Mini UGV - Maneuverability
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**Throwable UGV**

- **Light weight** – carbon fiber
- **Wireless control** range up to 1 Km
- **4 x brushless DC motors**
- **Speed** – 20 km/h
- **4 x wheel drive**
- **Li-Po batteries**

**Throwable UGV - Maneuverability**
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**SHRIMP UGV**

- High maneuverability and steer ability
- Climbing up and down obstacles of varying sizes
- Wheel fault / failure tolerant motion
- Rough terrain negotiation
Prosthetic Limbs
Robotics and Prosthesis Group

- Body Powered Upper Limb
- Myo Electric Upper Limb
- 7-DoF Myo Electric Upper Limb

- Research Focus
- Unmanned Vehicles
- Prosthetic Limbs
- Other Research Areas
Robotics and Prosthesis Group

Body Powered Upper Limb

- Light weight
- Economical
- Portable
- User Friendly
- 2 to 3 days battery life
- Patient testing complete

Patient training of body powered prosthetic limb

Left: Patient wearing the limb, Right: Limb close-up
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Myo Electric Upper Limb

- EMG signal actuated
- Light weight
- Economical
- Portable
- User Friendly
- Patient testing complete
Robotics and Prosthesis Group

7 DoF Myo Electric Upper Limb

- Independent finger control and wrist movement
- EMG signal actuated
- Light weight
- Economical
- Portable
- User Friendly
- 1/10th cost of international limb
- 1st prototype made and tested
Social Impact

- Mr. Idrees lives in Rawalpindi
- He lost both of his arms in an electrocution accident at the age of 8 years
- With the help of the artificial limb we developed, he was able to complete his F.A. at Gordon College
Other Research Areas
Other Research Areas

- Bio Medical - BCI
- Automotive - OBD
- Mobile Robotics
- Missile Guidance
- MEMS
- Intelligent Transportation Systems
Other Research Areas

- Bio Medical - BCI
- Automotive - OBD
- Mobile Robotics
- Missile Guidance
- MEMS
- Intelligent Transportation Systems – Pavement Condition Monitoring

Signal acquisition using emotiv headset
Other Research Areas

- Bio Medical - BCI
- **Automotive - OBD**
- Mobile Robotics
- Missile Guidance
- MEMS
- Intelligent Transportation Systems – Pavement Condition Monitoring

Indigenous EME Diagnostic Scanner (i-EDS) for Land Rover Defender

- **Generic scanner compatible with military and commercial Vehicles**
- **Tested on Defender Jeep, Toyota, Honda and Mitsubishi**
Other Research Areas

- Bio Medical - BCI
- Automotive - OBD
- Mobile Robotics
- Missile Guidance
- MEMS
- Intelligent Transportation Systems – Pavement Condition Monitoring

- SLAM using particle filter
- Intelligent driving system

Electronics lab, Department of Mechatronics
Ground floor corridor, Department of Mechatronics
COMPPEC project display area, Officers Mess, EME
Other Research Areas

- Bio Medical - BCI
- Automotive - OBD
- Mobile Robotics
- **Missile Guidance**
- MEMS
- Intelligent Transportation Systems – Pavement Condition Monitoring

- Experiments with static and dynamic targets and obstacles

- Pursuer trajectories for maneuverable targets
Other Research Areas

- Bio Medical - BCI
- Automotive - OBD
- Mobile Robotics
- Missile Guidance
- MEMS
- Intelligent Transportation Systems – Pavement Condition Monitoring

• Dual axis micromirror device

• Stress concentration region for piezoresistive beams
Other Research Areas

- Bio Medical - BCI
- Automotive - OBD
- Mobile Robotics
- Missile Guidance
- MEMS
- Intelligent Transportation Systems – Pavement Condition Monitoring

- Crack Detection - Classification

- Stress concentration region for piezoresistive beams
2. S. Mathavan, M. Rahman, K Kamal, “Use of the Self-Organizing Map for Crack Detection in Highly Textured Pavement Images” Journal of Infrastructure Systems (ASCE) – Accepted
3. A. Kumar, K. Kamal, M. Omer Arshad, T. Vadamala, S. Mathavan, “Smart irrigation using low-cost moisture sensors and XBEE-based communication” Global Humanitarian Technology Conference, California, USA – Accepted
THANKYOU