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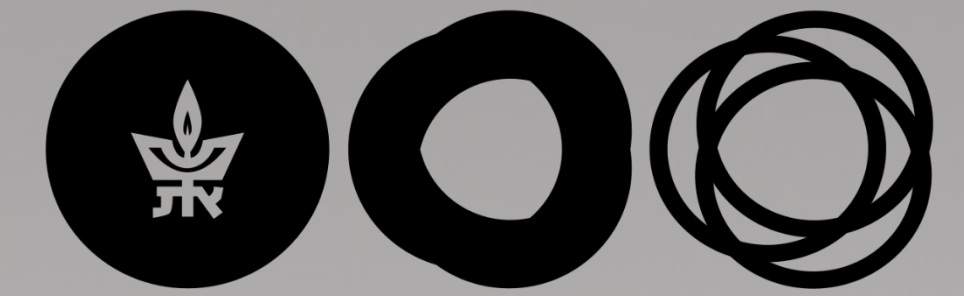
הפקולטה להנדסה
ע"ש איבי ואלדר פליישמן
אוניברסיטת תל-אביב

Juggling Robot

Project Number: 18-1-1-1623

By: Omer Ben-Nun , Ehud Hayat Advisor: Dr. Anatoly Khina

Project Carried Out at Tel Aviv University



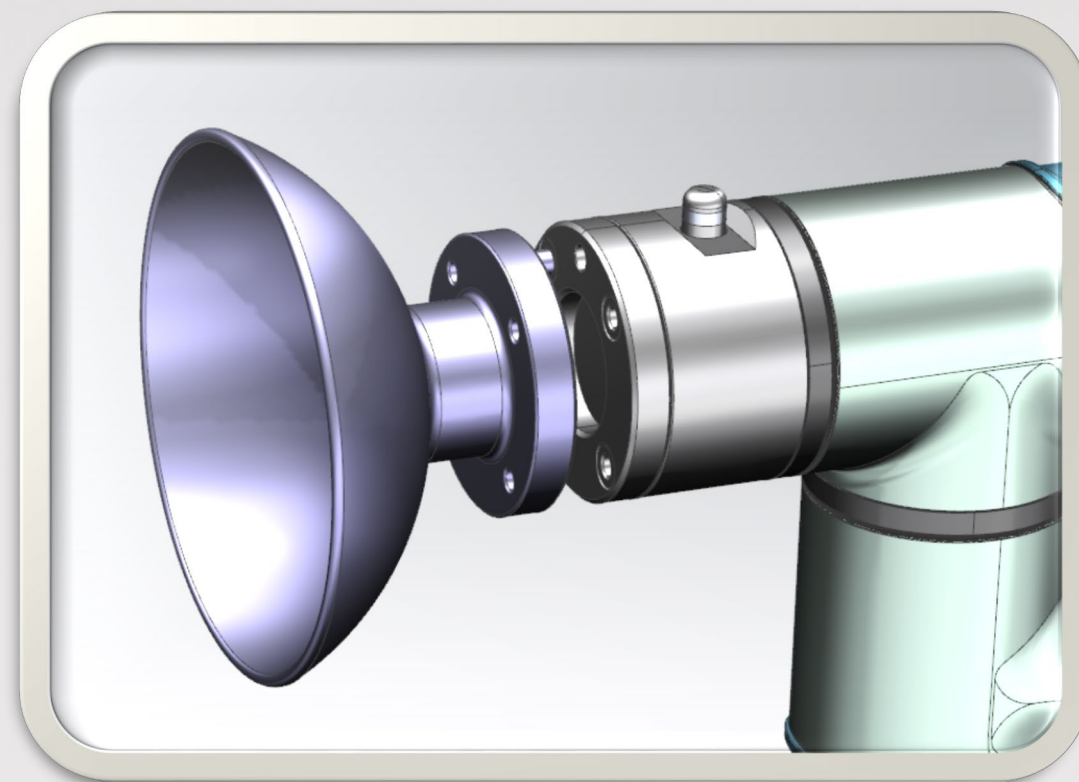
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A robotic arm system that receives commands using a custom Python interface via TCP/IP protocol, and can juggle a ball.

Stage 1 in a multi-year project

Motivation

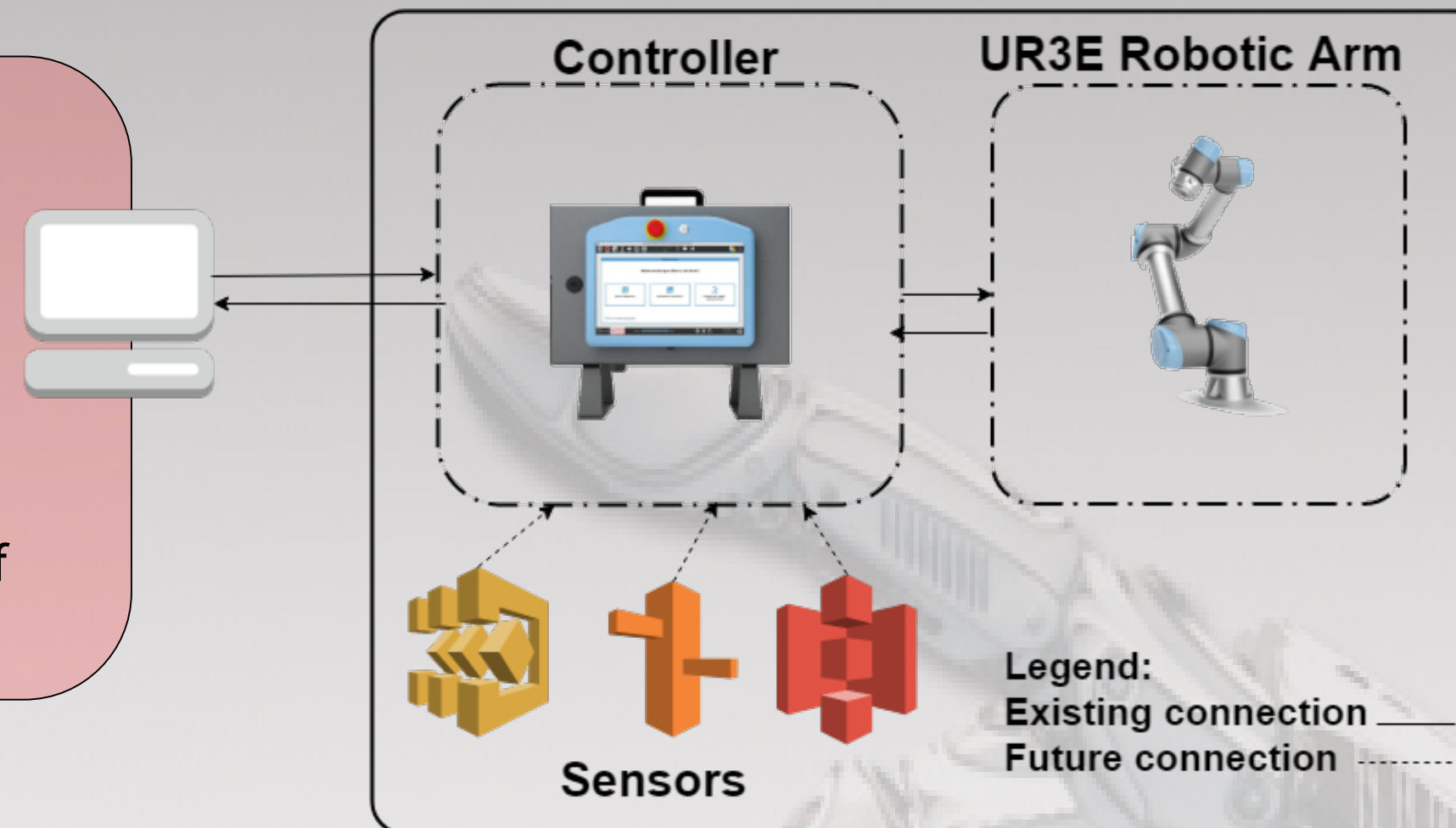
- Studying human motion.
- Understanding advantages of closed loop control
- Gaining understanding of sensorimotor control
- Studying theory of robotics and overcoming engineering challenges in their control
- Creating a modular system for future implementation of complex control algorithms



3D model of the grip attached to the arm

Goals

- Establish system requirements for desired performance
- Survey a variety of robots and purchase the best one
- Create and print a 3D grip model
- Develop user friendly control environment
- Conduct system 'bring up'
- Juggle using a computer via network connection



Results

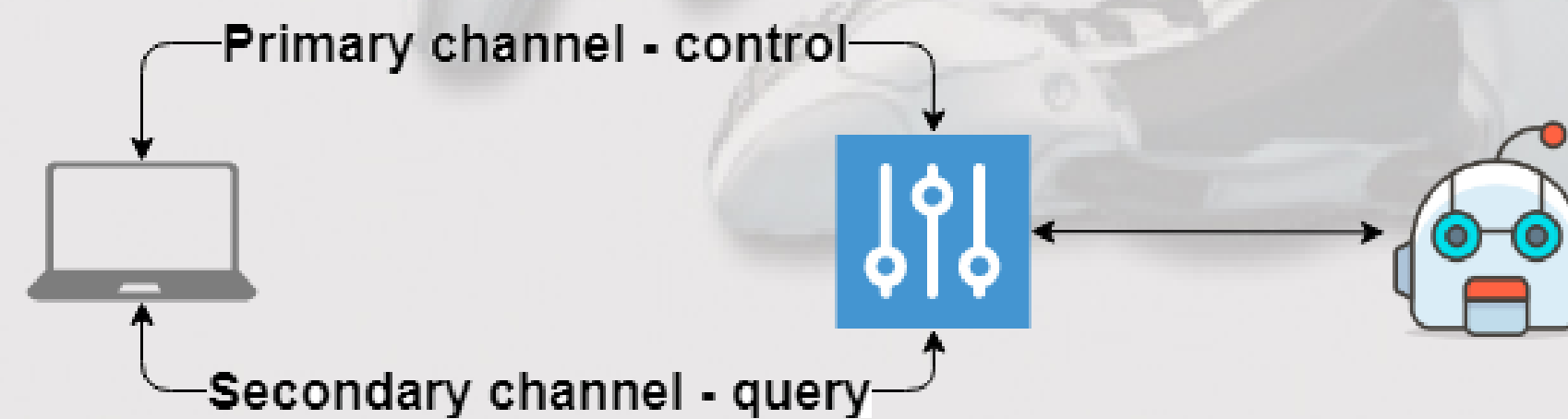
- Up and running robotic arm system
- Throw and catch a ball - controlled by computer
- Receive feedback of joint position on secondary port
- Open-loop methodology → motions took trial & error

Future

- Sensors will give feedback on ball location
- Closed loop control will allow for noise and non-ideal conditions

Implementation

- Computer communicates with robotic-arm controller
- Communication is via TCP/IP protocol, over Ethernet
- High communication frequency of up to 500 [Hz]
- The UR3E robot is a **Cobot**; a robotic arm that is intended to physically interact with humans in a shared workspace



Communication and Environment:

- Strings sent to controller and deciphered locally
- The strings are in dedicated URScript language
- Python based environment using OOP methods
- Adding functionality is easy and straightforward



3D model of the system