BMS College of Engineering, Bangalore – 19

Department of Electronics and Communication Engineering

AUTONOMOUS ROBOT DEVELOPMENT OPEN SOURCE PLATFORM (3.0)

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Abstract:

Robots are becoming indispensable in today's world. They are being used in a multitude of different sectors such as surgery, autonomous driving, etc. There is a growing requirement for intelligent robots that are capable of performing tasks that are time consuming or hazardous. Robots that will have an impact in industries or consumer markets will have to integrate several domains of robotics and coordinate these effectively. ARDOP 3.0 (Autonomous Robot Development Open-Source Platform) is the third-generation open source humanoid robotic mobile manipulation platform. This would serve as an extensive platform for robotic research making robots more commonplace. Custom designed experiments have been selected that test various abilities of ARDOP3.0, the accuracy of the kinematic and perception system is tested through the pick and place experiment and the ability of ARDOP to interact with humans and act logically is tested through a game of Tic-Tac-Toe.

Implementation:

The Perception System:

The Kinect camera is central to the perception system, it is used to solve the tasks of object recognition and localization of object within the camera frame.
Object Detection using YOLO v3 and trained on coco dataset. Perspective camera projection model for object localization.

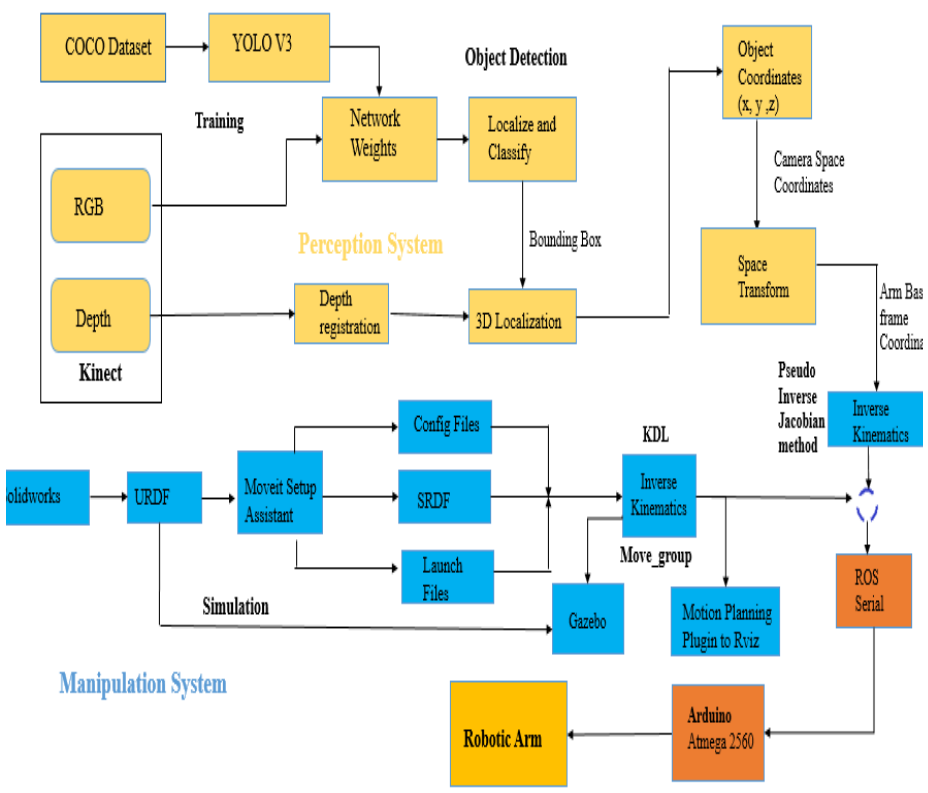
The Manipulation System:

The manipulation system comprises of the robotic arms and the inverse kinematic solver and the trajectory planner.
Kinematics Simulation using ROS was done on Rviz and Gazebo

The Tic-Tac-Toe Game:

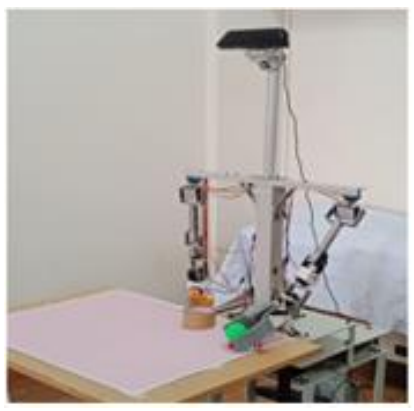
ARDOP has been enabled to interact and engage with Humans in a game of Tic-Tac-Toe. Through this game we attempt to demonstrate the ability of ARDOP to partake in social interactions, display its expandability and logically respond to a given situation in real time.

BLOCK DIAGRAM:



Results:

Workspace Aware Manipulation



Perception System: Spherical error of 0.4cm

Manipulation System: error of $x < 0.1$ cm; $y < 0.7$cm; $z < 1$ cm

The Tic-Tac-Toe Game