

**DEVELOPMENT OF DECENTRALISED APPS (DAPPS) USING BLOCKCHAIN
TECHNOLOGY TO IMPROVE INSURANCE PROCESS IN MALAYSIA**

BY
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To Improve Insurance Process In Malaysia

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ABSTRACT

Current insurance industry is having complicated process as well as heavily human involved. Parties involved usually consists of insurers, insured, auditor and 3rd party services. With inefficient processing time, lack of trust and lack of transparency, it prone to have reduce user experience. Insurance companies are also actively seeking a better solution. To this end, we proposed a decentralized application that build on blockchain network as a solution to the problems. Blockchain is an emerging technology that brings transparency and security to data storage and transparency. In this paper, we will introduce basic background of traditional insurance and blockchain as well as discuss how the integration of blockchain will bring positive impact to insurance domain. Furthermore, we will also indicate our system design. Our system aims to enhance insurance policy processing and claim handling with the least of human intervention. This solution is also able to avoids certain type of fraud with proper validation. The result of this project is a developed prototype of decentralized application on Ethereum blockchain.

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LIST OF ABBREVIATIONS

AI	Artificial Intelligence
DApp	Decentralized Application
DLT	Distributed Ledger Technology
ETH	Ether
FinTech	Finance Technology
IDE	Integrated Development Environment
InsurTech	Insurance Technology
IoT	Internet of Things
PoS	Proof of Stake
PoW	Proof of Work
SDLC	System Development Life Cycle

CHAPTER 1 INTRODUCTION

In this chapter, we present the background and motivation of our decentralized application development and our contributions to the insurance domain. This project is to develop a blockchain-based insurance decentralized application. Before getting into more details on the contributions of this project, one must know the basic concepts and processes in insurance and blockchain technology, and how both areas are integrated and create values upon existing solution.

1.1 Problem Statement and Motivation

The processes of applying for a policy and underwriting of the policy are costly, time consuming, tedious and are a burden to applicants/customers. In the year 2021, every transaction is expected to be instantaneous and real-time. Business organizations are transforming to cater to the needs of the millennials. Undoubtedly, complex insurance process is one of the pain points in traditional industry. Offline insurance purchasing process often entails a lot of manual forms-filling and documentations. After submission of application forms, underwriting process is required to determine the correctness and validity of customers. Claiming process is another cycle of hassle documentation which required lengthy waiting time. Although insurance industry has paid intensive effort on speeding up the claiming process, there is still a growing gap between the pay out and speed expected by the digital generation today. 74% of policyholder tend to be frustrated by insurer's call back and forth for the same question. (Accenture cited in Naylor, 2013). Fragmented data source use for validation requires back and forth processing and verification among multiple parties leads to low efficiency of information exchange which tend to consume longer time and have more human processing errors.

Second problem within whole insurance process is the involvement of intermediaries. Contacting an executive or agent to guide through insurance purchasing process makes customer have relatively low control. The main reason behind to reach out to intermediaries is that policy often contains jargon and which difficult for user to understand their coverage and policy details. In addition to that, it is a relationship build on selling and making profit instead of customer control what they have to buy. Therefore, higher chances of customer feel have been sold by agent things that actually does not need for example unnecessary add-ons for its own commission. (Das, 2019) The more intermediaries involve in business process, the more

human engagement. It eventually leads to relatively higher human error and higher amount of operational cost incurred. In this case, premium will be charged to insured to balance the benefit and loss.

Lastly, the transparency between insurer and customer is limited and the process for insurance claim is complicated too. With low transparency between both parties, it not only limits the accuracy of underwriting but also prone to fraud. People will tend to present their best condition to gain greatest policy quotation, therefore insurer has to spend more time on identifying the accuracy of information given to avoid loss. Fraudulent claim for unjustified reimbursement can be requested by malicious customer and insurer might not be able to identify. For example, insurance fraud of double dipping which individual imitate claims on same incident to multiple companies hence getting twice the pay-out for same loss. Frankly, fraud losses are only estimated numbers of loss as uncovered fraudulent claims are practically still exist in this industry. In addition, low transparency will also give dishonest insurer the opportunities to minimize or block rightful payouts by exploiting loopholes in insurance contract.

1.2 Problem Objective

- **To enhance user experience by providing more simple and efficient insurance process.**

Problem that we have brought up in previous section are lengthy and hassle of purchasing and claiming process. With the implementation of DLT, parties involve no longer spend long time on reconciling record as all data and record is recorded in each one ledger. For example, the request of claim will be propagated to related parties for required document, it no longer required insurer manually collect all the documents for filling a claim request. It reduces the need of insurers run through several departments on verifying documents sent by user as verified documents is directly provided by the authorities. The efficiency on claim processing will also be enhanced by using smart contract to automate claim. Rules can be predefined in smart contract such as proven windscreen damage image and receipt from select panel workshop is submitted, the claim will be automatically paid out.

- **To eliminate intermediaries throughout the whole insurance process.**

This application provides user to control their own purchasing and providing them high transparency involvement within insurance process. For example, user can reach out to this

application for policy purchasing and able to gain insight of every process of their request without agents. With minimum requirements needed, the whole process is easy and doesn't need 3rd party helps. Within the process of validation of purchasing, there is no human intervention to verify the policy quotation and determine the premium as all records can be retrieved and premium can be calculate using predefined algorithm. To perform claiming, smart contract will also play the roles to communicate and collect all required documents. It can effectively diminish the need for a third-party authenticator and reduce mistrust between stakeholders. With this application, user can connect directly to insurers with higher control of own data.

- **To reduce the potential rate of insurance fraud for insurer and reduce intention rejection claim for customer.**

With the implementation of blockchain, it provides higher level of transparency within each party with transaction history and document processing. With the transparency among involved parties, the unwanted situation can be reduced. From insurer perspective, it reduces the guessing works of insurer to calculate the premium and determine the coverage as every vehicle owner will try to best present themselves and their vehicle condition to obtain best policy quotation. With blockchain technology, all information such as user driving behaviour and vehicle condition can be retrieved on chain. Apart from underwriting process, the inaccuracy and fraud on claiming process will also be reduced. As documents required will straightforward retrieved from panel workshop's record's contract, it therefore minimises the potential risk of getting falsified records or fake copy of documents as they need proper documentation for their own operation too. Moreover, duplicate claim or claim fraud can be reduced as all transaction occurred on chain are recorded and immutable. Any fraud can be detected easily on this perfect audit trail. From insured point of view, smart contract is self-executed when it reaches predefined event, it no longer needs insurer to manually inspect the claim, meaning to say that insurer cannot intentionally reject claim by using loopholes in the policies.

1.3 Project Scope and Direction

The purpose of this project is to develop a decentralized application (DApp) that can improve traditional insurance process in Malaysia. This application will be built upon private Ethereum network, and it will have business logic in an Ethereum smart contract which will be executed by web application. Our DApp is mainly focusing on providing user car insurance service which include features of underwriting policy, view policy, claim insurance and real-time claim tracking. As intermediaries is the pain point on insurance domain, therefore we will also be focusing on providing the short and precise policy and user-friendly interface to minimise the difficulties level of whole process. The actors that mainly involved in this system are user who purchase policy and initiate claims, panel workshop and police who provide service receipt or accident report as well as insurer who make final approvals to the claims.

With the implementation of blockchain technology, all data provided will be shared with related parties. Therefore, the buying and claiming process will reduce hassle on filling long and complicated forms as well as not involving any paper works.

For underwriting policy, our proposed system will have features stated as below.

- **Less information required:** This DApp only required user submit fill up vehicle plate number and coverage type to generate quotation for the policy. Quotation will auto generate after measuring the successful retrieved related information from 3rd party according to user input. To ensure the security, only vehicle owner can request quotation for its own vehicle.
- **Zero involvement of intermediaries:** This DApp provide a clear-cut process for user to purchase policy and view purchased policy details on the web application based on their needs.

To request claim, our proposed system will have features stated as below.

- **Less information required:** This DApp only required user to fill up few details such as vehicle plate number, date and panel workshop's address for claim request.
- **Automation of collecting claim:** If the request claim is successfully initiate, this DApp will communicate with related parties such as panel workshops or police department to collect required document for claim verification. The whole process of collecting document will not involve any human based activities.
- **Semi-auto of claim approvals:** The automated payout will be released according to claim indident. For example, if windscreen damage or car theft claim is requested, smart contract will auto approve the claim and cover the cost of repairing to panel workshop once required

information is gathered. If car accident claim is requested, insurer will have to make the final approval as more parties are involved in this event. System will also have the functionality to auto reject user's claim when user is not covered by bought policies.

First of all, our application only requests just-enough information from user. While user identity can be authenticated by key-pair cryptography and all data captured and submitted will be stored on chain, it provides transparency on existing as well as past driving behavior, insurance policies and claim associated with insured. With these history record, underwriting no longer need weeks of time going through the process of user verification and premium determination as the process can be performed automatically with self-executing code. With the implementation of DLT, it established a shared interface for related parties to shared information between each other. All transaction occurred are recorded and can be view by each other. It increases the efficiency on information exchange which concurrently increase the efficiency on business process.

This application provides user more easy and hassle-free ways to perform buy and claim online. With the elimination of insurance agents within the whole insurance process, operational cost will be reduced so that insurer can provide lower premium. From insurer perspective, user identity will be verified and claim trail can be found in the blockchain, therefore claim fraud in industry is believed to be reduced. It is a win-win situation for both parties.

The whole buying and claiming transaction required a huge environment with several party's involvement, however, for current development trend there is no ready sample to simulate the data required for this system. To simulate the whole transaction, our development will also include a few sample parties that involves in the process such as government department who have all user identities, JPJ that store all the vehicle information and previous records, panel workshop who provide service receipts and police department who provide incident report evidence.

1.4 Contributions

Contribution of this project is to produce a lightweight application for car insurance based on blockchain technology for the industry. It covers basic insurance process such as a user purchasing policy, viewing policies, making claims and tracking claim progress while insurer can make or verify claims to insured. This process of the blockchain-based insurance process

will be conducted online with very minimal paperwork. It can achieve data security, immutability and process transparency and making the whole process more streamlined and efficient.

The impact of this project to current industry is that it will drastically improve the customer experience by making the whole process more pleasant, less time consuming and less costly. The enhancement of insurance process can get rid of old perception on insurance which are difficult to understand, expensive and unnecessary. By utilizing blockchain technology, it can promisingly help insured to have a better experience on performing insurance transaction. It can bring current industry to a new high level.

For citizens, our proposed application provides a lower barrier to purchase insurance plan. With the simple process and elimination of intermediaries, user can go through all process pleasantly with lower premium. Furthermore, user no longer required to physically reach out insurance company as every phase can be done online. With one device and network, everyone can enjoy the insurance services. This opportunity is given to every citizen regardless of age and financial status to purchase protection from undesirable risk which citizen's living quality and standard will eventually increase.

For insurance company, the characteristic of distributed ledger on blockchain can ease the process of underwriting and claiming process as every party's transaction is recorded and shared within each other. Disintermediation also allow organization further to cut down operational cost. Therefore, the increase of efficiency of insurance process will lead insurer to have more chance to focus improving core business instead of spending time on verifying documents.

CHAPTER 2 LITERATURE REVIEWS

2.1 Review of technology

2.1.1 Insurance

Insurance is a contract formed by policies which provide financial protection to an individual or entity against loss from insurance company. In exchange of constant premiums paid by personal or commercial, insurance companies offer to pay a sum of money when predetermined event occurs. The common types of insurance include life insurance, automobile insurance, health insurance, travel insurance and property insurance.

Before applying for a policy, one should be clear on all features and benefits indicated in the policy. However, traditional insurance often involves many industry-specific jargons in its communications. Hence, intermediaries - agents or brokers - are needed to communicate with customers in order to introduce and explain the insurance products. In traditional insurance industry, customer connection is built on trust of intermediaries. However, with poor communication between two parties, customer will often feel that they are accepting biased advice rather than being objectively introduced with suitable products. Figure 1.1 shows the common process of buying an insurance policy. To complete an application, typically, a customer is required to provide lots of information such as medical condition, medical history, financial statements, health and personal declarations and etc. Paramedic examinations or additional financial information are also required upon application of the policy for underwriting purposes.

Underwriting stage is to determine coverage and premiums, it usually takes 3 to 4 weeks for insurance company to contact relevant parties to verify the information pertaining to the applicant and the application. As many intermediaries are involved in the process, high operational costs in terms of time, manpower utilization and monetary fees, are incurred which makes traditional insurance expensive. The overall buying process is a hassle and complicated the many parties involved, especially to the applicants. (Brighthouse Financial, 2017)



Figure 2.1.1.4 Buying process of traditional insurance

When the insured event occurs, traditional insurance claim settlement will be processed as figure 1.2. In order to initiate a claim, customer have to report loss to intermediaries and file a claim by completing complex forms and gather physical receipts of costs incurred. After agents or brokers submit the claims, customers have to establish relationship with 3rd party data providers to get access to update data for loss assessment. Loss assessment phase requires back-and-forth communications with customer, intermediaries and insurer in order to gather enough information as there is no interrelationship between the many parties involved. Lastly, loss adjuster has to manually review and approve the claim request. Claims agent will only initiate payment after the claim approval is success. The process of claim settlement in traditional insurance is clearly seen to be heavily human involve and ineffective. It is a critical pain point for customer to go through complex and complicated procedures after stricken by an undesirable event.

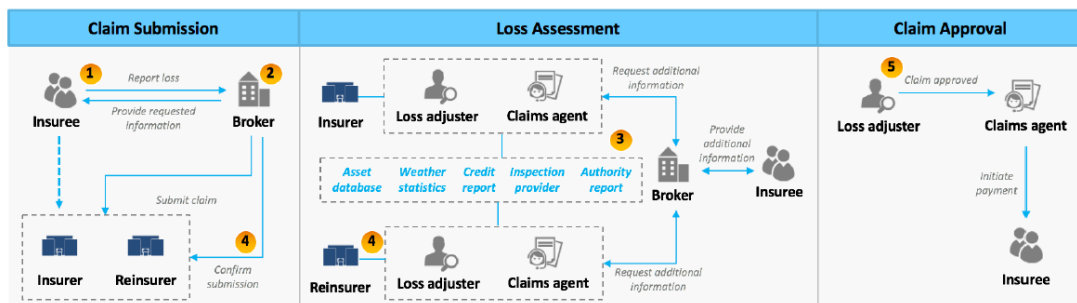


Figure 2.1.1.5 Traditional insurance claiming settlement

The emergence of InsurTech is creating impact on traditional insurance industry. Similar to FinTech, InsurTech is inspired by “insurance” and “technology” which transform current insurance industry model with innovative technology to increase its efficiency. As previously mentioned, traditionally, adjustor have to manually review and flag multiple claims, but in current norm, insurance company has expected to receive up to thousands of claims in one day. Bombarded with high volume of data, it is worth to mention that there are insurance companies currently using AI and robotic process automation to substitute adjuster’s works. (Inmediate.io, 2020) With these technologies, flag predetermination for fraudulent activities, risk monitoring and

prevention can be achieved with the least manual labor. New opportunities is created for insurance companies through InsurTech, such as a faster claims process through the use of real-time videos, usage-based insurance which track via telematics and more. Although InsurTech emerged around 2010, many insurance companies are still reluctant to adapt. Many InsurTech startups are still keen to seek help of traditional insurers on underwriting process to manage risk. (Hargrave, 2020) Moreover, 40% of insurers are unsure about the readiness of customer to accept InsurTech and a large portion of insurers are unsure and did not take InsurTech as their overall strategy (PWC, 2016).

2.1.2 Blockchain

Blockchain technology is first outlined by Stuart Haber and W Scott Stornetta in 1991 and first implemented by Satoshi Nakamoto as public ledger for transactions using bitcoins in 2009. (The Institute of Chartered Accountants in England and Wales, 2020) Nowadays, it is one of the hottest topics in FinTech and believed to be potential solution for insurance industry. Blockchain literally indicate several blocks of data cryptographically secured are connected to each other to form a chronological chain. In era of digitization, blockchain is a type of distributed ledger and an infrastructure that enable peer-to-peer exchange of information. The core concept of blockchain is to achieve decentralized transaction as every node on the network will have the copy of every transaction, it eliminates the needs of centralized authorities to store and manage data for data integrity. Moreover, it is an append-only database which all transaction occurred cannot be altered. Therefore, consensus mechanism will be utilized to ensure trustworthiness of data.

The main feature of blockchain is that it provides an environment where data recorded is immutable, secured and transparent. Technically, new block is added with a timestamp, corresponding transaction data and a 10-digit hash code of previous block to chain. The timestamp not only ensure every block is following a chronological order but also create an accurate audit trail for all transaction. Since hash function is a one-way function meaning that practically reverse action which convert hash to original data is impossible. Furthermore, value of hash will be changed according to data changes. If one intent to alter transaction, the corresponding block's hash value will change, it simultaneously needs to manually change the following block which required tremendous computer power for processing. Thus, it can be concluded that data is

tamper-proof with the structure of blockchain since each block are interconnected with hash of previous block.

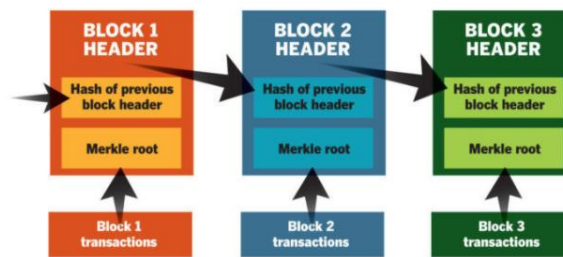


Figure 2.1.1.6 Data structure of block (7)

Cryptography is not only used to secured transaction on blockchain, but it has also been utilized to verified user with digital signatures too. With asymmetric key encryption, sender's plain text is encrypted with its own private key as a digital signature and encrypted with receiver public key to ensure confidentiality. Receiver's private key and sender's public key is needed in order to perform decryption. As only key pairs are able to decrypt itself, if receiver able to decrypt ciphertext with sender's public key, it authenticates the message is send by right person and it can serve as digital signature to verify user. It allows user to have full control of own data as to establish secured communication on blockchain, one can request for data access and one can decide which part to share or wholly reject.

Blockchain technology is also known as Distributed Ledger Technology (DLT) which can be said as a share append-only database which transaction state is confirmed and verified without the need of reliable centralized authority within the network. The concept of consensus mechanism is crucial to dive into how transaction is being verified and reach the state of agreement on blockchain network. There are several types on consensus mechanism introduce on different blockchain network, however we focus only on Ethereum network hence we discuss only Proof of Work (PoW) and Proof of Stake (PoS) .

2.1.3 Consensus Mechanism

PoW is currently used protocol on Ethereum, and this mining protocol will be phased out to PoS for upcoming years. PoW simply to said is a mechanism which similar to a trial-and-error race for participants to solve a math puzzle. (ethereum.org, 2021) Participants who solve the math puzzle is called miners and the math puzzle is to find the nonce for a block. All miners will be required to have high computing processing power for the whole trial-and-error process based on the block difficulties.

The harder the block, the more processing power is needed. The fastest miner who finds the nonce will be the only winner and rewarded with ether (ETH). The verified block with valid nonce will then be distributed around the blockchain network. The whole process of solving the math puzzle is known as “proof-of-work”. Although there is no minimum amount of ETH required to become a miner, the equipment to start mining is a big investment as longer the chain, harder the block and higher computation power is required to be the winner. As the process utilise high-powered computers to compete and consume lots of energy, therefore PoW is also proven to have bad impact on environment. A study found that Bitcoin’s carbon footprint is as large as China’s 10 largest cities. Elon Musk, CEO of Tesla, Inc, has also made announcement to stop trading with Bitcoin on 13 May 2021. (Hoskins, 2021)

PoS unlike PoW that miners must compete to be the first block validators. PoS select validator at a random basis to create block and other validators who are not chosen will be responsible to validate the proposed block. To become a validator, user is required to stake 32 ETH. Validators will be rewarded for creating new block and attest other blocks. If validators validate a malicious block, they will lose their stake as punishment. With PoS, it builds up a healthier environment that the balance of validation is maintain and no competition required which reduce carbon footprint. This mechanism is more decentralised as participants are increased based on its low entry such as lower investment on hardware compare to PoW and user who have not enough of ETH still can join staking pools. However, PoS its still in its infancy which takes time and test to become more practical solution like PoW. (ethereum.org, 2021)

Under these mechanisms, Gas as known as cost of completing a transaction based on supply and demand of processing power, and a few second of transaction time for block validation is required when performing a transaction on blockchain network. Once the data is verified with previous mentioned consensus mechanism, copy of the transaction will be distributed among every participant in the network. With real-time record’s distribution, it eliminates the need of synthetic process compared to data stored in silos. The elimination of centralization provides high transparency and single source of truth as transaction of every ledger is same and can be traced.

2.1.4 Smart Contract

The key concept in blockchain technology is smart contract. Smart contract is a self-executing code deployed on Ethereum blockchain which can automate business logic. When predefined criteria are met, it will execute sets of business logic define in contract and agree by parties involved. Smart contract is innovative because it dependable on on-chain data. Where data needed is not within blockchain, off-chain data sourced from other data provider could also be used to trigger predefined-event. Smart contract is important because its functionality on blockchain is built upon shared databases with variety sources of data.

Take life insurance as an example, to file claim for policy owner death, user is required to manually collect death certificate issue by hospital or government and submit to agents. Beneficiary will take around 1 week up to 2 months' time to receive the payout, the delay of payout can be due to variety reason such as wrong form submitted or long-time investigation. However, with smart contract, event and details can be predefined when policy is placed. Once the event is met, for instance copy of death certificate is received directly from authority, smart contract will automatically pay the amount to beneficiaries. It required minimum of human interference and automatically performs predefined event which enhance the efficiency of business process.

With above mentioned characteristic in blockchain technology, the implementation is no longer limited in cryptocurrency. It can act as the solution for data breach caused by single-point attack on centralized service providers, falsifying records or even identify theft. Blockchain can achieve the ideality of "everyone owns their own data". Different from centralized networks where user's personal information is stored centrally and might potentially face central points of failure. With blockchain technology, participants have full controls of their data to decide who can read and write. Moreover, participants can remain identity confidential and being authenticated with their digital signature at the same time. As mentioned previously all transaction is cryptographically distributed all over the network and it is impossible to edit and delete, therefore participants are able to verify and track every transaction. Therefore, fraud can be significantly reduced with its data immutability, transparency and distribution. Although this technology is still in its infant stage, it is believed that it will makes current industry undergo an enormous change.

2.1.5 Application of blockchain in insurance

To achieve fully automated smart contract insurance claim processing, current success application in insurance is mainly focus on parametric insurance. It is also known as index-based insurance, unlike traditional insurance which insured is required to pay premium and undergo loss assessment for claim, parametric insurance claim is given upon occurrence of triggering event. Flight delay insurance and crop insurance are both practical use case happened in industry. Oracle's data such as weather information and flight schedule are used in this kind of smart contract as parameter to trigger predefined event. The claim process become transparent and automated without creating a fuss for customer. Etherisc, the insurtech startup who won the "most innovative blockchain startup award", have develop flight delay DApp on Etheruem blockchain which enable users to share the risk of flight delay and cancellation.

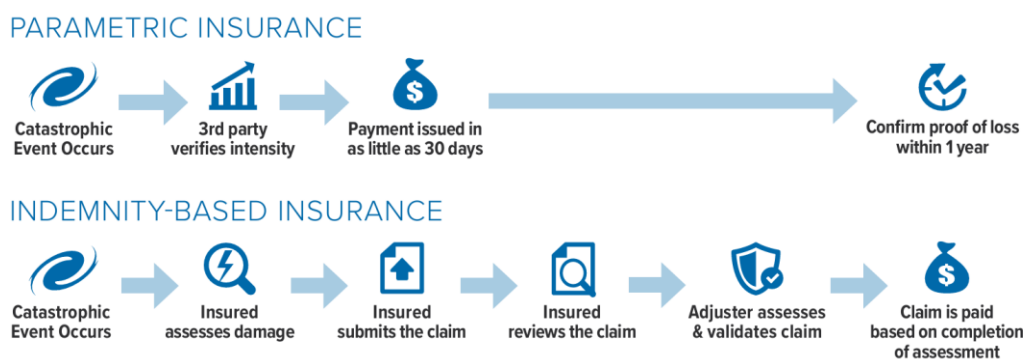


Figure 2.1.1.7 Comparison of claim process with parametric insurance and indemnity-based insurance (8)

The implication of DLT in insurance is still in its infancy or in the stage of proof-of-concept. Ideally, with the implementation of DLT future state of claiming process will evolve as figure shown below. Automated claim application will be triggered by insured or smart assets when loss occurred. Insurance policy via smart contract will confirm initial coverage for loss as well as informed insurer in real-time. DLT will then automatically query for secondary data sources to assess the claim and calculate the loss amount. If reinsurers exist, smart contract will then be able to identify the liability calculation for each carrier. After final decision is approved, payment will be initiated to insured via smart contract. As all data is recorded on distributed ledger so no reconciliation between parties is needed and transaction is semi-automated done by smart contract. With DLT and smart contract, insured able to initiate claim without involving intermediaries, thus it cut down operational cost in between and more time

saving. One of the products develop by ChainThat have utilized distributed ledger within insurance process among brokers, reinsurers, and settlement party.

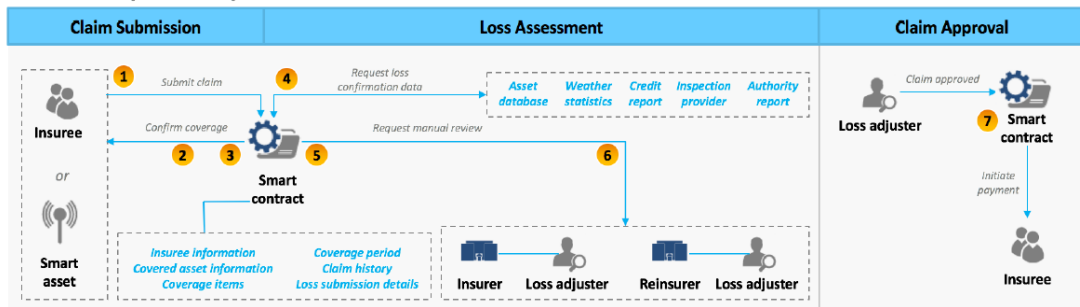


Figure 2.1.1.8 Future insurance claim process (Yerramsetti , n.d.)

Generally, the idea of implementation of blockchain technology in the insurance industry is not new, but many insurance companies are not engaging in this field because the risks and regulatory requirements still remained unclear. Interestingly, it is expected that InsurTech market will growth 41% annually between 2019 and 2023. (Hargrave, 2020)

2.2 Review of existing systems

2.2.1 Takaful Motor Insurance

Figure 2.2.1.1 Takaful - Insurance Quotation (1/3)

Figure 2.2.1.2 Takaful - Insurance Quotation (2/3)

Figure 2.2.1.3 Takaful - Insurance Quotation (3/3)

Takaful Malaysia is Shariah compliant which provide insurance option grounded in Islamic Muamalat products. User can reach their official site to get their quote and purchase online. To get quote, user have to give vehicle information which bound to identity card of the owner, then system will derive vehicle details and usage to calculate gross premium. After confirmation of gross premium, user will proceed to choose additional coverage. Total premium will be calculated and show at the panel according to user add-ons, once it is all set, system will proceed to payment. The overall get quote and buying process is relatively easy and user friendly. The interface shown and information shown is clear and concise. However, current website has no online claim submission, they only provide online policy purchases. User are requested to gathered document and file claim as well as manually submit to insurance agent.

2.2.2 Etherisc Flight Delay Insurance Decentralized Application

Figure 2.2.2.1 Etherisc - Apply policy (1/2)

Payouts for premium: 2€			
Delay in minutes	45+	Cancelled	Diverted
Payout	60.15€	100.25€	100.25€

Figure 2.2.2.2 Apply policy (2/2)

#	Flight	Departure	Premium	Status
1	KL1224	July 12, 2018 08:40	21 eur	active
2	KL1228	July 12, 2018 09:35	0.05 eth	active

Figure 2.2.2.3 Etherisc - View Policy

To highlight the usage on automated insurance claim via smart contract, Etherisc have made his innovative contribution to the industry. Etherisc is an insurance platform startup who offered blockchain-based flight delay insurance. (Etherisc, n.d.) It builds on Ethereum smart contract to automates the process of payout when event of flight is delayed or cancelled is triggered. After filling up personal and flight details, user is allowed to choose their preferred premium and view their estimated payout. To make the purchase, user can choose the currency of online currency Ether (ETH), or major fiat currencies which includes euros, us dollar and pounds sterling. User can also view their policy details by giving the policy number. The overall interface is clean and simple and navigation towards each step is clear. The main strength of this application is the elimination of file claim and claim waiting time as the smart contract implemented will automatically transferred money towards users account when event triggered. However, high processing fee is the tradeoff of the efficiency as 20% of the premium will goes to developer and investor. Moreover, the predefined event is based on 3rd party data, unavoidably the limitation of this application is the reliability of data.

2.2.3 Lemonade

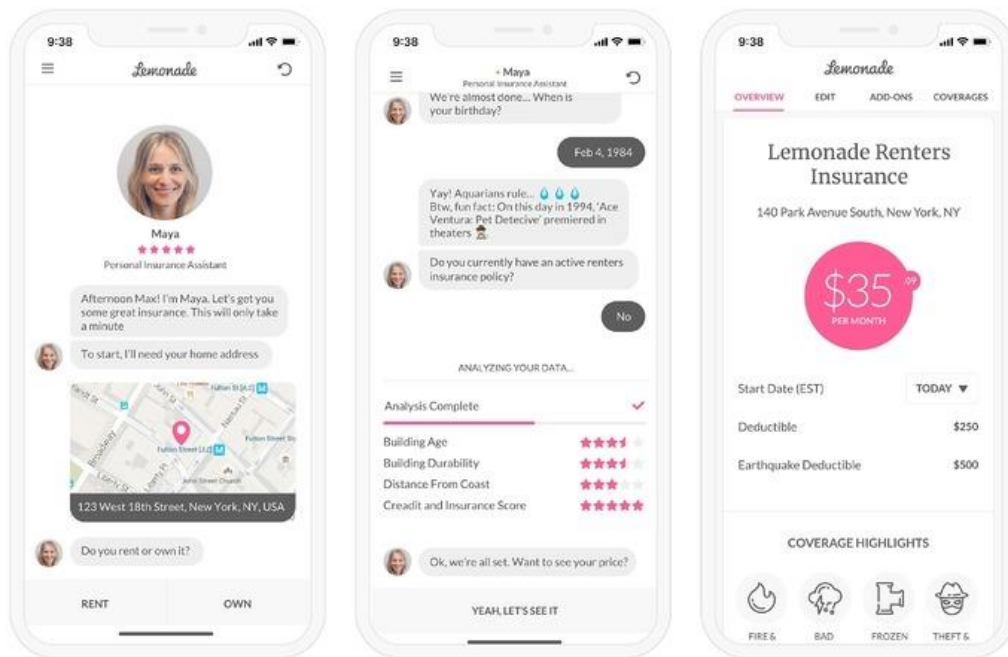


Figure 2.2.3 Lemonade Insurance Mobile App

Lemonade is a solely online insurer who offer risk protection for renters and homeowners with the combination of AI and Distributed Ledger Technology. After selected preferred insurance plan, user will be guided to fill up information by chatbot, Maya. Lemonade utilize AI to perform risk analysis based on information given by the user to determine premium. User have to paid fixed premium per month and smart contract will attempt to verify the loss when claim is requested. As the whole process have no human interference, by reducing operational cost, they aim to provide relatively low premium and faster claim. With the combination of AI and DTL, Lemonade have set the world record by paying one's stolen casualty in 3 seconds. (Daley, 2019) However, the algorithm uses for approving applicants, pricing risk and claim determination has its gap for improvement. Some user reviews indicated that the premium quoted is far high than normal insurance and Lemonade is suffered from 166% loss ratio in 2017. Lemonade is to be believed that they had little customer experience on training its algorithms. Indeed, loss ratio has dropped to a healthier 86% in the first quarter of 2019. Schreiber said, "Data is overtaking expertise.", the loss ratio was predicted to fall continuously with the improvement on algorithm. (Kauflin, 2019)

2.2.4 CAIPY car insurance policy framework

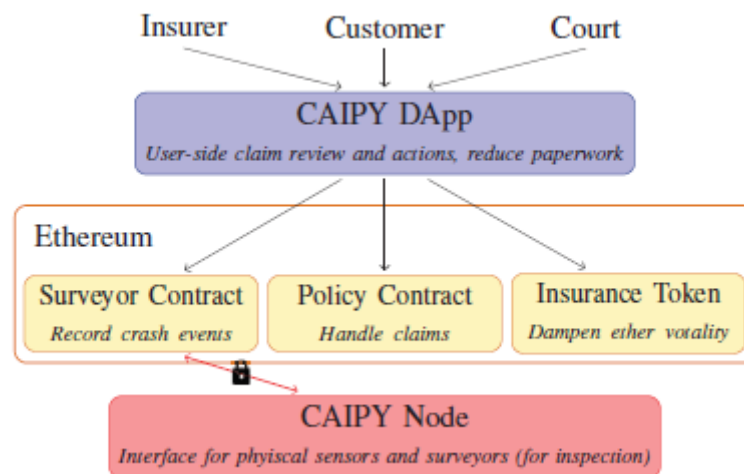


Figure 2.2.4 CAIPY - Overall design of system

CAIPY is a smart contract-based ecosystem for simple and transparent car insurance. Smart contract utilize in this framework is not aimed to replace but support current insurance process. It removed the needs of manual inspection to automated damage detection by the presence of tamper-resistant car sensors. Manual inspection of claim still can be requested if any doubt happens in claiming processing. Figure shown indicate the overall design of CAIPY DApp. It is based on public blockchain system, Ethereum, as Ether is widely accepted, and transparency of insurance process reduce the intentional malicious act from customer or insurers. The application is built upon assumption of vehicle acquire comprehensive sensors and reliable to detect insurance-events for instance malfunctional component or crash. Car damage data will be sent to surveyor through surveyor contract, after surveyor has read the crash reported by sensor, it then automatically generates customer claim, once claim is approved, insurance tokens, in this case is Ether, will be transferred via policy smart contract. To ensure its data privacy, information stored on blockchain will be secured by AES encryption and corresponding keys will be distribute to each involving authorized party. As smart contract is highly dependent on data-correctness, sensors proposed by CAIPY still need further investigation. Customer accountable is also one of the limitations in this application.

2.2.5 CioSy

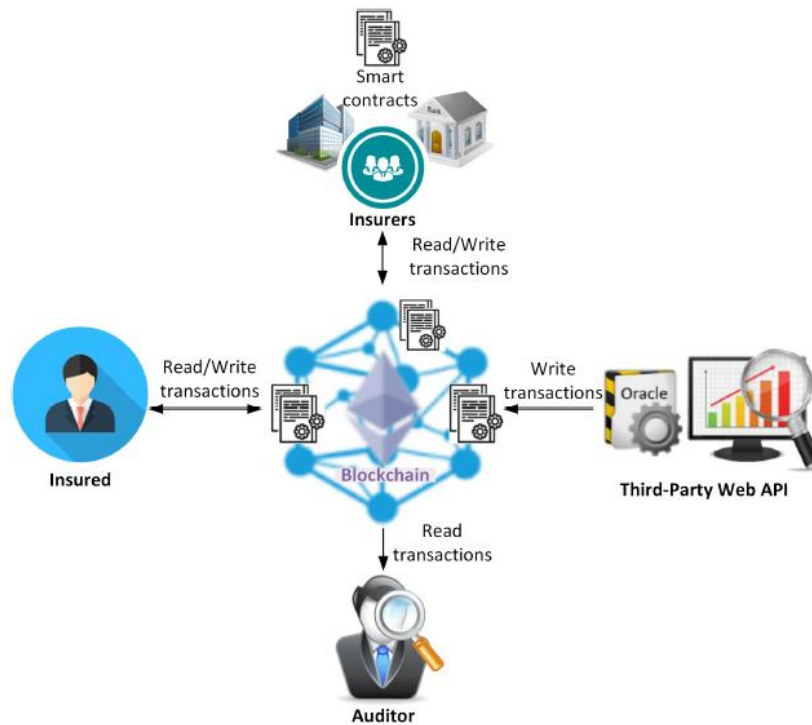


Figure 2.2.5.1 System model of CioSy

CioSy is a blockchain-based collaborative insurance solution, as known as peer-to-peer solution, where customer rely on each other instead of traditional insurance companies. The whole system involves 4 parties which are insurers who collaborate to contribute a pool, insured who have interest to purchase policies offered by insurers, 3rd party of web API who invokes smart contract's predetermine condition and auditor investigate transaction on blockchain as well as solve legal dispute among each party. CioSy uses smart contract to manage money collected from insurer, implementing policy as well as executing automated claim through smart contract. All transaction will be transparently recorded and tamper-proof.

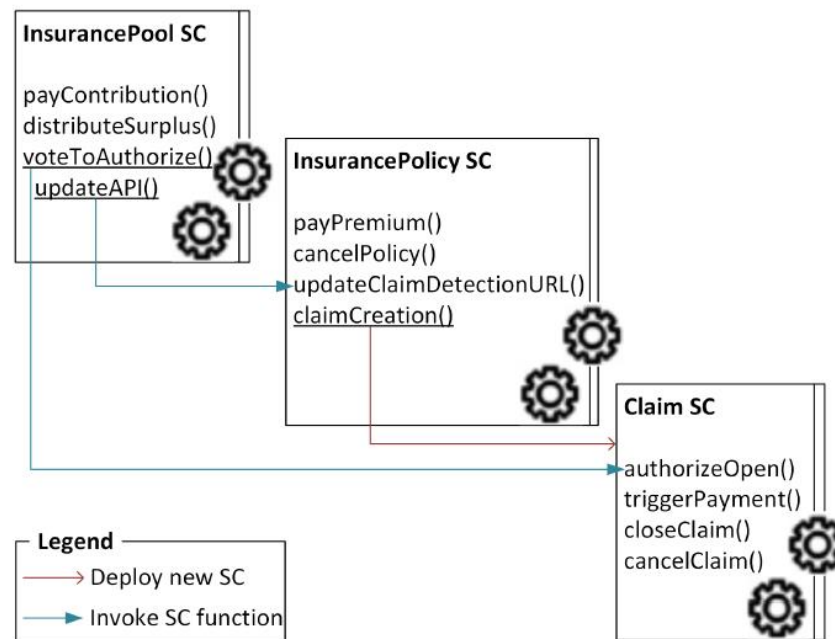


Figure 2.2.5.2 CioSy's smart contract framework

Insurance Pool Smart Contract plays the role to collaborate multiple individuals interested in proposing insurance offers which enable refund for insured for possible loss during incident. To enter this smart contract, individuals have to pay their contribution to become an insurer. They have the ability to update 3rd web API that invokes Claim Smart Contract and vote to authorize claim initiate by insured. At the end of the year, if insurer has not had any claims surplus of the collected money will be distribute to insurer. Insurance Policy Smart Contract is created when an individual is interested to purchase a machine readable and self-enforcing insurance policy. Individual who purchases policy as known as policyholder. In this smart contract, pay premium function allow policyholder to pay fixed amount of periodical premium set by insurer. Policyholder can also cancel their policy and policy status will be updated to terminated. Update claim detection URL function will be invoked by the update of API in Insurance Pool Smart Contract. Claim creation is connected with 3rd web API when claim notification is received it will automatically create an instance of Claim Smart Contract. In Claim Smart Contract, authorize open is invoke by vote to authorize, insurer can update the status of claim from “Created” to “Open” or to “Rejected”. When claim is authorized, trigger payment will be auto invoked to release the payout. Once insured is refunded, close claim will be invoked as well to update the status of claim to “Close”. Cancel claim function allows insurer to cancel and update claim status.

2.3 Comparison

	TAKAFUL	Ethrisc	Lemonade	CAIPY	CoiSy	Proposed Application
Auto risk calculation for premium	✓	✓	✓	✗	✗	✓
Online policy purchases	✓	✓	✓	✓	✓	✓
View policy purchased	✓	✓	✓	✗	✗	✓
View transaction history	✗	✗	✓	✗	✗	✓
Online claim request	✗	✓	✓	✓	✓	✓
Manual claim approval	✓	✗	✗	✓	✓	✓
Automated claim approval	✗	✓	✓	✓	✓	✓
IoT data process	✗	✗	✗	✓	✗	✗

Table 2.3 System Comparison

The comparison of existing system and proposed system is indicated as table above. Our system will have the ability to auto calculate premium and provide user purchase policy online. Purchased policy and transaction history will be made available to view by user. Furthermore, system will provide features of online claim request. Through claim process, claim will be automated or semi-automated based on type of policy and event occurred. However, this project is a prototype of insurance DApp, therefore we will not implement IoT data process in this project.

CHAPTER 3 SYSTEM METHODOLOGY/APPROACH

3.1 System Design Diagram

3.1.1 System Architecture Diagram

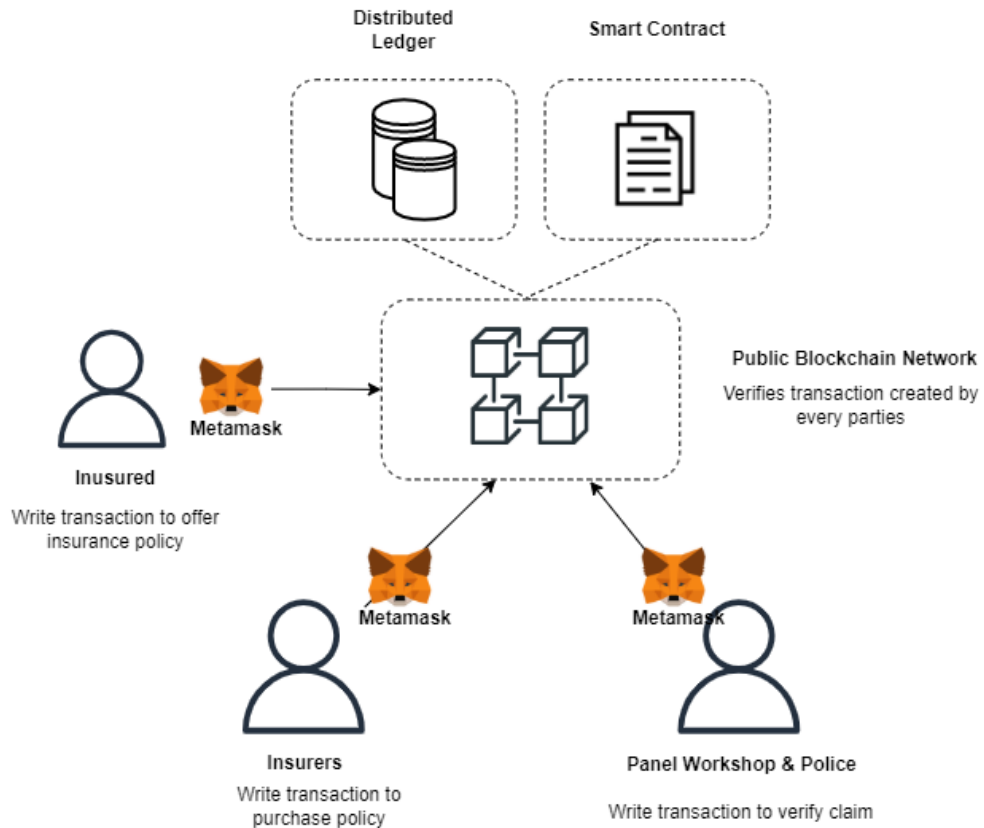


Figure 3.1.1 System Architecture Diagram

Figure 3.1.1 shows our application’s architecture diagram. There will be 4 roles highly involving in our contract which are insured, insurer, panel workshop and police. Each of them will need to have MetaMask as an identity verified e-wallet in order to perform transaction in blockchain network. Activity that performs on our application aim to be automated perform by smart contract and the whole transaction will be verified and stored in blockchain network in the nature of distributed.

3.1.2 Use case

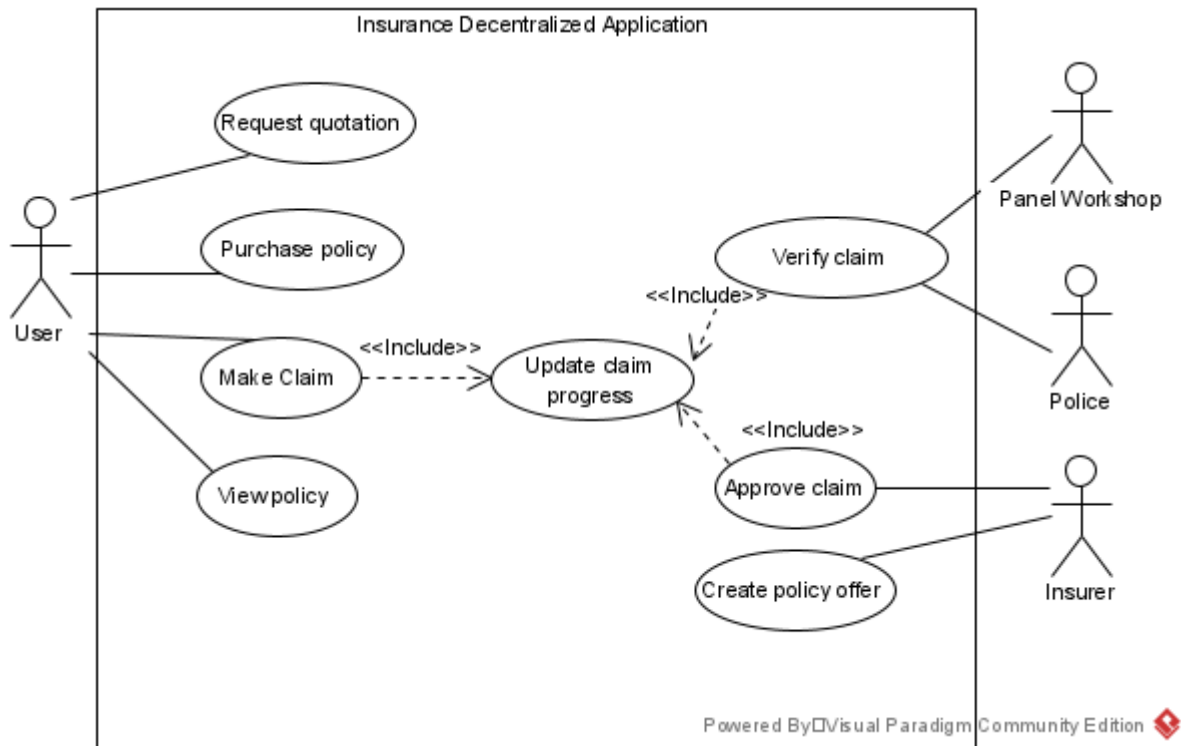


Figure 3.1.2 Use Case Diagram

Use Case Name: Create policy offer	ID: 1	Importance Level: High
Primary Actor: Insurer	Use Case Type: Detail, Essential	
Stakeholder and Interest: Insurer – wants to offer new insurance products.		
Brief Description: This use case describe how insurer can issue new policy offer.		
Trigger: Insurer offer new policy offer.		
Relationships		
Association: User		
Normal Flow of Events:		
<ol style="list-style-type: none"> 1. Insurer log in and enter to insurer page. 2. Navigate to create new policy offer page. 3. Enter details required for policy creation. 		
Sub Flows: Not Applicable		
Alternate/Exceptional Flows:		
<ol style="list-style-type: none"> 1a. System inform invalid login for insurer. 		

Table 3.1.2.1 Use Case Description (1/7)

Use Case Name: Get quotation	ID: 2	Importance Level: High
Primary Actor: User	Use Case Type: Detail, Essential	
Stakeholder and Interest: User – wants to get quotation.		
Brief Description: This use case describe how user can receive a quotation.		
Trigger: User see their policy premium and coverage.		
Relationships		
Association: User		
Normal Flow of Events:		
<ol style="list-style-type: none"> 1. User selects type of policy to purchase. 2. User fills in user address and vehicle plate number. 3. System retrieved details of user and registered vehicle and calculate premium. 		
Sub Flows: Not Applicable		
Alternate/Exceptional Flows:		
3a. System shows prompt window inform user that user address is not registered under the vehicle given.		

Table 3.1.2.2 Use Case Description (2/7)

Use Case Name: Purchase policy	ID: 3	Importance Level: High
Primary Actor: User	Use Case Type: Detail, Essential	
Stakeholder and Interest: User – wants to purchase policy.		
Brief Description: This use case describe how user purchase a policy.		
Trigger: User select to confirm purchase after received quotation.		
Relationships		
Association: User		
Normal Flow of Events:		
<ol style="list-style-type: none"> 1. User pays amount of ether according to the quote. 2. System indicates successful payment and purchase. 		
Sub Flows: Not Applicable		
Alternate/Exceptional Flows:		
2a. System inform user failed purchase due to insufficient amount of ether.		

Table 3.1.2.3 Use Case Description (3/7)

Use Case Name: View policy	ID: 4	Importance Level:
Primary Actor: User	Use Case Type:	
Stakeholder and Interest: User – wants to view purchased policy.		
Brief Description: This use case describe how user view their purchased policy.		
Trigger: User select to view policy.		
Relationships		
Association: User		
Normal Flow of Events:		
<ol style="list-style-type: none"> 1. System shows list of policies bought by user. 2. User clicks on certain policy. 3. System shows that particular policy in details. 		
Sub Flows: Not Applicable		
Alternate/Exceptional Flows:		
<ol style="list-style-type: none"> 1a. System shows a message of “No policy has purchased”. 		

Table 3.1.2.4 Use Case Description (4/7)

Use Case Name: Make claim	ID: 5	Importance Level: High
Primary Actor: User	Use Case Type: Detail, Essential	
Stakeholder and Interest: User – wants to make claim.		
Brief Description: This use case describes how user request to make a claim.		
Trigger: User wants to make claim upon incident.		
Precondition: User has to purchase policy before claim.		
Relationships		
Association: User		
Include: Update claim progress.		
Normal Flow of Events:		
<ol style="list-style-type: none"> 1. System retrieved policy bought by user. 2. User selects type of policy to claim. 3. User fills in required information. 4. System update claim progress and acknowledge related parties to submit relevant document according to type of policy. 		
Sub Flows: Not Applicable		
Alternate/Exceptional Flows:		
<ol style="list-style-type: none"> 1a. System shows prompt window inform user that he/she is not eligible to make claim. 		

Table 3.1.2.5 Use Case Description (5/7)

Use Case Name: Verify claim	ID: 6	Importance Level: High
Primary Actor: Panel workshop, Police	Use Case Type: Detail, Essential	
Stakeholder and Interest: Panel workshop, Police – verify the claim issued.		
Brief Description: This use case describes how panel workshop and police verify the claim.		
Trigger: When user has filed a claim.		
Relationships		
Association: Panel workshop, Police		
Include: Update claim progress.		
Normal Flow of Events:		
<ol style="list-style-type: none"> 1. System requests relevant record/evidence from panel workshop and police. 2. Both above parties approved the request. 3. System update claim progress. 		
Sub Flows: Not Applicable		
Alternate/Exceptional Flows:		
<ol style="list-style-type: none"> 1a. Panel workshop and police reject the claim request. 		

Use Case Name: Approve claim	ID: 7	Importance Level: High
Primary Actor: Insurer	Use Case Type: Detail, Essential	
Stakeholder and Interest: Insurer – wants to approve claim.		
Brief Description: This use case describes how insurer can approve claim.		
Trigger: Insurer is notified to approve claim.		
Precondition: Policy that required approval of insurer has been issued by user.		
Relationships		
Association: Insurer		
Include: Update claim progress		
Normal Flow of Events:		
<ol style="list-style-type: none"> 1. System notifies insurer to approve the claim. 2. Insurer checks all relevant document and approve claim. 3. System update claim progress. 		
Sub Flows: Not Applicable		
Alternate/Exceptional Flows:		
<ol style="list-style-type: none"> 2a. Insurer reject claim request. 		

Table 3.1.2.6 Use Case Description (6/7)

Table 3.1.2.7 Use Case Description (7/7)

3.1.3 Activity Diagram

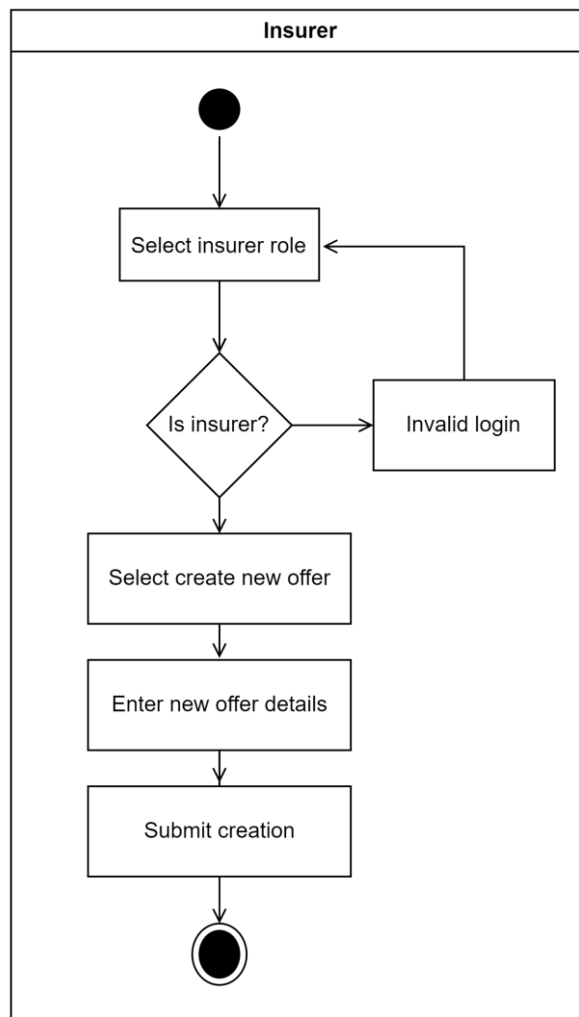


Figure 3.1.3.1 Create Policy Offer Activity Diagram (1/7)

To create a new policy offer, insurer must log in his/her MetaMask and select as insurer role to policy offer page. Once insurer identity is verified, he/she can select create new offer button and fill in details that are required for an offer creation. After submission, the policy will go online for user to purchase.

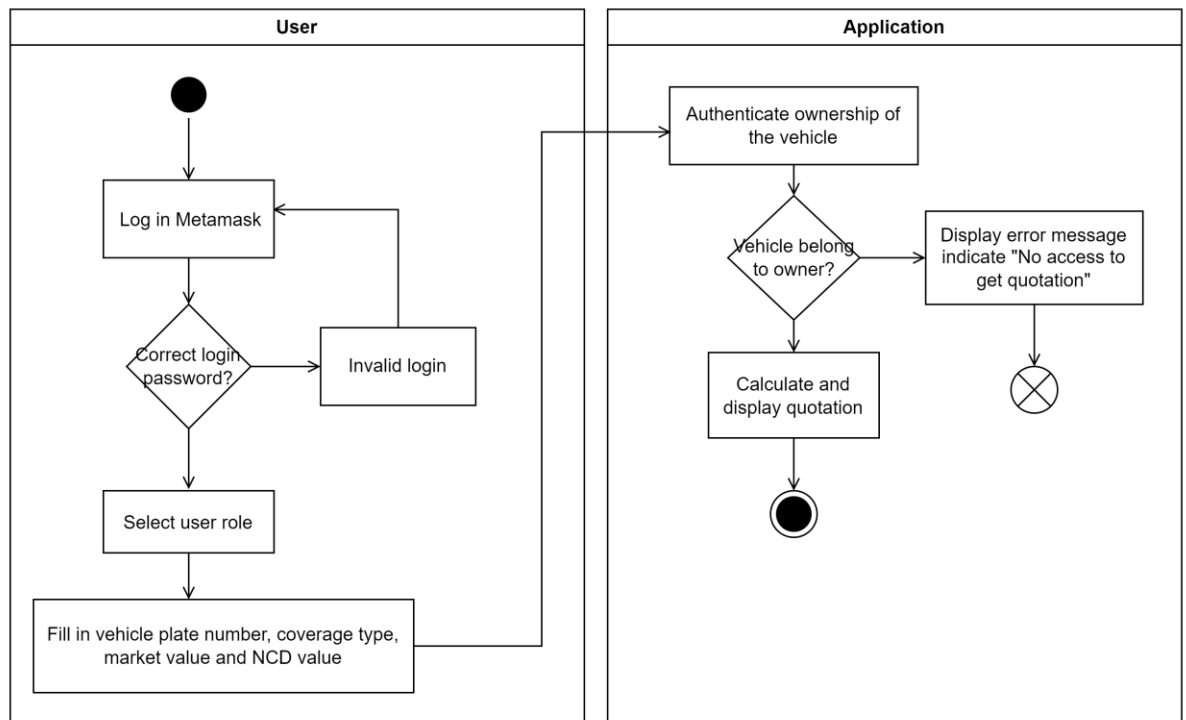


Figure 3.1.3.2 Request Quotation Activity Diagram (2/7)

To request quotation, user address and vehicle plate number are required. Hence, user have to log in their Metamask for our application to determine their identity. After user's input of vehicle information, our system will retrieve on chain records from 3rd party providers to authenticate the ownership of the vehicle, user address given must be registered under the vehicle number to ensure the validity of the policy. After it is authenticated, application will determine the premium of the policy based on the inputs of user then display as a quotation for user to proceed with payment. As whole quotation generating does not involve changing data on the block, therefore no gas or ether are required.

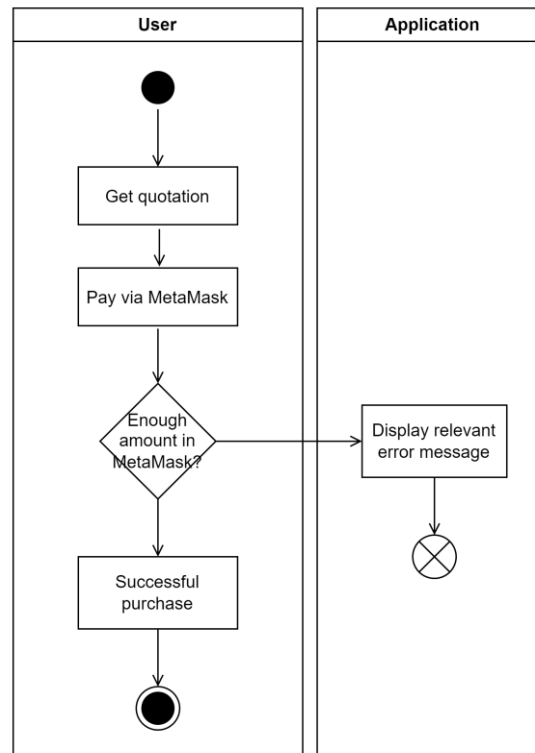


Figure 3.1.3.3 Purchase Policy Activity Diagram (3/7)

After the quotation is generated, user needs to pay the premium via their MetaMask wallet. If user have enough amount of Ether to pay for the premium, it will pass the verification to successful purchased which also means successfully registered themselves in the policy's smart contract. If user unable to pay for the premium, application will notify user for the error and end the whole purchasing process.

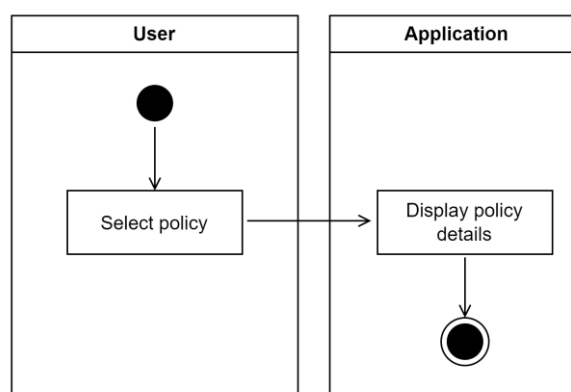


Figure 3.1.3.4 View Policy Activity Diagram (4/7)

User can also select specific policy in the policy list for viewing. After selection, our application will display selected policy in details.

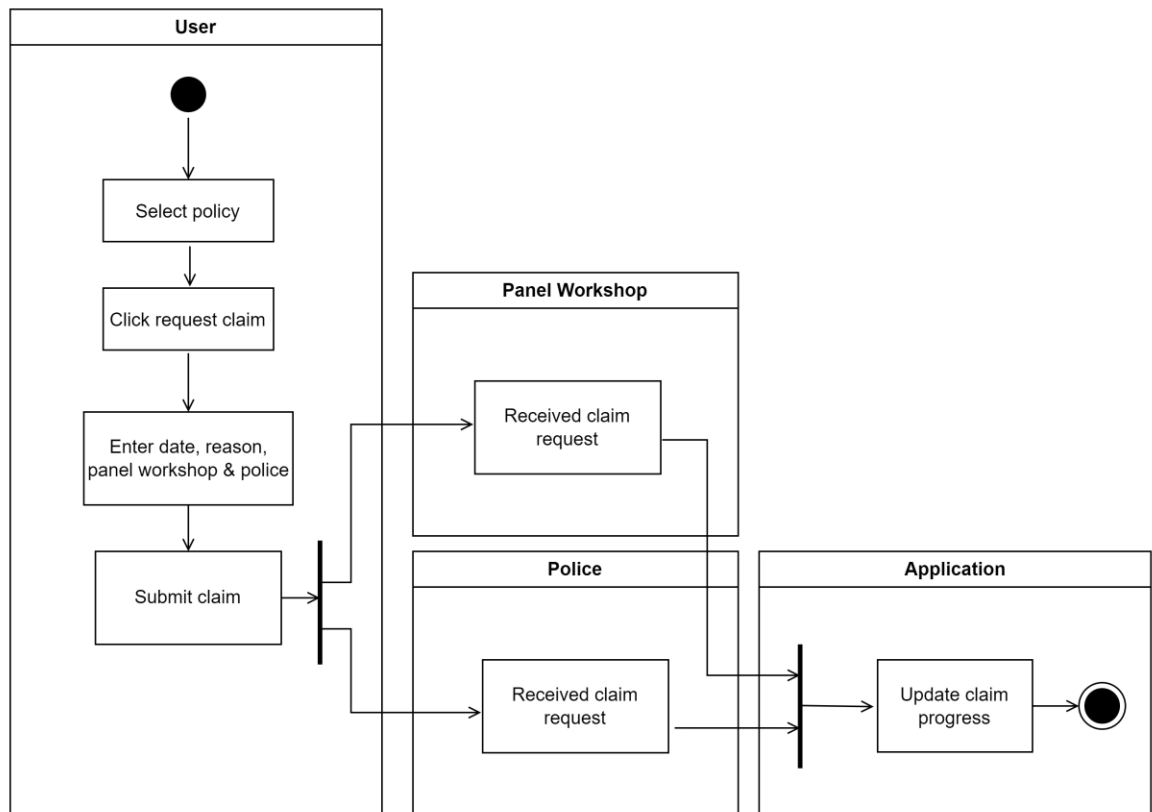


Figure 3.1.3.5 Make Claim Activity Diagram (5/7)

When incident occurs, user will need to initiate the claim by select the policy and click on request claim button. User will be required to give the date, place, reason and panel workshop's address they go for services. Claim will only successfully initiate when the vehicle has purchased policy and under the policy period. After user's submission, our application will auto propagate claim request to panel workshop and police department for further verification. The whole process will also be in real time updating for every relevant party to view.

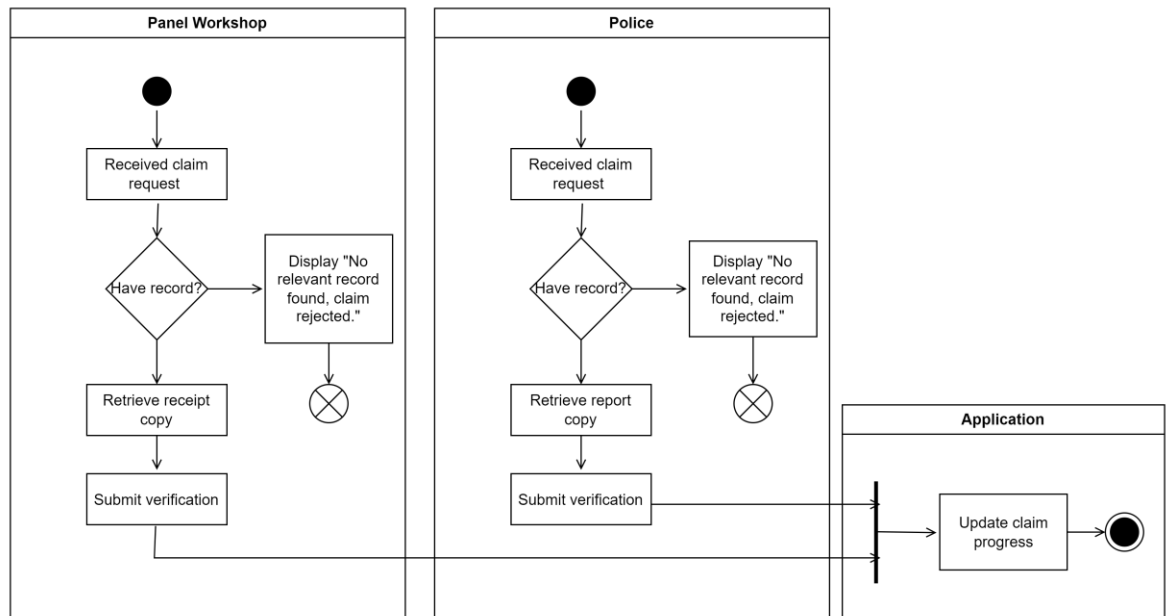


Figure 3.1.3.6 Verify Claim Activity Diagram (6/7)

Once the relevant panel workshop and police have received the claim request both parties will have similar process which our smart contract will search on 3rd parties' data to match the relevant incident. If matching record is found, a copy of the document will be retrieved and stored in this transaction. If no matching record of the incident, this claim request will be display error message and denied claim request. Once their verification is successfully submitted, our application will update the progress and the smart contract will proceed to next phase.

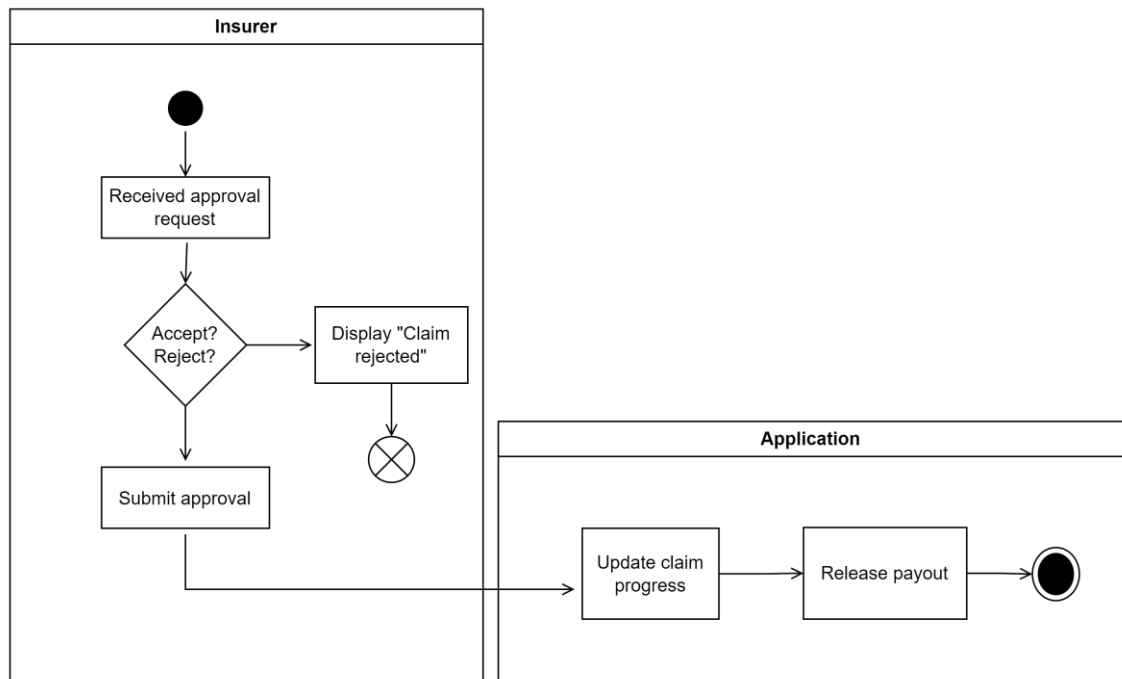


Figure 3.1.3.7 Approve Claim Activity Diagram (7/7)

To finalize the claim, insurer, can be said as the admin of this system, will need to make the final approval as a second validation of the request. If admin approved the claim, the smart contract would auto release the payout to beneficiary’s account. If request is rejected, system will terminate the process and notify the user about the reason of rejection.

CHAPTER 4 SYSTEM DESIGN

4.1 System Flow Diagram

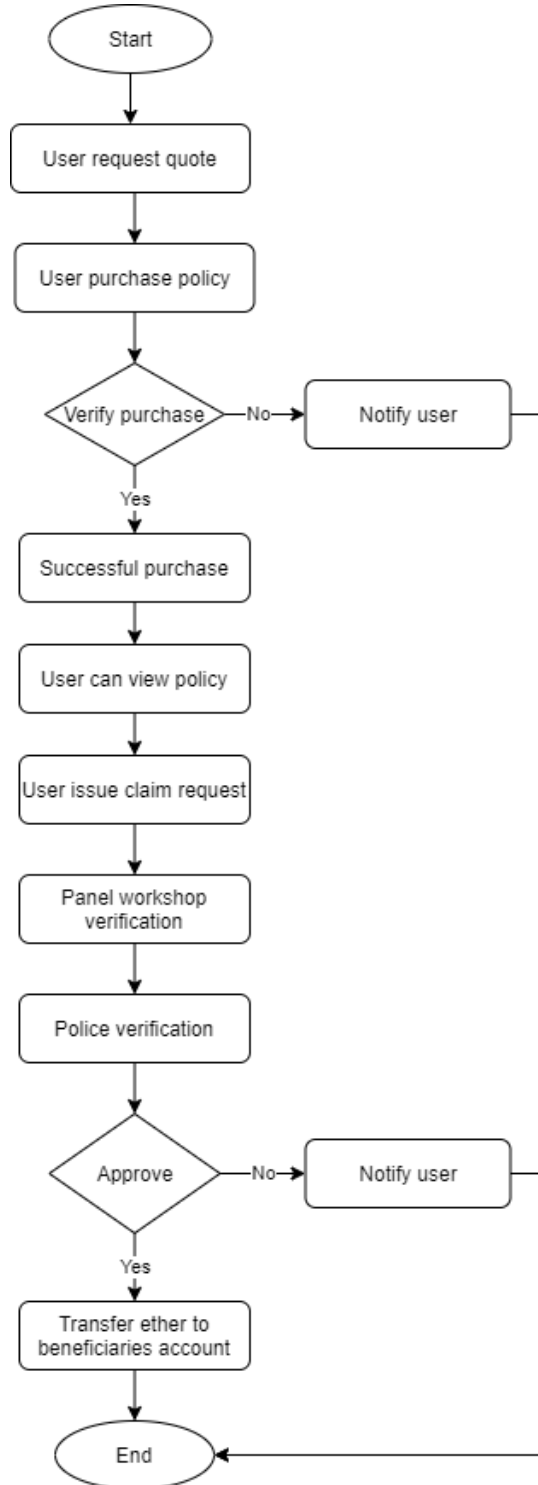


Figure 4.1 System Diagram

Figure 3.2.2 shows the system flow diagram of this decentralized application. Insurance process involved will be listed as below:

1. Insurer offer insurance product
2. User request quotation
3. User purchase policy
4. User view policy progress
5. User request claim
6. Panel workshop & police verification
7. Insurer final approval
8. Payout release

Above insurance process will be elaborate in more detail in upcoming use case and activity diagram.

4.2 System Components Specification

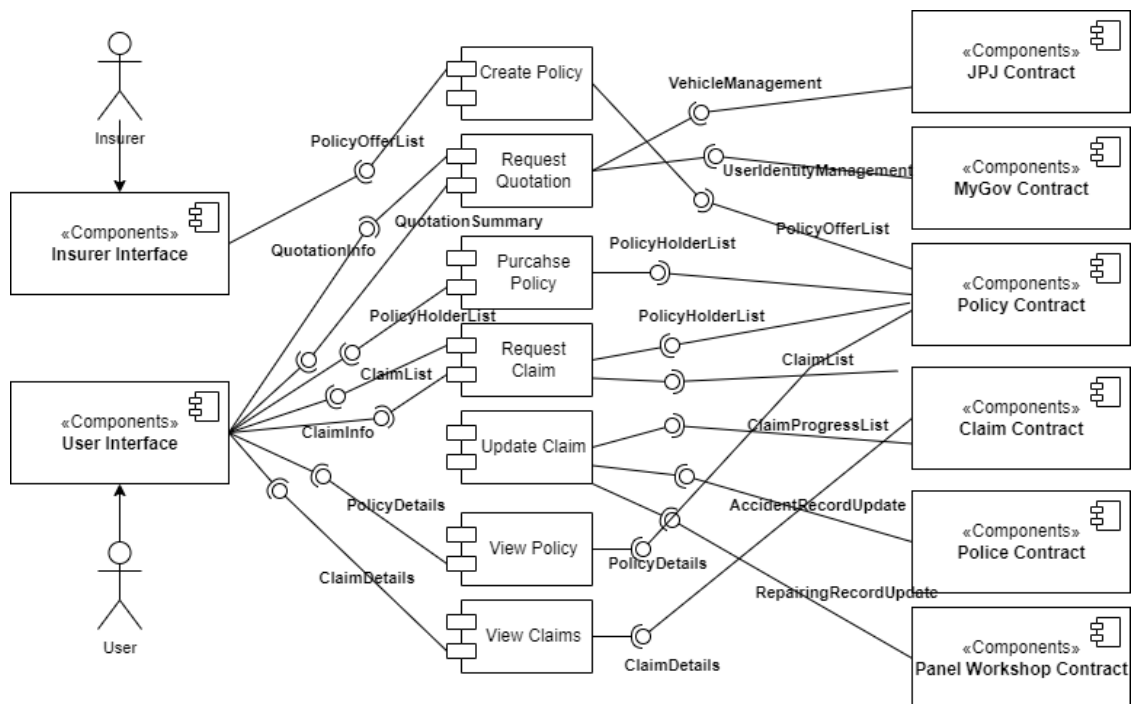


Figure 4.2 System Components Specification

Our application has 2 interfaces for insurer and user respectively, 7 module that include create policy, request quotation, purchase policy, request claim, update claim, view policy and view claim. As data are store on blockchain hence data will be processed and transferred via smart contract.

4.3 System Components Interaction Operation

Create Policy Offer Module:

Create Policy Offer will request data from insurer and pass to policy contract to create array and mappings for the offering and push to blockchain network.

Request Quotation Module:

Request Quotation will request data from user then it will request data from JPJ contract and MyGov contract to identify vehicle information as well as user identity information. After information is being verified, premium will be calculate based on user input and vehicle information. After summary quotation is generated, it will return to user interface.

Purchase Policy Module:

Purchase policy will be triggered once user pay for the premium at summary quotation page. Policy data will be written into policy holder list arrays and mapping and push to blockchain network. The policy holder list will then be retrieved and display to user.

Request Claim Module:

Request Claim will be required claim data from user and request policy holder info to verify the claim. Once the claim is verified, request data will be passed to claim contract to create claim list arrays and mapping and push the data to blockchain network. The claim list will then be retrieved and display to user.

Update Claim Module:

Update Claim will be not request data from either user or insurer side. When a claim request is initiated, the claim request will be populated to police and panel workshop system. This module will be triggered when they verify the claim on their system. Hence, accident record and repairing repair will be updated to claim contract.

View Policy Module:

View Policy will request policy holder list from policy contract to build the policy list interface. When a user selects on specific policy record, this module will query the specific record from policy holder mapping reside in policy contract.

View Claim Module:

View Claim will request claim list from claim contract to build the claim list interface. When a user selects on specific claim record, this module will query the specific record from claim mapping reside in claim contract.

CHAPTER 5 SYSTEM IMPLEMENTATION

5.1 Methodology

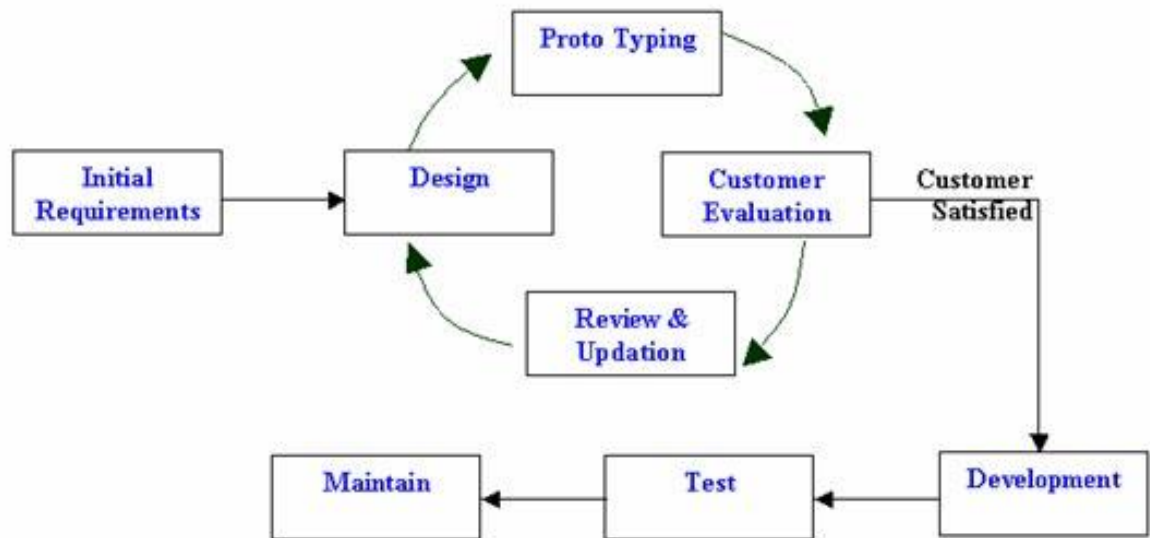


Figure 5.1 Prototype Model Diagram

The methodology that will be implemented in this project is the prototyping model, which is also one of the popular used Software Development Life Cycle (SDLC). With this methodology, it allows us to build a prototype to evaluate our proposal. Furthermore, it increases the communication between end user and developers to further rule out the system requirement in order to achieve desirable outcome. With prototype model, user can have better understanding of the proposed system so that missing features can be identified easily. However, the limitation for this methodology is that developers may put too much effort into develop prototype which increase cost and time consumption. Prototype model is an iterative process between analysis and design before moving forward to development phase.

Phase 1: Initial requirements

First phase is to gather initial requirement. In this stage, product requirement identification is critical to outline the product. In this project, we gather information by doing research on existing system and conducting informal interview to the potential product user.

Phase 2: Design

After gather all the requirement, we move to next phase which is a preliminary design of prototype based on requirement collected. We will come up with the system flow, use case design and basic UI design.

Phase 3: Build initial prototype

We then build our initial prototype from our design. This initial prototype normally may not be accurate or perfect.

Phase 4: Customer Evaluation

Therefore, we need to move into customer evaluation phase, which initial prototype will be presented and used by the user. The review and response of system strength and weaknesses will be collected from user and used for further system enhancements.

Phase 5: Review and update

Lastly, we will review customer requirements to further update and refine our design and prototype.

Above phase is an iterative process of system enhancement, which will only be end when system developed has met the satisfaction and requirement of user. Once the prototype is accepted by the user, refine process of prototype will be conducted to transform into final product. Finally, final product will be implemented, system testing, and maintenance will be carried out.

5.1 Hardware Setup

Hardware	Specification
Laptop	VivoBook 14_ASUS X407UF
Processor	Intel® Core™ i5-8250U CPU @ 1.60GHz 1800Mhz
Input Device	Wireless Mouse, Keyboard

Table 5.1 Hardware Requirement

This project will be developed on VivoBook 14_ASUS X407UF laptop with processor of Intel® Core™ i5-8250U and device used for input data is wireless mouse and inbuild keyboard.

5.2 Software Setup

Software	Specification
Operating System	Microsoft Window 10
Front-end	Semantic UI React, HTML, CSS
Blockchain network	Rinkeby Testnet
Integrated development environment	Remix IDE. Visual Studio Code
Programming language	Solidity, React
Cryptocurrency Wallet	MetaMask
API	Web3.js

Table 5.2 Software Requirement

Operating system that uses to develop this project is Window 10.

Our application is tested and deployed to Rinkeby Testnet. Moreover, our application's front end is mainly built with Semantic UI React which is a framework for theming websites. HTML and CSS knowledge is also required for development. Remix IDE is required to develop our smart contract. It is an open-source platform that can be accessed through web or desktop application for contract development. Meanwhile, Visual Studio Code IDE is used to develop and deploy this web application. Programming language that involved in this project are Solidity and React. Smart contract is written in Solidity language and front end of this application is written in React. API interface of Web3.js is also required to connect the application with

CHAPTER 5 SYSTEM IMPLEMENTATION

Ethereum node. Lastly to perform transaction, cryptocurrency wallet web browser extension will be used for transaction is MetaMask.

5.3 Settings and Configuration

Below is the version of packages and library that used to develop this project.

```
"@truffle/hdwallet-provider": "^1.4.3",  
"chart.js": "^3.7.1",  
"fs-extra": "^10.1.0",  
"ganache-cli": "^6.12.2",  
"mocha": "^9.2.2",  
"moment": "^2.29.3",  
"next": "^8.1.0",  
"next-routes": "^1.4.2",  
"react": "^16.14.0",  
"react-chartjs-2": "^4.1.0",  
"react-dom": "^16.14.0",  
"react-moment": "^1.1.2",  
"semantic-ui-react": "^2.1.2",  
"solc": "^0.4.26",  
"web3": "^1.3.6"
```

Figure 5.3 Project Configuration

Script to run when initialize project:

```
npm init
```

```
npm install --save ganache-cli mocha solc@0.4.26 fs-extra web3@1.3.6 next@8.1.0  
react@16 react-dom@16 semantic-ui-react @truffle/hdwallet-provider@1.4.3 next-  
routes moment react-moment chart.js react-chartjs-2
```

5.4 System Operation (with Screenshot)

Our system aims to minimise human intervention and maximise security, hence the whole ecosystem must be running on blockchain network. As there is no ready-made sample system to provide data, therefore all involving 3rd party system that act as role in providing data to our main application will also be developed in this project.

5.4.1 InsuranceDapp

- **Home Page**

This is the Insurance Dapp home page. This page give user a brief view on what we do and how we provide value to them. In order to proceed with our application, user will be required to log in their MetaMask account by clicking “Log In” button on top of the navigation bar.

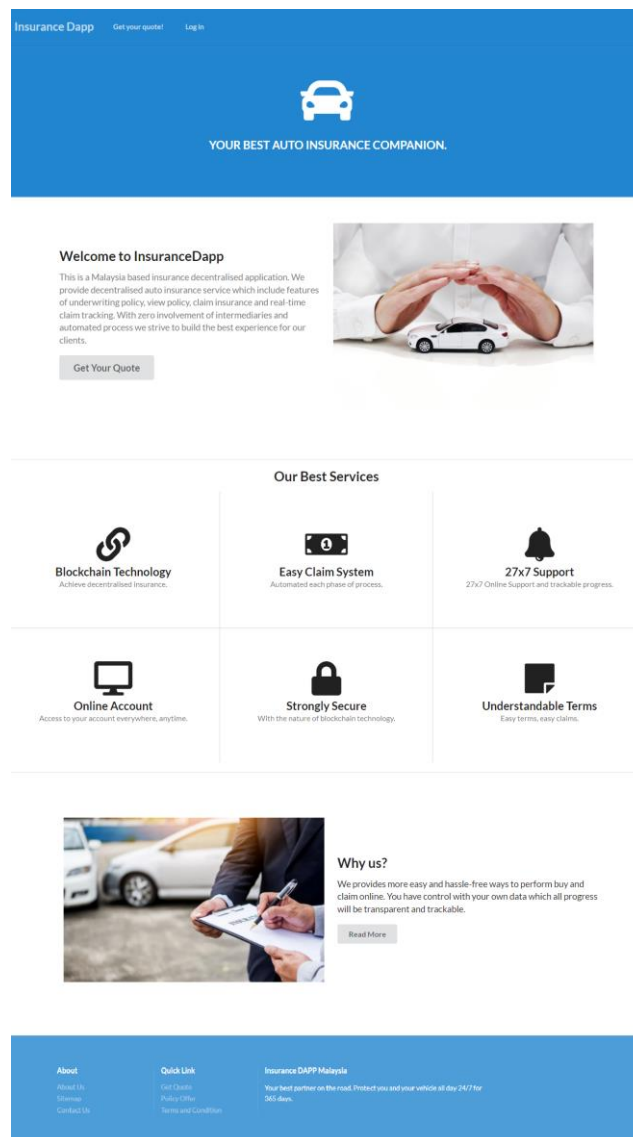


Figure 5.4.1.1 Home Page

- **Login Page**

Our application has 2 login phases. After clicking login button, user will be in first phase of login which is to ensure user MetaMask is connected to our web application. User will be required to click on “Connect to MetaMask” button and our application will check user’s MetaMask status. If MetaMask extension is not downloaded in their browser, application will prompt error message for installation. If MetaMask extension is found, user is required to connect and log in with accounts for access. After MetaMask account is connected, application will show current connecting user address and user may proceed to second phase which is “Select Role”.

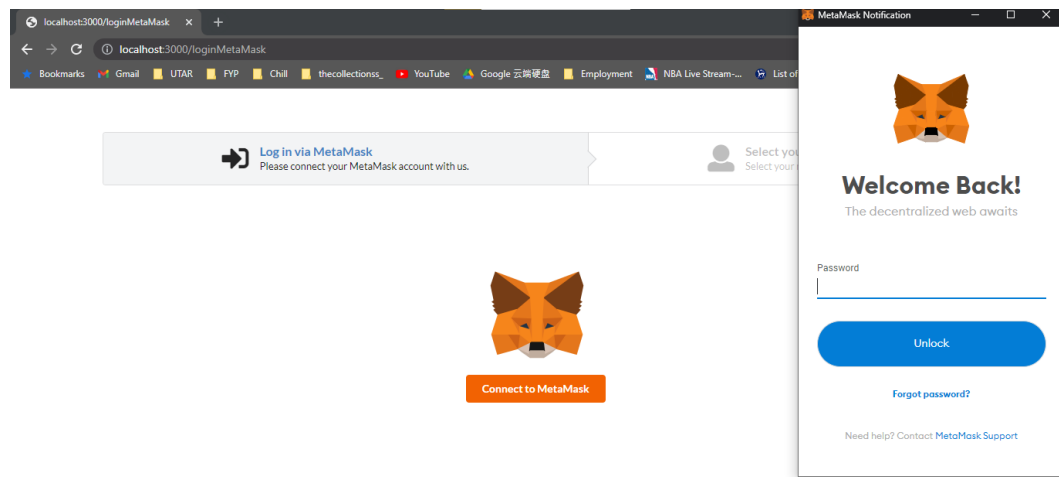


Figure 5.4.1.2 Connect to MetaMask (1/2)

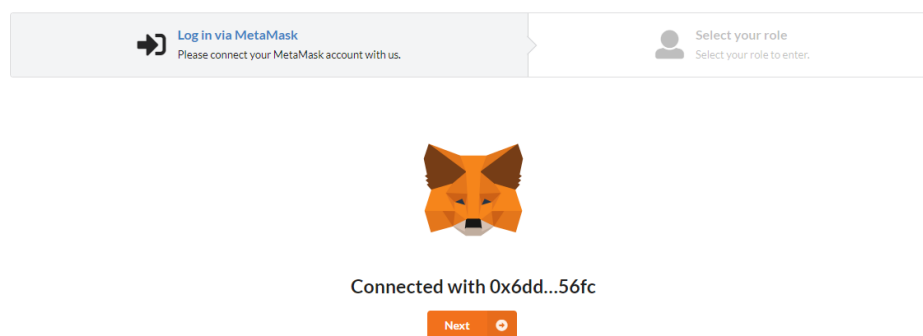


Figure 5.4.1.3 Connect to MetaMask (2/2)

In second phase, user can select their role to have access to more function. MetaMask account is only owned and can be accessed by the account owner. Therefore, with

Metamask secured nature, we can safely recognise current logged in users' identities and able to retrieve their user address.

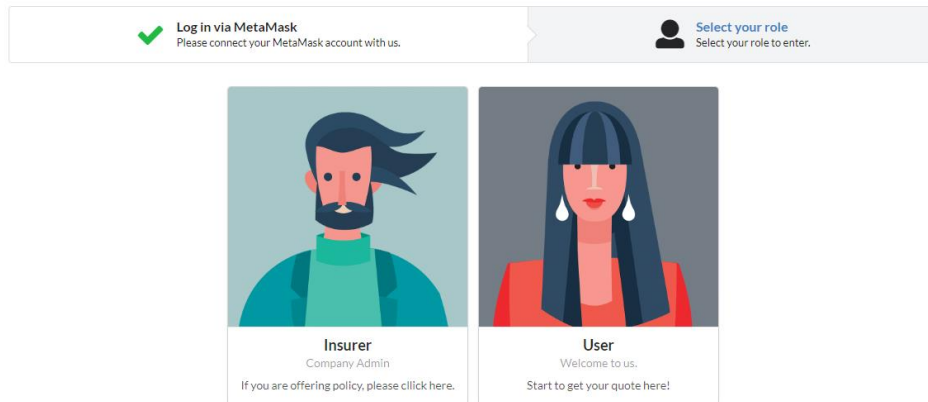


Figure 5.4.1.4 Login by Role

Then we perform comparison of current user address with customer list in our smart contract. Our application will compare current user address with insurer's address in our smart contract to determine the accessibility. If insurer tried to access user's role, error message will be shown as figure 5.4.1.5. Same validation goes to user tried to access insurer role.

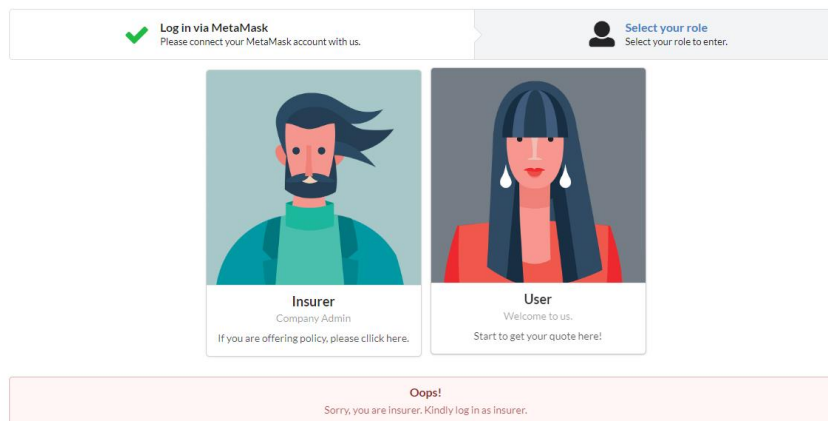


Figure 5.4.1.5 Login by Role Error (1/2)

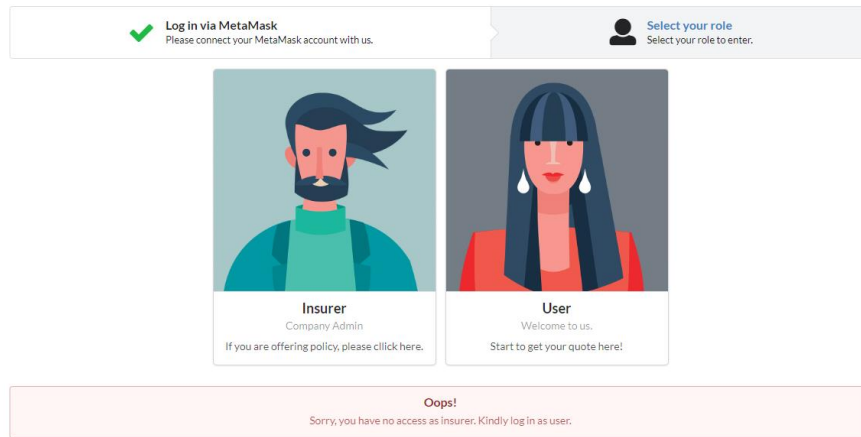


Figure 5.4.1.6 Login by Role Error (2/2)

- **Insurer**

- a. **Set Dependant Contract**

Our application is built upon 2 smart contract which are Policy Contract that store all policy transaction and Claim Contract that records all claim issued transaction. In order to interact with 3rd parties' smart contract, insurance admin will have to get their contract address and bind to our contract as figure 5.4.1.7 and figure 5.4.1.8 shown.

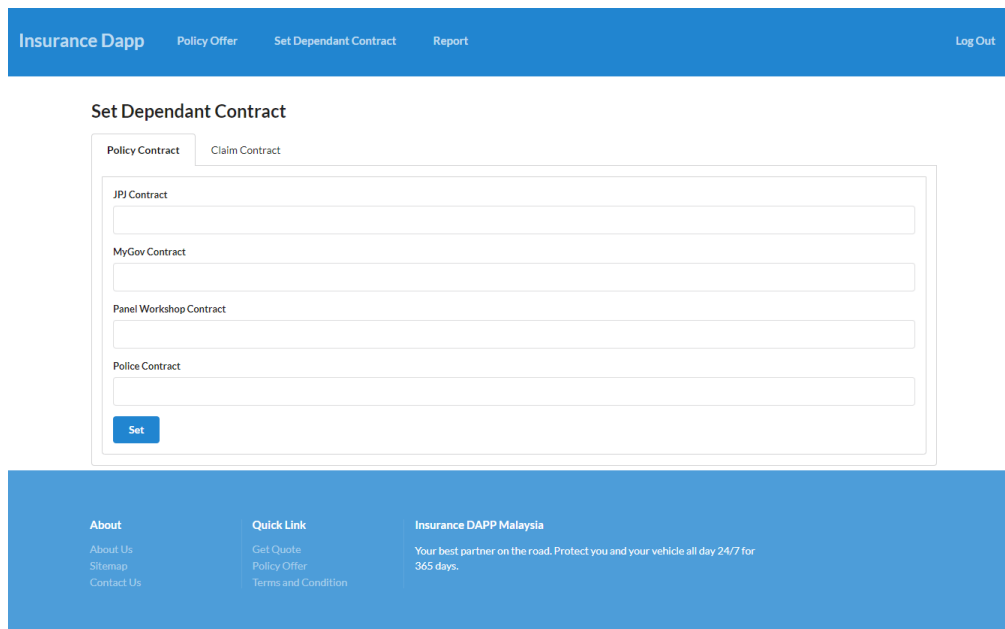


Figure 5.4.1.7 Set Dependent Contract (1/2)

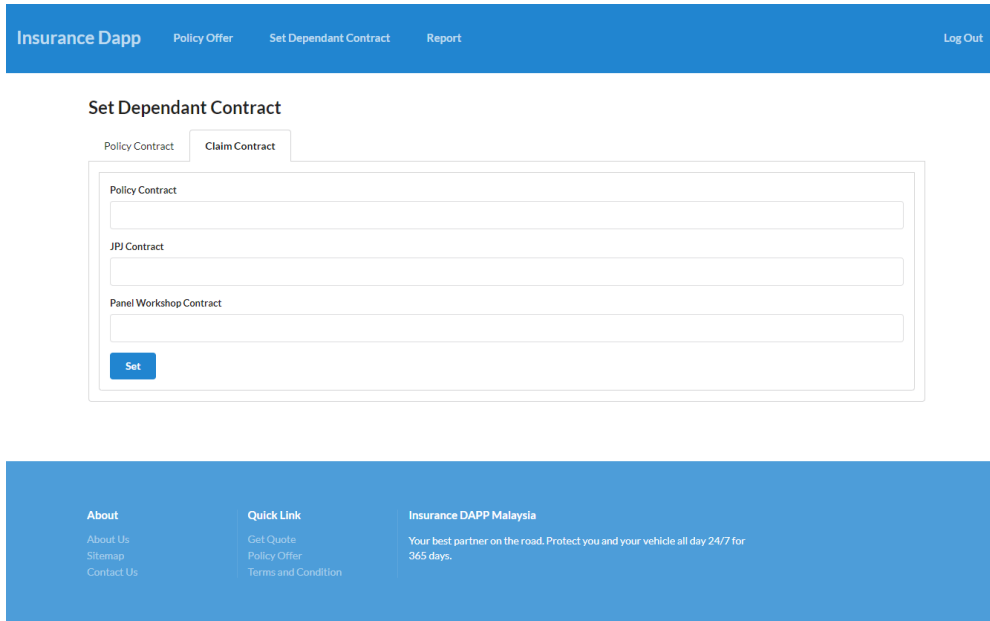


Figure 5.4.1.8 Set Dependent Contract (2/2)

b. Policy Offering – Main

This is the main page of admin view of application. In this page will show a list of offering policy and admin can create new offer by clicking “Create” button.

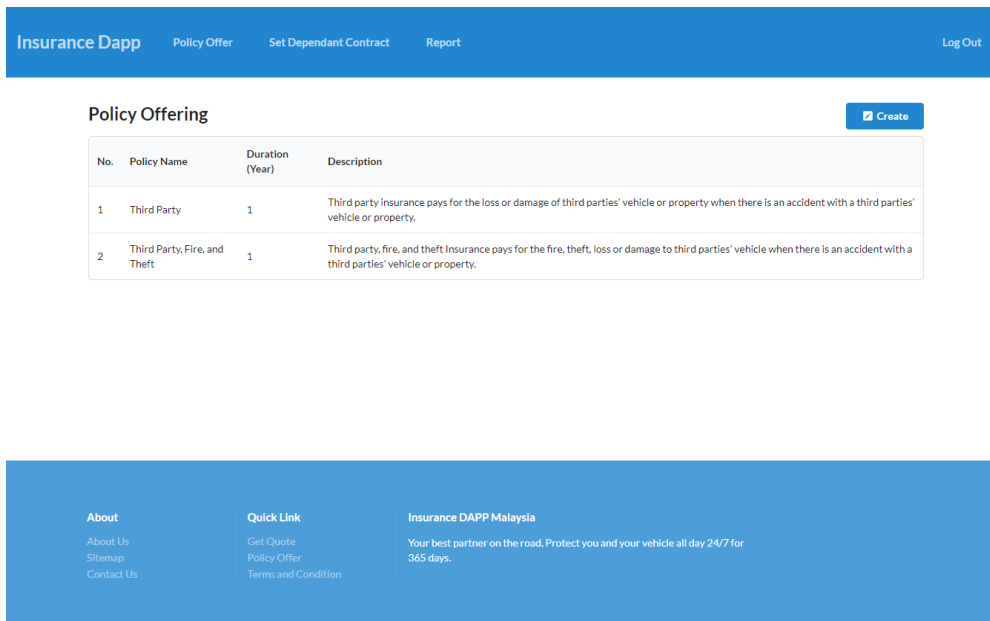


Figure 5.4.1.9 Policy Offering List

c. Policy Offering – Create

After clicking the “Create” button, insurance admin will be navigated to this page to create a new offer. When policy is successfully created, the offer will be displayed on the policy offering list.

The screenshot shows a web application interface for creating a new policy offer. At the top, there is a blue navigation bar with the text 'Insurance Dapp' and several menu items: 'Policy Offer', 'Set Dependant Contract', 'Report', and 'Log Out'. Below the navigation bar, the main heading is 'Create New Policy Offer'. The form contains three input fields: 'Policy Name', 'Duration (Year)', and 'Policy Description'. At the bottom of the form, there are two buttons: 'Back' and 'Create'. The footer of the page is a blue bar with three columns of text: 'About' (with links for About Us, Sitemap, Contact Us), 'Quick Link' (with links for Get Quote, Policy Offer, Terms and Condition), and 'Insurance DAPP Malaysia' (with the tagline 'Your best partner on the road. Protect you and your vehicle all day 24/7 for 365 days.').

Figure 5.4.1.10 Create Policy Offer

d. Report

Admin can navigate to this section through “Report” button on top of navigation bar. This page shows the up-to-date report of current policy and claims issued. First row shows the number of policies sold, number of claims issued, total premium in contract and total claim have been paid out. “Policy Analysis” and “Claim Analysis” button will navigate admin to have more insight from both aspects. Bar graph at the bottom give an overview of policy sold, successful claimed, rejected claimed and pending claim.

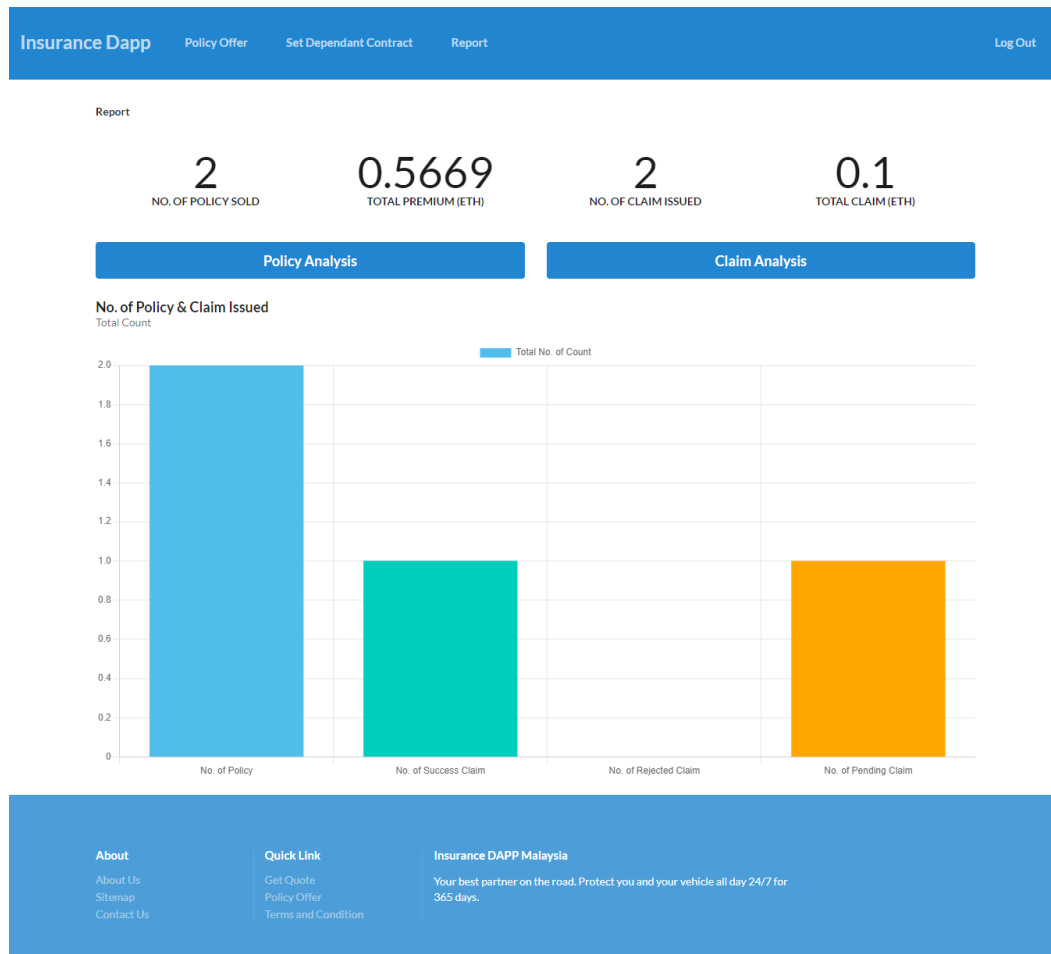


Figure 5.4.1.11 Report

e. Report – Policy

Figure 5.4.1.12 shows Policy Analysis with bar graph that shows number of policies sold by types and pie chart that shows % of each policy type sold. At the bottom of this page is a list of policies. By clicking the policy index, application will navigate admin to view policy details as figure 5.4.1.13.

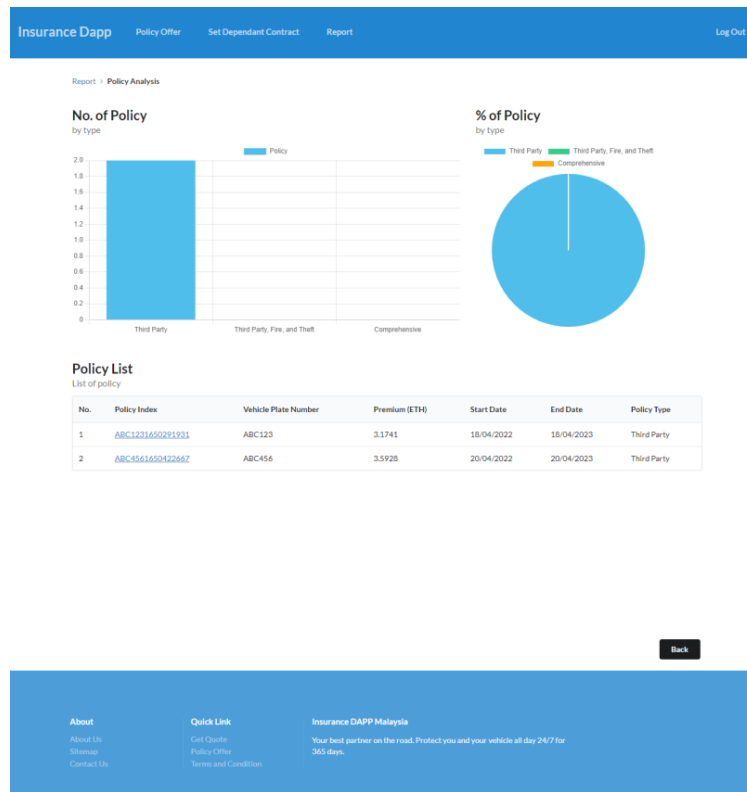


Figure 5.4.1.12 Policy Analysis

f. Report – Policy Details

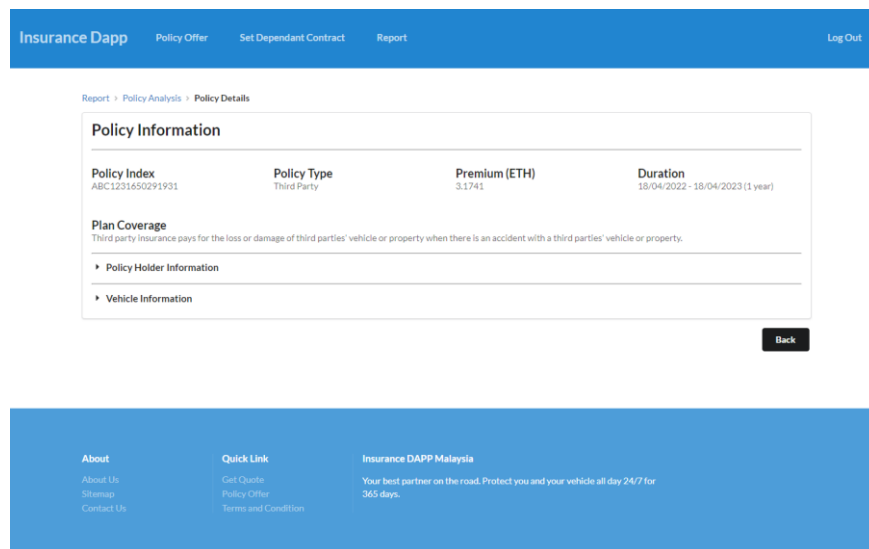


Figure 5.4.1.13 Policy Details

g. Report – Claim

Figure 5.4.1.14 shows Claim Analysis with bar graph that shows number of successful claims, rejected claim and pending claim. Pie chart on the right shows % of pending claim by department. At the bottom of this page is a list of claims. By clicking the claim index, application will navigate admin to view claim details as figure 5.4.1.15.

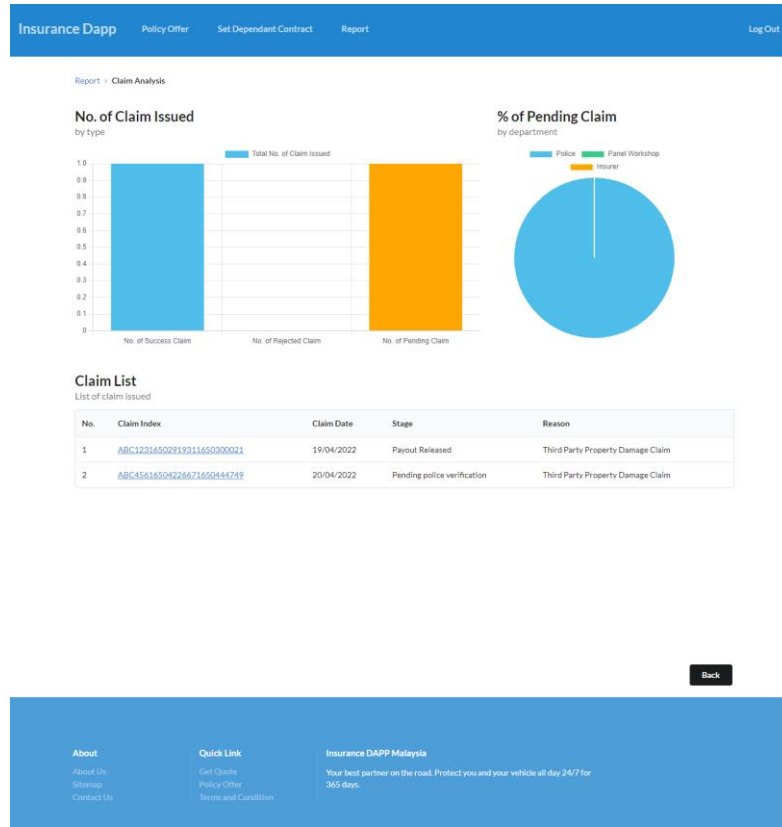


Figure 5.4.1.14 Claim Analysis

h. Report – Claim Details

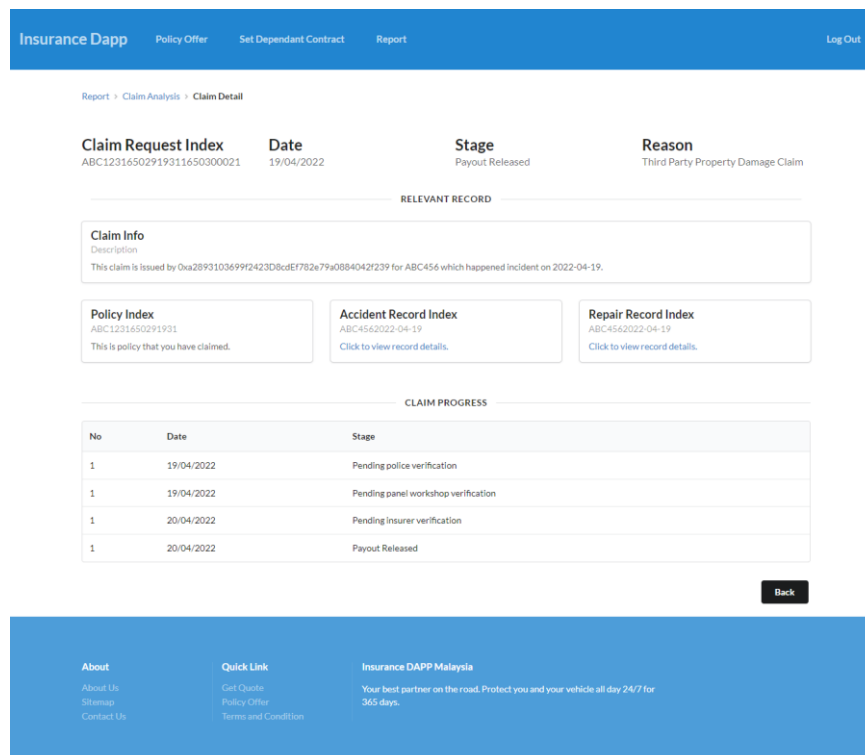


Figure 5.4.1.15 Claim Details

- User

- a. Policy - Main

This is home page when user log in to our application. If user have purchased policy in our application, a list of policy that he/she had purchased will be shown else it will show a message of “You haven’t purchase policy from us” and a Call-To-Action (CTA) button for user to request their first quotation.

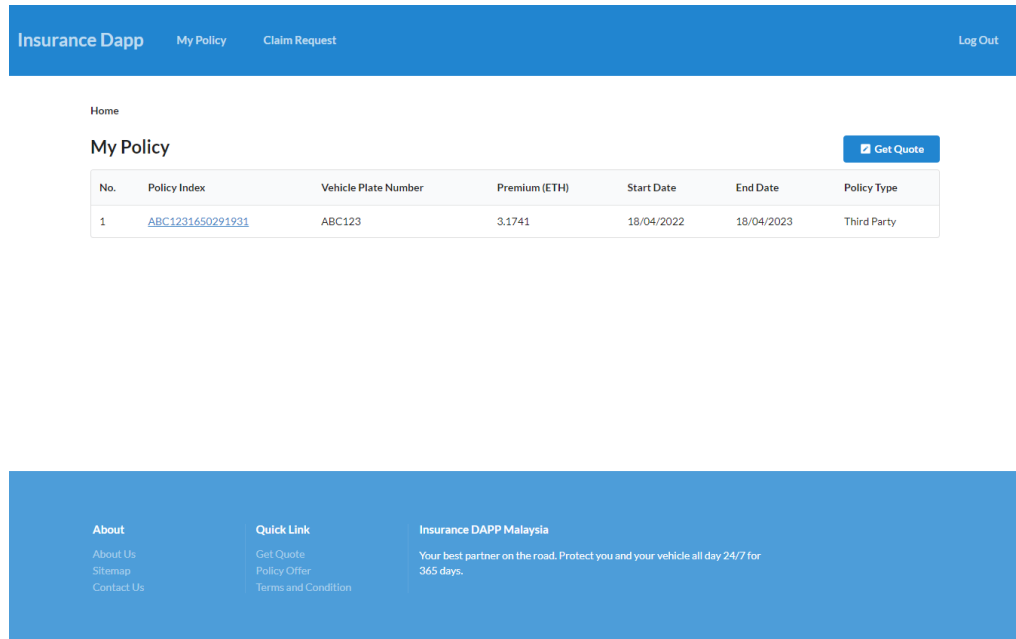


Figure 5.4.1.16 Policy List (1/2)

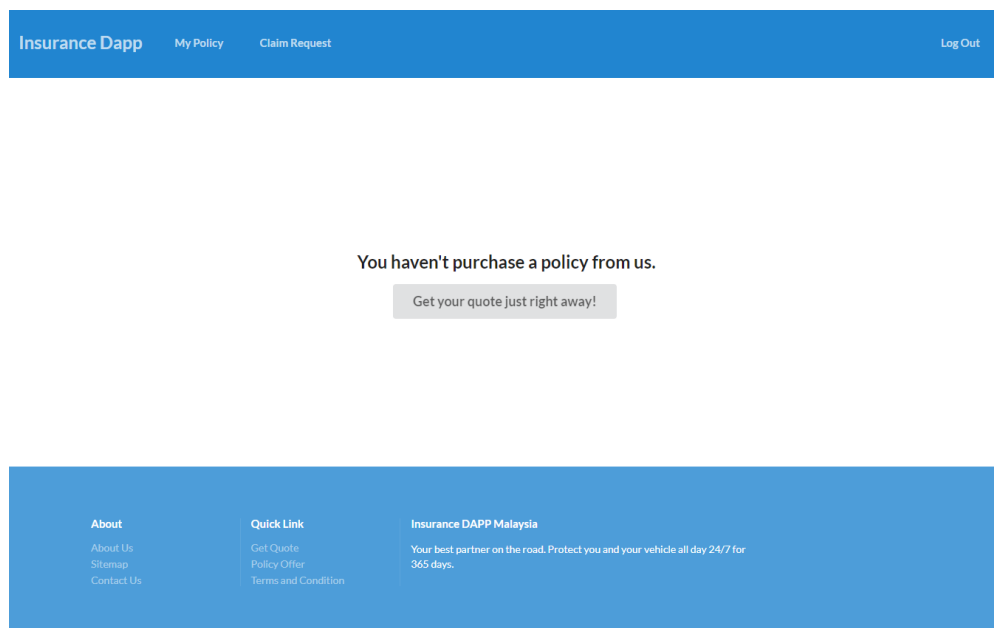


Figure 5.4.1.17 Policy List (2/2)

b. Policy - Details

When user click on the policy index from policy list, user can view the policy in detail.

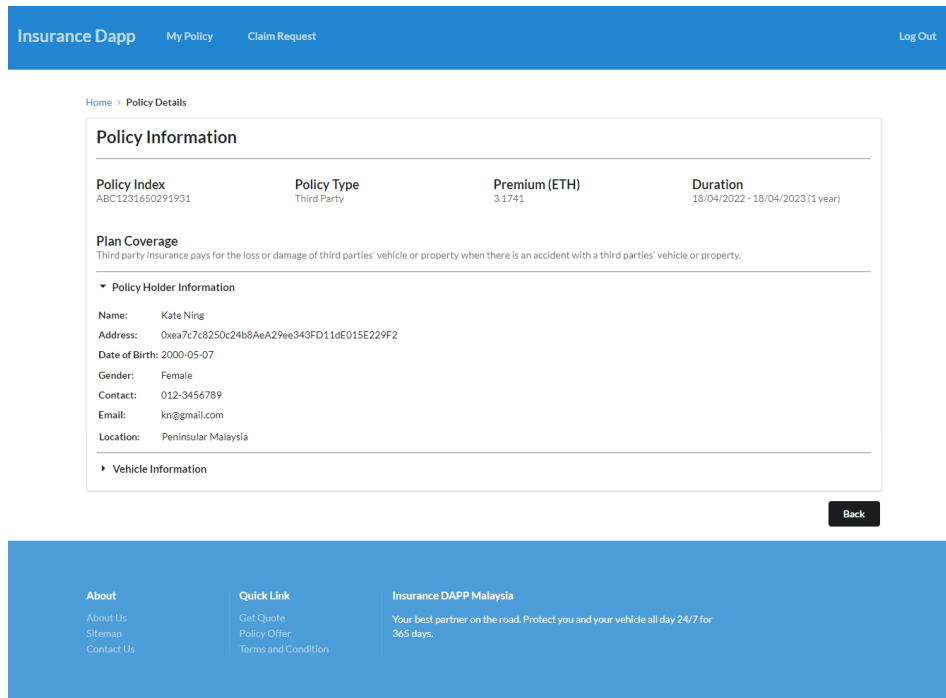


Figure 5.4.1.18 Policy Details (1/2)

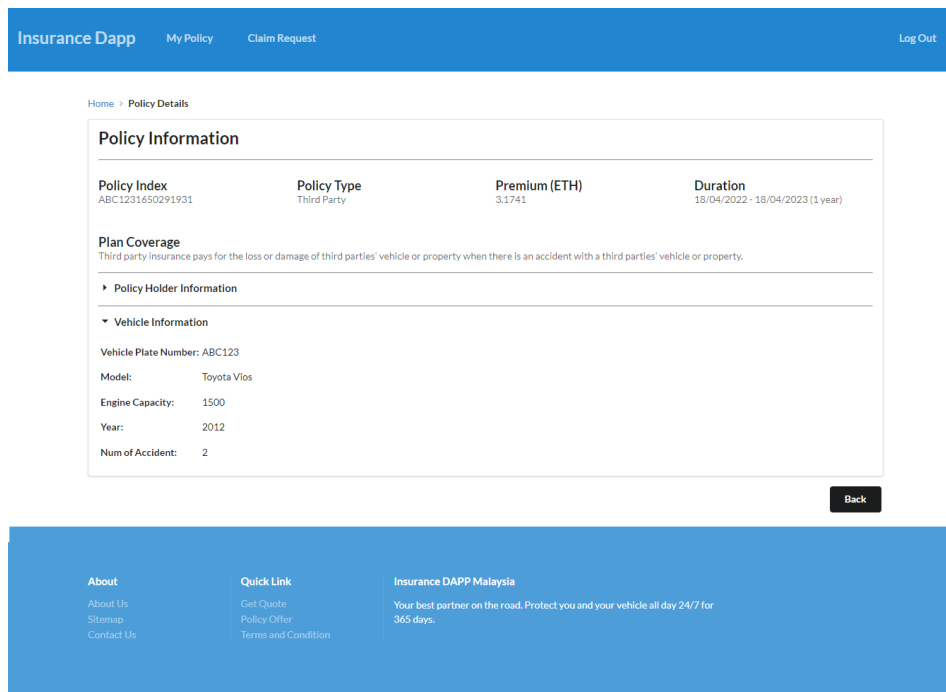


Figure 5.4.1.19 Policy Details (2/2)

c. Get Quotation

When user click on the CTA button to request quotation, user will be navigated to this page as figure 5.4.1.20. User are required to fill in minimum of relevant information to request a quotation. Our contract will first identify the input of vehicle plate number is it tally with the vehicle owner. This is done in the backend where our contract will use 3rd party data to perform checking on the validity of this policy. If the vehicle is proven to own by current user, application will navigate user to quotation summary page where user can perform secondary checking on all the information.

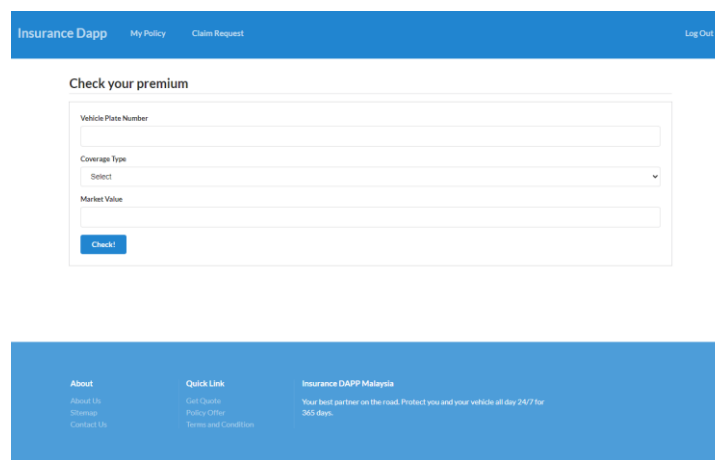


Figure 5.4.1.20 Get Quotation

With user address, we able to retrieve customer details from MyGov’s contract and with vehicle plate number, we able to pull out relevant vehicle details from JPJ’s contract. With all data given, a summary of the quotation as figure 5.4.1.21 will be constructed and show to user. After user is satisfied with the quote given, they can pay to purchase this policy and new policy will be displayed on the policy list.

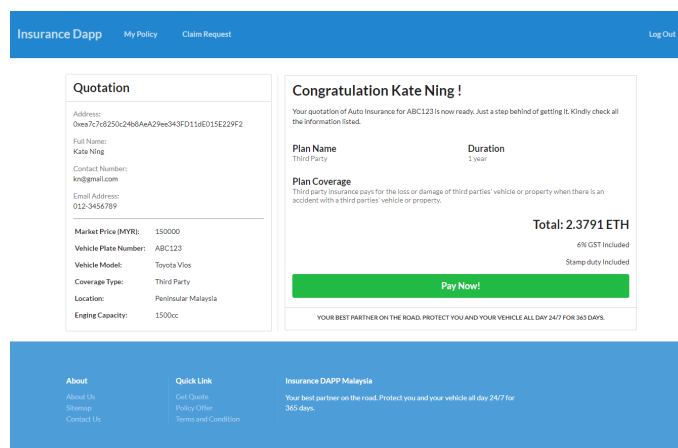


Figure 5.4.1.21 Summary Quotation

d. Claim - Main

This is claim list page that show a list of claim that he/she had requested in our application. If a claim request is not issued before, a message of “You haven’t purchase policy from us” and a Call-To-Action (CTA) button will be shown to user.

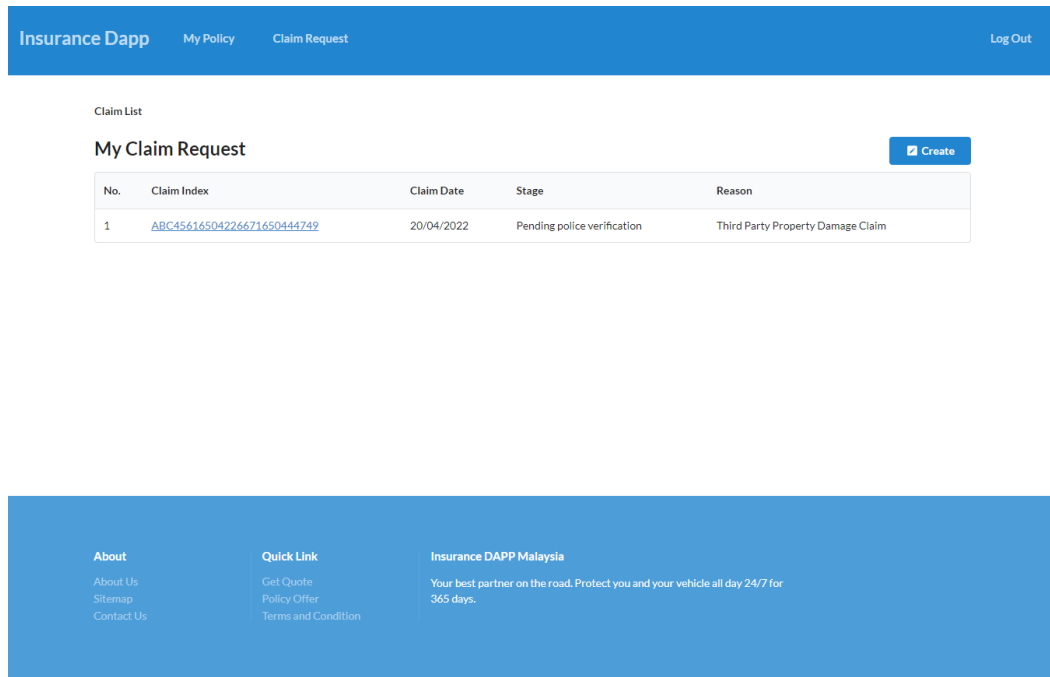


Figure 5.4.1.22 Claim List (1/2)

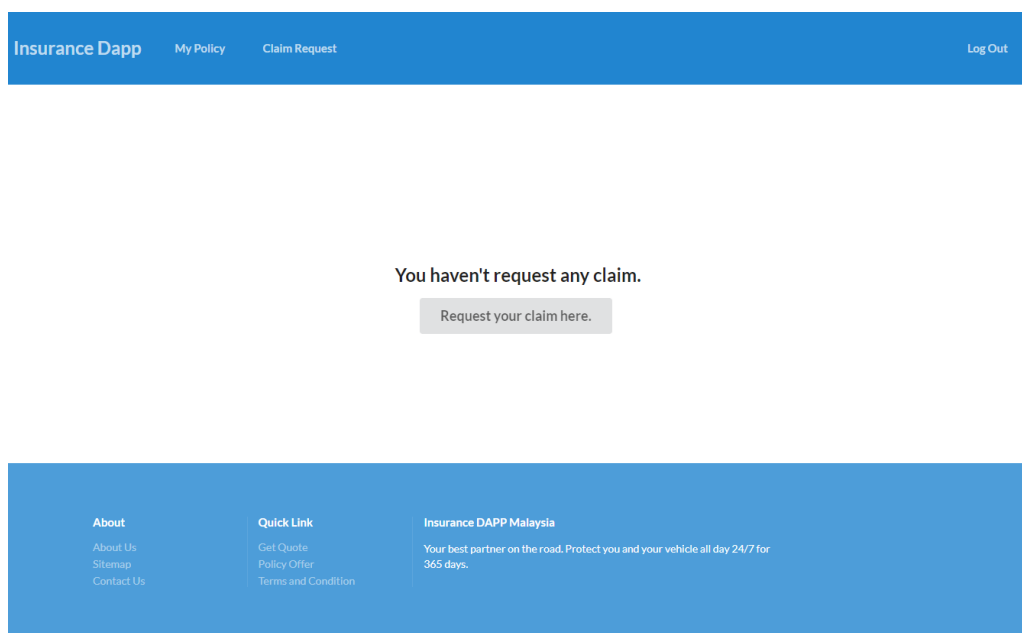


Figure 5.4.1.23 Claim List (2/2)

e. Claim - Create

User will be navigated to this page when he/she needs to create a claim request. After claim is created, it will be displayed on claim request list.

The screenshot shows the 'Create Claim Request' page. At the top, there is a blue navigation bar with 'Insurance Dapp', 'My Policy', 'Claim Request', and 'Log Out'. Below the navigation bar, the breadcrumb 'Claim List > Create Claim Request' is visible. The main heading is 'Create Claim Request'. The form contains the following fields:

- Your Vehicle Plate Number ***: A text input field.
- Vehicle Plate Number To Be Found Guilty ***: A text input field.
- Incident Date ***: A date picker with the format 'mm/dd/yyyy' and a calendar icon.
- Reason ***: A dropdown menu with 'Select' as the current selection.

A blue 'Check!' button is located at the bottom of the form. The footer of the page is a blue bar with three columns of text:

- About**: About Us, Sitemap, Contact Us
- Quick Link**: Get Quote, Policy Offer, Terms and Condition
- Insurance DAPP Malaysia**: Your best partner on the road. Protect you and your vehicle all day 24/7 for 365 days.

Figure 5.4.1.24 Create Claim Request

f. Claim - Details

When user click on “Claim Index” in the claim list, user able to view that claim request in detail. Claim detail can be divided into 3 sections. First section is claim information and current claim progress status. Second section is relevant record of the claim. It shows the 3rd policy that he/she has claimed, accident record and repairing record. The accident record and repairing record will only be updated when police and panel workshop verify the claim request. Figurexxx shows accident record and repairing record unavailable as that claim still pending for police verification. Meanwhile figure xxxx has complete the cycle of claim and released the payout so it will show relevant accident record and repairing record.

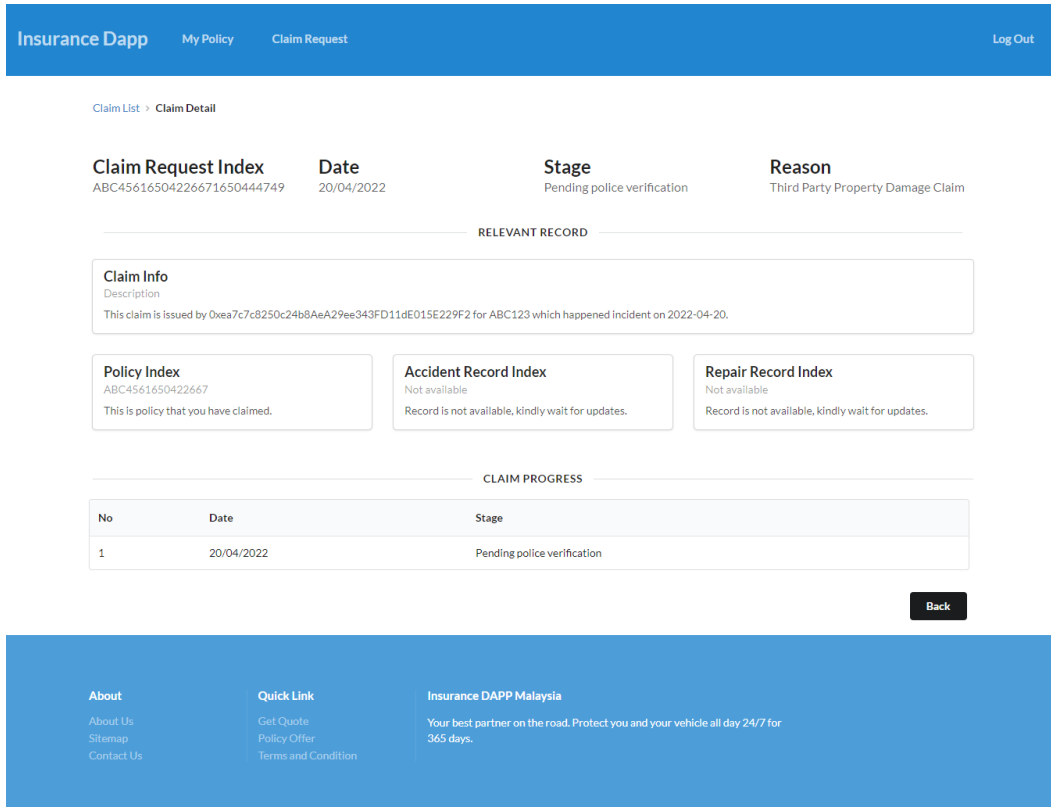


Figure 5.4.1.25 Claim Details (1/2)

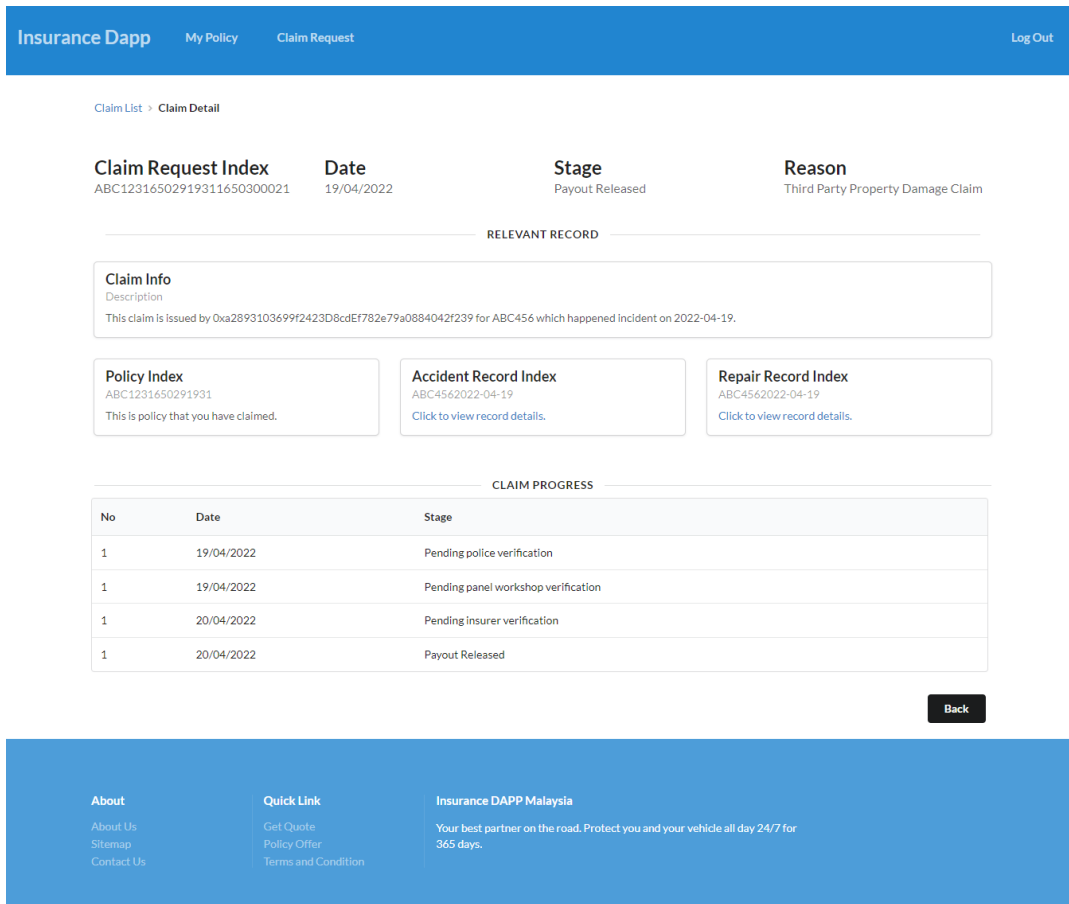
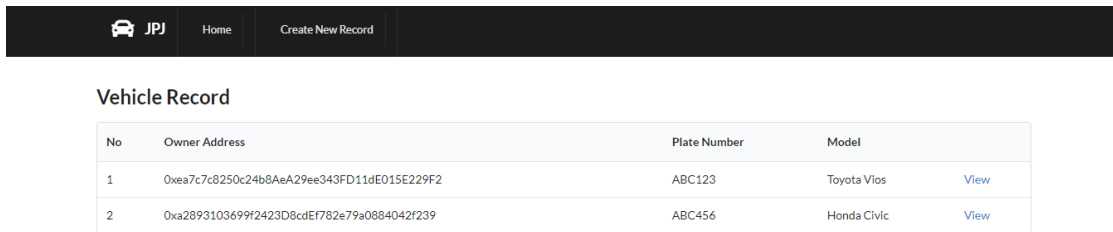


Figure 5.4.1.25 Claim Details (2/2)

5.4.2 JPJ

This is JPJ system that records vehicle information. It acts as vehicle data provider for our main insurance application. Figure 5.4.2.1 shows main page of this system is a list of vehicle record. By clicking “View” of each record, JPJ admin will be navigate to the record details as shown in figure 5.4.2.2.



No	Owner Address	Plate Number	Model	
1	0xea7c7c8250c24b8AeA29ee343FD11dE015E229F2	ABC123	Toyota Vios	View
2	0xa2893103699f2423D8cdEF782e79a0884042f239	ABC456	Honda Civic	View

Figure 5.4.2.1 JPJ - Main Page

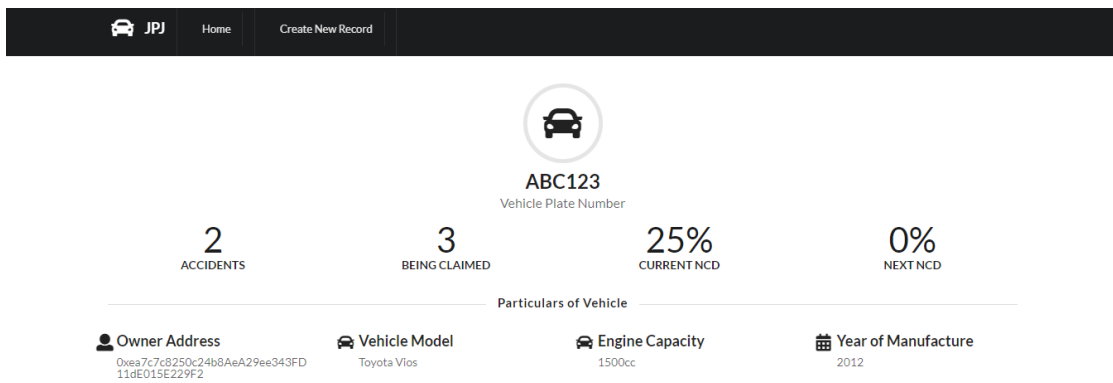
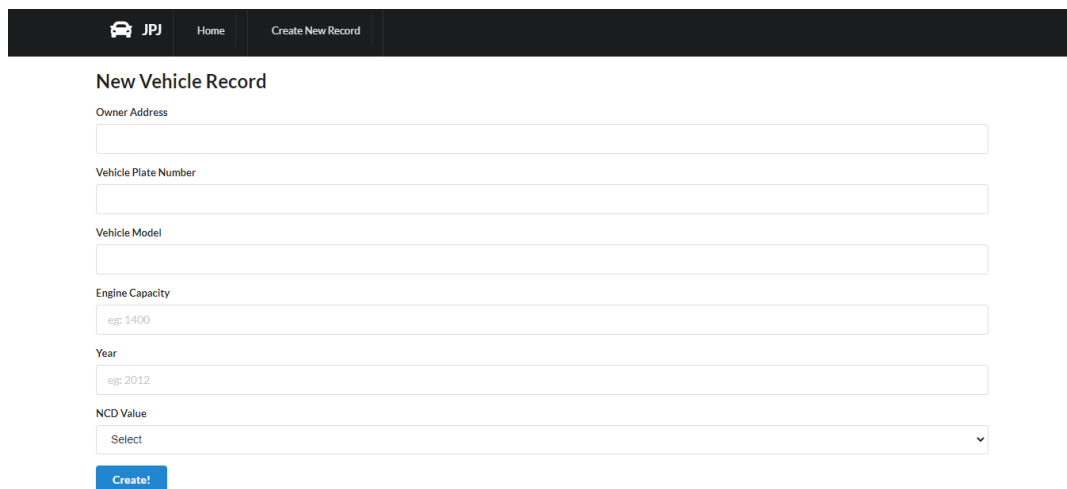


Figure 5.4.2.2 JPJ - Record Details

Create record function as figure 5.4.2.3 can be navigate through “Create New Record” button on top navigation bar.



New Vehicle Record

Owner Address

Vehicle Plate Number

Vehicle Model

Engine Capacity

eg: 1400

Year

eg: 2012

NCD Value

Select

Create!

Figure 5.4.2.3 JPJ – Create New Record

5.4.3 MyGov

This is MyGov system that records user information. It acts as user data provider for our main insurance application. Figure 5.4.3.1 shows main page of this system which consists of a list of user record. By clicking “View” of each record, MyGov admin will be able to view the record details as shown in figure 5.4.3.2.

No	Name	User Address	Email
1	Kate Ning	0xea7c7c8250c24b8AeA29ee343FD11dE015E229F2	kn@gmail.com View
2	Jason Soon	0xa2893103699f2423D8cdEF782e79a0884042f239	js@gmail.com View

Figure 5.4.3.1 MyGov – Main Page

Kate Ning

0xea7c7c8250c24b8AeA29ee343FD11dE015E229F2
Address

2000-05-07
Date of Birth

Female
Gender

User Information

- Contact**
012-3456789
- Email**
kn@gmail.com
- Location**
Peninsular Malaysia

Figure 5.4.3.2 MyGov –Record Details

Create record function as figure 5.4.3.3 can be navigate through “Create New Record” button on top navigation bar.

New User Record

User Address *

Name *

Date of Birth *
mm/dd/yyyy

Gender * Location *
Select Select

Contact *
012-3456789

Email *
joe@schmoe.com

Create!

Figure 5.4.3.3 MyGov – Create New Record

5.4.4 Police

This is Police system that acts as accident data provider for our main insurance application. Police Contract need to interact with vehicle records to update no. of accidents and update claim, JPJ and Claim contract address are required to bind with police contract as figure 5.4.4.1.

Figure 5.4.4.1 Police – Set Dependent Record

Figure 5.4.4.2 shows main page of this system which consists of a list of accident record. By clicking “View” of each record, police will be able to view the record details as shown in figure 5.4.4.3. Police can navigate to create record page as figure 5.4.4.4 through “Create New Record” button on top navigation bar.

No	Party Involved 1	Party Involved 2	Date	Fault	Description	
1	ABC123	ABC456	2022-04-19	ABC123	Car accident.	View
2	ABC456	ABC123	2022-04-19	ABC123	Car accident.	View

Figure 5.4.4.2 Police – Main Page

Figure 5.4.4.3 Police – Record Details

Police Home Create New Record Set Dependant Contract Pending Claim Request

New Accident Records

Vehicle Involved 1 *

Vehicle Involved 2 *

Date *

mm/dd/yyyy

Third-Party Claim *

Description

Create!

Figure 5.4.4.4 Police – Create New Record

When there is claim request pending for police to verify, it will show in the list as figure 5.4.4.5 shown, else it will show “No pending request to verify” as figure 5.4.5.5. Application will retrieve accident list and find the record that match with the claim request. If the record is found, under corresponding accident record section will show corresponding record index and link for police to view that record and “Reject” and “Approve” button will be active for police to proceed. If the accident is not found, the 2 button will be deactivated until the accident record is created and found.

Claim List

Pending Claim Request

No.	Claim Index	Claim Date	Stage	
1	ABC45616504226671650444749	20/04/2022	Pending police verification	View More

Figure 5.4.4.5 Police – Pending Claim List

Police Home Create New Record Set Dependant Contract Pending Claim Request

Claim List > Claim Detail

CLAIM REQUEST INFORMATION

Claim Request Index	Date	Stage	Reason
ABC45616504226671650444749	20/04/2022	Pending police verification	Third Party Property Damage Claim

RELEVANT RECORD

Policy Index
ABC4561650422667
This is policy that you have claimed.

CORRESPONDING ACCIDENT RECORD

Accident Record Not Found.
-
There is no matching accident record.

[Back](#) [Reject](#) [Approve](#)

Figure 5.4.4.6 Police – Claim Request Detail

5.4.5 Panel Workshop

Panel Workshop system acts as vehicle repairing data provider for our main insurance application. Panel Workshop Contract need to interact with Claim contract to update claim, hence claim contract address is required to bind with panel workshop contract as figure 5.4.5.1.

Figure 5.4.5.1 Panel Workshop – Set Dependent Record

Figure 5.4.5.2 shows main page of this system which consists of a list of vehicles repairing record. By clicking “View” of each record, panel workshop admin will be able to view the record details as shown in figure 5.4.5.3. Panel workshop admin can navigate to create record page as figure 5.4.5.4 through “Create New Record” button on top navigation bar.

No	Vehicle Plate Number	Amount	Done Repairing Date	Description
1	ABC456	0.1 eth	2022-04-20	Fix door & sidemirror View

Figure 5.4.5.2 Panel Workshop – Main Page

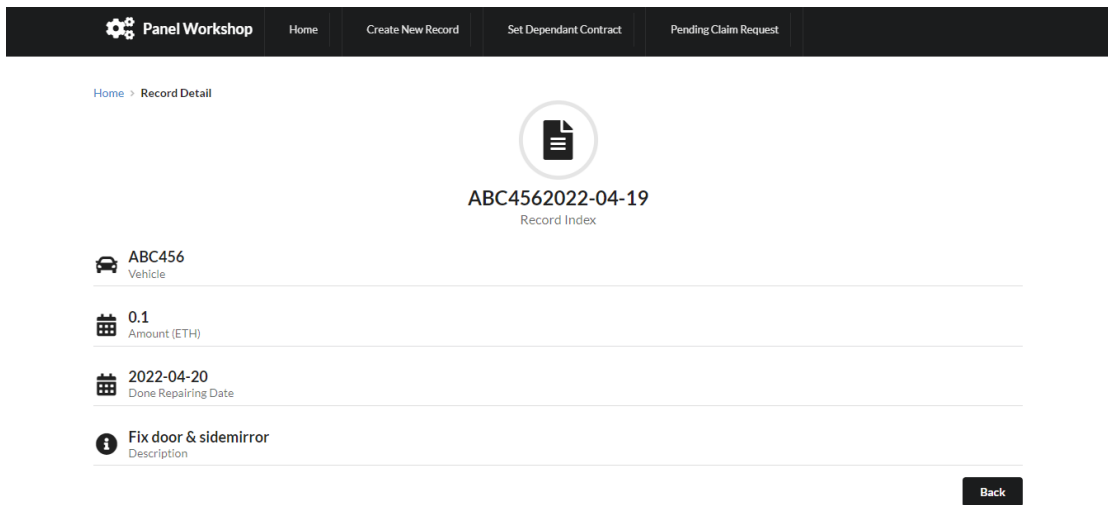


Figure 5.4.5.3 Panel Workshop – Record Details

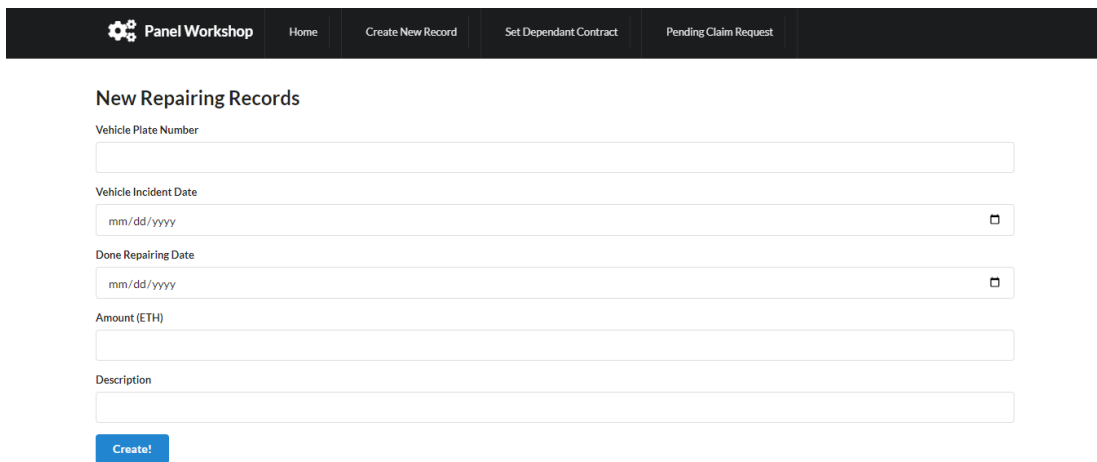


Figure 5.4.5.4 Panel Workshop – Create New Record

Figure 5.4.5.5 shows when there is no pending claim request for panel workshop to verify. When there is claim request pending for panel workshop to verify, it will have the similar process flow as shown in figure 5.4.4.5 and figure 5.4.4.6.



No pending claim request to verify.

Figure 5.4.5.5 Panel Workshop – Pending Claim List

CHAPTER 6 SYSTEM EVALUATION AND DISCUSSION

Insurance Dapp System Test (Insurer)			
Pre-requisite	Test Case	Expected Results	Test Data
Case 1: Insurer create policy offer.			
<ul style="list-style-type: none"> Metamask account must installed in user's browser User is registered on MetaMask. 	<ol style="list-style-type: none"> Users log in as insurer role. Insurer click on Create policy offer button. Insurer give input to the form. Insurer pay gas fee to create the offer. 	<ol style="list-style-type: none"> User address will be retrieved to check insurer identity. Display form to gather inputs. Navigate to policy offering page. 	<ul style="list-style-type: none"> Policy Name: Third Party Duration: 1 Policy Description: Third party Insurance pays for the loss or damage.....
Case 2: Insurer view policy offering.			
<ul style="list-style-type: none"> Metamask account must installed in user's browser User is registered on MetaMask. 	<ol style="list-style-type: none"> Insurer log in as user role. Insurer click on Policy Offering button. 	<ol style="list-style-type: none"> User address will be retrieved to check insurer identity. If user is insurer: List of policy offering will be shown to user. If user is not insurer: They will be rejected. 	<ul style="list-style-type: none"> None

6.1 System Testing and Performance Metrics

Table 6.1 Insurance Dapp System Test (Insurer 1/2)

Insurance Dapp System Test (Insurer)			
Pre-requisite	Test Case	Expected Results	Test Data
Case 3: Insurer view report.			
<ul style="list-style-type: none"> • Metamask account must installed in user's browser • User is registered on MetaMask. 	<ol style="list-style-type: none"> 1) Users log in as insurer role. 2) Insurer click on Report button. 	<ol style="list-style-type: none"> 1) Report main page will be shown. 	<ul style="list-style-type: none"> • None.
Case 4: Insurer view policy analysis.			
<ul style="list-style-type: none"> • Metamask account must installed in user's browser • User is registered on MetaMask. 	<ol style="list-style-type: none"> 1) Users log in as insurer role. 2) Insurer click on Report button. 3) Select "Policy Analysis" button. 	<ol style="list-style-type: none"> 1) Display policy analysis page. 2) Data must up to date. 	<ul style="list-style-type: none"> • None
Case 5: Insurer view claim analysis.			
<ul style="list-style-type: none"> • Metamask account must installed in user's browser • User is registered on MetaMask. 	<ol style="list-style-type: none"> 1) Users log in as insurer role. 2) Insurer click on Report button. 3) Select "Claim Analysis" button. 	<ol style="list-style-type: none"> 1) Display claim analysis page. 2) Data must up to date. 	<ul style="list-style-type: none"> • None

Table 6.2 Insurance Dapp System Test (Insurer 2/2)

Insurance Dapp System Test (User)			
Pre-requisite	Test Case	Expected Results	Test Data
Case 1: User can request quotation.			
<ul style="list-style-type: none"> • Metamask account must installed in user's browser • User is registered on MetaMask. • Vehicle to be checked is owned by user. 	<ol style="list-style-type: none"> 1) Users enter check premium page. 2) Users give input. 3) Users pay gas fee for checking. 	<ol style="list-style-type: none"> 1) Vehicle plate number will be checked with user address 2) If vehicle is owned by user: Navigate to summary page 3) If vehicle is not owned by user: Transaction failed 	<ul style="list-style-type: none"> • Vehicle Plate Number: ABC123 • Coverage Type: Third Party • Market value: 200000
Case 2: Customer view policy purchased.			
<ul style="list-style-type: none"> • Metamask account must installed in user's browser • User is registered on MetaMask. 	<ol style="list-style-type: none"> 1) Users log in as user role. 2) Users click on My Policy button. 	<ol style="list-style-type: none"> 1) User address will be retrieved to check customer identity. 2) If user is our customer: List of purchased policy will be shown to user. 3) If user is not our customer: They will be rejected. 	<ul style="list-style-type: none"> • None
Case 3: User initiate claim request.			
<ul style="list-style-type: none"> • Metamask account must installed in user's browser • User is registered on MetaMask. • Vehicle to be checked is owned by user. 	<ol style="list-style-type: none"> 1) Users log in as user role. 2) Users click on Claim Request button. 3) Users select "Create" button and give input. 	<ol style="list-style-type: none"> 1) Vehicle plate number who is found guilty will be check and match to retrieve 3rd policy index. 2) Navigate to claim request list page and display newly created record. 	<ul style="list-style-type: none"> • Own vehicle: ABC456 • Guilty vehicle: ABC123 • Incident date: 2022-04-19 • Reason: 1
Case 4: User view specific claim request.			
<ul style="list-style-type: none"> • Metamask account must installed in user's browser • User is registered on MetaMask. • Vehicle to be 	<ol style="list-style-type: none"> 1) Users log in as user role. 2) Users click on Claim Request button. 3) Users select Claim Index. 	<ol style="list-style-type: none"> 1) The selected claim request information will be shown in detail. 	<ul style="list-style-type: none"> • None.

Table 6.3 Insurance Dapp System Test (User)

JPJ System Test			
Pre-requisite	Test Case	Expected Results	Test Data
Case 1: JPJ admin can create new vehicle record.			
<ul style="list-style-type: none"> • Metamask account must installed in user's browser • User is registered on MetaMask. 	<ol style="list-style-type: none"> 1) Admin click on create record button. 2) Admin give input. 3) Admin pay gas fee for creating record. 	<ol style="list-style-type: none"> 1) Navigate back to main page when transaction is successful. 	<ul style="list-style-type: none"> • Owner address: 0xea7c7c8.. • Vehicle Plate Number: ABC123 • Vehicle Model: Toyota Vios • Engine Capacity: 1500 • Year: 2012
Case 2: JPJ admin view record created.			
<ul style="list-style-type: none"> • Metamask account must installed in user's browser • User is registered on MetaMask. 	<ol style="list-style-type: none"> 1) Admins enter the main page of system to view records created. 	<ol style="list-style-type: none"> 1) List of created record will be shown to admin. 	<ul style="list-style-type: none"> • None
Case 3: JPJ admin view specific record.			
<ul style="list-style-type: none"> • Metamask account must installed in user's browser • User is registered on MetaMask. 	<ol style="list-style-type: none"> 1) Admins click on "View" button of specific record. 	<ol style="list-style-type: none"> 1) The selected vehicle information record will be shown in detail. 	<ul style="list-style-type: none"> • None

Table 6.4 JPJ System Test

MyGov System Test			
Pre-requisite	Test Case	Expected Results	Test Data
Case 1: MyGov admin can create new user record.			
<ul style="list-style-type: none"> Metamask account must installed in user's browser User is registered on MetaMask. 	<ol style="list-style-type: none"> Admin click on create record button. Admin give input. Admin pay gas fee for creating record. 	<ol style="list-style-type: none"> Navigate back to main page when transaction is successful. 	<ul style="list-style-type: none"> User address: 0xea7c7c8.. Name: Kate Ning DOB: 13012000 Gender: Female Location: Peninsular Malaysia Contact: 012-3456789 Email: kn@gmail.com
Case 2: MyGov admin view record created.			
<ul style="list-style-type: none"> Metamask account must installed in user's browser User is registered on MetaMask. 	<ol style="list-style-type: none"> Admins enter the main page of system to view records created. 	<ol style="list-style-type: none"> List of created record will be shown to admin. 	<ul style="list-style-type: none"> None
Case 3: MyGov admin view specific record.			
<ul style="list-style-type: none"> Metamask account must installed in user's browser User is registered on MetaMask. 	<ol style="list-style-type: none"> Admins click on "View" button of specific record. 	<ol style="list-style-type: none"> The selected vehicle information record will be shown in detail. 	<ul style="list-style-type: none"> None

Table 6.5 MyGov System Test

Police System Test			
Pre-requisite	Test Case	Expected Results	Test Data
Case 1: Police can create new accident record.			
<ul style="list-style-type: none"> Metamask account must installed in user's browser User is registered on MetaMask. 	<ol style="list-style-type: none"> Police click on create record button. Police give input. Police pay gas fee for creating record. 	<ol style="list-style-type: none"> Navigate back to main page when transaction is successful. 	<ul style="list-style-type: none"> Vehicle 1: ABC123 Vehicle 2: ABC456 Incident Date: 12042022 Final Decision: ABC123 Description: Car Accident
Case 2: Police view record created.			
<ul style="list-style-type: none"> Metamask account must installed in user's browser User is registered on MetaMask. 	<ol style="list-style-type: none"> Police enter the main page of system to view records created. 	<ol style="list-style-type: none"> List of created record will be shown. 	<ul style="list-style-type: none"> None
Case 3: Police view specific record.			
<ul style="list-style-type: none"> Metamask account must installed in user's browser User is registered on MetaMask. 	<ol style="list-style-type: none"> Police click on "View" button of specific record. 	<ol style="list-style-type: none"> The selected vehicle information record will be shown in detail. 	<ul style="list-style-type: none"> None
Case 4: Police approve verification claim request.			
<ul style="list-style-type: none"> Metamask account must installed in user's browser User is registered on MetaMask. 	<ol style="list-style-type: none"> Police view claim request list. Police select "View More" for specific request record. Shows selected request info. Police click on approve and pay for the gas fee. 	<ol style="list-style-type: none"> System update claim progress. 	<ul style="list-style-type: none"> None

Table 6.6 Police System Test

Panel Workshop System Test			
Pre-requisite	Test Case	Expected Results	Test Data
Case 1: Panel Workshop admin can create new accident record.			
<ul style="list-style-type: none"> Metamask account must installed in user's browser User is registered on MetaMask. 	<ol style="list-style-type: none"> Admin click on create record button. Admin give input. Admin pay gas fee for creating record. 	<ol style="list-style-type: none"> Navigate back to main page when transaction is successful. 	<ul style="list-style-type: none"> Vehicle 1: ABC123 Vehicle 2: ABC456 Incident Date: 12042022 Final Decision: ABC123 Description: Car Accident
Case 2: Panel Workshop admin view record created.			
<ul style="list-style-type: none"> Metamask account must installed in user's browser User is registered on MetaMask. 	<ol style="list-style-type: none"> Admins enter the main page of system to view records created. 	<ol style="list-style-type: none"> List of created record will be shown. 	<ul style="list-style-type: none"> None
Case 3: Panel Workshop admin view specific record.			
<ul style="list-style-type: none"> Metamask account must installed in user's browser User is registered on MetaMask. 	<ol style="list-style-type: none"> Admins click on "View" button of specific record. 	<ol style="list-style-type: none"> The selected vehicle information record will be shown in detail. 	<ul style="list-style-type: none"> None
Case 4: Panel Workshop admin approve verification claim request.			
<ul style="list-style-type: none"> Metamask account must installed in user's browser User is registered on MetaMask. 	<ol style="list-style-type: none"> Admin view claim request list. Admin select "View More" for specific request record. Shows selected request info. Admins click on approve and pay for the gas fee. 	<ul style="list-style-type: none"> System update claim progress. 	<ul style="list-style-type: none"> None

Table 6.7 Panel Workshop System Test

6.2 Testing Setup and Results

- **Insurance Dapp System Test Result (Insurer)**

Case 1 & Case 2: Insurer create policy offer & view policy offering.

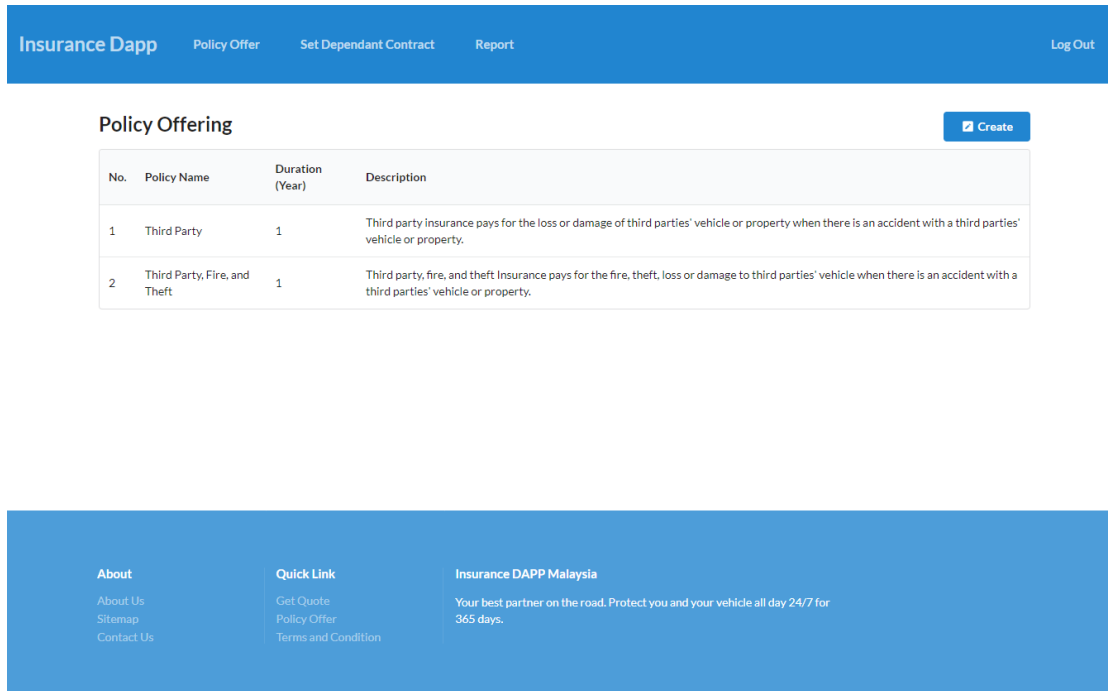


Figure 6.2.1 Insurance Dapp System Test Result (Insurer) (1/4)

Case 3: Insurer view report.

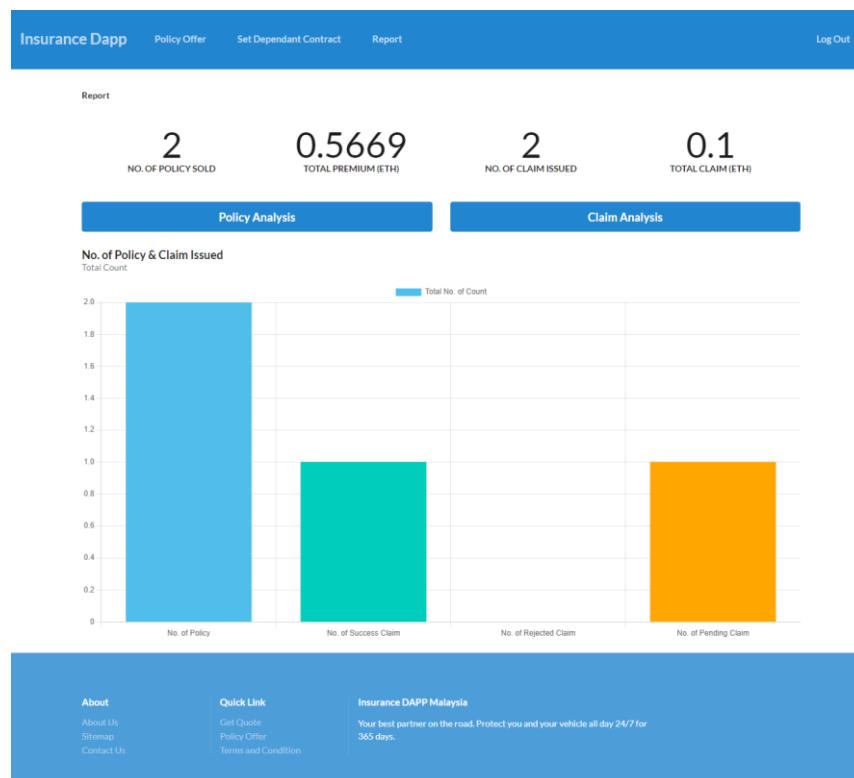


Figure 6.2.2 Insurance Dapp System Test Result (Insurer) (2/4)

Case 4: Insurer view policy analysis.

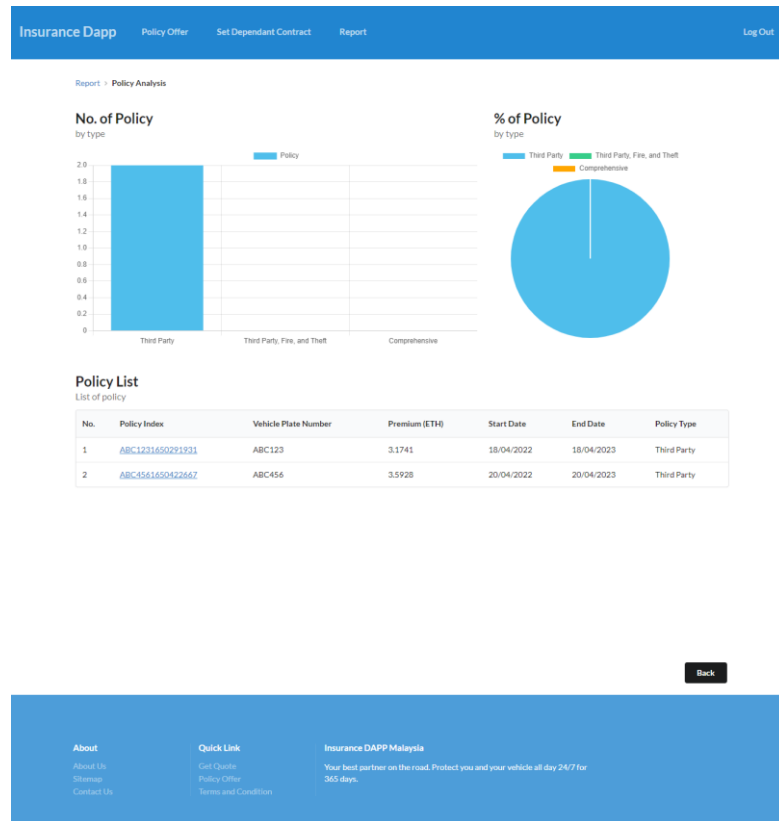


Figure 6.2.3 Insurance Dapp System Test Result (Insurer) (3/4)

Case 6: Insurer view claim analysis.

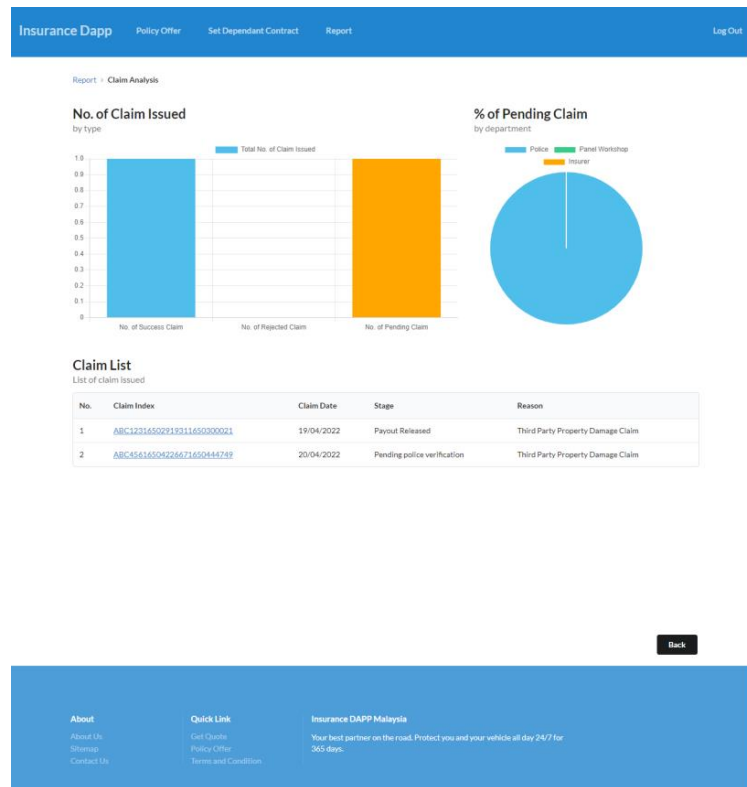


Figure 6.2.4 Insurance Dapp System Test Result (Insurer) (4/4)

• Insurance Dapp System Test Result (User)

Case 1: User can request quotation.

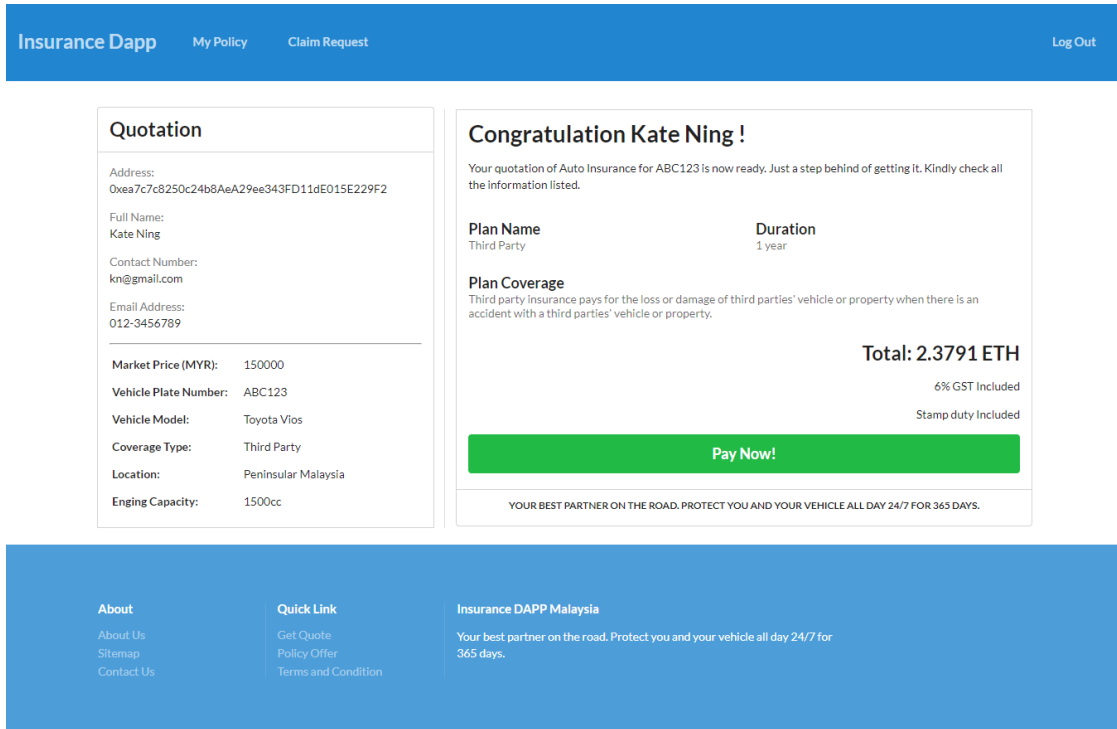


Figure 6.2.5 Insurance Dapp System Test Result (User) (1/4)

Case 2: Customer view policy purchased.

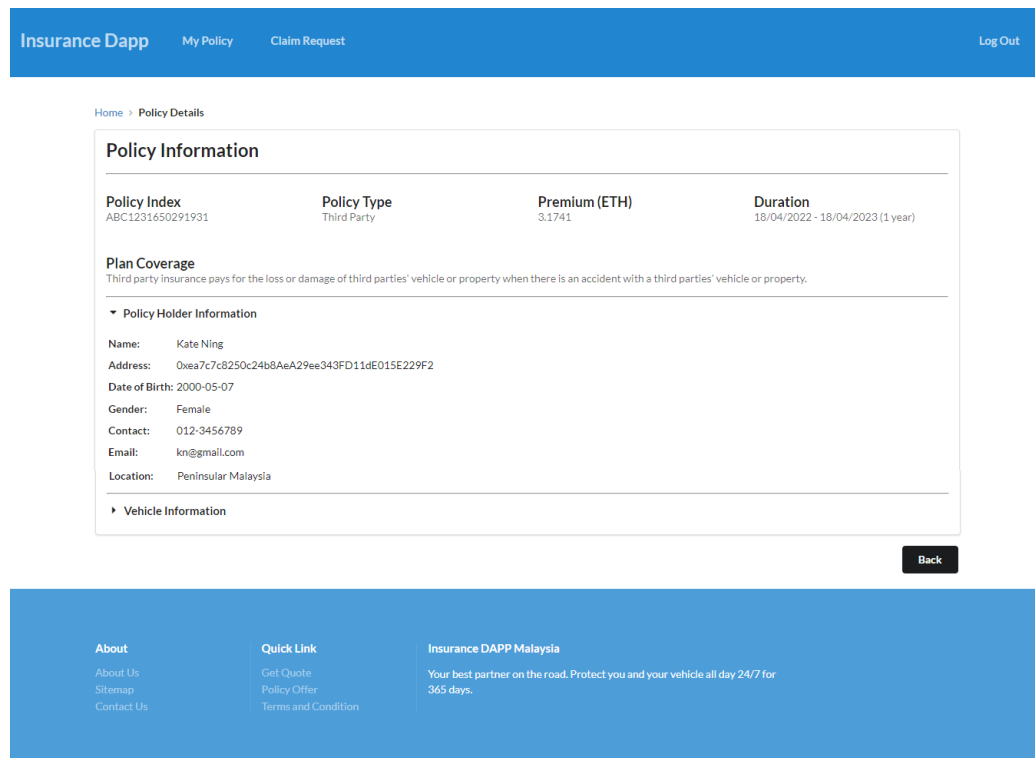


Figure 6.2.6 Insurance Dapp System Test Result (User) (2/4)

Case 3: User initiate claim request.

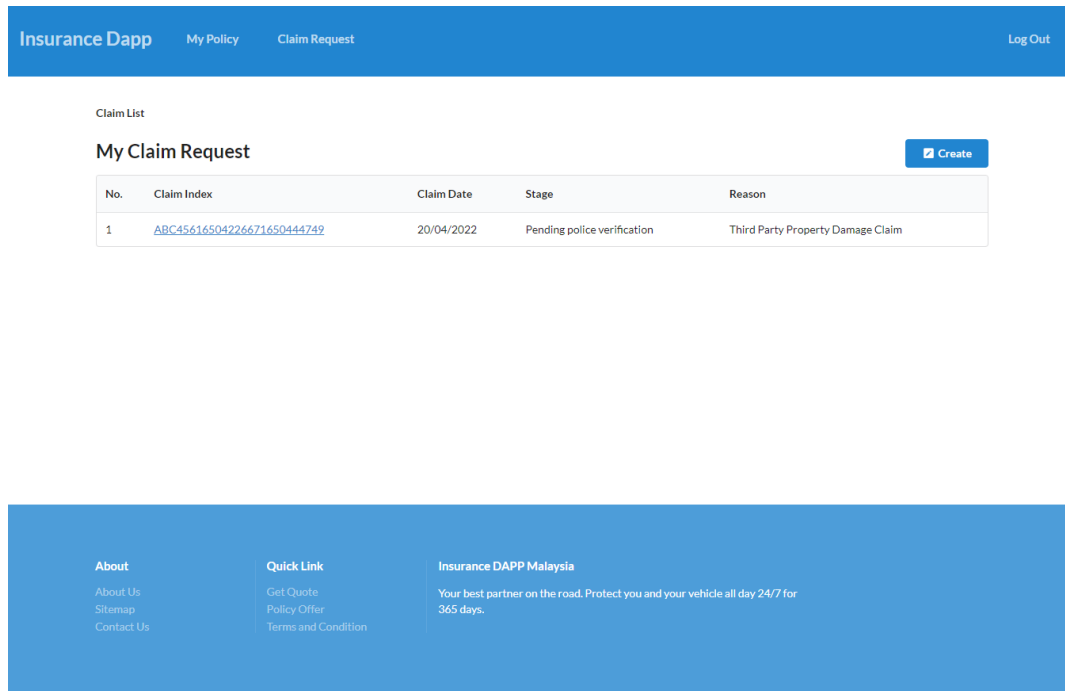


Figure 6.2.7 Insurance Dapp System Test Result (User) (3/4)

Case 4: User view specific claim request.

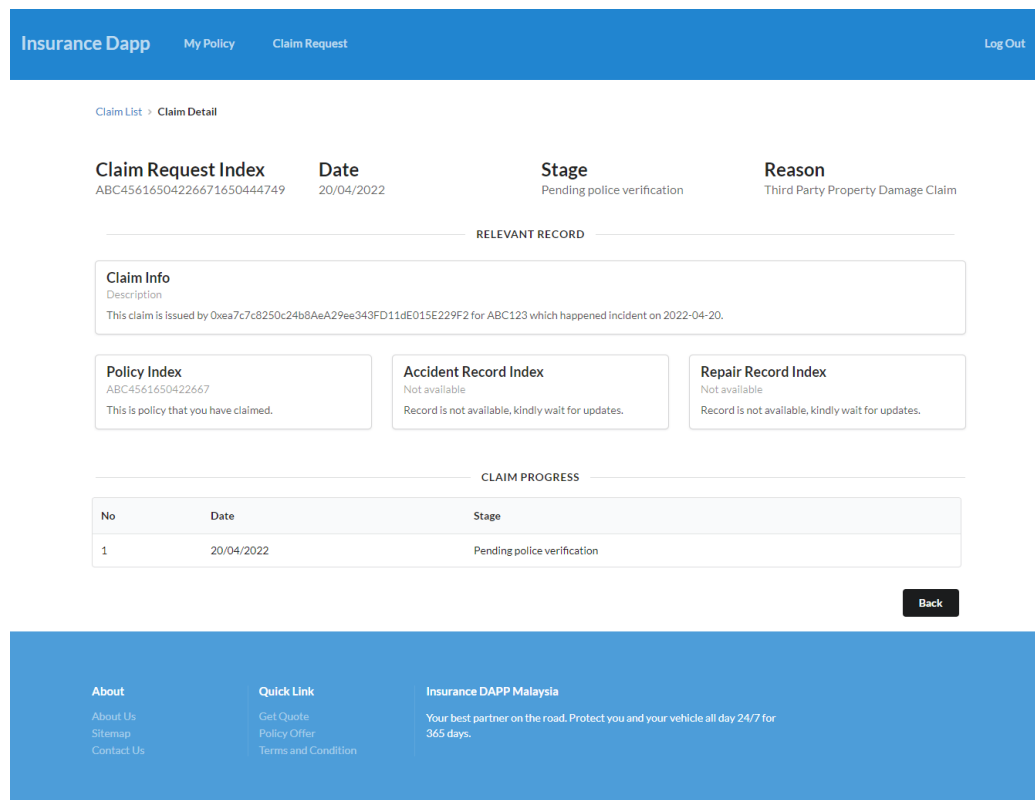


Figure 6.2.8 Insurance Dapp System Test Result (User) (4/4)

• **JPJ System Test Result**

Case 1 & Case 2: JPJ admin can create new vehicle record & View record created.

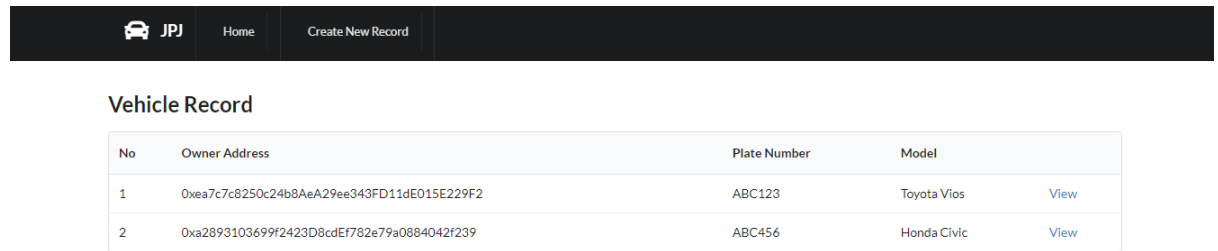


Figure 6.2.9 JPJ System Test Result (1/2)

Case 3: JPJ admin view specific record.

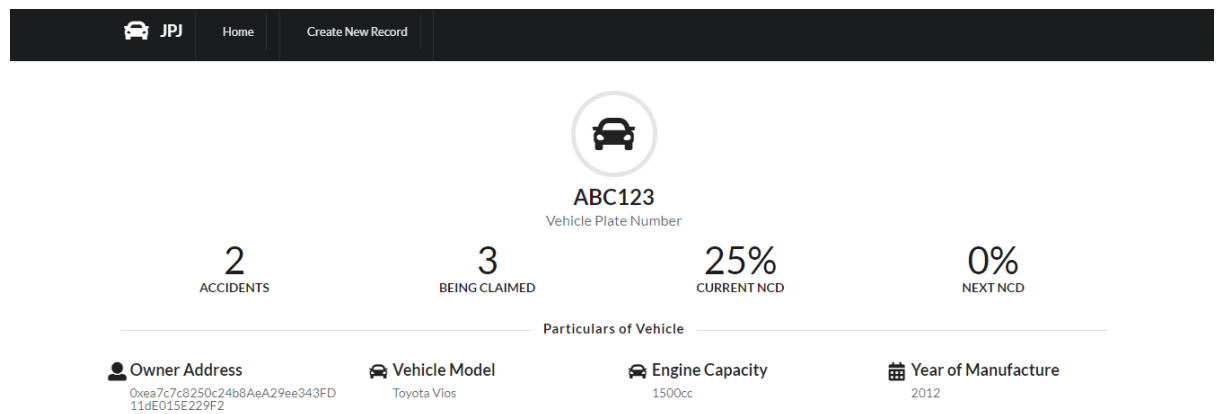


Figure 6.2.10 JPJ System Test Result (2/2)

• **MyGov System Test Result**

Case 1 & Case 2: MyGov admin can create new user record & View record created.

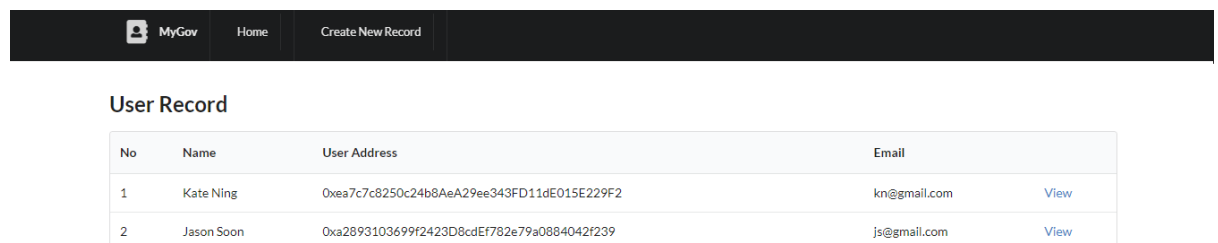


Figure 6.2.11 MyGov System Test Result (1/2)

Case 3: MyGov admin view specific record.

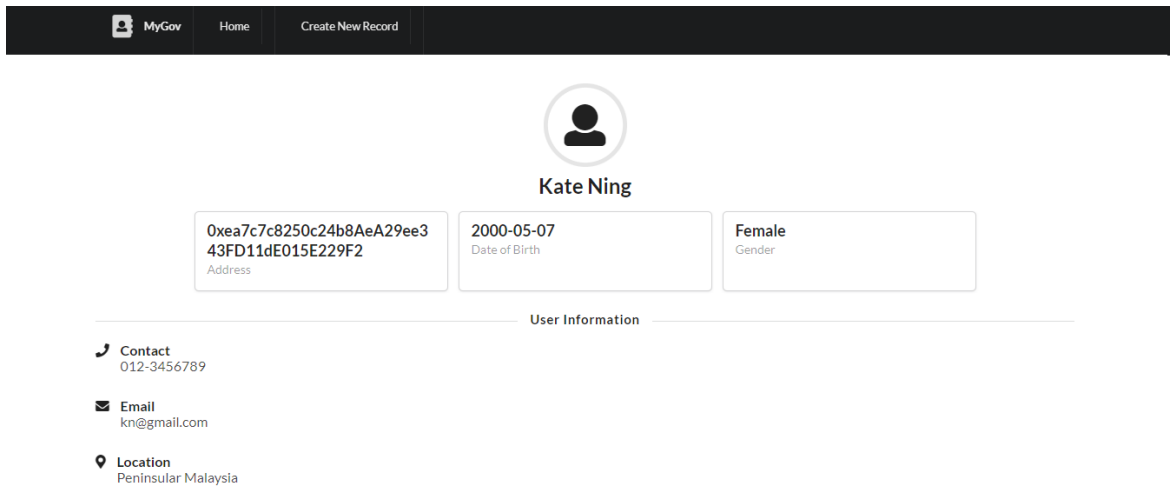


Figure 6.2.12 MyGov System Test Result (2/2)

- **Police System Test Result**

Case 1 & Case 2: Police can create new accident record & View record created.

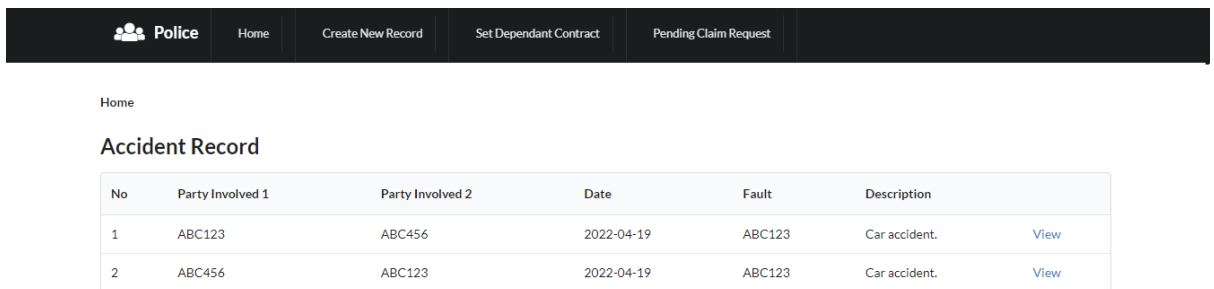


Figure 6.2.13 Police System Test Result (1/3)

Case 3: Police view specific record.

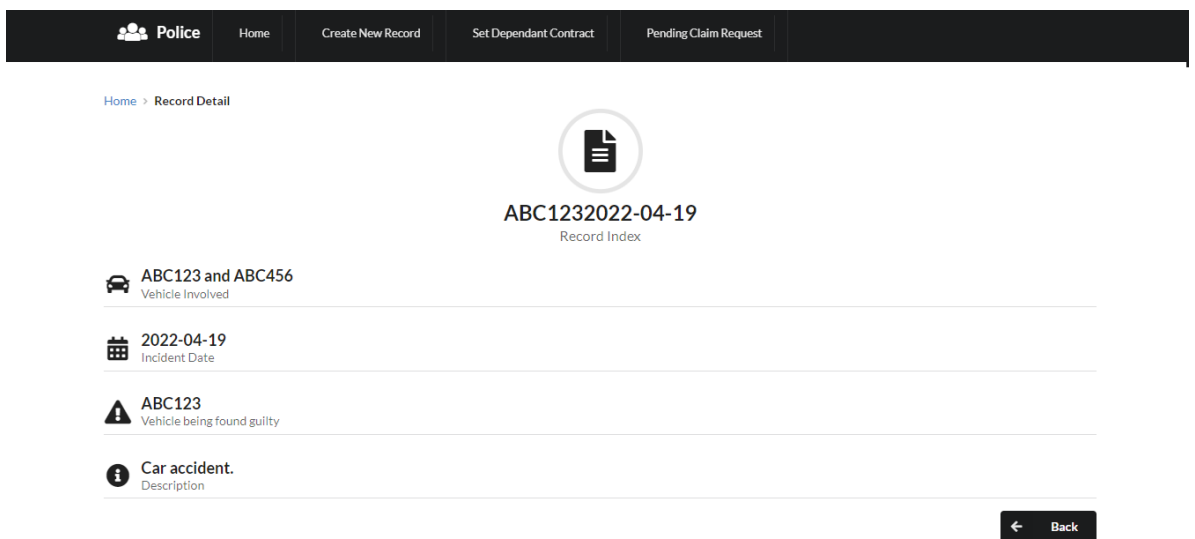


Figure 6.2.14 Police System Test Result (2/3)

Case 4: Police approve verification claim request = claim progress updated.

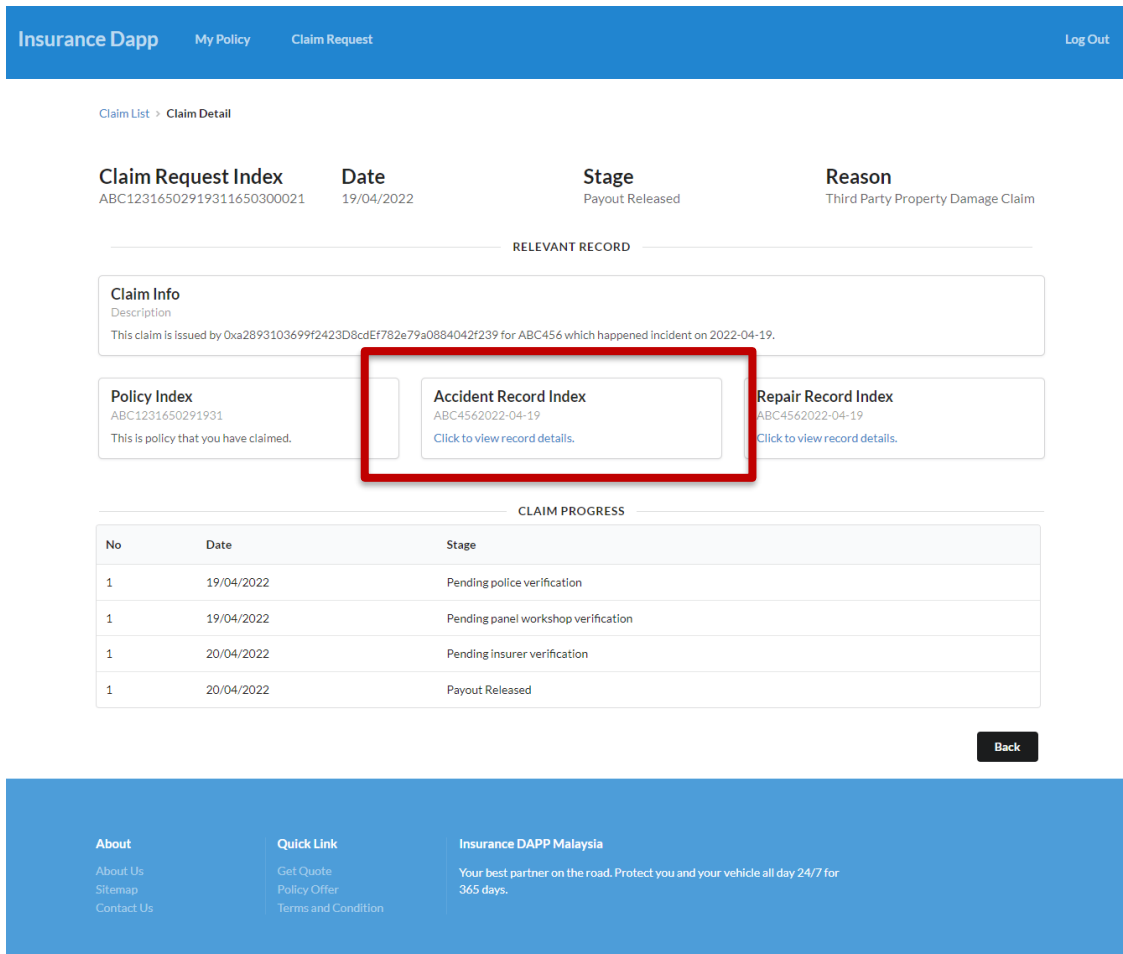


Figure 6.2.15 Police System Test Result (3/3)

• Panel Workshop Test Result

Case 1& Case 2: Panel Workshop admin can create new accident record & View record created.

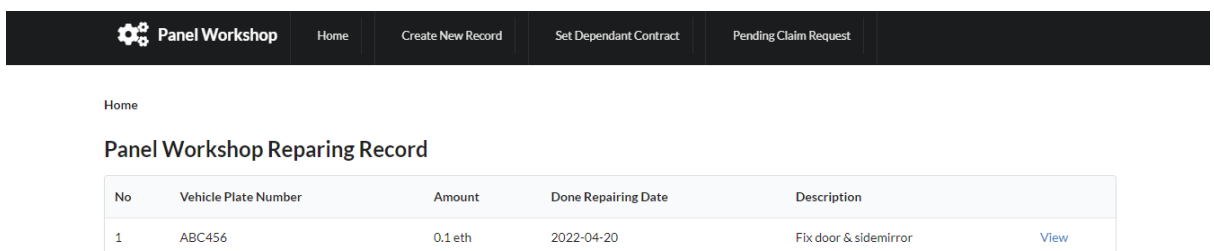


Figure 6.2.16 Panel Workshop System Test Result (1/3)

Case 3: Panel Workshop admin view specific record.

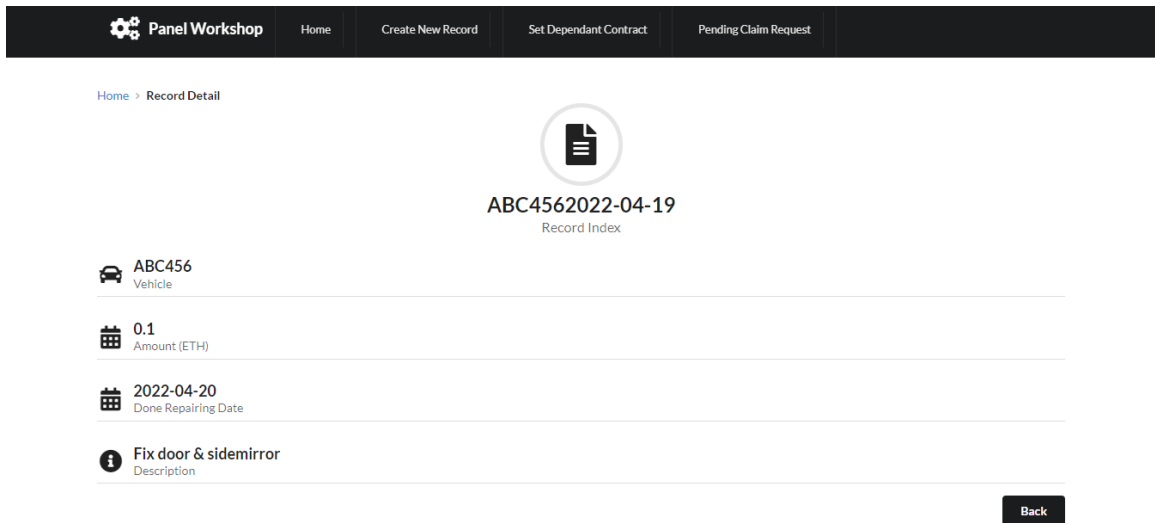


Figure 6.2.17 Panel Workshop System Test Result (2/3)

Case 4: Panel Workshop admin approve verification claim request = claim progress updated.

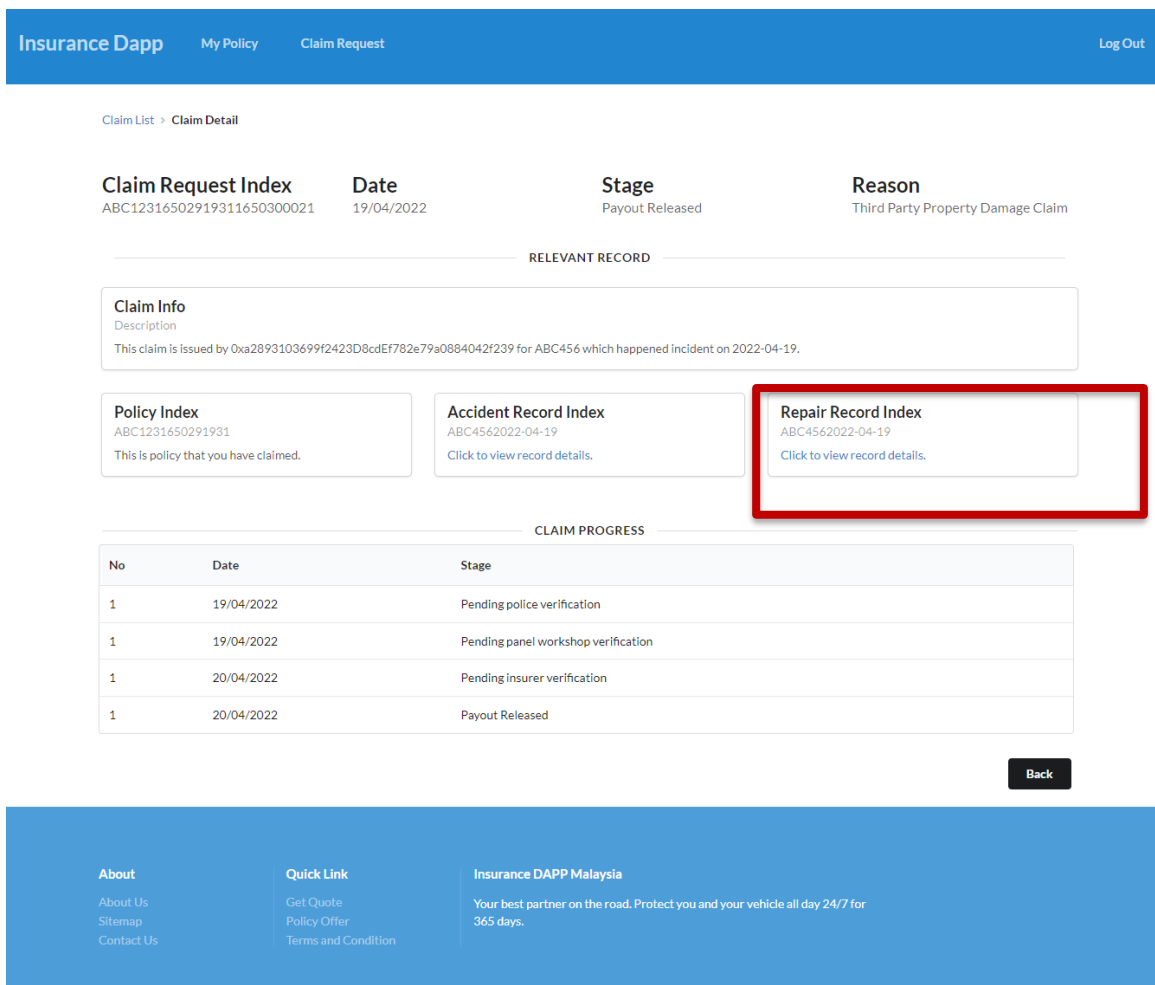


Figure 6.2.18 Panel Workshop System Test Result (3/3)

6.3 Project Challenges

From overall perspective, the challenges on developing a decentralized application are solidity language still in its continuous development stage and not yet mature as compare to JAVA or C++. In addition to that, the initial development on blockchain technology is focusing on cryptocurrency not and decentralized application. Therefore, resources and practical solution are harder to find in communities such as Stack Overflow, GitHub and GeeksforGeeks. Phase of going through documentations is a must experience to learn this new technology. As this knowledge is not taught before and this project is self-development project hence self-learning and exploration journey is quite challenging due to above mention reasons. A solid example is that decentralized application in insurance domain involves many businesses logic and lots of 3rd parties, hence there are very less open-source code or documentation for references. The whole development process took more time than I expected on finding and trying out different ways to develop functions on my application.

As I mentioned, Solidity is not yet comprehensive as other main trend programming languages, therefore there are lots of differences and improvements made on each version. Versioning of Solidity is one of the biggest pain points on development process. As different tutorials and solution we refer to will have big syntax difference which requires us to change the whole code structure. To seek for stability, I use 0.4.17 version to develop my application. One technical issue I have faced during my development is that function in the version I develop on is unable to return struct. Returning struct should not be a problem in other languages. After my hours of debugging, the reason of the problem is that solidity under 0.4.17 version is not supported to return struct, the workarounds is to use experimental ABI encoder or change solidity version to 0.8.0. By using the encoder, the final application is not able to deploy on main Ethereum network and changing version will result in change my whole code structure. At last, the solution I have implemented is used function to return data members one by one. It undoubtedly lengthens the process time of gathering all information.

Another challenge that worth mentioned is gas fee. As data are stored on blockchain network and every change and query made required processing power to validate the transaction. Hence, while developing this application, we have to ensure to minimize cost incur in each function. For example, to query a record from an array of records, traditionally we would use for loop to find that particular record which match the

criteria. Under blockchain, the process of using for loop will incurred huge amount of gas fee if the database to query is huge. The solution to this problem is using mapping to locate the exact record instead of trial and error among all records. Gas fee have forced us to adapt to new ways on building up the code structure which is challenging.

6.4 Objectives Evaluation

We have conducted a 40 responses survey to evaluate our project objectives. Survey data can refer to [Objective Evaluation Survey](#). Our respondents consist of 60% of male and 40% of female who mainly under category of 21 – 25 years old.

Figure A-3 shows that 72.5% of our respondent have knowledge on blockchain technology and 10% have expertise in this area. Hence, the survey results have its credibility since respondent have some background knowledge on this technology. Figure A-4 shows that 80% of them believe with decentralization it can reduce process time compared to management through central . From figure A-5 and figure A-6 show have similar tendency that most of our respondent have high confident on the features of immutability and auditability on blockchain. However, when they come to “51% attack”, the security attack on blockchain, their confident level dropped. The result shows no matter how efficient and effective the technology brings; security will still remain one of the important factors that affects user try new technology. Furthermore, 82.5% of them indicates smart contract is the better alternative to automate claiming process.

Figure A-9 shows that 62.5% of our respondent prefer to purchase and manage their insurance online. Among 62.5% of them, 80% of them choose to handle their purchasing online rather than reach out agent is due to bias advice from agent. 60% of them have technology readiness to embrace this new business model. On the other hand, 37.5% of our respondent prefer to deal with agent and 53.3% of them will consider purchasing only if the policy is easy and understandable. Hence from above results we conclude that, if user have high technology readiness level, user keen to make their own decision and believe in themselves.

From figure A-12, security of personal data and speed of insurance process are the main concern of user when they are purchasing an insurance product. Second concern

is high premium rate, and third concern is approval and rejection on claims . 75% of them shows that underwriting and claiming process often take lengthy process time and 65% of them indicated that too much paperwork information is requested during the process. Therefore, 62.5% of them are looking forward to having automation to speed up the process.

25% of our respondent have security concern on automation and small portion of them (12.5%) still prefer dealing with agents. To have more security assurance, transparency is crucial throughout the whole process as figure A-15 and figure A-16 shows that they believe with high transparency intentional unsuccessful claim rate will be decreased and they can have more control on their data.

Our project objectives are

- To enhance user experience by providing more simple and efficient insurance process.
- To eliminate intermediaries throughout the whole insurance process.
- To reduce the potential rate of insurance fraud for insurer and reduce intention rejection claim for customer.

In conclusion, our application can provide more efficient insurance process with less paperwork and document required as all process will be handle by smart contract. Claim request will be auto populate to relevant departments' system and document required will be auto fetched to verify the transaction. With zero intermediaries involve, less management fee incurs which potentially reduce premium fee. With high transparency, user will have full control of their data and glance of view of all process. Blockchain technology that decentralise each process in insurance domain are the key of our application.

CHAPTER 7 CONCLUSION AND RECOMMENDATION

7.1 Conclusion

Policy underwriting and claiming are costly and time consuming in current situation. Due to heavily human involved with 3rd parties and intermediaries, the whole insurance process is lengthy, costly, lack of transparency and prone to fraud. Therefore, our proposed solution is a decentralized application that aims to improve traditional insurance process in Malaysia using blockchain technology.

Insurance Dapp provides a solution to enhance user experience by maximizing automation through blockchain technology. With distributed ledger technology, all data can be retrieved and processed without the needs of intermediaries. Accuracy of records is also being secured with the nature of blockchain, as data on chain is immutable and transparent. Smart contract will play the role to replace human works such as manually collecting and auditing data accuracy with different parties. Smart contract will be self-executed when predefined rules or action is met, hence it massively increases the efficiency of whole insurance process.

This application focus on auto insurance domain and include functionality from policy underwriting phase to claiming phase. User can check their vehicle's premium, view their purchased policy and enjoy real time tracking of claim status on this platform. Insurer is responsible to create policy offer as well as act as auditor to approve the claim. 3rd party data provider in this application would be JPJ and MyGOV who provide vehicle data and user identity data as well as panel workshop and police that provide service receipt or accident report. The whole insurance process has zero intermediary's involvement, so the application interface is design to be clean and simple to cater novice user.

To gain better insight of developing this project, I have studied a few similar systems that involved in auto insurance and blockchain based insurance solution. We refer to Takaful Motor Insurance for traditional insurance and Etherisc and Lemonade for blockchain based insurance solution. We also studied two similar blockchain based auto insurance framework to benchmark our application. As our application is only on

prototype development and focusing on how blockchain will improve the insurance process therefore we will not include IoT or telematic data in our application.

To sum up everything, our application will consist of basic function of traditional insurance, but we improve it by implementing it on blockchain network. It is a novel solution in insurance domain in Malaysia.

7.2 Recommendation

Our application can perform insurance process from underwriting to policy claim. However, our application is a prototype to any blockchain based insurance in Malaysia. Hence, we have several ideas that yet to implement due to capital and technology constraints and we share the idea as 2 recommendation to improve current system.

First recommendation is to apply vehicle API that can fetch vehicle information that registered under Malaysia as the alternative of JPJ data provider that we have created. APIs that we recommended are Vehicle API - Malaysia (vehicleapi.com.my) and Octofacts (<https://otofacts.com/api/>). Both APIs provide vehicle data from Malaysia. Vehicle API is a global API for vehicle number plate lookups that support wide range of programming environment and programming language. It provides up to 20 data fields such as vehicle model, vehicle specification, registration date and etc. from a Malaysia plate number. Fee for per query is RM 0.81 (US\$ 0.20) with minimum purchases of 100 lookups. Octofacts is a vehicle identification (vin) lookups API that provide vehicle history checks. Data that return from this API are insurer history report and vehicle history report and each report cost RM6. Insurer history report will return data fields such as policy number, policy period, current insurer, and type of coverage. While vehicle history report will return data for instance stolen check and total loss check. Above APIs required capital to perform testing and development hence we create a JPJ 3rd party as data provider to our application.

Second recommendation is to implement vehicle IoT to improve claim verification. As current application only verifies transaction based on 3rd party data, the implementation of IoT tracking of vehicle can further ensure the verification involve less human interference and provide more solid evidence when vehicle involved in an accident. With IoT data, insurer can also further enhance the underwriting process to determine premium of different user based on their driving behaviour. This technology requires another domain of knowledge hence it is nor implemented in our project.

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APPENDIX

1. Objective Evaluation Survey

Demographic info

Gender
40 responses

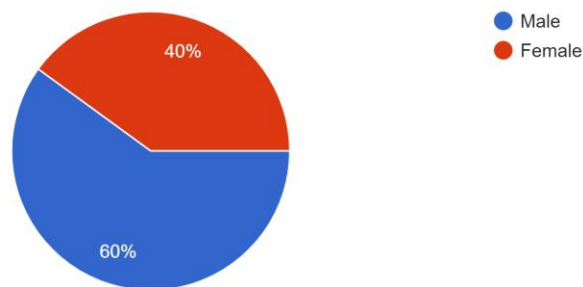


Figure A.1 Demographic Info - Gender

Age
40 responses

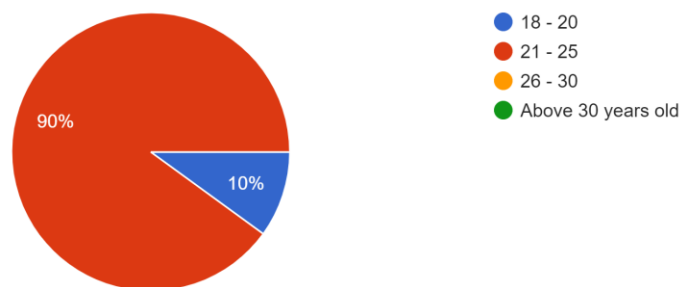


Figure A.2 Demographic Info – Age

Blockchain Technology

Rate your understanding of Blockchain technology.

40 responses

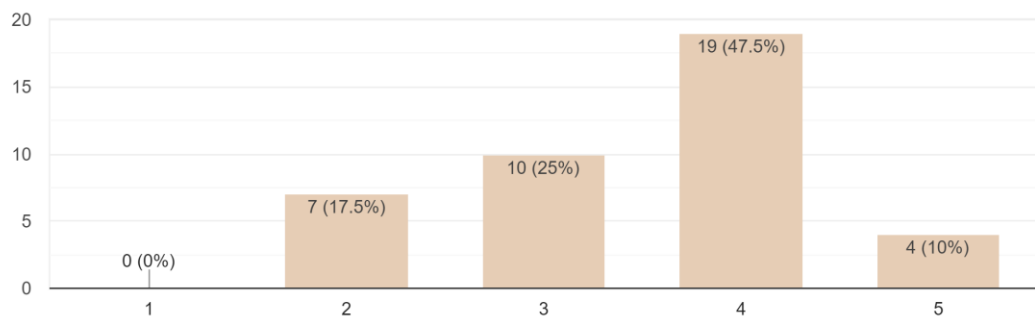


Figure A.3 Blockchain - Understanding

APPENDIX

In your opinion, do you think decentralization could help enhance insurance process time?
40 responses



Figure A.3 Blockchain - Decentralization

How much confident do you have on the Immutability in blockchain?
40 responses

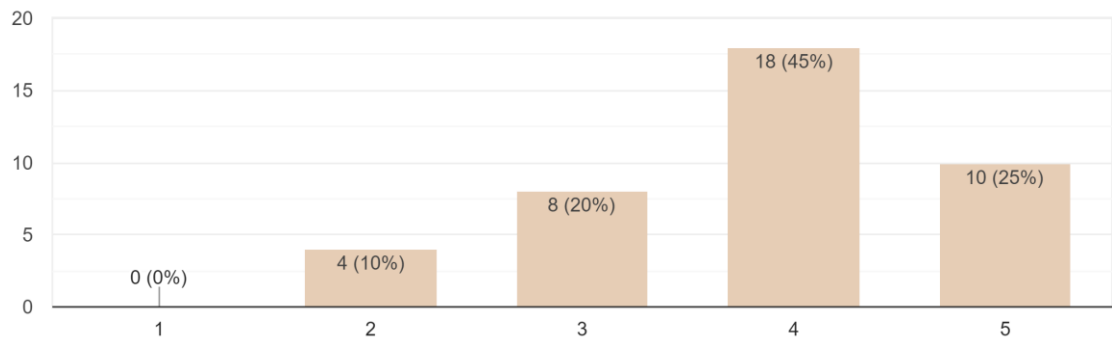


Figure A.4 Blockchain -Immutability

How much confident do you have on the Auditability in blockchain?
40 responses

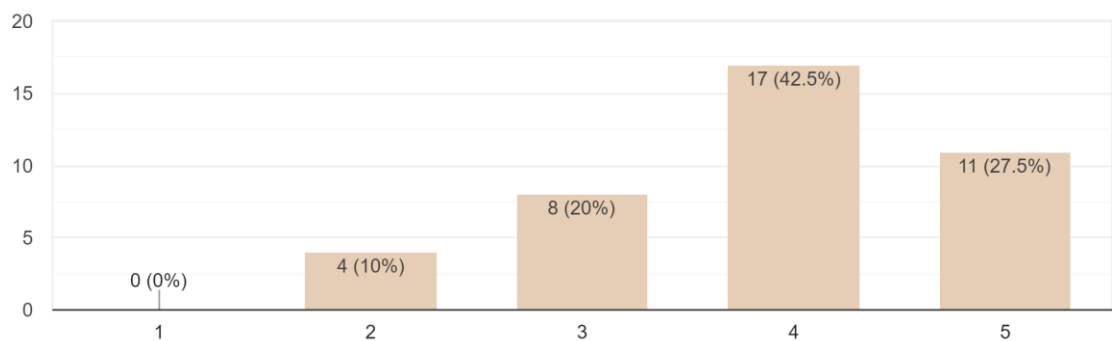


Figure A.0.5 Blockchain - Auditability

APPENDIX

How much confident do you have on the Immutability & Auditability in blockchain after knowing '51% attack'?

40 responses

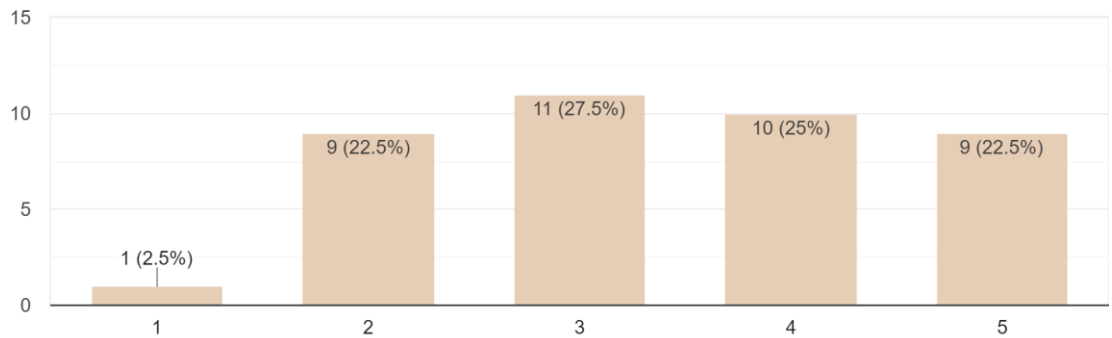


Figure A 0.6 Blockchain - '51% attack'

Do you think smart contract is a better alternative to automate claiming process?

40 responses

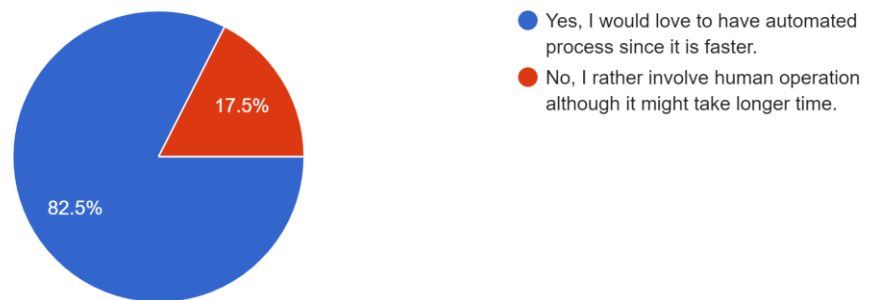


Figure A.0.7 Blockchain - Smart Contract

Insurance

Which insurance process do you prefer?

40 responses

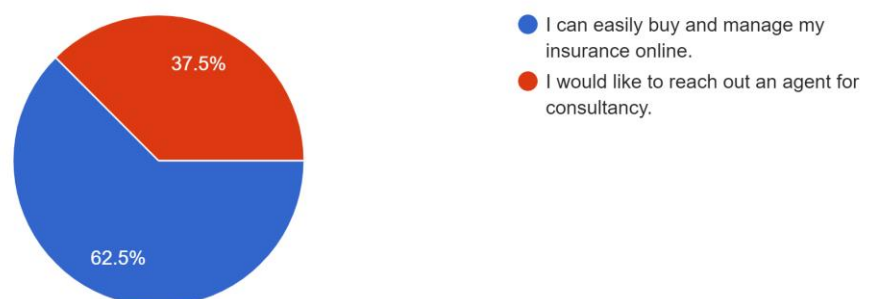


Figure A.0.8 Insurance – Process

APPENDIX

According to previous question , option “Yes” will answer below question.

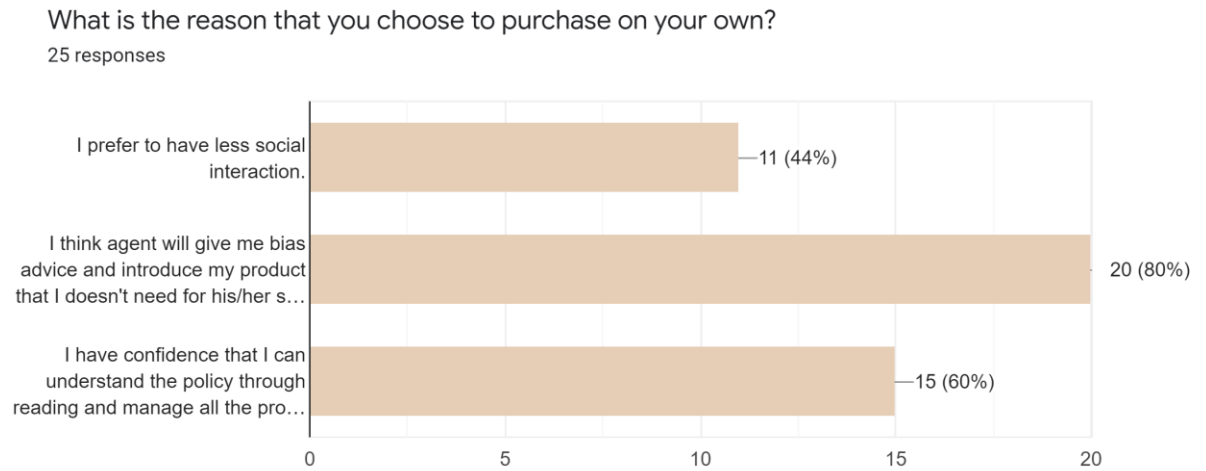


Figure A.0.9 Insurance - Option "Yes"

According to previous question , option “No” will answer below question.

Do you still willing to seek for an agent if the premium rate is higher than you purchase on your own?
15 responses

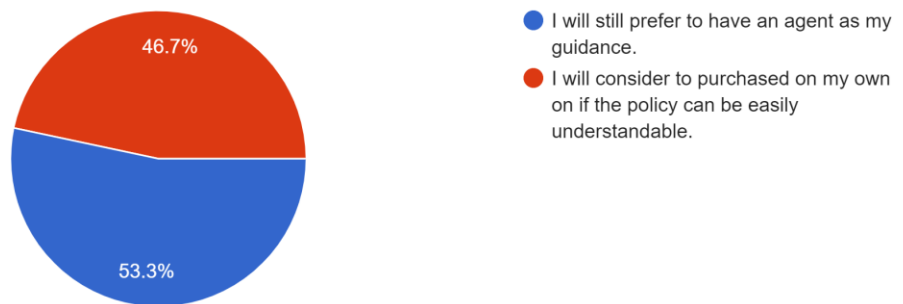


Figure A.0.10 Insurance - Option "No"

Proposed application

On scale 1 - 5, rate your concern on purchasing an insurance product.

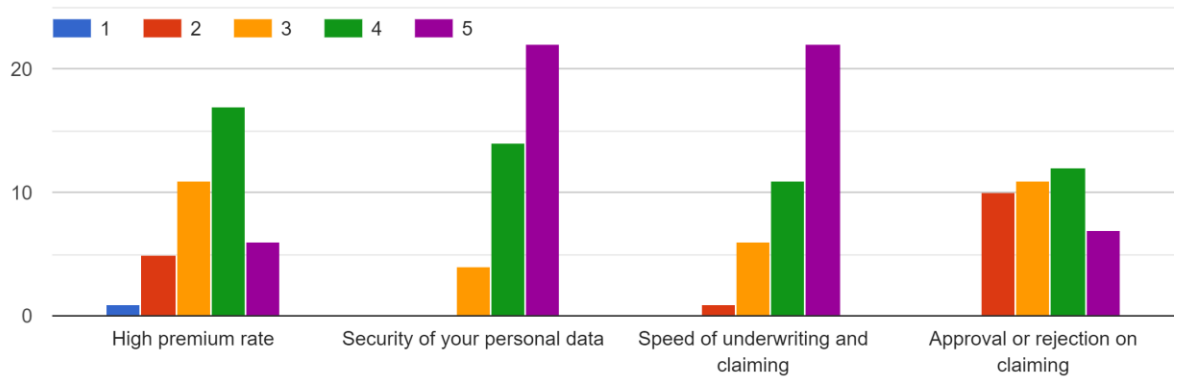


Figure A.0.11 Proposed Application - Concern

What is your opinion on current underwriting and claiming process?

40 responses

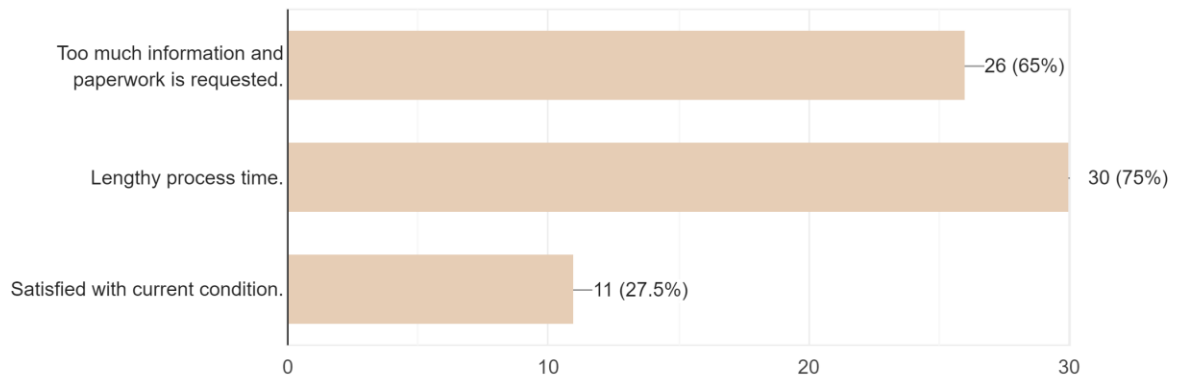


Figure A.0.12 Proposed Application - Current Insurance Process

Are you looking forward to have an automated underwriting and claiming process or you prefer stick to traditional insurance process?

40 responses

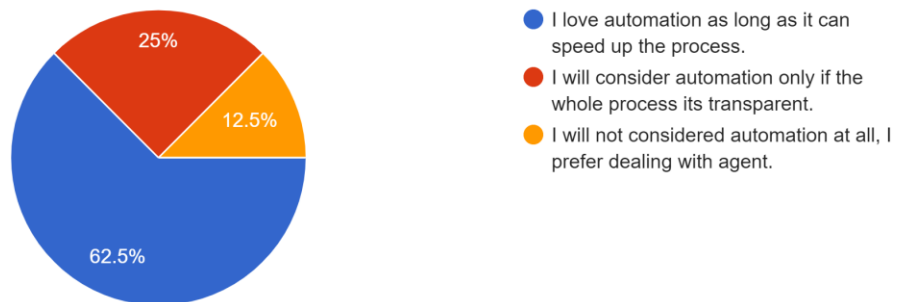


Figure A.0.13 Proposed Application - Tendency of insurance process

APPENDIX

Do you think transparency on insurance process will decrease unsuccessful claim rate?
40 responses

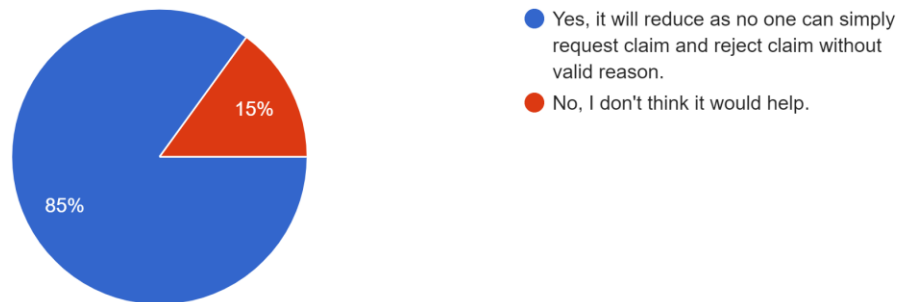


Figure A.0.14 Proposed Application - Claim Rate

Do you feel more secure when whole insurance process is transparent?
40 responses

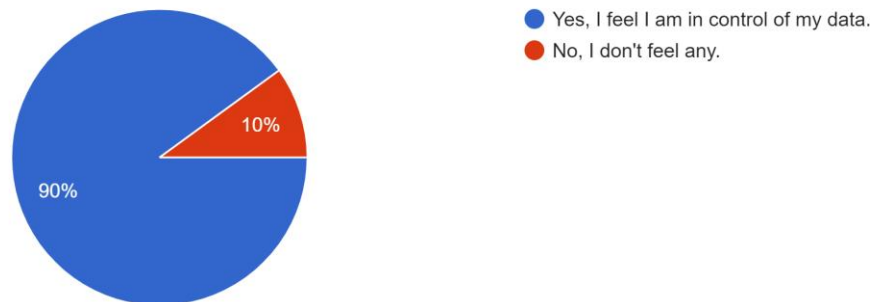


Figure A.0.15 Proposed Application - Data Security

If blockchain technology is applied in insurance sector, how much is your willingness to give it a try?
40 responses

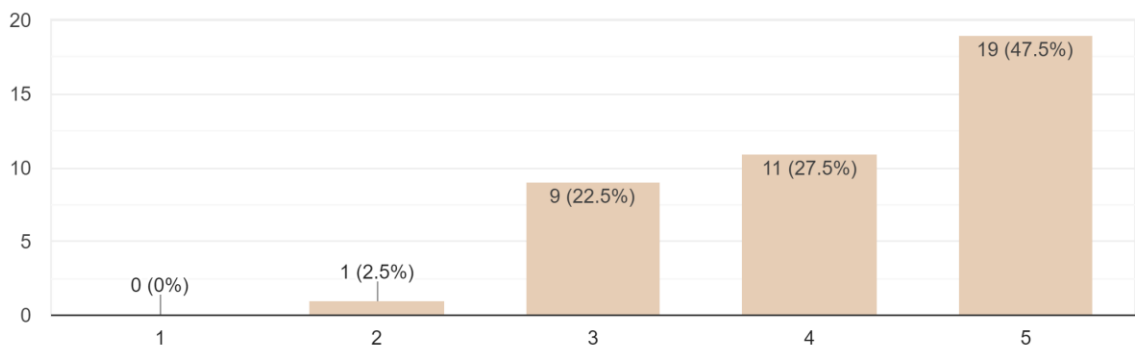


Figure A.0.16 Proposed Application - Willingness

WEEKLY LOG

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3, Y3	Study week no.: Week 1
Student Name & ID: Laan Wei Yi 19ACB01708	
Supervisor: Mr.Su Lee Seng	
Project Title: Development of Decentralised Apps (DApps) using Blockchain Technology to Improve Insurance Process in Malaysia	

1. WORK DONE: Project timeline planning.

2. WORK TO BE DONE: Study FYP1 and identify changes.

3. PROBLEMS ENCOUNTERED: No issue.

4. SELF EVALUATION OF THE PROGRESS: Project is on scheduled.

SuLee

Supervisor's signature

wiyi

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3, Y3	Study week no.: Week 2
Student Name & ID: Laan Wei Yi 19ACB01708	
Supervisor: Mr.Su Lee Seng	
Project Title: Development of Decentralised Apps (DApps) using Blockchain Technology to Improve Insurance Process in Malaysia	

1. WORK DONE: Created FYP2 report based on template given.

2. WORK TO BE DONE: Migrate and combine FYP1 report to FYP2.

3. PROBLEMS ENCOUNTERED: No issue

4. SELF EVALUATION OF THE PROGRESS: Project is on scheduled.

SuLee

Supervisor's signature

wiyi

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3, Y3	Study week no.: Week 3
Student Name & ID: Laan Wei Yi 19ACB01708	
Supervisor: Mr.Su Lee Seng	
Project Title: Development of Decentralised Apps (DApps) using Blockchain Technology to Improve Insurance Process in Malaysia	

1. WORK DONE: Complete combination of previous report to current report.

2. WORK TO BE DONE: Content improvement for report.

3. PROBLEMS ENCOUNTERED: No issue.

4. SELF EVALUATION OF THE PROGRESS: Project is on scheduled.

SuLee

Supervisor's signature

wiyi

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3, Y3	Study week no.: Week 4
Student Name & ID: Laan Wei Yi 19ACB01708	
Supervisor: Mr.Su Lee Seng	
Project Title: Development of Decentralised Apps (DApps) using Blockchain Technology to Improve Insurance Process in Malaysia	

1. WORK DONE: Complete content enhancement in the report.

2. WORK TO BE DONE: Draw system diagram and complete new added section for FYP2 report.

3. PROBLEMS ENCOUNTERED: No issue

4. SELF EVALUATION OF THE PROGRESS: Project is on scheduled.

SuLee

Supervisor's signature

wiyi

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT*(Project II)*

Trimester, Year: T3, Y3	Study week no.: Week 5
Student Name & ID: Laan Wei Yi 19ACB01708	
Supervisor: Mr.Su Lee Seng	
Project Title: Development of Decentralised Apps (DApps) using Blockchain Technology to Improve Insurance Process in Malaysia	

1. WORK DONE: Complete all drawings and elaboration.

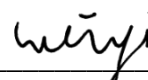
2. WORK TO BE DONE: Continue on new report section.

3. PROBLEMS ENCOUNTERED: New section is out of expectation, need to spend extra time than planning to complete.

4. SELF EVALUATION OF THE PROGRESS: Need to be more focus on new section.



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Student's signature

FINAL YEAR PROJECT WEEKLY REPORT*(Project II)*

Trimester, Year: T3, Y3	Study week no.: Week 6
Student Name & ID: Laan Wei Yi 19ACB01708	
Supervisor: Mr.Su Lee Seng	
Project Title: Development of Decentralised Apps (DApps) using Blockchain Technology to Improve Insurance Process in Malaysia	

1. WORK DONE: Completed new section and draft of survey.

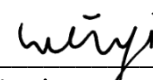
2. WORK TO BE DONE: Distribute survey and start system development.

3. PROBLEMS ENCOUNTERED: No issue

4. SELF EVALUATION OF THE PROGRESS: Project is on scheduled.



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Student's signature

FINAL YEAR PROJECT WEEKLY REPORT*(Project II)*

Trimester, Year: T3, Y3	Study week no.: Week 7
Student Name & ID: Laan Wei Yi 19ACB01708	
Supervisor: Mr.Su Lee Seng	
Project Title: Development of Decentralised Apps (DApps) using Blockchain Technology to Improve Insurance Process in Malaysia	

1. WORK DONE: Developed View Policy features.

2. WORK TO BE DONE: Development of Request Claim features.

3. PROBLEMS ENCOUNTERED: No issue.

4. SELF EVALUATION OF THE PROGRESS: Project is on scheduled.



Supervisor's signature



Student's signature

FINAL YEAR PROJECT WEEKLY REPORT*(Project II)*

Trimester, Year: T3, Y3	Study week no.: Week 8
Student Name & ID: Laan Wei Yi 19ACB01708	
Supervisor: Mr.Su Lee Seng	
Project Title: Development of Decentralised Apps (DApps) using Blockchain Technology to Improve Insurance Process in Malaysia	

1. WORK DONE: Undergoing development of Request Claim features.

2. WORK TO BE DONE: Complete development of request claim and conclude survey results.

3. PROBLEMS ENCOUNTERED: No issue.

4. SELF EVALUATION OF THE PROGRESS: Project is on scheduled.



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FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3, Y3	Study week no.: Week 9
Student Name & ID: Laan Wei Yi 19ACB01708	
Supervisor: Mr.Su Lee Seng	
Project Title: Development of Decentralised Apps (DApps) using Blockchain Technology to Improve Insurance Process in Malaysia	

1. WORK DONE: Report: Collect and evaluate survey results. System: Request Claim module complete.

2. WORK TO BE DONE: Proceed with Verify Claim module.

3. PROBLEMS ENCOUNTERED: No issue.

4. SELF EVALUATION OF THE PROGRESS: Project is on scheduled.

SuLee

Supervisor's signature

wiyi

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: T3, Y3	Study week no.: Week 10
Student Name & ID: Laan Wei Yi 19ACB01708	
Supervisor: Mr.Su Lee Seng	
Project Title: Development of Decentralised Apps (DApps) using Blockchain Technology to Improve Insurance Process in Malaysia	

1. WORK DONE: 50% Verfy Claim module.

2. WORK TO BE DONE: Complete development of Verfy Claim module and proceed with last module Claim Approval module.

3. PROBLEMS ENCOUNTERED: No issue

4. SELF EVALUATION OF THE PROGRESS: Project is on scheduled.

SuLee

Supervisor's signature

wiyi

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT*(Project II)*

Trimester, Year: T3, Y3	Study week no.: Week 11
Student Name & ID: Laan Wei Yi 19ACB01708	
Supervisor: Mr.Su Lee Seng	
Project Title: Development of Decentralised Apps (DApps) using Blockchain Technology to Improve Insurance Process in Malaysia	

1. WORK DONE: Complete report writing and Claim Approval module.

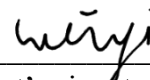
2. WORK TO BE DONE: Test on bugs for current works and FYP submission.

3. PROBLEMS ENCOUNTERED: No issue.

4. SELF EVALUATION OF THE PROGRESS: Project is on scheduled.



Supervisor's signature



Student's signature

FINAL YEAR PROJECT WEEKLY REPORT*(Project II)*

Trimester, Year: T3, Y3	Study week no.: Week 12
Student Name & ID: Laan Wei Yi 19ACB01708	
Supervisor: Mr.Su Lee Seng	
Project Title: Development of Decentralised Apps (DApps) using Blockchain Technology to Improve Insurance Process in Malaysia	

1. WORK DONE: Finalise system and submit report.

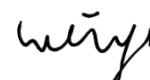
2. WORK TO BE DONE: Prepare presentation.

3. PROBLEMS ENCOUNTERED: No issue

4. SELF EVALUATION OF THE PROGRESS: Project is on scheduled.



Supervisor's signature



Student's signature

POSTER



DEVELOPMENT OF DECENTRALISED APPS (DAPPS)

using Blockchain Technology to Improve Insurance Process in Malaysia

WHY INSURANCE DAPP?

- Tedious documentation works on policy underwriting and claiming.
- Heavily human involved with 3rd parties and intermediaries.
- Whole insurance process is lengthy, costly, lack of transparency and prone to fraud.

WHAT IS BLOCKCHAIN ?

- A type of distributed ledger that can achieve decentralized transaction
- Append-only database
- Ensure the transparency and immutability of data

WHAT WE OFFER:

- Maximizing automation on data collection and auditing.
- Process policy purchased and claiming without the needs of intermediaries.
- Reduce fraud through nature of blockchain technology.

METHOD & TECHNOLOGY USED

ethereum Prototype Model remix

Visual Studio Code METAMASK NEXT.js

LAAN WEI YI
Bachelor Of Information Systems
(Honours) Business Information Systems



PLAGIARISM CHECK RESULT

PLAGIARISM CHECK RESULT

FYP2

ORIGINALITY REPORT

3 %	1 %	1 %	1 %
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Liberty University Student Paper	1 %
2	Faiza Loukil, Khouloud Boukadi, Rasheed Hussain, Mourad Abed. "CioSy: A Collaborative Blockchain-Based Insurance System", Electronics, 2021 Publication	<1 %
3	Submitted to University of East London Student Paper	<1 %
4	Submitted to Universiti Teknologi Petronas Student Paper	<1 %
5	Submitted to University of Nebraska at Omaha Student Paper	<1 %
6	D. Popovic, C. Avis, M. Byrne, C. Cheung, M. Donovan, Y. Flynn, C. Fothergill, Z. Hosseinzadeh, Z. Lim, J. Shah. "Understanding blockchain for insurance use cases", British Actuarial Journal, 2020 Publication	<1 %

PLAGIARISM CHECK RESULT

Universiti Tunku Abdul Rahman			
Form Title : Supervisor's Comments on Originality Report Generated by Turnitin for Submission of Final Year Project Report (for Undergraduate Programmes)			
Form Number: FM-IAD-005	Rev No.: 0	Effective Date: 01/10/2013	Page No.:



FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Full Name(s) of Candidate(s)	Laan Wei Yi
ID Number(s)	19ACB01708
Programme / Course	Bachelor Of Information Systems (Honours) Business Information Systems
Title of Final Year Project	Development of Decentralised Apps (DApps) using Blockchain Technology to Improve Insurance Process in Malaysia

Similarity	Supervisor's Comments (Compulsory if parameters of originality exceeds the limits approved by UTAR)
Overall similarity index: <u> 3 </u> % Similarity by source Internet Sources: <u> 1 </u> % Publications: <u> 1 </u> % Student Papers: <u> 1 </u> %	
Number of individual sources listed of more than 3% similarity: <u> 0 </u>	
Parameters of originality required and limits approved by UTAR are as Follows: (i) Overall similarity index is 20% and below, and (ii) Matching of individual sources listed must be less than 3% each, and (iii) Matching texts in continuous block must not exceed 8 words <i>Note: Parameters (i) – (ii) shall exclude quotes, bibliography and text matches which are less than 8 words.</i>	

Note Supervisor/Candidate(s) is/are required to provide softcopy of full set of the originality report to Faculty/Institute

Based on the above results, I hereby declare that I am satisfied with the originality of the Final Year Project Report submitted by my student(s) as named above.

SuLee

Signature of Supervisor

Name: Mr. Su Lee Seng

Date: 20/4/2022

FYP2 CHECKLIST



UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF INFORMATION & COMMUNICATION
TECHNOLOGY (KAMPAR CAMPUS)

CHECKLIST FOR FYP2 THESIS SUBMISSION

Student Id	19ACB01708
Student Name	Laan Wei Yi
Supervisor Name	Mr. Su Lee Seng

TICK (✓)	DOCUMENT ITEMS
	Your report must include all the items below. Put a tick on the left column after you have checked your report with respect to the corresponding item.
✓	Front Plastic Cover (for hardcopy)
✓	Title Page
✓	Signed Report Status Declaration Form
✓	Signed FYP Thesis Submission Form
✓	Signed form of the Declaration of Originality
✓	Acknowledgement
✓	Abstract
✓	Table of Contents
✓	List of Figures (if applicable)
✓	List of Tables (if applicable)
✓	List of Symbols (if applicable)
✓	List of Abbreviations (if applicable)
✓	Chapters / Content
✓	Bibliography (or References)
✓	All references in bibliography are cited in the thesis, especially in the chapter of literature review
✓	Appendices (if applicable)
✓	Weekly Log
✓	Poster
✓	Signed Turnitin Report (Plagiarism Check Result - Form Number: FM-IAD-005)
✓	I agree 5 marks will be deducted due to incorrect format, declare wrongly the ticked of these items, and/or any dispute happening for these items in this report.

*Include this form (checklist) in the thesis (Bind together as the last page)

I, the author, have checked and confirmed all the items listed in the table are included in my report.

Laan Wei Yi

(Signature of Student)

Date: 20/4/2022