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GPS Based Smart Stick for the Blind and Visually Impaired People

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Abstract - *In order to help the visually challenged people, we design smart stick. There are many issues over which humans have no control blindness is one of such issues. It snatches the vivid visual beauty of the world from an individual's life. But missing the beauty of nature becomes one of the last worries of such people as they have to face numerous difficulties in order to perform even the most basics of tasks in their day to day life. One of their most dominant problems is of transport, such as crossing roads, traveling in trains, or other public places. They always require human assistance to do so.But sometimes they are rendered helpless when no such assistance is offered. Their dependencies deteriorate their confidence. Traditionally they have been using the conventional cane stick to guide themselves by touching/poking obstacles in their way. This causes a lot of accidents and hence is dangerous for them and others. As this is a technologically driven era we decided to aid these differently abled people by coming up with a technology utilizing solution. We call it the "Smart Stick". It is a device which guides the user by sensing obstacles in the range of stick. It will identify all obstacles in the path with the help of various sensors installed in it. The microcontroller will retrieve data and pass it on as vibrations which will notify the user about hurdles on the way. It is an efficient device and will prove to be a big boon for blind people.*

***Key Words*: GPS-GSM module, Microcontroller, RF module, Sensors, Smart Stick, User Notification Setup.**

1. INTRODUCTION

Sensors serve as its eyes and the microcontroller as its brain, which will retrieve data from the surroundings and pass on commands to the user notification setup. This system mainly consists of a regulated power supply, RF transmitter, RF receiver. The survey conducted by an NGO, 98% blind people have met with accidents while traveling. Some innovators also tried to assist the blind people using IR sensor, but our research found that IR sensor cannot work in sunlight because it also contains some amount of infrared rays which can be detected by photodiode present in IR sensor, our device overcomes this limitation as well. In order to address all above-defined problems and to empower 36 million blind people worldwide, we are introducing a solution of what is christened as "Smart Stick". The sensor detects the presence of an obstacle in front of the persons. Some other products available in the market are the smart belt, smart ring, smart cane etc. The report by Times of India, India is now home to the world's largest number of blind people. RF module will help the blind person to locate the stick easily.

The stick is integrated with various sensors like ultrasonic sensor, water sensor with GPS-GSM module and RF module and with microcontroller etc. main aim to work on this project is to focus the blind population of the world and to assist them in every walk of life through the aid of technology.According to the procured data from World Health Organization (WHO) and National Federation of the Blind, there are around 253 million people who are visually impaired out of which 36 million people are blind worldwide. This will assist the blind persons during the walk and provides an alarm if any hurdle is detected with-In the set range. On the other hand, while India needs 2.5 lakh donated eye every year, the country's 109 eye banks (five in Delhi) manage to collect a maximum of just 25,000 eyes, 30% of which cannot be used.

So blind people are not interested in buying such products. But these devices have very limited usability and lack approach due to more cost. Of the 36 million people across the globe who are blind, over 15 million are from India. This System is design to detect the obstacle in front of the stick and giving the alarm. GPS keeps on monitoring the location of the blind person. Also, there are no special facilities provided to blind people in local transports resulting in the high number of accidents involving blind people.We found that the main aids that blind people use are trained dogs, but such dogs are very expensive and not very reliable.

This device of ours utilizes the latest available sensors to aid the people with visual disability. The main innovative aspect of our project is the traffic detector. Some important aspects of our project are:

(i) **Size:** It is a decently sized stick as it has so many features, but still is practical to use and would not limit the user's movement.

(ii) **Power:** It utilizes a rechargeable Li-ion battery which has the ability to last for at least 12 hrs.

(iii) **Cost:** It is a very cost-effective product and provides all these features at a reasonable price.

The stick vibrates in relation to the closeness of the incoming vehicle hence allowing the user to determine the location of the traffic around him. We have made it

considering the poor income of typical Indian families and hence it will be affordable.

2. RELATED WORK

Smart Stick for the Blind a complete solution to reach the destination. This system uses IR sensor, Ultrasound sensor and water sensor to detect the obstacle. However, this system just gives an alert if any one of the sensor is triggered, it uses a buzzer to alert the blind person. This system does not use any location identifier or location indicator.

Pothole detection for visually impaired which uses a camera that captures image 15 frame per second and based on the concept of image processing the pothole is detected. Problem with this system is use of camera makes it expensive, and also a lot of images captured per second increases overhead and storage requirement.

Smart Walking Stick for Blind describes about a Stick which use Raspberry Pi and an ultrasonic sensor to detect objects and intruder, the system also has a camera embedded with it, and based on the images captured the objects are detected. The objects are analysed based on the set of image datasets that are already stored. This system however, becomes costly due to the use of high-end camera and also because of storage constraints as large volume of datasets are needed to be stored. This system, sometimes might also be inaccurate because the obstacles are detected based on dataset (large set of images) as different objects vary in their shape and size.

Smart Belt for Blind uses a belt embedded with ultrasound sensor which detects the obstacle. The belt also has a buzzer which vibrates when obstacle is detected. The entire system is developed in such a way that the distance calculated is sent as an audio message for the blind person, where in which he hears the distance calculated using a speaker. A wearable ultrasonic obstacle sensor for visually impaired. This system uses a couple of ultrasound sensor on either side over the strap of the goggles. This seminar can detect the intruder in front of the blind person who is wearing the goggles. This system is not robust as the sensor embedded with the goggles makes it heavier and also it cannot detect complex objectsch as water, vehicle etc.

2.1: Sensors

The selection process of appropriate sensor depends on several factors such as, cost, atmospheric condition, kind of obstacle to be detected, detection range, and the desired precision of measurements collected information and its transmission frequency as shown in Table I. We used a combination of 2 types of sensors infrared and ultrasonic for the following reasons:

a) **Infrared sensor** recognize small obstacle but with less accuracy than laser sensors. However using laser sensor is costly which contradicts our aim in obtaining affordable aiding devices. They perform almost the same within 2 meter.

b) **Ultrasonic sensor** work well for close obstacles unlike laser one, when an object is so close the laser sensor (less than 15 cm) can't get an accurate reading. Moreover, it should be noted that radar sensors can easily detect near and far obstacles with equal perform once, but their medium accuracy doesn't allow them detecting small obstacles.

c) **Water sensor:** A water sensor is located at the base of the stick to have precaution against the wet surface which can causing slipping on the floor and thus can hurt the blind man. When the water sensor comes in contact of the wet surface, it produces an electrical signal, which triggers the Arduino controller. A voice instruction for wet surface is produced and also a buzzer is enabled for alarming against a wet floor.

Infrared sensor chosen has a detection range distance that goes from 20 to 200 cm, a resolution of 0.5 cm, a frequency of 26.3 Hz and an analogical output that goes from 0 to 5 V. Ultrasonic sensor used 40 kHz transmission signal. The 40 kHz frequency is produced by a transmission sensor of two centimeter diameter; it can generate 2.4644 beams of narrowness. This is a reasonable size to be installed in the stick. We use the infrared sensor to detect upward and downward stairs because the sensor spot is roughly 6 cm. This feature enables the user to identify precisely, any kind of stairs in front of him. We use a pair of ultrasonic sensor. An upper one at a height 90 cm to detect upper obstacles and another sensor at a height 30 cm to detect low obstacles. Detection using ultrasonic sensor is based on two factors:

- **Time of flight (TOF):** The amount of delay between the emission of a sound and the arrival of an echo depending on the distance of an obstacle, which is directly proportional to the distance.
- **Beam size:** Obstacle size is depending on amount of reflected wave. Obstacles whose dimensions are larger than the beam size, all of the sound waves will be reflected to receiver. If the obstacle size small as compared to the beam size, the part of the ultrasonic sound wave will be reflected to the receiver.

3. METHODOLOGY

3.1: Block diagram

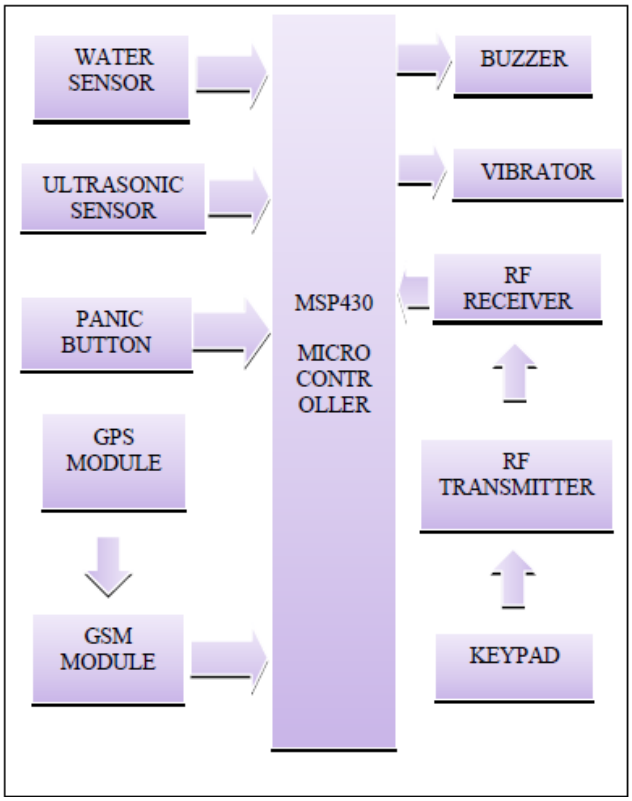

Fig.3.1: Block Diagram of Proposed System

The generally available blind walking sticks are capable of finding obstacle that touch the stick physically. It is helpful to a blind person but we here propose an advanced blond stick system that allows blind person to sense objects before stick touches them. Check if there is water in front. Also it includes gps tracking feature to find lost person along with other useful features. The system uses a microcontroller based circuit to handle the entire system functioning. Our system uses ultrasonic sensor to sense objects within certain range of the person and sounds beeps of a particular type to signal obstacles. Also we use a shorting system to detect water in front of the person. As soon as the front wires of the system dip in water that system signals the blind person by a different beep pattern to signal water in front. Now this system also has a light sensing feature to give the blind person a sense of light. It signals the person if there is light or darkness so that he/she can know if it is night or has entered a very dark room/facility. If the person looses the stick the person can use an rf remote so the stick starts beeping and the person can find it. One more important feature of the system is that the system allows the blind person to send out a sms message with his/her gps location to the caretaker/relatives/loved ones of the person in case of trouble or being lost.

3.2: Working

The block diagram of Smart Stick shown in Fig. 3.1. It shows all the important component embedded in the smart stick. Water sensor will detect the presence of water and will send the information to the microcontroller in digital form, the microcontroller will analyze this data/information and will send the command to the user notification setup i.e. buzzer and vibrator according to our program to alert the blind person. Ultrasonic sensor will detect the nearby obstacles that can cause an accident of blind people and the blind person will get informed about the same in a similar fashion as in case of water sensor. Suppose in case blind person forgot his/her stick by placing it somewhere else then he/she just have to press a button present in provided keypad the data will be sent to RF receiver present in the stick using RF transmitter, RF receiver will send this data to the microcontroller, microcontroller will activate the buzzer present in the stick so that blind person can search the stick easily. One of the main features of our stick is to track the real-time location of blind people this is done using SIM808 GPS-GSM module. We have also provided a panic button to help the blind person in case of an emergency.

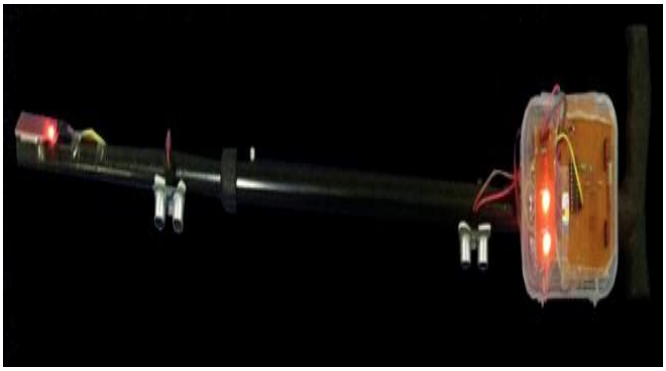

Fig. 3.2: Smart stick

3.3: Advantages

i. Having feacture to left & right turn alarm signal.

ii. Simple to use &n low cost.

iii. Low power consumption.

iv. Auto detection.

v. Less accidents will be occrued from the blind people.

vi. Facilitates the easier communication in case of emergency.

vii. Avoid the obstacle based on ultasonic sensor.

viii. Since the system is linked with the GSM and GPS module it provudes the direction information.

3.4: Disadvantages

i. Limited and fixed route to follow daily routine.

ii. Littele sensor support in this case.

3.5: Application

i. Help blind people to easily walk to destination.

ii. Help blind people for obstacle detection.

iii. Alert blind people about dig.

4. CONCLUSION

This gadget is a very practical creation which helps blind users by acting as his auxiliary senses. It has no-nonsense design which is purely focused on general usage. Even for mass production, it does not require heavy machinery. Based on the above facts we can confidently conclude that. The smart stick is a simple, cheap, easy to handle electronic guidance device, which is proposed to provide constructive assistant and support for blind and visually impaired persons. The device is efficient and unique in its capability in specifying the source and distance of the objects that may be encounter by the blind. It is able to scan areas left, right, and in front of the blind person regardless of its height or depth. It is a user-friendly device and can serve the purpose of potential beneficiaries.

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