**Summer 2019 Projects**

**Project A (Hand-held MRI):** Magnetic resonance imaging is a form of medical imaging that utilizes strong magnetic fields, magnetic field gradients, and radio waves to produce images of the anatomy and physiological processes in the body. For this project, a team of students will have the opportunity to design, test, and optimize constraints of materials to be utilized in the development of a handheld MRI device. A general understanding of high school physics (magnetic fields) is preferred, and algebra and trigonometry are required. Some experience with modeling software (ANSYS, COMSOL, or SolidWorks) is desired but not necessary.

**Project B (Sunflyer):** Unmanned aerial systems (UAS) can be used for a number of applications, from dispatching medical supplies in areas where travel is difficult due to lack of roads and infrastructure to delivering internet connections to remote locations. For this project, a team of students would be working together to modify a UAS to fly for long durations without need for repair or refueling. A general understanding of algebra and trigonometry are required, while an interest in building objects (prototyping) and aviation technologies are desired but not necessary.

**Project C (Raspberry Pi Water Test Kit):** Drinking contaminated water can lead to waterborne diseases and in turn cause serious health issues for the consumer. Developing a field test for public water sources could be beneficial in informing users of water quality for consumption. For this project, a team of students will use a Raspberry Pi to develop a sensor to determine the safety of drinking water in public places. A general understanding of basic algebra is required. Some experience with programming (MATLAB, Python, or C/C++) and measuring/recording data is desired but not necessary.

**Summer 2018 Projects**

**Project A (Visualize UAV Data):** A Graphic User Interface (GUI) is a platform that users can interact with in order to engage with electronic devices through graphical icons and visual indicators, instead of text-based user interfaces, typed command lines or text navigation. In order to develop and demonstrate navigation software for Unmanned Aerial Vehicles (UAV), a GUI is necessary. For this project, a team of students will have the opportunity to work with a Snapdragon Flight UAV and develop a GUI for visualizing the UAV’s navigation software, for both development and demonstrations. Familiarity with and interest in visual design, using Linux systems, MATLAB or Robot Operating Systems (ROS) are a plus.
Project B (Simulation of Novel Space Systems): Miniaturized satellites have reduced the costs associated with satellite construction and launch and created new opportunities in space. In order to survey a space-based target vehicle for condition and its location, extremely small femto-satellites can be employed. For this project, a team of students will investigate novel approaches to space systems that will service satellites, including uncooperative disabled target satellites, using femto-satellites. This will be in collaboration with work conducted by US Naval Academy interns, who will mentor the students in system simulation design. Geometry and Algebra II are required, and Trigonometry/Pre-calculus and Physics coursework are preferred. Some programming experience (MATLAB, Python, or C/C++) is desired but not necessary.

Project C (Sea Condition Buoy): Ocean buoys are instruments used to collect various metrics about ocean conditions, such as water temperature and aspects of the waves they encounter. For this project, a team of students will aim to create a small and affordable buoy that can detect environmental conditions including water temperature, current direction, and wave and swell height. Students should have a familiarity with Physics coursework, and readily be able to employ critical thinking skills. Some programming experience (MATLAB, Python, or C/C++) is desired but not necessary.

Project D (Turtlebot Test Platform): Turtlebot is a commercial off-the-shelf (COTS) ground robotics platform which consists of a mobile base, a 3D depth camera, and an onboard computer running open-source software known as the Robot Operating Systems (ROS). ROS is an open-source set of software libraries and tools that have been used to build robotics applications and offers a variety of packages for communication, control, and autonomous operation of the Turtlebot platform. For this project, a team of students will build a mature and reliable Turtlebot platform to gather data and test augmented reality tools, such as the Microsoft HoloLens, for more intuitive and capable human-robot interaction. Students will have the opportunity to demonstrate the performance of the platform by designing scenarios where the Turtlebot must navigate through an environment with unexpected obstacles to a user commanded position. Some programming experience (Python or C/C++) is helpful but not necessary. Familiarity with and interest in ROS are a plus.