Deliverable B

Customer Statement	Interpreted Need	Importance
We need to remind students of how much time is left in the day.	Making students aware of the time, ensuring students allow themselves enough time to finish a project before end of day.	4
Students struggle to find an open machine.	Redirecting traffic of students to available equipment.	3
	Reduce time that machines are idle, high machine turnaround.	3
	Increase student productivity.	3
We are often asked about the locations of various tools and rooms.	We need a map to save time by directing students to equipment sooner.	3
We want a display indicating the remaining time required for a tool (laser cutter, 3D printer) to complete its current job.	Create a clock to inform students of time left on their task.	5
People often rest in spaces that are designed for engaging group work.	Make the users engage with the design commons space and encourage them to stand	1
We have a tight budget.	Cost of project needs to fall under $100	4
We need a way to monitor the equipment to know when it needs maintenance	Automated system that monitors equipment use and condition.	5
We need a way to monitor how often equipment is used for the purposes of maintenance.		
We want a surveillance System to prevent theft	An automated system that maintains security	2
We need a way to monitor humidity and particulate matter.	Method to ensure that equipment is only being run under operable/optimal conditions.	3

Table 1: Interpreted need analysis according to the customers' statements during the client meeting. Each interpreted need is evaluated on a scale of 1-5 (1 being the least important and 5 being the most important) in order to list them according to their priority.

Benchmarking – Parking Space Sensors

Specifications	U-Spot Parking Sensor[1]	Fybr Parking Sensor[2]	ParkSonar-EZ[3]
Company	Urbiotica	Fybr	MaxBotix
Cost	$200-400	$330	$27.95 for 5
Dimensions	3.27 x 3.74 x 2.48 in	1.9 in radius	0.785 x 0.87 x 0.61
Weight	160 g	N/A	4.3 g
Lifetime	10 years	3 years	N/A
Type of Sensor	In-Ground Sensor	In-Ground Sensor	Air, Ranging Sensor
Detection Method	Optical and Magnetic	Magnetic	Ultrasonic
Accuracy	98%	99%	N/A
Image			
Additional Notes	• Keeps information stored in the cloud. • Does not process information itself.	• Sends data to a network to be processed.	• Only detects objects within 6 inches. • Can only use 14 sensors in the same environment (can increase depending on mounting however)

[1] "U-Spot Parking Sensor." *Urbiotica*, Urbiotica, www.urbiotica.com/en/producto/u-spot-2/.
[2] "Parking Sensor Technology Performance Evaluation." San Francisco Municipal Transport Agency, 2 June 2014.
[3] "Park-Sonar EZ Datasheet." MaxBotix Inc., 2012.

Client Needs Analysis

The Centre for Entrepreneurship and Engineering Design (CEED) is an organization at the University of Ottawa overseen by the Faculty of Engineering. In addition to fostering design teams and facilitating workshops, CEED hosts a number of design spaces that are open for student use. Here, students use and learn about technologies and specialty equipment to manufacture prototypes. MakerLab and Brunsfeild centre are two of the main design and manufacturing spaces in CEED, and with the exception of the Sandbox space, the rest of the spaces are also located in the STEM building. Many of the spaces are new, and are therefore still facing daily challenges for both staff and student users. After just over a year of operation in the STEM building, members of the CEED community have been able to identify a few specific issues that need to be addressed.

Our team is tasked with designing a tool that can address these challenges with the help of Ross Video Dashboard software. This is a versatile software that is capable of designing an interface that can be used with other Ross Video products, sensors, cameras, and much more.

To determine the current problems in the spaces, an interview was conducted with staff members to gain insight into the daily operations at CEED. One need that came up frequently was that students were not making effective use of their time in CEED. They presented three ideas to solve this issue.

Many students working on 3D-printer and laser cutter projects would run have their machines running longer than the CEED hours of operation. The staff believe countdown timers could be installed in various design spaces to remind students of the amount of time left before the spaces close. Other countdown timers could be installed on each machine to publicly indicate the time remaining on each project. Another issue mentioned was that students often had a hard time finding an open stations at any given machine. They suggested creating a method to monitor vacancies and equipment use. With this solution, students could reference the tool to anticipate availability and wait time instead of waiting in person for a machine to become available. The staff brought up another suggestion to create a tool that directs students to various spaces based on the equipment they need to use.

All of these suggestions stem from the client's desire to save the users' time, make sure everybody respects the hours of operation, and optimize the traffic flow of MakerSpace. Due to how

frequent this need was brought up in the interview, it is clear that the highest priority that should be addressed in the design.

The staff frequently brought up the need to observe the equipment maintenance. They suggested designing a product that could monitor machine use and environment (i.e. humidity and particulate matter). Both the environment and monitoring machine usage ensures that all equipment is being used properly and under optimal conditions. This would minimize any damage to the machines due to neglect. In case repairs are needed, being able to see the machine and how often it is used can help the staff solve any maintenance issues. Being able to monitor the machines would also aid in surveillance of the equipment and reduce theft, however it is important to note that addressing theft was not greatly emphasized during the interview.

Another important factor that came up during the interview was the cost of the project. It was emphasized that the project had to be at most $100. The design cannot be more ambitious than what the budget would allow. It should be noted that in spite of this being mentioned only once, this need cannot be understated. It is critical that the design be within the budget allocated to each group.

Problem Statement and Conclusion

The staff mentioned a multitude of issues in the interview, none of which can be solved by a single product. We identified select needs that were of higher importance than others and these should be prioritized by the design. From our analysis, the staff is looking for an automated system that monitors equipment use, availability, and condition and a way to make sure students respect the hours of operation in Makerspace.

We looked into various sensors that are currently being used in parking lots to detect parking space vacancy. We believe these designs will help us understand how to create a new product that will monitor equipment use in real time.

The staff of CEED need an affordable product which will optimize and monitor machine use, reduce confusion, and ensure all projects are completed during the MakerSpace hours of operation.