GNG2101

**Project Deliverable C**

The Communication Crew B 1.4

Submitted by:

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## 1.1 Problem definition:

Information.

- Basic communication: Client needs to communicate effectively basic needs (hunger, no, yes, bathroom), this is the most important need which all prototypes must meet.
- Accessibility: The client can only use one of his hands, so buttons must be large enough to hit it with just one hand.
- Durability: The device must be easy to clean and can be used for daily use.
- Flexibility: The device must be able to attach to the wheelchair but must also be removable whenever it's not in use.
- Aesthetics: Clients may prefer coloured buttons and text on buttons to help with usability.
- Programmable: Reprogrammable to add more buttons and to do other features
- Language audio: Devices audio in both English and client's native language

Unknown:

- What arm can he use to operate the device?
- Which prototype would the client prefer
- Where would the client want the prototype be placed

**Problem statement:**

A non-verbal client struggles with communicating basic needs such as expressing hunger and needing the bathroom. Due to his limited communication methods, his caregivers, who help with daily needs, also face challenges in understanding the client’s immediate wants and needs. To resolve this issue, a communication aid device with large buttons that the client can easily use to communicate his daily needs to be designed and manufactured.

**Inspired Metrics:**

Button size:

Metric: Button Width/height

Units: Inches, approximately 3x3 inch buttons

Descriptions: The buttons need to be large enough to accommodate limited motor skills.

Portability:

Metric: Time taken to attach/detach the device

Units: Seconds or minutes

Descriptions: The device should be quick to install and remove, preferably within a minute.

Device weight:

Metric: Total weight of the device

Units: Pounds (lbs)

Description: The device should be lightweight to avoid burdening the wheelchair or client.

Durability:

Metric: Material strength and lifespan

Units: (material)

Descriptions: The device should last for several years with minimal wear and tear

Language and Audio Capability:

Metrics: Number of languages supported

Units: decibel(dB)

Description: Audio output should be clear and loud enough for easy comprehension, supporting both English and the client's native language.

**Target Specifications and Technical Benchmarking**

| Feature | Imp | Units | desired | GoTalk 4+ | Mega Bee | Tactile Symbol Communicator | Gooshy Step Talk Communicator |
|---|---|---|---|---|---|---|---|
| Button size | 2 | in | 3x3 | ≈ 3x3 | ≈ 1x0.5 | ≈ 3x3 | ≈ 7 x3 |
| Lifespan | 3 | years | 5+ | ≈ 4 | ≈ 5 | ≈ 5 | ≈ |
| Easy to clean | 1 | yes/no | Wipeable plastic | yes | yes | yes | 149.95 |
| Portability | 4 | lbs | >3 | 1.6 | 2 | 3.5 | 1 |
| Number of buttons | 5 | # | 4 or 5 | 6 | 12 | 6 | 1 |
| Device size | 5 | in | ≈ 150 square in | 12x11x1 | 16x11x1.6 | 14x10.5x2 | 10x4.5x2 |
| Adjustability | 4 | easy, medium, hard | flexible | N/A | hard | easy | hard |
| Ease of use | 5 | easy, medium, hard | Easy for person with cerebral palsey | medium | hard | easy | easy |
| Price | 4 | $ | ≈ 100 | 190 | 1800 | 419.95 | 149.95 |
| Durability | 4 | (material) | resistant plastic | plastic | plastic | plastic | plastic |

**Images of similar communication devices used for benchmarking**

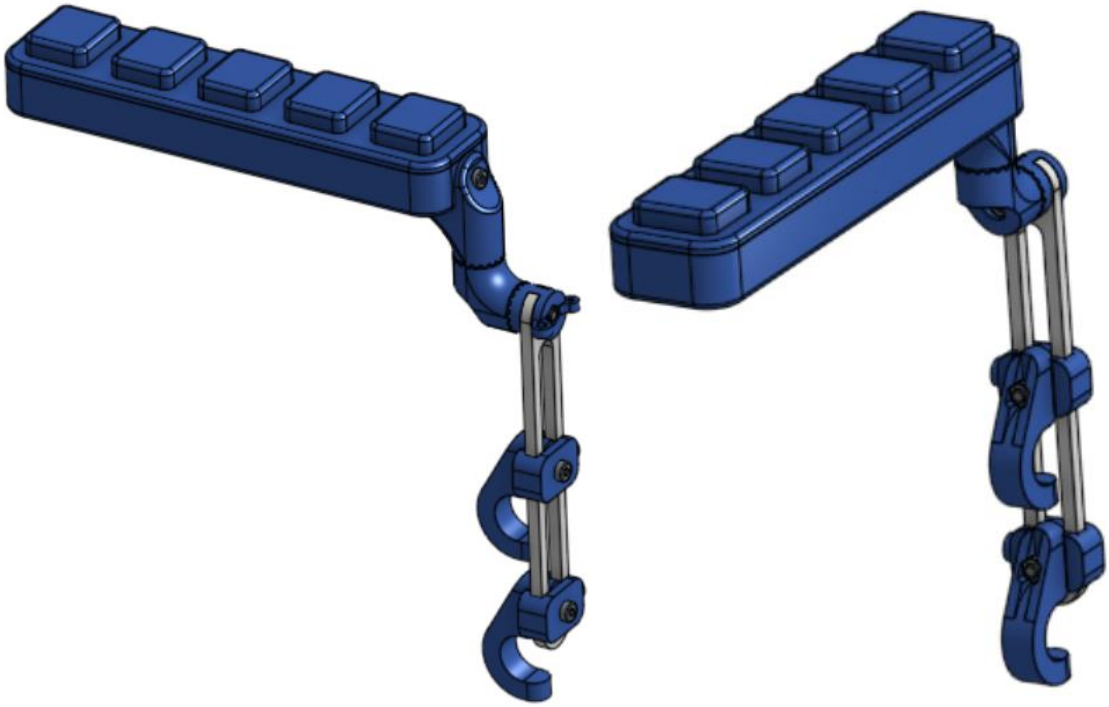

GoTalk 4+

Gooshy Step Talk Communicator

MegaBee

Tactile Symbol Communicator

## 2 Detailed Design and Prototypes



This design uses clamps to mount onto the side rails of the wheelchair, creating a stronger, more stable connection than the armrest, while also allowing for height adjustability as well as two degrees of freedom to best position the console according to our client's needs. The entire assembly can be positioned, mounted or disassembled with only two Allen keys which can be stored on the device, in an attempt to reduce complexity and make repairability as easy as possible once we hand over our final product. To further add to our goal of simplicity, each part is mounted to the next part using fairly common hardware, with no proprietary fasteners or clips.

This design uses a similar button layout to our concepts, but incorporates features for additional adjustment, possibility and strength. This concept is in accordance with our DFX statements in the following ways:

- Simplicity

  This design uses no complex mechanisms on the client-use side, ensuring anyone can use it without any training

- Installability

  This design uses two hooks that are tightened with bolts, so that installation can be performed quickly and easily

- Redesign

  The design is modular, with each part that has a purpose being separate from other parts, in order to easily swap out old parts with new, improved ones during the prototyping process

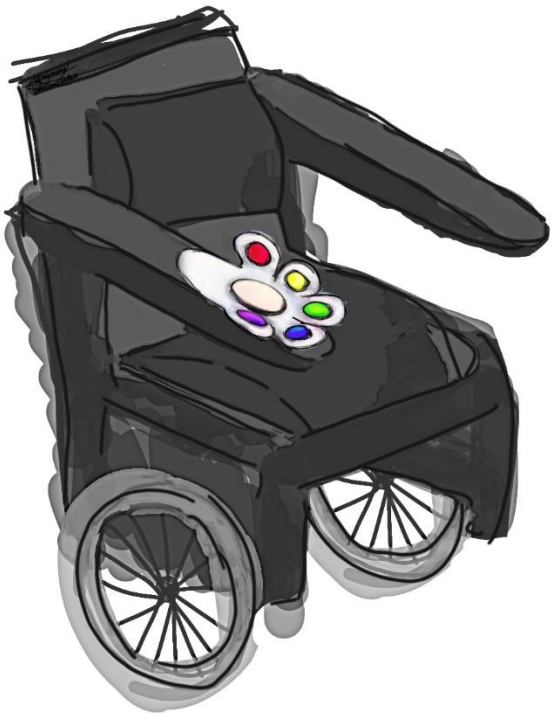
- Safety

  This design features very few sharp corners, with nearly all parts having filleted edges, to ensure our client does not injure himself on the device

- Speed

  This design uses large, easily-pressed buttons in order to let our client communicate quickly and effectively

**Sketch Prototypes:**



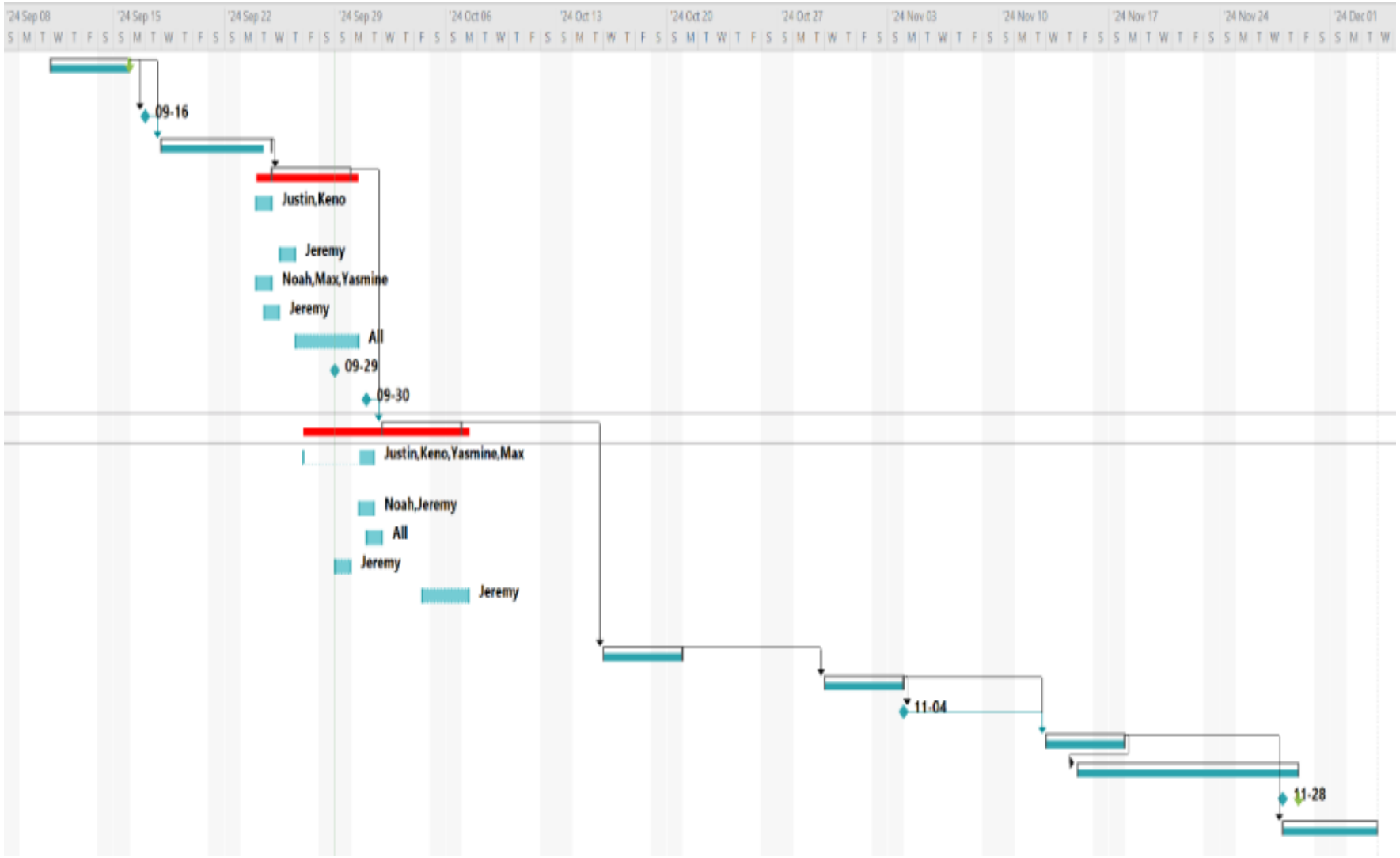
This prototype design features a wheelchair interface with a hand-shaped button board. The button layout is uniquely designed in the form of a hand, with each button positioned at varying heights and angles across the x, y, and z axes. This hand-shaped configuration is especially useful as it mimics the natural resting shape of a user's hand, allowing them to intuitively locate each button without needing precise motor control, which is often affected by Parkinson's disease. The ergonomic hand-like design ensures that each finger naturally aligns with a specific button, reducing the effort needed to activate the desired function and minimizing accidental presses. The coloured buttons offer clear visual cues, making it easier for the user to associate each button with specific communication needs. Additionally, the interface is securely fastened to the wheelchair arm using a flexible, scratch-resistant band, which allows for adaptable positioning—on the top, side, or front of the armrest—ensuring the most comfortable and accessible placement for the client. This thoughtful design enables the user to communicate with their caretaker more efficiently, providing an essential tool for overcoming their physical limitations.

This second prototype features a simplified and lightweight button board designed to assist a non-verbal, wheelchair-bound client with Parkinson's disease. The board consists of four dome-shaped buttons, each colour-coded for easy identification, which the client can interact with by guiding their finger along the surface. The design allows the client to both push and pull the buttons, offering flexibility based on personal comfort and physical capability. The buttons are hollow, reducing their weight and making the entire interface easier to manipulate. Additionally, the increased sensor sensitivity means the buttons require very little force to activate, addressing the motor limitations often associated with Parkinson's disease. This sensitivity ensures that even minimal effort can trigger a voice command, facilitating effortless communication with a caretaker. The user can engage with the device using gentle motions, preventing strain, while the ergonomic dome shape and colourful design aid in locating and operating the buttons, enhancing both accessibility and usability. This setup offers a smooth, intuitive interface, allowing for effective communication with minimal physical input.

The proposed design addresses the client’s caretaker's request for a removable button board to facilitate table use during meals. The solution includes a communication device with four large, coloured buttons (purple, yellow, red, and blue), housed in a rectangular board that is detachable and positioned on the right side of the wheelchair. The design allows for easy removal and reattachment of the board as needed, ensuring adaptability for different tasks. A vertical capsule will securely hold the button board when not in use, hugging the board to provide stability. To allow the board to move into a horizontal position, a sliding-and-locking hinge mechanism is proposed. This system would enable the board to slide upwards within the capsule via grooves or tracks, engaging a hinge that allows it to pivot outward. The board would then lock into place horizontally with a latch or clasp, preventing unintended movement during use. This mechanism ensures the button board remains stable and secure in both orientations while providing a smooth and convenient transition between vertical storage and horizontal operation. The design prioritizes user-friendliness, space efficiency, and the caretaker’s ease of adjusting the device as needed, ensuring the client’s communication device is both practical and functional for daily use.

## 3 Project plan update

| | | | | | | |
|---|---|---|---|---|---|---|
| | **PD A: Contract, client meeting preparation and project skeleton** | **4 days** | **Wed 9/11/24** | **Sun 9/15/24** | | |
| | Client meet 1 | 1 day | Mon 9/16/24 | Mon 9/16/24 | 1 | |
| | **PD B: Sustainability and DFX** | **5 days** | **Wed 9/18/24** | **Tue 9/24/24** | **7,1** | |
| | **PD C: Problem, concepts and plan** | **4 days** | **Wed 9/25/24** | **Sun 9/29/24** | **8** | |
| | PD C.1: Needs identification problem statement and metrics | 1 day | Wed 9/25/24 | Thu 9/26/24 | | Justin,Keno |
| | PD C.1: Benchmarking and specific | 1 day | Thu 9/26/24 | Thu 9/26/24 | | Jeremy |
| | PD C.2: Conceptual design | 1 day | Wed 9/25/24 | Thu 9/26/24 | | Noah,Max,Yasmine |
| | PD C.3: Project plan | 1 day | Wed 9/25/24 | Wed 9/25/24 | | Jeremy |
| | PD C quality check | 2 days | Fri 9/27/24 | Sun 9/29/24 | | All |
| | PD C submission | 0 days | Sun 9/29/24 | Sun 9/29/24 | | Jeremy |
| | Client meet 2 | 0 days | Mon 9/30/24 | Mon 9/30/24 | | All |
| | **PD D: Detailed design** | **4 days** | **Wed 10/2/24** | **Sun 10/6/24** | **16,23** | |
| | Detailed design | | | | | Max,Justin,Keno,Yasmine |
| | BOM | | | | | Noah,Jeremy |
| | PD D quality check | | | | | All |
| | PD D projet plan update | | | | | Jeremy |
| | PD D Submission | | | | | Jeremy |
| | In class design review | | | | | |
| | **PD E: Project progress presentation** | **4 days** | **Wed 10/16/24** | **Sun 10/20/24** | **24** | |
| | **PD F: Design constraints** | **4 days** | **Wed 10/30/24** | **Sun 11/3/24** | **31** | |
| | Client meet 3 | 0 days | Mon 11/4/24 | Mon 11/4/24 | 38 | |
| | **PD G: Economic and IP consideration** | **4 days** | **Wed 11/13/24** | **Sun 11/17/24** | **38,44** | |
| | **PD H: Design day** | **10 days** | **Fri 11/15/24** | **Thu 11/28/24** | **45** | |
| | Design day | 0 days | Thu 11/28/24 | Thu 11/28/24 | | |
| | **PD I: User manual** | **4 days** | **Thu 11/28/24** | **Tue 12/3/24** | **45** | |
| | **PD J: Final presentation** | | | | | |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09-16
Justin,Keno
Jeremy
Noah,Max,Yasmine
Jeremy
All
09-29
09-30
Justin,Keno,Yasmine,Max
Noah,Jeremy
All
Jeremy
Jeremy
11-04
11-28

## 4 Conclusions

Upon completion of this document, the team will have finalized key project components, such as a comprehensive Bill of Materials (BOM) for the initial prototype. This BOM will outline cost-effective components that align with the project's budget while emphasizing quality and durability. The team has also addressed Design for X (DFX) considerations, focusing on accessibility, utility, and the specific needs of a nonverbal, impaired client. These considerations ensure that the product will be user-friendly, safe, and long-lasting. Additionally, the team has prioritized sustainability in the product's development, exploring the use of biodegradable materials such as 3D-printed filament derived from environmentally friendly sources. This enhances durability and cost efficiency while reducing the environmental impact. The decision on whether to purchase components like buttons or develop them from scratch is still pending, pending a better understanding of the client's requirements. Overall, the team has laid a strong foundation for advancing the project, effectively balancing technical, environmental, and budgetary considerations.

## 5 Bibliography


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[2] “GoTalk 4+.” *Attainment Company Home*, www.attainmentcompany.com/gotalk-4. Accessed 29 Sept. 2024. https://www.attainmentcompany.com/gotalk-4

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[6] “Top 10 AAC (Augmentative & Alternative Communication) Devices.” *Speech Pathology Degrees | Find an Online SLP Program | Ready to Start Your SLP Career? Earn Your Degree in Speech-Language Pathology by Finding an Online SLP Master’s Program. Discover New Career Paths, Licensing Requirements & Certifications.*, 23 May 2024, https://www.speechpathologygraduateprograms.org/2017/11/top-10-aac-augmentative-and-alternative-communication-devices/

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