Undergraduate Research Symposium May 17, 2019 Mary Gates Hall

Online Proceedings

SESSION 1I

ROBOTS HUMAN SYSTEMS

Session Moderator: Santosh Devasia, Mechanical Engineering
MGH 248
12:30 PM to 2:15 PM
* Note: Titles in order of presentation.

Hopping and Grabbing Insect-Inspired Robot for Space Exploration
Cat Hannahs, Junior, Aeronautics & Astronautics
Maxx Naoyuki (Maxx) Yamasaki, Senior, Extended Pre-Major
Mentor: Sawyer Fuller, Mechanical Eng

Small insect-inspired robots have much potential in exploration and have been experiencing a wave of innovation in recent years. Small robots have promise especially in space exploration where each kilogram costs $10,000 to launch, but tiny robots tend to weigh under a gram. However, some problems persist, such as difficulty with landing after flight and hopping mechanisms wearing down after a few uses. Our work focuses on developing a hopping robot that is capable of attaching to an overhanging surface when it jumps and that has durable mechanisms to optimize the number of jumps per bot. The hooking mechanism differs from previous work, usually electrostatic patches, and instead is inspired by the hooked feet of beetles, which is lighter and does not require constant electrical power. For optimizing jumps, we are working to develop a jumping body constructed from and designed for carbon fiber rather than the previously used fiberglass. Carbon fiber has a higher strength to weight ratio and is more elastic than fiberglass, making it efficient for flight and the repetitive motion carried out by the body when bent by the onboard actuator. All designs are created using an iterative design process where parts are micromachined and assembled, then tested for desired qualities. From this, we are aiming to develop an autonomous hopper capable of completing multiple jumps and grabbing without maintenance on any part of the bot.

POSTER SESSION 2

MGH 241, Easel 140
1:00 PM to 2:30 PM

Wearable Gesture Sensing in an Industrial Setting
Maxx Naoyuki (Maxx) Yamasaki, Senior, Extended Pre-Major
Mentor: Rose Hendrix
Mentor: Santosh Devasia, Mechanical Engineering

This work describes an inexpensive and accurate gesture control implementation designed for an industrial setting. Sensing hand movements and being able to remotely operate devices without use of a tangible control can be useful, particularly in manufacturing applications where other methods of communication may not be available. One gesture recognition method is to use a camera or set of cameras to capture the motions of the user. However, this method imposes line-of-sight workspace constraints and is sensitive to environmental factors, such as consistent lighting conditions. My approach is to use an instrumented glove that detects the amount of bend in specific joints and sends those positions to a central processor that is programmed to recognize control gestures. Similar glove controllers are available but are either not well suited to an industrial setting because the sensors are vulnerable to metal dust and debris, or are not accurate enough to identify commands quickly and consistently. My version has custom sensors exactly fitted to this application and aims to have all sensors sealed and self contained to protect against contamination. This system is able to capture high resolution movement from the wearer and either save that data for machine training or send it immediately to be acted on. Going forward, onboard capabilities such as local gesture recognition will be added, as well as allowing the user to add custom gestures suited to their particular application.