FACULTY MENTOR
Nguyen, Truong

PROJECT TITLE
Transmission of Touch VR

PROJECT DESCRIPTION
Transmission of Touch consists of three devices, the primary of which is a wearable device termed “Touch Glove”. The Touch Glove permits the wearer to feel sensations originating from a remote source. The other devices are two types of remote source - a Robotic Arm and a VR Hand Controller - to demonstrate applicability of the Touch Glove in diverse fields - that is, remote control of robotics and virtual reality simulations. The Touch Glove senses when the wearer flexes their fingers and moves their hand, and actuates the movements on the Robotic Arm and VR Hand. Correspondingly, the Robotic Arm and VR Hand will transmit data describing the temperature, contact, and force upon objects or surfaces it interacts with in the environment to the Touch Glove, which will actuate the sensations for the wearer. Touch Glove actuators are organic haptic devices developed by the Lipomi Lab in UC San Diego’s Nanoengineering department - specifically, electrotactile arrays and kinesthetic actuators. Electrotactile arrays are nanoengineered devices that induce a sense of touch on the skin at a very fine point, generally on the finger. By having several arrays of these, the electrotactile arrays can be driven by a multiplexer to actuate in particular patterns to create sensations on the user. This sensation can feel like brushing the user’s finger across a smooth surface. The kinesthetic actuator is a spandex glove coated in conjugated polymer that has a glass-transition temperature close to room temperature. When the kinesthetic actuator is cooled a few degrees (Celsius), the rigidity of the glove increases. When heated, it restores its flexibility, characteristic of spandex. It can be used to inhibit movement when the remote source encounters resistance, such as resisting the wearer from closing their hand into a fist when the remote source grabs a ball.
Project Deliverables
By the end of summer, we aim to have electrotactile arrays installed on a Touch Glove prototype. This is the overall deliverable of the SRIP project. Specifications include:

● A driver for the electrotactile arrays, which generates a multiplexable** 100-120 Vpk-pk square wave with low current (on the order of uA) at a frequency of ~100Hz and is

appropriate for a wearable device (i.e. small, lightweight, low power consumption)
● A glove with electrotactile arrays integrated into each finger
● Patterns which can be programmed to each finger independently (e.g. each finger has a different pattern actuating simultaneously)
● Control of the arrays by the Robotic Arm or VR Environment

** Multiplexing is critical because it is how arrays of electrotactile devices will be programmed to generate patterns, so that we can create the sensation in multiple directions.

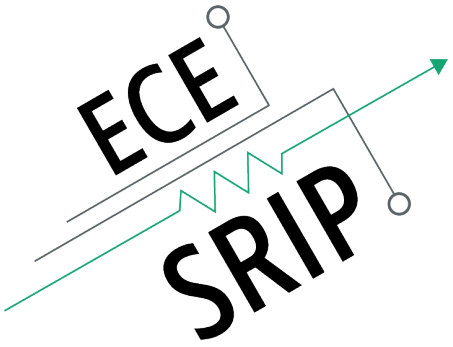
INTERNS NEEDED

1MS and 1 BS

PREREQUISITES

Skill Set Needed:

- PCB Design (EAGLE)
- How to design electrical component footprints (EAGLE)
- Mastery in through-hole and SMD soldering (reflow)
- Familiar with bootloading AVR microchips
- Deep knowledge of Arduino and/or experienced with other AVR microcontrollers
- Simple data structures
- Object-oriented design
- Analog and digital circuits
- Experience with HTC Vive
- Unity
- C/C++
- Mechanical CAD (3D modeling)
- Familiar with 3D printers
- Familiar with laser cutters



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PROJECT TITLE
Camera Systems for 3D Scene Reconstruction

PROJECT DESCRIPTION
3D scene reconstruction is a powerful technique utilized in a vast array of applications, including smart transportation, autonomous driving, virtual/augmented reality, etc. The first step towards getting an accurate 3D model is to capture images of the scene from different perspectives.

There are two major challenges in this process:
1. The limitations of available ports on a personal computer make it impossible to connect all cameras directly to one workstation. Therefore, camera data needs to be first merged via an external hub prior to being then either transmitted to the computer or stored in a hard drive.
2. All cameras need to be synchronized so that they capture the scene at the same moment. This is crucial when motion is involved in the scene reconstruction.

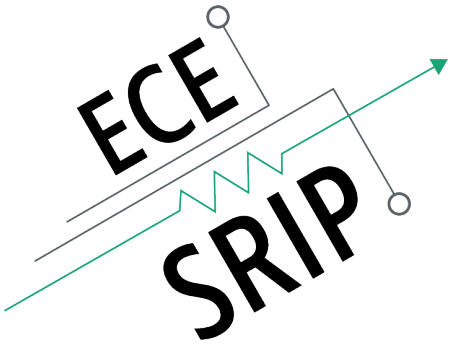
Our lab would like to recruit an undergrad/MS student. During this project, you will learn the whole algorithm pipeline of 3D modeling and reconstruction: from capturing videos, to point-cloud estimation, to scene reconstruction. There will be plenty of hands-on experience as well.

Responsibilities:
1. Build a data hub for multiple USB cameras
2. Develop a synchronization mechanism for multiple cameras
3. Learn algorithm pipeline from capturing images to generating 3D models and performing scene reconstruction

INTERNS NEEDED
Up to two students either BS or MS

PREREQUISITES

Qualifications:
Experience with Raspberry Pi or similar hardware
Coding skills in C++, Matlab, and OpenCV
Background in image processing and computer vision



FACULTY MENTOR
Nguyen, Truong

PROJECT TITLE
High quality free viewpoint video generation

PROJECT DESCRIPTION
Free viewpoint video allows viewers the freedom to choose desired perspective to watch the media content. For example, in a football game, viewers' viewpoint is currently selected by the director. With free viewpoint technique, viewers can pick any viewpoint inside the stadium. They can even place themselves as the quarterback and have an immersive experience in the game.

In this project, you will learn the complete algorithm pipeline of generating free viewpoint video and improve the state-of-the-art algorithm. There will be plenty hands-on experience of applying the algorithm to real world data. You will also participate in developing an interface on the cutting edge Oculus Rift VR headset. The interface will take the output of the algorithm and render it on the headset in real time.

Responsibilities:
Understand the algorithm for free viewpoint video generation
Improve existing method in both quality and speed
Implement real time viewing interface on Oculus Rift VR headset

INTERNS NEEDED
One student either BS or MS

PREREQUISITES
Qualifications:
Coding skills in C++, Matlab, python
Coding experience with OpenCV and CUDA will be preferred
Background in image processing and computer vision