

**Idea #1:** Soft Robotic Wearable for Early Detection and Support of Joint Degeneration (e.g. Osteoarthritis)

- **Research Interests:** Soft Robotics/Wearable Sensors/Biomechanics/Medical Diagnostics
- **Research Goals:**
  - Develop a wearable sleeve with embedded soft actuators and stretch sensors
  - Monitor joint kinematics and loading patterns
  - Use Machine Learning to detect deviations that correlate with early-stage degeneration.
- **Novelty:**
  - Most current wearables lack actuation or biomechanical intelligence
- **Feasibility:**
  - Moderate
  - Off-the-Shelf sensors
  - 3D-printed soft actuators can speeden up prototyping
- **Real-World Impact:**
  - Can help people of all ages who may face the challenge of Joint degenerations
  - Can assist people in early stages, through warning and preventive action

**Idea #2:** Soft Micro-Robot for Targeted Movement in Fluid Environments

- **Research Interests:** Microrobotics/actuation/soft mechanics/soft materials
- **Research Goals:**
  - Develop a small-scale soft robot that can navigate viscous fluids (e.g. using magnetic actuation or acoustic propulsion)
  - Test in gelatin or synthetic fluid environments
  - Integrate micro pressure or magnetic sensors for localization
- **Novelty:**
  - Focus on controlled movement in confined or medical-like environments
- **Feasibility:**
  - Small-scale build with soft polymers
  - External actuation systems
- **Real-World Impact:**
  - Can help advance drug delivery by mimicking travel in bodily fluids.

**Idea #3:** Magnetic Soft Actuators for Programmable Morphing Structures

- **Research Interests:** Smart Materials/Remote Actuation/Shape Control
- **Research Goals:**
  - Design a structure embedded with soft magnetic elastomers
  - Use an external magnetic field to trigger morphing (e.g. folding, bending, twisting)
  - Explore sensor integration to create a feedback loop for shape control
- **Novelty:**
  - Programmable matter concepts for robotics and morphing surfaces
- **Feasibility:**
  - Can use low-field permanent magnets

- Iron-Particle Elastomers
- **Real-World Impact:**
  - Can help in search and rescue

**Idea #4:** Modular Soft Actuation Units for Rapid Robot Reconfiguration

- **Research Interests:** Modularity/Plug-and-Play Robotics
- **Research Goals:**
  - Develop soft actuator modules that can be rearranged to create different robot morphologies.
  - Each module includes actuation and minimal sensing
  - Explore how reconfiguration affects robot behavior
- **Novelty:**
  - Few soft robotics systems explore true reconfigurability
- **Feasibility:**
  - Can be done with a few module designs
- **Real-World Impact:**
  - Can assist in search and rescue
  - Can assist in warzones where robots can be easily destroyed