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Development of Smart Shoe for Blind and Visually Impaired People

**Mr. K.Giri¹, Mrs.N. Jayanthi², Ms. T. Sowdeeswari³, Ms. J. Tamil Vani⁴, Ms. V. Siva Sai Lakshmi⁵,
Ms.V. Susmitha Sen⁶**

Assistant Professor, Department of ECE, Mahendra Engineering College, Namakkal, Tamil Nadu, India

Assistant Professor, Department of ECE, Mahendra Engineering College, Namakkal, Tamil Nadu, India

UG student of Mahendra Engineering College, Namakkal, Tamil Nadu, India

ABSTRACT: The Smart Shoe System is an advanced wearable solution designed to enhance the mobility, safety, and independence of visually impaired individuals by integrating multiple technologies into a compact and user-friendly device. Traditional mobility aids like white canes often fall short in detecting obstacles above ground level and lack navigational support, while existing technological solutions typically focus on either obstacle detection or navigation, failing to provide a holistic approach. To address these limitations, the smart shoe is powered by an Arduino uno microcontroller, serving as the central control unit that coordinates a suite of features including ultrasonic sensors for real-time obstacle detection, a camera with Python-based live streaming for capturing visual data and assisting navigation, and a voice feedback system that informs the user about the distance to obstacles and provides directional guidance. Additionally, the system includes a rainwater detection module to alert users about wet conditions. Multi-modal alert mechanisms such as LEDs, a buzzer, and haptic feedback ensure effective communication tailored to different user preferences.

I. INTRODUCTION

Blindness is defined as lacking the sense of light. The word “blindness” indicates the disability of the person from darkness to bright light. The term blind and blindness have been modified into wide range of visual impairments. Visually impaired people are get affected by the damage in their eyes and the damage in the sensory organ to receive the signal from the nerve of the brain. Visual impairments are due to the genetic disorders. It is prominent by birth or during childhood. Over 37 million people are blind all over the globe. In this 15 million people are from India. Most predicaments of the visual impairment’s disabilities are due to the retinitis damage or some of the development abnormalities in their life. Individual are those visually impaired are facing problem with their anatomical, sociable and methodical outcomes, hence the individuality of life and dispossess such visually impaired from fulfilling many of the activities of day-to-day life. Visual impairments are a subjective term used when condition the loss of visual field. The visual impairments can range from moderate to relentless. About 300-400 million people were visually impaired all around the world.

Out of this 80% people are totally blind at the age of 50. Moreover, totally blind peoples were about 50 million. Blindness has been categorized into different groups. They were blindness of colour, blindness of night and blindness of snow. Color blindness is due to the individual's disability to distinguish between red and green colours. In few literatures, some has done the valuable work in making the detection of obstacles and to navigate the people. They have designed a shoe for the visually impaired people to navigate. In this they have implemented and attach the GPS in the shoe to help the visually impaired people to travel by hearing the audio signals from the headphones. The white canes are used to detect the obstacles from the user knee covering only the little different. The system helped the user by providing different audio tones to different conditions as defined by the system. The system is most accurate and safely. Work is carried out for the visually impaired people to assist them in finding the obstacles.

They have major risk factors in migrating from one place to another place individually. During the time of their travel, it is very hard to find out the obstacles on their way. Many accidents, injuries and collisions may occur during their transportation as they are unaware of the obstacles present in front of them. To overcome this project is mainly focused on designing an electronically aided shoe for the visually impaired people for their better transportation[1]. “Smart

shoe" can assist the blind on their daily routine and can act as a comfortable and safe companion on their journey. Common assistances provided earlier for the blind include walking sticks or guide dogs.

It includes ultrasonic sensors with a step counter that can alert the person of the impending obstacles. The technology results can improve their ways of growth and can drive them to lead their independent lives[2]. The design of four different solutions for smart shoes that make use of energy harvesting apparatuses for the power supply of sensors and complex monitoring systems, for example aimed at GPS localization. An initial comparative assessment of the four architectures is reported, by weighing production costs, ease of manufacture and energy harvesting performance[3].

OBJECTIVE OF THE PROJECT

- To build an electronically aided shoe for the help and provide an ease for visually impaired persons
- To identify objects or impediments up to a specific distance and deliver an audio or vibrator alarm message to the receiver.

II. EXISTING SYSTEM

Till now, visually impaired persons are using white cane; which help them scan for obstacles and orientation marks. The cane will also inform the passerby to go slow and take appropriate steps to help them, while they move or walk. In this paper, the authors have tried to build an electronically aided shoe for the help and provide an ease for visually impaired persons.

The proposed framework for the e-shoes will identify objects or impediments up to a specific distance and deliver an audio or vibrator alarm message to the receiver. This will help blind persons to recognize objects on their path instantly through an alarm and will prevent any accidents.

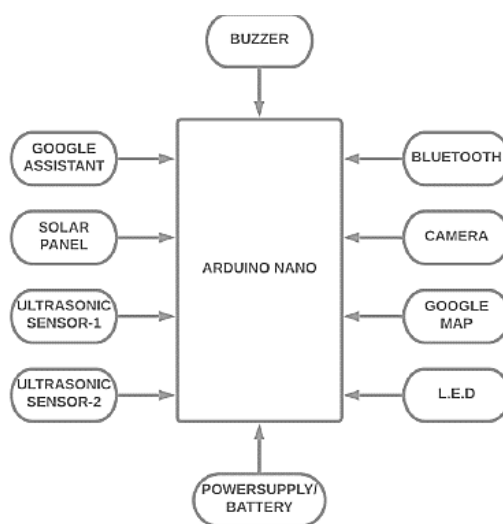


Fig 1: Existing Block Diagram

III. PROPOSEDSYSTEM

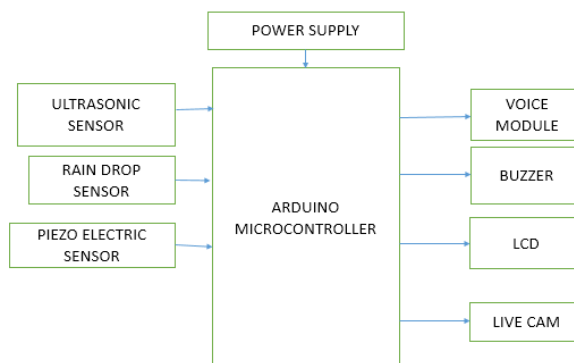


Fig 2:Block DiagramProposed

This process uses ultrasonic sensor, live cam, electric power detector and rain drop sensor along with micro controller.

The microcontroller receives the signal from various sensors. The Ultra sonic sensor detects the distance between obstacle and the blind person which is communicated to them via audio. The live cam detects the location and used for navigation purpose. The electric power detector is used mainly on rainy season to check the power.

HARDWARE REQUIREMENTS

- POWER SUPPLY UNIT
- ARDUINO UNO
- LCD DISPLAY
- ULTRASONIC SENSOR
- RAIN DROP SENSOR
- LIVE CAM
- ELECTRIC POWER DETECTOR

Power supply Unit

The main components used in the power supply unit are Transformer, Rectifier, Filter and Regulator. The 230V AC supply is converted into 9V AC supply through the transformer. The output of the transformer has the same frequency as in the input AC power. This AC power is converted into DC power through diodes. Here the bridge diode is used to convert AC supply to the DC power supply. This converted DC power supply has the ripple content and for normal operation of the circuit, the ripple content of the DC power supply should be as low as possible. Because the ripple content of the power supply will reduce the life of the circuit.

So to reduce the ripple content of the DC power supply, the large value of capacitance filter is used. This filtered output will not be the regulated voltage. For this purpose IC7805 regulator IC is used in the circuit.

ARDUINO MICROCONTROLLER

An Arduino board consists of an Atmel 8-bit AVR microcontroller with complementary components that facilitate programming and incorporation into other circuits. An important aspect of the Arduino is its standard connectors, which lets users connect the CPU board to a variety of interchangeable add-on modules known as shields. Some shields communicate with the Arduino board directly over various pins, but many shields are individually addressable via an I²C serial bus—so many shields can be stacked and used in parallel. Official Arduinos have used the megaAVR series of chips, specifically the ATmega8, ATmega168, ATmega328, ATmega1280, and ATmega2560. A handful of other

processors have been used by Arduino compatibles. Most boards include a 5 volt linear regulator and a 16 MHz crystal oscillator (or ceramic resonator in some variants), although some designs such as the LilyPad run at 8 MHz and dispense with the onboard voltage regulator due to specific form-factor restrictions. An Arduino's microcontroller is also pre-programmed with a boot loader that simplifies uploading of programs to the on-chip flash memory, compared with other devices that typically need an external programmer. This makes using an Arduino more straightforward by allowing the use of an ordinary computer as the programmer.

LCDDISPLAY

A liquid crystal display (LCD) is a thin, flat electronic visual display that uses the light modulating properties of liquid crystals (LCs). LCDs do not emit light directly. They are used in a wider range of applications including computer monitors, television, instrument panels, aircraft cockpit displays, signage, etc. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones. LCDs have displaced cathode ray tube (CRT) displays in most applications.

ULTRASONIC TRANSMITTER AND RECEIVER

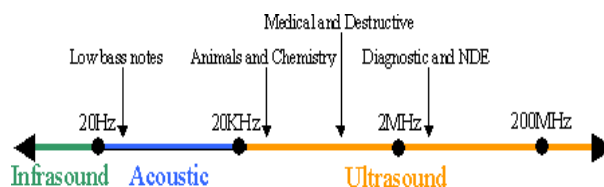
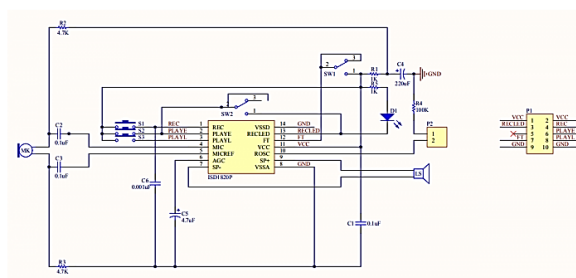


Fig 4 Ultrasonic Frequency

Ultrasonic refers to any study or application of sound waves that are higher frequency than the human audible range. Music and common sounds that we consider pleasant are typically 12 kHz or less, while some humans can hear frequencies up to 20 kHz. Ultrasonic waves consist of frequencies greater than 20 kHz and exist in excess of 25 MHz. Ultrasonic waves are used in many applications including plastic welding, medicine, jewelry cleaning, and nondestructive test. Within nondestructive test, ultrasonic waves give us the ability to "see through" solid/opaque material and detect surface or internal flaws without affecting the material in an adverse manner.

VOICE MODULE

In keeping with the modular principle, a voice module will generally have patch points for each of the functions that the module contains. These might be scattered around the panel near the controls for the functions that the patch points access, or they may be grouped together off to one side. A voice module can be a cost-efficient way of acquiring basic functions when starting a modular synth, as opposed to buying each of the functions as separate modules, although there is often a cost in patching flexibility. Voice modules are also used by modular synth performers who want to be able to play polyphonically, in order to save space and keep costs under control.



IV. CONCLUSION

The proposed work is a solution which is based on embedded system that combines hardware and software to provide a technical aid. This technology is used for blind and people with visual impairment for obstacle detection. The ultrasonic

sensor has been completely employed to help blind and visually impaired persons move around in a safe and autonomous manner. This system does not necessitate the holding of a large gadget over a long distance, nor does it necessitate any specific training. This technique also eliminates constraints associated with the majority of movement issues that may affect blind persons in their environment. Finally, it was able to create a low cost, standalone, and electrically safe smart shoes for people with visual impairment and for blind which give assistant.

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