Smart Blind Stick For Visually Impaired People

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Abstract: The term blindness is used for complete or nearly complete vision loss. Blind people need some help while travelling to feel safe. In this paper, we have developed a smart stick which increases the accessibility of blind person to move around and voice output is given when obstacle is or pothole is detected. This smart stick is cheap, lightweight and fast. The stick consists of 3 ultrasonic sensors for obstacle detection and 1 ultrasonic sensor for pothole detection.The android application is linked with ultrasonic sensors for notification of obstacle and pothole. The application has voice alerts that guides the blind person away from obstacles and potholes, Also there is an emergency alarm in the stick. It helps the blind person during emergency situation and sends message of his/her location to the concerned person or the emergency contact.

Keyowrds: Blind people,GPS navigation,Ultrasonic sensors,Arduino.

I.INTRODUCTION

As of 2012, there were nearly 285 million people who were visually impaired of which 246 million had low vision and nearly 39 million were blind. Blind people often have problems while moving around in an environment where they are not familiar. They use the traditional white cane. This cane detects obstacle only when they touch it and hence prior detection of obstacle is problem.The cane also cannot properly detect obstacle which are at certain height. Thus, blind people will feel confident to move around only when obstacles are known from far distance. This can be done with help of Ultrasonic sensors. There are various types of technologies and sensors available but ultrasonic sensors are chosen because they are cheap and light weight and can detect obstacle up to 400cm. There is also a possibility that blind person might not know the route or might have some emergency. Smart stick will help the blind person in easy mobility just like normal person.

II. OVERVIEW OF PROPOSED MODEL

The system consists of stick on which 3 ultrasonic sensors are placed (sensor 2, 3 and 4). These sensors are used for obstacle detection. Range of each sensor is 400 cm front and 60 degrees wide. Hence these, sensors are placed in such manner that covers most of the obstacles.

At the bottom of stick it consists of another ultrasonic sensor (sensor 1) which is used for pothole detection. The entire stick is variable in length according to height of the user. All the ultrasonic sensors are connected to the arduino.

The arduino is connected to the mobile which consists of android application. The application is used for obstacle and pothole notification through voice, real time GPS navigation system and gesture detection.

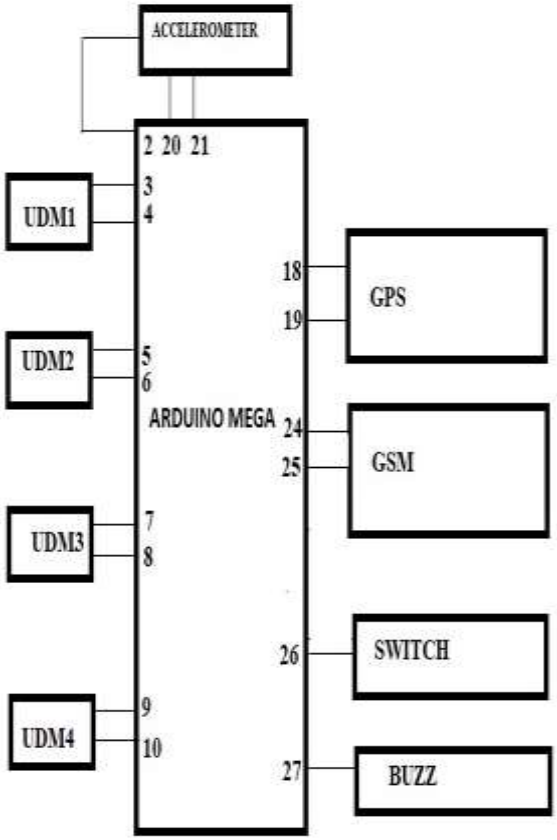

Fig: Block diagram

III. LITERATURE SURVEY

S. Gupta, I. Sharma,A. Tiwari and G. Chitranshi,"Advanced guide cane for the visually impaired people," 2015 1st International Conference on Next GenerationTechnologies(NGCT),Dehradun,2015,pp.For the safety of visually impaired people an advanced guide cane is developed that is useful for navigation purpose indoor and outdoor. The cane has an obstacle detector which works everywhere and a GPS navigation system which works outdoor. The entire cane is kept light weight to be portable and requires low power consumption via a rechargeable source. The raspberry pi used provides easy integration and programming of GPS and obstacle detectors used in cane.

Usually visually impaired people face problem to detect an obstacle .Here it is done by the means of ultrasonic sensors.To make navigation easier GPS receiver is used.By making use of GPS and ultrasonic sensors the main aim is to provide information to the blind person about his or her surroundings.The ultrasonic sensors are used for detection of obstacles in front and above waist height.Rasperry Pi provides easier extension of voice recorder capacity.

From the above proposed paper we have taken the idea of GPS navigation which can easily be modified to be used at any location lie home,office or college/university.Also we took the idea of using ultrasonic sensors to detect obstacles in front and around the blind person using echo and trigger pins in UDM sensors.Such a system is not just providing safety but also a reliable navigation via GPS for blind person and avoids any collision of the blind person with any large and dangerous objects be it man or woman,animal or even an electric pole.

A.K.Shrivastava,A.Verma and S.P. Singh,"Distance measurement of an **object** or an obstacle by ultrasound sensorsusing P89C51RD2",International Journal of Computer Theory and Engineering,VOL.2,No.1,February 2010**.**
Robotic movement control,vehicle control,blind man's walking stick,medical applications etc uses distance measurement of an object in the path of a person,equipment or a vehicle,stationary or moving.Measurement using ultrasonic sensors is one of the cheapest method amongst all.Here distance measurement of an obstacle by using separate ultrasonic transmitter,receiver and a microcontroller is presented. Distance measurement of an object that is in front or by the side of a

Moving thing is required in large number of devices .Distance measurement systems are available that are used in different inds of sensors and system.Their application requires low cost,accuracy and high speed.
Here a measurement system is mounted at a small distance that uses ultrasonic transmitter and receiver unit between them and a Philips P89C51RD2 microcontroller based system.This microcontroller is almost equivalent to 8051 microcontroller.It is therefore available at a very low cost.Ultrasonic waves are useful for both air and underwater and ultrasound sensors provide versatile distance measurements and also the cheapest solutions.In the sewage inspection system under development and testing this system is mounted in front portion on an automatic robotic vehicle.The obstacle and blockage distance is computed by the system and also communicate the distance and location of the obstacle or blockage to the control station above ground.The ultrasonic sensors thus do the distance measurement of the obstacle or blockage.In the smart stick the ultrasonic sensors are used to detect the obstacle that are in front or left or right of the blind person.

Jack Loomis,Reginald Golledge and Roberta Klatzky ," Navigation System for Blind-Auditory Display modes and Guidance",Presence: vol. 7,No. 2,April 1998,pp.193-195.The aim is to develop a navigation system for blind.The goal is to create a portable ,self-contained system that allows blind or visually impaired person to travel through familiar and unfamiliar condition without the help of any guide. Human wayfinding consists of two distinct components: sensing of the immediate environment for impediments to travel (e.g., obstacles and hazards) and navigating to remote destinationsNavigation, in turn, involves updating one's position and orientation during travel with respect to the intended route or desired destination and, in the event of becoming lost, reorienting and reestablishing travel toward the destination. Methods of updating position and orientation can be classified on the basis of kinematic order. Position-based navigation (called pilotage or piloting) relies on external signals indicating the traveler's position and orientation (often in conjunction with an external or internal map). Acceleration based navigation (called inertial navigation or path integration) involves double integration of the traveler's linear and rotary accelerations to obtain displacement and heading change from the origin; no external signals are required.

The research reported here is an effort to develop a navigation system for the blind people.The goal is to allow blind people to travel through familiar and unfamiliar environment without the assistance of guides. The experiment here is concerned with one function of the navigation system guiding the traveller along a predefined route.The GPS navigation thus helps the blind person to be guided to the correct destination even if the blind person goes in wrong direction and has to get back to the correct direction. Also through navigation the blind person can his/her destination without any guidance.

IV. METHODOLOGY

a) OBSTACLE DETECTION

Three sensors placed on the top of the stick are used for obstacle detection. Each sensor senses the obstacle towards the front using time required to receive the signal and then distance is calculated in the arduino using distance formula.
The algorithm used for obstacle detection is:
Step 1: dist_front = distance received from sensor 2 or front sensor.
Step 2: if (dist_front>=100 && dist_front<=200)

alert that obstacle is ahead.
Go to step 5
Step 3: calculate dist_right and dist_left i.e. distance from right and left sensor respectively.
Step 4: if dist_right<100 && dist_left>100
alert Turn left
else if dist_left<100 && dist_right>100
alert Turn right
else if dist_left<100 && dist_right<100
alert Path is blocked
else alert Turn anywhere
go to step 1
Step 5: check dist_front again for closeness
step 6: if (dist_front<100)
alert obstacle is very close in front
go to step 3
This output is send to android application using specific characters assigned to each direction. Using text to speech in android, the output is given in form of voice.

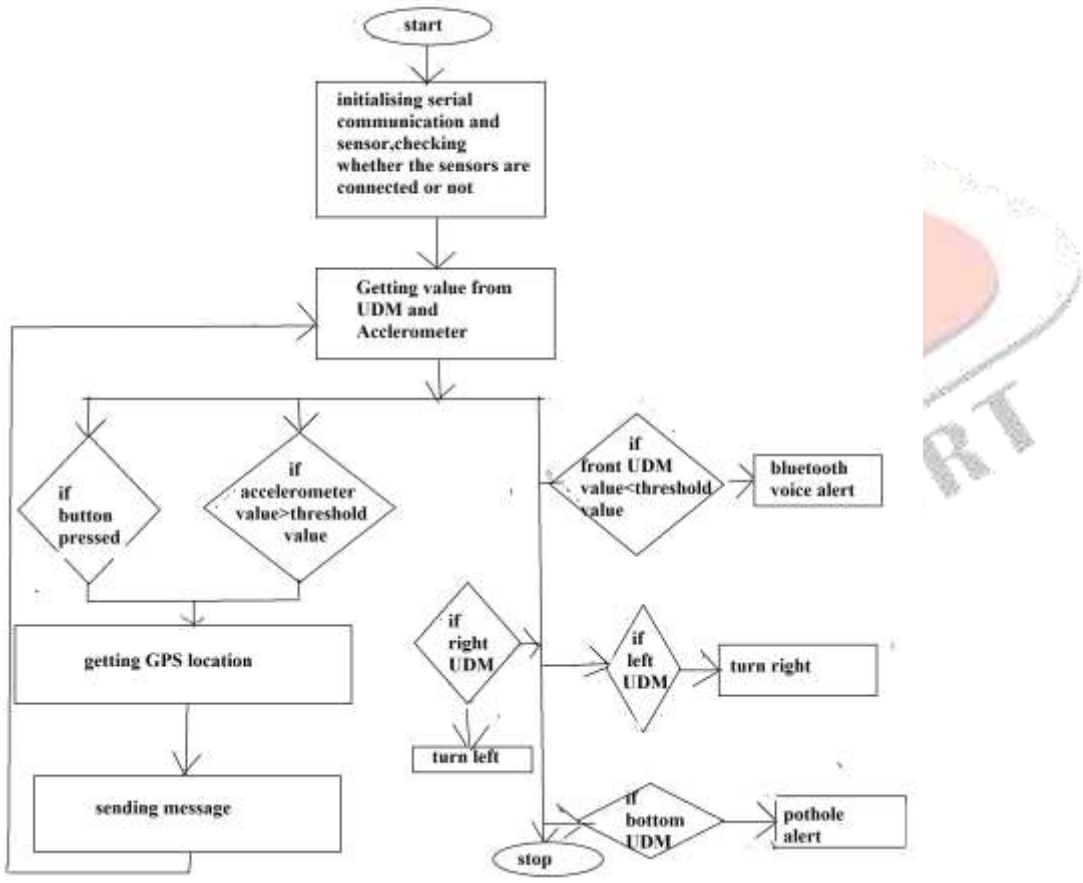

fig: flowchart

b) POTHOLE DETECTION

The pothole sensor attached at the bottom of the stick, facing towards ground, sends reading of the time required for the ultrasonic waves to reflect back from the ground; which is then converted to distance using the distance formula.
Speed of sound in air =340 m/s
Distance= (speed*time)/2 (Distance is divided by 2 is done because initial distance
received is for sending signal plus receiving signal)

avg_value = (sum of 10 values)/10.
max_value = maximum of initial 10 values.
fluct_value = max_value-avg_value.
Threshold = 2*fluct_value+avg
The arduino calculates distance from ground with each loop, using the readings from the ultrasonic sensor, and compares the new value with threshold value calculated previously to check for potholes. A value greater than the threshold value indicates the possibility of presence of a pothole ahead of the user and the arduino sends a value to the android application to warn the user.

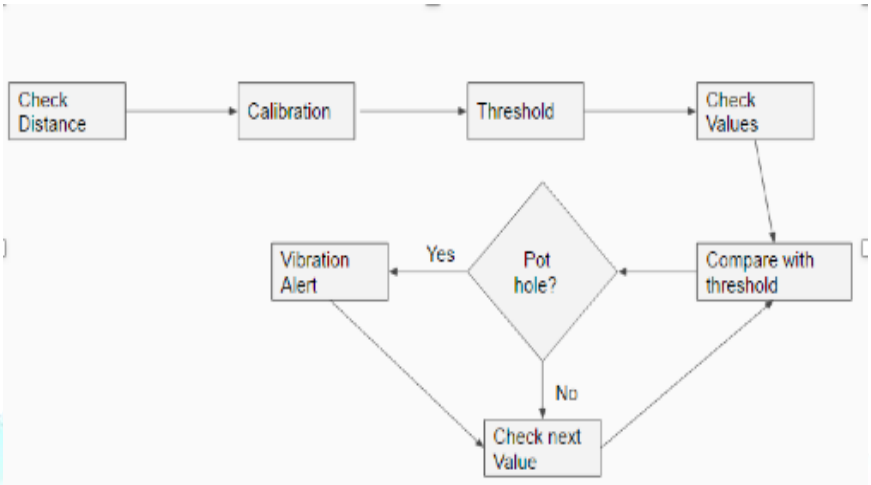

Fig:- pothole detection

c) ANDROID APPLICATION

The android application is used to alert the user about the various signals received from the sensors and also provides other functionalities. When a pothole or an obstacle is detected the app uses text to speech to speak out the alert to the user. It tells the user the where to turn if obstacle is present in its path.The application is connect through a Bluetooth module ,that is itself connected to the Arduino.When the obstacle is within the range ,text to speech conversion happens and the blind person would hear an alerting voice that guides him/her away from the obstacle.

d) BUZZER,SWITCH AND ACCELEROMETER

The buzzer is connected to pin number 26 of Arduino,switch is connected to pin number 26, the Accelerometer is connected to pin number 2,20 and 21 of Arduino.The switch acts as an emergency button.When the swtich is pressed an alert rings which is nothing but the buzzer.This signifies that the blind person is in trouble and he/she needs help.Also the accelerometer is an emergency help device.When the blind person falls on the road and meets with an accident ,the Accelerometer detects the freefall and alerts the buzzer.Through GSM module an emergency message goes to the emergency contact that contains the latitude and longitude of the blind person's location.These longitutde and latitude when analysed shows the actual location of the blind person.Thus the buzzer and the Accelerometer acts as an emergency help for the blind person.

e) GSM AND GPS MODULE

The GSM module is used to send the message to the emergency contacts in case of any accident or other emergency. It is connected to the 24 and 25 number pin of the Arduino. When the

switched is pressed or the blind person falls, the emergency message containing the latitude and longitude of his/her location is sent to the concerned person through this GSM module. The GPS module is used for the location information of the blind person. It is connected to 18 and 19 pin number of the Arduino mega.

V. RESULT

According to the distance of the obstacle the voice alert is given through the android application. If the buzzer is pressed then the location of the blind person goes to the emergency contact that is loaded in the code. If the blind person meets with an accidents or falls suddenly then also an emergency message goes to the emergency contacts. Text to voice conversion takes place, to give an audio output to the blind person, so that he can hear the alert and act accordingly .Fig 1,2 and 3 shows the screenshots of the android application, Text to voice conversion and text format when program and device interface.

Fig1:List of BlueTooth devices ready for the connection.

Fig2: Output shown in text format as program and device interface

Fig2: Connection established where Text to voice conversion occurs.

VI. CONCLUSION AND FUTURE SCOPE

The references that was taken brings to us a system where we use GPS navigation,Ultrasonic sensors to detect obstacles and provide navigation to the blind person.This helps the blind person to move around freely and without any fear or guidance.Therefore this increases their confidence to walk in non familiar environment.We hope that in future our system becomes more efficient and accurate so that it can be used by blind people without any doubt or fear

VII. REFERNCES

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