

# FAIZAN MUHAMMAD

## Robotics - Human-Machine Augmentation - Computer Vision

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## EXPERIENCE

### Software Engineering Intern

#### CTRL Labs

May 2019 – August 2019

New York

- CTRL Labs is currently developing CTRL Kit: a non-invasive neural interface for general purpose human-machine interaction
- Mapped EMG-based neural signals to a hexapod robot to mimic user's hand state and play soccer
- Devised and prototyped experimental features for CTRL Kit to power physically contextualized interactions
- Four patents are being filed based on the feature designs and prototype

### Robotics Research Assistant

#### Autonomous Intelligent Robotics Lab

Jan 2018 – Ongoing

Tufts University

- Proposed, designed and implemented an Augmented Reality interface for robots using Unity and ROS
- The interface allows a user to visualize the robot's state, intent and plan as an added visual layer over the real world
- Designed and conducted pilot studies involving the use of this interface as a tool for Human-Robot Interaction
- Currently planning the logistics and structure of a full study based on the feedback from the pilot study

### Co-President

#### Tufts Robotics Club

Apr 2018 – Apr 2019

Tufts University

- Reformed club's internal dynamics to promote diversity, accessibility and member retention
- Led the design of a custom, modular club robot that could be specialized to several competitions (Trinity Firefighting, Harvard PacBot etc.)
- Trained and mentored new members, particularly in the areas of software development
- Active members doubled during the year allowing us to work on more sophisticated project ideas

### Computer Vision Research Assistant

#### Center for Engineering Education and Outreach

Dec 2016 – Aug 2017

Tufts University

- Devised a programming paradigm for K-12 students to code robots using paper drawings (C++, OpenCV, LabView, Lego Mindstorms)
- Formulated a custom RESTful API for lab-based Internet of Things devices (C++, HTML, Arduino)
- Developed a teacher-assistance tool for digitization of classwork to promote discussion and collaboration (C++, OpenCV)

## EDUCATION

### BS Computer Science

#### Tufts University - School of Engineering

Sept 2016 – May 2020

GPA: 3.94

**Senior Honors Thesis (Planned):** Teaching Robots Object Manipulation through EMG-based Demonstrations

**Activities:** HYPE! Mime Troupe, Fencing Club, Robotics Club

**Elective Courses:** Probabilistic Robotics

Autonomous Intelligent Robotics

Human Robot Interaction

Computational Models in Cog. Sci.

Machine Learning

Computer Vision

## HONORS

### Tufts Summer Scholar 2018

Received a grant to pursue the Augmented Reality Interface research project at AIR Lab



### Verizon 5G EdTech Challenge 2019

Augmented Reality Interface was part of the winning proposal for the grant



### Trinity College International Fire Fighting Robot Contest

Won the Olympiad in Senior Individual Category in 2018 and 2019



### International Mathematical Olympiad 2016

Participated as a member of the Pakistani Team

## SKILLS

C++

Python

C#

Go

Matlab

C

VHDL

LabView

ROS

Unity

OpenCV

Git

Docker

English

Urdu

Punjabi

Hindi

# PROJECTS

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## Trinity College International Fire Fighting Robot Contest Tufts Robotics Club

**2018:** Led the development of software architecture based on a central Raspberry Pi Zero interfaced with an Arduino Mega

**2019:** Led the full-stack development containing dedicated real-time subsystems running on Arduinos and a central Raspberry Pi 3B+ running ROS

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## Sound Based Robot Localization Probabilistic Robotics Class

Used acoustic signatures in the form of Room Impulse Responses to classify spaces within an indoor environment as an augmentation of a robot's navigation stack as a solution to the kidnapped robot problem (*Matlab*)

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## Clappy Bird Digital Circuits Class

Recreated Flappy Bird video game on an FPGA using digital circuit design to maintain game state and render it on a VGA display. The system used clapping as the input to play the game. (*VHDL*)

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## Remote Virtual Reality for Service Robots Autonomous Intelligent Robotics Class

Created a VR experience that lets a user see through the perspective of a remote service robot to support remote human takeover when something goes wrong (*Unity, ROS, C#, C++*)

# MEDIA&PUBLICATIONS

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## Late Breaking Report, HRI 2019 - South Korea

Muhammad, F., Hassan, A., Cleaver, A., and Sinapov, J. "Creating a Shared Reality with Robots", *In Proceedings of Late-Breaking Reports Track at the 14th ACM/IEEE Annual Conference on Human-Robot Interaction, Daegu, Korea, Mar. 11-14, 2019.*



## Featured Video - Future You @ NPR

"Digital Telekinesis For the Future You?" featured the hexapod application I developed for CTRL Labs  
<https://youtu.be/cdZLg4IORc0>



## Featured Article - Tufts Now

"Hands-on Research for Undergraduates" featured my Tufts Summer Scholars research  
<https://now.tufts.edu/articles/hands-research-undergraduates>



## Featured Video - Tufts University

"Visualizing a Robot's Perspective of the World" featured our lab's aims, efforts and progress in the domain  
[https://youtu.be/9\\_9RNRNd9y8](https://youtu.be/9_9RNRNd9y8)



## Demos, Documentation, Code and More

For more details about me visit:  
<https://faizan-m.github.io>