Indoor Navigation using QR Code Based on Google Maps for Ios

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Abstract— **Indoor Navigation refers to the navigation within the limited area or a building. This approach is mainly used to navigate from one place to the other place within a building. For Ex: Shopping Malls, Big Organizations etc. In this approach Indoor Navigation is implemented using the Google Maps. The Floor maps of a building need to be uploaded to the Google Maps. User uses his/her iPhone to search find the particular location within a building. The indoor Google Maps works similar to the Google Maps and its navigation. As the user move from one location the position of a navigator within the Indoor map will be updated. User scans the QRCode of a destination. Indoor Maps automatically takes the destination name to search, immediately after scanning the QRCode. The Map shows the route to the specified destination in a dotted line. The position will be updated within the map, as the user moves towards the destination. When the user reaches the destination, the notification will be shown on user iPhone. This helps the users to get the exact location.**

Index terms: **QR code, Floor maps, Indoor Maps.**

I. INTRODUCTION

Conflicting to advances in street/outdoor navigation, wall mounted maps and signs are the main reference indoor navigation in hospitals, malls, museums, etc. the growing demand for location aware systems that filter evidence based on at present-day device location have led to an increase in research and product development in this field. Using Google Maps an attempt is made to provide location of a user in a building using WiFi signal strength on devices.

The advances of smartphone technology in recent years is leading to the uptake of a new class of Internet-Based Indoor Navigation(IIN), Which might soon decreases the need of satellite-based technologies in urban environments. IIN services relay on GPS based due to signal interface caused by an floors, walls, objects and furniture's. Because of these limitations, direction inside unknown buildings is still using large maps posted in building lobbies and in common places. Once the maps located it's capable of locating person and directing people to their correct destination. System that use cellular communication signals approach will only identify nearby WiFi access points, that do not provide an sufficient correctness to differentiate individual rooms and buildings. Approaches which make use of WiFi access points needs large collection of data and data calibrations. Data which lies on the place of WiFi access points and voice in the building is making used to model without a time wasting measurement requirement for WiFi fingerprint data.

Variety of reference signals which already exists; Bluetooth [1], Ultra-Wideband [2], and Radio Frequency [3] are the most similar. The WiFi access point fingerprinting approach is not more suitable due to unsupported to the installation of additional transmitting devices. It only makes use of already existing access points [4]. It's concluded that all of the above techniques achieved indoor navigation system but they present an compatibility and implementation problems.

This paper is divided into VI sections in which, section I provides introduction about indoor navigation, section II provides literature survey of indoor navigation used in different approaches, section III gives detailed information about proposed system by using QR code and google maps approaches, section IV gives information about modules used in proposed system, section V gives conclusion and section VI gives references used for research work.

II. LITERATURE SURVEY

The Bluetooth devices, RFID, Satellite based devices etc are used in most of the application. In these approaches, according to the requirement user has to set the devices. User must take care of the distance maintained between the devices.

The navigation is based on the range of the signals or waves between two devices. The system searches and shows the route on the user iPhone When the user enters the destination.

- If the Bluetooth, RFID or other devices are used, it leads to more cost. The system will not be cost effective.
- If a single device fails, it affects the whole Indoor Navigation System.
- User should take care of the devices. The devices may fail any time. Overhead of checking the functionality of devices.
- Device ID should be added to the code each time when the new device is added to the Indoor Navigation System. Table 1 will depicts the difference of existing system results.

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TABLE 1.

Comparison done in existing technologies.

Existing Approaches	Advantages	Problems
GPS	-Moderate high outdoor correctness -High availability	-Low to minimal indoor accuracy
A-GPS	-Moderate to outdoor accuracy	-Minimal indoor accuracy
Pseudolite GPS	-High indoor and outdoor accuracy	-Very expensive equipment
Cell tower	-Long range	-Highly inaccurate For both indoor and outdoor navigation
Wi-Fi	-Readily available throughout most building -Minimal cost for implementation -Medium range	-Network strength May vary due to multiple propagation
Bluetooth	-Low power -Low financial cost	-High cost of implementation Moderate to low range
Infrared	-Moderate to high accuracy	-High cost of implementation Sun light can Affect outcome Low range

III. PROPOSED SYSTEM

Proposed approach helps to find the exact location within a building. User uploads the map of a building to the Google Maps and specifies the different places within the building. User scans the QRCode of destination; the Google Maps takes the result of scanned QRCode. User needs to zoom the Google Maps until he gets the building map. Once he gets the whole building map, the route to the destination will be displayed in the form of dotted line. By following the route the exact place can be reached and user gets the message for completing his navigation once he reaches the destination.

- Scanning QRCode reduces the overhead of entering destination name.
- Google Maps takes the QRCode scanning result automatically once the destination QRCode is scanned.
- Cost effective method to implement indoor navigation.
- As most of the mobiles support GPS, it is an easy way.
- It works even in present of WiFi.
- No other devices required than user's mobile phone.
- If the device fails to fetch the location, indoor navigation system will not be affected.
- No need of monitoring the device and network again and again.

Data-point shown below easily available on any cell phone, after this you need fine tuning algorithms and a database that houses the data.

How does Google Maps work: A combination of the following

- GPS
- Triangulation of Wi-Fi Signals (even those that you are not connected to)
- Triangulation of Cellular Signals

A. GPS

The GPS conception is built on top of the location of specific time and specific satellites. The satellites will carry static and exact clocks that are associated with ground clocks. Similarly, accuracy of the satellites is known. A GPS receiver observers multi satellites at a time and resolves equations to regulate the correct position of the receiver and its deviancy from factual time. At least, four satellites need to be in view of the receiver for it to calculate four unidentified quantities that is three spot coordinates and clock deviance from satellite time.

Signal is distributed by an every GPS satellite (also with modulation of carrier wave) that embraces:

- The order of once and zeros of pseudorandom code is known to the receiver.
- A message or data will be containing satellite location at that time as well as Time Of Transmission (TOT) of code Epoch.

B. Triangulation of WiFi Signals:

Due to numerous causes which having multiple paths and signal blockage indoors, WiPS/WFPS or WiFi Positioning System is used. Such approaches will be having indoor positioning systems. In 21st century WiFi positioning will takes advantage of fast growth in town areas of wireless access points.

To positioning along with wireless access point the well-known localization procedure is used and built on verifying the strength of received signal (Received Signal Strength Indication Or RSSI) [5] and the method of "fingerprinting" to geo-locate the wireless access point and WiFi hotspot classic constraints are useful, MAC and SSID address of the access points is included in the wireless access points. The amount of positions that are entered into the record will gives the accuracy.

C. Triangulation of Cellular Signals:

Triangulation of cellular signals also acknowledged as reception acknowledged from a cellular network by a mobile

phone. Subjected on innumerable aspects, such as closenessto a tower, any impediments such as buildings or trees, etc., this signal power will fluctuate. Maximum mobile devices make use a set of bars of growing height to demonstrate the approximate power of this received signal to the mobile phone handler.

Conventionally five bars are used. In general, in urban area strong mobile phone signal is additionally liked, some dead zones also exists in these areas where no response is attains. For multipath response cellular signals [6] are planned to be unaffected.

In most of the highways many mobile phone suppliers are making an attempt to structure towers, to overcome network problem in many rural or lightly inhabited zones. Places which are away from urban regions now have cell phone reception for example some nationwide parks as well as other widespread tourist termini.

Triangulation:

Recognized propagation damages and signals power which is exist in the environment can be directly transformed to distance [7]. The signal power varies with inverse of square of distance from transmitter to the receiver in free space. Aspects such as antenna advances and interference from the substances in signal route must be accounted far too precisely convert to distance in an actual settings. Implementation is also easy. The below Fig 1 shows the structure of triangulation.

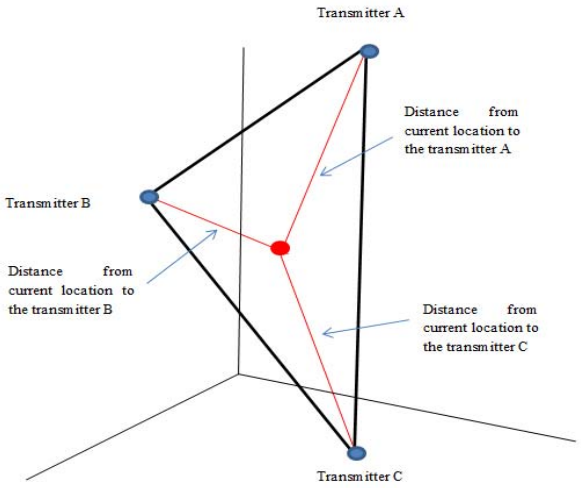

Fig. 1. Triangulation

IV. METHODOLOGY

Proposed approach has the fallowing methods

A. Current location to the organization/institute.
B. Generate QR code.
C. Scan QR code.
D. Upload map.
E. Update route.

A. Current location to the organization /institute:

Using GPS any user can come to the location here he wants to go, now a days every one use cellphones that will be having all futures like GPS, Bluetooth, watches etc. other than cell phone also GPS system can be used, in this approach mainly concentrating on cell phones (apple device). This is very simple because this facility is already available in the market.

B. Generate QR code:

QR code is the symbol for a category of matrix barcode or two dimensional barcode. QR code is abbreviated from quick response code**.** QR code can be scanned by imaging devices such as a camera, and handled using Reed–Solomon error alteration until the images can be applicably interpreted. The mandatory data are then mined from pattems that are exists in both of the horizontal and vertical modules of the image.

QR code administration platform QR-Server allows using dynamic QR codes. Their basic feature is that the stored QR code endpoint address (URL) can be reformed at any time and as often as needed e.g. marketing substantial has already been published. Adjust advertising operations at any time or correct errors (for example if an incorrect website address was used). Fig 2 shown below is the QR-maps system model.

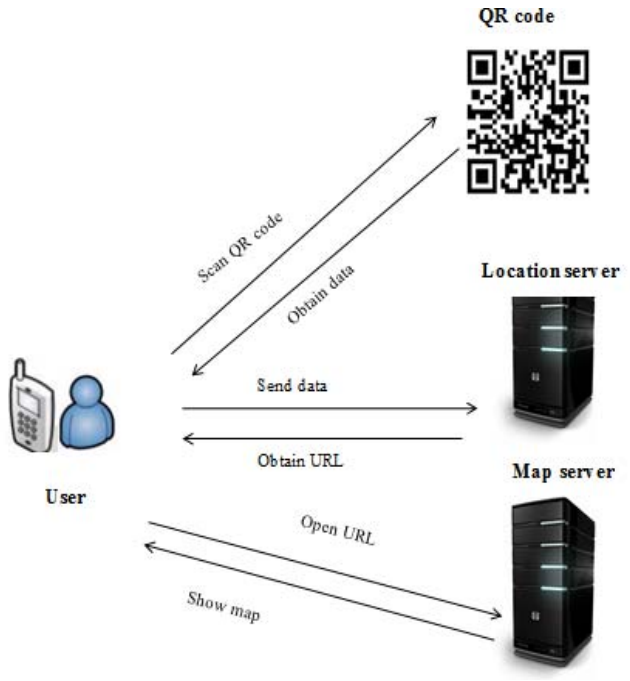

Fig. 2. QR-Maps systemmodel

Various QR code generating applications accessible in market, only thing user should have clear content to generate QR code. In this approach QR code is generated for individual locations available inside the building with adding real time image in it, it helps user to identify location easily.

C. Scan QR code:

Once QR code ready for any of location it can be scan anywhere anytime through camera. QR code may contain URL, text, any image, website exc. User can select destination in the application.

D. Upload map:

Users can see and navigate inside places like airports, department stores, and malls using the Google Maps app. Before using indoor navigation floor maps should be upload to the Google Maps.

Procedure to upload maps in to the Google Maps is given below.

iphone

To find for an indoor map, follow the stages below.

Open Google Maps app in the devise.

1. Search for a location that has Indoor Maps.
2. Zoom in to the map until unless see a floor plan.
3. In the bottom left, select between levels and floors.

Tip: To study more about a location in the building, touch the location on the map.

Search Indoor Maps

Make sure user fully zoomed in to a building with an indoor map to search an indoor navigation. Remaining things are done same as Google Maps.

Upload a floor plan to the Google Maps

User can add a floor plan to the Google Maps using their own computer. Follow the steps below to add a floor plan,

Have a note that it should hold the following conditions:

- Can only upload a floor plan in a country that has Indoor Maps.
- Can only upload a floor plan from own computer.

Step 1: Guidelines

Google uses uploaded floor plans as well other information to map inside layouts of buildings and assist people navigate indoors. If content is used, Google assets the right to correct, edit or make it own based off it without any ascription to user or any other source.

When uploading, follow the guidelines below. **Note**: These guidelines might change from time to time.

Prohibited content

- **Non-public buildings**: This contains private residences or protected buildings that require authorization for entry.
- **National defense content**: This contains content accompanying with national protection or government safety.
- **Secret content**: This contains any trade or government secrets.
- **Image of people**: This includes some identifiable person.
- **Trademarked content**: This comprises tags on floor plans that incorrectly imply endorsement or funding by the relevant symbol holder. It also contains trademarked logos or similar ornamental elements.
- **Copyrighted content**: This comprises alleged copyright content. Google retorts to clear warnings of alleged copyright infringement.
- **Illegal content**: This comprises content that interrupts any applicable law, instruction, or rule including owner commands, notices, or dispatched signage.
- **Inappropriate content**: This includes defamatory statements obscenities, pornography, hate speech, and intimidations of violence. Google assets the right to eliminate inappropriate non-factual contented and content that troubles our system including malware, spam, viruses, or other damaging code.

Step 2: To upload a floor plan

Using own computer upload a floor plan of a public location, follow the steps below.

- Make guaranteed the floor plan is saved as .JPG, .PNG, .PDF or .GIF.
- First open web browser then go to maps.Google.com/floorplansfind.
- Enter address or location of the building.
- Bring point to center of the building.
- Click on **Use this building**.
- Enter information about floor plan, like the floor tags, name of the building, and the number of floors in the building.
- Click on Upload map for this floor by selecting an image that want to be use.
- Step 3: Line up floor plan with satellite images

Fallow the steps mentioned below to line up floor plan with satellite images.

1. Rotate, resize and move the floor plan until unless it lines up with the footprint of building.
2. Click **Save Alignment**.

Step 4: Submit floor map

To submit floor plan, click on **Submit** for processing.

Once the floor plan is uploaded then it will be reviewed. After the approval from the google, it will be available to anybody who are using Google Maps.

E. Update route:

Geo-spatial positioning is provided by satellite navigation schemes along with global coverage. Together with the US NAVSTAR Global Positioning System (GPS) and The European Union's Galileo and the Russian GLONASS [8], number of global navigation satellite systems committed to civil positioning. This helps to update the route at each step of

user. Fig 3 shows the system architecture of the proposed system.

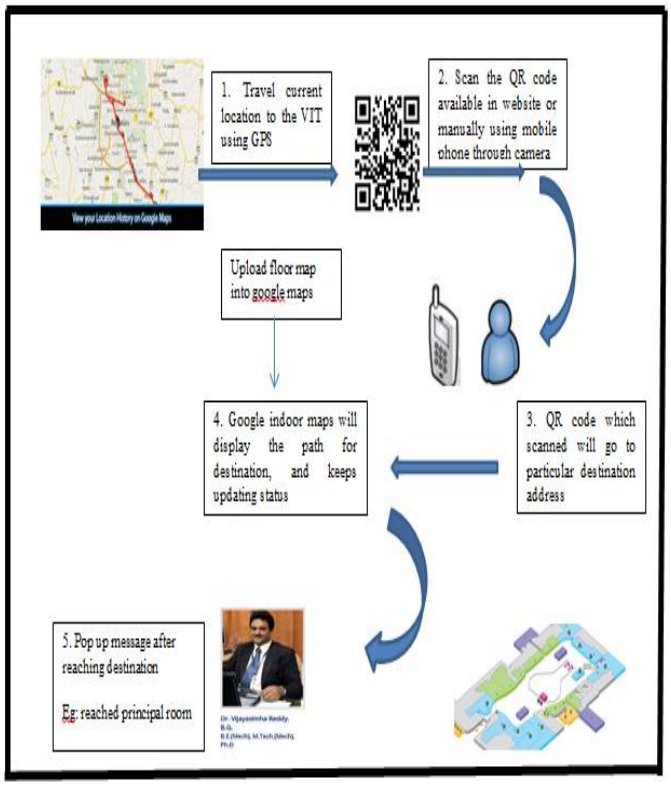

Fig. 3. System Architecture

The receiver can regulate latitude, altitude and longitude to extraordinary degree of correctness is because of satellite system. For functioning of these systems Line Of Sight is necessary. To overcome the LOS constraint of GPS methods have been established by setting up pseudolite system by transforming GPS-like improvement signals to receiver inside the floor.

To guide a GPS mobile user in an indoor environment proposed system uses pseudolite. The pseudolite use an inverse carrier stage variance GPS to calculates the mobile users location and also have a static position.

Algorithm used:

There isn't a basis that would openly say which Algorithm Google used for Google Maps. It is assumed in various cases that it used Dijkstra's shortest path process. Dijkstra's algorithm is an algorithm which consists of set of rules for result the shortest path way among modules in a graph, which can symbolize, example, road systems.

It was considered by Edsger W. Dijkstra computer scientist in 1956 and issued three years later. The procedure used is as follows:

The function Dijkstra mainly consists of Graph and source

Firstly, vertex set Q is created

In graph, for each vertex v is initialized

An unidentified distance from source is estimated that is infinity to vertex v called as dist[v]

An undefined path from source node called as prev[v] is optimal

Initially all nodes in vertex set Q is unvisited hence start adding v to vertex set Q

The distance from source node source node is 0

whilethe vertex set Q is not an empty set

Firstly a node with minimum distance will be chosen which designated as u

Now, remove u from the vertex set Q

Consider v is still present in vertex set Q, for each particular neighbor v of u

distance of u is added with the length(u, v) is symbolized as alt

A shorter path to v is established by using the condition alt<dist[v]

Now alt is initialized to distance of v

And u is initialized to previous node of v

Finally return the values of dist[ ] and prev[]

In case users are only worried in a shortest path way among vertices starting point and destination, at u = target we can dismiss the exploration. By reverse iteration, we can recite the shortest path from starting point to destination

1 S ← empty sequence

2 u ← target

3 whileprev[u] is defined: // Construct the shortest path with a stack S

4 insert u at the beginning of S // Push the vertex onto the stack

5 u ← prev[u] // Traverse from target to source

6 insert u at the beginning of S // Push the source onto the stack

Algorithm which mentioned above will helps to find shortest path from source to destination. The Fig 3 shows the flow of a system. Flow of a system is showed in all possible ways and if any failures how to retry the system.

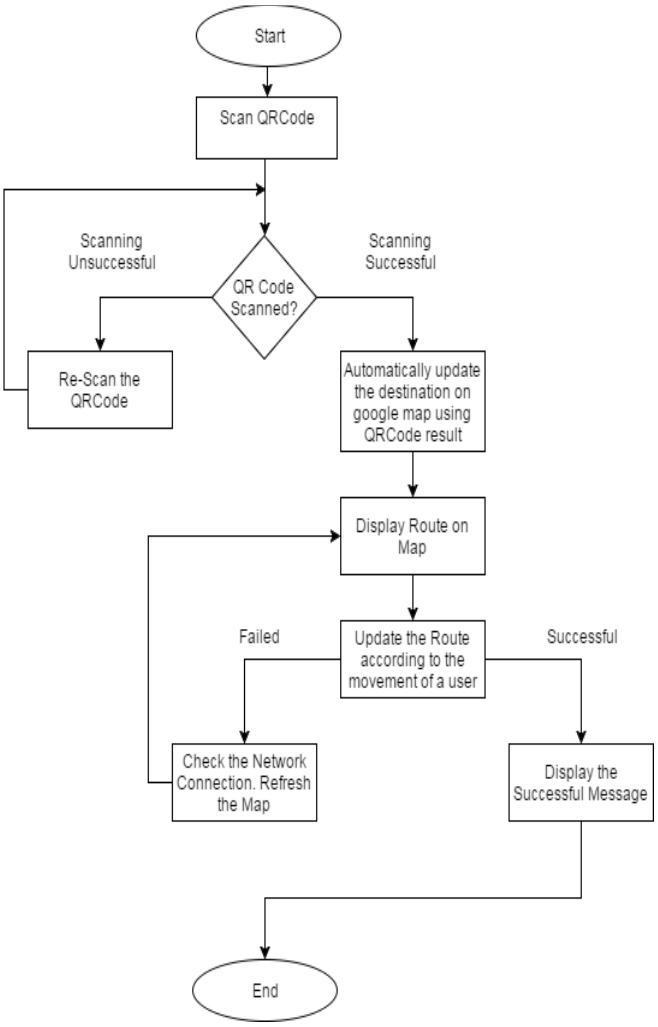

Fig. 4. Flow of proposed approach

CONCLUSION

The proposed system helps to find way in indoors without using additional extra sensor devices by using Google Indoor Maps and QR code. Because QR code is very user friendly system makes easier to use by common people. This system makes easier to find places inside any big buildings or organizations.

REFERENCES

[1]. Sagar V. Ramani, Yagnik N. Tank. Lecturer (Computer Engg .Department). "Indoor Navigation on Google Maps and Indoor Localization Using RSS Fingerprinting", http://www.ijettjournal.org *International Journal of Engineering Trends and Technology (IJETT)* – Volume 11 Number 4, Page 171, - May 2014.

[2]. Francisco J. González-Castaño1, David Conde-Lagoa1, Ana Belén Barragáns-Martínez2, "QR-Maps: an Efficient Tool for Indoor User Location Based on QR-Codes and Google MapsEnrique Costa-Montenegro1", *IEEE* 2011.

[3]. http://www.cs.ucy.ac.cy/~dzeina/papers/ ic16 - iin.pdf.

[4]. Sinan Gezici et al , "Localization via ultra-wideband radios: a look at positioning aspects for future sensor networks,", *IEEE in Signal Processing Magazine*, vol. 22, no. 4, pp. 70-84, 2005.

[5]. Paramvir Bahl and Venkata N. Padmanabhan, "RADAR: an In-building RF-based User Location and Tracking System", *in Joint Conference of the IEEE Computer and Communications Societies,* vol. 2, pp. 775-784, 2000.

[6]. https://arxiv.org/ftp/arxiv/papers pdf.

[7]. https://support.Google.com / maps / answer / 28037 4? co=GENIE.Platform %3DDesktop &hl=en.

[8]. https://www.infsoft.com / portals /0 /images /solutions /basics/ whitepaper /en - indoor - navigation - indoor – positioning – infsoft - ebook.pdf.