



UTM
UNIVERSITI TEKNOLOGI MALAYSIA

SCHOOL OF COMPUTING
Faculty of Engineering

SECP 1513
TECHNOLOGY AND INFORMATION SYSTEMS

PROJECT - LOW FIDELITY PROTOTYPE
Report for Project (Part 1)

SECTION 11

COURSE LECTURER: DR MUHAMMAD IQBAL TARIQ

NO.	NAME	STUDENTS' ID	PROGRAM
1.	GAN HENG LAI	A21EC0176	SECVH
2.	HENG XING YU	A21EC0183	SECVH
3.	CHONG JING WEN	A21EC0170	SECVH
4.	OOI JOO YEE	A21EC0218	SECVH

Introduction

The fourth industrial revolution is also called 4IR. It is the fusion of the digital world, the biological world and the physical world 4IR and allows everyone to slowly understand and adapt to new technologies. For example, the elements in 4IR are artificial intelligence, cloud computing, robotics, 3D printing, the Internet of Things and advanced wireless technologies. In this report, we will choose the Internet of Things (IoT) as our project.

Internet of Things (IoT) is the physical devices which are connected to the Internet, and used to collect and share the data in the whole world. The network of physical devices can be explained as the things with software, sensors and technologies. These are used to connect and switch data with other devices and systems. Nowadays, the world is now tightly connected by the Internet. Digital systems can be used as a recorder, monitor, and adjust every interaction between every connected thing. For consumers, they can communicate with the world's network information but do not need to use the keyboard and screen. Therefore, many of their daily objects and electronic devices can obtain instructions from the network instead of manual operation.. In the enterprise environment, the Internet of Things can also be very efficient for physical manufacturing and distribution. There are three types of Internet of Things (IoT) that are classified into consumer IoT, enterprise IoT and industry IoT. For consumer IoT, an IoT device is a device that can connect to a network, gather data or take automated action. After that, anything that is connected to the internet, intranet or LAN is considered as enterprise IoT. Industrial IoT is the one they are monitoring the machines or communicating back to a gateway.

Many physical objects have become IoT devices, so humans can directly communicate or control those devices as long as they are connected to the Internet. The first example is lightbulb, which is very popular, which can be set to switch through an app that is an IoT device which can be used as a motion sensor in your bedroom or a streetlight that can save energy. Smart cities project is also one of the examples for IoT which is installing sensors throughout the city, so that it can help citizens control Niangang and better understand environmental health. This project's contribution includes resolving the problem of traffic congestion, reducing noise, crime and pollution. Smart homes are also a well-known application of IoT. There are many products on the market that help users to control the device with their sound that can make their lives more comfortable, safe and convenient. Wearables are the one that appears the most in our daily life, such as smartwatch that is turning the wrists into smartphone holsters to enable us text messaging, phone calls and so on.

In this project, we need to include the low fidelity prototype which is a draft version of a product that can allow us to test our ideas and show the intention behind a feature. It can also help us to explore our overall design concept before we start to invest time and money into the development. Low fidelity prototype is focusing on how to sketch and mapping our content, menus, and also user's flow. It allows the participation between both designers and users in the design and ideation process. Low fidelity prototypes allow users to give feedback based on the function while the designer is still planning or designing the project.

Apart from that, we decided to plan a smart home for our customer to resolve his problems. There are many IoT devices that are included in our smart home such as smart light, smart music ideas, infrastructure ideas, entertainment automation ideas etc. Our smart home with safety and security system can ensure his kids and wife are in a safer place and he can monitor the situation of the house although he is working outside. Our smart home can take care of all aspects whether it is adults, children or the elderly. In this project, our aspects included security, medical system, entertainment, and also the system of daily use tools. In our content, we will explain the usefulness of the device and give some examples to let our client more understand our smart home technologies.

Content

In this project, we will plan a smart home for a client. A smart home is a home setup that is convenient. Smart home appliances and devices can be controlled remotely and automatically by connecting to the internet and using a networked device from anywhere. A smart home's devices can control and accessed through one central point because the devices are connected with each other. Central point can be any networked devices such as smartphone, tablet, laptop, and many more. Users can also set the time schedules according to their own requirements. Smart home is the most affordable and readily available for the consumers because they can purchase the devices by their own needs and capability.

Our client is a middle-aged man who is 40 years old. He is a father of three children. He normally lives with his wife, three children and his parents. He is very busy as an engineer and frequently works late at night. His wife is also frequently occupied until late at night. There are often only three children and his parents left at home. He wants to create an entertainment space for children so that they will not get bored at home. When he is free, he can also play with his children in the entertainment room. Besides, He wants the devices in the house, such as lights and daily appliances, to become automatic to reduce his and his wife's stress and worries, because they are always busy. Aside from that, he is an environmentalist. He wants to construct a smart home that is both environmentally friendly and energy saving. Client's parents who are senior citizens and they have limited mobility. Client's mother suffers from hypertension while father has Mild behavioural Impairment which is the symptom of Alzheimer. When the client and his wife are busy, they are unable to take good care of them. Hence, the client has decided to prepare computerized healthcare devices to remind them to take medicine. The medicine will divide automatically by time setting and do not worry about the parents taking the wrong pills. Besides, the client worries about their family safety when he is busy at work, he wants to create video doorbells and smart smoke alarms. When he does not have the time, the application can notify him about the condition at home.

The first smart home idea for our team is smart light. In this smart light, users can press only one button to turn on all lighting for a specific room. Users do not need to bother to turn on the light one by one. On the contrary, users also can turn off all the lighting by using a button only. Next, the light at the garage will turn on automatically when someone rings the doorbell. This function can prevent too dark surroundings and prevent the risk of robbing. Besides, at night, after the garage is opened, the lights from the garage to the house will automatically turn on and turn off automatically after a period of time. Moreover, there are some sensors in the critical areas and these sensors can close the light automatically when no one was detected in the critical areas for some time. Parents will definitely like this feature because children often forget to turn off the lights and cause waste of electricity. Furthermore, landscape lighting will turn on at sunset and turn off again at sunrise automatically. After 11.00 pm, the landscape lighting will decrease to 20% to save electricity. In some specific scenarios, the smart lights will have their special effects.

For example, for some users who like to read at bedtime, the light will be at the level just low to have comfortable reading. In addition, the light will control at low brightness to avoid disturbing family members when having a midnight snack. When users exercise, the sensor will sense and turn the light to 15% and it is suitable when exercising. Next, the light will be adjusted to 50% when the natural light in the room is less than 50%. If the natural light is less than 30%, the light will be adjusted to 70%, and so on. The smart lights will ensure the brightness is sufficient and protect users' eyes, especially for children. Lastly, the light closes automatically when children leave for school. Smart lighting is suitable for a family especially for a family with children. This is because smart lighting can help a family be more convenient and the family members no need to worry about the light.

The second smart home idea is **smart music ideas**. First, the sound insulation system will turn on automatically when the music is playing. This can avoid disturbing neighbors and users do not need to worry about others and enjoy music. Next, there are two ways to play or stop the music: using the keypad set in each room and using the application on the smartphone. Users can use the keypad or smartphone to specify which room to play or stop the song. By using our specially designed application, the application will detect the songs that the user often listens to and save the playlist. Besides, the keypad that uses to play and stop the music also has some buttons. Family members can customize the buttons they want to use by using the application. Next time users play the music, users can listen to his or her playlist by pressing the customize buttons in each room. Moreover, every family member can customize the color of the light they like. When family members play music, the light will change to an assigned color according to the preferences of each family member. Users also can design for their desired scene in our application and save the scene in the application for next use. Furthermore, the music will play when the shower light is turned on and stop when the shower light is turned off. In the bathroom, there is a touch screen installed on the waterproof wall to control the music when a user is bathing. Next, each room has sensors to detect whether someone is talking. If the sensor detects that someone is talking, the room will enter silent mode and the volume will automatically be reduced to 10%. Detecting that the user is not speaking, the volume will automatically change back to normal mode. Lastly, many musical instruments such as guitars, violins, and pianos can be a sound source and are played in every corner of the smart home.

The third smart home idea is **entertainment automation ideas**. In the smart home, there will be an entertainment space. In the entertainment space, users can watch a movie and play gaming equipment such as VR and PS5. When the entertainment space is in "PARTY MODE" by pressing a button on the sofa, the big screen in front of the room displays many options for gaming or movies and users can choose what they want to do. When users choose the gaming mode for game consoles and VR, the decorative elements in the entertainment space will be illuminated to have a good game atmosphere. Besides, the audio mode also changes to the gaming mode after pressing the gaming mode. Immersive sound allows users to focus on the game. Next, for the cinema mode, the audio mode changes to the cinema mode, and users can

enjoy it more when watching a movie. Next, if someone suddenly comes, users do not need to worry about it because users will get notified through the audio in the entertainment space.

The fourth smart home idea is **daily appliances automation ideas**. First, if the **fan sensor** detects someone in the area, each fan will automatically turn on. They will turn off when no users are in that area. Next is the refrigerator. The **refrigerator** will produce the ice cubes by itself when the ice cubes are not enough. Besides, if there are spoiled or expired items such as food and vegetables in the refrigerator, the refrigerator will send a notification to the user's phone to remind users. Moreover, robot vacuum is also one of the daily appliances. Robot vacuum will automatically turn on at a fixed time every day. By using an application, users can set the best route for the sweeping robot to **clean and the cleaning process** will be more efficient. The robot vacuum also will go to recharge and clean the rubbish from dustbin to station. Furthermore, air-conditioning can connect users' smartphones wirelessly and users can use application in smartphone to control the **air-conditioning** whether at home or outside. Thus, user can enjoy the air-conditioning when user comes home. Air-conditioning also can detect the temperature in the room by itself and adjust the temperature intelligently and create a more comfortable environment for users. Next is the **television**. Sometimes, the remote control cannot be found. By using the application on smartphone, users can press the find remote control button and the remote control will make a sound to let the user find it easily. Television turns off automatically if there is no one in front of the television after 15 minutes. Lastly, for the daily appliances in the kitchen such as induction cooker, rice cooker and electric kettle, all the daily appliances in the kitchen will automatically stop functioning when one of the daily appliances is detected to be faulty. Smartphone of users also will ring to remind users to avoid an accident.

The fifth smart home idea is energy-friendly ideas. In energy-friendly ideas, there is an energy management system to monitor the energy production of solar panels. Besides, the user's entire home's energy consumption is measured with home automation system. This system can control the energy consumption for every device and minimize electricity consumption. Next, most of the devices in smart homes have the function of shutdown automatically. Smart lights also just turn on the lights that are needed only and not use too many lights to cause waste of energy.

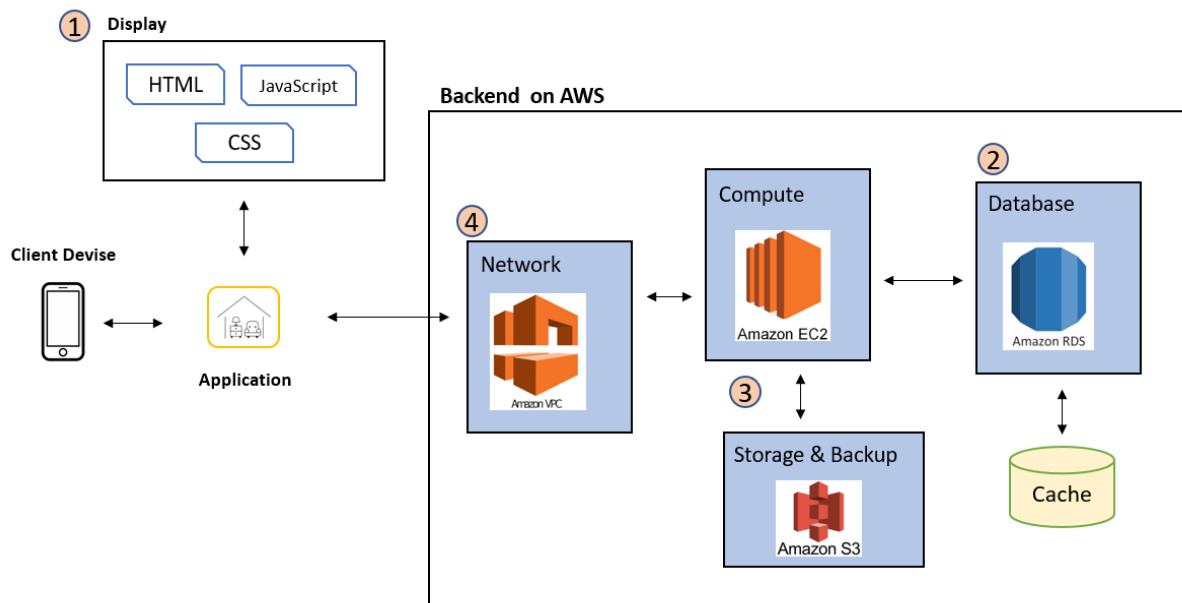
The sixth smart home idea is infrastructure ideas. Smart homes need a variety of cables for different services to let each of the room and central be connected. Without the correct cables, the users may face the problem that the devices may not function correctly. The cables need to run behind the walls for safety and make sure the walls are closed and plastered. The cables will be selected with the cables that can be used for ten years-time to avoid changing immediately. Our team will survey the property first before installing the cables because identifying the location where the signal is lacking is the most important problem for a smart home. If there are some places or locations where the signal is lacking, we boost it by adding wireless access points there to make the locations better. For example, hardwired cable provides a constant and stronger internet connection. Besides, smart gardening is the second idea of

infrastructure. Due to this pandemic, most of the workers work from home and they need to work and take care of their house at the same time. Smart gardening devices such as remote controlled sprinkler systems and robot lawnmowers. The user can set the time to open or off the water and how long the water should remain for the remote controlled sprinkler system. It can change the water supply and prepare the data on the next day's weather patterns to ensure the most suitable operation to the garden. Robot lawn mowers will cut the lawn and remove a part of grass as well as return some fertilizer with the combination of the cut grass to the garden to let the garden more nutritious.

The next smart home idea is safety and security. The devices are video doorbells and smart smoke alarms. For the video doorbells, it can allow users to receive video calls who are coming in, unlock and allow access to their home to their friends or family when the users are not around. The video doorbells will detect and notify the user when someone who is loitering near their house without the loiterer pushes the button of the doorbell. The user also can set it to not ring at some time when it is inconvenient. When the user forgets to lock their house, they can lock it using a smartphone application and unlock before they go in. The camera of the video doorbells is high-resolution video, it has motion sensing and two-way audio to make sure the video taken is clear. Besides, there are smart smoke alarms. Smart smoke alarms take a traditional smoke alarms system and bring it into digital form with Wi-Fi connection and the ability to communicate and pinpoint the exact place where the fire is located. It can send out the alert to the user phone to be aware the issues have happened when the users are not around.

Moreover, the smart home idea is **medicine such as smart pill dispensers**. There are many pills when there are people sick. Although the pill will be prepared in the specific plastic bag, it will occupy space when a lot of plastic bags are put together and it looks messy. The smart pill dispenser will divide which day the patient needs to eat and the proportion from the doctor's advice. The time will be set from the smartphone is the pill needed to eat after or before having meals and will notify the patient. Besides, there are some digital devices which can automatically guide the older person or senior citizens through their daily activities such as taking meal using audio or video reminder. The patient or user can control the state of the talk whether the user needs a reminder or not. For instance, there is a company that develops a different solution for remote health care which is Trapollo. The health care in a smart home can cost considerably less when compared to the hospital. It also can relieve some of the pressure on the currently overstretched healthcare system. In addition, E-health uses the information from the patient to integrate healthcare processes, problems and tasks as well as provide some services and devices such as E-prescription. The detailed and complete information about the patient's medical history can be stored in Electronic medical records (EMRs) or Electronic Health Records (EHRs). Those recordings are read for use to the emergency medical services staff and family doctors who are needed.

Architecture Planning and Design



In order to better develop our project, we divided our project into four layers. The display layer, middle layer, infrastructure layer and management layer are the four layers that make up our project.

The main function of the display layer is to show the content that users need in a friendly way. For this layer we plan to use HTML to write out the application's pages by associated the text and graphics in our computer. Next, we plan to use JavaScript to add interactive behavior to HTML pages to achieve the operational interaction between the browser and the user. Cascading Style Sheets (CSS) are also planned to be used by us to design page layouts so that the content of the page is presented in an elegant way.

The main goal of the middle layer is to better provide multiple services to users like caching service to reduce bandwidth consumption and response time for page visits. It will require a lot of space to store and process this huge amount of data. If we wish to have our own MySQL, we must first set up a server, then download and install a MySQL database installation file that is appropriate for the project. It will take a lot of time and spend more money. Therefore, we plan to start to use cloud computing architecture in Amazon Web Services to solve a lot of problems that we face. We plan to use Amazon Relational Database Service (Amazon RDS). By using Amazon RDS, we can create a database quickly and save more money as we only pay according to the time that we use. We can save the customer's data in Amazon RDS. Amazon will help us manage these database servers, such as software upgrades, patching, backup and restoration. By this way, we can pay more attention to our new application development and data optimization.

The infrastructure layer prepares the middle layer and also the users with the resources they need, such as compute and storage. We choose to use Amazon Elastic Compute Cloud (Amazon EC2) to be our main computing calculation as Amazon EC2 has high-reliability, high-elasticity scale-level cloud computing. Amazon EC2 provides adjustable computing capacity, so we don't need to invest in computing hardware in the early stage. This not only saves money, but also develops and deploys applications faster. Next, we plan to choose Amazon Simple Storage Service (Amazon S3). Because Amazon S3 provides us with a huge data space, we can store and manage our digital information and assets like photos, videos, music, documents, etc. We can store these mathematical assets in the Singapore region so that local people can use our apps, or store them in overseas regions for backup and at the same time to let more people know and use our products to improve the quality of life.

For the management layer, we feel like creating our own virtual network environment. So, we choose Amazon Virtual Private Cloud (Amazon VPC) for resource placement, ensuring connectivity of our application and network security. We can add the resources that we choose before into it like Amazon EC2 and Amazon RDS into Amazon VPC to assist us in controlling access to the subnet's instances. It is more convenient to use other cloud architectures and also freely control data transmission. Amazon VPC provides us with IPv4 and IPv6 for creating a safe network environment in order to prevent network attack from other hackers or leakage of customer information.

Conclusion

Customers can have a more comfortable and secure life because smart homes can not only control their devices, but also ensure their safety. The smart home designed by our project also includes a security system. This way they can live more comfortably and at ease. Moreover, smart home technologies also bring many benefits such as it can control and monitor consumer's houses by improving the method that they can monitor and control their home. Other than that, it is cost and energy savings because smart homes own the utility that can optimize the usage of the devices and adjust the smart home design in the most cost-saving way. Other than that, the system will shut down the devices when the device is not in use to cut down the power consumption. Smart homes can also bring environmental impact as it can reduce the bad impact on the environment and let our users live a 'greener' life. After that, it provides better security such as security cameras, smart locks that can detect the motion of smoke, and other sensors. All of these will work together and users will be notified when there is something wrong. Then, providing a more comfortable life also becomes an essential point to increase the value of a smart home. This is due to the fact that smart homes perfectly cope with the task that can improve and simplify the user's life as most of the processes in home can run autonomously.

The contribution of our project is providing our client a more comfortable, convenient and safer home. Firstly, our project is a smart home that means the devices and other services can be controlled remotely by using a laptop, tablet or a smartphone. In our app, users can add the system of other smart devices in the smart home by themselves, so that the smart devices can be operated in one central point. It helps our client to remote the devices more conveniently. Other than that, our smart home includes a security system that can keep the client's family safe and if there is something wrong such as if there is a suspicious person at home, customers can use our app One-key alarm inside. Otherwise, if there is a fire in the home, our application will immediately notify the customer through their mobile phone, computer or tablet and directly notify the firefighter in the meanwhile. Clients can also send out an alarm through the security system to notify people at home to leave immediately to avoid more injuries. Customers can also customize our app according to their needs and requirements. They can also change their center point anytime and anywhere because the settings and data in the app can be converted to another device with one click. Our requirement for our project is to provide customers with the most complete, safest, and most convenient home. So, they can live with peace of mind yet trust our service and design.