CSE461 Assignment - 03

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My ID is 19101098. According to the last digit of my ID, below I will describe the vision system and navigation of "Roomba robot vaccum cleaner."

① Vision system :- A robot vision system consists of one or more cameras, special-purpose lighting, software etc. Cameras basically allow the robot to 'see'. Most new cleaning robots use their seeing ability too clean better. also help them to see and avoid furniture, socks and other obstacles on the floor. Moreover, camera navigation system help to create a better map of anyone's home. Camera is constantly collecting data as it cleans. Furthermore, it also take a snapshot approach, mapping the area and then simply storing this image in their memory. The benefit of the camera continuously collecting data is that anyone can move furniture, set down a bag or allow animals to roam. It take a snapshot and store it are prone to running into moved or new objects until they map the room again. Roomba

robot used sensor and a low-resolution camera pointed at the celling to map anyone's home so the vaccum can move swiftly. But with a front facing camera, the latest model can see anything left on the floor and more easily avoid obstacles. Also Roomba contains both infrared sensors and photocell sensors which work in combination to clean a room. The infrared sensor at the very front of the Roomba allows the vaccum to bounce light off an object to detect its presence, even if it's cleaning after dark and there's limited natural light.

(2) Navigation system :-

Path Planning: Roomba robot vaccum use a navigation algorithm called visual simultaneous location and mapping or VSLAM. The optical system can identify 'landmarks' on the celling, as well as judge the distance between walls. While we use our eyes to see, a Roomba uses infrared and photocell sensors which serves a different purpose: cliff sensors let the vacuum know when it's near a 'cliff,' such as stairs or a balcony.

Mapping:

On top of the Roomba there's a camera pointed forward and up at what looks to be about 45 degrees. VSLAM is a way of dynamically building a map while keeping track of anyone's position at the same time. To create a map, the camera takes a picture, and then some fancy software looks for distinctive patterns of pixels in that picture. The VSLAM algorithm has picked out a bunch of features on a couch and the robot will remember what those features look like and keep track of them as it moves. The robot will continue to take pictures, detecting and tracking new features and gradually building up a picture-based map of its environment. ~~The VSLAM algorithm has picked out a bunch of features on a couch and~~ ||

Localization: To localize itself, however, the robot needs to combine the map with odometry and iRobot has added a new sensor to the bottom of Roomba to collect the data (like a gyro and IMU, as well). As far

as VSLAM algorithm go, the Roomba has to be a little bit clever, because it frequently finds itself under tables and couches and beds where tracking 'features' in the environment gets harder. And if it remerges some place it hasn't been before, it's going to have to work up a new map to the map that it had before to figure out where it is.

Exploration: Once the Roomba knows exactly where it is all sorts of new behaviors are made possible. It can vaccum in straight lines increasing the efficiency of its coverage. It can beeline back for the charger if it runs low on battery power, even if it's in a distant room. And most importantly, it can clean half of our floor, remember where it left off, go ~~at~~ recharge. and then finish the other half. This solves a significant limitation of the traditional Roomba, whose pseudorandom navigation meant it couldn't clean more than three rooms. Now we can hit "Clean" and the robot will clean an entire level of a home with multipe rooms. Engineers programmed the new version of Roomba to "automatically increase the performance of the motor on carpet and rugs".