Science Division Summer Research Fellowship – Development of portable battery-operated wireless devices for environmental monitoring Project

The main goal of the project is to develop a portable Wi-Fi running computing device for environmental monitoring. The key-function of the device is to measure such factors like noise, temperature, relative humidity, atmospheric pressure, and soil moisture through sensors and perform logging data for a month-long period. The ideal device will be operated with two main power sources: solar energy and rechargeable Li-Po battery. The device will run with solar power source during daytime, particularly whenever we have sunlight. Meanwhile, the power drawn from sunlight with the photovoltaic panel can be used to recharge the battery. Therefore, this satisfies the environmental friendly device criteria. Last but not least, not just using sensors to gather data, the device is embedded with microphone and webcam, so it can stream a live audio and video of wildlife without disturbing nature.

The research is divided into stages. First of all, there were similar systems like that existing such as the hunter camera system. Many other systems had been also looked up. As a result, we started to work on building the first prototype of the ideal device. The components used to build were: The Hackberry A10 mini-computer board that had Android OS built-in, Logitech HD C270 webcam that also had a microphone built-in. Since this project is the long-term project, the main achievement of this summer period is to stream video & audio wirelessly via the computer board. The device would work best if it uses a Linux Operating System (OS). Therefore, Aldo – my project partner, installed Linaro 12.06 OS – an Embedded Linux OS – via a bootable SD card. There were a lot of obstacles in the project such as the Webcam was not recognized by the Hackberry Board, or the OS could not boot via SD card because some system files corrupted. However, those issues were solved eventually. The live streaming video script was written in Python programming language, and the MJPEG streamer app (an open-source application written in C language) did the web-based streaming in approximately 15 frames/second with VGA resolution (640x480). So far, the board now can stream live video with VGA resolution (640 x 480 pixels), and HD resolution (1280 x 720) via the Logitech webcam in both web-based live streaming with the frame rates of ~20 fps (for VGA quality) and ~10 fps (for HD quality). We still have two more weeks to finish this project; therefore, the live audio streaming function and Wi-Fi modules will be installed to this board, to make it a complete streaming device.

Having done the research for 2 months of summer, the project had been beneficial for myself as well as my partner. It provides me with an opportunity to apply my knowledge in science and technology to solve a real-world problem. Thus, I also learned overall design processes ranging from literature search to realization with realistic constraints.