**POLITEKNIK UNGKU OMAR**

# HYDROSTATIC FORCE AND CENTRE OF PRESSURE E – CALCULATOR

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**STATEMENT OF AUTHENTICITY AND PROPRIETARY RIGHT**

# HYDROSTATIC FORCE AND CENTRE OF PRESSURE E-CALCULATOR

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Infront of me, AZMANIRA BINTI MUHAMED .....
As Project Supervisor on ……. )
AZMANIRA

**STATEMENT OF AUTHENTICITY AND PROPRIETARY RIGHT**

# HYDROSTATIC FORCE AND CENTRE OF PRESSURE E-CALCULATOR

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AZMANIRA

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| | |
|---|---|
| $FH$ | Hydrostatic Force |
| $\gamma cp$ | Center of Pressure |
| UOP | Ungku Omar Polytechnic |
| IR | Industrial Revolution |
| ICT | Information and Communications Technology |
| IOT | Internet of Things |
| AOSP | Android Open-Source Project |
| FOSS | Free and Open-Source Software |
| GMS | Google Mobile Services |
| IXX | Moment of Inertia |
| A | Area |
| $\bar{y}$ | Distance from center of gravity to the liquid surface |
| $y$ | Centroid of object |

## LIST OF APPENDICES

# ACKNOWLEDGEMENT

Initially, we express our gratitude to Allah S.W.T for providing us with all the necessary resources, strength, and patience to accomplish this study successfully. We would like to extend our deepest appreciation to all those who have contributed to the completion of our project report, " HYDROSTATIC FORCE AND CENTRE OF PRESSURE E – CALCULATOR." Throughout the preparation of this report, we have encountered numerous challenges and expectations, but we have learned from them, and the experience has been worthwhile. Our exhaustion is justified by the satisfaction of completing this report successfully.

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That is all and thank you.

# ABSTRACT

The goal of this study is to design and create a Hydrostatic Force and Centre of Pressure E-calculator utilising the Canva app and MIT App Inventor. The study's goal is to assess the efficacy of employing this calculator. The issue that the students frequently struggle with is time-consuming computations, which makes it difficult to answer problems within the allotted time. The programme intends to save students time while addressing calculation-related difficulties, allowing them to complete projects on time. This study also emphasises the usage of graphical calculators to emphasise the spatial significance of mathematical topics. Another problem statement focused on the importance of developing an appropriate study plan for university students. Machine learning methods can be used to address this issue. The fast calculator developed in this study can help in executing error-free calculations by simply inputting the given data. The application aims to serve as a comprehensive tool for calculating hydrostatic force and center of pressure on a normal surface, specifically for rectangular shapes. According to the findings, applications help students answer problems more quickly and precisely than manual ways. Based on time comparison, applications outperformed manual techniques, with just one student requiring 11 to 15 minutes to answer the tasks given using this application against five using conventional methods. Apps resulted in more accurate answers: As the result, from 42 responded replied properly using apps, just two of them got the questions wrong. Using manual approaches, 34 pupils responded correctly and 10 wrongly. Furthermore, all 44 semester 5 students preferred utilising apps to answer Hydrostatic Force problems, demonstrating great support for applications.

# ABSTRAK

Matlamat kajian ini adalah untuk mereka bentuk dan mencipta satu aplikasi berkaitan 'Hydrostatic Force and Centre of Pressure E-calculator' menggunakan 'Canva' dan perisian 'MIT App Inventor.' Matlamat kajian ini adalah untuk menilai keberkesanan penggunaan e-kalkulator ini. Salah satu isu yang sering dihadapi oleh para pelajar ialah masalah dalam pengiraan Dimana ianya mengambil masa yang agak lama untuk menyelesaikan masalah yang berkaitan dalam masa yang ditetapkan. Aplikasi ini dibangunkan selaras dengan hasrat untuk menjimatkan masa pelajar sambil menangani kesukaran berkaitan pengiraan dan membolehkan mereka menyiapkan latihan tepat pada masanya. Kajian ini juga menekankan penggunaan kalkulator grafik dalam topik matematik. Pernyataan masalah pula memberi tumpuan kepada kepentingan membangunkan rancangan pengajian yang sesuai untuk pelajar universiti. Kaedah pembelajaran mesin boleh digunakan untuk menangani isu ini. Kalkulator pantas yang dibangunkan dalam kajian ini boleh membantu dalam melaksanakan pengiraan tanpa ralat dengan hanya memasukkan data yang diberikan. Aplikasi ini bertujuan untuk berfungsi sebagai alat yang komprehensif untuk mengira daya hidrostatik dan pusat tekanan pada permukaan biasa, khususnya untuk bentuk segi empat tepat. Mengikut hasil penemuan, aplikasi ini membantu pelajar menjawab masalah dengan lebih cepat dan tepat berbanding teknik manual. Dari segi tempoh masa pula, aplikasi ini dapat mengatasi teknik manual, dengan hanya seorang pelajar memerlukan sekitar 11 hingga 15 minit untuk menjawab tugasan menggunakan aplikasi berbanding lima menggunakan kaedah konvensional. Dari segi ketepatan 42 pelajar menjawab dengan betul menggunakan aplikasi, manakala hanya dua sahaja menjawab dengan salah. Dengan menggunakan pendekatan manual, 34 murid menjawab dengan betul dan 10 salah. Tambahan pula, kesemua 44 pelajar semester 5 lebih suka menggunakan aplikasi untuk menjawab masalah Daya Hidrostatik, menunjukkan sokongan hebat untuk aplikasi.

# CHAPTER 1
# INTRODUCTION

## 1.1 Introduction

Nowadays technology is growing rapidly, which makes it easier for people in their daily lives. With the help of applications, students and lecturers were able to complete tasks and assignments a lot quicker. This final year project aims to make an alternative to solve problem and calculate the hydrostatic force on normal surface for rectangular shape.

Hydrostatic force is the force exerted by the static fluid on any object placed into it. It depends on the depth of the object from the free surface. This application can be used by students and lecturers in hydraulics subject. Also, thisapplication serves as a platform to help students in calculating the hydrostatic force on normal surfaces, especially rectangular shapes. In addition, this alternative application could also help students in their assignment about hydrostatic force to ensure that student is able to determine the right answer before submitting to lecturer. Finally, this application makes checking answers more accurate and faster. Besides that, lecturers can give marks to student assignments at a faster rate. For the formula, this application would be use is to find the hydrostatic force $FH = \rho g A \bar{y}$ and centre of pressure $\gamma cp = \frac{IXX}{(A\bar{y})+y}$.

To develop this application, MIT App Inventor is the software that would be used. With the help of the user-friendly, visual programming environment known as MIT App Inventor, even young children can create fully functional apps for tablets and smartphones. In less than thirty minutes, a novice user of MIT App Inventor can have a basic first app up and running. The design would be done in Canva.

## 1.2 Objectives

Every study has its own objectives, as well as this study. Particularly, this study has the following objectives.

1) To design Hydrostatic Force and Centre of Pressure E-calculator using Canva application.
2) To develop Hydrostatic Force and Centre of Pressure E-calculator using MIT App Inventor.
3) To evaluate the effectiveness of using Hydrostatic Force and Centre of Pressure E-calculator.

## 1.3 Problem Statement

The issue that always happens to students now is majority students always take a long time to solve the problem through calculations. As a result, they are unable to answer the question within the specified time. With this application, students can save more time in solving problems related to calculation. Students can submit the assignment have given according to the specified time that has been given from lecturer. Graphics calculators can take over time-consuming activities such as the calculation of coordinates. This leaves students more time for problem-solving activities. Students can concentrate on the necessary mathematics knowledge (for example, the concepts of equations and parameters) while the calculator executes the calculations. Using the graphics calculator makes it possible to emphasise the spatial meaning of mathematicalconcepts and methods especially in the domains of algebra, functions, and calculus [1].

Next, second problem statement is in a study done by Naresuan University, Phitsanulok 65000, Thailand, the study implies that some university students struggle with creating an effective study schedule, which can result in poor academic performance. Machine learning methods are incredibly effective methods that may be used to address this issue [2]. With this fast calculator, we would be able to solve the problem by executing the chances of error in the calculation result. Students are only required to insert the data given from the question to acquire the correct answer. This also speeds up the time required to teach the students on how to solve the equation as

the calculator would also provide the formula. Through the IOT technology, it would be much more efficient in handling the learning process of students. Creating an application that would make the learning process much faster will certainly prove the research papers to be accurate [2].

The other issue is that a lecturer must use a lot of time to check their student's assessment answer especially for complicated calculation. As a result, from this issue lecturers maybe will stress check the assessment and it involved for many students' assessment and give marks. This also can cause lecturers to be late submitting student's marks. With this application, lecturers can save time and relax more by giving marks to many students' assignments. Lecturers also can submit students' marks faster and discuss with their students about their answer. The role of the graphing calculator as a checking tool by both the students and the teacher was especially interesting in the case of the trigonometric functions. The periodicity of the trigonometric functions results in a particularly salient characteristic, namely the 'look alike' feature of the graphs of these functions. However, for periodic functions, it is the case that simple horizontal shifts of the viewing window can lead to no visible change in the appearance of the graph and this characteristic is not true for other functions [3].

Another issue arises as the students might not be able to catch up with the lecture in class. As a result, they would need to study by themselves to catch up with the class and understand the lecture. This certainly is not a new thing for students, however when we are talking about studying by yourself it is important to have a guide to make sure that the students are able to obtain the correct information or answer to the question. This application would work wonderfully for students who were studying by themselves as it would serve as a guideline or a tool for them to check whether their answer is correct or incorrect. A research paper about studying with guidelines has been developed to identify the advantages of guided instruction in studying. The paper stated that even though unguided or minimally guided instructional approaches are very common and intuitively appealing, the point is made that these approaches disregard both the structures that make up human cognitive architecture and evidence from empirical studies conducted over the past 50 years that consistently show that minimally guided instruction is less effective and efficient than instructional approaches that place a strong emphasis on guiding student learning. When learners acquire enough high previous

knowledge to give "internal" advice, the benefit of guiding starts to diminish [4].

In summary, the identified issues revolve around time management, accuracy in calculations, workload for both students and lecturers, and the effectiveness of independent study. Addressing these challenges requires a combination of technological solutions, such as graphics calculators and machine learning methods, as well as the implementation of guided instruction to enhance the overall learning experience. Therefore, the goal of this study is to create an application that not only addresses the time constraints and errors associated with manual calculations but also supports students in self-guided learning, ensuring they can confidently and accurately complete assignments within specified timeframes.

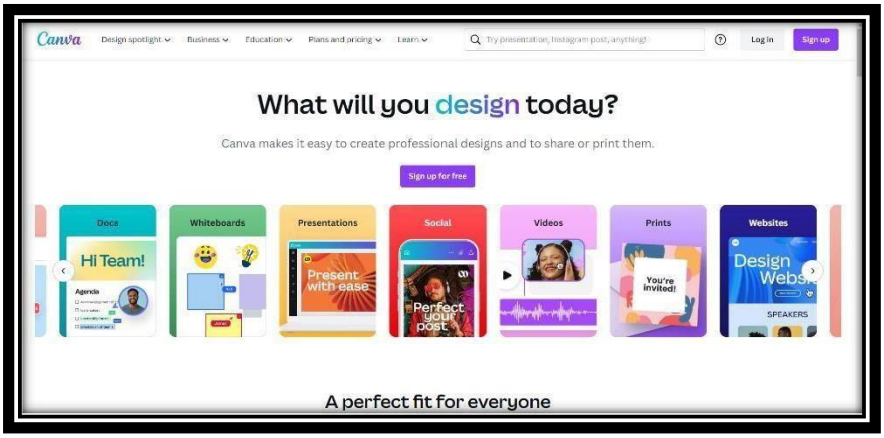
## 1.4 Project Scope

Identifying the scope of the application is important in this context to make sure that the application will fulfil the purpose. The focus of this application is to calculate the Hydrostatic Force and the Centre of Pressure for a rectangular shape object inside a liquid with normal surface only. The scopes of this application are separated into calculation, type of liquid, targeted device, platform for designing, platform for developing and the targeted audience.

For the calculation part, this application will only focus on calculating the Hydrostatic Force ($F_H$)and the Centre of Pressure ($Y_{cp}$) for the object and will not include any other calculation. The application will require you to input the data from the question such as the density of the liquid, the distance between the centroid of the object with the surface level into the calculator to determine the Hydrostatic Force for the object. While to calculate the Centre of Pressure it is required to input the area of the object, the moment of inertia for the rectangular object and the distance between the centroid of the object with the surface level into the calculator. The application will only be able to calculate the Hydrostatic Force for the rectangular shape.

The type of liquid, the density of the liquid will be determined by the user, which isthey by typing the value into the application. The value of liquid is important in making.sure, that the calculation is correct for calculating the hydrostatic forces. This

is often the first thing that students need to recognize to solve the equation for hydrostatic forces. This application can be installed for free by using the Qr code that will be provided. For this application the targeted device would be for android users only. The design process would be done on Canva. Canva provides a variety of design templates and the opportunity to create a unique and interesting design for our application. Canva is a free website for users to freely explore and express their creativity on making a design in graphical communication. Before the stage of developing, using MIT App Inventor to create the application, we used Canva as a platform to create design for the hydrostatic force calculator. Canva provides a wide choice of option to create the designtemplate for our application. By using Canva, we could create the design for our application logo, the menu screen or loading screen and the data insert box for the application. Figure 1.1 shows the canva application that we used to design this application.




Source: https://www.canva.com/

**Figure 1.0:** Canva Platform

For developing the application, we would only be using the MIT App Inventor to develop the application as it is easier to use and avoid any other complication while developing the application. MIT App Inventor is a free platform for internet users to create an app using simple and easy to understand functions for creating an application. The application could be used for android users only. The reason that we had chosen this platform to develop our app as it is easy and free to use. Using the platform,


Source:[https://learn.adafruit.com/mit-app-inventor-and-particle-io/what-is](https://learn.adafruit.com/mit-app-inventor-and-particle-io/what-is) appinventor

**Figure 1.1:** MIT App Inventor

For the targeted audience our application will only involve students who take the subject of hydraulics and lecturers who teach the subject of hydraulics. students and lecturers involved in this project is in Ungku Omar Polytechnic (UOP) only. The aim of this application is to make it easier for students and lecturer to calculate the Hydrostatic Force and centre of pressure accurately. The sample size for students would include 44 among 5$^{th}$ semester students who take the subjects hydraulic and all the lecturer who teaches the subject hydraulics. The sample size is taken from the Krejcie and Morgan Table 1970.

# CHAPTER 2
# LITERATURE REVIEW

## 2.1 Introduction

By offering a thorough analysis of the body of literature pertaining to an issue, theory, or methodology, literature review articles consolidate earlier research and enhance the body of knowledge. By delineating the objectives, methodology, and structure of the systematic review, the literature review guidecurates the most insightful and pertinent review articles. Students give an introduction of several review paper formats and demonstrate how other researchers have identified important articles by outlining general rules and procedures to follow. The article can also be found by using several websites or journals authored by professionals or researchers who have already conducted research on the topic of the project that has to be completed.

## 2.2 Previous Study

| Author | Title | What | Why | How | Finding | Suggestion |
|---|---|---|---|---|---|---|
| 1. Bai, Chunguang , et al (2020) | Industry 4.0 Technologies Assessment: A Sustainability Perspective.” *International Journal of Production Economics* | Information technologies that were disruptive and emergent gave rise to the fourth industrial revolution, or Industry 4.0. Production efficiency is rising to unprecedented heights thanks to these new technologies. | There isn't enough. direction in this area in the academic or professional literature. | It's possible that many industrial companies are unaware of these technologies ' benefits. | The present study posits that the objectives and tenets of Industry 4.0 technologies transcend traditional commercial and economic practises inside organisations, and instead have the potential to foster a more sustainable society. | present a framework for measuring sustainability that is based on the Sustainable Development Goals of the UN and includes a range of social and environmental. , and economic characteristics . |

Table 2.1: Previous Study

| | | | | | | |
|---|---|---|---|---|---|---|
| 2. Alaloul, Wesam Salah, et al (2019) | Industrial Revolution 4.0 in the Construction Industry: Challenges and Opportunities for Stakeholders. ” *Ain Shams Engineering Journal* | An extensive analysis to pinpoint the primary issues impeding the adoption of IR 4.0-related technologies in the construction sector and the long-term prospects. | There are a lot of obstacles that come from different angles that keep IR 4.0 from being implemented in the construction sector. | Although other businesses provide several benefits, the building industry is reluctant to adopt these approaches. | IR 4.0 aims to create a large, flexible manufacturing g and service network by digitising industrial processes. | comparing the developments across several industries by carrying out an exhaustive analysis |

Table 2.2: Previous Study

| | | | | | | |
|---|---|---|---|---|---|---|
| 3. Helen M. Doerr; Roxana Zangor (2000) | Creating Meaning for and with the Graphing Calculator, *Educational Studies in Mathematics*. | Explain how students and their instructor collaborated to create the meaning of a tool and how the students utilised the tool to create mathematical meaning from specific activities. | There is an absence of research on the link between instructors' usage of graphing calculators and their pedagogical practices and knowledge. | Many studies fail to include the role that teachers playin the classroom,the knowledge and proficiency that teachers have with graphing calculators, or the types of applications that teachers have for them in the teaching of mathematics. . | In a small group situation, using a calculator as a personal device might impede conversation. while the entire class benefited from its use as a shared device for mathematics instruction. | present the findings of a qualitative investigation conducted in a classroom. |

Table 2.3: Previous Study

| | | | | | | |
|---|---|---|---|---|---|---|
| 4. Mirjam G.A. oude Egbrink, Pauline Aalten, Anique B.H. de Bruin | Fostering Effective Learning Strategies in Higher Education – A Mixed-Methods Study | An intervention programme designedto raise.knowledge of, encourage contemplation n about, and promotethe application of efficient learning techniques | Recent decades of cognitive psychology research have demonstrated d that learning tactics that intentionally introduce challenges during learning. | Students tend to employ. passive, ineffectual techniques like underlining or rereading. | Students that took part in the programme demonstrated an improvement. ability to articulate the motivations behind and fundamental ideas of successful learning techniques. | created an intervention programme. With the goal of raising awareness of, encouraging contemplation on, and promoting the application of efficient learning strategies. |

Table 2.4: Previous Study

## 2.3 Industrial Revolution 4.0

Information technologies that were disruptive and emergent gave rise to the fourth industrial revolution, or Industry 4.0. Production efficiency is rising to unprecedented heights thanks to these new technologies. Additionally, they could have a significant impact on sustainable growth in the social and environmental spheres. Businesses should think about how Industry 4.0 technology might contribute to sustainability. There is not enough direction in this area in the practitioner or scholarly literature. Theuse and sustainability implications of Industry 4.0 technologies are further examined inthis study.

According to the findings, mobile technology has the biggest influence on sustainability across all industries. In the automotive, electronics, food and beverage, textile, apparel, and footwear sectors, on the other hand, mobile technology, simulation, nanotechnology, and drones have the biggest effects on sustainability. Our suggestion is to leverage Industry 4.0 technology adoption to increase sustainability impact; however, since individual technologies will vary in their effect on industry and sustainability dimensions, each technology needs to be carefully considered. When investing in these technologies, proper prioritization and advocacy should be considered [6].

## 2.4 Industrial Revolution 4.0 in Civil Engineering

The Industrial Revolution (IR) 4.0 is thought to revolve around the trends of digitization, automation, and increased use of information and communications technology (ICT). When comparing the advancements of various businesses, the construction sector is hesitant to adopt these cutting-edge technologies into its standard operating procedures, even considering the other industries' striking advancements. There are a lot of obstacles that come from different angles that keep IR 4.0 from being implemented in the construction sector. A thorough analysis is carried out to pinpoint the primary issues preventing the construction industry from implementing IR 4.0 related technologies and realising long-term prospects. After then, a survey using questionnaires was used to analyse the data that had been gathered. This study demonstrates that the crucial element influencing the What makes an implementation

successful are the technical and social aspects. Nevertheless, despite the identified crucial element, every contributing factor generated a major influence on the successful implementation [7].

## 2.5 Internet of Things (IOT)

The internet of things, or IoT, is a network of connected objects that communicates with the cloud and other IoT devices to exchange data. IoT devices, which can include consumer goods and both digital and mechanical machinery, are often embedded with technology such as sensors and software is being used by businesses across a range of industries to boost productivity, provide better customer service, make better decisions, and raise the company's worth. IoT allows data to be transferred across a network without requiring communication between people or between people and computers. An individual with an implanted cardiac monitor, a farm animal with a biochip transponder, a car with sensors built in to warn the driver of low tire pressure, or any other object can all be considered a thing on the internet of things or any other natural or man-made object with the ability to send data over a network and receive an IP address[8].

## 2.6 Internet of Things (IOT) in Civil Engineering

In recent years, there has been a lot of interest in the new technologies and IoT concepts. The goal of this technology is to increase productivity and quality across a range of industries. The Internet of Things (IoT) is about using smart devices and sensors to collect data and using actuators and embedded sensors to automate processes the data. Technology is being successfully applied in the various fields of civil engineering and has demonstrated its importance in numerous domains. The IoT's application is opening the door to more sustainable and intelligent infrastructure. The purpose of this paper is to examine the current state of IoT use in civil engineering as well as its challenges in civil engineering .it because use the technology to apply to site. IoT devices, which can include consumer goods and both digital and mechanical machinery, are often embedded with technology such as sensors and software. IoT is

being used by businesses across a range of industries to boost productivity on businesses, industry orin the sites to make best process[9].

## 2.7 Hydraulic Calculation in Civil Engineering

Understanding fluid behaviour and designing hydraulic systems are two key components of hydraulics, a foundational area of civil engineering. It is essential to many different applications, including drainage systems, hydraulic structures, wastewater treatment, and water supply. In hydraulics, mathematical formulas are vital instruments that let engineers precisely analyze and design these systems. Critical parameters like flow rates, pressure drops, and velocities can be calculated using these formulas. The Bernoulli equation, the Darcy-Weisbach equation, Manning's equation, and other formulas pertaining to pipe flow, hydraulic structures, and flow measurement are important examples. For civil engineers to make well-informed decisions during the design phase, optimize system performance, and guarantee the effective management of water resources, they must have a solid understanding of mathematics and hydraulics. Using mathematics based on fundamentals, engineers can take on challenging tasks and provide long-term solutions for hydraulic engineering projects[10].

## 2.8 MIT App Inventer on Development Application

Through the creation of mobile applications, computational thinking concepts can be taught using the MIT App Inventor online platform. Students use a visual blocks language to program the behaviour of applications they create by dragging and dropping components into a design view. This chapter covers the following topics: the background of MIT App Inventor's development, the project's goals and how they influence the system's design; and the methods MIT employs to create the platform and how computational thinking literature informs them[11].

## 2.9 Canva

With Canva which is a web-based design tool, anyone can create professional-looking images without requiring complex design knowledge thanks to its intuitive

interface because with its extensive library of templates, graphics, and design components, the platform is used by both novice and seasoned designers. Canva makes collaboration easier by allowing several people to collaborate on a creative project at once[12].

The usefulness of these collaborative capabilities for distant work and team projects has been studied in research, with an emphasis on increased workflow efficiency and communication. Several research studies have highlighted Canva's ease of use. Many people, including those who are not designers, have complimented its drag-and-drop capability, pre-designed templates, and user-friendly interface for making graphic design accessible to a broader audience. Recent research about Canva suggest that You can make art and design instructional resources with the Canva app. Three themes emerged from the research: 1) using Canva in a graphic design course; 2) using Canva to engage students with disabilities; and 3) assessing Canva from the standpoint of students with speech problems. The report also offers double strategies that other instructors in the fields of art and design may use to create virtual classrooms that encourage participation and communication among students with disabilities via the use of technological resources[12].

## 2.10 Hydrostatic Force

Hydrostatic knowledge is about fluids in a steady condition. Hydrostatic pressure is thesame as isentropic pressure in that it has the same value in all directions. This means that hydrostatic pressure is impacted by acceleration, gravity, density, and height of thefluid. Forces acting on the system are only controlled by active surface area; therefore, hydrostatic forces cannot be determined until active surface area is identified. Hydrostatic utilisation science may be found in daily activities, beginning with the construction of a dike, infusion installation, hydraulic jack, or the use of the primary tobuild a submarine[14].

## 2.11 Centre OF Pressure

In fluid mechanics, the centre of pressure is the point at which the whole pressure field pushes on a body, resulting in a force operating through it. The total force vector at the centre of pressure is computed by integrating the pressure vector field throughout the

body's surface. The resultant force and centre of pressure location have the same force and moment on the body as the original pressure field[15].

Pressure fields may occur in both static and dynamic fluid mechanics. The specification of the centre of pressure, the reference point to which the centre of pressure is referenced, and the associated force vector allow the moment formed around any location to be determined by translating from the reference point to the needed new position. The centre of pressure is usually placed on the body; but, in fluid flows, the pressure field can force such a large moment on the body that the centre of pressure is located outside the body[15].

## 2.12 Android Operating System

Android is a mobile operating system (32-bit and 64-bit) built on a modified version ofthe Linux kernel and other open-source software. It is primarily intended for touchscreen mobile devices like smartphones and tablets. Android is developed by the Open Handset Alliance, a developer consortium, however Google is principally responsible for the most frequently used version. It was introduced in November 2007, and the first commercial Android device, the HTC Dream, was released in September 2008[16].

The operating system is based on the Android Open-Source Project (AOSP), which is free and open-source software (FOSS) licenced principally under the Apache Licence. Most devices, however, run on Google's proprietary Android version, which comes pre-installed with additional proprietary closed-source software, most notably Google Mobile Services (GMS), which includes core apps such as Google Chrome, the digital distribution platform Google Play, and the Google Play Services development platform. Firebase Cloud Messaging is used to send push alerts. While AOSP is free, the "Android" name and logo are trademarks of Google, which has set regulations to prevent "uncertified" devices from using Android branding outside of its ecosystem[16].

## 2.13 Summary

A literature review is a written synthesis of important books and other sources on a particular subject. The sources for the review could be scholarly works, journal articles,government reports, websites, etc. The literature review includes a description, summary, and evaluation of each source. The literature review is summarized in the second chapter, which also covers Internet of Things (IoT) applications related to Industrial Revolution 4.0. Each issue is given more information based on the previous study. The conclusion that can be made from this chapter is the study made about the calculations in the hydraulics system. Then, Using the results of this study, an application pertaining to hydraulic system calculations may be developed. The purpose of this study was also to gain a deeper understanding of the IR4.0 and Internet of Things (IoT) technology that will be used in the upcoming project. IR 4.0 and Internet of Things (IoT) technology have been used to create a lot of technology, which has become popular among people these days because it makes everything faster and easier. Building applications that are connected to IR4.0 and the Internet of Things (IoT) can be made simpler by using MIT App Inventor.

# CHAPTER 3
# METHODOLOGY

## 3.1 Introduction

Methodology is the methodical and organized approach that directs a project or research endeavour. It includes every step of the research process, including developing the research question, choosing the study design, gathering, and evaluating data, and interpreting the findings. A clearly defined methodology guarantees the validity, reliability, and rigor of the study as well as the accuracy and significance of the findings.Additionally, it strengthens the research's credibility and makes the research process more transparent. To put it simply, methodology is the foundation of every research study and is essential to assessing the Caliber and dependability of the research findings. The phrase, however, can also apply to the approaches themselves or the philosophical analysis of their underlying presumptions. A method is a planned process used to achieve a certain objective, such as learning something new or confirming what you already know [13]. This chapter provides an explanation of the many approaches that were employed to collect and analyze data that was pertinent to the study. Research methodologies are conventionally classified into two categories: quantitative and qualitative. The primary approach used in the natural sciences is quantitative research. Precise numerical measures are employed. Typically, its objective is to identify general principles that may be applied to forecast future occurrences. The scientific method is the most widely used approach in the natural sciences. It involves actions like seeing and formulating a hypothesis. Subsequent actions include conducting an experiment to test the hypothesis, comparing the measurements to the predicted outcomes, and publishing the results [13].

## 3.2 Project Development

In the project development stage, the aim of this project is to create a fully functional application that serves as a calculator for calculating hydrostatic force and center of pressure on a liquid surface vertically. The project development plan includes planningand sketching, requirement, design, developing and testing.

## 3.3 Requirement

**Table 3.1: Requirement For This Application**

| No | Tools | Figure |
|---|---|---|
| 1 | MIT APP INVENTOR Software |   |
| 2. | Canva |   |

| | | |
|---|---|---|
| 3. | Android Phone |  |
| 4. | Laptop |  |
| 5. | Internet Service | |

## 3.4 CODING IN MIT APP INVENTOR

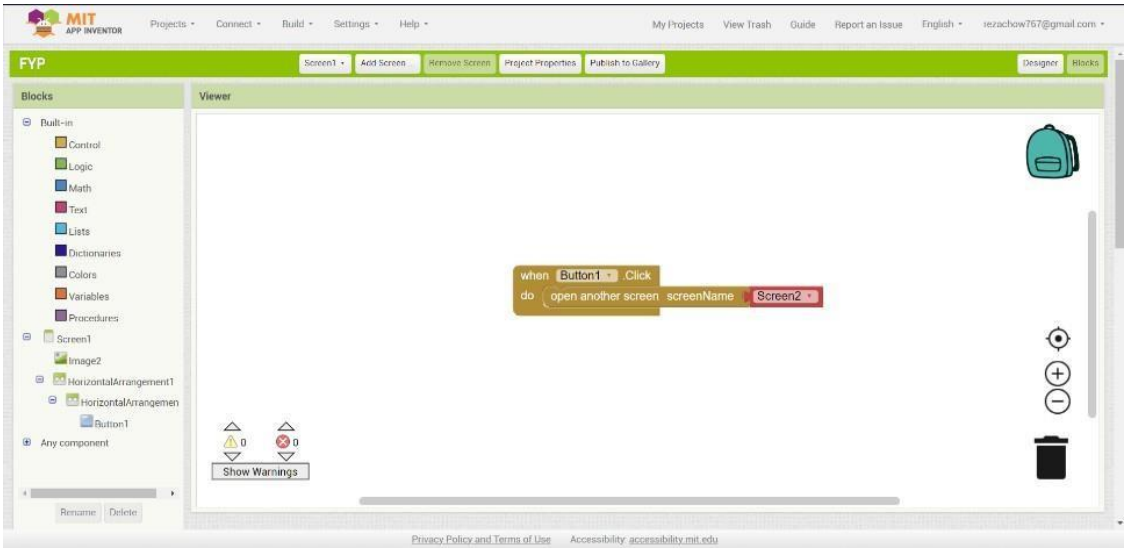



**Figure 3.0: Coding for screen 1**

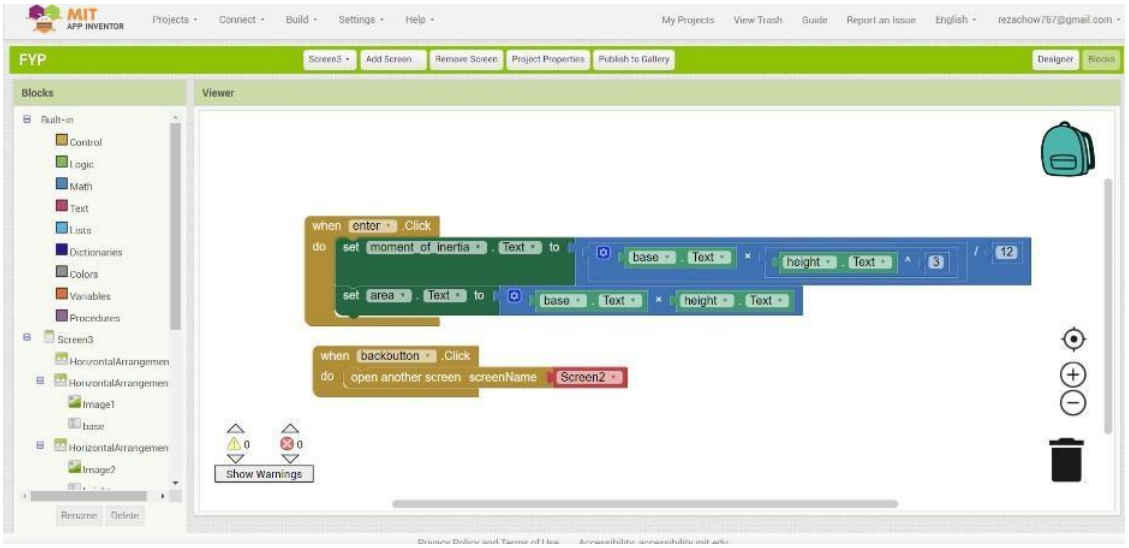



**Figure 3.1: Coding for screen 2**

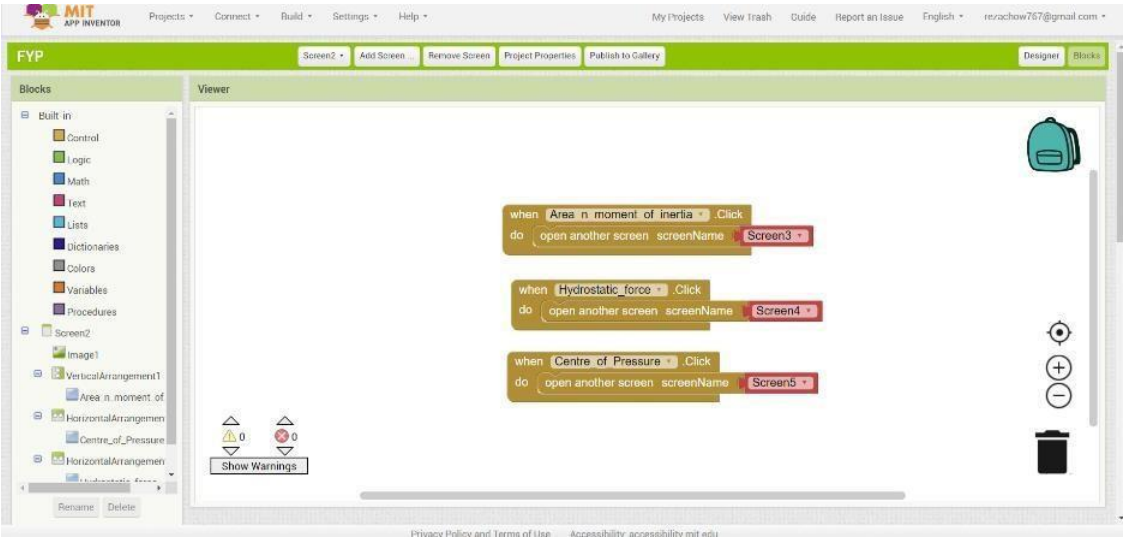


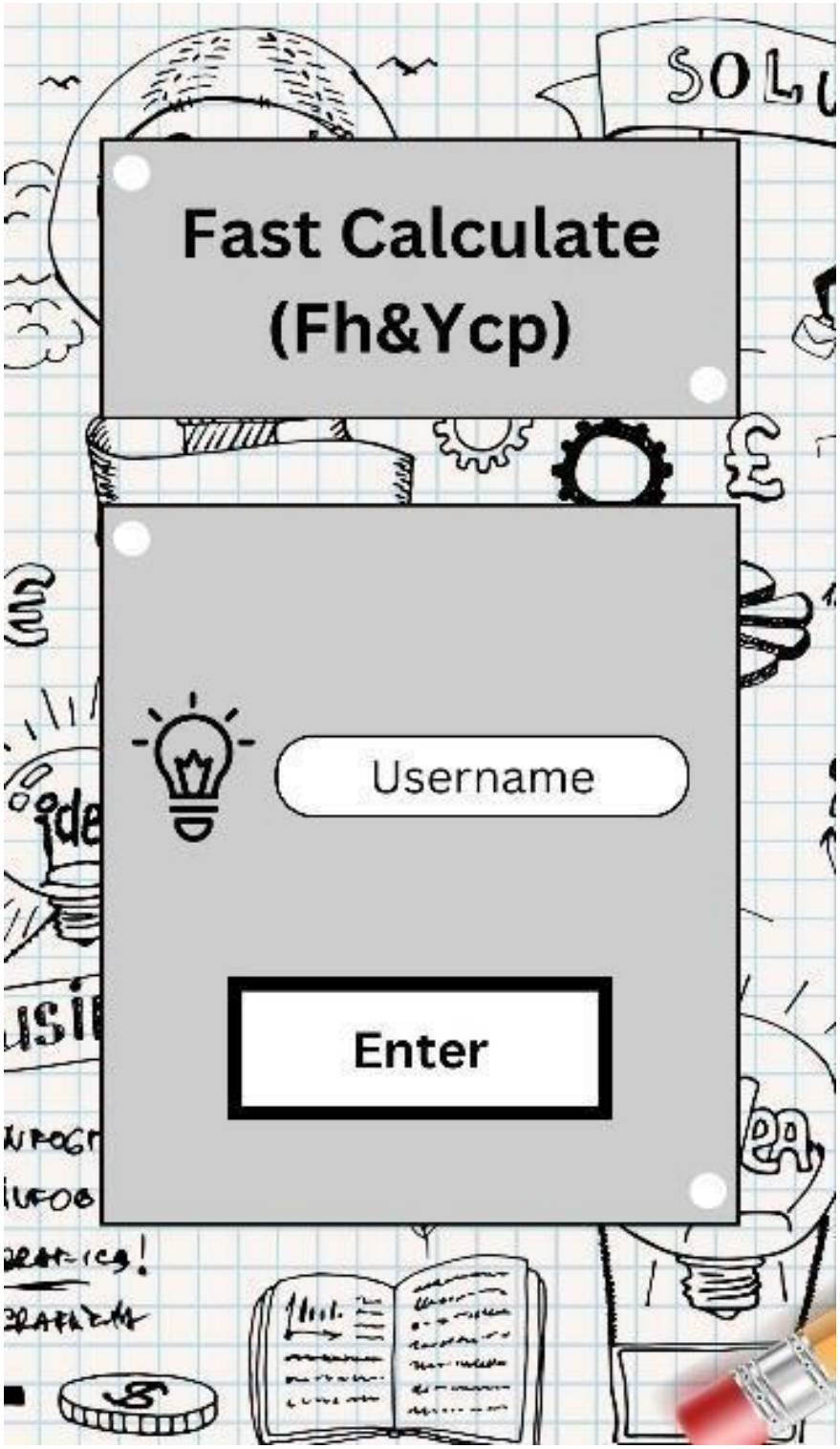

**Figure 3.2: Coding for screen 3**


**Figure 3.3: Coding for screen 4**


**Figure 3.4: Coding for screen 5**

## 3.5 Application Design

The design of the features inside the application includes select menu, front page of the application, The Hydrostatic Force calculation section, The centre of Pressure calculation section, Area calculation section, type box, enter button, next button, back button, and the text for each component inside the formula such as gravitational force,density of liquid, length, width, and y bar. All the components would be designed in Canva using the available free non copyrighted vector images on the internet for the background and the buttons. The figures below show the design that had been come up with the help of Canva as the platform for designing.




**Figures 3.5:** The design for screen 1

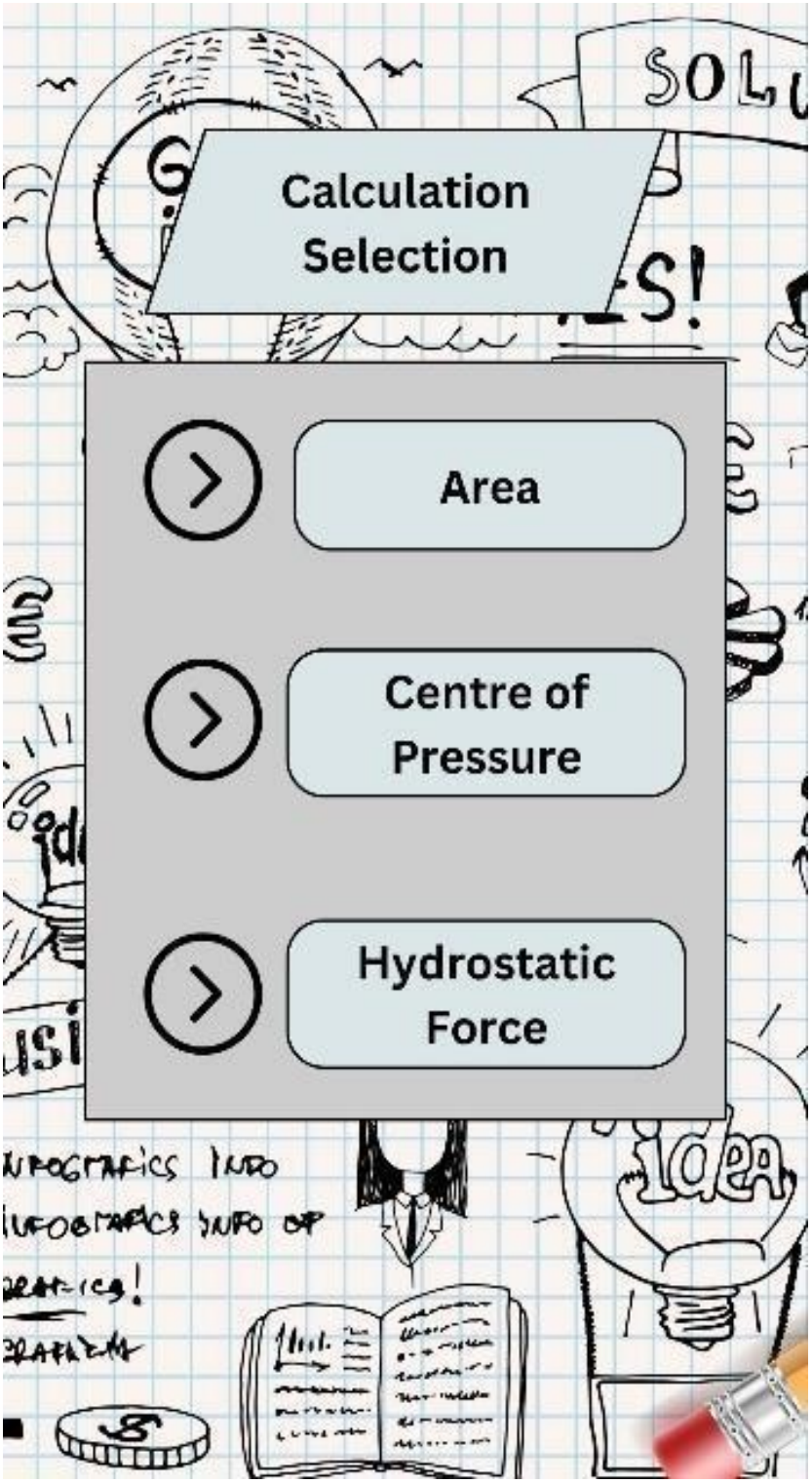



**Figure 3.6:** The design for screen 2

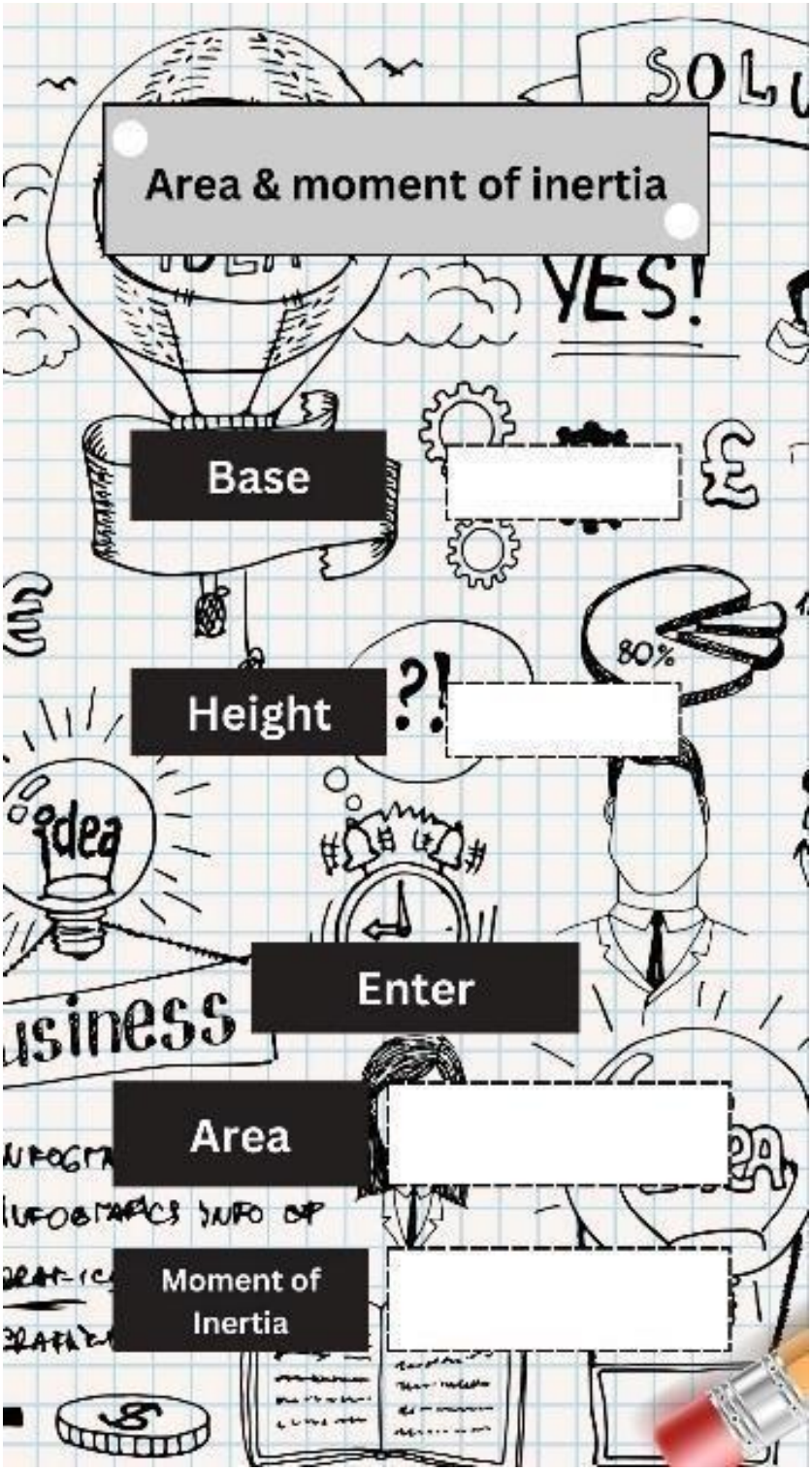



**Figure 3.7:** The design for screen 3

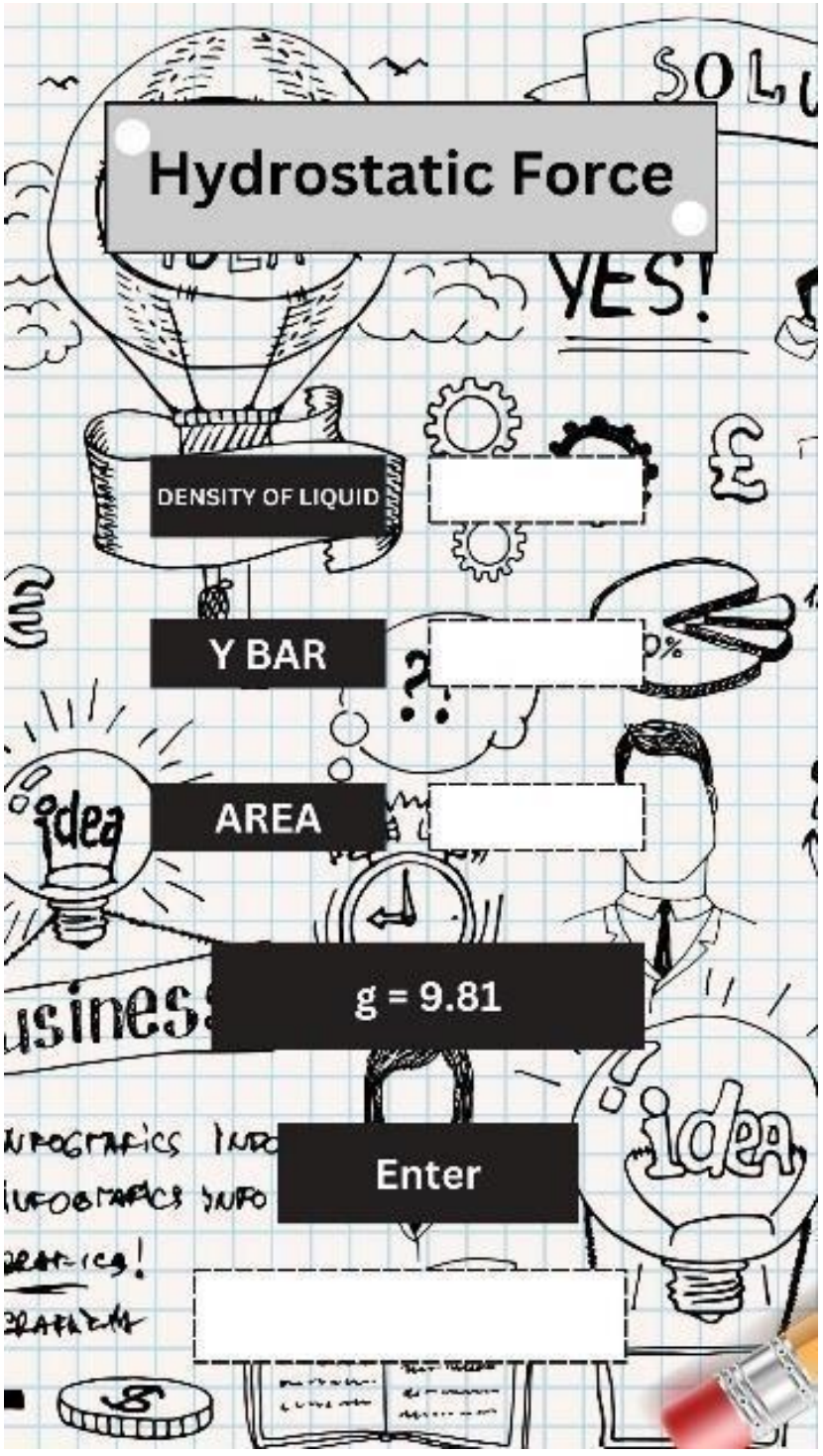



**Figure 3.8:** The design for screen 4

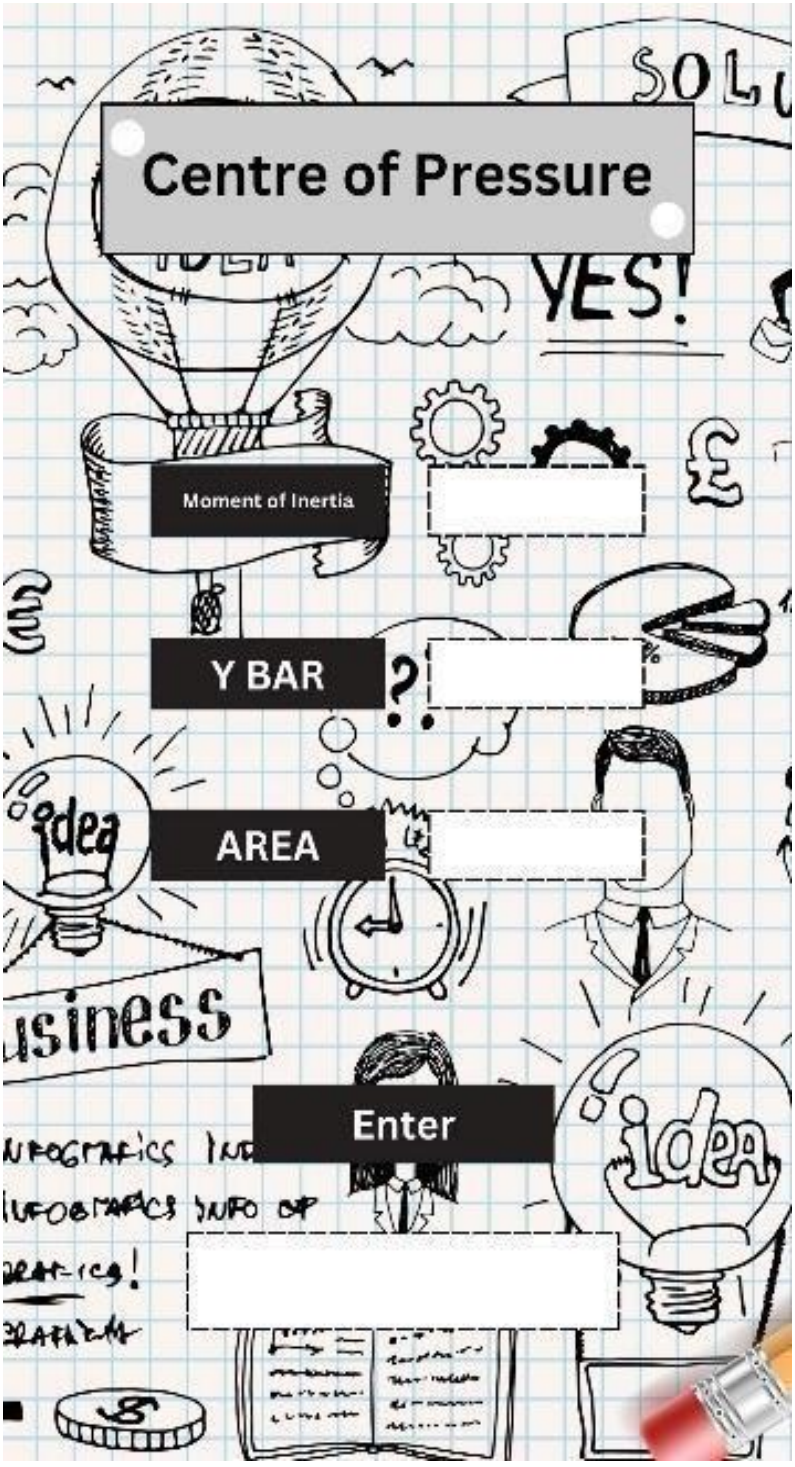
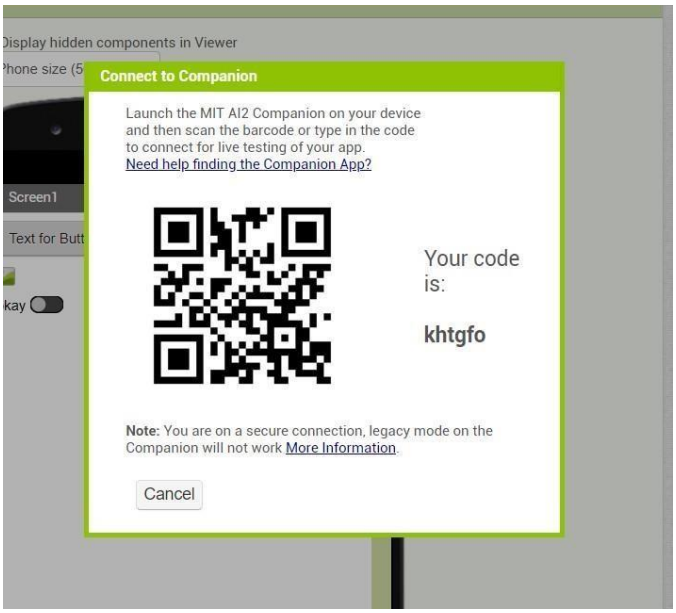



**Figure 3.9:** The design for screen 5

### 3.4 Testing The Application




Source: https://ai2.appinventor.mit.edu/

**Figure 3.10: Code for connecting to the application**.

The way to use the application, users will need to scan the Qr code to download the application from the link from the Qr code. Using the code would allow users to installthe application.

To test the functionality of this application, several questions on Hydrostatic Force and Centre of Pressure for a rectangular shape object inside a liquid with normal surface would be solve using the application.

Test the effectiveness of this application. There would be a google form that would include questions that will ask users on the effectiveness of this application in solving their problems with hydrostatic force calculations and centre of pressure calculation. Sample size would be referred from the Krejcie and Morgan Table.

# CHAPTER 4
# RESEARCH ANALYSIS & DISCUSSION

## 4.1 Introduction

The Research Analysis and Discussion chapter is the core of any academic or scientific study, where the results of thorough inquiry and analysis are presented and analysed. In this important chapter, researchers report the empirical findings of their study, based on collected data and analytical procedures. It provides a thorough assessment of the research questions or hypotheses provided at the beginning of the study, offering insighton the complexities of the examined phenomena.

In this chapter, researchers methodically document their findings, frequently using tables, graphs, and statistical analyses to create a clear and succinct picture of thedata. These findings are more than just a recital of raw data; they are synthesised and evaluated to reveal patterns, trends, and linkages inherent in the study topic.

Furthermore, the Discussion portion of this chapter provides an opportunity for researchers to dive deeper into the importance of their results. They contextualise their findings within the larger academic debate, addressing implications, limits, and prospective areas for further study. This part is critical for readers who want to comprehend the study's overall implications and addition to the current body of knowledge.

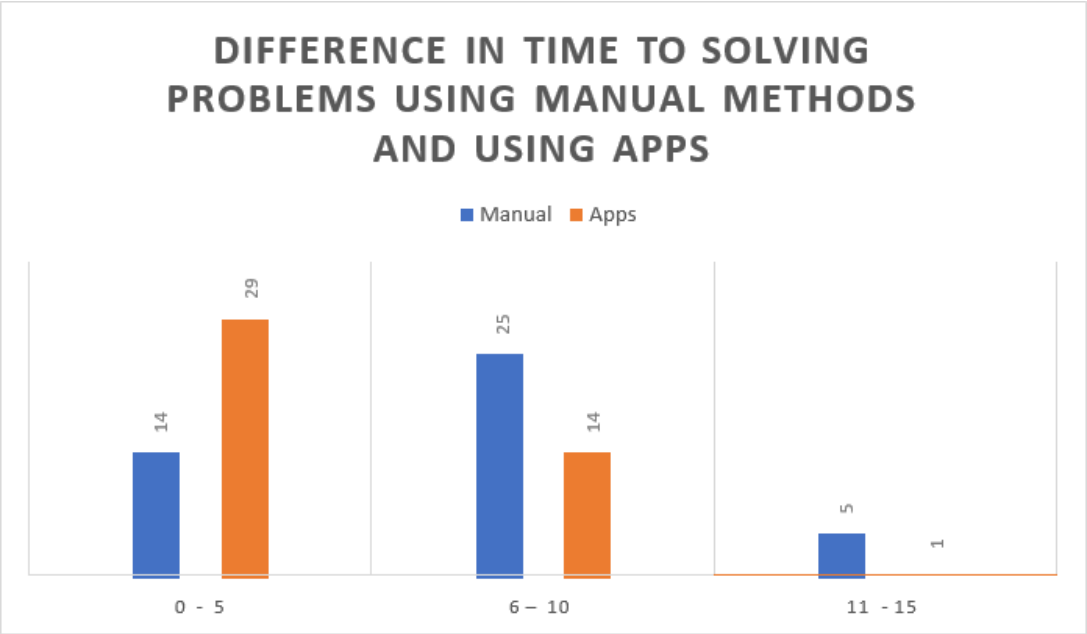
Ultimately, the Research Findings and Discussion chapter demonstrates the researcher's devotion, methodological rigour, and academic understanding. It captures the core of the research project, offering a thorough analysis that contributes to the growth of knowledge in the relevant field of study.

## 4.2 Research Analysis

Based on the table and diagram below shows the results obtained from an experiment to 44 students of the 5th semester of Ungku Omar Polytechnic (UOP) in trying to use the hydrostatic force and center of pressure E-calculator application. The experiment is done by looking at the time difference between manual calculations and calculations using the application. Table 4.1 below shows the difference in time to 44 students $5^{th}$ semester in solving problem using manual method and using apps. The number of students who can solve the problem in 0 – 5 minutes using manual method is 14 students and using apps is 29 students. Then, students can solve the problem in 6 – 10 minutes using manual method is 25 students and using apps is 14 students. The number of students can solve the problem in 11 - 15 minutes using manual method is 5 students and using apps is 1 student. Next, table 4.2 and 4.3 below shows how many students answer the question correctly and incorrectly. Table 4.2 shows the number of students who can answer the question correctly using manual method is 34 students and 10 students answer the question incorrectly. For the table 4.3 below shows the number of students who can answer the question correctly using apps is 42 students and 2 students answer the question incorrectly.

**Table 4.1**: **Difference in Time To Solving Problems Using Manual Methods and Using Apps**

| Times (min) | **Number of students** | |
|---|---|---|
| | Manual | Apps |
| 0 – 5 | 14 | 29 |
| 6 – 10 | 25 | 14 |
| 11 - 15 | 5 | 1 |

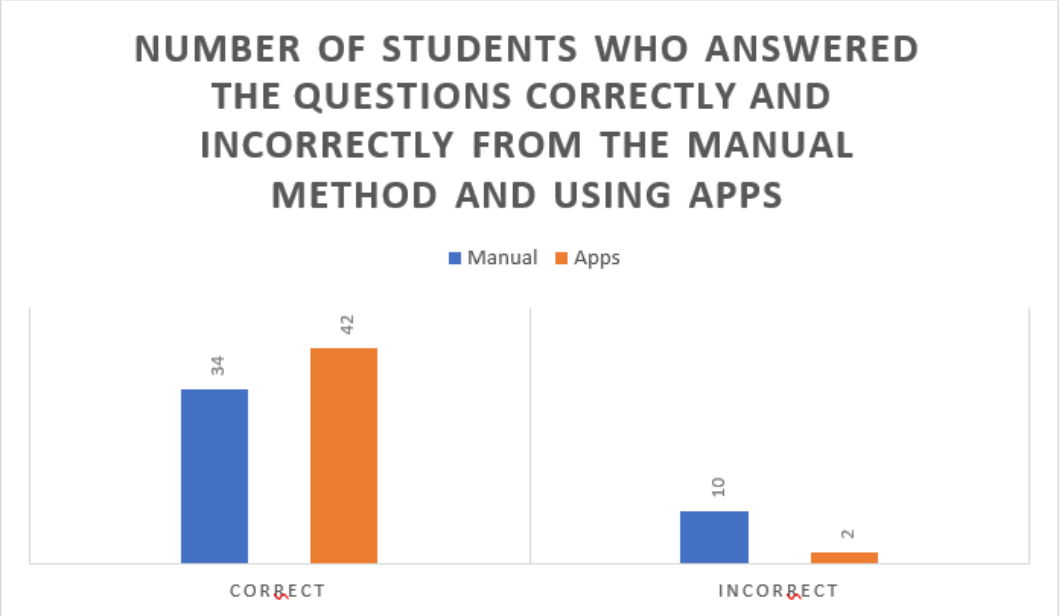



**4.2**: **Number of Students Who Answered The Questions Correctly and Incorrectly From The Manual Method.**

| Number of students | |
|---|---|
| correct | Incorrect |
| 34 | 10 |

**Table 4.3**: **Number of Students Who Answered The Questions Correctly and Incorrectly From Using Apps.**

| Number of students | |
|---|---|
| correct | Incorrect |
| 42 | 2 |




### 4.3 Discussion

The experiment conducted at Ungku Omar Polytechnic (UOP) aimed to assess the efficacy of the hydrostatic force and center of pressure E-calculator application in aiding students with problem-solving tasks compared to traditional manual methods. The results obtained from the experiment, as depicted in Tables 4.1, 4.2, and 4.3, provide valuable insights into the effectiveness of the application and its impact on students' problem-solving abilities.

**Table 4.1** outlines the time difference between manual calculations and calculations using the application among 44 students from the 5th semester. It indicates that a significant proportion of students were able to solve problems more efficiently when utilizing the application. For instance, 29 out of 44 students could solve problems within 0-5 minutes using the application, compared to only 14 students using the manual method. Similarly, for the time range of 6-10 minutes, 25 students resorted to manual calculations while only 14 students used the application. The trend continues with fewer students opting for manual calculations as the time required increases.

These findings suggest that the hydrostatic force and center of pressure E-calculator.

application substantially expedited the problem-solving process for students. The application likely streamlined complex calculations, resulting in a reduced time investment compared to manual methods. This efficiency gain is crucial, particularly in academic settings where time constraints often challenge students during assessments and examinations.

Moreover, **Tables 4.2** and **Table 4.3** provide insights into the accuracy of students' responses when using both manual methods and the application. Table 4.2 indicates that 34 out of 44 students answered questions correctly using manual calculations, with 10 students making errors. Conversely, Table 4.3 reveals a higher accuracy rate among students using the application, with 42 out of 44 students providing correct answers and only 2 students making errors.

The higher accuracy rate associated with the application suggests that it not only enhances efficiency but also improves the precision of students' problem-solving outcomes. This could be attributed to the application's ability to minimize human errors inherent in manual calculations, ensuring more reliable results.

Overall, the experiment's results underscore the benefits of integrating technology, such as the hydrostatic force and center of pressure E-calculator application, into academic settings. By facilitating faster and more accurate problem-solving, such applications have the potential to enhance students' learning experiences and academic performance. Future research could delve deeper into the specific mechanisms through which these applications impact student learning outcomes and explore strategies for optimizing their integration into educational curricula.

# CHAPTER 5
# CONCLUSION AND SUGGESTION

## 5.1 Introduction

The part at the end of a research paper, called the conclusion and discussion, brings together what the study found and talks about why it matters. This section summarizesthe main points and talks about what they mean, suggesting ideas for more research. Itsjob is to explain the findings, answer any questions, and think about what it all means for the bigger picture. The conclusion and discussion are important because they help show how valuable the research is. In this guide, we'll look at how to write a good conclusion and discussion in a way that's easy to understand.

## 5.2 Project Limitation

One major restriction is that the calculator's functionality is limited to rectangular forms exclusively, omitting various geometrical combinations that users may find in their computations. This constraint may be highly restricting for users that need to do computations using various forms, such as circles, triangles, or irregular polygons. Furthermore, the app's compatibility is confined to typical surfaces, which limits its usefulness in instances where computations must be performed on non-standard or uneven surfaces. Another disadvantage is the lack of a calculation path display, which is necessary for users to comprehend and verify the processes involved in the computing process. This lack of openness may reduce the app's instructional value and limit users'capacity to learn from the computations done. Furthermore, the application's platform compatibility is confined to Android users, eliminating those who use other operating systems like iOS. This platform limitation may limit the app's reach and accessibility, alienating many prospective users.

## 5.3 Suggestions and Recommendations

To improve the operation of the Hydrostatic Force and Centre of Pressure E-Calculator application, one key proposal is to expand the calculation choices to accommodate different forms. Currently, the application's reach may be limited to specific specified shapes, possibly omitting those seen by users in real-world circumstances. By broadening the variety of forms for which calculations can be conducted, the application becomes more adaptable and suitable to a wider range of circumstances.

This enhancement will not only increase the application's usability but would also adapt to the varying demands of users who may confront different types of situations when working or studying. For example, providing choices for irregular or bespoke forms in addition to standard geometries would considerably improve the application's functionality. This addition is consistent with the objective of providing users with a comprehensive and adaptable tool for analysing hydrostatic forces and establishing the centre of pressure, hence increasing the application's practical utility in engineering, physics, and related subjects.

## 5.4 Conclusion

In conclusion, this chapter has addressed the importance of the conclusion and discussion section in a research paper, emphasizing its role in summarizing key findings, suggesting avenues for further research, and highlighting the significance of the study. Additionally, the chapter discussed the limitations of the project, including the calculator's restriction to rectangular forms, compatibility issues with non-standard surfaces, and platform limitations to Android users. These limitations underscore the need for future development and refinement to enhance the calculator's adaptability, usefulness, and inclusivity. Furthermore, the chapter proposed suggestions for improvement, focusing on expanding calculation choices to accommodate different.

geometric forms. By broadening the variety of shapes for which calculations can be conducted, the calculator can become more adaptable and suitable for a wider range of scenarios. Ultimately, these enhancements aim to increase the calculator's practical utility in various fields such as engineering and physics.

## APPENDIX

## A. KREJCIE AND MORGAN TABLE:

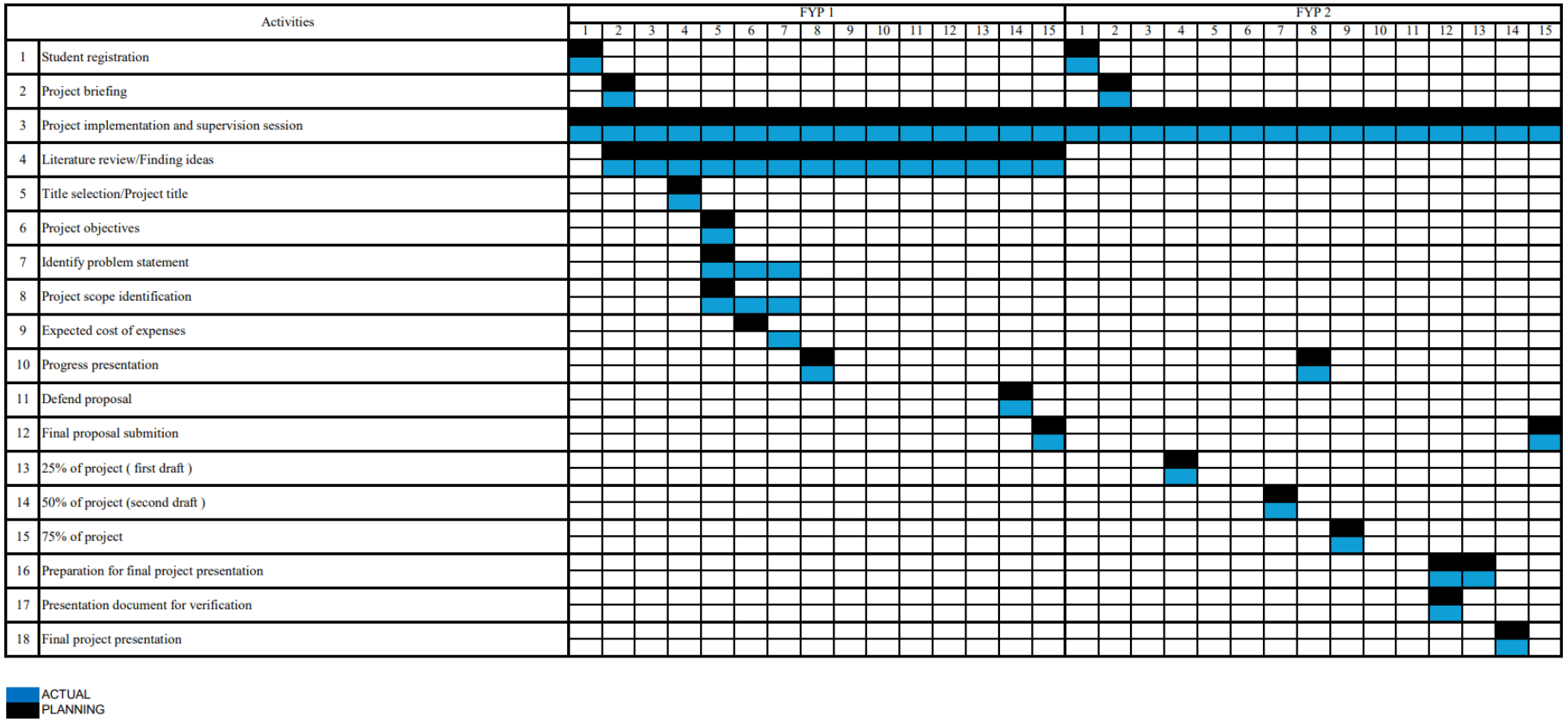
| *N* | *S* | *N* | *S* | *N* | *S* |
|---|---|---|---|---|---|
| 10 | 10 | 220 | 140 | 1200 | 291 |
| 15 | 14 | 230 | 144 | 1300 | 297 |
| 20 | 19 | 240 | 148 | 1400 | 302 |
| 25 | 24 | 250 | 152 | 1500 | 306 |
| 30 | 28 | 260 | 155 | 1600 | 310 |
| 35 | 32 | 270 | 159 | 1700 | 313 |
| 40 | 36 | 280 | 162 | 1800 | 317 |
| 45 | 40 | 290 | 165 | 1900 | 320 |
| 50 | 44 | 300 | 169 | 2000 | 322 |
| 55 | 48 | 320 | 175 | 2200 | 327 |
| 60 | 52 | 340 | 181 | 2400 | 331 |
| 65 | 56 | 360 | 186 | 2600 | 335 |
| 70 | 59 | 380 | 191 | 2800 | 338 |
| 75 | 63 | 400 | 196 | 3000 | 341 |
| 80 | 66 | 420 | 201 | 3500 | 346 |
| 85 | 70 | 440 | 205 | 4000 | 351 |
| 90 | 73 | 460 | 210 | 4500 | 354 |
| 95 | 76 | 480 | 214 | 5000 | 357 |
| 100 | 80 | 500 | 217 | 6000 | 361 |
| 110 | 86 | 550 | 226 | 7000 | 364 |
| 120 | 92 | 600 | 234 | 8000 | 367 |
| 130 | 97 | 650 | 242 | 9000 | 368 |
| 140 | 103 | 700 | 248 | 10000 | 370 |
| 150 | 108 | 750 | 254 | 15000 | 375 |
| 160 | 113 | 800 | 260 | 20000 | 377 |
| 170 | 118 | 850 | 265 | 30000 | 379 |
| 180 | 123 | 900 | 269 | 40000 | 380 |
| 190 | 127 | 950 | 274 | 50000 | 381 |
| 200 | 132 | 1000 | 278 | 75000 | 382 |
| 210 | 136 | 1100 | 285 | 1000000 | 384 |

Note.—*N* is population size. *S* is sample size.

Source: Krejcie & Morgan, 1970

## B. GANTT CHART

Gantt Chart ( FYP 1 and FYP 2 )



Gantt Chart (FYP 1)

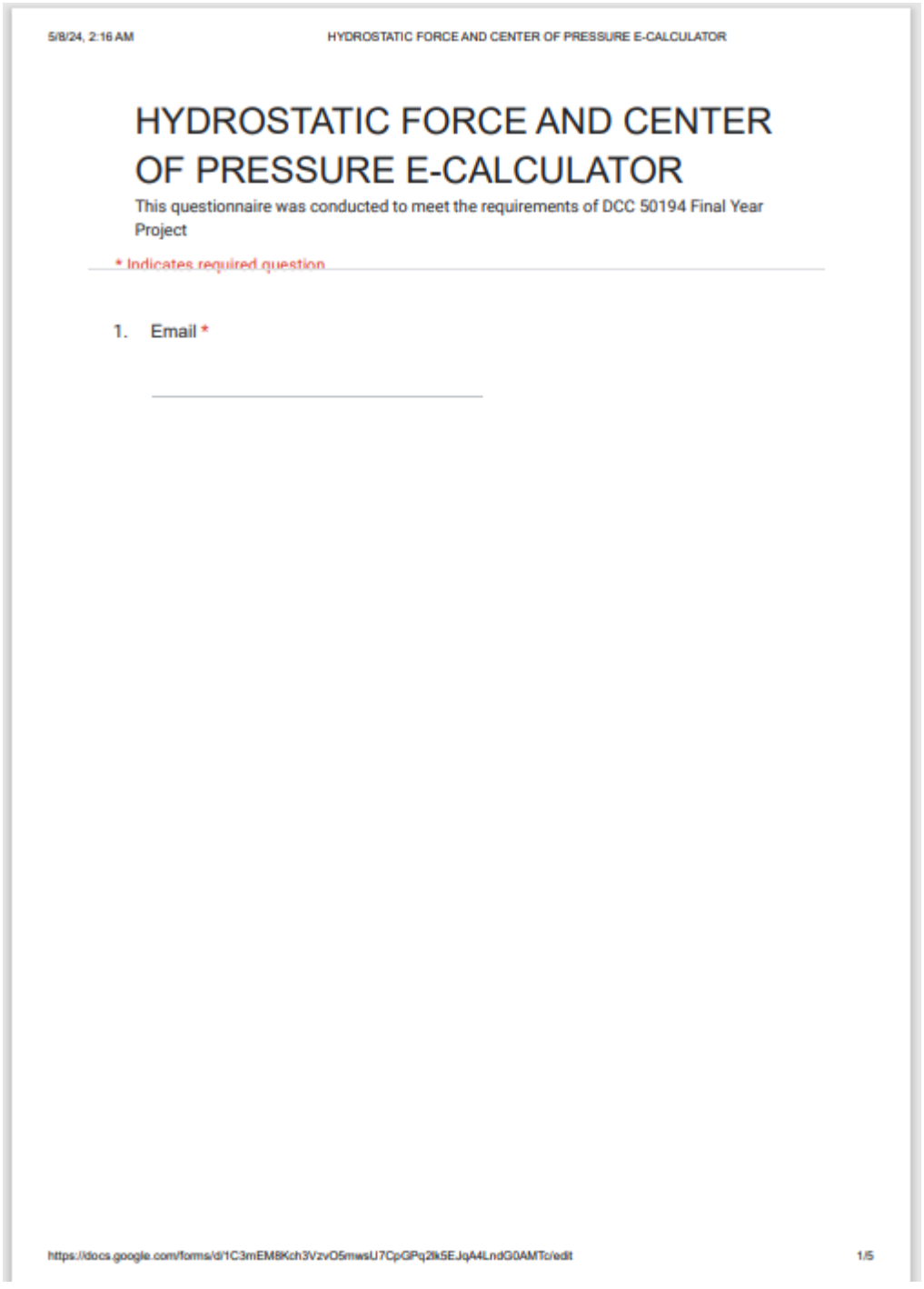
| Activities | | Week | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 1 | Student registration | | | | | | | | | | | | | | | |
| 2 | Project briefing 1 | | | | | | | | | | | | | | | |
| 3 | Project implementation and supervision session | | | | | | | | | | | | | | | |
| 4 | Literature review/Finding ideas | | | | | | | | | | | | | | | |
| 5 | Title selection/Project title | | | | | | | | | | | | | | | |
| 6 | Project Objectives | | | | | | | | | | | | | | | |
| 7 | Identify problem statement | | | | | | | | | | | | | | | |
| 8 | Project scope identification | | | | | | | | | | | | | | | |
| 9 | Expected Cost of expenses | | | | | | | | | | | | | | | |
| 10 | Progress Presentation | | | | | | | | | | | | | | | |
| 11 | Defend Proposal | | | | | | | | | | | | | | | |
| 12 | Final proposal submition | | | | | | | | | | | | | | | |

Gantt Chart (FYP 1)

| | Activities | Weeks (FYP 2) | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
| 1 | Student registration | | | | | | | | | | | | | | | |
| 2 | Project briefing 2 | | | | | | | | | | | | | | | |
| 3 | Project implementation and supervision session | | | | | | | | | | | | | | | |
| 4 | 25% of project (first draft) | | | | | | | | | | | | | | | |
| 5 | 50% of project (second draft) | | | | | | | | | | | | | | | |
| 6 | 75% of project | | | | | | | | | | | | | | | |
| 7 | Progress presentation | | | | | | | | | | | | | | | |
| 8 | Preparation for final project presentation | | | | | | | | | | | | | | | |
| 9 | Submit presentation documents for verification | | | | | | | | | | | | | | | |
| 10 | Final project presentation | | | | | | | | | | | | | | | |
| 11 | Final proposal submition | | | | | | | | | | | | | | | |

Gantt Chart (FYP 2)

## C. QUESTIONNAIRES



5/8/24, 2:16 AM HYDROSTATIC FORCE AND CENTER OF PRESSURE E-CALCULATOR

# HYDROSTATIC FORCE AND CENTER OF PRESSURE E-CALCULATOR

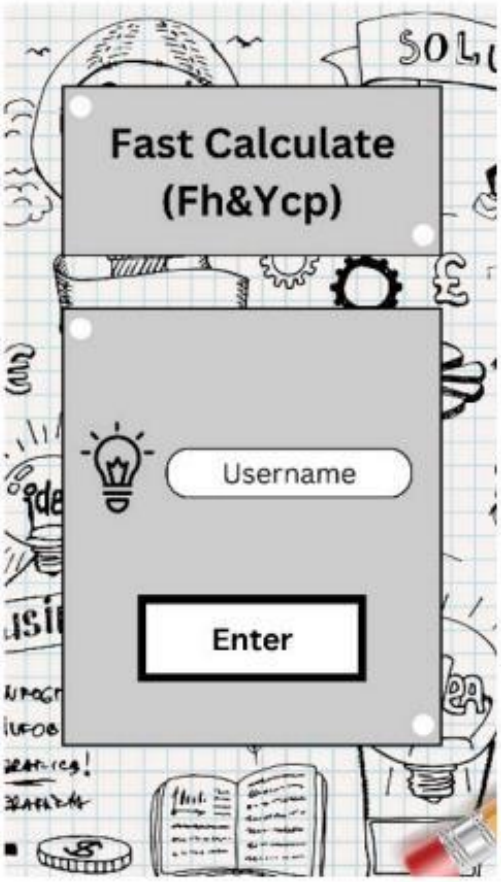
This questionnaire was conducted to meet the requirements of DCC 50194 Final Year Project

* Indicates required question

1. Email *

https://docs.google.com/forms/d/1C3mEM8Kch3VzvO5mwsU7CpGPq2lk5EJqA4LndG0AMTc/edit 1/5

# HYDROSTATIC FORCE AND CENTER OF PRESSURE E-CALCULATOR




**SECTION A**
Answer all the question

2. **NAME** *

3. **AGE** *

*Mark only one oval.*

- ◯ Under 20
- ◯ 20 and above

4. **GENDER** *

*Mark only one oval.*

- ◯ Male
- ◯ Female

**SECTION B**

Answer all the question

5. Do you ever heard about Hydraulics Calculator App ? *

*Mark only one oval.*

- ◯ Yes
- ◯ No

6. Do you have used a Hydraulics Calculator App before ? *

*Mark only one oval.*

- ◯ Yes
- ◯ No

7. Does this application help you in solving problems ? *

*Mark only one oval.*

- ◯ Yes
- ◯ No

8. In your opinion, is this application user-friendly and interesting ? *

*Mark only one oval.*

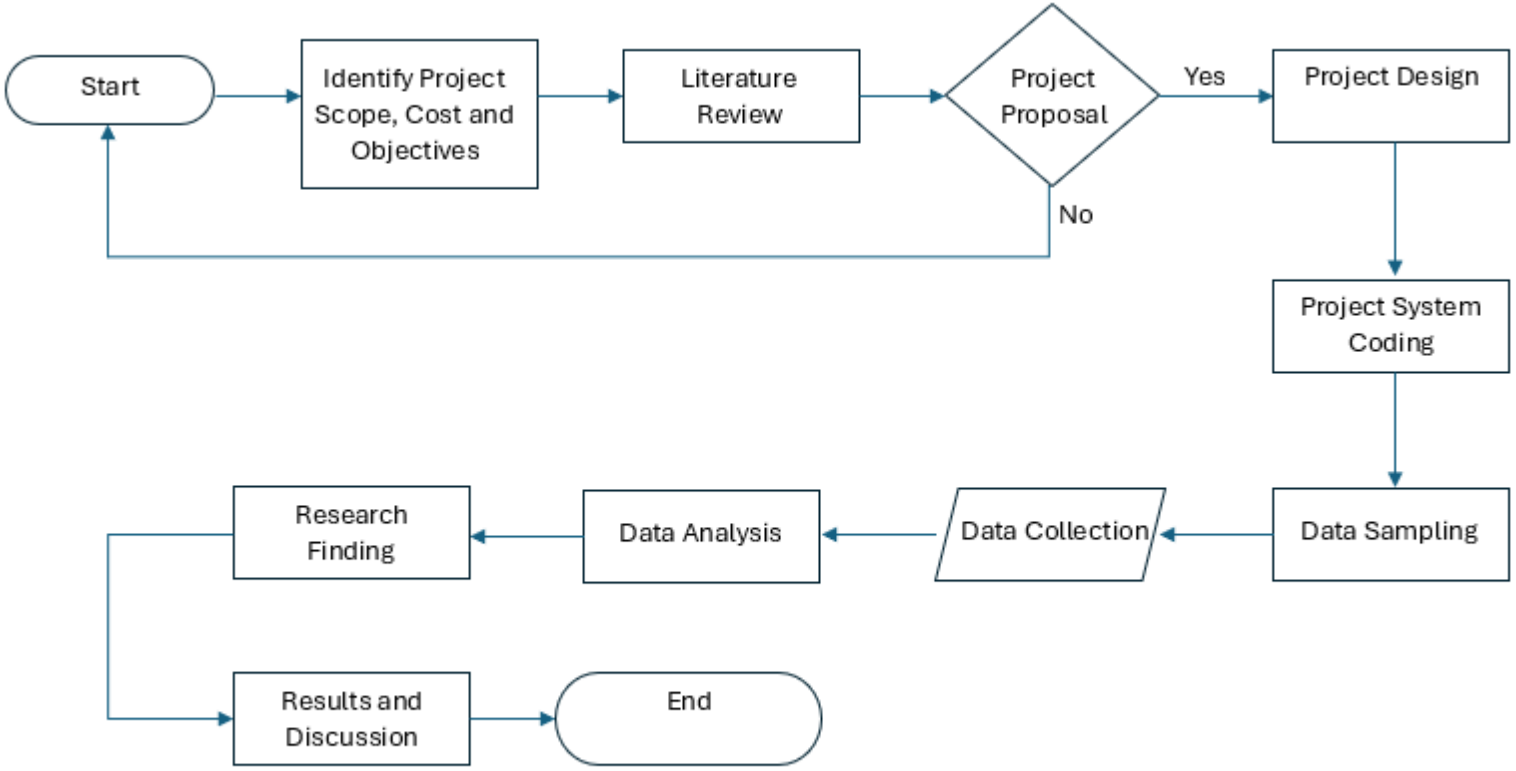
- ◯ Yes
- ◯ No

9. In your opinion, can this application help students who are weak in the subject of hydraulics ? *

*Mark only one oval.*

- ◯ Yes
- ◯ No

## D METHODOLOGY FLOW CHART



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**PARTS & DIVISION OF STUDENT'S INDIVIDUAL WRITING OF THE CHAPTERS IN FINAL REPORT (FYP 2):**

| | PARTS/DIVISION | STUDENTS NAME | MATRIC NUMBER |
|---|---|---|---|
| 1 | 1.1 Introduction | IKRAM BIN ISMAIL | 01DKA21F1022 |
| | | MUHAMMAD REZA BIN AHMAD CHOW | 01DKA21F1011 |
| | 1.2 Objective(s) | IKRAM BIN ISMAIL | 01DKA21F1022 |
| | | MUHAMMAD REZA BIN AHMAD CHOW | 01DKA21F1011 |
| | .3 Problem statement | IKRAM BIN ISMAIL | 01DKA21F1022 |
| | | MUHAMMAD REZA BIN AHMAD CHOW | 01DKA21F1011 |
| | 1.4 Scope of study/project | IKRAM BIN ISMAIL | 01DKA21F1022 |
| | | MUHAMMAD REZA BIN AHMAD CHOW | 01DKA21F1011 |
| 2 ature Review | 2.1 Introduction | MUHAMMAD REZA BIN AHMAD CHOW | 01DKA21F1011 |
| | 2.2 Previous Study | IKRAM BIN ISMAIL | 01DKA21F1022 |
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| | 2.3 Industrial Revolution 4.0 | IKRAM BIN ISMAIL | 01DKA21F1022 |
| | 2.4 Industrial Revolution 4.0 in Civil Engineering | IKRAM BIN ISMAIL | 01DKA21F1022 |
| | 2.5 Internet of Things (IOT) | MUHAMMAD REZA BIN AHMAD CHOW | 01DKA21F1011 |
| | 2.6 Internet of Things (IOT) in Civil Engineering | MUHAMMAD REZA BIN AHMAD CHOW | 01DKA21F1011 |
| | 2.7 Hydraulic Calculation in Civil Engineering | IKRAM BIN ISMAIL | 01DKA21F1022 |
| | MIT App Inventor on Development Application | MUHAMMAD REZA BIN AHMAD CHOW | 01DKA21F1011 |
| | 2.9 Canva | IKRAM BIN ISMAIL | 01DKA21F1022 |
| | 2.10 Hydrostatic Force | MUHAMMAD REZA BIN AHMAD CHOW | |
| | 2.11 Centre of Pressure | IKRAM BIN ISMAIL | 01DKA21F1022 |
| | 2.12 Android Operating System | MUHAMMAD REZA BIN AHMAD CHOW | 01DKA21F1011 |
| | 2.13 Summary | MUHAMMAD REZA BIN AHMAD CHOW | 01DKA21F1011 |
| 3 ethodology | 3.1 Introduction | IKRAM BIN ISMAIL | 01DKA21F1022 |
| | 3.2 Project Development | MUHAMMAD REZA BIN AHMAD CHOW | 01DKA21F1011 |
| | 3.3 Requirement | IKRAM BIN ISMAIL | 01DKA21F1022 |
| | 3.4 Coding in MIT App Inventor | MUHAMMAD REZA BIN AHMAD CHOW | 01DKA21F1011 |
| | 3.5 Application Design | IKRAM BIN ISMAIL | 01DKA21F1022 |

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| | **3.6 Testing the Application** | MUHAMMAD REZA BIN AHMAD CHOW | 01DKA21F1011 |
| **4 lysis & Discussion** | **4.1 Introduction** | MUHAMMAD REZA BIN AHMAD CHOW | 01DKA21F1011 |
| | **Research Analysis** | IKRAM BIN ISMAIL | 01DKA21F1022 |
| | **4.3 Discussions** | IKRAM BIN ISMAIL | 01DKA21F1022 |
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| **5 n and Suggestions** | **5.1 Introduction** | IKRAM BIN ISMAIL | 01DKA21F1022 |
| | **5.2 Project Limitation** | MUHAMMAD REZA BIN AHMAD CHOW | 01DKA21F1011 |
| | **5.3 Suggestions** | MUHAMMAD REZA BIN AHMAD CHOW | 01DKA21F1011 |
| | **5.4 Conclusion** | IKRAM BIN ISMAIL | 01DKA21F1022 |
| **d Sources** | | IKRAM BIN ISMAIL | 01DKA21F1022 |
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