• **Goal/Purpose**
  Tackling a broad range of issues related to human-robot symbiosis/synergism by means of mechatronics technology in simulation and physical implementation

• **Approach**
  • Proposing and developing new features/architecture, with demonstration in simulated and real world environments
  • Building systems while integrating broader knowledge and relevant technology
  • Emphasis on collaborative work and team communication

◆ **Step-on Interface (SOI)**
  ![Diagram of Step-on Interface (SOI)]

◆ **Walking Training mobile robot (Customizable trajectory)**
  ![Diagram of Walking Training mobile robot (Customizable trajectory)]

◆ **Human detection/following robot (considering mobility)**
  ![Diagram of Human detection/following robot (considering mobility)]

◆ **Image-projective Desktop Arm Trainer (IDAT)**
  ![Diagram of Image-projective Desktop Arm Trainer (IDAT)]

◆ **Education/Learning System**
  ![Diagram of Education/Learning System](Literacy-alphabet/Calligraphy-brush stroke)
**3D Aerial Holographic Image Interface (3DAHII)**

Navigation of mobile robots in semi-structured outdoor environments
- Without pre-driving recording (i.e. SLAM)
- Using network-provided maps (i.e. OpenStreetMaps)
- Contextual awareness for navigation (vision, location)

**Outdoors Path Planning for Mobile Robots**

- Mobile Robot Testing Platform
- 2D Internet Map
- Edge Analysis & Path Formation

**Precise Hand Pose/Gesture Capture**

- Usage of a multi-camera setup
- Accurate identification of hand pose
- Overcoming incorrect detections due to poor viewing angles

**Dynamic Precise Localization of Multi-Mobile Robots in 2D Plane**

- SMR: Small Mobile Robot
- FMR: Frame Mobile Robot
- Example: hand gestures

**Robot Arm Manipulation with Machine Learning in Simulation**

- Robot Manipulator: 7 DOF Kuka Arm, Barrett Hand
- Study Contents: Arm joints’ impact on hand finger joints while operating with objects, Stable object holding by hand under impacts
- Training Methods: Reinforcement Learning (Q-Learning), Neural Networks

**Human Gait Characterization**

- Problem Definition
  - Dependence on certain devices (e.g. acceleration sensor, pressure plate, laser range scanner etc.)
  - High devices cost, detection area limitation
- Purpose
  - Detecting by Kinect (low cost)
  - Recording walking activities (stance phase, swing phase, step length, stride length, and stride width etc.)