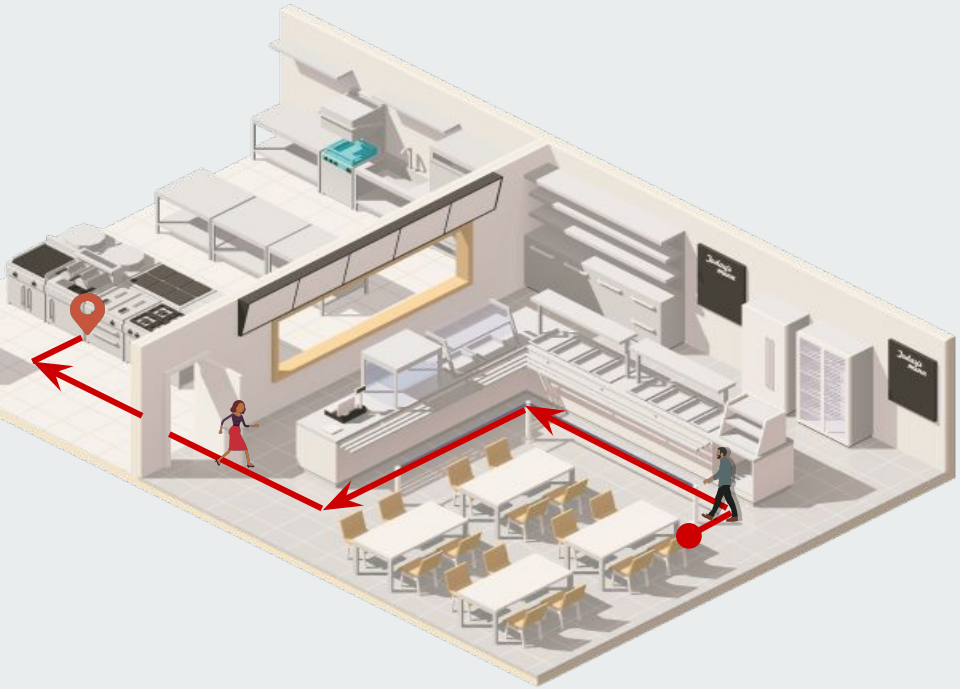
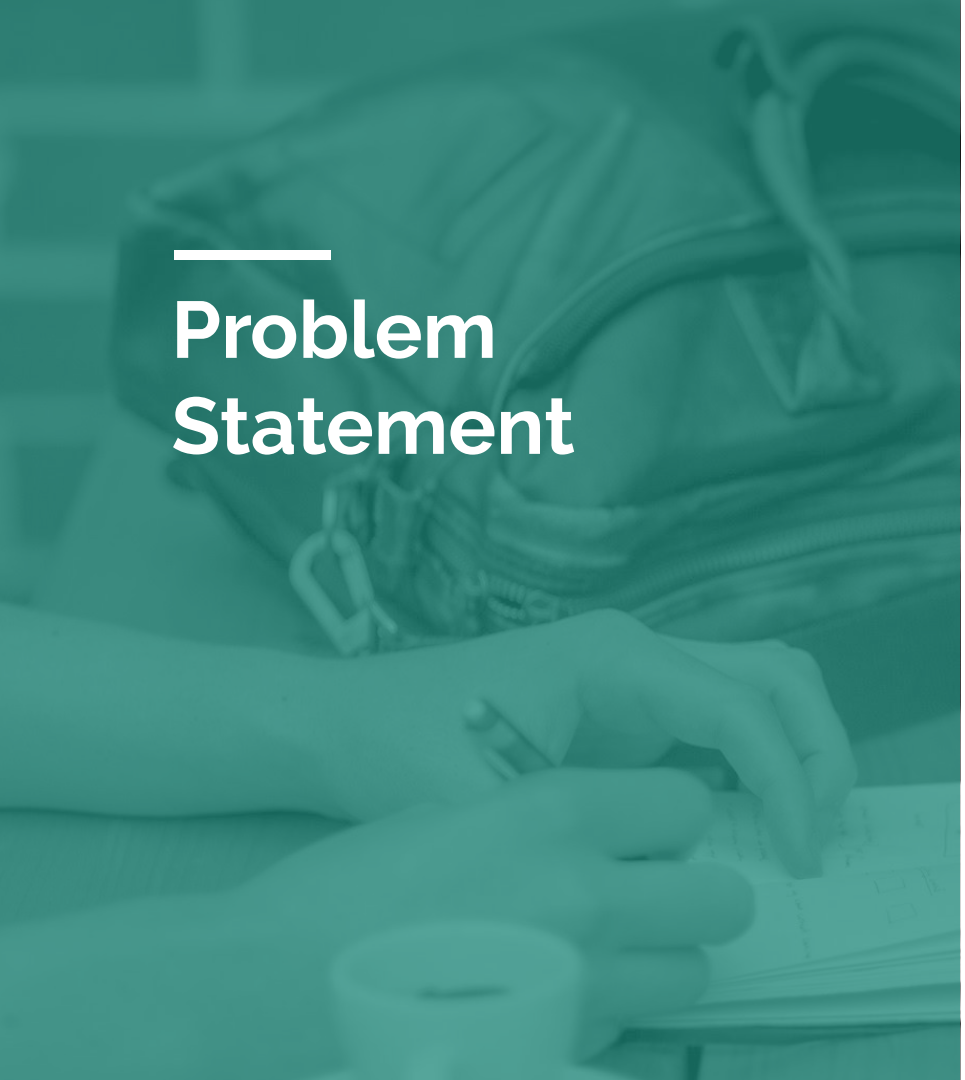


SIH 2020 Idea Proposal

Indoor Navigation System

An efficient peer-to-peer navigation system for Indoor spaces

TOC



Problem Statement

Ministry/ Organization name: Dte of IT & Cyber Security, DRDO

Problem Statement : Lot of navigation apps like Google map are available for navigation but none of them support navigation inside a building by taking into account rooms, corridor and floors. The challenge is to create an app that would show a navigation path in the real world on your mobile device screen.

Team Name : TITANS007

Team Leader Name : Deepak Pandey

College Code : 1-5719293

Our Solution

Our Solution is based on visual positioning system, and floor mapping for indoor navigation. Our solution is unique in the way that it offers an “end-to-end” navigation facility.

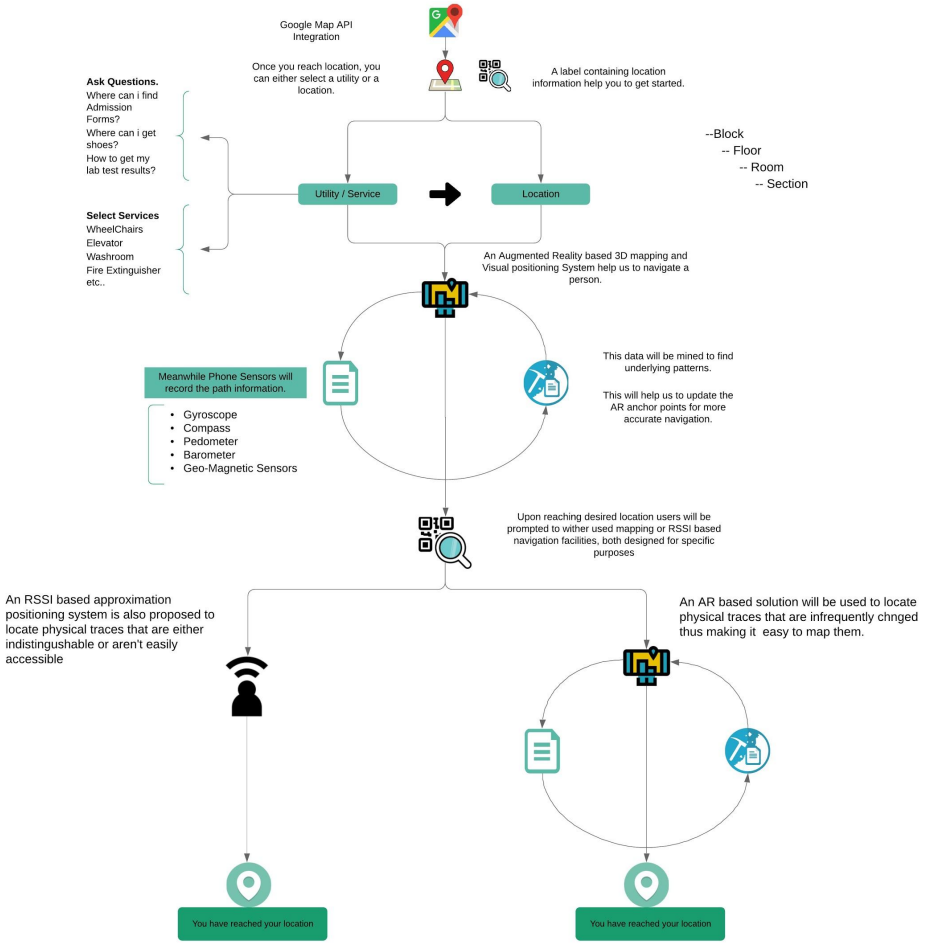
We are using augmented reality to visualize navigation path on top of real world map. A 3D mapping based anchor point setup allows us to achieve cutting edge precision.

Our google maps integration factor allow us to navigate people in outdoor spaces, we are using absolute global position of a building as it’s composite ID to store layout and navigation information. It also serves as a warehouse for all other information related to a building.

This help us to achieve better abstraction and allow us to easily replicate our solution for multiple buildings.

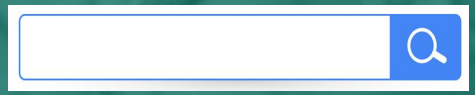
Once users reach outside a building, we can help them to navigate to different location in an already mapped environment. Users can either request to access a services or can simply feed in their desired destination.

Our Solution



Our Solution

Google Maps In-Built API



Location Searching or getting live location

Latitude and Longitude Values of location is used as composite ID to fetch data from server

Back-End Server with all the location/building information (blocks,floors,scanning location,etc)

Data received from server is displayed and used for further navigation

A user can either fill in a location or can simply ask for a service.

Eg.. Where should i get shoes from?
How to get my lab test result?

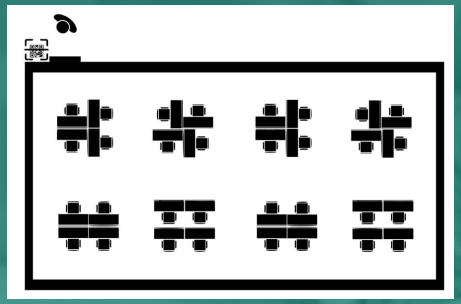
A powerful language processing system at the backend allows us to provide navigation facilities over these queries.

An AR based mapping systems takes over from here, which allow users to visualize navigation routes on real world maps, we have both rendered and mapped floors for smoothing details.

The app simultaneously store path information collected from phone sensor's in the backend, this information will be encapsulated in a warehouse bounded by unique ID of building, thus keeping the information secure.

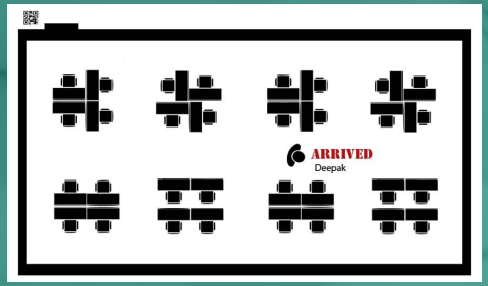
We then extract relevant underlying patterns from this information, which allows us to readjust AR visual markers, thus making more accurate navigation routes.

Our Solution

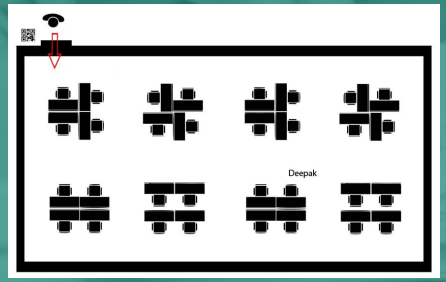


- Scanning for result

- Scan Results



- Reached Destination



- AR Navigation

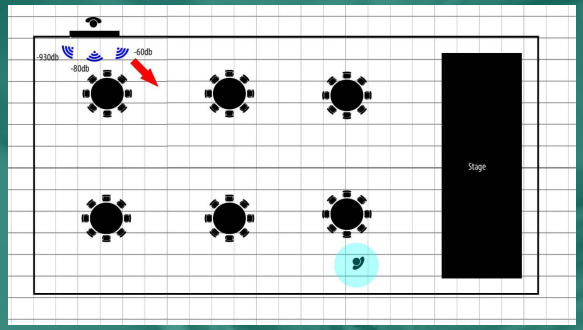
Once user reaches in close proximity of target location for eg. outside a room, we provide them with a optical label which allow them to confirm their location and let them to access additional information. This usually contain room type, sitting patterns, object positioning.

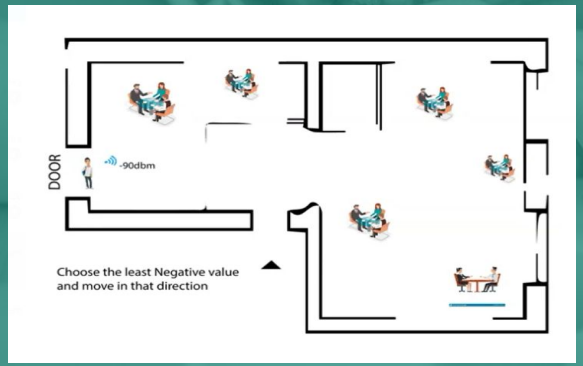
Users are prompted to choose among the options of using either AR navigation or use a more flexible signal strength indication method.

AR navigation system can be used to locate physical traces that are either fixed or are very infrequently moved.
Eg. in a large hall with many cubicles, you can simply choose to navigate to a particular cubicle or desk.

RSSI distance model based method can be used for purpose of inventory or location tracking, it can also provide approximate positioning facilities in densely packed areas.
Eg. Meeting your friend in a large auditorium filled with audience.

Our Solution





- RSSI Distance Model
  Scale:- unit grid=unit step

RSSI distance Model is used for approximate positioning and location tracking purposes.

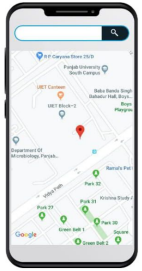
A person can start from a location and can request other person to enable his wifi-hotspot using navigators wifi. This will establish a connection between two persons, the navigator can than manually travel in small directed sectors to trace a person.

A log based distance formula will help us to figure out remaining distance with good accuracy. Multiple iterations of the same can help in easy navigation in areas which are not well labelled.

We are also using magnetometer data to get orientation details, and provide more accuracy over these predictions from RSSI based models. This will help us to better understand the direction as well as distance from a location.

APPLICATION DEMO

1. Integrated Google Maps built-in API



2. Searching location (getting latitude and longitude)

3. Layout of the searched building with scanning points

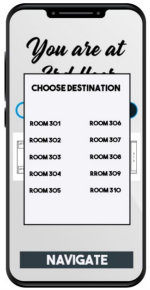
4. Scanning Optical Label at the building

5*. Different utilities of the building

UTILITIES NAVIGATION

5. Fetched data

6. Floor layout for navigation



7. Selection of the destination

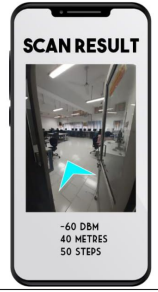
NAVIGATION STARTS

8. Navigating

9. Navigating

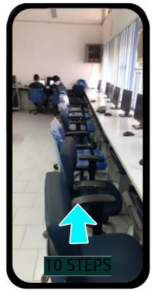
10. Scanning Optical Label with Wi-Fi Navigation functionality

11. Wi-Fi Navigation

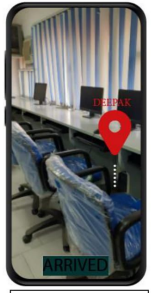


12. Following direction according to the result

11*. Fetched result



12*. Navigating



13*. Navigating

Technology Stack

Firebase

ANDROID

Java

ARCore

unity

Use Cases

An indoor navigation system can be used in indoor spaces where GPS and other positioning systems fails to give any satisfactory results.

Our app can be used to search location over queries, making it easy to navigate.

We will have listed most utilities for newcomers making it easy for them to navigate to essentials, eg. washrooms, office, guest house, coffee shops, wheel chairs, emergency exits etc.

It can be easily expanded to any enclosed environment, eg. University, Hospital, Offices, Houses, Hotels, Malls etc.

Our solution can also help in Inventory and asset tracking, location sharing and can be expanded in other dimensions to provide more personalized services.

Dependencies

Android Phone (SDK 25)
AR cloud Storage
Google Cloud Storage
Google Firebase Analytics
Internet Connection

Phone Sensors:

- Gyroscope
- Magnetometer
- Pedometer
- Accelerometer

Show Stoppers

Our RSSI based positioning system is unique in a sense that it allow us to overcome the challenges of traditional navigation systems, and let's us build more unconventional yet suitable solutions.

All the building data along with it's layout, navigation information and optical label information will be saved on the cloud which will help us build a lighter and faster app. It will also help us to easily replicate the application.

The application will improve with time and can help people to navigate to essentials quickly, our language processing system let's people navigate over queries.

For detailed visualizations and flow diagrams :

https://drive.google.com/open?id=1ROQz6UpXz8MHIMeRLzJwovxQj2uqEn6w

Thank You