Mobile Blind Navigation System Using RFID

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Abstract *– Blind people need assistance in detecting obstacles, finding locations, and getting directions while moving around to reach their specified destination. Based on this persistent need, we suggest a navigation system to facilitate these requirements. We provided this navigation system to blind students, employees, or guests within King Saud University campus area. The technologies used in our proposed system are: the blind mobile device, RFID tags and Reader, GPS, text to speech, voice Recognition, and WiFi. The system detects the blind location using GPS, if internet connection is available, and uses RFID tags fixed outdoors and indoors on the building in the path, WiFi routers are used indoors to detect the location. The system uses voice recognition and text to speech to communicate with the blind to lead him to his destination and to give him the directions. The results show good performance in obstacles avoidance and in blind guidance.*

Keywords: Blind, Navigation System. RFID, GPS

I. INTRODUCTION

Guiding blind persons in moving is a major factor in the enhancement of community service, support of disabilities, and providing for the special needs of all members within the community. This electronic assistance could help blind people be normal and productive members in society. Blind needs to navigate in a known or unknown environment indoor or outdoor. This requires knowledge about his location, direction, building entrances, distance to object/place around and routing to reach specific destination.

This paper studies the requirements of the blind students, employees, or guests within King Saud University. It provides them with a smart and inexpensive system to guide them to navigate within the university campus area.

II. RELATED WORKS

There are several studies concentrating on the assistance of the blind, especially for navigating his environment. One of the most important issues, in many aspects as it affects mobility, freedom of movement and independency. Several methods have been developed as the technology has progressed, such as the use of mobile devices and sensors.

Chakchai So-In et al. [1] proposed a new system where a number of units work simultaneously to assist a blind person to navigate while walking. The blind is able to go anywhere using a voice recognition tool to translate the voice or speech commands into useful information that can be interpreted systematically. The system is a prototype and was developed for a Windows phone. Its main interaction unit for the user. User Interface Control is installed on the operating system of the phone only. It works on speech recognition facility. It has a command database module that collects all commands including query service from embedded XML database. Obstacle detection distance very low at 1 cm. This distance can be unsafe for the blind while walking. The system is only in prototype stage as claimed by the authors themselves.

S. Chumkamon et al. [2] used Radio-Frequency Identification (RFID) to provide location information to users, and then a routing server is used to calculate the shortest path toward the destination via General Packet Radio Service (GPRS) networks.

In addition, B. Ding et al. [3] studied the use of RFID to interpret the location, condition of road, and vicinity building, and so the optimal route can be acquired. Moreover, R. Ivanov [4] applied Near Field Communication (NFC) to enhance the RFID system in 2010 in that the dimension and relative position of points of interest information are stored in RFID tag in WAP Binary eXtensible Markup Language (WB XML) format. Similarly, however, the image processing, voice recognition, and GPS functionalities are not considered resulting in the limitation of the system coverage.

M.A. Shah et al. [5] focused on the GPS functionality for mobile navigation unit. They developed a prototype of a hand-held based on micro-controller in comparative size to the mobile telephone handset.

Iannizzotto, G. [6] proposed a real time system to help blind people to discover the indoor environment by reading the barcode attached to all interesting objects. The system also

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used ultrasound to detect obstacles (no tags objects). Sensors detect objects (& their distances) within range that echoes back ultrasonics based on the level of frequency detected from it. The ultrasound is attached to the user's belt. It uses a head-mounted camera to read barcode tags and it uses a hearphone to get the result of querying/asking the system (by microphone) about any interesting object around. Eventually, it can drive the user towards the object he/she asked for. The unknown (i.e. untagged) obstacles are detected and avoided by means of an alarm (sonar-like Sound) triggered by an ultrasound-based device mounted on the user's belt; the higher is the frequency, the closer is the object.

Kaminski, L. [7] proposed an outdoor system to help blind users in street navigation using GIS database. It can find a route to the requested destination and support him in his movement. The system consists of two main parts: the street navigation supporting system (the main system) which is located in the notebook, and the spatial data providing system that will be located in the server. However, the spatial data may not include new modifications like detours and needs to be updated.

III. PROPOSED SYSTEM

The system is composed from the blind Android operated mobile, the blind white cane with the RFID reader attached to it, GPS, and RFID tags fixed in the main points in the blind path. The system may use WIFI routers that are already distributed all around the university.

The system works as follows: the system detects the blinds location by GPS if possible or by reading the RFID tag that is near to it using the RFID reader shown in figure 1. The system will communicate with the blind by voice telling him about his location, then the user needs to ask the system to move to a specified destination (predefined like college, restaurant, class room, toilet, or office). The system will direct him to move to the correct direction and distance to destination using electronic compass, GPS, and by reading the next detected RFID tags in his path.

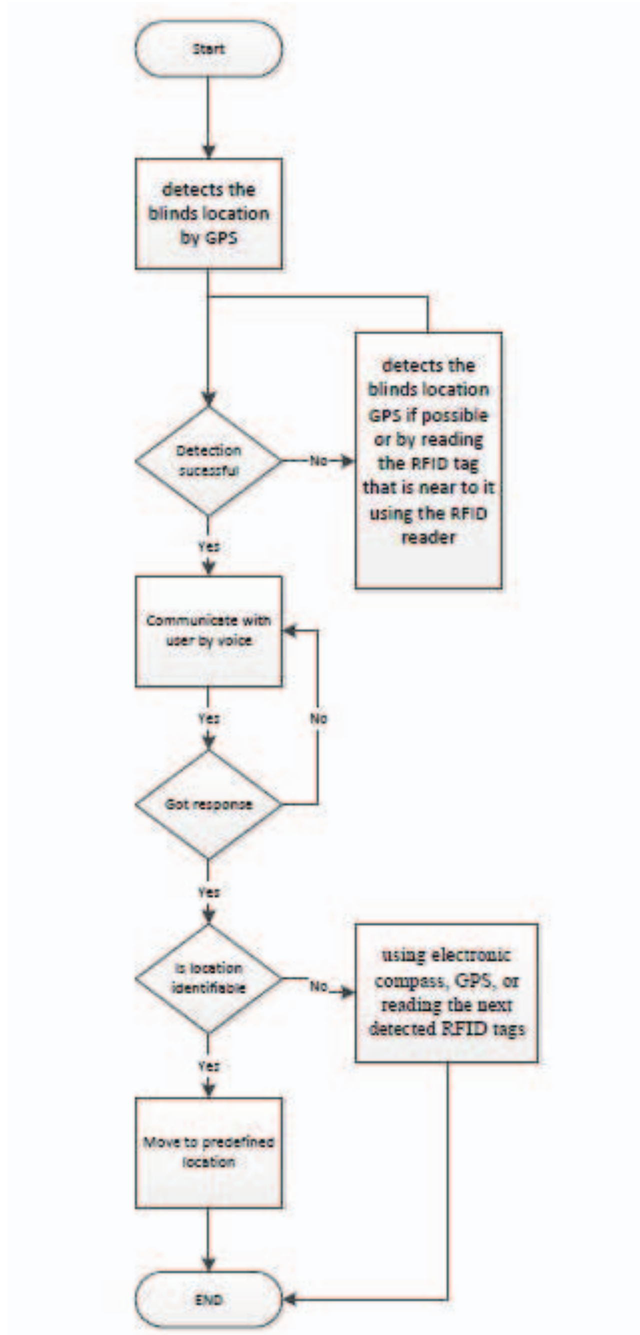

Figure 1 System Flow Chart

The system contains a detailed database about the RFID tags fixed in the path including its location, distances between each other, where the distance between each other was 15 meters in the long path and four meters in the main points, gates, and bus stations as shown in figures 1 and 2.

The system does some computations to decide in which direction must the blind walk in order to reach his destination. This will be done by comparing the current location with the destination and the nearest RFID tag.

The output of the system is a clear instruction including the blind location, routing directions, and the estimated distance to reach his destination.

Figure 2: The RFID Handheld Reader and its Characteristics

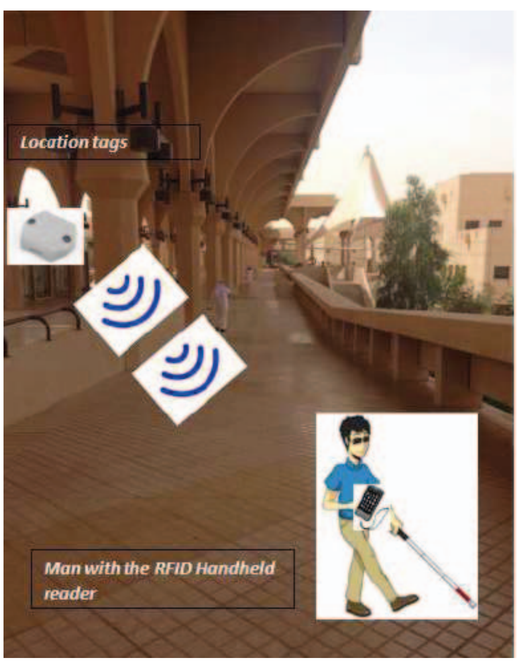

Figure 4: A blind man carrying the RFID Reader and how he will read the nearest tag around

Figure 3: the path inside KSU showing the places of the RFID tags.

IV. CONCLUSION

Helping blind people to lead an independent life is the main motivation of our research. The system shows good results in detecting blind locations and in communicating with them in a clear and operative way.

The next stage in our research is to incorporate vision to solve the problem of obstacles detection both the fixed and the moving obstacles either on ground or the hanged ones in order to make blinds feel safe while moving easily in the university or in any place outside.

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