

FYRE First Year Research Experience

Jade Morton is looking for First Year students to become part of her research projects through the new FYRE program.

To apply, e-mail Martha Weber at weberme@muohio.edu

YU T. MORTON PROFESSOR

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Available FYRE Projects

Project 1: Software-defined radio

Project 2: GPS Multipath Characterization and Mitigation for Intelligent Vehicle Systems

Project 3: Atmosphere remote sensing using GPS

The overall objective of Dr. Morton's research program:

To develop very accurate and robust GPS receivers for a wide range of applications in navigation, precision agriculture, animal tracking, intelligent vehicle systems, robotics, and remote sensing of the earth atmosphere.

Visit the website <http://www.users.muohio.edu/mortonyt/>

Project 1: Software-defined radio

During the past decade, software-defined radio (SDR) emerged as a new paradigm of design and implement multi-function devices in electrical and computer engineering. A SDR uses software to replace traditional hardware devices and functions in communication, networking, radar, and navigation systems. The results are flexible, reconfigurable, multi-functional systems. I have been engaged in developing a special SDR, the software-defined GPS receiver since 2002. In this project, an undergraduate student will research commercial available radio frequency front end devices and select an appropriate set of hardware for purchase and raw digital data collection of raw signals in the environment. GPS signals can then be extracted from the data and processed to yield user position information. The student will have the opportunity to work with state-of-the-art hardware and software in my labs and interact with graduate students and professionals in the field. The student will have opportunities to interact with professionals and graduate students working in the field and attend national and international professional workshops and conferences.

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Sample Projects Jade Morton, Professor Electrical and Computer Engineering

Project 2: GPS Multipath Characterization and Mitigation for Intelligent Vehicle Systems

An accurate and reliable navigation system is an important component of any future intelligent vehicles traveling on road surface, waterways, and in space. GPS is the leading technology in navigation applications. A major source of error in GPS measurements is the multipath error which is caused by reflections of direct line-of-sight GPS signals off structures near a GPS antenna. This project will involve both static and dynamic measurement and characterization of GPS signals in rich multipath environment such as urban environment and under forest canopies. The students will also have the opportunity to collaborate with graduate students from Miami and other universities to work on techniques that mitigate the multipath induced GPS measurement errors. The student will have the opportunity to work with state-of-the-art hardware and software in my labs and interact with graduate students and professionals in the field. The student will have opportunities to interact with professionals and graduate students working in the field and attend national and international professional workshops and conferences.

Project 3: Atmosphere remote sensing using GPS

GPS satellites travel in orbits that are somewhere between 20,000 to 25,000km above the earth. The signals propagate through the atmosphere and interact with various ions, electrons, and neutral particles along their propagation path. These interactions lead to signal refraction, scattering, diffraction, and distortion. GPS receiver designers do not like these interactions because they result in receiver position measurement errors. We are interested in turning these error measurements into a useful scientific tool to study the atmosphere. With the abundance of satellites in the sky, the small and inexpensive GPS receivers provide us with a great opportunity to remotely sense distribution of species, structure of the atmosphere, and temporal variation of the environment. The students will have the opportunity to work with many different grades of GPS receivers and participate in data collection experiments in interesting locations such as Puerto Rico, Peru, Alaska, etc. One of my previous undergraduate students was given the opportunity to participate in a summer workshop at MIT and presented papers at professional conferences. The students will have opportunities to interact with professionals and graduate students working in the field and attend national and international professional workshops and