Problem Statement : In warehouses, we come up with situations where we have to place heavy goods or products from one place to another. Mostly in warehouses in India human labour is used or forklifts which can be operated by humans. Here arises a need for an automated solution.

Category : Student Innovation

Team Name : LANCE

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Lift And Navigation Control Equipment

DESCRIPTION OF IDEA

- We are coming up with a solution by developing a fully automated robot with which the user can communicate by any system(computer or mobile) connected on the local network.
- After taking the input for source and destination, a map is automatically generated using SLAM(Simultaneous Localization And Mapping).
- The object detection is done using OpenCV and TensorFlow with the help of raspberry pi camera module.
- Arm lift/Forklift mechanism is used to carry out picking and placing of the item.
- Whatever the bot sees can be viewed live using socket programming.

TECHNOLOGY STACK

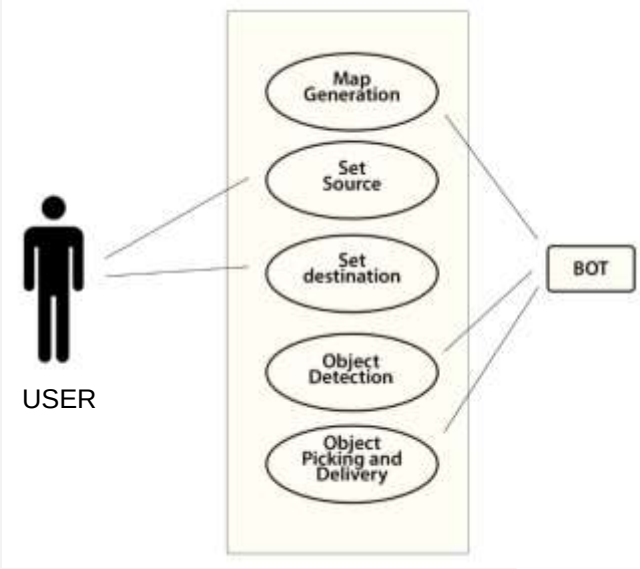
- Raspberry Pi 4
- ROS Melodic
- RPLiDAR(Hector SLAM)
- Python Libraries – OpenCV, TensorFlow
- Proximity Sensing achieved through HC-SR04
- Raspberry Pi camera module

FEATURES

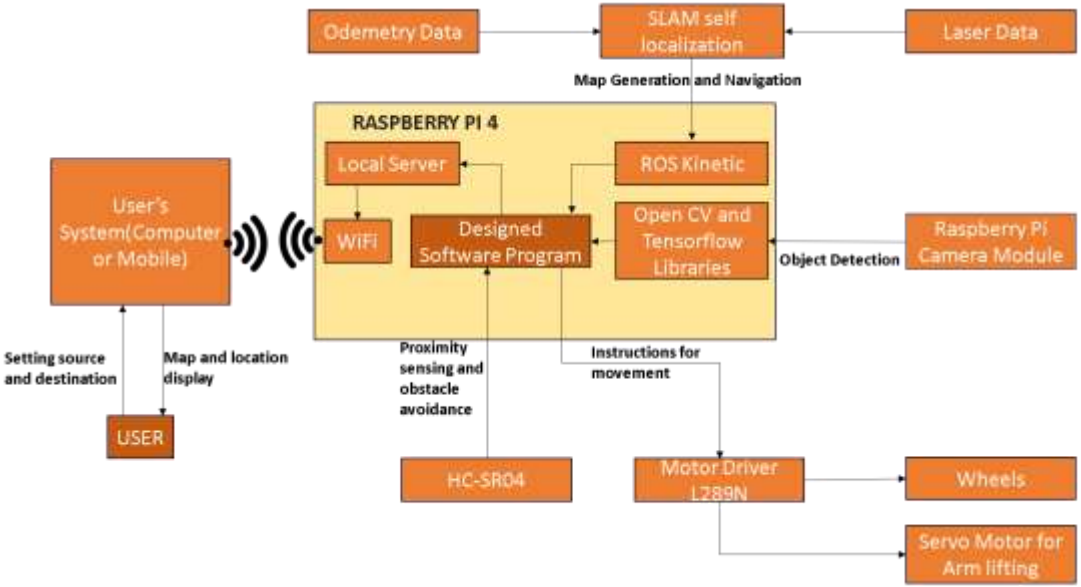
- No prearrangement required
- Real-time video streaming
- Cost-effective
- Can use Fork-Lift Mechanism as well as Robotic Arm Mechanism

Lift And Navigation Control Equipment

USE CASE DIAGRAM



DATA FLOW DIAGRAM



PROTOTYPE IMAGES DURING INTERNAL HACKATHON

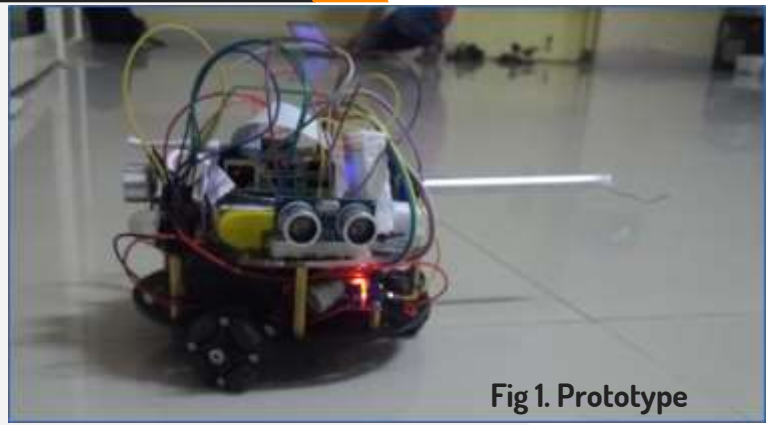


Fig 1. Prototype

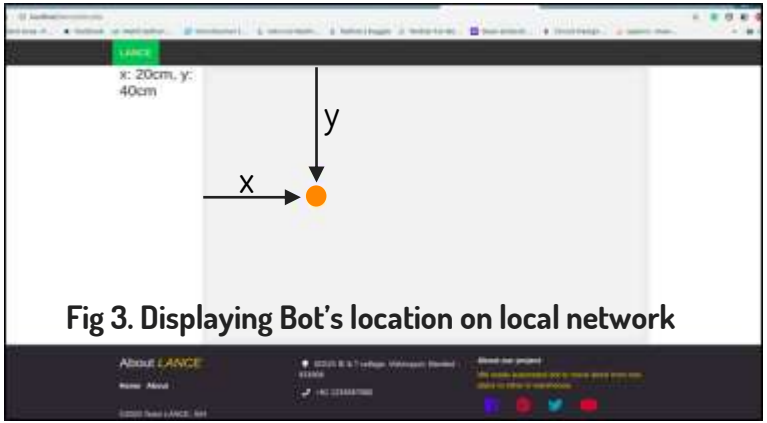


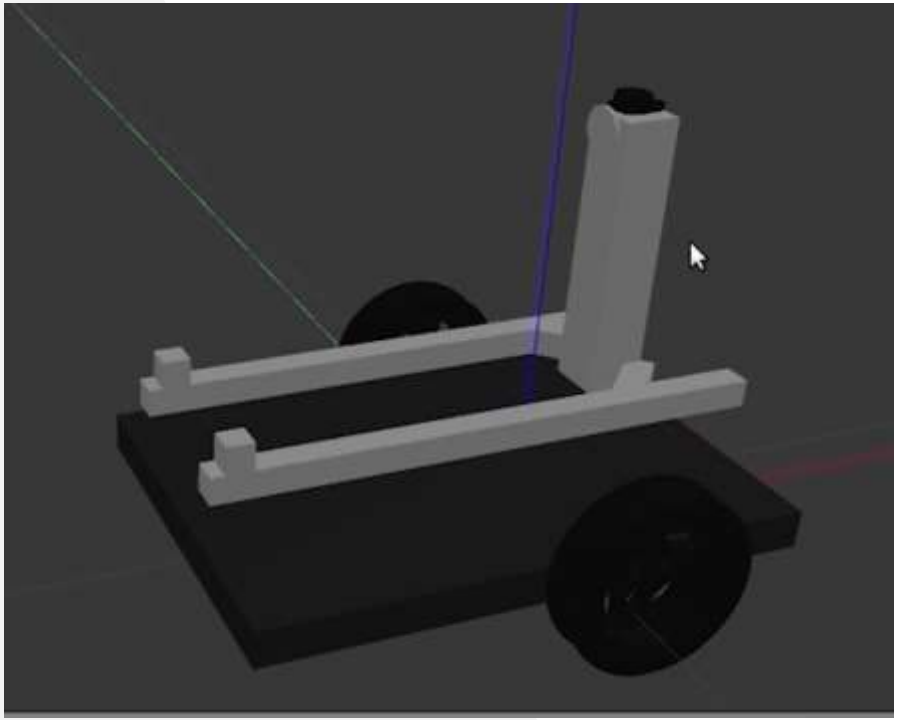
Fig 3. Displaying Bot's location on local network

Fig 2. Object Detection

DEPENDENCIES

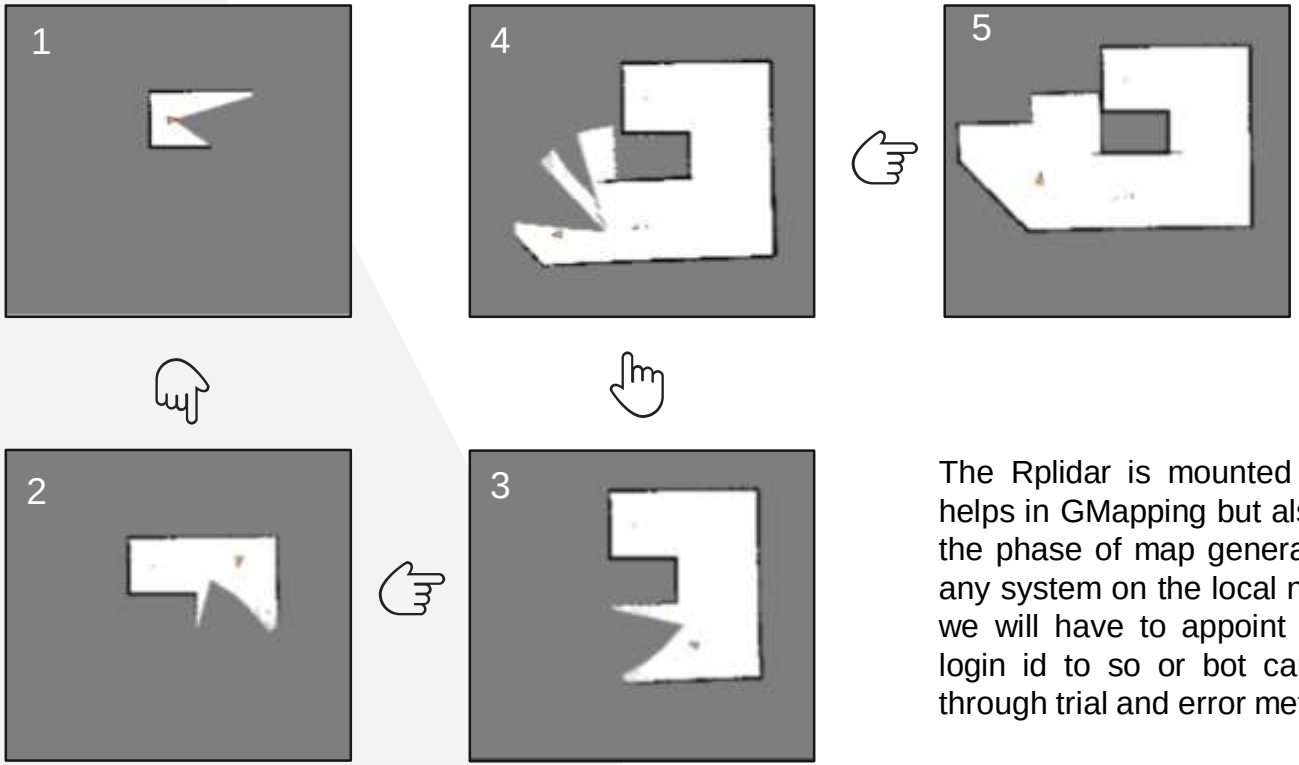
- There should be a plane surface for moving bot.
- Environment should be bounded

Bot Description



Here is our bot. The chassis has one caster wheel at the front and two rear wheels. Forks are in prismatic joint with the riser attached to the base in between two wheels. RP-LiDAR is mounted on top of the fork riser and slightly below it, a camera is mounted facing the forks. The forks are allowed to rise only up to a specific height such that it will not disturb the camera's vision and laser scanning.

Map Generation

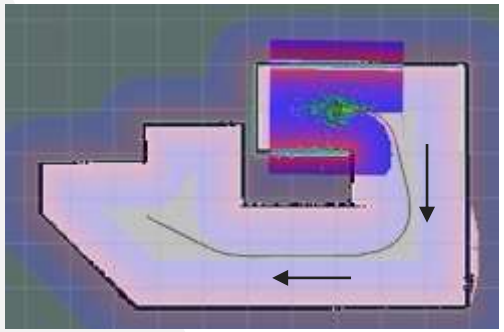


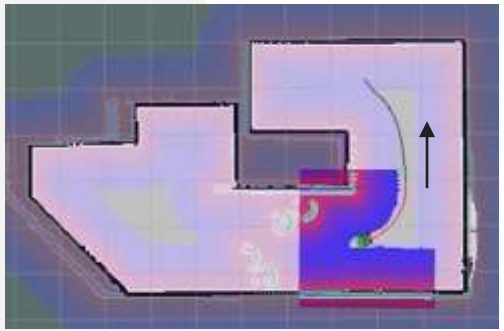
Our bot is autonomous and adaptive to any bounded environment. Also, it does not require pre-installments like in the case of line follower robots. So to navigate in an unknown environment firstly has to generate a map of that environment and save it to its disk. This process of map generation is achieved by Rplidar's Simultaneous Localization and Mapping also called the SLAM.

The Rplidar is mounted on top of the robot. Rplidar Not only helps in GMapping but also helps in obstacle avoidance. Only for the phase of map generation, the Bot can be controlled through any system on the local network connected with Wi-Fi. Obviously we will have to appoint some authorized users and give them login id to so or bot can be programmed in such a way that through trial and error method it will generate the map on its own.

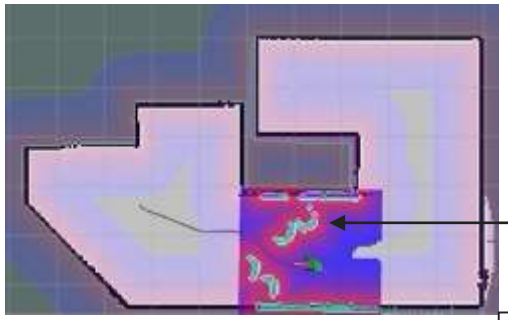
Navigation and Obstacle Avoidance

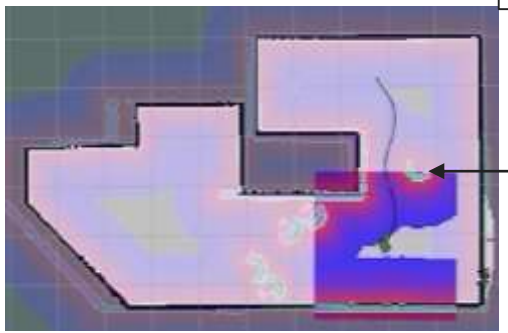
PATH WITHOUT OBSTACLE





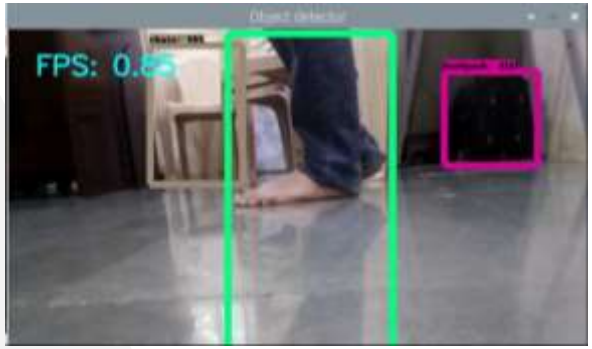
PATH WITH OBSTACLE

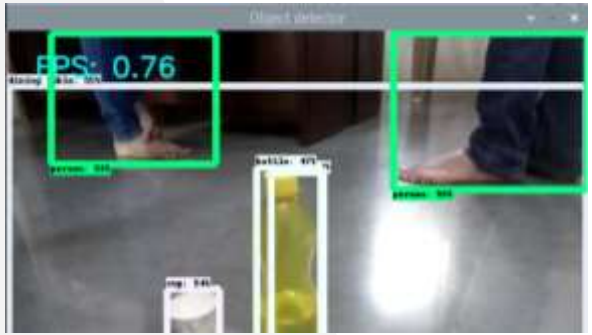




OBSTACLE

Object Detection





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THANK YOU 😉