GUIDING VISUALLY IMPAIRED PEOPLE USING BACKPACK

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***Abstract*— In this paper, implementation of backpack is presented that can be used to assist the visually impaired people. It can help the blind person to avoid hurdles using vibrations produced by five haptic motors. It does not only navigate the path to blind person but also informs his/her location to others through a message on the mobile device. Six ultrasonic sensors are used to scan the environment and provide inputs to processor. It can help their caretaker to locate them using the received co-ordinates from Global Positioning system (GPS) and Global System for Mobile Communication (GSM).The obstacles are detected by different modes and alerts are given using haptic motors.**

Keywords---Visually impaired, Arduino, Obstacle detection, GSM, GPS, Navigation.

I. INTRODUCTION

The spread of visual impairment is a very sensitive issue worldwide. Blind people have to play in the everyday actions of different difficulties.These include the difficulties of moving in complete autonomy and the ability to seek and recognize objects.

Visually impaired persons have to encounter many difficulties in their daily routine due to the deficiency of information from their surroundings. The knowledge of their surroundings can help the visually impaired people to evade the obstacles and recognize the alternative ways to get into the desired location.

Implementation of visually impairment aiding system is an active field and a lot of works has been already done. It is getting improved with the passage of time. It has been in different ways to facilitate the blind person.

As of 2015 there were 940 million people with some degree of vision loss.246 million had low vision and 39 million were blind. The majority of people with poor vision are in the developing world and are over the age of 50 years. Rates of visual impairment have decreased since the 1990s. Visual impairments have considerable economic costs both directly due to the cost of treatment and indirectly due to decreased ability to work.Therefore this study is going to suggest the method to navigate the path to blind people and to locate their positions.

II. MODES OF OBSTACLES

Technological challenges: Blind people can make it difficult to use the internet for research,recreation,social media and shopping.Even those who,although not completely blind have extremely poor vision may have difficulty with small fonts,interpreting icons.
Environmental challenges:People who are completely blind may face difficulty while navigating to outside spaces.
Social challenges:Blindnessmay also cause difficulties while participating in activities outside the workplace.

III. TECHNIQUES USED IN DETECTING OBSTACLES

Obstacles detection and warning can improve the mobiliyas well as the safety of visually impaired people

specially in unfamiliar environment.For this, firstly obstacles are detected and localized and then the information of the obstacles will be sent to the visually impaired people by using different modalities.Different techniques for obstacle detection and classification are available.The widely used techniques are based on computer vision techniques because of their run time efficiency and cost effectiveness.

A.Computer Vision-based:

An image is captured by using a camera and processed by image (background) subtraction followed by Edge Detection, Pixel clustering, Edge linking, Noise Elimination,Object Enhancement etc. to extract the objects present in these images. Further, detected objects are compared to a database of objects.The user is alarmed about the matched object name with its colour information through headphones.

Fig1:

B.Audio feedback:

Obstacle information is sent to user using text to speechengine and the loud speaker.The voice system translates live images into sounds for the blind persons to hear through a stereo headphone.The position of visual pattern corresponds to high pitch,while the brightness is represented by the loudness.The segmented image is divided into left and right parts,transformed to (stereo) sound that is sent to the user through headphones. The acoustic feedback is in charge of informing the visually impired users about the potential obstacles in their way.However to avoid blocking the ears,they use audio bone conducting technology which is easy to wear andears-free.

B.Tactile feedback:

This approach is to transform obstacle information into vibrotactile or electrotactile stimulations on different parts of the body.Visually impaired users are then trained to interpret the information.This approach allows the hearing sense to be free for the task of precautions or warning dangers.The wearable devices consist of vibrator motors,each motor is assigned to detected regional obstacles.The value of closest object in each region is transformed to vibration applied on the skin of abdomen.The obstacle information is transformed to electrical pulses that stimulate the nerves in the skin via electrodes in the data gloves.

C.Haptic feedback:

Haptic feedback is the use of advanced vibration patterns and waveforms to convey information to a user.Haptic uses a vibrating component (actuators) such as vibration motors or a linear resonant actuator which is driven by a electronic circuit.It is common for a microcontroller to decide when to vibrate and with which pattern and for adedicated haptic driver chip to control the actuator.

IV. EXISTING SYSTEM

In the existing system model, wearable device provides function of distance measurement, feedback using sound,feedback using vibration for deaf,monitoring via GPS and GSM and alert system using buzzer.This existing system can help the blind person in four ways,1)A buzzer system alerts the blind person if he/she gets near to hurdle.2)A haptic feedback system helps the blind person by means of vibration.Its vibration starts to increase if person reaches near the specified distance.3)A voice feedback system tells the blind person about the distance of the hurdle in front of her/him.4)A GSM and GPS system helps to inform the position of the blind person to the specified emergency number.

As the system is turned on,microcontroller sends signals to the specific ultrasonic sensor depends upon the selection switch whether long or short distance measurement.Then selected ultrasonic sensor send out sound pulses and wait for echoes and reflect to hurdles.These echoes are fed in the form of PWM pulses to the microcontroller and then controller calculates the distance of the hurdle/object by measuring width of the these pulses.If the hurdle is present and lies within the specified range,the motor and buzzer starts to vibrate and beep for indicating the presence of hurdle to the blind person.

Fig 2: final output of existing system

DRAWBACKS OF EXISTING SYSTEM

The existing system sense the hurdles only in forward direction.The sensors used in this model may fails to work if the gloves get wet.The long range and short range sonars can sense the presence of obstacles upto distance of 4-

8m(16feet).The existing system may difficult to fit all the components in a single gloves.This design is very complex since different users may have different finger sizes.

V. PROPOSED SYSTEM

We are proposing the system by addressing the problem which was present in all existing systems.The main objective of our proposed system is to guide the visually imapaired people by using backpack.Messenger bags and backpack concept are proposed, since they are universal to all users and have added utility to be carried around.Take backpack design , we locate seven sensors with two in each strap, two on both sides and one on the back to cover areas in each direction.Motors are attached on the surface where the backpack contacts the back of the user.Batteries and processor are in one of many pockets.

CONCEPT:-

Six sensors will be used to scan the environment and provide the information to the processor.The processor will need to be programmed to convert information obtain from the sensor to trigger haptic response through the five motors.The sensors are located as shown in figure 4 and figure 5 to allow the users to have situational awareness in all directions.The motor and the processor locations are shown in the below figures.

As shown in the figure there are two sensors that detect objects directly in front of the user.A larger cone of detection is necessary in the front direction since it is most important for the users to know what is happening directly in front of them.In order to provide this larger cone of detection , two sensors were used.Six motors used correspondingly to provide haptic feedback.The motor are programmed to use patterns to convey obstacle distance.When the obstacle is close to the user, the motor output more pulses per second and when the obstacle is farther away it output less pulse per second.

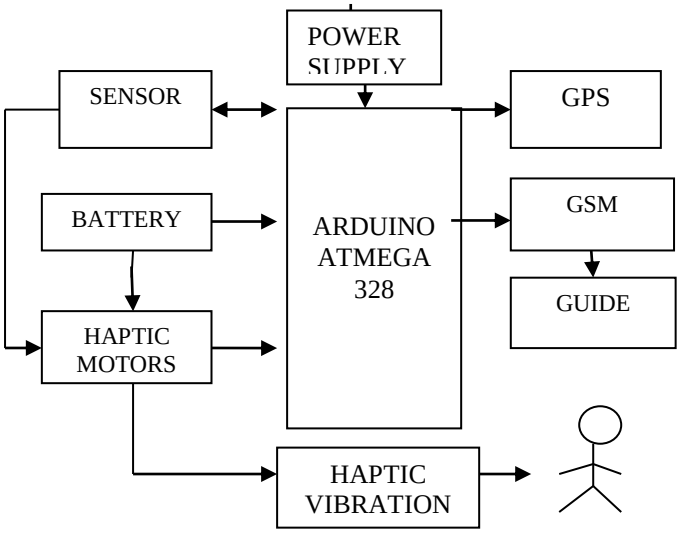

Fig. 3. Architecture of proposed system

The ultrasonic sensors transmit sound wave and receive an echo that is reflected back from an object and to calculate the distance.The battery will be used to power the processor.The power out pin from the processor can be used to provide a constant power to the sensor.A DC to DC converter and transistor need to be used in the connection with the battery to provide the proper voltage and current to the motor.The device has main piower switch is placed right side of the backpack which is connected to the battery.This switch can be used to turn the device in and off by the user.When the switch is in off mode, the battery can be plugged into the charger for charging.

Apart from main power switch, this prototype also has five switches located on the left side of backpack.Each of the five switches corresponds to one of the motors.This allows the user to turn off a certain motor when they are aware of the obstacles.

For example, user may be walking next to a friend.Since they already know there is a person next to them,the user can turn off the side motor switch to disable vibration for that area without losing the information about the rest of the environment.

VI. USED HARDWARE COMPONENTS

A.Arduino UNO(Atmega328)

The Arduino microcontroller boards are open source hardware platforms.In this project Arduino UNO is used which has Atmega 328 as microcontroller.The required input voltage is 5v.It has 14 digital input output pins and 6 analog input pins.Its clock frequency is 16 MHZ and a flash memeory of 32 KB.It has a EEPROM of 1KB and a SRAM of 2 KB.All haptic motors and sensors are connected this microcontroller.

B.Haptic Motors

Motors will be attached to the bag using iron on patch,with motor wires passing into backpack.This will create an invisible attachment while still allowing the user to feel the haptic feedback by vibrations.Wire starin relief is done by using fabric adhesive to firmly glue the wires to the patch,if the wires experience tension the glue will hold the wire in place and the tension will not transferred to person who is holding bag and only some vibrations alone transferred.

C.Ultrasonic sensors

The sensors would be housed to be protected from rainand it is attached to the backpack.The housing consists of 2 parts made from ABS plastics and it does not requires unnecessary spaces.The two parts of housing will be mated using screws,and the surfaces will make contact with enough tolerance to prevent a wire from entering the housing when the halves are mated.The ultrasonic sensor requires constant 5v supply and it operates at 0 to 70degree Celsius.The accuracy of this sensor is around 10 percent.It can even able to sense the sound of air.

Cair=331.5+(0.6*T) m/s.

D.Global System for Mobile communication(GSM)

GSM is a digital mobile network and it is widely used by mobile phone users.It is a globally accepted standard for digital cellular communication.It provides improved spectrum efficiency and it operates at 900 MHZ.It supports various network services.The basic purpose of this GSM module is to deliver the coordinates of the blind person through a text message.

E.Global Positioning System(GPS)

GPS is satellite based navigation radio navigation system.It is used to find accurate location of the user and it providesreal time,3D,worldwide timing.It uses triangulation method to find target location.Triangulation is the process by which the location of a radio transmitter can be determined by measuring either the radial distance, or the direction of the received signal from two or three different points

FLOW DIAGRAM:

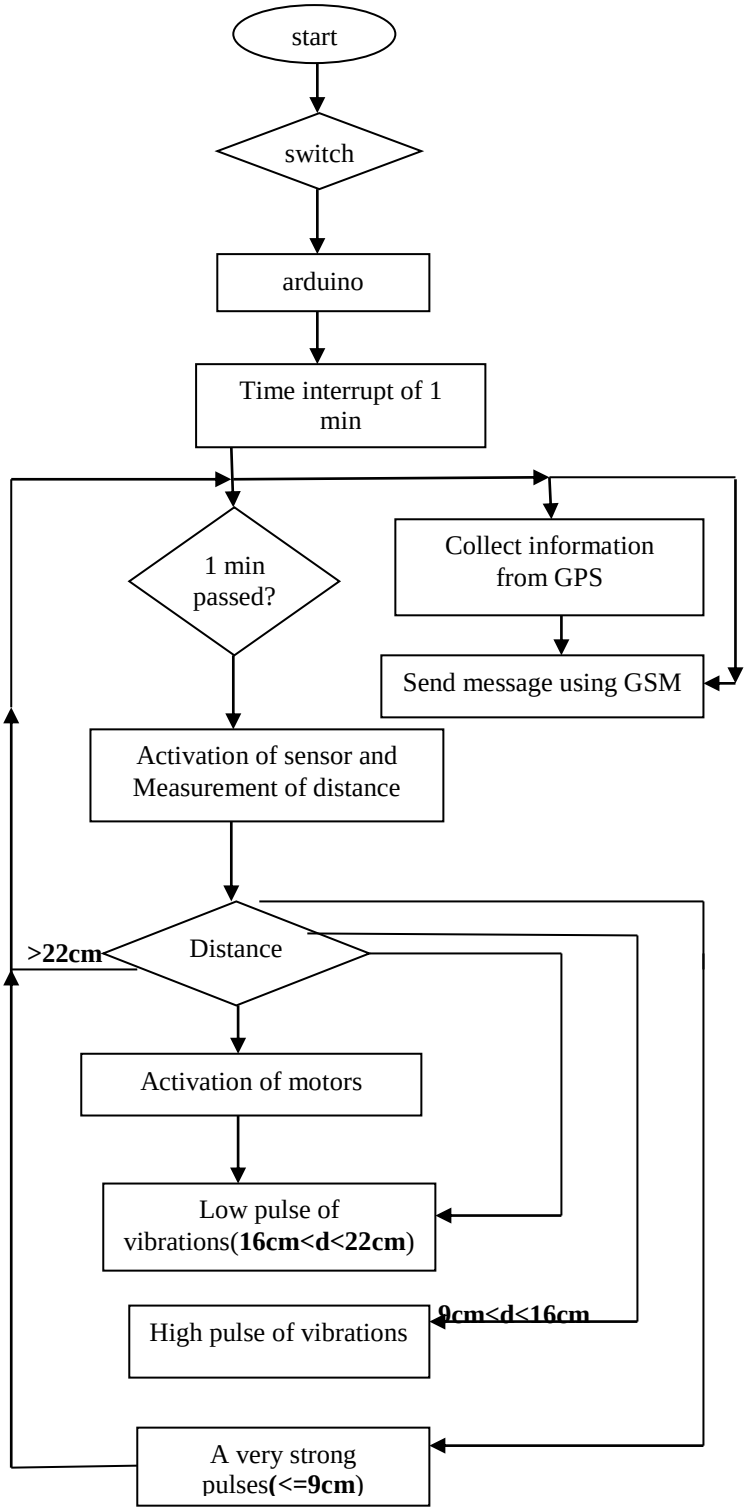

Fig. 5.Flow chart of working concept

VII. APPLICATION

The proposed system is applicable to all persons who seeks this device for guiding to reach the desired destination. This concept is very simple to implement in real time.Because of continuos changing vibrations it cannot be predicted that the vibration will be similar to already generated vibrators.It is less expensive it requires one bag so that all components can be fitted in the bag.

VIII. CONCLUSION

By using this system, it provides security to blind person to get rid of the obstacles.This concept is easy to implement in all of the sectors and it is user friendly.Apart from all other surveys, this system is very effective since the sensors will not get wet because it fitted and bolted in the bag.It not only notifies the hurdles but also informs the location of the user to the caretaker through GSM technology.Size and weight of the bag can also be reduced by using smaller versions of Arduino.

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