HUMAN COMPUTER INTERACTION

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2021

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1. BACKGROUND

1.1. Purpose and problem definition

During the assignment, I received and handled the problem of designing a car app that was used to locate cars and find directions, besides being able to entertain people in big cars. So the problem assigned to me was to design a new car navigation and entertainment app. Regarding the entertainment, I choose and use the design of the car music app, I will design for users 1 about navigation and the other is entertainment by listening to music in the car. The purpose of me designing a music app is because listening to music will help reduce stress and entertain the driver, I don't design entertainment to watch movies because the movie car app can help people in the car entertain themselves by watching movies. watching movies but sometimes can distract the driver from driving and can be dangerous that is my personal opinion. So I designed a new app in the car with the functions of locating, viewing the map and entertaining as listening to music.

1.2. Background literature

In my app design project that is being implemented, it is to show the user's interaction with technology devices, thereby giving the choice and design to be reasonable and beautiful for the user like each other. Small details such as the logo for the app or the avatar, the title and the interface of the app for the user. Making it easy for users to use is not too difficult while using the app's functions, the app is not too colorful and the logo or typography images are not too difficult to read and miscellaneous. The end result must be a product that makes users want to try and use the app when they see it, and help users have a good experience with the app through interaction with the user's eye interface and functions. of the app that the user uses.

2. Processes and Frameworks for Interaction Design

2.1. Interaction Design Theory

According to (Siang, 2020) , (Yvonne Rogers, Jennifer Preece, Helen Sharp , 2015) Interaction design is the design of the interaction between the user and the product. Usually, when people talk about interaction design, the products tend to be software products like apps or websites.

The goal of interaction design is to create products that allow users to achieve their goal(s) in the best possible way.

The interaction between the user and the product often involves factors such as aesthetics, movement, sound, space, and many others. And of course, each of these elements can relate to more specialized areas, like sound design to create sounds used in user interactions.

There is a huge overlap between interaction design and UX design. After all, UX design is about shaping the experience of using a product, and most parts of that experience involve some interaction between the user and the product. But UX design is bigger than interaction design: it also involves usage research (finding out who the user is in the first place), creating usage personality (why and under what conditions). what product they will use), do user testing and usability testing, etc.

3. Design concept and prototypes

3.1. A discussion of the five dimension of interaction design and their application to the coursework task.

According to (Siang, 2020) The 5 dimensions of interaction design is a useful model for understanding what is involved in interaction design. Gillian Crampton Smith, an interaction design scholar, first introduced the concept of the four dimensions of an interaction design language, to which Kevin Silver, senior interaction designer at IDEXX Labs, added fifth opinion.

A. 1D: Words

Words - especially those used in interactions, like button labels - must be meaningful and simple to understand. They should convey information to the user, but not so much that the user is overwhelmed.

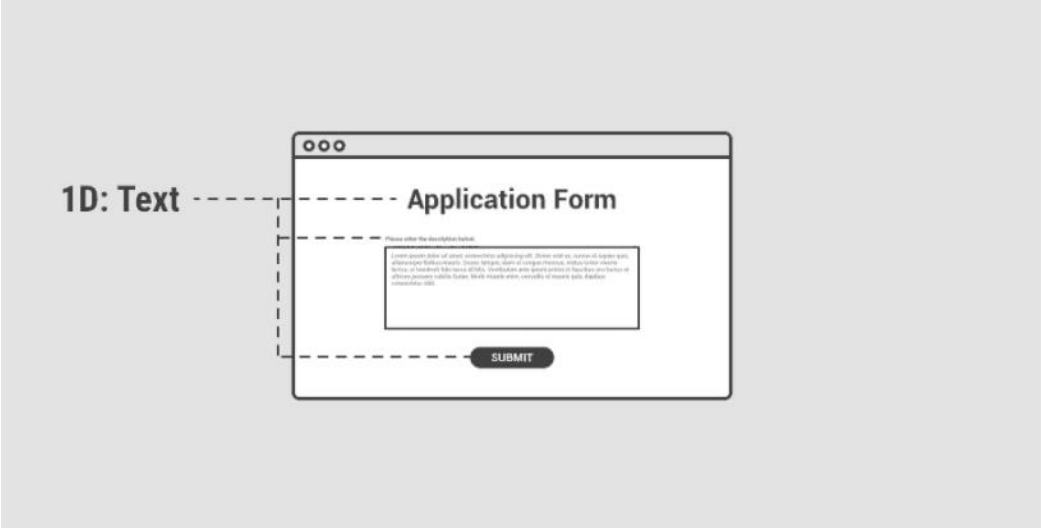


Figure 1. Dimension Words (Siang, 2020)

B. 2D: Visual representations

This involves graphic elements such as images, typography, and icons with which the user interacts. They often add words that are used to convey information to the user.

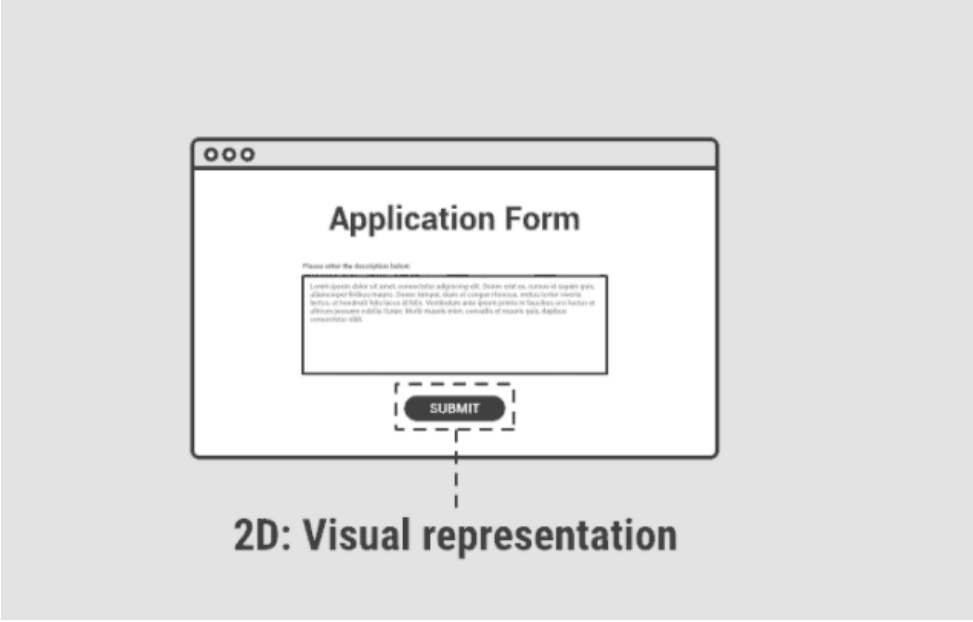


Figure 2. Dimension Visual representations (Siang, 2020)

C. 3D: Physical objects or space

Through what physical objects do users interact with the product? A laptop, with a mouse or trackpad? Or smartphone with user's finger? And in what physical space does the user do so? For example, is the user standing in a crowded train while using a smartphone app or sitting at his desk in the office surfing a web page? All of these affect the interaction between the user and the product.

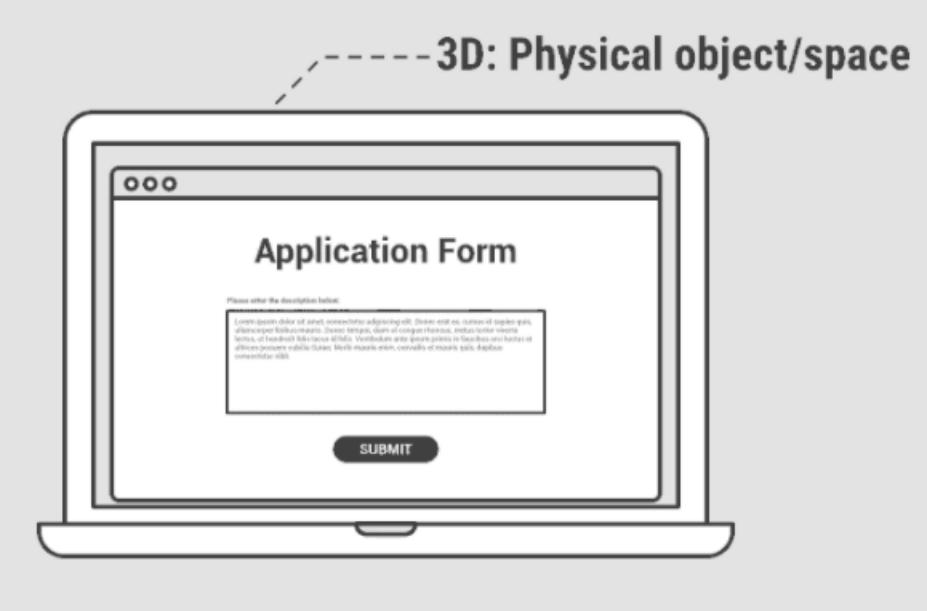


Figure 3. Dimension Physical objects or space (Siang, 2020)

D. 4D: Time

While this dimension may sound a bit abstract, it mainly refers to media that change over time (animation, video, audio). Motion and sound play an important role in giving visual and audio feedback to user interactions. Another issue of concern is the amount of time the user spends interacting with the product: can the user track their progress or continue to interact sometime later?

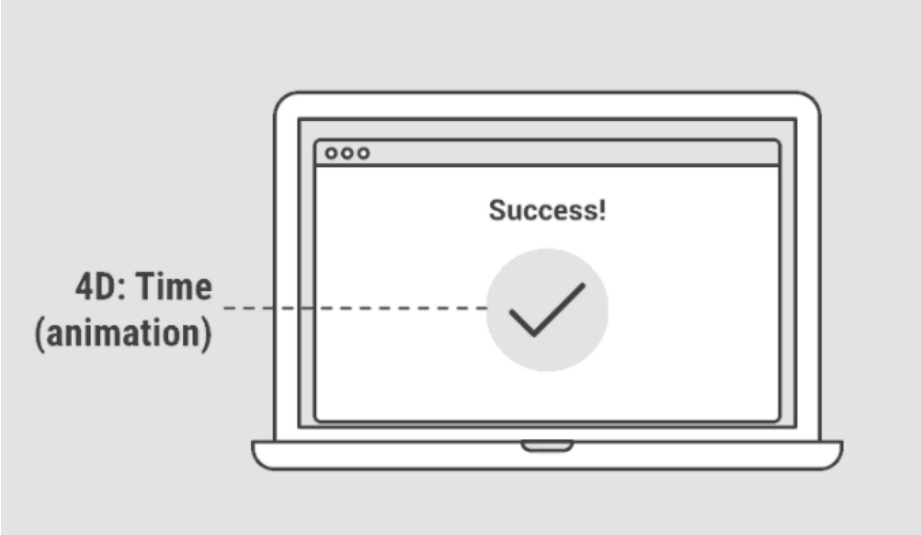


Figure 4. Dimension Time (Siang, 2020)

E. 5D: Behavior

This includes the mechanics of a product: how do users perform actions on the site? How do users operate the product? In other words, it is how the previous dimensions define product interactions. It also includes feedback - for example, feedback or emotional feedback - from users and products.

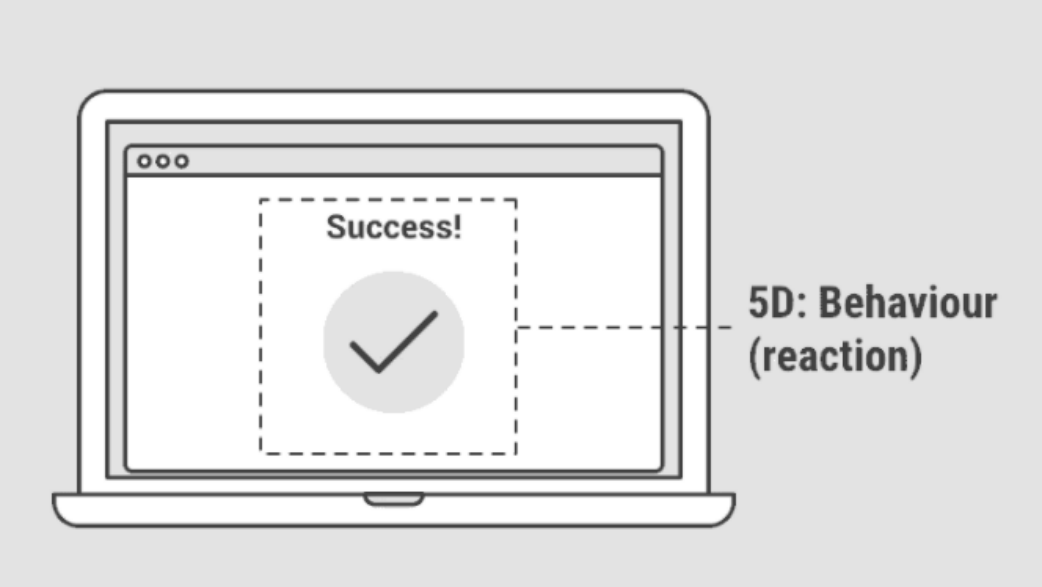


Figure 5. Dimension Behavior (Siang, 2020)

4. Cognitive Psychology

4.1. Cognitive theory

According to (Kozbelt, 2011) , (Y. Erisen, Nadir Çeliköz, Mehmet Şahin, July 2016) Cognitive theories emphasize the creative process and the person: process, which emphasizes the role of cognitive mechanisms as the basis for creative thought; and individuals, when considering individual differences in those mechanisms. Some cognitive theories focus on universal competencies, such as attention or memory; others emphasize individual differences, like those indexed by divergent thinking tasks; some focus on conscious activities; others, on unconscious, implicit or unintentional processes.

According to (Grider, Clint, 2019) The dominant aspects of cognitive theory concern the interaction between mental components and the information processed through this complex network. As individuals learn, they actively create cognitive structures that define their concepts of self and the environment. Interestingly, learning specifically is not the main area of interest in cognitive research; instead, learning is considered only one of many processes included by the human mind. Although all cognitive theorists consider these functions to discover more about human behavior and learning, they often differ in emphasis. Some approaches deal with detailed analyzes of information processing skills, while others focus on mental models or cognitive growth and development. Therefore, cognitive psychologists do not adhere to a particular set of rules or methodologies in their research.

According to (Kozbelt, 2011) Similarly, another cognitive theory focuses on how concepts are combined to create novelty. Research shows that conceptual congruence - bringing two different sets of information together - is often associated with creative ideas, that initial insights are more likely to occur when two characteristics differ. . . put together, and the connection between these concepts can only be seen at a very high level of abstraction. This kind of thinking is known as metaphorical logic, the idea that something like 'angry weather' can only be understood in a non-verbal fashion. Such processes can suggest creative alternatives to worn lines of thought.

4.2. Summary of the scope of your prototype, how it is informed by the contents of this sections and how it will work.

In the project to design and develop an application used in cars to help users navigate and entertain. During the design process I will consider and design so that it is not too difficult for users, not too complicated functions and instead designs are mostly easy to use and close to the devices. smart technology that users are and have used. My ultimate goal to influence user's cognitive is that when the user uses it for the first time, he will feel the interface and functionality along with a friendly layout, easy to use and simple operation without too much difficulty. to the user's cognitive and make the user comfortable when using the application.

5. Research Study

5.1. Methods of Research

In the process of designing the application, I also use a number of research methods to test, analyze and evaluate in an overview the process of users using technological devices in cars. From there I will design to meet the desired needs of the user. Here are some of my research methods applied and projects.

a. Survey

The first I used the research method of the user survey, according to (JULIE PONTO, PhD, APRN, AGCNS-BC, AOCNS, 2015) Survey research is understood as “the collection of information from a sample of individuals through their responses to questions”. This type of re-search allows for a variety of methods of participant recruitment, data collection, and the use of a variety of mentoring methods.

Survey research can use quantitative research strategies (e.g. use of questionnaires with numerically assessed items), qualitative research strategies (e.g. use of open-ended questions). or both strategies (i.e. mixed methods)

b. Quantitative research

After getting the results from the user survey I will use quantitative research to conduct data analysis and user requirements. According to (Apuke, 2017) Quantitative research describes a research method that is the sum total of steps the researcher uses to embark on a research work. Therefore, a quantitative research method deals with quantitative variables and analyzes to

obtain results. It involves the use and analysis of numerical data using specific statistical techniques to answer questions such as who, how much, what, where, when, how much and how.

c. Qualitative research

According to (McLeod, 2019) Qualitative research focuses on multi-methods, involving a natural, interpretive approach to its subject. This means that qualitative researchers study things in their natural environment, trying to understand or explain phenomena in terms of the meaning that humans give them.

I use qualitative research to focus on approaching the needs and desires of users to the application of technology systems in cars using many different methods from which to have data and analysis.

d. Interviewing

According to (Jamshed, 2014) This is the most common data collection format in qualitative research. Qualitative interviewing is a type of framework in which practices and standards are not only documented, but achieved, challenged, and reinforced. Since no research interview is unstructured, most qualitative research interviews are semi-structured, lightly structured, or in-depth. Unstructured interviews are often recommended in the conduct of long-term field studies and allow respondents to express themselves at their own pace and pace, without the need to withhold questions.

We use the user interview method to evaluate before the user has not used the application and after the user uses it to obtain data and analyze the impact of the application on the user and provide Make further development ideas for the application

5.2. Question to research

a. Survey

1. Are you old enough to drive a car?

- ○ Yes
- ○ No

2. How often do you come into contact with its built-in technologies in your car?

- ○ Sometime
- ○ Often
- ○ Never
- ○ Always

3. How does a car entertainment system feel to you?

- ☐ Important
- ☐ Very important
- ☐ Normal
- ☐ Unimportant
- ☐ Important in Entertainment

4. What do you think about the entertainment application system designed in the car?

- ☐ Great
- ☐ Good, it will make me more comfortable in the car
- ☐ I always want to have a great entertainment on the application system of the car
- ☐ Normal
- ☐ I don't like that very much

5. How do you feel after experiencing using the entertainment application system?

- [ ] Great
- [ ] Good, it will make me more comfortable in the car
- [ ] I like it very much and want more good things to be updated in the future
- [ ] Normal

...

6. Do you find it difficult to use car entertainment applications?

- ( ) No
- ( ) Yes
- ( ) Maybe

7. While driving, does the entertainment application system disturb you?

- ( ) No, I like to drive while listening to entertainment music.
- ( ) I like to be comfortable while driving so entertainment is less stressful.
- ( ) Yes, it helps me not to concentrate on driving.

5.3. Research subjects

The object I focus on surveying and researching is the group of people who have worked as teachers in universities because only those who have worked can be old enough to drive and own a car or have been in the past. use or experience on car entertainment systems. I focus on the group of working people and mainly teachers in information technology schools because the teachers will have the most general and objective view for us and from there we will have different methods. The best data and problem handling method, besides the data will be sufficient and sufficient for research in the project.

5.4. The process of researching and analyzing data

In the process of researching and analyzing data, I came up with research methods such as user surveys, user interviews, and I researched myself through online documents. First, after I have researched myself and have basic data, I will proceed to design a demo of the car entertainment application interface. Then I'll fix the common bugs and come up with a completely finished interface. After having the data from the user survey and interview, I conduct the data analysis, the user request data I will handle separately, the user difficulties encountered and the main problems I will cut down the problems and handle them step by step to give users the best quality entertainment application product.

5.5. Project management

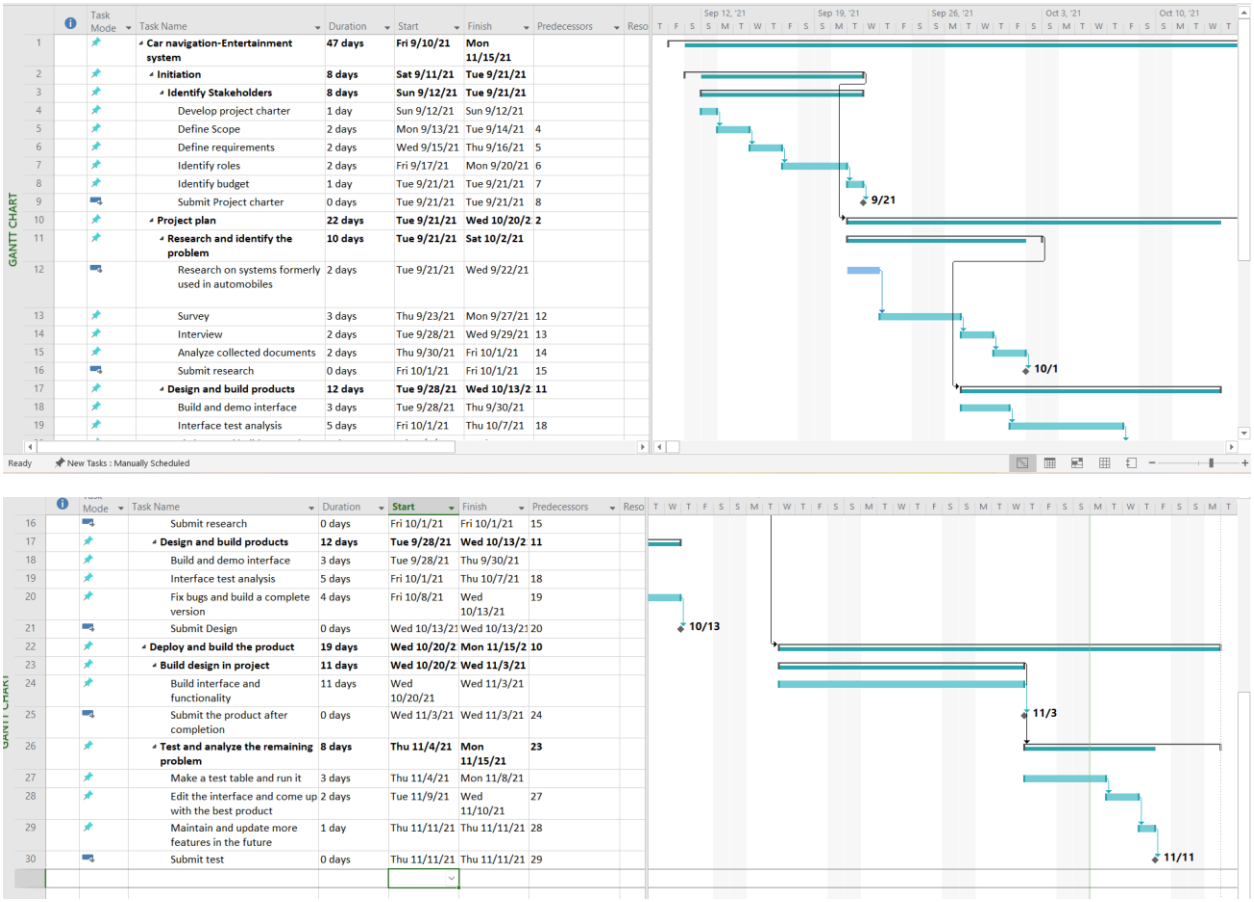


Figure 6. Gantt chart

6. Design Process

6.1. Assumption

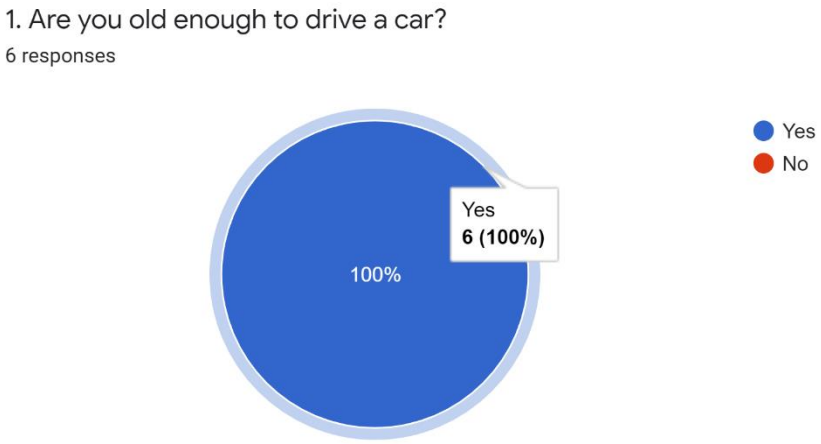
In the process of building and designing the application of the car entertainment system after it is completed before construction and after construction is completed, we make two hypotheses at the time of construction:

First, the product will be completely new and modern design will make it difficult for users to use and interact at first, so will it affect the user's driving?

Second thing, In the process of using users, are there difficulties in using functions and interfaces that affect the user's entertainment experience?

6.2. Results from Questionnaires

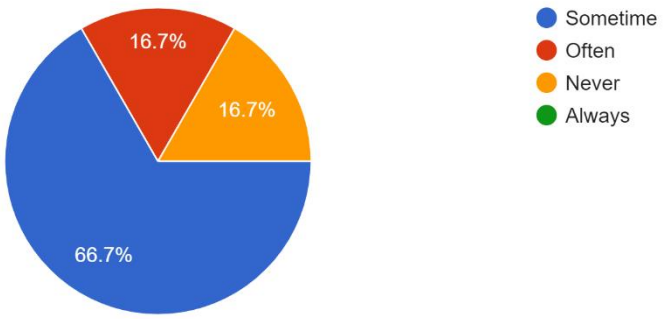
a. Survey



When I was surveyed about whether people were old enough to drive, most of the people I focused on were of age or older, so almost 100% of the people surveyed were old enough to drive.

2. How often do you come into contact with its built-in technologies in your car?

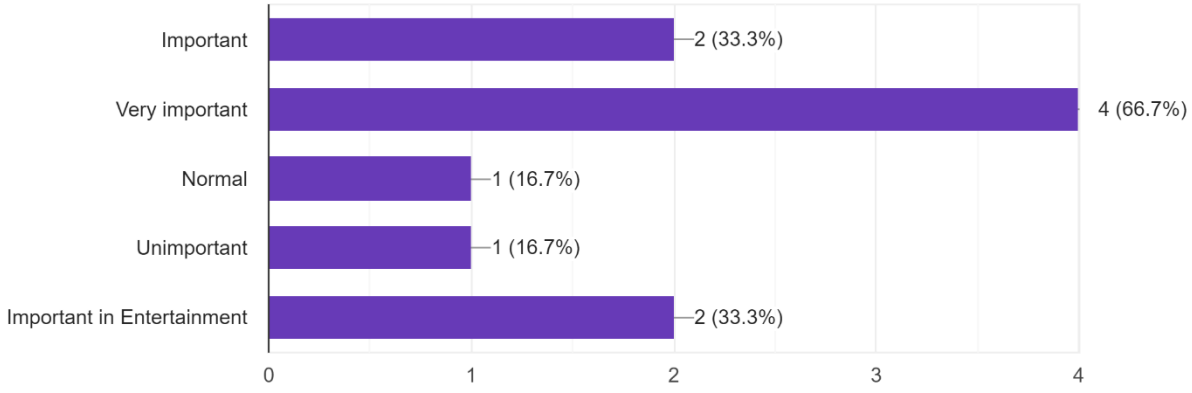
6 responses



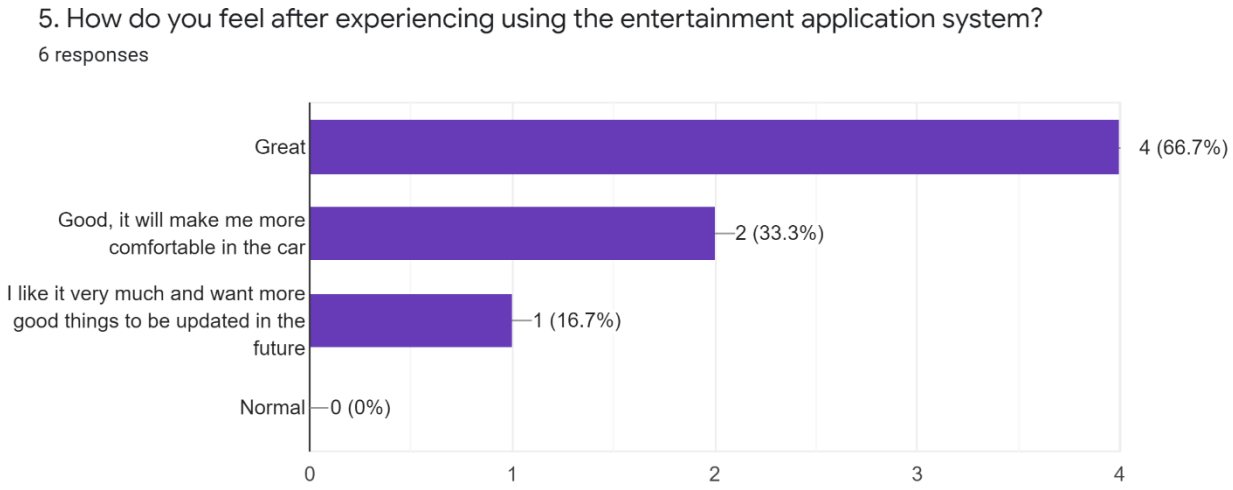
Survey of users about how often people use technology in their cars. Most people only use car technology occasionally (66.7%), 16.7% are users who regularly interact with car technologies and 16.7% are users who have never used car technologies. hours of use with in-car technology

3. How does a car entertainment system feel to you?

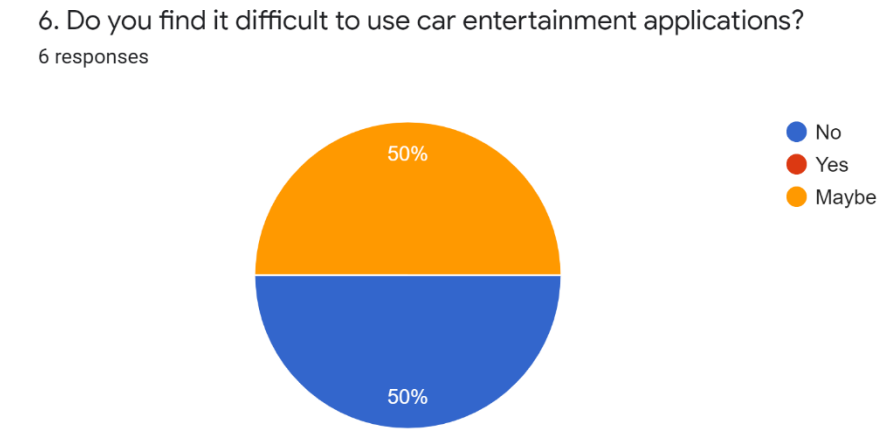
6 responses



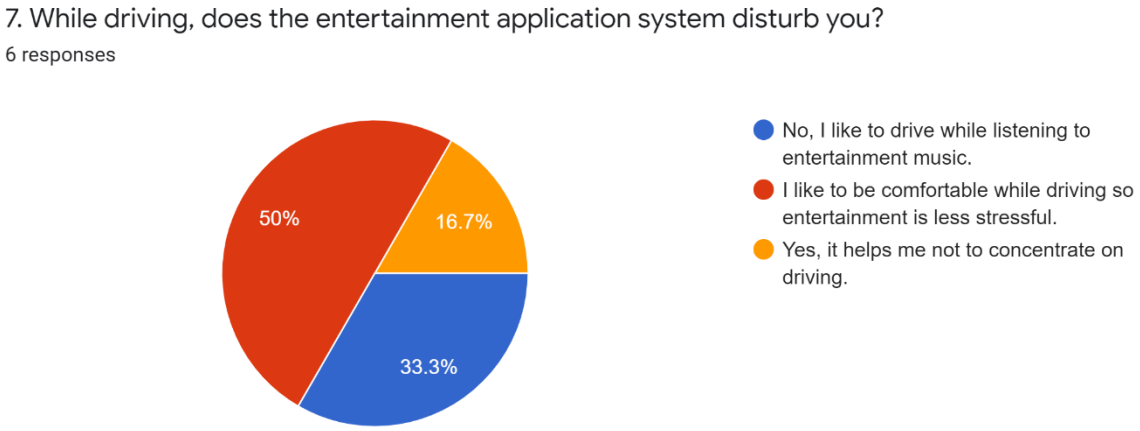
Survey of users evaluating car entertainment systems, most people rate it very important to them 66.7% and 33.7% of users rate car entertainment as important to them, the rest a few. all rated normal and unimportant to them 16.7%.



The survey results show that most of 66.7% of users give excellent reviews before and after using the car entertainment system application, there are 16.7% of users who rate the product like it, besides that users expect want the system to develop more new features to increase their experience



The survey results when asked if people using our car technology system products have difficulties, 100% of users rated no. There are 50 users who rate it easy to use and 50% of users who rate it as easy to use but having some difficulty. So we see most people can use our technology products in cars.



When surveying users about whether the application of the car entertainment system affects people's driving. The survey results show that the majority of more than 50% of users rate it as having no effect and they feel comfortable while driving and to relieve stress. The remaining 16.7% of users rated it as not able to concentrate.

b. Interview

During the interview process due to the worldwide covid situation, I interviewed some people through phone calls and data collection. The subject I interviewed is a student of a university

I interviewed a student of an architecture university, I interviewed you because I know many young people today have been exposed to many technologies and have also used or used a lot with today's technology.

Interviewer: Hi, My name is Tuan Anh, I'm a 3rd year student at the University of Greenwich. Currently, I have a project and am in the process of designing and building an application product on the car. So I ask you for a moment to answer some quick interview questions related to information technology.

Trung: Ok friend

Interviewer: Can you introduce yourself?

Trung: My name is Trung, I'm a 3rd year student at the university of architecture

Interviewer: Oke Trung, let me ask you, do you know the car entertainment technology system that you have used before?

Trung: I do, I also use it often, but I mainly listen to music because there is a USB socket in the car, so I copied the music to the USB and plugged it into the car and it played music.

Interviewer: Did you have any difficulties or problems using the product?

Trung: I also find it a bit limited because it has a song limit. Because if I copy less, it has less and if I copy less, it just repeats.

Interviewer: How do you feel about that entertainment system?

Trung: for me, I don't like it because it has no interface at all and only buttons, and can only connect to USB with any music player having to copy to USB sometimes very annoying for me.

Interviewer: You see our product, how do you feel?

Trung: I feel very modern and it looks very interesting. It's like an app in a smartphone.

Interviewer: How do you feel and rate our products?

Trung: I find it very useful because it can connect to my phone via bluetooth so I don't have any song restrictions anymore. Besides, I find the touch interface quite smooth, the function is also simple, not too difficult for me to try. I quite like this in-car entertainment system.

Interviewer: We are very happy if you like, do you want our system to add any new functions or updates?

Trung: I think if there are some more functions such as saving favorite songs or adding some other entertainment, the car will enrich it, but if it does, it will not be able to focus on driving so I think so. it's ok but if the interface is updated with more beautiful effects, it will be great.

Interviewer: We thank you for your feedback, thank you for making more creations for our products, have a nice day. Thank you for the interview.

Result: During the interview process and survey results, we have collected data that users have provided and the user's experience after using our entertainment system. The majority of users who evaluate the optimal experience with the car entertainment system product appreciate the simple function, not too difficult for them. The fact that the entertainment system does not affect their driving, but users also feel less stressed, they want to have more experiences in the process of using the application.

Through this, the 2 hypotheses I gave have been thoroughly resolved and help users have a comfortable and simple entertainment experience.

6.3. Five different dimensions of interaction design was applied

Application to the coursework task

Apply the five dimensions to the task given in my lesson and in the development of my design project, I will break it down and analyze each part of it.

- **1D: Words**: First about Words, I will focus and develop key words and words that are familiar to users in the app to help users use it for the first time without difficulty and make it easy for users to use with functions. Long paragraphs or words I will omit or shorten and find other words to replace them so that the user when entering the application does not have too many words and cause bad feelings about the application.
- **2D: Visual representations**: Regarding Visual representations designed in terms of images, typography and icons, I will analyze and design layouts with images that are not too colorful and dazzling that will make users have a bad experience of the interface. face. The typeface will also not be too big or too small, besides the icons or symbols in the application must also match the color designed in the image to help users easily search, choose and use the application.
- **3D: Physical objects or space**: Regarding Physical objects or space in my project about user-interactive objects, I define it as a small screen in the space of a car. Users will interact through words, gestures to use are touch on the screen like a smartphone.

- **4D: Time**: About Time in my design project determines the time that the user interacts with the functions in the application will be different, as with the entertainment function is music the time will interact to respond to the user faster to give users a comfortable and fast entertainment experience. As for the positioning function, the location will respond to the user interaction with a little slower time to show professionalism and careful positioning will give a feedback interface.
- **5D: Behavior**: About Behavior in my project the user behavior of interacting with the application will be through speech and manual touch on the device screen. For example, when the user clicks or selects a function or an event, the application will have a quick response to the user interface. Besides, users can also switch to using the voice function, the application will recognize the main keywords in the user's speech and send the results to the device screen in the car.

7. Usability Testing

7.1. Preparation

During the actual product testing with users, we will tabulate the overall quality of the product that approaches the user interaction.

Prepare	test	result
Test User Accessibility	Check the actual load time of the entertainment application system	Fast uptime, instant system response to users
	Check if the text contrast is equivalent to the background	User-friendly, the background colors and text in the application are not too bright and suitable for users while driving.
	Check that the font size and space between texts are readable correctly.	The font size with gaps in the application are all adjusted to be easy to read for users
	Check if the image is hard to see and affects the user experience	The image suitable for the application of the system is

		not too big and annoying for the user
Navigation	Check that the navigation of the car entertainment system application is easily recognized by the user.	Easy to recognize by users because the navigation design system closely resembles the smartphone that people use, thus helping users to interact with the experience easily.
	Check that the redirect options are easy to understand and concise.	The navigation options are easy for users because the system designed the navigation options to be semantic icons that make it easier for users to use and concise without too many words in the application.
	Check how many logical buttons/links there are	In the system, there are 2 main buttons, navigation and entertainment, and are indicated by the use of images to help users easily use. In addition, there are a number of buttons to help users connect to other technology devices and redirect interfaces.
	Check that the link style is consistent on all pages and easy to understand.	The types of links are easy to understand and use because the design of the pages is not different, but all use a common main color for the pages in the application and each page has a logo representing each page, so it's easier for users to use the app
	Check if the search in the entertainment system app is on the page and easily accessible to the user.	Search in the system is easy to recognize and use because the system is designed to be simple and easy to

		understand, thus making it easier for users to use.

7.2. Observation

Using the entertainment system product as a user, we actually used it and observed the interaction between the application and the user.

During my observations, the interactive system responds to the user quickly, the modern system interface is easy to use because it looks like a smartphone in the user's car. The background colors of the system are suitable for the driver because it is not too bright and dazzling, the background color of the system is slightly dark to match both day and night, the letters and fonts are designed. Compact design does not have too many words in the application and instead has the main keywords that help users easily recognize. The buttons in the application are easy to recognize and use because they are designed with semantic icons or alternative logo images. Redirection of pages in the system is smooth without stuttering. Through the process of observing products, most of them are easy for users to access and use, besides the functions are also easy to use, quick response time does not cause difficulties for users.

7.3. Key component questionnaires

During the user experience of the product, we also ask some questions to see the user's evaluation of the system's product.

1. You see our product, how do you feel?
2. How do you feel and rate our products?
3. While driving, does the product cause problems for you?

In the process of asking and interviewing users, users also responded positively to the entertainment system product, specifically:

Interviewer: You see our product, how do you feel?

User: I feel very modern and it looks very interesting. It's like an app in a smartphone.

Interviewer: How do you feel and rate our products?

User: I find it very useful because it can connect to my phone via bluetooth so I don't have any song restrictions anymore. Besides, I find the touch interface quite smooth, the function is also simple, not too difficult for me to try. I quite like this in-car entertainment system.

Interviewer: While driving, does the product cause problems for you?

User: It doesn't have a negative effect on me, but on the contrary it helps me to be less stressed while driving, more comfortable, alert and focused.

8. Conceptual Design

8.1. Ideation process

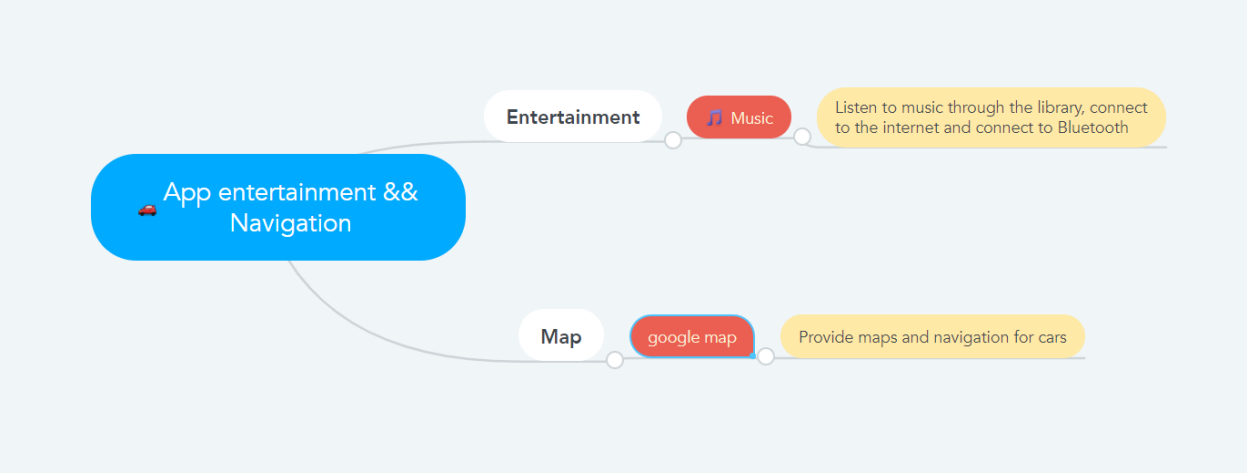


Figure 7. Concept of Idea generation for the Car entertainment system

8.2. Conceptual Model

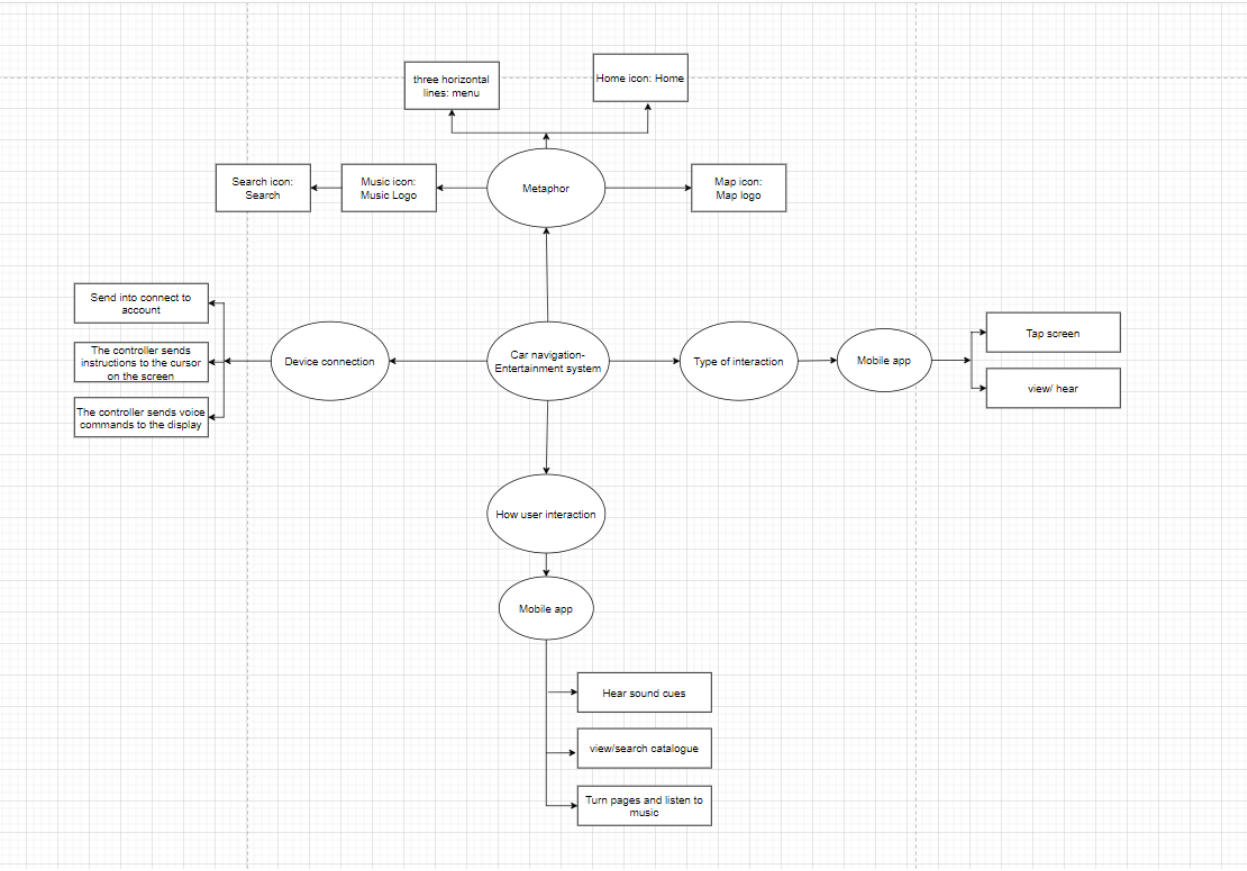


Figure 8. Conceptual model of the system

9. Prototype

Link Axure file

https://drive.google.com/drive/folders/1NREUvUFCpqNXHdXzckSCZedpWKQflFbv?usp=sharing

Link Axure online

https://mhrrj7.axshare.com

9.1. Low fidelity diagram

In the drawing below, I design a basic outline of the car entertainment system including 4 basic images, 1 picture of the home user interface, the next picture is about navigation, the next part is entertainment and the last is a drawing of the navigation design connecting the devices.

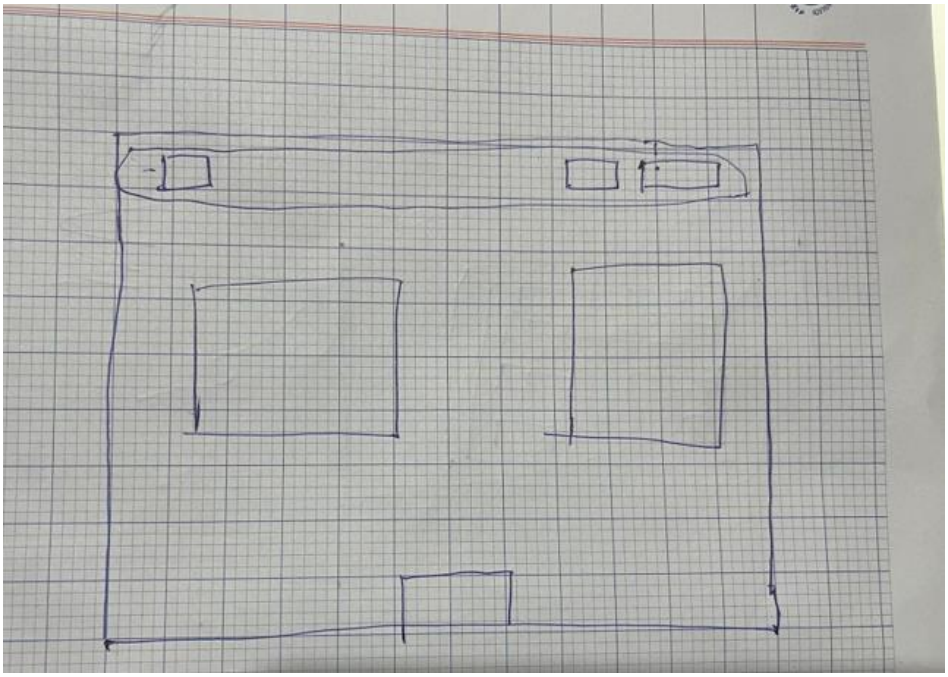


Figure 9. Home interface

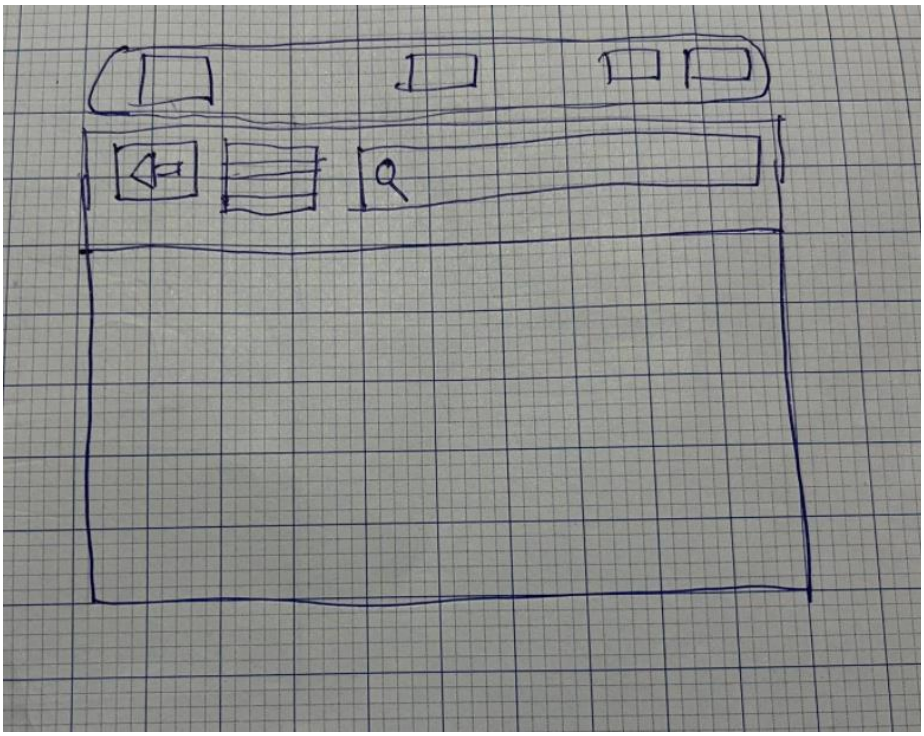


Figure 10. Navigation interface

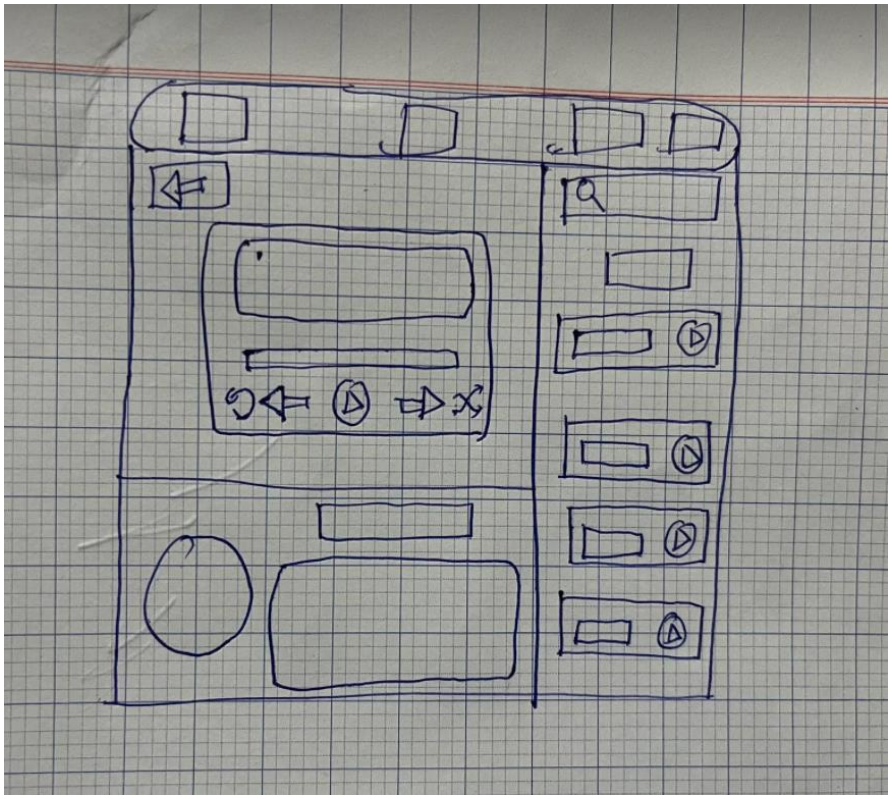


Figure 11. Entertainment interface

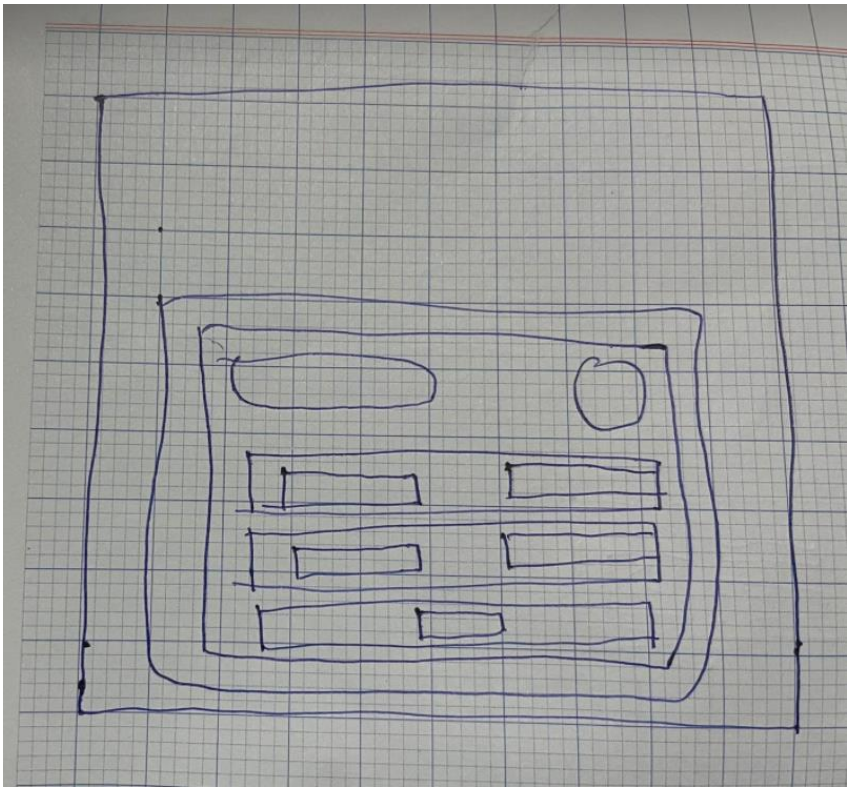


Figure 12. Connect device interface

9.2. Mid-fidelity diagram

This is the interface of the components of the entertainment system designed with the Axure tool

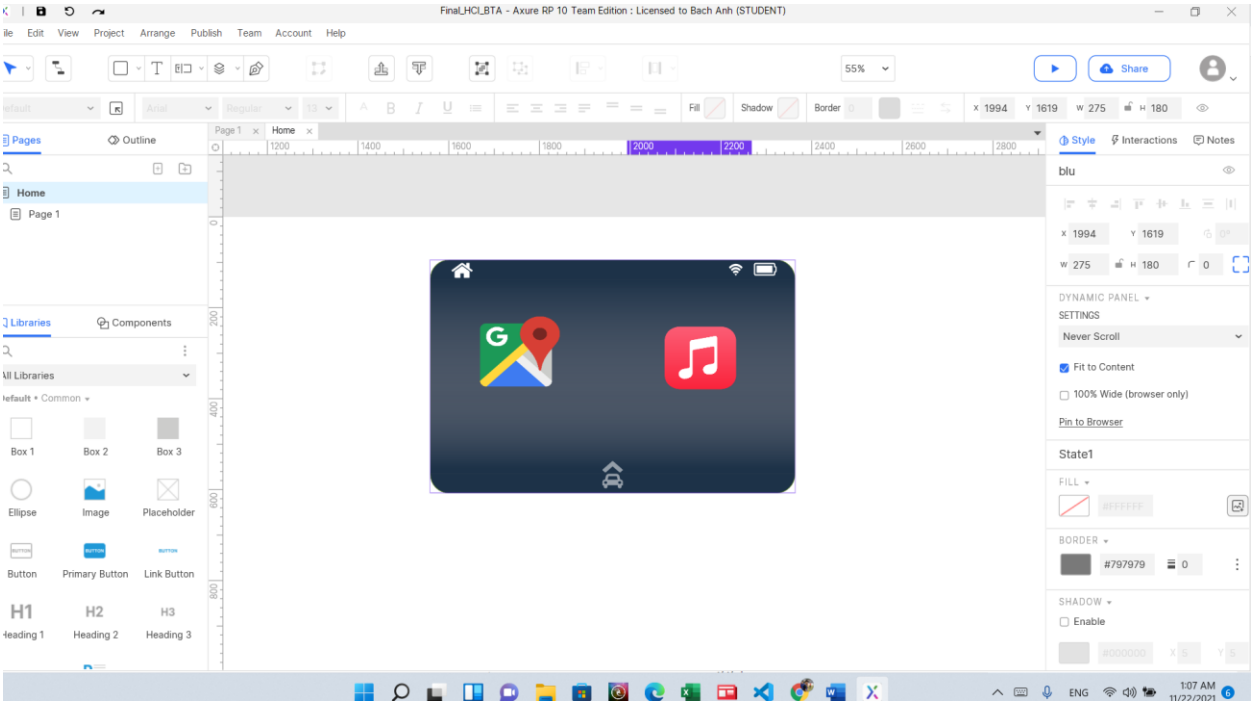


Figure 13. Home Axure design interface

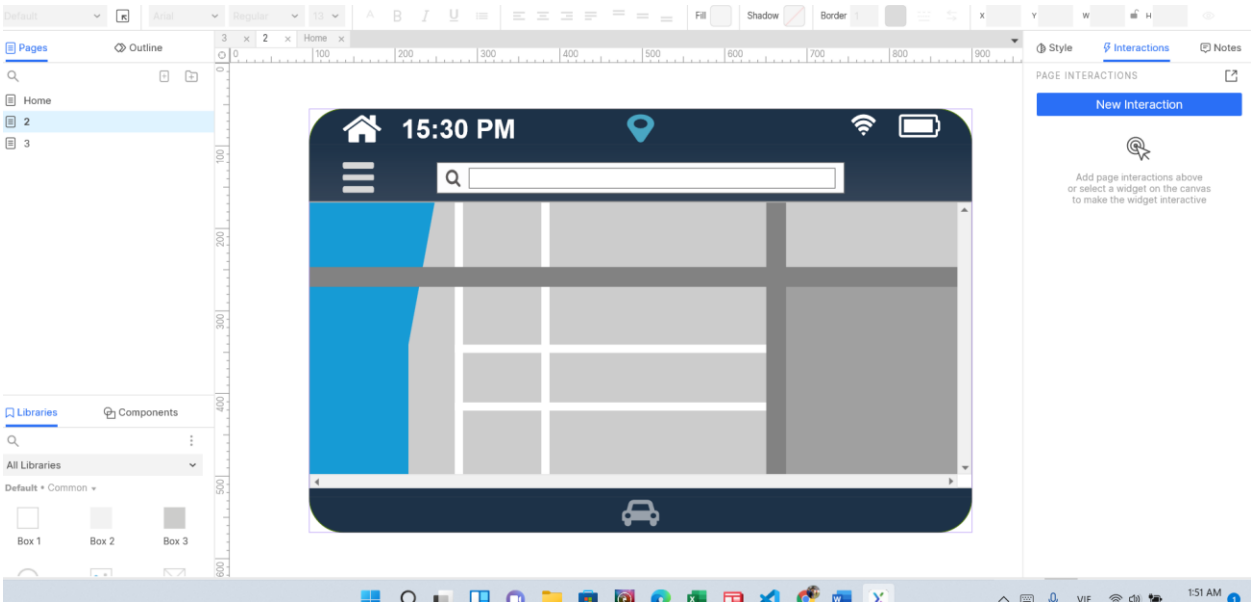


Figure 14. Navigation Axure design interface

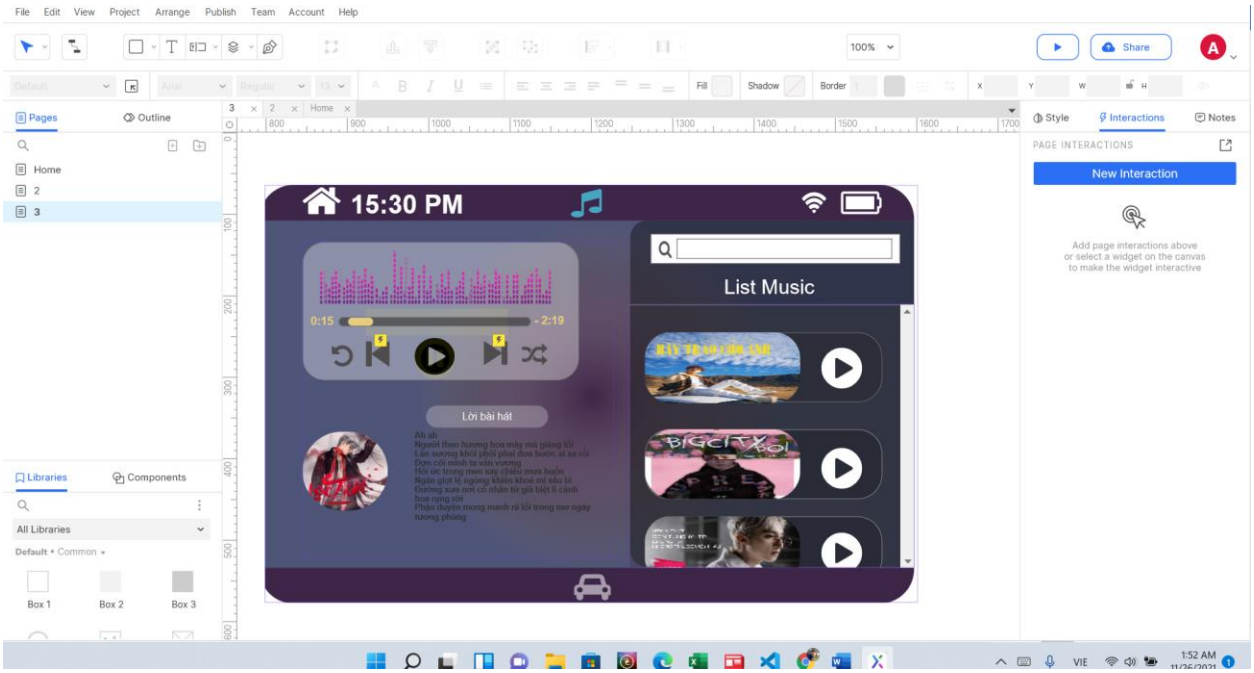


Figure 15. Entertainment Axure design interface

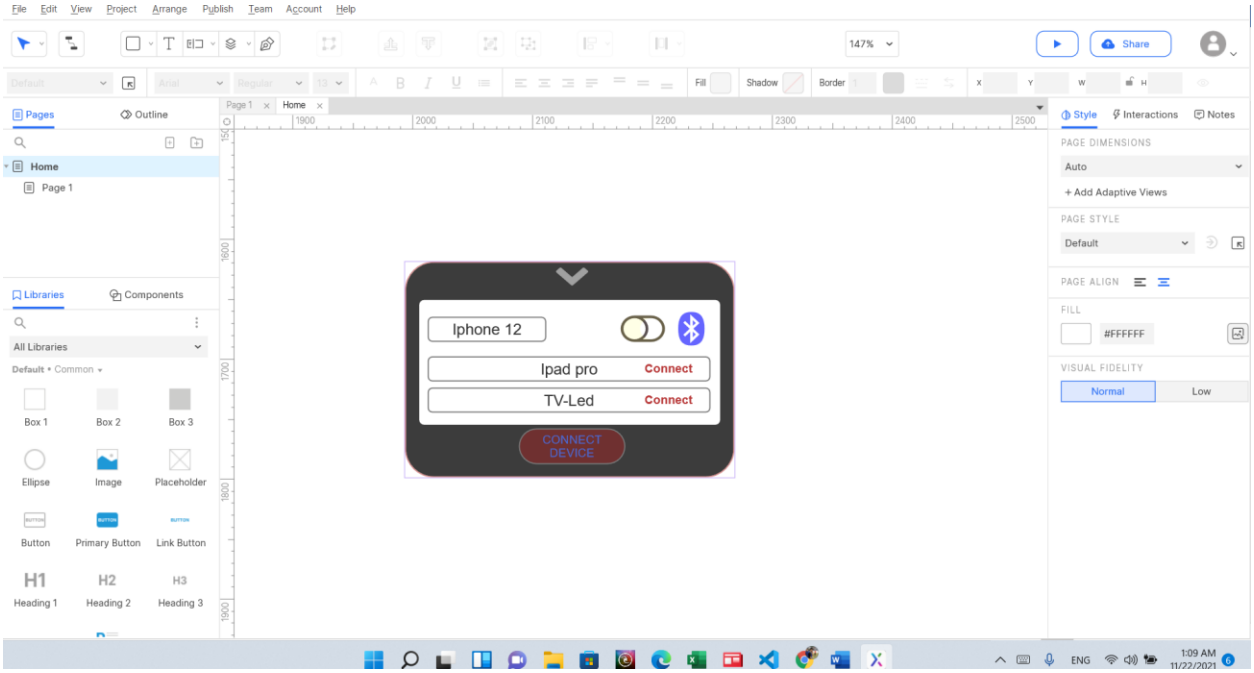


Figure 16. Device connect Axure design interface

9.3. High fidelity

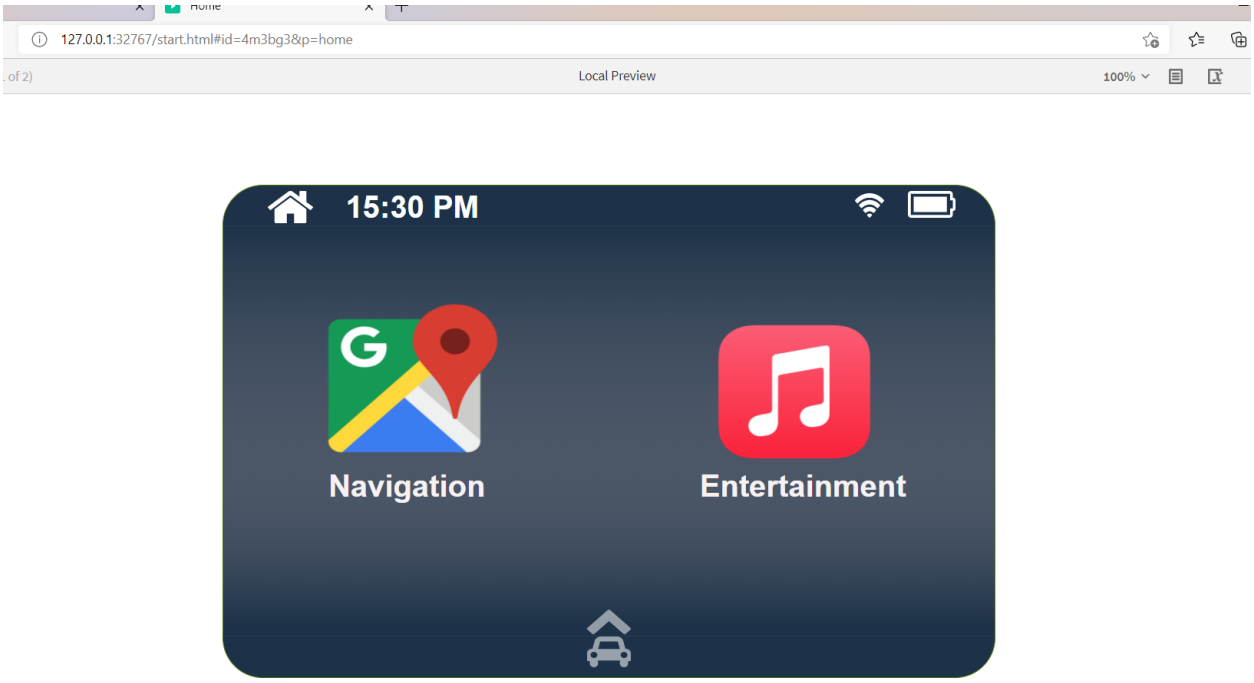


Figure 17. Run home interface

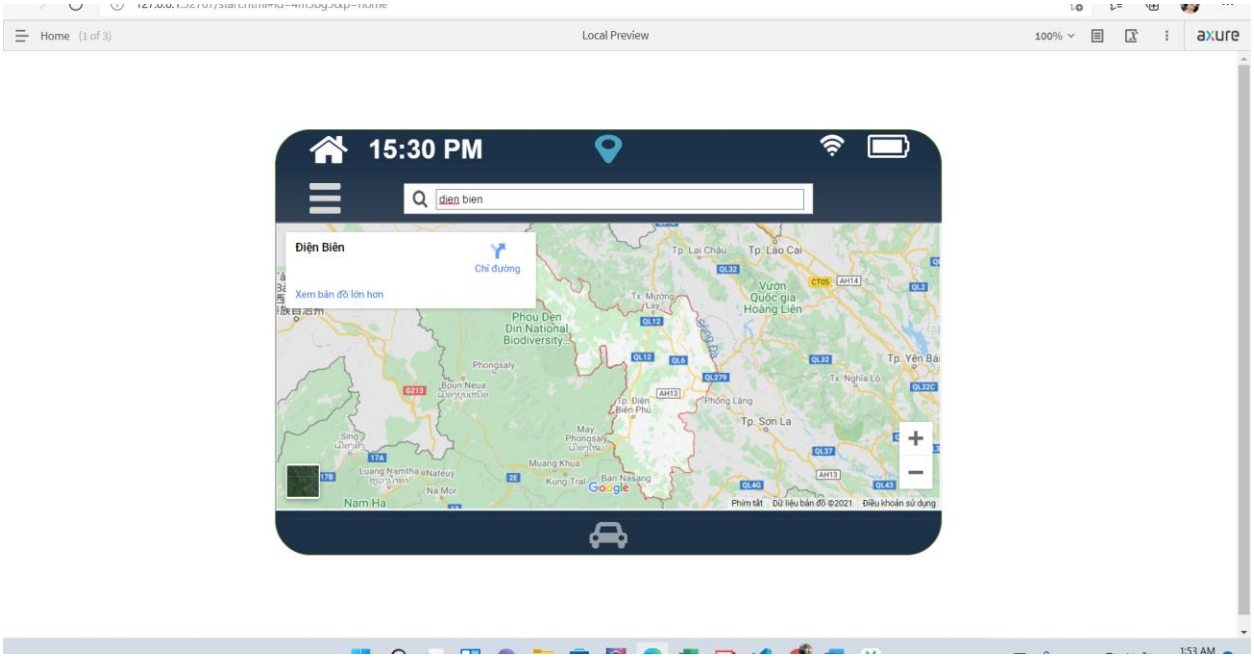


Figure 18. Run navigation interface

The search function here when the user searches for navigation, it will redirect to the correct address that the user is looking for, here are some places that we have designed for users

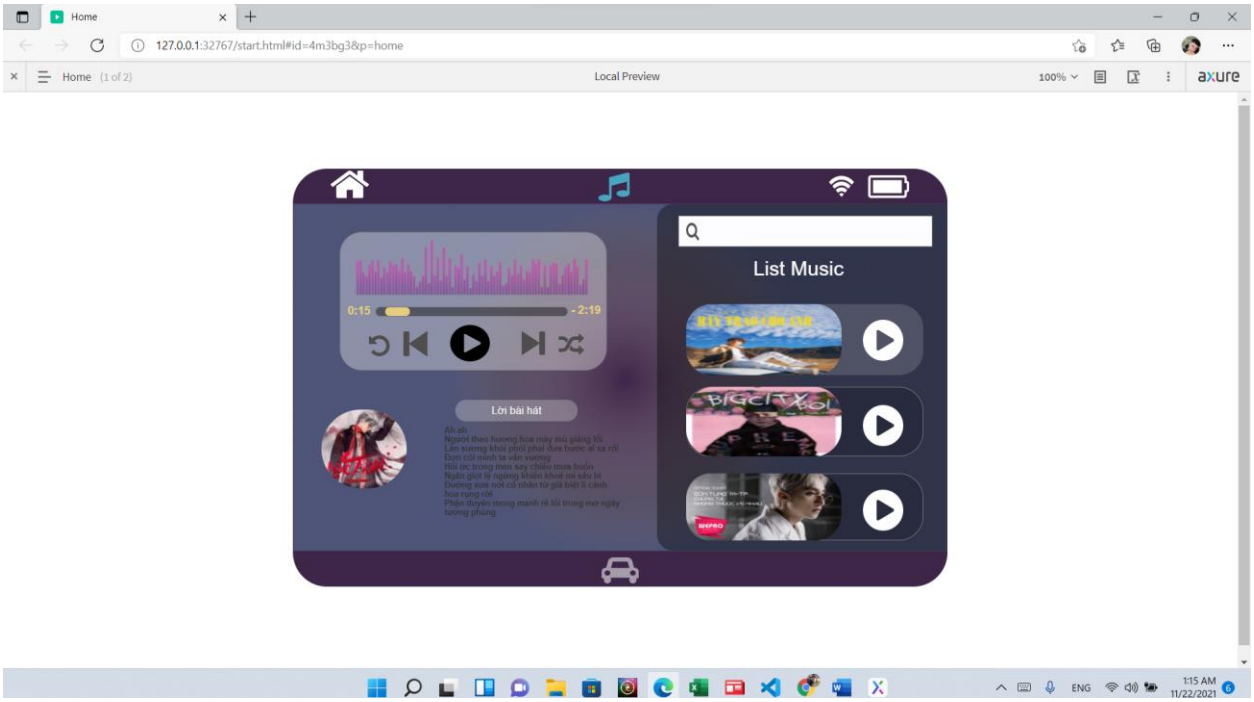


Figure 19. Run entertainment interface

This is the user's music player interface, users can also switch songs and search as they like

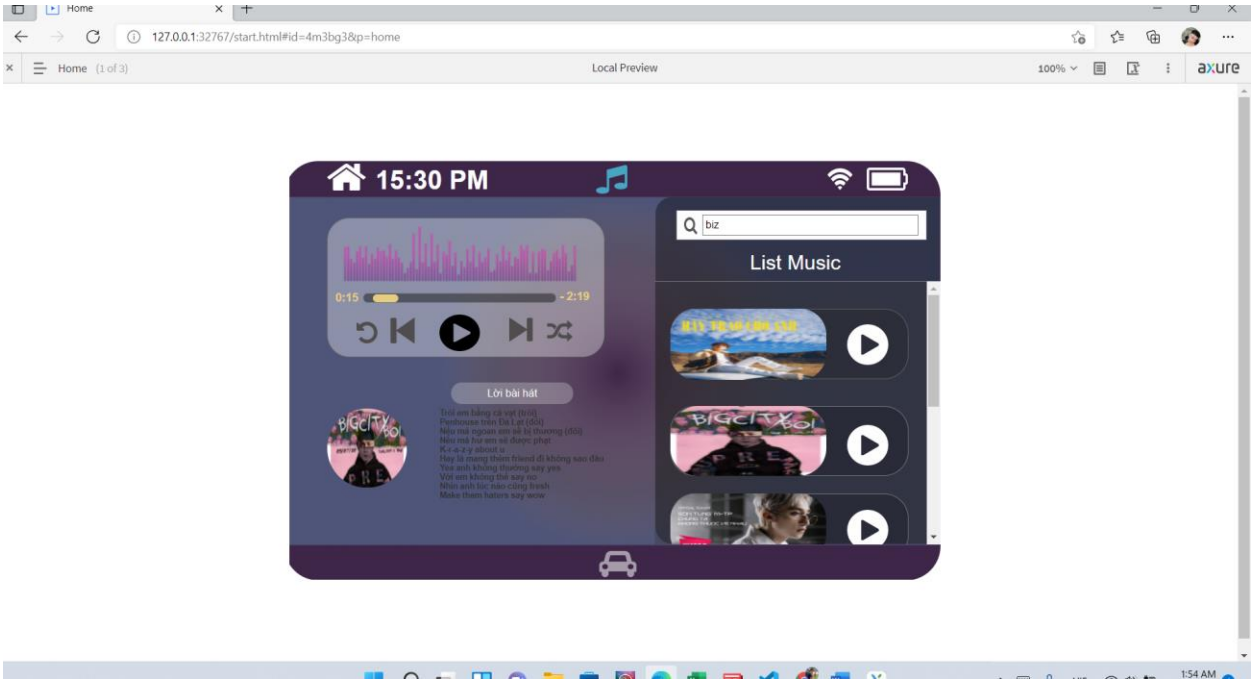


Figure 20. Run show device connect

10. Conclusion

In the process of designing and building the car entertainment system, we have basically perfected the design and construction for users and completed some functions such as location search and user navigation to the location they are looking for. There are also some functions to transfer songs or search for music on the music interface of the entertainment system, but the search and transfer of songs we only simulate using the interface and have not yet performed the function of the music player it. So if there is time in the future, we will build full functions of the car entertainment system, besides there are many other potentials for development such as: we will develop more reception functions with voice interface, the user can control some system functions through the use of speech. In the far future, we will also develop other features for the system such as adding entertainment components or artificial intelligence AI to the system to communicate with users to help users when driving without needing to drive must type. While driving, users can call the system out and communicate with it like a virtual assistant, the above feature helps the car entertainment system become more and more modern as a friend can communicate with other people use and entertain users.

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