Project Deliverable F: Prototype I and Customer Feedback
GNG 1103 – Engineering Design
Faculty of Engineering – University of Ottawa

Objective:

Devise a test plan and develop your first prototype. Get customer feedback on your prototype.

Instructions:

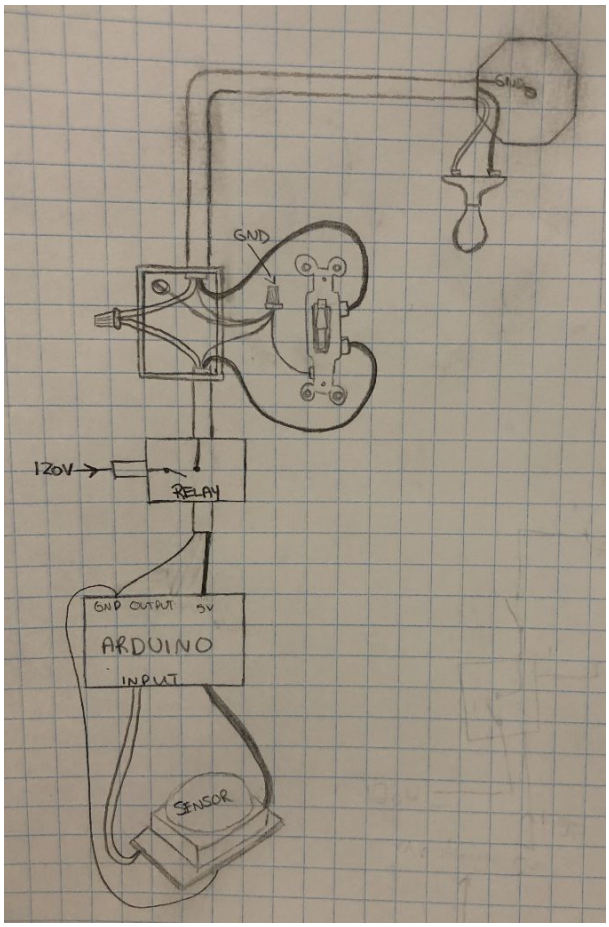
Teams will outline a prototyping test plan based on the template provided in "Lecture 11 – Prototyping Test Plan" and develop a prototype which will be used to achieve the objectives your team has set out in this plan (i.e. you need to answer the "why", "what" and "when" of prototyping). Typical objectives include communicating and getting feedback for ideas, verifying feasibility, analysing critical subsystems or system integration or reducing risk and uncertainty. You must also define a stopping criteria which will allow you to end the test once you are satisfied that you have achieved your testing objectives. Be very clear about what you are trying to measure and define an acceptable fidelity based on the objectives of your prototype.

Since this will be your team's first prototype, you should focus on creating a basic proof of concept which should be made using materials and components that cost very little (e.g. things found around the house, scraps, etc.). Get creative in order to improve your results. A simple analysis of critical components or systems should also be included, based on your current knowledge of engineering science or other knowledge. Finally, you must gather feedback and comments on your ideas and prototype from potential clients/users that you have sought out and identified on your own.

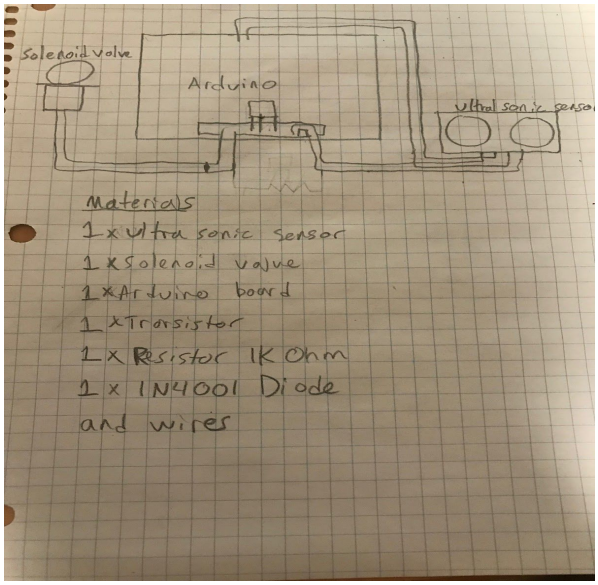
Carefully document your prototyping test plan, analysis and results (including detailed images of your prototype), as well as the feedback and comments you have gathered. It is strongly recommended that you start early, as prototyping takes a significant amount of time.

Lighting

For the first prototype of the lighting automation, we have designed a detailed diagram following the design concept chosen in the last deliverable. The lighting system will consist of a basic two way switch connected to the light. This switch will receive power from a relay connected to a 120V power source and the arduino. When movement is detected, the arduino will send a ‘HIGH’ signal to the relay in order to complete the circuit and turn the light on. However, after 10 minutes of no movement detected from the sensors, the arduino will a ‘LOW’ signal to the relay and the light will turn off. In other words, having the light switch on puts the system in automatic mode. The user can also chose to have the light off, for example when they go to bed, by simply turning the light switch off and cutting the power to the light until it is turned back on and movement is detected from the sensors. This lighting system will be implemented for the outdoor light by the door and a diagram can be found for it below. The indoor lighting will be the same system as shown in the diagram, except where the relay is will simply be a 120V power source and it will not be connected to the arduino.



Water



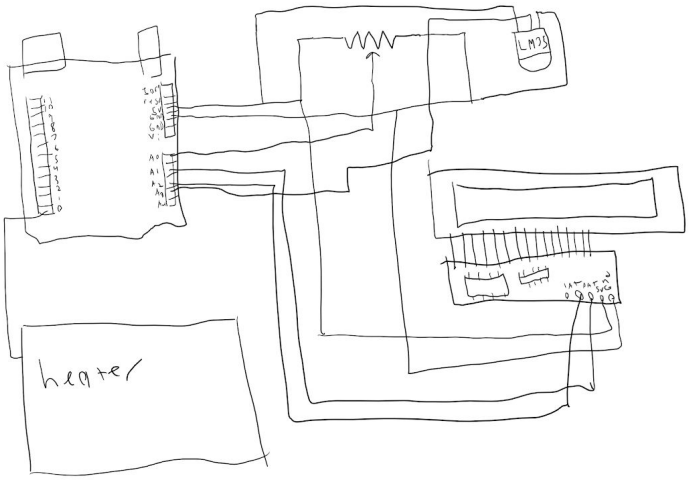
For the first prototype of the water automation, we designed a simple diagram which followed the design concept we proposed in the last deliverable. The water system is the most simple out of the three sub-groups and will consist of the materials listed in the above picture.We elected to go with a solenoid valve as our source which will result in the outflow of water, (in one direction). We will also be needing a diode because it will help eliminate the power a magnetic coil loses since the solenoid is an inductive load. The next step would be the set up the code and make sure it is compatible with the ultrasonic sensor. Once this is done, the solenoid will start opening and closing.

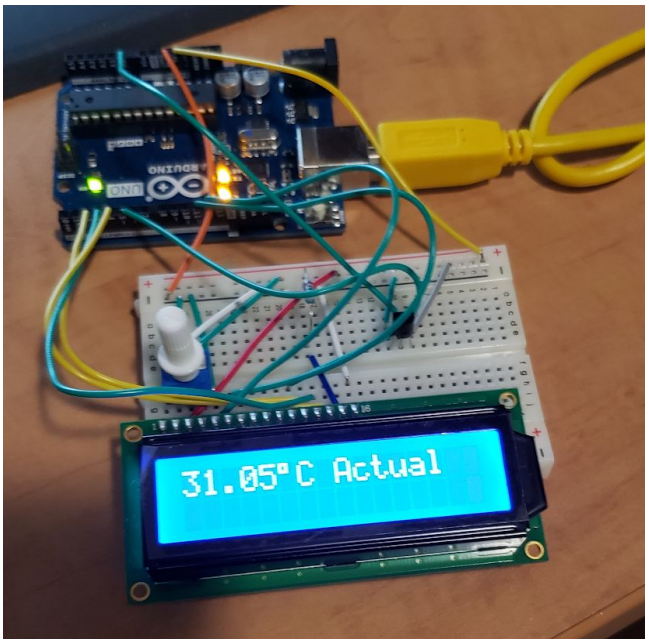
Heating

By following the main concept generated previously, we have managed to create the first prototype by breaking it up into 3 main sections. The first section contains the sensors, which are currently represented by the heat sensor on the breadboard. This part can be tested directly; after converting the imputed values by the sensor into degrees celsius. By comparing the temperature being read by the sensor to a thermometer we can find out the reliability of said sensor, or find out if we need to fix something. Similar methodologies will be applied to the other sensors; for the motion sensors the distance will be varied to see the effectiveness.

The second section is the output of the arduino; the LED display. This has been slightly altered from the previous concept of 2x 7-segment displays in order to display more information, and to improve the user interface. Now, as opposed to simply showing the temperature, the LED display will now also show the desired temperature directly below the actual temperature, and will be the number impacted by the third section, which houses the user inputs.

The third section will include a dial which the user can interact with to turn the temperature up or down. Again, this is different from the initial concept in order to combat hardware limitations as well as heighten user interaction. The new idea is that as the dial is turned the voltage sent to the arduino as an input varies, and by reading this voltage the “appropriate” change in temperature can be applied, and the threshold for turning on the heating unit will also be changed. Testing for this section will take longer, and is reliant on the other sections’ accuracy. A combination of these 2 factors leaves this section to be the last of which to be tested. The test itself will be a set of 3-5 tests that involve using the dial to alter the threshold temperatures to either extreme (hot or cold) and then putting the whole system in a similar temperature to see if an LED (in lieu of a heating unit) will light up when the threshold temperature is reached.


LM35
heater


31.05°C Actual