An Assistive Robot that Fetches Objects from Flat Surfaces

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Healthcare robotics is a field in which robots are implemented to serve functions that healthcare professionals or assistive animals normally do.

In United States, there are over 250,000 people living with spinal cord injuries and 3 million stroke survivors alone. Additionally, there are over 16 million US citizens currently over the age of 75. Of these 16 million, 20% of the people from ages 75-79 require assistance in everyday living. The percentage of elderly citizens needing assistance with everyday tasks escalates with age. Currently assistance provided by human caregivers and assistive animals come at high costs among other sacrifices. Recent progress in assistive robotic technology at the Georgia Institute of Technology and Emory aspires to replace or augment the need for these more expensive options.[1]

For individuals affected with motor impairments, a high priority is placed on object retrieval. This is because a dropped object can become out of the range of motion of a motor impaired individual. Currently, helper monkeys for quadriplegics are directed using laser pointer and simple words to retrieve such out of range objects. The quadriplegic operates the laser pointer using their mouth, but easier interfaces have been developed such as a sip-and-puff for more control over laser direction.

Researchers at the Healthcare Robotics Lab at Georgia Tech and at Emory University have taken a similar approach to building implementing an autonomous assistive robot to receive commands based on laser pointer direction.

The El-E (Elevated-Engagement) robot operates through detection of laser pointer selection of 3d objects in a real world environment. The robot is made out of commercially available systems that are implemented together through several computer programs written in Python and C++ that the researchers developed. The use of a laser scanner and several cameras enable the robot to view an area from 0.2cm to 92.5cm off the ground within a 240^{o} maximum radius.

Through computer programming and the several cameras the robot is able to develop a 3d model of the world to accurately sense and navigate a room to complete tasks of retrieving objects from floors, tables, or shelves and delivering them to another flat surface low or high. Currently the robot has a very high success rate in retrieving and delivering objects but is limited in speed because of the many necessary computations to take effect to accurately pick up an object without missing it.

Further research is projected to be in developing easier user interface through patient-researcher interaction and testing, extension of detection capabilities to cluttered environments, and in performing other high priority functions such as opening doors and turning lights on and off.

References

[1] El-E: An Assistive Robot that Fetches objects from Flat Surfaces, Hai Nguyen, Cressel Anderson, Alex Trevor, Advait Jain, Zhe Xu, and Charles C. Kemp, 3rd ACM/IEEE International Conference on Human-Robot Interaction (HRI) Workshop, 2008

[2] A Point-and-Click Interface for the Real World: Laser Designation of Objects for Mobile Manipulation, Charles C. Kemp, Cressel Anderson, Hai Nguyen, Alex Trevor, and Zhe Xu, 3rd ACM/IEEE International Conference on Human-Robot Interaction (HRI), 2008