Summer 2014 Summer Research Students

In the summer of 2014, four Engineering and Computer Engineering students spent up to ten weeks collaborating on a wide variety of research projects with department faculty. Students explored the use of technology in Amish families, worked toward developing novel methods for removing nitrogen from agricultural run-off, a semi-autonomous training pace car for runners, and a pair of clinical rehabilitation tools. For all these students gaining real world experience moving a significant research project forward will return exciting dividends. Many alumni of summer research programs have continued on into graduate research programs. Others have found the experience gained through managing a substantial project provided leverage for landing a desired research and development position in industry.

Nitrogen pollution due to agricultural runoff threatens aquatic ecosystems across the nation and within Pennsylvania. The use of drainage tile exacerbates this problem. Drainage tile improves soil condition by removing excess groundwater. Although drainage tile may be essential for successful crop yields, it provides an efficient conduit for nitrates to reach receiving waters. Dr. Brenda Read-Daily seeks to develop an engineered drainage tile that would remove nitrates at the source to prevent downstream nitrogen pollution. Daniel Gresh (Engineering, class of 2015) has collaborated with Dr. Read-Daily for over a year now. His research has focused on developing and testing an engineered drainage tile containing elemental sulfur that would provide efficient drainage but also promote in situ denitrification. Ongoing research is seeking to optimize the performance of the drainage tiles. Dan hopes to continue work on similar projects in a PhD program.

> *"After…being involved with denitrification research, I am motivated to focus on a better environment for the future."*

In the spring of 2013, Brian Layng (Engineering, 2014) identified a need among track athletes for a programmable training tool. He envisioned a pace car that could be programmed to guide athletes through interval or tempo track workouts. With the mentorship of Dr. Tomás Estrada, Brian and his senior project team presented their work on this project at a regional meeting of the American Society for Engineering Education (ASEE). Last summer, Martin Fevre (Engineering, 2016) took over the project in continued collaboration with Dr. Estrada. Martin spent most of the summer further developing the initial prototype. The research project combines mechanical engineering, electrical engineering, and computer science into the design of the pace car. The car needs to follow any type of line on indoor and

outdoor tracks while performing the different workouts. Dr. Estrada and Martin will present this work at the National Meeting of ASEE next summer.

Tommy James (class of 2016) worked on a project at the intersection of Amish studies and engineering, advised by Dr. Sara Atwood and Dr. Donald Kraybill. Very few institutions have Etown's local Amish connections and expertise; even fewer of these institutions also have an accredited engineering program. Tommy used his background in sociology courses to conduct an environmental impact investigation based on observations during site visits and interviews with several typical Amish families. Data was collected and analyzed regarding the energy usage of Amish households in Lancaster County compared to the energy usage of a typical American (English) family. They found that the Amish practice sustainability in the following order (opposite of most Americans): reduce considerably, reuse, and sometimes recycle. This research was the first of its kind to explore the energy usage of the Amish and record their attitudes on sustainability issues.

Collaborating with Dr. Kurt DeGoede and Dr. Dan Panchik Devin Drennen (Computer Engineering, 2017) spent the summer continuing the development of the E-HAT and the E-MAT (patents pending). The E-HAT provides low cost fine motor control assessment and therapy tools through a tablet PC. Devin built on the work of past E-HAT researchers to incorporate specific exercises designed for adult stroke recovery patients. This final development prepared the E-HAT for commercial release for the stroke rehab market. A small scale clinical release will be overseen this spring by three OT masters students at a nearby rehabilitation clinic. We are developing the E-MAT to provide similar clinical tools for gross motor control using Micro-Electromechanical System (MEMS) Motion Sensors. For this system Devin's work centered on a transition to non-proprietary MEMS sensors. This transition will both improve the performance of the system and reduce hardware costs by factor of 10.