Ashrut Aryal

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EDUCATION

Michigan State University	**East Lansing, MI**
PhD, Mechanical Engineering, GPA: 3.88/4.0	Expected May 2027
MS, Mechanical Engineering	Expected May 2026
Kathmandu University	**Kathmandu, Nepal**
BS, Mechanical Engineering	2017 - 2021

RESEARCH EXPERIENCE

Graduate Research Assistant   Jan 2024 - Present
Michigan State University, MOTRE Lab

Autonomous Robotic System for Cloth Flattening
- Built perception system to detect cloth deformations (wrinkles) and extract their location, orientation, and size
- Implemented 3D pose estimation system using ArUco markers in Python to track finger motion during human subject study; used camera calibration to transform marker poses to world coordinates
- Trained predictive models (neural network, linear regression) to map wrinkle geometry to human flattening actions, achieving generalization to novel wrinkle types
- Integrated real-time perception with robot control on FANUC industrial manipulator to autonomously flatten cloth using continuous visual feedback

Body-Machine Interface for Industrial Sewing Machine Control
- Developed a torso-lean IMU Body–Machine Interface (BoMI), enabling precise control of industrial sewing machine (continuous speed control + discrete state control including presser-foot/needle lift mechanism)
- Interfaced sewing machine control board via Arduino (UNO R4 DAC) to output pedal-equivalent analog voltages, replacing foot pedal with IMU-based torso lean control
- Integrated bHaptics vest providing continuous haptic feedback (proportional to lean angle) for speed awareness and pulse-based alerts for state transitions

WORK EXPERIENCE

Robotics and AI Engineer   June 2022 - July 2023
National Innovation Center, Kathmandu, Nepal

Multi-Object Tracking and 3D Perception System for Autonomous Robot
- Developed real-time multi-object tracker using YOLO detection with SORT architecture, Kalman filtering for state estimation and track continuity during occlusions, and Hungarian algorithm for IOU-based data association
- Estimated object depth by mapping 2D bounding boxes from YOLO detections to corresponding regions in aligned RGB-D depth image, then transformed pixel coordinates and depth to 3D positions

Synchronized Sensor Data Acquisition and Annotation System
- Built data acquisition system synchronizing dual RGB-D camera streams, LiDAR scans, odometry, and control commands for collecting robot navigation training data
- Created PyQt GUI for real-time visualization, frame-level annotation, and data validation and editing

TECHNICAL SKILLS

Programming Languages: Python, MATLAB, C, C++, Arduino
Computer Vision & ML: OpenCV, YOLO, PyTorch, TensorFlow, ArUco markers, 3D pose estimation, Kalman Filter
Robotics & Tools: ROS 2, FANUC Robot, IMU, Linux, SolidWorks, PyQt

PUBLICATIONS

- **A. Aryal**, N. Kant, R. Ranganathan, R. Mukherjee, C. Owen, "Robotic Manipulation for Flattening Wrinkled Cloth: A Human-Inspired Algorithm," *IEEE Transactions on Human-Machine Systems*, 2025 (Under Review)
- N. Kant, **A. Aryal**, R. Ranganathan, R. Mukherjee, C. Owen, "Modeling Human Strategy for Flattening Wrinkled Cloth Using Neural Networks," *IEEE SMC*, 2024. https://doi.org/10.1109/SMC54092.2024.10832048