# Indoor Guidance for Public Buildings using Android Smartphones

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**Abstract**

*This paper describes an android application for indoor map guidance system that guides visitors inside the public buildings ( colleges, schools, shopping malls etc).It utilizes Bluetooth technology which is at lowest cost. We propose a new approach that uses Bluetooth module to determine the location of person inside the building. So for this we are using routing algorithm (Dijkstra's algorithm) to find the shortest path from user's location to destination. By using Bluetooth, sufficient accuracy can be achieved in indoor navigation. We are using Bluetooth technology because GPS does not provide sufficient range inside buildings. This application consists of two modules: a) Desktop Module & b) Mobile Module. This system is open source and freely available.*

***Index Terms:*** *NFC, GPS, IOS, QR, RFID.*

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## 1. EXISTING SYSTEM

Fastmall is an application for indoor map guidance inside shopping malls. This application supports android and IOS platforms. This application can be operated offline. But user has to pay in order to download indoor maps.

Micello is another indoor map guidance application for android and IOS platforms. The users of Micello application needs to manually select the start point and end point from the map and then the path will be generated. However the proposed application utilizes Bluetooth technology for finding the current location.

## 2. RELATED WORK

This system uses Bluetooth technology for indoor map guidance in order to locate the users inside the building. The developed application is able to find the shortest path to selected destination by using NFC technology and QR code. To work properly the developed application require android smart phone that have NFC reading capability and/or with the use of its built in camera. On the other hand, the proposed system requires Bluetooth enable android phones.

We can use this proposed system for any premises without changing the code. We just need to upload the map of any premises and we need to click on the create app button. So after clicking it the new android app gets created. We just need to upload this application into our android mobile.

## 3. INTRODUCTION

As we all know, with the advancement in technology and infrastructural facilities, it has become difficult for a person to remember all the paths and ways in particular premises. Although, there are helpdesks available in some places, many a times they are placed at such places which is either not known to the public or is so complicated or vast that it becomes difficult to recall almost every destination we need to travel. Also, the available helpdesks or indicators never provide us the exact location of our desired place.

To overcome such flaws, we provide an alternative for people where they need not memorize or remember the path to their destination at every instant, rather they would be able to crosscheck or verify their relative position anywhere and everywhere inside the premises and move ahead accordingly just by merely using their android phones. While implementing this, there are a number of ways which can be used to fulfil this requirement such as by using NFC, RFID, and Bluetooth. Let us have a briefing over a few of these:

### 3.1 NFC (Near Field Communication)

At its core, all NFC is doing is identifying us. The technology is simple, but it's a short-range, low power wireless link that can transfer small amounts of data between two devices held a few centimeters from each other. This distance could be within a range of 10cm which is very less comparatively. Every time the user needs to find his location inside the campus, he/she will have to manually place their phones near the NFC tags. Also, there needs to be NFC chip inbuilt in the user's Smartphone.

### 3.2 Bluetooth

An alternative for all above technologies is the use of Bluetooth. In this we develop an indoor navigation system on a Bluetooth-enabled smart phone. We propose the development of a new approach that uses data from the device's Bluetooth module to determine user position. A routing algorithm (DIJKSTRA, etc.) calculates the optimal path from user position to destination. Sufficient accuracy for navigation can be achieved at low costs. This technique shows promise for future handheld indoor navigation systems that can be used in malls, museums, hospitals, and college campuses

## 4. SYSTEM ARCHITECTURE

The project is divided into several parts.

4.1 Desktop Module

4.2 Mobile Module

### 4.1 Desktop Module:

The desktop module that will be used by administrator to do the following:

- Set map information
- Save/Load map information to/from files
- Set Bluetooth device information
- Set paths
- Find optimum paths
- Auto compiles mobile application.
- Upload mobile application to dedicated website for public download access.

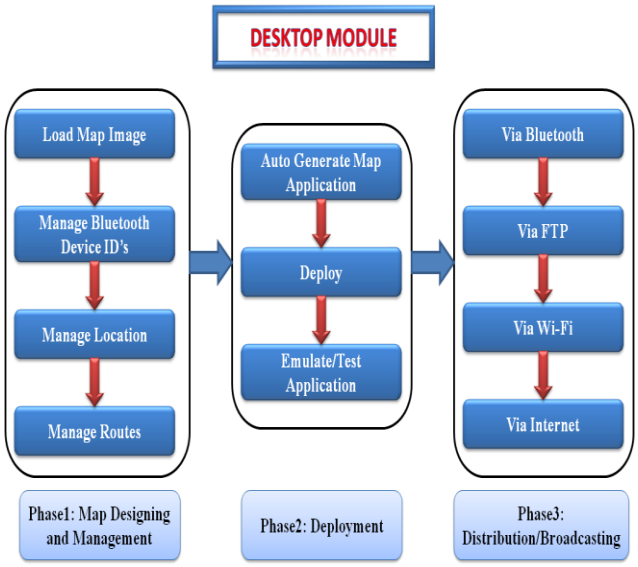


Fig-1: Desktop module

#### 4.1.1 Dijkstra's Algorithm:

'S' is a set of Bluetooth Devices, discovered Bluetooth devices, locations, routes, Dijkstra's shortest Path.

$S=\{B,B',L,R,D_{sp}\}$

Where, $B=\{b1,b2,\ldots..bn\}$ Set of Bluetooth devices.

$B'=\{b'1,b'2\ldots.b'n\}$ Set of discovered devices.

$B' \varepsilon B$

$L=\{l1,l2,\ldots..ln\}$ Set of locations (set of vertices)

$L_{sp}$ =Location start point

$L_{ep}$ =Location end point

$L_{sp}, L_{ep} \varepsilon L$

$R=\{r1,r2,\ldots.rn\}$ Set of routes (set of edges)

$D_{sp} = SP\{L,R\}$

Where $L_{sp}=l_{sp1}',l_{sp2}',\ldots..l_{spn}'$

$L_{sp} \varepsilon L$

Example:

The person has to go from the location L1 to L4

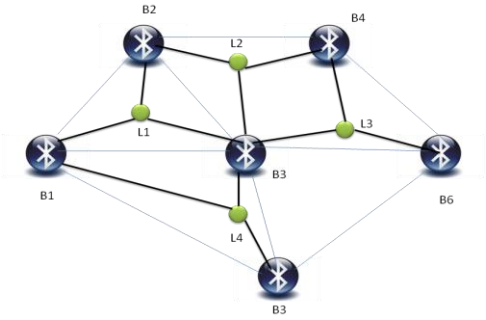


Fig-2: Dijkstra's implementation

Then the shortest path to reach L4 from L1 by using Dijkstra's algorithm is:

1. User selects his source as L1.
2. Also select destination as L4.
3. All distances from L1 to L4 are calculated.
4. The shortest possible distance from all the calculated ones is selected
5. All the paths from L1 to L4 are shown along with the shortest path as shown in figure (shortest path is shown with red line).

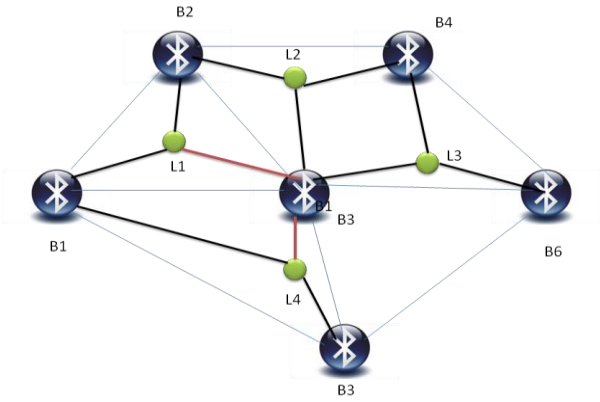


Fig-3: Dijkstra's implementation

The shortest path is L1-B3-L4

### 4.1.2 Why Bluetooth:

These are ultra low cost Bluetooth devices that will be setup in premises at regular intervals. These devices will transmit their Device-ID to all Bluetooth devices in range. This is the only purpose these devices shall serve. These devices can also simultaneously be used for other purposes without affecting the navigation system at all.

### 4.2 Mobile Module:

The mobile application that can be downloaded from internet by any user on a smart phone will show the user overall map of the premise. Apart from this the application will allow the user to

- See his current location
- Select source point
- Select destination point
- Show all paths from source to destination
- Show optimum path from source to destination

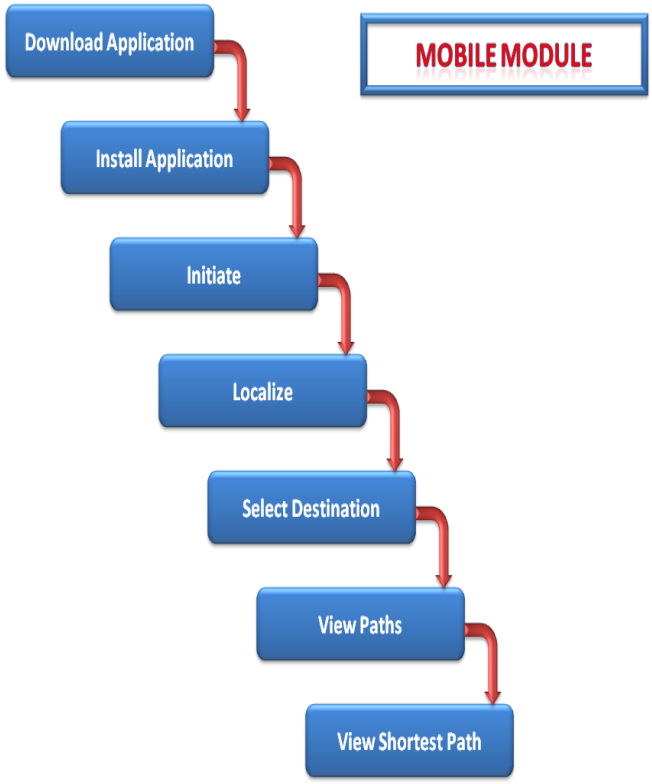


Fig-4: Architecture of Mobile Module

## 5. CONCLUSION

This project has detailed the designing of an Indoor Map Guidance system via the use of portable mobile devices, with its application set on a smart indoor campus environment. It is

a mobile application for Android platform with Bluetooth that allows the user to readily localize and view the map of the building on their Smartphone's.

The proposed system is also able to assist and guide visitors within any public buildings such as shopping malls, airports, hospital, museums, exhibition centers, schools and colleges.

It utilizes modern technology such as Bluetooth. Bluetooth is platform independent and has high degree of standardization. It is widespread supported, has low cost and low power consumption. Also, the Bluetooth devices that we use have low interference with devices that work on same frequency range.

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## 7. BIOGRAPHIES

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