ABSTRACT

People with disabilities, especially those with limited mobility, are greatly helped by the presence of a wheelchair. Along with the times and technology, technological developments in wheelchairs are increasingly sophisticated. Application of autonomous mobile robots will be applied to wheelchairs, with the goal that the wheelchair can walk alone back to the charging station for recharging.

The navigation system is the most important part of an autonomous mobile robot to be able to move independently. The navigation system on an autonomous mobile robot is defined as the ability to guide movement from one location to another by determining the location and direction of its movement. In this study, a wheelchair is an autonomous mobile robot using a navigation stack package in the ROS framework as a navigation system. The navigation stack is a concept for a mobile robot network program and uses a LiDAR sensor to navigate as well as to map the room in advance and uses an adaptive control system for the speed of a dc motor. There is also a system incorporated in the navigation stack package to control the position of the wheelchair, namely the odometry control method, which utilizes the physical modeling of a mobile robot's differential drive to get the linear and angular velocity of each drive wheel, then from the speed gain, the displacement distance and angle of the wheelchair are obtained. wheelchair uses a LiDAR laser sensor, a device that uses a laser beam to determine the distance to an object and provides information in the form of surrounding conditions as wide as 360^o of detection range from the point where the sensor is located.

With the navigation stack package system and LIDAR sensors, the wheelchair can go to a certain destination point without anyone controlling it, making it more effective when not in use the wheelchair can go to a certain destination point autonomously. The wheelchair moves autonomously with a dc motor actuator whose speed is controlled by a PID control system with a constant value of P = 0.16, I = 5.5, and D = 0 on each microcontroller connected to the right and left dc motors, these values are obtained by doing trial and error. The wheelchair can run autonomously in a straight pattern from the point (0.0) to (2.9,

0) for ten times of testing so that the average error percentage is 10.31% on the x-axis and 76.77% on the y-axis, also the smallest error percentage namely 2.9% on the x-axis, 15.57% on the y-axis, the largest error percentage is 17.94% on the x-axis and 98.24% on the y-axis and the wheelchair's final stop pose with the closest coordinate value is at the point (2.76, 0.15), and walking straight from the point (2.3, -1.3) to (2.3, -3.3) for ten times of testing so that the average percentage of navigation errors is 8.53% on the x-axis and 11.03% on the y-axis, also the smallest error percentage is 0.58 % on the x-axis, 4.87% on the y-axis, the largest error percentage is 14.18% on the x-axis and 25.12% on the y-axis and the wheelchair's final stop pose with the closest coordinate values is at the point (2.56, 3.1). wheelchairs are also able to walk autonomously with a back and forth pattern from the starting point (0,0) to the second point (29.0) and back to the starting point which was tested ten times so that a large percentage of the average error was 31, 13% on the x-axis and 49.38% on the y-axis for the initial stop, 77.67% on the x-axis and 85.62% on the y-axis for the final stop (Back to the starting point), also the smallest error percentage of the initial stop is 16.06% on the x-axis, 27.32 % on the y-axis, the largest percentage of errors in the initial stop is 50.71% on the x-axis and 73.31% on the y-axis, the smallest error percentage for the final stop is 48.17% on the x-axis, 66.76% on the y-axis, the largest percentage of errors in the final stop is 95.88% on the x-axis and 98.99% on the y-axis and the wheelchair's initial stop poses with the closest coordinate values are at points (2.45, -0.07) and (0.009, 0.02) for the final stop.

Keywords: *Autonomous Navigation, LIDAR, ROS, Odometry, SLAM, PID*