Artificial Intelligence (AI) – Cover Sheet

ASSIGNMENT

Instruction:

- Marks will be awarded for good presentation and thoroughness in your approach.
- Referencing Code: If you use some code, or ideas for code, which are taken or adapted from another source (book, magazine, internet, discussion forum, etc), then this **must** be cited and referenced using the Harvard Name convention within your source code. Failure to reference code properly is considered as plagiarism.
- Complete this cover sheet and attach it to your project.
- This project is to be attempted by a group of 3 students.

Student declaration:

I declare that:

- *We understand what is meant by plagiarism*
- *The implication of plagiarism has been explained to us by our lecturer*
- *This project is all our work and we have acknowledged any use of the published or unpublished works of other people.*

Group Leader's Signature: Sia . . . . . Date: 28/2/2021 . . . . . .

Project Title:	Communication and Internet Technology	**Intake:** APU2006CS(DA)

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Team Leader	**Sia De Long (TP060810)**	Sia
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Problem Specification

Abstract

In this current generation, there are existing countless of field that required an experienced expert. The most common experts would be human experts but as long as they are human beings, therefore they will still have some weak points. However, with the rapid development of artificial intelligence, expert system has been introduced to the society which can be mimic a human expert in a particular field while solving problem for the users.

The purpose for this assignment is to good use of knowledge about artificial intelligence to create an expert system running with a knowledge base for a specific field to be able to give advice to the users. Since expert system is only act as a knowledge base for the whole assignment, so that an interactive consultant should be existed between expert system and the users which would be Verbot.

The team has decided to develop an expert system focus on communication and internet technology in order to teach people more about knowledge within that field. Based on the team assumptions and expectation, it should be able to let users understand the method of how all the technology gadgets are connecting together while they will be able to build a private network with fundamental security methods applied.

In this report, the field of communication and internet technology has been chosen by the team and the team will develop an expert system to teach or advice user about problem within the field. Firstly, a problem specification with clear statements has been proposed while mentioning expert system with references given. Besides that, this report also included a chapter for knowledge acquisition which having the content of literature review for both expert system and chatbot. Moreover, a semantic network for expert system will be shown under knowledge representation chapter. Last but not least, for the implementation part, test plan and screenshot of special features will be present as well following with user acceptance testing in questionnaire and the result.

Problem Statement 1 (Sia De Long)

In this era of having advanced technology all over around our surrounding, Communication and Internet Technology is very important because it can help all the technology gadget such as Internet of Things (IoT) link with each other and form a network, eventually, every gadget shares the data of us to analyse and bring out the most suitable outcome for us. However, all these activities will lead to one harm which is a security issue, although data sharing is really convenient for us to enjoy the result but anyone with malicious behaviour can access the network and easily steal all the personal data. This is because people know how to interact with technology or even setting their own network but they do not understand how those data flow which lead to **lack of knowledge to secure data within their network**.

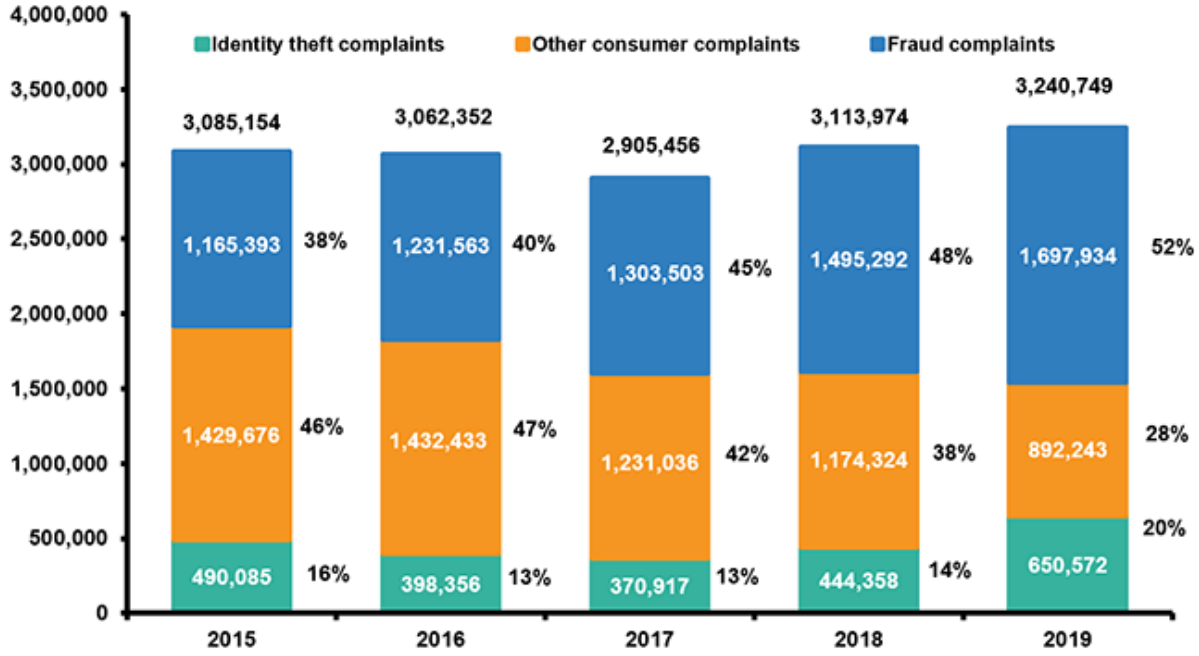


Figure 1: Identity Theft and Fraud Reports (Insurance Information Institute, 2020)

Figure 1 shows that identity theft is always there among our society while it is increasing year by year and it is almost impossible to overcome it. There are lots of potential cybercrimes will be committed after personal data being stolen such as identity fraud, account takeover, phishing attack, harm companies or even selling our data to other criminals (F-Secure, 2020). Therefore, we as the technology users must have the knowledge of how those

communication and internet technology works in order to prevent any unauthorized access by securing data from our network.

In this case, a chatbot which can access an expert system containing the knowledge base of Communication and Internet Technology would be the most suitable way. An expert system is a computer program that makes good use of Artificial Intelligence technology to mimic behaviours of a human expert in the particular field (Rouse, 2016), which means the chatbot can teach or give advice to the users in the way of how human experts will do in that situation. The reason why chatbot is the choice including chatbot can give instant assistance while the interaction of chatbot is engaging to let the user to be interested on the knowledge of communication and internet technology and increase their awareness of data security, not only that, it also enable the chatbot to keep giving advices on how to secure the network or even trace back those unauthorized access (Rajput, 2019).

Problem Statement 2 (Chieng Shoa Wei)

Nowadays, technology is growing too fast for people to adapt but most of the things we will rely on technology such as the common one, communication and internet technology. Although the technology is there but we are not able to set up our own network properly, we still need an expert to help us which will **cost more money to build a desired network** because we ourselves lack knowledge in this particular area.

In this case, a developed chatbot which domain in this area would be the best way to overcome this problem. Chatbots teaching communication and technology are helpful applications that help you save a lot of work by always maintaining usability and serving many customers at once. But unlike humans, for every business, each chatbot needs to be configured differently. Hence, we do not need to be an expert or hiring an expert because the chatbot is helping us while mimic an expert in this domain area,

For example, chatbots have been used for business but it is a risky investment, given the last-minute adjustments that can often occur, as upgrading the software would produce additional costs. As a one-time charge, the agency will normally do the setup and deployment of the chatbot for anywhere from $500 to $2,500. Typically, this setup cost involves items such as basic chatbot design, chatbot deployment, chatbot troubleshooting, and even training you or your team to use the chatbot.

	In-House Chatbot Costs	Agency Chatbot Fees
Chatbot Software Platform	$50-$500/month	$50-$500/month
Chatbot Setup and Development	Salaries (5-100 hours of work)	$500-$2,500
Ongoing chatbot support and maintenance	Salaries (0-10 hours of work per week)	$50-$5000/month

Figure 1: Chatbot Pricing (Threlfall, 2021)

Chapter 1: Knowledge Acquisition

1.2 Literature Review on Expert System

1.2.1 Literature Review for Expert System (Sia De Long)

Research is considered as essential before working on an expert field. Hence, the team has studied to at least three literature about expert system for advice in order to inspire our creativity and innovative since the team will get to know the methodology, usage and trend of expert system when facing a similar problem with us. Thus, the team can develop an expert system which will fulfil the requirement to achieve their objectives successfully.

The existence of several contrasting trends has been revealed by the academic literature on IOP Conference Series: Materials Science and Engineering where they designed an expert system in purpose of improving technological processes of composite manufacturing. The expert system is given the expert knowledge in area of pressure treatment for structurally inhomogeneous materials (Zalazinsky, et al., 2020).

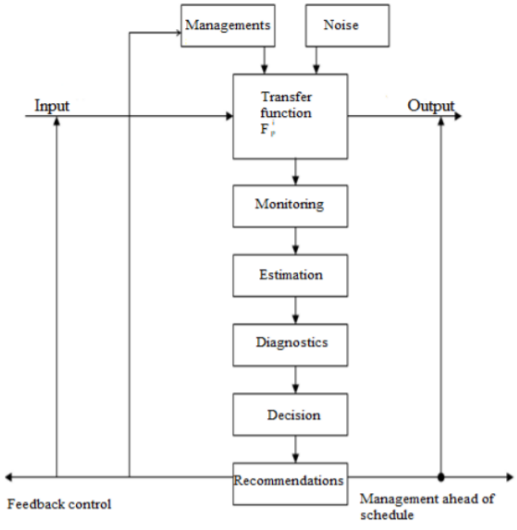


Figure 1: Functions of the product quality control window (Zalazinsky, et al., 2020)

Based on figure 1, it is showing that the aim of expert system in this case is to understand and interpret experimental data while predicting the impact for the products. Meanwhile, the expert system will be playing as an advisor role which will state out the most suitable recommendations for improving the processes of producing the products based on those data it gets from experimental data. Eventually, expert system will solve problem of planning, computational experiments, statistical processing of experimental data, regression

analysis, checking the adequacy of mathematical models, multiparameter optimization of the systems and processes under study. In this research, it shows out the methodology of expert system advice precisely which consist few important step, at first, the expert system must be given a certain amount of raw data which can then run through diagnostics and analysis so that the expert system can suggest out a flawless advice in order to achieve the objectives just like how figure 2 showed (Zalazinsky, et al., 2020).

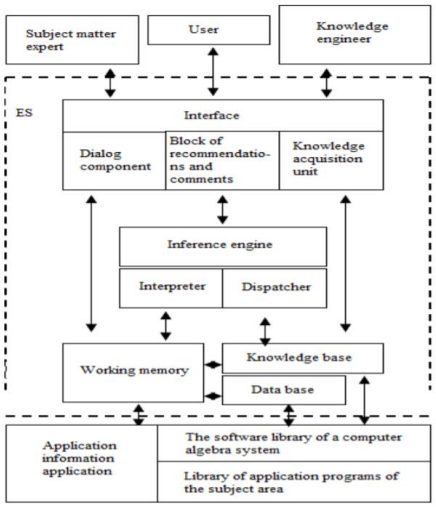


Figure 2: Functional scheme of the expert system (Zalazinsky, et al., 2020)

Besides that, the existing literature on International Journal of Academic Information Systems Research (IJAISR) is focuses particularly on an expert system for a better sleep. This literature mentioned that sleep is very important to human as it help to renew our body cells, hence, they proposed an expert system to help people with sleep disturbances to access themselves and possibly get some useful advice so that they can get better sleep using the mainframe of what is showing on figure 3 (Almadhoun, 2020).

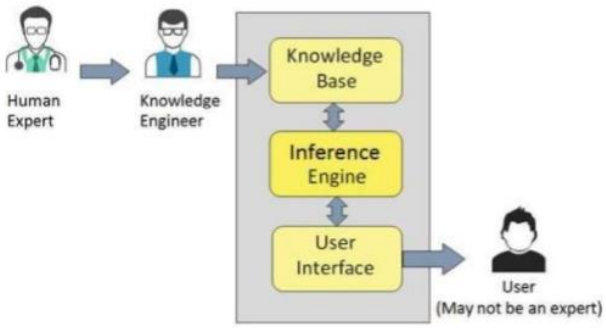


Figure 3: Main components of an Expert System (Almadhoun, 2020)

The method they apply the expert system are the expert system will first accept the data such as the symptoms of sleep disruption that the users are facing through a list that can be selected by user showed on figure 4, the expert system will then diagnosis the sleep disease and give some advice or recommendations to the users showed on figure 5. The whole process, the expert system will follow what is scripted in the decision tree made by a specialist doctor which is showed on figure 6 in order to ensure that every recommendation that users receive is based on a human expert who is professional on this field and the effectiveness of the recommendations (Almadhoun, 2020).

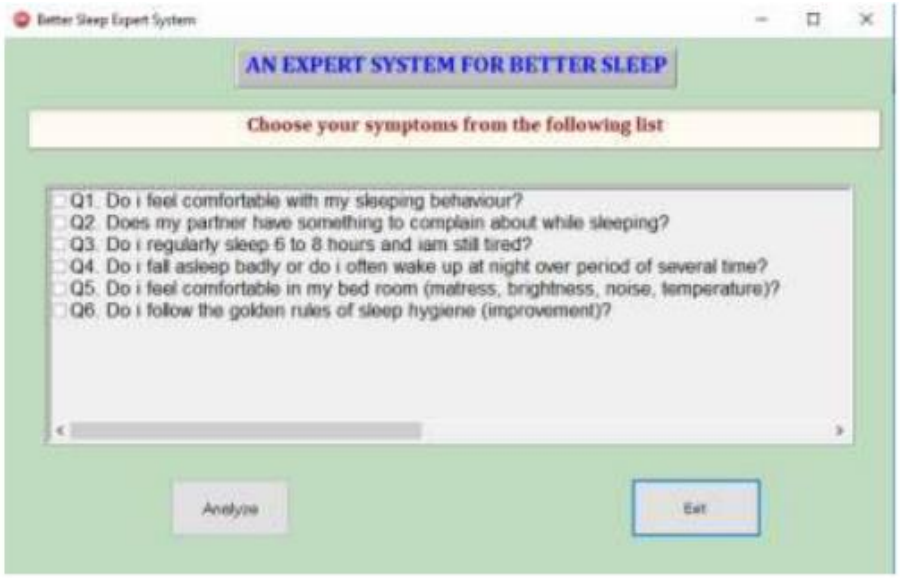


Figure 4: user interface to select the symptoms (Almadhoun, 2020)

Figure 5: diagnosis and recommendation (Almadhoun, 2020)

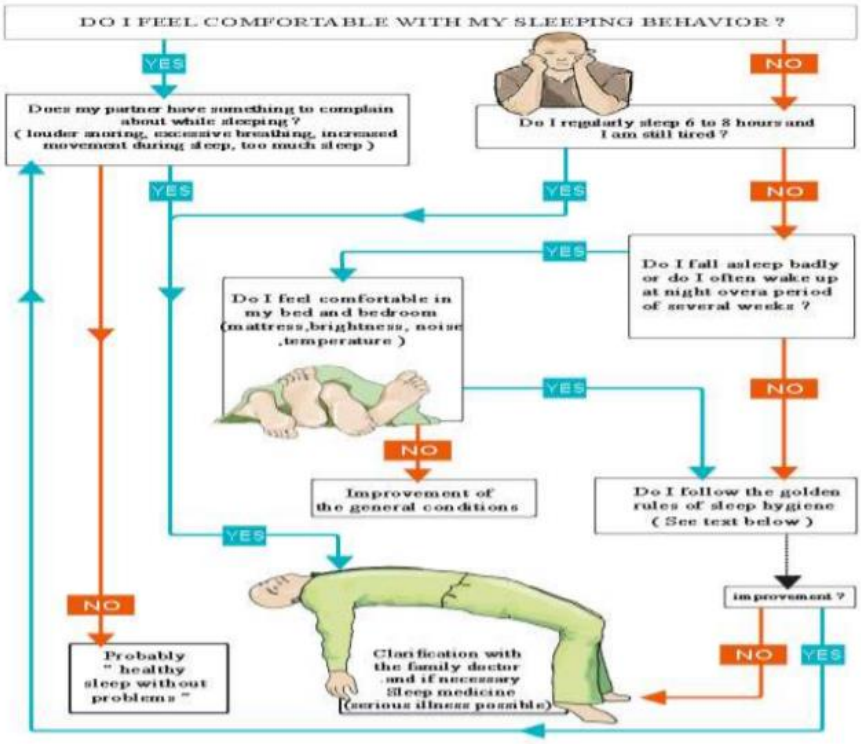


Figure 6: Decision Tree for Expert System (Almadhoun, 2020)

For the conclusion in this proposal stated that, expert system can be helping both specialists and patients with providing a decision support system, interactive training tool and expert advice. This system has been receiving positive feedback from the users since it is easy to user and does not need any intensive training before used (Almadhoun, 2020).

Moreover, there is another literature highlight on using expert system at medical field from International Journal of Gastroenterology Sciences. They are mentioning about early diagnosis of gastrointestinal diseases using an expert system according to the patient's symptoms. Based on their result, they stated that expert system can be very useful in cases where the patient cannot get immediate access to the human experts. Much of the literature emphasis that expert system is computer program that can mimic the behaviour of a human expert in a particular field including this literature. These applications interpret the information that the user gave to express an opinion on a topic, expert system will then continue ask the user if they can find a topic that matches the given answers. In the process, the expert system is solving the problems in the particular field using the rules used by human professionals. They believe that expert system is used in a variety of field and giving out a good result (Mirmozaffari, 2020).

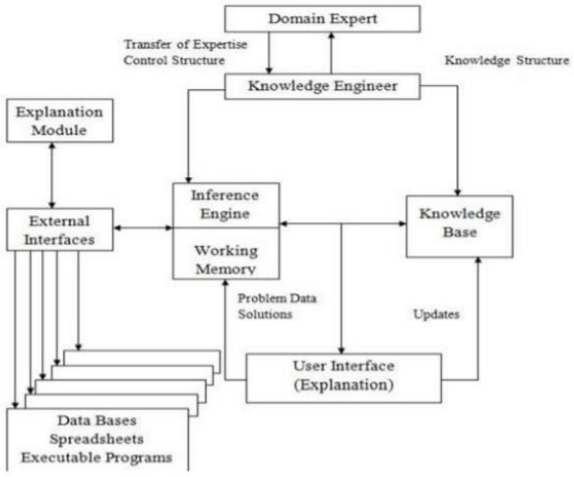


Figure 7: The structure of an expert system (Mirmozaffari, 2020)

Figure 7 shows that the trend for structure of an expert system. In 1980s, Expert systems started to emerge into a branch of artificial intelligence and these systems are then found out can be many applications in various of field quickly. There are many successful applications showed that Expert systems can be very useful in the areas of consulting and decision making in management, business, economics, troubleshooting, and medical diagnosis. An expert system is a smart computer program that uses knowledge and inference methods to solve problems that require a human expert. Expert system will provide guidance and solutions using a knowledge base and necessary review if needed. So, an expert system will be consisting of three components including knowledge base, inference engine and user interface (Mirmozaffari, 2020).

In conclusion, expert system is being more popular and in trend of problem solving because the expert system is mimicking a human expert behaviour and expert system can be build using the common structure of an expert system.

1.2.2 Literature Review for Expert System (Chieng Shoa Wei)

This section aims to review the literature to provide a clear view from the viewpoint of SMEs on sustainable manufacturing practises. Since the study objective is to improve the framework of performance evaluation experts, the literature review also focused on models and indicators for sustainable performance evaluation. (Singh, 2016)

The capacity needed to achieve sustainable production over the last decade has been built by global or larger businesses. In 2005, Eco imagination was announced by General Electric to significantly increase the company's business, taking the environmental aspect into account. However, concentrating on sustainability reporting, the number of larger CSR publishing companies is about 95%, while only around 48% of small and medium-sized enterprises (SMEs) publish their CSRs (KPMG CRR, 2011). The purpose of this study is to develop a web based expert system that will aid decision makers in the performance assessment of their manufacturing system based on the Triple Bottom-Line (TBL) of sustainability. The TBL framework provides a very comprehensive approach towards the sustainability. The performance assessment system is based on the evaluation framework adopted from [42] as shown in Fig. 1. This framework is developed for Malaysian SMEs and may not applicable to bigger companies or the SMEs from developed countries. (Singh, 2016)

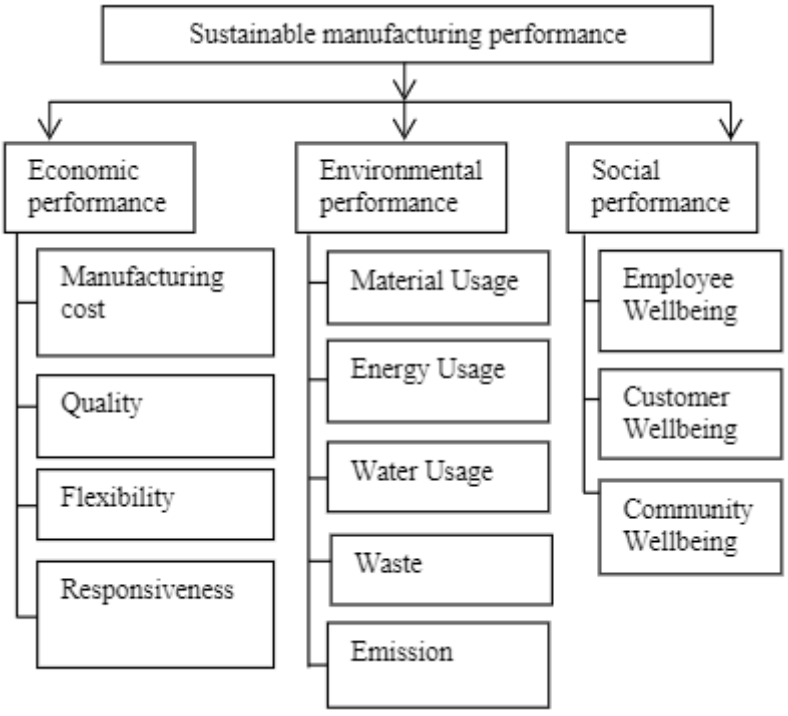


Figure 1: Framework for expert system (Singh, 2016)

In the expert system, the assessment process is based on the hierarchical fuzzy inference system. A collection of rules is used in each fuzzy inference method to draw the conclusion. Each combination of variables involves a different rule in a fuzzy rule-based system, thereby

increasing the result of the linguistic variable in the explosion of the rule. The linguistic variables used for performance ratings are bad, fair and decent, and measurement weights are low, moderate and high for significance. (Singh, 2016)

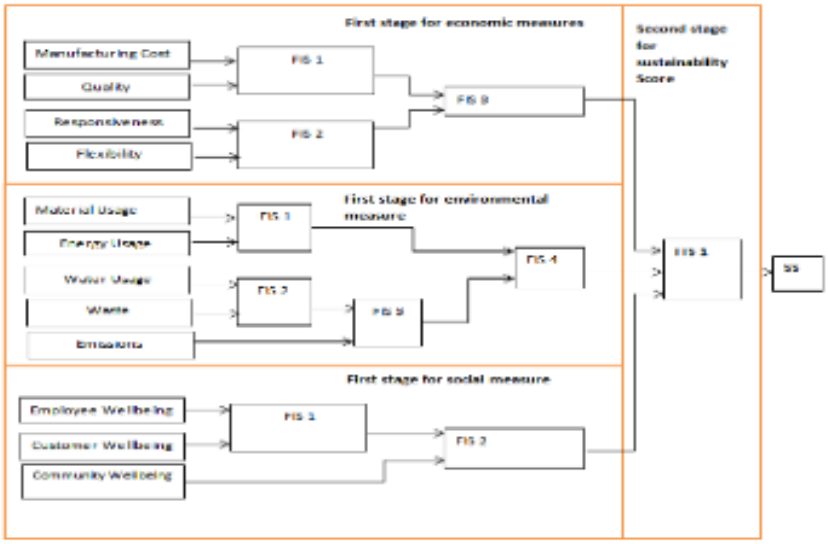


Figure 2: Hierarchal structure of fuzzy assessment system (Singh, 2016)

In Fig.3, an example of the screenshots of the sustainability assessment framework is given. The method is shown to be user-friendly and applicable in the assessment of sustainability and then sufficient for strategy selection. Users were expected to use radio buttons to input the values of essential weights and performance scores in linguistic terms.

Figure 3: Screenshot of economic performance indicators (Singh, 2016)

The language of Expert Systems is a collection of programmes that allow an expert system to be developed by creating information and rules, [6,10,11,13,21] see Figure 4 for specifics. The three basic components of expert systems are:

1. User interface: provides the user with queries and accepts entries from them.

2. Knowledge base: In a particular knowledge domain, it contains data, facts, rules and artefacts. As most human experts are not skilled in computer programming, an information engineer prepares the knowledge base acquired from the human expert.
3. Inference engine: this is programmed that compares the feedback of users with information found in the knowledge base to achieve adequate responses. This is achieved using rules of inference, e.g. IF circumstances, THEN statements, rules of ELSE statements.

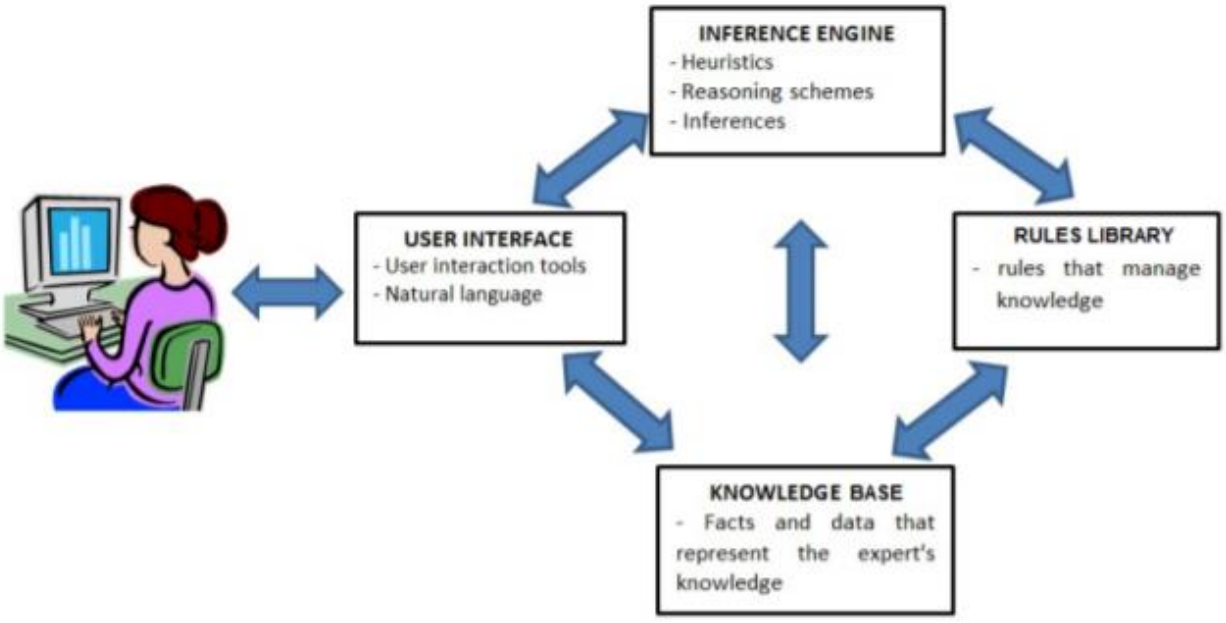


Figure 4: Component of expert system (Naser & Al-Bayed, 2016)

Using the SL5 Object language, which stands for Simpler Level 5 Object expert system language, the Expert System for detecting gaming health issues was introduced. It is a forward-chaining system of experts who can use rules, artefacts and take appropriate action to draw inferences about world reality. Delphi Embarcadero RAD Studio XE6 implements the SL5 Object language. For the information engineer to build the expert system and for the end users when they use it, the SL5 object language is simple. (Naser & Al-Bayed, 2016)

In humans [1,5,9,14-20,26-29,34-37] and plants, there are several expert systems designed to diagnose diseases. But there is no advanced expert system to classify health issues for gamers. Since it is associated with many human diseases, such as: diabetes, bacterial problems, ear, eye, foot, mouth. An expert system for diabetes diagnosis was developed by Talayeh. MYCIN is a well-known professional system for the treatment of bacterial infections. Some of these advanced structures are specialised in one particular disease and a few diseases in another. The new proposed expert scheme, however, is specialised in the evaluation of health issues playing video games. (Naser & Al-Bayed, 2016)

The suggested expert system diagnoses video games with health issues by asking questions that require Yes/No responses. In each question window, the proposed expert system would ask the user to select the correct answer. The proposed expert method provides the correct diagnosis of the problem at the conclusion of the diagnosis session and provides users with a suggestion of the symptoms. The first screen of the expert system session is shown in figure 5. An example of the STRING query is shown in Figure 6. An example of the NUMERIC

question is shown in Figure 7, and Figure 8 shows how the expert system shows the patient details, the health issue, whether the patient has one, and the advice for treating the health problem. (Naser & Al-Bayed, 2016)

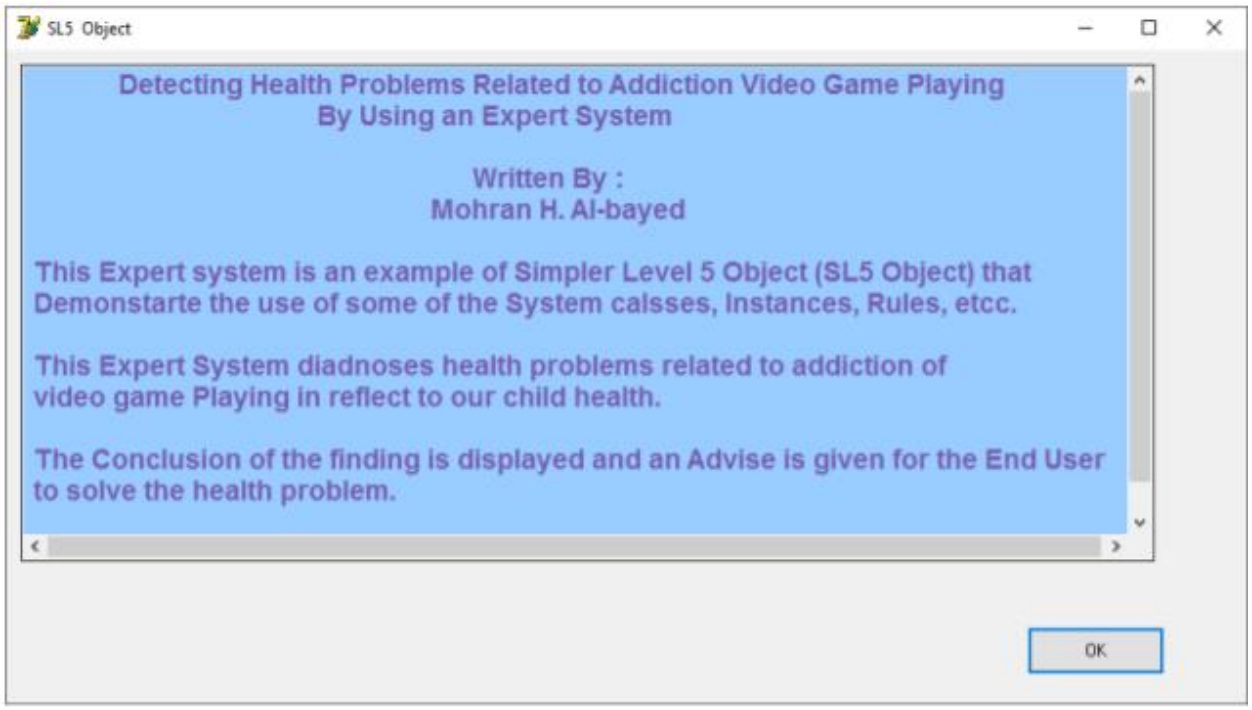


Figure 5: Shows start screen of the expert system session (Naser & Al-Bayed, 2016)

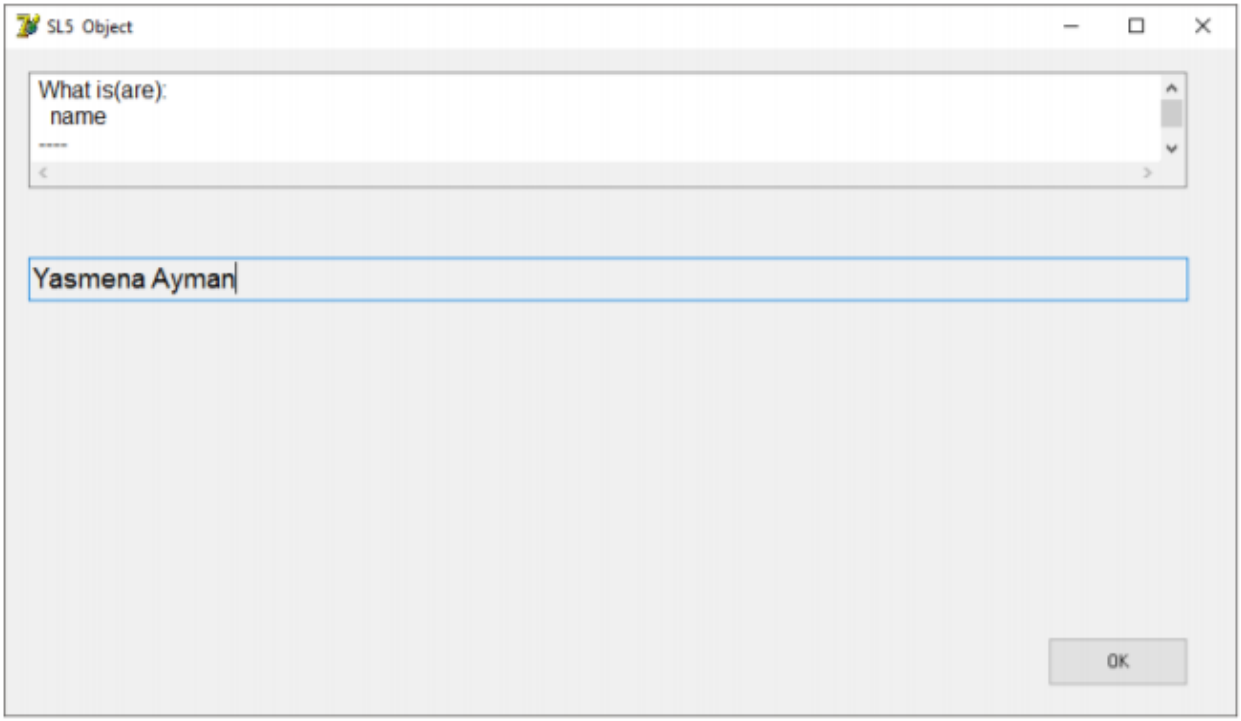


Figure 6: Shows an example of STRING question type (Naser & Al-Bayed, 2016)

Figure 7: Shows and example of NUMERIC question type (Naser & Al-Bayed, 2016)

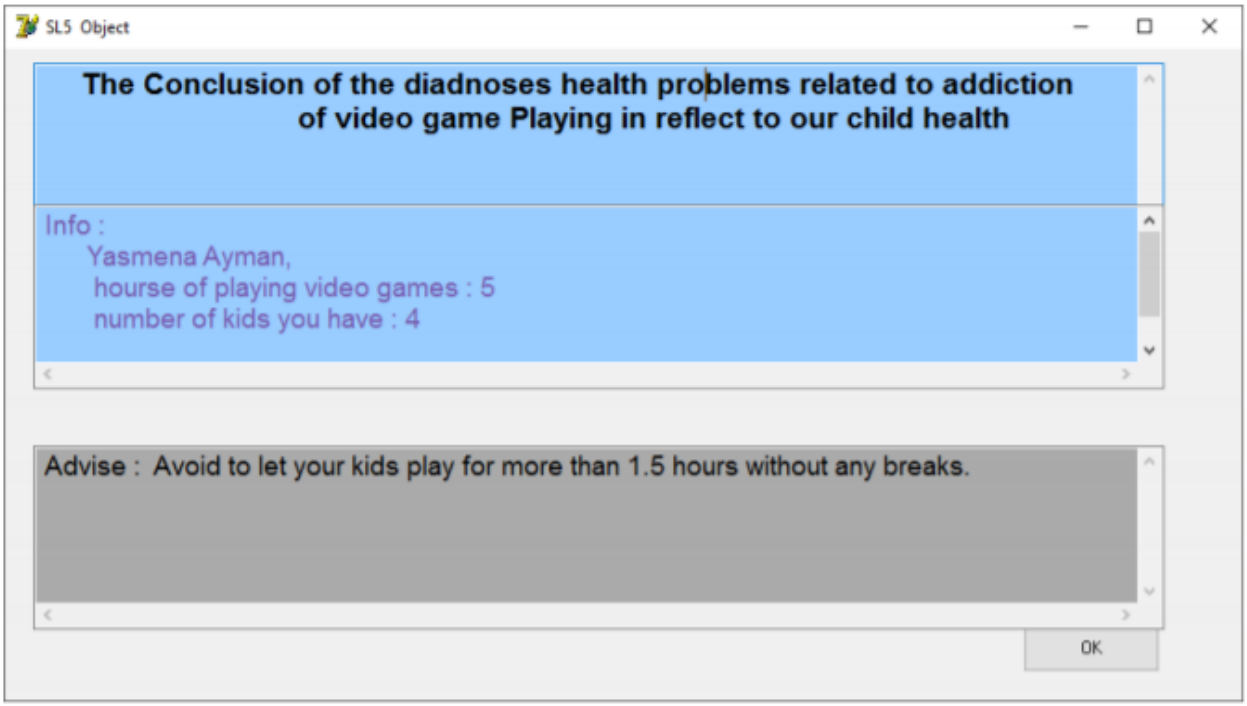


Figure 8: The expert system displays the diagnosis of the problem and the recommendation for treating the health problem. (Naser & Al-Bayed, 2016)

In many fields, such as health for the diagnosis of diseases such as eye, endocrine, skin, foot, shoulder, and other forms of disease, there are a lot of expert programmes designed and implemented [4-12,14-34]. But there is no advanced expert system available free of charge for diagnosing photocopier issues. Professor Samy Abu Naser created the SL5 Object (Simpler Level Five Object). SL5 Object is a language of the rule-based expert system that is fitting for

our expert system. m. The SL5 Object is a productive expert system tool for creation and distribution that provides a complete setting for the construction of expert systems based on rules and/or objects. The methods for setting and managing the SL5 object environment are included in this class. For educational use, it is free. Knowledge.prl is loosely based on many of the rule sets used in the system. Figure 9 displays the Photocopier Repair Expert System V.01 decision Tree. (Bakeer, 2017)

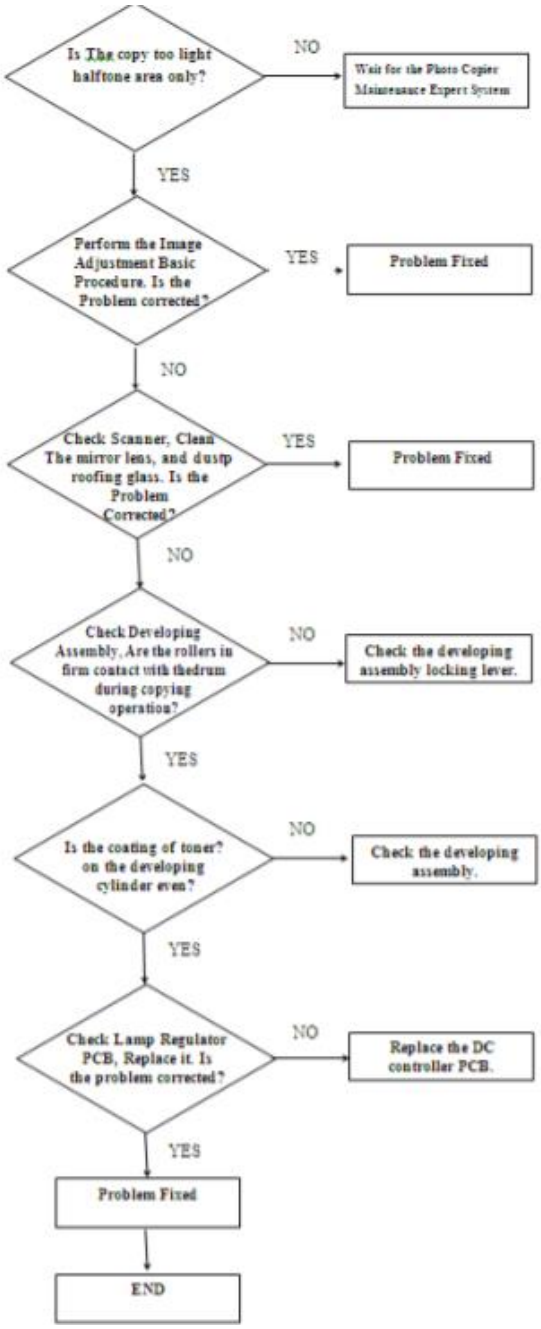


Figure 9: Photocopier Maintenance Expert System V.01Tree. (Bakeer, 2017)

Figure 10 demonstrates the configuration of the system. A stating screen is seen when the expert system begins and the patient is expected to read the instructions in figure 11. Communication between the user and the expert system is achieved through the English Language user interface that has been introduced using Yes or No questions to be simple for the normal end user (see Figure 12 and 13). (Bakeer, 2017)

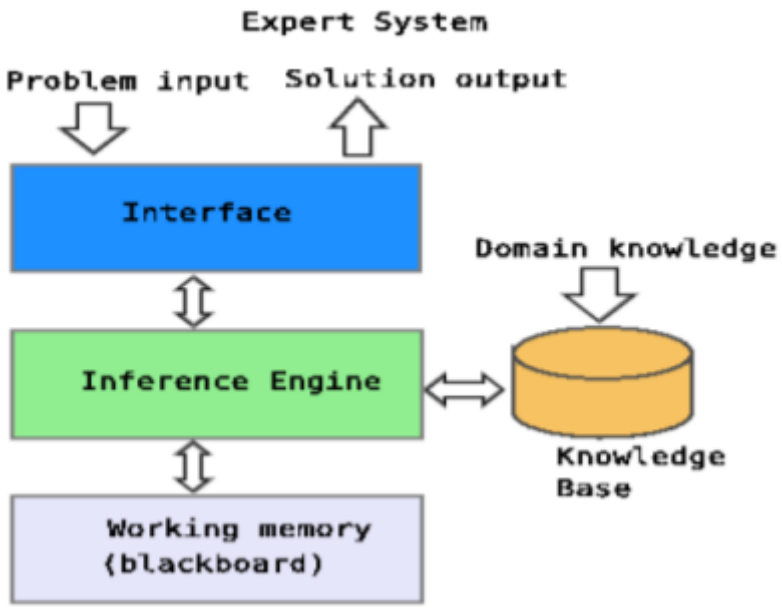


Figure 10: Main component of the Expert System (Bakeer, 2017)

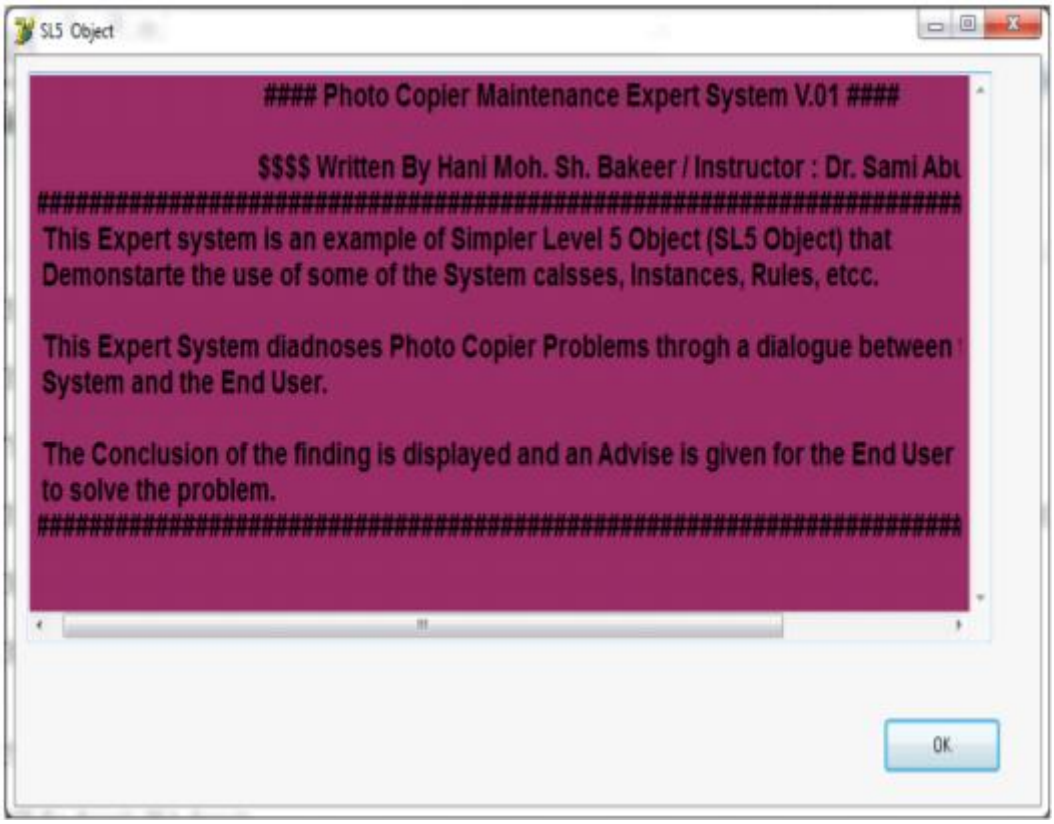


Figure 11: starting screen of the expert system (Bakeer, 2017)

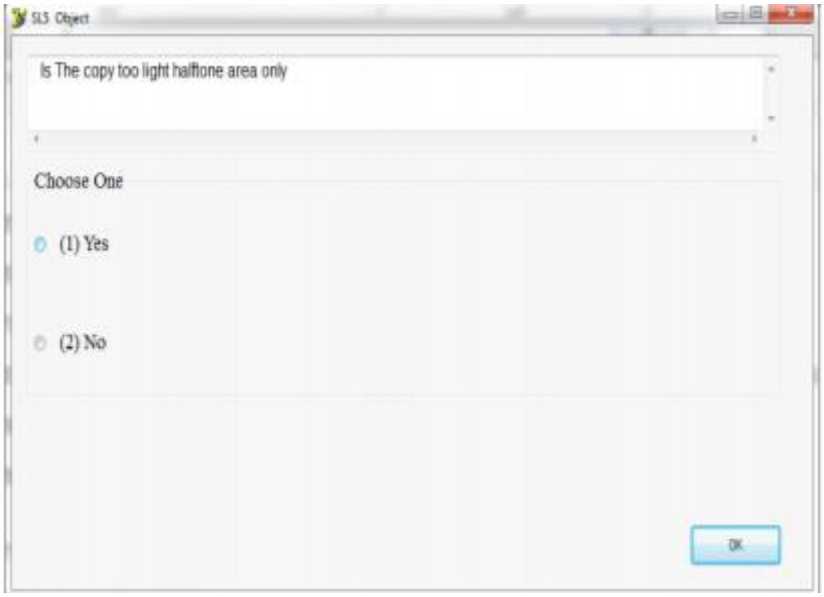


Figure 12: Dialogue between the user and the expert system (Bakeer, 2017)

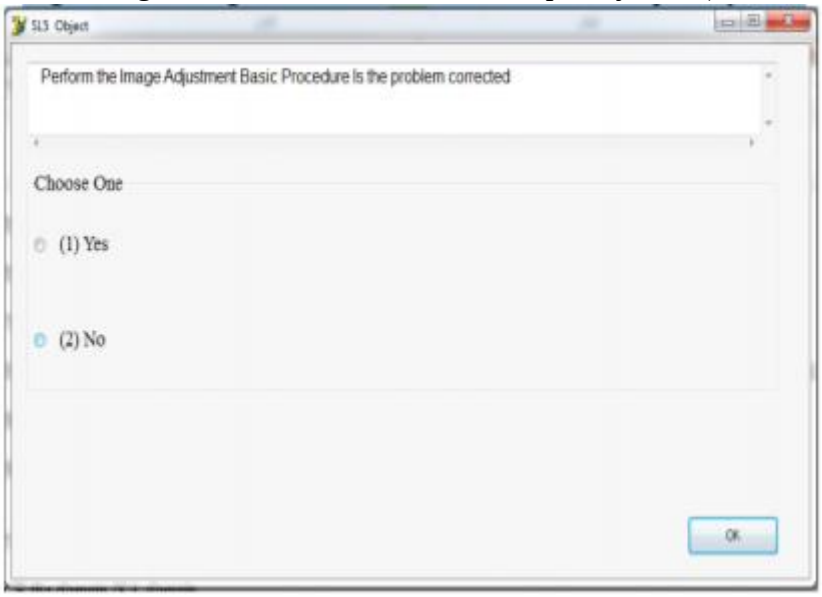


Figure 13: Dialogue between the user and the expert system (Bakeer, 2017)

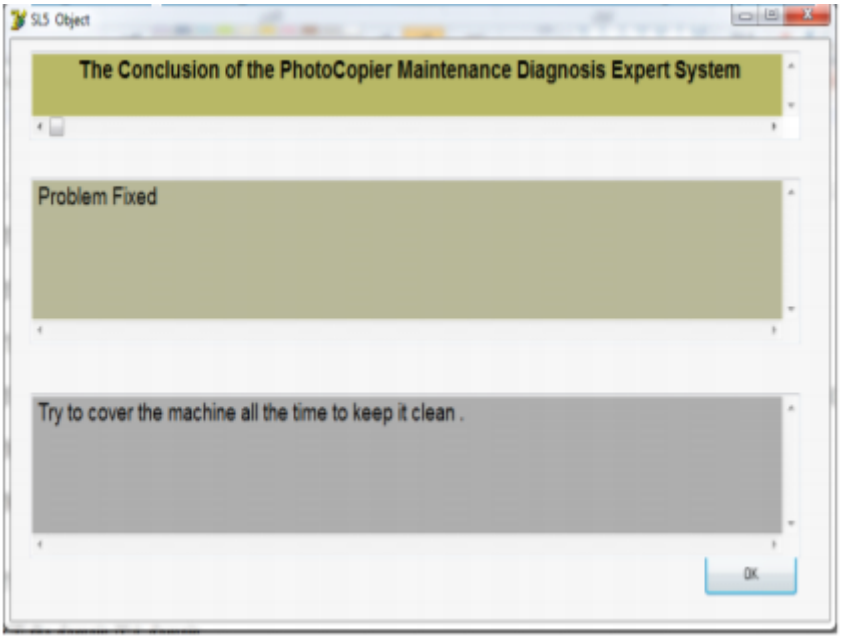


Figure 14: The conclusion of the expert system (Bakeer, 2017)

A few classical test cases were used to test the expert system in a preliminary assessment of the expert system and the outcome of the system was correct compared to the outcome of the service department for repairs. A few classical test cases were used to test the expert system in a preliminary examination of the expert system, and the outcome of the system was correct when compared with the outcome of the repair service department. (Bakeer, 2017)

1.3 Literature Review on Chatbot

1.3.1 Literature Review on Chatbot (Sia De Long)

Since the idea is to build a chatbot as intermediary between expert system and the users, therefore the team has also studied to at least three literature about to understand more about the role of chatbot will be in this assignment. Hence, the team can achieve the objectives successfully.

The literature on International Journal of Computer Sciences and Engineering has highlighted several requirement or structure about chatbot. They stated that a computer program which designed to having a smart conversation on a text or spoken ground with human is called a chatbot. Chatbot is always using pattern matching to recognize what user input and then access information to provide a predefined acknowledgment which mean when a user input something into the database, the chatbot will then response with a answer which defined by its creator. They stated that although chatbot is widely popular nowadays but it still has some weak point such as the chatbot is hard to register to the database if the input given is consists of complex questions and it is hardly to perform compound activities. Chatbot is just a chatting robot which will simulate computer program using communication, it is all about the conversation with the users. Hence the design of a chatbot should be represented as shown on figure 1 and figure 2 show that how the response from chatbot given according to user input (Dahiya, 2017).

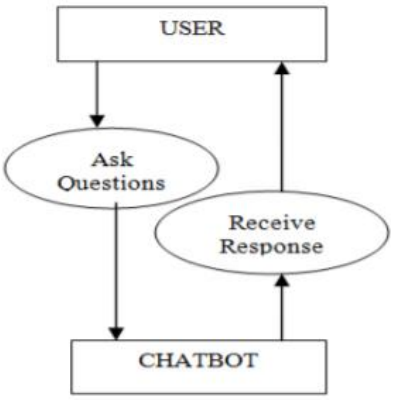


Figure 1: Use Case Diagram of Chatbot Design (Dahiya, 2017)

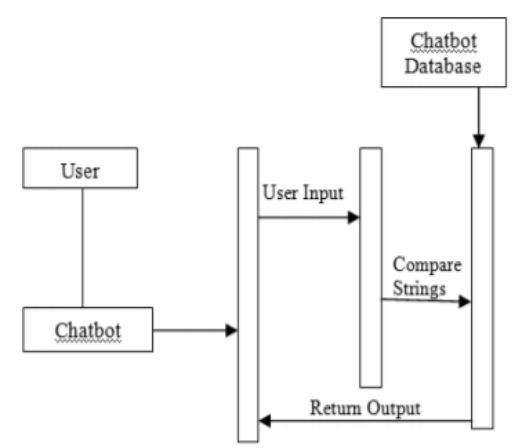


Figure 2: Sequence Diagram Representing Design of the Chatbot (Dahiya, 2017).

A chatbot is one of the simple ways to get data from a computer without even need to spend time browse on the internet to collect information which mean that users can easily get the information they want by typing their query in natural language. Chatbot is a suitable tool for a quick Interaction between computer and the user. Chatbot not only help us to save time by answering the questions that are hard to find, sometime chatbot can be entertaining to us. Hence the chatbot must be designed in a simple form and user friendly so that it could be applied in various field (Dahiya, 2017).

Besides that, according to the literature on International Conference on Advances in Computing, Communications and Informatics (ICACCI), they proposed a chatbot to answer query from user about university related FAQs. Chatbots are computer programs that are able to mimic human conversation using Artificial Intelligence (AI) technologies. It can be designed as a virtual assistant, entertainment purpose program, answering question, providing driving directions, turning up the thermostat in smart home, play music and much more. Chatbot has become more popular in business groups right now because they can be really useful when handling customer services including reduce the cost and solving multiple customer problem in the same time (Ranoliya, et al., 2017).

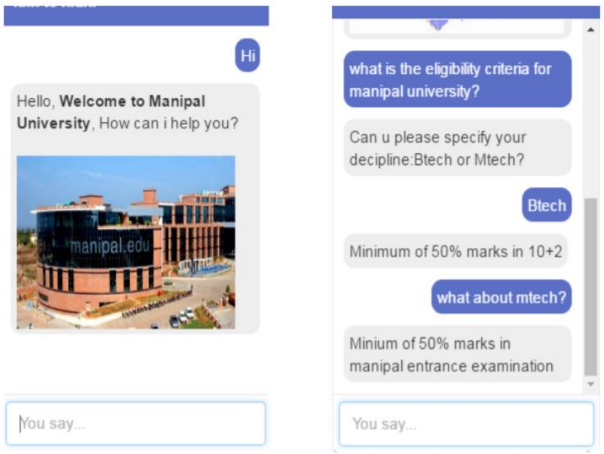


Figure 3: Chatbot response snapshot 1 (Ranoliya, et al., 2017)

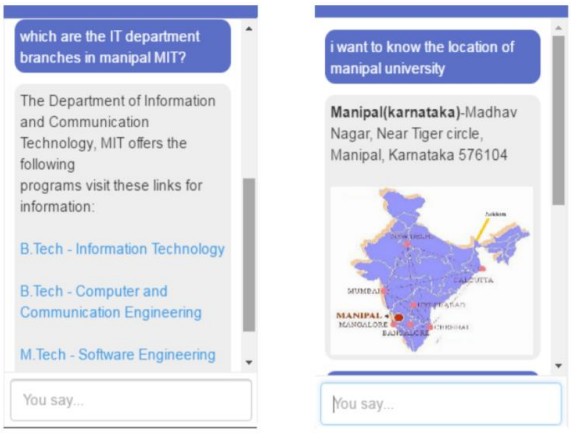


Figure 4: Chatbot response snapshot 2 (Ranoliya, et al., 2017)

Figure 3 and 4 turn out the result of the chatbot is successful and being able to solve student FAQs because the chatbot is designed simple and user friendly as it is a chatbot that is intended to have a clever discussion with human accomplices through their regular language meaning that students can easily get the information they want juts like chatting with a human using normal language (Ranoliya, et al., 2017).

Moreover, there is another literature on International Journal of Computer Sciences and Engineering support that application of chatbot on Frequently Asked Questions (FAQ). What different is the chatbot they proposed is designed to answer common questions people have in their mind Chatbot is a software application used to having an on-line chat conversation using text or text-to-speech, in instead of having an interaction with a live human or searching on the internet. However, the chatbot they proposed is a type of bot that used in website or software application that is beneficial for answering and solving some of the most frequently asked questions your customers may have similar to customer services but without the need of human

control. For example, it will help to direct customers to the right or desired website pages and answering customers queries easily any time of the day just like how figure 5 showed (Sethi, 2020).

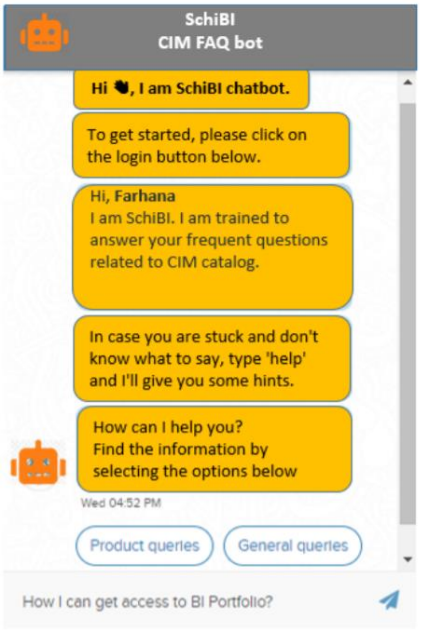


Figure 5: User Interface of FAQ Chatbot (Sethi, 2020)

In conclusion, chatbot is a trend for being useful tool to answering questions because it is simple and user friendly as the users only need to have a normal conversation just like with friend to get the information they want.

1.3.2 Literature Review on Chatbot (Chieng Shoa Wei)

The basic mechanism of a chatbot starts with the user's post. NLP (Natural Language Processing) was used to process the request, and the chatbot replied by replying to the message using the existing database (see figure 1). When a user asks, "How are you?" for example. (Haristiani , 2019)

message, the chatbot will scan the database for answers that fit this question, such as "I am fine."

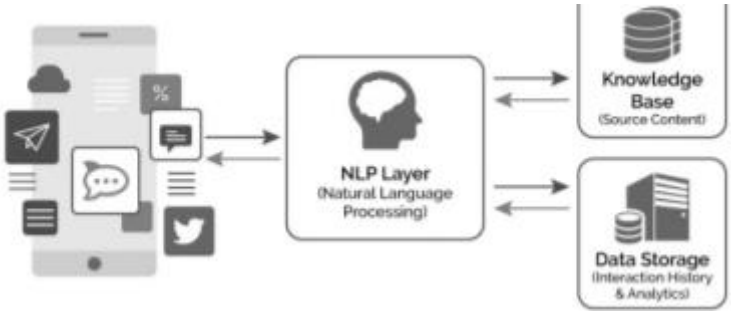


Figure 1. The mechanism of chatbot. (Haristiani , 2019)

The three types of chatbots discovered in this study can be classified based on their structure, function, and target audience. Table 1 lists the sub-categories and their purposes. (Haristiani, 2019)

Category	Sub-category	Function
Structure	Flow *chatbot*	A tree-based *chatbot*. This *chatbot* has fixed responds set by the developer, and only responds to questions that are already in the database. Flow chatbots include buttons, keywords, and catchphrases instead of free writing to drive the client down the predefined path.
	Artificially intelligent	Chatbot with artificial intelligence has the ability update their knowledge and perception from previous conversations and users' experience, letting the users engage more freely.
	Hybrid	This type of chatbot combines the concepts of Flow and AI chatbots. This chatbot can understand and communicate with users, but remains in the pattern determined by the developer.
Purpose	Functionality	This chatbots have certain functions depends on the developer (i.e. chatbot for learning, personal assistant, reminder, online shop assistant, etc.)
	Fun	Chatbot that intended only for entertainment (i.e. games, *funbot*, etc.).
Audience	Generalist	This chatbot has general knowledge that we can ask directly. I.e. Siri developed by Apple ,and Cortana developed by Microsoft. Both Chatbots can help us solve common problems such as searching for restaurants, locations and more.
	Specialist	This chatbot focus on one constrained thing and do *that one thing* extremely well (i.e. chatbots that used to serve customers online when ordering items).

Table 1. Types of chatbot (Haristiani, 2019)

Table 1 shows that chatbots fall into many categories and can be personalised to suit the needs of the developer. Chatbots built for educational purposes, on the other hand, are more likely to use artificial intelligence structures. MILABOT, an artificially intelligent chatbot for general use, has also been created. MILABOT is a deep reinforcement learning chatbot that can converse with humans in both voice and text on popular small talk topics. An ensemble of

natural language generation and retrieval models, including template-based models, bag-of-words models, sequence-to-sequence neural network, and latent variable neural network models, make up the framework. In the following segment, we'll go over chatbots that were created for educational purposes, especially language learning. (Haristiani, 2019)

The creation of chatbots for the purposes of learning and teaching has been completed. Freudbot was designed for psychology students who wanted to learn more about how students and material communicate in distance education. The findings show that the chatlogs' simple analysis showed a high proportion of on-task activity. The results also indicate that chatbot technology may be useful in distance and online education as a teaching and learning tool. In a science lecture class, the use of a chatbot was compared to that of a humanoid robot, and it was noticed that the visualisation provided by the chatbot helped students understand the lecture more easily. However, studies on the use and creation of chatbots to aid language learning are hard to come by. Table 2 displays the findings of this study's research on language teaching and learning. (Haristiani, 2019)

First author (year)	Chatbot name	Subject	Focus	Sample	Research type
Jia (2004)	-	English, Germany as Foreign Language	Application of a Web-based Chatbot system on foreign language teaching	1256	Experiment
Fryer (2006)	Cleverbot	English as Foreign Language	Chatbot as *English* language learning tools	211	Experiment & survey
Jia (2009)	CSIEC *chatbot*	English Learning	A computer assisted English learning *chatbot* based on textual knowledge and reasoning	1783	Experiment, survey & questionnaire
Goda (2014)	Cleverbot	English as Foreign Language	The use of Chatbot before online EFL discussion and The effect on critical thinking	130	Comparison based (Experimental & Control group)
Fryer (2017)	Cleverbot	English as Foreign Language	Comparison of chatbot and human task partners in English learning	122	Comparison based (Pre-test & Post-test)

Table 2. Chat researchers on language learning (Haristiani, 2019)

Table 2 shows that the majority of chatbot studies were performed in the English language learning area. According to study, chatbot dialogues are usually very short because users consider the machine to be much less intelligent than a person, as the computer's answers are often repetitive and unrelated to the topics and background. However, the findings show that many participants are interested in using a chatbot as a chatting partner in a foreign language since it is accessible anywhere and at any time, while finding native speakers as a human chatting partner is difficult. The students also felt more comfortable interacting with a chatbot, which is clearly less intelligent than a human. Chatting with an artificial intelligence system

that could "truly" comprehend natural language and communicatively produce natural language to form a human-like dialogue would be pedagogically appealing. (Haristiani, 2019)

Chatbots that encourage physical activity and a balanced diet are developed to help people improve their habits, such as exercising for particular periods and/or distances and sticking to healthy meal plans. Several articles on chatbots addressing health care topics ranging from mental health assistance and smoking cessation to disease detection have been published, despite the fact that no systematic review of chatbots for lifestyle change programmes has been published. Some chatbots were developed based on existing mental health intervention programmes such as cognitive behavioural therapy, while others were developed based on established mental health intervention programmes such as cognitive behavioural therapy, due to the various natures of targeted behaviours. One critical study addressed the creation of embodied conversational agents for a healthier lifestyle, noting that the perception and implementation of behaviour change theories is rarely published. (Zhang, 2020)

Most previous chatbot research depended on either finite-state (i.e., dialogue consisting of a series of predetermined steps or states) or frame-based (i.e., dialogue is not predetermined but is dependent on the content of the user's feedback and the details that the system must elicit) systems. Due to a lack of broad training data sets on human-to-human conversations in domains involving behaviour changes, such systems are limited in their ability to enable free conversations. (Zhang, 2020)

The recent success of broad pretrained language models, such as Google's Bidirectional Encoder Representations from Transformers (BERT) and Open AI's Generative Pre-Training-2 (GPT2), indicates that language priors could be used in down-stream natural language processing (NLP) tasks. Pretrained models, for example, can be optimised for task-oriented dialogue generation, such as restaurant recommendations and donation persuasion, according to several articles. BERT and GPT2 are huge neural network models that have been trained on large text data sets with self-supervised task objectives including retrieving masked tokens and predicting the next term. These models generate outputs that are difficult for humans to interpret and can make errors that violate common sense in specific domains because they work on representation space and do not have access to symbolic common-sense knowledge. Building systems that integrate pretrained models to promote building dialogues that are relevant for interacting and persuading users to follow daily physical activity and a balanced diet is one general way to advance this field. (Zhang, 2020)

We provide a theoretical perspective and a model to direct the creation and evaluation of AI chatbots for behaviour changes in order to advance the science of developing effective and ethical AI chatbots for health behaviour changes, especially in the context of improving physical activity and healthy eating behaviours. The purposes of this perspective paper are threefold: (1) to summarise the current state of AI chatbot applications in encouraging physical activity and a balanced diet; (2) to suggest our research team's AI chatbot behaviour change model; and (3) to discuss ethical concerns and values. (Zhang, 2020).

Chatbots' mistake completes the conceptual model as a moderator in order to see how the fundamental structure of our model interacts with previous research findings. It is well known that people shape opinions about robots based on how they are depicted in the media, which is often as ideal machines. As mentioned by Mirnig et al., conversational agents are viewed as social actors, which elicits mental models from Human-to-Human Interaction. Ragni et al. have discovered that most people consider robots to be practical, capable, and intelligent. As a consequence, there is a widespread misconception that robots are faultless.

The analysis of social robot errors is unquestionably a novel subject. Several exploratory research, on the other hand, looked at people's impressions of unreliable robots as well as their responses when communicating with them. (Toader, et al., 2020)

Ragni et al. found that agents who make errors are viewed as less trustworthy, less knowledgeable, and having poorer reasoning skills, all of which have a negative effect on objective task performance. An experiment was performed in which participants had to interact with an anthropomorphized chatbot that was presented as either a Male (Paul) or a Female (Paula) in order to test the differences that gender could entail (Sarah). The research used a 2 (Chatbot Gender: Male vs. Female) 2 (Chatbot Gender: Male vs. Female) 2 (Chatbot Gender: Male vs. Female) 2 (Chatbot Gender) (Toader, et al., 2020)

Table 3 demonstrates the between-subject experimental design (Chatbots' Error: Yes vs. No).

	Chatbots' Gender	
	Male chatbot (Paul)	**Female chatbot (Sarah)**
Chatbots' Error	Yes (N = 60) No (N = 60)	Yes (N = 60) No (N = 60)

Table 3. Experimental Design. (Toader, et al., 2020)

The nature of the study, the three parts involved, and the length of each part were all clarified to the participants at the start of the study. The nature of the analysis, the three parts involved, and the length of each part were all clarified to pants. The participants then conducted a pre-survey in which we controlled for many significant alternate reasons for the experiment's rationale such as assessing tech know-how or the relevance of human relationships in a buying situation. (Toader, et al., 2020)

Following the study's launch, participants were given the opportunity to explore the website, where they were greeted by the virtual assistant after clicking on the chat icon. Both participants were allocated to one of four experimental conditions at random. The chatbot approached all of the participants with an introductory comment that was suitable for their situation: "Hello! Paul/Sarah is my name. I'm here to welcome you to the world of sportswear and to help you make product choices." (Toader, et al., 2020)

Following that, study participants were guided through a pre-written interaction script that was supposed to lead to a product recommendation. Given that the virtual assistant must consider the customer's needs in order to make an appropriate product recommendation, The format was Q&A (Questions and Answers). The virtual assistant started the discussion by asking the

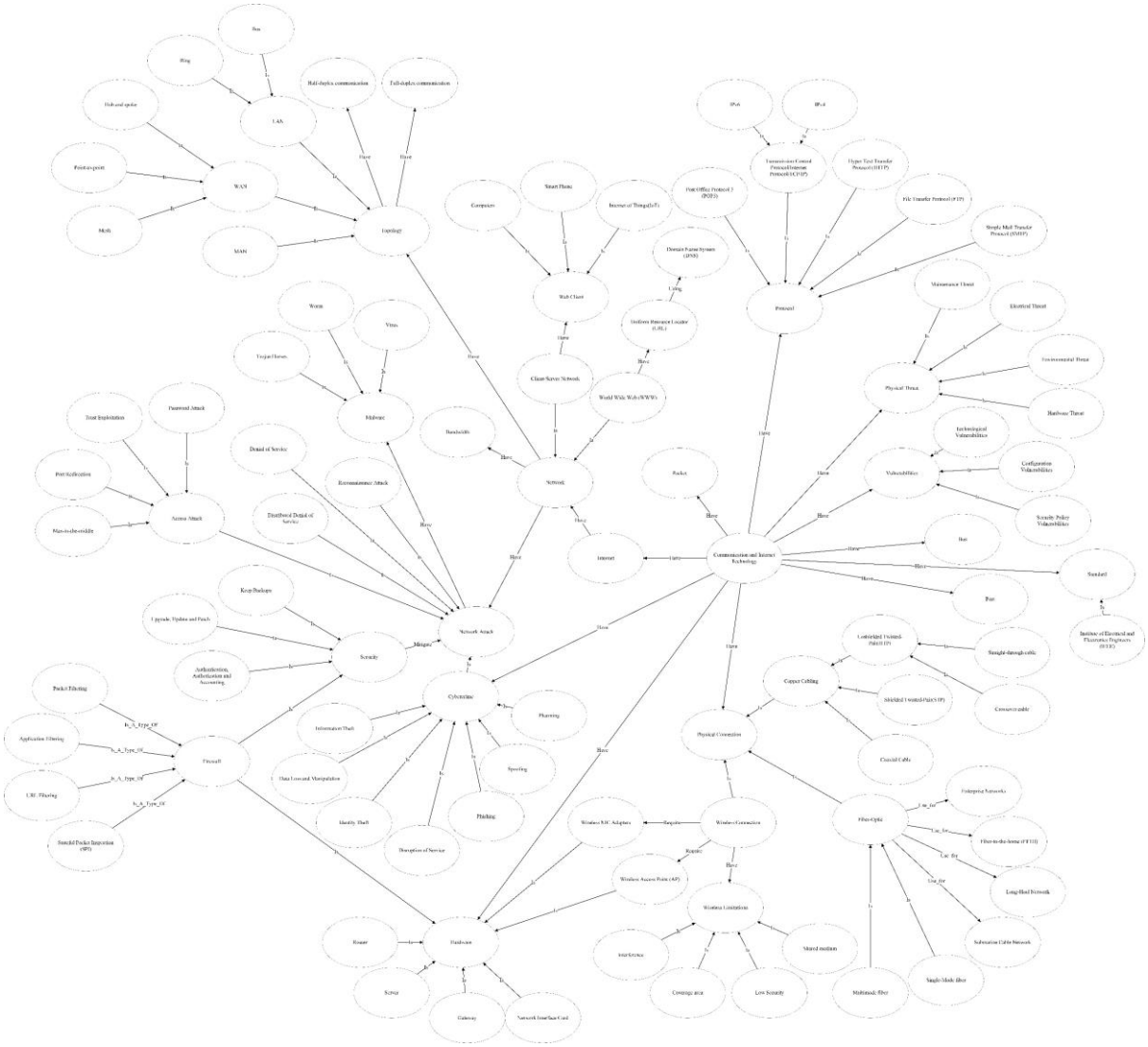
respondents a series of questions about their country of origin, the type of sports apparel they are interested in, how much they exercise, their favourite fit, colour, material, and brand. The virtual assistant waited for the participant to respond after asking a question. The chatbot then replied to the participants' responses with a programmed delay in the high anthropomorphic state, which was used to give the impression that they were communicating with a real person typing an answer. (Toader, et al., 2020)

The chatbot was configured to redirect the conversation back to the pre-defined script if participants did not reply according to the pre-defined script or asked other questions unrelated to the main topic. The virtual assistant gave the participant a product suggestion and two choices at the end of the interaction: make a purchase or add the suggested product or items to Favorites. In addition, the virtual assistant promised to help with the participants with additional distribution options details The experiment took about 5 minutes to complete. (Toader, et al., 2020)

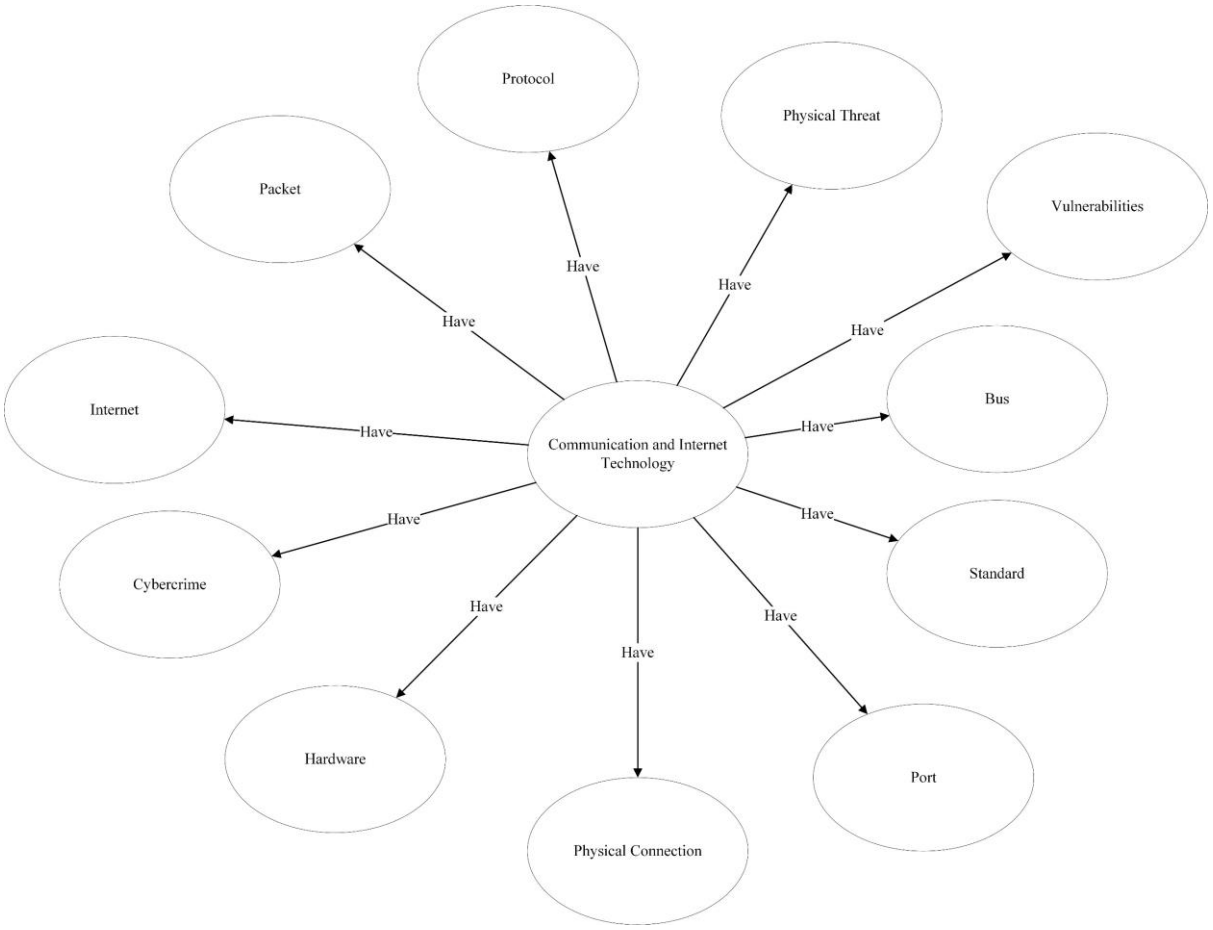
After the virtual assistant talk ended, participants were asked to answer a series of questions about the variables in our conceptual model: impressions of the chatbot's anthropomorphic signals, social presence, perceived competence, confidence, and positive emotions. Finally, we looked at people's willingness to share personal details and their feelings about the chatbot, as well as demographic data. (Toader, et al., 2020)

Chapter 2: Knowledge Representation

2.1 Semantic Network



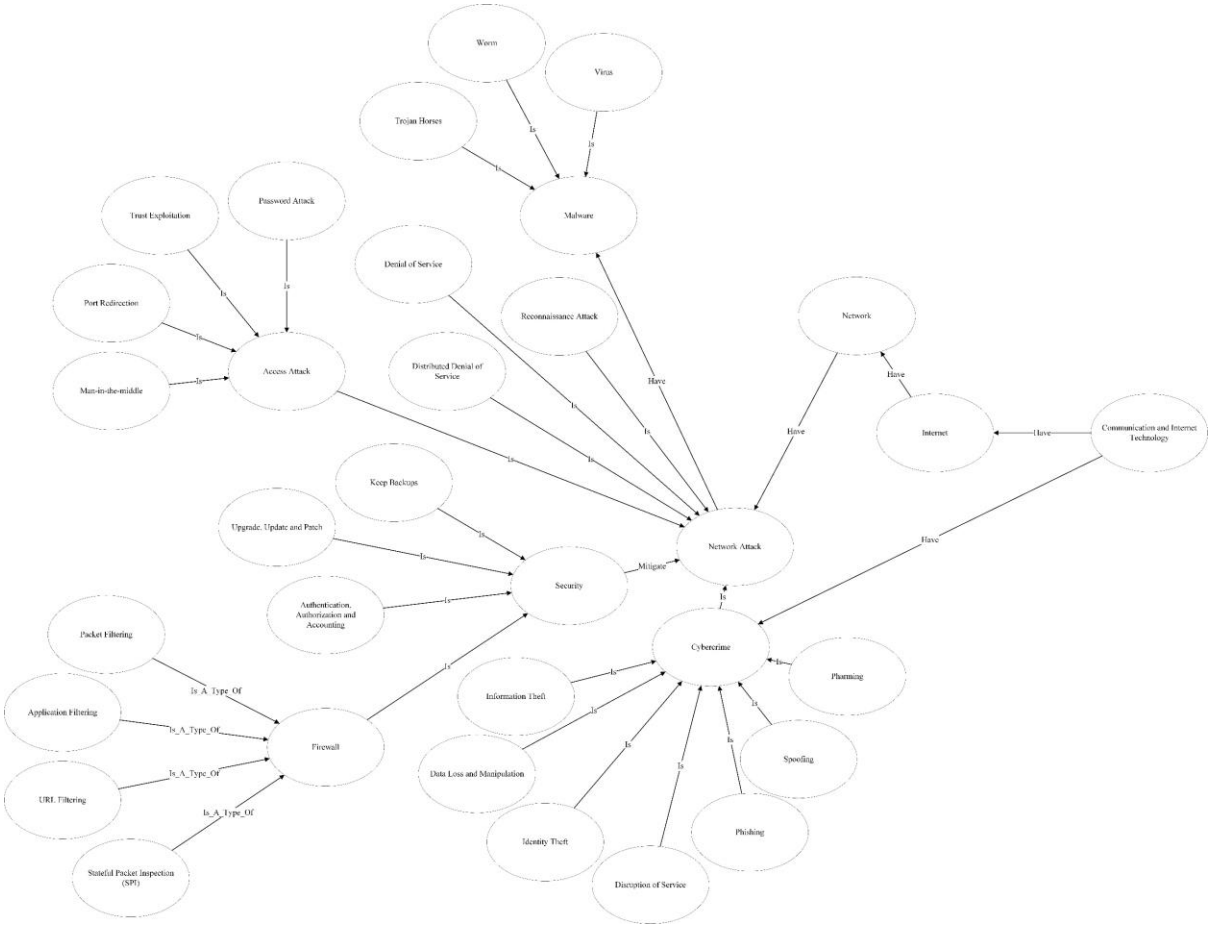
Semantic Network 1: Full size



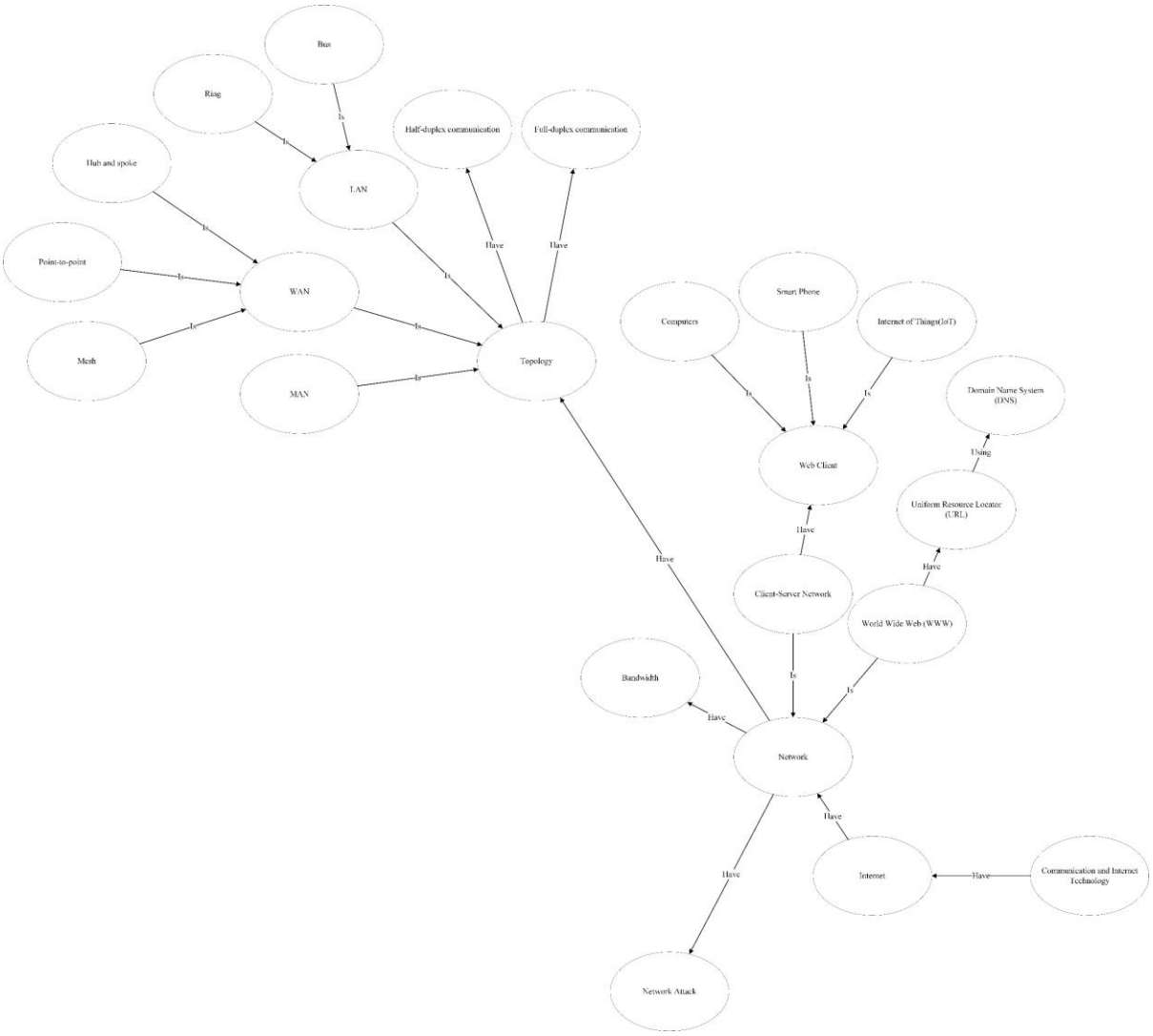
Semantic Network 2: Main connection

Semantic Network 3: First part

Semantic Network 4: Second part



Semantic Network 5: Third part

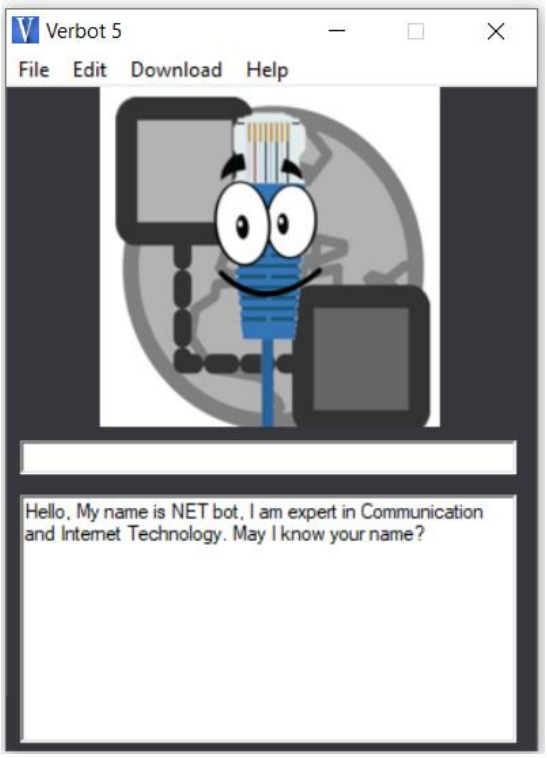


Semantic Network 6: Fourth part

Chapter 3: Implementation

3.1 Test plan / Screenshot of special features

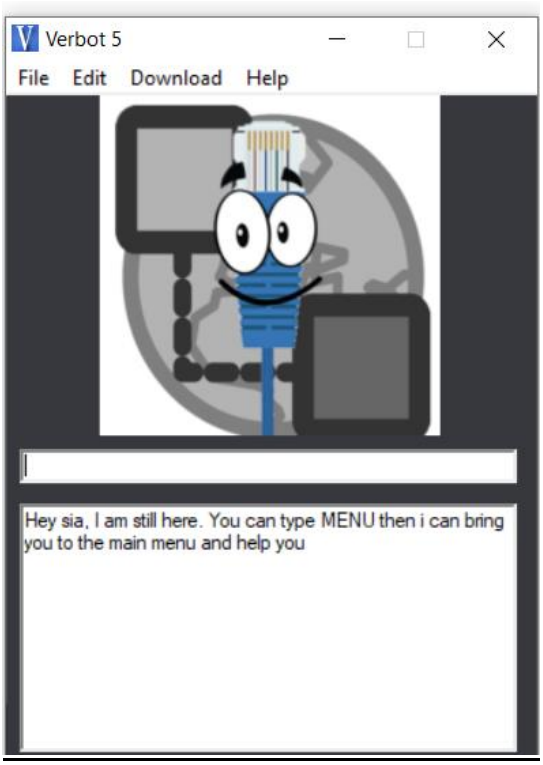
3.1.1 Start-up



Test Plan1: Start-Up

When the NET bot has been activated, NET will start the conversation automatically by greeting to the user and introducing himself about what he is expert at. Besides that, he will greet by following real- time such as he will greet to the user “Good morning” if the time is between 5am to 12pm and he will ask for a name that will be remembered by NET until the end.

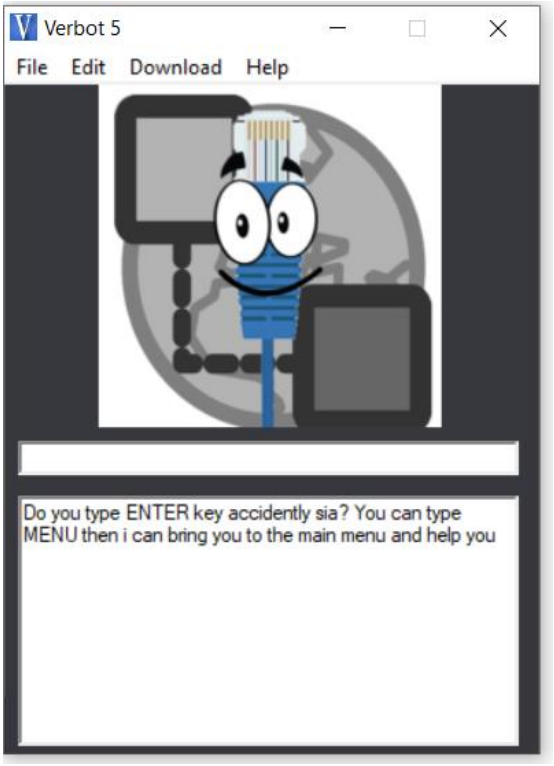
3.1.2 Bored



Test Plan 2: Bored

When the user let NET wait input for so long, NET will try to inform the user that he is still there and guide the user to the main menu for further help.

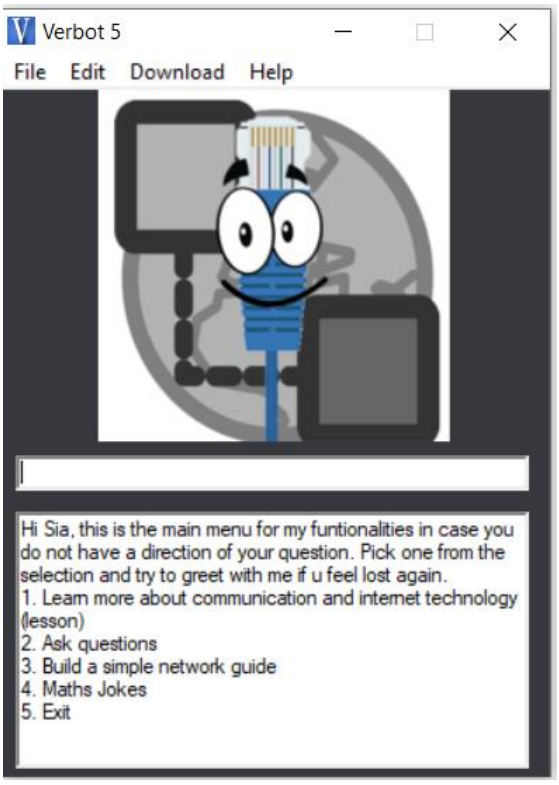
3.1.3 Blank



Test Plan 3: Blank

When the user did not type anything else and press ENTER key, NET will ask the user about is the user press ENTER key accidently and then he will guide the user to get to the menu.

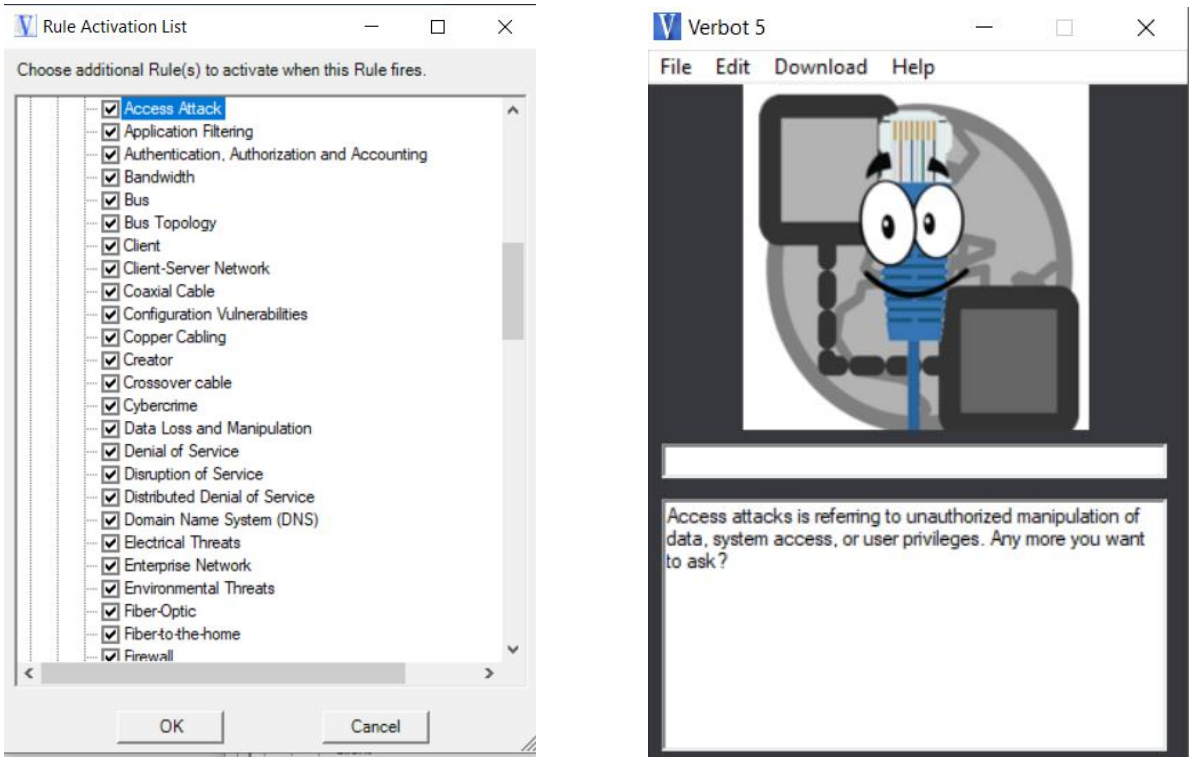
3.1.4 Main menu



Test Plan 4: Menu

User can access to the main menu everywhere in the conversation after the user type MENU. When user come to menu, NET will greet to user again and shows the user all the functionalities that NET have.

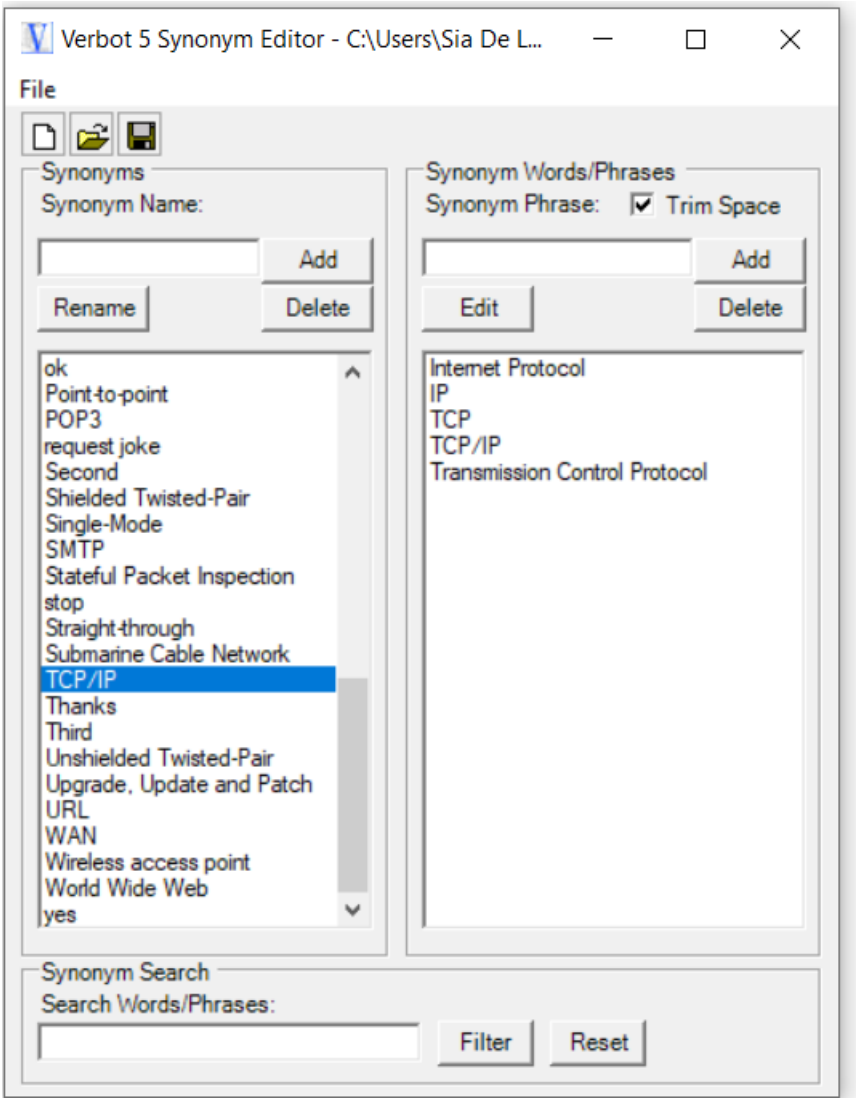
3.1.5 Virtual Child



Test Plan 5: Virtual child

Virtual child is a condition that can let user activate when another condition is activated. For example, if the user ask Access Attack, then the user can now activate other question condition by typing the question topic such as Topology and Firewall.

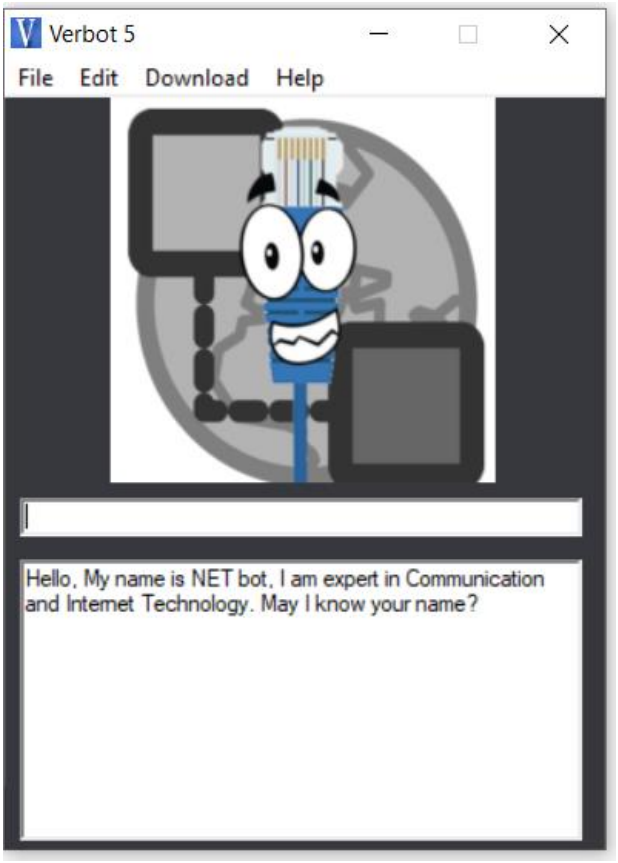
3.1.6 Synonyms



Test Plan 6: Synonyms

Synonyms is used for NET to understand user more easily when user asking some questions. For example, when the user has query about TCP/IP then the user can type Internet Protocol, IP, TCP, TCP/IP oi Transmission Control Protocol, either of these, NET can understand them all and give a response to that.

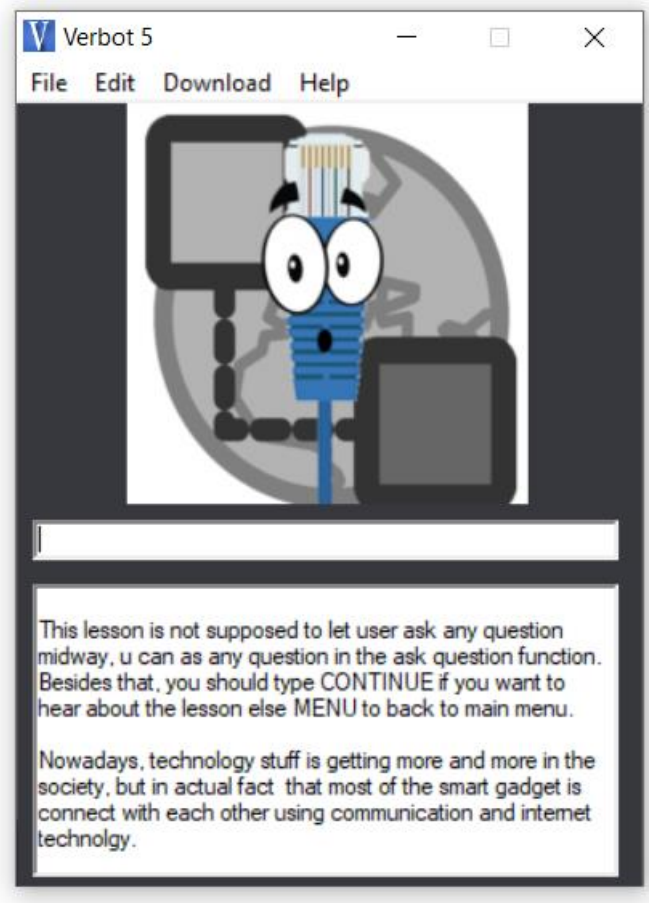
3.1.7 Avatar Emotion



Test Plan 7: Avatar Emotion

In the conversation, NET will smile to the user when the situation is being friendly as shown on the figure above. It is executed by Text to Replace which will change ": -)" to <agent.play smile>.

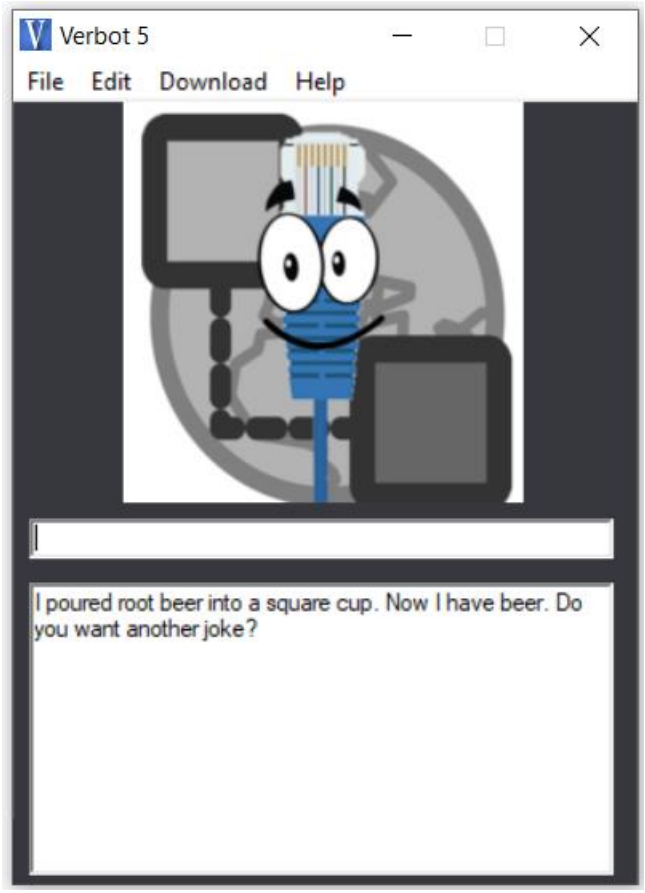
3.1.8 Lesson



Test Plan 8: Lesson

When the first selection is choose by the user, NET will start a lesson about communication and internet technology to the user, user can decide when to stop the lesson. Eventually, user can learn something and have a briefly idea of what NET know about, hence the user can ask question afterward if something they did not understand in the lesson.

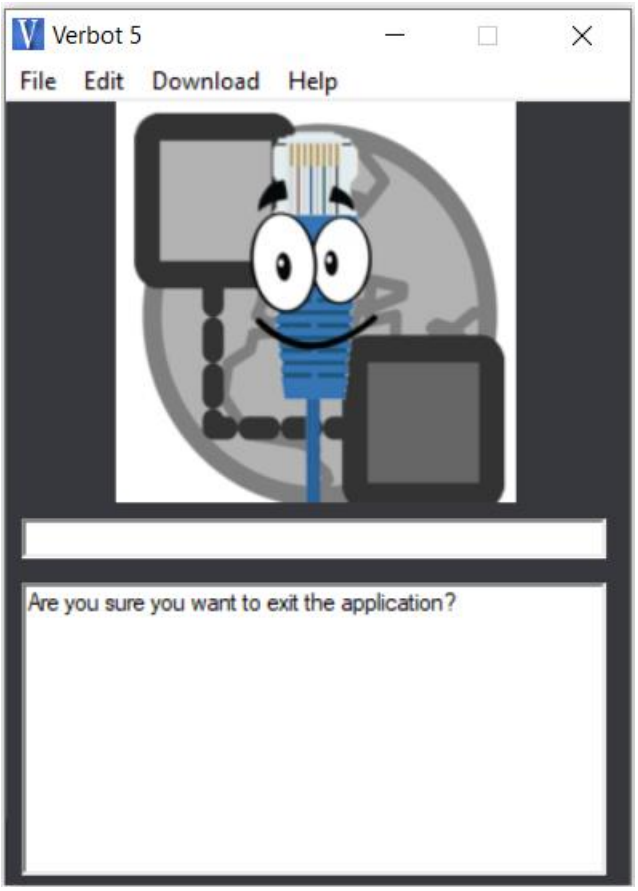
3.1.9 Maths Pun Jokes



Test Plan 9: Lesson

If the user tell NET to tell joke, he will randomly take about some maths pun joke, then he will ask about whether the user want to hear another joke else he will guide the user back to menu again.

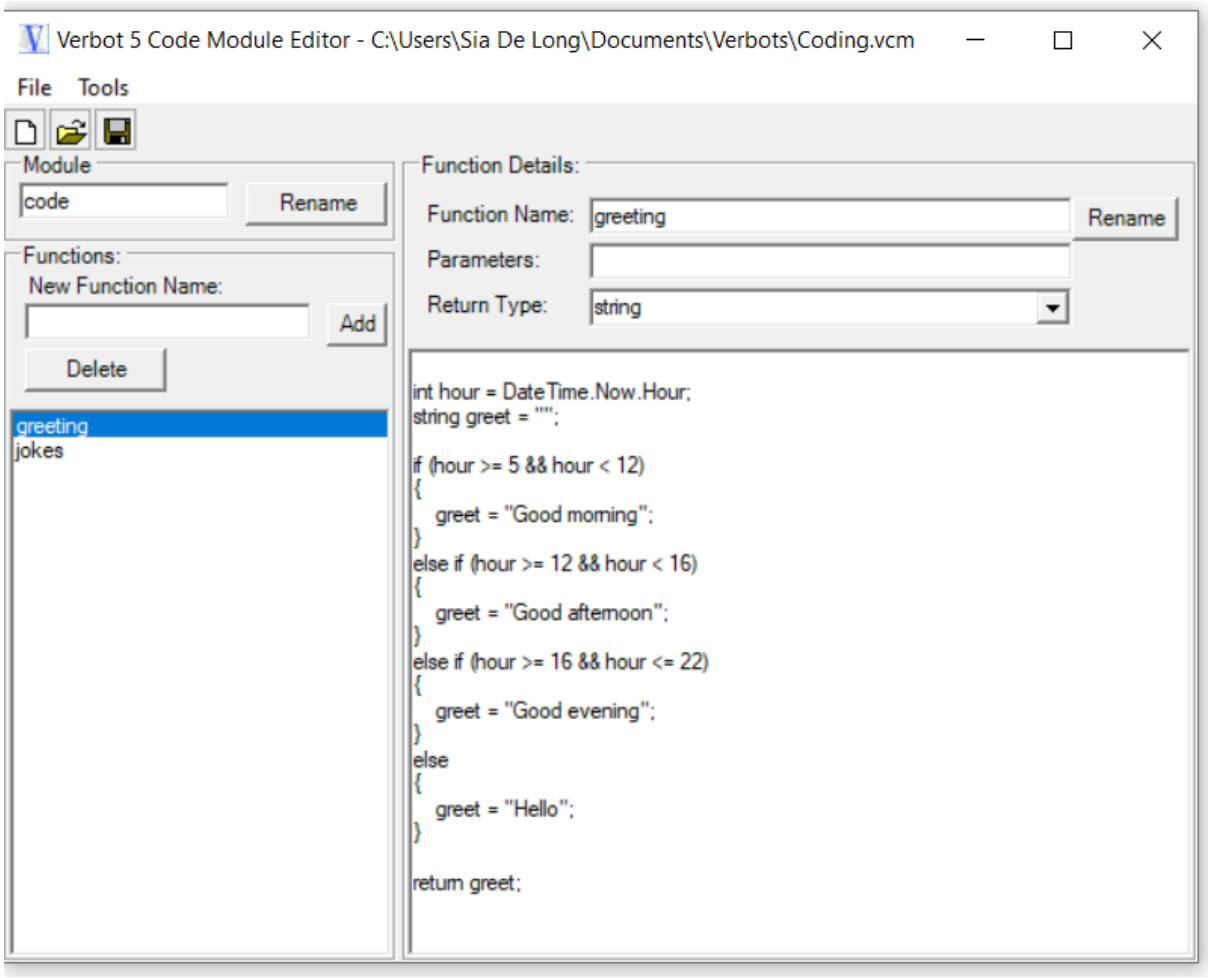
3.1.10 Exit



Test Plan 10: Exit

If the user say bye to NET anywhere in the conversation, NET will ask whether the user want to exit the application, if yes then the application will automatically closed else, NET will guide the user back to menu.

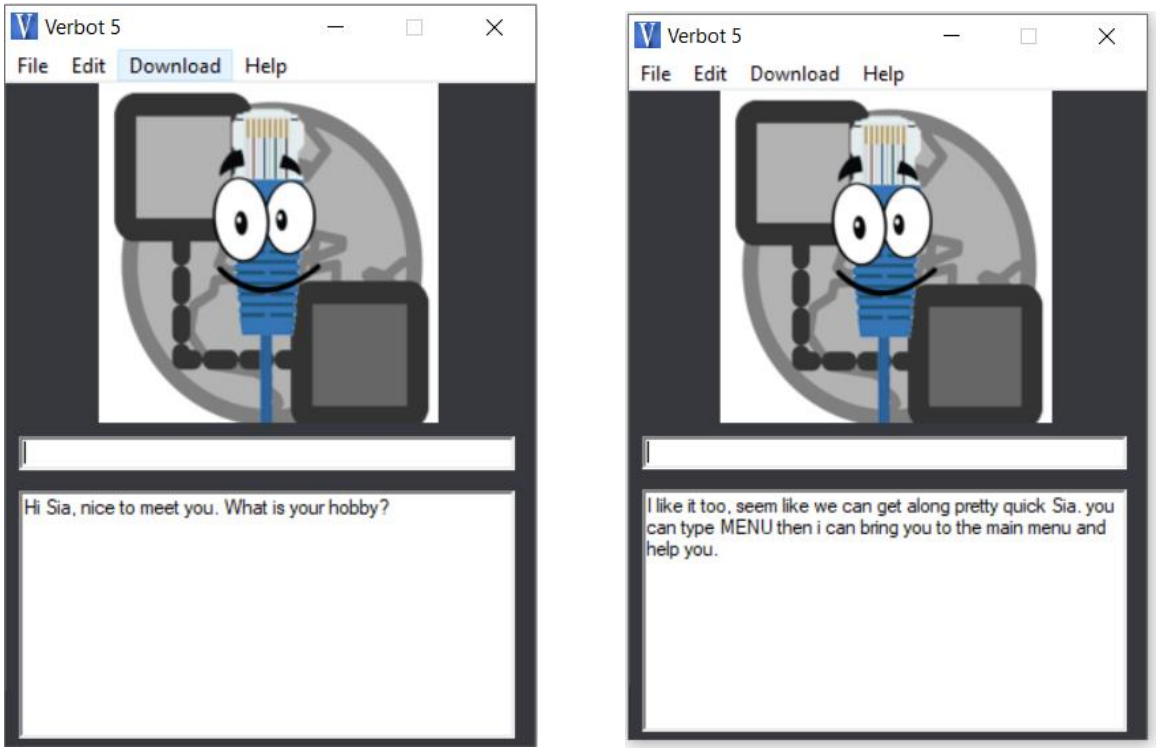
3.1.11 C# implementation



Test Plan 11: C# implementation

Some C# code is implemented in the system if necessary, such as getting the real time hour or randomize the joke.

3.1.12 Hobby

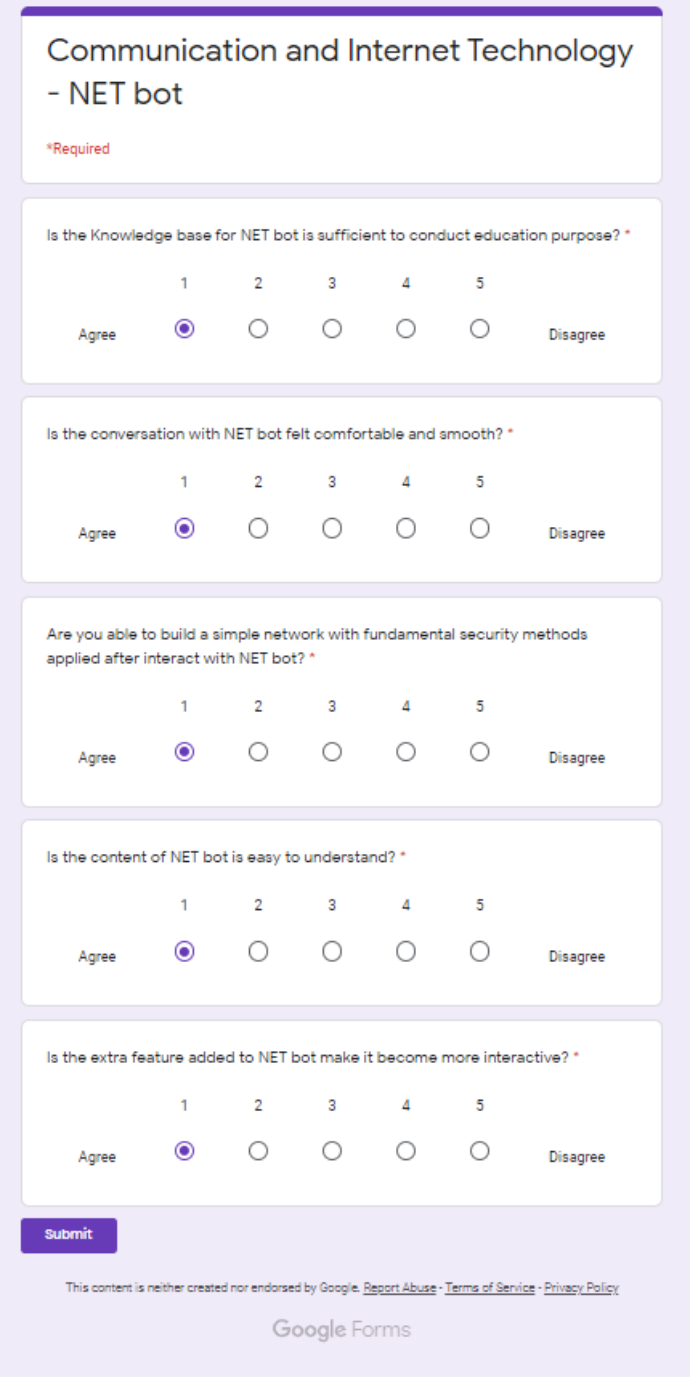


Test Plan 12: C# implementation

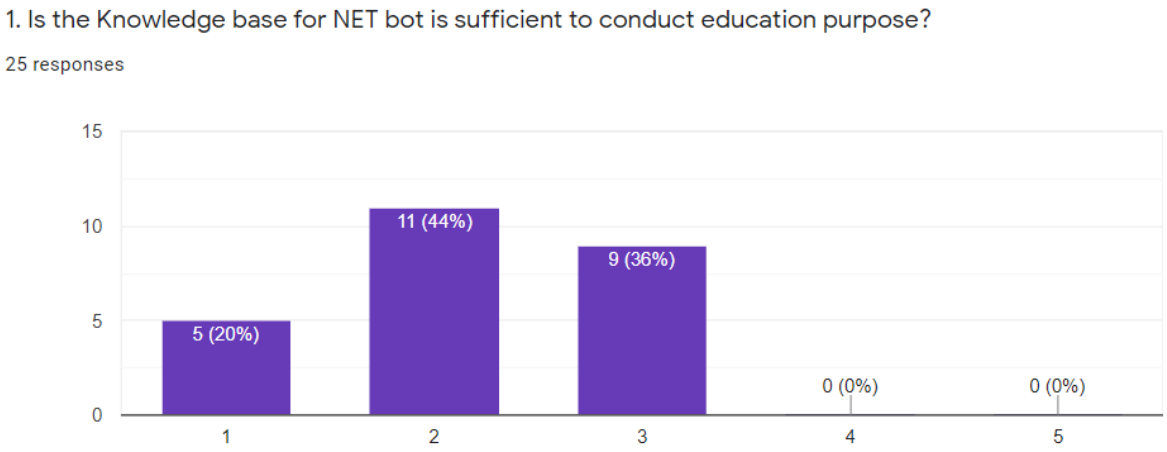
NET will ask for the hobby for the user after user give him a name. Then NET will chat a little and guide user to the main menu so he can give more help.

3.2 User Acceptance testing in questionnaire

After the team completely developed NET bot, the team prepared five questions about the feedback of NET after using it. In result, there are total 25 people who participant in experience NET and give a feedback.



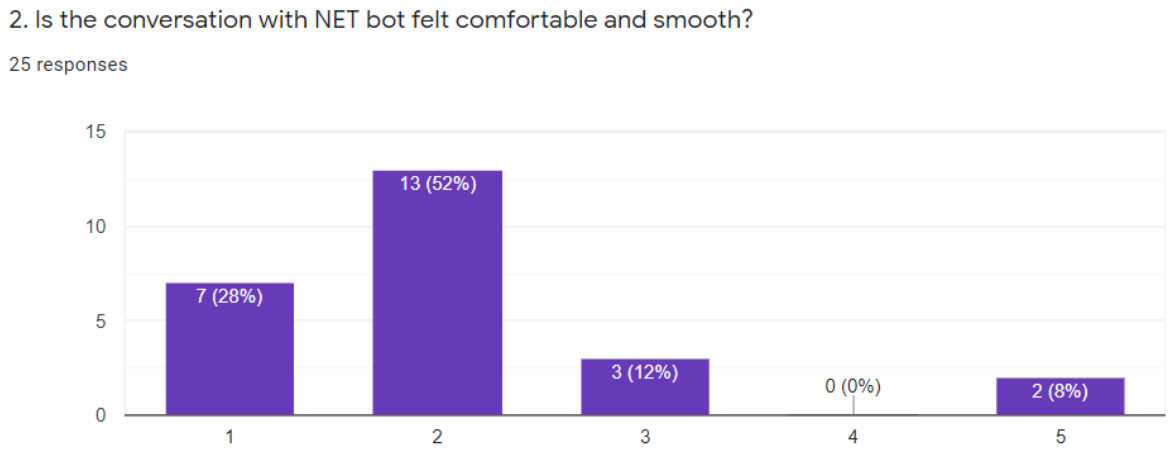
3.3 Results of user acceptance testing in graphs format



The purpose of the question is to confirm that NET is being able to teach beginner about communication and internet technology using the knowledge base developed and given by the team.

As the result shown in the graph, majority of user is toward between agree and normal. Strongly agree get a 20% from the response, agree get a 44% from the response which is the highest one among the other and normal or neutral get a 36% from the response.

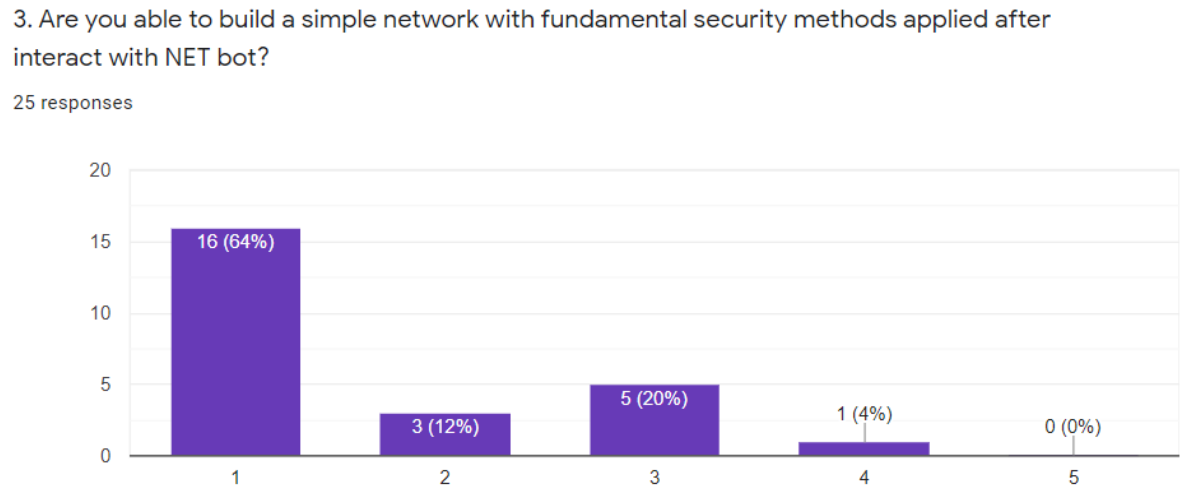
From the result, it shows that every user agree about NET is being able to do education purpose but it is more focus on beginner knowledge. However, the team think that the knowledge base for NET should be improved more by adding more advance knowledge.



The purpose of the question is to find out that the NET is being user friendly or not and whether chatting with NET is similar to chatting with a human.

As the result shown in the graph, majority of user is toward agreeing. Strongly agree get a 28% from the response, agree get a 52% from the response which is the highest one among the other, normal or neutral get a 12% from the response and strongly disagree get a 8% from the response.

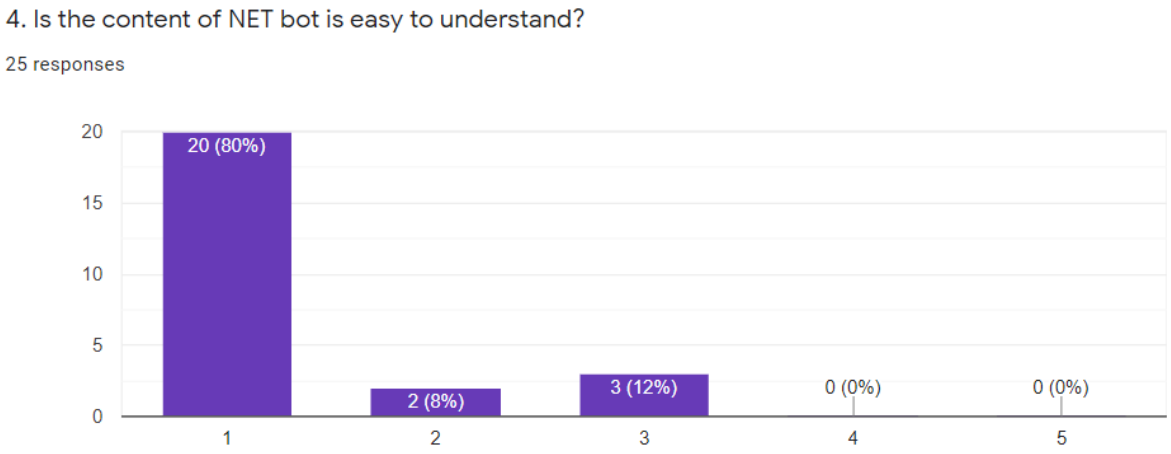
From the result, it shows that user is able to chat with NET easily but it is not as smooth as chatting with a human, hence some of the user strongly disagree to this question. However, the team think that the conversation flow for NET can have more improvement.



The purpose of the question is to make sure that every user can build their public or private network after interact with NET, or at least the user is understanding how all the technology gadget is connecting together.

As the result shown in the graph, majority of user is toward strongly agreeing. Strongly agree get a 64% from the response which is the highest one among the other, agree get a 12% from the response, normal or neutral get a 20% from the response and disagree get a 1% from the response.

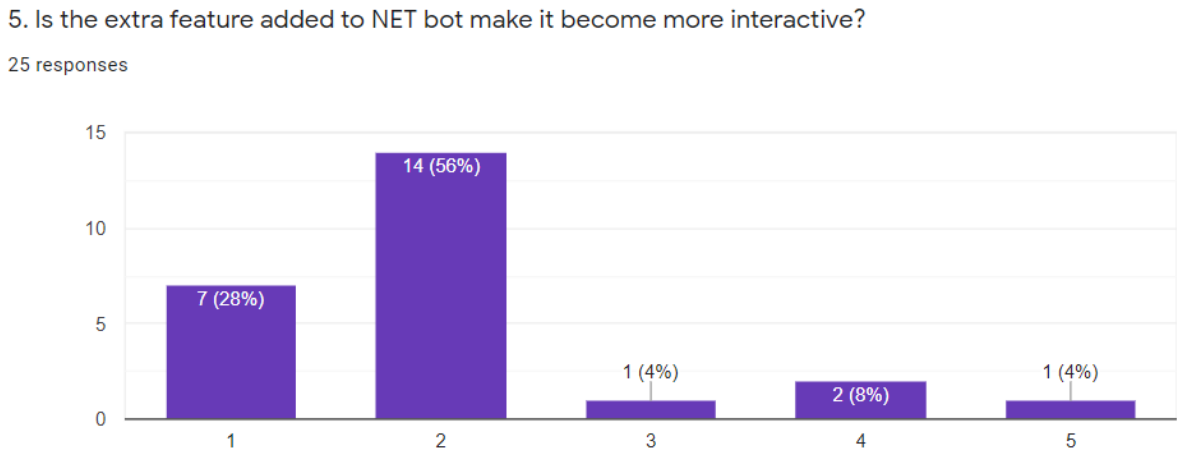
From the result, it shows that NET is able to teach the user until they can build their own network or understand how communication and internet technology work. However, the team think that NET should also can teach user more complicated network.



The purpose of the question is to make sure that the content of NET is easy to understand for all user so that can make sure the age range for user is big and they can all understand the content.

As the result shown in the graph, majority of user is toward strongly agreeing. Strongly agree get a 80% from the response which is the highest one among the other, agree get a 8% from the response and normal or neutral get a 12% from the response.

From the result, it shows that there is a big age range of the user who they can understand the content so that, there is more people can learn more about communication and internet technology. The team think that this part for NET is performing excellent.



The purpose of the question is to find out how the user feel about NET extra feature, whether it is making NET more fun to interact with or it is just normal.

As the result shown in the graph, majority of user is toward agreeing. Strongly agree get a 20% from the response, agree get a 56% from the response which is the highest one among the other, normal or neutral get a 4% from the response, disagree get a 8% from the response and strongly disagree get a 4 % from the response.

From the result, it shows that user is agree about adding extra features to NET, it will make them more volunteer to interact with NET. However, some of the user does not agree that so the team think that more interesting feature should be added to NET.

Chapter 4: Coding Implementation

4.1: Verbot code

KnowledgeBase Name: C:\Users\Sia De Long\Documents\Verbots\(knowledgebase)Communication and Internet Technology.vkb
KnowledgeBase Version: 1.0
KnowledgeBase Build: 97

KnowledgeBase Info:
Author: Sia De Long
Author's Website:
Copyright:
License:
Creation Date: 20/12/2020 11:20:37 PM
Last Update Date: 28/2/2021 4:58:49 AM
Rating: General for: Other
Rating Description: Education

Category: Educational
Language: English
Comment: Mainly about communication and internet technolgy and cybercrime. It is for educational purpose.

ResourceFiles:
Emotion - Communication and Internet.vrp
synonyms - Communication and Internet Technology.vsn
Coding.vcm

Rules:
Rule Name: UNKNOWN
Input Text: *
Output Text: I am sorry [Name], that's not in my domain. If you feel lost, you can type MENU then i can bring you to the main menu and help you.

Rule Name: _startup
Input Text: _startup
Output Text: <?csharp Console.Write(code.greeting()); ?>, My name is NET bot, I am expert in Communication and Internet Technology. May I know your name?:-)
  Rule Name: blank
  Input Text: _blank
  Output Text: Don't be shy:-), if you mind telling me your name, how about tell me your nickname?
  Rule Name: name
  Input Text: [name]
  Output Text: Hi [name], nice to meet you:-). What is your hobby?
    Rule Name: blank/no hobby
    Input Text: _blank
    Input Text: (no)
    Output Text: it's okay if you don't tell me [name], you can type MENU then i can bring you to the main menu and help you:-).
    Rule Name: hobby
    Input Text: *
    Output Text: I like it too, seem like we can get along pretty quick [name]:-). you can type MENU then i can bring you to the main menu and help you.

Rule Name: main menu
Input Text: (Hello)
Input Text: Lost
Input Text: Help
Input Text: Menu
Input Text: Main Menu
Output Text: Hi [name], this is the main menu for my funtionalities in case you do not have a direction of your question. Pick one from the selection and try to greet with me if u feel lost again.
1. Learn more about communication and internet technology (lesson)
2. Ask questions
3. Build a simple network guide
4. Maths Jokes
5. Exit
  Rule Name: 1. Start Lesson
  Input Text: (First)
  Output Text: <Reminder><Only show once>

This lesson is not supposed to let user ask any question midway, u can as any question in the ask question function. Besides that, you should type CONTINUE if you want to hear about the lesson else MENU to back to main menu.

Nowadays, technology stuff is getting more and more in the society, but in actual fact that most of the smart gadget is connect with each other using communication and internet technolgy.

Rule Name: internet
Input Text: (Continue)
Output Text: Related to that, The most basic for communication and internet technology would be an Internet. Internet is actually the global system of interconnected computer networks which consists of network and devices.

Rule Name: www
Input Text: (Continue)
Output Text: Internet can be refers as World Wide Web(WWW), it can be easily access to when you type an Uniform Resource Locator(URL) in your web browser such as google chrome. Since internet is having Domain Name System(DNS) so that you only need to type the domain name for the website instead of IP address. Talk about internet, it is actually form by many networks together.

Rule Name: network
Input Text: (Continue)
Output Text: Networks is an essential component to form an internet. Usually it would be a client-server network which consist of server and client such as a computer or smartphone then they all wil bel connecting together with different or same topologies.

Rule Name: topology
Input Text: (Continue)
Output Text: Network topology is the arrangement of the elements of a communication network. for example, we have ring and bus topology for Local Area Network (LAN) whereas hub and spoke, point-to-point and mesh is mainly for Wide Area Network (WAN). Besides that, Metopolitan Area Network(MAN) is also one of the topology. All of these need to have at least a physical connection to form.

Rule Name: physical connection
Input Text: (Continue)
Output Text: Physical connection is refering to ethernet for example coble cabling, fiber-optic cable and wireless connection using bus or port. The most common is cheapest is copper cable which have types of Unshielded Twisted-Pair(UTP), Shielded Twisted-Pair(STP) and Coaxial Cable where usually UTP will have type of Straight-through cable and Crossover cable.

Rule Name: fiber optic and wireless
Input Text: (Continue)
Output Text: Fiber optic is rather expensive cable but the transmission speed is fast while it has type of single-mode fiber and multimode fiber. Hence, application of fiber optic cable includes enterprise networks, fiber-to-the home (FTTH), Long-Haul Network and submarine cable network. Wireless connection refers to WLAN that client connect to using wireless Network Interface Card (NIC) and Wireless Access Point(AP) but it will have some limitations including interference, coverage area, low security and shared medium. Any more you want to ask?

Rule Name: standard and protocols
Input Text: (Continue)
Output Text: Since every different device or system is connecting to together, they cannot understand each other, hence there will be standard and protocol in networking to make sure every devices can communicate with each other. POP3, TCP/IP, HTTP, FTP, SMTP is examples for protocols while IEEE is example for standard.

Rule Name: duplex
Input Text: (Continue)
Output Text: Topology is also having two mode which is full-duplex and half-duplex communication where full-duplex allow both end point to transmit data at the same time and half-duplex only allow one sender at a time. Beside that, physical connection can affect the bandwidth for all device which refers to internet speed.

Rule Name: vulnerabilities
Input Text: (Continue)
Output Text: Although communication and internet technology is being popular right now but it still having some vulnerabilities such as Technological Vulnerabilities, Configuration Vulnerabilities and Security Policy Vulnerabilities and it will lead to let cybercrime being commit.

Rule Name: cybercrime
Input Text: (Continue)
Output Text: Cybercrime refers to those crime commited via internet. Most of it is done by malware including trojan horse, virus and worm. If they exist in a computer or a system then it can execute network attacks.

Rule Name: network attack
Input Text: (Continue)
Output Text: Network attack have many type including Reconnaissance Attack, Denial of Service, Distributed Denial of Service and Access Attack where Access Attack have Password Attack, Trust Exploitation, Port Redirection and Man-in the-middle (MITM). All of this can be mitigate with some fundamental security methods.

Rule Name: security
Input Text: (Continue)
Output Text: Security is basic for a network and effective to network attack but it only can mitigate them but not completely prevent from it. Hence, Keep Backups, Upgrade, Update and

Patch, Authentication, Authorization and Accounting and Firewall is examples for security methods where firewall have type of Packet Filtering, Application Filtering, URL Filtering and Stateful Packet Inspection (SPI).

Rule Name: hardware
Input Text: (Continue)
Output Text: Hardware is necessary to form a network and the examples for it including firewall that I just mentioned, all the cables, router, gateway and server and NIC. Unfortunately, it also will lead to physical threat such as Maintenance Threat, Electrical Threat, Environmental Threat and Hardware Threat.

Rule Name: End of the lesson
Input Text: Continue
Output Text: Congrat! This is the end of the lesson, I had teach you everything I have in my knowledge base:-). What can I help you? If you have no idea, you can type MENU and I will bring you to the main menu.
Rule Name: _Stop
Input Text: (stop)
Output Text: The lesson has ended. You can type MENU then i can bring you to the main menu and help you:-).

Rule Name: 2. ask questions
Input Text: (Second)
Output Text: What questions you want to ask me [name]? If you have no direction I suggest you to start a lesson with me first in main menu.

Rule Name: Application Filtering
Input Text: Application Filtering
Output Text: Application filtering is the most sophisticated level of filtering performed by the firewall service and is especially useful in protecting the network against specific types of attacks such as malicious SMTP commands or attempts to penetrate the local DNS servers. Any more you want to ask?
Rule Name: Bandwidth
Input Text: Bandwidth
Output Text: Bandwidth is the maximum rate of data transfer across a given path. Any more you want to ask?
Rule Name: Bus Topology
Input Text: Bus Topology
Output Text: Bus topology is a topology for a Local Area Network (LAN) in which all the nodes are connected to a single cable. The cable to which the nodes connect is called a "backbone". If the backbone is broken, the entire segment fails. Any more you want to ask?
Rule Name: Client
Input Text: Client
Output Text: Client is a piece of computer hardware or software that accesses a service made available by a server as part of the client¡Vserver model of computer networks. Any more you want to ask?
Rule Name: Client-Server Network
Input Text: Client-Server Network
Output Text: A client-server network is the medium through which clients access resources and services from a central computer, via either a local area network (LAN) or a wide-area network (WAN), such as the Internet. Any more you want to ask?
Rule Name: Coaxial Cable
Input Text: Coaxial
Output Text: Coaxial cable is a type of electrical cable consisting of an inner conductor surrounded by a concentric conducting shield, with the two separated by a dielectric. It is used as transmission lines for radio frequency, video and data signals. Any more you want to ask?
Rule Name: Configuration Vulnerabilities
Input Text: Configuration Vulnerabilities
Output Text: Configuration Vulnerabilities might include unsecured user accounts, system accounts with easily guessed passwords, misconfigured internet services, unsecure default settings, and misconfigured network equipment. Any more you want to ask?
Rule Name: Copper Cabling
Input Text: (Copper Cabling)
Output Text: Copper cable uses electrical signals to pass data between networks while it is is cheap and flexible. There are three types of copper cable inlcuding coaxial, unshielded twisted pair and shielded twisted pair. Any more you want to ask?
Rule Name: Cybercrime
Input Text: (Cybercrime)
Output Text: Cybercrime is a crime that involves a computer and a network. The computer may have been used in the commission of a crime, or it may be the target. Example for cybercrime including Information theft, data loss and manipulation, identity theft and disruption of service. Any more you want to ask?
Rule Name: Data Loss and Manipulation
Input Text: (Data Loss and Manipulation)
Output Text: Data loss is refering to straight away damage or delete data whereas data manipulation is a fraudulent cyber activity wherein a malicious actor alters, tweaks, or modifies the valuable digital documents and critical data. Any more you want to ask?
Rule Name: Denial of Service
Input Text: (Denial of Service)

Output Text: Denial-of-Service (DoS) attack is one of network attack meant to shut down a machine or network, making it inaccessible to its intended users. DoS attacks accomplish this by flooding the target with traffic, or sending it information that triggers a crash. Any more you want to ask?
Rule Name: Distributed Denial of Service
Input Text: Distributed Denial of Service
Output Text: Distributed denial-of-service (DDoS) is similar to DoS but A DDoS attack is an attack in which multiple compromised computer systems attack a target, such as a server, website or other network resource, and cause a denial of service for users of the targeted resource. Any more you want to ask?
Rule Name: Environmental Threats
Input Text: Environmental Threats
Output Text: Environmental threats is one of the physical threat include temperature extremes (too hot or too cold) or humidity extremes (too wet or too dry). Any more you want to ask?
Rule Name: Fiber-Optic
Input Text: (Fiber-Optic)
Output Text: Fiber optic cable is a network cable that contains strands of glass fibers inside an insulated casing. They're designed for long-distance, high-performance data networking, and telecommunications. Compared to wired cables, fiber optic cables provide higher bandwidth and transmit data over longer distances. Single-mode and multimode fiber is types for fiber optic cable. Any more you want to ask?
Rule Name: Firewall
Input Text: Firewall
Output Text: Firewall is a network security system that monitors and controls incoming and outgoing network traffic based on predetermined security rules. Packet filtering, application filtering, URL filtering and stateful packet inspection (SPI) is examples for types of firewall. Any more you want to ask?
Rule Name: FTP
Input Text: (FTP)
Output Text: File Transfer Protocol (FTP) is a standard network protocol used for the transfer of computer files from a server to a client on a computer network. Any more you want to ask?
Rule Name: Gateway
Input Text: Gateway
Output Text: Gateway is a node (router) in a computer network, a key stopping point for data on its way to or from other networks. Thanks to gateways, we are able to communicate and send data back and forth. The Internet wouldn¡¦t be any use to us without gateways. Any more you want to ask?
Rule Name: Hardware
Input Text: Hardware
Output Text: Hardware refers to the physical elements of a computer. This is also sometime called the machinery or the equipment of the computer. Router, server, gateway, NIC and firewall is examples of hardware. Any more you want to ask?
Rule Name: HTTP
Input Text: (HTTP)
Output Text: Hypertext Transfer Protocol (HTTP) is an application layer protocol for distributed, collaborative, hypermedia information systems. Any more you want to ask?
Rule Name: IoT
Input Text: (IoT)
Output Text: Internet of things describes the network of physical objects ¡§things¡¨ that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the Internet. Any more you want to ask
Rule Name: IPv4
Input Text: IPv4
Output Text: Internet Protocol version 4 (IPv4) is the fourth version of the Internet Protocol (IP). It is one of the core protocols of standards-based internetworking methods in the Internet and other packet-switched networks. Example of a IPv4 address would be 144.237.7.39. Any more you want to ask?
Rule Name: IPv6
Input Text: IPv6
Output Text: Internet Protocol version 6(IPv6) is the most recent version of the Internet Protocol(IP), the communications protocol that provides an identification and location system for computers on networks and routes traffic across the Internet. Example of a IPv6 address would be 606d:74a0:78da:0b39:0db9:8c44:9717:751f. Any more you want to ask?
Rule Name: LAN
Input Text: (LAN)
Output Text: Local area network is a computer network that interconnects computers within a limited area such as a residence, school, laboratory, university campus or office building. Any more you want to ask?
Rule Name: Maintenance Threats
Input Text: Maintenance Threats
Output Text: Maintenance threats is one of the physical threat that include poor handling of key electrical components (electrostatic discharge), lack of critical spare parts, poor cabling, and poor labeling. Any more you want to ask?
Rule Name: Malware
Input Text: Malware
Output Text: Malware is the collective name for a number of malicious software existing in a computer, it typically consists of code developed by cyberattackers, designed to cause extensive damage to data and systems or to gain unauthorized access to a network. Any more you want to ask?
Rule Name: MAN

Input Text: (MAN)
Output Text: Metropolitan area network(MAN) is a computer network that interconnects users with computer resources in a geographic region of the size of a metropolitan area. Any more you want to ask?
Rule Name: Network
Input Text: Network
Output Text: Computer network is a group of computers that use a set of common communication protocols over digital interconnections for the purpose of sharing resources located on or provided by the network nodes. Any more you want to ask?
Rule Name: Network Attack
Input Text: Network Attack
Output Text: Network attack refers to actions taken through the use of computer networks to disrupt, deny, degrade, or destroy information resident in computers and computer networks, or the computers and networks themselves. Any more you want to ask?
Rule Name: Packet Filtering
Input Text: Packet Filtering
Output Text: Packet filtering is a firewall technique used to control network access by monitoring outgoing and incoming packets and allowing them to pass or halt based on the source and destination Internet Protocol (IP) addresses, protocols and ports. Any more you want to ask?
Rule Name: Physical Threat
Input Text: Physical Threat
Output Text: Physical threat is mean by a threat actor damaging the network resources physically. If network resources can be physically compromised, a threat actor can deny the use of network resources. There are four classes of physical threats including hardware threats, environmental threats, electrical threats and maintenance threats. Any more you want to ask?
Rule Name: POP3
Input Text: (POP3)
Output Text: Post Office Protocol(POP3) is an application-layer Internet standard protocol used by e-mail clients to retrieve e-mail from a mail server. Any more you want to ask?
Rule Name: Protocol
Input Text: Protocol
Output Text: Protocol is an established set of rules that determine how data is transmitted between different devices in the same network, it is similar to a language translator but in computer language form. Any more you want to ask?
Rule Name: Reconnaissance Attack
Input Text: Reconnaissance Attack
Output Text: Reconnaissance attacks are general knowledge gathering attacks. These attacks can happen in both logical and physical approaches. Any more you want to ask?
Rule Name: Ring
Input Text: Ring
Output Text: Ring topology is a network configuration where device connections create a circular data path. Each networked device is connected to two others, like points on a circle. Any more you want to ask?
Rule Name: Router
Input Text: Router
Output Text: Router is a networking device that forwards data packets between computer networks. Any more you want to ask?
Rule Name: Security
Input Text: Security
Output Text: Network security consists of the policies, processes and practices adopted to prevent, detect and monitor unauthorized access, misuse, modification, or denial of a computer network and network-accessible resources. Any more you want to ask?
Rule Name: Security Policy Vulnerabilities
Input Text: Security Policy Vulnerabilities
Output Text: Security Policy Vulnerabilities might include lack of a written security policy, politics, lack of authentication continuity, logical access controls not applied, software and hardware installation and changes not following policy, and a nonexistent disaster recovery plan. Any more you want to ask?
Rule Name: Server
Input Text: Server
Output Text: Server is a piece of computer hardware or software that provides functionality for other programs or devices. Any more you want to ask?
Rule Name: Shielded Twisted-Pair
Input Text: (Shielded Twisted-Pair)
Output Text: Shielded twisted pair (STP) is similar to Unshielded Twisted Pair (UTP) but every two individual wires will be covered with a foil shielding, which prevents electromagnetic interference, thereby transporting data faster. Any more you want to ask?
Rule Name: SMTP
Input Text: (SMTP)
Output Text: Simple Mail Transfer Protocol(SMTP) is a communication protocol for electronic mail transmission. Any more you want to ask?
Rule Name: Standard
Input Text: Standard
Output Text: A standard is a set of specifications for hardware or software, agreed upon by academic and industry contributors. Any more you want to ask?
Rule Name: Stateful Packet Inspection (SPI)

Input Text: (Stateful Packet Inspection)
Output Text: Stateful packet inspection (or dynamic packet filtering) is a technology that monitors active connections and checks whether incoming data packets correspond to these connections. It then decides whether to grant or deny permission for them to pass the firewall. Any more you want to ask?
Rule Name: TCP/IP
Input Text: (TCP/IP)
Output Text: TCP/IP is a set of standardized rules that allow computers to communicate on a network such as the internet. Any more you want to ask?
Rule Name: Technological Vulnerabilities
Input Text: Technological Vulnerabilities
Output Text: Technological Vulnerabilities might include TCP/IP Protocol weaknesses, Operating System Weaknesses, and Network Equipment weaknesses. Any more you want to ask?
Rule Name: Topology
Input Text: Topology
Output Text: Network topology is the arrangement of the elements of a communication network. Network topology can be used to define or describe the arrangement of various types of telecommunication networks, including command and control radio networks, industrial fieldbusses and computer networks. Any more you want to ask?
Rule Name: Trojan Horse
Input Text: Trojan Horse
Output Text: Trojan horse a harmful piece of software that looks legitimate. Unlike viruses and worms, Trojan horses do not reproduce by infecting other files. They self-replicate. Trojan horses must spread through user interaction such as opening an email attachment or downloading and running a file from the internet. Any more you want to ask?
Rule Name: Unshielded Twisted-Pair
Input Text: (Unshielded Twisted-Pair)
Output Text: Unshielded Twisted pair cabling is a type of wiring in which two conductors of a single circuit are twisted together for the purposes of improving electromagnetic compatibility without having any other protection. Any more you want to ask?
Rule Name: URL
Input Text: (URL)
Output Text: Uniform Resource Locator (URL), colloquially termed a web address, is a reference to a web resource that specifies its location on a computer network and a mechanism for retrieving it. Any more you want to ask?
Rule Name: URL Filtering
Input Text: (URL) Filtering
Output Text: URL filtering is one of the firewall which limits access by comparing web traffic against a database to prevent employees from accessing harmful sites such as phishing pages. Any more you want to ask?
Rule Name: Virus
Input Text: Virus
Output Text: Computer virus is a type of malware that propagates by inserting a copy of itself into, and becoming part of, another program. It spreads from one computer to another, leaving infections as it travels. Any more you want to ask?
Rule Name: Vulnerability
Input Text: Vulnerability
Output Text: Vulnerability is the degree of weakness in a network or a device. Some degree of vulnerability is inherent in routers, switches, desktops, servers, and even security devices. Typically, the network devices under attack are the endpoints, such as servers and desktop computers. Any more you want to ask?
Rule Name: WAN
Input Text: (WAN)
Output Text: Wide area network(WAN) is a telecommunications network that extends over a large geographic area for the primary purpose of computer networking. Any more you want to ask?
Rule Name: World Wide Web (WWW)
Input Text: (World Wide Web)
Output Text: World Wide Web(WWW), commonly known as the Web, is an information system where documents and other web resources are identified by Uniform Resource Locators, which may be interlinked by hypertext, and are accessible over the Internet. Any more you want to ask?
Rule Name: Worm
Input Text: Worm
Output Text: Computer worms are similar to viruses in that they replicate functional copies of themselves and can cause the same type of damage. In contrast to viruses, which require the spreading of an infected host file, worms are standalone software and do not require a host program or human help to propagate. Any more you want to ask?
Rule Name: Straight-through cable
Input Text: (Straight-through)
Output Text: Straight-through cable is a type of twisted pair cable that is used in local area networks to connect a computer to a network hub such as a router. Any more you want to ask?
Rule Name: Crossover cable
Input Text: Crossover
Output Text: Crossover cable is one of the unshielded twisted-pair (UTP) used to connect computing devices together directly. It is most often used to connect two devices of the same type. Any more you want to ask?
Rule Name: Enterprise Network
Input Text: Enterprise Network
Output Text: Enterprise network consists of physical and virtual networks and protocols that serve the dual purpose of connecting all users and systems on a local area network (LAN) to applications in the data center and cloud as

well as facilitating access to network data and analytics. Mostly it is build with fiber-optic cable. Any more you want to ask?
Rule Name: Fiber-to-the-home
Input Text: (Fiber-to-the-home)
Output Text: Fiber to the home (FTTH) is the installation and one of the application of optical fiber from a central point directly to individual buildings such as residences, apartment buildings and businesses to provide high-speed internet access. Any more you want to ask?
Rule Name: Long-Haul Network
Input Text: (Long-Haul)
Output Text: Long-haul network is one of the fiber networks connect cities and countries throughout the world. Today, these networks typically range from a few hundred to several thousand kilometers. Any more you want to ask?
Rule Name: Submarine Cable Network
Input Text: (Submarine Cable Network)
Output Text: Submarine networking is the process by which data is carried on subsea cables to connect continents. It mostly uses fiber optic cable for high data transmission speed. Any more you want to ask?
Rule Name: Single-Mode fiber
Input Text: (Single-Mode)
Output Text: Single mode fiber is optical fiber that is designed for the transmission of a single ray or mode of light as a carrier and is used for long-distance signal transmission. Any more you want to ask?
Rule Name: Multimode fiber
Input Text: Multimode
Output Text: Multimode fiber (MMF) is a kind of optical fiber mostly used in communication over short distances, for example, inside a building or for the campus. Multimode fiber optic cable has a larger core, typically 50 or 62.5 microns that enables multiple light modes to be propagated. Any more you want to ask?
Rule Name: Shared medium
Input Text: Shared medium
Output Text: Shared medium is a medium of information transfer that serves more than one user at the same time. For example, WLANs operate in half-duplex, which means only one device can send or receive at a time. Many users accessing the WLAN simultaneously results in reduced bandwidth for each user. Any more you want to ask?
Rule Name: Wireless network
Input Text: Wireless
Output Text: Wireless network is a computer network that uses wireless data connections between network nodes. Any more you want to ask?
Rule Name: Interference
Input Text: Interference
Output Text: Copper cable and wireless connection both are having some interference issues. For example copper cable signal can be interupt by electromagnetic interference (EMI) and radio frequency interference (RFI) while wireless connection ben be disrupted by many common devices. Any more you want to ask?
Rule Name: Wireless access Point(AP)
Input Text: (Wireless access point)
Output Text: Access point is a device that creates a wireless local area network, or WLAN, usually in an office or large building. An access point connects to a wired router via cable. Any more you want to ask?
Rule Name: Network Interface Card (NIC)
Input Text: (NIC)
Output Text: Network interface card (NIC) is a hardware component without which a computer cannot be connected over a network. It is a circuit board installed in a computer that provides a dedicated network connection to the computer. Any more you want to ask?
Rule Name: Upgrade, Update and Patch
Input Text: (Upgrade, Update and Patch)
Output Text: Upgrade, Update and Patch is one of the security way which refers to enterprises need to keep current with the latest versions of antivirus software. Any more you want to ask?
Rule Name: Authentication, Authorization and Accounting
Input Text: (Authentication, Authorization and Accounting)
Output Text: Authentication, authorization, and accounting (AAA) is one of the the primary framework for network security services. AAA will control who is permitted to access a network (authenticate), what actions they perform while accessing the network (authorize), and making a record of what was done while they are there (accounting). Any more you want to ask?
Rule Name: Keep Backups
Input Text: Keep Backups
Output Text: Backing up device configurations and data is one of the most effective ways of protecting against data loss. Backups should be performed on a regular basis as identified in the security policy. Data backups are usually stored offsite to protect the backup media if anything happens to the main facility. Any more you want to ask?
Rule Name: Password Attack
Input Text: Password Attack
Output Text: Password attack is Implemented using brute force, trojan horse, and packet sniffers to get someone password. Any more you want to ask?
Rule Name: Trust Exploitation
Input Text: Trust Exploitation
Output Text: Trust Exploitation refers to an attacker uses privileges which have been granted to a system in an unauthorized manner. Any more you want to ask?
Rule Name: Port Redirection

Input Text: Port redirection
Output Text: Port redirection attack is another type of attack based on trust exploitation. The attacker uses a compromised host to gain access through a firewall that would otherwise be blocked. Any more you want to ask?
Rule Name: Man-in-the-middle
Input Text: (Man-in-the-middle)
Output Text: Man in the middle (MITM) attack is a general term for when a perpetrator positions himself in a conversation between a user and an application¡Xeither to eavesdrop or to impersonate one of the parties, making it appear as if a normal exchange of information is underway. Any more you want to ask?
Rule Name: Hub and spoke
Input Text: Hub and spoke
Output Text: Hub and spoke topology refers to a distribution method in which a centralized "hub" exists. Everything either originates in the hub or is sent to the hub for distribution to consumers. It is mostly use for WAN. Any more you want to ask?
Rule Name: Mesh
Input Text: Mesh
Output Text: Mesh network is a local network topology in which the infrastructure nodes connect directly, dynamically and non-hierarchically to as many other nodes as possible and cooperate with one another to efficiently route data from/to clients. Any more you want to ask?
Rule Name: Half-duplex communication
Input Text: (Half-duplex)
Output Text: Half-duplex devices can only transmit in one direction at one time. With half-duplex communication mode, data can move in two directions, but not at the same time. Any more you want to ask?
Rule Name: Full-duplex communication
Input Text: (Full-duplex)
Output Text: Full-duplex communication is refering to data transmission simultaneously bi-directional. The end devices can transmit and receive simultaneously. Any more you want to ask?
Rule Name: _no question
Input Text: (no)
Output Text: You can type MENU then i can bring you to the main menu and help you:-).
Rule Name: Creator
Input Text: Creator
Output Text: My creater is named Sia De Long, he is currently studying in Asia Pacific Unirversity at his hometown, Kuala Lumpur in Malaysia. Any more you want to ask?
Rule Name: Disruption of Service
Input Text: Disruption of service
Output Text: Disruption of service is refering to system unable to provide any customer service anymore mostly due to DoS or DDoS. Any more you want to ask?
Rule Name: Point-to-point
Input Text: (Point-to-point)
Output Text: Point-to-point connection refers to a communications connection between two communication endpoints or nodes. An example is a telephone call, in which one telephone is connected with one other, and what is said by one caller can only be heard by the other. Any more you want to ask?
Rule Name: Bus
Input Text: Bus
Output Text: Bus is a communication system that transfers data between components inside a computer, or between computers. Any more you want to ask?
Rule Name: Port
Input Text: Port
Output Text: Port serves as an interface between the computer and other computers or peripheral devices. Any more you want to ask?
Rule Name: Packet
Input Text: Packet
Output Text: In telecommunications and computer networking, a network packet is a formatted unit of data. Any more you want to ask?
Rule Name: Electrical Threats
Input Text: Electrical Threats
Output Text: Electrical threats is one of the physical threat include voltage spikes, insufficient supply voltage (brownouts), unconditioned power (noise), and total power loss. Any more you want to ask?
Rule Name: IEEE
Input Text: (IEEE)
Output Text: Institute of Electrical and Electronics Engineers Standards Association is an Operating Unit within IEEE that develops global standards in a broad range of industries.
Rule Name: Access Attack
Input Text: Access Attack
Output Text: Access attacks?is referring to unauthorized manipulation of data, system access, or user privileges. Any more you want to ask?
Rule Name: Domain Name System (DNS)
Input Text: (Domain Name System)
Output Text: Domain Name System (DNS) is the Internet's system for mapping alphabetic names to numeric Internet Protocol (IP) addresses like a phone book maps a person's name to a phone number so that you do not need to type a whole IP address to browse a website. Using the www.example.com URL, example.com is the domain name, and www is the hostname. Any more you want to ask?

Rule Name: Identity Theft
Input Text: Identity Theft
Output Text: Identity theft is the crime of obtaining the personal or financial information of another person to use their identity to commit fraud, such as making unauthorized transactions or purchases. Any more you want to ask?
Rule Name: Information Theft
Input Text: Information theft
Output Text: Information theft is similar to identity theft but it is mainly focus on stealling an organization information which is also one of the cybercrime. Any more you want to ask?
Rule Name: 3. build a private network
Input Text: (Third)
Output Text: What type of network you are going to build [name]? Do you want your server have a network?
Rule Name: Have Server
Input Text: (yes)
Output Text: I will suggest you to build a ring network. First, you need to connect one of the computers to the server with a straight-through cable then using another straight-through cable connect the same server with another computer. Finally, two of the computers will be connect together with a crossover cable. Of course, I suggets that you should install firewall in software form as well. Then your private network should be complete now :-)! You can type MENU then i can bring you to the main menu to help you.
Rule Name: No server
Input Text: (no)
Output Text: I will suggest you to build a ring network. You just need to connect all computers with crossover cable with each other and form a circle. Of course, I suggets that you should install firewall in software form as well. Then your private network should be complete now :-)! You can type MENU then i can bring you to the main menu to help you.
Rule Name: 4. jokes
Input Text: (Fourth)
Output Text: Are you ready for a joke [name]?
Rule Name: no
Input Text: (no)
Output Text: I see you get enough for my jokes:-). You can type MENU then i can bring you to the main menu and help you.
Rule Name: yes
Input Text: (yes)
Output Text: <?csharp Console.Write(code.jokes()); ?> Do you want another joke?
Rule Name: 5.Exit
Input Text: (Fifth)
Output Text: <exit>

Rule Name: _exit
Input Text: (Close)
Output Text: Are you sure you want to exit the application?
Rule Name: yes
Input Text: (yes)
Output Text: Bye bye, It is fun to chat with you [name]:-)!
<agent.pasue 360>
<exit>
Rule Name: no
Input Text: (no)
Output Text: I will send you to the main menu now:-).
<agent.pause 360>
<send main menu>
Rule Name: else
Input Text: *
Output Text: I really need a yes or no. Do you want to exit the application?

Rule Name: _bored
Input Text: _bored
Output Text: Hey [name], I am still here. You can type MENU then i can bring you to the main menu and help you :-).

Rule Name: _blank
Input Text: _blank
Output Text: Do you type ENTER key accidently [name]? You can type MENU then i can bring you to the main menu and help you :-).

4.2 C# code

4.2.1 greeting

```
int hour = DateTime.Now.Hour;
string greet = "";

if (hour >= 5 && hour < 12)
{
   greet = "Good morning";
}
else if (hour >= 12 && hour < 16)
{
   greet = "Good afternoon";
}
else if (hour >= 16 && hour <= 22)
{
   greet = "Good evening";
}
else
{
   greet = "Hello";
}

return greet;
```

4.2.2 jokes

```
string [] joke = new string[] {
"I just saw my math teacher lock himself in his office with a piece of graph paper. I think he must be plotting something.",
"Parallel lines have so much in common. It is a shame they will never meet.",
"I do not get the point of decimals. I am more partial to fractions.",
"Old mathematicians never die. They just disintegrate",
"When algebra teachers retire, how do they cope with the aftermath?",
"I knew a mathematician who could not afford lunch. He could binomial.",
"What did the triangle say to the circle? You are pointless.",
"How does a mathematician plow fields? With a pro-tractor.",
"What is a math teacher favourite kind of tree? Geometry",
"I had an argument with a 90 degree angle. It turns out it was right.",
"Did you hear about the over-educated circle? It has 360 degree!",
"What do mathematicians do after a snowstorm? Make snow angles!",
"What do geometry teachers have decorating their floor? Area rugs!",
"Why was math class so long? The teacher kept going off on a tangent.",
"How do you solve any equation? Multiply both sides by zero.",
"What tool is best suited for math? Multi-pliers.",
"Why was six afraid of seven? Because seven, eight, nine!",
"Have you heard the one about the statistician? Probably.",
"You should never start a conversation with Pi. It will just go on and on forever.",
"What do you get if you divide the circumference of a jack-o-lantern by its diameter? Pumpkin Pi.",
"What is the official animal of Pi day? The Pi-thon",
"What do you call two friends who love math? Algebros.",
"I poured root beer into a square cup. Now I have beer.",
"Why do plants hate math? Because it gives them square roots.",
"Why does algebra make you a better dancer? Because you can use the algo-rhythm!",
"Which snakes are good at math? Adders.",
"Who is the king of the pencil case? The ruler."};

Random rnd = new Random();
int index = rnd.Next(0, 26);
return joke[index];
```

Chapter 5: Conclusion

In a nutshell, the problem stated can be solved but not completely with the system developed by the team due to the version of the software is too old and there is a time limit for this assignment. However, the final product that developed by the team is been through all the effort and try to make it as ideal as possible.

The team stated out some of the improvement that can give to NET, the mainly is about let NET do not need rely on main menu to give any help to the user so that it can be more similar to human conversation.

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Appendices

Workload Matrix

No	Task	Sia De Long (TP060810)	Chieng Shoa Wei (TP055763)
1.	Aim/abstract	100%	
2.	Problem statement	50%	50%
3.	Literature review for Expert System	50%	50%
4.	Literature review for Chatbot	50%	50%
5.	Semantic network	100%	
6.	Development of Verbot	100%	
7.	Test plan / Screenshot of special features	100%	
8.	User Acceptance testing in questionnaire	100%	
9.	Results of user acceptance testing in graphs format	100%	
10.	Coding Implementation	100%	
11.	Conclusion	100%	
12.	References	50%	50%
13.	Workload Matrix	100%	
14.	Proposal	50%	50%