time information on rainfall in local areas. He hopes that a network of rainfall sensors will allow for smarter infrastructure management, mitigating risks of flooding within wastewater infrastructure.

Hassan's work addresses a significant problem faced in many cities nationwide. As aging infrastructure is stressed by increased waste volume, intense storms cause sewers to overflow, spewing pollution into streets and local waterways. Virginia Beach is one such city facing concerns over the effectiveness of its wastewater management system. The city's current wastewater management system has eight pumping stations. These transfer water stored in Best Management Practices facilities through the sewer system to larger bodies of water with additional storage. The pumping stations increase waste flow rates in the sewer, leaving less room for additional water introduced by major storms. Once installed, Hassan's sensors will allow pumping stations to operate more intelligently, by reducing pumping rates during periods of peak rainfall, when more capacity is needed in the sewage system.

With this technical approach in mind, Hassan has begun working on developing individual rainfall sensors. Each sensor must be able to collect real-time rainfall data and transmit this data to a server cost-effectively. For the first part of this problem, the team is working to design a solid-state rain sensor since tipping bucket-based data collection would be too expensive to maintain in a large-scale implementation. Hassan is developing a piezoelectric sensor which that accumulates charge under mechanical stresses, such as the sounds produced by raindrops hitting the sensor's surface. With careful calibration and efficient algorithms, he believes this approach can provide a reliable, low-cost, low-power solution to data collection. In addition to developing better sensors for data collection, Hassan's project requires efficient storage and transmission of data. Using Particle Photon microcontrollers, Hassan has programmed sensors to read data, wake up, sleep, and send raw data to a server while reducing power consumption. He plans to begin working with the new Particle Electron microcontroller, which has 3G capabilities, for prototyping and future city-wide implementation.

With the guidance of Dr.Professors Whitehouse and Dr. Goodall, Hassan hopes to contribute his sensors to the growing "Internet of Things." The team plans to present their its work at the upcoming ASCE-EWRI conference in May 2016 and plannedplans to begin calibrating and field testing their the system beginning in February, 2016. Hassan is looking forward to continuing his work on this project. After graduation, he plans to get a job in the aerospace industry and launch a small startup.

SAMUEL HAVRON hails from Winchester, Va. and is a second-year computer science major. Driven by a desire to broaden his understanding of his major and develop an appreciation for the impact of computer science research, Samuel explored various CS research labs at the University in his first-year. His fascination with various ciphers eventually led him to work in computer security, under the mentorship of Professor David Evans. Samuel is contributing to the development of a secure multi-party computation (MPC) data analysis program, which facilitates the analysis of sensitive data sets from multiple sources.

A secure MPC has practical uses for many organizations that have sensitive data sets they cannot share, even though they could learn a lot by computing statistical functions on their joint data. Secure MPC protocols, as implemented in Samuel's data analysis program, allow organizations to share their sensitive data in such a manner that only the output of the program is revealed to the organizations, with all sensitive input and intermediary data being hidden. For instance, two competitor companies may want to compute statistical functions on joint sales data and publish the results for internal company research and marketing, without allowing either competitor to uncover sensitive sales data about the other. In such situations it is important that neither company know the sales data inputs of their competitor, as they may learn secrets or be able to manipulate the data in their favor. Samuel's contributions implement secure MPC protocols that allow computations such as the aforementioned example to be possible. He optimized and tested the scalability of his program on large data sets. The program was written in Obliv-C, a data-oblivious lightweight GNU Compiler Collection (GCC) wrapper created by UVA Ph.D. student Samee Zahur. Obliv-C implements secure MPC through optimizations of Yao's garbled circuit protocol for use with semi-honest adversaries. This effectively creates a black box, such that semi-honest adversaries cannot gain addition insight about the source data, receiving only the computated results. The language's library includes numerous Application Programming Interface (API) protocols, which allow an application programmer to quickly implement MPC programs. Samuel's data analysis program takes advantage of such protocols in its implementation, linking function calls appropriately between C and Obliv-C source files to minimize hardware use, reducing cost and time.

After demonstrating the performance, utility, and development techniques of the Obliv-C data-oblivious programming language, Samuel is developing a white paper to explain the benefits of MPC to researchers and programmers with little exposure to computer security and cryptography. He is also now starting a separate project in computer security research, which he plans to submit to the Annual Computer Security Applications Conference (ACSAC), USENIX: The Advanced Computing Systems Association, Applications Conference (ACSAC), USENIX: The Advanced Computing Systems Association, or similar conferences for publication.

Teaming up with recent UVA graduate Shaun Moshasha, fourth-year student **PAYAM POURTAHERI**, a nanomedicine major, and third-year student **AMEER SHAKEEL**, a biomedical engineering major, are working to apply biomedical engineering to reduce the environmental impact of the farming industry. The pair is working to develop a meaningful application to Shaun's previous work with minicells for the 2013 UVA IGEM team. They are applying these novel cells to create a spray that will degrade toxins in pesticides, allowing for safe consumption and reduced water pollution.

To induce the production of minicells, a bacterial cell must be modified to express certain proteins on its outer membrane. Lacking DNA, minicells cannot undergo further cell division, but they can carry out normal protein synthesis, making them an empty vehicle that is capable of expressing desired proteins on the outer membrane. Shaun's IGEM group had expressed a green fluorescent protein on the surface of a bacterial cell and then induced minicells with the same protein, demonstrating the fact that minicells can express desired proteins. Payam and Ameer took this concept to express pesticide degrading enzymes on the surface of minicells.

Under the guidance of their principal investigator, Dr. Mark Kester, a pharmacology professor in the UVA School of Medicine, Payam and Ameer have created a pesticide degrading device utilizing minicells that focus on pesticides containing organophosphates. Dr. Kester graciously offered his lab and resources to jumpstart this project. Harmful to insects, wildlife, and humans, organophosphate pesticides contain a deadly toxin called paraoxon that leads to nerve damage and muscle convulsions. The degrading spray contains minicells expressing an organophosphate hydrolase, an enzyme that breaks down the paraoxon into benign byproducts. This efficient and cheap pesticide degrading device allows for healthier farmworkers, safer food, and a cleaner planet, especially in developing regions of the world where toxic pesticides are more prevalent.

The duo is well motivated and dedicated to this research, and they are thankful for the excellent guidance along the way. Shaun, the initiator of the group, brought experience with scientific and business development, while Dr. Kester and Dr. James Adamswere key mentors to discuss future directions and help steer the pair when it came to grants and competitions. Payam and Ameer have enjoyed great success with their endeavor, winning the Entrepreneurship Cup Concept Stage in the Science