Batch – 2013

Sheffield Hallam University

B.Eng in Electrical Engineering 3rd Year Individual Project.

Design and Implementation of Explosive Ordnance Robot (EOD) using Image processing and computer vision.

Project Objective was to develop an EOD Robot (explosive ordnance robot) to locate, recognize and execute a bomb disposing task using a pre-trained dataset and computer vision.

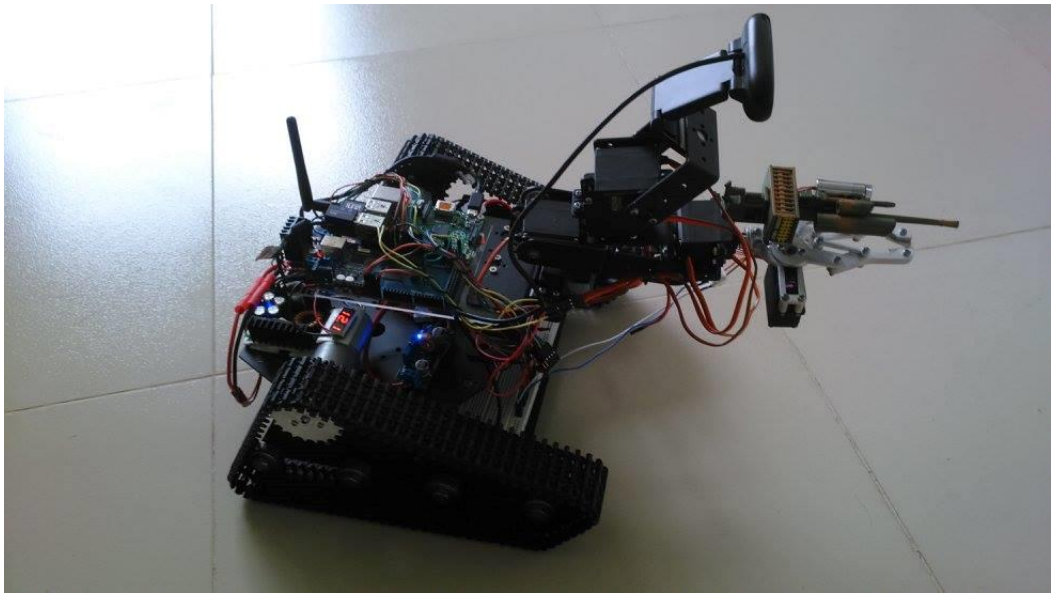
In this Project, the first part was to recognize direction signs placed on the path to manoeuvre the Robot. I have used a high-definition camera and Raspberry pi three-board for object recognition and classification. Python programming language and OpenCV libraries are used to run the image processing on Raspberry pi 3. This includes the techniques R-CNN, Fast R-CNN, and Faster-RCNN designed and demonstrated for object localization and object recognition. Based on the direction signals, Raspberry pi sends coordination to another MCU (Arduino board) to move toward the object. The PID algorithm is also used to keep the movement at a steady pace. It was initially simulated using MATLAB Simulink environment.

for the second part, once the Robot reached its target, an arm uses to pick up the target to perform the disposing task. In order to make the Arm movement precisely, I have incorporated mechanical inverse kinematics to plan the trajectory of the ARM. It combines multiple constraints to generate a course that guides the Arm gripper to grab the object. These constraints ensure that the gripper approaches the target in a straight line and that the gripper remains at a safe distance from the object, where it doesn't require the poses of the gripper to be determined in advance. Then servo motors of the arm is driven by Object Oriented Programming (OOP / C++)technique to operate each motor parallelly. Distance to the target is also calculated by triangular similarity using computer vision.

Overall, Project was focused on using computer vision in the field of military EOD services, where automated vehicles will be used to move dangerous terrains like minefields. The camera vision and the real-time performance of the hardware I used weren't enough to perform such an extreme task in a given time period. I experienced a lag, when receiving the real-time video feed to MCU, which I have used. for future work, In the report, I have mentioned that such tasks need high-end MCUs/ Hardware and Machine Learning knowledge to improve the performance of the Robot. It also can integrate the SLAMM path mapping technique to self-return to the starting location.

Learning outcomes from the Project.

- Computer vision and Image processing
- Python language / OpenCV libraries
- Robotic Arm movement using Inverse Kinematics



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