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Survey on Visually Impaired Assistance System

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***Abstract*— In today's advanced hi-tech world, the need of independent living is recognized. The main problem of social restrictedness is seen in case of visually impaired people. They suffer in an unknown environment without any manual assistance. This paper is based on the survey of the system which is proposed to help those people who are blind. In this paper, proposed system will have add-on assistant features based on precedent blind path identification system [1, 2]. This is a RFID based System to identify certain paths easily, especially in an environments unknown or not designed with assistive purpose.**

Independent mobility is an important objective to achieve but with this there is a need to provide certain features so that it will be near about complete assistant package for the visually impaired people. As necessary provisions can be provided like identification of objects by integrating basic system with the RFID glove or by placing Tag's over the objects directly, Personal assistant for directing blind to the required destination, also blind can easily search the objects at home or at known places by using tags placed at those objects.

Basic assistant system is blind path identification design with the help of RFID technology which help blind to know the direction during walking, also provides the knowledge of the exact location of the street. The main design is that when a blind person walking on the path which has electronic tags pre-built under the floor of the blind path, those tags activated by radio wave came from the RFID reader sent their identity codes transmitted by the reader to the computer, and after the query of the database, the number of the street, the name of the current location of the blind will be known immediately, for now, the corresponding voice data will be sent via earphones to the blind in order to get the accurate identification.

This system is composed of the hardware and software where the hardware mainly consists of RFID components, wireless earphone and other parts required for the implementation of add-on features of assistant system, also in case of software main part is database which will control the read-write of the tags, the management of all the information related to the path, location, objects description and more than this data required to make blind to gain the feeling of visualization.

***Keywords*— Blind mobility, GLIDEO GPS, GSM, RFID navigation system**

I. INTRODUCTION

The purpose behind this assistant system is independent mobility of a visually impaired people. Moving through an unknown environment becomes a real challenge for most of them, although they rely on their other senses. An age old mechanism used for assistance for the blind people is a white cane commonly known as walking cane a simple mechanical device to detect the ground, uneven surfaces. However such aid fails to detect dynamic obstacles to prevent from accidents occurring to the blind person. Further the biggest hurdle for blind and disabled is to travel distant unknown or dynamically changing environments.

Apart from the above mentioned walking cane there are not many systems reported so far to help them by using technology. After a thorough literature survey it is revealed that visually impaired people have always been out off the big companies' scope and successful technological means are yet to be developed which will empower them [6]. The proposed system aims to be a techno-friend of visually impaired people to assist them in the orientation and mobility in their residences.

The purpose of this system will be to develop a design and propose a plan to implement RFID technology that will help the blind people navigate in buildings or unknown environment. This system will help to understand and develop a prototype model which will be used as a system used by visually impaired people to accomplish their requirements of navigation and identification. This will be the application of RFID technology towards a social cause which will have its own economic future into the market.

The basic blind path identification system is based on RFID technology. The main idea is that when a blind man walking on the path which has electronic tags pre-built under the tile of the blind path, those tags activated by radio wave came from the RFID reader then tags in response sent their identity codes to the reader and those identity codes will be transmitted by the reader to the computer, and after retrieving query result of the database where query will be based on identity codes, the number of the street, the name of the current location of the that blind person will be known immediately, and that information will be provided as a voice data to the blind via earphones in order to obtain the accurate identification.

II. RELATED WORK

The main encouraging factor for the application of technology for visually impaired people is the policy measures adopted by the western countries for social inclusiveness. Lot of development work in these countries

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is attributed to the above mentioned policy measures and grants invested for supporting this work. In the last year's international conference dedicated to the theme of application of technology for all aspects of sight loss showcased many such devices [9].

Some notable devices exhibited were PAN OPTICUS (sits between a digital satellite receiver and a TV to read the on-screen menus), MONOMOUSE (fitted with a diffuser in order to minimize glare when reading things like CD or DVD covers for low vision people), SONUS 1XT (a device for voice readout of the scrolling text that most stations transmit to provide programme or track information), MOBI-CLICK (a device to keep track of a person's movements) etc. Serious work and surveys have also been undertaken to provide access of electronic resources to the visually impaired people by changing the format of the web sites and

URLs [10].

Yet another successful project undertaken was RadioVirgilio/Sesamonet to design and implement a reliable system to assist visually impaired citizens' independent mobility in urban settings [1]. The goal was achieved by integrating traditional assistive technologies with wireless and RFID technologies to realize an intelligent and easy to use navigation system. However the system was not very successful, since it failed to integrate with the state of art internet technology. Some new commercial devices appear on the market, like the Ultra Cane which uses a build-in sonar system and sends back vibrations through the handle according to the presence of obstacles [11]. The ultra cane enhanced the traditional white cane by giving information about the obstacles before direct contact. But it doesn't provide any new functionality to the traditional cane and the localization is still done by movement of the cane and it doesn't detect objects at head height.

Most of the system developed so far focus on maintaining spatial orientation which is a major challenge for people with visual impairment. There is the need of systems in providing blind people with information on where they are, hazards that might be in the way, and a description of what lies in their surroundings [12]. The notion of "Spatial orientation" refers to the ability to establish awareness of space position relative to land marks in the surrounding environment [13].

III. Overview of RFID Technology

RFID is the wireless Radio Frequency Identification technology growing recently, which is used to address the disadvantage of the barcode. Radio-frequency identification (RFID) is the use of a wireless non-contact system that uses radio-frequency electromagnetic fields to transfer data from a tag attached to an object, for the purposes of automatic identification and tracking.

A. How do RFIDs work?

A typical RFID system is shown below in fig 1. In every RFID system the transponder Tags contain information. This information can be as little as a single binary bit, or be a large array of bits representing such things as an identity code, personal medical information, or literally any type of information that can be stored in digital binary format.

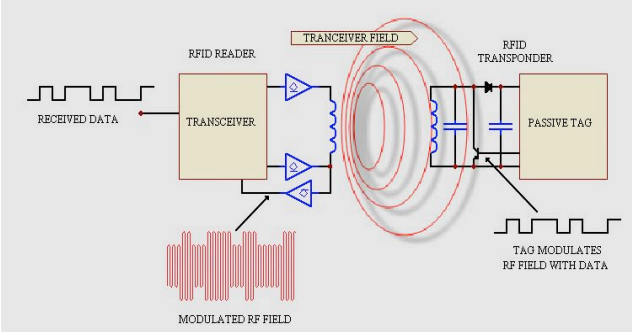

Fig. 1 RFID system [20]

A RFID transceiver communicates with a passive Tag. Passive tags have no power source of their own and instead derive power from the incident electromagnetic field. Commonly the heart of each tag is a microchip. When the Tag enters the generated RF field it is able to draw enough power from the field to access its internal memory and transmit its stored information. When the transponder Tag draws power in this way the resultant interaction of the RF fields causes the voltage at the transceiver antenna to drop in value. This effect is utilized by the Tag to communicate its information to the reader. The Tag is able to control the amount of power drawn from the field and by doing so it can modulate the voltage sensed at the transceiver according to the bit pattern it wishes to transmit.

IV. Overview of GPS and GSM Technology

Proposed system can use any of the GPS or GSM technologies to retrieve the location details. Following section presents details of GPS and GSM with their merits and demerits as per their integration with the navigational applications [18, 19].

A) GPS

The Global Positioning System (GPS) is the Global Positioning System that uses satellite signals to triangulate one's location. The GPS is a navigation and precise-positioning tool. Commercially, GPS is used in airplanes, boats, cars, and for almost all outdoor recreational activities [18]. GPS technology is global technique with following strengths but it lacks behind because of some weakness as follows:

Strengths:

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- GPS works in all type of weather and provides 100% coverage on the planet
- Relatively low costs hence it can be integrated with required applications.
- Accuracy can vary from millimeters to several meters depending on the technique that is used

Weaknesses:

- The main issue is that it must have continuous radio access to the satellites i.e. GPS satellite signals are weak (when compared to, cellular phone signals), so it doesn't work as well indoors, underwater, under trees, in tunnels, or underground etc.
- The highest accuracy requires line-of-sight from the receiver to the satellite.

B) GSM

GSM (Global System for Mobile Communications, originally *Group Special Mobile*), is a standard set developed by the European Telecommunications Standards Institute (ETSI) [19].

GSM is a cellular network, which means that cell phones or mobile device connect to it by searching for cells in the immediate vicinity. *GSM Location database update*
GSM can update the database for the location of the mobile device based on the some components of the GSM Network Architecture like Location Area (LA), Home Location Register (HLR), Mobile Switching Centre Visitor Location Register (MSC VLR).

V. Overview of Blind Path Identification System

Following section describes overall design of the base system for blind path identification base on RFID [1, 2].

A) System Structure and flow:

The RFID blind path identification system consist of some components such as the electronic tags which will be hidden under the street, the reader will be carried by the blind person, computer to process the data, earphone to provide information in the form of voice data, power supply and GSM circuit used for updating the data, and the software consist of the middle ware, as shown in Fig 2.

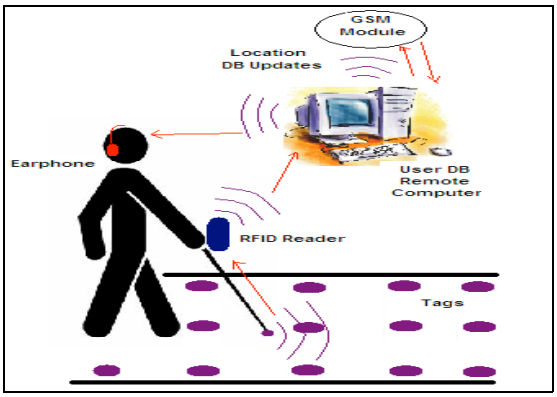

Fig. 2: System Structure

A blind person walking on the path which has electronic tags pre-built under the floor of the blind path and the stick will have an antenna with the reader which will be carried by the same person. While walking when reader is approaching the electronic tags, the wireless signal active tags and tags sent back the exclusive identity code to the reader and this signal is put into computer via reader. Middle ware software picks up the related info based on the identity code, and broadcast via earphone to the blind person as shown in fig. 2.

The earphone sounds the location information of the respective place where tag in contact is placed, for example for Tag #1 it will sound Store #1.similarly it sounds arriving locations as it passing by the #n tag. GSM is used to modify the database storing all the information related to the tag ID's, so that the changes of the street keep updating the database.

B) The key concern of the system

1. Tag:

It mainly divided as the low-frequency, high-frequency, super high-frequency and microwave. The typical frequencies are the following: 125 kHz, 133 kHz, 13.56 MHz, 27.12 MHz, 433 MHz, 902~928MHz, 2.45GHz, 5.8GHz and so on. The communication distance grows with the increasing of the frequency, like close-coupling (0~1cm), remote coupling (0-1m) and remote system (>1m).

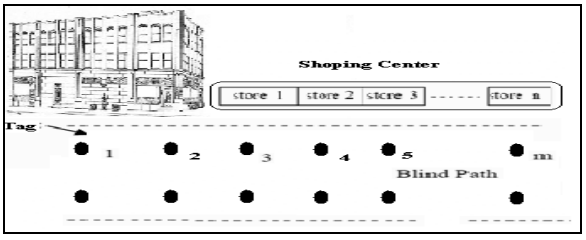

Fig.3: Location Orientation by Tag

Moreover, for the active Tag, the communication distance is tens of meters. Due to the short identification distance low frequency tag has, it can locate exactly, but it needs more tags, and can be used for indoor location. On the other hand, the communication distance of high-frequency tag and super high-frequency one is longer, according to the test results; the distance of super high-frequency tag is 2 to 4 meters, more proper for the blind path. It only needs few tags between two neighbour stores or locations, and the signal can be received even in the transition zone, shows as fig. 3.

2. Reader:

Here considered RFID reader is the LXRP-400 fixed super high-frequency RFID reader manufactured by Legend Silicon Corp, the frequency is between 860~ 960

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GHz and the interfaces are USB and RS232. The longest reading distance is more than 4 meters due to the limitation of circumstance and quality of the tag.

3. Middle-software:

There is a need to design the software based on the characteristic of the system, it consists database setup, interface programming between computer and reader, voice recording and broadcasting programming, interface programming between computer and GSM circuit and GUI programming. When the tag is read, it has a database query of the corresponding voice recording, and then broadcast this voice in order to guide the blind from the earphone.

4. GSM Module:

As the person passes by the tagged locations that respective data has to be updated in the user database for the further use. The GSM module is used for maintenance and updates of the computer user database. It is issued by mobile communication system once a street is completed, and users can download the corresponding information according to the identity code in that case to update the user database.

C) The Design of GSM Module

The main task of the hardware design is the circuit setup of the GSM module, while the software is completely self-development. The GSM module will use the TC35i chip of Siemens. This chip connects the outer circuit via ZIF-40 interface, using MAX3232 for the serial connection between computer and ZIF-40.

The GSM module is an outer accessory device for the whole system. Since the street update does not happen frequently, the module is rarely used. In that case, the module cannot be brought daily to reduce the weights. Actually, it is a tradeoffs using GSM. The voice signal can be downloaded directly by using GPRS, but based on the experimental results, the cost can be increasingly high due to the large amount of the data download, so the internet download should instead of the data download.

The principle objective of the software design is to control the read-write of the GSM via serial interface, control the read-write of the tag via USB, and manage the database as well as GUI. It includes the street name, number, store name and identity code of the tag, moreover, it has the command keys of reading and writing the tag and broadcasting the location information for maintenance and management.

1. GSM Circuit Process:

It understands the function of sending computer data via GSM. The data will be driven by program Read the electronic tag. It read the code correctly driven by program. Then to successfully display the corresponding information based on the identity code there will be call to the database. After retrieving location information from the database it will broadcast it through the proposed function of broadcasting the location via earphone.

GUI will be provided for easy interaction. It can manually or automatically broadcast the information, manage and maintain the system by command keys designed on GUI of system.

VI. Assistant Package Features For The Visually Impaired People.

Independent mobility is an important objective to achieve but with this there is a need to provide certain features so that it will be near about complete assistant package for the visually impaired people. As necessary provisions can be provided like identification of objects by the RFID glove, Personal assistant, and search of the objects at home or at known places.

A) Identification of objects by the RFID glove

To make guide system perfect it can be integrated with another application: GLIDEO (GLove for Identification and DEscription of Objects) [3].

In order to overcome the inability of blinds in recognizing objects before tactile contact, this system is able to provide them audio information about objects, in a way compatible with the software of blind path identification system. The GLIDEO tech-glove is a sort of technologic wearable accessory that allows the user to store essential information about objects, and to listen them, using RFID tags and a Computer connected to a headset via wireless connection, on which the software and the information's database are installed as shown in fig. 4.

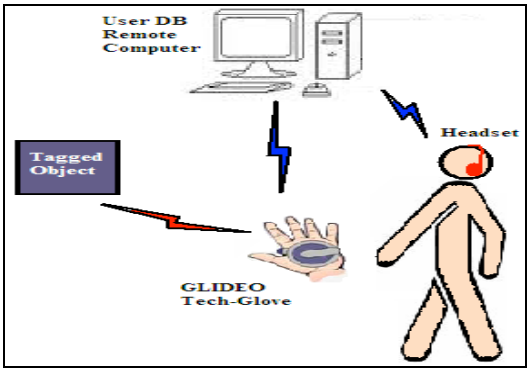

Fig. 4. The integration between GLIDEO and Basic Path Identification System

This glove can be provided with the visually impaired person as whenever he wants to know about particular or the object passed in his way. For the integration of this feature with the base guide system following steps can help,

1. Place tags at the objects.

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2. Installation of database on the computer where database will store all the description information of the tagged objects.
3. RFID Reader system will be embedded in the glove.
4. Visually impaired person will have wireless headset.
5. Computer will be in wireless communication with headset and RFID Reader.

Process Flow:

1. After wearing RFID Glove, when visually impaired person will come nearby or touch to the tagged object. Like Base guide system, tag unique ID code will be transmitted to the reader then from reader to the computer through wireless communication.
2. Then computer will process that Tag unique ID Code as a query on database which will return description of the object as a result of that query.
3. That result will be in the form of voice data which will be transmitted to the respective person through wireless communication with the headset.

In this way system will work as an object Identification assistant. Here Blind path identification system will be isolated in the functionality with glove to identify or to know about the object.

Also, object detection can be provided by directly placing Tag's over the objects and creating separate DB for Object detection information on the server. Whenever user will come with the reader in the rage of the Tag placed on the object it will give information about that object. This is simple technique for implementation.

B) Personal Assistant

The Personal Assistant will be solely based on the software part. Whichever software will be developed for the identification of the path, the same can be composed to direct the person as per the wish. It can easily customize the interaction environment according to user preferences and profile. The blind will be able, as it now done by GPS navigators, to select the destination and the paths, to store in the system's memory the user preferences and past selections in terms of locations and most frequently selected paths [4]. Personal Assistant System can be designed according to the following steps:

1. When user will be using base guide system for the identification of the path at that time those passed locations with its respective information according to the roots will get stored in the user database with the help of software.
2. Also manual provision can be given to enter the routes with description which will be needful to the user for the daily routines or as per requirement.
3. Software will be designed to ask user about the source and destination location and after receiving voice data from the user software will process it then it will query that request to the database.
4. Query result will be provided to the user in the form of voice data.
5. By following voice instructions user will get path to the destination location.

In this way, Personal Assistant can be designed for directing the visually impaired people.

C) Objects Search

With this assistant feature visually impaired people will be able to search the objects of their need in their known environment or at home. This application can be designed by using following steps:

1. RFID tags will be placed on the objects, like keys or wallet, watch etc.
2. The cane customized for the bind path identification system and the software of the same can support the user to find them in a domestic environment.
3. Here we can have separation of database according to the purpose i.e. for object search it will have database storing all the information related to the objects also software can be designed to provide manual update and new objects entries to the database.
4. This blind path identification assistant system could also help the blind to move in a shopping mall, while the system supplies the needed information about the tagged products on the shelves: e.g. the name, price, description, and other types of information [5].

These steps can help to clear the idea of implementation needed for this assistant feature.

This system with all the expected features implementation will become complete package to assist the visually impaired people.

VII. Conclusions And Future Developments

In this paper, the proposed strategy is Assistant System for Visually Impaired People, which comprises a mechanism that aim at ensuring convenience for the visually impaired, and it broadcasts the detected location via voice in order to find the details of locations. Mainly it interests in extra features with the base system to make it near about complete package for providing independent mobility to visually impaired people.

- Virtual Spectacles

In future, any kind of possibility can be designed to make their life easier. For example we can design a system with Virtual Spectacles. Where scenes will be captured by the spectacles and those will be processed to describe the current situation to the user. So that user will get live imagination about the situation.

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