

D. Detailed Design and BOM

D.1 Detailed design

1. Client feedback

- Color Palette:

The client prefers a yellow and purple combination for the product.

- Color Placement:

The client prefers the wood/outside to be purple and the inside of the box to be yellow

- Box specifications:

The client is happy with our ideal values and marginal values from project deliverable C (ie. weight, thickness, dimensions, etc...)

- Improvement of design:

The client really likes the idea of the product also acting as a charging station; therefore we need to ensure that there are the necessary ports and functions to do so.

2. Detailed design

Mechanical design

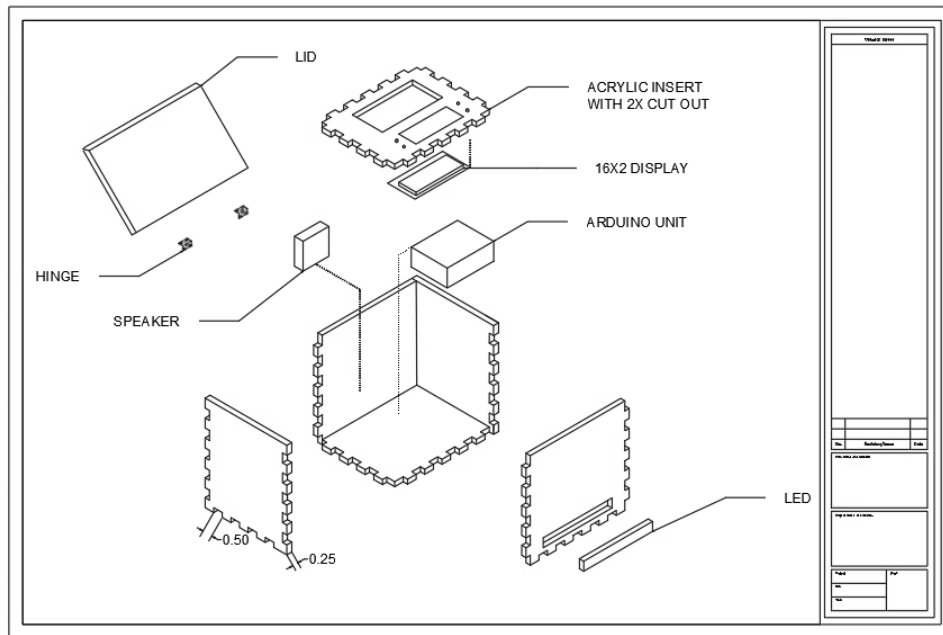


Figure : exploded block diagram

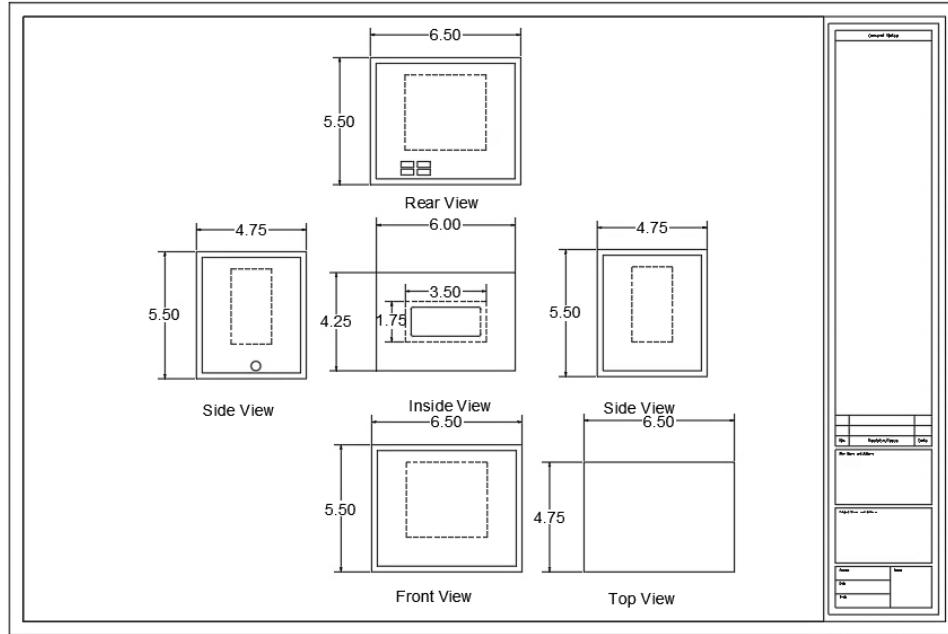


Figure : detailed view of system

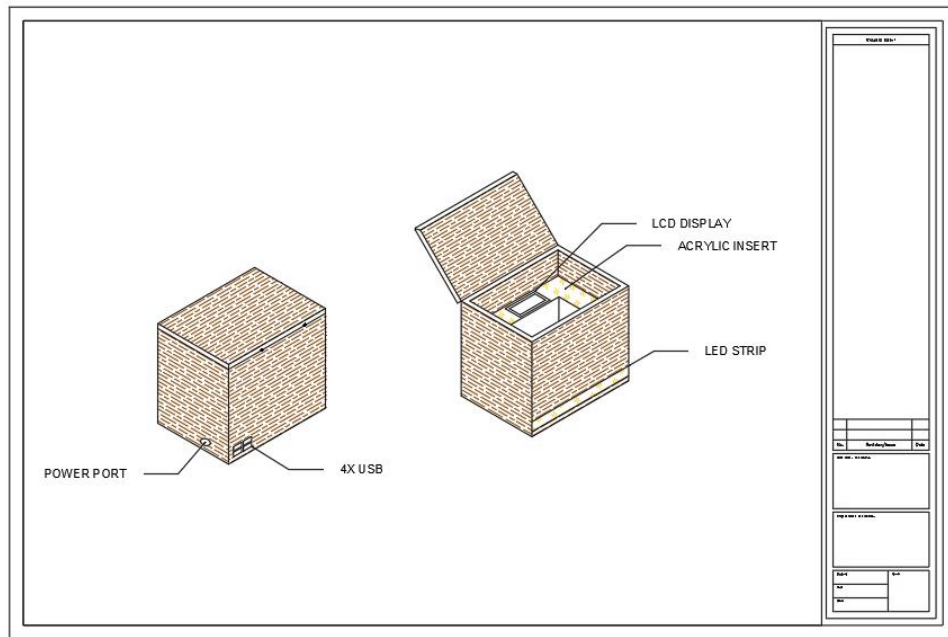


Figure : 3D view of system

Electrical design

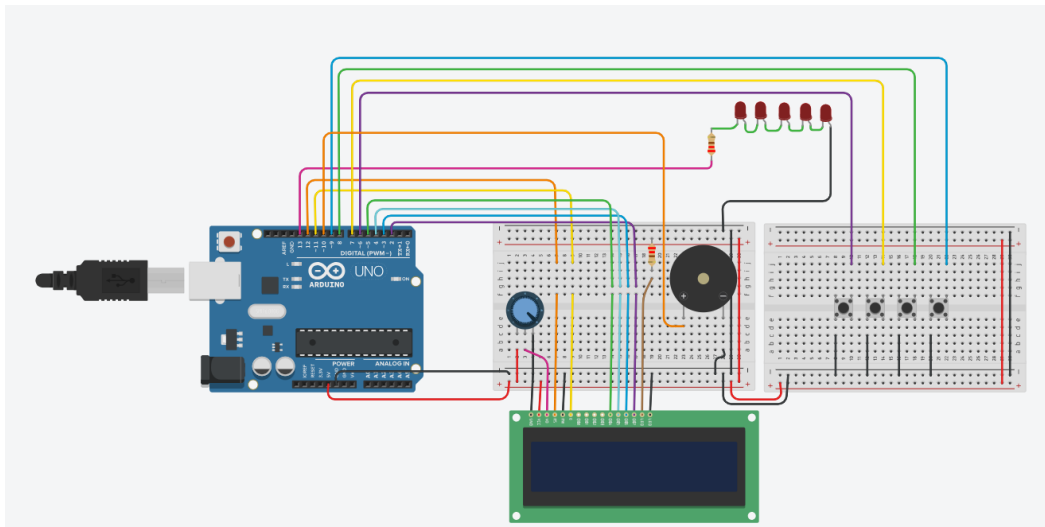


Figure : Arduino components design

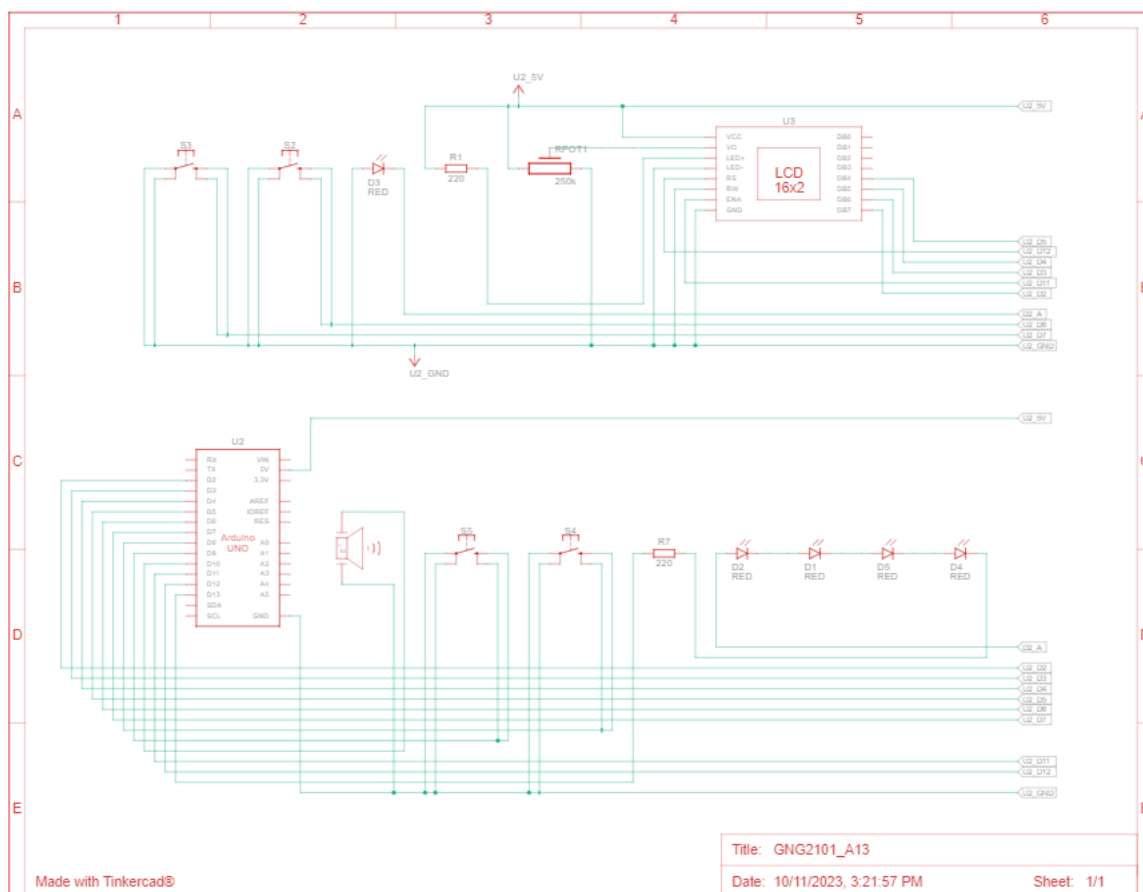


Figure : Electronics schematic

3. List of skills and resources

Skills

1. Design software

- Auto CAD: Technology for designing and modeling overall products.
- Tinker CAD: For the electrical components
- Arduino software, compilation, and simulation of programs

2. Electrical circuit design

- Power: Circuit design and wire connection to supply power to the enclosure
- LCD display: Circuit design for use as a user interface and wire connection for power supply
- LED light strip: Circuit design for visual alarm and wire connection for power supply
- Speaker: Circuit design for auditory alarm and wire connection for power supply

3. Electronic software

- C programming: Used to program the Arduino board

4. Production technology

- Laser cutting: Used to precisely cut wood, the enclosure material.
- 3D printing: Technology for interior design using acrylic.
- Machining: Used for sizing, shaping or holes

5. Project management

- Technology for planning, tracking and managing project schedules
- Wrike

Resources

1. Materials (exact equipment detailed in BOM)

- Wood & Acrylic
- LCD display for UI
- LED light strip for visual alarm
- Speaker for auditory alarm
- Arduino and/or raspberry pi for implementing electronics.

2. Manufacturing equipment

- Laser cutting machine
- 3D printer

3. Power and charging

- Power cord
- 4 USB ports

4. Management software

- Wrike

Effort for scarce skills and resources

To successfully complete this project, various engineering technologies and expertise are required. To compensate for the lack of skills and resources, we can use the many resources available for engineering students at the University of Ottawa.

First, Makerepo offers a variety of online resources. Through online resources on digital and manufacturing technologies, we have information on laser cutting and 3D printing. We can also try and learn technologies (laser cutting, 3D printing and coding) through workshops.

Second, our team members belong to a variety of engineering programs (computer, electrical, and biomedical mechanical engineering). We can make up for our shortcomings by acquiring and learning skills in the classes taught in each program. Time can be set aside from team members to help teach new skills required for completion of the project.

Lastly, we can progress our project by seeking advice from professors and TAs through lab, classes, and email.

4. Time analysis

To execute our final design in the form of a first prototype, a list of tasks must be performed. Specialized tasks will be dedicated to each member in terms of their expertise and experience. This will allow us to utilize time and resources efficiently. Other tasks will be done as a group.

| Tasks | Duration |
|---|----------|
| Design of enclosure box layout for laser cut | 1h |
| Design of acrylic insert piece | 1h |
| Execute laser cut of enclosure and acrylic insert | 15 min |
| Assemble enclosure and acrylic insert | 30 min |
| Attachment of hinges | 15min |
| Assemble electronics | 1h |
| Soder the final circuit | 2h |
| Program the system | 4h |

5. Define any other critical product assumptions that could affect your ability to implement your design. For example: the acceptable values for a specification, availability of material/component, or critical functionality.

Assumption 1

The material used for the enclosure is plywood. Plywood is not the most durable and only serves as representation. Realistically, a durable enclosure is made from metal or a form of plastic, but we are restricted in cost and in the available manufacturing facilities.

Assumption 2

The manufacturing of the enclosure by laser cut doesn't make the structure as secure or stable due to parts being glued together.

Assumption 3

The USB charging supply being an extra add-on feature is not expected to function. However, cut outs and space will be made for that functionality to be implemented later. The design of a charging supply network onto the circuit is not the focus. Efforts will be made for it to function, but it might not be feasible due to the complexity, the limited resources and time availability.

Assumption 4

For powering electronics, an Arduino is used as it is feasible within the budget. It is relatively simple to implement and doesn't require intensive knowledge about electronics.

D.2 BOM

| Bill of material | | | | | | |
|------------------|--|--|-----------------------|----------|--------------|-------------------------|
| Item # | Name | Description | Dimensions | Quantity | Cost (CAD\$) | Link |
| 001 | plywood | Birch Materials of the exterior of the enclosure | 12 * 24 | 2 | 2x3.95 | wood |
| 002 | Clear Polycarbonate Plastic Sheet | Clear plastic to encapsulate led | 6x12 | 1 | 4.96 | plastic |
| 003 | Arduino | Arduino + USB cable Power supply | 3.3*2.2 | 1 | 17.00 | Arduino |
| 004 | display | Liquid Crystal Display LCD | 16*2 | 1 | 12.98 | LCD |
| 005 | hinges | Small Connector for opening and closing the enclosure lid on the enclosure | 0.08 | 1 | 0.96 | hinge |
| 006 | Led strip | 5pk Visual alarm | Blue | 1 | 8.00 | led |
| 007 | buzzer | Auditory alarm | 0.496" Dia 1.5V | 1 | 1.00 | buzzer |
| 008 | wires | Connect electronics | | 5ft | 1.60 | makerstore |
| 009 | Resistors(22 0ohm) | Decrease current | | 5 | 0.01 | makerstore |
| 010 | DS3231 RTC module | Real time clock | 22W x 38H mm | 1 | 10.99 | amazon |
| 011 | Push Buttons | To operate system | 6 x 6 x 5 mm | 4 | 0.61 | button |
| Total | | | | | 66.02 | |

