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SAVVY STICK FOR VISUALLY CHALLENGED

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Abstract : Vision is one of the most important human senses, and it plays a critical role in understanding the surrounding environment. However, millions of people in the world are experiencing visual impairment. They are facing difficulties in their daily navigation since they cannot see the obstacles in their surroundings and also recognizing a person is one of the major problems faced by them. There are many applications other than automation that use object detection but are not explored in depth till date. This project involves one such application that uses detection to help the visually impaired to identify the objects ahead of them for safe navigation. For identifying the objects on their way while walking in streets or roads, the vibrating cane is designed using ultrasonic sensor, water sensor, inertial sensor and a vibrating system. Thus, this model helps in assisting the visually impaired people in a more comfortable way.

IndexTerms **- Visual impairment,walker,stick,sensor.**

I. INTRODUCTION

The biggest challenge for a blind person, especially the one with the complete loss of vision, is to navigate around places. Obviously, blind people roam easily around their house without any help because they know the position of everything in the house. People living with and visiting blind people must make sure not to move things around without informing or asking the blind person. Commercial places can be made easily accessible for the blinds with tactile tiles. But unfortunately, this is not done in most of the places. This creates a big problem for blind people who might want to visit the place.

Firstly, there has traditionally been an overwhelming emphasis on ICT (Information and Communication Technology) tasks such as reading or using a computer, rather than helping those with vision loss better interpret real-world scenes. Portability and convenience remain a second major problem and, even though many such issues have been significantly mitigated by the emergence of the smartphone over the past ten years, blind people have long been crying out for solutions that are more seamlessly integrated and wearable. The most valuable thing for a disabled person is gaining independence. A blind person can lead an independent life with some specifically designed adaptive things for them. There are lots of adaptive equipment that can enable a blind person to live their life independently but they are not easily available in the local shops or markets. Assistive technology to help those who are blind or severely sight impaired has, for several decades, been dogged by a number of critical issues. In order to help them with a best assistive technology we have designed a savvy walking stick which is very easy to use as well as efficient.

II. PREVIOUS RELATED WORKS

Many assistive devices for the visually challenged people have been created by many researchers. New devices and technologies can be found by many researchers but the one device that is more convenient for the visually challenged people is the need of the moment.

Smart glove[1] is designed to aid the blind in locating the desired object. The whole system functions as an independent stand-alone unit. The system is analyzed thoroughly in order to minimize power consumption as the system is running on battery power. The stand-alone unit comprises of the Raspberry Pi which has a Universal Serial Bus (USB) camera with a built-in microphone. The whole process of the proposed solution starts with the user vocally communicating to the system about the object being looked for. The audio input from the user received by the microphone connected to the Raspberry Pi is converted into text, using the “pyttsx3” – speech to text module for python. The name of the object needed by the user is extracted from the vocal command using keyword extraction technique. This extracted keyword is passed to the object detection algorithm running DNN. The DNN used for the smart glove is implemented using the Caffe framework. The DNN running on Raspberry Pi processes the real-time video and locates the required object and tags it. The object tracking algorithm then takes control to improve the frame rate. The object, once located, must always remain in the center of the frame relative to the glove. The major disadvantage of this system is the system loses the convenience factor. The visually challenged people are already struggling. They can’t stretch their hands all over the day.

A smart wearable shoe[2] which is integrated with sensors like ultrasonic ,water and an arduino nano device. Android application will be created which connects the shoe with Bluetooth so that it will assist the user with voice control assistance. The visually challenged people don't walk by their own because they find it difficult for therm to stand individually. They always carry a stick or move with a person. So when they were given a pair of shoes they find it very difficult to move.

So after analyzing the problems of the previously existing systems, our device is designed to overcome those problems in a wise manner.

III. EXISTING SYSTEM

It consists of two ultrasonic sensors and a water sensor. The ultrasonic sensor is used to detect the obstacles on the way. The water sensor is used to detect the presence of water in the way. It also contains a microcontroller, where arduino UNO is used. The microcontroller has inbuilt comparator which will compare obstacle distance and reference distance and then generate an error as according. The microcontroller is programmed in such a way that it will sends a required trigger signal to the two vibrating motor and a piezo buzzer whenever error is found to be beyond tolerance range. The output stage involves two coin vibrating motor which will set according to signal receive by microcontroller. A piezo buzzer is also there that sound when water sensor detects presence of water.

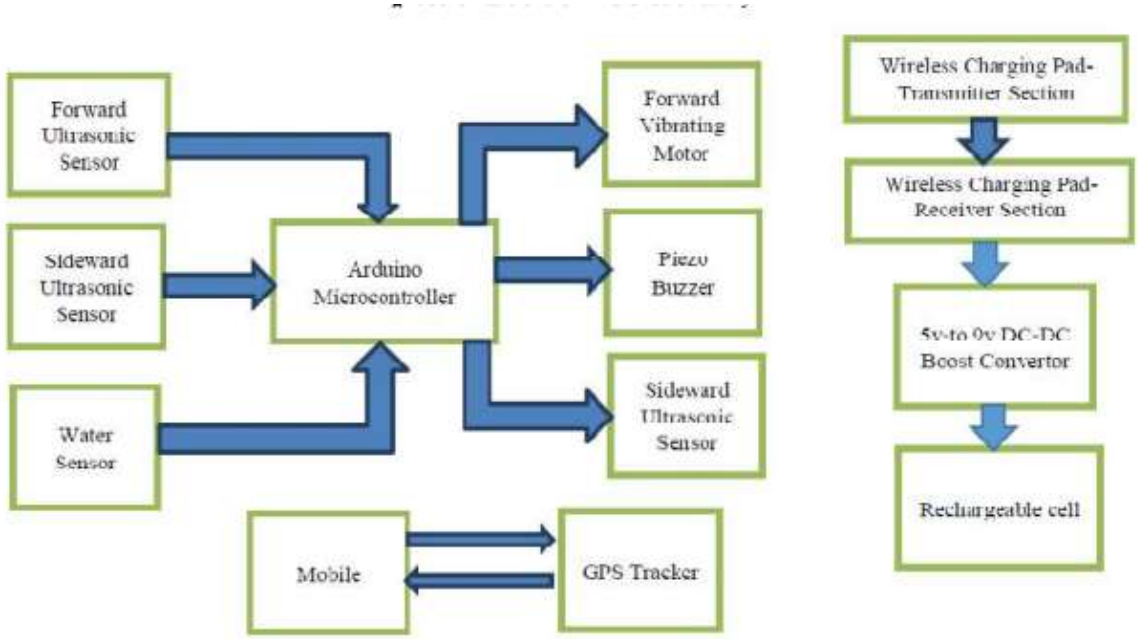

Fig.3.1 Block diagram of existing system

The shoe proposed can be wear by visually impaired people walking. The prototype was implemented with the minimum resources. The circuitry was kept simple. To ensure fast and easy charging, wireless charging is added. A 9V 600mah rechargeable battery is used to power the circuitry. The shoes can be used for nearly 3-4 hours once the rechargeable battery gets fully charged. The obstacle detection range can be set just by making small change in the program according to walking pattern and step size of visually challenged. GPS is also added for visually impaired person movement and to track his location.

3.1Advantages and disadvantages

The main advantage of the system is fast charging and also the shoes are cost efficient. The disadvantages of the system are the shoes can be used only for few hours as they are not sufficient for a whole day. The another disadvantage is the loss of comfort. The visually challenged people can't move on their own without the support of a cane or a person. Because they have been walking like this from the beginning. So the shoes will be difficult for them to adapt with.

IV. RESEARCH METHODOLOGY

The research methodology of our proposed system is done by five steps. The first step is finding the problem. The major problems faced by visually challenged people is to move freely without the help of others. The second step is defining the problem. The problems in the defined problem is studied. The issue which is taken as the main problem is the comfort of the user. The third step is searching the suitable technology to solve the problem. The targeted customer for the device designed by us is the visually challenged people. They can't afford much to advanced devices. So the task is to design a cost effective device which is more efficient than the other devices. The fourth step is designing the prototype. The savvy stick is our desired system. The mechanical design of the traditional walking stick won't be much comfortable for the advancements that we are gonna make. So the mechanical design of the system needs to be changed. Then by using microcontroller the simple circuitry is made for the detection of obstacles, water, fall and shock. The last but essential step is the testing of the designed product. The main objective of the system is to design a device that fulfills the need of the targeted customers. So the testing is made and the results of the required parameters are noted. If necessary, redesigning is done.

4.1Mechanical design

The savvy stick designed by us is totally different from the traditional cane. The changes are made for mutual benefits. That is the design is helpful for the implementation of the device and also it is comfortable for the blind to use. The savvy stick is made with four legs to make it more stable. The mobility of the cane is maintained by wheels at the bottom of the legs. The hands of the stick are connected horizontally at the top with a narrow plate, which is especially for the resting of the user's hand.

4.2 Technical design

The hardware part of the savvy stick is built using microcontroller Arduino UNO and sensor namely ultrasonic sensor, water sensor, inertial sensor which detects the required parameters.

4.2.1. Arduino UNO

For controlling or handling the data as gotten by ultrasonic Sensor a microcontroller is utilized. Here we have utilized an Arduino Uno microcontroller. The microcontroller is modified to get signal from two ultrasonic sensors and a water sensor. The microcontroller is modified to trigger the twocoin vibrating engine, at whatever point ultrasonic sensor tracked down snag inside its reach. The obstruction discovery scope of ultrasonic sensor can be set through the program written in microcontroller, which can be change as indicated by the strolling example and step size of the outwardly hindered individual. The microcontroller is customized to peruse the voltage across 470ohm resistor of voltage isolating circuit shaped by water sensor, without water, voltage across 470ohm resistor will be zero because of open circuit between copper stripes, within the sight of sloppy way a voltage is seen across the resistor on distinguishing the voltage, microcontroller will trigger the bell to let the visually impaired individual mindful with regards to the sloppy way .On identifying presence of water a higher voltage perusing is seen across resistor, microcontroller is modified to such an extent that sound of signal will be corresponding to voltage perusing across 470ohm resistor this is finished utilizing PWM controlled advanced pin 9 of microcontroller.

Fig.4.1.Arduino UNO

4.2.2. Ultrasonic sensor

Ultrasonic sensor is used to measure the obstacle distance. It is done by using sound waves generation so that they detect the obstacles nearby. The time for wave to return back is noted down and then the distance is defined. It is possible to calculate the distance between the sonar sensor and the object. An ultrasonic sensor is fixed in the stick that is connected to the pin 7 and 8 of the microcontroller. Whenever the sensor detects the object, it sends information to the microcontroller.

Fig.4.2. Ultrasonic sensor

4.2.3. Water sensor

A water sensor is utilized to distinguish the presence of water in the way of visually impaired individual. The water sensor is mounted on the lower part of shoe. The water sensor is comprised of elastic cushion with four stripes of copper wire. Out of four stripes, one strip is kept at high potential utilizing microcontroller supply while rest of the copper stripes are associated with ground capability of microcontroller by means of a 470ohm resistor. The copper strip alongside resistor structure a voltage isolating circuit. The Voltage across 470ohm resistor is estimated utilizing A0 simple pin of microcontroller. at

Fig.4.3. Water sensor

whatever point sensor gets in contacted with water a way gets shaped between copper stripes and we get a voltage perusing across the resistor. The worth of voltage across 470ohm resistor gives how much water present.

4.2.4. Inertial sensor

Even with the ultrasonic sensor and water sensor, there are chances for the subject to fall or stuck. So in order to observe fall and shock the inertial sensor is fixed in the system. The use of this inertial senor is to double fold: One is for the fall detection, the vertical front and end are continuously monitored and also the angle of the system is monitored and the information is given to the microcontroller.

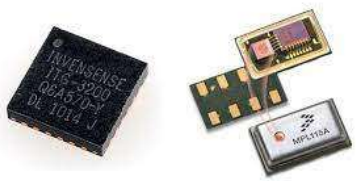

Fig.4.4. Inertial sensor

4.2.5. Buzzer

A Piezo Buzzer is an electronic part ordinarily used to create sound or a signal. In this proposed shoe, piezo signal sounds at whatever point the water sensor identifies the presence of water in outwardly weakened individual way. The signal is associated with PWM control computerized pin 9 of Arduino Microcontroller. The force with which ringer sounds rely upon the power of water present in the visually impaired individual way. The power of signal sound can be controlled utilizing Pulse Width Modulation method gave in the microcontroller. By differing the beat width on PWM regulator computerized pin 9 of microcontroller force of sound can be alter as required.

Fig.4.5 Piezo buzzer

4.2.6. Vibration module

Vibration engine module is a little implicit vibration engine module in the wake of contributing 5V to the module we can handle it to be in ON/OFF state or vibration power. In our task this is utilized as a result part. At whatever point an item or water is identified by the sensors, they give data to the Arduino UNO and make the vibration engine module vibrate and caution the visually impaired individual with regards to the obstruction in their way. Here the positive terminal of the module is associated with advanced pin 3 and 4 of microcontroller and the negative is grounded.

Fig.4.6. Vibration module

4.3 Procedure

The following are the steps involved in the obstacle detection, water detection and fall and shock detection of the system.

Step 01: The ultrasonic sensor is fixed in the front of the design. The echo pin of the sensor receives the echo pulse from the obstacle and determines whether it is closer to the subject or not.

Step 02: If it is closer to the subject, then the information is sent to the microcontroller.

Step 03: The microcontroller then sends the information to the piezo buzzer and the vibrating module as showm in the fig.4.7.

Step 04: The water sensor is fixed below the chassis of the stick. When the sensor detects the presence of water, it sends the information to the microcontroller.

Step 05: The inertial sensor is fixed on the top of the chassis. It continuously monitors the angle and vertical component of the system.

Step 06: If there is a change in the vertical component or the angle, the sensor sends the information to the microcontroller.

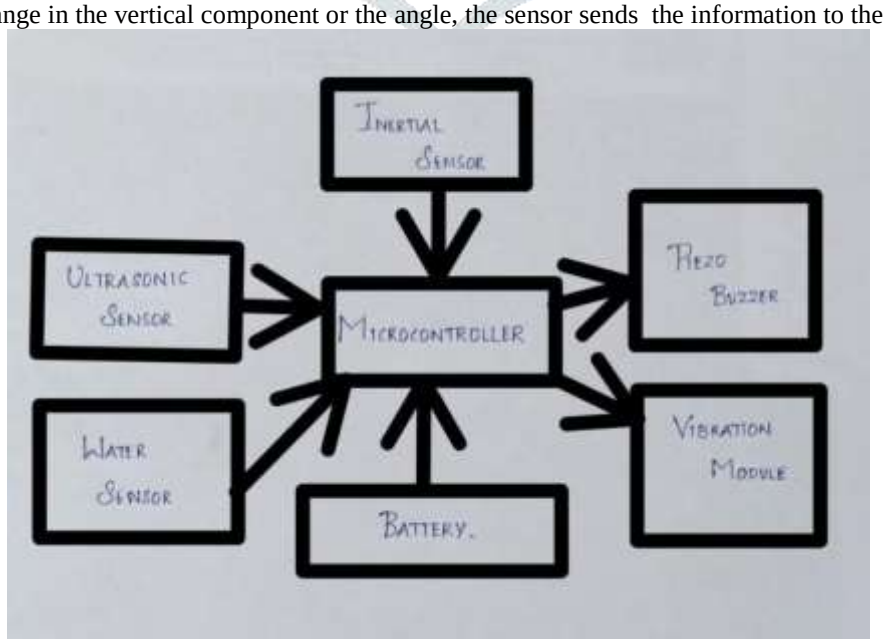

Fig.4.7 Block diagram of the proposed system

V. RESULTS AND DISCUSSION

5.1 Results and future work

Table 5.1: Comparison between proposed and existing system

Parameter	Existing system	Proposed system
Object detection	Yes	Yes
Water detection	Yes	Yes
Fall detection	No	Yes
Shock detection	No	Yes
Comfort	No	Yes

Table 5.1 shows the comparison between the proposed system and the existing system. The object detection and water detection is available in the existing system. The fall and shock detection and new mechanical design of the stick is added to our proposed system in order to make it more comfortable for the user. Our proposed system is also cost effective which is affordable by all the visually challenged people.

The electronic walker created in this exploration goes along with the necessities of a helped living framework. Agreeing to the above outcomes, the walker demonstrated its dependability and viability to give help to outwardly hindered people. Youthful grown-ups tried the electronic walker in indoor and open air conditions. Future investigations should be conveyed to approve results on older fragile and visually challenged individuals.Title page is additionally wanted to stay away from stroll through sharp obstacles. The future work will include the introduction of artificial intelligence for automatic detection of the obstacles and also face detection. It may also have automatic e-reading facilities which will be more helpful for the outwardly challenged.

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