

Simulated Driving Learning System

Report for Assignment 3: The IT World

June 1st, 2019

Provided by:
Stick Finger dismissal

Xuyi Wu

Basil Livovac

Jialiang Gong

Yuhao Tang

Junquan Chen

Hui Li

Zongzhou Wang

Zhenghui He

Contents

1. Team profile.....	3
2. Personal information.....	3
3. Group processes.....	5
4. Career Plans.....	5
5. Tools.....	6
6. Project Description.....	6
6.1 Overview.....	6
6.1.1 Topic.....	6
6.1.2 Landscape.....	6
6.1.3 Motivation.....	7
6.2 Aims & Goals.....	7
6.2.1 Built up sensor network.....	7
6.2.2 Built up shared database using Blockchain.....	7
6.2.3 Design systemAI.....	7
6.2.4 Making system as well as software and application.....	7
6.2.5 Design peripherals.....	7
6.3 Plans and Progress.....	8
6.4 Roles.....	13
6.5 Scope and Limit.....	13
6.5.1 In scope.....	13
6.5.2 Out of scope.....	13
6.5.3 Limits	13
6.6	
Tools	
and	
Technologies.....	14
6.7	
Testing.....	15
6.8 Timeframe.....	18
6.9 Risks.....	23
6.10 Group processes and communications.....	25
7. Skills and jobs.....	26
8. Feedback.....	28
9. Group Reflection.....	28
10. Reference.....	32

Assignment 3: The IT World

1. Team Profile

Team name: Stick Finger Dismissal

2. Personal information

Name: Xuyi Wu (Virgil)

Student number: s3733582

My name is Xuyi, you can also call me Virgil. I come from China, I majored in Information and Communication Engineering in a military school and served in the army as a sergeant before I came here and majored in Info Tech. I love computer games and I'm very interested in programming. I hope one day I can develop my own game.

Name: Hui Li

Student number: s3642065

I come from China, so I am an international student in Rmit university. I have received 12 years of education in China. So Chinese is my first language, and English is my second language. Then, I will talk about my hobbies, computer is my favorite thing, I like playing computer games, watching movies, surfing internet etc. Computers is a best thing for me. After that playing basketball is my favorite outdoor sport, I like watching the NBA. LeBron James is my favourite NBA star.

Name: Basil Lilovac

Student number: s3786614

My name is Basil Lilovac and I was born in Australia. I am a first year RMIT student and am doing a Bachelor of Technology. Some hobbies of mine include basketball, video games, movies and tv shows. I have always been interested in IT. I chose to pursue a career in IT last year in year 12 because I felt passionate about it and thought that I could do well in it. My IT

experience is very limited, the only real IT I have done was in high school although it didn't go into any real depth.

Name: Gong Jialiang (Datura)

Student Number: S3678537

This is Gong Jialiang. I'm from Southern China, Guangdong Province. I enjoy playing games, including ball-games and e games; hiking or driving out for a trip are also hobbies of mine. For information technology, I have firstly heard, and tried, and now learning. The more I know about IT, the more I am interested in it: a way to command a servant who never refuses you request, if you pay for electric fee. I have few IT experiences and the first experience is about the tiny little bit of knowledge about different of languages.

Name: Junquan Chen

Student number: s3762081

I'm from Hangzhou, which is located in the southeast of China. I'm studying a Bachelor of Information Technology at RMIT. I'm a kind of a rookie in the computer and IT area, this is my first time to study IT. I've never touched it before, computers used to be just entertainment for me. My favorite sport is basketball; I watch the NBA as well. Also, I play League of Legend and some video games on PS4.

Name : YuHao Tang

Student number: s3699311

I come from China, I can speak Mandarin and English. This is the first semester at Rmit. I felt so excited and nervous about my university life. I have no IT experience but I think I will like it. I like baking, I am enjoy making desserts in my spare time, so I have become a foodie slowly. I also like sports so much, like skateboarding and basketball. I skateboard to and from school almost every day.

Name: Zhenhui He (Herbert)

Student Number: S3670160

Email: s3670160@student.rmit.edu.au

My name is Zhenhui, you can call me Herbert, I am from south part of China and I'm a crazy Liverpool fans, before I came to RMIT, I was studying Bachelor of Graphic Design in China, I want to become a web developer.

Name: Zongzhou Wang(Kim)

Student number: s3688540

Email: s3688540@student.rmit.edu.au

My name is Zongzhou Wang, and you can also call me Kim. I major in Bachelor of IT and this is my first year. I was born in China, so I speak Chinese and also English. I had no IT experience before but I think I will learn a lot in RMIT. I have some hobbies such as playing basketball and table tennis, playing video game and listening to music. And I really love pets especially dogs.

3. Group processes

Our team worked well during Assignment 2, There were no complaints, no arguments during the whole process. Everyone had a clear division of tasks, worked actively, efficiently and completed their own parts on time. Whenever something happened, everyone responded very quickly, helped each other, encouraged each other and solved the problem in a very short time. A new member joined us after Assignment 2 so we have more manpower to handle Assignment 3 and now we need to know each other again. During the process of Assignment 2, we have clearly understood everyone's strengths and weaknesses. This time, we will assign tasks according to the strengths and weaknesses.

4. Career Plans

All of us plan to work in IT industry in the future but in different positions according to our interests. Three of us plan to take the positions of web developers mainly because the web developer is the position which has lowest requirement. One of us would like to be a technical consultant because he's both interested in IT and communication. Some of us plan to work as engineers due to different reasons. Some want to follow the trend, others just enjoy coding. Most of us plan to work after graduation while some of us would like to find a IT related part time job during the semesters. Most of the positions require

mastering at least one programming language and some work experiences there for, all of us need to learn at least one programming language and accumulate as much experience as possible during the study time.

5. Tools

Link to group's website: <https://kretous.github.io/Group-Web/>

Link to group's Git repository: <https://github.com/kretous/Assignment2>

Most of the report was done on Google doc and Integrated by Xuyi then uploaded to GitHub so there's only one contributor on GitHub.

6. Project Description

6.1 Overview

6.1.1 Topic

Technology have a huge boost to human life and improve the quality of life in every single field. It has changed the way of living, the way of working, the way of playing and of course, the way of studying. Nowadays, people can almost study everything online while driving is not included due to many reasons. After observing our team ideas, we thought of a simulated driving learning system which will change the situation.

Our simulated driving learning system will be based on artificial intelligence and Internet of Things, developed by software and built on Blockchain technology. With the help of some peripherals It will teach us knowledge the novice drivers the driving skills they need and allow them to improve their driving skills by driving in virtual reality which is almost the same with the real-time traffic.

6.1.2 Landscape

There are many driving simulators on the market like Ambulance Simulator, Car Simulator, Bus Simulator and so on. most of them are used for entertainment and a small number of them are used in training of driver's education courses taught in educational institutions and private businesses("Driving simulator", 2019). The problem is, they only allow the driver to learn basic driving knowledge and most of the time, the simulators are so unreal that the situation in the simulator is almost totally different with the real world. Currently, the most real simulators are probably the games on home console like Froza 7 and GT sport and as

everyone knows, they are only designed for entertainment and even the best player in the game can not drive a car without a driving license.

6.1.3 Motivation

Our simulator will completely change the pattern of driving learning system. The AI will make the whole system extraordinary smart, the IoT will ensure the reality and the blockchain will protect the security and reliability. Many drivers experience unexpected situations while driving because sometimes it will be quite difficult to make the right decision if they have never experienced it. Many people can't pass the driving test because they don't have enough time to go out for a driver's education course. However, these problems will no longer exist with the help of our simulator as everyone who wants to drive can be trained and get their license at home and it will undoubtedly reshuffle the whole industry.

6.2 Aims & Goals

The aim of this project is to design and build a simulated driving learning system which is almost 100% simulation of real scenes. The system will be suitable for multiple platforms like PC, mobile phone and home console. The system will have the ability to learn crisis management from previous traffic accidents, give appropriate advices to the users and of course, teach the users how to drive.

To achieve the aim, we setted several goals:

1. Built up sensor network:

Just like Uber, Google and other technology companies who use laser beams, radar, high-powered cameras, sonar, along with other sensors, to construct their internal map and build up their self-driving system, we will also use these devices to build up our sensor network. The only different is, instead of setting these devices on the vehicles, we will locate them along the road within a certain area so that everything, every movement will be shown on our 3D modeling map(UCS, 2018).

2. Built up shared database using Blockchain:

After setting up the sensor network, we will build up our database on Blockchain so everyone can store and share their information in a transparent but secret way. This database will be particular designed to collect information about traffic accidents as preparation for the system AI that might be designed next.

3. Design system AI:

If conditions permit, we will design our system AI. The system AI will be very smart. By machine learning, our AI will statistic and analyse the information from database, find the best solution to the accident cases and enhance users' crisis judgment ability by restoring accident scenarios.

4. Making system as well as software and application:

Our system will be designed on PC platform first due to the limitation of computing power of other platform but it should have the ability to be ported to another platform. Therefor, software design and application design will be necessary at this stage.

5. Design peripherals:

Some peripherals will also be required to run the system in order to simulate real driving. There's already some driving peripherals in the market, we will probably choose one or customize one if necessary.

6.3 Plans and Progress

Most of the car accidents are caused by the driver's misjudgment. A small mistake is likely to cause a fatal injury. Panic takes up the driver's brain to make a wrong judgment, but when people have encountered the same situation, make the behavior of misjudgment is relatively reduced. When an emergency occurs, the driver uses the coping method learned in the simulated driving learning system, which may have a high probability of reducing the accident or reducing the loss caused by the accident. The ultimate goal of this system is to give drivers more perfect driving skills, thus reducing accidents and mitigating accident losses.

The whole project will be divided into several stages and will be implemented on both physical and software level at the same time.

The physical level is mainly about the sensor network and the choose of devices. Firstly, we will find the best field according to our budget. The diversity of situation in this field should be as considerable as possible. It should include most of the landform include hills, mountains, plateaus, canyons, and other landforms like valleys, shoreline features if possible("Landform", 2019). It should also locate at a busy place with complex and busy traffic, a variety of transportation and many pedestrians. The weather should also be diverse including sunny days, rainy days and other situations. These conditions may not be met at the same time but they will be sort by priority and the most suitable place will be located.

The implementation of the sensor network will be started after obtaining the permission. The sensor network will be able to gather information and process it to make a 3D modelling map. Our sensors will be able to get information about cars that are in basic situations that happen on the road which we can interpret and implement into our simulated driving learning system. We can use our sensors to get a whole lot of information on the road such as the environment around the cars, how the cars respond to different commands such as stopping and accelerating and just in general how the cars and other objects function. We need this information because it will then be used to construct a more genuine and authentic simulation which will provide a better experience to the user and prepare them better for the real world.

The choice of sensor devices will also depend on our budget. Laser beams, radar and high-powered cameras will probably be the best choice. With More sophisticated instruments, we will have the ability to make a more accurate 3D modelling map and with the increasement of the number of devices, the map will cover a wider space so that the users will experience the real driving environment more freely.

Currently, the driving seats used for driving simulator like DXRacer PS/COMBO/200 Racing Simulator and Playseat Evolution REM00008 Alcantara Universal are mainly designed for entertainment thus a lot of features of real cars are subtracted. To simulate the real driving experience, we may need to customize a new peripheral which almost have all the buttons on the real car. A VR headset will also necessary, headset like Oculus Quest or Sony PlayStation VR will be enough.

Another goal of ours is to have a database using blockchain, the security and transparency that blockchain provides is a very good thing and it can be trusted to store sensitive information. We decided not to go with a centralized server to store our information because it is vulnerable to hacking and our data could be manipulated which can lead to wrong learning from our system and although the driving isn't real it's meant to be a simulation and this could lead poor habits learned and then taken out into the real world which could cause serious injury or even death. We also value that by using blockchain our users can be certain of the integrity of our data and that our data is safe to use. Our blockchain database will have decentralized control which gets rid of the risks of having centralized control. Anybody with enough access to a centralized database can destroy or corrupt the data within it. Blockchain technology uses decentralized data storage, thereby forming security into its design.

Other benefits include transparency, because more than one person will have access to the database it's important that the data can be shared between multiple people therefore, we will have smart contracts for our data. A smart contract is a contract between people in computer code, these contracts hold the people involved in the contract responsible and we would have these to hold our team responsible. This is also a fantastic way to get rid of a third party which makes our tasks more efficient and effective. This database will be used to store all our data that has been collected, data such as traffic accidents, traffic conditions and road

conditions and then be shared. We feel our data should be protected and only seen by people that have authorization to view it.

The database, AI and system will be designed and executed at the same time as the sensor network.

We can store our data, analyze it and later the system AI through machine learning will produce information on things like the most common type of traffic accidents, for e.g. rear end collisions and low speed collisions. Through machine learning it will also produce information on the road conditions and show the most typical types of road conditions while also showing the least typical because if you're not introduced to that type of situation people would not know how to react. After the system has analyzed the data and produced the information it can then find the most effective solution to dealing with accidents, the system will make sure that these solutions can be implemented into the real world so users can make sure that this is and will also make sure the user has practiced them. As said earlier most car accidents are caused by the driver's misjudgment, therefore the System AI will also test the user's crisis judgment ability with different scenarios and how the user responds will determine their abilities. To complete all these tasks, we will have a CPU that will be the brain of the whole system but also program machine learning by writing algorithms which is basically steps that the system will follow and complete. By using a beginner programming language, we can program an algorithm that completes all the tasks that are required by the system and this will make it easier because the system will be more efficient and precise when going through the data.

As we were planning our project, we found that a by-product was created. Our information could be used in a host of different ways besides a driving simulator, we could have a traffic information sharing platform which can be used by plenty of groups who would want to use the data. Everyone will have free access to the platform and be able to share their information by their personal devices such as GPS information supported by google maps and we probably would have to be the third party to facilitate and take care of the distribution of the data provided. Another by-product could be that our system could analyze the drivers driving habits so it can provide a better way of navigation to our users although we would also have to work with GPS navigation or some sort of other GPS technology to achieve it and provide a better service to our users. An example could be if someone wants to avoid highways and freeways our system can provide navigation on how to avoid it or if someone prefers quiet streets and dislikes crowded streets, our system could provide navigation away from crowded streets and towards discreet streets.

The system should have the following features:

Before using the system, the system will ask the user to select the model of the car to be driven in the future. The system will analyze the car's handling and safety levels based on the car selected by the user and performs the most realistic car simulation.

When a beginner uses the system, the system only requires people to learn basic driving skills, drive at a low speed, good weather and does not cause any interference to the driver's driving.

As the driver's practice time becomes longer, the system will provide the driver with more complex driving conditions, such as weather changes, landform changes, road narrowing, and an increase in the number of vehicles traveling. At this stage, the system extracts the state of the car from the cars around the world, and feeds the information back to the driver's driving process through system switching, thereby enabling the driver to experience more complicated driving situations.

When driving time is accumulated to a certain extent, the users will be able to choose the real driving mode which is supported by the sensor network and system AI and is the restoration of the real scene. The users will have the chance to feel the real world, real drivers around them.

During the users' driving, the system will record the user's driving habits in complex road conditions in the background, and analyze the driver's bad driving habits. Based on these analysis, the system will calculate the most likely emergency and test the driver in the next phase.

To achieve these features, firstly, we need a perfect 3D modeling technique to make the scene more realistic.

(1) Study the physical modeling environment based on the state of virtual vehicle motion. This will provide a more practical simulation for our users because our simulation will be very similar to driving in the real world which provides a great learning experience for our users. Key technologies such as power system flexibility, collision detection, friction, etc.

(2) Organizing and managing simulated driving interaction information in virtual three-dimensional space Study various human-computer interaction interface modes.

(3) Exploring the realization of parallel multi-user distributed virtual drive technology and communication technology.

(4) A huge road model, and to ensure smooth, comfortable and beautiful.

(5) Local application of GIS information system in automobile simulation driving Road navigation vehicle positioning.

(6) Research on virtual world visual effects modeling technology. Learning efficiency, feasibility, etc., mainly to solve environmental problems in the virtual world, Visual effects such as water flow particle system atomization effect rain snow light shadow .

(7) Spring, summer, autumn, winter intertwined, day and night conversion, Match changes in driving conditions. Our users would most likely have to drive in different weather conditions in the real world therefore our simulation will be able to provide different weather conditions to the users and the system will see how the user will respond to the different weather conditions and provide tips on dealing with those conditions.

(8) Simulating car driving in the virtual world, numerous and digital art, Characteristics of surgery and aesthetics. This is important because the more aesthetically pleasing it is, the more likely drivers would gravitate to our simulated learning system.

When the student enters the next stage after being familiar with the complicated road conditions, the system will analyze the sudden driving situation according to the driver's driving habits in the previous stage and identify which bad habits must be corrected or reminded. Of course, the system does not prompt the driver's phase transition, allowing the driver to maintain a calm driving state. As the road conditions change, the system will simulate the car accident information collected from all over the world, and let these situations appear in the driver's simulated driving. In the process of the first time, the driver who faced this situation for the first time often did not know how to operate because he lost his calmness. The system recorded the driver's reaction after the occurrence of this situation, showing the damage caused by the accident, and what caused the sudden change. The occurrence of the situation and give the driver the correct operational procedures. After experiencing this situation, the driver will have a preliminary understanding of the situation, understand how to correct his driving habits and deal with emergencies. When the driver exercises again, the system will put this sudden situation again.

In simulated driving, assess whether the driver's handling of such an emergency meets the established criteria (reducing the loss within an acceptable range or completely controlling the situation). If the assessment meets the criteria, the driver will be allowed to no longer face the same The sudden situation. Each time the driver processes the simulated sudden burst, the system will give a score based on the driver's reaction. This score will ultimately determine whether the driver passes the simulated driving test. If the driver does not pass the test, the system will Analyze the driver's score and then customize a similar test, which will help the driver to play an important role in real life driving.

This simulated driving learning system provides the most realistic driving experience for the novice driver to experience the unpredictable dangers that may occur in real driving in the future. Using a game-like exercise may make many people like this type of driving training. Building this system requires a lot of software and hardware support.

6.4 Roles

For this question, our answer is no, because currently, each of us has almost the same skills which come from our own experience. We can define roles for particular participants otherwise, each person would probably only stick to their personal work when necessary if we work together.

It is true that sometimes it is useful to define roles for particular participants, we may define role for particular tasks that will happen naturally.

6.5 Scope and Limit

6.5.1 In scope

The scope of this project is to design and carry out a simulated driving learning system including designing and building up the database, the software, the system AI, the applications on multi-platform, the sensor network and necessary peripherals. The project also includes testing and debugging. Some deliveries may not be completed due to the limitations below.

6.5.2 Out of scope

- Equipment maintenance
- Database management
- System protection
- Follow-up development
- Follow-up accident handling

6.5.3 Limit

There will be many limitations in implement of the project:

1. Technical limitations

Both vision-based systems and LiDAR-based systems have perceived difficulties under snow conditions. Many vision-based autopilot sensing systems rely on observing road markings to navigate the road. However, a thin layer of snow can cause these traces to disappear completely. In addition, even fuzzy, dirty, worn or painted road markings (without snow conditions) can adversely affect the Autonomous Driving System. This is one of the limitations. At the same time, similar situations can occur in the case of rainy or foggy conditions. Raining can affect the reflection of the lidar, which can obscure the camera's line of sight, thereby suppressing the ability to reliably perceive the surroundings of the vehicle.

In addition, a critical step is to apply artificial intelligence methods to the availability of problems and data. Because these systems are "trained" rather than programmed, processes typically require large amounts of tagged data to accurately perform complex tasks. Getting large data sets can be difficult. In some areas, they may not be available at all, but even if they are available, the identification work may require a lot of human resources.

2. Financial limitations

The project requires huge money to be completed. Both purchasing devices and researching will probably lead to lack of budget. If there is no financial support, it will be very difficult to complete the project.

3. Manpower limitations

More importantly, manpower is also very limited. A project always requires more than one team to implement, our will require a lot of people to test the data analyze it build up the system and so on. A team of 8 people may be not enough.

4. Privacy limitations

It is also very difficult to collect data from the users. Our privacy policy may be resisted by the people due to many reasons and if the user refuse to share their information, our project will be blocked.

5. Field limitations

The implementation of sensor network may be restricted due to the law since the sensors need to be located along the roads and it may be forbidden by the government.

6.6 Tools and Technologies

The sensor network:

Authentication technology is an important part of the security system, so it is of great significance to study the authentication technology of sensor network. Therefore, authentication technology is required as permission. It is necessary for protecting the information in the base. Also, computer languages are essential for these technologies, such as C++ and JAVA. The deep understanding of JAVA will be very helpful when we doing the project. What's more, JAVA Web is a good choice for developing server software. In addition, the excellence of algorithms is mostly evaluated by simulation software. The commonly used simulation software for a sensor network includes Matlab, NS2/NS3, OpenNet, etc.

3D modelling map:

tools: 3DMAX (3dmax is a PC based 3d animation rendering and production software)

Non-professionals can't understand the two-dimensional map, and the three-dimensional map is more intuitive and easier to get information from the map. Complex in three dimensions, the technical content is higher. We have to make sure the information on the map is the same as the real road conditions to avoid accidents.

Radar, high-powered cameras:

These will help system get more information. The sensor network is based on radar and high-powered cameras which collect every situation around the car, then sensor network start to work.

Blockchain:

Blockchain technology uses the new encryption authentication technology and the whole network consensus mechanism to maintain a complete, distributed and untampered continuous ledger database. Participants can ensure the security of funds and information through a unified and reliable ledger system and 'timestamp mechanism'. The data which stored by blockchain technology will be much safe.

AI:

Artificial Intelligence is one of the most important technology for the simulated driving learning system. AI can learn every skill as a human, it is going to model the learning ability of people to improve themselves (database). AI is applied in the control system and simulation system. However, Python works for most AI, so it has become the first AI programming language trend. We are supposed to use PyCharm which is a useful tool for professional developers and beginners. There are a lot of helpful functions in PyCharm, such as Code jump, smart prompt, autocomplete and unit test.

VR:

VR technology is now widely used for entertainment and education. It is a kind of computer simulation system that can create and experience the virtual world. it uses the computer to generate a simulation environment to immerse users in the environment.

Tools: VR headset, controller

6.7 Testing

Basic testing

The basic testing will base on the progress of the program. Each of the program will under the test, which will make the program the most simple and direct way to be used.

Sensor network testing

- Due to the great amount of data which need to be transform, the network should be stable enough and fast enough.
- In case of the AI system will need a real-time or a live street view, the network should not be disturbed by the weather.
- According to the system, the network should cover the whole part of the map.

Database Testing

- Expected response time for both input and output should be good enough to handle the great amount of data.
- The storage of the database should be large enough for the AI system to learning.
- Check whether the database is going to fulfil the following needs
- Check the database structure

Software testing on PC

- Model testing, including the model behaviour, the distance feeling of the mirror and the crash feedback. The model should give a right feedback on crashing, showing the point of crashing and based on the crash, the AI system is able to give a report on the crash.
- The 3D model making. Though the map is directly from the real world, the system should show the distance correctly while the corner should be shown the same as the truth.
- The response system testing. On the PC platform, the test will be simply tested to ensure the system behaves good enough to run on the visual map.
- Test the models from different devices is running properly at the same moment.
- Test the visual unit generating system. In this test, different unit should be generated to imitate the true road. It can be whether the vehicle in the real world which is driving on the real road and been taken into the system or the total visual car

AI testing

- The learning system will give an overall map for developer, which will directly give the information about the degree of how much it had learning. From the overall map, the developer will follow up and fill in the blank areas. On the other hand, a test car will be driven on the “road” for debug the part, which is not as clear as possible.

- Test if the system is able to set the departure and the arrival places. In the system, AI will help people to set a place and make a route in order to make sure the driver will be able to have chance to drive in different place and experience enough
- Test if the system if able to check the problem happened in the driving history and make a report properly. The report should include the irregular behaviour or the unsafe behaviour happened in the trip.
- Test if the weather is bringing difference changes to the map. The system will help to change the map in order to follow the truth.
- Test the system

Software integration test

- The interface of the app. Long as the program is facing to the people who is learning for the real-world driving, each parameters of the receptor will be checked, including the air-conditioner button. By the side, the sight of the mirror will be test, based on the data from the company of the brand of the car.
- Testing on the change of the rood, including the bridge, skew wave and rainy situation. For a beginner, learning to drive in different situation will be a great chance for student to know the way dealing with different kinds of emergencies. Besides, though for most of the true drivers may not have to deal with the accidents, people have to get some experience about dealing with the problem properly in a second. In this case, the simulation of some accident will be join into the learning system. Testers will check whether the system have the ability to perform an accident to the drivers.
- Model checking. For the most important change that the system bring to the world is: people have the chance to test the car they are going to drive. This is, people won't get confused when they firstly get to their new car. The system will include a size-changeable steering wheel and the parameter will change based on the real car. In this case, the learner will directly get the feeling of their cars. With the VR performing system, users will easily got used to their cars. For us testers, the VR performing system and check the parameter comparing to the data provided by the vehicle company.
- Light system. In different season, the most effective thing to the drivers will the sunlight. In the case, the light, based on the reality, will be check whether it's the same as the truth. In case of the place, which is different as the normal situation, such as the light in fog or by the side of the sea, developers will pay more attention.
- Light feedback testing. Light is important for a driver. In the test, the headlight in different model, the reflection of the light and the light in different mode should be test.

Peripheral running test

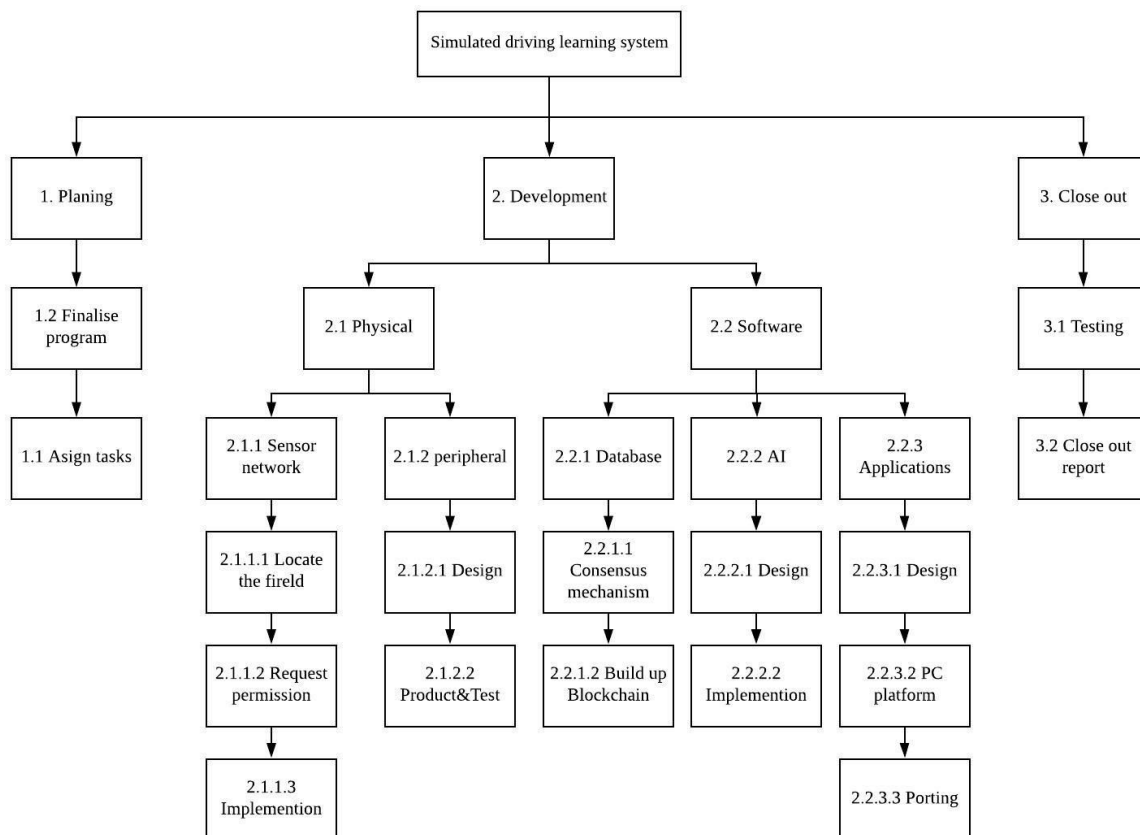
- The peripheral of the software should based on the truth. The peripheral test should firstly test the response time. The data should be join into the AI learning system, which should be take away from the real response speed.
- The force response should also been test and comparing to the reality. While the car is been driving, the feedback of different pedal is different. Test whether the pedal is giving different feedback.
- Set different indicator light; test whether the learner has switch on the light on the

proper time. As the known truth, some of the accident happened due to the indicator light is not working properly. By the side, the model should be the same as the car they are driving.

Cross-platform software migration test

- Test the map and simulating system
- Test the peripheral
- Test the database system on different platform

6.8 Timeframe



Task name	Duration	Start	Finish
Simulated driving learning system	120 days/ 180+ days	10/06/19	27/10/19

Planing	3 days	10/06/19	12/06/19
Assign tasks	2 days	13/06/19	14/06/19
Finalise program	2 days	15/06/19	16/06/19
Sensor network	70 days	17/06/19	25/08/19
Peripheral	80 days	17/06/19	04/09/19
Database	120 days	17/06/19	14/10/19
AI	180+ days	17/06/19	13/12/19
Applications	180+ days	17/06/19	13/12/19
Testing	7 days	14/10/19	20/10/19
Report	7 days	21/10/19	27/10/19

	Xuyi Wu	Hui Li	Basil	Zhenghui He	Junquan Chen	Yuhao Tang	Jialiang Gong	Zongzhou Wang
Week 1	Meeting and Assigning tasks	Meeting and Assigning tasks	Meeting and Assigning tasks	Meeting and Assigning tasks	Meeting and Assigning tasks	Meeting and Assigning tasks	Meeting and Assigning tasks	Not in the group
Week 2	Discussing the project ideal	Discussing the project ideal	Discussing the project ideal	Discussing the project ideal	Discussing the project ideal	Discussing the project ideal	Discussing the project ideal	Not in the group
Week 3	Planning and start doing the project	Waiting for the description and	Planning and start doing the project	Planning and start doing the project	Waiting for the description and	Waiting for the description and	Waiting for the description and	Waiting for the description and

	description	preparing for own part	description	description	preparing for own part	preparing for own part	preparing for own part	preparing for own part
Week 4	Adding features and technical details and start writing overview and aim	Familiar with the description and writing the scope and limit	Adding features and technical details	Finishing the project outline	Familiar with the description and writing technical	Familiar with the description and writing the reference	Familiar with the description and writing testing	Familiar with the description and writing the risks
Week 5	Finish the project description and start doing the Timeframe	Writing reflection and feedback	Writing reflection and feedback	Writing reflection and feedback	Writing reflection and feedback	Finishing format and writing feedback	Writing reflection and feedback	Writing reflection and feedback
Week 6	Writing reflection, feedback and finalise the report	Finalise the report	Finalise the report	Preparing the slides	Finalise the report	Finalise the report	Finalise the report	Finalise the report
Week 7	Planing, assign tasks and finalise the project	Planing, assign tasks and finalise the project	Planing, assign tasks and finalise the project	Planing, assign tasks and finalise the project	Planing, assign tasks and finalise the project	Planing, assign tasks and finalise the project	Planing, assign tasks and finalise the project	Planing, assign tasks and finalise the project
Week 8	Researchin g on sensor network	Researchin g on sensor network	Researchin g on Blockchain and database	Researchin g on Blockchai n and database	Researchin g on AI technology	Researchin g on AI	Researchin g on Applicatio n design for PC	Researching on Application design for mobile phone
Week 9	Continue studying on sensor network	Continue studying on sensor network	Continue studying Blockchain	Continue studying database	Continue studying on AI technology	Continue studying on programmi	Continue studying on programmi	Continue studying on programmin g

						ng	ng	
Week 10	Continue studying on sensor network and design the field	Continue studying on sensor network and apply for permission	Continue studying Blockchain and start build up	Continue studying database concepts	Continue studying on AI technology	Continue studying on programming	Continue studying on programming and start to design the software	Continue studying on programming and start to design the software
Week 11	Choose the appropriate sensors	Choose the appropriate sensors	Building up the blockchain	Building up the blockchain	Continue studying on AI technology	Continue studying on AI technology	Implementation the software	Implementation the software
Week 12	Purchasing the devices	Purchasing the devices	Building up the blockchain	Building up the blockchain	Implementation the AI	Implementation the AI	Implementation the software	Implementation the software
Week 13	Implementation the sensor network	Implementation the sensor network	Building up the blockchain	Building up the blockchain	Implementation the AI	Implementation the AI	Implementation the software	Implementation the software
Week 14	Implementation the sensor network	Implementation the sensor network	Building up the blockchain	Building up the blockchain	Implementation the AI	Implementation the AI	Implementation the software	Implementation the software
Week 15	Implementation the sensor network	Implementation the sensor network	Building up the blockchain and apply it to the software	Building up the blockchain and apply it to the software	Implementation the AI	Implementation the AI	Implementation the software on PC platform	Implementation the software on PC platform
Week 16	Design the map	Design the map	Apply it to the software	Apply it to the software	Implementation the AI	Implementation the AI	Implementation the software on PC platform	Implementation the software on PC platform

Week 17	Design the map	Design the map	Testing	Testing	Implement ation the AI	Implement ation the AI	Implement ation the software on PC platform	Implementat ion the software on PC platform
Week 18	Implement ation the modeling	Implementa tion the modeling	Supporting other people	Supporting other people	Implement ation the AI	Implement ation the AI	Porting to Android	Porting to Android
Week 19	Implement ation the modeling	Implementa tion the modeling	Supporting other people	Supporting other people	Implement ation the AI	Implement ation the AI	Porting to Android	Porting to Android
Week 20	Supporting other people	Supporting other people	Supporting other people	Supporting other people	Trying to apply it to the system	Trying to apply it to the system	Porting to Android	Porting to Android
Week 21	Supporting other people	Supporting other people	Supporting other people	Supporting other people	Trying to apply it to the system	Trying to apply it to the system	Porting to IOS	Porting to IOS
Week 22	Supporting other people	Supporting other people	Supporting other people	Supporting other people	Trying to apply it to the system	Trying to apply it to the system	Porting to IOS	Porting to IOS
Week 23	Supporting other people	Supporting other people	Supporting other people	Supporting other people	Supporting other people	Supporting other people	Porting to IOS	Porting to IOS
Week 24	Testing one	Testing one	Testing one	Testing one	Writing the close out report	Writing the close out report	Writing the close out report	Writing the close out report
Week 25	Testing two	Testing two	Testing two	Testing two	Writing the close out report	Writing the close out report	Writing the close out report	Writing the close out report

6.9 Risks

Risk category	Risk description	Impact level	Consequences	Mitigation Strategies
Human risk	ineffective management and communication: lack of a good schedule and tradition of meeting and reporting	high	Poor end result. Delay in project.	Have regular meeting, collect feedback of problem, suggestion and project progress timely.
Technical risk	lack of proper development tools and relevant experience: which is caused by shortage of human source of developing the system or a tight schedule of project	high	Poor end result. Delay in project.	Increase investment to get prepared in the early stage of development.
Technical risk	no backup: which can caused permanent loss of	high	Project fails.	Use cloud computing storage service to backup data.

	data, caused by bad habit of data backup			
Technical risk	insufficient hardware reliability:breakdown happens when hardware being used,mainly caused by bad maintenance and lack of check and recondition	high	Poor end result. Delay in project.	Have regular check on the hardware reliability, substitute unreliable part timely.
Technical risk	wrong system architecture:taking the wrong direction when developing the system architecture, caused by wrong decision making	high	Poor end result. Delay in project.	Ensure the team to include experts who understand the architecture and have the capability to make sound design choice.
Financial risk	budget shortage:lack of necessary capital to support operating activity	high	Poor end result. Delay in project.	Decrease unnecessary cost and ensure to get enough financial support
Process risk	potential to cause user's outbreak of panic, phobia or the disease like PTSD	medium	Cause damage to user's health. Delay in project.	Do relevant research, collect user feedback and improve the system.
Political risk	Change of relevant politics:politics will keep changing to adjust the changing environment, lack of study of the politics may cause the activity against the politics	low	Be warned or fined.	Get business licence and study and follow the latest relevant law and regulation.
Technical risk	sensor device's performance unable to meet actual needs: chosen device unable to have the expected performance, caused by the wrong choice of device or lack of budget	medium	Lower the quality of product	Take different kind of devices on trial to test their performance.

Technical risk	bad design of user training pattern:the training pattern is inefficient to help user achieve the goal	medium	Lower the effect of the training	Collect users' feedback and help to improve the design continuously
Technical risk	Poor portability of the system:difficulty on porting the system to other platforms, caused by the poor process of software development	medium	Damage the life cycle of the system	Take early measurement to ensure the portability of the system
Technical risk	Stuck in AI development:AI development is full of technological difficulty	medium	Poor end result. Delay in project.	Hire experts in the field of AI to work in the project and planning the schedule reasonably
Human risk	Delay of the delivery of purchased device:caused by the supplier or sudden change of the order	medium	Delay in project	Trace the order and connect to the supplier in time
Technical risk	Sensor network damaged:sensor device is fragile and can be damaged easily, and once damaged, its performance will be badly influenced	high	Delay in project	Ensure the Installation is without error, regularly check and maintain the sensor network

6.10 Group processes and communications

Communication was the part all of us most wanted to improve according to the reflection of Assignment 2. While it was also the part that most difficult to improve due to many reasons among which language was the biggest barrier. Since most of the group members come from china and some can hardly speak fluent English, there could be a lot of problems when having an English meeting. At the meantime, if we have a meeting in Chinese, the group members who can only understand English will find trouble. It was not so easy to find the balance and last time, Xuyi Wu was the interpreter between English and Chinese. There were also communication barriers between the members who spoke the same language since some

members were too shy to share their opinions in the group and Xuyi should communicate with them in private to get their feedback.

This time, to change the situation, we thought of several solutions.

- Change the way of communication. Since most of the members come from China, we used Wechat to communicate during Assignment 2. Some members who seldom use the application may not receive the information on time. This time we will use both message and Wechat for communication and it will probably improve the communication.
- We will have meetings once a week to give feedback of the progress. If someone cannot attend the meeting, he should leave message to let other know his progress and others should also tell him what he should do next.
- We will have both face to face meeting and online meeting. If someone who is not good at expressing or showing personal opinions, he could prepare for the online meeting and tell others what he thinks.
- If someone doesn't respond to communications, one of us will take responsibility to finish his part. If he doesn't respond for a long time, we will think about another method to deal with it.
- If someone doesn't speak in the team for a long time, at least one group member should talk with him in private to understand his ideas.

7. Skills and Jobs

Building this four-person project team to build this project requires considerable professional talent and must have a very rich experience.

First, the team needs a **data development engineer**, and needs to have very rich experience in cloud data development and collection. In addition, it needs to have :

1. Embedded bootloader and kernel development
2. Industrial communication protocol analysis (Modbus.EtherCAT.ProfitNet,etc.)
3. Windows/Linux platform gateway application layer program development
4. Software function test verification of the gateway product
5. Industrial Gateway product software SDK and Library development
6. Familiar with C / C++ development language
7. Familiar with industrial field data transmission protocols
8. Familiar with the Windows and Linux development platform
9. Cheerful, logical thinking, good team communication skills, good teamwork

Second, the team needs a **3D game designer** to build a system 3D scene. Designer must have Construct Well Engineered & Maintainable Software using C++, C#

1. Development of Advanced AI & Gameplay Features
2. Experience with Xamarin, MonoGame, Unity3D & Unreal Engine
3. Console Game Development & Multiplayer Development
4. Design & Implement Robust Innovative Solutions
5. Optimise Software for Speed & Memory Efficiency
6. Strong with Technical Code & 3D Math Skills
7. Familiar with the development of car game physics engine
8. Time Management & Task Breakdowns
9. Provide Technical Input to Programmers
10. Rapidly Prototype & Produce Final Code
11. Debugging, Diagnosing & Fixing Complex Code
12. Work Autonomously & within a Motivated Focused Team
13. High Level Problem-Solving, Detail & Critical Sense Skills
14. Strong Communications Skills
15. Organised, Efficient & Comfortable in Gaming Environments

On the hardware side, the team needs an **engineer** responsible for the terminal development unit.

Engineer needs

1. Years of experience in electronic product design and development.
2. Schematic and PCB design of the Altium or Protel
3. Low Power Embedded Microcontroller Design
4. Analog and / or digital electronic devices.
5. RF communications such as Bluetooth, Wi-Fi, Zigbee, LORA Low Power ISM.
6. As shown in Figure 12C, RS232, RS485
7. Embedded programming 8-32-bit microcontrollers in C/C++ of interest.
8. Low power, high volume applications
9. Strong quality and innovative ability.

Finally the team needs an **AI engineer** to combine data and systems

Minimum 3 years relevant experience in software engineering as well as:

10. Solid technical skills in SQL, Python and R
11. Scikit learn, SciPy, NumPy, Pandas, IPython, Matplotlib
12. Proven exposure to Big Data projects
13. Exposure to AWS Redshift, Clojure will be an advantage
14. Excellent communication skills

15. Strong analytical and problem solving skill set

8. Feedback

This part is done on Spark.

9. Group Reflection

Xuyi Wu

This assignment is a lot harder than the Assignment 2 especially when assigning the tasks. Unlike Assignment 2, Assignment 3 only have few parts and there is a close relationship between each part especially the project description. I can hardly divided it into several parts since it's coherent and it will be very strange if it is written by several persons. After assigning the tasks, another problem appeared. Most of the group members have few knowledge about the topic which serious limited their imagination since it is a high tech project it would be quite difficult if you know nothing about the tech. There for sometimes I should redo other's work and finally I was involved in most of the works since I needed to tell others what they should do and help with the revision and modification of their works. Certainly, it made me very tired.

What went well: We finished the work on time.

What could be improved: Our knowledge and skills were too limited.

One thing that was surprising: Li Hui thought of the point that I didn't think about before.

One thing that you have learned about groups: Although we have eight people, sometimes it was still not enough.

Basil Livovac

I think that as a group we completed our work well, there was collaboration with our parts and people helped each other when people were not sure what to do. Another thing that went well is that the members in my group all completed their work and there were no problems which is a really good thing because problems can arise in groups and I find it lucky that no massive problems arose. Something that could be improved is communication because although we completed our work there was not a lot of communication between me and my group members which could have helped us a lot with completing our work more efficiently and effectively. Something else that could have been improved on is our planning for the assignment, although we completed our assignment it could have been much easier to have planned our assignment earlier to avoid the stress of being on time constraints. Honestly

something that was surprising was the level of work from my team, I am very surprised and proud of my teams level of work which is very high. One thing I have learned about groups is that it's important to have a leader that can bring all the members together and assign and discuss tasks with the members especially if there is a language barrier.

Jialiang Gong

In this task, I've shared some of my opinions about the assignment and joined the part, dealt with the testing part.

In this assignment, I didn't get the information at the very beginning. But later, with the information, I changed my plan on writing my part, which make my part a lot more reasonable. On the other hand, my speed on writing is faster than before. But actually, without the reminder from my teammate, it will me a lot more time needed. Finally, I find it important in planning the project. Letting all the mates know about the project makes it easier for each of us cooperate.

There is no doubt that the project went smoothly with the cooperate from each of the mates. It can be surprisingly found that each of the member come to the play quickly and each of the members in this group works well. However, the thing still can be improve is, we should join more opinion together. In case that we separate the work into different parts, we lost the chance to exchange the idea we found while working. If there is more communication, it seems we will make the project more like integrated.

Yuhao Tang

The third assignment was an improvement and expansion of the second assignment, so when we started to type three assignments, we didn't know what to do, because it came from the previous assignment of one of the team members. However, we organized a meeting, and after our discussion, we made clear the purpose and specific plan of this project, which was very happy. The only downside is that many people on the team seem to be procrastinating, which slows down the project and leads to a rush of time and anxiety when it comes to typography or revision. Of course, what is surprising is the quality of our team's work, which may have many advantages, but the quality is very satisfactory, including the extension of the problem and all kinds of problems that may occur. All in all, everyone in the team has done a great job and made a contribution to the team.

Junquan Chen

In my point of view, our group did a great job for Assignment 3. I wrote Tools and Technologies which is based on Plans and Progress (Zhenhui He, Basil Lilovac and Xuyi Wu) that about our project idea Simulated Driving Learning System. I finished my part a little bit late but it's still on time which is not a good way to improve the group work, so I

have to deal with it before the next group assignment. In last assignment, we had two group-meet out of class which only had half of the group member came each time and the two times came different member. But in this group-meet for Assignment 3, everyone came on time and took their own task which did make everyone's life easier. Also, we are very clear about our respective tasks and others' tasks. We didn't know what others wrote except Xuyi Wu knew what everyone did last time, in particular, I really just cared about my own part in A2. However, it is necessary for each member to know other member's tasks in A3. Someone's task has to start when the other's task finished.

All in all, we did have great communication on chat platform and everyone finished their task on time. I'm still appreciated with Wu scheduled the group-meet and efficiently directed us to complete this assignment.

What went well:

everyone came to the meet

finished their own part on time

communication

At least one thing that you have learned about groups:

Everyone should be responsible for the group assignment.

Herb

From the second assignment, I formed a group with my team members until the third group assignment joined two new team members. I learned a lot of novel IT ideas from them, and everyone knows about IT. Different, in each group communication, we gave each other their opinions. In the second homework, we reflected that the members' participation in the group meeting was not active enough, resulting in many group meetings being absent, but came to the third. We changed a lot during the group work. Everyone attended the meeting on time and assigned their own work. This made us feel very motivated to complete the homework. However, there are still many things that need to be improved. For example, when everyone finishes their homework, some team members can't complete their parts according to the planned time, which leads to other parts that can't continue to complete well, and the quality of the homework. Relatively imperfect, it needs to be fixed many times. We hope that everyone's attitude towards homework will be strengthened in future assignments. To my surprise, despite the increase in our team members, we did not make our ideas conflict.

Everyone gave their own ideas and combined their ideas perfectly, even at certain times. There was some criticism of the homework between some group members, but there was no complaint from one person, and it was very patient to listen to the corrections of others. The atmosphere of the group was very friendly, which is very commendable.

Hui Li

By completing this task, I feel that the best part of my job is to actively discuss issues with other team members instead of missing each meeting. The most important thing is that I take my work very seriously. However, there is still a part that needs to be improved is that my writing skills are relatively poor. When I finished my part, other team members helped me find a lot of syntax errors in the sentence. What surprised me most of our team members was that one of the classmates could help us modify our grammar mistakes and some typographical errors. I have learned a lot in this team task, but I think the most important thing for me is teamwork. I understand how to discuss how to integrate into the team.

Zongzhou Wang

The distribution of tasks went well in the first meeting. Everybody came to the first meeting and discuss actively. We took members' advantages and disadvantages into consideration and everyone was assigned to the right part of work. Thus, it is not surprising that every member finished the distributed work timely with high quality. My part of work is to analyse and identify the risks of our project. I did it well and timely thanks to Xuyi Wu (Virgil) who generously offered his ideas and advice to me.

What surprise me is that everyone in the team are willing to help each other and to contribute to the group work. What can be improved is that members could work online in the same time. So when one member is working, others can give advice on improving the work. This will help to make team work more efficient and high quality. What I learned about group is the importance of communication and respect different ideas. Different opinions are not bad things. On the contrary, it will not only improve the team work, but also help members learn about each other.

Like the Assignment 2, we still did well this time in general. The progress was not very good at the beginning mainly because the Assignment of other courses especially Database Concepts' Assignment 2, which seriously affected the progress. Luckily, we still have a whole week to finish the Assignment and everyone took active part in the tasks. It was surprising that most of the works were done within 6 days and we finished the whole report one day before the deadline.

The Team Profile and the part of tools were almost the same with the last time, the rest part was finished by Xuyi Wu. Everyone was assigned the tasks that suited their abilities during the first meeting.

The project description made up half of the assignment and can hardly be assigned to different people which was really a trouble. The best solution was to do it all together which was obviously impossible. Finally, it was assigned to Xuyi, Herb, who knew the project well and Basil, who was good at writing.

The most parts of the description were finished one week before the due date. Others started to help after the Plans and Progress was done. The Overview and Aims were written by Xuyi, he was also responsible for the Timeframe.

Tools and Technologies was written by Junquan, he started a little bit late but completed his part quickly after knowing that others had all completed their Testing was done by Jialiang. Although he did not finish it very well at the beginning, he did not bother to modify it until the last version.

Risks was done by Zongzhou who was new in the group. He didn't finish it well at first but kept modifying his work without any complaint.

Communication, which should be improved was still a question due to the language and other problems. Some group members were not active enough and didn't want to talk in a group environment and it made the work quite difficult to be done sometimes.

Related skills and knowledge could also be a problem especially when we know nothing about a certain, it always so difficult to start from zero.

Another thing could be improved is some of the group members' writing habits. It was so difficult to integrate the parts full with mistakes.

10. Reference

UCS. (2018, February 21). Self-Driving Cars Explained. In *UCS*. Retrieved May 12, 2019, from <https://www.ucsusa.org/clean-vehicles/how-self-driving-cars-work>

Driving simulator. (2019, May 6). In *Wikipedia, the free encyclopedia*. Retrieved May 12, 2019, https://en.wikipedia.org/wiki/Driving_simulator#Types

Landform. (2019, May 20). In *Wikipedia, the free encyclopedia*. Retrieved May 24, 2019, <https://en.wikipedia.org/wiki/Landform>

