Fostering Resilient Aging with Self-Efficacy and Independence Enabling Robot (FRASIER)

AUTHORS: Lucine Bahtiarian, Cameron Canale, Loan Chau, Vanderlei Cunha, Helei Duan, Farhat Kohistani, Kristina Walker

ADVISOR: Taşkın Padır, Jeanine Skorinko

ABSTRACT

With the percentage of the elderly population rapidly increasing as the baby boomer generation reaches retirement, the demand for assistive care needed will soon override the supply of caregivers available. Thus, the robotic industry has emerged with alternative solutions to this challenge. Through FRASIER, the team developed an assistive robot with a goal of supporting the care of elderly and individuals with age-related disabilities to help restore daily independence. The team determined the robot functionalities by conducting user studies through surveys and interviews to potential users. From these user study results, the team developed a user-friendly mobile robot incorporating both aesthetic and companionship aspects. FRASIER will ultimately be able to interact with its environment and users through a robotic manipulator, cameras, and user interface.

USER CENTERED DESIGN APPROACH

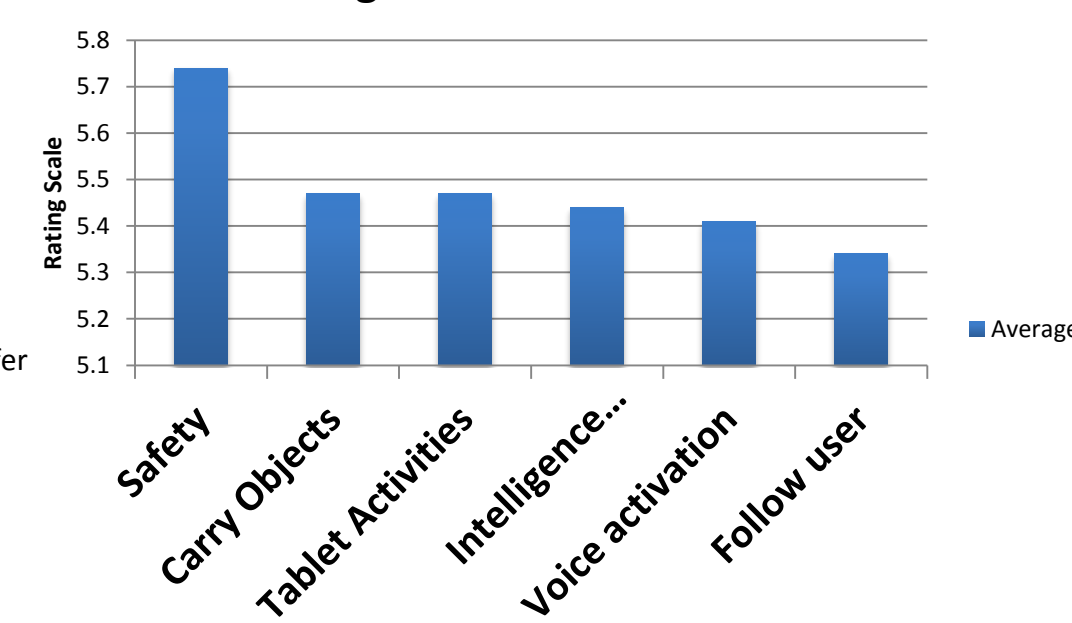Three studies were conducted to determine most desired robot functionalities.

STUDY 1
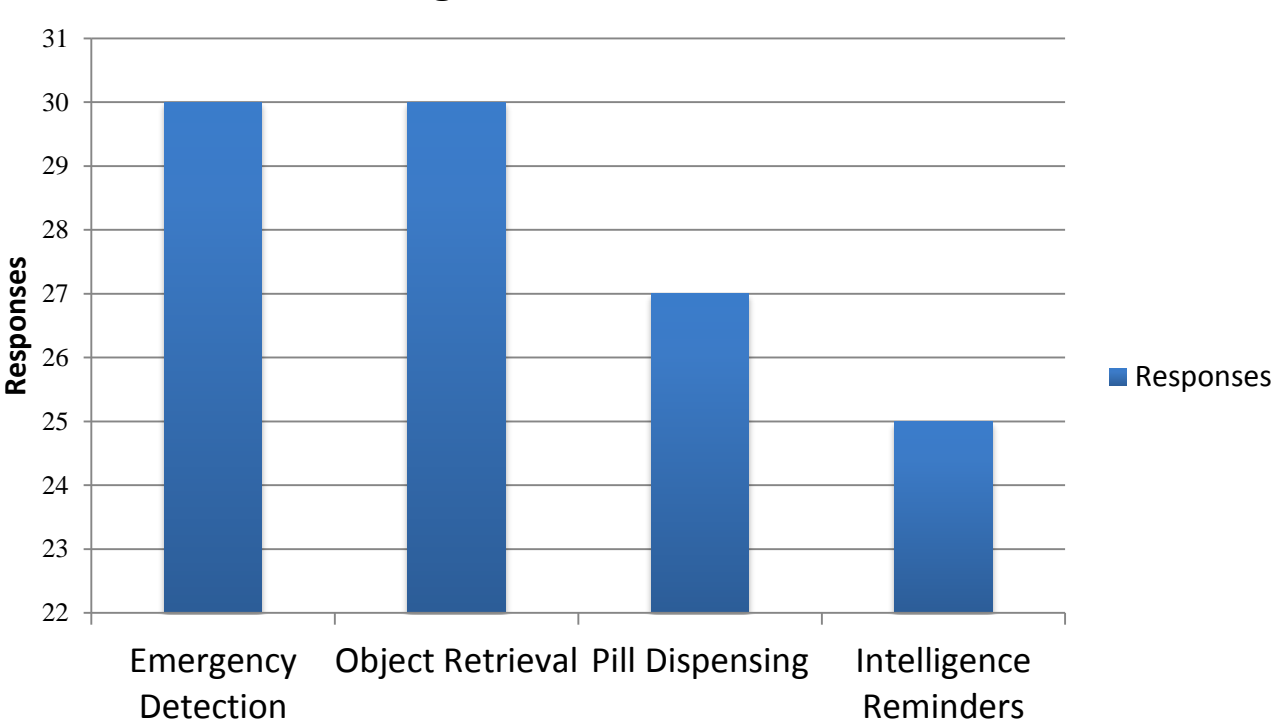

Possible Features of Personal Assistant Robot
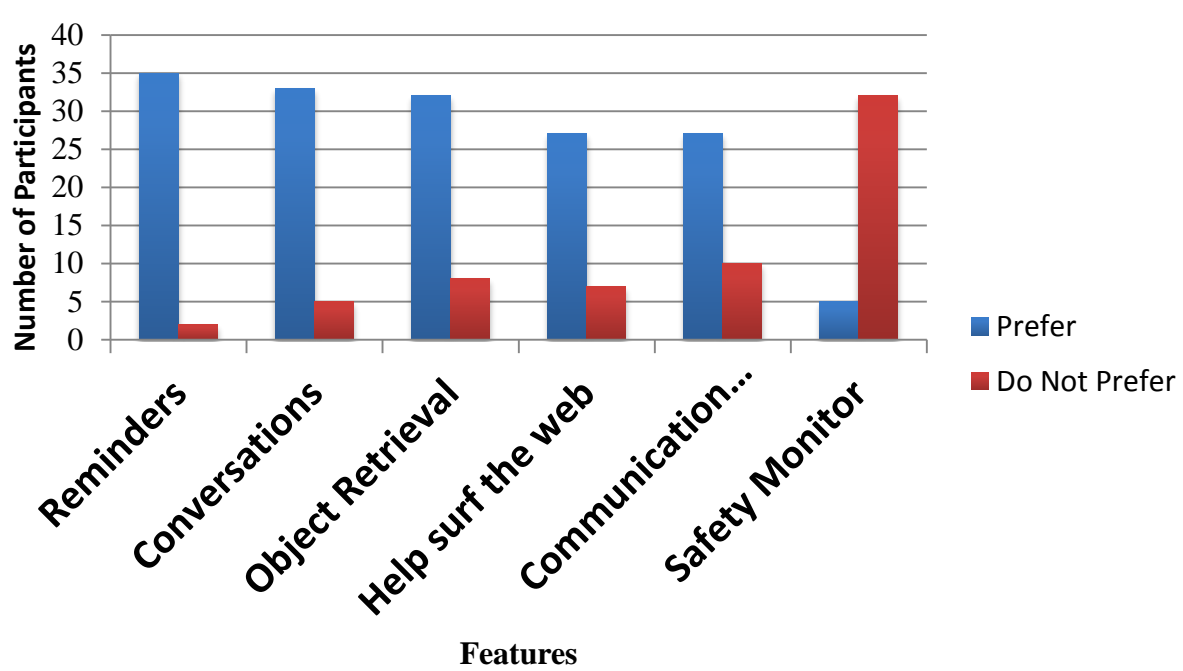
STUDY 2
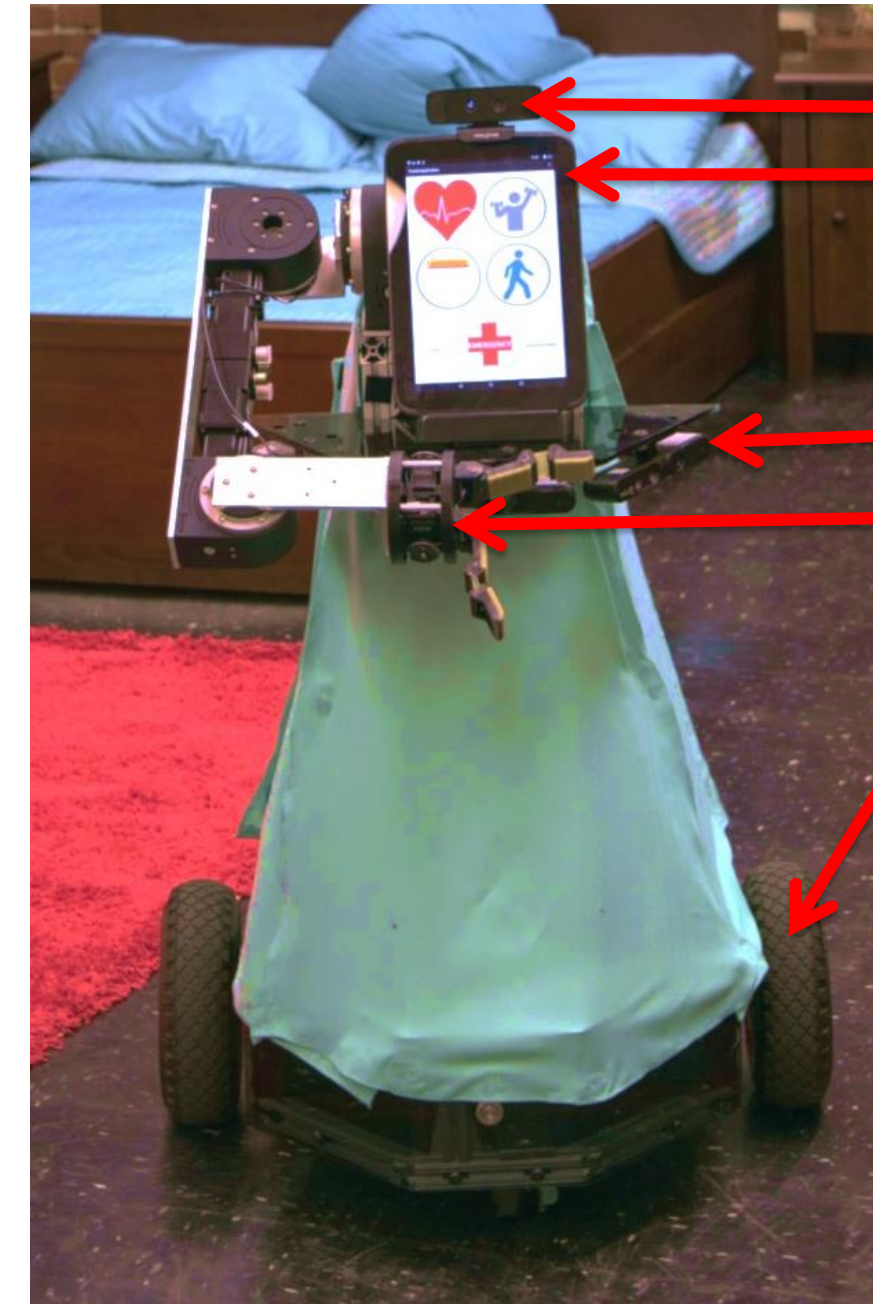

Highest Rated Functions

STUDY 3

Highest Rated Functions

STUDY 3 COMMON THEMES:
- Cost
- Size
- Human Care vs. Robot Care

## ROBOT SYSTEM OVERVIEW

Design Requirements
- Object Detection & Recognition
- Graphical User Interface
- Non-Threatening
- Easy to Use
- Robust Indoor Navigation
- Robotic Manipulator
- Modular Robot Base

Results
- Robot designed from User Studies
- Object Detection & Recognition
- User Friendly Application
- Joint Control of the Manipulator
- Narrow Passage Navigation
- ARTags for localization
- Base successfully built

ROBOTIC MANIPULATOR

- 3 Degrees of Freedom (DOF) each joint by igus Robolink D with worm gearbox integrated

- Prefabricated 2 DOFs under actuated fingers

- Joint control by Arduino and messages from ROS


Manipulator System Diagram
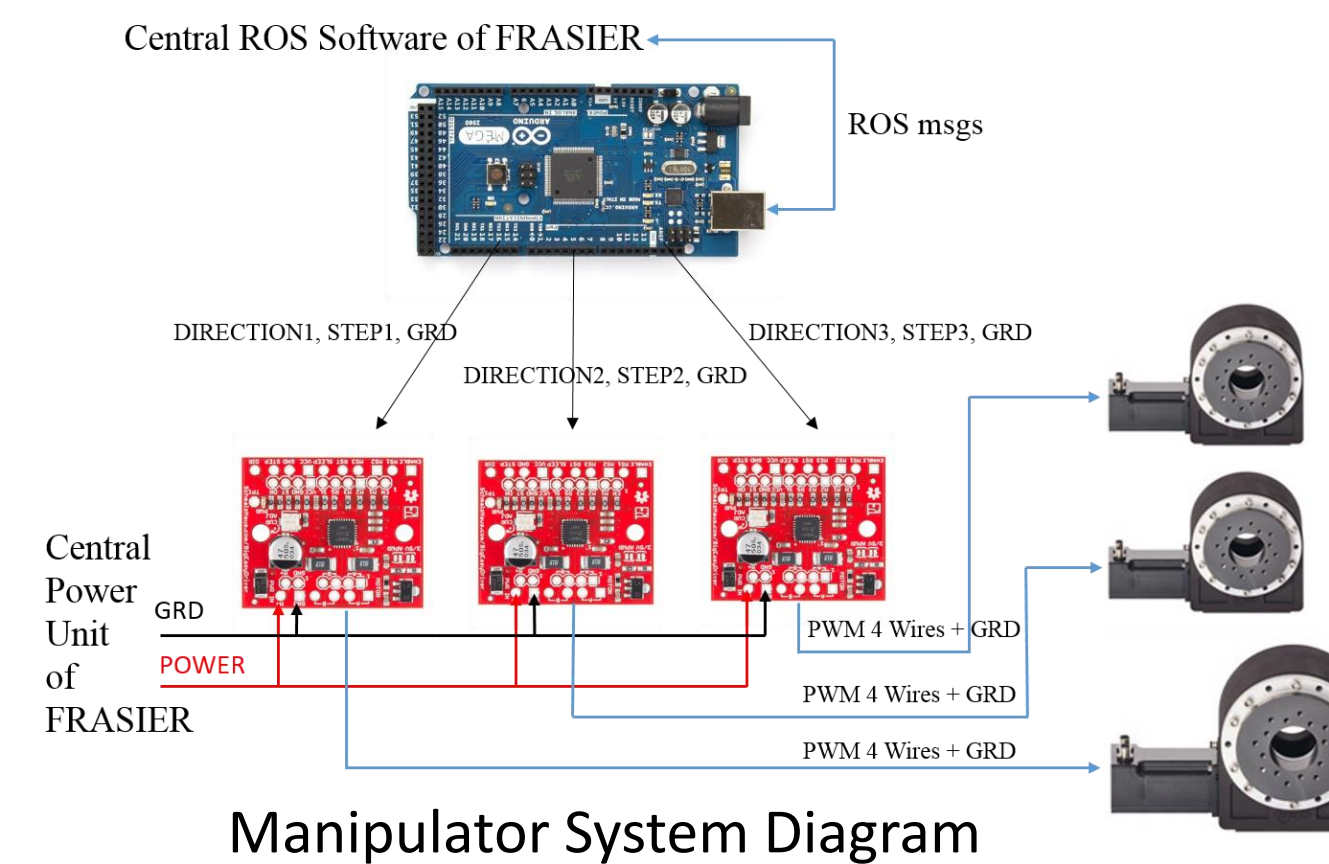
NAVIGATION

- Dynamically-controlled Navigation Planner for Holonomic Mobile Robot
- A* , SLAM, ARTag for Home Living Environment Localization

GRAPHICAL USER INTERFACE (GUI)

FRASIER is equipped with its own android application. This touch screen application can control robot functions as well as provide users with easy access to a blood pressure monitor, physical therapy exercises, a daily calendar and more. When FRASIER is in operating mode the friendly cartoon face accompanies the user.
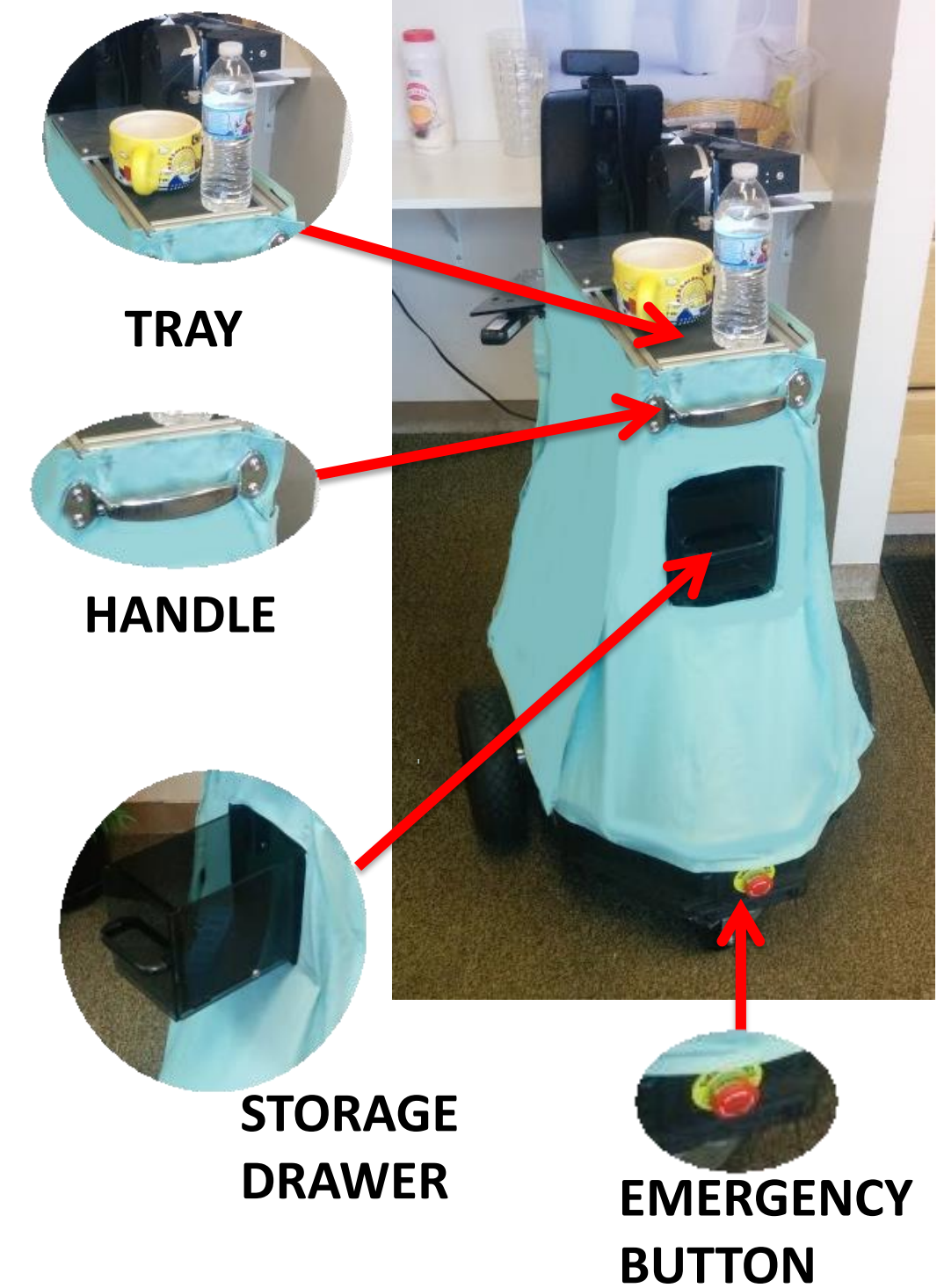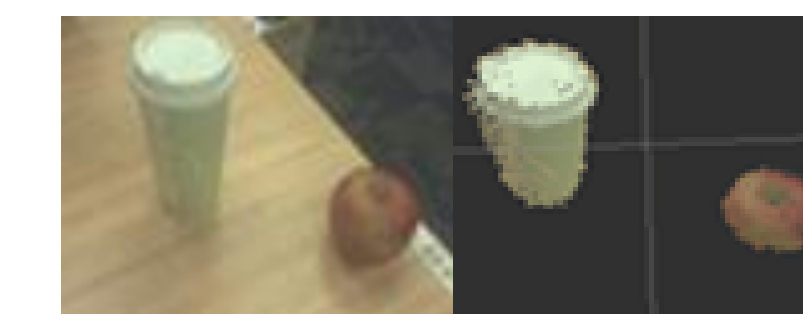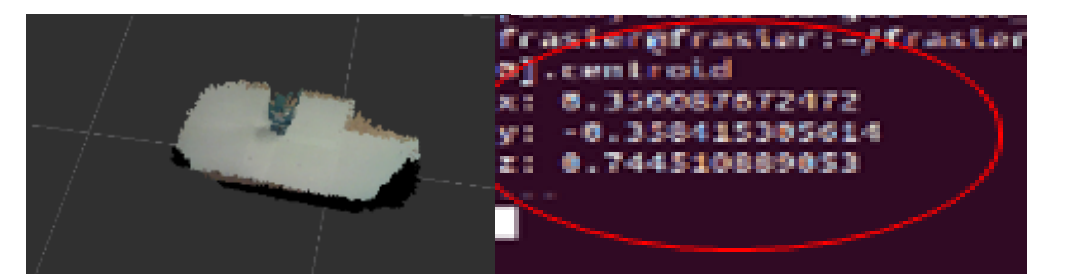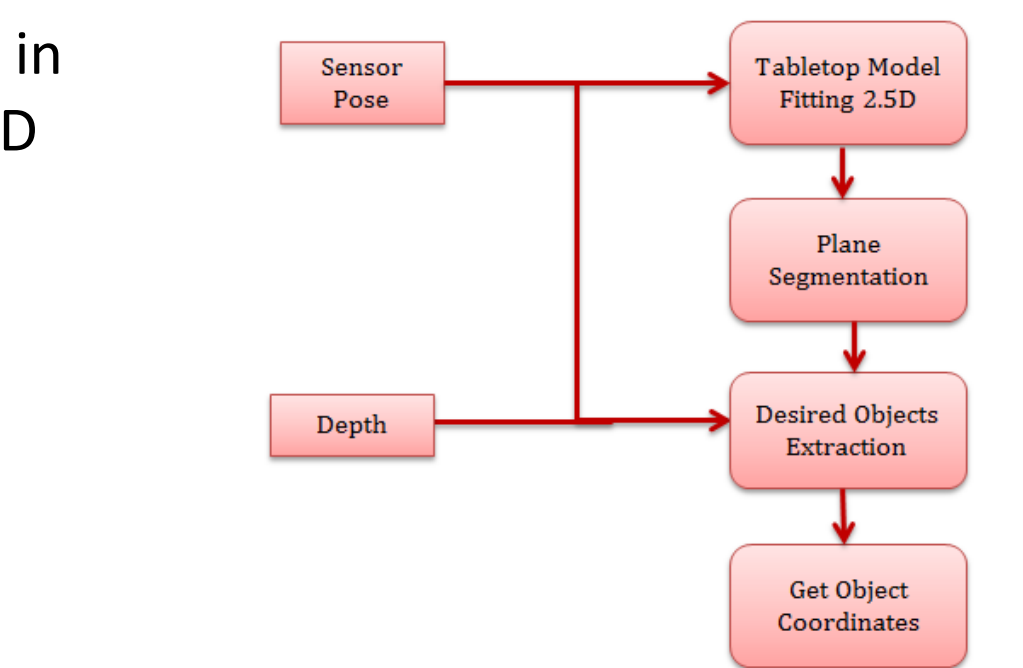

COMPUTER VISION

Object Recognition and pose estimation in highly clustered environment using RGBD sensor (Creative Senz3D).

Segmented Objects

Number of Objects Identified

Coordinates of Object

ADDITIONAL FEATURES

TRAY

HANDLE

STORAGE DRAWER

EMERGENCY BUTTON

Acknowledgments

References

1. Ortman Jennifer M, Velkoff Victor A, & Hogan Howard. (2014). An Aging Nation: The older. Population in the United States. United States Census Bureau
2. Werner Carrie A. (2010). The older population: 2010. United States Census Bureau.

Sponsor