Research Paper E-ISSN NO : 2455-295X | VOLUME : 9 | ISSUE : 6 | SPECIAL ISSUE JUNE-2023

SMART SHOES FOR VISUALLY IMPAIRED PEOPLE

DR.G.SUDHA*	PROFESSOR, DEPT. OF BIOMEDICAL ENGINEERING, MUTHAYAMMAL ENGINEERING COLLEGE, NAMAKKAL, INDIA.
MRS.M.BIRUNDA	ASSISTANT PROFESSOR, DEPT. OF BIOMEDICAL ENGINEERING, MUTHAYAMMAL ENGINEERING COLLEGE, NAMAKKAL, INDIA.
H.SARANYA	FINAL YEAR STUDENT, DEPT. OF MEDICAL ELECTRONICS ENGINEERING, MUTHAYAMMAL ENGINEERING COLLEGE, NAMAKKAL, INDIA.
E.ABINAYA	FINAL YEAR STUDENT, DEPT. OF MEDICAL ELECTRONICS ENGINEERING, MUTHAYAMMAL ENGINEERING COLLEGE, NAMAKKAL, INDIA.
A.SINDHU	FINAL YEAR STUDENT, DEPT. OF MEDICAL ELECTRONICS ENGINEERING, MUTHAYAMMAL ENGINEERING COLLEGE, NAMAKKAL, INDIA.

ABSTRACT:

This paper proposes a system that utilizes Python programming language to detect objects in front of a blind person using a camera and IR sensor, coupled with an Arduino Uno microcontroller board. The system aims to enhance the independence of visually impaired individuals by alerting them of obstacles in their path. The IR sensor detects obstacles in close proximity and sends signals to the Arduino board. The board uses the Python Open CV library to analyze the images captured by the camera to identify the object and determine its distance from the user. Once an obstacle is detected, the system will alert the user using audio or vibration. The results demonstrate that the proposed system has the potential to assist visually impaired individuals in navigating their environment more safely and efficiently.

KEYWORDS:

OPEN CV, MACHINE LEARNING, MICRO CONTROLLER UNIT.

INTRODUCTION

The development of technology has brought about significant changes in our daily lives. With each passing day, new and innovative technologies are being created, with the aim of making our lives easier and more comfortable. However, as technology advances, there are certain groups of people who are often left behind, particularly those with disabilities. The visually impaired, for example, face significant challenges when it comes to navigation and orientation, as they often cannot rely on visual cues.

In recent years, there have been various attempts to address these challenges, with the development of assistive technologies such as smart canes and talking watches. However, these technologies have limitations and are not always effective in providing the necessary support to individuals with visual impairments. To address these limitations, researchers have explored the use of cameras and sensors to detect obstacles in the path of visually impaired individuals. One such system is the use of a camera and IR sensor, coupled with an Arduino Uno microcontroller board, to detect obstacles in front of the user.

The proposed system aims to enhance the independence of visually impaired individuals by alerting them of obstacles in their path. The IR sensor detects obstacles in close proximity and sends signals to the Arduino board. The board uses the Python Open CV library to analyze the images captured by the camera to identify the object and determine its distance from the user. Once an obstacle is detected, the system will alert the user using audio or vibration. The use of Python programming language for object detection is a significant advancement in assistive technologies for the visually impaired. Python's ability to process large amounts of data quickly, coupled with its compatibility with various hardware devices, makes it an ideal choice for developing assistive technologies. This system has the potential to assist visually impaired individuals in navigating their environment more safely and efficiently. By providing real-time information about obstacles in their path, the system allows visually impaired individuals to take necessary precautions to avoid potential hazards.

LITERATURE SURVEY

[1] "A Review of Object Detection Techniques for the Visually Impaired using Cameras and IR Sensors": This literature review examines different object detection techniques using cameras and IR sensors for the visually impaired. Advantages of this approach include its low cost

and ease of use, while disadvantages include limitations in accuracy and reliance on environmental factors such as lighting.

[2] "An Analysis of Machine Learning Techniques for Object Detection in Assistive Technologies": This literature review analyzes machine learning techniques for object detection in assistive technologies. Advantages of machine learning include improved accuracy and ability to learn from new data, while disadvantages include the need for significant computational resources and large amounts of training data.

[3] "A Comparative Study of Wearable Technologies for Object Detection in Blind Navigation": This literature review compares different wearable technologies for object detection in blind navigation. Advantages of wearable technologies include their portability and convenience, while disadvantages include limitations in accuracy and difficulty in integration with other assistive technologies.

[4] "The Use of Computer Vision for Object Detection in the Visually Impaired": This literature review examines the use of computer vision for object detection in the visually impaired. Advantages of this approach include improved accuracy and ability to recognize a wide range of objects, while disadvantages include the need for significant computational resources and limitations in real-time detection.

[5] "A Review of Haptic Feedback Systems for Object Detection in Assistive Technologies": This literature review reviews haptic feedback systems for object detection in assistive technologies. Advantages of haptic feedback include its ability to provide tactile feedback to the user, while disadvantages include limitations in accuracy and difficulty in distinguishing between different objects.

EXISTING SYSTEM

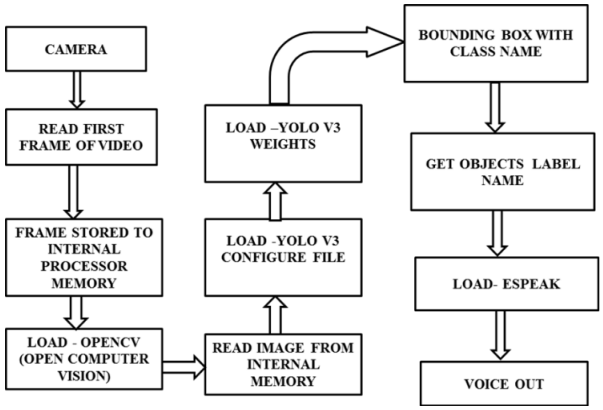
The existing system for blind people uses an ultrasonic sensor fixed in a stick to detect objects in front of them. If any object is detected, the system sounds a buzzer alerting the person to stop or change direction. However, the system has limitations in terms of accuracy. The object detection using Open CV-based methods implemented in the system has issues with finding objects accurately. Additionally, object recognition through MATLAB software is a simulation output and may not reflect the real-world performance of the system. There is a need for improvement in the accuracy and reliability of the system to better assist blind individuals.

DISADVANTAGE

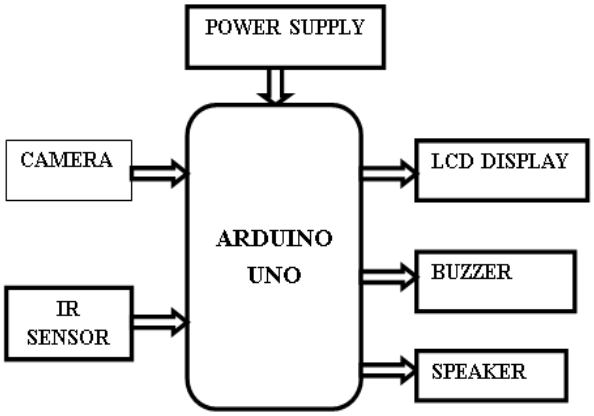
- It's simulation software. So we could not implement in real-time
- Output accuracy low

PROPOSEDMETHOD

SOFTWARE BLOCK DIAGRAM



HARDWARE BLOCK DIAGRAM



In this proposed system we will find objects in real time using AI, OPENCV, YOLO (You only live once).After acquisition of image it has to be pre-processed and compressed. Various daily use objects' images are used to train the model. It is trained by performing feature extraction on the image to obtain the required pattern in the image. Followed by feature fusion and dimension reduction to compress the image for reliable and real time performance. Then this YOLO dataset is used to train the classifier. Comparing the performance of various classifiers we select the optimum one, and thus the object recognition model is achieved. Now any test image may be given to this model which will be classified into one of the classes the model has been trained into. We propose a navigation device for the visually impaired which is focused on providing voice output through speaker for obstacle prevention using Camera and display with LCD display. Blind stick uses IR sensors to detect obstacles ahead using ultrasonic waves. On sensing obstacles the sensor passes this data to microcontroller. If the obstacle is close the microcontroller sends the signal to sound a buzzer.

PYTHON IDLE

Python is a versatile and powerful programming language that is widely used in a variety of industries and applications. It is known for its simplicity, readability, and ease of use, making it a popular choice among developers

of all levels. Python's comprehensive standard library, which includes modules for tasks such as file I/O, networking, and web development, has earned it the reputation of a "batteries included" language.

Python can be used for various programming paradigms, including procedural, object-oriented, and functional programming. It is also dynamically typed and garbage-collected, meaning that memory management is handled automatically, allowing developers to focus on writing code rather than worrying about memory allocation and deal location.

In addition to the standard desktop integrated development environments (IDEs), Python offers a variety of web browser-based IDEs such as Python Anywhere and Canopy IDE, which emphasize scientific computing. Other shells such as IDLE and I Python add further abilities such as auto-completion, session state retention, and syntax highlighting, making Python an accessible language for developers of all skill levels. Sage Math is another popular Python-based IDE intended for developing science and math-related programs**.**

MODULE LIST

- Camera
- Processor
- Open CV
- Machine Learning
- Arduino UNO
- Power Supply Board

MODULE DESCRIPTION

CAMERA

A camera is an optical instrument used to capture an image. At their most basic, cameras are sealed boxes (the camera body) with a small hole (the aperture) that allow light in to capture an image on a light-sensitive surface (usually photographic film or a digital sensor). Lenses focus the light entering the camera, the size of the aperture can be widened or narrowed to let more or less light into the camera, and a shutter mechanism determines the amount of time the photo-sensitive surface is exposed to the light.

PROCESSOR

A processor (CPU) is the logic circuitry that responds to and processes the basic instructions that drive a computer. The CPU is seen as the main and most crucial integrated circuitry (IC) chip in a computer, as it is responsible for interpreting most of computers commands. CPUs will perform most basic arithmetic, logic and I/O operations, as well as allocate commands for other chips and components running in a computer

OPENCV

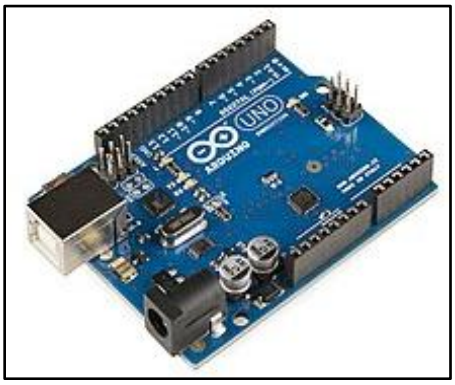
Open CV is a cross-platform library using which we can develop real-time computer vision applications. It mainly focuses on image processing, video capture and analysis including features like face detection and object detection. In this tutorial, we explain how you can use Open CV in your applications. Open CV is one of the most popular computer vision libraries. If you want to start your journey in the field of computer vision, then a thorough understanding of the concepts of Open CV is of paramount importance.

MACHINE LEARNING

YOLO, a single CNN simultaneously predicts multiple bounding boxes and class probabilities for those boxes. YOLO trains on full images and directly optimizes detection performance. This model has a number of benefits over other object detection methods: YOLO sees the entire image during training and test time so it implicitly encodes contextual information about classes as well as their appearance.

ARDUINO UNO

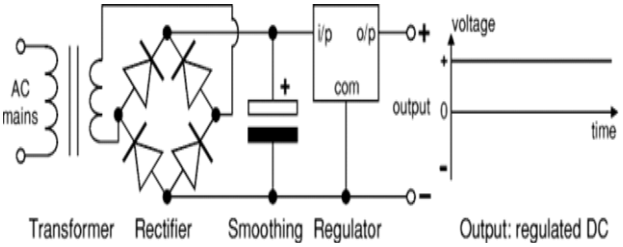
The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9 volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under a Creative Commons Attribution Share-Alike 2.5 license and is available on the Arduino website. Layout and production files for some versions of the hardware are also available. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform. The ATmega328 on the Arduino Uno comes pre-programmed with a boot loader that allows uploading new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol. The Uno also differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it uses the Atmega16U2 (Atmega8U2 up to version R2) programmed as a USB-to-serial converter



POWER SUPPLY BOARD

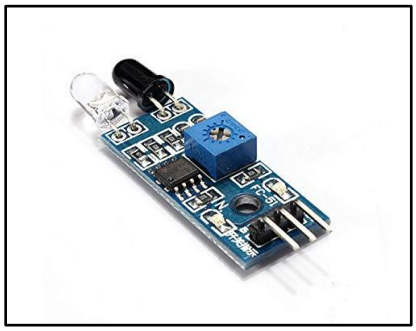
Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

Power supplies for electronic devices can be broadly divided into linear and switching power supplies. The linear supply is a relatively simple design that becomes increasingly bulky and heavy for high current devices; voltage regulation in a linear supply can result in low efficiency. A switched-mode supply of the same rating as a linear supply will be smaller, is usually more efficient, but will be more complex.



IR SENSOR

An infrared sensor is an electronic device, which emits in order to sense some aspects of the surroundings. An IR sensor can measure the heat of an object as well as detects the motion. These types of sensors measures only infrared radiation, rather than emitting it that is called as a passive IR sensor. Usually in the infrared spectrum, all the objects radiate some form of thermal radiations. These types of radiations are invisible to our eyes that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and these output voltages, change in proportion to the magnitude of the IR light received.



WEB CAM

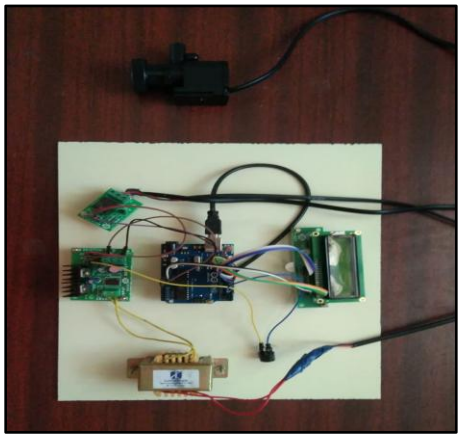
A webcam is a video camera that feeds or streams its image in real time to or through a computer to computer network. When "captured" by the computer, the video stream may be saved, viewed or sent on to other networks via systems such as the internet, and email as an attachment. When sent to a remote location, the video stream may be saved, viewed or on sent there.

Unlike an IP camera (which connects using Ethernet or Wi-Fi), a webcam is generally connected by a USB cable, or similar cable, or built into computer hardware, such as laptops. The term "webcam" (a clipped compound) may also be used in its original sense of a video camera connected to the Web continuously for an indefinite time, rather than for a particular session, generally supplying a view for anyone who visits its web page over the Internet.

LIQUID CRYSTAL DISPLAY

A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images which can be displayed or hidden, such as preset words, digits, and 7-segment displays as in a digital clock. They use the same basic technology, except that arbitrary images are made up of a large number of small pixels, while other displays have larger elements. An LCD is a small low cost display. It is easy to interface with a micro-controller because of an embedded controller (the black blob on the back of the board). This controller is standard across many displays (HD 44780) which means many micro-controllers (including the Arduino) have libraries that make displaying messages as easy as a single line of code.

RESULTS AND ANALYSIS



CONCLUSION

The main goal of this paper is to develop a walking guide to help vision impaired people to navigate independently in their environment. The developed system consists of two main parts that are obstacle and voice assistant. The obstacle detection system is designed to indicate the presence of obstacles in the front, left and right directions around the surroundings. The In the future, the development of an Application Specific Integrated Circuit (ASIC) with the functionalities of the developed walking guide can reduce the size, weight and cost of the prototype. Semantic pixel-wise segmentation of the surroundings may contribute to categorize obstacles in the environment. The proposed combination of various working units makes a real-time system that monitors position of the user and provides dual feedback making navigation more safe and secure. This project presents a novel navigation device for the visually impaired groups to help them reach the destination safely and efficiently. This system installed with IR sensor for detecting the obstacle in front of the blind people. When it detected it alert the visually impaired people through the buzzer.

REFERENCES

1. V. V. Meshram, K. Patil, V. A. Meshram and F. C. Shu, "An Astute Assistive Device for Mobility and Object Recognition for Visually Impaired People," in IEEE Transactions on Human-Machine Systems, vol. 49, no. 5, pp. 449-460, 2019.

2. R. Jafri, R. L. Campos, S. A. Ali, and H. R. Arabnia, "Visual and Infrared Sensor Data-Based Obstacle Detection for the Visually Impaired Using the Google Project Tango Tablet Development Kit and the Unity Engine," IEEE Access, vol. 6, pp. 443-454, 2018.

3. R. R. Bourne et al., "Magnitude, temporal trends, and projections of the global prevalence of blindness and distance and near vision impairment: a systematic review and meta-analysis," The Lancet Global Health, vol. 5, no. 9, pp. e888-e897, 2017.

4. E. Cardillo et al., "An Electromagnetic Sensor Prototype to Assist Visually Impaired and Blind People in Autonomous Walking," in IEEE Sensors Journal, vol. 18, no. 6, pp. 2568-2576, 2018.

5. A. Riazi, F. Riazi, R. Yoosfi, and F. Bahmeei, "Outdoor difficulties experienced by a group of visually impaired Iranian people," Journal of current ophthalmology, vol. 28, no. 2, pp. 85-90, 2016.

6. M. M. Islam, M. S. Sadi, K. Z. Zamli and M. M. Ahmed, IEEE Sensors Journal, vol. 18, no. 6, pp. 2568-2576, 2018."Developing Walking Assistants for Visually Impaired People: A Review," in IEEE Sensors Journal, vol. 19, no. 8, pp. 2814-2828, 2019.

7. S. Mahmud, X. Lin and J. Kim, "Interface for Human Machine Interaction for assistant devices: A Review," in 2020 10th Annual Computing and Communication Workshop and Conference (CCWC), 2020, pp. 0768-0773.

8. R. Tapu, B. Mocanu, and T. Zaharia, "Wearable assistive devices for visually impaired: A state of the art survey," Pattern Recognition Letters, 2018.

9. N. Sahoo, H.-W. Lin, and Y.-H. Chang, "Design and Implementation of a Walking Stick Aid for Visually Challenged People," Sensors, vol. 19, no. 1, 2019.

10. H. Wu, A. Marshall and W. Yu, “Path planning and following algorithms in an indoor navigation model for visually impaired,” in 2nd Int. Conf. Internet Monitoring and Protection (ICIMP 2007), San Jose, 2007, pp. 38-38.

11. W. C. S. S. Simões and V. F. de Lucena, “Blind user wearable audio Assistance for indoor navigation based on visual markers and ultrasonic Obstacle detection,” in 2016 IEEE Int. Conf. Consum. Electron. (ICCE), Las Vegas, 2016, pp. 60-63.

12. H. Zhang and C. Ye, “An indoor navigation aid for the visually impaired,” in 2016 IEEE Int. Conf. Robot. Biomimetics (ROBIO), Qingdao, 2016, pp. 467-472.

13. Dr.G.Sudha, B.Karthikeyan, G.Midhun, S.Vijay. “International Journal of New Innovations in Engineering and Technology,” in 2023 pp.658-662.

14. Dr.G.Sudha, M. Birunda, T.Alavanthar, M.Devipriya, K.Gayathri, R.Mahalakshmi, M.Meganathan ”International journal of new Innovations in Engineering and Technology,” in2023pp.647-651.

15. G Sudha, L Bhuvaneshwari, J Deepika “ Journal of Engineering Sciences,” in 2020 2020,pp.576-579.