AN ELECTRONICALLY GUIDED WALKING STICK FOR THE BLIND

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Abstract: **Mobility for the blind is always a great problem. Just like a sighted, blind also needs to travel around inside a closed premises like house, factory, office, school etc. They may also like to go for shopping, visiting friends and other places of their interest. Presently available electronic travelling aids like sonic path finder, sonic torch etc. are not suitable for using inside a closed premises such as school, factory, office etc.**

In this paper an electronically guided walking stick that can be used conveniently inside a closed premises has been discussed.

Key words: **Mobility, walking stick, closed premises, Electronic travelling aid, radio frequency signal**.

I. INTRODUCTION

Blind since old age have been using walking stick for their mobility purposes. In addition some of them are also using guide-dog for their mobility. Due to the development of modern technologies, many different types of devices are available to assist the blind [1]. They are commonly known as electronic travel aid [2].

Many of these travelling aids use either ultrasound or laser beam. One of such devices is the laser cane that is similar to a long cane with built-in laser ranging facilities [3]. But most of the commonly used electronic travelling aids use ultrasound for functioning [4]. These devices use the reflectance property of the high frequency ultrasound and are available in different models such as:

A. Sonic torch

It is battery operated and is about the size of a large electric torch. It is a hand held device and operates on the principle of transmitting ultrasound in the forward direction and receiving the reflected beam from a nearby object.

B. Mowat sensor

It is a light weight, hand held, pocket size device and is quite similar to a common torch that is used by the sighted people. It can detect object by sending high frequency ultrasound in pulses and receiving the reflected beam from any nearby object. User can identify the distance of the object by the rate of vibration that is produced by the device.

C. Sonic pathfinder

Like a Mowat sensor a sonic pathfinders also identify an object by receiving the reflected ultrasound that is emitted by the device[5]. But unlike Mowat sensor which is a hand held device a sonic pathfinder is to be fitted on the head of the user. The audio output from the sonic pathfinder is made up of notes of a musical scale which produce a familiar tonal progression as the user approaches an object, is fed to the user through earphones.

II. DISADVANTAGES OF THE PRESENT METHODS

The main disadvantage of the commonly used ultrasonic devices is that, such devices can not be used in side a closed premises like office, house, school etc. due to the multiple reflection of ultrasonic beam by the boundary walls. The laser cane is however very costly and is not very popular.

III. SUGESTED DEVICE

The suggested device that can be conveniently used inside a closed premise, uses radio frequency signal for its operation. The device transmits radio frequency signals having different carrier frequencies. Each path to a certain destination (like main office, library, canteen, toilet) from the user's room, carries a specific radio frequency signal. The information in each carrier may be identical. The information may be square wave pulses that can be used to produce tactile vibration . Thus each path is basically identified by its carrier as shown in figure 1.

A. Transmitter

The radio frequency signals are transmitted using different transmitting antennas that start from the user's room to the respective destination such as main office, library, canteen and toilet. Each individual antenna carries a specific radio frequency signal as shown in figure 1. The antenna is made up of a single

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Abstract

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ended electrical wire that runs from the user's room to the destination.

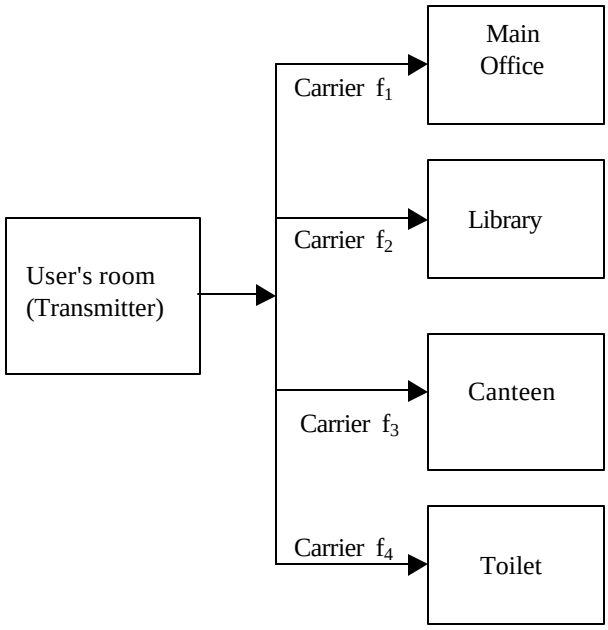

Fig. 1. Block diagram of the transmitter

According to the block diagram shown in figure 1,the carrier frequencies can be represented as follows:

i) Modulated signal with carrier frequency f_1, is transmitted through the antenna that connects the user's room to the main office.

ii) Modulated signal with carrier frequency f_2, is transmitted through the antenna that connects the user's room to the library.

iii) Modulated signal with carrier frequency f_3, is transmitted through the antenna that connects the user's room to the canteen.

iv) Modulated signal with carrier frequency f_4, is transmitted through the antenna that connects the user's room to the toilet.

The transmitter is normally operated from the supply mains. In general all the transmitting antennas may be kept under the floor mates for safe placement and beautification.

B. *Receiver*

A receiver is placed inside the walking stick and is battery operated. A small ferrite rod placed at the top of the walking stick will act as the receiving antenna. The receiver may be either AM or FM depending on the type of the transmitter and can be tuned to a specific carrier frequency as shown in figure 2.

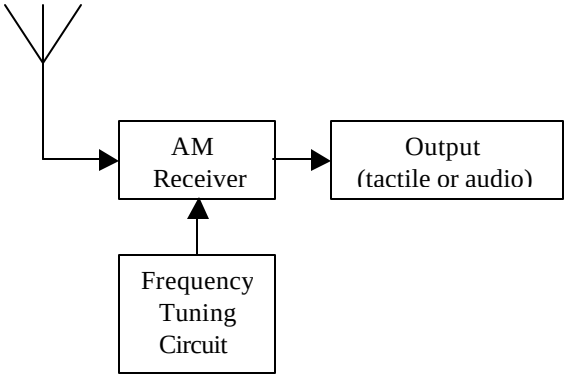

Fig. 2. Block diagram of the receiver

The frequency tuning circuit basically consists of different switches S_1, S_2, S_3, and S_4 as shown in figure 3. Each switch connects a capacitor to tune the receiver at the require carrier frequency.

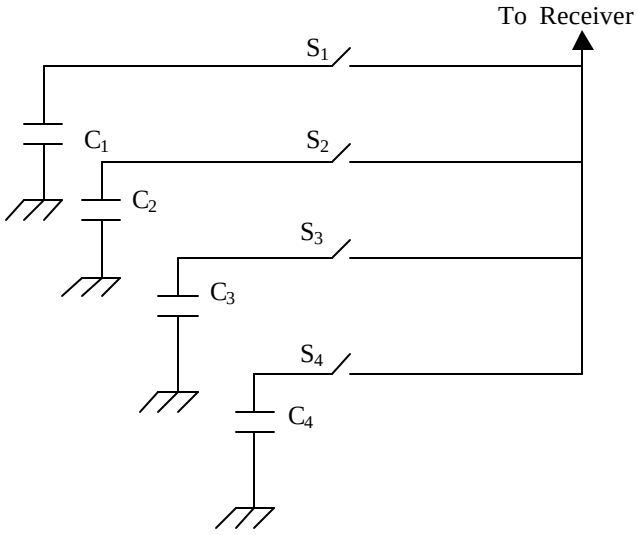

Fig. 3. Frequency tuning circuit

All these switches are placed inside the walking stick and their respective functions are as follows;

i) Switch S_1 will allow the user to visit the main office from his room, by connecting the capacitor C_1 to the tuning circuit that will tune the receiver at the carrier frequency f_1.

ii) Switch S_2 will allow the user to visit the library from his room, by connecting the capacitor C_2 to the tuning circuit that will tune the receiver at the carrier frequency f_2.

iii) Switch S_3 will allow the user to visit the canteen from his room, by connecting the capacitor C_3 to the tuning circuit that will tune the receiver at the carrier frequency f_3.

iv) Switch S_4 will allow the user to go to the toilet from his room, by connecting the capacitor C_4 to the tuning circuit that will tune the receiver at the carrier frequency f_4.

C. Output devices

The output from the receiver may be audio signal that fed to the user through earphones. This detected audio signal will guide the user from his room to the require destination. A loudspeaker may also be used instead of earphones. But the loudspeaker will consume more energy (thus shortening the battery life) in addition to disturbing the surrounding people.

An earphone will however reduce the cosmetic beauty of the user. Alternatively the output from the receiver may be used to produce tactile vibration that may be easily sensed be the blind user.

IV. METHOD OF USING

The user has to select a specific path by pressing the proper switch which in turn will tune the receiver to the corresponding carrier frequency that will lead the user to desire destination. As such if the user is interested to visit the main office then he will have to press switch S_1 (thus basically tuning the receiver to carrier frequency f_1) and start walking with the stick from his room. If the user walks in the correct direction with the help of his stick, then he will continue to receive tactile vibration or specified sound. At any crossover point the user has to select the path that continue to produce the tactile vibration (or the specified sound). Once selected the user will receive the tactile vibration or sound, only in the direction that will lead him to the desired destination.

V. DISCUSSION

In our present device we have used AM transmitter and receiver[6]. For the experimental purpose the carrier frequencies considered were 600 kHz , 700 kHz, 800 kHz and 900 kHz. The size and the power consumption of the transmitter are not very important as it is a stationary device and is powered from the supply mains.. The receiver should be small enough to be fitted inside the walking stick. Again the receiver is being battery operated should consume less power.

Fortunately in this device the transmitter and the receiver are very close to each other and thus a low power transmitter is quite sufficient.

The required tactile output can be produced by driving an electromechanical relay (with suitable transistor like CL 100) from the output of the receiver. The relay may be operated from 6v dc supply.

VI. CONCLUSION

This device is very simple, low cost and easy to use. It can be conveniently used inside a closed premises specially organized with the transmitters. In a closed premises like school building blind students can move simultaneously and independently. If require the receiver may also be fitted inside the shoe and thus eliminating the requirement o f the external stick.

The transmitter that is used in this device will not interfere with the local radio communication system due to its low power output. More over the carrier frequencies may be properly chosen to avoid any interference with the local radio communication system.

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