Team Background

Team Members

Iram Arshad: Iram is enrolled as a PhD student at Technological University of Shannon: Midland Midwest, Athlone, Ireland. She is doing her PhD in the area of deep learning models. In particular, she is identifying deep learning vulnerabilities based on identification. She will propose a counter solution to mitigate them. Beforehand, she has four years of international industrial experience with expertise in software testing, design, and development of automation frameworks to ensure software quality.

Email address: i.arshad@research.ait.ie

Roopesh Bharatwaj K R: Roopesh is working as a Computer Vision Research Assistant at

Technological University of Shannon: Midland Midwest, Athlone, Ireland. He recently studied his Master of Science in Software Design with Artificial Intelligence (first-class honours). Beforehand, he has four years of full-stack software development experience in various domains with multiple international clients for web applications, NLP based students admission recommendation systems to universities in Europe and North America, ChatBot application development, NLP based text analysis and optical character recognition application developments.

Email Address: rramesh@ait.ie

Summary Report

We first came up with the idea to work on ROS. For this purpose, we start learning ROS. We abort this idea because it was more complex to understand in a short time, and we tried simulations, and they did not work well. Later, we start working after receiving the Lego kit. We first did the paperwork to design the lego kit. Once we had done designing, we started planning to develop the prototype. We decided on sub-task speech recognition, object detection, and object tracking to complete the prototype. We begin doing R&D on the speech recognition module, and we develop custom skillsets to do object recognition. We completed this prototype to detect the object by using the Alexa simulator. For object detection, we have used the yolov5 deep learning model.

In the last week of the challenge, we started developing the decided sub-tasks. We have faced many challenges and limitations with the software.

We came to know that the integration of Alexa with lego Mindstorm inventor is challenging, and we cannot complete this task within a limited time frame. So we skipped this idea and focused on object detection and tracking. We decided to use the CAIT toolkit interface to connect the lego hub with the toolkit interface and planned to perform object tracking and

detection with the lego hub. We were sure to complete the task by using the CAIT toolkit. However, we faced the problem at a crucial time. When we deployed the model on okd-lite, we faced PyTorch packages issues. We performed R&D and got the idea that the torch is more supportive of 64-bit os compared to 32 bit.

In contrast, the CAIT toolkit is only compatible with 32-bit os. Therefore, we need to change the plan at a very crucial time. We tried spike-prime plugins for micropython programming as well. However, it required some R&D and time to grasp this new knowledge. Therefore, we drop this plan and use the Mindstorm coding interface to control the lego and perform object detection and tracking.

Challenges:

1. We faced challenges during connectivity of the lego hub with raspberry pi Bluetooth.
2. We faced challenges in integrating our sub-modules object detection and tracking due to compatibility issues.
3. We observed the discontinued of a hub on raspberry pi even if it is connected with Bluetooth.
4. We converted our model weights to onnx, openvino IR to blob. Though documented are very well written we faced the issue during blob conversion due to model parameters. We solved this issue by using netron.app application.
5.

Tools: Lego Mindstorm-Inventor, lightweight shapes, CAIT Toolkit

Environment:

Raspberry Pi: 4B 64-bit OS

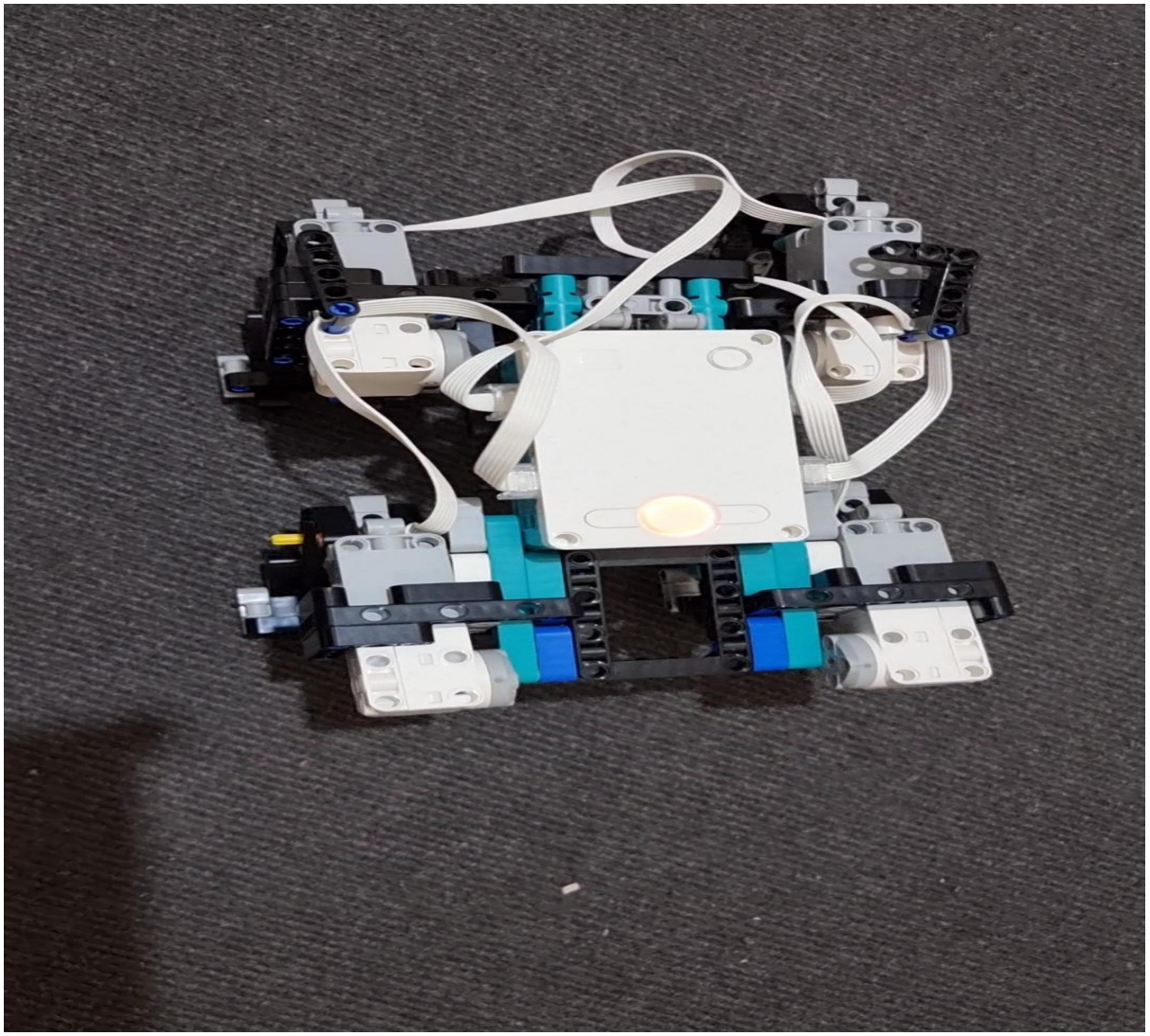
Cameras: OKD-lite

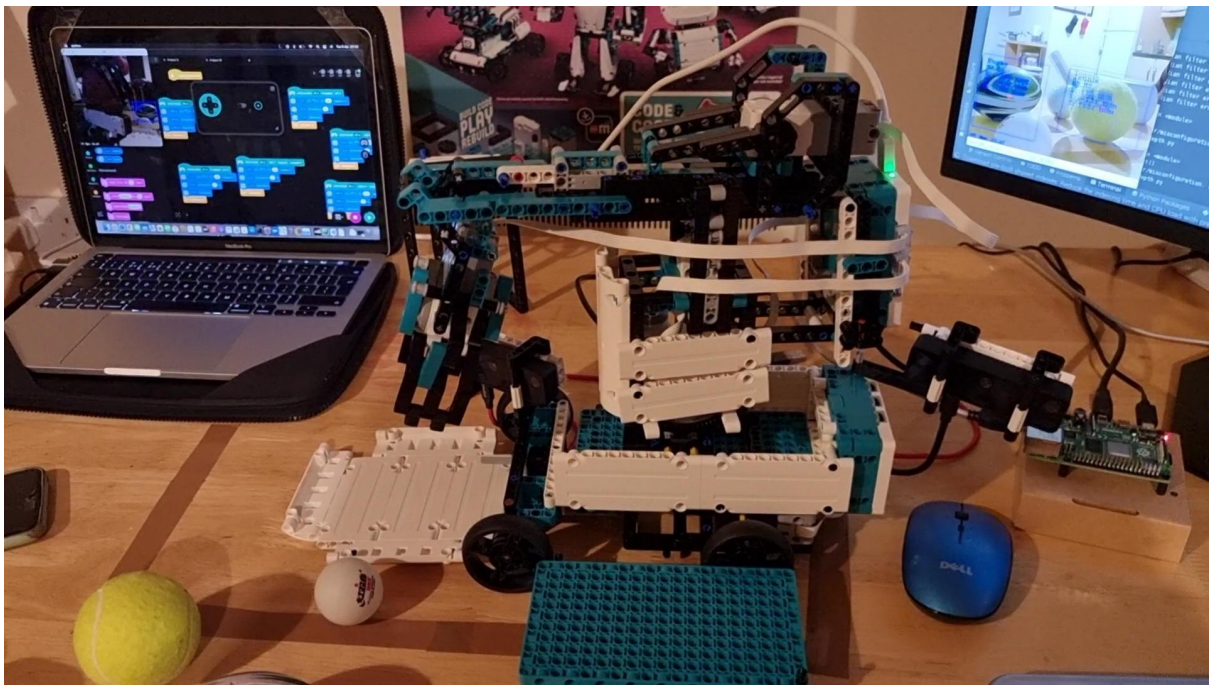
Deep learning model: Yolo5

Development: Collab, Pycharm

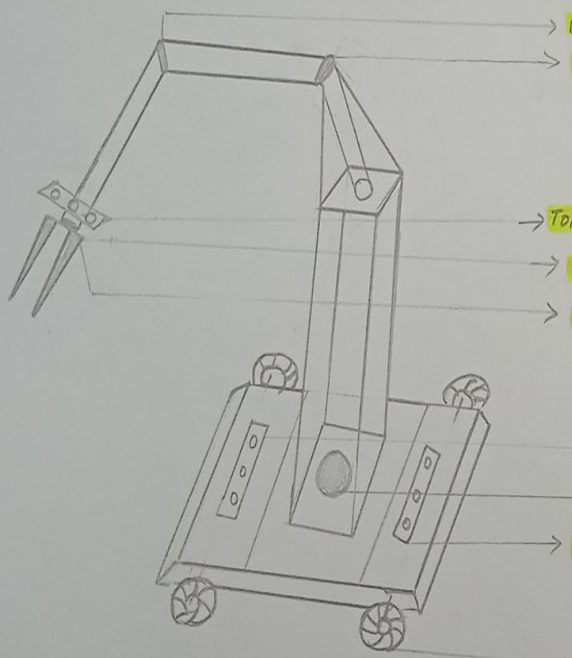
Training framework: Pytorch, Roboflow

Supporting Material:




DELL

WHEELED ROBOTIC ARM: (BASIC DESIGN) - 1



MOVABLE JOINT 180°

MOVABLE JOINT 180°

TOP CAMERA TO MEASURE DEPTH/OBJECTS (OAK-D-LITE)

EXPANDABLE FORK (SIZE ADJUSTABLE)

MOVABLE JOINT 180°

FRONT CAMERA (OAK-D-LITE)

360° MOVABLE DISK (FULL ARM MOVABLE)

REAR CAMERA (OAK-D-LITE)

WHEELS

REQUIREMENTS

1. 3 CAMERA - OAK-D-LITE
2. 5- MOTOR (FOR EACH MOVABLE JOINTS AND (REAR-WHEEL DRIVE)
3. ADJUSTABLE FORK (OR ANY, WHICH CAN LIFT OBJECTS)
4. 4- WHEELS
5. BATTERY TO POWER (3-CAMERA / ROBOT)