Title : Project Tsuki-no-me

Problem statement : Smart in-house autonomous robot helper for day-to-day activities.

Proposed solution :
For autonomous navigation with dynamic object obstacle(walking person) avoidance we will implement an adaptive monte carlo localization algorithm with the map generated using simultaneous localization and mapping using gmapping algorithm and try navigating a custom made rover in simulation. We will add a ur5 arm on the top surface of the rover via fixed joint. Using moveit motion planning packages to generate kinematics and inverse-kinematics solvers using KDL plugin for 6 dof ur5e arm and make it ready for pick and place. Now that the navigation and object pick and place working we will add an intel realsense depth camera just above the end effector of the arm to get the planning scene to enable collision avoidance of the arm with the environment. We will also extract 3D poses using depth image to perform object pickup and place autonomously. This all will be done in simulation as a proof of concept because as of now we don't have all the hardware.

Technologys : Robot operating system, Gazebo simulator, AMCL, SLAM, Moveit, Motion planning, ur5 arm.

Flow Diagram :

Gazebo Simulator

Simple Diagram of bot → Setting dimensions → Creating meshes in blender
→ Creating xacro and assembling all the links → setting up joints and roscontrol and camera and laser scanner and transmissions in gazebo

ROS

- Creating navigational packages and configs → creating map file using SLAM gmapping → creating AMCL launch files and tuning costmap params
- Joining ur5 arm xacro to mobile robot base → attaching end effector '2 finger gripper' → creating manipulation kinematics and inverse-kinematics solver package using moveit → integrating navigation and manipulation packages
- Adding perception using find - object - 2d → using object detection and 3d pose estimation to use autonomous pick and place of objects