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Finger-Braille Interface for Navigation of Blind People in All over Barrier Free Space

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Abstract - *This paper discusses the development of Finger Braille interface for navigation of blind people in all over barrier free space. Blind people can use several methods of communication. Finger Braille is one of tactual communication media of blind people. In this hand is placed on Braille display. Blind people communicate only with interpreters. In this project, a Finger Braille interface System with its design, implementation and audio support system are presented for navigation of Blind people. A prototype capable of deploying physically Braille characters is developed. Device is connected to a wearable computer, so that Blind people can use it in their daily life. In order to support the wearable computers equipped with the Finger-Braille device and audio support, a ubiquitous prototype environment is designed and developed. This environment consists of wireless networks, floor-embedded Radio Frequency Identification tags (RFID), audio support etc. In the environment, blind people can be guided through Finger-Braille device which will output location based information obtain from various wireless nodes. Blind people depend on information and feedback means, about what is around them. Hence it is difficult for these people to access information, if they don't get the right support.*

Key Words*: *Finger Braille; Blind; wearable computer; Radio Frequency Identification;

I. INTRODUCTION

Out of the 37 million people across the globe who are blind, over 15 million are from India. In order to support their mobility, the use of guide dogs, the long white cane and leading blocks for the Blind, which are route finders of the footpaths, has spread widely. However conventional leading blocks for the Blind have a weakness of unexpected change of environment. Hence to solve such problems and design novel navigation system with cutting-edge technology, like wearable computer and ubiquitous computing design and development of communication support technology and position identification technology is essential which will support Blind people.

Blind and visually impaired people uses various maps (e.g. street maps, tourist maps and floor plans) to access information, prepare journey routes or learn about related geographic information. In addition to printed maps, map applications on different electronic devices have been used widely. The colorful visualization of such interactive maps and dynamic routes enhance user experience for sighted people. However, for blind and visually impaired people, visual-based maps and map applications are inaccessible.

Hence to support blind and visually impaired people to access map data, tactile maps on different materials have been developed. Most existing tactile maps are desktop based although some global positioning system(GPS) based navigation applications on mobile phones or special assistive tools can guide the visually impaired to their desinations via Braille and audible turn-by-turn instructions. System proposed in this paper uses RFID tags instead of GPS. Visually impaired people have to carry wearable computer equipped with the Finger-Braille device which receive location based information from ese RFID tags. So that they can access map data through these tags. Overall system concept is explain in next paragraphs.

II. FINGER BRAILLE SYSTEM

Fig. 1 shows the concept of the Finger Braille system. In this, index finger, middle finger and ring finger of both hands are placed on keys of a Braille typewriter. A sender dots Braille code on the fingers of a receiver like whether he does the type of the Braille typewriter. Then the receiver recognizes the Braille code. Because there are small non-disabled people who are skilled in Finger Braille, blind people communicate only with interpreters. Hence need has been araised to develop independent finger braille interface for blind people.

Fig. 1 Finger Braille system

III SYSTEM CONCEPT

Basic block diagram of the proposed system is shown in Fig. 2. Here, the device consists of three main modules, Input Module, Processing Module and Output Module. To initialize the system hand must be placed on Braille display. It consist of IR pair mounted on display which will detect hand is kept on it or not and then initiate the system. When user enter in to new location RFID receives location based data, the Processing Module processes the data and then generates related output responses, including solenoid raised and lowered and audible information.

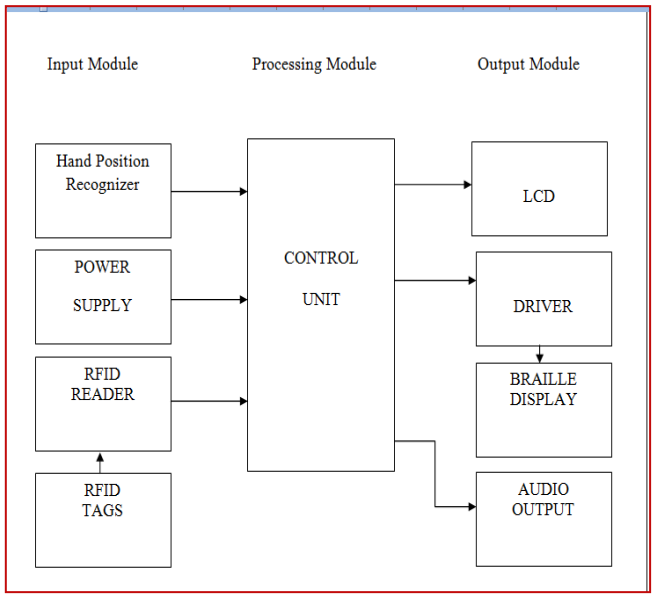

Fig. 2 Basic Block Diagram of the Proposed System

Generally, blind people read information through Braille paper consist of Braille character or audio feedback. It is difficult to access location based information while roaming in environment. In order to render this, tactile solenoid - matrix displays have been developed. Braille - matrix displays can be classified into two categories. One is based on electromechanical actuators. The second uitilizes chemical polymer- based materials that can be reshaped. In this project we have used solenoids as a Braille- matrix.

Aims to deploy :

- System which is more efficient, reliable and cost effective.
- It is easy to configure and setup this system and is secured.
- To overcome the limitations of existing systems.
- To build a simple system for blind people, and all sensors are simple.
- To implement system so that blind person can access location information using conventional Finger Braille.
- To evaluate and implement interface which navigate the blind person.

IV IMPLEMENTATION OF BARRIER-FREE EXPERIMENT SPACE

In order to support the wearable computers with the Finger-Braille device, with audio support, implemented the indoor ubiquitous experimental environment for barrier-free applications. This environment consists of different RFID tags placed at different location, containing location information.

V SYSTEM FLOW CHART

Flowchart of the system is shown in Fig. 3. First blind user have to keep his hand on hand position recognizer module i. e electromagnetic solenoids. After recognizing input sensors below the solenoids get activated. RFID receiver is provided to user. Also for audio, provision of loud speaker/headphones output is also provided in the system. Depending on the information in the RFID tag, control unit will provide that respected location data to user through Braille display and audio output.

Here , system is purposely designed with Braille output. If user is in crowded area, then audio output will not be clear. Hence in such situation user can recognize the map data or his location through Braille display i. e. electromagnetic solenoids as shown in Fig.4.

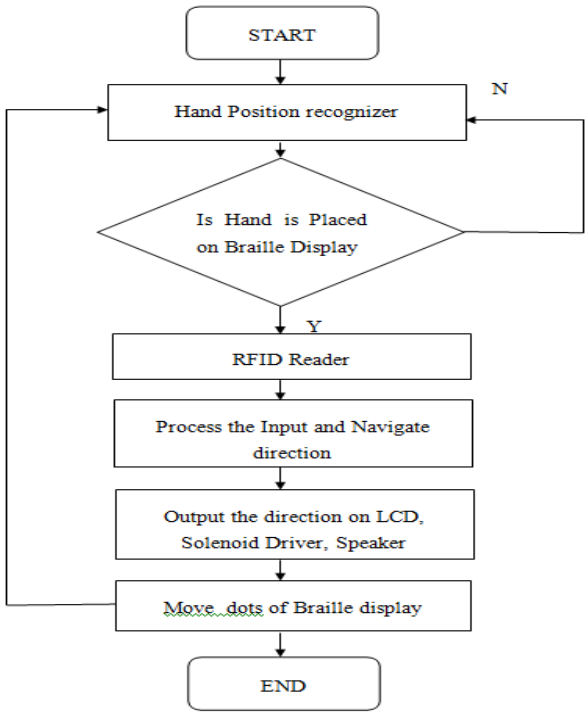

Fig. 4 Flowchart of system.

Fig. 5 Electromagnetic Solenoid.

A solenoid is simply a specially designed electromagnet. A solenoid usually consists of a coil and a movable iron core called the armature. When current flows through a wire, a magnetic field is set up around the wire. If coil is of many turns of wire, this magnetic field becomes many times stronger, flowing around the coil and through its center in a doughnut shape. When the coil of the solenoid is energized with current, the core moves to increase the flux linkage by closing the air gap between the cores. The movable core is usually spring-loaded to allow the core to retract when the current is switched off. The force generated is approximately proportional to the square of the current and inversely proportional to the square of the length of the air gap.

VI TESTING AND ANALYSIS

For testing a system testing environment is created with the following dummy location

- Classroom
- Laboratory
- Library
- Main gate
- Office

In the above location a passive RFID tag is placed which is dedicatedly assign to particular location. When system get initialize it will search for RFID tag. As soon as it detect RFID tag it will encode tag I'd number and process it. Once I'd number compared with stored data appropriate message is called from memory. Which contain navigation audio information and Braille character on Braille display driver which drives electromagnetic solenoid. Respected audio message is out from audio system.

VII CONCLUSION

Finger Braille is efficient method to communicate with blind people and by using this technique with the help of wireless sensor we can develop efficient navigation system for blind and visually impaired people. System is very cost effective and easy to implement. Blind person can map their location using this system and Finger Braille data. For future work, this system can be implemented using GPS system so that user can use their mobile for mapping required data.

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