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UNIVERSITI TEKNOLOGI MALAYSIA

SCHOOL OF COMPUTING
Faculty of Engineering

SECP1513 – 07
TECHNOLOGY & INFORMATION SYSTEM

PROJECT 2
Low Fidelity Prototype

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Introduction

FIDELITY PROTOTYPE AND AWS ARCHITECTURE DESIGN

We are provided a low-fidelity prototype in this project. A low-fidelity prototype is a concept image that is typically drawn by hand on paper or digitally. As a result, we used the proto.io software to digitally demonstrate our app. We designed the AWS Architecture with various AWS services like AWS IAM,AWS S3,AWS Dynamo, and many more that showcast the ecosystem of the entire system in order for it to work smoothly and securely. We used Internet of Things(IOT), which is one of the fourth Industry Revulsion technologies in this project. We have designed a Smart IOT Plug with this IOT. This Smart IOT Plug is based on cloud computing, with data saved in the AWS database service centre as a cloud.

SMART IOT PLUG

A Smart IOT plug is a power receptacle that plugs into a standard plug socket and connects to your smart home network, ability to control whatever you put into it using a smartphone app.Example like,simply plug the smart plug into an outlet and link it to your Wi-Fi network using the app that's suitable together with your smartphone or tablet. Simply plug an appliance, like a lamp or fan, into your smart plug once it's been connected, so control the device via the app.Smart plugs turn your "simple" electronics and appliances into "smart" ones for a little fee. With smart plugs, the possibilities are unlimited. Even if you get out of bed in the morning, you can turn off the lights without getting out of bed, manage your heater from another room, or schedule your coffee machine.

So,this Smart IOT Plug we created,comes with an app that can be downloaded from the Play Store or App Store. The elderly and young children were the primary targets of this Smart IOT Plug's development. It is difficult for older persons to relocate from one location to another. As a result, they may control all of their electrical appliances from their smartphone with this Smart IOT Plug. Young children may not be aware of whether or not their hand is moist. They will simply turn on the plug with their hand without even realising it. They may control which plug should be on

using the Smart IOT Plug system. This will keep children's damp hands from causing an electrical shock.

To utilise the Smart IOT Plug app, the user must first connect their smartphone to a reliable internet connection. The app has a simple and colourful UI that we designed. The consumer will have a simpler time using or identifying the appliance, as well as setting up all of their household appliances in the app. The places or areas that can be found in a house have been divided into groups. For instance, consider the living room, study room, kitchen, and other places. This will make it much easier for people to organise their home appliances into groups. Our technology is not just present; in the future, we will introduce the Smart IOT Plug,which will be able to communicate with home assistants such as Google Assistant and Amazon Alexa.

Detail steps and discussion

Our team recorded the steps, procedures, journey and progress of the project using a log journal. Below is the log journal of the project;

Detail Description

Client Problem

During this pandemic, many doctors and nurses had chosen to quit their job due to excessive amount of stress and also health risks. Our client, who is the Chief Executive Officer (CEO) of a hospital, took a survey from his staff and found out that the lack of manpower had caused difficulty taking care of many patients. In addition to the presence of the pandemic, the number of patients admitted to hospital had increased drastically. In order to combat with this issue, the CEO is looking for solution in order to ease the workload of its staff by making it easier for patients to control their environment, such as controlling their air-conditioner, fan and air purifier remotely while on their bed, without needing the help of nurses through one device. The CEO is currently looking for a product that allows patients to control their appliances through one smartphone that is fool-proof, multifunction availability and also has a reasonable price.

Solution to client

One modern solution we came up with in order to fulfil the need of the CEO is a product called Smart IOT Plug. This product falls in the category of being a 4th Industrial Revolution technology which is the Internet of Things. IOT is a network of interconnected computing devices, electronics, things, animals, and people with unique IDs (UIDs). It also has the ability to communicate without requiring human-to-human or human-to-computer engagement. By applying the IOT concept in our project, we had developed the Smart IOT Plug that has the ability to makeshift a simple device into a smart device such as charger, air conditioner, fan and many more. The Smart IOT plug is essentially a normal plug but with more functionality, automation and connection. With this Smart IOT Plug, every corner of your ecosystem is accessible as long as it is connected to the Internet because it uses the IOT technologies. What is even better is that it is also accessible even though you are not in close proximity with the product. This product could revolutionise the whole market and could potentially make the wired environment die out. When a product is attached into the socket, it allows users to control their appliances through their smartphone.

Based on the IOT concept, when you connect any device with the Internet, it enables us to collect, process and send data from the input device without any human intervention. With the help of the Internet, sending data through a network regardless of distance from the product is effortless and opens up the possibility of managing and monitoring appliances remotely. One of the examples that could be given is that you can remotely switch off the air purifier without moving off the bed. Other than that, you can control the brightness of the lamp without even moving an inch. Lastly, you can also set a timer for lights to turn off in order to save electricity. This Smart IOT Plug uses cloud computing technologies where the data and information will be organised and stored in Amazon Web Server (AWS). Data will be collected from the input of the user and will be broken into smaller chunks called packets to be sent to AWS. Each packet will contain the address of the origin and the destination address similar to postage service. Upon arriving at the destination, the receiving computer (AWS) will assemble the data and then it will process and transfer back the packets to the original destination based on the address. The cycle will be repeated until it reaches the output and the Smart IOT Plug will process the output.

Problem with smart plug iot

The IOT smart plug has a lot of benefits, but there are also some problems that arise when using the IOT smart plug. One of the problems with the IOT smart plug is that it has some difficulty in connecting to the appliances due to not being very compatible with other varieties of devices. This has caused the user to have some discomfort when using the device, especially when trying to access appliances or devices in the house when they are outside or inside the house itself. Other than that, IOT smart plugs might have a high chance of getting hacked from compromised devices that have access to confidential data. This causes loss in trust between the user and the company, hence making the IOT smart plug not a reliable device for people to use and also might risk users' personal information such as bank number or password that could lead to danger and loss for the users. The company can also get sued due to the lack of security for client's private information causing the company to be in debt and in the worst case, closing down businesses. IOT smart plugs also face problems such as lack of intelligent analysis. This causes data that is input into the system not being able to properly analyse and creating inaccurate results. This would cause clients to look down on the company quality production of the IOT smart plug causing the company to be seen as unprofessional and not recommended by new users. The IOT smart plug might also be too complicated for users to use and understand. This causes the user to avoid trying the device despite not knowing about it in more detail. Users who need quick access to the appliance and devices would find this very troublesome. For example, families who have small children need quick access to appliances in the house. In conclusion, understanding the problem

that arises when using the IOT smart plug might help the company to understand and see the perspective of the users and make it a more fun and enjoyable experience for the users.

Solution for smart iot problem

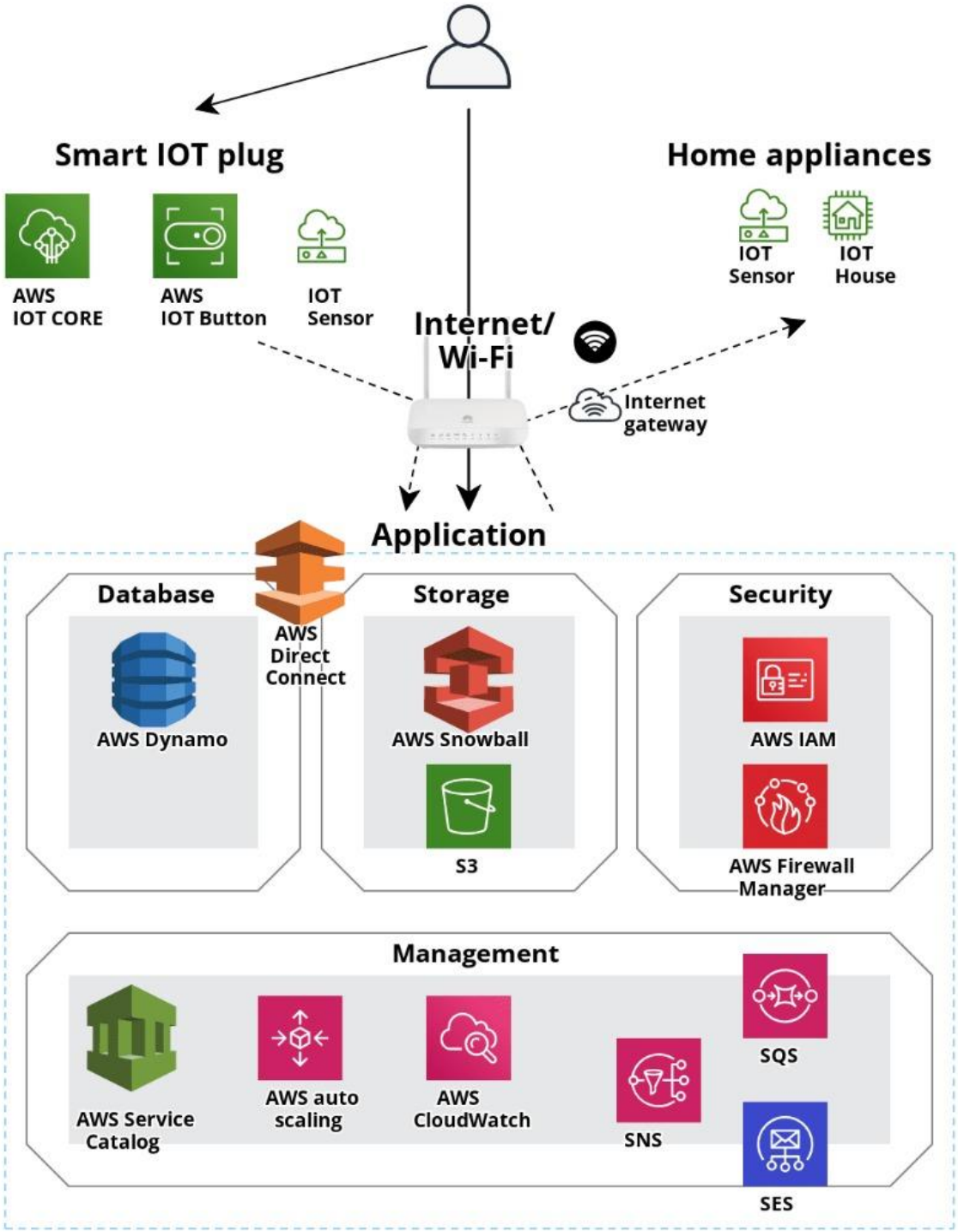
A way to solve the issue regarding the connectivity issue when connecting the IOT smart plug to other appliances is for the company to create a unified controller, where it enables the user to control a variety of multipurpose smart home devices. For example, ALYT hub. A constant smooth power supply is also another way to solve this problem. For example, tools like Ossia's Cota are revolutionary wireless connections that give out power while using the WIFI. It connects every powered device to the internet and controls, monitors and maintains the devices connectivity in a more stable and efficient way. The company came up with a solution to solve the IOT smart plug regarding the high chance of getting hacked from compromised devices that have access to confidential data by using more complicated cloud security components that are difficult to breach into. For example, AWS IAM. The component controls access to AWS resources in a more secure way. This enables the ability to set up and govern user authentication services as well as create a restricted access to specific groups of users that use cloud resources. The use of blockchain technology can also be used to avoid the IOT smart plug from being hacked because it enables devices across the internet to send data to private blockchain networks to create tamper-resistant records of shared transactions. This provides a much more robust level of encryption that makes it impossible for breaches to overwrite data that had already existed. A way to solve the issue regarding the lack of intelligent analysis is for the IOT smart plug to be equipped with a proper analytical tool that has an algorithm that produces accurate results. This helps by making sure that the data that is accepted is accurate enough for the IOT smart plug to analyse and produce proper results that can ensure no errors. A solution to solve the IOT smart plug being too complicated for users to use is by having a design that is easy to use and understand. By making the IOT smart plug more user-friendly, it will be much more manageable for users to use it. It also avoids unnecessary anxiety for users. It also helps the company in increasing their skills in problem-solving and face tasks given in a more professional and sophisticated way.

Teamworking

Introduction was written by Vinodh A/L Nadarajah, in which he had written a rough idea of the whole report that had some correlation from the elective subtopics. Meanwhile, Ryan was assigned to write detailed descriptions of problems and solutions that arise in the IOT smart plug device. The AWS architecture design system was designed by Mohamed Ziyaafser bin Mohd.

Zinnah and the ecosystem was explained with full details. Additionally, Muhammad Kamil Eizaz bin Othman drew the low-fidelity prototype mock-up. Other than that, Muhammad Syahmi bin Saleh was assigned to write the reflection of the whole project in the report. Last but not least, everyone has to record and take screenshots of their own work even when editing the prototype for documentation purposes.

AWS Architecture and Explanation



The figure above illustrates the entire ecosystem of AWS Architecture Design for the Smart IOT plug. This ecosystem includes all the AWS services needed to support the entire AWS

platform for the Smart IOT plug in cloud computing. From this illustration, our client and users may easily understand how the project is related to the cloud computing system, as this diagram shows the AWS services involved in each phase from user till appliances (input till output). The architecture of AWS is basically a hybrid of Service Oriented Architecture (SOA) and Event Driven Architecture (EDA). The architecture can be divided into two major primary elements, the front-end user, which are the user infrastructures and another element is back-end user which consist of few components on a remote server such as applications, database, storage, security and management.

From the diagram, it can be seen that the front-end user is the Smart IOT plug and home appliances. This is because it has interfaces and devices in which users can access. For the Smart IOT plug to function, AWS IOT core, AWS IOT button and IOT sensor has been installed in it. AWS IOT Core is the main service to connect the IOT device to the AWS services and to the home appliances that use AWS services as well. The AWS IOT button is used to ease the work in making the Smart Plug to function well without the need to write the specific code. This enables the Smart Plug to directly connect with cloud platform ones it is turned on and disconnected when its off easily. This also saves cost and effort to generate the code. Moving on is the IOT sensor, this service is used to connect the device used with the cloud as it sends information in a signal form when the user enables it.

Moving on, the other front end user is the home appliances. In order for the home appliances to function and get information from the application and Smart IOT Plug, few AWS services are connected and programmed as well in the cloud architecture. First IOT sensor is used to get any kind of information and signal then implement the signal to function the appliance according to users needs. Besides, IOT house is used in the cloud services to provide users edged based software to connect the appliances to their data, information gained.

Then, the backend user which is the cloud services used in applications and in the cloud platform, to function the smart plug well with the application and then send the information to home appliances. AWS Direct Connect is used as one of the AWS services as it helps in using the Internet to utilise the AWS cloud services. As mentioned earlier, there are few subcomponents in the backend cloud architecture to smoothen the process in cloud platform, which are;

1. Application

The software running behind an application is classified as the back-end user. For the Smart IOT plug, an application is used in order to perform specific adjustments to the home

appliances like increasing the fan’s speed, increasing the light bulb’s brightness and so on. This makes the users feel convenient as it satisfies the client problem to make home appliances accessible to users in an easy way. During this process, this application takes data from the Smart IOT plug's sensors and delivers it back to the home appliances based on the user's desired modification. Many other primary components have been used in conjunction with the cloud platform to create cloud activity.

2. Database

For the database, one AWS service is used which is the AWS DynamoDB. This service is a serverless, fully managed key-value NoSQL database built to run high-performance applications at any size. This component contributes to the project by providing data and makes the application run smoothly.

3. Storage

In storage, two AWS services are used, which are AWS Snowball and S3. AWS Snowball is used as it allows to deliver AWS computing services and storage capabilities to the AWS platform and applications. It also allows the transfer of data in and out of AWS by using secure, robust devices. Besides, S3 which is Amazon Simple Storage Service Glacier is used for the storage of data archiving and to back up the data. It is a low-cost cloud storage option for data.

4. Security

In the aspect of security in the back end, 2 AWS services is used, which are AWS IAM and AWS Firewall Manager. Cloud security is one of the most prioritized in AWS cloud. AWS Identity and Access Management (IAM) is a web service that allows you to regulate access to AWS services in a secure manner. It allows you to set up and govern user authentication services, as well as restrict access to a specific group of users who use your AWS resources. IAM allows you to control and safeguard access to AWS services and resources. Besides, with the use of AWS Firewall Manager, with just setting up the safeguards once using Firewall Manager, and the service will apply them across all your accounts and resources, even as you add new accounts and resources.

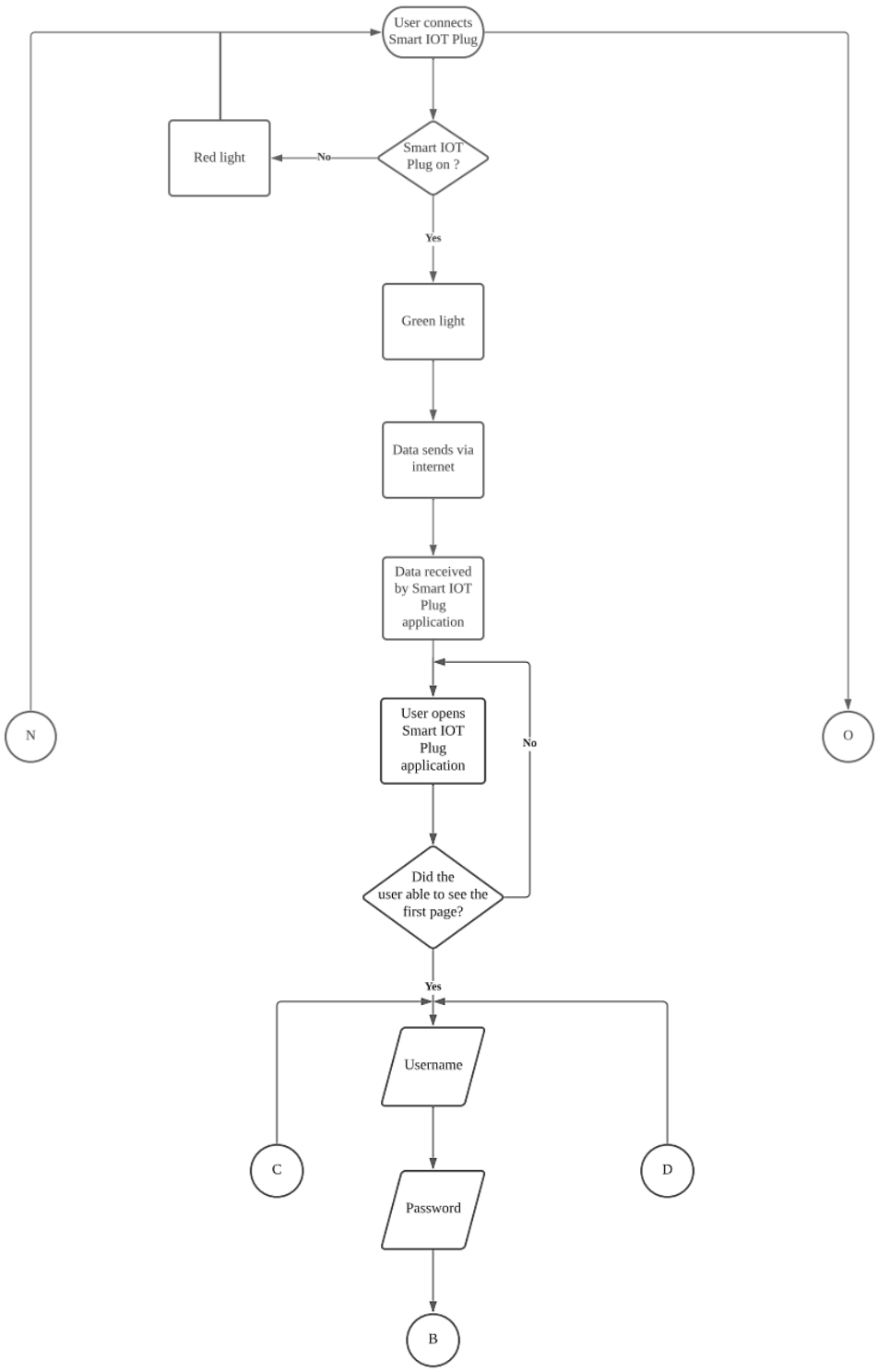
5. Management

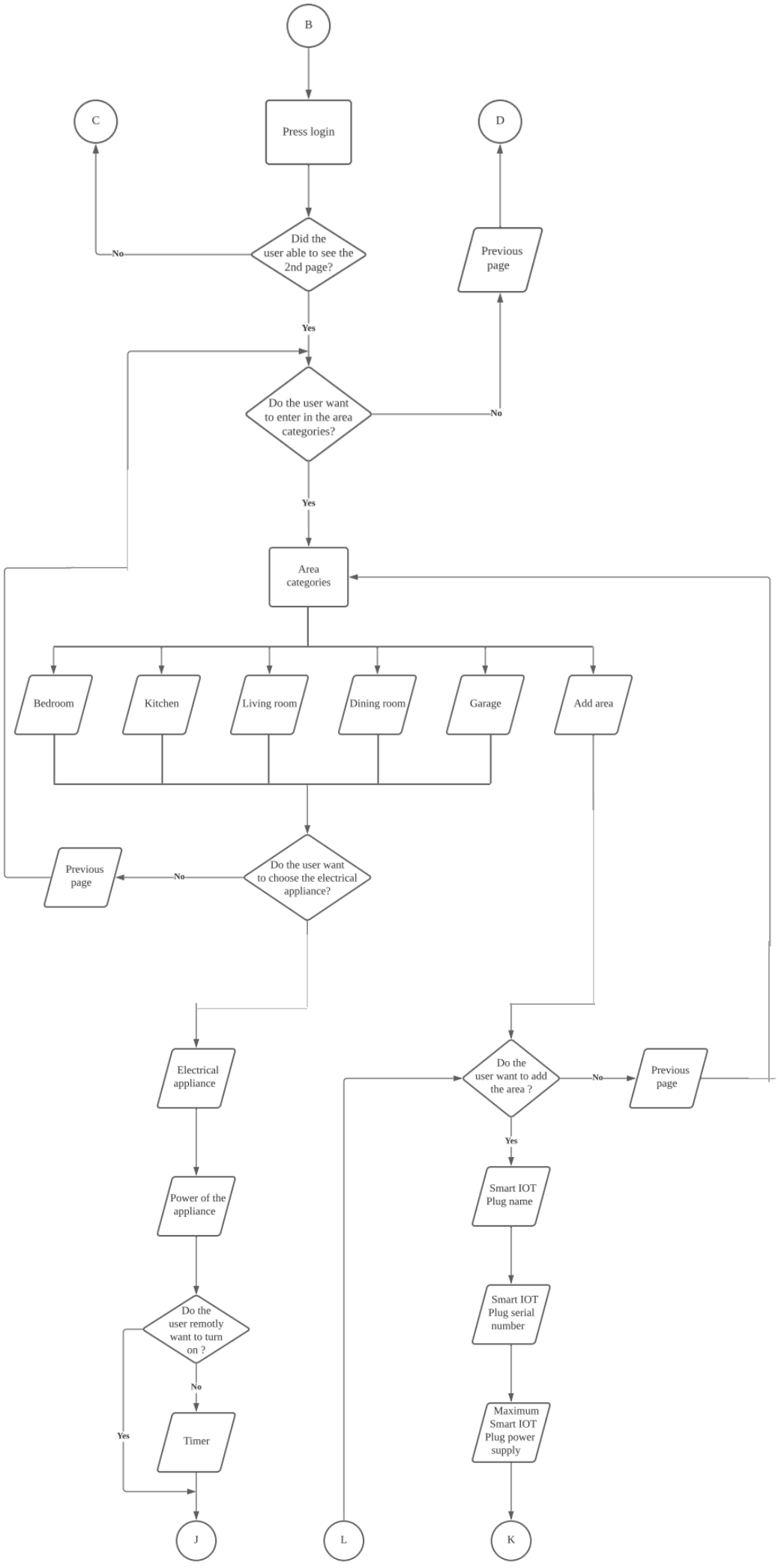
Management is one of the most essential components in the back-end as this component aids in managing and coordinating components such as the application, service, runtime cloud, storage, infrastructure, and other security problems. There are many AWS services included in this component. First, AWS Service Catalog. This is used to generate, maintain, and distribute catalogues of approved items to end users, who may then utilise a customised gateway to get the outcome they require. Besides, AWS CloudWatch is used for real-time monitoring of AWS resources and the application to run on AWS. CloudWatch is also used to gather and track metrics, which are variables that can be measured for the applications. Moving on, AWS auto scaling is used in monitoring the applications and modifies capacity automatically to provide consistent, predictable performance at the least cost. Next, for email and messages purposes, AWS SES and AWS SNS is used as it carries the function of enabling the email service within the application and to enable the completely controlled messaging service for both application-to-application (A2A) and application-to-person (A2P) communication respectively. Finally, AWS SQS is used to separate transmitting and receiving components and is used by distributed systems to exchange messages using a polling paradigm.

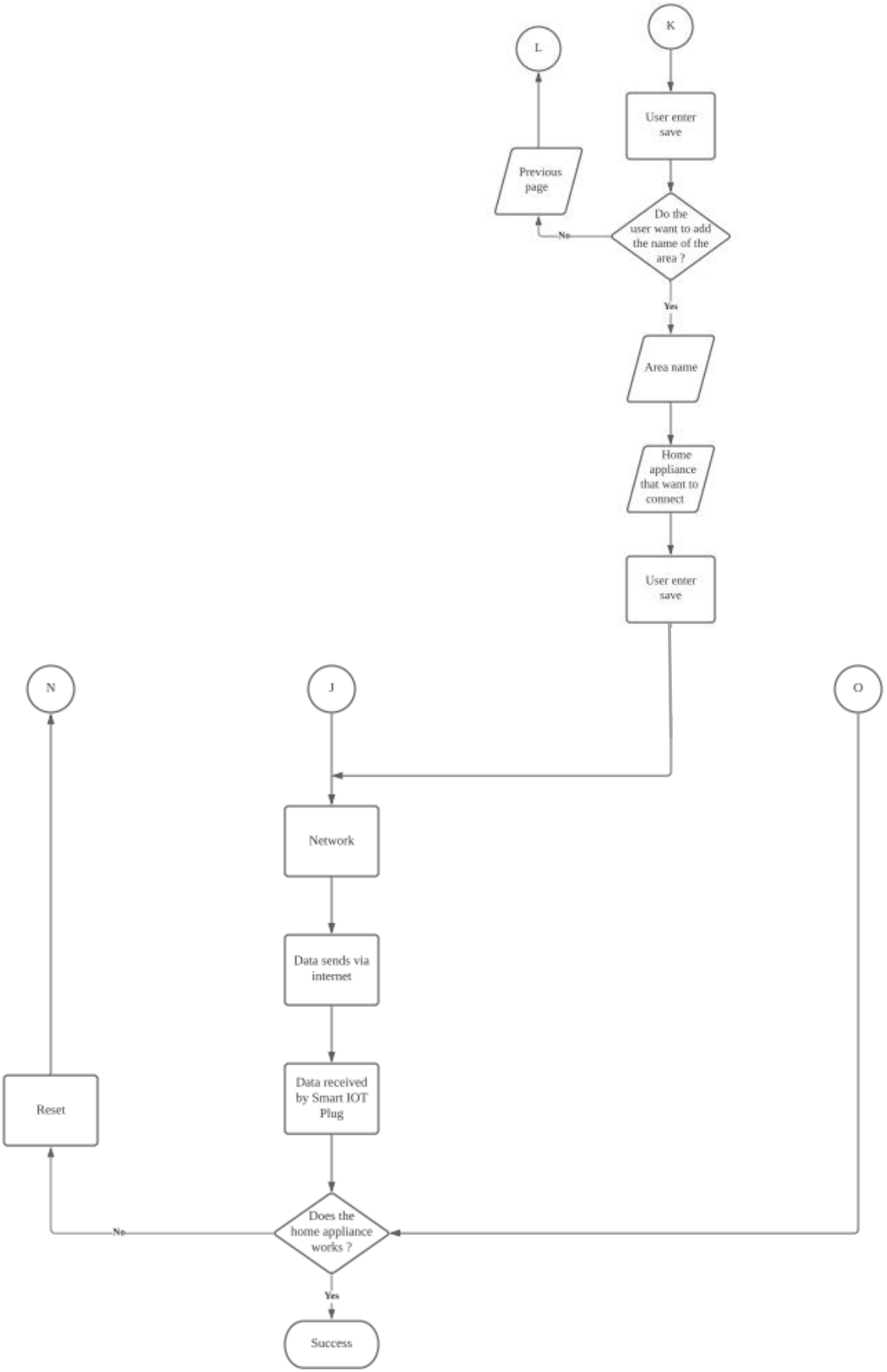
Finally, another important component in the AWS cloud architecture is the Network, which is the Internet/Wifi. This is a very crucial parts in the architecture as it as a bridge to link and interact with the front end and back-end user cloud. To connect it with the cloud architecture, Internet gateway and AWS Direct Connect is used to send data to the cloud and to the application. Therefore, these are the explanations on the AWS cloud architecture ecosystem in order to run the Smart IOT plug, application and home appliance.

Business process flow diagram

Below is the diagram of business process flow chart for the Smart IOT plug;

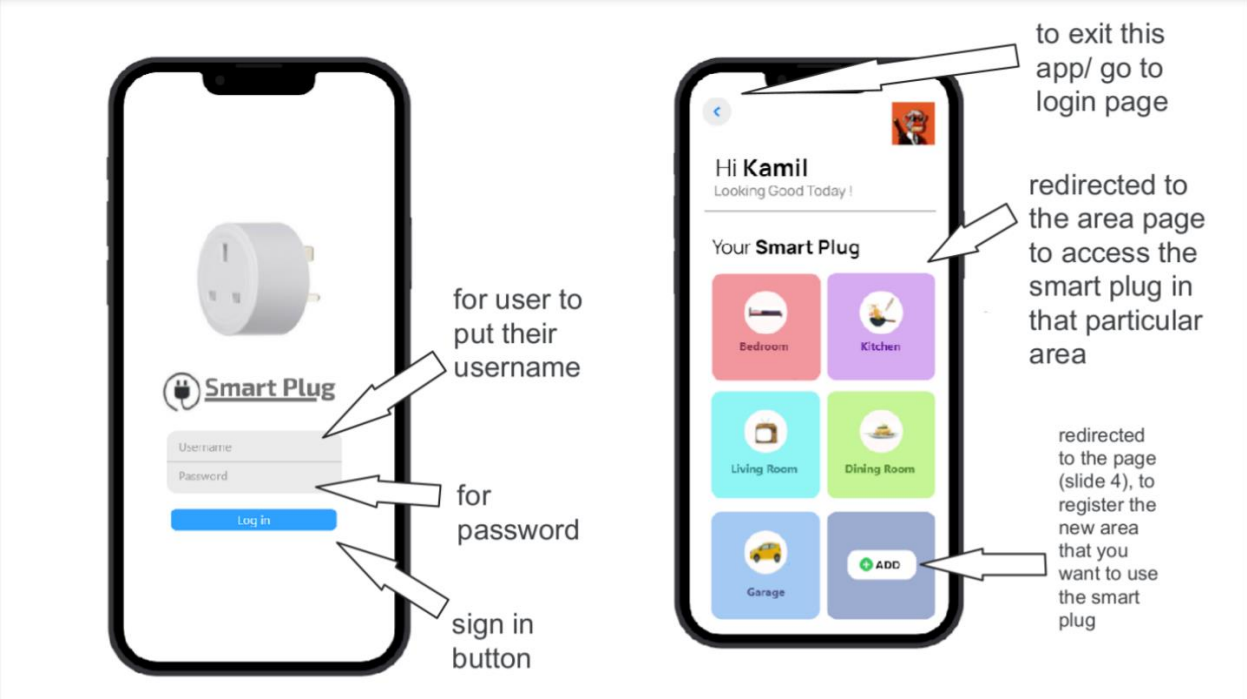



B
Press login
C
D
Did the user able to see the 2nd page?
No
Previous page
Yes
Do the user want to enter in the area categories?
No
Yes
Area categories
Bedroom
Kitchen
Living room
Dining room
Garage
Add area
Previous page
No
Do the user want to choose the electrical appliance?
Electrical appliance
Power of the appliance
Do the user remotly want to turn on ?
No
Yes
Timer
J
L
Do the user want to add the area ?
No
Previous page
Yes
Smart IOT Plug name
Smart IOT Plug serial number
Maximum Smart IOT Plug power supply
K


K
L
User enter save
Previous page
Do the user want to add the name of the area ?
No
Yes
Area name
Home appliance that want to connect
User enter save
N
J
O
Network
Data sends via internet
Data received by Smart IOT Plug
Reset
Does the home appliance works ?
No
Yes
Success

Low Fidelity Mockup and Explanation

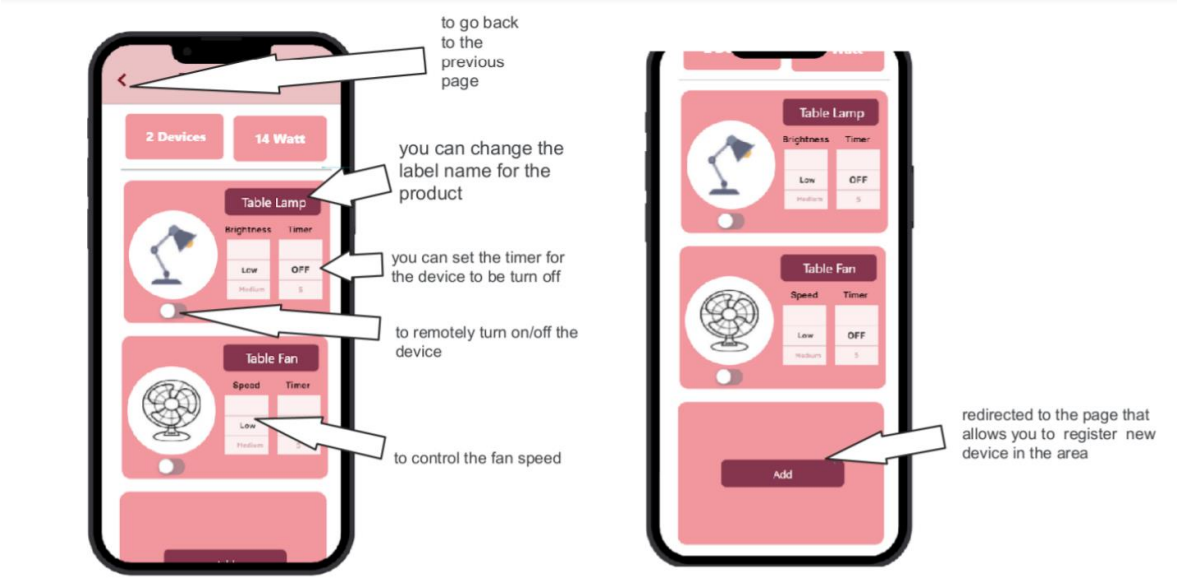
Explanation about the prototype



Page 1&2

From this Smart Plug application, it has 5 pages that contain many functions. Firstly, when the users downloaded and opened the apps, they will see the first page as in the diagram. In this page, the users will see the username part which the users need to sign in to use the functions in the apps. They need to insert their username and password in the password part to make sure the account is in good privacy and secured. After they fill the information needed, the users need to click the 'login' button to continue into the apps.

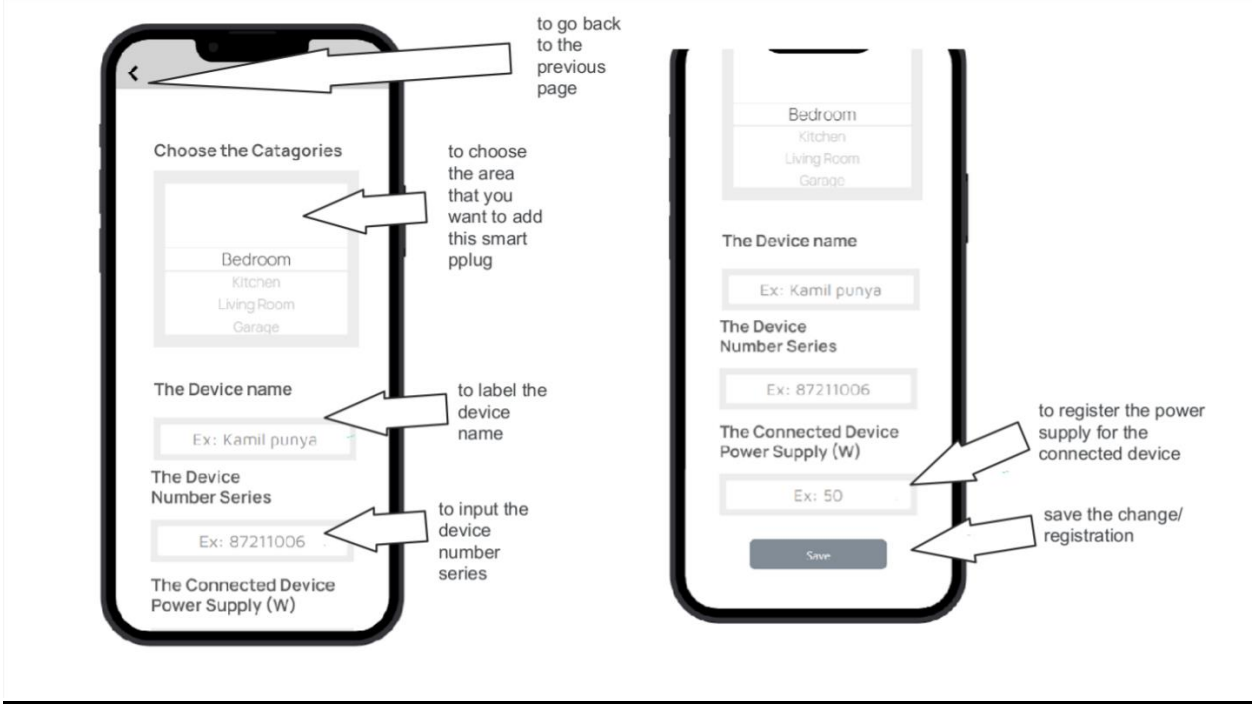
After users finish their sign in process, the apps will bring them to the next part. The next part of the apps will redirect the user to the area page where the user can access the smart plug in a particular area. The user can select the area that they want to use the smart plug such as bedroom, kitchen and many more. There is also a button which the function is to add or register a new area that you want to use the smart plug which is called “ADD”.



Page 3.

After the user already clicks the particular area button from the previous page, the apps will bring the user to the next page. In this page which is page 3, users will see a few functions of the smart plug. For example, when you click the ‘bedroom’ area. The applications will show some of the accessories or devices in the bedroom that are connected with the smart plug such as table lamp and table fan from the diagram.

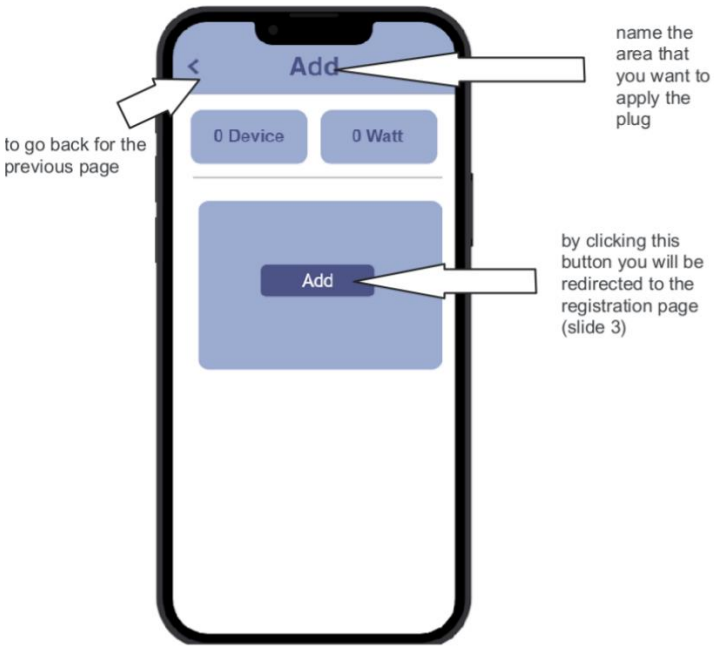
First function is you can click the “Table Fan” name to change the label name into another name. Second, you can set the timer for the devices for how long you want it to turn on and off. When the timer ends, the devices will automatically turn off without the user needing to turn it off manually. Third function is the user can control the fan speed or the lamp brightness. This will ease the user to slow down the fan of lower and higher the brightness of the lamp. Lastly, this page also has an “ADD” button where the apps will bring you to the next page to register a new device.



Page 4.

After the user already presses the “ADD” button, the apps will redirect to the page where you can register the new device. As shown in the page 4 diagram, the apps will ask the user about the device and the area of the house. Firstly, the user needs to select the category which is the area of the device to connect with the smart plug.

Next, the user needs to put a name to label the device name such as “Table Fan” or other name. Third, the user will need to provide the device series number, so that the apps can connect easily with the device. Furthermore, the user needs to register the power supply for that connected device. Lastly, the user needs to press the “SAVE” button to save changes and register the devices.



Page 5.

For this last page, it will be redirected when the user presses the “ADD” button in page 2. In this page, users can add the area to connect with the smart plug. Users may press the “ADD” button on top of the page to name the area. Then the user needs to press another “ADD” button which will bring them to page 3 where they need to register for the devices to be connected to the smart plug. Also as you can see, every page will have the back button on the top left page that will bring the user to the previous page when pressed.

Design A

Design B

Our Smart Plug only uses one type of colour which is white. We choose white because it symbolises premium and luxury which will increase the sales for this product. Beside that, white colour can help the consumer to find it in the dark incase of any emergency. With this colour, the user can differentiate between the normal plug and our smart plug.

For now, we only use two designs which are circular and square design. Both designs have different functionality for the electronics that are connected to it. For Design A, we apply round for its shape and its function is to connect casual electronics such as charger, table lamp, fan and insect repellent. Meanwhile for Design B, we apply square for its shape and the function for this design is to connect high voltage electronics such as iron, oven, spotlight and battery charger. With this professional and simple design, we expect that consumers can easily differentiate between the functionality of both products.

Furthermore, our Smart Plug is built in a small size. The reason why we built it in small size is because the Smart Plug can easily be connected in any plug. For example, users want to connect with a power plug behind a cupboard. The small size of the Smart Plug will ease the user to connect them without struggling to fit it. It will also make the plug hard to see when it is connected. So it will not be seen by the visitors or other people.

Lastly, our Smart Plug will be built with a power button. The function of the button is for emergency cases. For example, when the Smart Plug is overheating or suddenly providing smoke, the user can just press the button to turn off the plug and disconnect the circuit. This case is only valid if the automatic off button from the apps is not functioning.

Reflection of project

Writer : Mohamed Ziyaafser Bin Mohd. Zinnah

From this project, I have learned a lot as I have gone through several states and processes in completing this project. During the planning stage, I was able to think very wisely in developing ideas and solutions to the clients problem in which I believe it requires a lot of thinking skills. I have learned a lot in how to find the best solutions involving client problems and what are the factors that could satisfy the client in many resources. Besides that, after getting the idea of making Smart IOT plug, I have gained so much knowledge in the aspect of how to develop IOT devices, which is related to 4th IR and modern era. I had to search and gain many information about how the application works, the software, front end and back end. Not only that, I also gains a lot while making the AWS cloud architecture, as in order to do the structure, I need to spend a lot time to understand on how to make that structure, what are the purposes of AWS services, and in which category it should be placed and all. This made me learn alot in the topic of AWS cloud. One of the biggest motivation to complete this project was I had the huge responsibility as the group's leader in order to do the best in making sure everything goes well. I also was so eager and excited to solve a client's problem by using our team's ideas.

During the project, we have faced a few issues as well, such as first, we faced difficulty after fixing our idea of Smart IOT plug in which we found it hard to really understand how it would work and how can this device run using the aid of the cloud. As for that solution, we manage to do it by referring to a lot of resources and other devices of IOT in order to aid us in this project. Another issue was the time as it was a packed schedule for every teammate including me. I found it a little hard as this project really requires a lot of research that would be time consuming. As the solution, we divided our task equally to finish up the project as soon as possible. All the team members were able to contribute equally and that made us handle the issue which then makes our project a success.

After completing this project, my direction would be to learn more about this concept so that I could bring this project into real life if possible. But, for sure, it will take a lot of knowledge and effort to do that. I will try my best by learning more in the upcoming semesters and also by getting information from other resources.

An important necessity in order to improve my potential in industry is knowledge and skills. I am now in the learning stage of getting new informations, ideas, tutorials and everything as I'm now in the tertiary stage. Therefore, gaining enough knowledge in the specific aspect will definitely put me well in industry. Not only knowledge, skills are also important as just gaining knowledge without the skills or technique to implement it is useless. Therefore, I would strongly say that knowledge and skills are key elements for me to improve my potential in industry. These are my reflections and feedback I could gain and take from this project.

Writer: Ryan Lim Shen

During this group project, I have learned a lot about applications, software and advanced devices that can bring a lot of benefit for future users. I have gained a lot of knowledge that can actually be very beneficial for me in the future. In this project, I also learned a lot about teamwork and communication when it comes to trying to bring an idea or maybe opinion across to the group. I had set a motivation to finish this project by implementing the idea of wanting to learn and improve myself for my future assignments and jobs. One of the issues I faced was trying to find some ideas or points for my part of the project, which is “IOT smart plug”. There was not much information that I could make out from the topic itself but with some help from my teammates and also book references, I managed to have a better understanding of the project in a clearer light. My direction after completing this project was to try and perfect the final results of the project. I also have the idea of just trying to find my mistakes and flaws in the project and try improving myself for my own benefit in the future. I learned that I need a lot of improvement in the way I present my idea and the way I explain the idea if I am going to work in a professional field in the future. Other than that, I learned that I might need a lot of improvement in communication where I have a bit of difficulty when it comes to communicating with my teammates/ co-worker in my future career.

Writer: Vinodh a/l Nadarajah

I've learned a lot from this Smart IOT Plug project, including the importance of teamwork. Because each team member must offer their ideas in order to complete this Smart IOT Plug project, everyone on the team must give their thoughts. In the calendar, I've also established a deadline for my work. This will motivate me to complete my work more quickly. When I first got my hands on this Smart IOT Plug project, I had no idea what I'm going to do with it. They show me how to

do this project with the help of my Technology Information System lecture and my pals on my team. I also conduct extensive internet research for this project.After finishing this project, I have a better understanding of how the given project will play a role in my future career. When I was working on this project, I ran into a few issues. One of them is that I find it difficult to adapt to new situations. For example, when I first received the project, I had no idea what I was doing. To be honest, I was beginning to feel anxious. But, fortunately, I have the support of my teammates. But I'm not going to get aid like this till I'm further along in my profession. So, in order to finish my project in my career, I need to start relaxing and thinking outside the box. I also experience communication issues with my teammates from time to time. As a result, I'll have to work on those as well.

Writer: Muhammad Kamil Eizaz bin Othman

I was able to gain some understanding about front end developers as a result of this group project. I understand the responsibilities of a front end developer, which include site structure and design. Aside from that, I get to see what a developer does in their day-to-day work. The Smart IOT Plug is a fantastic project since it incorporates 4IR technology and also assists me in developing crucial soft skills such as digital skills, communication skills, and teamwork skills. With the help of friends and family, I was able to maintain my motivation to complete this project. I was able to stick to the timetable for this project since they are continually encouraging and reminding me of things to do. It's difficult for me to understand the Smart Plug because I've never participated in any event that uses the cloud computing concept. Furthermore, we must create our own product, which will require a significant amount of time and research. I was able to resolve all of these issues by completing all of the Amazon Web Service (AWS) courses. The AWS course is quite useful because it provides a vast amount of resources and knowledge about cloud computing. Additionally, other group members play a significant role since they educate me from the beginning to the end of the project. After finishing this project, I intended to broaden my skills in the front end area. With some basics in this project, I discovered that doing this type of work is far more enjoyable compared to the back end field. I discovered that there is still area for development, and I aim to expand my understanding of current technology by reading magazines and articles from reputable websites such as Reddit, Lowyat, and Github. As a result, I will be able to compete with other competent IT specialists which will increase my marketability.

WRITER : MUHAMMAD SYAHMI BIN SALEH

Throughout this project, I've learnt a lot especially teamwork. Each one of the members needs to give their corporation and ideas to solve every of the problems in this Smart Plug project. I keep on motivating myself to complete this project to earn more knowledge and improve in every assessment we do. Throughout this project I had so many issues such as didn't knowing how to do my part, to give ideas, and many more. But with the help and guidance from my group members, I managed to complete my part to complete this project. After this project, I will start to check my mistakes and try to improve for my future. Maybe for my future work and life. I also need to improve my thinking skills and the way to communicate with the members when you are doing group discussion. I need to learn how to "Critical Thinking" throughout a discussion. So that in the future, I will not have the problem of giving ideas and communicating with my group of workers.

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