

Combination Of Real And Virtual World For Indoor Navigation using Mobile Application

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Abstract-In today's life when the cities are rising usage areas of mobile phones have increased in the last 10 years[1]. Although there have been improvements in many areas, most of the developments are in the field of positioning systems. Although the people's lives continue in indoor environments, location-based information system receives data from the satellites, which can detect a person's location in outdoor areas alone. But for indoor areas no efficient and perfect technology has been developed for the navigation or positioning. In this paper we have come up with an exceptional solution that is indoor navigation mobile-application which works with augmented reality, in our proposed solution, we will be using mobile camera as the scanner for getting the path and extracting the features from various objects in the path[6]. We use ARCoreSDK which is the heart of this project which has an inbuilt property called area learning which helps the system to extract and learn about the features present in a particular scenario using Machine Learning. Keywords-Mobile application, augmented reality, ARCore SDK, indoor positioning and navigation.

I. INTRODUCTION

The booming enhancement of mobile technology in today's 21st century is one of the prime factors of the growing technological environment in every country. One of the key concerns has always been the development of mobile applications and researchers have put in a lot of effort for compatible operating systems for supporting these applications[9]. Thanks to the modern day technologies android has emerged as one of the top notch mobile operating systems which even has an easier development interface for application developers as compared to other OS. This paved the path for easier development of complex applications for developers[10]. One of the many major requirements in our day to day life is positioning and navigation of oneself, i.e. where the person wants to go and his actual position. With the advancement in mobile technologies there has been an urge for the advancement of navigation based technologies, in which mobile application can play a crucial role. With the advancements in above said technologies outdoor navigation has enhanced ten-folds. But with lives of people who are indoor oriented a complex indoor scenario like an office space, IT-campus, hospitals, malls navigation becomes a major concern[7]. Going to a new campus and getting used to the campus environment takes time for a fresher.

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In these types of conditions an indoor navigation system is a must and becomes a friend in need. Many solutions have been proposed for this problem and some of them are:-

A. Bluetooth Beacons:-

Bluetooth Beacons broadcast their identifier to nearby portable electronic devices[4].

Disadvantage:- But this technology enables smartphones/tablets and other devices to perform actions and navigation when only in close proximity to a beacon.

B. Wi-fi positioning system(WPS):-

WPS uses the characteristics of nearby wi-fi hotspots and other wireless access points to find where a device is located. The most common and widespread localization technique used for positioning is based on measuring the intensity of the received signal and the method of fingerprinting[2].

Disadvantage:- But the accuracy depends on the number of the access points whose positions have been entered into the database[5].

C. Radio Frequency Identification Tags (RFID):-

RFID uses electromagnetic fields to automatically identify and track tags attached to objects.

Disadvantage:- But a large amount of data may be generated that is not useful for managing indoor navigation or other applications and makes the system inefficient[1].

In our proposed system we will be implementing indoor navigation mobile application based on augmented reality. This solution is far more better option for the future of indoor navigation as it is more cheaper and efficient.

II. PROPOSED SYSTEM

In existing systems we particularly are more influenced with the systems based on Wi-fi positioning and the use of Bluetooth beacons which more or less is a system that works in the context of indoor navigation but is not as efficient and error free that an indoor navigation has to be. Some of the problems which already exist in the current system are:- error percentage in locating is very high, non-adaptive systems and huge reliance on hardware which also increases the overall cost of the project and inefficient.

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So we in this paper propose a system which will be totally based on software rather than hardware, the only hardware module that is used will be the mobile camera. In this paper we propose a system based on Augmented Reality which is potentially present everywhere and is used by everyone but are not aware of the other uses of this technology. This technology basically embibes or combines the virtual world which cannot be seen by humans with real world. The requirements needed for efficiently using this proposed system are:-

- A. **Mobile Camera**
- B. **System that supports ARCore.**
- C. **Highly efficient processors for processing real world objects.**

In our proposed system the heart of the project goes with ARCore SDK which basically takes the real world objects as input through the camera and converts them into logical and unique features. ARCore SDK has a special property called places learning model which is based on Machine Learning which helps it to extract the features from real world objects. ARCore also uses motion tracking which also helps in the extraction of features in accordance with the movement and orientation of the phone. So this is how are proposed system works:

- A. Firstly the user will open an application based on AR.
- B. This app will intimate the user either to create his own map/route or will ask him/her if the user needs assistance with navigation.
- C. If the user clicks on the create map then the user automatically will be asked the name of source and destination and will be asked to start his/her camera.
- D. After the camera is initialised the application using ARCore will start extracting features from the camera input and user will be asked for marking waypoints at the place where feature extraction has been completed.
- E. This will complete the mapping phase.
- F. If the user clicks on assist me for indoor navigation the user will be next asked for destination.
- G. Once the destination has been taken the camera will be initialised and features from current location of the user will be extracted.
- H. These features will be matched with the various features already present in the database and if a match is found the system will get the users current location.
- I. After this the system will start the route planning algorithm and will find the best route from various routes hat have already been mapped.
- J. If no route is found to the destination the user will get a prompt message that either the entered destination is wrong or no route has been found for the entered destination.
- K. This route will lead the user to the desination.

The major advantage that our system has, is that it is adaptive because the user input will be taken as a video feed

other than AR camera feed and will be analysed if the place has added some new objects or features, if yes then those features will also be added to the database. And other major problem that exists is if there is an environment where no noticeable/unique objects are present for example: stairs of a building then we'll be taking the help of QRcodes which will act as features for these kind of environments.

III.SYSTEM ARCHITECTURE

In our proposed system we have two phases:-

Mapping Phase:- In this phase the real time mapping of the route occurs, in this phase the we map the features present on the route and place them in a json format in the database. Below given is the implementation level milestones for this phase :-

- A. **Extraction of features**
- B. **Initialisation of the camera for scanning real time objects**
- C. **Features will be uploaded in the database in JSON format.**
- D. **Marking of waypoints.**

Testing Phase:- In this phase we will take the user input from the user for the destination and then route planning algorithm will map the most suitable route from the users current position to the destination.

Below given is the implementation level milestones for this phase :-

- (a) User input will be taken.
- (b) Camera will be initialised for showing the route to the users.
- (c) Route planning algorithm will find the best route possible from the current position.
- (d) The marked waypoints will be shown on the mobile screen using arrows.

Below given is the architectural diagram of our proposed system:-

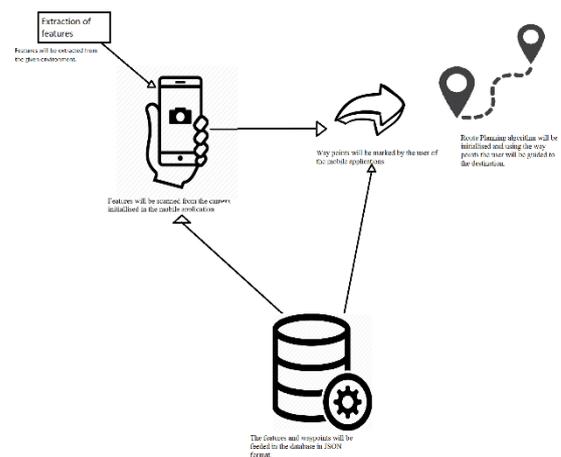


Fig.1 System Architecture



IV.EVALUTION AND ANALYSIS

ARCore SDK normalized detection parameters:-

These parameters symbolize the normal distance required for object detection. Object recognition accuracy of our system is affected by the camera-object separation. The minimum distance recommended by the ARCore SDK manufacturers is 30 cm. As the separation increases, the quality of the depth data deteriorates 1/4 times and beyond 1 m, texture details of target objects are hard to capture[3]. The error is capitalized by the SDK with the help of special features like machine learning models and motion testing with various angles. From reliable observations, to achieve a reliable sensing and good quality visualization, we set an acceptable score of 0.5-1 for both the metrics[3].

These are the results of the motion tests that are involved for testing the accuracy for detection.

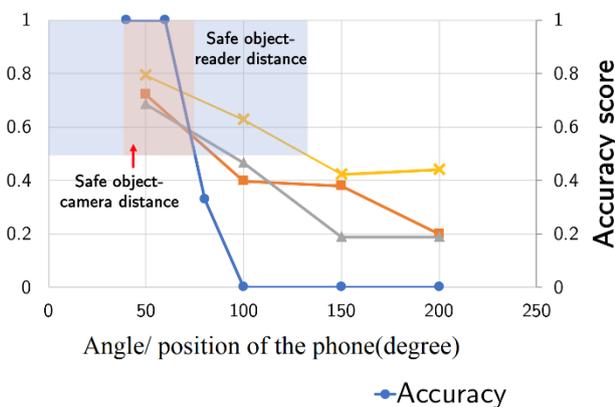


Fig.2 Accuracy testing for detection of objects

V.CONCLUSION AND FUTURE SCOPE

In this paper we have developed a system for indoor navigation based on augmented reality which is supported on android platform. We have kept in mind the tiresome work that goes into individuals mind for looking through the map to navigate themselves in indoor environments. We have also kept in mind the complex scenerios which can be found in various indoor environments where one cannot find a real world object which acts as a feature for the navigation hence we have introduced the Qrcode based feature which helps users in scenerios such as the above mentioned[10]. As a future work we are planning to make this application cross platform by using native environments for development this would be helpful not only for android users but also for users who use ios and other major os. We would also work on how the system will be able to differentiate between similar objects placed at different places in the same indoor environment[8]. We would also try to integrate outdoor environment navigation techniques with our system so as to navigate from one room in one part of the campus to the other room present at some other part of the same campus[10].

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AUTHORS PROFILE



Ms. Vidhyavani.A is an Assistant Professor in the Dept. Of CSE at SRMIST- Ramapuram Campus, Chennai, she completed her M.E and has an experience of over 6 years in teaching and tutoring and has guided this project. Her Research interests are in the domain of Software Quality.

Some of research papers published by her are:-

- Paper published in journals "Comparing the clustering method for user centered development" IJRIT, 1 (4) 275-276, 2013
- Paper presented in International conferences "User centered process framework for the realization of clustering based interactive system", 2012
- Paper presented in International conferences "User centered process framework for the realization of clustering based interactive system", 2012

Her academic experience:-

- Assistant Professor, Gnanamani College of Engineering till December 2014.
- Assistant Professor, Sathagiri College Of Engineering till May 2017.



Stephin Stanly is a B.Tech student of 3rd yr. from SRM Institute of Science and Technology, Chennai, his current interests are in the field of Android app Development, Networking and augmented reality based mobile applications.

Some of his key achievements are:-

- Been a part of the team which won the special appreciation award at the hackathon of college level techfest named texus.
- Had been a tech-head in a technical club of our college called andropedia.
- Mentored younger students that had been a part of club in the areas of android development.
- Conducted various events in collaboration with various tech heads such as google, amazon, microsoft.



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Some of research papers published by him are:-

- Published a paper in the IJSART-- Volume 4 Issue 10 – OCTOBER 2018 titled "Smart Attendance Marking System Using Facial Recognition" Link-<http://ijsart.com/Home/IssueDetail/2783>
- Published a paper in the IJSART- Volume 4 Issue 10 – OCTOBER 2018 titled "GARBAGE COLLECTION AND MANAGEMENT SYSTEM USING CROSS-DOMAIN APPLICATION" This paper was even selected for publication in SOCSpro-2019 journal Link-<http://ijsart.com/Home/IssueDetail/27845>



Ankit Kumar Pandey is a B.Tech student of 3rd yr. from SRM Institute of Science and Technology ,Chennai ,his current intrests are in the field of Web Development and Networking.

Some of his key achievements are:-

- Participated in IDEAXPO'18 held in SRM institute of science and technology and presented a unique idea on Chatbot.
- Member of a club called Andropedia where we make projects with unique ideas and provide education on mobile app development.

Some of research papers published by him are:-

- Garbage Management system using ultrasonic sensor
We used the concept of IOT to make a efficient garbage management system along with the help of ultrasonic sensor.
LINK-<http://ijsart.com/Home/IssueDetail/27844> Publication: IJSART
- 2-Garbage monitoring And Management system using cross-platform app
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LINK-<http://ijsart.com/Home/IssueDetail/27845> Publication: IJSART



Shivam Choudhury is a B.Tech student of 3rd yr. from SRM Institute of Science and Technology ,Chennai ,his current intrests are in the field of Python Developer and computer graphics.

Some of his key achievements are:-

- Won 3rd prize in interschool science exhibition
- Collected funds for an Non Profit Organization in India caring for disadvantaged elderly senior citizens.
- Became a member of the photography club in our college and took coverage of many national level events in our campus.

Some of research papers published by him are:-

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