

**A
SYNOPSIS
ON**

**A ZIGBEE AND RFID BASED SYSTEM TO ASSIST VISUALLY
IMPAIRED IN NAVIGATION**

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M.Tech. (Electronics technology)**

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M.TECH. DISSERTATION SYNOPSIS

Name of University	: Shivaji University, Kolhapur
Name of Course	: M.Tech. (Electronics Technology)
Name of Student	: Miss Thombare Nilima Dagadu
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Name of Guide	: Dr. R.K. Kamat
Title of Project	: A ZigBee and RFID Based system to Assist Visually Impaired in Navigation

1. Relevance:

In today's advanced technological world, the need of autonomous living is undisputed. The main problem of social exclusiveness is seen in case of visually impaired people. They suffer in an unknown environment without any manual assistance which is difficult to get at all the time. India is home to almost half of the world's blind with an estimated 15 million blind people, more than any other country in the world ⁽¹⁾. Minassian and Mehra estimated that for India 3.8 million people become blind alone due to cataract each year⁽²⁾. Globally the incidence figure is probably at least 5 million. A figure of 1000 new blind people from cataract per million population per year is used for planning purposes in developing countries.

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 and purely mechanical device to detect the ground, uneven surfaces, holes and steps using simple tactile-force feedback. However the device fails measurably in case of dynamic obstacles owing to the noise they produce.

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⁽³⁾. 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 proposed system will be based on ZigBee wireless communication and RFID technology. RFID tag will be placed at few pre-planned places in the home of the

visually impaired person. The RFID reader will act as the techno-walking cane that will pass the position to the microcontroller based system. The system will further activate the voice assisted board to play appropriate message to guide the navigation.

In a broader sense the project aims at e-Inclusion i.e. other than preventing risks of digital exclusion from the Information Society, tapping new digital opportunities for the inclusion of socially disadvantaged people due to their disabilities.

2. Related Work (Literature Survey):

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 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⁽⁴⁾. 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⁽⁵⁾. 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⁽⁶⁾. 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 UltraCane⁽¹³⁾ which uses a build-in sonar system and sends back vibrations through the handle according to the presence of obstacles. 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⁽¹⁴⁾. The notion of "Spatial orientation" refers to the ability to establish awareness of space position relative to land marks in the surrounding environment⁽¹⁵⁾. The goal of supporting functional independence to visually impaired people can be achieved by providing references and sorts of land marks to enhance awareness of the surroundings⁽⁹⁾. Systems on similar lines have been reported⁽⁷⁻⁹⁾ and even patents are also filed in this area of development⁽¹⁰⁻¹²⁾.

Reasons for undertaking the work:

The literature survey reveals several following important trends:

Although the number of blind people is going up day by day, there are very few systems, publications or patents reported in recent years. In spite of a lot of development work done in this area, none of the systems are successful and distributed worldwide. The reasons for this are two fold viz. techno-marketing and cost. In the first place for the blind people, it is hard to convince them regarding the usefulness of the product due to their basic impairment. Secondly the cost of these devices are prohibitively high and therefore they are out of the reach of the common man especially for the Asian countries. The above mentioned facts are the motivating factors behind taking up the proposed project.

Innovative features of the project:

- The proposed system is innovative because so far no commercial organization or research group has come forward to integrate the benefits of the ZigBee protocols and the RFID tags to help the visually impaired people.
- Project is taking the benefit of the fact that the Passive or active RFID tags are becoming ever less expensive and easily available.
- Most of the systems reported so far are based on PCs. Proposed system is based on microcontroller which not only optimizes the space but also power and brings down the cost drastically.
- It is worthwhile to cover details of the ZigBee protocol and its advantages and comparison vis-à-vis other well established technologies such as blue-tooth to appreciate the rationale behind the choice.

3. Underlying theory of ZigBee:

ZigBee-

Creating the wireless networks can be done using variety of protocols. Some protocols are proprietary to individual vendors, and others are industry standards. Out of that, two are Bluetooth and ZigBee.

ZigBee is better suited for controls, sensors, low duty cycle, long battery life. Also it is suitable for applications where battery life should be large.

Table 1: Comparison with Bluetooth:

Features	Bluetooth	ZigBee
Power profile	Days	Years
Nodes/master	7	64000
Range	10m	70m-300m
Data Transfer Rate	1Mbps	250kbps

ZigBee is a protocol that uses the 802.15.4 standard as a baseline and adds additional routing and networking functionality. The ZigBee protocol was developed by the ZigBee Alliance. The ZigBee Alliance is a group of companies that worked in cooperation to develop a network protocol that can be used in a variety of commercial and industrial low data rate applications. What ZigBee is designed to do is add mesh networking to the underlying 802.15.4 radio. Mesh networking is used in applications where the range between two points may be beyond the range of the two radios located at those points, but intermediate radios are in place that could forward on any messages to and from the desired radios.

RFID:

Radio-frequency identification (RFID) is an automatic identification method, relying on storing and remotely retrieving data using devices called RFID tags or transponders.

An RFID tag is an object that can be applied to or incorporated into a product, animal, or person for the purpose of identification using radio waves. Some tags can be read from several meters away and beyond the line of sight of the reader.

Most RFID tags contain at least two parts. One is an integrated circuit for storing and processing information, modulating and demodulating a (RF) signal and can also be used for other specialized functions. The second is an antenna for receiving and transmitting the signal. A technology called chipless RFID allows for discrete identification of tags without an integrated circuit, thereby allowing tags to be printed directly onto assets at lower cost than traditional tags.

Today, a significant thrust in RFID use is in enterprise supply chain management, improving the efficiency of inventory tracking and management. However, a threat is looming that the current growth and adoption in enterprise supply chain market will not be sustainable. A fair cost-sharing mechanism, rational motives and justified returns from RFID technology investments are the key ingredients to achieve long-term and sustainable RFID technology adoption.

4. Proposed Experimental Work:

The block schematic of the proposed setup is shown in figure 1. Arrays of RFID tags are placed at the places shown as Left, Back, Front and Right. The person with vision impairment is provided with a techno walking-cane which comprises of the RFID reader placed so as to receive the transmitted data from RF transmitters. The person when walks amidst this network arranged as per the geometry, shape and size of the room, he gets voice assisted guidance as regards to obstacles and his distance from the walls.

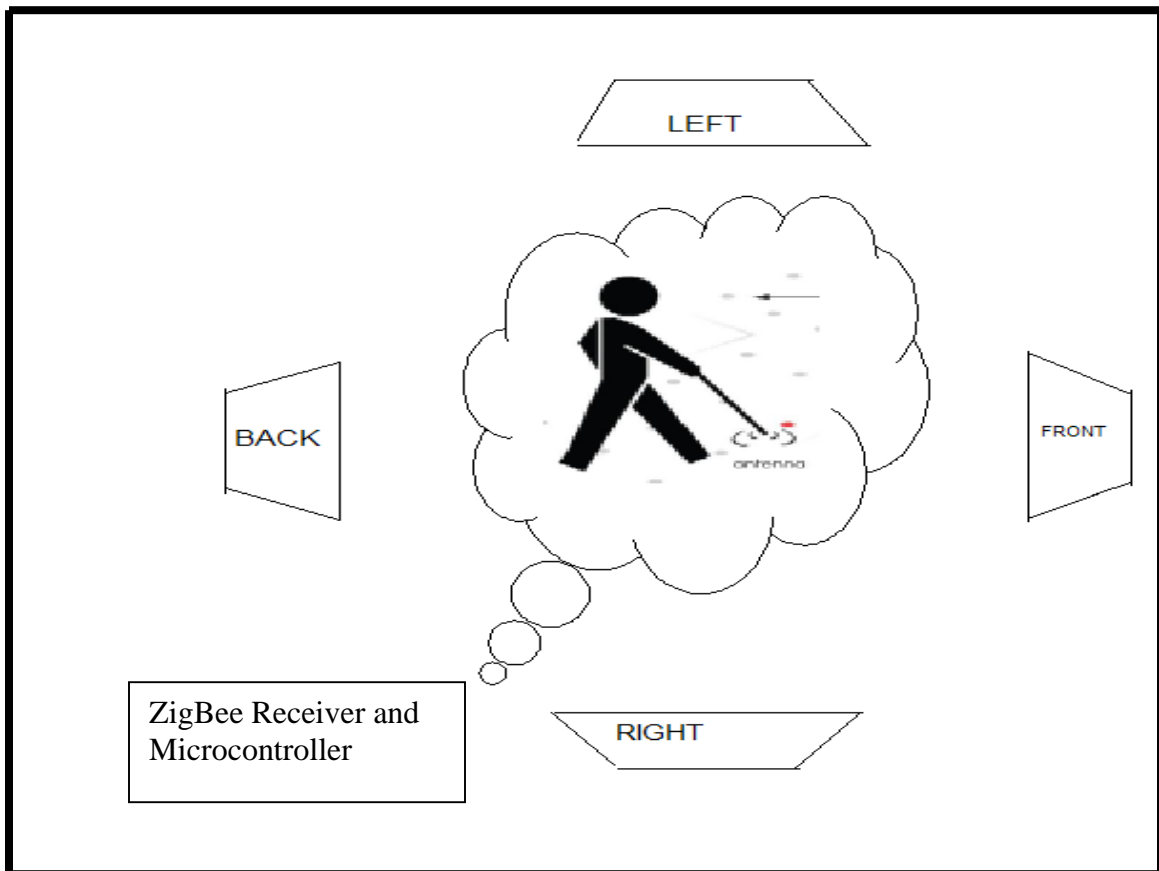


Figure 1: Block schematic of the proposed system
Left, Right, Front and Back: Locations of arrays of RFID tags

Detailed block diagram of the implementation is shown in figure 2. A clear-cut demarcation of wired and wireless networks is shown in this figure. Integration of RFID technology with the ZigBee is the main feature of the system.

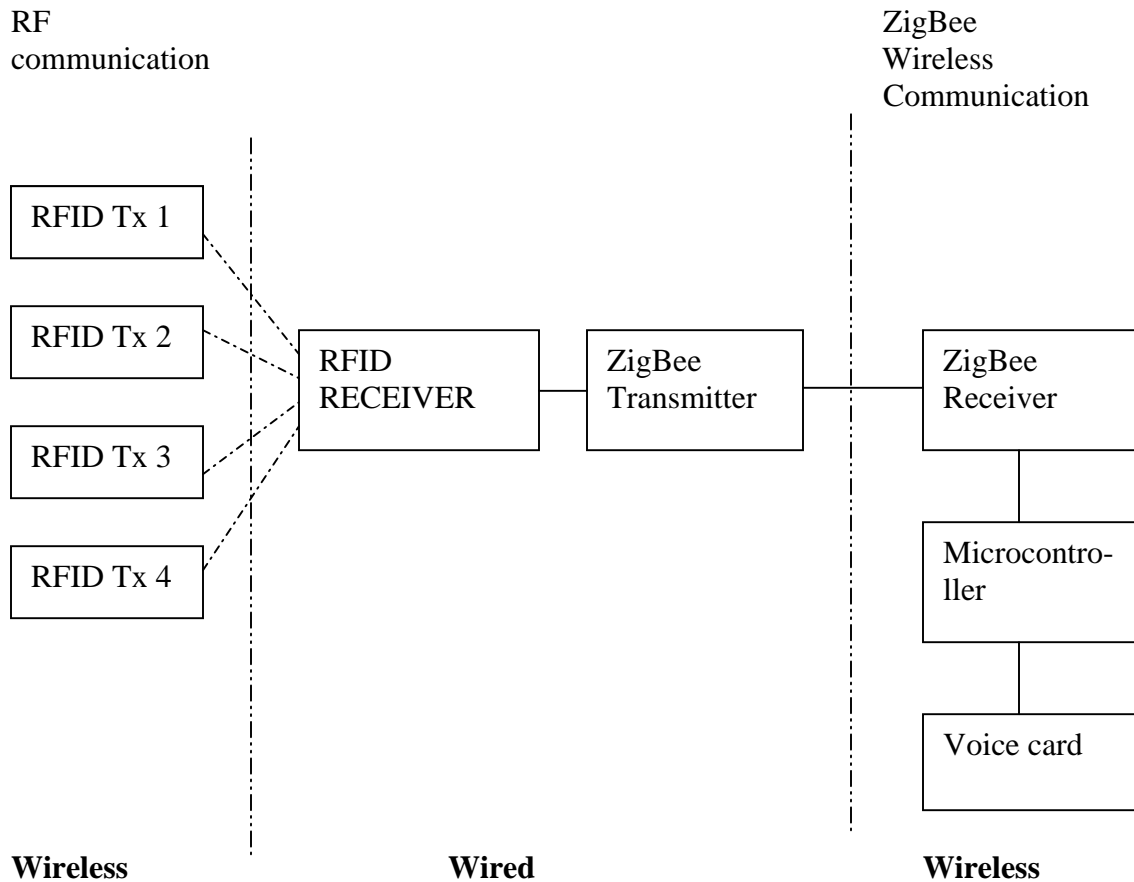


Figure 2: Detailed Block Diagram of the System

The person with vision impairment when comes in the vicinity of a particular RFID tag, it gets activated and transmits the encoded data to the RF receiver placed in the walking cane. This is further transmitted to ZigBee transmitter placed in the same walking cane through data cables. The ZigBee transmitter subsequently transmits the data to the ZigBee receiver, placed at a suitable location in the home. The ZigBee receiver further activates a microcontroller based voice guidance system to generate a proper voice message to the blind person.

Testing of the System:

The system will be tested at different locations with houses having different structures. The data regarding the parameters such as usability which includes effectiveness, efficiency and pleasantness of use, will be collected from person with vision impairment in different age groups. The system will be refined accordingly.

Facilities Available:

Library, Computer, Electronics Laboratory, Internet.

Software requirement:

Different IDEs of microcontrollers (Student Versions).

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Estimated Cost:

Rs. 10,000/- The project is sponsored by Logsun Systems, Pune.

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