HIØF Easy Navigator: An Augmented Reality App Which Guides a User to Reach Their Destination

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Abstract. New students often have trouble finding classrooms, laboratories, libraries, or other places inside a new study place. At Østfold University College (HIØF), they provide paper maps to the students to find locations inside the university which are difficult to understand and hard to use. To solve this problem, we have developed an app named "HIØF Easy Navigator". The application guides new students to find the inside location here at HIØF, Norway. We also conducted a survey of eight students to check the user experience and opinions of paper maps and the HIØF Easy Navigator. Our findings demonstrate that the app is easier to use than paper maps to locate locations inside the university.

Keywords: University application · 360 View · Location Tracking · Street View · Augmented Reality based application · AR location track · Location-based Computing · Navigation application

1 Introduction

There are several location-tracking applications available, such as Google Maps, mSpy, Find My Kids, Waze, etc. According to a report, approximately 154.4 million people use Google Maps monthly [4] to find their way to various destinations, and this application has been downloaded more than ten billion times from the Google Play Store. It provides local recommendations for restaurants, entertainment, and activities as well as real-time navigation. However, applications like Google Maps barely provide the direction to reach the destination, whereas only a few applications are built that are able to guide inside an area or building [1,3]. Millions of high school graduates enroll in universities each year, many of them far from home or even abroad. Finding the admissions office, classrooms, labs, and even the library is never easy for a new student at a university. This is a very common and old problem for new students at every university. When the university area is large, students have more difficulty finding their way around. Here at Østfold University College (HIØF), Norway, new students face similar issues and have

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difficulty finding classrooms, labs, and other university rooms. Finding a room takes time, and occasionally, students are reluctant to contact their elders or university staff for assistance. The difficulties for physically challenged students are greater than for other students. Based on the problem, the team built a demo mobile application that will guide the new students here at HIØF in finding the locations of classrooms, laboratories, or even the library.

In this paper, we have explained the design process and the methodology we performed. Moreover, through our evaluation, we collected the necessary data to answer the following research question:

Can an AR-based location tracker help students find their way on campus?

- Why are paper maps not enough for finding the actual location?
- Would new students use an AR-based location tracking app for finding their location?

2 Related Works

Author Ching-Sheng Wang developed a mobile navigation system that uses 3D augmented reality to help find indoor positions. This application was created for Oxford College, located in Taiwan. Oxford College is a mix of Chinese and Western architecture, now known as the national monument [1]. The system gathered historical information to create 3D models that reflected the actual goals and built both the external and internal 3D buildings of Oxford College in the past and present. In another paper, author Gerhard Reitmayr from the Vienna University of Technology mentioned an indoor location-based application built using an augmented reality system [2]. Moreover, they prefer augmented reality because this technology helps to visualize the position or direction of a location.

In a paper, authors Teddy Mantoro, and Siti Athirah Saharudin wrote a paper about a system that can navigate the user's location using the Global Positioning System (GPS). This system has both 2D and 3D facilities, and users can choose based on their preferences. The 3D function immerses the user in the real-world environment, whereas the 2D function provides an overview of the campus [3]. Furthermore, this navigation application could track the continued movement of the user on the map. The 360-degree view of the campus in HIØF Easy Navigator provides an immersive experience, benefiting individuals with disabilities and prospective students who wish to familiarize themselves with the campus prior to their arrival.

Anindya S. Paul and Eric A. Wan mentioned in their paper that it is always hard to build an indoor location tracking and localization application [5]. Their paper discussed a low-cost indoor location tracking system that can be used with an existing WiFi network and can also accommodate new sensor observations. In another paper, Chang Lui et al. introduces an indoor location-tracking application that uses the footstep to guide the user [6]. The authors of this paper made the statement that, at present, indoor location tracking technology is a key technology. Their indoor localization system used sensor technology that counts users' footsteps without any other infrastructure. Our indoor university location tracker, based on AR and GPS, offers convenience and time-saving benefits for locating specific areas within the campus.

As mentioned in several aforementioned studies, the practicality of combining AR and 3D modeling with location-based services and applications is evident. These technologies significantly enhance the speed and convenience of location tracking. Taking

advantage of these technologies, we adopted GPS as our primary approach to develop our location-based AR application.

3 Methodology

Our whole process was divided into four main steps; idea generation, design (via use-case scenarios and wireframes), prototyping, and evaluation. In Fig. 1, we show the whole interaction design process, which is composed of the following steps.

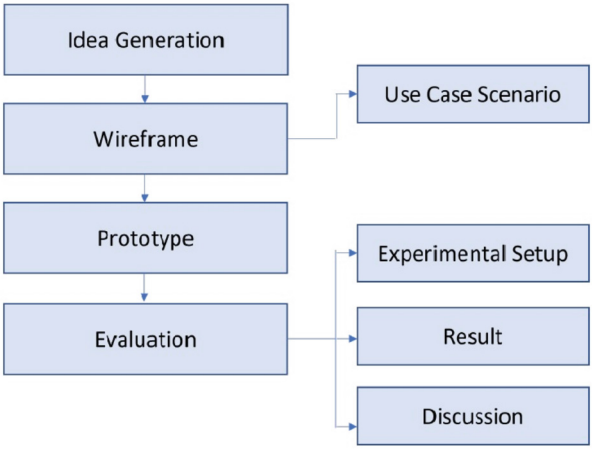

Fig. 1. Design process.

3.1 Idea Generation

When we first started this project, we focused more on the implementation rather than focusing on the problem. Our main focus was to design a VR 360 tour of our campus where students can put a VR set and have a tour of the campus. But it was not fulfilling any needs or solving any problems. After a few discussions, we finally could figure out a problem which was, that students face a problem while finding rooms on campus and it was a common problem mostly for the new students. Deciding upon this problem, we tried to keep some part of our initial idea and merged it with the new idea we thought of.

By eliminating the VR part, we focused on a more realistic solution that actually can help the students find their destination faster. The first thing which came to our mind was a smartphone because everyone has it and it is really convenient to use a smartphone rather than a VR headset. So, we decided to go with a mobile app that will act as a social robot to guide the students on campus. Since every smartphone has a camera, so instead of using VR we can go with AR. Moreover, many people are familiar with using AR for face filters and playing different kinds of games. So, this is how we came to the conclusion that we will develop an app that will help a user by showing them arrows

and path points in the augmented space where they can just simply follow the arrows to go to their destination rather than asking for help or getting confused with a paper map. Ultimately, we decided to replace the arrows with an avatar in the shape of a robot. The robot will guide people in order to help them to find their location. Additionally, it has a voice assistant which is optional. Users can turn it on and listen to the voice to find the location or keep it off and use the mobile screen for navigation. The reason behind our decision is better interaction and to create a more sociable application.

Moreover, from our initial idea, we only eliminated the VR part but kept the 360 tour idea as an additional feature to our app. It is still a useful feature that can be very beneficial for students who would like to roam around the university. This feature is the same as Google Earth's street view where a user can rotate an image 360 degrees and look around a specific area. But it does not cover the campus area of our university. We decided to implement that idea for our university.

3.2 Wireframe

After figuring out the problem and identifying the needs, we started implementing the prototype, and to achieve that, a good wireframe was needed. First, we noted down everything in a paper and then decided to have a visualization of the whole system. Hence, we created a wireframe of the whole prototype using the software Figma which helped us to visualize what steps we should take to make our prototype better. In order to illustrate our design, even more, we have written a use-case scenario.

Use Case Scenario of Location Tracking Feature
Alisa is a new student who joins at Østfold University College, Norway, and she wants to go to his advisor's office to complete some formalities. As a new student, she is facing difficulties finding the advisor's office because the university is big and has several rooms. She also looked at the map which was hanging on the wall but couldn't understand it properly. Being an introvert, she is afraid or shy about asking others for help. She is late, and the time is running out because she had an appointment already. But then, she sees the QR code of the "HIØF Navigator App" and downloads it. The app locates her position with the help of GPS. In the app, she finds a search button and an input field where she could type her destination. Because of the easy interface, she quickly types the location where she wants to go and presses the search button. On the next screen, the mobile camera opens up within the app and asks the student to hold the mobile phone in the forward direction. Then the student points her phone in the forward direction, and immediately she sees some 3D arrows indicating where she has to go next. With the help of the 3D arrows, she moves towards the arrow and a new arrow appears. She keeps following the arrows and after 2 min of walking, she sees the room where she wants to go. The mobile app even was pointing at the door and she finally felt relieved because she made it in time.

3.3 Prototype

We made a demo app as our prototype which was able to showcase all the features. To build the app, we chose the software Figma for the wireframe and the design of the app.

And for making the app, we chose Unity 3D software as it was faster to develop an app with that. We gave a suitable name to the app which was "HIØF Easy Navigator". Some screenshots from our application have been provided in Fig. 2.

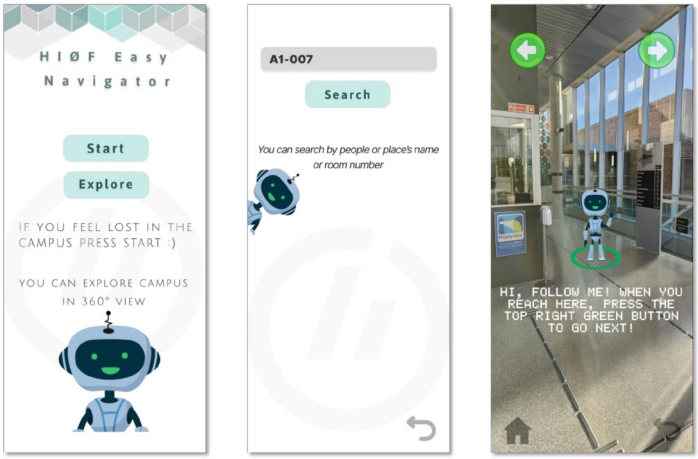

Fig. 2. Digital prototype

On the main screen of our app, a user can see two buttons. If a user presses the start button then an input field will appear where a user can type his destination. After typing the destination, the app shows a picture of the current position of the user. In this prototype, the default starting location is at the entrance of the university. Since our motive was to build a social robot, we made an avatar robot that pops up as soon as a user taps the search button. The robot tells the user to go next with a robotic voice. There are also instructions on the screen with each of the photos to assist the user find his destination. There are two buttons on the screen, which enable the user to go forward and backward. By pressing the next button, a user can see the picture of the next destination. Then a user just needs to follow the robot in order to find the location.

There was another button on the main screen which was for the 360 tours of the campus. Upon pressing the button, a user can see 360 photos of the campus and rotate around it. These photos were taken with iPhone 13 pro max's camera and we used the Google Street app to capture those photos in 360. We clicked multiple photos of the campus, both inside the university and outside the university. To view that, there was an arrow button and with the help of that, a user can easily view the images. All the screens had a convenient back button so the user can easily go back and forth and explore the features. For a friendly user experience, we used our robot avatar on different screens.

3.4 Evaluation

Eight students at the institution were recruited to take part in this evaluation. They were fairly new to Østfold University and it had been a common problem for all of them to find the exact location of certain places.

Experimental Setup

For the evaluation, We brought the evaluators to the entrance of the University building and asked them to go to a specific place. Then, we gave them consent forms to sign and provided them with the prototype app. The application was already installed in one of our tested smartphones which was a One Plus 9RT smartphone. There were 8 participants and they were divided into two groups. We gave our prototype app to one group and the other group was provided with a paper map of Østfold University. Each member of the two groups took part individually. Every participant started at the entrance of Østfold University and the room they were supposed to find was A1–007, which was a fairly difficult room to locate. We measured the time count of each participant with a help of a stopwatch and observed them during the activity. After they were done with finding the room, they filled a questionnaire.

Results

After collecting data from the survey paper, we used the data visualization technique to make the result more stable. In our survey paper, we had a total of seven questions. Figure 4 illustrates the result based on the participants' answers.

For ease of comparison and due to not being able to find the room using paper maps, those who used paper maps were later allowed to use digital maps as well. Figure 3 gives an overview of the survey paper for the eight participants.

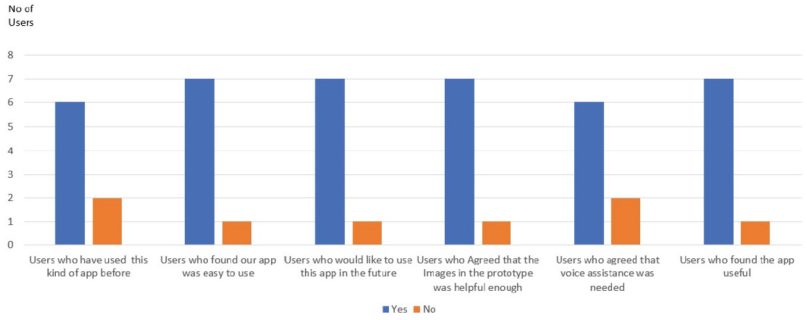

Fig. 3. Answers to the questions from the questionnaire

As we can see, seven out of eight users, which is 80% of the total participants, found our app useful and agreed that the user interface of the app was easy to understand and they would like to use this app in the future. Seven of the participants also agreed that the images used in the prototype were in good condition and it helped them find the actual location. However, 40% of evaluators did not find the voice instruction feature that much helpful and did not use similar types of apps before.

When the participants were using our prototype, we observed and took some additional data and one of the main variables was the amount of time they were spending to find the room. Figure 4 shows that those who used the HIØF Navigator app took only 2 min on average to find the room whereas those who used the paper maps took more than 10 min.

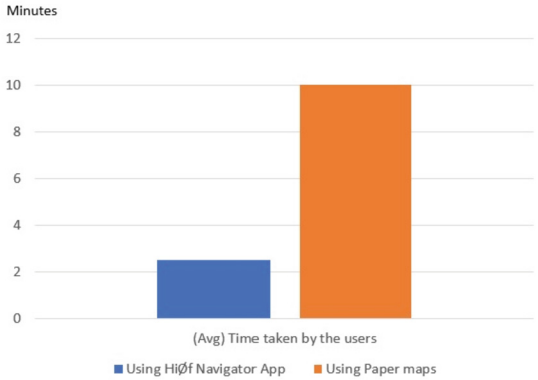

Fig. 4. Time difference between the two groups of users

In Fig. 5, we can see that none of the users were able to find the room using the paper map but they all found the room when they used the application.

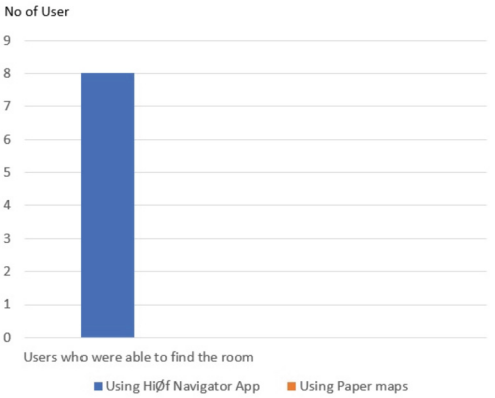

Fig. 5. The number of users who were successful in finding the room

Discussion

From Fig. 3, we can see that, among all the participants, the majority of them used similar types of apps in the past and found them easy to use, whereas a few of them never used this kind of app. Moreover, almost all the users agreed that they want to use similar types of applications in the future and are satisfied with the prototype features such as voice assistance and image view. A significant number of participants found that the images in the prototype were helpful enough. In the "HIØF Easy Navigator" we also added the voice assistant feature." Six participants liked it, whereas two felt it was not necessary to have this feature in the app. This gives us a clear understanding that if this kind of app is made available for the users then they can really use it easily and get the benefits out of this app.

Figure 4 shows information about time which was a crucial variable for the measurement. As we can see that there is a significant difference between the two bars as the users who used the app took only 2 min and 30 s whereas the users with paper maps took more than 10 min. Not only that, Fig. 6 tells us that users who used the paper maps could not even find the actual room due to the difficulty of understanding the map. Although we expected some users to find the room using paper maps, it turns out that the room we chose was not properly pointed at the map. But, it is known that maps are not always detailed and it is difficult to illustrate the whole campus and rooms on a small piece of paper. That is why, from this evaluation, we can agree that there is a need for a location-tracking application like HIØF Easy Navigator for the students.

The HIØF Easy Navigator will be connected to the university's network infrastructure through the Internet. Our application will be accessible on the 'Home page' of Østfold University College's website. Additionally, to provide more convenient access, separate applications will be provided for both Android and iOS systems. The application can be installed and utilized on smartphones and tablets. Both features of our application can also be used with VR-XR tools, which will be available at the university's entrances. These tools will allow our users to explore their locations using VR technology.

4 Conclusion

We conducted a survey asking participants to evaluate their experience using the "HIØF Easy Navigator" app compared to the paper maps the university provided. According to the survey report data, most of the participants found it easy to find the location using the app, and they also plan to use it again in the future. They prefer the app because paper maps are difficult to understand and the information is not sufficient to find the indoor location. In the future, we aim to develop the app with more features that will help new students, as well as disabled students, find the indoor location of the university.

Appendix

Survey Form (Questionnaire)

1. Do you find this app easy to use?

a. Yes
b. No

2. Have you used similar types of apps before?

a. Yes
b. No

3. How helpful do you think our app was to find the destination?

a. Very helpful
b. Helpful
c. It can be helpful sometimes
d. Not helpful at all

4. Do you think the captured images were sufficient to help you find the location?

a. Yes
b. No

5. Do you prefer an app or a paper map to find your destination?

a. Only app
b. Both the app and paper map
c. Only paper map

6. Would you prefer the app with voice assistance or without voice assistance?

a. With voice assistance
b. Without voice assistance

7. Would you like to use this app frequently in the future?

a. Yes
b. No

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