G. Other Considerations

G.1 Economics report

1. Include a list of variable/fixed, direct/indirect, and material/labour/overhead costs associated with your business, based on the manufacturing and sale of your product. Make sure that you distinguish between price and cost and realize that prototyping and higher-volume manufacturing costs will probably be different.

Materials

- Plywood: The exterior of the enclosure
- Plastic sheet: Clear plastic to encapsulate led
- Arduino: Power supply and control
- Display: User interface
- Hinge: Connector for opening and closing the enclosure lid on the enclosure
- Led stirp: Visual alarm
- Buzzer: Auditory alarm
- Wires: Connect electronics
- RTC module: Real time clock
- Button: To operate system
- Resistors: Decrease current

Labour

- Product designer: The person in charge of main product design
- Software Engineering: The person in charge of software development, testing, and maintenance
- Mechanical Engineering: The person in charge of product design, testing, and maintenance
- Electrical Engineering: The person in charge of product circuit design, testing, and maintenance
- Manufacturing Technician: The person in charge of assembling products and operating machines

Overhead

- Rent for Office: Cost for office rent
- Equipment depreciation: The cost of distribution the purchase cost of equipment over the expected period of use of the equipment
- Utilities: Cost of public service at workplace
- Marketing: Costs for product promotion
- Internet: Internet service

- Maintenance: Equipment and facilities maintenance costs
- Insurance: Business insurance

In the case of materials, the cost changes depending on the amount of production and is a variable/direct cost because it is a material that is directly consumed when manufacturing a product.

In the case of labour, product designers, software engineers, mechanical engineering and electrical engineering that indirectly support product manufacturing are fixed/indirect costs. However, because manufacturing technicians are directly involved in the actual manufacturing of products, the required labour hours vary depending on production volume. So, they are direct/variable costs.

In most cases, Overheads are fixed/indirect because they remain constant regardless of production or sales volume. However, utilities and marketing may change from time to time.

	Material	**Labour**	**Overhead**
Variable	Plywood, Plastic sheet, Arduino, Display, Hinge, Led strip, Buzzer, Wires, RTC module, Button, Resistors	Salary Manufacturing Technician	Utilities Marketing
Fixed		Salaries Product designer Software Engineer Mechanical Engineering Electrical Engineering	Rent for office Equipment depreciation Utilities Marketing Internet Maintenance Insurance
Direct	Plywood, Plastic sheet, Arduino, Display, Hinge, Led stirp, Buzzer, Wires, RTC module, Button, Resistors	Salary Manufacturing Technician	
Indirect		Salaries Product designer Software Engineer Mechanical Engineering Electrical Engineering	Rent for office Equipment depreciation Utilities Marketing Internet Maintenance Insurance

G.1.2 Projection of a 3-Year Income Statement

build a projected income statement for the first 3 years after a potential startup of a business, the following assumptions were established:

1) Sale price per unit: 80$/unit

   Based on an overview of various types of alarm clocks sold on amazon which are comparable to our product, research shows the prices range from 50$/unit to 100$/unit.

2) Cost per unit: 40$
   Based on the BOM, the cost of making the prototype is around 60$ which can be cut down to 40-50$ as mass production debuts with supplies bought in bulk. As you produce more, the cost per unit decreases. The ideal profit margin should be 50%. Therefore, efforts should be made to cut down the cost per unit to 40$ which represents exactly 50% of the sale price.
   https://www.brex.com/journal/what-is-a-good-profit-margin

3) Total units sold per year

   Year 1: 500 units
   Year 2: 2000 units
   Year 3: 4000 units
   These numbers are simply goals set out as a starting point.

4) Marketing cost was fixed at 3% of total revenue.

   According to the Business Development Bank of Canada, a common rule of thumb is that small startups should budget between 2-5% of total revenue on marketing expenses.
   https://www.bdc.ca/en/articles-tools/marketing-sales-export/marketing/what-average-marketing-budget-for-small-business

5) R&D expenses was fixed at 5% of total revenue.

6) General expenses are fixed at 15% of total revenue. It includes mainly postage fees, packaging, legal fees and any other unexpected costs that may arise.

   According to BDC, general expenses depend widely on the specific business, but generally it should fall between 15% to 25% of total revenue. https://www.bdc.ca/en/articles-tools/entrepreneur-toolkit/templates-business-guides/glossary/general-expenses

7) Labour cost includes the salaries of 3 workers. Each worker has a yearly salary of 50,000$. It is assumed that the salaries will remain constant in the first 3 years.
8) It is expected for these fixed rates on the total revenue to vary in the upcoming years, but it will be assumed constant for the first 3 years.

Calculations

	Year 1	**Year 2**	**Year 3**
Revenue			
Net Sales	= 500 x $80 = $40,000	= 2000 x $80 = $160,000	= 4000 x $80 = $320,000
COGS	= 500 x $40 = $20,000	= 2000 x $40 = $80,000	= 4000 x $40 = $160,000
Gross Profit	= $40,000 - $20,000 = $20,000	= $80,000 - $40,000 = $80,000	= $160,000 - $80,000 = $160,000
Operating expenses			
Marketing	= $40,000 x 0.03 = $1,200	= $80,000 x 0.03 = $2,400	= $160,000 x 0.03 = $4,800
R&D	= $40,000 x 0.05 = $2,000	= $80,000 x 0.05 = $4,000	= $160,000 x 0.05 = $8000
General expenses	= $40,000 x 0.15 = $6,000	= $80,000 x 0.15 = $12,000	= $160,000 x 0.15 = $24,000
Labour cost	$150,000	$150,000	$150,000
Total Operating Expenses	= $1,200 + $2,000 + $6,000 + 150,000 = $159,200	= $2,400 + $4,000 + $12,000 + 150,000 = $168,400	= $4,800 + $8000 + $24,000 + 150,000 = $186,800
Net Income	= $20,000 - $9,200 = -$139,200	= $40,000 - $18,400 = -$88,400	= $80,000 - $36,800 = -$26,800

Income Statement
For The Year Ended December 31, 2024 to 2026

	2024	2025	2026
REVENUE:			
Net Sales	$40,000	$160,000	$320,000
Cost Of Goods Sold	$20,000	$80,000	$160,000
Gross Profit	$20,000	$80,000	$160,000
OPERATING EXPENSE:			
Marketing	$1,200	$2,400	$4,800
R&D	$2,000	$4,000	$8,000
General expenses	$6,000	$12,000	$24,000
Labour cost	$150,000	$150,000	$150,000
Operating Expenses	$159,200	$168,400	$186,800
Net Income	-$139,200	-$88,400	-$26,800

G.1.3 NPV Analysis

Assumptions :

Discount rate : 10%

500 units for first year

First year materials : 40$/unit x 500 units = $20 000

Initial Investment: 66.02$ (First prototype) + Laser cutter (12 000$) + First year materials ($ 20 000) + overhead (8000$) ≈ $40 000

Below is a break down of the year over year NPV, factoring all expenses that were captured in the 3 year income statement.

Year 1

Net Cash flow (year 1):

Net cash flow = -$139 200

Net Present Value (NPV) (year 1) = Net cash flow / (1+Discount rate)^years = -$126 545.45

Year 2

Net Cash flow (year 2):

Net cash flow = -$88 400

Net Present Value (NPV) (year 2) = Net cash flow / (1+Discount rate)^years = -$73 057.85

Year 3

Net Cash flow (year 3):

Net cash flow = -$26 800

Net Present Value (NPV) (year 3) = Net cash flow / (1+Discount rate)^years = -$20 135.14

Based on the above information it can be seen that the break even point would be after the 3rd year. When taking into consideration only the per unit cost of the project, the break even point would be after 1299 units. The calculation for this can be seen in the figure below.

Considering all the factors involved in the manufacturing process and a set labour cost the company would become profitable in the 4th year.

Net Sales per Unit = Selling Price per Unit – Cost per unit = $80 – $40 = $40

Expense percentage = Marketing + R&D + General Expenses = 3% + 5% + 15% = 23%

Net revenue per Unit = Net Sales per Unit - (Net sales per Unit x Expense Percentage) = 40 - (40/0.23) = 30.80

Break Even Point = Initial investment / Net revenue per Unit = 40 000 / 30.80 = 1298.7 = 1 299 units

G1.4 Assumptions

The first assumption would be for the number of units sold. We assumed that we would have an increase in sales year over year as the product gained popularity. The second assumption would be the construction price per unit. Looking at comparable items the construction cost could be between $20 - $40, and the sale price should be between $80 - $120. Lastly we assumed that the salaries for the first few years would be fixed at $150k for 2 – 3 people.

G2.1 Intellectual property exploration

The basic construction of our project is an alarm system built into a box to remind the user that is time to put on their hearing aid device. This is very similar to many patented projects however does have elements that make this project unique. The main constraint being the accessible charging compartment designed for the hearing aid. The following are two examples of patents on the market that resemble our project proposal and design.

1) Medication reminder assembly https://www.freepatentsonline.com/9734696.html
   PDF : https://www.freepatentsonline.com/9734696.pdf

- " A medication reminder assembly includes a box that may have medication placed therein. An alarm unit is coupled to the box and the alarm unit may be manipulated. The alarm unit is programmable to emit a selected one of an audible alarm, a vibratory alarm and a visual alarm at selected intervals. Thus, the alarm unit generates a reminder to take the medication within the box."
- In this scenario the project specifies an alarm unit (we have one), and audible or visual (we have that) and a unit generating the reminder (we have a display). However, the nuance is found that they mention a box that may contain medication but our box is designed to contain a charging device. This patent would not qualify us to sue our company as we don't have each element of their declaration.

2) Alarm clock with wireless earphones
   https://www.freepatentsonline.com/y2006/0153007.html
   PDF: https://www.freepatentsonline.com/20060153007.pdf

- "An alarm clock with wireless earphones has a housing and a power cord for interconnecting the housing with a power source which may be internal or external to the alarm clock. The alarm clock can include memory, one or more processors, a clock, one

or more counters, a display, a tuner, one or more speakers, an alarm A, an alarm B, one or visual indicators, and one or more audio indicators. The alarm clock can also include a microphone, one or more transceivers, an antenna, one or more modems, one or more input/output interfaces, and one or more input/output ports. The alarm clock is configured to allow users to set an associated alarm at a particular time and with a particular type of alarm, such as a voice message from family or friends. Users receive their selected alarm with a wireless earphone via a wireless communication link with the alarm clock."

- With this patent it contains the elements of an alarm system, much like our proposal. However, this system includes earphone signal to output the sound rather than a buzzer like our design, it is capable of snoozing which is not an option for us, and it does not have an inside compartment to hold objects. In this case this business is not able to sue our company.

G.2.2 Intellectual property report

1. The first and probably most important concern would be surrounding IP is for alarm clocks. An alarm clock now is a very easy to explain device, but does it do something specific or different that would set it apart from a normal one or does it do something that would infringe on the design of another alarm clock.

The next area for concern would be surrounding the Arduino and how it is being implemented in this project. What components are we using and how are we using them. We have the basic component as well as power cables, a screen, and some other components.

The last thing to consider would be components that are being used in the construction of the enclosure. How are we implementing the hinge mechanism. What type of material are we using for the box. What type of adhesives and hardware are we using.

2. The main component in our design is its alarm clock functionality. Currently there are many applications for purpose build time monitoring equipment or alarm equipment. However, the basic concept of an alarm clock does not appear to infringe on an obvious patent.

When looking at the electronics that were using in the project, the Arduino is open-source hardware. The software implemented on the Arduino for our project is also open source. This means that if we site where we sourced the code then we will not be breaking any copyright laws.

For the construction of the enclosure, we used a standard hinge on a wooden box with a lid that opens to reveal a storage spot for the hearing aids. No specialty designs were developed or implemented as part of the enclosure so there shouldn't be a concern for copyright or patent infringement.

G.3 Project plan update

https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=GBWaTGk1IAtNU03RnaLLBQXz1sv4ZwpV%7CIE2DSNZVHA2DELSTGIYA