A Smart Wireless Home Maneuver for Indoor Blind Pedestrians via Indoor Positioning System

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Abstract—In recent times lots of assisting and navigating device were introduced to help the physically challenged person to make their life to be comfortable. When it comes to the blind people, the main concern is about their guidance in both the indoor and outdoor environment to avoid object collision. Basically they were guided by either by the alarm or beep sound when the object is interrupted on their way. What is the name of the object they could face? Whether it is a safe or unsafe? The above two issues is the major problem in assisting a blind person. To overcome this safety problem voice based assistance is provided to blind person in order to identify the objects which interrupt their way. The current location of the indoor environment is preloaded by geo tagging method. And zigbee protocol and digital compass is used to identify the current location of the blind person and adapt to their movement.

Keywords — Inertial, Geo-tagging, Haptics, Maneuver, Zigbee.

I. INTRODUCTION

Assisting a blind person through voice is possible one but the object the collide may end their life example If he touches a switch it may cause the person trouble Blind or visually impaired persons are a significant community in virtually all societies around the world. These people have demonstrated that they have the ability to contribute to various aspects of the society .However; the lack of sagacity of direction can make a visually impaired person feel confused and even inaccessible. Another significant impact of the lack of vision is the need in many cases to depend on other persons for guidance. This obviously affects the independence and life style of the blind persons. It also places a burden on the person conducting the guidance process. Initially, Dogs were trained for the virtually impaired persons.These dogs were trained by some other person and made to hang around with the blind person to navigate them in Outdoor or indoor circumstance. It is very difficult to train a dog and make them to remember each and every location to which the person has to travel.

This dog communication didn't give a guarantee for blind people's life[3]. To avoid this problem a basic technology was introduced for navigating the impaired person. It was a (Haptics) touch based technology, which the blind person will embed them around their vest and the carry the machine along with them.

The machine works on a central vibration system. The person will act according to the vibration given to the person either to travel left or right or straight or back. But the weight of the machine is great problem to them. Since they have to carry it wherever they use to go and make them uncomfortable to sit in the chair. To avoid this problem Alarm and voice base assistance were introduced to avoid collision with the unknown object this paper presents the results of a study that led to the development of a fully integrated wireless system that guides visually impaired person and helps him/her navigate within an indoor environment. The system is, at this stage, targeted at use within the home. It makes an association between the present location, including orientation, of the user and the target item or area within the home that the blind person wishes to locate or reach[5]. The system is designed to be compact and portable. But they were not up to the extant for the indoor navigation system. In this paper voice based guidance is given to the blind people in the indoor navigation in an enhanced way which will be better solution to avoid object collision and provide details of the object in front of them.

II. RELATED WORK

The object colliding is avoided by two basic schemes one is time constraints and priority constraints The time limitation is a specified time period in which a manipulator must complete the desired motion from one location to another. If the time constraint does not exist and there exists a potential collision, a collision-free route can always be found, as long as the obstacles do not collide with the manipulator at the initial location throughout their movement on a segment. In order to increase the productivity, the minimum-time collision free route is generally desired for the manipulator movement. The priority limitation is defined as the moving priority between the manipulator and the obstacle[6][8]. If the priority constraint is given to the obstacle, the manipulator involved needs to change its motion strategy for avoiding the potential collision with the time-varying obstacle.

III. SYSTEM COMPONENTS

A. Hardware Components

1) *zigbee*

Zigbee is the set of specs built around the IEEE 802.15.4 wireless protocol. The IEEE is the Institute of Electrical and Electronics Engineers. They are a non-profit organization dedicated to furthering technology involving electronics and electronic devices. The 802 group is the section of the IEEE involved in network operations and technologies, including mid-sized networks and local networks.

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Group 15 deals specifically with wireless networking technologies, and includes the now ubiquitous 802.15.1 working group, which is also known as Bluetooth. While Bluetooth focuses on connectivity between large packet user devices, such as laptops, phones, and major peripherals, zigbee is designed to provide highly efficient connectivity between small packet devices[3]. As a result of its simplified operations, which are one to two full orders of magnitude less complex than a comparable Bluetooth device, pricing for zigbee devices is extremely competitive, with full nodes available for a fraction of the cost of a Bluetooth node. zigbee devices are actively limited to a through-rate of 250Kbps, compared to Bluetooth's much larger pipeline of 1Mbps, operating on the 2.4 GHz ISM band, which is available throughout most of the world.

2) Indoor Wireless Mesh Network

Mesh network is a type of network where each node have a direct link to every other node by which each node serves as a relay on other node (i.e.)it is not only capture and disseminate its own data. Formula for mesh network:

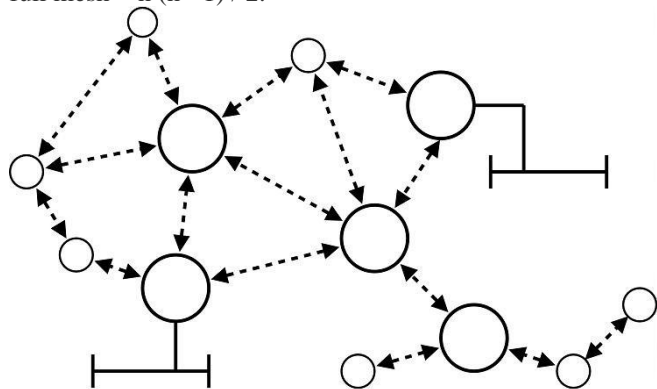Where n = number of nodes the number of connections in a full mesh = n (n - 1) / 2.

Fig 1: Wireless mesh network with available nodes

Connect to the Dashboard and click on "Create". Give you network a name and provide a password. Add each router to the map, providing, when prompted, the MAC ID of the router. Finally, customize the network parameters accordingly and click "Update Network". Once the update has completed, all but one of the Open-Mesh routers can be disconnected from the wired network (at least one must be left to function as a gateway). The routers that are disconnected will form wireless mesh links with the other routers and the gateway.

3) Digital Compass

Digital compass is like a virtual compass is built into your cell phones. It uses the built in GPS and the other sensors (if built in) in your phone to give you the directions... The only sensible advantage is that you do not have to carry an extra physical compass with you.

B. Software Components

1) Indoor Positioning System

An indoor positioning system (IPS) is an idiom used to locate the person inside the building and connect them wirelessly manner.IPS were used in wireless network device for the function mentioned above. GPS is used in outdoor is inevitable but due to Signal attenuation and interference it

loses its capacity for the covering the receivers. The walls and other constructed materials can also cause signal power reduction [7]. The indoor affects the required coverage for receivers by at least four satellites. In addition, the multiple reflections at surfaces cause multi-path propagation serving for uncontrollable errors. These very same effects are degrading all known solutions for indoor locating which uses electromagnetic waves from indoor transmitters to indoor receivers.
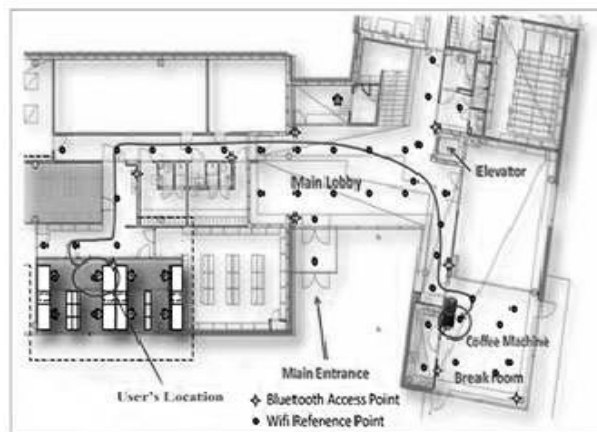

Fig 2: Sample Blueprint of the Indoor Environment

2) Database based On GIS Data

The Geographic Information System is a system used to present all types of geographical data. Those GIS data were captured, managed, manipulated, and edited. The database is made up two important features; they were the Maps and the paths inside the map of the indoor environment. The blueprint of the indoor environment is created using AutoCAD. Then the path in the indoor is created using ArcView. The AutoCAD file then converted into a GIS format and stored in the database. For instance consider the blueprint of the house, the location of the bathroom, bedroom, dining hall etc was added to the GIS data.
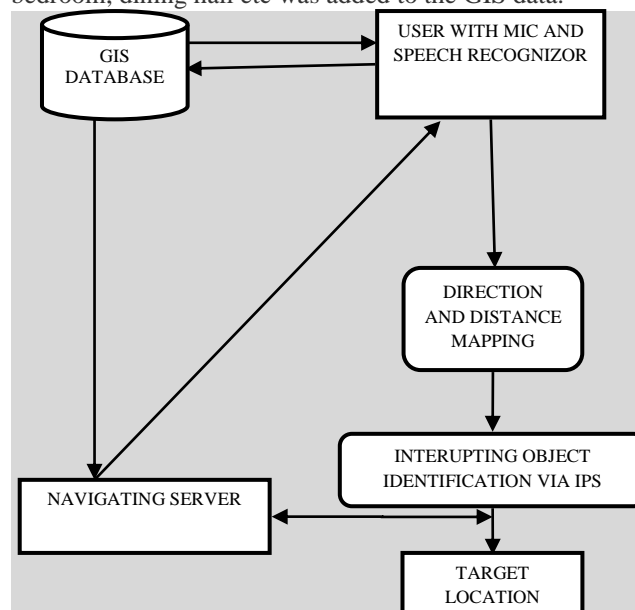

Figure 3: Functioning of Maneuver system.

IV. SYSTEM CONCEPT

A mobile push cart or can embedded with IC chips which contains micro controller with IPS system. Initially user allowed moving to the target location of the indoor environment. The user asks for the direction and distance of the target location. Server calculates the distance by measuring the current location of the user and the user was guided by the server. Then adapted location of the user was also calculated by the movement of the user. While user moves towards the location, if he were to collide with the object. The voice from the mobile push alerts about the object. If the object is identified it will pronounce the name of the object example wall, Door. Else, it will be saying as unidentified object. The mobile push cart or a embedded can is carried by user. At the reference receivers, for regular intervals the power signal will be read by the zigbee mobile node which is fixed on the mobile cart. By the use of location engine which is implemented in CC2431, The position with respect to its house map will be calculated. The mesh wireless network is used to send the sense data from other sensors along with the calculated position to the server. The new position of the user will send to the server simultaneously when the user executes the server speech commands which is received by mobile cart. As the additional safety measure, the mobile cart is developed to give an alarm signal as the user moving near to the object. The sound of an alarm will increase as the distance decreases simultaneously caution commands are send to the user by the server in order to alert the user until the user passes the obstacle.

A. Speech Synthesis

The desired word address need to be synthesized is sent via the network where this is the reverse functioning of ecognition technique .the sound will play according to the address received where this sounds will pre-recorded in the chip.

V. EXPERIMENTS AND RESULTS

The experiments were done by both the user and developers. The features for the users were shown in the table1. At user point of view the device is classified by various features such as portable, wearable, environment they use the device and cost of the device. And also the system is RT systems since, they adapt according to the current location of the user.

Above user supporting table is shown only for some much specified features and all the common features are supportable such as reliability, user friendliness. The Construction of the system is well designed to stand firm in unconditional environment. It can also function partially under some technical failures.

Table 1: User Supporting features

S .no	Supporting Features	Narration
1	Portable	Low weight
2	Wearable	No need to wear this device.
3	Environment	Only Indoor purpose.
4	Cost	Cost at

S .no		
5	Real Time	affordable price, Operates according to the movement of the user

Table 2: Developer supporting features

S .no	Supporting Features	Narration
1	Robustness	Works perfectly in indoor environments
2	Innovation	Own scientific features.
3	Environment	Only Indoor purpose.
4	Connectivity(Wireless)	Connected with server in order to provide continuous information,

The device is wirelessly connected to the server so that the server can fetch the location, distance and direction of the user. Each and every location in the indoor environment is tagged with specific name in the IPS. Whenever the user cross or come along narrow path of the obstacle or a object, the name of the object is pronounced by the speech synthesizer software by converting displaying text in IPS to voice

VI. CONCLUSION AND FUTURE ENHANCEMENTS

The system is semi-sovereign, so that is operates in path basis and local navigation. The visually impaired peoples are always to face a challenging life but the main concern is about their safety while facing those challenges. The alarm signal produces by the wearable device alone won't save the endangered life of the blind people. In this paper, a voice command is given to the object about the name of the object in their path. So the user can find the danger of the object in front of them. In future, Geo-tagging can be used with IPS system. Geo-tagging options are used only with GPS available in the outdoor area.

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