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Micro-controller Programming and Interfacing Control of the Machinery

My name is Bertrand Irakoze Nkurunziza and I am a sophomore at the University of the South, Sewanee. Over this last summer I was working on an internship in the Physics department. The title of my internship was "Micro-controller programming and interfacing control of the machinery." More specifically, this internship was about getting to know how to use a micro-controller device called Arduino. Arduino is designed to make the process of using electronics in many multidisciplinary projects more accessible. This micro-controller is made of a hardware and software that help it do its work. The hardware consists of a board and a lot of processors. The software is made of a standard computer programming language compiler. So using this Arduino in any project is all about combining the work of both the hardware and the software to make the device do whatever you tell it to do. This means building circuits on the Arduino board and most importantly programming the software with computer codes. Basically, my internship was all about getting to know how to use Arduino and coming up with small and simple projects that involve using the Arduino. I was supervised by Dr. Greg Pond from the Art department and Dr. Randolph Peterson from the Physics department.

As I stated above, my work involved getting to know what is the Arduino, how it works and how I could use the little knowledge I already had in physics to make the Arduino do any kind of work. One of the ways that helped me do this was attending a seminar that is called Shakerag workshops. This is a seminar that brings together people from different backgrounds and has them work together in small classes with their teachers. This seminar gives many classes and the one I attended was the Electronics Textiles and Reactive Garments class. This class was about constructing soft circuits and electronic textiles with a variety of conductive fabrics, thread, and other electronics. It also involved working with the Arduino as well. The instructor of this class was Dr. Joanna Berzowska. This was an amazing opportunity for me

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because she is so experienced and so good with electronics that involve using Arduino. She is the founder and research director of XS Labs, a design research studio that develops innovative methods and applications in electronic textiles and responsive garments. She is Associate Professor of Design and Computation Arts at Concordia University and a member of the Hexagram Research Institute in Montreal. She lectures and consults internationally about the field of electronic textiles and related social, cultural, aesthetic, and political issues. Her art and design work has been shown in the Cooper-Hewitt Design Museum in NYC, the V&A in London, the Millenium Museum in Beijing, SIGGRAPH, ISEA, the Art Directors Club in NYC, the Australian Museum in Sydney, NTT ICC in Tokyo, and Ars Electronica Center in Linz among others. Her research is supported by the Canada Council for the Arts, the Canada Foundation for Innovation (CFI), the Social Sciences and Humanities Research Council of Canada (SSHRC), Canadian Heritage, Hexagram Institute for Research/Creation in Media Arts and Technologies, and the Fonds québécois de recherche sur la société et la culture (FQRSC). She was recently selected by Maclean's Magazine as one of "thirty nine Canadians who make the world a better place to live in." But most importantly, she recently finished conducting a scientific research in M.I.T (Massachusetts Institute of Technology) about Arduino. I was so grateful to get to work with her as I had read many of her work about Arduino. I worked with her on a couple of projects. What is great about it also is that besides learning from Dr. Berzowska, I also got to work with other people that have many different experiences in electronics and I learned a lot from them too. So besides learning a lot about electronics that use Arduino, I actually left the seminar with a big motivation and inspiration that helped me develop all the projects for the rest of my internship. I felt like I had gotten everything I really needed to be able to fully work with Arduino.

I finished the Shakerag workshop about late June. So I had about a month to think of a bunch of projects using electronics and the Arduino to make. But as I said before, using Arduino

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also involved computer programming. So, this also happened to be my chance to study a couple of computer programming languages like C++ and Processing. I had a little experience about programming because I had taken one computer science class in my freshman year. But this class was about the Java programming language which is a little different from the other two. I came up with about 5 projects that all used Arduino. Most of them were about making the Arduino collect data using a couple of sensors and analyze or just display them with a computer. Most of those sensors were light sensors, motion sensors and temperature sensors. So, for example with just a simple circuit and a temperature sensor on the Arduino board and the Arduino board connected to a computer via a USB port; I would get all the values of the temperature for the whole day displayed on the screen of my computer. This is just a simple description of one of my projects. But it is not as easy as it sounds because it also involves a lot of programming.

However, there is another project that I would like to talk a little about because it is the one that interested me the most. I got the inspiration to work on this project from Dr. Joanna Berwoska in the Shakerag workshop. I started this project with her in the workshop and kept working on it even after the workshop. The idea was to make the Arduino work as a small security camera. The way this works is that there is a motion sensor that is connected to the Arduino board with a circuit of course. However, also there is a computer program that has been compiled in the software of the Arduino. There is also a small camera connected on this circuit too. So this computer program makes the Arduino take pictures or a video with the camera whenever the motion sensor detects any close movement to the Arduino board. This means that, for example, you would leave the whole thing set up in your room and it would take pictures of anybody who comes in your room. This wasn't an easy project but I successfully finished it and I was so grateful to work on such an interesting project.

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Briefly, I had a great time working on this internship; this is because I learned a lot about electronics and Arduino and many other things that a physicist would love to learn. This was a good experience because I feel like it somehow affected my career goals. This is because before doing this internship, I wasn't really sure about whether I would follow civil engineering or computer engineering as my career. I had so many questions about computer engineering and I didn't really think that there was a lot that I can do with computer engineering. But now I feel like that internship answered most of the questions I had, and meeting Dr. Joanna Berwoska was definitely a big motivation to me. I was so lucky to get this internship and I really had a good time.