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A Survey- Qr Code Based Navigation System for Closed Building Using Smart Phones

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Abstract - Smart phone is essential part of our day-to-day life. The main feature of Smart phone is mobility in other words move from one place to other place i.e. navigation. Many of the Smart phones having navigation application or Map application inside it. Navigation systems are one of the more common location-aware services, and many people use them on a daily basis. Providing location information through a user-friendly interface is crucial in a navigation system, as is the accurate determination of user locations and target locations. These Map application provide correct navigation for outdoor location using GPS. But provide a correct navigation inside a closed building is still challenge. Some solutions are available in the market like Bluetooth, Wi-Fi and AGPS but their reliability is still challenge. This Survey paper gives cost effective & 3D Smart phone solution for indoor navigation system by using QR (Quick Response Codes) codes. Smart phone will use these QR codes to provide accurate indoor navigation for the user.

Keywords- GPS, indoor maps, indoor navigation, navigation using QR code, QR (Quick Response Codes)codes, closed building navigation

I. INTRODUCTION

Mobile with advanced features such as smart phones, a wide range of mobile services have become available to users. Some of these services provide geolocation, which is the identification of the real-world geographic location of an object with the help of different technologies. Most of the applications are successful in providing the user with his current location and providing directions to particular destination for outdoor locations. In most of the scenarios this is achieved using the GPS system of the Smartphone. But accurate navigation in side closed building with GPS satellites is still a challenge. There is a limitation for smart phones to locate their exact position while in covered areas such as, buildings, apartments, airports, railway stations, shopping malls multi storied buildings. There are indoor navigation systems available in the market which uses Bluetooth, Wi-Fi, AGPS or RFID. In the area of Bluetooth applications requires expensive receivers. Also the accuracy of Bluetooth navigation depends upon the number of cells used. Wi-Fi also requires expensive access points for indoor navigation system. AGPS having network assistance servers for indoor navigation. Using AGPS technique, accuracy is very much limited due to approximation. Both active and passive RFID technology use for this, which supports automatic positioning of mobile devices in closed building. RFID requires active tags for indoor navigation, here the accuracy is directly proportional to the number of active tags used in that system. Active tags are self powered so those are costly. Also close pass by is required to sense RFIDs. The user needs to be aware of the RFID position. So, Most of the existing solutions are not providing an accurate and cost effective indoor navigation.

II. RELATED WORKS

Indoor navigation system using QR code is a very useful and important technique. By using it we can easily visit the buildings, apartments, airports, railway stations, shopping malls ,multi storied buildings. Wide range of technologies is used by various authors for this navigation.

A. Indoor Location Sensing Using Active RFID

L. M. Ni, Y. Liu, Y. C. Lau, A. P. Patil [1] in 2004 present paper on indoor location sensing using Active RFID. A

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number of wireless technologies have been used for indoor location sensing**.** In this paper here present landmark, a location sensing prototype system that uses Radio Frequency Identification (RFID) technology for locating objects inside buildings. The major advantage of landmark is that it improves the overall accuracy of locating objects by utilizing the concept of reference tags. Based on experimental analysis, demonstrate that active RFID is a viable and cost-effective candidate for indoor location sensing. Although active RFID is not designed for accurate indoor location sensing. A detection range of 150 feet does not provide needed accuracy for many practical applications. However, there are three problems that RFID vendors have to overcome in order to compete in a growing market. The first problem is that none of the currently available RFID products provides the signal strength of tag directly. Instead, the reader reports detectable or not detectable in a given range. The second problem is the long latency between a tracking tag being physically placed to its location being computed by the location server. The third problem is the variation of the behavior of tags. When employing this approach, the basic assumption is that all tags have roughly the same signal strength in emitting the RF signal.

B. Technology Such as GPS

In 2009 [2] Yanying Gu, Anthony Lo gives details of wireless network Global positioning system is most widely used satellite-based positioning system, which offers maximum coverage. GPS capability can be added to various devices by adding GPS cards and accessories in these devices, which enable location-based services, such as navigation, tourism, etc. However GPS can not be deployed for indoor use, because line-of-sight transmission between receivers and satellites is not possible in an indoor environment. Comparing with outdoor, indoor environments are more complex. There are various obstacles, for example, walls, equipment, human beings, influencing the propagation of electromagnetic waves, which lead to multi-path effects. Some interference and noise sources from other wired and wireless networks degrade the accuracy of positioning. The building geometry, the mobility of people and the atmospheric conditions result in multi-path and environmental effects.

C. Bluetooth

Bluetooth is a most promising technology designed for the wireless personal area network. In the area of bluetooth applications, the work where the authors F. J. Gonzalez-Castano, and J. Garcia-Reinoso [3] in 2002 gives a Bluetooth Location Network (BLN) for location-aware or context-driven mobile networks and evaluate the performance. As bluetooth like RFID, is not designed for location sensing, it also has some inherent problems. Bluetooth requires expensive receivers and the accuracy of bluetooth navigation depends upon the number of cells used.

D. Other Devices

Wi-Fi also require expensive access points for indoor navigation. The Wi-Fi wireless internet access. In cafes, college campuses, airports, hotels, and homes has generated particular interest in indoor positioning systems that utilize physical attributes of Wi-Fi signals. Typical applications include tracking equipment and personnel in hospitals, providing location specific information [4]. In a standard Wi-Fi setup, one or more access points serve end-users. In what follows we focus on networks with multiple access points (typical of networks in buildings or large public spaces). Wi-Fi location estimation can employ one or more of several physical attributes of the medium. In AGPS technique, accuracy is very much limited because of approximation. In addition, Wireless Location Area Networks (WLANs) have been frequently used as indoor positioning system.

E. QR Based System

1) *QR-Code*: A small label usually placed on a wall containing the name of a map. QR codes are two dimensional codes where the data is encoded in an optically readable format.

2) *Smartphone*: An advanced mobile phone capable of decoding QR-Codes, with a connection to the Internet.

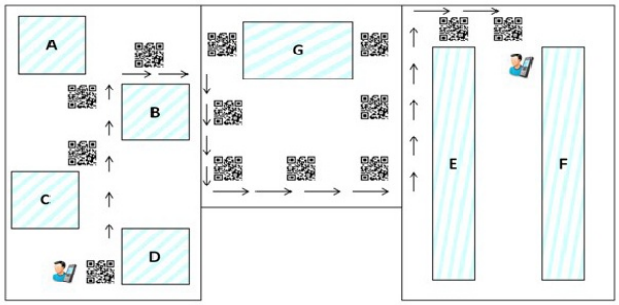

Fig. 1 Sample Floor with QR codes placed

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To provide correct navigation to the user, the indoor location plan should be made available to the user. A floor plan needs to be created for the indoor location. Figure 1 depicts a sample floor plan, where areas A to F denote important places in the floor. These areas could represent shop, escalator, lift, washroom, entrance/exit areas and so on. Once floor plan is created, the floor plan is made available for the user through a URL link. Each floor should have the corresponding floor plan. This could be made accessible using any of the wireless technologies. Once the map is made accessible wirelessly, the URL of the floor plan is encoded into the QR code .

QR codes aid the user for indoor navigation. QR codes can be placed all along the pathway which provide the user accurate navigation. The navigation application in the mobile uses the camera to read frames.

QR code(X, a) = URL for floor plan(X) + Location Details(a); here Location Details (a) = Latitude, Longitude & Altitude of the geographical point a.

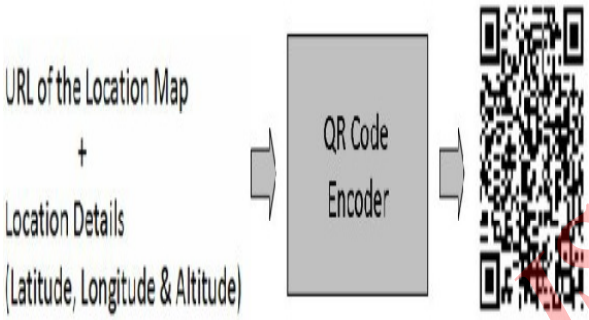

Fig. 2 QR code contents

For indoor navigation QR codes are used for two purposes.

- To Provide the user link to the map of the indoor location.
- To Provide the location details to the user.

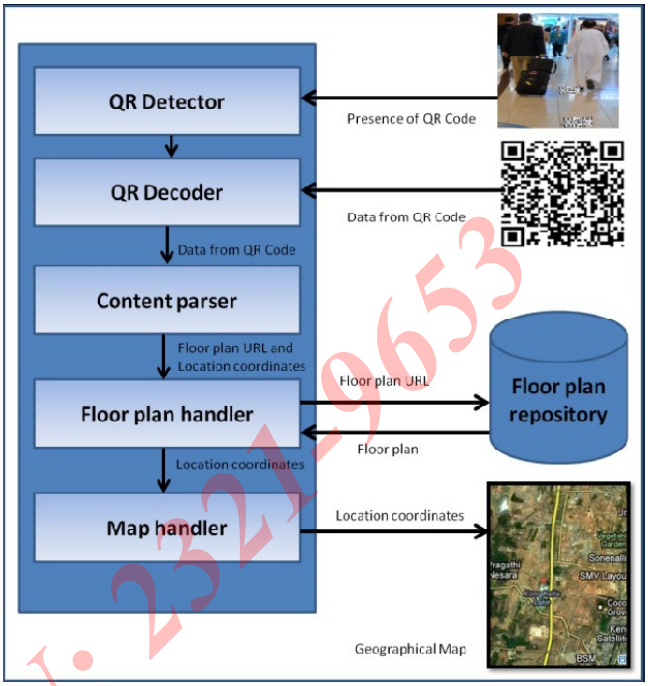

Fig. 3 Smart Phone Application components

Figure 3 depicts details about the mobile application components. QR detector processes the visual frames and checks for the presence of a QR code. Once a QR code is detected then QR Detector forwards the QR code to QR Decoder. QR Decoder component decodes the QR code and obtains the code contents. This content is being accepted by content parser module and parses to find out floor plan URL and location details. Floor plan handler module uses the URL to download the floor plan and its location coordinates from the floor plan repository. Once the floor plan is downloaded, plan handler overlays the plan on top of the geographical map using the location coordinates. A final step the location details from the QR code is used to provide the user his/her current location.

3) User Scenario:

User- The user walks along the floor with smart phone application active inside a closed building.

Navigation Application- The application uses the camera sensor to process the current visuals inside the indoor location. This is performed to check the existence of a QR code in the current frame. Once application finds a valid QR code, the application checks whether the floor plan is already present in

the mobile phone. If the floor plan is not present then floor plan with corresponding location coordinates is downloaded in mobile.

TABLE I

COMPARISION OF DIFFERENT APPROACHES

Technique	Accuracy	Maintenance cost	Infrastructure Cost
AGPS	Less	High	High
Bluetooth	Medium	Medium	High
RFID	Medium	High	High
Smartphone and QR code	High	Low	Low

III. CONCLUSIONS

QR code based navigation system for closed building is a best way for indoor navigation. This system is User friendly and accurate. To provide proper navigation to the user, the indoor location plan should be made available to the user. This simple tool employs QR-Codes to obtain the current position of the user. It also helps to find points of interest, and shows users how to reach them within the map.

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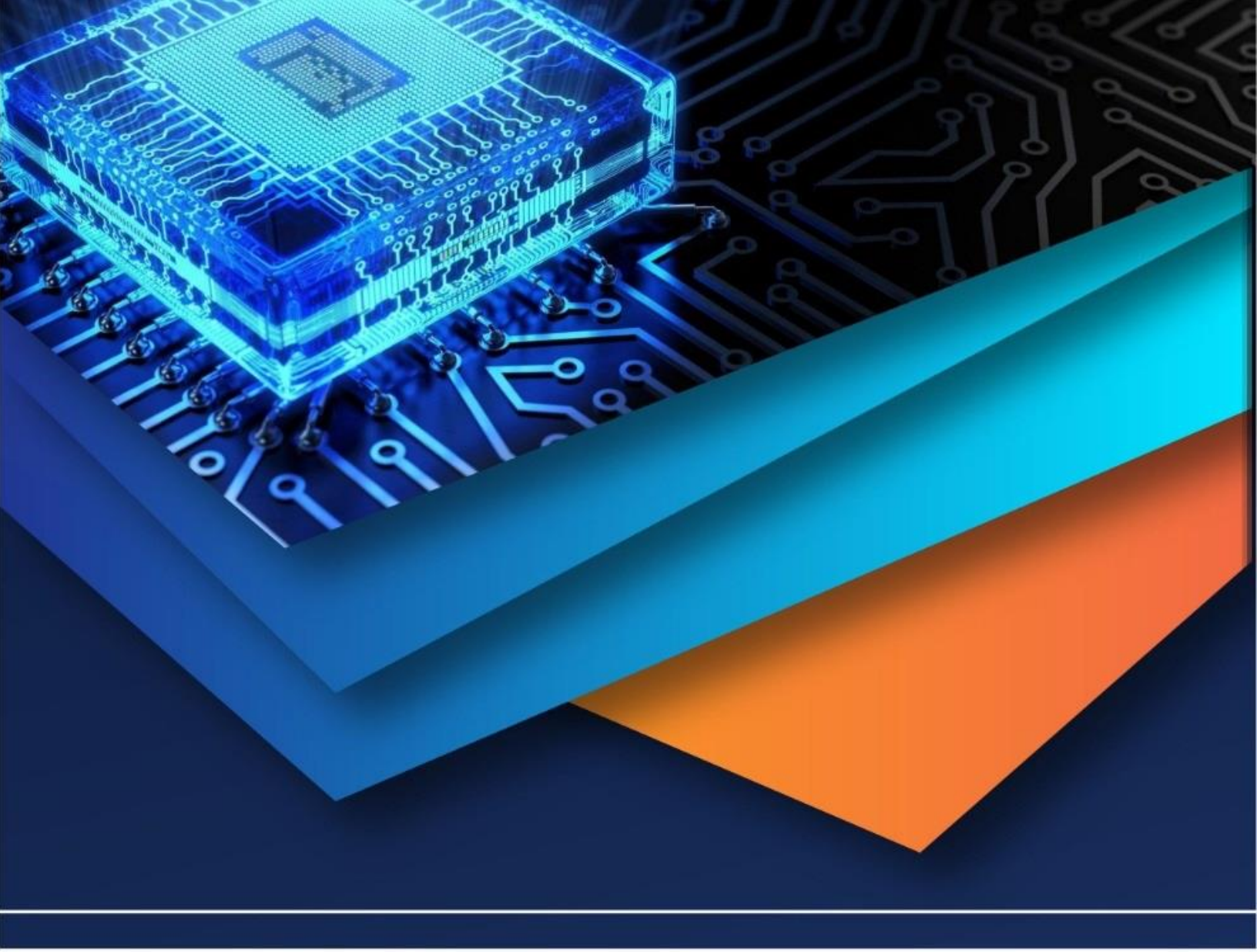

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