

EN1190
ENGINEERING DESIGN PROJECT

iCli Q

**All in one smart clicker to make
the life of a public speaker easier**

PROGRESS REPORT

14/05/2023

Company of Noobs

210234H - W.A.O. Janandith
210035A - Y.W.S.P. Amarasinghe
210041M - A.S.S. Amugoda
210097M - A.N.T. De Silva

Problem Identification

Both professional speakers and amateur speakers have a struggle in managing their time while delivering a speech no matter they are delivering a short-prepared speech or a long impromptu speech or something in between. If it is a short-prepared speech, speakers usually struggle with being on time with their script as it is not always possible and convenient to get the assistance of time cards or a clock. Also, when delivering a long speech, usually a keynote or a lecture, it is important to make sure about the timings because otherwise the delivery may sound boring.

Apart from this, aspiring public speakers (specially people with a technical background) find it really hard to keep up with the right mind before going up on the stage to speak. They become really stressed and uncomfortable before and during a speech. This is one of the main reasons for introvert people with good technical skills not wanting to pursue entrepreneurship, as they are very concerned about their confidence in communication skills. Also, while delivering a presentation, many have found it difficult to use the clicker as its design is not very intuitive, and it may cause wrong slide transitions or other glitches worsening the presentation.

Problem Validation

Even for an experienced public speaker, presentations can really be a challenge. So, the root idea on which we started developing our project, was how to make the life of a presenter easier. More precisely, how an improved and smarter clicker can really make a difference in this daunting work of presentations.

Without stopping after brainstorming and critically thinking among the group members, we started surveying a group consisting our target audience not just random participants. First verbal feedback session university and professional level was done to get feedbacks from “Gaveliers” and “Toastmasters”. We asked them about the problems they faced while

preparing and delivering a speech/presentation. 15 of them including well rounded speakers confirmed that time management is the most common problem they face. 8 of them who are still beginners to public speaking said that memorizing the key points of the speech was hard for them. All of them agreed to the fact that nervousness and stress are major factors affecting the delivery of their speeches despite their skill level. Additionally, they provided some valuable feedback to improve our ideas.

A good presentation is a valuable method of conveying one's ideas for professionals of a variety of fields. Therefore, as our formal survey we chose a group of professionals from academics to corporate executives. This survey consists of people who frequent in public speaking and presenting and are the crowd directly targeted by our product.

The main inconvenience we hope to address is regarding time management. Whether it is a short-prepared speech or a long impromptu speech or pitching presentation speakers usually struggle with being on time with their script. We believe using conventional methods such as timecards, clocks, and flash cards are outdated and inconvenient. And 'iCliQ' is an all-in-one answer.

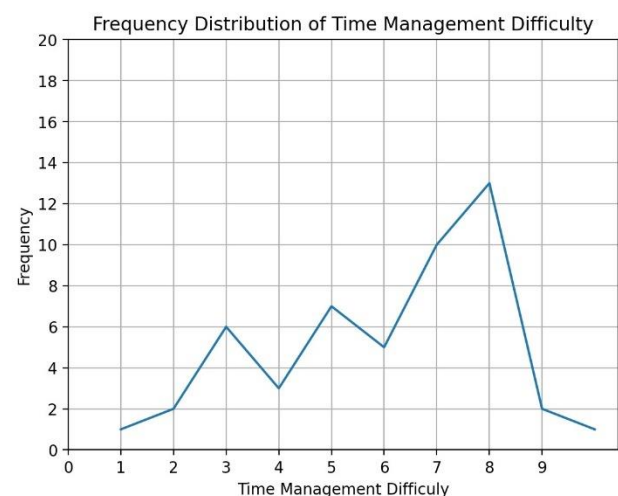


Figure 1: Frequency Distribution of Time Management Difficulty vs Frequency

Our solution is to rethink the design of a clicker as a wearable by allowing public speakers to keep up with their timings through vibration patterns. Additionally optional features such as vibrotactile haptic stress reduction and ability to save visual notes are included as well. As per the request of a toastmaster who loves to have the conventional timecard concept reimaged, 'iCliQ' is incorporated with lights as an additional way of conveying time.

Technical Specifications of iCliQ

Performance specifications:

- Response time of slide transition: < 0.5 seconds
- Accuracy of vibration patterns to convey time: +/- 1 second
- Allowable safe vibration frequency: 130-180 Hz
- OLED display resolution: 128x64 pixels
- Distance of operation: 20 meters max

Power Consumption:

- Battery type: Lithium-ion rechargeable battery
- Battery life: At least 6 hours of continuous use
- Charging time: Less than 30 mins

Product Dimensions and Weight:

- Dimensions (LxWxH): 11 x 2.5 x 1 cm
- Weight without packaging: 70 g
- Weight with packaging: 200 g

Lifetime of the Product:

- Warranty terms: One-year warranty for manufacturing defects and faulty components

- Replaceability of battery to enhance product duration
- Durability of enclosure to withstand vibrations
- Expected lifetime of the product: At least 2 years with proper use and maintenance

Main Product Features:

- Vibration patterns to convey time and keep track of speech/presentation timing
- Visual indicator for timing
- Grip less wearable design: 2 DOF ring
- Ergonomic enclosure design to reduce hand strains
- Intuitive user interface to enhance productivity
- OLED display for configurations

Secondary Product Features:

- Vibrotactile haptic sensing to stimulate and reduce the stress levels
- OLED display to keep important notes or flash cards (Optional)

Technical Feasibility

1) Hardware Requirements

- i) PCB Designing
 - (a) Should use Surface Mount Devices (SMD) to design the PCB
 - (b) A microcontroller with integrated BLE
 - (c) Two disk vibrators for vibration feedbacks
 - (d) An OLED display for interfacing and configuration purposes
 - (e) PCB should be vibration resistant

- (f) Battery management module for charging and protecting Li-Po battery
 - (g) Designing a copper cladded pad for touch slider (Optional)
 - (h) Basic gesture control with accelerometer (Optional)
- ii) Enclosure Design
- (a) Enclosure should be resistant to vibration
 - (b) Enclosure should comply to general wearable device designs standards
 - (c) Materials should be durable under common indoor environment conditions
 - (d) A sealed compartment to isolate Li-Po battery
 - (e) A ring that gives 2 Degree of Freedom to adjust the position of iCliQ : sliding & rotation
 - (f) Intuitive button design and placements
- iii) Wireless transmission
- a) In built Bluetooth low energy to connect with computer while in operation mode
 - b) BLE to connect with mobile phone while in configuration mode
 - c) Increasing the maximum safe distance between the user and computer
- (b) A configuration view to set the timings using the two main buttons and touch slider
 - (c) Note Card view : To display additional notes if users wants to
- ii) Timing Algorithm
- (a) Predefined time blocks to select
 - (b) Customizable time slots that can be accessed via mobile app
- iii) Vibration Pattern Algorithm
- (a) Identifying differentiable vibrational patterns to convey messages
 - (b) Researching on vibrotactile haptics to simulate the stress relieving mechanism
- iv) Mobile App
- (a) Connectivity with iCliQ
 - (b) Configuring time blocks
 - (c) Adjusting settings
 - (d) Configuring customizable button/ touch slider for user preferences: Video Play/pause button, Volume control

Product Architecture

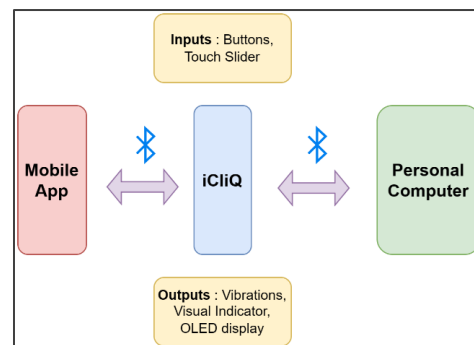


Figure 2: High Level Architecture of iCliQ

The main link in the high-level architecture of iCliQ consist of the device itself and the personal computer that is being used in the presentation. The wireless connection is done through Bluetooth low

2) Software Requirements

- i) Screen Menu
 - (a) Should have an operational view to display remaining battery power, Connectivity.

energy to minimize the power consumption while decreasing the latency.

The user interface of iCliQ mainly consist of three buttons: the bigger one for forward function, another one for backward function and a customizable button. A touch slider is used to provide scrolling function for navigation. Output interface of the iCliQ design mainly consist of vibration motors to convey vibrotactile feedbacks, A visual indicator and aOLED display for user interfacing.

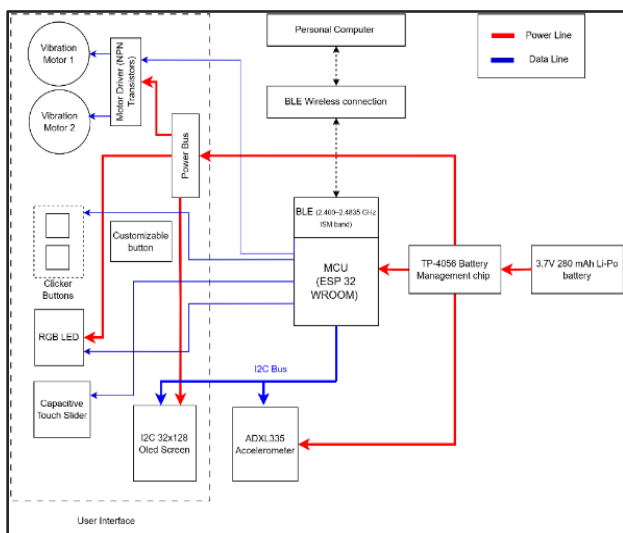


Figure 4: Low Level Architecture depicting Critical Blocks and their Connections.

ESP32 WROOM SoC was selected as the main microcontroller to control the device as it comes with integrated BLE and an in-built PCB antenna. Since it is an SMD components, it is very tiny in footprint but is packed with a number of features including the enhances support for touch pins.

Enclosure Design

Enclosure designs is a critical part in our product design journey as it is a key element in differentiating our product from existing clicker designs in terms of user experience. We studied anthropologic data of human hand to come up with the most ergonomic design. Finally, we came up with two unique designs

with their own pros and cons. Our target is to find the best design by evaluating their performance practically. All the dimensions were measured in respect to the 50th percentile of total population in Sri Lanka. Our aim is to develop two more sizes to cater the 25th and 75th percentiles of the populations to make iCliQ accessible to everyone.

Design 1:



Figure 3: Enclosure Design 1, on hand (Left), Annotated (right)

Design 1 is a unique design which was specifically designed with ergonomics in mind. This palm wearable can be worn by two fingers using two loops. Buttons will be placed as they are easily accessible by the thumb. Best features of this is it blends well into the hand of the user without constraining most movements.

Design 2:

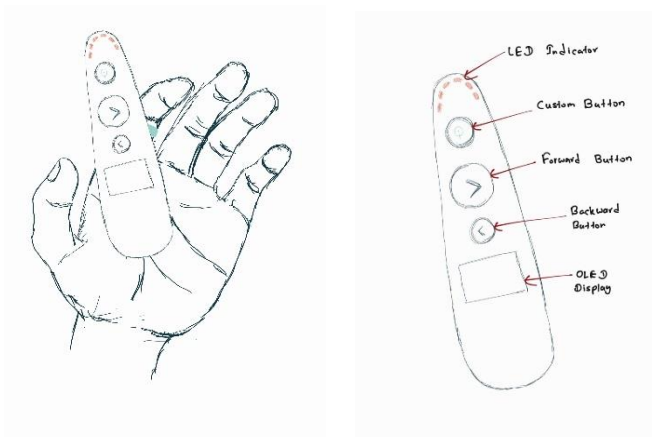


Figure 5: Enclosure design 2, On hand (left), Annotated (right)

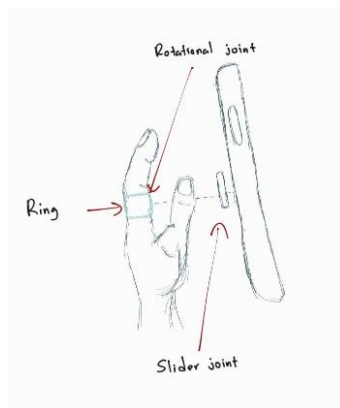


Figure 6: Side view of Design 2, A ring with a rotatable joint and a slider is what holding the iCliQ

Design 2 came into birth with the assumption that some users might be reluctant to have a big shift from the conventional clicker design they have been using for ages. So it is a huge design risk to stick only with design 2 as it is totally novel and needs validation. Enclosure design 2 is inspired by the typical remote type body but unlike a normal one it can be worn on finger using a ring. iCliQ is attached to the ring through a rotatable joint and it is also possible to slide the body a bit along the finger. So the iCliQ can be adjusted easily to have the most comfortable position on the hand depending on the user. Here the buttons are placed intuitively so that users will not mis click or confuse.

Our plan is to test both designs by actually giving it to a sample of users and getting their feedbacks. By doing that we are not leaving any room for assumptions.

Material selection

The materials selected for the production of iCliQ are PLA and TPU. PLA will be used to manufacture the main enclosure while TPU will be used to manufacture the button tops. TPU is a flexible and long-lasting material, while PLA is a biodegradable and simple-to-use plastic. Both substances are workable and suitable for 3D printing. To prototype one product, 20 grams of PLA and 5 grams of TPU material are needed.

3D printing

The actual manufacturing process would begin with 3D printing of the product using PLA and TPU materials. This would involve loading the 3D model into the 3D printer and setting the printing parameters such as temperature, printing speed, and layer height. The printer would then use the PLA material to create the body of the iCliQ and the TPU material to create the buttons.

Post processing

The enclosure would go through post-processing to get rid of any support structures, smooth out any jagged edges, and clean up any messes. This might entail polishing, sanding, or any other technique appropriate for the selected materials.

Marketing, Sales and Rest of the Product Life

Target Audience

iCliQ is designed to be used by mainly public speakers which include lecturers, Professional keynote speakers, Toastmasters, Entrepreneurs and Professionals in cooperate sector. They generally have an above average purchasing power so it is possible to place our product as an all-in-one premium product for professionals. Initial stage iCliQ will mainly feature as a tool for public speakers but future developments will result in adding usability as an air mouse. So, our product has the ability to expand its target audience and present it self as a consumer electronic product for the masses.

Competitive analysis

Logitech, Baseus and Micropack companies are the leading companies that produce presentation clickers to the local market. Their clickers price is ranging between 20-100 USD. These clickers are mostly featuring basic presentation commands such as move forward, back and play/ pause. All of them are required to be hold tightly while using as they are not designed as wearables. A typical characteristic of these clicker designs are buttons of these clickers are same in size and texture so it is always required to look before pressing buttons. Also, it leaves lot of room for mis clicking scenarios. None of these devices come with the additional features iCliQ is providing even though they are selling at a premium price. Logitech's R800 remote selling at a 80 USD price tag is only design with a screen embedded on it. It uses the screen the convey time which is highly impractical considering it is hard to read that small device. But vibrations are more powerful in communicating the timings with lesser distractions.

Value proposition

iCliQ aims to address the common struggles of public speakers, such as time management, stress, and confidence, and provide a reliable and convenient tool for improving the delivery of speeches and presentations. The value proposition of iCliQ is to help users become more effective and confident public speakers, leading to better communication and career opportunities.

Quality control

The final product would go through quality control before being delivered to make sure it complies with the standards. This could entail evaluating the vibration patterns, examining the button functionality, and the finish of the enclosure.

Testing & Updating

As a product that is developed around the user to cater his needs, we will be putting our best effort to continuously test and improve our hardware and software to enhance the user experience. Also testing would incorporate individuals from different demographics to increase inclusiveness and accessibility of our products.

Packaging and delivery

Once the product has passed quality control, it would be packaged and delivered to the customer. The packaging would be made out of recycled and hardened paper boxes. A padding with a hollow cut in to the shape of the enclosure is required to keep the product inside the packaging safely. A warranty card, an instruction manual with a necessary instruction to activate the free course will be included in the package as well.

Marketing Strategy

1.Free Course for every purchase of iCliQ

Everyone who will purchase this product will get a free subscription for a tutorial course to improve their public speaking skills from beginner to advance. This will be an incentive for amateur public speakers to buy our product.

2. Crowd Funding Campaigns

Empirically, it is a good move to seek capital through crowdfunding to scale the product. We can start a crowd funding campaign on “Kick Starter” to get the traction from the international community and these types of products tend to have a good exposure in these platforms.

3.Attend Professional’s Conferences (Toastmasters/Lecturers)

Increasing the presence at events organized by toastmasters or any other body of professionals is one of the best ways to promote iCliQ. This is a fantastic chance to show the product in action, highlight its features, and explain how it can help the customer.

4.Influencer marketing

Find and interact with influential members of the public speaking communities so they can review and advertise the iCliQ on their blogs or social media pages. This could help to raise interest in our product and raise brand awareness.

5.Paid Advertising

Use paid advertising channels to specifically target the target audience, such as Google Ads or social media advertising.

6.Trade Shows and Conferences

Meeting potential customers in person, showcasing the product, and generating sales leads can all be accomplished by attending trade shows and

conferences that are centered on public speaking, presentation skills, or education. Additionally, this can support the industry positioning of the iCliQ brand.

7.Customer Reviews and Testimonials

Encourage satisfied customers to leave reviews and testimonials on our website or social media channels. This is very helpful in building our credibility as a user friendly device.

Sales Strategy

1.Direct Sales

We will launch a website for iCliQ with a payment gate to buy our product through online means. This will be our main method of sales. This method will allow us to let user customize our product for his/her specific needs for an added price in the future. Also, we will be directly pitching our product to individuals at public speaking conferences, toastmaster clubs, gavel clubs and universities by giving them an opportunity to test the product themselves and understand the difference. Then if they are satisfied with our product that buy it from us directly.

2.Partnership Programs

Establishing partnerships with public speaking organizations like Toastmasters and TED will give us the much-needed credibility and reputation. These partnerships may be in form of marketing or providing our product to the members of those organizations at a discounted price where the discount is compensated by the particular organization.

3. Distributors

We’ll select few distributor networks to distribute our product to only top selling bookshops and computer accessories shops so that users can purchase iCliQ from these places. But these places would be mostly high end and will be very limited.

Recycling

Mechanical recycling, which involves breaking down the plastic into tiny pieces and melting them to create new products, can be used to recycle PLA. In some recycling facilities, PLA is also accepted for chemical recycling, which involves disassembling the plastic into its chemical constituents and using those components to create new materials.

TPU can also be recycled mechanically, but because of its flexibility, the process is different. The TPU material can be cleaned, ground into tiny pieces, and then extruded into brand-new items.

Disposal

Since PLA is a biodegradable material, our product can be easily disposed without ending up in landfills or in nature. Our instruction manual will carry detailed methods of disposing the batteries and other electronic circuits without exposing them to the environment.

Project Budget

Project Cost Estimation (in USD)

Component	Amount	Price (\$)	Total Price (\$)
Vibration motor	2	0.47	0.94
NPN transistor(D	2	0.032	0.064
Push buttons	3	0.095	0.28
RGB led	1	0.063	0.063
3D printing (25g)		4	4
I2C OLED screer	1	2.84	2.84
ADXL335 accele	1	3.95	3.95
TP4056 Battery t	1	0.51	0.51
ESP32 module(V	1	6.31	6.31
3.7V 380mAh Lip	1	2.65	2.65
Total Price			21.607

Figure 7: Bill of Materials for prototyping

Manufacturing Plans

100 units will be manufactured in the first batch of production. These will be mostly catered towards the crowd funding campaigns or the first set of partnerships we established with public speaking organizations. PCBs will be imported from a foreign manufacturing service provider to reduce costs and we are planning to move toward to injection molding to manufacture the enclosures as it is affordable in the large scale.

Product Pricing

Cost estimation is done considering a batch of 100 units. Component costs are estimated to be reduced by 40% when bought for 100 modules. Inventory costs will be not considered for initial batch because it is not viable to opt for it.

Expenditure	Cost (USD)
Components	$21.607 \times 0.6 \times 100 = 1296$
PCB Manufacturing & Assembly	90.81
Shipping	116.34
Inventory costs	0
Enclosure manufacturing	70
Packaging	60
Total cost	1633.15

So, unit manufacturing cost would be around 17 USD.

Typically, profit margins for consumer electronics can range from 5% to 20%, with some high-end products having even higher margins. However, it is important to note that profit margins can vary widely depending on the product category, brand, and market demand.

In the case of iCliQ, since it is a new product in the market with unique features, the profit margin can be higher initially to cover the research and development costs and generate revenue for future growth. As the product gains market acceptance and competition increases, the profit margin may need to be adjusted accordingly to remain competitive.

By taking 15% as a middle range profit margin our product can be sold at around 20 USD which is the low-end price range of normal clickers in the market. Considering economics of scales, manufacture costs even be lowered more when going in to higher number of productions,

Task Allocation

Odil Janandith	Systems Engineering, Schematic Design, Prototyping, Vibrotactile haptic sensing development, PCB Assembling
Sasika Amarasinghe	Sketching initial designs, User Interface Coding, PCB Assembling
Navindu De Silva	PCB Designing using Altium, Market Research
Sayuru Shenal	3D designing using Solid works, Design validation, User testing

We'll be using a professional project management tool called "Clickup" to plan and execute our work on time.

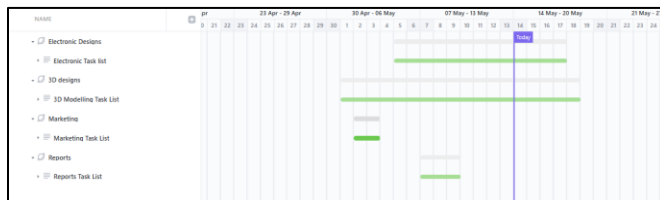


Figure 8: Gantt chart to manage work up to the submission of progress report