UNIVERSITY OF GOTHENBURG

DEPARTMENT OF EDUCATION, COMMUNICATION & LEARNING

CAJOLE: ESCOOTER MOBILE APP DESIGN FOR RIDERS IN GOTHENBURG

Teaching how to ride EScooters safely

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Thesis:	30 higher education credits
Program and/or course:	International Master's Programme in IT & Learning
Level:	Second Cycle
Semester/year:	Autumn term 2019
Supervisor:	Marisa Ponti
Examiner:	Mona Lundin
Report no:	HT21-2920-004-PDA699

Abstract

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Keywords:	EScooters, Micro-mobility, Design Thinking

Purpose: The overall goal for my project is to design a valuable mobile app that teaches end-users how to ride, behave, and follow traffic rules by applying design thinking methodologies (DT). In addition, a deep understanding of electric scooters users and the intentions of the municipality administration can result in a handy app.

Method: Design Thinking used as a methodology to identify and solve the needs of participants of the project.

Results: A mobile app design to solve challenges of beginner riders by providing updated information, preparing a course, and creating an opportunity to have a community of practice. The design prototype includes five main modules.

1. EScooters parts: it informs the user about different parts of a scooter and their application.
2. Scooters in Gothenburg informs the user about available Scooters.
3. Campaigns: creates awareness using various information campaigns.
4. Get certified: guides the user to get certified on different learning areas about scooters.
5. Community of practice: users can share experience with each other.

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Introduction

As EScooters, also referred to electric scooters, motorized scooters, are steadily becoming more and more common across Europe, municipalities are belligerent to control their use following a series of road accidents. These vehicles with two wheels can travel at speeds more than 55km/h (or instead 35mph), of recently have been convoluted to several accidental occurrences, counting to several deaths (Hamilton et al., 2018). Germany is on the verge of enforcing sound and requisite laws. Its transportation authority claims: The supervisory body is supposed to decide whether these scooters are used on main roads, pavements, or cycle lanes (Bakir & McStay, 2018). These vehicles have lesser electric motors and mechanical systems that power them, thus demonstrating complexity to institute the safest operational space for handlers and passersby.

Using EScooters in public is allowed in most European countries like France, Spain, Switzerland, and Austria. However, Ireland and the UK legislation abolished scooters on roads and pavements (Bakir & McStay, 2018). In the countries mentioned earlier, scooters are only used on private property with a permit from the property owner. Riders brought to book to use scooters on roads or in public are charged with a fixed penalty of not less than 300 euros, alongside six points onto the driving license. Sweden recently joined the limiting countries by banning the use of scooters that can exceed speeds of 20km/h and beyond, out of the bicycle lanes in the city (Bakir & McStay, 2018). In France, the transport regulatory body has also introduced fines for riding scooters on pavements. These laws are being introduced to specifically try and regulate or improve the safety of scooter riding (Gössling, S. et al., 2019).

The impulse increase in the widespread use of EScooters seems to have caught the governments in Europe by surprise. The companies involved in manufacturing and stocking these scooters are not under any safety laws to provide specific safety features (Absar & Ahmed, 2019). Most scooters have a single break, and it is often difficult to stop the Scooter while it is travelling at high speeds. Since 2018, an average of 11 deaths was directly linked to the scooters in some European nations, including France, UK, Spain, Germany, and Sweden. (Absar & Ahmed, 2019). A French case study shows that the first electric scooter fatality had been put to record in June 2019, when a young man got involved in a road accident with an oncoming lorry.

Crashes with other road vehicles are not as unalike as they could seem to be. Both the crashes reflect a lack of infrastructure intended for the individuals who choose to have different means of conveyance. Scooters thrive in the market due to their convenience and ease of use (Hamilton et al., 2018). The scooter market is thriving, not only in Europe but in many other countries in the world. In the transportation of the wild-west, people are perplexed on what to do about scooters (Bakir & McStay, 2018). They came up just at once in most of the cities, triggering parking complaints and strained sidewalks. Scooters pose as sidewalk bullies in busy streets, create tension, and are dangerous enough to create safety issues (Brunner et al., 2018).

In some countries, like Sweden, one does not need a driver’s license to ride a scooter; neither does it need an examined user training. Compared to car users, the Scooter saves the user the cost of getting a driver's license. This reason, put together with its ease of use, sure shows that the population of scooter users is yet to increase even more (Absar & Ahmed, 2019). This reason also translates to a probable increase in scooter fatalities without safety measures put in place and this is why governments should invest in solutions for the current problems facing this novice means of transport. (Hamilton et al., 2018). This study will focus on a mobile application solution to the current issues facing scooter riders in Gothenburg to teach scooter riders in Gothenburg about scooters, behaviours, and rules.

This study was conducted in Gothenburg city where EScooters were introduced as one of the options for micro-mobility in November 2018. Since June 2020, four electric scooter companies have been established in Gothenburg. The number of EScooters deployed in 2020 increased from about 1,300 at the beginning of the year to 4,000 in June. During the second half of the year, the number remained between 5,500 and 6,000. The number is much higher than in 2019 when it was at most 3,600 in September, and then vehicles were primarily taken in for the winter. (Trafik- och resandeutveckling, n.d.)

The number of trips with EScooters has increased with the number of EScooters. From March to August 2019, when EScooters were a new phenomenon, an average of over 100 trips was made per electric scooter, while the corresponding number of other months is significantly lower. Compared with 2019, travel with EScooters has increased by 24 percent. Nevertheless, the increase is not evenly distributed over the year. Most of the 2020 (three quarters) trips were made in the second half of the year, and this period was the number of trips about 42 percent higher than 2019.

In the first half of the year, there were 12% fewer trips than the first half of 2019. There were 2.3 million electric scooter trips in 2020. It corresponds to about 6,300 trips on an average day. About 70 percent of the trips were made on weekdays. In August 2020, when the number of trips was highest, just over 10,000 trips were made by EScooters on an average weekday. The journeys are relatively short and are primarily made in the city center. Compared to traveling by bike, these trips are associated more with leisure than with commuting. Gothenburg's traffic office reported in their attitude survey on cycling (see more in Experience of Cycling in Gothenburg) that 14 percent of citizens aged 18 to 65 plan on using an electric scooter at least once in September 2020. This proportion was higher among men than women and highest in the age group 18-29 years (25 percent) and among residents of the center (22 percent). (Trafik- och resandeutveckling, n.d.)

Mobile learning can help users to learn across multiple contexts through different types of interactions such as social interaction and content interaction in their convenient time. Mobile gadgets have grown to be very pervasive and ideal for content consumption today. Eighty percent of the world’s population has subscribed to smartphone applications. With mobile learning, a person can learn anytime and anywhere (Ryan, 2019). Bite-sized delivery has reduced cognitive stress and increased mobile understanding. Mobile learning is readily available, and since it has been personalized, the engagement rate with the stakeholders is higher (Ryan, 2019). Moreover, mobile learning has proved to be very responsive, resulting in faster adoption and sustainability going into the future.

The overall goal for this project is to design a valuable mobile app called Cajole that teaches end-users how to ride, behave, and follow traffic rules by applying design thinking methodologies. According to Merriam-Webster dictionary, cajole means to influence or persuade in the face of reluctance or objections (Cajole, n.d.). Therefore, I called the app Cajole to influence EScooters riders in Gothenburg ride safely by following traffic rules. In addition, a deep understanding of electric scooter users and the intentions of Gothenburg’s municipality can result in a handy app.

The goal is to find basic learning features for the design product at hand, get rid of the clutter around it, and present it in a way that is as simple as possible, great to use, ultimately, something that the Scooter users want to use. The most crucial part for a researcher and designer is finding out what the end users' problems are and creating a prototype that best addresses those problems. Taking this step will ensure the researcher builds the right thing in the right way. It is essential to frame the problem correctly before developing a solution.

Problem Statement

According to mobility services administration of Gothenburg municipality, there are six companies and 7000 EScooters in Gothenburg with 450,000 trips per month and approximately 15,000 trips per day. Many EScooters in the urban environment of Gothenburg are experienced and have created opportunities and problems that are similarly observed in the experience of cycling in Gothenburg. Though the traffic office and EScooters companies are working to improve mobility services, parking and dangerous traffic behaviours are still the remaining problems caused by the users, with parking complaints accounting for the majority.

Though the EScooters mobility service is a sort of public transport, it is not integrated into Gothenburg city's public transportation system. The city occasionally publishes information campaigns, press releases, and guidance documents on how to behave and to provide traffic tips. They are not regular and held only when problems have already escalated. Therefore, regular digital-based campaigns can be implemented to inform scooter riders quickly and easily in the city. Following are the questions that this thesis seeks to answer:

Research Questions

i. What are the challenges to be considered when designing a mobile app of EScooters?
    a. From the riders' perspective?
    b. From the municipality administration perspective?
ii. What features and functions need to be included in the mobile app design?

Outline

This thesis has been organised in the following way. First, a literature review containing related works to research questions and the topic of the capstone project. Second, Design Methodology containing initial design decisions, design phases, participants, and ethical considerations. Next, the paper elaborates the design process of the project. The last parts are the discussion and conclusion of the project.

Literature Review

As the overall purpose is to get an answer of the challenges, features, and functions for the mobile app design, this section provides a detailed review of previous research that underlie this thesis work. Particularly, focusing on four main domains.

The first section describes the rise of EScooters in Europe. The second section describes the problems facing scooters or caused by scooters. This section presents clogged sidewalks, injuries, EScooters sharing, lack of enforcement, safety issues of the Scooters, compliance with the updated government norms, Integration and alignment with the cities, and utilization of urban space as the main challenges cause by or facing EScooters. The third section describes IoT as a solution to micro mobility challenges. – as a compliance with regulatory requirements and as a data sharing mechanism with traffic authorities. The fourth section discusses mobile learning design, particularly, – challenges of designing EScooters apps for learning.

The Rise of EScooters in Europe

The needs for urban mobility are rapidly evolving, and innovations have taken center stage in advancing the means of movement from one place to another. Many of the European cities face transportation externalities such as poor aeration, congestion, reduction in social accessibility and mobility, and loss of green spaces (Madapur, Madangopal & Chandrashekar, 2020). The challenges exhibit higher economic costs and create a hazardous environment within the transportation industry. A greater understanding of the impact of the issues on people's health has led to a growing impetus for the cities to address the transportation issues. The rise of EScooters has been necessitated by the need to enhance the health safety of people and minimize the associated environmental and economic effects that arise due to the challenges of the transportation system. Cities in Europe are advancing towards addressing climatic issues that result due to increased levels of carbon emission from the transportation sector. The need to preserve the environment is among the leading cause of revolution in the transport sector, and this has given the rise of development and innovation of environmentally friendly devices that mainly utilizes electricity. According to Abduljabbar et al. (2021), sustainability in the cities is best enhanced through environmental conservation by reducing the amount of carbon emission in the environment.

Accommodating the growing population has also necessitated the development of EScooters. The public busses and trains existing are no longer adequate to transport the residents, and this has been found to lead to congestions and the creation of health hazards that has mostly affected the health sectors (Zagorskas & Burinskienė, 2020). People have lost more hours stuck in traffics, and this translates to the economic performance and general productivity of the population. Operation of the devices has been made easier hence preferred by many people. They are mainly popular with the youth and are widely utilized in short distances. Additionally, the cost of acquiring them is considerably low compared to cars that are mostly affected by traffic and associated with higher operating costs. Their rise is pegged into the need to solve the city challenges, enhance health standards, and improvements of mobility ecosystems (Zagorskas & Burinskienė, 2020).

Problems facing scooters / Caused by scooters

The usage of EScooters is vital in shaping and enhancing sustainability in the cities, but this comes with increased challenges associated with the devices. Addressing the challenges facing the EScooters is key in enhancing sustainability in the cities. The key problems that affect the smooth development of the micro-mobility devices include the level of safety, compliance with various governmental norms, and integration into the mobility ecosystem of the cities, alignment with social and urban attributes of the cities, affordability, and the safe and efficient utilization of the urban space (Zagorskas & Burinskienė,

2020). Additionally, there is the inadequate application of technology in the sector to track the devices and improve their efficiency in protecting users and other citizens and addressing the challenges associate with e-powered vehicles is a step forward in enhancing sustainability in the cities (Zagorskas & Burinskienė, 2020). The future of smart micro-mobility depends on the utilization of technology, track them, and enhance their security features.

With most cities trying to put up an environmentally friendly living, many people are shifting to scooters, with companies focusing on the modern EScooters as a green way of replacing other automotive that operate on petroleum fuel (Absar & Ahmed, 2019). Generally, scooters release fewer contaminants to the environment and the ones that work on gasoline release lesser greenhouse gases into the atmosphere (Geels, F. W. et al., 2017). Since the people living in the city do not require a car to move to the next street, the Scooter comes in handy as the most convenient means of transport, doubling up as an environmentally friendly practice (Bakir & McStay, 2018). All this began with city bikes, far ahead, car sharing advanced at a confounding pace, and currently the roads of big cities get the better of micro-mobility by scooters. The impression of automobile sharing is fetching a lot of popularity in these cities, regardless of the type of vehicle. Even though the scooter is an opportune and, in particular, a convenient means of transportation, city establishments cause substantial problems. All for the reason that it is quite challenging to categorize an individual riding a scooter. Is a scooter rider still a pedestrian, or perhaps a driver? Or is it in order to handle them: as cyclists or a rider? No one knows about that, particularly the Law enforcement agencies. And the Police are spreading their hands since they do not know who and what to punish. For that reason, the Police department take traffic regulation in a definite manner, linking scooters to pedestrians. This approach of understanding the law give the impression to be incorrect. However, away from legislative problems, a few more issues are facing these Scooters, both the EScooters and the ones using gasoline. The following are some of them:

Clogged Sidewalks

In most Gothenburg, it is illegal to ride or instead cycle on the sidewalk. In this case, scooters can easily pose a reasonably dangerous threat to pedestrians using the sidewalk. A rider on a scooter moving at high speed can easily hit a pedestrian on the sidewalk, and if not hitting someone, the rider will run over a handful of pedestrian toes (Absar & Ahmed, 2019). One common prerequisite that most scooter riders delight in while riding on their scooters is the simplified maneuvering on the streets. Scooters utilize little space, unlike cars, therefore at times of an unavoidable slowdown of traffic, scooter riders will maneuver in between vehicles or instead shift and ride on the sidewalk to dodge the heavy traffic. This cruel practice by scooter drivers is unsafe for several reasons (Bakir & McStay, 2018).

Suppose the prospective accidents, to the scooter rider and the busy pedestrians, is not an adequate justification, with scooter riders often shifting to the sidewalk. In that case, it can be expected that the traffic on the sidewalks would clog up from time to time (Absar & Ahmed, 2019). There is no adequate space for scooter riders to make their way from side to side when the sidewalks are already congested with pedestrian traffic. This does not seem to stop the scooter drivers, most so in the state of California in the USA. At this time, scooters are banned from using the sidewalks in the Golden State (Absar & Ahmed, 2019).

Injuries

Just like motorcycles and bicycles, the scooter riders are supposed to put on safety gear while riding. However, the population of the people who even put on a helmet while depending is slim. This is common in the cities for scooter riders who want to reach a few blocks away to grab something and get back, who would not see the importance of carrying a helmet with them. Unfortunately, even the short pick-up time is good enough for a fatal accident to take place. The scooter riders' habit of furthering their movement along at a higher speed, thus placing them at a higher risk. Accidents usually occur. However small or rather sizeable the Scooter might be, no scooter stands a gamble against a car (Gössling, S. et al.,

2019). Due to this, many scooter riders are being injured and consequently damaging other road users. In the incidents where a scooter rider strikes a pedestrian, the pedestrian either dies or ends up injured fatally (Gössling, S. et al., 2019). Helmets and safety wears are essential for scooter riders, but most riders are not interested in this.

Scooter Sharing

Notably, the widespread trend for scooter riders in the fast-evolving use of scooters is the technique of scooter sharing. After paying the required fee, anybody could rent the Scooter and run errands with it for a short time, or even for a long time, to the user's preference (Altheide, D. et al., 2013). However, the hiring companies are still struggling with various means of regulating their services. Many users are leaving the scooters carelessly. It is similar to bike-sharing, which equally translates to a set of scooters piling up on sidewalks and alleys (Degele, J. et al., 2018).

In most cases, people interested in using the scooters cannot find the scooters since the people who used them before just decided to store them away for personal interest, or rather for individual use later. (Altheide, D. et al., 2013). This happens because there are barely existing regulations and legislation in the sharing services of the scooters. Consequently, this leaves the interested users frustrated with the services (Degele, J. et al., 2018).

Lack of Enforcement

Indeed, the most significant problem with scooters as a means of transport is the overall lack of law enforcement measures. Just as mentioned before, how scooter riders prefer to ride without wearing helmets is a single characteristic of this relatively common problem. In some European countries, while scooter riders are supposed to ride with a driver's license, most do not. While people are not supposed to ride their scooters on the sidewalk, other riders ignore that and ride undisturbed on the sidewalks (Absar & Ahmed, 2019). The impression of automobile sharing is fetching a lot of popularity in these cities, regardless of the type of vehicle. Even though the scooter is an opportune and, in particular, a convenient means of transportation, city establishments cause substantial problems. All for the reason that it is quite challenging to categorize an individual riding a scooter.

Is a scooter rider still a pedestrian, or perhaps a driver? Or is it in order to handle them as cyclists or a rider? No one knows about that, particularly the Law enforcement agencies. And the Police are spreading their hands since they do not know who and what to punish. The rules and regulations, together with the enforcement of these rules, are still not clear to all the scooter riders (Banister, D., 2018). There is uncertainty whether it falls in private enforcement or public enforcement. With undefined regulations and enforcement, the problems caused by scooters will continue, and the offenders will continuously cause more problems (Altheide, D. et al., 2013). In some cities in Europe, the scooters are well accepted, whereas, in other cities, these scooters are causing quite some problems. All in all, a comprehensive solution for enforcement is needed (Banister, D., 2018).

Safety Issues of EScooters

The safety of the users of mobile devices and the general public is vital in the development of better devices. The EScooters safety could be jeopardized as a result of mechanical, human factors, and electrical malfunction that leads to accidence and other damages. Mechanical failures that lead to injuries to the users include falls, collisions with other vehicles, pedestrians, and others. The collisions typically occur due to braking issues and other structural failures. Various electrical hazards associated the micro-mobility devices include battery-related problems and software malfunctions that lead to accidents (Tuncer & Brown, 2020). Human actions on the operation of the micro-mobility devices are vital in enhancing their safety levels.

The safety hazards are leading factors in the number of accidents that arise from the devices. EScooters are prone to accidents because of mechanical failure. The probability of one falling due to lost balance is increasingly higher in micro-mobility compared to other motor vehicles. Additionally, they are not regulated on the maximum speed that they should apply, and this increases the chances of accidents taking place. Another key issue that relates to safety in the sector is the high speed with which the devices are driven. In Sweden, various deaths have been recorded and are linked to the EScooters. Safety issues may also entail.

Compliance with the Updated Government Norms

The rise in competition among the key players and the increase in population coupled with the deployment of micro-mobility devices is a challenge to handle. There exist various regulations to abide by, and they differ from one city to another, and they have been made stricter, making it difficult for companies to overcome the hurdle (Milakis, Gedhardt, Ehebrecht & Lenz, 2020). Among the regulations include driving vehicles and other associated devices within the required speed limit, vehicle capping, and parking laws.

Integration and Alignment with the Social and Urban Attributes of the Cities

The usage of EScooters is increasingly developing into the new normal in numerous cities globally. A challenge exists on the incorporation of the developments into the existing systems governed by standards of operations. For instance, the electric scooter, when not in use, is parked on various sidewalks used by pedestrians contrary to the stipulated parking procedures, and this leads to an increase in the level of public anger. Failure to secure adequate parking of the devices leads to accidents that risks the life of the pedestrians. Public anger rises as a result of the risk imposed by the devices. The operations of the micro-mobility are not integrated to include the IoT devices, GPS trackers, and various mobile apps that are key in enhancing the operation of the transportation systems in Gothenburg. Failure to integrate the devices contributes to the decline in safety procedures in micro-mobility transportation. The inability to have data on the devices shared in real-time on a network leads to increased misconduct and law offenders tend to escape the justice system. Adequate integration of micro-mobility into the public transport network and systems is key in enhancing their level of accessibility and constant leasing, and this is ideal in promoting their usage in a move to reduce carbon emission. The operation of the devices faces backlash from society since the security of the community is hampered. The hilly roads and terrains that are in poor states are not suited for the e-bikes and the EScooters.

Utilization of the Urban Space

Micro-mobility devices face a challenge in getting adequate space. Ideally, some users in Gothenburg utilize the same roads used by vehicles making it more dangerous. The EScooters and other e-bikes are widely driven on the footpaths meant for pedestrians, and the implication is increased risk and accidents. Public outcry has been on the rise due to the increased un-procedural conduct of the devices. The free-floating bikes and the scooter-sharing devices enhance the convenience of the users but result in blockage of the sidewalks hence preventing free movement of the pedestrians. Users also abandon their vandalized devices on the paths leading to more risks.

IoT as a Solution to Micro-mobility Challenges

The Internet of Things has continuously evolved and gained broader usage in the world. IoT has influenced various industries, including the transportation sector (Imre & Szalay, 2002). The industry and the micro-mobility industry are utilizing the IoT in their operations in advancing their solutions to the various problems associated with the devices. IoT is arguably transforming the micro-mobility industry, and this has changed the attitude and approaches of people towards the options available for the shared mobility. The development is crucial in enhancing the utilization of the shared options for mobile vehicles instead of having personal vehicles that are expensive.

IoT and Compliance with Regulatory Requirements

In overcoming the compliance issues, IoT is applied to track the various vehicle metrics that are crucial in establishing the movement speeds, the time taken to arrive at a destination, and the routes taken. Installation of the IoT devices, like the GPS sensors and trackers, on the vehicles. Through the solutions, the micro-mobile vehicles can be easily controlled to ensure they abide by the set regulations. IoT is critical in solving the increasing safety solutions, and they can be embedded on mobile phones or through developed apps that are remotely controlled to enhance maximum safety.

The IoT solutions are crucial in aiding the scooters, and other shared devices find the nearest docking place. This measure is key in ensuring safe docking and prevention of parking on the pedestrian walking paths. Safe docking of the devices is crucial in the reduction of accident rates and improved public perception. The IoT devices notify the users in case of attempts to park wrongly and the availability of free docking spaces. Wrongly packed devices can be perceived to be in contravention of the law, and the users are responsible since it is assumed they ignored the notification.

IoT and Data Sharing with the Traffic Authorities

The traffic authorities are essential in enhancing road safety. Their approach to efficient operation and execution of the regulatory requirements is made easy through data sharing and available information regarding the micro-mobility devices. The devices offer the authorities data such as the existing environmental conditions, driving routes, traffic patterns, speed limits, and the data relating to the vehicle. However, micro-mobility devices sometimes face attacks and security-related issues, given that they are prone to hackers who seek to control the applications. In overcoming the problems, various organizations are implementing over-the-air- firmware, a wireless system of delivering software to the different mobile devices where they are needed for installation or update purposes. The firmware is vital in updating the codes of the remote device. This is essential in constantly updating the behavioural aspects of the devices to improve their performance.

Mobile Learning Design

The solution of IoT mainly focuses on changing the behaviours of the devices not the riders. This implicates the need of a robust learning app design for riders of EScooters. Designers must identify what attracts their most excellent lifetime value users, who are more inclined to spend and promote the learning app to their friends and relatives (Hammershoj et al., 2010). Designers must look deeper to learn how to keep users interested in using the designed app for extended periods. Users will see all accessible features and have a simple search navigation to quickly get the information they need. Users can experience the benefits of the mobile app designed for learning because of the contents, quick loading time and easy-to-use mobile app design (Ahmad et al., 2018).

Challenges of Designing EScooters Apps for Learning

According to Hammershoj et al. (2010), addressing the questions posed by users can help you determine the originality of an idea of the app's functionality for learning. Further details of its intent should also be considered while designing an app. The designers are faced with the concept of unique and make it simple for their users to understand and use them. Because mobile is so frequently utilized, designers increasingly engage in mobile app design for learning and development to accommodate on the increased demands (Hammershoj et al., 2010).

According to Ahmad et al. (2018), the challenge for designers is to define the target users properly. Defining target users for mobile app design from learning standpoint is critical. But it's difficult to achieve because simply establishing the users is not enough; ensuring that the audience is getting the expected features is important (Ahmad et al., 2018).

One of the most important things to remember when designing apps is to understand user needs and deliver the most excellent possible experience (Rachmanto, 2020). Therefore, designers should be conscious of the considerations of the needs to assist users in making the ideal learning experience. End users are interested in mobile app innovation because it makes using the mobile app easier. Nevertheless, relevant and appropriate apps for training is not always available (Tuncer & Brown 2020). According to (Tuncer & Brown 2020), One of the essential features of a mobile app is content of instruction, so users can easily familiarize themselves to new skills and knowledge.

Conclusion

After the rise of EScooters, countless applications have been developed to improve and simplify our lives. The IoT device of EScooters is continuously advancing the solution design, mainly, to change the behaviours of the EScooters. However, learning apps for scooter riders are needed to change the dangerous practices of the riders. For people to understand EScooters, how they function, the rules and regulations, they must have adequate learning apps. A well-designed mobile learning app for EScooters riders may substantially assist the users for safe and smooth experience. Mobile app design for learning can continue to play a vital role in eradicating challenges associated with EScooters and other devices. Solving these challenges of EScooters and EScooters riders is viewed to be a step forward not only in improving skills and safety issues but also in enhancing the sustainability of the city.

Design Methodology

Initial design decisions

Study area

The study was conducted in Gothenburg city. The study area was selected purposively since dearth of studies has been conducted in Gothenburg on designing a mobile app for scooter riders which can be used as a learning resource and possibly certify riders. Moreover, the designer selected this study topic because of severity of the problem in Gothenburg because of increased number of EScooters.

Methodology

Knowing that any design process depended on innovation and creativity, as Lowgren & Stoterman (2004) put it, the designer had to develop a design process to use. Four design processes at hand to be deployed included the Addie Model, the Design Thinking, Dick and Carey instructional design, and Gagné's Nine Events of Instruction. Furthermore, these had to be enhanced by design principles articulated by other designers such as Norman (2011). Considering that the ADDIE model is primarily concerned with strengthening quality in instructional systems (Clayton W, 2006), it could be considered as an option. However, since ADDIE model is not iterative and can possibility take a long period of time, the designer opted not to employ it. Moreover, ADDIE model is time consuming, expensive, and can be problematic (Clayton W, 2006). Similarly, Gagné's Nine Events of Instruction employs a more classroom-centered design, rendering it less valuable. Though Gagné's Nine Events of Instruction can provide a systematic and simple process which can be adapted to suit different kinds of learners, it requires a lot of guided assistance and there is not a lot of independent learning (Kurt, S. 2016). This capstone project aimed at teaching EScooter riders with the help of a mobile app, not with a guided physical assistance. The third design methodology option, Dick and Carey's instructional design, concerns creating an instructional curriculum with a bias towards producing specific learning outcomes based on classroom and online teaching (Kurt, S. 2016). As an advantage, Dick and Carey's instructional design adjusts well for changes with emphasis on organizing training content. However, it is extremely time consuming and not flexible (Kurt, S. 2016). Moreover, this instructional model can possibly be the choice for blended types of learning; however, it can create unintended learning gaps for mobile app designs which imply no classroom base teaching. The researcher finally decided to use the design thinking approach because of its iterative nature and its ability to tackle complex problems that are human-centered (Gössling, S., & Cohen, S., 2014). Though Design thinking methodology requires direct involvement of users, it provides a fast solution adoption, strong engagement of users with iterative and innovative approach (Gössling, S., & Cohen, S., 2014). Moreover, based on hands-on experience from previous projects, the designer believed that design thinking methodology is an approach that can support a user-centered procedure which helps to understand the users' needs.

Just as introduced before, design thinking is a procedure that resolves complex tasks through user integration, practicable technology alongside economically feasible solutions. This kind of method has proved to be effective in tackling complex problems such as the problem statement of this study. The current issues facing scooter riders in Gothenburg that need to be resolved using a practical application are just the kind of task that needs to be handled with design thinking (Gössling, S., & Cohen, S., 2014). To illustrate the importance of this methodology, a breakdown of this problem can be done. Public transport and safety are amongst the versatile areas of research.

This is because most of the problems in this sector are poorly defined, lack effective enforcement, and are just as complex as the problem at hand. However, public transport has a vital role in the progression of economic sustainability (Gössling, S. et al., 2019). Compelling scooter riders to reduce or rather append

the use of scooters would affect the economy in one way or another. Therefore, the design thinking process would come in handy to break down this problem into a practical mobile application solution without suspending scooters. The methodology lived up to generating the independent features for the mobile app, which would, in turn, solve the problems facing scooter drivers in Gothenburg by educating and informing them where necessary (Gössling, S., & Cohen, S., 2014).

Benefits of Design Thinking Process

1. It is a way problem solving and innovation
2. This process cultivates collaboration
3. It gives an assured competitive advantage
4. Breaks down complex problems into practical solutions
5. It is user centred.

Design Thinking Methodology

Design Thinking is a procedure that purposes to confront an exceptionally complex problem. Complex problems are challenging to describe and cannot be elucidated by using traditional approaches and methodologies (Gössling, S. et al., 2019). These are the reverse of "domestic" complications, which could be cracked by implementing a tried and tested set of rules or logic. However, the choice of implementation of the design thinking process remains unchanged: to give an approach to complex problems from the human perception (Gössling, S. et al., 2019). This procedure fosters inventiveness, innovation, and together with user-centricity. Therefore, assisting in coming up with practical solutions which are:

1. Appropriate for the user
2. Sustainable
3. Technologically practicable

This process places the user needs and user requirements first before anything else. The first phase of this process is devoted to building empathy with the targeted consumers, alongside understanding the users' behaviours, needs, and prospects. Then a focus is set on making up ideas that are then swiftly turned into prototypes. The constructed prototypes then get tested on actual users. Characteristic to the design thinking procedure is the time to time testing of solutions. Through this, feedback can be easily obtained, and then the necessary changes are made before developing the final product. In summary, this procedure helps realize innovative solutions to some multifaceted problems motivated by the target user's needs.

The task here was to use the Design Thinking Methodology to generate the independent features for this mobile app, which would, in turn, solve the problems facing scooter drivers in Gothenburg by educating and informing them where necessary.

Design Thinking stresses giving a design that creates empathy. Anyone might ask how the design works. The design thinking assisted the designer to design the product that will correspond to the needs of the users. The designers have to think and understand the consumer of the products. Therefore, to understand this, the designers need to strategize in the work and integrate the needs of the consumer and integrate them in the product (Bakir & Mcstay, 2018).

From a point of view in understanding acts as a guiding principle involves in design thinking. The empathy applied here, assisted me to put myself in the situations of the the users. Therefore, it helped me to have a good interaction with the users and help them to engage effectively.

Phases of the Design Thinking Methodology

1. Empathize
2. Define
3. Ideate
4. Prototype
5. Test

Empathize

This phase was the core the design process. The mode of empathy was the input I made to get a good understanding of the participants, in the concept of the intended design. As a designer in this project, it was my responsibility to have a good understanding of how the design variables operate, the needs, perception of the environment, and that which is directly affecting them. As a thinker in the line of design, the problems being solved are rarely the designer's problems. Instead, they are those of a specific group of individuals which are the participants; so that the problems get designed, the designer is supposed to gain empathy for who the users are and what they need (Bakir & Mcstay, 2018). Observing what the clients do and how they interact with their environment gave me some ideas on the way they think and feel. This also assisted me in deeper learning about what they need. Through watching them, I had a first-hand encounter with the physical manifestations of their experiences and their interactions.

Three methods were used for data collection: observation, semi structured interviews, and questionnaire. Field observation was used as one of the methods in this stage. The observation sessions were around Gothenburg city and in one of the warehouses for of the EScooters companies. Semi-structured interviews were made with Municipality Officer and five EScooters riders. In addition to this, a questionnaire was also used as a data collection method. Typeform platform was used for this purpose.

This allowed to have a clear understanding of the intangible meaning of the experiences, therein uncovering insights. Insights provide for one a certain direction to make up innovative solutions. Ideal solutions are usually from the best comprehension keen on human behaviour. However, learning to do a recognition of those insights is hard work since the human mind naturally filters out a lot of evidence without really realizing it. A personal engagement with people makes known a lot of things about them, the way they think, the principles they hold, and the unexpected insights they end up revealing. Before embarking on interview preparation and making inquiries, a quick personal inspection was carried out to define the scope of this task in a better way (Bryman, 2016). Moreover, I have tried to determine the elements the problem being solved, the audience, and competition.

Implementation of a well-designed mobile app that will help address the problems facing scooter riders by teaching scooter riders in Gothenburg about scooters, ethical motorist behaviours, and rules (Bryman, A., 2016). Indeed, the most significant problem with scooters as a means of transport is the general lack of awareness of the necessary basic knowledge and needs that a scooter rider must-have. Be it on law, educational, technical, and practical awareness (Absar & Ahmed, 2019). The solution proposed in this study is the combination of mainly both technical and educational awareness creation by designing a mobile application solution.

People using scooters as a means of transportation are consistent mobile application users, preferably individuals who have used navigation and vehicle applications before (Bryman, A., 2016). The audience will be primarily individuals who are using shared EScooters in Gothenburg. However, individuals who privately own scooters or get to use scooters from time to time can also possibly benefit from this solution design. The audience should also be holding a smartphone that would support the mobile application.

In my case, among the many existing transportation and vehicle applications, I will be producing an application that can be considered as a new learning resource.

Define

The define stage of the design process entails pulling out the clarity and focus to the specific design at hand. It was a chance and equally my responsibility to make a good definition of the challenges of the EScooters riders and the municpality being taken based on what has been learned, the users, and the context. After getting acquainted with the invaluable resources, mainly from the EScooters riders, empathy was then defined significantly with relevance to the task at hand. This stage make to purely make sense of all the data that has been gathered. The goal in this stage was to make up an evocative and practical problem statement, in other words: point of view. The problem statement was used as a guide, as it bases its focus on a composite character. The insight emerged after a thorough process of synthesizing information to determine influences and trends. It can be concluded that the define stage is all about sense-making.

The interview with the EScooter riders and municipality administrator and the general empathy stage were used to find out what the core issues are. The responses were evaluated and assessed keenly (Bryman, A., 2016). All the findings were pieced together. The common themes were then grouped; response patterns were also observed. I also noted the user needs and challenges that consistently came up, such as lack of resource for learning and increased problem of EScooters (Absar & Ahmed, 2019). After the findings were synthesized, a problem statement was formulated. The formulated point of view outlined the specific broken-down issue that was being addressed. The purpose of the point of view was to keep the design in focus with the design goal. Therefore, the problem statement formed the application's basis of ideas and potential solutions (Altheide, D. et al., 2013).

This stage was critical to the design process since it resulted in the point of view. The point of view is the explicit expression of the task being addressed. Additionally, the point of view expounds more on the relevant challenge to solve, regarding the new comprehension of the participants and the problem space (Bryman, 2016). The process gave me the impression of being counterintuitive but fashioning a more closely fixated problem statement leans toward yielding both a bigger scale and an advanced eminence solution as the ideas are being generated. The defined method is an exertion to amalgamate the designers' scattered conclusions into dominant understandings. It is this amalgamation of the responsiveness effort that stretches the improvement that nobody else made findings that the designer can influence to confront the project task.

Problem space and design brief were formulated at this phase taking the results of empathy map and personas design from the empathize phase. This helped to focus on the problem space and dive directly into bringing possible design ideas into the table. Problem statement was redefined and refined at this phase.

Ideate

This is the third stage in design thinking development. The target users were already identified to be the EScooters riders. A clear problem statement had also been developed by then. Now, the possible solutions to the problem statement were being formulated at this stage (Bryman, A., 2016). The ideation stage was conducted with a judgment-free mode to explore all the possible solutions to the problem at hand. The many sourced ideas were then narrowed down into five main moudules, EScooter parts, List of EScooters, Campains, Course certifications, and Community of practice. These were the ideas turned into prototypes to be tested on real users.

My focus in this phase was concentrating on producing possible numbers of solutions generation. The ideation stage makes available both the energy as well as the foundation material for the construction of

the prototypes and receiving inventive clarifications into the hands of the users. I ideated to changeover from ascertaining all the relevant problems to generating elucidations for the users (Degele et al., 2018). Ideation is the designer's chance to conglomerate the appreciative environment that exists in the problem space and the users that are being designed for with the designer's resourcefulness to produce solution concepts. Predominantly, the initial ideation stages in design development were about insisting on the most comprehensive possible assortment of contemplations, from which the designer can choose, not simply defining a single, preeminent solution. The fortitude of the preeminent resolution was exposed later, at the time of testing.

The numerous practices of ideation were influenced to:

a) Phase further than understandable elucidations and thus escalates the invention perspective of the designer's solution.
b) Connect the cooperative viewpoints and strong points of the participants.
c) Disclose unanticipated results of investigation.
d) Generate eloquence (volume) and suppleness (diversity) in the invention options.
e) Get recognizable clarifications out of the resources.

Quick paper sketches were produced at this phase as described in the next chapter. The aim was to bring as much possible design ideas as possible. Brainstorming was used to produce design ideas. At the end of this phase, affinity diagram was designed to consider best solutions for the prototype phase.

Prototype

This was the fourth stage of the design thinking process, where the progressive ideas from the ideation stage had now to be turned into prototypes. The prototype here was a scaled-down account of the intended mobile app design. In this case, an interactive digital representation of the intended product. This stage aimed to convert the progressive ideas from the ideate phase into a tangible product that can, in turn, get tested on real users (Bryman, A., 2016). This was done to achieve the user-centric approach, which allowed me to gather feedback continuously before the full product was developed. It acted as an examination process with evaluation procedures that ensure that the final design of the mobile application essentially solves the problem at hand and can be easily used.

Figma was used to produce high fidelity prototype product. A clickable and responsive product was used as a final product of this stage and as input of the testing phase. I have got hands-on experience in the process of designing the prototype.

Test

This last step of the whole process was fully dedicated to testing: placing the composing prototypes onto the EScooters riders and evaluating how they use the application. This stage allowed me to observe these target and representative users as they interrelate with the composed prototype. Feedback then gathered on the way the users felt through the whole process. The testing phase helped in highlighting the design flaws that had to be addressed swiftly. The feedback was then used to improve the application prototype (Bryman, 2016). The process is usually iterative and non-linear; therefore, back and forth visits to the ideation and prototyping stage had to be made to create an effective prototype.

Usability testing was used to examine if participants were interacting with the prototype as expected and if they are satisfied or not. The combination of Figma Mirror and Zoom was used to access screens of participants and follow their actions and difficulties in a live session.

Iterations

A total of four iteration has been made throughout this design project. The first one was from testing to Empathize stage in order to understand user needs in broader sense. Second, from prototype phase to ideate phase. The purpose was to include more design ideas into the prototype product. The last two iterations were from the testing stage to define and ideate stage to refine problem statement and produce more design ideas respectively.

Participants

The participants for this research were EScooters riders and government entities. The EScooters riders were recruited randomly through referral by the me. The random selection of participants was first performed by defining the participants I wanted to study. These were the EScooters riders and mobility services project manager at the municipality administration of Gothenburg. I have used Facebook and WhatsApp groups to select random participants living in Gothenburg.

A questionnaire was distributed to the participants. The access to the participants was through the mail for survey and Zoom for interview purposes. For the survey, I have got a total of 30 responses from EScooters riders in Gothenburg. I had semi-formal interviews with five EScooter riders and one mobility service project manager, Mr. Shahriar Gorjifar, at the Gothenburg's municipality administration. For testing purposes, usability, and satisfaction testing, nine participants were involved with the use of Figma Mirror and Zoom.

Ethical Considerations

With a substantial design project on this mobile app design, it is necessary to build up a robust ethical platform that will guide the whole process. While searching for information, it was necessary to consider the essence of developing a contemporary and necessary stance on the contextual issues. The concept of ethics enabled the project work to be conducted in the procedural context to allow the engagement with ethics (Markham, 2018). The ethical plan for this research was mainly aimed at addressing the key issues and responsibilities of the designer in the study of various outcomes.

Ethical concepts must be adhered to in seeking information. The first ethical concept that was observed was seeking consent before using information from somebody or carrying out survey research (Samuel 2020). The research participants was aware of the project being conducted to give the necessary information honestly. Another aspect that needs to be observed was the protection of the research participants through anonymity.

I have also fully considered the ethical aspects during the observation in the main areas of the city. Studies based on observation must respect privacy and psychological wellbeing of the participants (Markham, 2018). However, observational research is acceptable in. public situations where those observed would expect to be observed by strangers (Samuel 2020). Apart from this, I have provided informed consent and anonymity aspects for the participants I have interviewed during the observation. For the semi-formal interview with the mobility service manager for Gothenburg municipality, the participant has voluntarily consented for his name to be specified in this capstone project. Finally, it was is essential to note that appreciation of others' work is vital and should at all costs be referenced to protect the concept of academic integrity (Markham, Tiidenberg, and Herman, 2018).

Methods, Tools, and Iterations

Figure 1 summarizes the methods and tools applied in each stage of the design process. Different methods and at least one tool was applied in each phase. In the empathize stage, after the collection of survey, interviews, and observation, I have used a Miro tool to produce an Empathy map. Based on the persona

design with Xtensio platform, I have developed a problem space and design brief at the end of the define stage. After producing several ideated solutions using quick sketches, Affinity map was created to pinpoint the best solution using Creately tool. Next, a clickable, responsive, and iterative prototype was designed with Figma software. Finally, I have used Figma mirror and Zoom environments to test usability and satisfaction aspects of the EScooters riders.

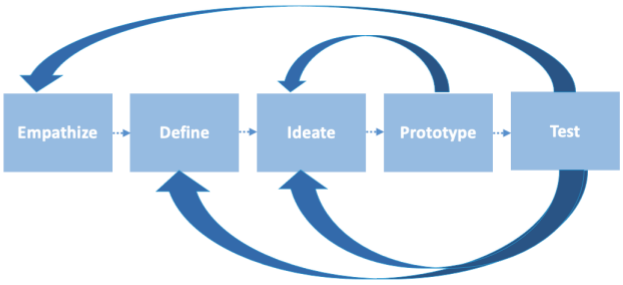
The design also went through different iterations. Taking an advantage of the iterative behavior, I have learned from the prototype stage to redesign new ideas. Similarly, the test stage creates new ideas, insights, and redefinitions of users and problems. As a result, the first iteration was made from the prototype design to the ideate stage to refine the ideated solutions. Moreover, I have made three iterations back form the test phase to the empathize, define, and ideate stages when revising and redefining the problem space, the needs of the EScooters riders, and the ideations was needed.

Figure 1

Methods, tools, and iterations in each phase

Empathize	Define	Ideate	Prototype	Test
Survey	Problem	Sketches	Clickable	Usability
Interview	Persona	Idea Board	Responsive	Satisfaction
Observation	Design Brief	Models	Iterative	

Tools used in each Stage		
Stage	**Product**	**Tool**
Empathize	Empathy map	Miro
Define	Persona	Xtensio
Ideate	Affinity map	Creately
Prototype	Prototype	Figma
Test	Test results	Figma Mirror, Zoom



Design Process

The following steps were followed: empathize, define, ideate, prototype, test.

Phase 1: Empathize

As a first stage of the design project, the empathize stage commenced as a first foundational juncture. As a researcher, dropping assumptions, judgments, and biases was a key to determining the target users' feelings, needs, and pain and gaining points. (Löwgren & Stolterman, 2007; Norman, 2013)

The methodologies used to achieve this stage were surveys, observations, and interviews. After collecting data, categorizations using sticky notes on a whiteboard—an empathy map was designed with a Miro tool. The designer has designed the empathy map putting what the targeted users feel and think, see, do and say, hear, and their gains and pain points.

Observation
Deeper understanding of the problem was gained through observation in different areas of the city of Gothenburg and one warehouse in one of the EScooters companies in the city. A curious and non-judgmental mindset helped the designer for a better understanding of the core problems and for valuable insights. Main problems learned as a result of this method are the following:

- Vandalism and breaking some parts of the EScooters (specially the front and rear mudguard parts of the scooters)
- Graffiti
- Riding more than one person on a single scooter
- Parking issues
- Riding on sidewalks and car and train roads.

Interview with Municipality Officer

In order to identify the main challenges of the experience of EScooters' usage in Gothenburg, the designer needs to have a proper understanding of the situation from the Municipality's perspective. (Research Question 1). Therefore, to get a detailed understanding of the main issues and challenges, I had a semi-structured interview with mobility services projector manager of Gothenburg city's Urban Transport Administration. The following points were raised during the discussion.

There are two main problem areas - parking issues and dangerous traffic behaviors, where parking being the overwhelming majority of complaints. The parking issues are generally related to the users, not the companies. The city's mobility services office has reasonably good contact with the companies, and they, the collectors of the companies, know where they can and how they are supposed to park. The biggest issue is when the users just park the scooters anywhere. Another vital issue from the city's mobility perspective is that the Scooters are not really integrated into the transport system of Gothenburg. Although it is a sort of public transport, it is not integrated with the public transport system of Gothenburg. It is better connected to where people want to ride than the municipality's transport system. Furthermore, the scooters are concentrated in the central parts of the city, which is more well off. It creates an imbalance and inequality basically in equal access to mobility services.

There are occasional information campaigns when needed and if there are plans and measures the city is taking to get some order into the transport system. These are not regular events that the municipality does yearly or quarterly, but it is now and then when the office feels the need arises or the problems escalate. The campaigns are basically press releases and guide documents where the city tries to get an enormous

impact and uptake in public. Further, the municipality is trying to coordinate with the companies to have their own campaigns for their own customers simultaneously.

Scooter service is not a mobility service that the city provides, and it is not a mobility service that the city asked for. The municipality did not ask for many scooter companies to start a business here; hence, the office does not promote it. What the municipality must do is try to manage the situation. that we have. On the other hand, with bikes, for example, where there is a much higher uptake of private bike ownership, the municipality considers there are a lot of private citizens that need more information. Nevertheless, when it comes to the scooters, that is the responsibility of the companies to inform their customers. The administration does not involve in that part of it. We involve with what we do is the management from the city side, basically.

Semi-structured interview with scooter riders

Next, I had a semi-structured online interview, via Zoom, with five riders on the main challenges of Scooter riding and Scooters in general. The five scooter riders who were interviewed had three commons complaints. They needed parking areas for scooters within the municipality, they also needed a mobile app solution for quick learning about EScooters and finally, the users also complained of their scooters lacking an updated user manual. A scooter is broader than a standard bike, and a scooter could characteristically go quicker than a biker who usually is cycling. In this case, scooters can easily pose a reasonably dangerous threat to pedestrians using the sidewalk. A rider on a scooter moving at high speed can easily hit a pedestrian on the sidewalk, and if not hitting someone, the rider will run over a handful of pedestrian toes. One common prerequisite that most scooter riders delight in while riding on their scooters is the simplified maneuvering on the streets. Scooters utilize little space, unlike cars, therefore at times of an unavoidable slowdown of traffic, scooter riders will maneuver in between vehicles or instead shift and ride on the sidewalk to dodge the heavy traffic. This cruel practice by scooter drivers is unsafe for several reasons (Brunner et al., 2018).

The following main points were raised during the interviews:

- Lack of technical skills for driving EScooters.
- The participants do not consider the existing apps as a learning product. The primarily use the apps to lock and unlock EScooters.
- Information gap.
- Unsure about traffic rules and parking areas.
- The need of a mobile app which fully focuses on training riders

Questionnaire

Questionnaire was also used as a data collection method in this phase to get information about scooter riders in a cheap, quick, and efficient manner. Typeform platform was used for this purpose and the questionnaire was available for four weeks. During my visits in Gothenburg city center, and around the areas of Brunnsparken, Valand, and Järntorget, I invited some riders, who were driving in group and parking the EScooters carelessly, to fill the survey. I have also distributed the link for the survey in some groups of WhatsApp and Facebook. I have got a total of 30 responses. From existing shared EScooters in Gothenburg 80% of the participants use Bolt Scooters and 60% use Voi scooters. Four of the participants have their own private scooters (see Figure 1). Participants were asked about their usage frequency. According to the responses, more than 50% of the participants use scooters at least once a week.

Figure 2

The Scooter Types the riders mostly use

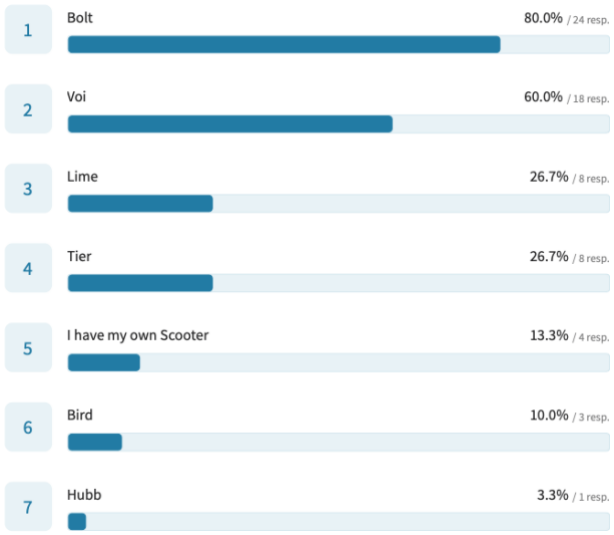
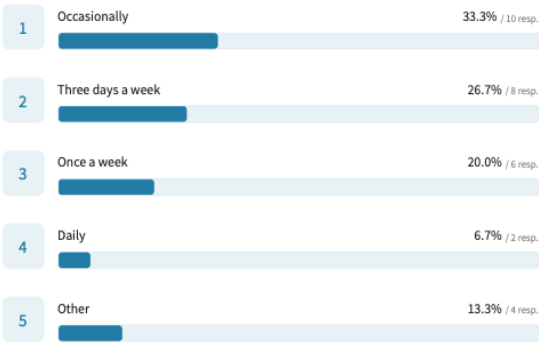


Figure 3

Usage Frequency of riders



The third question was aimed at checking if the participants are getting the information they need from the scooters. 73.3% of the participants are not getting enough information from existing apps. (See figure 3). As a result, from figure 4, only two participants said they learned how to ride using a mobile app.

Figure 4

Do the riders get the information they need from the apps?

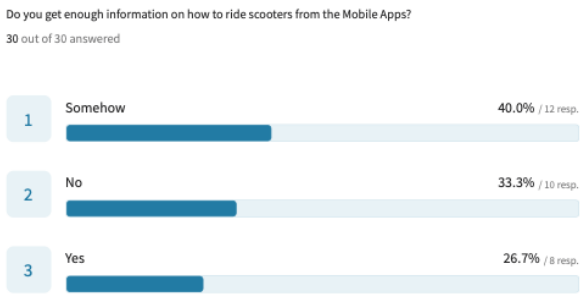
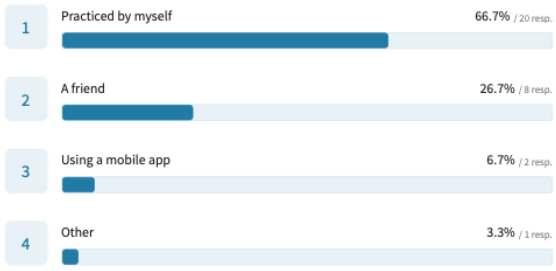


Figure 5

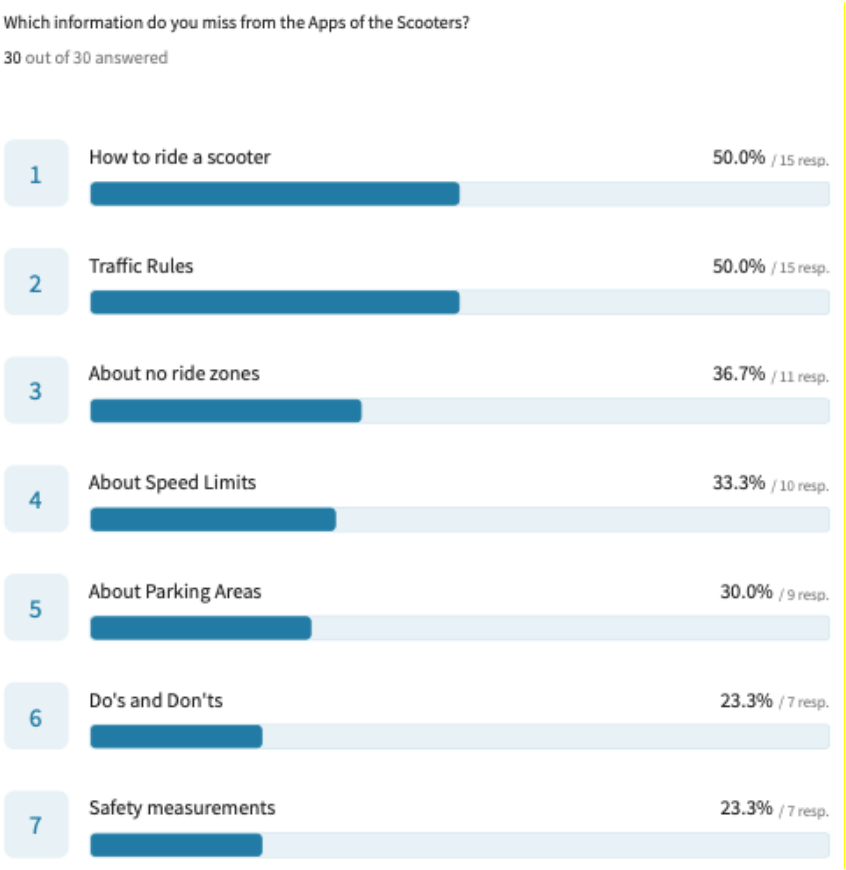
Who taught you how to ride a Scooter?



The fifth question, figure 5, was about information gap. 50% of the participants are not getting information about how to ride a scooter and about traffic rules. Other areas of information gap are about no ride zones (36.7%), about parking areas (30%), do's and don'ts (23.3%), and safety measurements (23.3%).

Figure 6

Missing information from riders' perspective



The results of observation, interviews, and questionnaires gave the designer some ideas on the way the participants, especially the riders, think and feel. This also assists the designer in deeper learning about what they need. Through watching them, the designer had a first-hand encounter with the physical manifestations of their experiences and their interactions. This allowed me to have a clear understanding of the intangible meaning of the experiences, therein uncovering insights. Insights provide for one a certain direction to make up innovative solutions. Ideal solutions are usually from the best comprehension keen on human behaviour. However, learning to do a recognition of those insights is hard work since the human mind naturally filters out a lot of evidence without really realizing it (Degele et al., 2018). The engagement with participants made known a lot of things about them, the way they think, the principles they hold, and the unexpected insights they end up revealing. Below is the empathy map that was deduced after the aforementioned process. The map has been divided into four sections and consequently subdivided into two conclusive groups as follows.

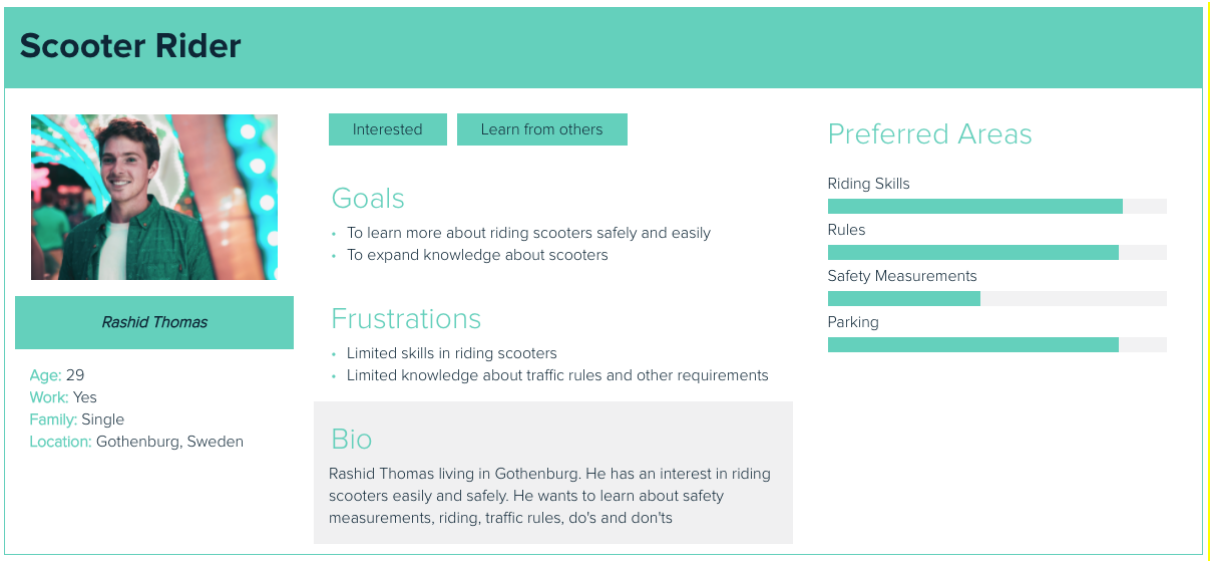
Figure 7

Empathy Map

Next, the targeted users of the process, EScooters riders, are refined and described as follows, figure 8. The persona design includes goals, frustrations, bio, preferred learning areas and general information of an EScooters rider. Preferred learning areas of most of the participants in this project are: riding skills, rules, safety measurements, and parking.

Figure 8

Persona: Scooter Rider



After the empathy stage, the designer is then tasked to conclude every single occurrence during the empathy phase. Everything that had been seen and said needs to be processed to get a good comprehension of the bigger picture and get hold of the conclusions. Unpacking the resources could be a good way to begin the whole process (Degele et al., 2018).

Phase 2: Define

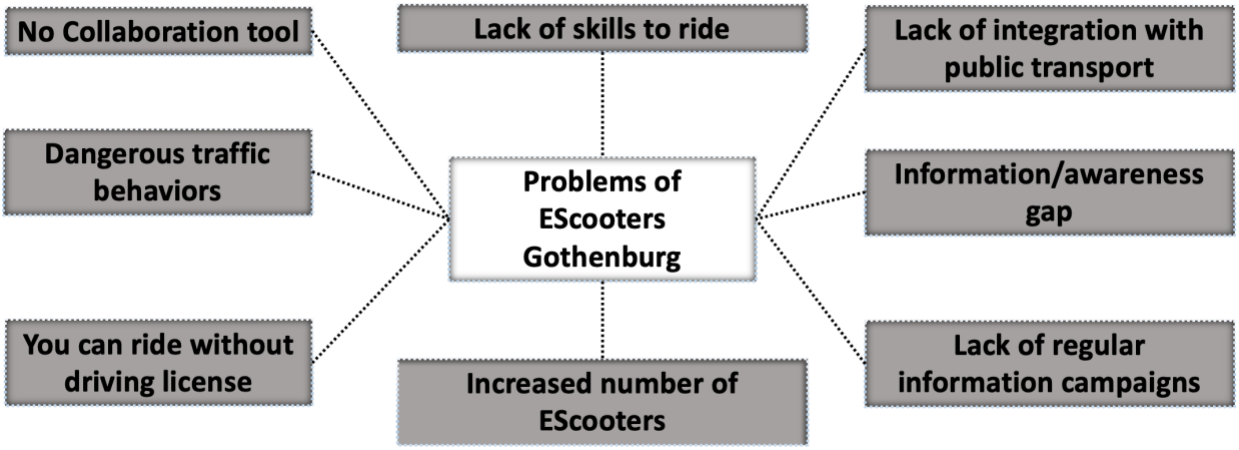
Interviews, observations, and literature review were used to define the problem. The data gathered for problem identification is redefined and elaborated from the empathize stage in a refined way. As a result, the problem space of the project has been developed.

Next, the problem statement is formulated in line with what the users need. The core focus of the problem area remained on the main challenges and issues of users on fixing, riding, and behaving with scooters. The design implication here is that the client's needs should reflect the users' needs (Norman 2011; Lowgred & Storterman 2007). A thoughtful designer should not rush into designing based on the client's information alone. It is from the problem statement that leads to the formulation of the design objective (Löwgren & Stolterman, 2007). Based on the gathered information, the researcher has prepared a design brief which was helpful at the final stages to ensure whether the solution meets the existing problem.

The interview and the general empathy stage were to find out what the core issues are. The responses to the consultations were evaluated and assessed keenly (Bryman, A., 2016). All the findings were pieced together. The common themes were then grouped; response patterns were also observed. I also noted the user needs and challenges that consistently came up, such as lack of apps for learning and engine breakdowns in scooters (Absar & Ahmed, 2013). The data gathered at the empathize phase is redefined and summarized in a refined way as follows:

Figure 9

Problem Space



After the findings were synthesized, a problem statement was formulated. The formulated point of view outlined the specific broken-down issue that was being addressed. The purpose of the point of view is to keep the design in focus with the design goal. Therefore, the problem statement formed the application's basis of ideas and potential solutions (Altheide et al., 2013). Therefore, I have prepared a design brief which was used as a product of the define phase and was helpful for the next stage of the design process to make sure whether the solution design considers the real problem space.

Figure 10

Design Brief

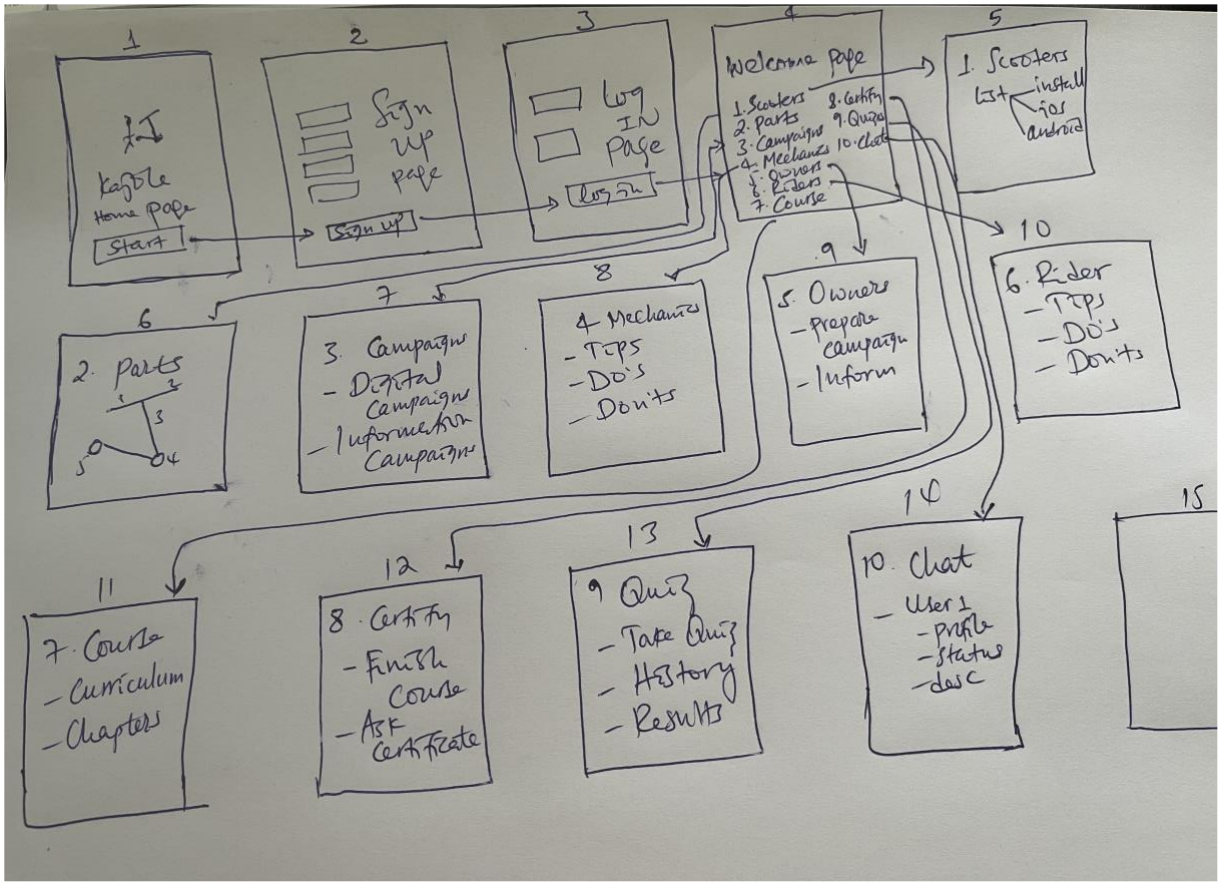
User Feedback	
EScooters riders need a mobile app to learn about EScooters and traffic rules	Riders used different scooter apps but do not consider them as learning apps
Problem Statement	
As the number of EScooters increases, problems such as dangerous traffic behaviors are increasing where an intervention is needed to create awareness and build skills.	
Design goal	
Design an easy and organized learning mobile app for EScooters riders. Riding, learning, and community.	
Design Requirement	
Convenient and easy to use For EScooters riders in Gothenburg	App designed to be used by beginners and experienced users promoting collaboration.

Phase 3: Ideate

In the third stage in design thinking development, the target users were already identified to be the scooter riders. A clear problem statement had also been developed by then. Now, the possible solutions to the problem statement were being formulated at this stage (Bryman, 2016). The ideation stage was conducted with a judgment-free mode, whereby the group working on the ideation process had been encouraged to explore all the possible solutions to the problem at hand. The many sourced ideas were then narrowed down into a few ideas. These were the ideas that will later be turned into prototypes to be tested on real users.

Figure 11

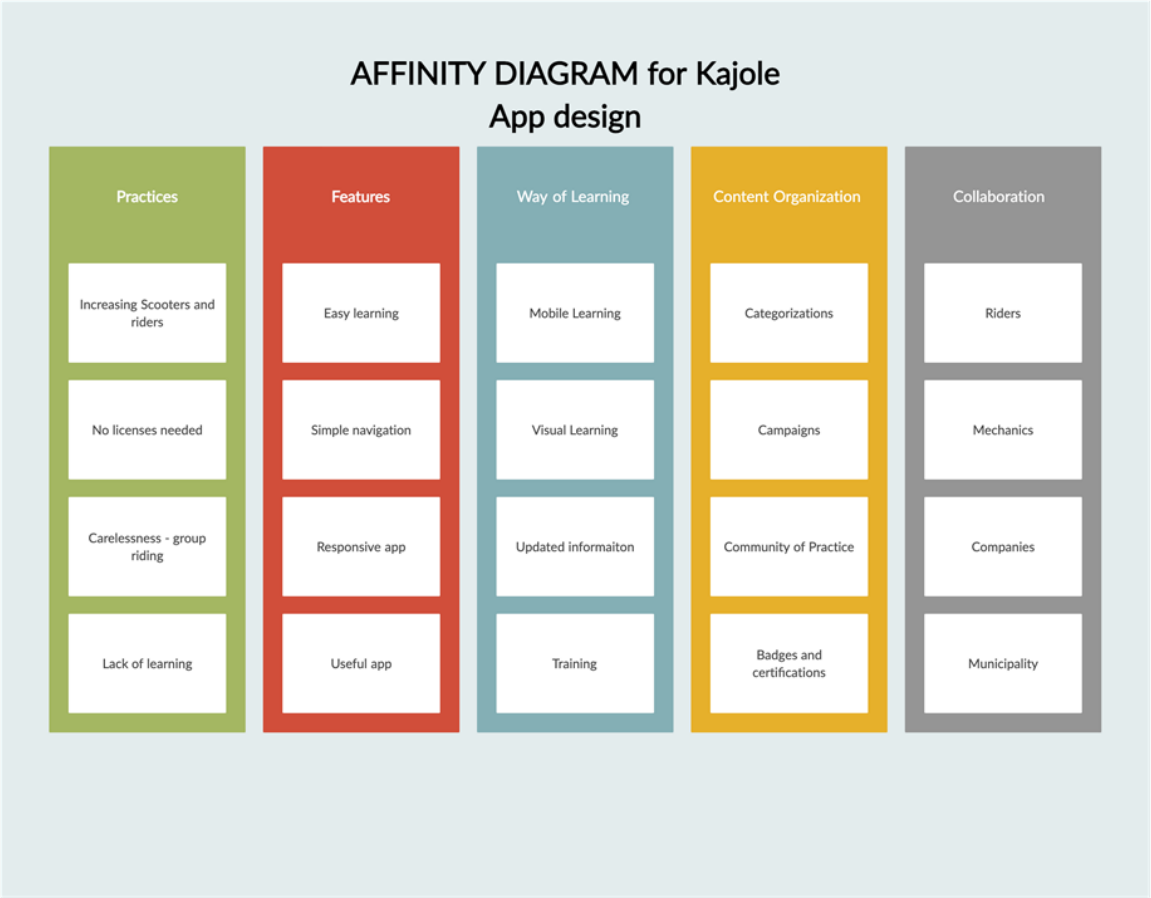
Quick sketches of ideas



The research and data collection from the previous phases were used as cornerstone for this phase. When commencing the ideate stage, the primary focus was on generating random solution ideas and placing every choice on the table to develop quantity and diversity of design ideas and quick sketches. I had a brainstorming and drawing sessions to bring all ideas to the table and design quick sketches using whiteboard. This phase had created the opportunity to develop some out-of-scope design ideas that need to be redefined back at the defining stage of the problem space (Löwgren & Stolterman, 2007). After bringing all ideas to the table and refining the sketches, the following affinity diagram was then conclusively formulated to refine and minimize the solution space and, as a result, proceed to next phase.

Figure 12

Affinity diagram



This stage made available both the energy as well as the foundation material for the construction of the prototypes and receiving inventive clarifications into the hands of the users. The data got ideated to changeover from ascertaining all the relevant problems to generating elucidations for the users. Ideation was used as a chance to conglomerate the appreciative environment that exists in the problem space and the users that are being designed for with the necessary resourcefulness to produce solution concepts (Absar & Ahmed, 2013). The elucidations were grouped into five groups as follows: practices, features, way of learning, content organization, and collaboration. Predominantly, the initial ideation stages in design development are about insisting on the most comprehensive possible assortment of contemplations, from which a choice was made not simply define the single, preeminent solution. The fortitude of the preeminent resolution got exposed later, at the time of operator testing and response.

There are additional ideation practices for instance; body storming, mind mapping, and outlining. Nevertheless, one subject through all of them is acceding conclusion (Hamilton & Wichman, 2018). That is, sorting out the cohort of thoughts from the assessment of concepts. In practicing that, the designer gives the team's thoughts and inventiveness a voice, while conciliating the team's cogent side in understanding that they must get to the analysis of qualifications later.

Phase 4: Prototype

By considering the best solutions, a prototype was designed with a high-fidelity wireframes tool, Figma, which offers widget diagramming placements, designing interactions such as conditional linking, showing, or hiding features, data framing simulation for data items. As a result, a clickable digital prototype was produced. The best ideas and sketches at the ideate phase were taken as a cornerstone for the prototyping phase—the prototype design aimed at having accessible and bright pages with responsive and straightforward navigations.

This was the fourth stage of the design thinking process, where the progressive ideas from the ideation stage had now to be turned into prototypes. The prototype here was a scaled-down account of the intended mobile app. In my case, an interactive digital representation of the intended product. This stage aimed to convert the progressive ideas into a tangible product that can, in turn, get tested on real users (Bryman, 2016). This was done to achieve the user-centric approach, allowing feedback gathering before the full product now gets developed. It acts as an examination process with evaluation procedures that ensure that the final design of the mobile application essentially solves the problem at hand and can be easily used. The following prototype, Figure 12 to 26, was included as a final product of this phase:

Figure 13

Home Page

It introduces the user to the application and briefly mentions the application.

Figure 14

Sign up page

This is the Sign-up page; it registers new users to the application for service access.

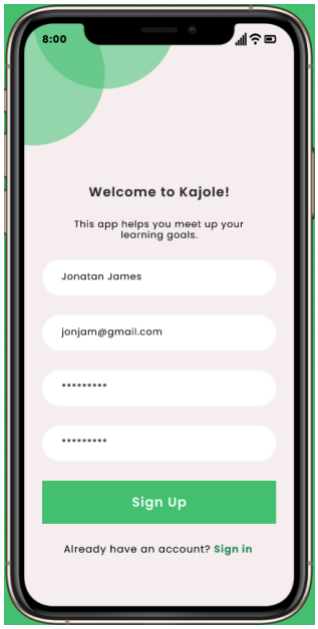


Figure 15

Sign in page

This is the sign-in page, it logs in a member for access to service

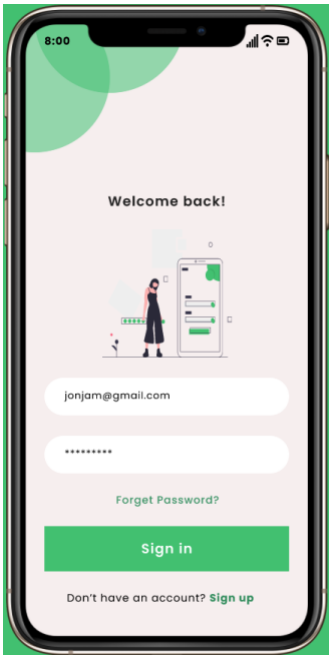


Figure 16

Welcome Page

This page shows the user the different sections of the application

Figure 17

Scooter Parts Page

This is the first section of the application; it informs the user about the different parts of the scooter.

Figure 18

Scooter Parts Page

This is what appears when the precise scooter part is selected. In this case, the throttle part of the scooter had been selected, details of the throttle then get displayed on the screen.

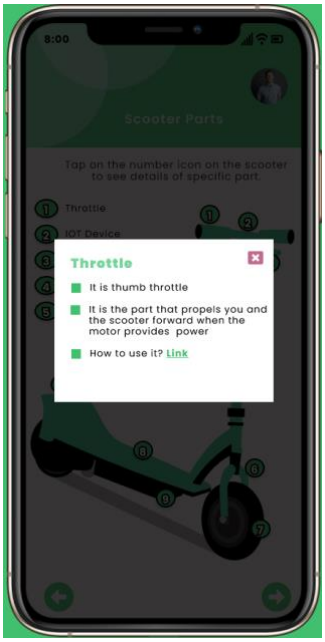


Figure 19

Scooter Parts Page

The display unit of the scooter had been selected, consequently, its specific details appear on the screen.

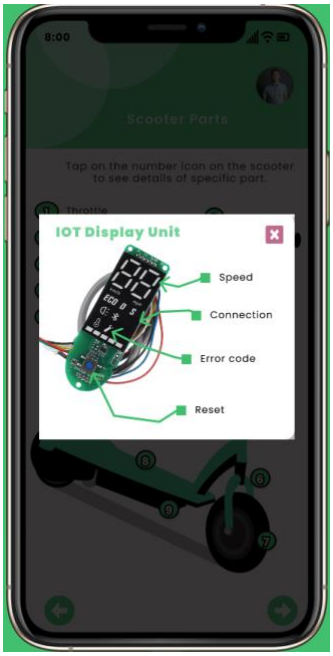


Figure 20

Scooter Parts Page

When a scooter part is selected, the below prompt will appear, the user would then choose the specific information needed about the scooter part that had been chosen before.

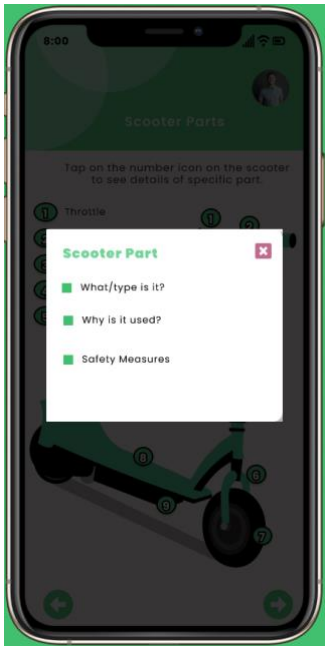


Figure 21

List of Scooter

This part informs the user about scooters available in Gothenburg. The user gets to choose either Android or IOS to install the specific app in their phones.

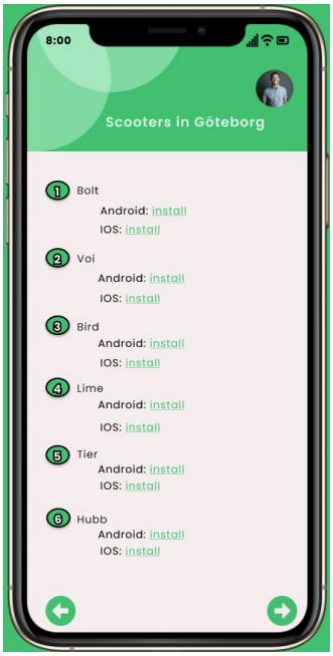


Figure 22

Campaigns Page

This is the campaign part of the application. Its goal is to create awareness of the various campaign categories to the user.

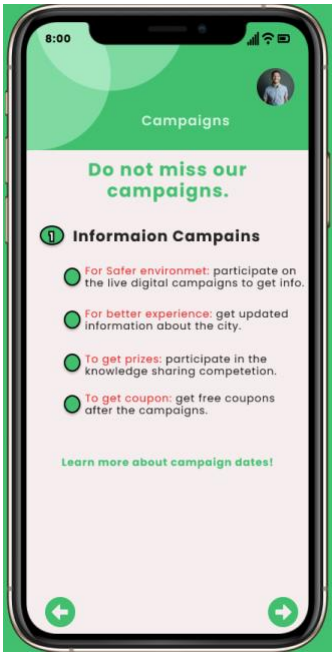


Figure 23

Campaigns Page

In the campaigns section, this prompt could appear. It adds more information to campaign dates. It informs the user of more detailed information.

Figure 24

Get certified page

This part guides the user on how to get certified as a scooter rider, by enrolling for a course through the application.

Figure 25

Get Certified Page

In the Get Certified Page, this prompt could appear. It informs the user of more tips, what should be done, and what is not supposed to be done.

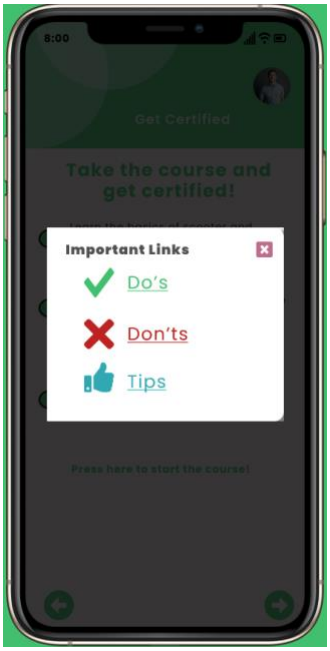


Figure 26

Get Certified Page

This prompt appears on the 'Get certified section' it informs the user of a chance to take more training in an advanced learning area on scooters.

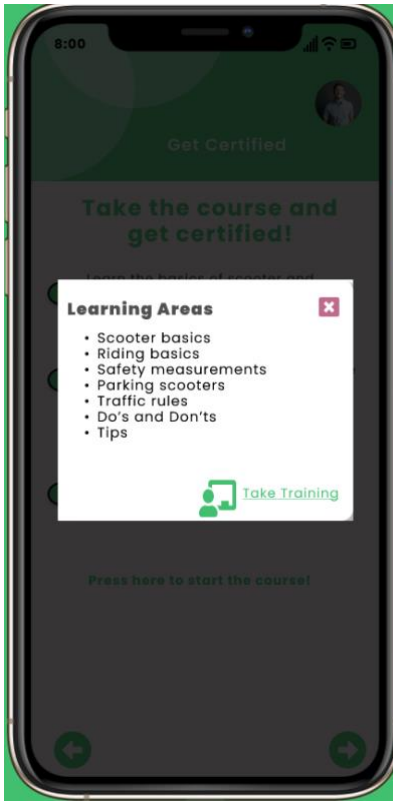
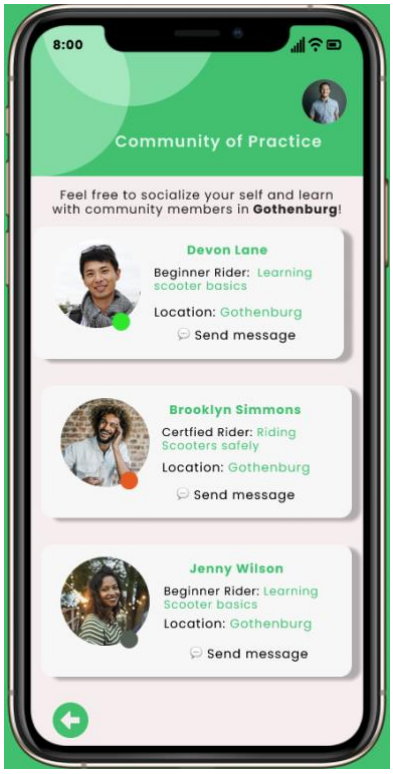


Figure 27

Community of Practice

This part is for the application community, where the users can socialize and exchange. It displays the profiles of other different users, with their contact details, location, and description. The users can send text messages to each other through this feature.



The prototype was done to:

a) Ideate and solve problems
b) Begin a precise product conversion
c) Fail cheaply and quickly
d) Test the prospective
e) Management of the solution constructing procedure

Phase 5: Test

This last step of the whole process is fully dedicated to testing: placing the composing prototypes onto the actual users and evaluating how they use the application. This stage allowed me to observe the target and representative users as they interrelate with the composed prototype. Feedback was then gathered on the way the users felt through the whole process. The testing phase helped me to highlight the design flaws that had to be addressed swiftly. The feedback was then used to improve the application prototype (Bryman, 2016). The process was iterative and non-linear; therefore, back and forth visits to the ideation, define, and empathizing phases had to be made to create an effective prototype. This phase provided a forum for the EScooters riders to test out the prototype and receive feedback. The ultimate goal was to get a better understanding of the participants I am working with. This phase had two benefits: it helped me to learn more about the EScooters riders and their challenges and to frame the problem with related prototype solutions.

These variables are bound to examine users' interactions with the prototype solutions, but my testing phase went beyond just deciding whether people like the designed product. The focus was on finding out as much as could be found about the issue and the responses rather than assuming solutions, and there was a constant inquiry on why the problem exists and what solution can help the user with it (Absar & Ahmed, 2013). When creating solutions, I prototyped like I was sure of the effectiveness, but tested like the elucidations could be incorrect, since that was the opportunity to enhance the main modules of the designed learning mobile app.

I have applied the testing using the Figma Mirror tool to allow users to navigate through the prototype remotely. Screen sharing on ZOOM platform was used to test the features and usability with the users. The solution space was redefined based on usability and user satisfaction tests and feedback from nine participants which has different levels of skills on using the EScooters.

Discussion

This capstone thesis project implemented a responsive and clickable mobile app design using the design thinking methodology to identify main challenges of EScooters users in Gothenburg municipality. The results indicated that the experience of EScooters riders is challenged, mainly, with dangerous traffic behaviours and parking issues. From the perspective of EScooters riders, they are struggled with lack of learning app which mainly focuses on changing these behaviours for safe experience. As a solution space, a mobile app design prototype, called Cajole, was produced with five main modules, teaching about available EScooters, EScooters parts, information campaigns, Certifications, and Community of practice.

Design thinking was the methodology used for this mobile app design project. It is a human-based issue-resolving approach that is founded on the principles of empathy, co-creation, alliances, and stakeholder responses to spur creativity and innovation; it is based on the feasibility of the technical aspects of the ideas and their economic viability (RCSC, 2017). Design thinking can be considered as solution-centered method of solving complicated issues and generating effective resolutions for the target consumer (Singh, 2018). It integrates desirability, technical feasibility, and economic viability of a proposed solution to be efficient for the specific requirement of the users (Singh, 2018).

This project had two main research questions: challenges to be considered and features and functions to be included. The salience of humanity to the design thinking approach was the key reason I have used to identify the challenges and include main functionalities, and, as a result, to design the mobile learning app for EScooters riders in Gothenburg. The methodology is a solution-oriented, mechanism of pinpointing and resolving issues, which integrates the specific requirements of humans by restructuring the issue in human-salient ways (Woodford, 2018). Design thinking is critical for resolving problems that are not well-defined (Sing, 2018). RCSC (2017) indicate that the important principle is to commiserate with the users to discover those needs that are yet to be satisfied. This process involves understanding and incorporating their beliefs, morals, inspirations, comportment, wins, sufferings, and obstacles to offer innovative approaches to resolving these problems. Apart from its human-based nature, other principles include collaboration with participants, a willingness to experiment and explore creative ideas, and a hands-on approach to the process (RCSC, 2017).

There are different reasons for choosing the solution space for this capstone project to be the design of mobile learning app. The literature has identified the need of solving the challenges of EScooters experiences. These challenges are directly related to unsafe driving practices of the EScooters users (Bakir & McStay, 2018; Absar & Ahmed, 2019). Though there are law enforcement solutions in some cities, the problems are remained challenging (Banister, 2018; Althiede et al., 2013). IoT as another solution space of the challenges has continuously utilized advancing the solution for the challenges but it did not bring fruitful solutions (Imre & Szalay, 2002). Thus, robust and proper design of mobile learning app can be taken as one of the best solutions for the challenges that mainly caused by EScooters rides (Ahmad et al., 2018; Rachamanto, 2020; Tuncer & Brown 2020). Moreover, addressing users' challenges with a mobile app design for learning can help designers to produce a usable solution space (Hammershoj et al., 2010).

The mobile learning app for EScooters riders in Gothenburg should provide creative and meaningful solutions. The popularity of EScooters in Gothenburg rose rapidly when the service providers in the sector decided to offer the EScooters on a rent-by-the-minute system (Rachmanto, 2021). Sweden has a history of commitment towards establishing and promoting sustainable mobility, particularly in its bigger cities (Rachmanto, 2021). The country's administration works towards achieving this objective by developing transport infrastructure that promotes walking. However, the presence of EScooters in the city has affected the way pedestrians use the sidewalk (Rachmanto, 2021). Therefore, design

thinking is the best approach to addressing these and other issues affecting EScooters riders in Gothenburg, while integrating the perspectives both riders and the municipality.

The mobile app was developed to teach the end-user about how to ride EScooters and their key components. It is also meant to educate the final user on standard behaviour when in public spaces with an EScooter, and how to ensure that they constantly adhere to the traffic rules. Nonetheless, the development of this scooter mobile application takes account of the following specific steps:

1. The first purpose is to find out the challenges of rider and the municipality
2. The following section discourses the core features of the mobile scooter app for the user to put up a robust mobile application.
3. A conclusion by integrating the necessary educative, technical resources and the operating framework of the mobile application.

This study proposed implementing a well-designed mobile app that will help address scooter riders' problems by teaching scooter riders more about scooters, ethical motorist behaviours, and rules. The application will address the following three major factors that in turn lead to the problems with scooters:

1) Awareness creation
2) Asset certification
3) Education / Communication

To understand awareness creation aspect of this capstone project, an information campaign module has been identified as one of the elements of the designed mobile app. The literature has found that the effect of learning apps elevated high awareness among different users to acqure skills and realize benefit (Ahmad et al., 2018; Rachamanto, 2020; Tuncer & Brown 2020). In this capstone project's case, it is highly important to create awareness both on the availability of the learning app and the main features of it by educating the users to enhance its usage.

The designed application is divided into five main categories; Scooter parts, Available EScooters, campaigns, get badges, and community of practice. This application had been fully designed using the design thinking methodology in five stages: Empathize, define, ideate, prototype, and testing. This process places the user needs and user requirements first before anything else. The first phase of this process is devoted to building empathy with the EScooters riders, alongside understanding the users' behaviours, needs, and prospects. Then a focus is set on making up ideas that are then swiftly turned into prototypes. The constructed prototypes then get tested on actual users. In the empathy stage an observation was made on what the clients do and how they interact with their environment gives the designer some ideas on the way they think and feel. This also assists the designer in deeper learning about what they need. As mentioned before, this allowed us to have a clear understanding of the intangible meaning of the experiences, therein uncovering insights. For example: from the interviews and survey, the following conclusion was made. Undoubtedly, the most significant problems with EScooters riders are parking issues and dangerous traffic behaviours. In summary, this procedure helps realize innovative solutions to some multifaceted problems motivated by the target user's needs. The define stage involved the evaluation of the responses to the consultations and the responses were assessed keenly (Bryman, 2016). All the findings were pieced together. The common themes were then grouped, and response patterns were also observed.

The ideation stage then followed, it made available both the energy as well as the foundation material for the construction of the prototypes and receivingclarifications into the hands of the users. The data got ideated to changeover from ascertaining all the relevant problems to generating elucidations for the users. Ideation was used as a chance to conglomerate the appreciative environment that exists in the problem space and the users that are being designed for with the necessary resourcefulness to produce

solution concepts. Prototyping was the fourth stage of the design thinking process, where the progressive ideas from the ideation stage had now to be turned into prototypes. The prototype here was a scaled-down account of the intended mobile app (Gössling & Cohen, 2014). The last step of the whole process is fully dedicated to testing: placing the composing prototypes onto the actual users and evaluating how they use the application. This stage allowed me to observe the target users as they interrelate with the composed prototype. Feedback was then gathered on the way the users felt through the whole process. The testing phase helped us to highlight the design flaws that had to be addressed swiftly.

Test Implementation Don't just tell us, illustrate it. Put your prototype in your user's hands or put your user into the experience. Watch how they implement and adapt what you've given them, as well as how they deal with and work through it. Listen to their ideas and comments, and pay attention to any queries (Degele et al., 2018). To make a better experience, things must be done. When prototyping and testing, aim to provide a pleasant experience that gives users the impression of being immersed in a reaction, rather than being scrutinized while solving a problem (Bakir & Mcstay, 2018).

The mobile app design aimed at solving the learning issues for EScooters riders in Gothenburg by providing lessons on how to ride the scooters. It will also educate the riders about the traffic rules and how to conduct themselves in public transport spaces so as to enhance the mobility efficiency targets of Gothenburg. The riders will be able to obtain riding certifications through the application and also offer a platform for them to communicate with each other. The application also provides all the key aspects of EScooters such as their parts and availability within Gothenburg for the users within a single platform. This new convenience provides them with the important information more expediently than they would be getting it without the application.

The application enables the riders to become certified, thus they can avoid liability for issues that arise on the roads where their ability to ride is under scrutiny. EScooters riders in Gothenburg tend to be involved in a considerable number of traffic issues and their capacity to operate the EScooters in public spaces is always a sticking point (Rachmanto, 2021). This application will eradicate such problems for its users. The application will also offer the riders information on the authentic parts of the EScooters. EScooters are a relatively new phenomenon and most riders, especially the novice ones, are not very well versed on how to acquire them or their genuine parts. This application will be important in overcoming such challenges. Finally, the application can be used to teach the riders about the traffic rules and regulations, and how they should conduct themselves whilst actively engaged in riding the scooters in public spaces. Therefore, the role of the app in educating the riders on the traffic rules and their behaviour while in public spaces should mitigate this challenge.

Conclusions and Recommendations

By applying the widely used methodology, Design Thinking, for the generation of new ideas and solutions, this capstone project of mobile application design was produced for EScooters riders in Gothenburg. The methodology has offered the designer a fresh knowledge of the issues and solutions, leading to innovation, creative inspiration, and problem-solving while it also stimulates thought. The research focused exclusively on Design Thinking implementation for EScooters learning mobile app design. One of the most important elements of the Design Thinking approach is to concentrate on both comprehending and identifying the issue, rather than focusing only on coming up with a solution. Without proper planning, user research, and the consideration of user requirements, the project would have an inferior experience.

This capstone projects challenge was to keep participants for the multiple iterations of the process. Design thinking aids in evaluating the viability of a design's construction and iteration throughout the creation of new goods. The methodology guaranteed the product was a success in both the usability and design of the mobile app. Testing is done to identify any faults in the design, which iterative experimentation and analysis of design thinking accomplish through the prototypes. This method involved iterating on prototypes until I identify the best and can then refine it. The continuous review ensured that I provide the best I can with the final design.

My final design was successful. From the feedbacks collected, I saw that the participants liked learning about the EScooters parts, list of available EScooters, and the community of practice. In addition, the participants found it easier to get awareness by participating in different regular information campaigns and like the idea of taking a bite-size units of modules. The participants managed to use the app and increase their awareness about EScooters experience in Gothenburg. When creating these new ideas, it is consequently essential to adopt these approaches, design thinking and a fresh mindset. Innovation and coming up with unique ways of applying new ways of looking into things are some approaches one can adopt when designing quality app.

As a designer in this capstone project, I have noticed that the relationship between the EScooters companies and the municipality’s mobility services administration is voluntary as the EScooters are not integrated into the public transport system. Further research and collaboration between EScooters companies and the municipality are necessary for efficient and all-inclusive solution developments. Though this capstone project can be considered as one solution area from an educational technology perspective for awareness creation and learning skills, more research is needed to design other areas of solution space, such as parking services design, robust geofencing implementation, continuous improvements on the design of IoT devices of the scooters, and law enforcement solutions.

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Appendix A – Questionnaire for Riders

Thesis title: Cajole: EScooter mobile app design for riders in Gothenburg

Teaching how to ride EScooters ethically and safely

I have prepared this study survey as part of thesis work at the University of Gothenburg, IT and Learning program. I request your consent for participation in this study about a mobile app design - learn to ride and fix EScooters. Your responses will remain anonymous, and your participation is completely voluntary. If you decide not to participate, there will not be any negative consequences.By clicking the Start button below, you are indicating that you agree to the terms as described. If you have any questions, please get in touch with us at berhane.teklu.93@gmail.com.

Thank you in advance for your participation!

1. Which of the following scooters do you ride? (Multiple choice)
    a- Voi
    b- Bolt
    c- Tier
    d- Lime
    e- Bird
    f- Hubb
    g- I have my own scooter
4. How often do you ride Scooters?
    a- Daily
    b- Three days a week
    c- Once a week
    d- Occasionally
    e- Other
5. Do you get enough information on how to ride scooters from the Mobile Apps?
    a- Yes
    b- Somehow
    c- No
6. Which information do you miss from the Apps of the Scooters? (Multiple Choice)
    a- How to ride a scooter
    b- Safety measurements
    c- Traffic rules
    d- Do’s and don’ts
    e- About parking areas
    f- About speed limits
    g- About no ride zones
7. Who taught you how to ride a Scooter? (Multiple Choice)
    a- Practiced by myself
    b- Using a mobile app
    c- A firend
    d- Other
8. What challenges do you face while trying to learn how to ride eScooters using the mobile apps, for the first time?

Appendix B – Interview Questions for Municipality Manager

1. How many EScooters companies and EScooters are there in Gothenburg?
2. What are the main issues and challenges facing because of EScooters?
3. What solutions are you taking to tackle the challenges?
4. How do you communicate with the companies and the riders?
5. Are there any interventions to teach the riders about ethical driver behaviors?
6. What are the plans regarding the mobility services in Gothenburg?