UTM

UNIVERSITI TEKNOLOGI MALAYSIA

SECP 1513 (TECHNOLOGY AND INFORMATION SYSTEM)

SEMESTER 1 (2021/2022)

PROJECT - LOW FIDELITY PROTOTYPE (PART 2)

SECTION 5

GROUP 9

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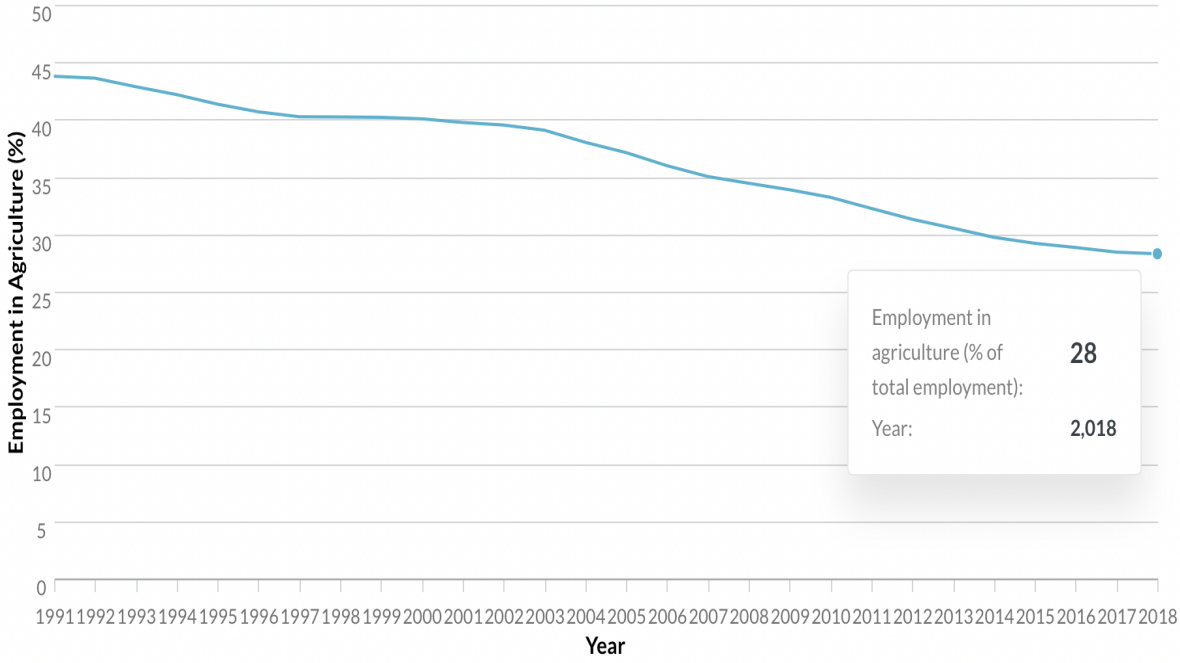
Introduction

In every era of history, food has served as a motivating factor for the development of society in terms of its growth, organization, competitiveness, advancement, and expansion. As a consequence, families and social organizations arose, which eventually evolved into sophisticated civilizations. After civilizations had spread throughout the world, food was used to bring them all back together again. Food plays a significant role in many cultures. Food may evoke lovely memories of our past and help us feel closer to our loved ones or our nation. Food, like the phrase "to break bread with someone," may serve as a bridge between individuals from diverse backgrounds. It’s also scientifically proven that the release of endorphins from food may improve one's mood.

As I said before, food serves as a motivating force for the growth, organization, competition, progress, and expansion of civilization. I would like to reference something about the Ottoman Empire's history, since it was one of the most powerful and long-lived empires in human history. For more than 600 years, this Islamic powerhouse governed huge areas of the Middle East, Eastern Europe, and North Africa.I'm not going to mention sovereignty since our subject is agriculture, but I'd want to give you an idea of their food consumption. The first dish in Ottoman feasts is traditionally a broth, which is served as the first course. Bone broths, which were generally considered to be healthful meals, were prepared from beef or chicken broth, yogurt, or fish stock, and were served with rice, steaming wheat, crushed minestrone, dried or fresh vegetables, and root vegetables, among other things. Can you make a connection between this and the critical role that agriculture had in the Ottoman empire . As an example, Yemen, one of the poorest nations in the Middle East, is today grappling with some of the most severe poverty problems the world has ever seen. Having a poor economy, poverty, and a poor use of their agricultural resources are all problems that may be resolved by modifying agricultural technology.

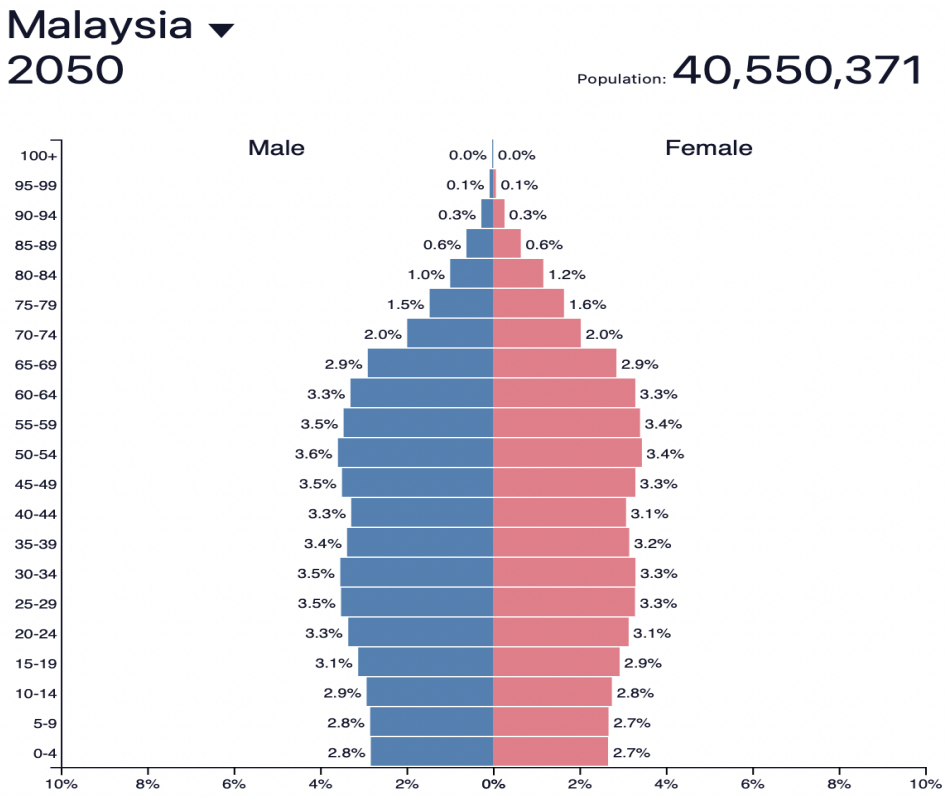
Have you ever considered what agriculture is and why it is important?Agriculture is the process of growing plants and rearing domesticated animals to provide food, feed, fibre, and a variety of other desirable items. Modern agriculture goes well beyond the conventional provision of human food and animal feed. Agriculture employs an estimated 28 percent of the world's workforce as of 2018, making it by far the most popular employment. [1]The graph below shows World Bank statistics on agricultural employment throughout time. Agriculture employs approximately 1 billion people worldwide, accounting for approximately 28 percent of the workforce in 2018.



Although it is the most populous employment sector, it has suffered a number of setbacks in recent years as a result of population growth. We have not been able to achieve complete success in agriculture, and as a consequence, there is food insecurity around the globe, particularly in Malaysia, where we are.

[2] Malaysian agriculture employment is expected to reach 10.09 percent by 2020, according to World Bank predictions. According to predictions, Malaysia's population would reach more than 45 million people by 2050. As a result of the investigation, the 10.09 percent to

45 million figure seems to be inadequate and low. Obviously, as the population grows, more food will be required.



Food insecurity will be one of the most critical challenges that the country will confront in the coming years. The improvement of farmer skills will be the major focus of efforts in order to avoid facing this challenge. Food security will be achieved through higher production, which will be the primary focus of efforts. In Malaysia's economy, it is envisaged that the deployment of IR 4.0 in the agriculture sector would accelerate the processes of transformation and development.

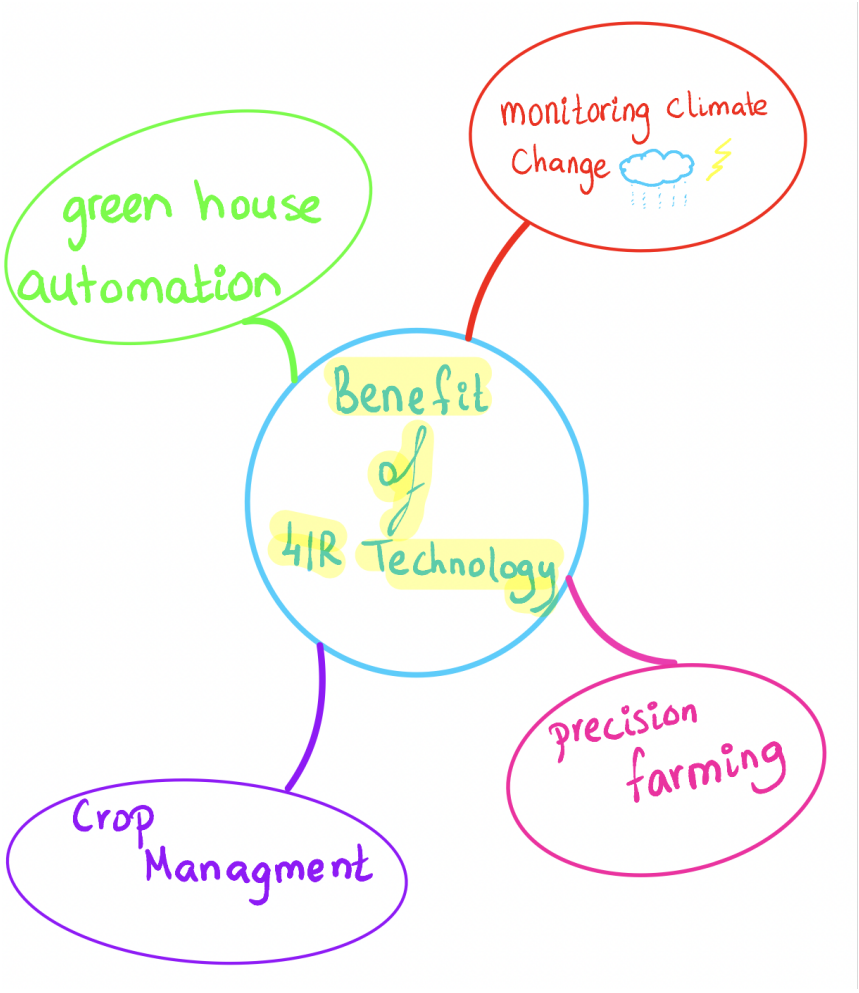
Precision farming, the Internet of Things (IoT), and the utilization of big data are examples of technologies that are being used in the agricultural industry as part of Agriculture 4.0. Malaysia is prepared to encourage innovation and agricultural technology development in order to assist this industry in its transformation and expansion. The private sector is encouraged to invest in smart farming and to develop high-quality, premium-priced agricultural products for both the domestic and international markets. The goal of Agriculture 4.0 is to make farms more

modern and make them smarter. Smart farming could be the start of more production in quantity, quality, sustainability, and cost-effective ways. It's possible to use the Internet of Things (loT) so farmers don't have to be in the same place at the same time as their irrigation equipment, crops, and livestock feed.

Malaysia's agricultural sector is rapidly improving, but with the help of the Internet of Things (IOT), we can improve it even further. We can easily monitor climate conditions, greenhouse automation, crop management, precision farming, predictive analytics for smart farming, and end-to-end farm management systems simply by having IoT technology. These technologies can also support other areas in agriculture, such as safety and nutrition, health, and sustainability. IOT technology will provide us with numerous benefits in the field of agriculture worldwide, particularly in Malaysia. In this report, we will explore the use of the Internet of Things (IoT) in agriculture, including a detailed overview, AWS architectural design, business process flow, and low-fidelity.

Detailed Overview

We raised a question in our project in the beginning to have everyone on the same page with the same aim. As with many ideas, we started with a piece of paper and compiled a list of the most significant advantages of 4th IR technologies in agriculture. As it's clearly seen in the diagram below[3], our mind map contains a large number of points. These include monitoring climate conditions and greenhouse automation; crop management; precision farming; predictive analytics for smart farming; and crop management.



[3] Mind map for BENEFIT OF 4th IR TECHNOLOGY

After identifying the primary topics of discussion, we dug further into the research to uncover more precise and more specific ways to the solution.The main point that we listed in the mind map were :-

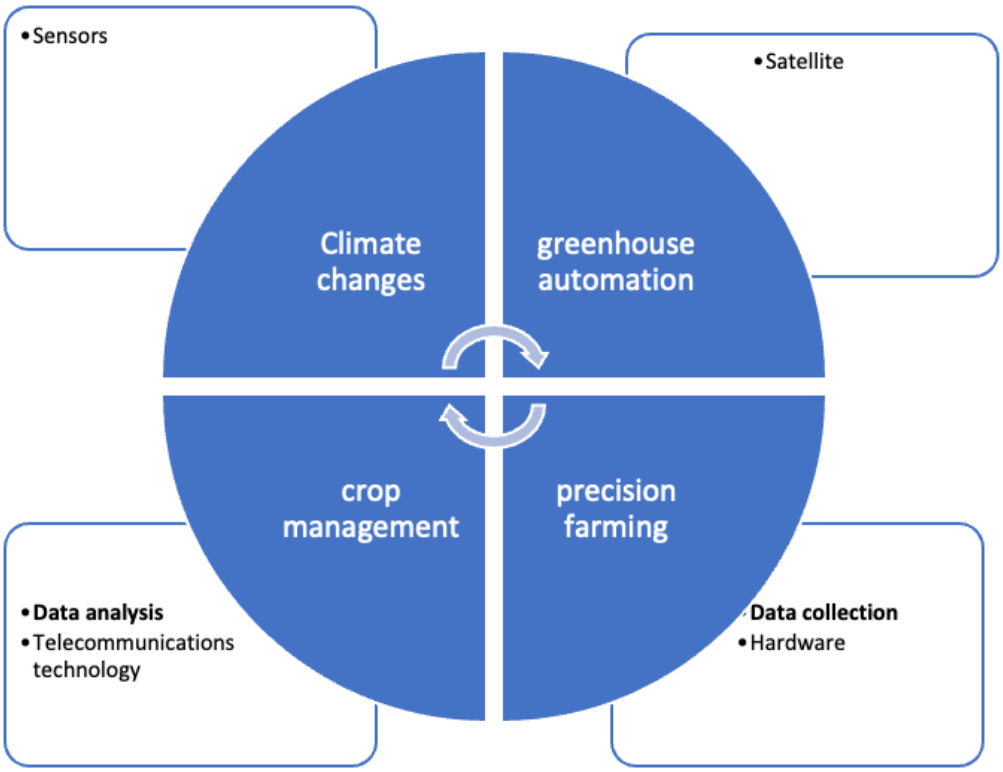
1. climate conditions
2. greenhouse automation
3. crop management
4. precision farming
5. predictive analytics for smart farming
6. Crop management

The first difficulty we encountered was storing the date of all of the big data information; nevertheless, the answer was not that difficult. Simply stated, cloud computing was a more secure technique than keeping data on hardware storage. Cloud computing provides us with a massive amount of storage space for keeping all of our vital data in one place, including documents, photos, music, video, and other types of media. It is possible to view our data at any time owing to the internet cloud architecture. Cloud computing helps firms save money by lowering their hardware and software maintenance expenses. Data security is one of the most important aspects of security since it guarantees that information is kept and handled in a safe manner.

It was difficult to implement the 4th IR technology in agriculture because of a variety of obstacles. First and foremost, changes in weather and temperature may lead to product degradation. As for the second issue, there is a scarcity of labor, which results in fewer goods since there are several tasks to be handled, such as planting and watering, inspecting the quality of products, among others. Third, a lack of adequate monitoring necessitates a great deal of human intervention as well as a lengthy monitoring period. Fourth, the issue of analyzing vast amounts of unstructured data is inefficient, and the

organization is unable to keep up with the ever-increasing amount of data. The fifth point to mention is that the enormous amount of data stored results in high expenses.

This diagram represents our initial step in solving the issue by precisely analyzing it in way to proceed up with the best possible solutions.



Sensors: soil, water, light, humidity, and temperature are all monitored and controlled.

Hardware: automatic tractor, processing equipment

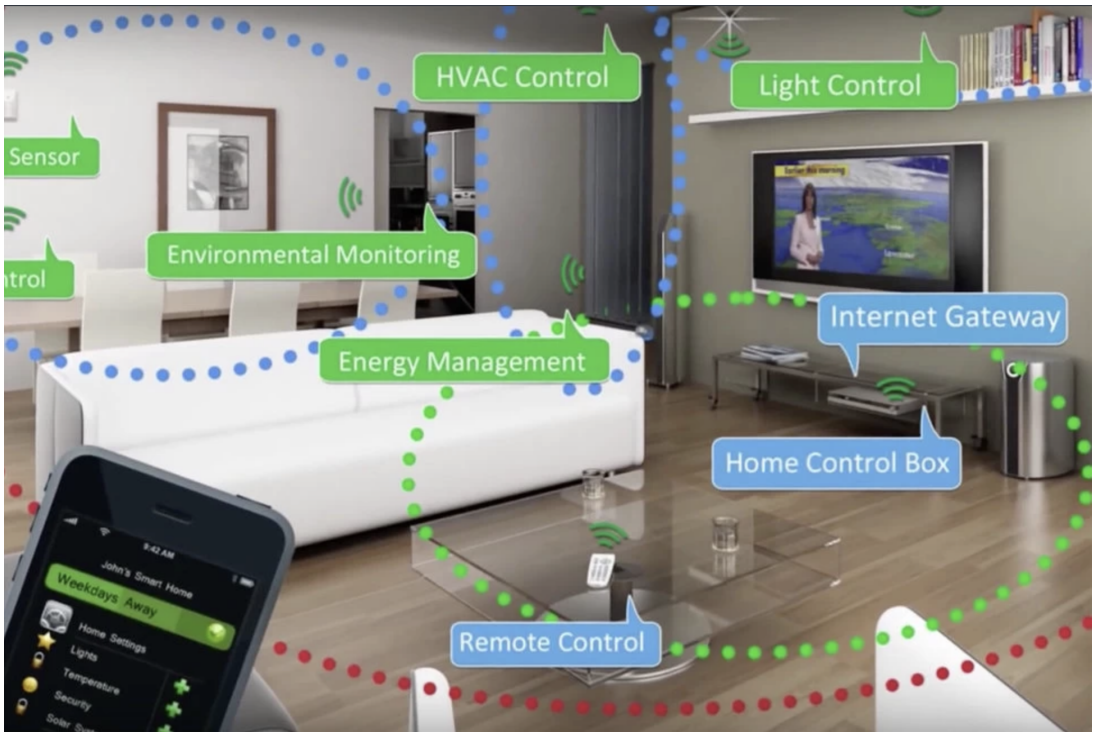
Telecommunications technology: GPS, advanced network

Satellite: 24/7 data collection from the entire field

Data Analysis: Data pipelines for downstream solution

Data Collection:crop yield, soil mapping, climate change, fertilization, weather data, mechanical conditions, animal health values

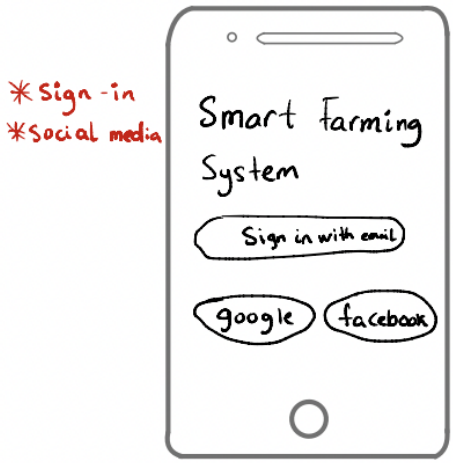
ZigBee may be beneficial to Wi-Fi and the Internet of Things. Wireless standard technology may reduce costs and usage of wireless machines and IoT networks.
It has low power consumption, great security, resilience, and complexity, making it ideal for IoT applications. The data transmission range of the ZigBee mesh network is 15-100 meters.

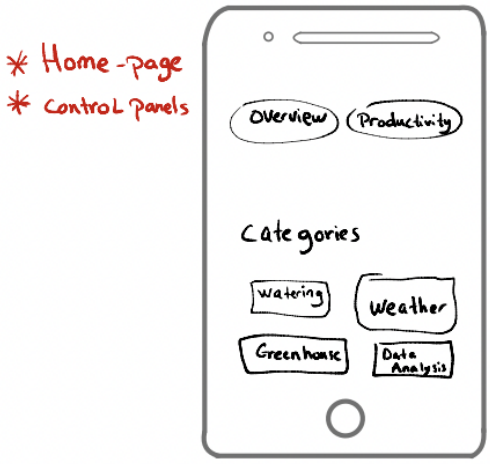


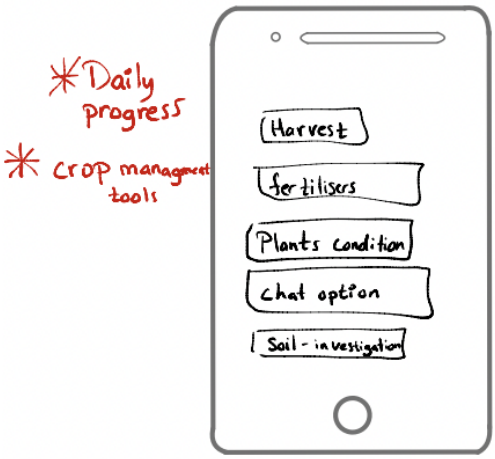
Smart agriculture technology allows farmers to keep a closer eye on the demands of particular animals. Smart sensors can monitor climate variables and water use via SMS or Wi-Fi-based systems with the help of these smart sensors. Drones are used to check the quality of air, soil, and moisture on the one hand, and they can also assist with physical operations like automatic fertilizer spraying.
Inspirations we got from the above solutions are from

- DJI MG-1S - Agricultural Wonder Drone
- Top Uses for Drones on the Farm in 2021
- The Future of Farming

For our Software we as well design Low-fidelity prototypes that provide early visualization of various design options, encouraging creativity and improvement.We did preliminary drawings on paper so it can allow us to make modifications more easily.



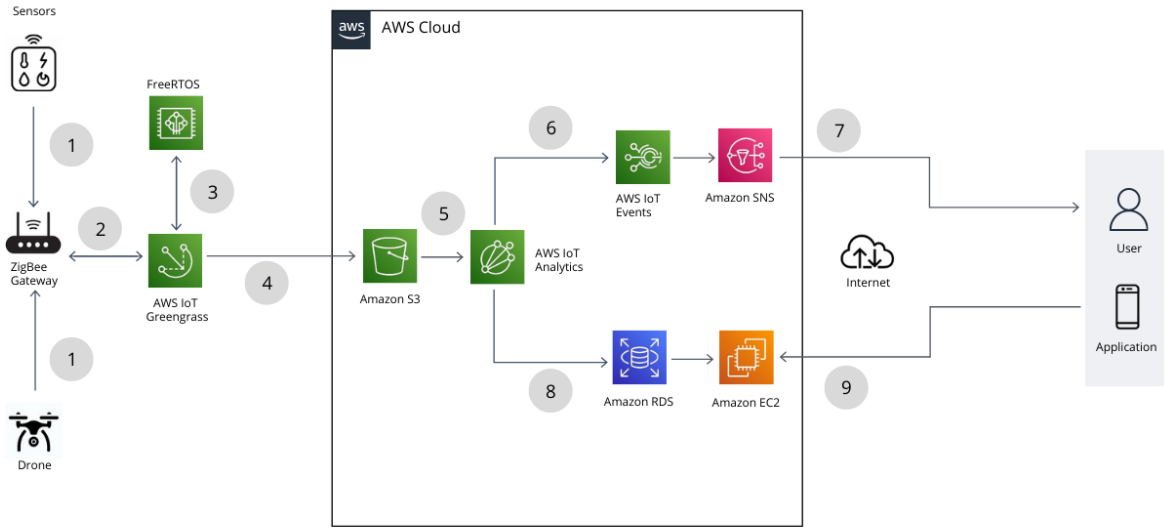




After we did the paper modifications we worked on digital Low-fidelity prototypes using uizard.

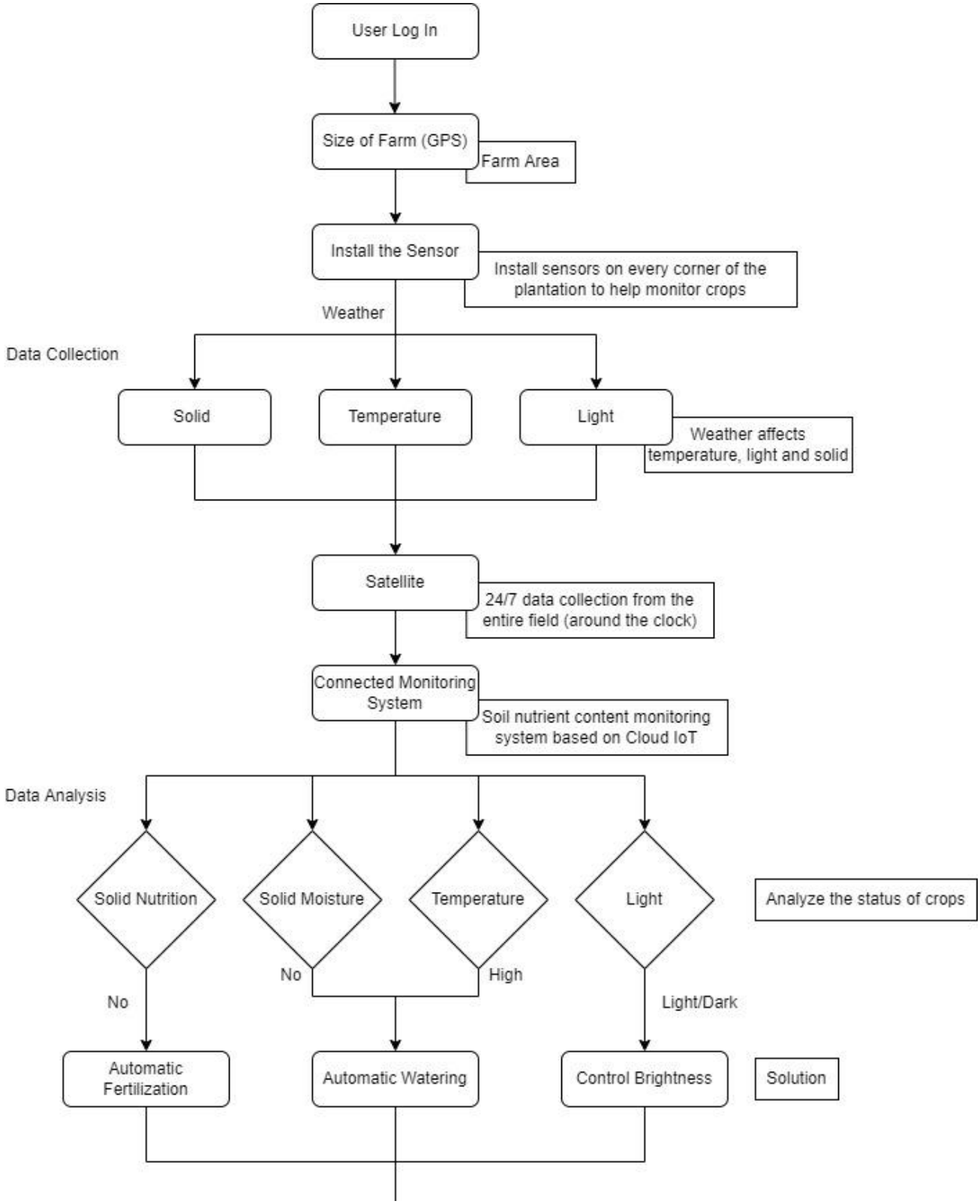
Advances in technology have increased the size, speed, and productivity of agricultural equipment, enabling more areas to be farmed more efficiently as a result of these advancements. Seed, irrigation, and fertilizer quality have all improved dramatically in recent years, allowing farmers to enhance yields.

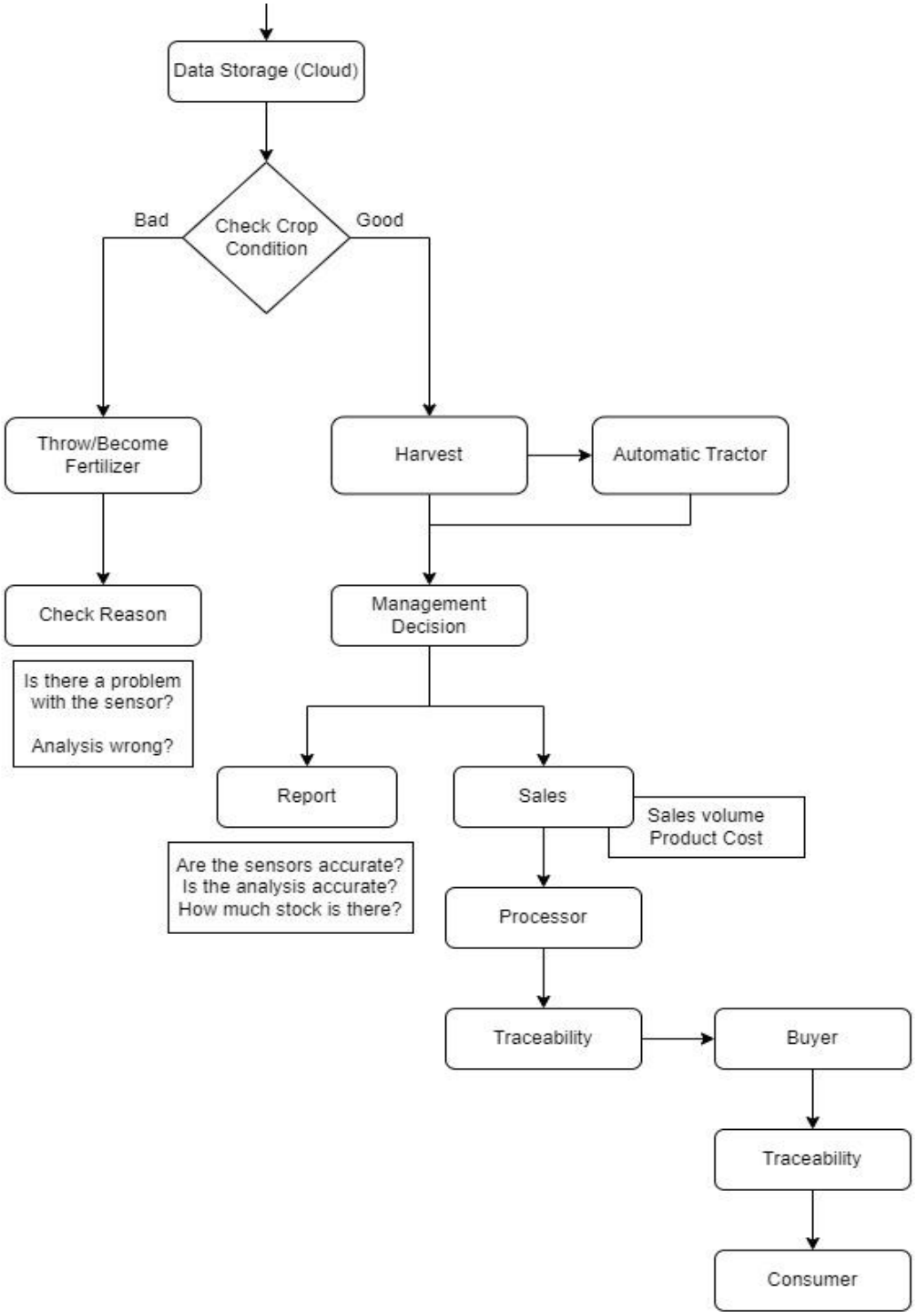
AWS Architecture Design



1. The sensors and drones that are not using FreeRTOS will transmit the data through the ZigBee gateway.
2. ZigBee will act as wireless protocol to make a protocol conversion and send the data to AWS IoT Greengrass.
3. The sensors that use FreeRTOS will send data AWS IoT Greengrass as it operates to avoid intermittent connection. AWS IoT Greengrass will connect the sensors and other devices to make it continue to communicate with each other over the local network.
4. AWS IoT Greengrass sends the data such as temperature, soil's moisture, pH, nutrients and drone's picture or video to store at Amazon S3.
5. AWS Iot Analytics will use the data recorded in the Amazon S3 to analyze the corps conditions and make the insights to report the user.
6. AWS IoT Events will detect the problems of the analyzed data according to the user settings and will produce the signal.
7. Amazon SNS will notify the users.
8. All analyzed data was kept in Amazon RDS.
9. Users can use the application in order to view the insights of the crops and the video by accessing the data from Amazon EC2 instance.

Business Process Flow Diagram





Flow Diagram Description

The user logs into the app, first of all, we need to know your farm size through GPS to detect how big your farm is. Users need to install sensors in every corner of the plantation to help monitor crops. Solid-state, temperature, and light are affected by the weather. Collect soil,

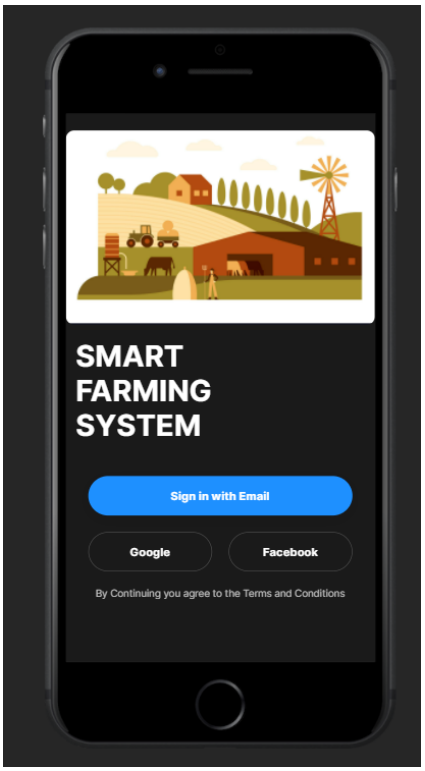
temperature, brightness data. 24/7 satellite data collection and transmission to users for real-time insights. A cloud-based IoT link monitoring system can observe and monitor the situation. Analyze soil and environmental conditions and act on the data.

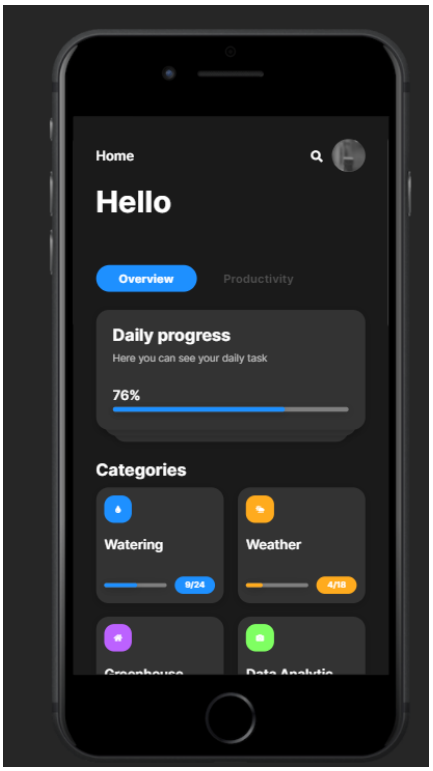
Here I assume several conditions, soil nutrition, if the soil has no nutrition, the crops will not be fertile enough, so when the data analysis shows that the soil nutrition is not enough, you can turn on the automatic fertilization function to solve the problem. Followed by soil moisture and temperature. If the soil moisture is insufficient, it means that the water is insufficient. In addition, the weather is hot, the temperature is high and the water is dry, which will cause damage to crops. Therefore, we can judge and take action based on real-time data analysis. If the above situation occurs, please turn on automatic watering to ensure that the crops have enough water. Then there is the relationship of brightness. Too bright will dry out the crop because brightness has thermal energy, too dark will make it unable to photosynthesize. In this data case, you can analyze whether the brightness needs to be reduced or increased by controlling the brightness.

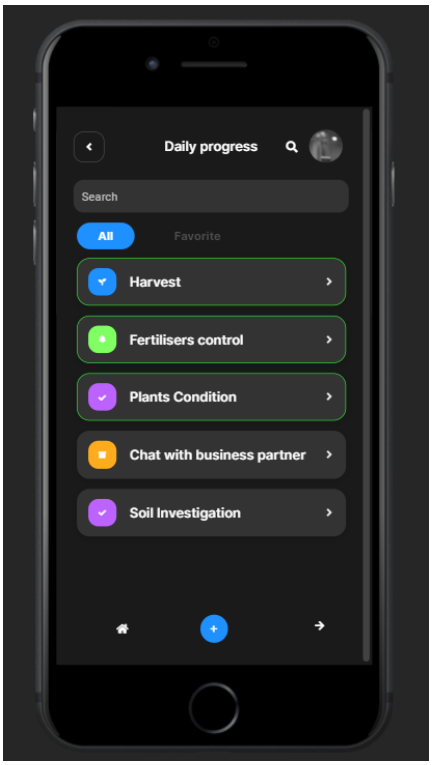
The data you analyze, such as when you control the brightness, whether you turn on automatic watering or fertilization, and the data you collect, such as soil condition, crop condition, weather, and environmental conditions, are stored in the cloud. This software can be used to observe whether crops are mature, and can detect the quality of crops when they are mature. If the crop is bad, it can be thrown away or used as fertilizer. Of course, we need to know why the crops are bad. For example, the reason could be a faulty sensor or an analysis error from which to learn.

The crops are of good quality and we can harvest them with automatic harvesters. Then comes the management decision, which is to let the user choose whether to sell or store it in a warehouse and put together a report. The report includes various measures taken this time and the number of crops in the warehouse for statistics. In selling, it is necessary to decide how many quantities and prices to sell, and then pass these associations through the processor to the buyer, who in turn sells it to the consumer.

Low-fidelity Prototype



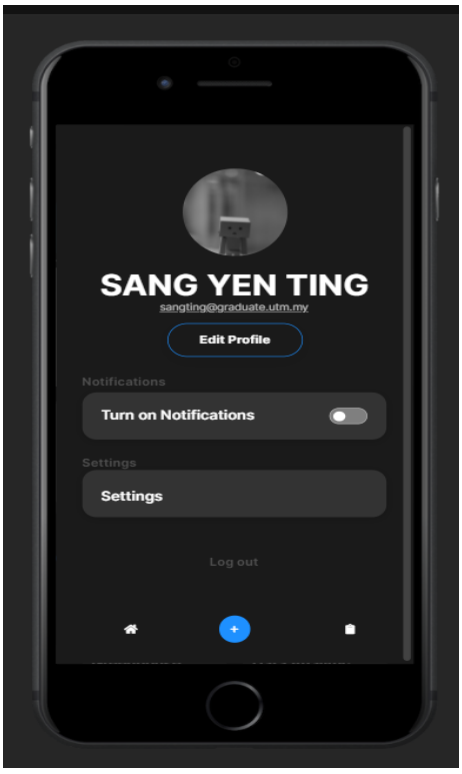





Greenhouse
Total Greenhouse
12
Total Crops
50
Total Energy Usage (Kw)
5000
Total Water Usage (gal)
11000
Total Yield (Ton)
125
Total Alerts
05
180 gal
150 KW
Greenhouse 1


Greenhouse


Data Analytic
Tomato
Seed Sown Date 13/11/2021
Estimated Yield (Ton) 20
Estimated Harvesting Date 2/2/2022
Estimated Soil Changed Date 5/6/2022


SANG YEN TING
sangting@graduate.utm.my
Edit Profile
Notifications
Turn on Notifications
Settings
Settings
Log out

I have done a low-fidelity prototype by using uizard. I choose to use uizard is because it is more easier to handle and manage. I created a low-fidelity prototype for a smart farm system with a sign in page. Which enables users to sign in by using email, Google or Facebook.

Secondly, I create a Homepage which is easier to have all the information for users to access. The home page includes a daily progress which allows users to check their progress and also add to-do lists after this page. The home also includes categories which users will be using to monitor the watering system, weather, greenhouse, and data analytics. By clicking these icons, they will be able to bring users to the page they want to.

In the third page is the daily progress which allows users to check thiery daily activity and also by clicking on the plus button below the page and allow users to add new activities. Users can also click on the activities which have been done and delete the activities done.

On the fourth page is the watering system monitor. It shows the percentage of plants facing insufficient water. If the percent drops means plants are facing water shortage and emergency actions should be taken. This page will also present the next run which means next watering time is on when.

On the fifth page is the timing set to water the plants automatically. Time arrangement can be done on this page and users can also add new time by clicking on the plus button at the bottom.

Moreover, in the sixth page, it will provide weather forecasts to users on what time, what date and even weather forecasts for tomorrow and the next 7 days. It will also show a graph that provides information about the possibility of raining on what time.

In the seventh page, it shows a total analysis of the greenhouse for users. It displays the total greenhouse, total crops, total energy usage, total water usage, total yield, total alerts. It will also display graphs for total water usage and energy consumption for every greenhouse that is owned by users.

In the eighth page, it will redirect users to access the information of one of the greenhouse. Users will be able to see the total crops in the greenhouse, total energy usage, total water usage, total yield and total devices. It will also display the temperature, moisture and humidity in the greenhouse. Alerts will be given and sent to this system once the greenhouse is facing any problems. Graphs about water usage, energy usage and productivity will be also displayed in this page to allow users to get updated information.

In the ninth page, it is a data analytic page that makes it easier for users to know history data and also know which plants have been planted, how long does it take to harvest and how long the soil needs to be replaced to plant other things. This page will provide all the information that users wanted to access and also the condition of the crops. It will show the soil nutrition levels, water and energy usage, yield and also it will provide disease information and the ways to cure and prevent if the crops are facing any problems.

In the last page is the user profile page, users can update their profile and information to let other companies know each other and also help to promote the crops. This increases the business between users and other companies.

This is a simple introduction about the low-fidelity that has been done and more features can be added into this system to improve the system.

Below is the link that can access to this low-fidelity prototype :
https://app.uizard.io/p/1e9940a4

Self Reflection

a. What have you learned and your motivation to complete this project?

Tan Li Sin:
I am more familiar with Cloud IoT and AWS. I know what kind of problems to make different decisions to solve. Which AWS service is more suitable for different needs. I can also better understand the usefulness of different AWS services. I also gained a better understanding of today's smart farms by searching for information on the internet. IoT helps the agriculture sector (smart farm) get more accurate data to improve yield and crop quality. This greatly increases the efficiency of agriculture. I've been motivated to do it, of course, because I can better understand the multifaceted nature of the 4IR. On the other hand, because this is a collective report. My team members are nice and positive and I don't want to drag them down.

Sang Yen Ting:
I learn about how AWS Cloud works and how IoT helps in human daily life. I know what services that AWS provides and how it helps customers in different needs. I also learned about how Iot and Cloud cooperate together to help humans in the agriculture sector. IoT helps to minimize the amount of workers and it is very important during the pandemic. IoT helps the agriculture sector in obtaining more accurate data and preventing plant diseases. I even learned how to make a low-fidelity prototype which I was in charge of designing. It is easier to have a low-fidelity prototype to understand how the software works and how the software gets applied into the agriculture sector. I also gained a better understanding on smart farming which most of the agriculture companies have started to implement technology into the agriculture sector.

Sukanja a/p Somsak:
Throughout this project, I was able to understand more about the 4IR and Amazon Web Services (AWS). I was assigned to do the AWS Architecture Design part which is important to creating the prototype part. I need to do more research about the usage of AWS in designing the IoT ecosystem of agriculture. I need to consider the appropriate services of AWS that we need to use in order to solve our problems. The motivation for me to complete this is my father and my

teammates. Firstly, my family is already involved in the agriculture sector since our great grandfather and now is my father who will inherit the work in this sector. My father is the first person who implemented the use of IoT in the watering system in our own estate, which is my inspiration for doing an assignment about agriculture. Thus, I suggest finding the problem regarding agriculture to my teammates and they show their support by agreeing to this topic.

Edip Uslu : I was especially motivated by my group colleague by their great effort, which I much appreciated. The efforts of my buddies motivated me to learn more and to study harder. I have gained a great deal of knowledge about smart farming as well as how to handle massive amounts of data information. I've gained knowledge about cloud computing, AWS, and a variety of other technologies. I also gained a better understanding of smart farming, which is becoming more popular in the agricultural business. I believe that the knowledge I've gained will help me to make significant improvements in my professional life and to have a positive impact on the world. I've also discovered that the Internet of Things enables businesses to automate procedures and save money on labor. This training was really beneficial to me in every way. I received more information about technology as well as about working in a group. This constant stream of new topics that I studied and gained knowledge about kept me driven to continue learning and understanding more. I was grateful for the opportunity to obtain significant experience that would make me more valuable in the future.

b. What issues and solutions are implemented to make the project a success?

Tan Li Sin:
I encountered three major problems: time, data, thinking. The first is time. When I did this report, I was faced with multiple assignments and exams and I couldn't change them. To solve the problem of lack of time, I had to stay up late. The second is information. There aren't many examples of smart farms online, so I'm looking at multiple sites that aren't very relevant to our project, so I discuss ideas with team members and exchange information they find with each other. The third is thinking, I think we need to think, we need to be creative because most of this project is written with thinking. When I don't know what to do, I ask my friends for advice to give me more ideas.

Sang Yen Ting:
I am facing a few major problems. I don't have enough time to complete this project due to multiple assignments and tests being nearby. I solve this problem by sacrificing my sleep time for doing this project. I'm facing the issues of creating a low-fidelity prototype. Most of the apps are not free to use for me as a student which I cannot afford. I solved this problem by screenshotting the picture of my design rather than exporting it from the apps which they didn't allow me as I didnt pay for the apps. I also have to think about how to make the design work and I solved this problem by higher order thinking skills. I think as much as I can and don't lose any detail from it. Besides rational thinking, I also need to be creative so I can have marvelous ideas to be implemented into this project.

Sukanja a/p Somsak:
I believe in every journey of completing the tasks, the problems will arise even if it is a small problem. As for me, I have issues about the time management, the ideas of the project and also the most difficult part is my internet connection at my current location. For the first problem, as all the assignments and tests were day by day, I need to manage my time wisely in order to do the revision for the test and also time for completing the assignment. Moreover, the internet connection was a serious issue that disturb all of my workflow as the connection went worse during night time which is the time that is suitable for doing revision and assignment for me. So, I came up with waking up early in the morning to do the assignment and revision instead of doing it at midnight. As for finding the ideas of the project, all of the members in our group have a discussion and work together in order to come up with the most preferable ideas.

Edip Uslu: As the case with any group project, the most crucial components were coming up with an idea and working efficiently. I was able to manage my time by effortlessly arranging my weeks and assigning myself due dates to complete. The WhatsApp group that we created was also really beneficial in terms of notifying me. My group friends were really helpful in everything and always assisted me with any problem. Using suggestions from the group was really beneficial in keeping us on the same page and focused on the same goal of the project. We exchanged relevant information and set due dates for each other's assignments.I really believe

that nothing is difficult when done in a group setting, since the large effort is broken down into smaller chores. The little pieces of work are less difficult to manage.

c. What is your direction after completing this project?

Tan Li Sin:
At the end of this report, I would like to see reports from different people and would like to know what their 4IR options are so that I can learn more about how others will use the 4IR options for different situations. Continue researching the sector I'm studying： it will be helpful for future projects. Of course, if I have the ability, I want to do something about intelligence. After all, the development of the times is so advanced that if it does not progress, it will be eliminated. The most important direction is to study hard. We wouldn't be able to make this report if we didn't study hard. For the future and direction, we must study hard.

Sang Yen Ting:
At the end of this report, I would like to know how people think about implementing technologies into the agriculture sector as humans are improving and there will be more and more things that could be related with technologies. I wish to know their opinions about 4IR so I can get more ideas during studying further into 4IR. I wish to create a full system which can be launched to help others in the future. Moreover, I need to keep on studying to get progress as the development of humans nowadays is getting faster and faster. If we don't study hard to catch up, we will be easily replaced by others, even AIs and will be out of this society.

Sukanja a/p Somsak:
After completing this project, I will learn more about things other than IoT such as machine learning and AI. These days, AI plays a crucial role in our daily life such as self-driving cars, smart assistance, social media monitoring and others. Hence, I think we need to explore more about these sides as it can help us more understand its mechanism and have time to think on how we will live with these machines in the future.

d. What is the improvement necessary for you to improve your potential in the industry?

Tan Li Sin:
I need to improve my arranging and creative skills. I feel that my creative ability is not high, and it is difficult to come up with outstanding features and ideas. Creative ability is very important in the market, because many life problems can be solved through creativity, and many things can be invented through creativity to benefit people. Then there is the ability to arrange. The point here is scheduling. Make good use of your time and do things with less energy. This is also my weakness. Everyone's time is the same, he/she can do it in a limited time, why I can't. These are areas where I need to improve so that I can increase my potential in this industry. Suppose these skill advancements are more helpful and efficient for me to do things.

Sang Yen Ting:
I need to improve my hard skills and soft skills. I need to improve my hard skills such as technical knowledge that can be learned from university. I need to gain as much knowledge that I can to keep myself from falling off track. Knowledge never betrays us, just keep studying until we can’t. I also need to improve my soft skills such as communication skills and leadership skills. I can communicate easily with others to have a great social relationship and I can lead a team better with good communication skills. I also need to improve my thinking skills so that I can get more ideas easily and think out of the box. I also need to increase my efficiency as I need to finish all the tasks at the same time and it is all about time management. When I manage my time nicely, I won't be rushing and I can also finish my tasks perfectly and efficiently.

Sukanja a/p Somsak:
In my opinion, I need to always be alert or up to date on the news about 4IR and the other technologies that were implemented in this era. Moreover, I need to always polish my soft skills and hard skills and also need to develop my new skills. As we can see, today’s world is moving forward at a fast pace which we need to catch up with the latest trend, otherwise we will be left behind.

References

[1] Cassidy, E., & Snyder, A. (2019, May 30). *Map Of the Month: How Many People Work In Agriculture? - Resource Watch Blog.* Resource Watch Blog. https://blog.resourcewatch.org/2019/05/30/map-of-the-month-how-many-people-work-in-agriculture/.

[2] Malaysia - Employment In Agriculture (% Of Total Employment) - 2022 Data 2023 Forecast 1980-2020 Historical. (n.d.). Malaysia - Employment In Agriculture (% Of Total Employment) - 2022 Data 2023 Forecast 1980-2020 Historical. https://tradingeconomics.com/malaysia/employment-in-agriculture-percent-of-total-employment-wb-data.html.

[3] Download Farm Food Production Flowchart for free | Flow chart, Agriculture design, Flow chart design. (n.d.). https://www.pinterest.com/pin/458030224606161128/

[4] Russo, B. J. (2019, September 25). A Framework For Managing Information In Precision Ag. Retrieved from https://www.precisionag.com/digital-farming/data-management/a-framework-for-managing-information-in-precision-ag/

[5] K. (2021, November 25). What You Need To Know Before Drawing A Business Process Flow Diagram. Retrieved from https://kissflow.com/workflow/bpm/business-process-flow-diagram/#:%7E:text=What%20is%20a%20business%20process%20flow%20diagram%3F%20A,may%20occur%20when%20the%20process%20is%20in%20action.