POLITEKNIK UNGKU OMAR

DUMP TRUCK MANAGEMENT FOR EARTHWORK

MOHAMAD KHAIRUL BIN ABD KADIR

(01BCT201F3019)

CIVIL ENGINEERING DEPARTMENT

SESSION 2 2022/2023

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A project report/thesis submitted in partial fulfillment of the requirement for the award of the Bachelor of Civil Engineering Technology with Honours

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STATEMENT OF AUTHENTICITY AND PROPRIETARY RIGHTS

DUMPTRUCK MANAGEMENT FOR EARTHWORK

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ABSTRACT

Earthmoving equipment is a heavy-duty vehicle designed for construction operations involving earthworks. A garbage truck, also known as a dumper truck, is used to pick up garbage such as sand, gravel, or demolition waste for construction. Lack of equipment maintenance planning and delays in reporting diesel usage will cause delays in completing earthworks. Thus, the objective of this study is to develop the application of Dump Truck Management using Xampp and to determine the effectiveness of these applications. The diesel consumption and unexpected damage to the machine can be identified in terms of time and cost. By using current technology, such as Dump Truck Management applications, the delay caused by dump trucks can be reduced, and diesel can be purchased prior to the deadline. So, this Dump Truck Management application is effective for use in the construction industry, especially earthwork.

Keywords: *Earthworks, diesel consumption, delay, dumptruck management*

ABSTRAK

Peralatan bergerak bumi adalah kenderaan tugas berat yang direka untuk operasi pembinaan yang melibatkan kerja tanah. Sebuah trak sampah, juga dikenali sebagai trak dumper, digunakan untuk mengambil sampah seperti pasir, kerikil, atau sisa pembongkaran untuk pembinaan. Kekurangan perancangan penyelenggaraan peralatan dan kelewatan dalam melaporkan penggunaan diesel akan menyebabkan kelewatan dalam menyelesaikan kerja tanah. Oleh itu, objektif kajian ini adalah untuk mengembangkan aplikasi Dump Truck Management menggunakan Xampp dan untuk menentukan keberkesanan aplikasi ini. Penggunaan diesel dan kerosakan mesin yang tidak dijangka dapat dikenal pasti dari segi masa dan kos. Dengan menggunakan teknologi semasa, seperti aplikasi Dump Truck Management, kelewatan yang disebabkan oleh trak pembuangan dapat dikurangkan, dan diesel dapat dibeli sebelum tarikh akhir. Oleh itu, aplikasi Dump Truck Management ini berkesan untuk digunakan dalam industri pembinaan, terutamanya kerja tanah.

Kata Kunci: Kerja Tanah, penggunaan diesel, kelewatan, pengurusan trak dumper

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INTRODUCTION

1.0 INTRODUCTION

One of the sectors that is crucial to the growth and improvement of an economy as well as the development of a nation is the construction business. General construction and specialized trade work are the two main segments of the Malaysian building sector. Building construction (both residential and commercial construction) and civil engineering construction make up general construction (sewers, roads, highways, bridges and tunnels). Malaysia has several successful projects, including Mass Rapid Transit (MRT), Kereta api Tanah Melayu (KTM), and many more. Construction industry and private sector has assumed the important role in generating wealth and improving the quality of life through the government's socio-economic policies into social and economic infrastructures and buildings. (Robby Dwikojuliardi, 2015)

Earthwork is the processes whereby the surface of the earth is excavated and transported to and compacted at another location. A good understanding of earthworks design and construction enables the delivery of successful projects and avoidance of costly problems. (Paul Nowak, 2015). Site clearing, cutting and excavation, transport and relocating, compaction and slope are all included in the scope of earthworks. Numerous powerful machineries are used in all of these tasks to complete the work. The Earthworks activity includes the construction of earthworks for all types of transport infrastructure and associated facilities, such as road and motorway infrastructure, railway infrastructure including high-speed lines and Harbor and airport facilities.

Enhancing load bearing capacity, managing shrinkage and swelling, and reducing or improving permeability are the goals and objectives of earthwork activities. When suitable building techniques are followed, intended outcomes are efficiently attained. Densification of a soil by compaction may decrease permeability, decrease compressibility,

and enhance shear strength. The soils at certain project sites may need to be treated with chemicals in order to satisfy these design objectives (cement or lime). A clay soil's plasticity index will decrease when lime is added. An efficient way to improve soft conditions is to treat sandy or silt soils with cement. Even modest amounts of cement can decrease a soil's flexibility and improve its bearing capacity.

1.2 PROBLEM STATEMENT

Earthmoving equipment is heavy equipment, typically heavy-duty vehicles designed for construction operations which involve earthworks. They are used for a wide range of earthworks including laying foundations, grading soil, removing dirt and rocks, digging trenches, demolition works. Earthmoving equipment may also be referred to as excavator, bulldozer, compacter, lorry and many more. Excavators are among the crucial equipment used in earthwork. This excavator is used for cutting hills, sloping on the hills, and excavating soft soil in the treatment area.

In this research, the focus is only on the maintenance of the 47-tonne dump truck due to all the maintenance being done at the workshop site only. The brand name of the dump truck is Sinotruck 47 tons. Corrective maintenance and preventive maintenance all done by workshop site. Corrective maintenance is to bring systems back to regular operation as quickly as possible. (ToolSense, 2022) Preventive maintenance seeks out and repairs more minor issues and decreases the occurrence of major repairs. (ToolSense, 2022) Other machines, such as a bulldozer, excavator, and compactor, are serviced by the branch. Maintenance according to mileage is done randomly, and if it breaks down suddenly, the machine branch will do maintenance directly on site.

Maintenance is required for equipment because the efficiency and quality of production is reduced over time and the machines may fail more often. (Xh. Mehmeti, 2018). Because of poor management, all of the machines are not well maintained. Lack of planning and inadequate repairs to the machineries led to delays on the job site. As an example of a delay at the site, the truck needs to go out to do services during working hours. This will cause delays on the job site, such as filling works, moving rotten soil, and so on.

Machine inspection refers to scheduled, purposeful, proactive equipment checks that are carefully designed to identify possible issues and forecast necessary maintenance needs. (Jong-Jang Lin, 2015). Costs increase due to not keeping records on equipment, services and maintenances of the machineries. The main contractor's machinery inspection is another factor in rising expenses. A lot of paper was used in the inspection, and the employee saved it all. The inspection form will be misplaced and improperly documented by the site clerk as a result of this activity.

One of the issues at the site also involves the usage of diesel. Sending the diesel consumption form beyond the deadline will cause the fuel to arrive after it should, which will slow down operations. The focused site for the diesel issues is the East-Coast Railway (ECRL) earthwork site from Chainage 288 to Chainage 302 in Gebeng, Kuantan. The length of this site is 14 km, and there are two zones, namely Zone 2 and Zone 3.

1.3 OBJECTIVES

This study particular goals are as follows:

i. To identify management of machineries at study area.
ii. To develop the application of dumptruck management system using Xampp.
iii. To determine the effectiveness of the Dump Truck Management application.

1.4 SCOPE OF STUDY

The study's scope is at the earthwork site of the CCCC-ECRL project, which is to construct an earthwork for a railway track. As shows in figure 1 site length is from chainage 287-300 until chainage 304-100. It covers all the earthwork job which is Replace and Refill (RNR) treatment, Deep Soil Mixing (DSM) treatment, slopping and site clearing. In this research, the focus is only on the maintenance of the 47-tonne dump truck due to all the maintenance being done at the workshop site only. The brand name of the dump truck is Sinotruck 47 tons. This study also focuses on maintenance management for dumptruck and diesel consumption.

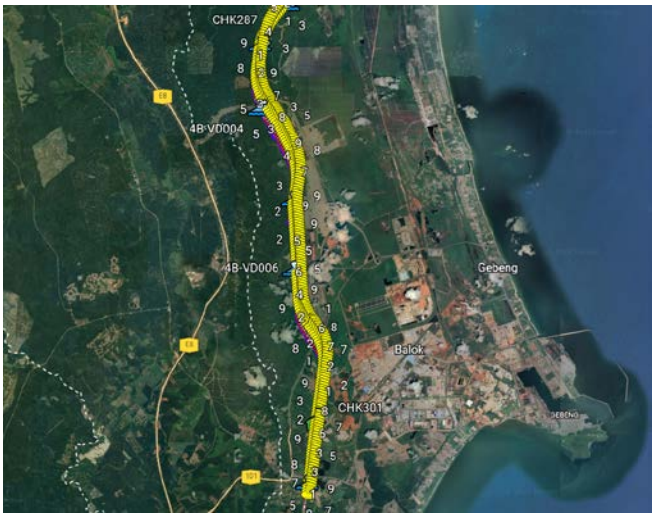


Figure 1: View on google earth ECRL project from chainage 287-300 until chainage 304-100

CHAPTER 2

LITERATURE REVIEW

2.1 BACKGROUND OF STUDY

The general practises in the building industry have seen a substantial change over the past two decades, moving from manual to computer-supported methodologies for knowledge processing. The concepts and theories of continuous learning will be the main topic of this chapter. Additionally, background data on project monitoring technology will be included in this chapter. For the purpose of generating writing of the highest calibre, appropriate information must be gathered. The material is provided in both print and electronic formats. Electronic media sources include websites on the internet, whereas print media sources include books, journals, articles, reports, and news on current events. Additionally, technological growth has a significant influence on a country's capacity to lead the developed world.

2.2 CONSTRUCTION EARTHWORK IN MALAYSIA

Earthwork is an important engineering work for construction. It may even start working before a project is launched. Land clearance is required to flatten the land and make it easy for heavy machinery to enter and exit. The initial phase in clearing the land for the project site is often demolishing the terrain and any buildings, but in order to do so effectively and securely, the clearing process must be well-planned and adhere to a timetable. Soil erosion is a common occurrence on construction sites without adequate planning, and it is important to prevent accidents like this from the outset of the planning process to prevent resource loss and potential fatalities. Once the site has been cleared, the garbage and debris will be taken to a large dumpster so that any potential for recycling the rubbish may be explored. Other relevant civil services offered by an earthwork contractor include trench construction for drainage and cable runs, underground excavation for subway and other pipe connections, etc.

2.2.1 EARTHWORK SERVICES

Work in the earth is tiresome and untidy. It includes all types of excavation, including topsoil, earth, rock, and muck excavations, among others. In order to build a building on the soil, the excavation would also involve cleaning the soil beneath the surface. Its primary uses include stripping, digging roads, building drainage systems, building bridges, digging channels, digging footings, digging with borrowed money, digging underground, etc. The majority of earthwork services are involved in building construction or other associated structured work, including flyovers. The majority of the project relates to civil works including building roads, railroad lines, dams, canals, causeways, and Hermes. Additionally, it may be employed for private purposes such as building your own garden, barn, home, pathway, pavement, parking, etc. Since renting earthwork gear is an expensive expense, normal preparation must be done before starting an earthwork project to prevent any waste.

2.2.2 EARTHWORK HEAVY EQUIPMENT

Earthwork Heavy Equipment is the hydraulic machinery that able to move around and do heavy lifting work such as soil transportation, debris excavation, and demolition purpose. Using an equipment like the dump truck 47 tones to remove and harvest the wood simultaneously will allow you to clear a wood quickly and without wasting any wood. dump truck 47 tones have its own restrictions regarding the removal of large trees, however in the majority of circumstances, a common tree may remove a tree as quickly as boiling an egg. The excavator is another well-known hydraulic device. An excavator is a device that is frequently used to move dirt and waste. Its use extends beyond what it was intended for, for example, to destroy a little building and a hard surface. It levels out the environment and creates a level surface for construction of roads and buildings as well as for moving vehicles. There is several other hydraulic equipment that may be used for earthwork, but renting and purchasing them will cost you money, so careful planning of utilization will significantly lower the operation cost of a building project.

2.2.3 EARTHWORK WITH GEOTECHNICAL ENGINEERING

Since soil work is continuously involved in earthwork, it is important to have geotechnical engineering as well in order to offer a broad range of services. The safety and longevity of earthworks may be consulted on thanks to geotechnical engineering. For instance, a road construction project involves adding the appropriate layer to guarantee that the finished asphalt road can withstand use for a long time. To ensure that the soil beneath the asphalt road will not erode over time and increase maintenance time and expense, that layer contains soil, aggregates, and geotextile. Another example is the use of geomembrane when building a pool or damp area to guarantee that the soil at the bottom is not lost over time. To guarantee that the civil work lasts a very long period, a competent earthwork must be completed along with geotechnical engineering expertise. Earthwork must collaborate with a reputable geotechnical engineering firm to provide a comprehensive and extra service for your earthwork project so that our service and safety can be extended and sustained.

2.3 MACHINERIES IN EARTHWORK

Earth-moving gear is by far the most recognizable piece of equipment on any construction site because to its size and importance, and it is used in virtually all construction-related activities. They are employed in a variety of earthworks, such as the laying of foundations, the grading of soil, the removal of debris and rocks, the digging of trenches, demolition projects, etc. Professionals run these intricate machineries. Due to technical improvements in the sector, there are now many different types of earth-moving machinery available on the market that can accommodate practically any form of construction activity. Different types of earth-moving machines are capable of carrying out different types of operations.

2.3.1 EXCAVATORS

These large machines have a base cabin and an extended arm with a bucket attachment. They operate on a hydraulic system. From the 3600 rotations per minute base cabin, the operator controls the excavator. The base cabin is supported by a frame that has wheels or tracks. The usage of excavators is commonplace on both small and big building projects. They can be used for a variety of tasks, such as excavation, demolition, heavy lifting, grading, landscaping, mining, and dredging.

2.3.2 BACKHOE LOADER

Backhoe loaders, often known as backhoes, are wheeled vehicles with a shovel at the front and a bucket coupled to a jointed arm at the back. They resemble agricultural tractors in appearance, and because of their mobility, they are perfect for usage in cities. Medium-sized backhoe loaders can be used for a variety of tasks, including trenching, laying pipelines, filling trenches, lifting items, and excavation activities. Some backhoe loaders include retractable buckets that can be swapped out for tools used for different construction tasks or buckets of different diameters that may be used for tasks like excavating ditches of different widths.

2.3.3 BULLDOZERS

Bulldozers are one of the heaviest pieces of equipment that can be seen at a construction site and are frequently used to move vast quantities of earth or dirt on expansive building projects. They contain two hydraulic pistons linked to a huge metal plate in the front that may be moved up, down to a specific depth, or in a small range of angles. In addition to moving dirt, they can also be used for crushing or removing boulders, rough or fine grading, and other tasks.

2.4 MAINTENANCE OF MACHINERIES

Machine maintenance is the work that keeps mechanical assets running with minimal downtime. Regularly scheduled servicing, routine inspections, and both planned and unplanned repairs can all be considered as part of machine maintenance. Parts that are worn, damaged, or out of alignment may also need to be replaced or realigned. Machine maintenance can be carried out both before and after a failure. Any company or facility that employs mechanical assets has to perform regular machine maintenance. It enables businesses to adhere to production deadlines, save expensive downtime, and reduce the likelihood of workplace accidents and injuries.

2.4.1 PREVENTATIVE MAINTENANCE

Preventive maintenance, also known as preventative care, is routine maintenance carried out on physical assets to lower the likelihood of equipment failure and unscheduled machine downtime, which can be highly expensive for facility managers and maintenance teams. Based on real-time data insights, effective preventative maintenance is planned and scheduled. To avoid unplanned breakdowns, a preventative maintenance procedure is carried out while the equipment is still functional. A method that lies between reactive maintenance (also known as run-to-failure) and predictive maintenance is called preventative maintenance.

Due to the fact that it serves as the cornerstone for effective property management, preventive maintenance is crucial. Preventive maintenance keeps your assets and equipment in good working order, maintains a high degree of employee safety, and assists you in avoiding major and expensive repairs in the future. An effective preventative maintenance programmed makes sure that operational hiccups are kept to a minimal overall.

In order for a maintenance expert to provide the equipment the greatest possible functioning condition and lifespan, you may arrange and priorities your maintenance duties using a preventative maintenance schedule (such establishing a work order). You can make sure your equipment continues to run safely and effectively by doing routine preventative maintenance. When managing a large amount of equipment, maintaining a preventive

maintenance plan may be particularly difficult, thus maintenance staff frequently utilize preventive maintenance software to arrange their preventive maintenance activities.

2.4.2 CORRECTIVE MAINTENANCE

Corrective maintenance is any activity that restores assets to normal operating condition, although it's most frequently related to smaller, non-invasive actions that address a problem before it results in a total failure. Realigning a component, for instance, during a regular inspection.

Corrective maintenance takes place in three circumstances:

1. When an issue is detected through condition monitoring
2. When a routine inspection uncovers a potential fault
3. When a piece of equipment breaks down

2.4.2.1 PLANNED CORRECTIVE MAINTENANCE

Corrective maintenance is planned when a run-to-failure maintenance strategy is used. An asset is run until it malfunctions, at which point it is fixed or replaced. Only non-critical assets that can be quickly and inexpensively fixed or replaced, or systems with redundancies, are suitable for this kind of corrective maintenance. When corrective maintenance is carried out in conjunction with preventative maintenance or condition-based monitoring, it is planned. Both condition-based and preventative maintenance try to identify issues before they lead to equipment breakdown. Maintenance can be planned and performed if an issue is discovered.

2.4.2.2 UNPLANNED CORRECTIVE MAINTENANCE

When a failure happens in between preventative maintenance tasks, corrective repair must be performed without prior planning. Depending on the availability of

equipment, parts, and manpower, maintenance can be done now or at a later time. Corrective maintenance may also be required when an asset exhibits warning indicators of impending failure or fails suddenly. In this case, there aren't any scheduled maintenance procedures to prevent or fix the breakdown once it occurs.

2.5 MANAGEMENT AND DIESEL PURCHASING

Managing diesel purchasing on an earthwork site involves efficient planning, procurement, and monitoring of fuel requirements for the equipment and machinery involved in earthmoving operations. One crucial aspect is assessing the fuel consumption rates of the machinery and equipment on-site, considering factors such as engine size, age, and load capacity. This information helps estimate the approximate diesel requirements for the project.

To ensure a reliable supply of diesel, a well-defined fuel procurement strategy should be developed. This strategy may involve establishing contracts with fuel suppliers or setting up on-site fuel storage facilities. Factors such as fuel delivery schedules, accessibility to fuel stations, and cost-effective procurement options should be considered.

Implementing a fuel tracking and inventory management system is essential for effective diesel management. Regular monitoring of fuel levels in tanks, tracking fuel usage per machine, and reconciling fuel deliveries with consumption help identify discrepancies and potential fuel losses. Efficient fueling practices should be encouraged among equipment operators, including following manufacturer guidelines, avoiding unnecessary idling, and practicing smooth operation.

Regular maintenance and inspections play a vital role in optimizing fuel efficiency. This involves cleaning and replacing air filters, inspecting fuel lines for leaks, and maintaining proper tire inflation. Well-maintained machines perform more efficiently and consume less fuel.

To track fuel consumption trends and identify areas for improvement, implementing a monitoring and reporting system is crucial. Regular reports provide insights into fuel

usage patterns, machine efficiency, and anomalies. Training and awareness programs should be conducted to educate equipment operators and site personnel on fuel management practices, emphasizing the importance of fuel efficiency and proper maintenance.

Continuous evaluation and improvement of diesel management practices are essential. Analyzing fuel consumption data, gathering feedback from equipment operators, and exploring new technologies or strategies help optimize fuel usage. Embracing innovation and considering alternatives such as alternative fuels or electric equipment can further enhance fuel efficiency and minimize environmental impact. Overall, effective diesel purchasing and management contribute to cost savings, improved efficiency, and reduced environmental footprint on earthwork sites.

2.6 INDUSTRY REVOLUTION IR 4.0 IN CONSTRUCTION INDUSTRY

Industry 4.0 is the concept relating to the idea of "industrial revolution", whose main\subjective is the integration of production processes with the information technologies and techniques. It integrates information and communications technologies with industrial techniques. It assumes that things can be produced depending on the unique requirements of clients, such as sneakers with a bespoke sole and a style they choose themselves or a piece of furniture with a unique, personalized design. Industry 4.0 enables the production of one-of-a-kind things with top-notch quality at a cost comparable to that of mass-produced goods. The technological foundation for this notion is provided by intelligent, digitally interconnected systems and manufacturing methods. Industry 4.0 also describes the full life cycle of a product, starting with its conception and continuing through

its development, manufacture, usage, and maintenance, and concluding with its recycling. Figure 2.1 depicts the evolution of the Industry 4.0 concept to help with comprehension.

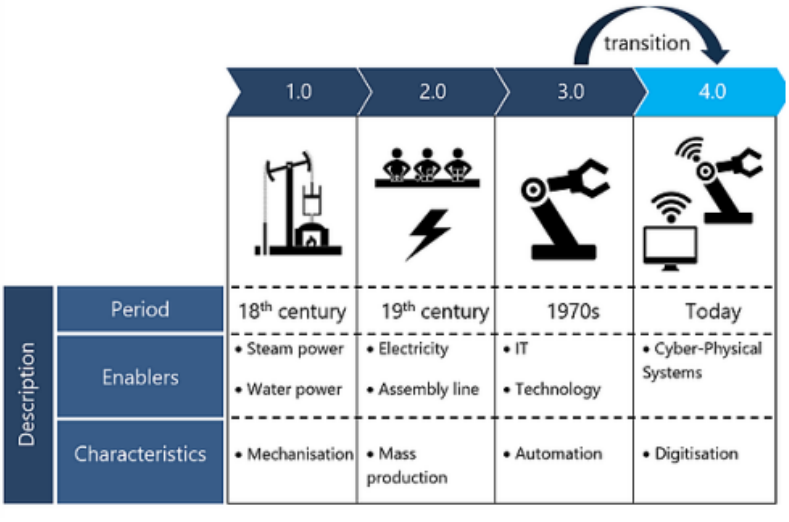


Figure 2.1: Industry 4.0 concept development

Historical evidence supports the theory that the introduction of the steam engine, which permitted a large degree of mechanization relative to the level of the preceding industry, was the catalyst for the first industrial revolution. The second industrial revolution was associated with the introduction of mass manufacturing in the 19th century with the use of electricity and the development of assembly lines. The third industrial revolution was associated with the development of IT, the application of technology in manufacturing, and process automation. 4.0 level can be described as usage of cyber physical systems (CPS) connected with the digitalization and the Internet of Things (IoT) concept. (Jerzy Paslawski, 2017). Length of the industry's development 1.0 was huge because it took a long time to develop steam-powered machinery. There were around 100 years between version 1.0 and 2.0. Level 3.0 was presented after 70 years, and after 30 to 40 years after the previous revolution, debate is currently focused on the 4.0 idea. It should be mentioned that a 5.0 version of this might be expected to be released soon.

2.7 INDUSTRIAL REVOLUTION (IR) 4.0 ELEMENTS

Generally, Industry 4.0 concentrates on the growing trends of process automation and data exchanged within the manufacturing industry. Industrial Revolution (IR 4.0) elements include: Internet of Things (IoT), Cloud Computing, Augmented Reality (AR), Simulation, Robotic Automation, System Integration, Additive Manufacturing, Big Data and Cybersecurity (Erboz, 2017).

2.7.1 INTERNET OF THINGS (IOT)

IoT allows data transfer between objects and humans. It consists of three main relationships in a digital network; between humans and humans, humans with objects and objects with objects. IoT architecture consists of three layers; perceptions, networks and applications (Yang et al., 2011). The perception layer is referring to the peripherals that collect data from the environment such as barcode, camera digital or RFID. The network layer provides a platform for data transmission and the application layer is the interface between the users and IoT devices. The IoT is made based on the development of technologies, real-time analytics, sensors, wireless systems, automation, control systems and machine learning.

IoT platforms are designed to determine the actions based on the pattern of data detected and performed the required action, make recommendations and find the best solution. For example, when you are driving, the dashboard of your car suddenly displays a red signal indicating that the engine is having a problem. Through IoT technology, the sensor from your car will transmit the data to the car manufacturer. The manufacturer will then analyse the car faults and automatically make an appointment with the owner of the car to fix the fault at the nearest car dealer. Furthermore, the IoT ensures that the replacement parts are ready in stock whenever you arrive at the centre (TWI, 2021).

Many smart homes embedded IoT technology to save energy by automatically turning off the devices whenever the device is unused. Lighting, heating, air conditioning, security systems and other smart devices and peripherals are controlled through

smartphones or tablets. Besides, IoT is also applied for healthcare purposes to monitor the sugar level, pulse rate and blood pressure of the patients to avoid serious malfunctions or injuries (TWI, 2021).

2.7.2 CLOUD COMPUTING

Cloud computing is on-demand access via the Internet facility, allowing the resources such as application systems, database systems, data storage, development tools, servers, mobiles and networking infrastructures to be used for sharing purposes to reduce capital expenses (Vennam, 2020). Cloud computing helps to lower IT costs by reducing the purchasing, installation and configuration costs as well as managing the resources available at a premise. In addition, cloud computing encourages the use of real-time enterprise applications instead of waiting for a couple of weeks or months for the supplier to install and configure the application at a premise after the purchase.

Generally, cloud computing consists of three common models, namely Infrastructure-asa-Service (IaaS), Platform-as-a-Service (PaaS) and Software-as-a-Service (SaaS). IaaS enables the end-users to scale and shrink resources such as the servers, networking and storage based on the needed basis, utilisation, optimisation and overbuying the resources. PaaS provides software developers with on-demand platforms such as the hardware, complete stack of software, infrastructures, development tools for development, running, testing and managing the applications without cost, complexity and inflexibility of maintaining the platform at their premise. Meanwhile, SaaS is also known as a hosted cloud application that needs to be accessed via a web browser. The SaaS users must pay the monthly or annual subscription fee. SaaS offers automatic upgrading and protection from data loss.

The type of cloud computing consists of public cloud, private cloud, hybrid cloud and multi-cloud. The public cloud is a cloud in which the service provider might be making the computing resources accessible for free. Amazon Web Services (AWS), Google Cloud and IBM Cloud are examples of public cloud. Private cloud is only dedicated and accessible by only one customer, hosted at on-premises in the customer’s data centre, highly secure

and customised based on the premise infrastructures. Hybrid cloud combines public and private cloud services. The goal of the hybrid cloud is to establish a mixture of public and private resources for flexibility to choose the most optimal cloud for each application. The multi-cloud is the use of two or more types of clouds for two or more different cloud providers. Almost 85% of organisations have been reported using multi-cloud environments.

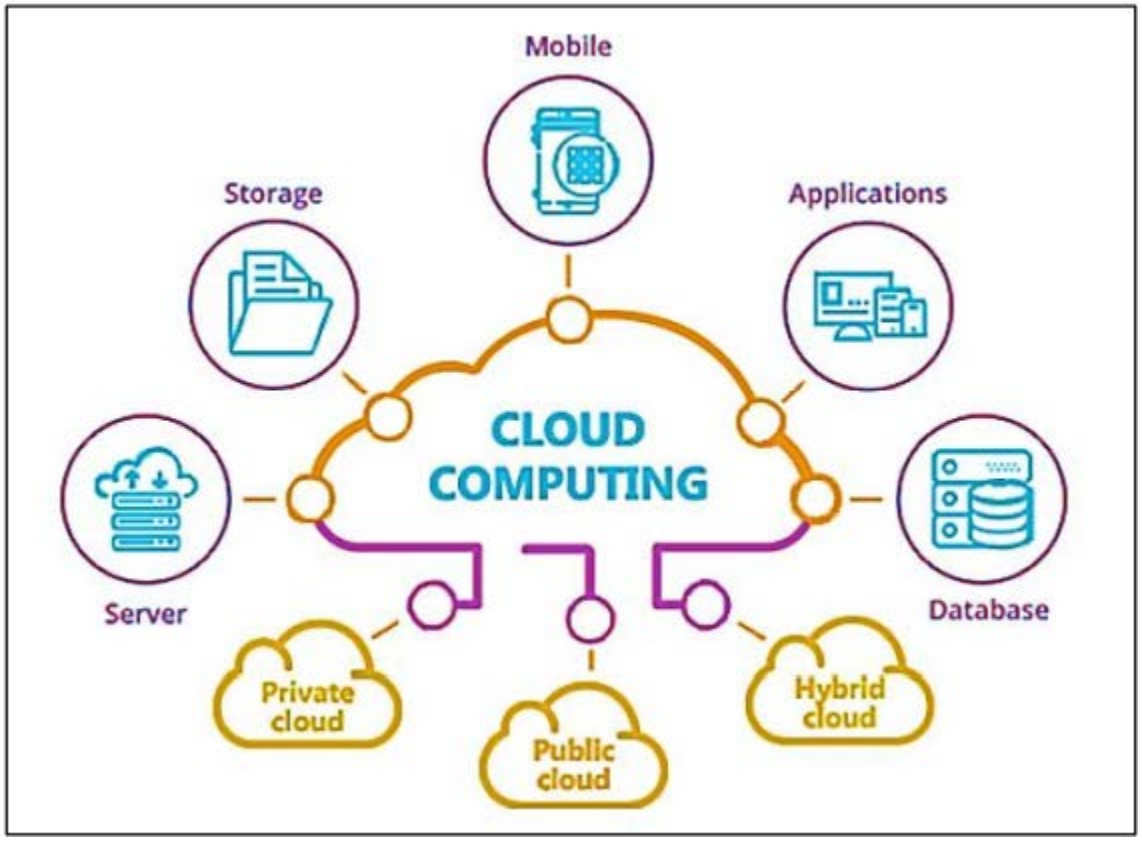


Figure 2.2: Cloud Computing Frameworks

2.7.3 AUGMENTED REALITY (AR)

Augmented Reality (AR) is an enhancement or improvisation of the real physical image upgraded through the use of digital visualisation, sound engineering and other sensory stimulus delivered through the technology. Among the popular AR applications are AcrossAir, Google Sky Map, Layar, Lookator, SpotCrime and PokemonGo.

Augmented Reality (AR) can be categorised into Augmented Reality in 3D viewers, Augmented Reality in Browsers, Augmented Reality Games and Augmented Reality GPS (Anurag, 2017). Augmented Reality in 3D viewers allows the users to put life-size 3D models in their environment with or without the use of trackers. Trackers are the simple images of 3D models that can be linked to Augmented Reality. Examples include AUGMENT and Sun Seeker. The AR browsers can enhance users' camera display with contextual information. For example, when someone points his or her smartphone at a building, its history or estimated value will be displayed. Examples for AR browsers are Argon4 and AR Browser SDK.

AR Gaming software creates mesmeric gaming experiences that use your actual surroundings. For instance, Pokémon Go, Parallel Kingdom, Temple Treasure Hunt, Real Strike and Zombie Go. AR GPS is generally an application in smartphones that include Global Positioning System (GPS) to spot the users' location and a compass to detect device orientation. Examples for this category are AR GPS Compass Map 3D and AR GPS Drive/Walk Navigation.

2.7.4 SIMULATION

Simulation is a model or representative of a process using computer technology to develop the users' understanding. For example, the operation of an aircraft simulation for the training purposes of new pilots before handling the real aircraft. The computer model mimics the operation of any real application system. The best simulation can help the organisations to estimate better Return of Investment (ROI) before it can be initiated. Besides, simulation also provides a free risk environment to avoid risk on product

standards, cost, time and people's life (Restart 4.0, 2021). Practically, the correct simulation model with the right data would enable organisations to predict future outcomes.

Today, many industrial facilities that concern with reducing the risk and optimising the scheduling processes have implemented industrial 4.0 technologies to improve overall productivity. This will leverage the digital twins and simulation modelling to accomplish the whole process to produce outstanding throughput.

2.7.5 ROBOTIC AUTOMATION

Innovations of robotics, automation and artificial intelligence (AI) are the main concern for Industrial Revolution (IR) 4.0 in the manufacturing industry. Robots are generally taking place the repetitive tasks, which encouraged the workers to focus on more exclusive and intensive tasks. The number of new robots created is increasing by approximately 14% throughout the years (Polly, 2022). Factories prefer futuristic robots and humans working side-by-side to meet the global productivity demands. This is the new paradigm of manufacturing that should be prepared by all industries. AI is expected to increase the productivity of the labour by up to 40% by the year 2035.

According to research, 57% of workers indicated that they have shown interest to increase productivity by implementing automation and robots in the working environment. Furthermore, the implementation of robots will create new job opportunities and allowing employers to hire more staff in future (Polly, 2022).

For example, robot technology is currently applied at restaurants to make and send orders to the customers. The business could save its cost by employing many workers and spaces in the restaurants. In addition, it could reduce human error whenever taking orders from the customers.

2.7.6 SYSTEM INTEGRATION

System integration is involved in system engineering and information technology fields. It combines various application systems and software packages to create larger and comprehensive systems. The system integration works cohesively in a coordinated and unified manner at optimum operation and occupies all requirements at the strategic management. The systems that have been integrated should be up to date and working properly is one of the main challenges in the system integration process for IR 4.0 (Automation.com, 2015). Another concern is to ensure that the database is secure from cyber threats and attacks besides avoiding any malicious activity.

The following Figure 7 shows a system named MyATP that integrates the systems from Research Management Systems, Publication Management Systems, Consultation Management Systems and Training Information Systems in a single integrated platform for appraisal or staff promotion. The system helps the panel to decide those who deserve a good appraisal or are suggested for the promotion.

2.7.7 ADDITIVE MANUFACTURING (AM)

Additive manufacturing (AM) technology offers the ability to produce products with lower cost, shorter time of production, less energy and material waste needed during the manufacturing process. The AM promotes the integration of smart technologies and production systems. The manufacturers can innovate complex parts and hence reduce the inventory spaces and transport distances. Furthermore, additive manufacturing encourages making products based on users' demand and even reduces the supply chains (Zimmerman, 2018). AM requires continuous and effective communication between the devices, machines and robots with the existence of adequate digitisation and smooth manufacturing activities.

Additive manufacturing (AM) is commonly applied in the healthcare and aerospace sectors. For example, in the healthcare sector, bioprinting is understood as the production of customising human organs and transplants. Bioprinters artificially construct living

tissues by outputting living cells layer upon layer in 3-D structures. Bio-printed tissues are already used in drug toxication tests nowadays, saving money and the health of test subjects during clinical trials. The second sector is the space whereby the AM is feasible for component replacement. Most of the failures at ISS (International Space Station) involve plastics and composites that could be replaced onsite by AM. Besides, AM could make the plastics and other wastes or scraps to be recycled at ISS.

2.7.8 BIG DATA

Big data is an area of integrating data from isolated systems to obtain a complete visualisation. It collects the data, analyses it and facilitates the output in proper representation. Organisations in today's eras seek to achieve business intelligence through the compilation, analysis and sharing of data across all related entities to attain business excellence (nexusintegra, 2021). Big data classifies the huge information that has been collected and organised into relevant conclusion that helps the organisations to improve the operation of the production. The improvement involves the warehousing processes, elimination of bottlenecks in the production, prediction ability on customers' demand through the internal and external analysis beyond the historical data and forecasting on the future maintenance or possible machinery failure or breakdown that affects the production.

Education institutions especially at the tertiary level have introduced the Python programming language to expose the students to the concepts of Big Data. Python has been acknowledged as the fastest-growing programming language. Since Big Data involves a lot of data analysis and scientific computing, Python provides libraries comprising packages such as numerical computing, data analysis, statistical analysis, visualisation and machine learning (nexusintegra, 2021). Nowadays, Python is considered the most popular language for software development owing to its high speed and performance.

2.7.9 CYBERSECURITY

Cybersecurity is the most important element in any business to secure data and ultimately human safety. Manufacturing sector is the second most attacked and yet requires a powerful security system to secure the data (Balbix, 2021). Industries are exposed to vulnerability exploitation, malware, denial of service (DoS), device hacking and other common attack methods. There are few challenges facing the industries in the age of IR 4.0; for instance, every connected device represents the potential risks, the isolated systems are exposed to cyber-attack and visibility is very poor across the isolated environment and different systems.

The manufacturing industry is currently emphasising digital transformation, in which Cyber-Physical Systems (CPS) combine physical components and digital networks to revolutionise the way companies automate processes and share information. Besides, the smart factory's combination of virtual and physical systems makes interoperability and real-time capability possible. Digital transformation ensures the implementation of a proper security system as the key success factor for Industrial Revolution (IR) 4.0.

2.8 XAMPP

XAMPP, an acronym for cross-platform (X), Apache (A), MySQL (M), PHP (P), and Perl (P), is a robust and widely used software package that offers a comprehensive local development environment for creating and testing web applications. Designed to be versatile and user-friendly, XAMPP is available for various operating systems, including Windows, macOS, Linux, and Solaris. At the core of XAMPP is the Apache HTTP Server, a powerful web server software that handles the serving of web pages, manages HTTP requests, and supports a multitude of web technologies. With Apache, developers can simulate a real server environment on their local machines, facilitating the creation and testing of web applications without the need for an internet connection.

In addition to the web server, XAMPP incorporates the MySQL database server, a widely adopted relational database management system. MySQL enables developers to

efficiently store, manage, and retrieve data using the structured query language (SQL). It provides a robust foundation for web applications that require persistent data storage and retrieval. Furthermore, XAMPP includes PHP, a server-side scripting language that empowers developers to create dynamic web content and interact with databases seamlessly. PHP is highly popular due to its simplicity, versatility, and extensive support for various frameworks and libraries. It allows developers to write code that executes on the server side, generating dynamic web pages tailored to user interactions.

Another notable component of XAMPP is Perl, a versatile programming language known for its text processing capabilities and rapid development potential. With Perl, developers have an additional tool for scripting, automation, and complex data manipulations in their web development projects. In addition to these core components, XAMPP offers a range of supplementary utilities and libraries that enhance the development experience. For example, it includes the FileZilla FTP server, which facilitates file transfers between the local machine and the web server. Additionally, XAMPP incorporates OpenSSL for secure connections, enabling developers to implement encryption and ensure data privacy.

By installing XAMPP, developers can establish a self-contained web development environment on their computers. This environment closely mimics the setup of a production server, enabling thorough testing and debugging of web applications before they are deployed to live servers. XAMPP eliminates the need for individual installation and configuration of each component, as it conveniently provides a preconfigured bundle of all the essential software required for web development.

Overall, XAMPP is a highly beneficial tool for web developers, offering a comprehensive suite of web development technologies in a user-friendly package. Its versatility, ease of use, and extensive feature set make it an ideal choice for both beginners and experienced developers seeking a robust and efficient local development environment.

CHAPTER 3

METHODOLOGY

3.1 INTRODUCTION

This chapter's goal is to outline the strategies and tactics employed to maximise the usefulness of the contract-related documentation that will be put together. The study location, sample size, demographic, research design, data collection, data analysis, and hypothesis were all covered in this chapter. Additionally, in order to achieve the goals of this study, data from primary (a survey questionnaire) and secondary sources will be collected (literature review). In order for others to learn from and build upon as future research, many approaches or findings from this discipline are largely published in journals.

This application can be used to update the diesel consumption, and recorded maintenance for dump truck with the site manager, and employees at the site office who are associated. Any project-related papers or images may easily be accessed through the programme at any time and from any location. Without creating any delays, this application is made to save time and increase job efficiency. To determine the problems with the digital final account document tracing system and how well it works in comparison to the traditional way in resolving problems at the building site between headquarters to achieve the project's goals.

A set of questionnaires will be distributed to all contract departments team members at PTT as well as site personnel. As a result, they may provide feedback on the effectiveness of the database to solve the problem at construction site between headquarters. Prior to the questionnaire being distributed to all the related staff at PTT, employee should download the mobile application database to their smartphone and apply the database system to the construction site.

3.2 RESEARCH METHODOLOGY

Figure 3.1 show the flow of the methodology of this research based on the objective.

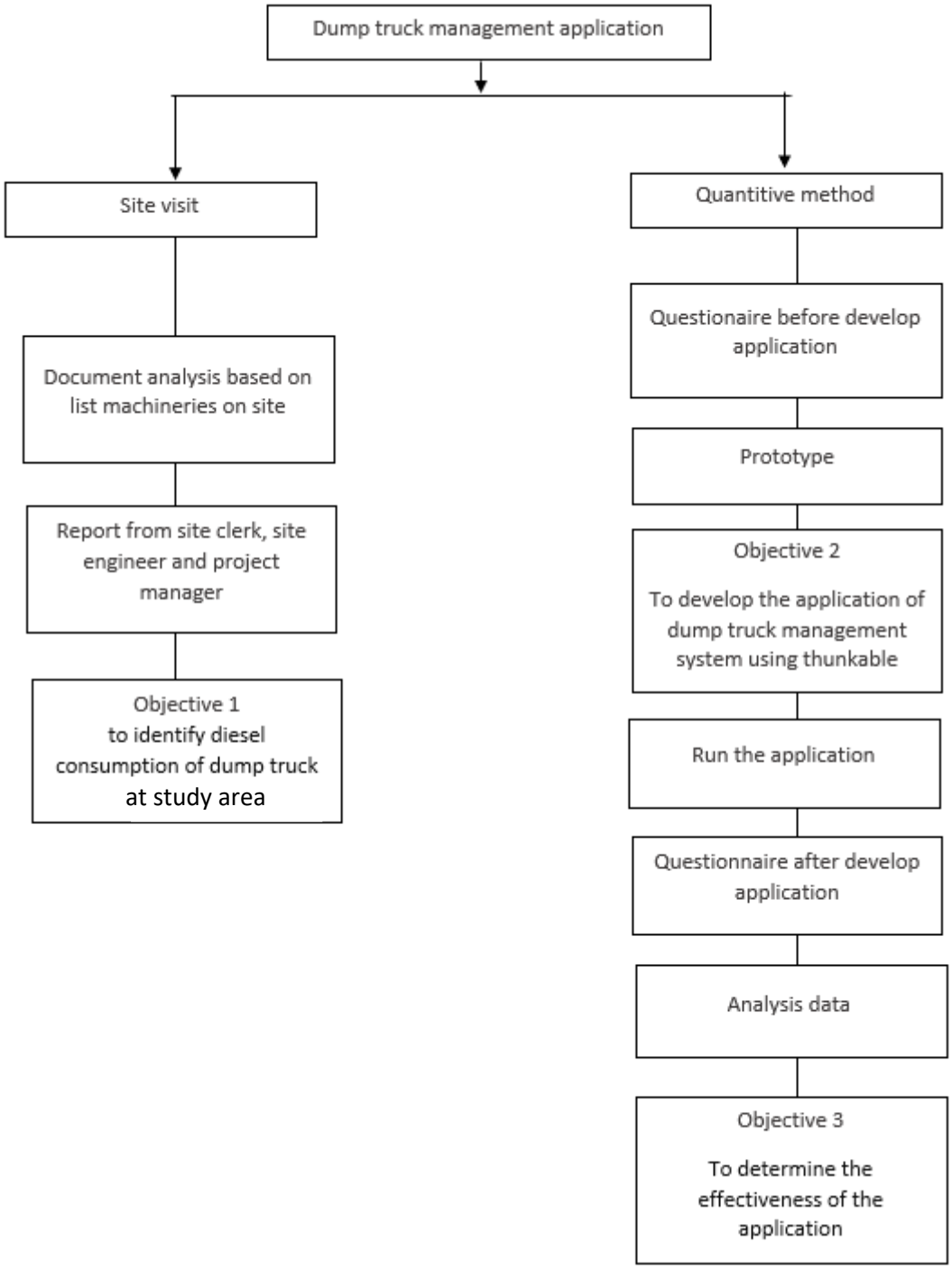


Figure 3.1: Flow of methodology

3.3 DESIGN RESEARCH

Research design is the framework of research methods and techniques chosen by a researcher. Because of the design, researchers may concentrate on choosing procedures for their investigations that are suited for the topic matter. Planning and observation require this methodology. It is important to monitor the implementation process to spot any potential issues early on. If there is a crucial problem that is a significant reason why the task cannot be implemented, changes must be made. Finally, controls must be put in place to guarantee a steady flow.

The design of a research topic identifies the style of study, including experimental, survey, correlational, semi-experimental, review, and its sub-types, experimental design, research problem, and descriptive case study. Data gathering, measurement, and analysis are the three primary types of study designs. The research design will be determined by the sort of research challenge a business is experiencing, not the other way around. Which tools to employ and how to utilise them are decided upon during the design phase of a research.

Effective research typically reduces data bias and fosters more confidence in the veracity of the information gathered. In experimental research, the ideal outcome is typically thought to be a design that results in the lowest possible margin of error. The crucial components are:

1. Accurate purpose statement
2. Techniques to be implemented for collecting and analyzing research
3. The method applied for analyzing collected details
4. Type of research methodology
5. Probable objections for research
6. Settings for the research study
7. Timeline
8. Measurement of analysis

Therefore, the purpose of design research is to discuss and explains method used by researcher in provide a plan of study that permits accurate assessment in conducting the

usability using the Dump Truck management (DTM) application. As figure 3.2 shows the method of illustrated to create a Dump Truck management (DTM).

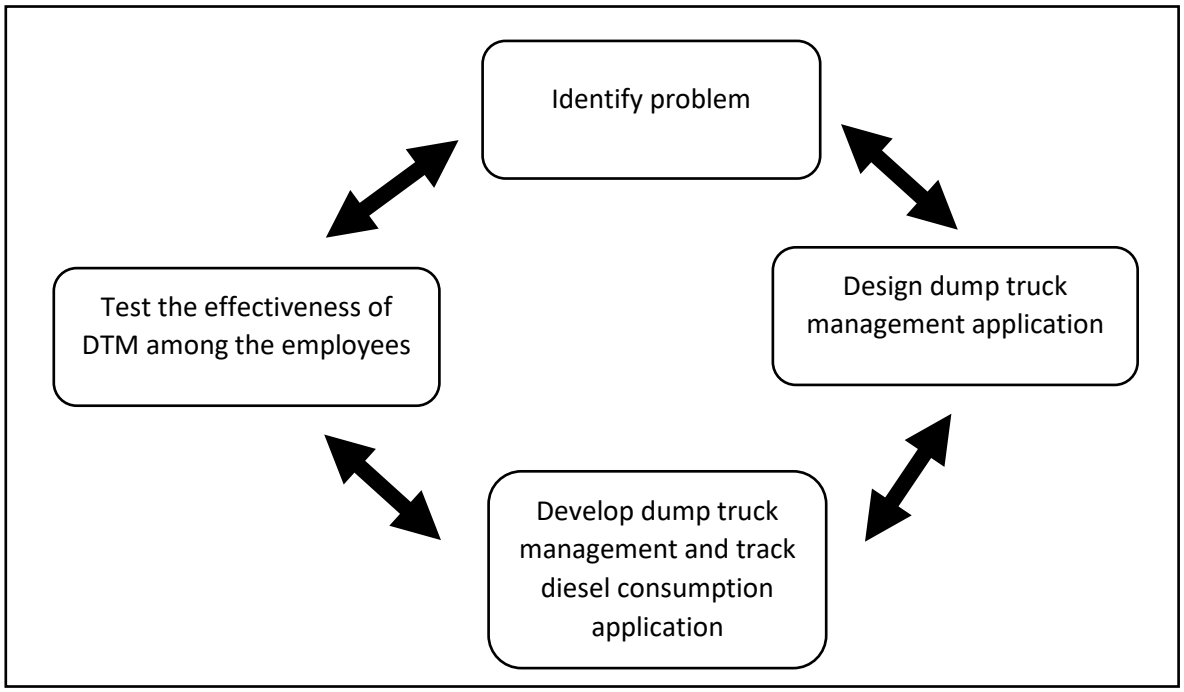


Figure 3.2: The method of illustrate to create application

3.4 DESIGN THINKING PROCESS

Design thinking establishes an approach for innovative problem-solving. rather than adopting a one-size-fits-all philosophy. It encourages a holistic point of view in which doubt and ambiguity are welcomed and tolerated in order to consider all facets of the problem. Applying a design attitude, which emphasises thinking proactively and responding with understanding, may be beneficial in any situation.

Today's design process uses a variety of versions. They typically consist of three to seven stages or phases. Fortunately, all of the variations have the same fundamental principles. The Design Thinking Model (Hasso Plattner Institute of Design at Stanford, n.d.) model proposed by the Hasso Plattner is a preferred approach. This is due to its forefront application and teaching of Design Thinking. According to Plattner et al. (2009), the Design Thinking process consists of five process steps: empathize, define, ideate, prototype and test.

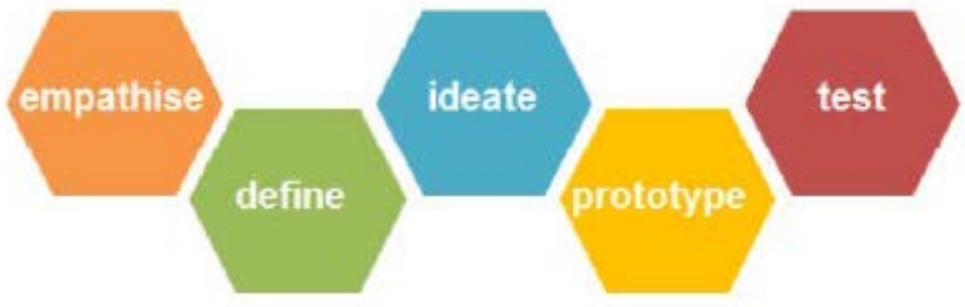


Figure 3.3: Design Thinking Process

3.5 RESEARCH FRAMEWORK

Figure 3.4 show the flow of research framework of this research.

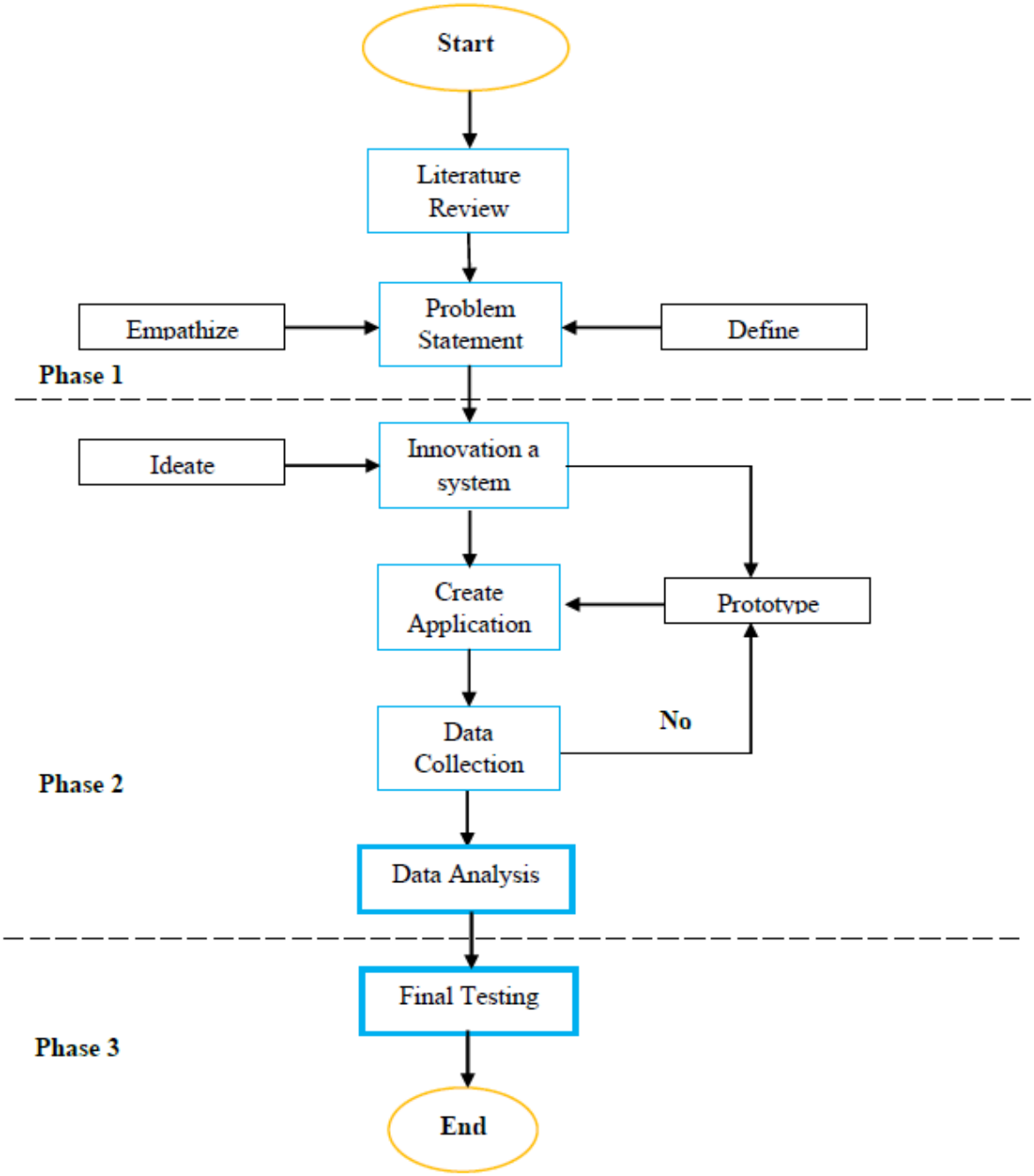


Figure 3.4: Flow of Research Framework

3.6 STUDY AREA

Knowledge of actual building methods is improved by hands-on activities like construction site investigations. Learners may get first-hand spatiotemporal knowledge of a building project through site exploration, which also creates a compelling learning environment for them. Site visits provide us the opportunity to learn more about dump truck maintenance on a theoretical and practical level, as well as pinpoint the issues that are contributing to the delay on the project site. Coverage of the study region at East Coast Railway (ECRL) chainages 288 until 300 at Gebeng Kuantan. ECRL Section 5 is another name for this study area.

Figure 3.5: Drone view study area at Chainage 293+500

Figure 3.6: Drone view study area at Chainage 294+200

3.7 DOCUMENT ANALYSIS

Document analysis produces a thorough summary of a given subject from prior research. These studies consulted scholarly articles, journals, books, and other sources. A review of the literature can teach us about the definition, types, and other aspects of machine maintenance. Like other analytical methods in qualitative research, document analysis requires that data be examined and interpreted in order to elicit meaning, gain understanding, and develop empirical knowledge (Corbin & Strauss, 2008 and Rapley, 2007)

3.8 QUANTITATIVE METHOD

Quantitative methods place an emphasis on precise measurements and the statistical, mathematical, or numerical analysis of data gathered through surveys, polls, and other types of research, as well as the manipulation of statistical data that has already been obtained using computing methods. Quantitative research focuses on collecting numerical data and using it to understand a specific event or generalise it across groups of individuals. Quantitative research methods as the explaining of an issue or phenomenon through gathering data in numerical form and analyzing with the aid of mathematical methods; in particular statistics. (Aliaga, and Gunderson, 2002)

3.9 PROTOTYPE

Prototyping is an important part of design thinking and consumer experience prototyping in general since it helps us check and validate our ideas quickly. A prototype could be usable by a customer as a finished item. It may be related to a story board, an activity replay, a wall of Post-It notes, or even a tool you develop. To do this and offer a graphic that shows how these applications are used, we created a prototype platform. Users may now clearly understand what this programme is designed to do. They believe that this satisfies their wants. A prototype might be a storyboard, a tool you develop, a game you play, or anything else that enables interaction with users.

Log in as an existing user or sign up as a new user.

Figure 3.7: Log in or sign up interface

Operators need to update their dump truck mileage to make it easier to plan for their next service maintenance. This interface also shows the history of their dump truck maintenance.

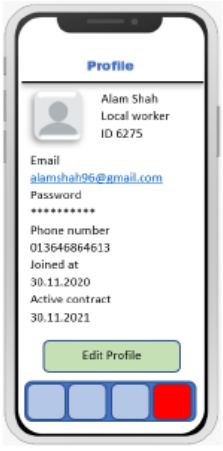
Figure 3.8: First interface

This interface indicates that the operator must create a ticket for a broken dump truck while on the job, such as a burst tire, a non-functional air conditioner and many more.

Figure 3.9: Second interface

This interface is for the inspection dump truck form that the operator must complete.

Figure 3.10: Third interface



This interface is for operators of dump trucks to edit their profiles and personal information. Setting options are also on this interface.

Figure 3.11: Fourth interface

3.10 XAMPP

XAMPP is a free and open-source software package that provides a local development environment for creating and testing web applications. It stands for cross-platform (X), Apache (A), MySQL (M), PHP (P), and Perl (P). XAMPP bundles together several key components commonly used in web development. It includes the Apache web server, which serves web pages, handles HTTP requests, and supports various web technologies. The MySQL database server is also included, allowing you to create and interact with databases using SQL. PHP, a server-side scripting language, enables dynamic content generation and interaction with databases. Perl, another programming language, offers additional flexibility. Additionally, XAMPP includes utilities like FileZilla FTP server and OpenSSL for secure connections. By installing XAMPP, user can set up a local web server environment on your computer, simulating a production server. This allows user to develop and test web applications before deploying them live. XAMPP simplifies the setup process by providing a preconfigured bundle of essential software, making it beginner-friendly and convenient for web developers.

3.11 QUESTIONNAIRE (AFTER USING THE APPLICATION)

A questionnaire is a research instrument that consists of a series of questions asked of respondents to gather information. The content of the questionnaire was developed using details and information that another researcher had discovered in academic articles. The substance of the questionnaire was divided into two parts. The first segment's main goal was to acquire background information on whether the company could test the developed apps and decide whether they were viable for implementation. In order to discover and choose the criteria that will be utilised to develop the questionnaire and interview, the study framework must be defined before the questionnaire can be created. The variable was discovered through the literature review.

The widely circulated questionnaire's goal is to gather information on awareness and understanding that could be relevant to our research. Additionally, to gather viewpoints that may be used to enhance the implementation. Next, there is one whose goal is to solicit

precise customer feedback on whether they agree or disagree with our programme vision. Questions are asked to respondents based on the Technology Acceptance Model (TAM), which measures perceived usefulness and perceived ease of use. A few questions on diesel consumption management were also added to the questionnaire to complete it.

3.12 DATA ANALYSIS

The use of statistical analysis in any study project or experiment that employs statistics as a research methodology is highly advantageous. The vast majority of social sciences as well as important fields of research in engineering and natural science employ statistical analysis. The genuine shape of the approximations to a problem that is exceedingly complex or unknown can be revealed using this method, which is also very beneficial. Statistics are at the heart of social science research. Sadly, whether done intentionally or unintentionally, it is feasible to infer the wrong conclusions from statistical analysis. Statistics are merely a tool for in-depth analysis and reasoning, which are still required.

In a diesel consumption and dump truck management project, various statistical analyses can be conducted to gain insights into fuel efficiency and operational performance. Descriptive statistics provide an overview of data, correlation analysis examines relationships between variables, regression analysis determines the impact of independent variables on fuel consumption, and time series analysis identifies patterns and trends over time. Hypothesis testing assesses significant differences or relationships, cost-benefit analysis evaluates the economic feasibility of interventions, and comparative analysis compares performance across trucks, drivers, or routes. Utilizing statistical software and expert guidance can facilitate these analyses for informed decision-making.

CHAPTER 4
RESULT: DATA ANALYSIS AND DISCUSSION

4.1 INTRODUCTION

The analysis and discussion of data results play a crucial role in understanding the findings and implications of a study or project. In this context, we will explore the results of the data analysis conducted for the diesel consumption and dump truck management project. By analysing the collected data, we aim to gain valuable insights into fuel efficiency, operational performance, and the impact of various factors on these outcomes. This discussion will provide a comprehensive overview of the data analysis findings and delve into the key implications and conclusions drawn from the results. Through this analysis and discussion, we aim to shed light on the effectiveness of the implemented strategies, identify areas for improvement, and provide evidence-based recommendations for optimising diesel consumption and dump truck management practises. The findings of the project were shown according to the objectives mentioned in Chapter 1.

4.2 EXISTING METHOD USING ON STUDY AREA

Dump truck management on construction sites primarily relied on manual methods. Here is an overview of the old methods used for dump truck management on-site:

1. Paper-Based Systems: Paper-based systems were commonly used to manage dump trucks on construction sites. This involved using physical paperwork, such as logbooks, delivery tickets, and load tickets, to track and record information related to dump truck operations. Site supervisors or truck drivers would manually record details like the time of arrival and departure, load quantities, and material types on paper forms.
2. Manual Communication: Communication between different stakeholders involved in dump truck management was primarily done through manual

methods. Site supervisors would physically communicate with truck drivers, instructing them on their tasks, directing them to specific loading and unloading areas, and providing information about the materials to be transported. This process often relied on face-to-face or two-way radio communication.

3. Visual Management: Dump truck management also involved visual cues and signs to guide truck drivers and indicate specific areas for loading, unloading, and parking. Visual markers, such as flags, cones, or painted lines, were used to designate designated zones for different truck-related activities.
4. Manual Tracking and Coordination: Dump truck movements and activities were manually tracked and coordinated by site supervisors or project managers. They would visually monitor the movement of trucks, keep track of the number of loads transported, and manually update records accordingly. This process required constant supervision and coordination to ensure efficient truck operations.
5. Manual Reporting and Documentation: Reporting and documentation related to dump truck management were done manually. Site supervisors or administrative staff would compile and maintain paper-based records, including truck schedules, delivery details, load quantities, and any incidents or issues encountered during truck operations. These records were then used for reporting purposes and for generating invoices or payment documentation.

While these old methods were widely used in dump truck management on construction sites, they had certain limitations. They were time-consuming, prone to errors, and lacked real-time visibility and data accuracy. Fortunately, advancements in technology have led to the development of more efficient and automated solutions for dump truck management, such as digital fleet management systems, GPS tracking, and cloud-based software applications that streamline operations, enhance communication, and improve overall efficiency on construction sites.

4.3 DUMPTRUCK MANAGEMENT APPLICATION

4.3.1 FLOW CHART OF THE APPLICATION

The flow chart below shows the flow for current practices of using Dumptruck management application on site in Figure 4.5. This flow will help users to easily understand well the flow on how to operate the application.

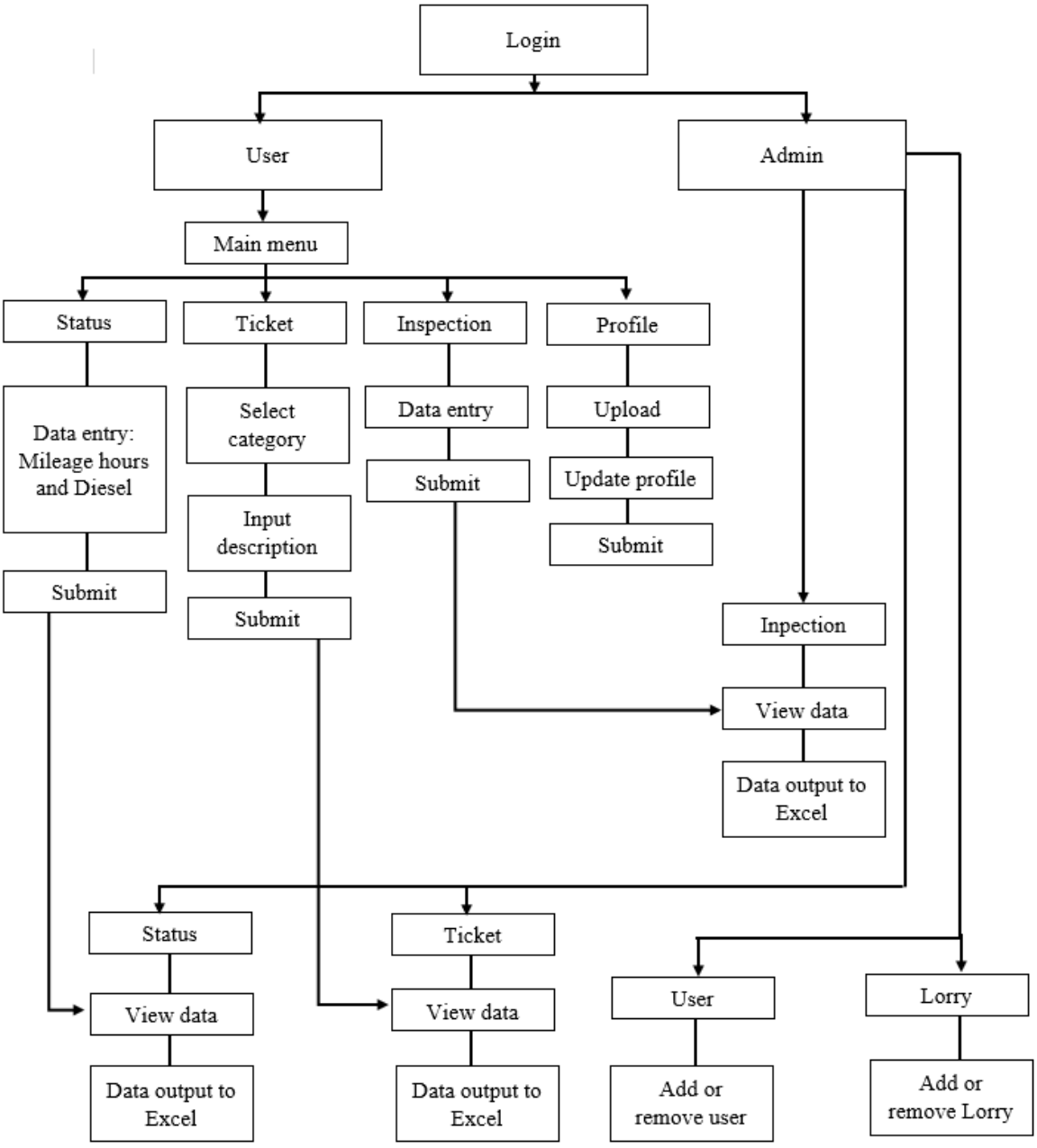
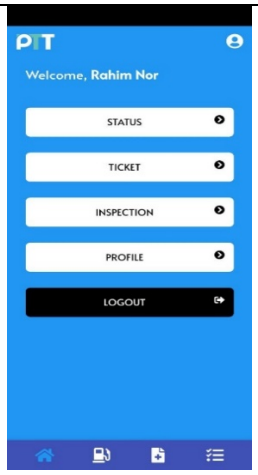


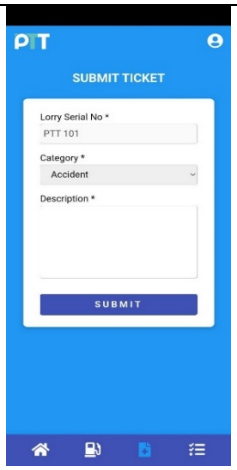
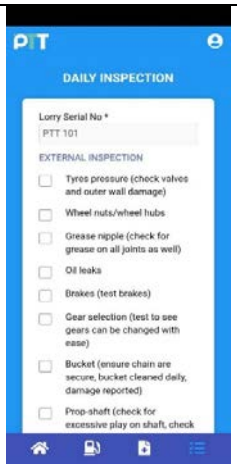
Figure 4.1: Flow chart of using the application

4.3.2 INTERFACE APPLICATION FOR USERS

The dumptruck management application have to variation of users and the workshop team or site clerk. This application build using Xampp. Table 4.1 illustrates the sequential steps involved in utilizing the application for the users.

Table 4.1: Step using the application for users.

No	Figure	Description
1.		The first thing a user can see after opening the application is the log in menu. This page required the user to enter their worker ID and password to access the apps. There are no sign-up options in this interface because new users will be added by the admin on the web page.
2.		After the user has already logged in, this layout will come out, and the user can see on the main menu four items: status, ticket, inspection, and also profile. These tabs are also available at the bottom of this interface, and for profiles, there is a little icon at the right top of the corner of this interface.

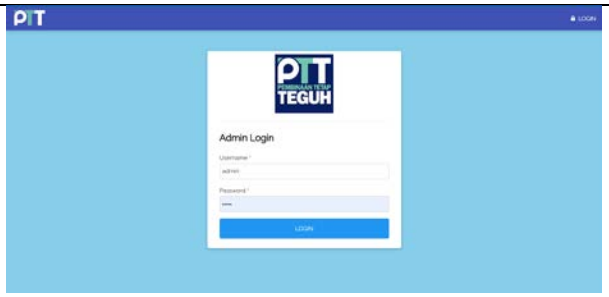
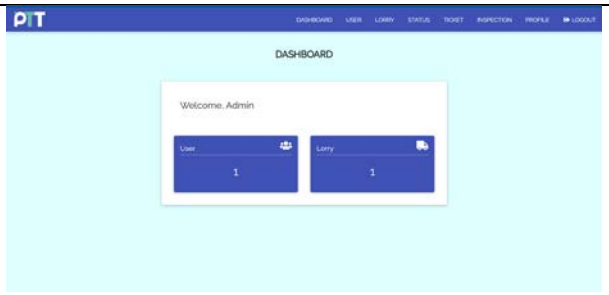
3.		For this page, the user needs to fill in the data, which is the mileage hours of the dump truck and how much diesel they used for the day.
4.		For submitting a ticket, users need to submit a ticket if they want to repair or service their dumptruck so the workshop team knows what spare parts they need to order from the HQ. For an accident case, the user also needs to submit a ticket and fill out the description so HQ knows what happened to the dump truck.
5.		This interface is for inspection of dump trucks. Users need to check their dumptruck before ticking off all the items on the inspection list.

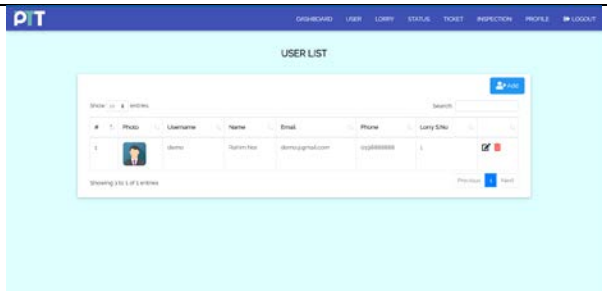
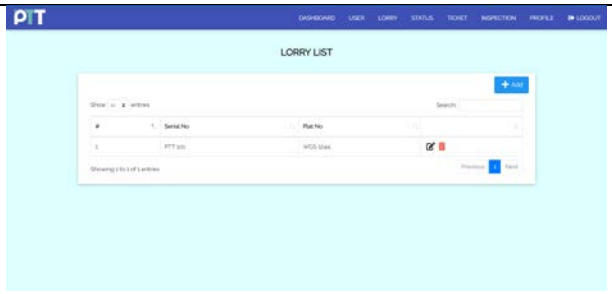
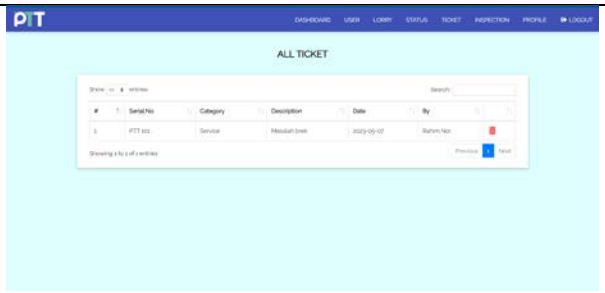
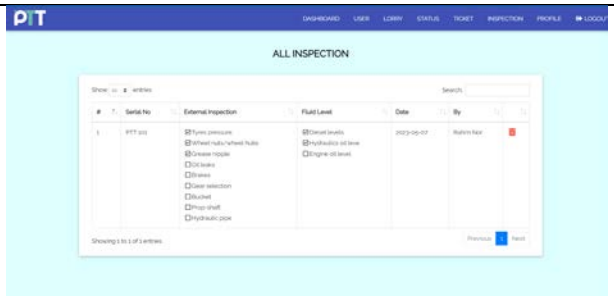
6.		This is the interface for profiles; users can edit their profiles from here, such as their name, picture, and many more details about their information.

4.3.3 INTERFACE APPLICATION FOR STAFF OR SITE CLERK

These interfaces are for HQ and staff at the site. Table 4.2 illustrates the sequential steps involved in utilizing the application for the workshop team or staff at the site.

Table 4.2: Step using the application for the staff.

No	Figure	Description
1.		On the first page, users need to log in to their account to access all the data in the application.
2.		This interface is to know how many users of the dumptruck application and how many lorries are available on site.

3.		This interface is used to see all the current users and to add new users for new workers.
4.		This interface is used to see all the available lorries and to add new lorries.
5.		This interface is for checking all the users submitted tickets from the application. It is easier to track all the problems for all the trucks on site and to send the new spare part for on-site purposes.
6.		This interface is for the inspection that the user submitted from the application. This will help reduce the amount of paper wasted on site.

4.4 THE EFFECTIVENESS OF THE DUMPTRUCK MANAGEMENT SYSTEM.

To evaluate the effectiveness of the application, a questionnaire was given to 20 respondents to gather feedback from them. The questionnaire contains demographic questions, the Perceived of Usefulness (PU), Perceived Ease of Use (PEOU) and Diesel consumption. Perceived usefulness is a feeling that users hold toward the improvement in dumptruck management on site and Perceived ease of use refers to a level of easiness that users feel when using the dumptruck management application. Diesel consumption is a measure of the user's satisfaction with diesel management on site.

Section A, Section B, and Section C formed this questionnaire's sections. In Section A, the demographic profile is discussed. The application utility evaluation question is situated in Section B. The opinions of the respondents on usability are discussed in Section C.

4.4.1 DEMOGRAPHIC DATA

There are four questions on the respondent's backgrounds in Section A, which collects demographic information. The following are the items:

a) Age
b) Gender
c) Position
d) Work experience

i. Age

Table 4.3 shows the age grouping of the respondent in this research. The age groups were divided into three categories by the researchers. This section was formed to assist with the data processing and identifying the respondents at construction site. In this survey, the age group of 26 years old until 35 years old has the most responses with 13 more than 65 percent (65%), followed by under 25 years old which is has 3 respondents (15%) different 10

respondents than 26- years old. For age 36 years old until 45 years old and more than 46 years old only have 2 respondents both ages which is 10 percent (10%) which is the less among two categories of age.

Table 4.3: The percentage of respondents by age

Age	No. of Respondent	Percentage (%)
<25 years old	3	15
26-35 years old	13	65
36-45 years old	2	10
>46 years old	2	10
Total	20	100

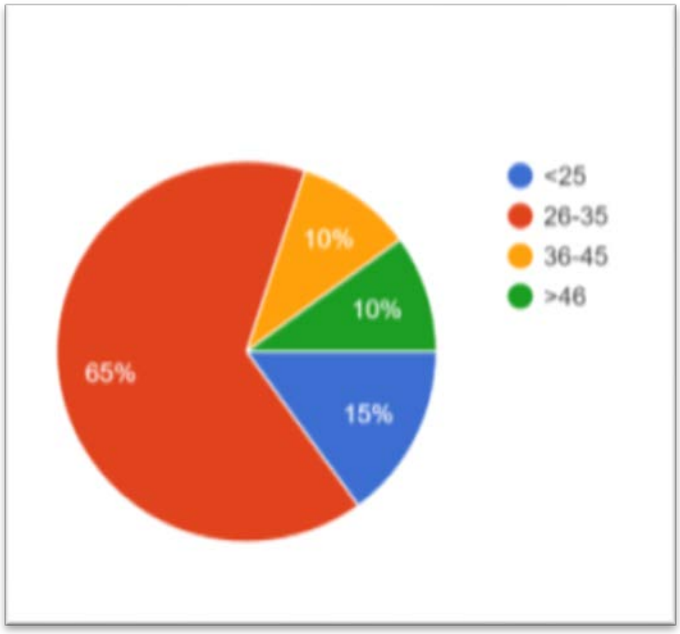


Figure 4.2: The percentage of respondents by age

ii. Gender

In this study, there were 14 (70%) men and 6 (30%) women responders. As seen by the percentage, men respondents outnumber female respondents by a significant margin. This is because men, not women, predominated the site's answers. Table 4.2 below lists the respondents' numbers by gender.

Table 4.4: The percentages of respondents by gender

Gender	No. of Respondent	Percentage (%)
Male	14	70
Female	6	30
Total	20	100

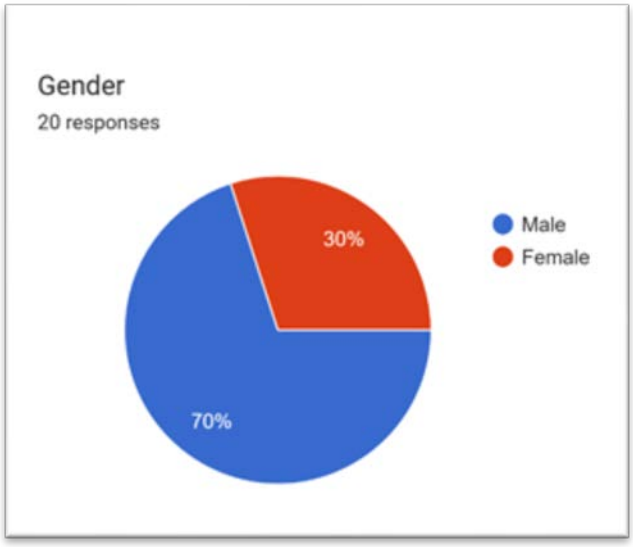


Figure 4.3: The percentages of respondents by gender

iii. Position

The titles of the jobs at a construction site, including Project Manager, Planner Engineer, Site Supervisor, Project Engineer, and others. According to Table 4.3, there were 10 respondents (50%) for the Workers and Driver lorry position. With 3 responses (15%), the Site Supervisor placed second. Only two people, or 10%, responded to the question about the site supervisor. for the general manager, project manager, superintendent, project engineer and site clerk all come with one respondent at 5 percent on the chart (5%).

Table 4.5: The percentages of respondents by position

Position	No. of Respondents	Percentages (%)
General Manager	1	5
Project Manager	1	5
Superintendent	1	5
Project Engineer	1	5
Site Engineer	2	10
Site Clerk	1	5
Site Supervisor	3	15
Workers or Driver lorry	10	50
Total	20	100

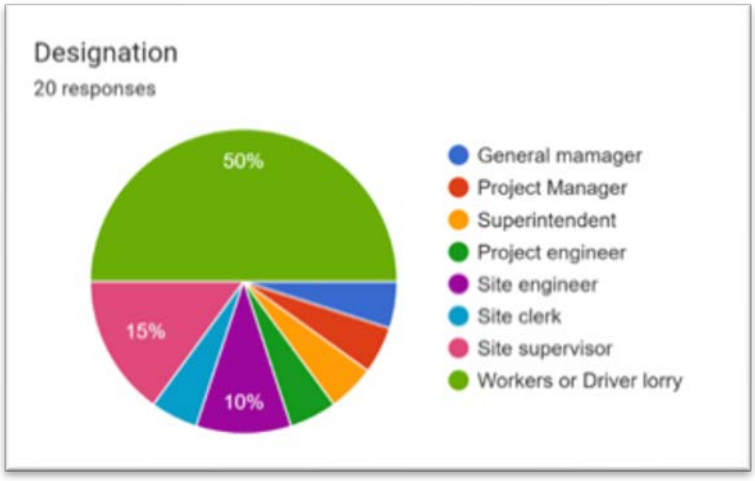


Figure 4.4: The percentages of respondents by position

iv. Working experience

Majority respondents in this survey (45%) had more than 2 years of work experience, with 5 respondents that having from less than 2 years work experience (25%), only 3 respondents work experience between 6 to 10 years experience which is (15%) and other 3 respondents got the working experience more than 10 years is also (15%). The number of responses by work experience is shown in Table 4.4 below.

Table 4.6: The percentages of respondents by work experience

Work Experience	No. of Respondents	Percentages (%)
<2 years	5	25
2-5 years	9	45
6-10 Years	3	15
>10 years	3	15
Total	20	100

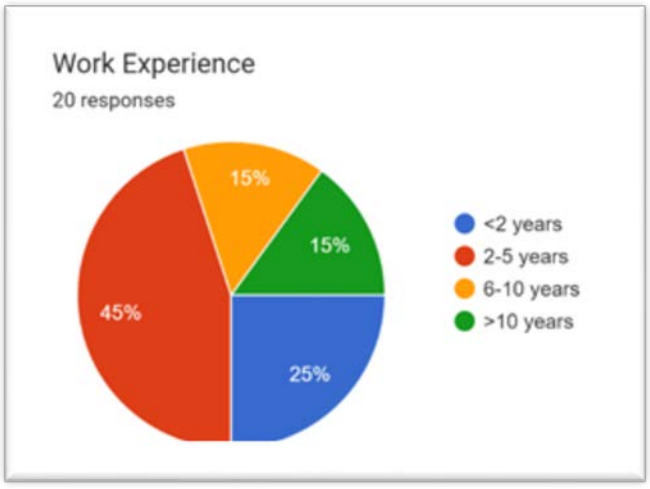


Figure 4.5: The percentages of respondents by work experience

4.4.2 PERCEIVED OF USEFULNESS (PU)

Sections B and C of the questionnaire will be analysed in this phase of the study. The analysis obtained from the questionnaire is displayed in the figures and tables below. These two sections used scale to collect data from respondent perspective on evaluation of usefulness for the dumptruck management application. The scale representing from 1 to 5 are “Strongly Disagree” to “Strongly Agree”.

The Perceived Usefulness Questionnaire measures an individual's perception of how useful a system, product, or service is. Participants rate statements on a scale to assess the system's impact on their job performance, task efficiency, and overall improvement. The questionnaire helps researchers understand users' attitudes and provides insights for system improvement and user experience enhancement. It focuses on subjective perceptions rather than objective performance measures.

Table 4.7: Question for Perceived of Usefulness (PU)

Perceived of usefulness items		
Construct	**Operational definitions**	**Measured items**
Perceived of usefulness (PU)	Perceived usefulness is a positive attitude that employees and workers have toward improving material application through the system approach.	**PU1**: Using Dump Truck Management apps in my job would enable me to accomplish tasks more quickly. **PU2**: Using Dump Truck Management apps in my job would improve my job performance. **PU3**: Using Dump Truck Management apps in my job would increase my productivity

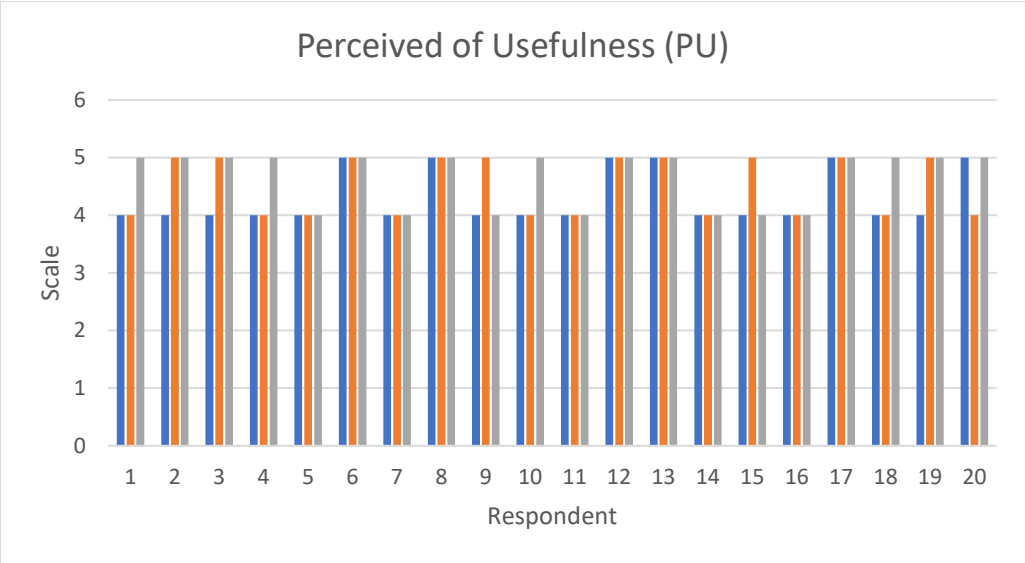


Figure 4.6: Analysis result for Perceived of Usefulness (PU) questions.

Perceived of usefulness is a feeling that users hold toward the improvement in producing RFI for post-concreting inspection by using e-PCI. From Figure 4.6 above, it is showing bar graph regarding the analysis result for Perceived of Usefulness (PU) question. The 'X' axis of this graph is number of the respondent and "Y' axis is scale. This question has scale which is 1 to 5 and 1 refer to strongly disagree and 5 refer to strongly agree, where 1 indicates strongly disagree and 5 indicates strongly agree. Out of the total questions, 29 received a scale rating of 5 (Strongly Agree), while the remaining 31 questions were rated 4 (Agree) by the respondents.

4.4.3 PERCEIVED EASE OF USE

Perceived Ease of Use (PEOU) refers to an individual's subjective assessment of how easy or difficult it is to use a specific technology, system, or service. It is a concept often used in the field of human-computer interaction (HCI) to evaluate user experiences and attitudes towards technology. The Perceived Ease of Use questionnaire is a common tool used to measure and assess users' perceptions of the ease of use of a particular technology or system. It typically consists of a series of statements or items that users rate on a Likert scale, reflecting their level of agreement or disagreement with each statement. The PEOU questionnaire helps researchers and designers understand users' perspectives, identify usability issues, and make improvements to enhance user satisfaction and adoption of technology.

Table 4.8: Question for Perceived Ease of Use (PEOU)

Perceived ease of use items		
Construct	**Operational definitions**	**Measured items**
Perceived ease of use	Perceived ease of use refers to User's acceptance of the dumptruck management application system.	**EU1**: Learning to operate the Dump Truck Management would be easy for me. **EU2**: My interaction with the Dump Truck Management would be clear and understandable. **EU3**: I would find it easy to get the Dump Truck Management to do what I want it to do.

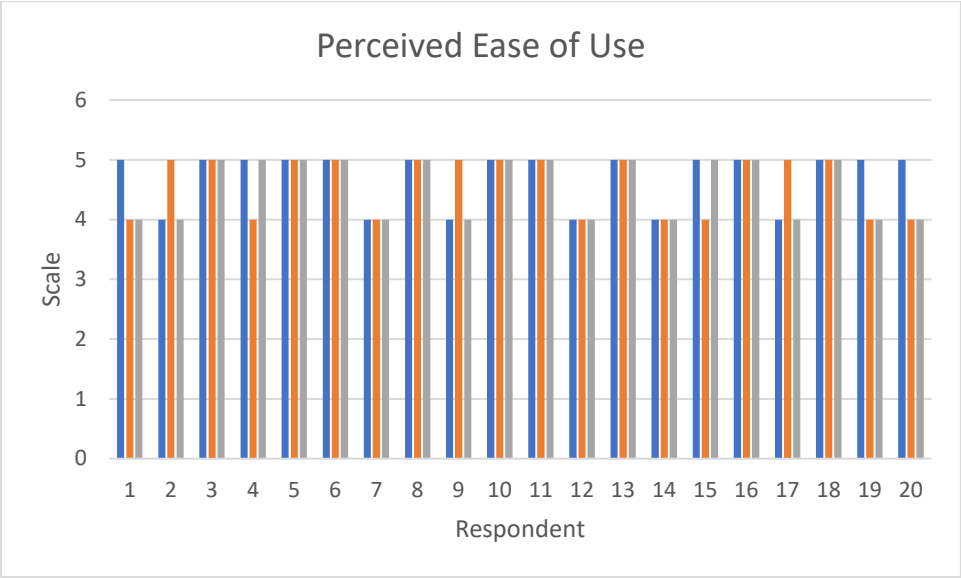


Figure 4.7: Analysis result for Perceived Ease of Use (PEOU)

Perceived ease of use pertains to the level of ease experienced by users when using dumptruck management application. The bar graph presented in Figure 4.6 displays the analysis results for the Perceived Ease of Use (PEOU) question. The horizontal axis ('X' axis) represents the number of respondents, while the vertical axis ('Y' axis) represents the scale. This question utilizes a scale ranging from 1 to 5, where 1 indicates strongly disagree and 5 indicates strongly agree. Out of the total questions, 34 received a scale rating of 5 (Strongly Agree), while the remaining 26 questions were rated 4 (Agree) by the respondents.

4.4.4 DIESEL CONSUMPTION

The Diesel Consumption on Site questionnaire is a survey tool used to gather information about the usage of diesel fuel at a specific site or location. It aims to collect data related to the quantity of diesel consumed, the purpose of its usage, and any factors that may influence consumption patterns. The questionnaire typically includes questions about the type and size of equipment or machinery using diesel, the frequency and duration of usage, the load or workload during operation, and any specific operational conditions or practices that may impact fuel consumption. This questionnaire helps organizations and researchers assess and analyze diesel consumption patterns, identify potential areas for optimization or efficiency improvements, and make informed decisions regarding fuel management strategies, cost control, and environmental impact reduction.

Table 4.9: Question for Diesel Consumption

Diesel consumption items		
Construct	Operational definitions	Measured items
Diesel consumption	Diesel consumption refers to the satisfaction of users with the application of diesel management on site	**EU1**: Using dump truck management apps, diesel will come at the right time. **EU2**: Using dump truck management apps, diesel consumption can be easily controlled. **EU3**: Using Dump Truck Management Apps, Diesel consumption records from the apps are accurate.

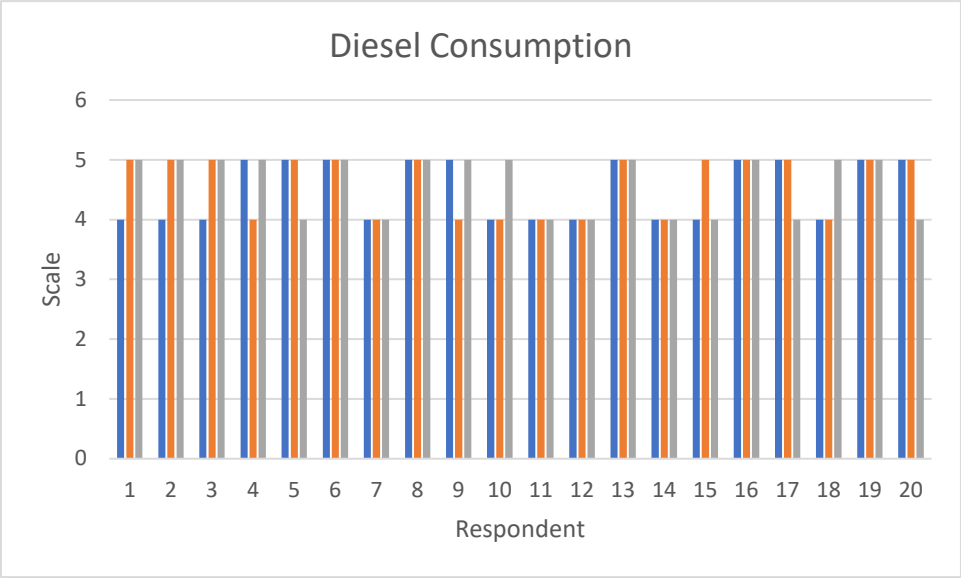


Figure 4.8: Analysis result for Diesel consumption

The Diesel Consumption on Site questionnaire is a survey tool used to gather information about the usage of diesel fuel at a specific site or location. This questionnaire focuses on how satisfied the user is with diesel management on site. The bar graph presented in Figure 4.8 displays the analysis results for the Diesel Consumption question. The horizontal axis ('X' axis) represents the number of respondents, while the vertical axis ('Y' axis) represents the scale. This question utilizes a scale ranging from 1 to 5, where 1 indicates strongly disagree and 5 indicates strongly agree. Out of the total questions, 34 received a scale rating of 5 (Strongly Agree), while the remaining 26 questions were rated 4 (Agree) by the respondents.

4.4.5 THE INTERPRETATION OF MEAN AND STANDARD DEVIATION FOR THE DATA ANALYSIS

Table 4.10: Summarize of Analysis on Effecctiveness Dumptruck Management Application.

Demographic				Perceived of Usefulness (PU)			Perceived Ease of Use (PEOU)			Diesel Consumption		
Gender	Age Range	Designation	Work Experience	Using Dump Truck Management apps in my job would enable me to accomplish tasks more quickly.	Using Dump Truck Management apps in my job would improve my job performance.	Using Dump Truck Management apps in my job would increase my productivity	Learning to operate the Dump Truck Management would be easy for me.	My interaction with the Dump Truck Management would be clear and understandable.	I would find it easy to get the Dump Truck Management to do what I want it to do.	Using dump truck management apps, diesel will come at the right time.	Using dump truck management apps, diesel consumption can be easily controlled.	Using Dump Truck Management Apps, Diesel consumption records from the apps are accurate.
Male	>46	General mamager	>10 years	4	4	5	5	4	4	4	5	5
Male	36-45	Project Manager	>10 years	4	5	5	4	5	4	4	5	5
Male	>46	Superintendent	>10 years	4	5	5	5	5	5	4	5	5
Female	26-35	Project engineer	<2 years	4	4	5	5	4	5	5	4	5
Male	26-35	Site engineer	2-5 years	4	4	4	5	5	5	5	5	4
Male	26-35	Site engineer	<2 years	5	5	5	5	5	5	5	5	5
Female	36-45	Site clerk	6-10 years	4	4	4	4	4	4	4	4	4
Male	26-35	Site supervisor	2-5 years	5	5	5	5	5	5	5	5	5
Male	26-35	Site supervisor	2-5 years	4	5	4	4	5	4	5	4	5
Male	26-35	Site supervisor	2-5 years	4	4	5	5	5	5	4	4	5
Female	<25	Workers or Driver lorry	<2 years	4	4	4	5	5	5	4	4	4
Male	<25	Workers or Driver lorry	<2 years	5	5	5	4	4	4	4	4	4
Female	26-35	Workers or Driver lorry	2-5 years	5	5	5	5	5	5	5	5	5
Male	26-35	Workers or Driver lorry	2-5 years	4	4	4	4	4	4	4	4	4
Female	26-35	Workers or Driver lorry	2-5 years	4	5	4	5	4	5	4	5	4
Female	26-35	Workers or Driver lorry	2-5 years	4	4	4	5	5	5	5	5	5
Male	26-35	Workers or Driver lorry	6-10 years	5	5	5	4	5	4	5	5	4
Male	26-35	Workers or Driver lorry	6-10 years	4	4	5	5	5	5	4	4	5
Male	<25	Workers or Driver lorry	<2 years	4	5	5	5	4	4	5	5	5
Male	26-35	Workers or Driver lorry	2-5 years	5	4	5	5	4	4	5	5	4
N				20	20	20	20	20	20	20	20	20
Mean				4.30	4.50	4.65	4.70	4.60	4.55	4.50	4.60	4.60
Standard Deviation				0.47	0.51	0.49	0.47	0.50	0.51	0.51	0.50	0.50

Table 4.11: Percentage of Respondent

SCALE	1 STRONGLY DISAGREE	2 DISAGREE	3 NATURE	4 AGREE	5 STRONGLY AGREE
PERCENTAGE OF RESPONDENTS (%)					
PU1	0	0	0	70	30
PU2	0	0	0	50	50
PU3	0	0	0	35	65
				52	48
EU1	0	0	0	30	70
EU2	0	0	0	40	60
EU3	0	0	0	45	55
				38	62
DC1	0	0	0	50	50
DC2	0	0	0	40	60
DC3	0	0	0	40	60
				43	57

Table 4.10 provides a summary of the analysis conducted on the effectiveness of dumptruck management application. The summary includes the mean and standard deviations for all the collected data. The mean value for all the questions is 4.5 or higher, indicating that the respondents' ratings on the questionnaire were predominantly "strongly agree" (scale 5) for almost all the questions.

Table 4.11 presents the survey results indicating the percentage of respondents evaluating the effectiveness of dumptruck management application. In Section B, for the Perceived Usefulness (PU) question, 48% of the respondents strongly agreed and 52% gave a rating of 4 (Agree). However, no respondents chose scale 1 (Strongly Disagree) or scale 2 (Disagree). Regarding the Perceived Ease of Use (PEOU) question, 62% of the respondents strongly agreed (scale 5), 38% agreed (scale 4), and none of the respondents chose scale 1 to 3. Lastly for Diesel consumption 57% of the respondents strongly agreed (scale 5), 43% agreed (scale 4), and none of the respondents chose scale 1 to 3

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 INTRODUCTION

This chapter presents the summary of the findings, conclusions, and recommendations based on the data analyzed data in the previous chapter. The effectiveness of the Dumptruck management application for project presentation especially for the project design phase evaluated by respondents (workers, site engineer, project manager, and workshop team).

In today's fast-paced and resource-intensive industries such as construction, mining, and waste management, dump trucks play a vital role in transporting materials, excavated earth, and debris. These powerful workhorses enable the efficient movement of heavy loads, contributing to the progress and development of infrastructure projects worldwide. However, with their robust engines and substantial fuel consumption, dump trucks also pose significant challenges when it comes to managing diesel consumption effectively. Diesel fuel accounts for a substantial portion of operating costs in dump truck operations, making it imperative for businesses to implement strategies that optimize fuel efficiency. With fuel prices often fluctuating and environmental concerns increasingly in focus, finding ways to minimize diesel consumption has become a priority for fleet managers and operators. Effective fuel management not only helps reduce operational expenses but also contributes to sustainability goals by reducing greenhouse gas emissions and minimizing the industry's ecological footprint.

5.2 DISCUSSION

The data analysis and discussion focused on three key objectives. Firstly, the study aimed to identify the management practices and diesel purchasing patterns in the study area. The findings provided insights into current practices, including route planning, load

capacity management, and maintenance schedules. Secondly, a dump truck management system application was developed using Xampp, leveraging its features for fuel monitoring, route optimization, driver performance tracking, and integration with fueling stations. The application aimed to streamline operations and improve efficiency.

Lastly, the effectiveness of the application was evaluated, revealing positive outcomes such as improved fuel efficiency, reduced travel distances, optimized resource utilization, and proactive maintenance. These findings suggest that the developed application has the potential to significantly impact diesel consumption and enhance dump truck management practices in the study area, providing valuable insights for future optimization and expansion.

5.3 RECOMMENDATION

Based on the importance of dumptruck management system in the construction industry, here are some recommendations for selecting and implementing an effctive dumptruck management system:

1. Combined with the InfoTech attendance application, it is easier for the user to update all the data in one application.
2. Make it simpler for users to access the data on the admin web page with just a phone by enhancing the mobile application.
3. Increase the number of machines in the programme, such as an excavator, to make managing the excavator on the job site easier.

5.4 CONCLUSION

In conclusion, the management of dump truck operations and diesel consumption is of utmost importance for businesses seeking to improve their bottom line and reduce their environmental footprint. By implementing fuel management strategies such as route optimization, maintenance programs, and driver training, companies can significantly reduce fuel consumption and associated costs. Additionally, embracing emerging

technologies such as telematics and alternative fuel options can further enhance operational efficiency and promote a greener approach to dump truck operations. With careful planning and continuous improvement, dump truck operators can achieve a balance between productivity, profitability, and sustainability, ensuring a more efficient and environmentally responsible future in the industry.

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APPENDIX

APPENDIX A **POST SURVEY**

APPENDIX B **GANTT CHART**

APPENDIX A

Final Year Project

Dear respondents, I am Mohamad Khairul bin Abd Kadir, a final year student of Bachelor in Civil
Engineering Technology (BCT) from Politeknik Ungku Omar (PUO) would like to invite you to participate
in a survey on evaluation of "Dump Truck Management" after experienced on it. I'd appreciate it if you could take the time to complete this survey. Your assistance with this survey is highly appreciated. Thank you.

1. Gender

Mark only one oval.

- ◯ Male
- ◯ Female

2. Age Range

Mark only one oval.

- ◯ <25
- ◯ 26-35
- ◯ 36-45
- ◯ >46

3. Designation

Mark only one oval.

- ◯ General mamager
- ◯ Project Manager
- ◯ Superintendent
- ◯ Project engineer
- ◯ Site engineer
- ◯ Site clerk
- ◯ Site supervisor
- ◯ Workers or Driver lorry

4. Work Experience

Mark only one oval.

- ◯ <2 years
- ◯ 2-5 years
- ◯ 6-10 years
- ◯ >10 years

Part B : Perceived of Usefulness (PU)

Read each statement and choose

5. Using Dump Truck Management apps in my job would enable me to accomplish tasks more quickly.

Mark only one oval.

	Strongly Disagree					Strongly Agree
	1	2	3	4	5	

6. Using Dump Truck Management apps in my job would improve my job performance.

Mark only one oval.

strongly disagree

1
2
3
4
5

strongly agree

7. Using Dump Truck Management apps in my job would increase my productivity

Mark only one oval.

strongly disagree

1
2
3
4
5

strongly agree

Part C: Perceived ease to use (PEU)

Read each statement and choose.

8. Learning to operate the Dump Truck Management would be easy for me.

Mark only one oval.

strongly disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

strongly agree

9. My interaction with the Dump Truck Management would be clear and understandable.

Mark only one oval.

strongly disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

strongly agree

10. I would find it easy to get the Dump Truck Management to do what I want it to do.

Mark only one oval.

strongly disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

strongly agree

Part D : Diesel Consumption

Read each statement and choose

11. Using dump truck management apps, diesel will come at the right time.

Mark only one oval.

strongly disagree

1 ◯

2 ◯

3 ◯

4 ◯

5 ◯

strongly agree

12. Using dump truck management apps, diesel consumption can be easily controlled.

Mark only one oval.

strongly disagree
1
2
3
4
5
strongly agree

13. Using Dump Truck Management Apps, Diesel consumption records from the apps are accurate.

Mark only one oval.

strongly disagree
1
2
3
4
5
strongly agree

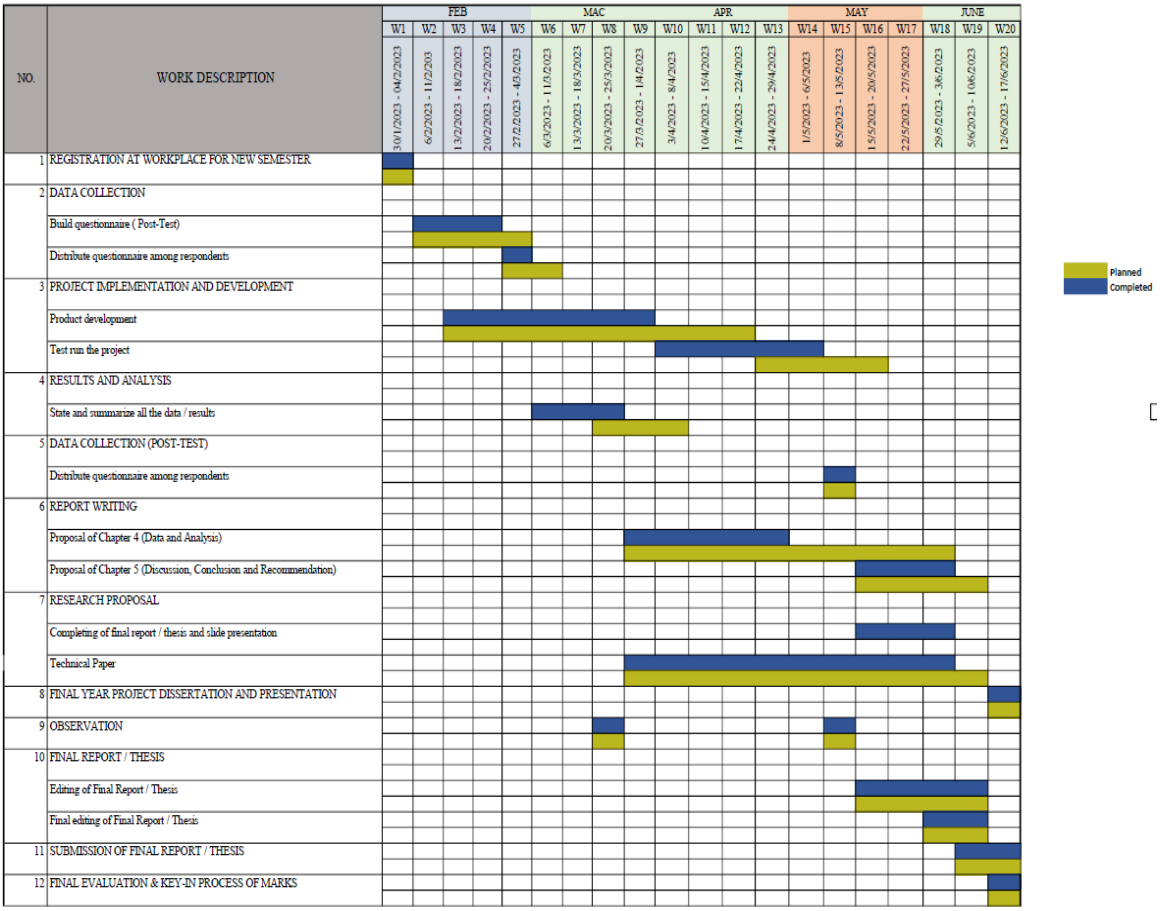
14. Thank you for completing this survey. Your feedback is highly appreciated and will help us to improve our Dump Truck Management in the future.

APPENDIX B

SEMESTER 7

Gantt Chart Semester 7

SEMESTER 8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8/5/2023 - 13/5/2023
15/5/2023 - 20/5/2023
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29/5/2023 - 3/6/2023
5/6/2023 - 10/6/2023
12/6/2023 - 17/6/2023
NO.
WORK DESCRIPTION
1 REGISTRATION AT WORKPLACE FOR NEW SEMESTER
2 DATA COLLECTION
Build questionnaire (Post-Test)
Distribute questionnaire among respondents
3 PROJECT IMPLEMENTATION AND DEVELOPMENT
Product development
Test run the project
4 RESULTS AND ANALYSIS
State and summarize all the data / results
5 DATA COLLECTION (POST-TEST)
Distribute questionnaire among respondents
6 REPORT WRITING
Proposal of Chapter 4 (Data and Analysis)
Proposal of Chapter 5 (Discussion, Conclusion and Recommendation)
7 RESEARCH PROPOSAL
Completing of final report / thesis and slide presentation
Technical Paper
8 FINAL YEAR PROJECT DISSERTATION AND PRESENTATION
9 OBSERVATION
10 FINAL REPORT / THESIS
Editing of Final Report / Thesis
Final editing of Final Report / Thesis
11 SUBMISSION OF FINAL REPORT / THESIS
12 FINAL EVALUATION & KEY-IN PROCESS OF MARKS
Planned
Completed