MD. TANVIR HOSSAIN TAAHA

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Education

Bangladesh University of Engineering and Technology **2019 - 2024**
Bachelor of Science in Mechanical Engineering – CGPA: 3.02/4.00

Research Experience

Interests: *Robotics, Control Theory, Deep Learning, Image Classification and Localization, Embedded Systems.*

Automated Waste Sorting using Deep Learning and Robotic Manipulation: A Comprehensive Approach *ROS, MoveIt, Gazebo, PyTorch, YOLO*
[Presented at ICMIME'24]

- Using computer vision, object localization to classify various waste objects for recycling.
- ROS & MoveIt based autonomous pick and place to the correct bin with robotic arm, thoroughly tested in Gazebo.
- Successfully categorizing waste objects and successfully sorting them with the prototype.

Extra Curricular Activity

Software Team Lead, Team Interplanetar – BUET Mars Rover Team **2021 – Jun 2024**

- Facilitate development of mars rover's Full Software Stack for three generations of rover. Developed arm inverse kinematic control stack using MoveIt, wheel odometry and micro level communication system using CAN Bus.
- Lead the development of navigation stack, controller GUI and camera systems.
- Conducted various workshops, webinar and hands-on session for the next generation of students.

Academic Projects

Deep Learning Based Trash Sorting Robotic Arm *ROS, MoveIt, PyTorch, YOLOv5, SolidWorks*

- Trained YOLOv5 with custom dataset using transfer learning to categorize trash object found around the campus.
- Developed autonomous control for robotic arm using MoveIt starting from the image detection to finish sorting all the trash items.
- Designed a prototype to carryout tests and proof of concept.

Design and Manufactuer a Shell & Tube Heat Exchanger *SolidWorks, HTRI, MATLAB*

- Designed and Manufactured a Shell and Tube Heat Exchanger to lower Engine Oil temperature.
- Optimization and preliminary analysis were performed using HTRI Xchanger Suit v6.00
- Comprehensive testings were conducted to validate the performance and identify areas for future improvements, which included hydraulic testing, flow metering

Industry Experience

Machine Learning Engineer, ACI PLC – Tejgaon, Dhaka **Dec 2024 – Present**

- Developed a monitoring system with real time video inference, developed architecture which is highly optimized and scalable with minimum resources.
- Developed IoT devices with AI backend, developed the whole messaging pipline using MQTT.
- Implemented a custom data labeling pipeline using Dockerized Label Studio with ML backend for pre-annotation supporting images, audio and text for training and testing for the whole team.
- Administered and troubleshot development and production Linux servers, ensuring system security and operational robustness.

Junior Software Engineer*(Part-time)*, Bydo Academy – Lalbagh, Dhaka **Dec 2020 – Oct 2024**

- Worked on several android apps for clients featuring live audio-video chat, public posts, telemedicine and various govt. projects.
- Gained experience in team work, agile development strategies, managing large codebase, designing complex UI and handling database.

Projects

Field-Oriented Control (FOC) for BLDC Motor [GitHub] *STM32Duino, C/C++, FOC, CAN Bus*

- Developed a robust real-time communication interface using the CAN bus protocol for motor command and feedback from hall-effect sensors.
- Implemented high-performance Field-Oriented Control (FOC) algorithm on an STM32 microcontroller for precise BLDC motor commutation.
- Very high efficient and low overhead application layer on top of CAN bus.

Pico PIO-Based Software I2C Expansion [GitHub] *Raspberry Pi Pico SDK, Pico's Programmable IO Assembly*

- Implemented software I2C communication channels on Raspberry Pi Pico using its Programmable I/O (PIO) state machines.
- Expanded the number of available I2C interfaces beyond hardware limits, enabling concurrent communication with multiple sensors.
- Developed a robust and efficient solution for complex embedded sensor interfacing applications, demonstrating advanced microcontroller utilization.

Open Source Contributions

YOLO Annotator [GitHub] [Marketplace] – VSCode Extension *Typesctipt, HTML, CSS, YOLO*

- Made a VSCode Extension to annotate images directly as Ultralytics YOLO format.
- Auto detect directories based on common practice instead of a single directory as LabelImg.
- Fast loading in remote ssh sessions of VSCode for smoother experience.

Serialx: Cross-Platform C++ Serial Library [GitHub] *C++, Serial Communication, POSIX, Windows API*

- Modernized a lightweight, cross-platform C++ serial library inspired by PySerial.
- Added reliable serial communication support for microcontrollers on Linux (POSIX) and Windows (WinAPI).
- Designed a clean, user-friendly API to simplify serial data exchange in C++ embedded applications.

Undergraduate Thesis

Battery Thermal Management System with the combination of Phase Change Material, Metal Foam and Fin *ANSYS, Solidworks*

- Improved heat dissipation of Li-ion batteries using a passive thermal management system with phase-change material and metal fins.
- Carried out a comparative study of different variation of dimensional parameters.

Supervisor: Dr. Md. Ashraful Islam, Professor, Dept. of Mechanical Engineering, BUET

Honors and Awards

Champion | AutoInsights 2023: Presented poster regarding ADAS system in modern vehicles
Finalist | University Rover Challenge: Held in Mars Desert Research Station, Utah, USA, contributed to the rover in 2021 & 2022 and participated in person in 2023, as part of Team Interplanetar.
Team Interplanetar.
European Rover Challenge Remote Formula: Secured world-wide ranking 13th in 2023(as software team lead), 4th in 2022, 11th in 2021 organized by European Space Agency
Finalist | Anatolian Rover Challenge: Held at İstanbul Technical University. Secured 1st place and 2nd place (as arm kinematics lead, later software team lead) in the final round of anatolian rover challenge 2023 & 2024 respectively, as part of **European Rover Challenge Onsite Formula 2022:** Secured 8th position worldwide which was held at the Kielce University of Technology, Kielce, Poland.
Finalist | National High School Programming Contest: Organized by ICT Department of Bangladesh secured individual rank 6th.
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