FACULTY OF COMPUTING
DESIGN THINKING (REPORT)
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GROUP 1: GENSHIN STARTUP

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Introduction

In this era of globalization and modernization, transportation has become a basic need for people to go anywhere in the world. There are several forms of transportation such as vehicles, buses, trains and ships. Vehicles are the most common transportation since they are more convenient and suitable for personal usage. With the rapid growth of number of vehicles, the percentage of road accidents also increases year by year. This is because road accidents are mainly caused by reckless driving which includes speeding, driver inattention, tailgating and drunk driving. Due to human factors, the lives of road users and also the driver has become endangered. Therefore, an issue about implication of emerging technologies in transportation especially vehicles is discussed in this report to reduce road accidents.

From my point of view, the solution of above problems is by implementing automated driving system to the vehicles. These types of vehicles can be called as an autonomous vehicle or a driverless vehicle which defined as a vehicle that can operate itself without any control of human through sensors that detect its surroundings. The automated driving system which enables the sensors of the vehicles to work together by providing and sharing data that required to perceive surrounding. For example, there have several types of sensors such as lidars, cameras and radars. In automated driving system, artificial intelligence, deep learning, neutral network and machine learning technologies are used to improve the accuracy and performance of the autonomous vehicles when making any decision in a complicated road situation. This system can adjust the vehicle's speed automatically to ensure a safe distance with others vehicles and keep in line on the road through the control of steering, acceleration and braking. The advantages of implementing automated driving system are reducing congestion while improving traffic safety and efficiency that can decrease the risk of road accidents as autonomous vehicle is more reliable and accurate compare to human-driven vehicle.

Methodology

In this design thinking, there have six phases for the process which are preliminary investigation, problem analysis, designing of prototype, development of prototype, testing of prototype and implementation of prototype. In preliminary investigation phase, a problem related to Chapter 1 is identified which is implementation of emerging technologies in transportation that can reduce the risk of car accidents. Moreover, in problem analysis phase, data about car accidents is collected and analyzed to identify the main cause of car accidents which is reckless driving. This problem should be solved quickly to ensure the safety of road users and also the driver. Therefore, the requirement for the problems is investigated which is reducing road accidents through implementation of ICT. In designing of prototype, a lot of alternatives to solve the problem have been proposed. However, the best and the most effective solution is selected based on the aspects of economic feasibility, technical feasibility and operational feasibility which is the implementation of automated driving system in the vehicles. Besides, steps and description for each step is stated in development of prototype phase. Furthermore, in testing phase, the prototype is tested by implementing the system to a tested car. The tested car will make experiments in closed first before going to main road. Therefore, the problems occur during testing can be diagnosing and troubleshooting. This is to ensure that the final product come out without any mistakes and increase the confidence level of user. At the end in implementation of prototype, types of conversion approaches include direct, parallel, pilot, phased are determined. The tips and practices for automated driving system are determined to ensure the users can fully benefit this system well. In addition, the system also can be maintained through updating software via Internet to ensure the system function well and keep updated with latest features.

Phase 1

 Implication of technologies to the future is the topic of our design thinking. Road accidents increase year by year mostly due to human factors. Automation of transportation is one of the issue or problem discussed and focused in this era of globalization where technologies keep advancing in a high pace. What is transport automation? Transport automation cover the range of technologies and control system implemented for transportation modes such as automobiles, including vehicles such as car, bus and trucks. Besides, it also covers the control system at the terminal such as bus terminal, airports and train station. In this design thinking, our group will focus on the automation of driving system. Transport Automation can be categorized into 6 level of automation from 0 to 5. The first level of automation is level 0 which is no automation. At this level of automation, all the function of vehicles are performed by the driver or user manually without any system assistance. The second level of automation is level 1 which is known as the basic level of automation. At this stage, drivers or users are provided with basic system assistance and still need to take responsible for core driving functions. The basic assistance includes the form of adaptive driving assistance, for example the ability to change speed under adaptive cruise control. However, under automation level 1, driver or user still perform most of the vital or core function of operating the vehicles. Next on is level 2. Automation level 2 also know as partial automation. This is because some of the driving tasks such as steering, accelerating and deceleration are partially automized and controlled by system. Driver or user is responsible to supervise or monitor the environment and be ready to take control at any moment since this kind of system is to be used under a well-defined circumstance. This level of automation is recently a trend of system that is available for commercial automobiles. Next level of automation also known as conditional automation is the level 3 automation. Under this level of automation, most of the driving tasks are automized. Besides, the vehicle is equipped with various kind of sensors that can assist user to supervise and monitor the driving environment. At this level, user just need to be ready to take control of the vehicle when there is request. Next, the level 4 automation represent high. At this level, the vehicles are highly automated and are equipped with various complex sensors to enable the vehicle to adapt to changes of the driving environment. All the driving tasks are automized and the vehicle has the ability to supervise or monitor controlled driving environment. Driver or user does not need to be ready to take control at any circumstances. However, there will still be an option for the driver or user to operate the

vehicle on his or her own. The final level of automation is the level 5 automation. Level 5 automation also known as full automation. At this level, the vehicle is full or completely autonomous. User just required to provide location or information of the destination and the vehicle remotely performs all the driving functions under all environments. Our prototype is focused on the level x of automation.

Phase 2

The issue of transport automation is focused as it could bring a lot of benefits. First of all, transit service will be much standardized. This is because when vehicle is autonomous, a safe standardized driving system or style is performed by the system. This could reduce the risk of dangerous driving and subsequently reduce the occurrence of road accident. Besides, transport automation can reduce the stress of driving. This is because some of the driving tasks are automized and assisted by autonomous system of vehicle. This could reduce the mental workload of driver or user. Besides, environmental gains are also one of the potentials of transport automation. This is because automation may spur more demand for electric vehicles. This could reduce fuel used by vehicle. Besides, there are fewer traffic jams due to the automation of transportation. This could reduce greenhouse gases such as carbon dioxide from needless idling and thus improving the quality of out environment.

Prototype

We decided that we want to make a device that is tangible and compatible with all types of vehicles with an easy to navigate interface. It can adapt to any vehicle that the user chooses. The user will pick a location that they wish to travel to inside the program. The vehicle will use the most efficient route given by GPS. Vehicles will be equipped with cameras to detect any obstacles in the way, to ensure the safety of passengers as well as people outside the vehicle. If the vehicle detects a person, it would come to a halt to make sure the person does not get hit. This is extremely important, given that this is the problem we are trying to solve. These vehicles will follow the speed limit, using data from maps to know what speed it should move at.

Our prototype is a mindmap, showcasing how the software could look like. It shows the steps the user can take to have their personalised automated transportation experience. We made the mindmap using an iPad.
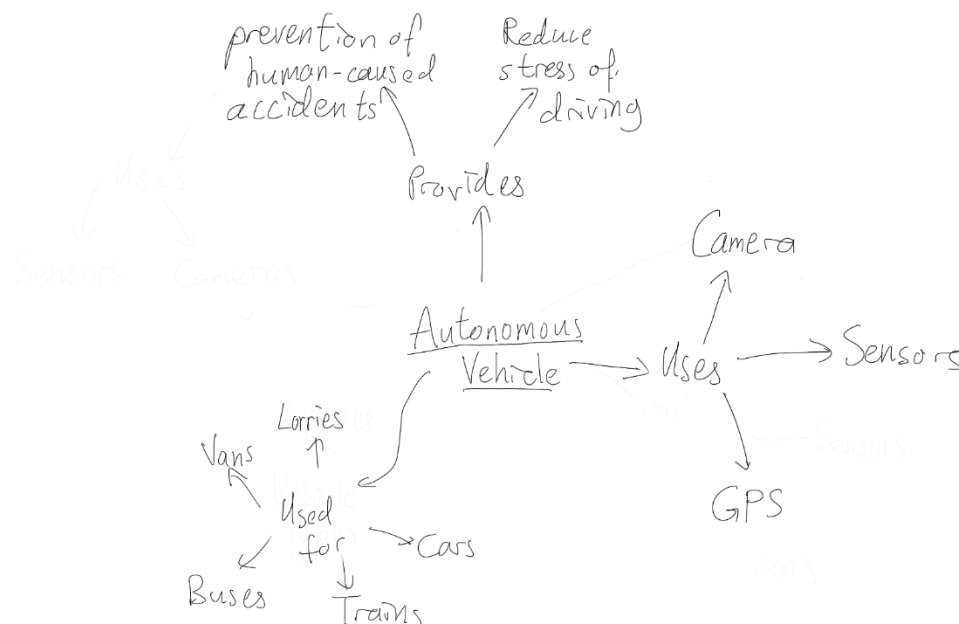
<u>Implementation of product</u>

Our product is highly versatile. Meaning that the application of our product is not limited to one type of vehicle, instead it is applicable to all types of vehicles ranging from cars to trains alike. All the user needed to do was to make sure they got the correct type of software for the system to work on. As an example, for a vehicle of type car they should use software that is suitable for cars. The same goes for all different types of vehicles.

Even though our main goal is to automate all types of automobiles, we would like to remind our users to never 100% trust the automation. The users should always be ready to take control of the vehicle in case there are problems with the automatic mode. This is because sometimes there could be technical problems and bugs that could make the vehicle act in strange ways. This could be dangerous as it could cause accidents and unwanted behaviors. These accidents could be fatal for those around the vehicle and the driver according to the situation.

Another suggestion that we would our users to take seriously is to make frequent maintenance of their vehicle both physically and software wise as even a simple problem could snowball into something even more deadly. Users should always make sure that their vehicle is in tip-top condition and their software is up to date. We will always update our software to address any minor problems that existed in the previous version. Even though there might be problems with the current version, users should not be wary about using our product as they have been factory tested and have been made sure to pass the requirement tests.

<u>Testing</u>

Upon consulting with our testers, we have identified some potential improvements and some pre-existing problems with our product. One of the improvements that got suggested the most is to add more sensors to keep track of the vehicle surroundings. This could further improve our vehicle's ability to make decisions and react accordingly to a lot more situations. This, however, could lead to more problems as we would need to add more layers to the AI that is pre-equipped on our vehicle. The product could also become exponentially expensive, and it might cross the threshold of what our user would like to pay for newly developed technology.

Another popular complaint is that our design's user interface is hard to get used to as it is crowded with various buttons. To address this issue, we will have a board meeting with our designers to improve the design to allow our users to navigate through our system efficiently.

So far, this is what we as a team have come up with to improve our design. Keep in mind that even if there are some issues that were not addressed here, we will eventually resolve all those issues as the development of our system progresses. So, please reach us to report any problems that occur to you as our users will always be our top priority.

Reflections (Chuah Chun Yi)

As a computer science (graphic and multimedia) student, my dream is to become a video game programmer. This is because I am a game lover and I am interested in video game development that involving programming, user interface, animation and 3D modelling. I hope that I can involve in development of a game by having jobs in any companies that operating in the gaming industry worldwide such as Hoyoverse, Nintendo, Ubisoft, Tencent and Sony. Through this design thinking, I have a better understanding on software development lifecycle and research methodology used in video game development. Moreover, I also learnt about the process of design thinking which are empathize, define, ideate, prototype and test that can implemented in others development such as video games. To improve my potential in the industry, I will keep maintain my passion in continuous learning to ensure I am on the track of globalization by adapting and learning new technologies and tools. Besides, I will not easily give up when facing any obstacles by thinking out of box to find the best solution to overcome them.

Reflection (Chong Jun Hong)

my goal with regard to this course is that I can learn and master more knowledge about computer sciences and technologies. Since technologies keep updating at a rapid pace nowadays, it is important for me to keep myself updated through continuous learning so that I can adapt myself with the rapid advancing technologies. After doing this design thinking, I have learnt that the implication of the rapid changing technologies on our daily life and future. A lot of perspectives are needed to be considered when designing a new system since it may bring some negative effects aside from benefits or advantages. I have learnt that automation of transportation system could affect our life and environment. Steps that are necessary for me to improve my potential in the industry is through continuous learning and make use of the latest technologies or tools to help me in the process of learning to increase the efficiency of learning.

Reflection (MUHAMMAD AMMAR BIN MOHAMAD IDHAM)

I am studying Computer Science (Graphics and Multimedia Software) in hopes of becoming a video game developer. Video games have been my favourite hobby ever since I was little and I hope that this course will expand my skills and knowledge in developing programs so that I can realise my dream of developing my own video games. This design thinking project has helped me know and understand the steps as to how to create and realise a project. Because of this, I can definitely be more fit to work on projects in the future. I think that I should join workshops and get certificates to expand my skill set in this ever growing industry.

Reflection (NAZMI HAIKAL BIN KHAIRUL)

When I first started this course, I only had one goal in mind which was to increase my general knowledge regarding computers and technologies and now I can finally declare that I have achieved that goal. This design thinking project has been of massive help to me to understand the general steps taken by professionals in the industry to plan out their projects. The distinct phases of the projects and what to do in each phase. It really makes me appreciate the apps and systems that we are using daily. With this, I can make plans to prepare myself and increase my potential to land a job in the industry. These plans include keeping myself knowledgeable about the current trend of technologies in general and knowing about the little details of a system so that I can recreate or manipulate it to use at my advantage. In conclusion, I am satisfied with the knowledge I gained from this course, and I hope to use all the information I have learned when it matters.

Reflection (Tai Yi Tian)

As a graphic and multimedia student, I would like to become a programmer in the future. In my opinion, design thinking is a very important skill for a computer science student. This is because one of the purposes of using computers is to make it easy for humans to finish the daily task. Through this design thinking, I learnt how to find the problem that we can solve in our daily life using a brainstorming method, find the solution and make a prototype for the solution. The skill I learnt from design thinking must be used in the future if I want to continue studying and working in the IT field. So, it is a very useful experience for me to get in touch with design thinking in the first year when I study in university. To improve my potential in the industry, I should keep following and updating the information about IOT because the technology keeps improving every day without waiting for humans. Lastly, I think it is also important to improve my problem solving skills as I must face a lot of challenges in the future.

Conclusion

In conclusion, the widespread use of vehicles has undeniably increased the convenience of travel. Especially in Malaysia, this is because the public transport is underdeveloped in most of the states and the cheaper price of petrol. This has caused private transportation always become the first choice when we want to travel somewhere. However the growth of vehicles on the road has brought with it an increase in road accidents due to the reckless driving, speeding, driver inattention, tailgating and drunk driving.

In this report, we explore the automated driving system, most widely known as driverless vehicles as a solution to reduce the road accidents. With the design thinking for the automated driving system which relies on sensors such as lidars, cameras, and radars to detect and respond to their surroundings. This is because computers can have a shorter reaction time than humans which can reduce accidents on the road effectively. However, the situation on the road can be complex, thus artificial intelligence, deep learning and a lot of testing need to be done and used to make sure that automated driving systems can make the best decision in the shortest time.

As we look towards the future, the implementation of automated driving systems will bring a lot of benefits in reshaping the landscape of transportation. Although there still a lot of challenges and concerns may persist, the potential benefits in terms of safety, efficiency, and overall improvement in the quality of transportation underscore the importance of continued research, development, and integration of these technologies. Embracing automated driving systems represents a transformative step towards a safer and more sustainable future for global transportation systems.

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