

Developing a Novel Mobile Humanoid Robot for Nursing Assistance

Team

Maanav Iyengar – BS/MS in Robotics Engineering
Yveder Joseph – BS in Robotics & Electrical Engineering
Hoang Nguyen – BS/MS in Robotics Engineering

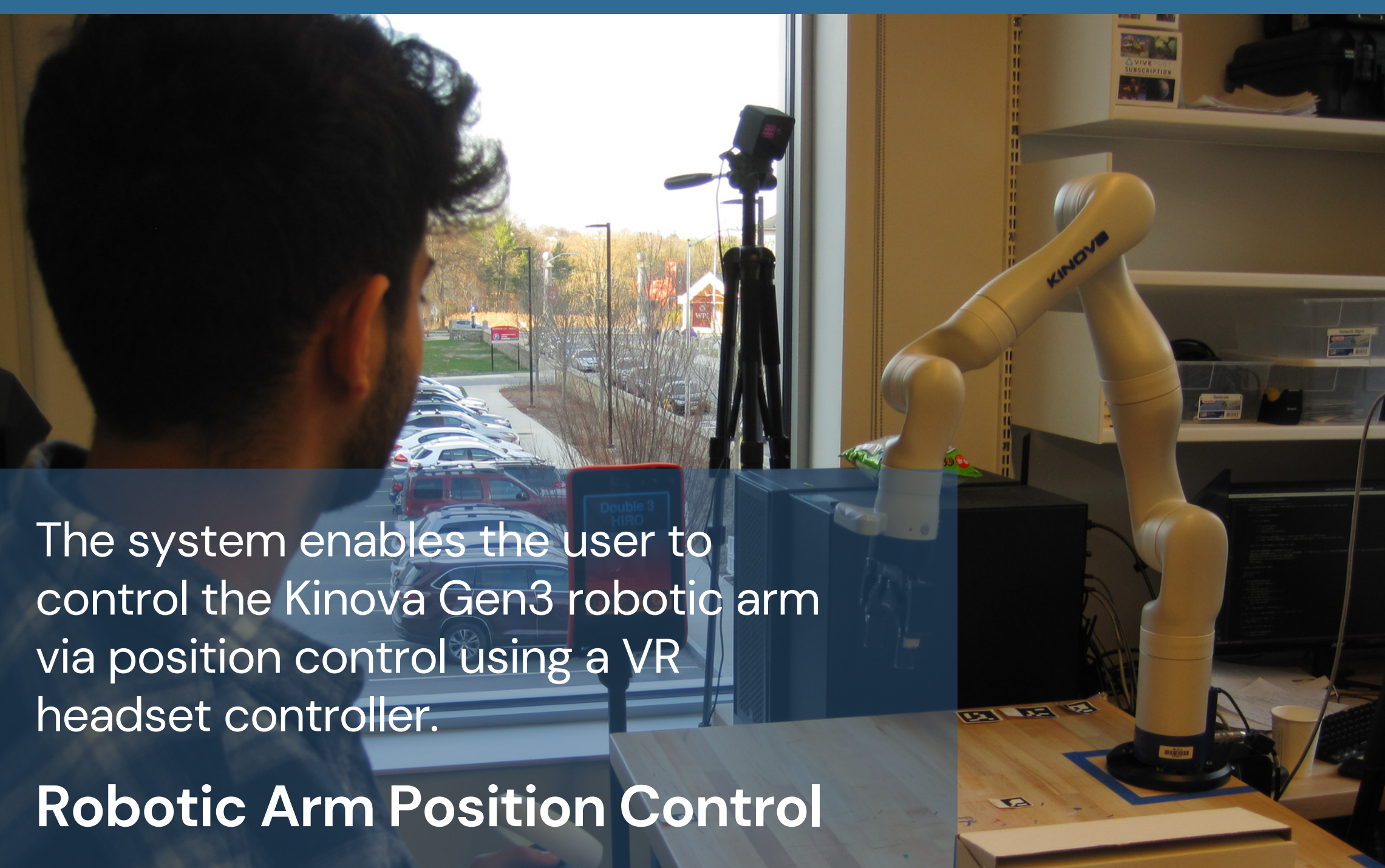


Advisors

Jane Li – Robotics Engineering
Bashima Islam – Electrical Engineering

Abstract

This Major Qualifying Project aims to integrate a bimanual mobile manipulator robot ("Gopher") for nursing assistance. To this end, we developed a motorized supporting structure to integrate seven-degrees-of-freedom (DOFs) manipulator robots (Kinova Gen3) with a nonholonomic mobile base (Freight research platform). The motorized supporting structure can be controlled as an additional DOF to significantly improve the robot's reachability and manipulability when mobile manipulation tasks are performed in cluttered patient rooms. We further integrated virtual reality (VR) human-robot interfaces (Meta Quest, with head-mounted display and hand-held controllers) to support the intuitive robot control and visual display. The project involves the efforts for: 1) hardware design, manufacturing and assembly; 2) developing Unity- and ROS-based software architecture; 3) integration of VR human-robot interfaces, and 4) pilot user studies to test the system usability for mobile manipulation.



The system enables the user to control the Kinova Gen3 robotic arm via position control using a VR headset controller.

Robotic Arm Position Control



The camera mount has 2 DoF and can be controlled using serial communication. The rotation of the VR headset is translated to the servo mount's movement.

Camera Mount



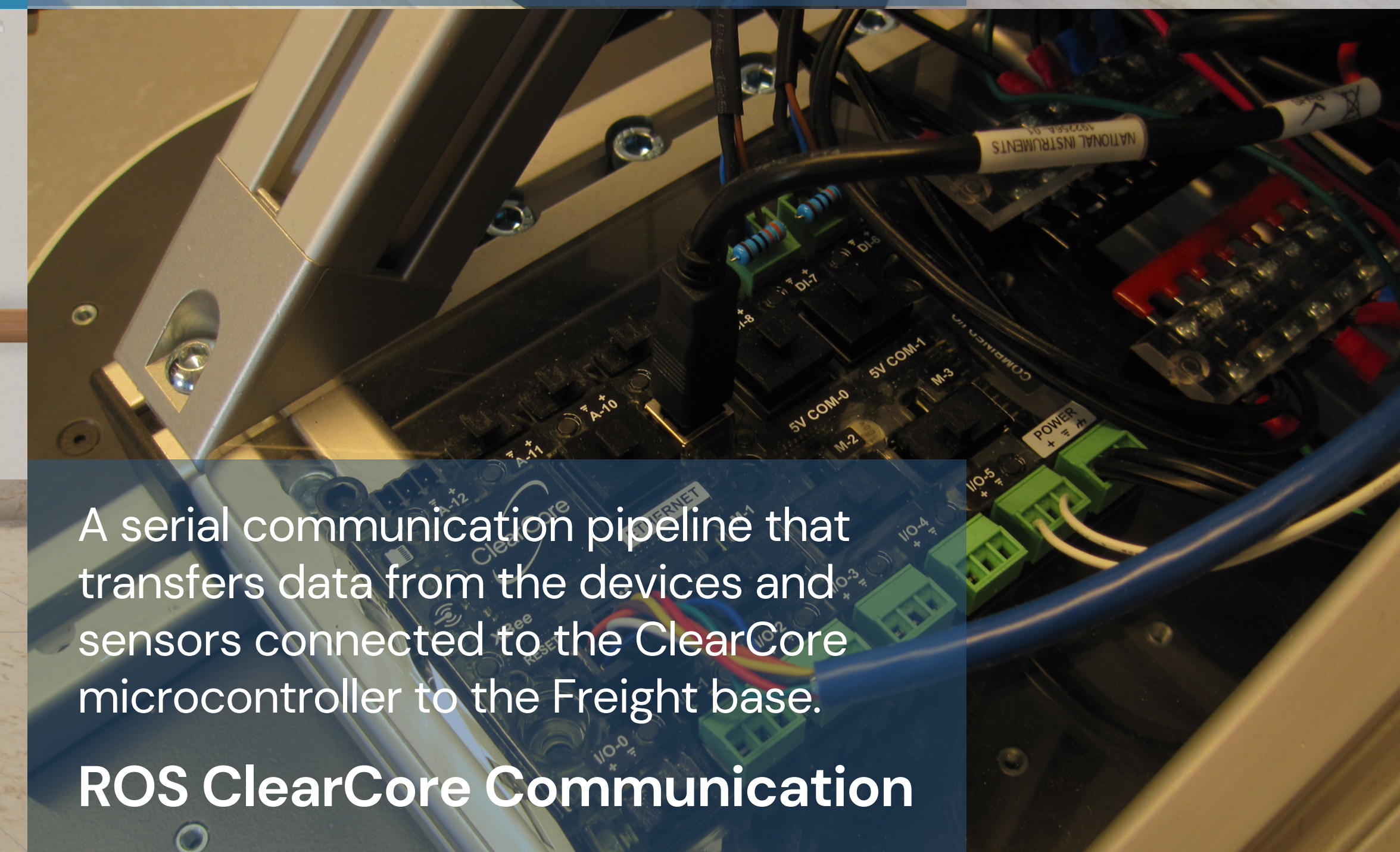
The system maps the user's movements on a VR treadmill to a virtual avatar in real-time.

VR Treadmill Motion Simulation



An interactive virtual model of a Gopher robot that mirrors the movements of the physical robot in real-time.

Simulating Gopher



A serial communication pipeline that transfers data from the devices and sensors connected to the ClearCore microcontroller to the Freight base.

ROS ClearCore Communication