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SMART STICK FOR THE VISUALLY IMPAIRED

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Abstract : **Smart stick is an innovative stick designed for visually disabled people for improved navigation. We here propose an advanced blind stick that allows visually challenged people to navigate with ease using advanced technology. A visually handicapped person has physical limitedness on the sense of vision. So to facilitate their mobility they typically use a cane. However, the cane contains a deficiency in terms of function. The deficiencies of the cane are that it cannot observe an out of range obstacle and blind's family is unable to trace the blind's location. Supported by these issues, we have developed a smart and innovative blind stick for a visually handicapped person using Raspberry Pi as a microprocessor and Arduino Uno as a microcontroller and it has sensors and buzzer to facilitate and provide help to its user as well as GPS and GSM as an added feature. Our proposed project first uses ultrasonic sensors to detect obstacles ahead using ultrasonic waves. On sensing obstacles the sensor passes this data to the microcontroller. The microcontroller then processes this data and calculates if the obstacle is close enough. If the obstacle is not that close the circuit does nothing. If the obstacle is close the microcontroller sends a signal and the vibrating motor starts vibrating. The vibrating motor is placed on the grip of the Smart blind stick to let the person sense the obstacle in front of him. The blind stick is integrated with two ultrasonic sensors that will help to detect the obstacles in front of the stick. The purpose of using two ultrasonic sensors is the difference of height of the obstacles. One sensor will be placed on the bottom of the stick and the other sensor will be placed in the middle of the stick. As a result, the smart blind stick will help the blind person to realize the exact nature of the obstacle in terms of its height. To help in tracking the location, this smart cane utilizes GPS to see the location and send it via SMS. This tactic utilized in this analysis is the design of hardware and software package, tool creating, and testing tool. The expected results of this research are to form a smart cane for a visually handicapped person which may assist their daily activities. A visually handicapped person will avoid a collision as a result of this smart cane as the stick can advise the person through the vibration motor and it may notify their family if they're lost. The major objective of this project is to assist blind individuals to maneuver more freely by employing a reliable stick.**

IndexTerms: Ultrasonic sensors, Smart Blind Stick, GPS, GSM, Rpi, Arduino Uno.

I. INTRODUCTION

Visually impaired people are the people who find it difficult to recognize the smallest detail with healthy eyes.

Those who have the visual acuteness of 6/60 or the horizontal range of the visual field with both eyes open have less than or equal to 20 degrees. These people are regarded as blind. A survey by WHO (World Health Organization) carried out in 2011 estimates that in the world, about 1% of the human population is visually impaired (about 70 million people) and amongst them, about 10% are fully blind (about 7 million people) and 90% (about 63 million people) with low vision. The main problem with blind people is how to navigate their way to wherever they want to go. Such people need assistance from others with good eyesight. As described by WHO, 10% of the visually impaired have no functional eyesight at all to help them move around without assistance and safely. [1]

This study proposes a new technique for designing a smart stick to help visually impaired people that will provide them navigation. The conventional and archaic navigation aids for persons with visual impairments are the walking cane (also called white cane or stick) and guide dogs which are characterized by a many imperfections. Eyes are among the senses that are extremely vital for humans as a result it serves to record the circumstances or conditions that are all around, thus people determine and verify things that they saw. Anyone will do a range of activities a lot of simply if they have normal seeing. However, not everybody was born with a normal eye; there are people experiencing vision disorders since birth. One among the issues typically encountered by the blind is the limitation of activity and mobility. Blind people urgently would like tools to sight obstruction so that they might walk anyplace without worry of about to crash into objects ahead of them. Based on these issues, this research can develop a smart cane for the blind using Raspberry pi, and so, we are going to install the ultrasonic detector, buzzer, GPS+GPRS module, and a vibration motor to facilitate the user. To help relatives to the blind's location, the smart cane can use the GPS system as the determination of the location, and it'll send the location through the SMS.[2]

The cane also can 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. These problems can be taken care with real time navigation and gesture recognition. Smart stick will help the blind person in easy mobility just like normal person. [3]

II. LITERATURE SURVEY

A Brief Study and Survey has been Carried out to understand various issues related to the project which involves providing a smart electronic aid to the blind people to provide artificial vision and object detection, real time assistance via GPS module by using Raspberry Pi. A survey is made among the Blind people finding difficulties in detecting obstacles during walking in the street . Our project mainly focuses on the visually impaired people who cannot walk independently in unfamiliar environment.The main aim of our project is to develop a system that helps the blind people to move independently. An ultrasonic sensor based blind stick is proposed by Agarwal and Kumar in 2015 with GPS system and a buzzer. As they didn't give any pictorial view of the stick, so according to device description it seems to be pretty heavy. Besides that, there was no information about how long the buzzer would be in ON condition. And the sending sms issue by an illiterate blind person seems to be quite impossible. An outdoor navigating device also came into attention in 2012. The stick uses GPS technology and a SD card to store information about different locations. But the device cannot help in indoor environment as there is no GPS signal available. In 1973, an optical triangulation based laser cane was proposed, which could only detect head-height obstacles. And in 1989, a navigating device equipped with a small computer and sensors was planned. It took images and then translated them into a series of audio cues to inform the user which routes are blocked by obstacles. And after late nineties, wearable obstacle detection system was introduced, which was quite heavy to wear and handle. [1]

An Electronic Travel Aid is form of Assistive technology forenhancing mobility of blind person. The research problem of designing a better ETA is tough one. Blind people find travelling difficult because they cannot determine where obstacles are. This process is also called as „Spatial Sensing". There are various problems with existing system. First, the rangefinder technology is unreliable in detecting steps. Second, Blind people find various sound pitches and vibrations difficult to understand. Third, these systems are quite expensive and since blind person have to depend financially on someone, they don"t feel worth to invest so much. Problems and various existing systems. [2]

Voice operated outdoor navigation system for visually impaired persons done by Somnath and Ravi (2012). Uses a stick equipped with ultra-sonic sensors, GPS. The stick contains GPS which will have SD memory card which used to store different locations. The user can set the location by GPS will guide the person to his/her destination. This system will also provide the speed and the remaining distance to reach the destination. When the ultra-sonic sensors detect any obstacle directly the buzzer will activate the vibration motor. This system can be classified as a low cost system affordable by the user. [3]

The system uses the ARM processor which has more memory space, so that the operating speed is high. However, this system cannot operate indoors because there will be no signal for the GPS system. The accuracy of the GPS signal need to be improved because it only can be controlled within 5 meters radios. Finally, the blind person need to be trained on the system so that he or she can use it effectively. Obstacles detections, artificial vision and real time assistance via GPS. This system operate by using GPS, artificial vision system, obstacle detection.. This system also contains ultra-sonic sensors to detect the obstacles. Furthermore, this system include GPS system is to reach the required destination. Once any obstacle is detected or the destination is reached the voice circuit will activate providing certain type of voice. All these sub systems are connected to microcontroller which control the entire operation of the system. This system can be classified as a low cost system. The accuracy of the artificial vision unit provides a high accuracy output for the user. In addition to that, the detection distance of the system is 15 meters. However, the designing complexity of the system make it difficult to design and understand. Another study in the same field to help blind people uses the pulse echo technique in order to provide a warning sound when detecting the obstacles. [4]

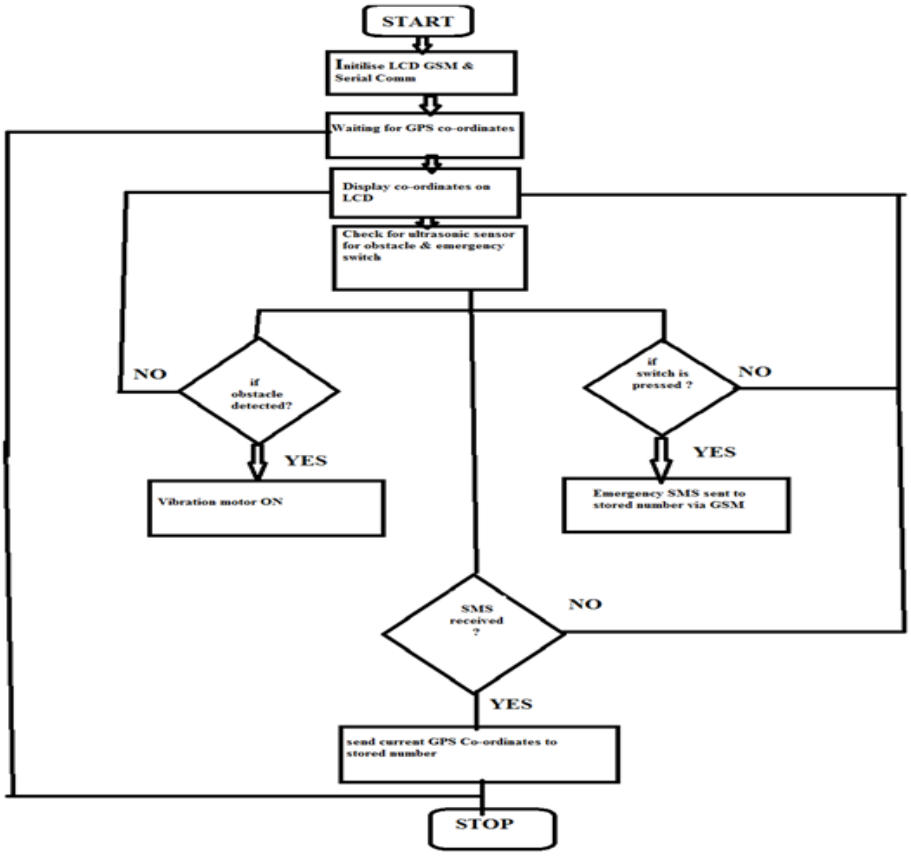
This technique is used by the United States military for locating the submarines. They used pulse of ultrasound range from 21 KHz to 50 KHz which hit the hard surface to generate echo pulses. By calculating the difference between signals transmit time and signal receiving time we can predict the distance between the user and the obstacles. It has a detection range up to 3 meters and a detection angle between 0 degree to 45 degree. However, this system require more power to operate because of the transmitter and receiver circuits. So, this system need to be re- designed to operate with less power consumption. [5]

III. METHODOLOGY

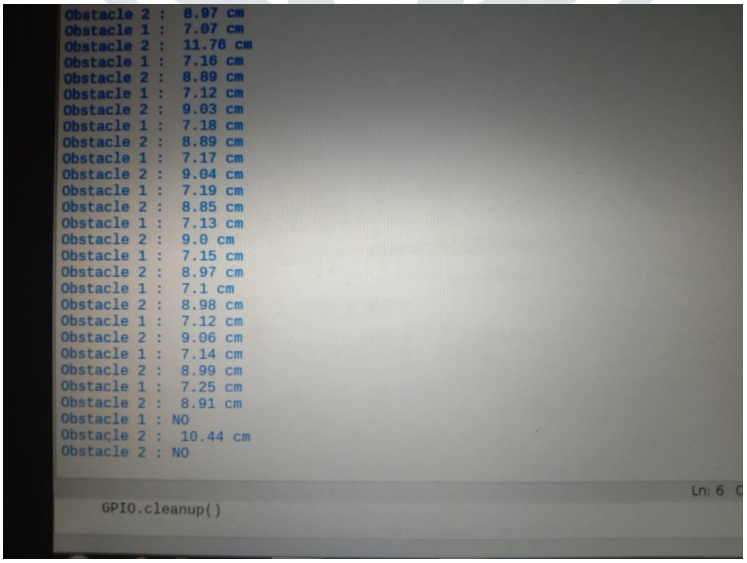
The major part in the system is the microcontroller (Raspberry Pi and Arduino Nano - ATMEGA 8) that controls the other mechanism in the system. When the ultrasonic sensors detect any obstacle in 180 degree area it will activate the buzzer and the vibrator motor will start vibrating. The ultrasonic sensor works based on the theory of the reflection of sound waves, the sensor produces a sound wave that is then reflected back by the time difference as the basis for measuring distances.

In addition to that, when the GSM modem receives a message it will be sent to the microprocessor which will get the position of the stick from the GPS modem and broadcast the location to the GSM modem in response to the sender with the help of Thingspeak IOT. In the areas with low signals, cameras can be used. This system works by fitting a camera on the person's head; it will use certain algorithm to recognize the highs and obstacles in front of the blind person.

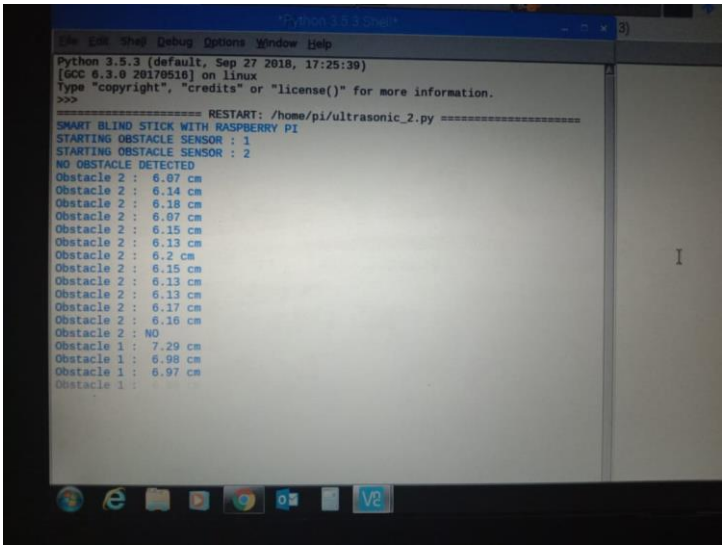
In case of an emergency, the user of the stick will press the emergency button and the signal from the button will go to the microprocessor which will get the location from the GPS modem and transmit the location to the GSM modem which will send SMS messages to the all saved numbers in the system by the concept of IOT. GPS as the user's location signal transmitter. A Push button which acts as a panic button sends an SMS to the family and relatives when the blind gets lost.



IV. SIMULATION AND RESULTS

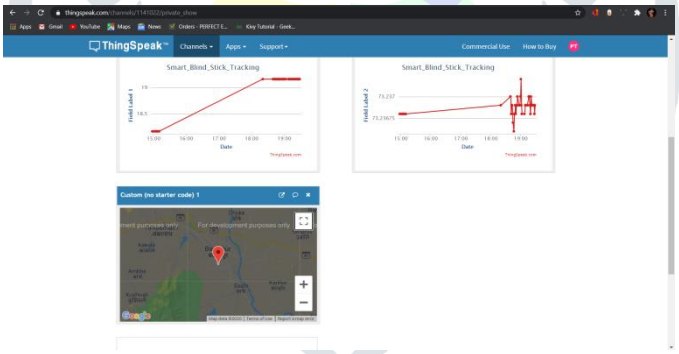


Ultrasonic Sensor readings



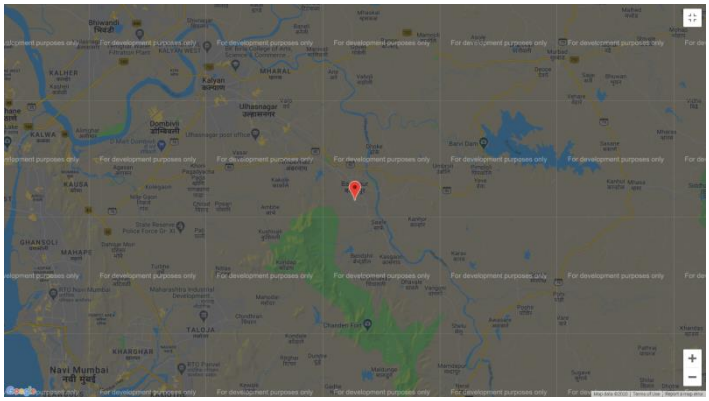
Ultrasonic Sensor readings

Ultrasonic is the production of sound waves above the frequency of human hearing and can be used in a variety of applications such as, sonic rulers, proximity detectors, movement detectors, liquid level measurement. Ultrasonic Ranging Module HC - SR04. Ultrasonic sensors work by emitting sound waves at a frequency too high for humans to hear. They then wait for the sound to be recited back, calculating distance based on the time required. The smart stick is basically an embedded system integrating a pair of ultrasonic sensors to detect obstacles in front of the blind from ground level height to head level height in the range of 100 cm .In this system the ultrasonic sensors are used to sense the obstacle (if there is any). The sensors are set a threshold limit if any obstacle is found within that range it gives beep speech through speaker. The ultrasonic sensors emit sound scopes with frequency lying in ultrasonic spectrum(20kHz), which is in- audible to human ears. The sound waves hits the obstacle and bounces back to detectors. The ultrasonic sensor is used for detecting objects/obstacles which are in front whereas the two IR sensors are used to detect the obstacles on the sides. Ultrasonic sensors and send it to the microcontroller. After processing this data, the microcontroller activates the buzzer. We also have a vibration sensor on the grip of the blind stick to let the person holding the blind stick realize that there is an object or an obstacle in front of him. There are the readings of our ultasonic sensors when an obstacle is detected. As you can see, When there are no obstacles present, the ultrasonic sensor detects no obstacle and gives a result of no obstacles in front of the blind stick.



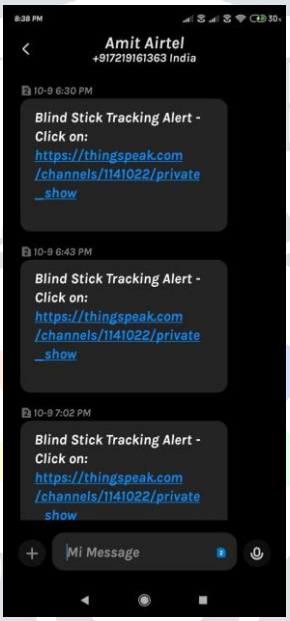
Output on Think Speak

To help in tracking the location, this smart cane utilizes GPS to see the location and send it via SMS. This tactic utilized in this analysis is the design of hardware and software package, tool creating, and testing tool. The expected results of this research are to form a smart cane for a visually handicapped person which may assist their daily activities. The GPS receiver obtains the data as a whole NMEA format text. Only the latitude and longitude coordinates are taken from it; using the Arduino TinyGPS library. Then the GSM module sends SMS to the number specified in the code. This code is useful for GPS and GSM projects like Vehicle Tracker and other Arduino based live location sharing or tracking devices, similar proto-types etc. The switch input based GPS needs a manual action to operate or sends SMS. It is to just send the location by ourselves. By just simple modifications the circuit can be integrated with a wide range of sensors to detect ame,vibration, or similar devices to automatically operates on specific events.Such as, using with a ame detector sensor to automatically send the location of the accident, vehicle accident detection system to send the location of accident vehicle to rescue team, etc. . .



Location of Blind Person on google Maps

The Location of the Blind person will be displayed on the Google maps.The accuracy of the location will depend according to the accuracy of the google maps. The relatives or the family of the blind person can view the blind person's location by clicking on the text message. The text message will be sent via SMS on the mobile numbers provided by the blind person. By clicking on the SMS link. It will take you to the ThingsSpeak Cloud server where the location of he blind person is updated and also the previous locations are stored as well. In this way , anyone related to the blind person can detect the location and come to the rescue of the blind person. This helps in carefree maneuver without having the risk of getting lost.



Text message of location sent to family member

GPS determines the distance between a GPS satellite and a GPS receiver by measuring the amount of time taken by a radio signal (the GPS signal) to travel from the satellite to the receiver. To obtain accurate information, the satellites and the receiver use very accurate clocks, which are synchronized so that they generate the same code at exactly the same time. If accuracy is important, you need GPS with a wide-area augmentation system (WAAS) capability. This is a satellite service providing additional correction information to the GPS receiver in order to increase its accuracy.This system can also be used where the information is not needed so frequently and the subject has to be tracked at irregular time periods, such as monitoring of adolescents by parents, in research to track animals in the jungle, coordinating search and rescue efforts, and mapping trails and exploring new terrains.

V. CONCLUSION

Embedded Systems based Recon Device is a detection device which can be used for n number of purposes, be it scanning of an unknown place for military usage or for finding missing people in a natural calamity. The base of the device is a Raspberry Pi 3 microcontroller, which primarily uses two sensors, PIR and Ultrasonic used for detecting dynamic moment and calculating the distance resp. The device gives a full 360° view of the unknown place, capturing the dynamic movement and their coordinates. All the data is sent to the user in Real time which helps them in making quick precise decisions.

In this paper, solution was proposed to help blind people so that they can walk with confidence by detecting obstacles and potholes in their path. Solution consisted of arrangement of sensors.

The horizontal sensors were able to detect obstacle whereas bottom most inclined sensor was able to detect pothole and output was provided in form of voice. Navigation and gesture recognition are also accurate enough, thereby increasing the accessibility for the blind and increasing their confidence to walk in non familiar environment.

A better device can be constructed using ultrasonic sensors, Raspberry Pi and other devices that employ audio commands to alert the user of what is in his path of movement. A vibrator may also be added for ease of use and convenience.

In the future, further modifications to enhance the performance of the system will be added. These include: A global positioning method to find the position of' the user using the GPS, and GSM modules to communicate the location to a relative or care giver. It should also accommodate wide varying grips for flexible handling.

REFERENCES

[1] World Health Organization, "Visual Impairment and Blindness," Fact sheet N "282", Oct 2014.
[2] National Disability Policy: A Progress Report - October 2014, National Council on Disability, Oct 2014.
[3] T. Terlau and W. M. Penrod, "K'Sonar Curriculum Handbook", Available from: "http://www.aph.org/manuals/ksonar.pdf", June 2008
[4] L. Whitney, "Smart cane to help blind navigate", Available from: "http://news.cnet.com/8301-17938_105-10302499-1.html", 2009.
[5] J.M. Hans du Buf, J.Barroso, Jojo M.F. Rodrigues, H.Paredes, M.Farrajota, H.Fernandes, J.Jos, V.Teixeira, M.Saleiro."The SmartVision Navigation Prototype for Blind Users". International Journal of Digital Content Technology and its Applications, Vol.5 No .5, pp. 351 – 361, May 2011.
[6] I. Ulrich, and J. Borenstein, "The guide cane-Applying mobile robot technologies to assist the visually impaired," IEEE Transaction on Systems, Man, and Cybernetics-Part A: Systems and Humans, vol. 31, no. 2, pp. 131-136, 2001.