



# HUSA

## Have You Signed Attendance?

### Written Business Plan

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## Table of Contents

Table of Contents .....	1
Summary .....	2
Product Purpose.....	2
Product Functionality .....	3
Competitor Analysis.....	9
Intellectual Property (IP)....	11
5-Year Development Plan .....	13
Gantt Chart.....	15
Risk Mitigation.....	16
Reflection on Business Plan Outline.....	18
Reflection on Productive Teams .....	18
References .....	22
Appendix .....	25
Business Plan Outline .....	26
Belbin Test Result.....	27

## **Summary**

‘HUSA: Have U Signed Attendance?’ is a comprehensive solution that integrates extensive features to streamline efficient and effective attendance monitoring. Using technologies such as Artificial Intelligence (AI), edge computing and cloud computing, HUSA aims automate the process of real-time attendance-taking, absence requests and enforcing security measurements [1]. It may be surprising to know that many education institutions are still using traditional methods such as QR codes and mobile applications, as well as hand-written absent request forms [2]. This causes the inevitable: grappling with manual processes that are both time consuming and prone to problems such as time theft, or a dead flat mobile phone. Research indicates an increasing demand for sustainable and meticulous attendance management in educational institutions, with shown increment in Compound Annual Growth Rate (CAGR) of the attendance monitoring market using IoT and facial recognition technologies. To address these challenges, two types of products were developed to cater to different needs of clients, HUSA Premium and HUSA Basic.

HUSA Premium enables real-time facial recognition technology to identify students and take attendance, which subsequently unlocks the lock of the venue’s door which allows the students to enter. The system utilizes cloud computing to store and process large amounts of data, which will be deployed into an all-in-one website that can be accessed by the students to submit absent requests, check their past attendances and future classes. HUSA is an embedded device with a liquid-crystal display and camera that can be easily installed on any types of classroom doors. The device should be connected to a door lock of the client’s choice, customised according to their needs and door specifications. HUSA Basic retains most of the functionality to its premium counterpart, but targeted to clients that are not as security centric. The basic product is a cloud-based service that allows educational institutions to deploy on any device of their choice that meets the operating requirements. Nonetheless, both solutions offer convenience to the institution and provides the students with a coherent system for attendance monitoring.

## **Product Purpose**

HUSA addresses multiple crucial problems in attendance management of traditional methods used in educational institutions currently. Some of these methods used for comparisons are spreadsheets, QR codes, and mobile applications. HUSA’s range of solutions provides clear advantages and solves root problems of traditional methods.

HUSA mainly aims to combat the inefficiency of traditional attendance monitoring measures [3][4]. Traditional methods require manual labour to enable attendance-taking of the students. For example, QR-code based attendance would require manual generation according to the time and location and takes up time during lectures for the students to take their attendance [5]. In the case of using mobile applications, lecturers are required to ‘turn-on’ attendance manually. In some institutions, attendances are taken by passing around a piece of paper for students to tick-off. These methods are prone to errors due to the need for human operations, it is time consuming and encourages ‘buddy-punching’ behaviours in students due to lack of enforcement of better attendance monitoring methods [6]. HUSA focuses on automating attendance-taking by using facial recognition technology to detect the student’s faces against a given database. The recognition is performed using a front facing camera and using an LCD to display information. HUSA is universally compatible to be installed easily on any types of doors, which requires students to take attendance in real-time at the correct time and location. This eliminates human errors, time-consumption and takes off additional burden from lecturers as well as students. HUSA goes above and beyond to produce a solution that encourages students to be present in class, to boost productivity and reduces manual intervention on repetitive tasks.

Next, HUSA solves the inconvenience of inconsistent attendance monitoring. Institutions typically focuses on attendance-taking and neglects the other side of attendance monitoring, such as absentees

and the availability of transparent attendance policies [7]. A coherent solution must be developed with the student's needs and ease in mind, to avoid unnecessary and painstakingly complicated processes. Utilising cloud computing, HUSA's website is a student-centric all-in-one solution for all-information attendance. The three main features are attendance checking, absent requests and attendance policies. With one simple click, absentees can submit their proof of absence that allows the system to automate the process of obtaining absent approval. OCR (optical character recognition) is used to detect the uploaded proof and compile the information into a standardized format report. Student can check their past attendance and upcoming classes with attendance to be taken, alongside gain easy access to their institute's attendance rules and policies.

HUSA views accuracy in attendance monitoring and security as a crucial consideration in educational settings of all levels, giving rise to HUSA Premium. Through the integration of electronic locks, the system ensures only verified individuals gain access to classroom according to a pre-determined timetable in a global database. Sensing is performed via the built-in camera to detect single entry per face recognised when the door is unlocked to ensure single entries. Security vulnerabilities are addressed as the HUSA device includes an alarm system and intricate software design that enables theft detection and provides security on the institutes assets. Automating secure lock allows simpler control over space utilization during off-hours by the students and provides great monitoring during class hours. Should the client wish to accurately monitor students' presences, HUSA Premium can be implemented on both entrance and exit of a location. By enforcing 'scan-per-entry', students' durations in classrooms can be logged to generate a comprehensive report on their attendance.

Other than the three main issues solved by HUSA's extensive functionalities, there are other existing root problems that HUSA can be a great consideration for clients seeking for an attendance monitoring solution. Automation is the perfect solution to eliminate manual monitoring, and other minor problems such as poor administration. Staffs that are in charge might not be equally trained on attendance policy, leading to inconsistencies in enforcements of rules and policies. This is one of the underlying micro problems that HUSA seamlessly solves [7]. HUSA provides customization towards specific problems that the clients may face and providing reasonable solutions towards them. Additional features such as ability to perform low-light facial recognition, adjustable security settings and battery-powered emergency access are the few of many features that were implemented to cater to all clients with different needs. HUSA has many purposes, but with only one goal in mind: customer satisfaction, which puts HUSA ahead of many other competitors.

## Product Functionality

In accordance with the depicted product design in Figure 1, the night vision camera serves the purpose of scanning and executing facial recognition. The 9-inch LCD screen is utilised for the presentation of outputs and messages. The edge computer is responsible for image and data processing, in addition to overseeing the control of peripherals within the HUSA. Batteries are utilized as a contingency measure during power outages. A buzzer functions as an alarm system triggered upon detection of an intruder. The voltage regulator is being used to regulate voltage to facilitate the powering of the edge computer. The relay is being controlled via an edge computer to unlock the door upon successful face verification. The emergency button is used to unlock the door manually in the case of fail-safe.

As mentioned briefly in the product purpose, HUSA aims to tackle the ongoing issues of attendance monitoring systems, implementing cutting-edge technologies such as AI, automation, and edge and cloud computing. Seamlessly integrating advanced face recognition technology, HUSA goes beyond the conventional and introduces a spectrum of functionalities tailored to enhance automation and security in academic settings, particularly within the engineering discipline. Our design places a strong emphasis on rapid deployment, ensuring that our device is truly plug-and-play. With minimal setup requirements, users can seamlessly integrate and start using our solution without any hassle. Connectivity and environmental sustainability issues are also considered in our design.

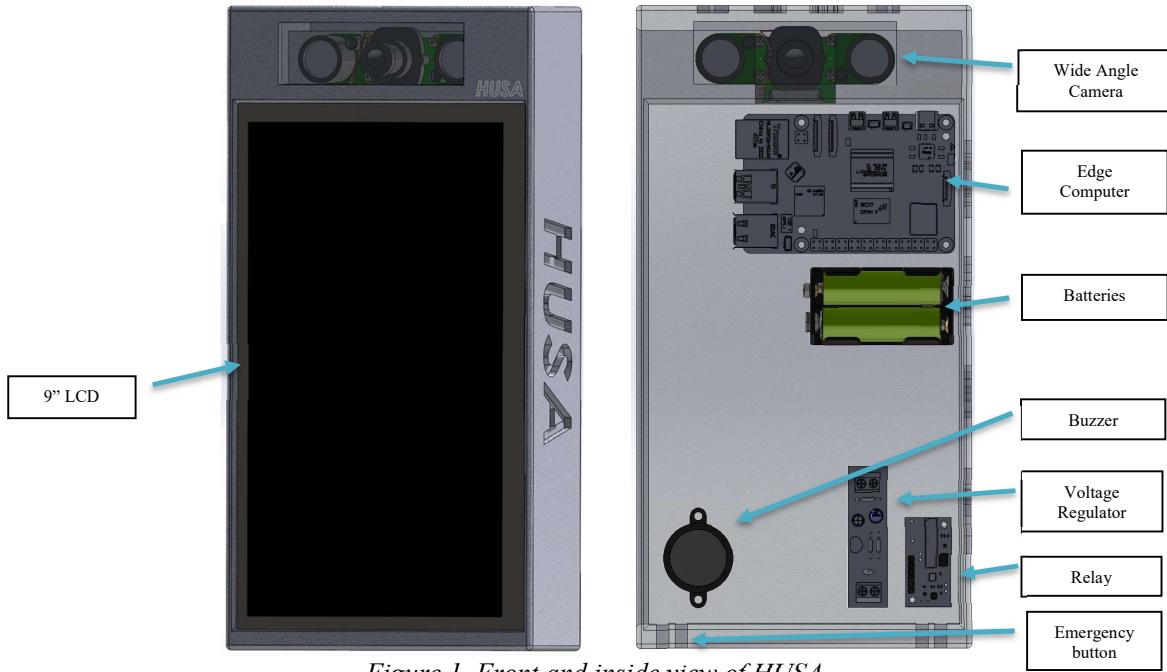


Figure 1. Front and inside view of HUSA.

#### Automation:

*Automatic Entry:* HUSA enhances the entry process to lecture halls by automatically granting access to students with verified faces. This functionality not only reduces entry bottlenecks but also establishes a seamless flow, particularly in large classes where efficient movement is essential. The automatic unlocking of doors exclusively upon successful face verification adds an extra layer of security. This feature prevents unauthorized access, safeguarding both students and resources. OPC Unified Architecture is being adhered to ensure secure data exchange between different systems. [8]

*Class Information Display:* In cases of inadvertent wrong entries, HUSA dynamically displays relevant class and schedule information on-screen. This real-time guidance is invaluable in institutions with complex schedules and varied classrooms, ensuring students promptly find their correct destinations.

*Duration Calculation:* HUSA automates the calculation of student's time in class by scanning faces in and out. This not only eliminates the need for geofencing but also provides accurate data on student presence. In the engineering discipline, where lab sessions and collaborative work are common, this feature aids in understanding and optimizing resource utilization.

*Attendance Report Generation:* The system automates the generation of comprehensive attendance reports. This not only saves valuable time for educators but also ensures accuracy in record-keeping.

*Automated Absence Monitoring:* HUSA employs OCR technology to automate the monitoring of medical certificates and absent letters, complete with fraud detection capabilities. In academic programs where lab sessions are critical and absences must be carefully managed, this feature ensures an optimized and reliable process. ISO/IEC 27701 is being complied with when handling sensitive information such as medical certificates. [9] Since sensitive patient information is being handled, the Personal Data Protection Act needs to be adhered to as there is no HIPAA Certification in Malaysia. [10]

*Lecturer Independence:* Lecturers benefit from the QR or app-free attendance system. They no longer need to manually take attendance or switch on the system, freeing up time for more instructional activities which optimizes the educators' time and increases efficiency in administrative tasks.

*Low-Light Face Recognition:* HUSA is equipped with advanced face recognition technology that operates effectively in low-light scenarios. This capability is especially vital in use cases at night or in environments that have low lighting conditions. This feature emphasizes adaptability and performance in diverse operational environments, providing a comprehensive solution for attendance management in all lighting conditions.

**Security:**

*Face Recognition and Student Data Encryption:* HUSA employs face recognition technology coupled with robust encryption for student data. This safeguards the privacy and security of sensitive information, adhering to engineering principles that prioritize data integrity and confidentiality. Several encryption methods are used such as the Secure Hash Algorithm (SHA) that generates a unique hash for facial features during face recognition. The hash should be irreversible, ensuring that the original facial features cannot be reconstructed from the hash. [11]

*User Entry Detection:* Utilising the available camera with an infrared sensor, HUSA detects the number of entries for every verified faces. If only one face is verified but multiple entries are detected, an alarm system will go off to notify the surroundings about the presence of the intruder. HUSA provides a comprehensive log of user entries, contributing to heightened security measures by allowing thorough access tracking and analysis, which is vital for maintaining a secure learning environment.

*Spaces Utilization During Off-Hours:* HUSA allows for the utilization of spaces during off-hours while maintaining security. This flexibility is particularly valuable in institutions where round-the-clock access to certain facilities may be necessary.

*Battery-Powered Emergency Access:* In emergency scenarios, such as power outages, HUSA operates on battery power, ensuring doors can still be opened. This feature aligns with safety protocols in engineering disciplines, where uninterrupted access to certain spaces is critical.

**Plug and Play:**

*Ease of Implementation:* The plug-and-play design streamlines the implementation process, reducing the time and effort required for installation. Engineering institutions can swiftly adopt HUSA without the need for lengthy downtime or extensive reconfiguration.

**Customizability and Flexibility:**

*Non-Invasive Installation:* One of HUSA's key advantages lies in its non-invasive installation. By requiring only the replacement of the lock/system and not the entire door structure, the system seamlessly integrates into the current infrastructure of educational institutions, making it a versatile and adaptable solution. Solenoid or electromagnet locks can be used to replace conventional locks at low cost. This universal compatibility is a game-changer, allowing the system to be implemented without the need for extensive modifications to the existing door structure.

*Adjustable Security Settings:* Recognizing the diverse security needs of educational institutions, HUSA offers adjustable security settings. This allows administrators to tailor the system's security protocols to specific requirements, ensuring a balance between access control and user convenience.

*User Interface Customization:* HUSA provides a user-friendly interface that can be customized to align with the branding or specific needs of the educational institution. This ensures a seamless user experience for both students and educators. When designing the UI, ISO 9241-210 is referred to as it sets the guidelines for human-centred design, emphasizing the importance of tailoring systems to meet the needs of users. [12] Customizing the UI should also consider accessibility standards to ensure that the interface is inclusive and usable for individuals with disabilities. Adherence to Web Content Accessibility Guidelines (WCAG) supports accessibility best practices. [13]

**Connectivity:**

*Local Data Storage:* HUSA incorporates local data storage capabilities, allowing it to function independently of external servers. This is a practical feature in engineering disciplines, where certain environments may have limited access to central servers. The ability to store and retrieve data locally enhances the system's resilience and adaptability. ISO/IEC 27001:2022 which sets the standards of cybersecurity and privacy protection is being adhered. [14] AES Encryption is being applied to sensitive student data, including personal information and attendance records. [15]

*Integration with Existing Networks:* HUSA is designed to integrate seamlessly with existing networks when internet connectivity is available, facilitating data transfer and updates. Adherence to IEEE 802.11 standards ensures compatibility and efficient communication over wireless networks. [16] When transmitting encrypted data over networks, the use of SSL/TLS protocols to establish a secure communication channel is being done. This ensures that data is protected during transit between HUSA and any connected servers or databases. [17]

**Sustainable:**

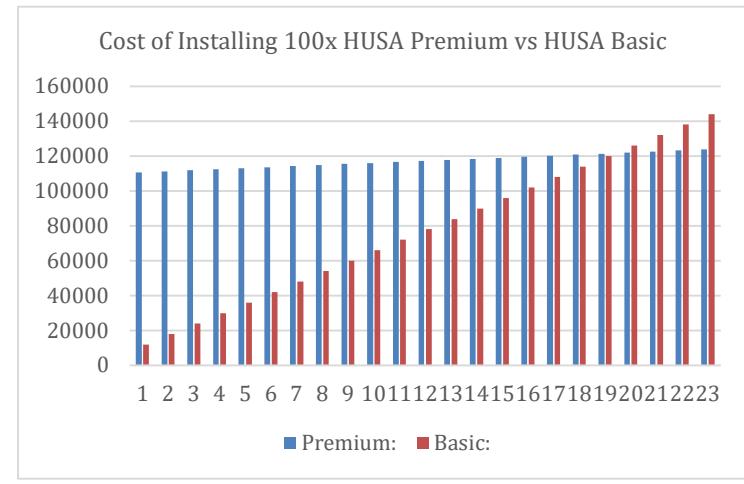
*Environmentally Friendly Materials:* HUSA is constructed using environmentally friendly materials such as bioplastics, recycled rubber, recycled metal, etc. This sustainable approach aligns with accepted engineering practices that advocate for eco-friendly solutions, reducing the environmental impact of technological implementations. In Malaysia, the Board of Engineers Malaysia (BEM) sets the standard for engineering practices, including developing codes of practice for sustainable resource utilization [18]. By utilising environmentally friendly materials, CO<sub>2</sub> emissions could be reduced significantly which complements Goal 9 in the Sustainable Development Goals. [18] {19}. [18] When considering environmentally friendly materials, several ISO standards that align with sustainable resource utilization and environmental impact reduction are considered such as ISO 14040 series where the life cycle of the product is assessed {20}.

*Energy-Efficient Design:* HUSA's energy-efficient design is a conscientious choice that not only reduces operational costs but also lessens its overall environmental footprint. This approach reflects a responsible stance in the engineering discipline, where sustainable practices are increasingly valued as this would complement Goals 7 and 12 in the Sustainable Development Goals. [19] [15] ISO14020 series are referred to to make sure that HUSA complied with environmental labelling and declarations. The system employs a power-efficient management strategy by activating device peripherals, such as sensors and displays only when human presence is detected. When developing HUSA, IEEE 1680 which focuses on sustainability standards with the assessment of environmental performance of electronic products is complied. [20] Energy Star certification is taken into consideration when designing an energy-efficient product. [21] SIRIM certification will be applied and obtained before launching to the market.

*Longevity and Durability:* The use of sustainable materials contributes to the longevity and durability of HUSA. In engineering settings, where the lifespan of technological solutions is a significant consideration, this sustainable approach aligns with the principle of creating lasting and resilient systems.

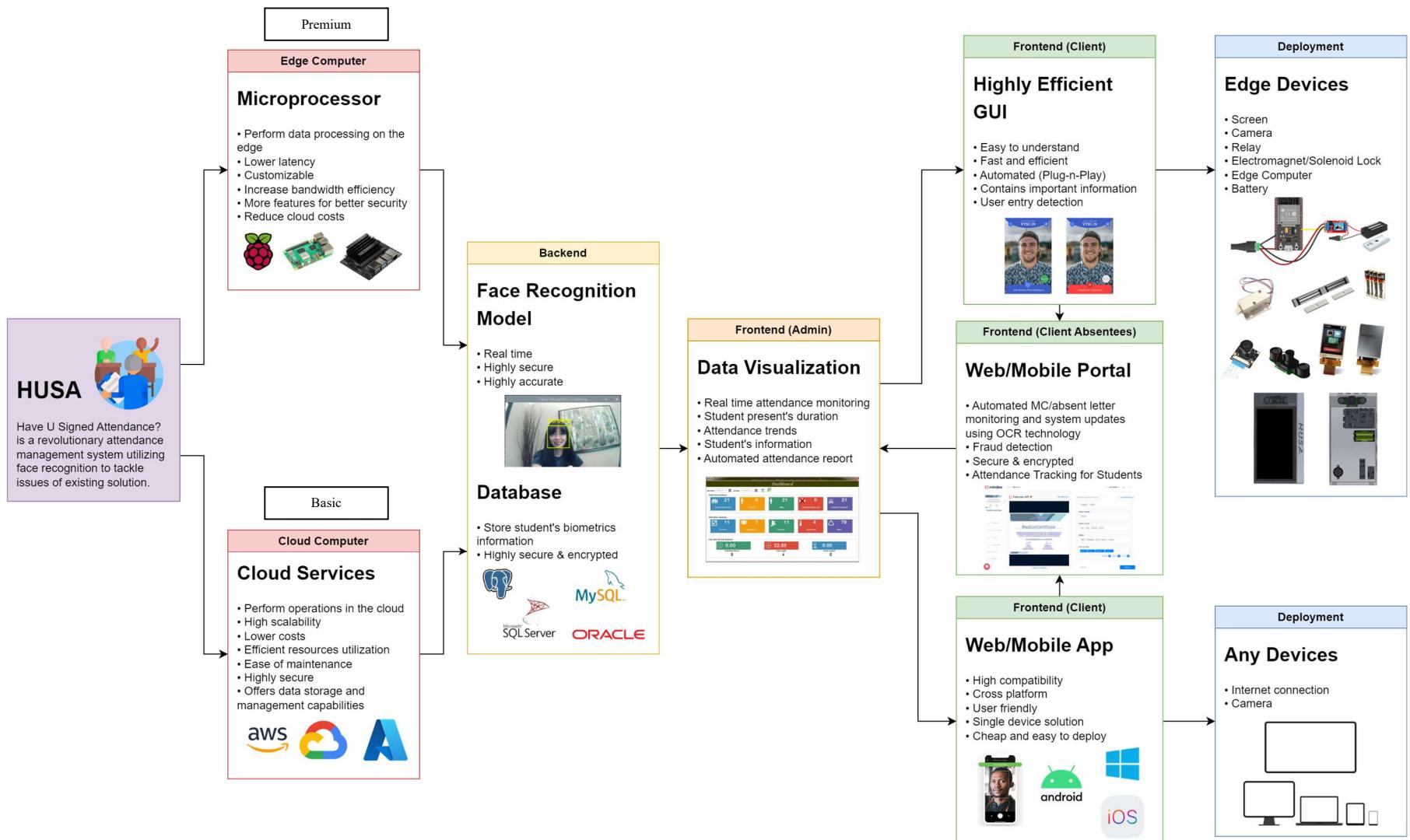
# Price of Product

Credit (RM):			Debit (RM):		
Product Cost:	One-Time	Recurring (pa)	Price of Product:	One-Time	Recurring (pa)
Edge Computing:			HUSA Premium:	1100	600
Edge Computer:	250		HUSA Basic:		6000
Camera:	100				
Screen:	350				
Battery:	10				
Solenoid Door Lock:	20				
Power Supply:	50				
Relay:	5				
Case:	30				
Cloud Subscription (pa):	500				
Domain Name Purchase (pa):	100				
<b>Company Establishment Cost:</b>					
Business Name Reservation Fees:	60				
Incorporation Fees:	1000				
Compliance Costs:	3000				
Solicitor's Costs:	3000				
Business Insurance (AIA):	500				
Bank Opening Cost:	800				
<b>Product Development Cost:</b>					
Research and Development Cost:					
Tools and Hardware:	5000				
<b>Marketing and Sales Cost:</b>					
Advertisement:	5000				
Social Media Campaigns:	2000				
<b>HUSA Premium Total:</b>	815	600	<b>HUSA Premium Profit per Device:</b>	285	0
<b>HUSA Basic Total:</b>		700	<b>HUSA Basic Profit per annum:</b>		5300
<b>Cost to Develop:</b>	20360				



Based on the graph above, it only takes 20 years for HUSA Basic to become more expensive compared to installing 100x HUSA Premium. The profit of installing 100x HUSA Premium is RM28500, which could generate a positive net cash flow after subtracting the cost to develop. On the contrary, it takes approximately 4 years or 4 HUSA Basic clients for our company to receive positive net cash flow after subtracting the cost to develop, without considering cost of labour. A contract of a minimum of 4 years HUSA Basic or 100x HUSA premium installation needs to be signed with clients to secure

## Block Diagram:



## Competitor Analysis

This section will provide a comprehensive overview of the key competitors for HUSA. Three strategic analysis methods which include PEST analysis, SWOT analysis and Porter's Five Forces analysis are used to analyse the competitiveness of HUSA in the market. Other than that, this section will also highlight how HUSA distinguishes itself among all the competitors in terms of innovation, functionality and adaptability.

### Key Competitors of HUSA

The research of key competitors for HUSA is focused on the region of Malaysia as this product will be first released to the Malaysia market and market expansion will only happen after the successful introduction of the product in Malaysia. The key competitors identified include ZKTeco, FingerTec, eLEAVE.MY and Info-Tech [22][23][24][25]. All the companies mentioned are providing facial recognition attendance monitoring system which is similar to HUSA. However, the target customer or application of their systems are more toward corporate sector instead of educational sector. For example, the system provided by eLEAVE.MY can be integrated to the Human Resources Management System (HRSM) and simplify the workload of the Human Resources department of a company [24]. This means that the opportunity and market for the facial recognition attendance system in educational institution is very promising and HUSA can easily stands out in the competition. Besides, the price of the facial recognition device provided by the competitors ranges from RM 2000 to RM 6300 [22][23][24][25]. The price of HUSA is relatively cheaper compared to the competitors and at the same time having more advanced technology equipped in it. This can easily attract more potential customers as budget consideration will always be the major factors in decision making. In comparison with the competitors, HUSA comes with several unique features in terms of AI automation and security features that enable it to stand out of the competition. The unique features compared to the competitors is tabulated in Table 1.

Table 1: Comparison of Features between HUSA and its competitors.

Features	HUSA	Competitors
Single Entry Detection	Able to detect if the students have entered the classroom and prevent the intruders.	No detection will be made, will allow entry in a certain grace period.
Duration Calculation	Users need to scan their face for both enter and exit to calculate the duration of the user in the class.	Faces will only be scanned when entering the door, not able to trace the duration of student in the class.
Low-light facial recognition	Equipped with advanced camera that can still perform facial recognition in a low-light condition.	Decreased facial recognition accuracy in low-light condition.
Automated absence monitoring	Automate the absence request process by using OCR technology.	This feature is not available.

### Strategic Analysis

A comprehensive strategic analysis is carried out for HUSA to identify the internal and external factors that can impact the success and sustainability of the product. The strategic analysis carried out are PEST analysis, SWOT analysis and Porter's Five Forces analysis. These strategic analysis can help to identify the potential risk and challenges, to understand the competitive market, to identify the market trends and emerging opportunities. The following section will discuss each strategic analysis in detail.

## PEST Analysis – HUSA

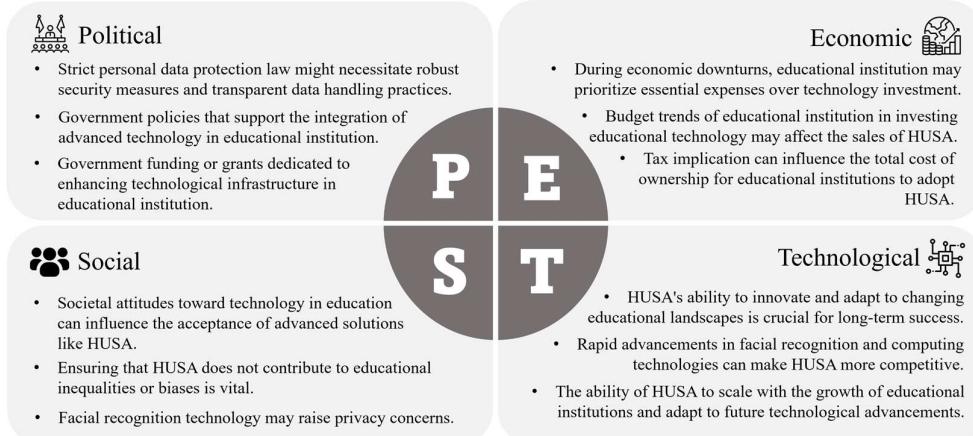


Figure 2: PEST analysis of HUSA.

PEST analysis serves as a tool employed to examine and observe external environmental elements that influence and affect a product or a company [26]. PEST analysis will cover different aspect of external factors like political, economic, social and technological. In the case of HUSA, it is important to align with regulatory requirements especially personal data protection law as HUSA will process a large volume of personal data. The support from government in terms of introducing policies and funding or grants dedicated to improving the technological infrastructure in educational institution can create favourable environment for HUSA's growth. HUSA basic can be used as an alternative product during economic downturns as well as for the educational institution that has budget concerns. For social, the acceptance of facial recognition needs to be researched and the user might have privacy concern when using facial recognition system. The technology advancement of HUSA must be updated and adapted to the evolving landscape. HUSA must strategically navigate these factors to establish itself as a trusted and effective solution in the educational technology market.

## SWOT Analysis – HUSA

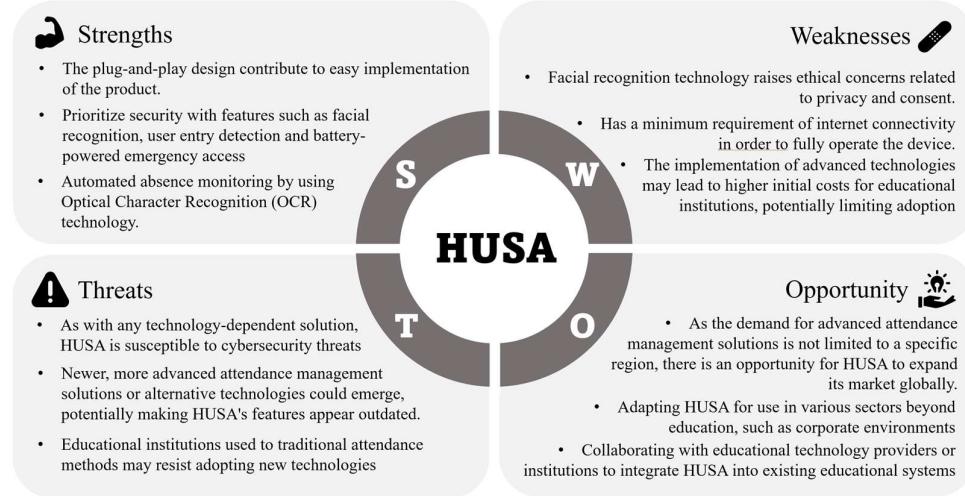


Figure 3: SWOT analysis of HUSA.

SWOT analysis has evolved into a fundamental instrument for organizations to assess their market standing. It is extensively employed to scrutinize both the internal and external environment of organizations. Strength and weaknesses are used to evaluate the internal capabilities of the product or organization while threats and opportunity focus more on the external factors that can positively or negatively affect the product or organization [27]. The plug-and-play design, comprehensive

security design as well as automated absence monitoring system make HUSA a better and more unique system compared to its competitors. However, privacy concern, internet connectivity and cost might be the downside of HUSA. HUSA should also prevent the possible threats like cybersecurity by implementing a more robust way in data storing, processing and sending and always keep the technology used in HUSA to be updated through software updates. HUSA has a very great potential in expanding its market globally and adapting it in other sectors such as corporate sector. It can also collaborate with educational institutions to carry out some research related to attendance monitoring.

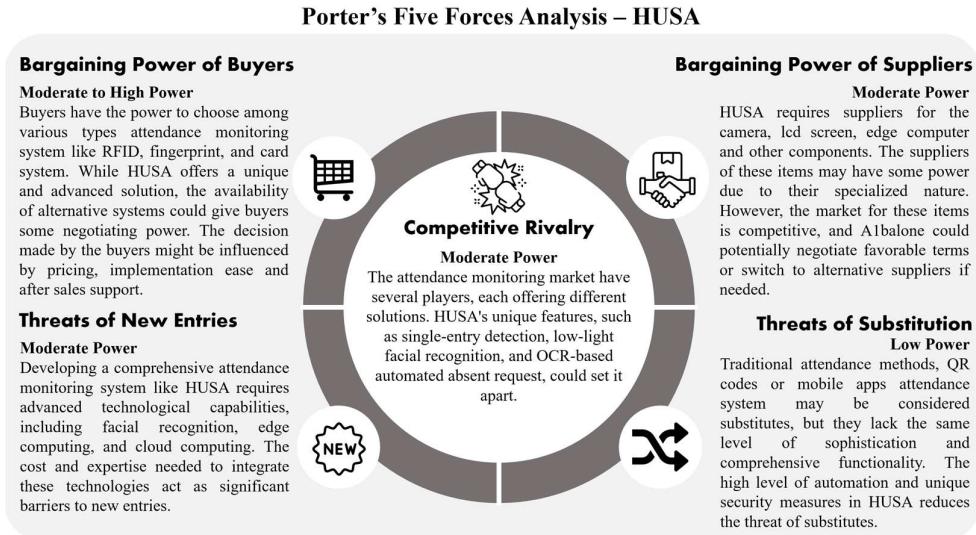


Figure 4: Porter's Five Forces Analysis for HUSA.

Michael Porter's model of competitive advantage, consisting of five crucial forces within an industry, presents a compelling perspective on how a company can attain a competitive edge in that specific sector [28]. In analyzing Porter's Five Forces for HUSA, the bargaining power of buyers is deemed moderate to high, as buyers can choose from various attendance monitoring systems. Although HUSA offers an advanced solution, alternatives like RFID, fingerprint, and card systems provide buyers with negotiating leverage based on factors such as pricing, implementation ease, and after-sales support. While suppliers possess some power due to the specialized nature of these items, the competitive market allows A1balone, the creator of HUSA, to potentially negotiate favourable terms or switch to alternative suppliers if necessary. The threat of new entries is seen as moderate, as the development of a comprehensive system like HUSA requires advanced technological capabilities, acting as barriers to entry. Finally, the threat of substitution is low, as traditional attendance methods or QR code-based systems lack the same sophistication and functionality as HUSA, which features high automation and unique security measures, reducing the appeal of substitutes.

## Intellectual Property (IP)

Company Name: A1balone

Company Logo:



Product Name: Have U Signed Attendance? (HUSA)

Product Logo:



A1balone, as the parent company of HUSA is responsible for securing and managing the various components of HUSA's intellectual property, which includes patents, trademarks as well as industrial design. Other than the intellectual property of the product itself, it is also important to protect the

intellectual property of the company as intellectual property plays a vital role in the modern economy. As a registered company in Malaysia, A1balone will fully adhere to the intellectual property system in Malaysia, which is administered by the Intellectual Property Corporation of Malaysia (MyIPO). [29] Patents, trademarks and industrial design are all included in the Malaysia's intellectual property system. The intellectual property laws enforced in Malaysia are aligned with international standards and undergoes regular evaluations by the Trade-Related Aspects of Intellectual Property Rights (TRIPS). The section below will cover the intellectual position of the company as well as the methods to protect the company's intellectual properties [30].

### **Patents**

According to MyIPO, definition of patent is "A patent is an exclusive right granted for an invention, which is a product or a process that provides a new way of doing something or offers a new technical solution to a problem". A patent in Malaysia is protected up to 20 years from the date of filing. [29] In the case of HUSA, the core technology or component used in that system is facial recognition technology. The facial recognition technology applied in the system needs to be protected by patents covering the unique algorithms and processes involved in student identification and verification. The facial recognition algorithm will be able to cover low-light situations and can accurately recognize faces with minimal light. The algorithms are diverse and inclusive where it can detect faces of any skin tone or face features. The unique single entry detection model can also be protected by patents. With the successful patent filing, A1balone will gain exclusive rights to the patent for a period of 20 years and can prevent the competitors from copying and using the similar algorithm without authorization. This exclusivity serves as a powerful incentive for the company to further invest in the research and development of the system, fostering a culture of innovation. A1balone, as the patent holder, will have the option to license their technology to others, which can be another way to generate additional revenue streams.

### **Trademarks**

In addition to the technological aspects of its intellectual property, A1balone has taken proactive measures to secure its brand identity. The company's name and logo as well as the product's name and logo are protected through trademark registration. Trademarks are very useful in protecting the distinctive visual components of the logo and preventing others in the industry from using similar logo and name. Trademarks also prevent confusion among consumers and competitors and at the same time create a distinct and exclusive brand identity for the company and the product. Besides, it also provides an extra line of protection from any possible infringement or unlawful usage by other parties. With this all-encompassing intellectual property approach that covers both brand identity and technology advancements, both A1balone and HUSA are positioned to be well-protected in the competitive environment. [31]

### **Industrial Design**

Other than protecting brand identity, it is also crucial to protect the industrial design of the device for the facial recognition attendance tracking system. As the owner of HUSA, A1balone will register industrial design protection for the device to establish a legal foundation for safeguarding its unique visual features. Similar to trademarks, this industrial design protection will prevent competitors from copying or replicating the distinctive and exclusive aspect of the device and at the same time creates a competitive advantage in the marketplace. Other than preventing direct imitation, industrial design protection is also essential in preserving the integrity of the company's brand image. [31]

### **Employee Agreement and Non-Disclosure Agreement (NDA)**

As an intellectual property protection strategy, A1balone is very careful and meticulous in crafting and enforcing the employee agreement as well as the Non-Disclosure Agreement. The company's employee agreements are comprehensive and explicitly stating that all intellectual property created by employees during their tenure is the sole property of the company. NDA establishes a legal obligation for the third party not to disclose or use confidential information for any purpose other than the intended collaboration. Both agreements are committed to protecting the intellectual property

and confidential information of the company and at the same time foster the culture of trust and compliance within the organization. [32]

Other than securing and managing the intellectual property of HUSA, research and survey of the similar product available on the market is carried out to address the Freedom to Operate (FTO) concerns. The FTO analysis will ensure that the development, manufacturing and commercialization of HUSA do not infringe on existing patents, trademarks or any other intellectual property held by the third parties. A thorough Prior Art research is carried out before launching and developing the system. The features comparison of HUSA with the relevant Prior Arts are presented in Table 2.

Table 2: Features comparison of HUSA with the relevant Prior Arts.

Feature	HUSA	Relevant Prior Arts
Exit Scanning for Duration Tracking	Scan faces upon exit to record the duration of student presence	Exit by pressing button to unlock the door, no duration tracking feature
Single Entry Detection	Dedicated AI model that can detect if the students have entered the room after verification and can prevent tailgating by intruders.	No detection for student's entry and
Automated absence monitoring	Automate the absence request process by using OCR technology.	This feature is not available.

## 5-Year Development Plan

HUSA's 5-Year Development Plan is largely correlated with its company, Albalone's vision, mission, and future direction. This plan spans over a five-year period in effort to create a robust and innovative attendance monitoring system. This plan incorporates a Gantt Chart to provide visual representation of the project timeline and depicts a Waterfall Project Management structure. A scrum board is shown for the current HUSA product's development process using an Agile Project Management structure. An overview of the time-plan will be discussed briefly.

The Gantt Chart highlights the development of HUSA in phases, where each phase represents a milestone to be achieved. Phase 1 defines the foundation work done by the project team in preparation to design the HUSA system. HUSA envisions to change the attendance monitoring market, by providing a coherent and automated solution to current problems. Thorough market research was carried out to understand the market value, trends of the market and feasibility of the idea. HUSA should utilize cutting-edge technologies such as facial recognition and edge computing in the design to achieve the goal. Project Initiation was carried out by the core team in Albalone and completed within the timeframe of 6 months.

Phase 2, HUSA enters the system design phase to create detailed system requirements and architecture. System design is carried out by a group of engineers of Albalone company, using a scrum agile project management structure. By breaking down final milestones into small achievable goals through a pre-set time frame, the milestones can be achieved. The design components include AI model training for facial recognition, model training for OCR, back-end design for the HUSA website, front-end design for user interface, software for electronic lock integration, edge-device controls, and implementation as well as cloud computing database management and storage solutions. These tasks are managed via agile methodology and can be seen from Figure 5 below. After the design is finalized, IP protection and patency should be obtained to secure the design of HUSA.

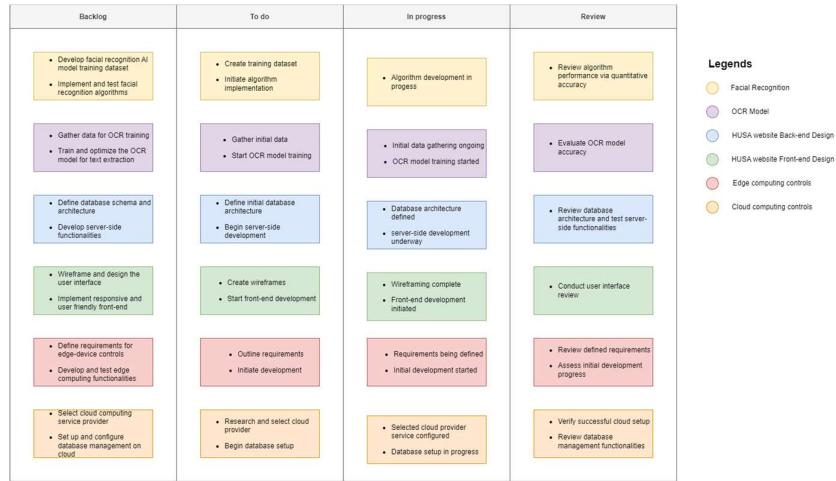


Figure 5. Scrum Agile development road map of HUSA's system design.

Phase 3 and Phase 4 depicts the Quality Assurance and planning requirements before deployment of HUSA to the general market. For HUSA's Premium device, stress tests must be carried out to ensure their physical integrity and ability to sustain long-term usage. For the software models and website, load testing must be carried out to test the performance and capabilities of the application, detecting problems early on to solve them. Quality assurance spans 2 months to complete, which moves the project onto a pre-deployment phase. Marketing and branding strategies are developed by external source to better promote HUSA to the relevant clients in the education sector. Customer relations and supports teams should be formed to assist all users. Deployment should happen during May of 2024, and the team should take a month to intensely monitor the performance of HUSA and address any post-deployment issues.

HUSA will be deployed as a subscription-based solution. HUSA Basic plan comes with a fee of RM6000.00 per annum for a minimum four-year contract. HUSA Premium plan allows clients to install a minimum of 100 units of HUSA device, each costing RM1100.00, but with subsequent subscription of RM600.00 per annum. These contracts allow HUSA to make a profit of RM285.00 per Premium device sold, and an annual profit of RM5300 for the Basic plan. Given two plans, each provides different approach in making a profit from HUSA. With the current contract, it takes one client that purchases 100 units of HUSA Premium to generate a positive cashflow; whereas it would take approximately 4 years or 4 HUSA Basic clients for Albalone to receive positive cashflow. The positive cashflow is determined by considering only development cost and operating costs.

HUSA would go into Phase 5 next, Maintenance and Optimization which spans 12 months. Is it important to keep current clients satisfied by consistent updates and improvement to better their user experience of HUSA. The process of maintaining HUSA is as follows: a specialised team should define a standardized protocol for user-reported issues and provide support on the framework. Monitoring tools could be implemented for automated performance review. Other than that, since HUSA uses facial recognition technology which could raise concerns about privacy issues, security audits must be performed occasionally for the AI models and system to ensure HUSA is not compromised. Majority of this phase should be used to implement minor feature updates and enhance performance of HUSA, as well as better data protection measures.

Phase 6, Phase 7 and Phase 8 are very much future plans that involves upgrading HUSA, into a new era, HUSA 2.0. A new method to attendance taking that could be taken to the corporate level of attendance monitoring. There are no specific plans on this yet as the development of HUSA series ultimately depends on customer feedback and satisfaction. However, as a company, Albalone is projected to step up in size during Phase 7, through a transition of becoming a listed company. Phase 8 details expansion of HUSA to dominate the attendance monitoring market in regions outside of Malaysia. The future possibilities of HUSA are endless, but HUSA's purpose and mission remains.



# Risk Mitigation

## **Political:**

HUSA encounter risks associated with regulatory compliance and shifting government policies. Changes in data privacy and facial recognition regulations may pose challenges to the legality and acceptance of the system [33]. To address these risks, HUSA will establish a dedicated legal team of consultant tasked with continuously monitoring regulatory changes. Implementation of robust measures, such as data anonymization and encryption, will be prioritized to align with evolving data privacy requirements [34]. Privacy policies and practices will be regularly updated to ensure compliance with changing regulations, and internal audits will be conducted periodically to identify and rectify any deviations. In addition to these internal measures, HUSA will engage in proactive advocacy efforts, building strong relationships with policymakers to positively influence potential policy changes [35]. Recognizing the need for adaptability, HUSA will establish a task force dedicated to assessing the potential impact of policy changes and swiftly adapting the system to meet evolving regulatory standards [35]. Therefore, the most serious risk for HUSA lies in the potential impact of regulatory changes in data privacy and facial recognition. The risk is paramount due to its profound legal implications, where non-compliance could lead to fines and operation restrictions. In addition, the challenge of acceptance may also arise, as changes in regulation will influence how the system is perceived, affecting its adoption by stakeholders.

## **Social:**

Subsequently, HUSA acknowledges potential social risks tied to data privacy concerns and the resistance to change [36]. To address apprehensions regarding facial recognition technology, the system will implement robust privacy measures, including end-to-end encryption for secure data transmission and strict access controls with multi-factor authentication to prevent unauthorized access [37]. Data Loss Prevention (DLP) tools will be deployed to monitor and halt unauthorized data transfers, minimizing the risk of data leakage. A commitment to data minimization ensures only essential information for attendance tracking is collected and stored, reducing the impact of any potential security event [37]. Transparent communication with stakeholders will be prioritized through the implementation of clear privacy policies and awareness campaigns, offering opt-out options for individuals uncomfortable with facial recognition. To mitigate resistance to change, HUSA will implement a comprehensive change management plan, involving key stakeholders in the development process and highlighting the system's benefits through case studies and success stories via online and offline campaigns. Furthermore, we will be actively seeking and promptly responding to user feedback which help enhances trust and addresses privacy concerns, ultimately facilitating a smoother adoption process [37]. Addressing data privacy concerns is critical to building and maintaining trust, as privacy lapses can lead to a loss of confidence among stakeholders and damage HUSA's reputation. User acceptance of facial recognition system is closely tied to privacy perceptions, making it essential to mitigate concerns to ensure widespread adoption. Thus, data privacy concerns is considered as a crucial risk among other social risks.

## **Technological:**

Moreover, HUSA recognizes the potential technological risks it encounters, notably poor connectivity and potential technological failures. Poor connectivity could hinder the real-time functionality of HUSA, impacting its overall effectiveness. In response to this challenge, HUSA is adopting a proactive approach. As part of the strategy, stakeholders are now required to meet a minimal connectivity standard to ensure optimal performance. Before purchasing the product, stakeholders are notified to have a pre-existing stable internet connection. The adjustment is designed to streamline the user experience, emphasizing the importance of a reliable internet connection for seamless operation and minimizing the risk of disruption and downtime.

In addressing technological failures such as software bugs and glitches, we're prioritizing the system's reliability and security. Regular updates and patches will be applied to address vulnerabilities, ensuring that HUSA stays ahead of potential risks [38]. Our commitment to cybersecurity involves investing in advanced measures such as encryption and secure data storage [38]. Before any updates are deployed, thorough testing and quality assurance processes will be conducted to identify and rectify any potential glitches. In the event of technical issues, we have a rapid response plan in place to address and communicate about these issues promptly. A dedicated response team will be deployed to handle the technical difficulties promptly and efficiently. By taking these proactive measures, HUSA aims to maintain the integrity and functionality of its facial recognition system, providing a seamless and secure experience for users. Technological failures emerge as the most crucial risk towards HUSA's facial recognition system. The reliability of the system is essential, as frequent technological failures will undermine its trustworthiness and dependability, eroding user satisfaction and trust.

**Environmental:**

In our pursuit of seamless and technologically advanced attendance management, HUSA is aware of the environmental responsibilities that come with innovation. With a firm commitment to sustainability, we are proactively addressing potential environmental risks associated with our operations.

To address the risk of electronic waste production, HUSA is meticulously designed with longevity in mind. The approach ensures that hardware components have an extended lifecycle, contributing to sustained performance over time. Our company goal is to reduce the frequency of hardware replacements, thereby minimizing the amount of E-waste generated [39].

Within our supply chain management, the upmost importance is placed on sustainability. We give preference to suppliers who demonstrate robust sustainability practices, and we have established precise guidelines for the sustainable sourcing and manufacturing of our products [39]. A1balone commitment to environmentally conscious practice is evident in the exploration of using recycled materials in the hardware production. In addressing the end-of-life disposal phase, we are developing HUSA product with components that are easy to disassemble, facilitating efficient recycling processes. Additionally, user guidelines promoting responsible disposal, coupled with our exploration of take-back programs, further emphasize our unwavering commitment to responsible product lifecycle management [39].

Through these strategic measures, HUSA not only aims to revolutionize attendance management but also strives to contribute responsibly to our environmental landscape. By proactively addressing environmental risks, we're shaping a future where cutting-edge technology and sustainability seamlessly coexist.

**Ethical:**

The implementation of facial recognition technology in attendance systems, such as HUSA, raises significant ethical considerations that demand careful attention. One paramount concern is the potential infringement on privacy and consent [40]. HUSA acknowledges the risks associated with automatic biometric data collection, lack of individual choice and control, and the potential for bias and discrimination. To address these concerns, HUSA is committed to embedding robust privacy measures into its system design, including data anonymization and limited data retention policies. Transparent communication about data usage through privacy policies and the provision of clear information to users regarding facial data usage, along with opt-out options, will be integral components of HUSA's ethical framework [40].

Moreover, HUSA recognizes the ethical challenge of bias and discrimination inherent in facial recognition technology [41]. To mitigate this risk, the system will undergo regular audits and

algorithm updates to minimize biases. Diverse datasets, encompassing various demographic groups, will be employed during the training phase to ensure fair and accurate results. HUSA will also invest in high-quality cameras and lighting to reduce the risk of false positives and negatives, further ensuring equitable outcomes [41].

Transparency and accountability form another critical facet of HUSA's ethical approach. Measures will be implemented to guarantee transparency, offering individuals access to their biometric data and establishing clear governance and escalation processes. Regular audits will be conducted to ensure compliance with legal and regulatory requirements, fostering an environment of accountability and ethical responsibility in the utilization of facial recognition technology within the HUSA system [41].

Through comparison, potential infringement on privacy and consent is deemed the most crucial risk in the implementation of facial recognition technology. It can be further emphasized that potential misuse of facial recognition data can result in serious consequences towards individuals, including identity theft, discrimination and unauthorized tracking.

## **Reflection on Business Plan Outline**

Verbal and written feedback are given upon business plan outline whereby privacy issue may be raised when some students don't want to scan their faces for face recognition. To address privacy concerns related to facial recognition, HUSA prioritize data protection acts and security concerns related to student's image data and clear communication of the purpose of facial recognition, how data will be handled, and ensure compliance with privacy regulations will be done extensively to encourage students to opt for HUSA solution. Establishing transparent policies and incorporating feedback mechanisms will contribute to building trust and addressing privacy apprehensions.

The second feedback raised was required product hardware is costly and cost-effective solution can be considered so the overall product price can be reasonable. Comparing to card system whereby every user needs a personal card and make sure they have it when they enter a classroom, it is already cheaper since no additional consumable is needed. Furthermore, HUSA offers a cheaper option via cloud computing whereby HUSA system can be deployed into any devices such as laptops, tablet, smartphones, computers, etc as long as it has connectivity and camera. This option does not involve any hardware from HUSA while clients only need to subscribe to our services. However, this approach would not provide security features. Moreover, HUSA could explore partnerships with hardware manufacturers to source more cost-effective but environmentally compliant components without compromising functionality. Additionally, offering scalable pricing models or leasing options for the hardware can make the product more accessible to a broader range of educational institutions, including those with budget constraints.

For a comprehensive understanding of the market dynamics, several strategic analysis methods and tools such as SWOT (strengths, weaknesses, opportunities, and threats), PEST (political, economic, social, and technological), and Peter's Five Forces analysis which had been discussed in the previous section. The analysis helps in identifying the internal and external factors that can impact the success of HUSA in the market. By evaluating strengths such as real-time facial recognition and cloud-based solutions, weaknesses like potential privacy concerns, opportunities for market growth, and threats such as competition or changing regulations can be identified. This strategic insight will guide the product development, marketing, and overall positioning of HUSA in the competitive landscape, ensuring its long-term success.

## **Reflection on Productive Teams**

As our team embarked on the collaborative journey, the Belbin Team Roles assessment became a pivotal tool for assessing the team's dynamics. Initially, designated roles were assigned to each member, providing a fundamental understanding of each individual strengths and weakness. This approach enhances the awareness of how each team member contributes uniquely to the group.

Additionally, Bruce Tuckman's 5 stages of group development were incorporated during the collaborative process, to analyse the team evolution over time [42]. The examination proved to be crucial for comprehending not just our current dynamics but also the evolution of our collaboration across the forming, storming, norming, performing and adjourning stages, shown in Figure 6 [42].

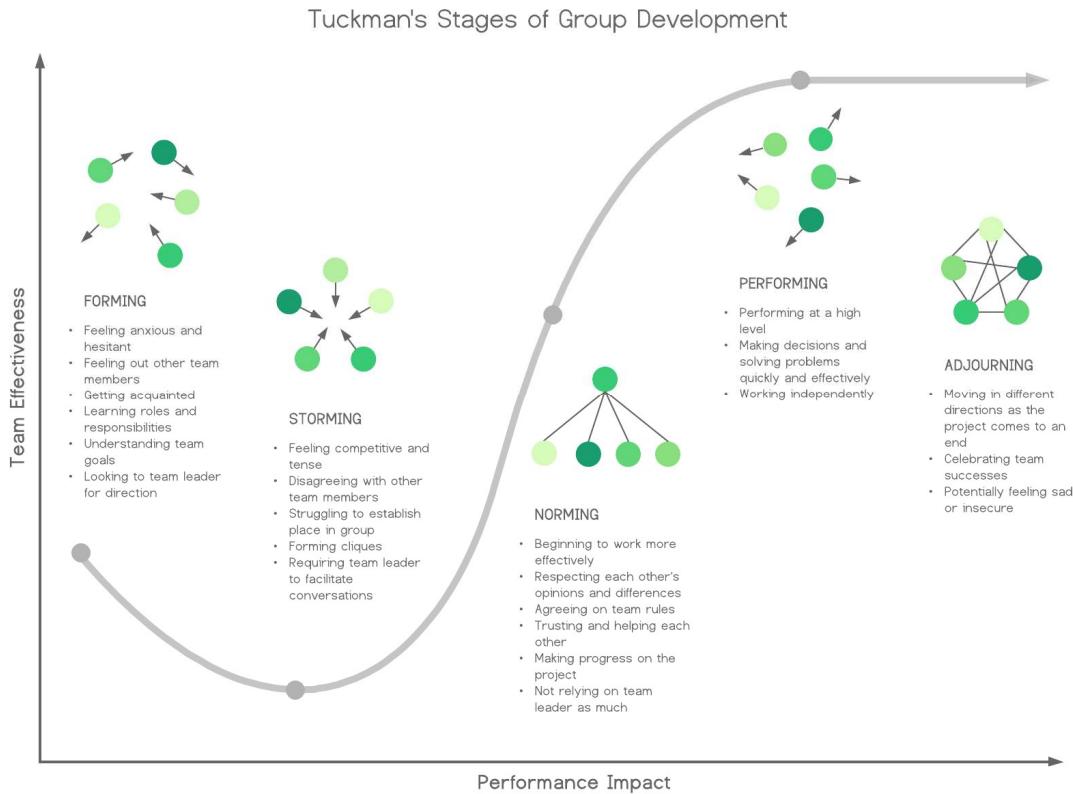


Figure 6 : Bruce Tuckman's 5 Stages of Group Development [42]

Member 1 (Kuay Xian Cong), identified as the 'Shaper,' brought a dynamic and results-oriented approach to the team. His inclination for challenging the status quo and pushing for progress played a crucial role, especially during the "storming" phase of Tuckman's model. The Shaper's assertiveness and ability to stimulate action were instrumental in addressing conflicts and steering the team towards effective solutions [43]. A key responsibility undertaken by Xian Cong was the research of product purpose and functionality. As this role required a comprehensive understanding of the goal and capabilities of the product, Xian Cong has demonstrated both dedication and expertise in addressing the inefficiencies of traditional attendance monitoring approach compared to HUSA. Furthermore, he has also engaged in a detailed discussion on the main functionality of the product HUSA, which examine its unique feature and capabilities. His contribution in the section articulates the distinctive selling points of HUSA addressing specific pain points in modern attendance monitoring system.

Additionally, Member 2 (Kelly Ng Man Yie), designated as the 'Coordinator,' assumed a central role in integrating the diverse talents within our team. During the "norming" phase, her ability to harmonize the team's efforts and ensure that each member's strengths were recognized and utilized fostered a cooperative atmosphere. The coordinator's diplomatic skills were particularly evident in aligning our goals and strategies, contributing significantly to the overall cohesion of the team [43]. To begin with, Kelly has compiled complex information into a concise yet informative summary. Her ability to capture the essence of the product information within the summary section provided stakeholders with clear and accessible overview. Furthermore, Kelly has also collaborated with Xian Cong in conducting research on product purpose. Her insights into the product purpose laid

foundation for effective communication of its value proposition to stakeholders, ensuring a comprehensive understanding of the issue HUSA aimed to solve. Conversely, Kelly has also extended her responsibilities in the development of a comprehensive 5 year plan using a Gantt Chart. She has created a Gantt Chart to visualise the project trajectory over the next 5 years, outlining key milestones, specified tasks and timelines.

Furthermore, Member 3 (Chai Yee Xuan), characterized as the 'Team worker', played a crucial role in maintaining group harmony and fostering a collaborative spirit. His focus on interpersonal relationships and supportiveness became especially evident during the "performing" phase. The Team worker's ability to mediate and create a positive team dynamic was vital in sustaining the group momentum and productivity [43]. Initially, he has conducted research to identify and analyse key competitors of HUSA which offers similar functionalities in current market. This comparison of features between HUSA and its competitors provides valuable information towards refining and enhancing the product to ensure a competitive edge. He has also researched and applied strategic analysis tools such as PEST, SWOT and Porter's Five Forces Analysis. The strategic analysis is useful in decision making and shaping the overall market strategy for HUSA. Other than that, Yee Xuan took the responsibility to investigate the intellectual property landscape. The process involved a detailed discussion on patents, trademarks and industrial design related to the company A1balone and its product HUSA. His research in this area, ensured a clear understanding of legal protection, potential area of innovation and related risk to intellectual property infringement. Furthermore, as a cooperative team member, Yee Xuan has also work effectively with Xian Cong in the design of HUSA product using 3D modelling tools, SolidWorks.

In contrast, Member 4 (Ryan Wong Sie Xu), the 'Plant', contributed a unique and innovative perspective to the team. During the "forming" stage, the Plant's creative ideas injected a fresh energy, stimulating our initial brainstorming sessions. While his unconventional thinking sometimes introduced challenges during the "storming" phase, it ultimately enriched the problem-solving processes and pushed the team to explore new avenues [43]. Ryan played a crucial role in the risk mitigation section by presenting potential risks in 5 different categories, political, social, technological, environmental and ethical. This provides an in depth understanding of external factors which may impact the success of HUSA. By identifying potential pitfalls and developing mitigation plans, Ryan has contributed significantly to ensure the resilience and adaptability of HUSA in dynamic business environment. Additionally, he also dives deep into the reflection of productive teams, examining both individual and group dynamics by aligning Belbin team roles with Tuckman's group development stages. This strategic approach helped leverage individual strengths, navigate challenges and enhance overall team performance to foster a more cohesive and resilient team structure.

Although the Belbin Team Roles model is beneficial, it is not without its limitations. A primary drawback lies in its tendency to oversimplify individuals by assigning them with predefined roles, overlooking the dynamic and evolving nature of teamwork [44]. The model rigidly assigns individuals to specific roles, neglecting the complexity of individuals and their capacity to extend beyond a singular role. Additionally, teams might benefit more from considering alternatives model that address these limitations. One such model is the Myers-Briggs Type Indicator (MBTI), which focuses on personality types and preferences. The model provides a more fluid understanding of individual differences, acknowledging that individuals preferences may vary depending on the context [44]. On the other hand, GRPI model developed by Richard Beckhard is another useful model. In Comparison, to Belbin Team Roles which offers a fixed set of roles, GRPI recognizes the situational and flexible aspects of teamwork through clarification in goals, processes and interpersonal relationship [44]. A thorough comparison of various models is listed down below as shown in Table 3.

Table 3 : Comparative Analysis of Team Development and Interaction Models

	<b>Belbin Team Role Model</b>	<b>Bruce Tuckman's 5 Stages of Group Development</b>	<b>MBTI (Myers-Briggs Type Indicator)</b>	<b>GRPI Model (Goals, Roles, Processes and Interpersonal Relationships)</b>
<b>Focus</b>	Individual roles within a team	Group development stages	Personality types and preferences	Team effectiveness, through clarity in goals, roles, processes and interpersonal relationship
<b>Key Concepts</b>	Nine team roles, each with strengths and weaknesses	5 Stages of Group Development	4 dichotomies: Extraversion/Introversion, Sensing/Intuition, Thinking/Feeling and Judging/Perceiving	Ensuring alignment in team goals, defining roles, establishing effective processes, and fostering positive relationships
<b>Purpose</b>	Identify team members strengths and allocate roles accordingly	Understand and navigate through group development stages	Understand individual differences and preferences for decision-making and information processing.	Enhancing team performance by addressing key components critical to success
<b>Development</b>	Meredith Belbin	Bruce Tuckman	Isabel Briggs Myers and Katharine Cook Briggs	Richard Beckhard and David Gleicher
<b>Stages/Roles</b>	Coordinator, Shaper, Plant, Teamworker, Monitor Evaluator, Implementer, etc.	Forming, Storming, Norming, Performing, Adjourning	16 personality types based on combinations of the 4 dichotomies	No specified roles but focuses on 4 key components which are Goals, Roles, Processes and Interpersonal Relationships
<b>Interaction</b>	Emphasizes collaboration and synergy	Describes the evolving interpersonal relationships within a group	Emphasizes individual preferences in how people perceive the world and make decisions	Describe progression and challenges in group dynamics

Throughout the duration of our collaborative project, our team encountered a variety of obstacles, with significant challenges arising from divergent opinions during group discussions. The array of roles and perspectives within our team led to conflicting viewpoints on optimal approaches, particularly concerning the integration of facial recognition technology, timelines, and the purpose of the product. To address this, we took proactive measures by enhancing communication channels and organizing regular online and offline meetings to encourage open discussions. This strategy effectively minimized misunderstandings and ensured that all team members remained well-informed with updated information. Conversely, we also grappled with time constraints due to members juggling multiple commitments and facing unexpected schedule conflicts. In response, our group devised a strategic time management plan, which involved the creation of a revised timeline. This plan allocated different sections to individual team members, each with realistic deadlines for the corresponding subtasks. The implementation of this approach not only heightened overall group performance but also guaranteed that each member made meaningful contributions. In the future, our dedication to ongoing enhancement remains unwavering, and we are actively investigating additional measures to enhance the synergy of our collaborative endeavours. One such strategy involves incorporating regular checkpoints during meetings, enabling team members to share updates on their individual progress and promptly address any emerging group issues. Furthermore, we actively encourage constructive feedback and assessments of group dynamics, providing the opportunity to evaluate our current progress and implement essential refinements. Through the consistent application of these methods, we aim to foster continuous improvement within the group, ultimately paving the way for a more effective and harmonious working environment in the times ahead.

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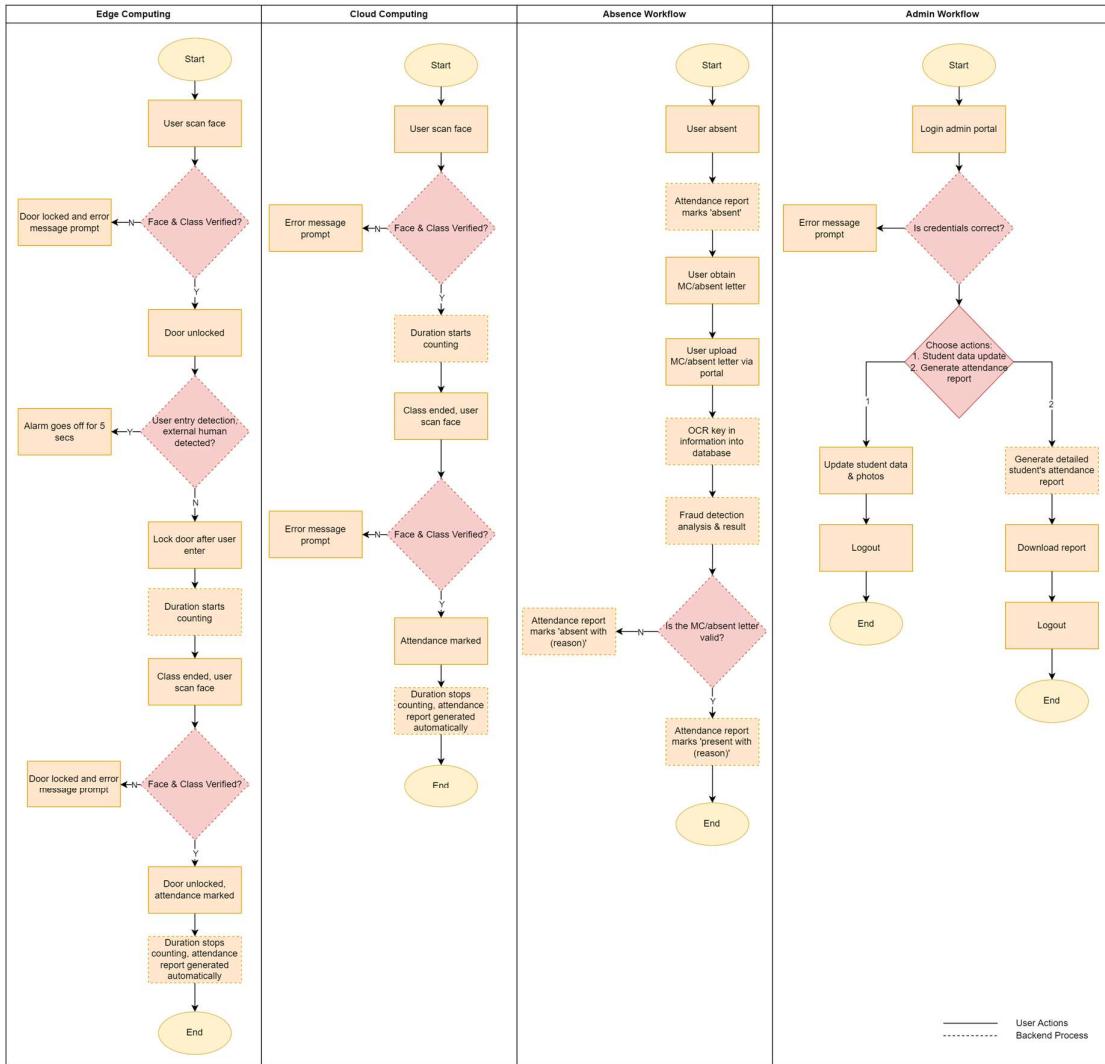
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# Appendix

## Customer Journey:



## ***Business Plan Outline***

“HUSA: Have U Signed Attendance” aims to streamline attendance-taking in educational institutions by tackling several issues for the current solution like the inconvenience of manual class unlocking for attendance, which is inconvenient for users with low phone batteries or those who miss sign-in windows. The current system relies on proximity to the classroom, leading to connectivity issues.

HUSA offers two products: Basic and Premium. HUSA Basic is a cloud-based service accessible via a web-app, designed for efficient attendance-taking. The service leverages facial recognition to identify students and takes attendance once the students are verified. It offers a simple and cost-effective solution for schools and universities, as it can be deployed on their choice of device that meets the operational requirements.

HUSA Premium integrates additional features for enhanced attendance management and security. It includes real-time integration with edge devices and electronic door locks, where access to the classroom is only granted upon successful face verification which disables the lock, ensuring only verified attendees gain access to classrooms based on a preset timetable. Students’ faces can be scanned upon their exit of the classroom which allows the system to record the duration of the student’s presence in the classroom.

The key features of HUSA are facial recognition, real-time access controls, flow monitoring, timetable integration as well as security and efficiency. The versatility of HUSA allows potential expansion into the corporate sector as well. In summary, HUSA is a one-size-fits-all solution that caters to the needs of educational and corporate clients.

## ***Belbin Test Result***

### **Member 1: Koay Xian Cong (Shaper)**

#### **Scoring Key for Self-Perception Inventory**

Transfer your points allocation from the seven sections of the Self Perception Inventory to the appropriate boxes below. The pre-printed numbers in the grid refer to the question numbers of each section. For example, if for Section A you scored seven points for question 6 and three points for question 1, you would allocate them in the columns RI and IMP respectively.

	SH	CO	PL	RI	ME	IMP	TW	CF
A	3 <u>0</u>	7 <u>1</u>	4 <u>2</u>	6 <u>2</u>	5 <u>1</u>	1 <u>2</u>	8 <u>1</u>	2 <u>1</u>
B	1 <u>2</u>	6 <u>1</u>	5 <u>2</u>	8 <u>1</u>	4 <u>2</u>	7 <u>1</u>	3 <u>0</u>	2 <u>1</u>
C	7 <u>1</u>	4 <u>1</u>	6 <u>1</u>	2 <u>1</u>	3 <u>2</u>	5 <u>1</u>	8 <u>2</u>	1 <u>1</u>
D	2 <u>1</u>	3 <u>2</u>	6 <u>2</u>	4 <u>2</u>	5 <u>0</u>	1 <u>2</u>	8 <u>0</u>	7 <u>1</u>
E	6 <u>3</u>	5 <u>2</u>	1 <u>0</u>	7 <u>0</u>	3 <u>0</u>	4 <u>0</u>	2 <u>3</u>	8 <u>2</u>
F	6 <u>2</u>	4 <u>0</u>	5 <u>1</u>	1 <u>2</u>	3 <u>2</u>	8 <u>1</u>	7 <u>2</u>	2 <u>0</u>
G	5 <u>2</u>	7 <u>1</u>	6 <u>2</u>	3 <u>0</u>	2 <u>1</u>	1 <u>1</u>	8 <u>2</u>	4 <u>1</u>
<b>TOTAL</b>	<b>11</b>	8	10	8	8	8	10	7

Once you have allocated all your points, total each column.

The highest two totals represent your primary and secondary preferred team roles.

## Member 2: Kelly Ng Man Yie (Co-ordinator)

### Scoring Key for Self-Perception Inventory

Transfer your points allocation from the seven sections of the Self Perception Inventory to the appropriate boxes below. The pre-printed numbers in the grid refer to the question numbers of each section. For example, if for Section A you scored seven points for question 6 and three points for question 1, you would allocate them in the columns RI and IMP respectively.

	<b>SH</b>	<b>CO</b>	<b>PL</b>	<b>RI</b>	<b>ME</b>	<b>IMP</b>	<b>TW</b>	<b>CF</b>
A	3 <u>  0  </u>	7 <u>  2  </u>	4 <u>  1  </u>	6 <u>  1  </u>	5 <u>  1  </u>	1 <u>  2  </u>	8 <u>  1  </u>	2 <u>  1  </u>
B	1 <u>  6  </u>	6 <u>  0  </u>	5 <u>  0  </u>	8 <u>  1  </u>	4 <u>  1  </u>	7 <u>  0  </u>	3 <u>  0  </u>	2 <u>  3  </u>
C	7 <u>  2  </u>	4 <u>  0  </u>	6 <u>  3  </u>	2 <u>  0  </u>	3 <u>  2  </u>	5 <u>  1  </u>	8 <u>  1  </u>	1 <u>  1  </u>
D	2 <u>  2  </u>	3 <u>  5  </u>	6 <u>  1  </u>	4 <u>  1  </u>	5 <u>  1  </u>	1 <u>  0  </u>	8 <u>  0  </u>	7 <u>  0  </u>
E	6 <u>  0  </u>	5 <u>  0  </u>	1 <u>  0  </u>	7 <u>  0  </u>	3 <u>  3  </u>	4 <u>  3  </u>	2 <u>  2  </u>	8 <u>  1  </u>
F	6 <u>  2  </u>	4 <u>  3  </u>	5 <u>  0  </u>	1 <u>  0  </u>	3 <u>  3  </u>	8 <u>  2  </u>	7 <u>  0  </u>	2 <u>  0  </u>
G	5 <u>  0  </u>	7 <u>  2  </u>	6 <u>  2  </u>	3 <u>  0  </u>	2 <u>  0  </u>	1 <u>  2  </u>	8 <u>  2  </u>	4 <u>  2  </u>
<b>TOTAL</b>	13	<b>13</b>	7	3	11	10	6	8

Once you have allocated all your points, total each column.

The highest two totals represent your primary and secondary preferred team roles.

## Member 3: Chai Yee Xuan (Teamworker)

### Scoring Key for Self-Perception Inventory

Transfer your points allocation from the seven sections of the Self Perception Inventory to the appropriate boxes below. The pre-printed numbers in the grid refer to the question numbers of each section. For example, if for Section A you scored seven points for question 6 and three points for question 1, you would allocate them in the columns RI and IMP respectively.

	SH	CO	PL	RI	ME	IMP	TW	CF
A	3 <u>0</u>	7 <u>1</u>	4 <u>0</u>	6 <u>1</u>	5 <u>1</u>	1 <u>2</u>	8 <u>3</u>	2 <u>2</u>
B	1 <u>0</u>	6 <u>2</u>	5 <u>2</u>	8 <u>2</u>	4 <u>0</u>	7 <u>2</u>	3 <u>1</u>	2 <u>1</u>
C	7 <u>0</u>	4 <u>1</u>	6 <u>1</u>	2 <u>1</u>	3 <u>1</u>	5 <u>1</u>	8 <u>3</u>	1 <u>1</u>
D	2 <u>2</u>	3 <u>3</u>	6 <u>0</u>	4 <u>4</u>	5 <u>0</u>	1 <u>1</u>	8 <u>0</u>	7 <u>0</u>
E	6 <u>4</u>	5 <u>3</u>	1 <u>0</u>	7 <u>0</u>	3 <u>2</u>	4 <u>0</u>	2 <u>1</u>	8 <u>0</u>
F	6 <u>2</u>	4 <u>1</u>	5 <u>1</u>	1 <u>1</u>	3 <u>1</u>	8 <u>1</u>	7 <u>1</u>	2 <u>2</u>
G	5 <u>1</u>	7 <u>1</u>	6 <u>1</u>	3 <u>0</u>	2 <u>1</u>	1 <u>0</u>	8 <u>5</u>	4 <u>1</u>
<b>TOTAL</b>	<b>9</b>	<b>12</b>	<b>5</b>	<b>9</b>	<b>6</b>	<b>7</b>	<b>14</b>	<b>7</b>

Once you have allocated all your points, total each column.

The highest two totals represent your primary and secondary preferred team roles.

## Member 4: Ryan Wong Sie Xu (Plant)

### Scoring Key for Self-Perception Inventory

Transfer your points allocation from the seven sections of the Self Perception Inventory to the appropriate boxes below. The pre-printed numbers in the grid refer to the question numbers of each section. For example, if for Section A you scored seven points for question 6 and three points for question 1, you would allocate them in the columns RI and IMP respectively.

	<b>SH</b>	<b>CO</b>	<b>PL</b>	<b>RI</b>	<b>ME</b>	<b>IMP</b>	<b>TW</b>	<b>CF</b>
A	3 <u>0</u>	7 <u>0</u>	4 <u>0</u>	6 <u>0</u>	5 <u>0</u>	1 <u>4</u>	8 <u>0</u>	2 <u>6</u>
B	1 <u>0</u>	6 <u>0</u>	5 <u>4</u>	8 <u>2</u>	4 <u>0</u>	7 <u>0</u>	3 <u>4</u>	2 <u>0</u>
C	7 <u>0</u>	4 <u>0</u>	6 <u>0</u>	2 <u>3</u>	3 <u>0</u>	5 <u>3</u>	8 <u>4</u>	1 <u>0</u>
D	2 <u>0</u>	3 <u>0</u>	6 <u>5</u>	4 <u>3</u>	5 <u>0</u>	1 <u>2</u>	8 <u>0</u>	7 <u>0</u>
E	6 <u>3</u>	5 <u>0</u>	1 <u>0</u>	7 <u>0</u>	3 <u>3</u>	4 <u>4</u>	2 <u>0</u>	8 <u>0</u>
F	6 <u>0</u>	4 <u>0</u>	5 <u>3</u>	1 <u>0</u>	3 <u>4</u>	8 <u>0</u>	7 <u>0</u>	2 <u>3</u>
G	5 <u>2</u>	7 <u>4</u>	6 <u>0</u>	3 <u>0</u>	2 <u>0</u>	1 <u>0</u>	8 <u>4</u>	4 <u>2</u>
<b>TOTAL</b>	5	4	<b>12</b>	8	7	13	12	11

Once you have allocated all your points, total each column.

The highest two totals represent your primary and secondary preferred team roles.