

# AR Based Indoor Navigation System

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**Abstract**— Smartphones are growing more easily with internet access to smartphones, user location information can be used easily anywhere at any time.

Users can be used with the existing applications in various fields. One of the major technologies introduced is Augmented Reality, which can be used to interact with the real world using virtual objects. Augmented Reality based Technology enables the providing a variety of information such as photos and placement of buildings in the travel field. This field can likely wise utilized in the navigation as examined in paper. Navigation will give us the proper way to locate at the proper place.

**KEYWORDS:** Navigation Systems, Augmented Reality, Indoor Positioning, Indoor Navigation, Android Based Navigation.

## I. INTRODUCTION

Mobile outdoor GPS navigation apps have proven to be lifesavers to countless people. With a smartphone, it's easy to find your destination even in an unknown city. Guiding people to specific indoor locations is a challenging task. Especially in complex buildings like hospitals, airports, colleges or other public buildings operators are struggling with the problem of guiding visitors through their building in a proper way. Augmented reality is a technology, which connects the virtual information generated by computers to the real world to create a better way for users. The motivation force behind the technology is the enhancement of the visual effect that could assist users in Assuming an object is more easily possible. AR technology has been applied for many fields, such as digital marketing, Tourism Industry, Business Logistics, Classroom Education, Design & Modeling, Field Service, etc. Mobile navigation application based on AR has also become new research. Augmented Reality navigation would work in the following ways:

- Get the real-world information from the user's perspective.
- Get the information is the GPS coordinates.
- Generate the virtual information based on real-world location information [9][7].
- Save the virtual information i.e, longitude, latitudes generated with the real world, and display the way to the user, by creating an augmented reality.

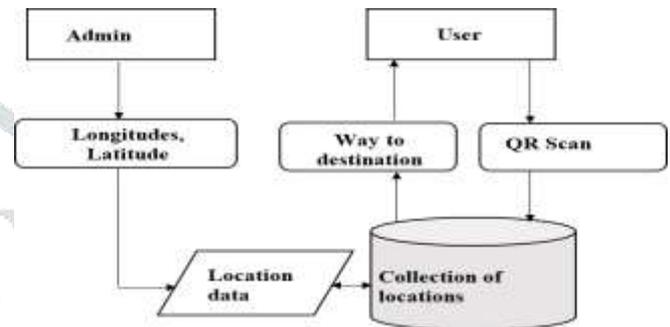


Figure 1. System Architecture

## II. LITERATURE SURVEY

- Wong Joanne, Sanna Taking, Nazrin Isa, And Kok Chao School Of Microelectronics Engineering Universiti Malaysia Perlis (Unimap) Perlis, Malaysia has introduced “Indoor Navigation And Localization Application System”. Which once the most suitable method has been chosen, which is the Wi-Fi technology based on the literature review, the project proceeds with developing the localization application. This part focuses on fingerprinting the user's estimated location by using mathematical algorithm techniques to triangulate the approximate position of a user within the building floor using Android technology [5].
- Pradeep Kumar G H Akhila N, Assistant Professor Dept. of CSE KSIT, Bangalore, Karnataka, India, Aravind R, Mohith P 4th year, Dept. of CSE KSIT, Bangalore, Karnataka, India, has developed INDOOR NAVIGATION USING AR TECHNOLOGY, which contents Mobile outdoor GPS navigation apps have proven to be lifesavers to countless people. With a smartphone in hand, it's easier to find your destination even in an unfamiliar city. Particularly in complex structures like air terminals, medical clinic or other public structures administrators are battling with the issue of directing guests through their structures in advance manner [9].
- Munesh Kumar Sharma, Satya Chachaundiya, Vishal, introduced “Augmented Reality Navigation”, Which Offers an optimized experience for a variety of web phones and devices. Can access this site from any mobile web browser, with real-

time data. Can discover structures nearby or track down telephone numbers simply utilizing your thumb: auto populating individuals locator will even finish client composing, saving time in a crunch [10].

- Adam Satan, Focused Bluetooth-based Indoor Navigation Mobile System, Which Contents in the first step, the Received Signal Strength Indication (RSSI) for each Beacon is measured and filtered. Then the distance from each beacon is determined by the Log-Distance Path Loss Model based on the average of RSSI values [1].

- José Antonio Puértolas Montañés<sup>1</sup> Adriana Mendoza Rodríguez<sup>2</sup>, Iván Sanz Prieto<sup>3</sup> IBizeu introduced Tech Smart Indoor Positioning/Location and Navigation: Which include a Lightweight Approach International Journal of Artificial Intelligence and Interactive Multimedia, Vol. 2, N° 2. Some improvements will be shown, for example, plant aerial view of buildings, different levels of detail within the map, zoom in the area where the user is situated so you could get a clearer idea of where is located. A cartographic base with vector maps are being created at this moment, which will be useful, for example, to remember the position where our car is parked, offer custom routes and maps, different levels of detail inside the map, show distance and time to our destination using 3D maps [6].

- Andrew Mackey Petros Spachos Konstantinos N. Plataniotis School of Engineering, University of Guelph, Guelph, ON, Canada Department of Electrical and Computer Engineering, University of Toronto, Toronto, ON, Canada "Indoor Navigation System". Albeit the Global Positioning System (GPS) is an exact answer for outside use. The vast majority of these gadgets have at any rate one detecting unit, setting out open doors for more straightforward combination between the actual world and PC based frameworks. This is the thought behind the Internet of Things (IoT), an advancement of the Internet where ordinary items have network availability, permitting them to send and get information [2].

- Lennart Oldenburg Jan Meznarič Eridy Lukau Andreas Hechenberger "Indoor Navigation". The Global Positioning System (GPS) works nicely outdoors but indoors it gets much worse and not precise. So GPS does not work well indoors. The goal is to research possibilities for indoor navigation to find other participants indoors. An Android application as well as a backend to handle to persist project data. One main technology provided by the SNET department at Technical University Berlin (TU Berlin) was Estimote Bluetooth beacons [7].

- Rhuta Joshi, Anuja Hiwale, Shivani Birajdar, and Renuka Gound, "Indoor Navigation with Augmented Reality". Indoor Navigation using Augmented Reality [2020-21] they mentioned that GPS is the primary player for outdoor navigation, indoor navigation techniques have certain additional requirements to be met. Some of the common indoor positioning techniques such as Wi-Fi are explored here. These procedures anyway have a lesser precision when contrasted with the GPS as expressed by A. Sudarsanan and group in their examination paper which is talked about further [8].

- Abdelrahman M. Sawaby<sup>§</sup>, Hesham M. Noureldin "Indoor Navigation System over BLE". A new indoor navigation system based on Bluetooth Low Energy (BLE) is proposed. Moreover, a more efficient routing technique based on the A\* algorithm is utilized [4].

### III. EXISTING INDOOR LOCATION SYSTEMS

A descriptive location is associated with geographic objects such as mountains, lakes, cities, highways, countries, or other structures and has a description such as a name, identifier, or number. A spatial location has a description such as a name, identifier, or number.

- A Lightweight Approach to Smart Indoor Positioning/Location and Navigation. Spatial location is more commonly employed in professional applications where a descriptive location does not provide enough information [10]. A network location is a location determined by a communications network's topology. Wireless Local Area Networks (WLANs), Bluetooth, Ultra-wideband (UWB), Ultrasound, Radio Frequency Identification (RFID), Hybrid technologies, and the QR scanning method have all adequately used the strategies used to appraise area in a cellular network [6].

#### • *Systems based on WLANs:*

WLAN radio-signal-based positioning systems, which are supported by underlying Radio Frequency (RF) and Infrared (IR) transmission technologies, have experienced tremendous growth in recent years and are expected to continue this trend because they are a cost-effective solution that provides convenient connectivity and high-speed links, and they can be implemented relatively easily in software. Using either actual data or a mathematical model of indoor radio propagation, the Wave LAN system triangulates the 2D position of an object within a building. This method has the advantage of requiring minimal base stations and using the same general wireless networking across the building.

#### • *Systems based on Bluetooth:*

Bluetooth is a wireless technology that was created to provide short-range connectivity for personal, portable, and handheld electronic devices. • Bluetooth is a lighter standard than WLAN, is widely used (integrated with most phones, PDAs, and other devices), and enables a variety of networking services in addition to IP.

#### • *Systems based on UWB:*

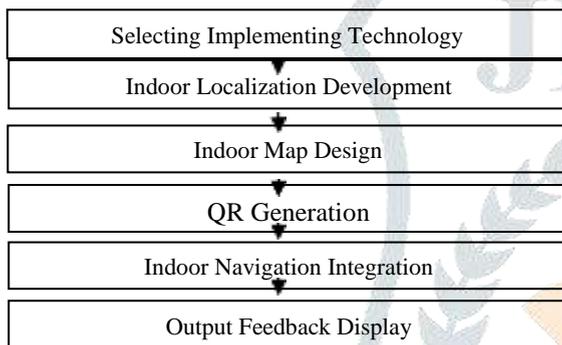
For localization and tracking, ultra-wideband (UWB) impulse radio waves are used. Because this system platform was built with common electronics components, it enables quick performance evaluation and estimation of the time of arrival (TOA) of received pulse signals. UWB systems use receivers placed throughout a building to track users wearing tiny tags that transmit ultra-wideband signals. Finally, these signals are sent to a server, which calculates the transmitter's location.

### • Systems based on RFID:

Radio Frequency Identification (RFID) is a fast-evolving technology that allows things to be automatically identified. RFID location estimate relies on the electromagnetic connection between RFID readers and tags, which allows RFID readers to read data from RFID tags. Near Field Communication (NFC) readers based on RFID technology are also becoming more prevalent on mobile devices, allowing them to scan these tags. NFC stands for Near Field Communication, which is a bidirectional, short-range wireless communication technology. As a result, communication takes place between two nearby devices: a mobile phone operating as an NFC reader on the one hand, and RFID tags that are processed by the device on the other. The mobile device gathers the current position from NFC tags, and the system calculates the best route.

## IV. SYSTEM METHODOLOGY

Research Methodology: Figure.1 depicts a generic flow chart for the entire study. The goal of the research is to develop strategies to reduce power use [5].



**Figure 2. Research Methodology**

### A. Selecting Implementation Technology

If there is enough time and money, and implementation approach will be chosen through a literature review or experimental processes. For the time being, the technology is chosen based on the method that appears to be the most viable from the literature review.

### B. Indoor Localization Development

Following the selection of the most appropriate method based on the literature assessment, the project moves forward with the development of the localization application.

### C. Indoor Map Design

Because the focus of the research is now on detecting a user's location, a map of the intended location, which is the selected floor of a building, is required as the system's foundation graphical layout. This portion, while appearing to be simpler than the others, necessitated a substantial investigation into the chosen site based on the technology chosen.

### D. QR Generation

To make using the app even easier, we've created a QR code that will allow you to quickly download and use the app.

### E. Indoor Navigation Integration

The system then incorporates indoor navigation to track the user's location on the floor plan of the building. This area is built utilizing Android technology for mobile devices once again.

### F. Output Feedback Display

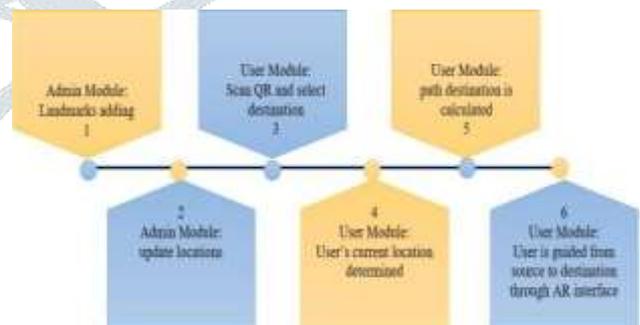
The project's application system will then provide preliminary feedback in the form of a notification message or step-by-step guidance on navigating an indoor terrain. For the user's convenience, it will be presented on a mobile phone or other relevant smart devices.

## V. BACKGROUND OF TECHNOLOGY

Indoor positioning technologies can be divided into two categories: wireless transmission methods and computer vision methods. To locate a device, wireless transmission methods use technologies including ultrawideband, wireless local area networks, and radio frequency identification. These technologies frequently necessitate the deployment and installation of physical infrastructures in the indoor environment, such as Wi-Fi routers and BLE beacons [2][4]. The majority of these solutions are inaccurate and have significant localization errors, albeit these mistakes could be decreased by using inertial sensor-based positioning algorithms and probabilistic techniques like particle filtering. During the detecting phase, some technology options, such as Bluetooth and infrared technologies, have a significant delay. While these technologies are widely used for localization, they have difficulty calculating the user's orientation, making them unsuitable for AR applications.

## VI. INDOOR NAVIGATION WITH AUGMENTED REALITY

The sample flow of implementation on a smartphone device depicted in Figure 3 can be used to navigate in an unknown interior setting with direction guides augmented in the real world to traverse from source location to destination. There are two elements to the flow: owner setup and visitor navigation [8].



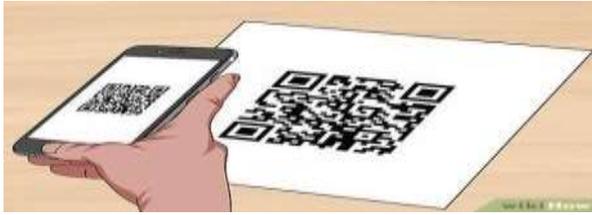
**Figure 3. Process Flow**

**Admin-** Admins can control the system, maintain security and add or delete locations.

**Database-** A database is a collection of information that is organized so that it can be easily accessed, managed, and

updated. In an indoor navigation system, the admin can store different locations in the database by calculating latitude and longitude. we have created the database using MySQL. That database details also visible at admin login [1].

**QR Code-** QR codes will be used across the building to carry the information required for the navigation system. The mobile application will use QR codes to provide accurate indoor navigation for the user.



**User-** The user needs to scan a specific QR code after that user can enter the navigation system. There will display various location list, users can select a particular location where a user wants to go. After that system will search this certain location in the database. Later processing this path will be displayed from source to destination on the user's Android phone.



## VII. CONCLUSION

This paper presents a thorough overview of current advancements in indoor navigation and locating systems. We classified the existing systems based on the positioning technologies used. We published a full assessment of the numerous suggested indoor positioning and navigation solutions. For Android, an Indoor Navigation System was created. The utility of the produced application is demonstrated by the experimental findings. The administrative tasks were the greatest challenge during development. Even in a tiny area like this, connecting the positions with paths and selecting where to put new positions proved difficult.

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