Energy Efficient Smart Guidance System For Visually Challenged Persons

K Hema, Kamala L, Mohan Gowda V, Rajesh S M

Abstract—One of the social responsibilities of emerging technologies is to help physically challenged people. One of them is to assist the blind people to walk alone. The main challenges confronting the visually disabled people while walking is that they are not conscious of the environment as they move in and out because they are not fully aware of their position and direction with regard to traffic and barriers in their path. Smart shoes provide the blind people with auditory assistance in coping with the difficulties they face in walking like regular human beings. The objective is likely to make a self direction framework which helps outwardly tested (or daze) individuals to walk autonomously. The idea is more about the smart shoes that warn visually disabled people in their ways to challenge which may allow them to move with less collision. The target is to tackle a reliable solution that involves a shoe interacts with users through vibrations and audio alert. Our key contribution is towards energy efficient self guidance system.

Keywords*: *ETA Kit, Piezoelectric Sensors, Ultrasonic Sensor, Visually Impaired.

I. INTRODUCTION

INTERNET of things (IoT) devices aims to bring tremendous value to our lives. With newest cellular networks, superior sensors and innovative computational technologies for its share of the pocket, the Internet of Things may be the next frontier in the war with the support of healthcare automation, technology and other emerging innovations including next-generation healthcare services, which will simplify the patient care workflows.

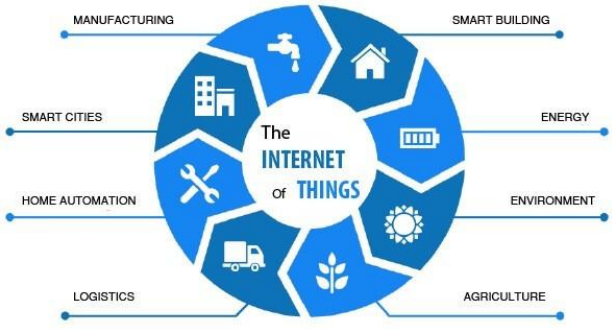

Fig .1. IoT Applications across various sectors

IoT in healthcare enables interoperability, machine-to-machine connectivity, sharing of knowledge and flow of data that makes distribution of healthcare services efficient.

Blindness, impaired vision, sensory deficiencies have significant effects on people with these conditions. They channel with the anatomical, cognitive, communal and monetary impacts, there by affecting the standard of growth and denying the people from playing out the daily doing things utmost significant which is steering and versatility. Myopia is a psychological concept defining the psychiatric disorder in which people have no experience of light as a consequence of complete loss of vision. Blindness often applies to the people with very less perception, should focus primarily about certain functions as skills for vision replacement. As an alternative side, perceptible deterioration is a clinical concept defined where the vision loss disorder is described by deterioration in perceptual functions at the stage of the brain, such as lack of visual acuity or visual area.

The Ultra Cane gives instructions to the blind but is bulkier and hands are not free. It uses ultrasonic sensors for sending the waves and collecting transmitted waves to sense objects in front of the blind. Some devices such as Ultra Cane help blind people gather information via sensors and then send feedback to the user through vibration or sound warning.

Fig. 2. Ultra Cane Model.

The major drawback of this system is difficult to find the hidden obstructions, Repetitive hand strain can occur after a while of using it, this can get caught in paving crack.

Smart Shoe offers a prototype model and a device design that provides blinker community an agile computerized assistance. This setup built includes long-term object recognition procedures, as well as to give details to the blind people. The device is comprised of a microcontroller, an ultrasonic monitor, and a vibratory mechanism.

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This work aims to develop a Computerized Transmit Assist (CTA) bag helping the unsighted to navigate hazard safe road.CTA is hooked to the cleat. An entity when sensed in the vicinity of the foot, they are warned by the aid of vibration connection, buzzer and beforehand by the support of orator or else by headphones, a voice command is sent through a Digital app. The energy source is a key requirement because the cleat is combined by the ascetic service propagation device and there will not be any issue with service substitute.

II. LITERATURE SURVEY

An agile pole analogous to the model pole is developed relatively by the equivalent setups. This pole senses obstacles using echo monitors and servo engines. Inside the pole there exists a micro checker that will operate on the directions obtained such as right, left, straight etc. However this device has certain disadvantages such as not being easy to manage and requiring a wide area of room to be put because they cannot be folded up. In fact, this pole is very costly because of the inclusion of a huge number of ultrasonic sensors and servo motors [1].

A smart stick was designed which uses radiation detectors towards detecting obstacles and curbs. A microphone with a high pitch “BEEP” was used to classify hurdles. Radiation pole architecture looks pretty plain and perceptive. The pole may sense barriers; it can’t have social and emotional assistance. It just has a beep tone which unleashes every barrier and has no aid to direct it [2].

A smart stick prototype was developed with a simple navigation aid in scale, inexpensive and easily wearable. The blind stick operates by discussing global navigation to direct the user to any destination and local navigation to navigate roads, sidewalks and corridors, while ignoring both static and moving obstacles. Alternatively, they invented a chest height worn stereo monitor, a handheld device in a bag with back braces or else in a purse, with just single headset or a tiny orator. This method becomes unobtrusive when moving along the stick, often without any hindrance. This also does not obstruct natural speech in the vicinity [3].

Through speech warning and vibration signal, a cane may interact with users. Echo monitors helps to locate obstacles in the forefront, because echo monitors are excellent at discovering obstacles within a short distance which is transmitted as a vocal sign. Then the vocal sign is transmitted to recipient by a speaker. The unsighted community can consider this hard to move without immediate warning instead of getting just ultrasonic sensors [4].

A digital white cane named unseen blot which integrates navigation mechanism, communal networks and echo monitors that stimulate individuals with vision disability navigate to public spaces. The GPS uses ultra-sonic sensors to sense the direction of hurdles and warn the blinker to stop from whipping the hurdles. Global Positioning System didn’t show the productivity to monitor the hurdles position because echo monitors only inform the hurdle space [5].

A Useful technical tool termed as long computerized pole acts like functional device for unsighted and visibly disabled persons. The Writer introduced a pole with appropriate nature, integrated computer device that works into a typical long cane handle. The device was designed to sense objects beyond the waistline, utilizing haptic sensors. This way, it acts as a barrier. When an obstruction is sensed it acts in such a way the cane vibrates or produces a tone. This machine merely senses hazards above the waistline, though [6].

III. SYSTEM DESIGN

A. Smart Shoe

Smart Shoe offers a prototype model and a device design that provides unsighted users an agile computerized assistance. The Smart Shoe device is built to include general obstacle detection, human identification, real time micro checker support network, echo sensor [9], and vibration connection. The key goal is to create the CTA package to help blind people move around the obstacles. CTA is hooked to the cleat. An entity when located at the foot, and if some obstruction occurs in front of it, warns the blind with the aid of the vibratory circuit and the sound alarm. Here the power supply is the key requirement under which the cleat and the ascetic service propagation device are coupled, so that piezoelectric sensors will not trigger any power backup issue. Advantage: Low design period, low cost of development, this device can be used for indoor and outdoor conditions. Dynamic system and occupies less space.

A 4-pin assembly Echo monitor (HC-SR04), called for VCC, Spark, Echo and Field. It is a common monitor for large number of functions where space calculation or entity sensing are needed. The panel consists of two viewers on the forehead including ventures that make up the Ultrasonic transmitter and Receiver.

Fig. 3.Smart Shoe

B. Smart Shoe: Methodology

The system provides a test model and a device definition to provide blind people with smart technological assistance. The aim is to have general measures for object identification, real time support through Wide Balancing Program. It comprises of micro checker, ultrasonic monitor and vibratory circuit. This initiative seeks to create a Computerized Transmit Assist (CTA) kit for supporting the unsighted to navigate hurdle free road. CTA is hooked to the cleat, when an item is sensed near the foot or if another human arrives in front of it, with the aid of vibratory sensor and buzzer it warns them.

Here the power supply is the key.

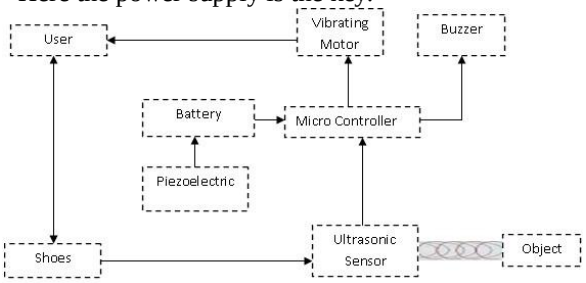

Fig. 4. Block Diagram.

The purpose of this prototype is to be used as a device or assistance to support blind people move or fly. The system works on controller UNO ARDUINO. This work involves features for detecting obstacles using ultrasonic sensors and giving signals through buzzer and vibration sensor. Supports even the development of self power utilizing piezoelectric sensors. Vibratory circuit is used to warn the unsighted individuals when hurdles are on their way. Power generation device consists of battery and other piezoelectric sensors that transform mechanical energy into electrical energy. This energy is therefore supplied to the power supply unit, which in effect supplies the remaining system.

IV. EXPERIMENTAL SETUP AND EVALUATION

A. Working concept of Ultrasonic module

Ultrasonic module systems use transformation of electrical mechanical energy to determine the length between monitor and objective. Echo influx is electromagnetic seismic influx, which passes through the medium as a series of rare factions and compressions in the path of influx broadcasting. It is adopted in echo substance monitoring (to locate holes, wind blobs and different component flaws), entity identification, location identification, ultrasonic cursor, etc. in addition to distance measuring. Based on their operating phenomena, these sensors are divided into two groups as piezoelectric monitors, electrostatic monitors. In this place piezoelectric theory is used to describe the ultrasonic sensor. Piezoelectric ultrasonic sensors produce ultrasonic waves utilizing piezoelectric material. Ultrasonic sensors contain a sender and recipient which can act like independent entities or like a sole device integrated together. The following picture displays the receiver and the ultrasonic transmitter.

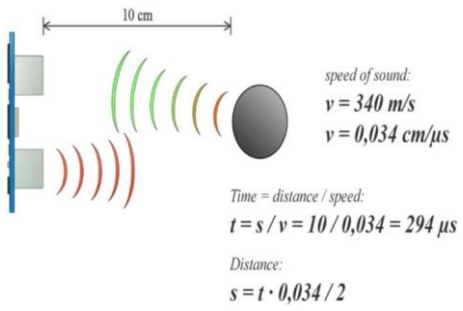

Fig. 5.Principle of ultrasonic sensor

At regular intervals, the echo monitors emanate small, huge density echo vibrations. They move at the level of echo in the air. When it strikes an entity, it is pictured back to the monitor as imitation sign which itself determines the length to the target based on the time gap between the signal transmitted and the imitation obtained. Given that the length to an entity is defined by calculating the flight duration and not by the noise intensity, echo monitors are magnificent in reducing noise. Basically all noise reflecting surfaces are observed irrespective of colors. Micro sonic echo monitors are appropriate to the aimed lengths between twenty mille meters and ten meters which are able to assess a value with absolute precision while they calculate flight time. Some of our sensors may also set the signal to a precision of mille meter. Echo instruments could be viewed via the dust laden weather and the moisture of inks. Also mild strains do not inhibit its work on the sensor membrane. Today, monitors with a null area of only twenty mille meters and incredibly narrow shaft range render totally fresh operations. Filler level calculation in micro titer plates and test-tube wells, also identification of tiny jars in the packing business segment; a visible monitor consists of communicator and collector, whereas an echo monitor makes use of one echo component for both omission and collection. One oscillator generates and absorbs ultrasonic waves alternately in a transparent device ultrasonic sensor. It allows the sensor head to be miniaturized.

Distance calculation:

Length Determination:

Length can be determined with the below method:

Velocity of sound V=340m/s V=0.034cms

Time=Length travelled/Velocity

T=S/V = 10/0.034 = 294s

Length: S=T*0.034/2

B. Piezoelectric module

Piezoelectricity is the electrical charge which accumulates in particular sturdy elements (such as metals, some wares, organic materials such as bones, RNA, and different proteins) as a reaction to mechanic driven pressure. The term piezoelectricity implies electric power that is produced by pressure and latent heat.

Fig. 6. Piezoelectric module.

Piezoelectric effect is the phenomena by which electrical energy may be produced from a piezoelectric crystal when it is added to mechanical energy and vice versa. There are several naturally occurring crystals that exhibit piezoelectricity which has been in use for a long time. It also developed artificial sources for generating piezoelectricity. The PVDF stave is small enough to be shaped into a sole and placed together with several other components within the pair. In the PVDF stave,

the bending of the sole results in piezoelectricity and the resultant voltage is collected using silver-inked electrodes. Alternatively, energy may be derived from the strain placed on the feet. Using this process, a lightweight ceramic piezoelectric material can be used to incorporate energy harvesting. Latest developments in these intelligent shoes involve USB power banks that charge gadgets such as smart watches. An alternative to piezoelectric ceramics is the use of piezoelectric polymer materials which have similar properties to those used in shoes.

C. Working of piezoelectric sensor

While piezo stress monitors are suggested mainly to calculate effective stress, few quartz stress monitors have long term constants in discharge that expand less in regular functionality for enabling constant evaluation, quasi static pressure calculation in a few seconds. Virtually all sensors earn a single NIST-traceable configuration sticker. Effective stress calibrators are accessible to the clients, to recalibrate their sensors on-site. Piezo stress monitors are classified according to the charge procedure or the output procedure of the ICP voltage. Charge procedure monitors are normally owned in applications with larger temperatures above 275F. It produces an immense combat charging sign coupled by a less buzz wire and charging amplifying device to readout instruments. A charging amplifying device transforms the immense combat charging output sign of sensor to a functional small combat intensity sign normalizes the sign allowing for growth, ranging and refining. Immense combat charging procedure entity should be really healthy. As a consequence, they are not doing well at applications that involve broad cable inputs in plant, farm, outside or in sultry conditions. ICP monitors work at a less-price and are straightly linked to read device with an optimized static power source.

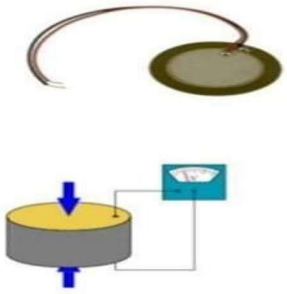

Fig. 7.working principle of piezoelectric sensor.

D. Experimental Results

TABLE I: Test Cases on Smart Shoe

Functionality to be tested	Input	Tests Done	Status
Working of Arduino	Arduino switches on when power source is connected	Manually check is the Arduino powers on.	Success
Working of Ultrasonic sonic	Response from ultrasonic sensor when obstacle is detected in 3 3.5 Meters	Manually check is the ultrasonic sensor gives output of distance	Success
Working of Buzzer	Check if the buzzer gives out sound when in on Condition	Manually tests the working of buzzer	Success
Working of Vibration sensor	Check if the vibration sensor gives out vibration when in on Condition	Manually tests the working of vibration sensor	Success
Working of Distance alert	Check if the vibration and sound alert turns on when distance condition is met	Testing for the distance, vibration, and sound alert.	Success

V. CONCLUSIONS

We would like to say that the planned work was effectively implemented. As stated earlier, the past issue such as fewer data transmission, low IR sensor performance and stick dependence was solved and effectively applied with object detection output and consistent knowledge for their guidance to a blind person. It can also be inferred that this effort will offer a huge difference and can hit a significant part in making the unsighted move with ease. Future research should concentrate on optimizing device efficiency and reducing consumer load by introducing the camera to specifically direct the blind. Photos obtained by web camera and NI-smart cameras aid to recognize items as well as search all instances for the existence of number of artifacts along the blind persons direction. The texture and form of the target may also be observed. Mono-pulse radar concepts can be used to evaluate reference artifacts of long duration. For a blind person, the other field may involve a modern definition of optimal and secure path detection centered on neural networks.

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