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Moving Aid System for Elderly and Blind Safety Protection

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Abstract

In order to help visually impaired person, the proposed work presents a smart aid navigation system. The arrangement detects obstacles via an infrared proximity based detecting system and sends back a vibro-tactile or buzzer feedback. We have made an insightful use of visually impaired people's habitual support, i.e. white cane, and a sensor module is properly fixed on a light weight cap to acquire an exact information about obstacles (near from head area). Furthermore, GPS technology has been integrated with pre-programmed locations to determine the optimal route to be taken. The user can choose the location from the set of destinations stored in the memory and will lead in the correct direction of the stick. Upon reaching the destination, with the help of voice module an alert message will get generated into TTS format.

Keywords*: The GPS, infrared, proximity sensor, TTS format*

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INTRODUCTION

The majority of information that an individual obtains from his/her surroundings is by vision. It is in fact the most important human physiology. But there are significant numbers of people around the world who are completely or partially blind. A survey by World Health Organization (WHO) shows that there are almost 285 million people in the world who are completely blind or have low vision. Many researchers studied and investigated to develop the walking stick to fulfil the elder and blind navigation tools in several aspects [1–4]. These people face various challenges in their daily life. Moving through an unknown and unresolved environment becomes a significant challenge for those who cannot rely on their own eyes. As we know, dynamic obstacles usually produce noise and vibration due to their motion; visually challenged people develop their sense of hearing to realize their location. But other stationary objects and the unfamiliar surroundings in general pose a great challenge for them. A visionless person's habitual support i.e. white cane does not provide ample help for navigation. The walking cane is a simple mechanical device to detect static obstacles on the ground, uneven surfaces, holes and steps through simple tactile-force feedback. This device is light but its range is limited to its own size. Another indispensable assistance that provides the best travel aid for the blind is the guide dogs. Most of the information is passed through tactile feedback by the handle fixed on the animal. The user is able to feel the attitude of his dog, analyse the situation and also give him appropriate orders. But guide dogs are still far from being affordable, around the price of a luxury car, and their average working period is limited, an average of 7–8 years. In this paper, the use of intelligent walking stick is presented [5–8]. The proposed system focuses on addressing these problems with the use of modern technology to improve the mobility of a visually impaired person. It is capable of obstacle detection, pit detection and location finding document. Numerous attempts have been made to aid the visually challenged people with the help of technology and by other approaches. Electronic travel aids (ETA) is nowadays very popular among researchers of this domain. These types of systems use a number of electronic components and circuits to help the visually challenged. Most of these aids are mounted on the white cane that these people usually use to form what is known as a

smart stick. Most of the authors have used a system based on PIC microcontroller. Various navigation technologies like GPS [9–10], RFID etc. are also quite popular among the authors. However, some of these technologies have been proved to be inefficient, for example, the RFID sensor based location finding system. Vibration feedback is found to be the most used output method. As different authors used different approaches and methodologies, each of these smart solutions has some scope of improvement that can be done.

DESCRIPTION OF OUR PROPOSED SYSTEM

Our system provides smart electronic aid for visually impaired people. The system is being intended to provide both object detection and real time assistance via global positioning system (GPS). Here also we have a stick having four switches along with two buzzers and a cap to complete the total wireless system.

Logical Representation

The foremost switch in the stick is the initialization switch. When this switch is on, continuous infrared radiation will flow. Then, there are a number of modes, which can be selected to avoid nuisance. Basically, there are two modes: light vibro mode and hard vibro mode. Light vibro mode is being kept for comfort of the user whereas hard vibro mode is being kept to ensure better performance in crowded and noisy areas, and the last switch is for location tracking (Figure 1).

Microcontroller Unit

Arduino UNO has been used as our processing unit of the total system. It receives the signal and converts it into its appropriate form, which is to be used as output for the user.

Sensor Unit

As a sensor for object detection proximity IR sensor is being used and it is mounted on a stepper motor. Stepper motor rotates continuously with an angle of 90°. Now the 90° angle is divided into three 30° areas. Two 30° areas are for indicating left direction or right direction obstacles respectively, and third 30° area is for indication front obstacles. This helps our system on protecting the near head portion, which a walking cane cannot do.

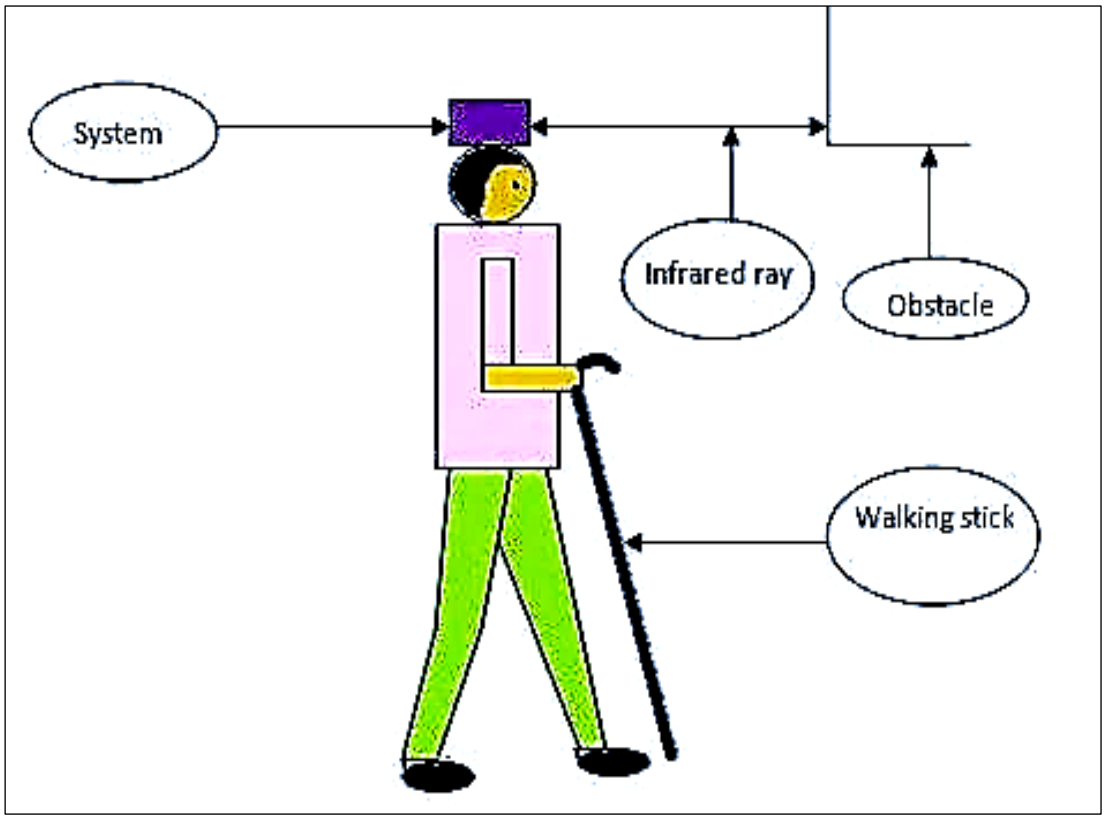

Fig. 1: *Proposed Smart Stick System.*

GPS Module Unit
It is being used for tracking the latitude, longitude and altitude of the location where the person currently is, and also a destination putting strategy is being used.

Voice Module
Upon reaching the destination with the help of this module a male voice will read out a text that destination is reached by TTS (Text To Speech) procedure, and whenever the user will switch on the last switch (i.e. the location tracking switch) then the latitude, longitude and altitude of that location will be tracked and will be read out by the male voice.

Block Diagram and Flow Chart (Figure 2)
When the power supply will be on that is the initialization switch will be on then the user have to select the mode that is either light vibro mode or hard vibro mode. Now continuous infrared rays will flow and whenever it will detect obstacles, a signal will be passed with the help of IR sensor. This signal will be taken as input in the Arduino and as a result, if left buzzer gets activated then the obstacle detected is in the left side or vice versa.

At first, there will be two inputs x and y, which will be initialized as 0. Dist. is a variable for measuring distance range and max is a variable taken as per proximity sensor's range, which is 100 cm (i.e. it cannot detect beyond the distance of 100 cm). Now, it will check whether the initialization switch is on, if not, then it will stop and if yes, then the system will continue working.
So here,
x= input from the obstacle at left side,
y= input from the obstacle at right side.
Now it will check whether the inputs are less than max or not, so if it satisfies then it will check whether the input is taken from x or y. If from x then the obstacle is in the left side, if otherwise it is from the right side (Figure 3).

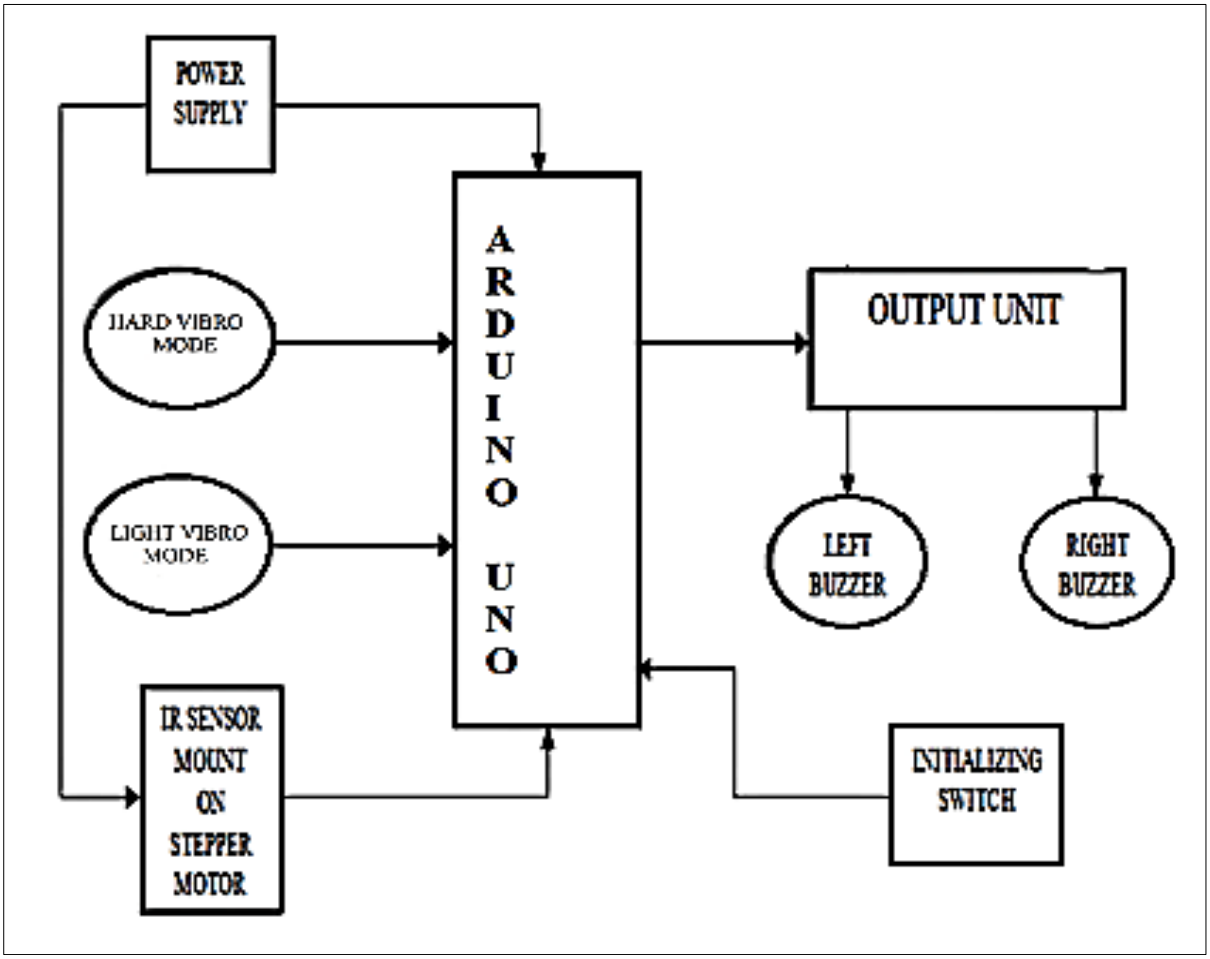

Fig. 2: *Block Diagram of the System.*

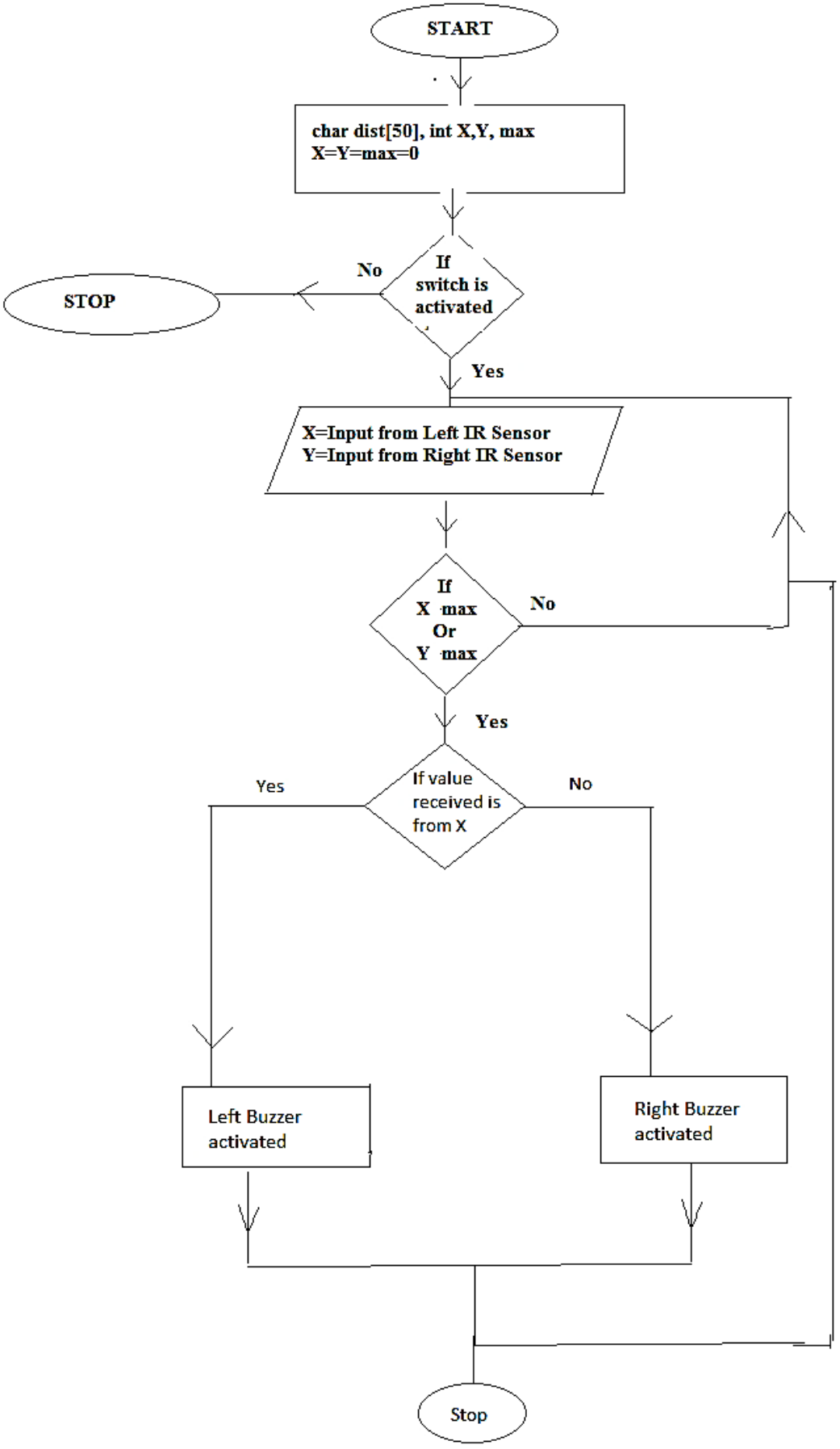

Fig. 3: *Operation Flow Chart.*

RESULTS AND DISCUSSION

The experiments were conducted to evaluate the performance of the stick. The experimental data presented in this paper is the efforts to build the blind stick for blind people and also for the elderly people. The circuit that has been designed for the object detection has provided an accuracy of 500 cm. The detection range for various objects in cm are as listed in the below Table 1.

Table 1: *Different Obstacles and Tested Data.*

Obstacle	Test 1	Test 2	Test 3	Test 4
Wall	122	125	128	132
Cardboard box	100	105	110	111
Man-Holes	95	97	99	101
Human Body	131	139	135	131

CONCLUSION

This paper proposed the design and making of a new innovative concept of moving aid system for elderly and blind safety and protection. The advantage of the kind of system is the fact that it can show a way to be very low cost solution to millions of blind people throughout the world. The system has been implemented using microcontroller and Arduino. Thus, the following conclusion can be made by implementing this system:

1. The system will be able to detect obstacles and notify the person regarding their directions using voice message.
2. The system will be able to detect the potholes and staircases and alert the users of the same.
3. GPS functionality could also be added to keep a track of the blind person.
4. The system will serve as a simple and compact aid for the blind.

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