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Smart Glasses Using IOT and Cloud for Visually and Physically Impaired People

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***Abstract*:** People who faces physical disability and vision impairments sometimes have trouble moving around on their own and solving numerous obstacles in their daily life. Artificial intelligence and computer vision techniques help the physically and visually impaired (VPI)persons are able to complete their principal tasks independently of others. For VPI individuals, smart glasses could be a useful assistive tool that facilitates independent travel and offers social security and comfort. Practically speaking, the VPI cannot move by themselves, especially at night and in dimly lit environments. Followingly, we suggest smart glass system for VPI users that use technologies like deep learning, acoustic feedback, tactile graphics and computer vision techniques accessing information even in darker places and lack of connectivity.

This project aims at providing a multiutility smart glass that identifies and integrates suitable sensing mechanisms responsible for assistance for VPI users' safety and protection in hazardous situations like fire outbreak, etc. The vitals that are implemented are obstacle detection and measurement, object identification through web cam, GPS based location tracking, displaying of measured distance, calculated temperature of the environment etc. on guardians' phone of VPI. Sensors such as Ultrasonic sensor, DHT11, were implemented into it. The proposed system is a prototype system to provide assistance to VPIs through hardware and software implementation.

Keywords: Wearable, VPI (Visually and Physically Impaired) Person, IOT, TTS (Text to Speech), CNN (Convolutional Neural Networks), DNN (Deep Neural Networks)

I. INTRODUCTION

Nearly 2 billion people all over the world have vision impairment and in almost half of these cases, vision impairment could be prevented.

Nowadays few more faculties and occupations can accommodate them, a combination of technological limitations and financial constraints are to blame. Because of this, the majority of people continue to survive on low incomes. Despite the availability of technology, their high cost and lack of accessibility cheap ones have restricted capabilities. The major objective is to assist those who are blind or have vision problems using IOT technologies. Giving them assistance so they can walk on their own is the key factor here. The Internet of things, or IOT, is positively impacting our lives from the beginning to the end, from a CCTV that can be controlled through a smartphone to a car that can provide the shortest route, a smart watch that can manage daily tasks, or a robot that can be controlled by smartphones. Figure 1 depicts the IOT as a network of devices, gateways, and data centres. It collects data from gadgets using sensors that are built within the gadgets. These data are then saved on a shared platform and used for analysis or extraction as needed later. Finally, the results are presented in an organised fashion for improved user experience.

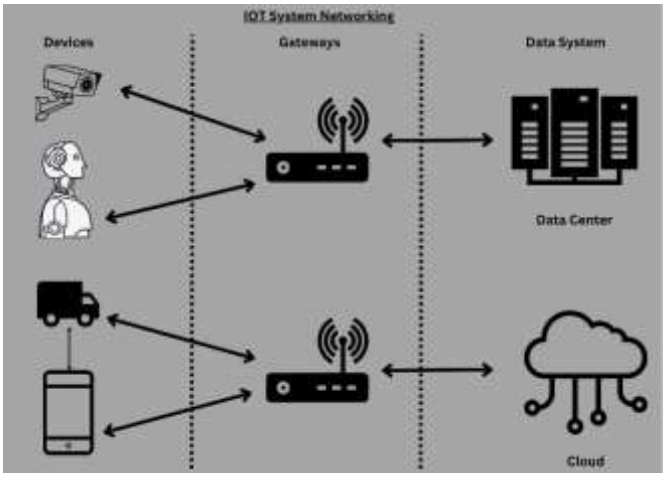

Figure: 1 IOT System Networking

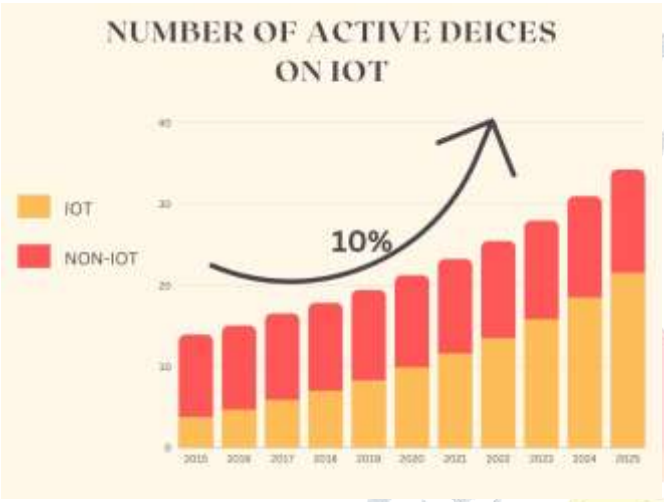

Figure: 2 IOT Evolution

Because they don't require the use of hands or just minimal hand use, wearable gadgets are thought to be the most helpful of all assistive technologies . The head-mounted gadget is the most common kind. Their primary benefit is that, unlike other devices, they naturally point in the direction of the viewer, negating the need for extra direction cues . This article introduces a brand-new style of smart glasses with multitasking capabilities and minimal construction costs. The Arduino UNO connect board, a camera, on board mic and loud speaker are used in the design to provide information to the user through OLED output .

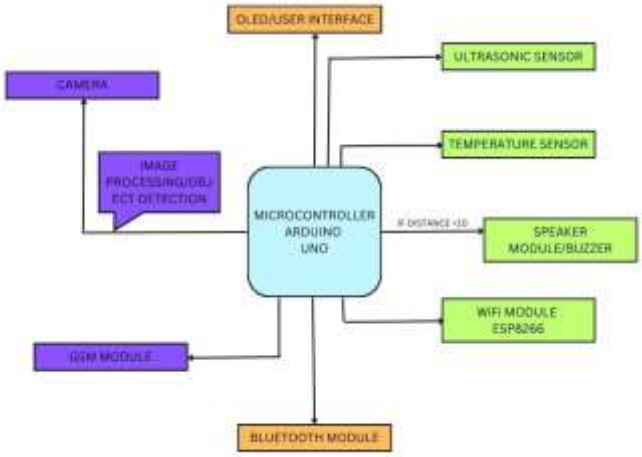

Figure: 3 Block Diagram Of IOT Smart Glass system

II. LITERATURESURVEY

Google X created the ground-breaking optical head-mounted display that could imitate a smartphone screen. It was a voice-activated interactive device featuring a number of gesture functions.[1]Wearable Device Technology refers to the usage of a computing device that can be worn as an accessory in daily life to send or receive data. For example, a helmet was created which has an antenna that could broadcast/receive data wirelessly in 1981.[2]

Object detection using retinal smart glasses is an emerging technology that combines retinal projection and computer vision to enable real-time object detection and recognition in a wearable device. This device was proposed by Babak Taraghi [3]

A system was created by University of Piraeus, Greece to assist blind people to walk independently by giving them oral instructions after calculating its size and potential movement of obstacle in the environment so that it could be to avoided. They used ultrasonic sensor and GPS module [4]

A model for Face mask detection was made by using Computer vision and deep learning techniques by using various mask detection which can be incorporated with several existing technologies such as face detection, biometric authentication and facial expression detection for further advancements in the future .[7]

A GPS-based device was created by Morad as a localisation tool for those who are vision impaired which is used to communicate with the user once the device retrieves the GPS location that the microcontroller has connected to a previously stored audio message. The designer loads speech messages that are appropriate for various locations using the LCD. [8]

A smart electronic and wearable system was created to be used by Visually impaired, even those with a partial or fully hearing

impairement, with sensors, GPS and alarm to get required Assistance.[9]

III. PROPOSED WORK

The entire project's implementation has majorly three objectives as follows-

- obstacle detection and distance measurement

object recognition model, which enables a VPI person to gain a real-time understanding of every object in his environment and Temperature and humidity sensor compute real time temperature and humidity of the environment to alert guardian's of the user in any hazardous situation by using GPS and GSM Modules.

III. Obstacle Detection and Object Recognition Model:

Obstacle detection in IoT smart glasses relies on sensors that measure the distance between the user and nearby objects. HC-SR04 also known as ultrasonic sensor uses ultrasonic waves to measure distances. It consists of a transmitter that emits ultrasonic pulses and a receiver that detects the reflected waves. By measuring the time taken for the waves to bounce back, the sensor calculates the distance to the obstacle. In proposed system we have implemented ultrasonic sensor with the Arduino UNO on the front of the glasses which beeps buzzer less than 20 cm of any obstacle detection in the path of he sensor. The buzzer indicated to the Bluetooth device connected through speaker and measured distance is shown on the OLED display attached.

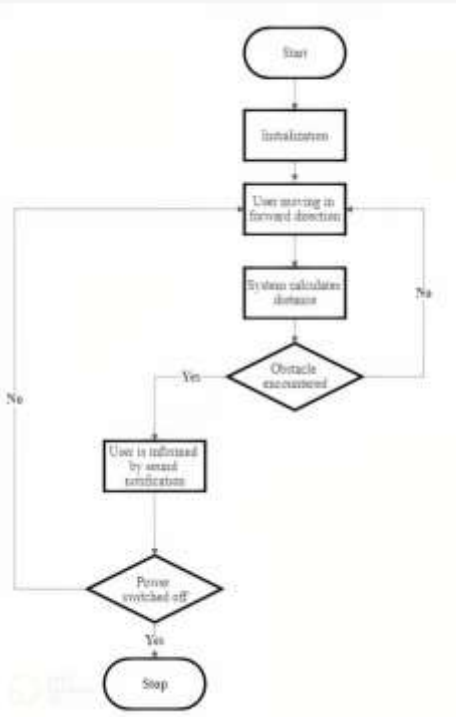

Figure: 5 Object Detection and Proximity Calculation Algorithm

The basic concept behind object detection in videos engrosses the verification of the presence of an object in image sequences and possibly locating it in particular for recognition. This is done by solving the temporal correspondence problem, the problem of matching the target region in successive frames of a sequence of images taken at closely spaced time intervals. These two processes are closely related. Detection is the basis for tracking and it usually starts with detecting objects, while detecting an object repeatedly in subsequent image sequence is often necessary to help and verify tracking. By interfacing ESP32 CAM with Arduino UNO, we can perform object identification using Techniques like CNN and DNN on software.

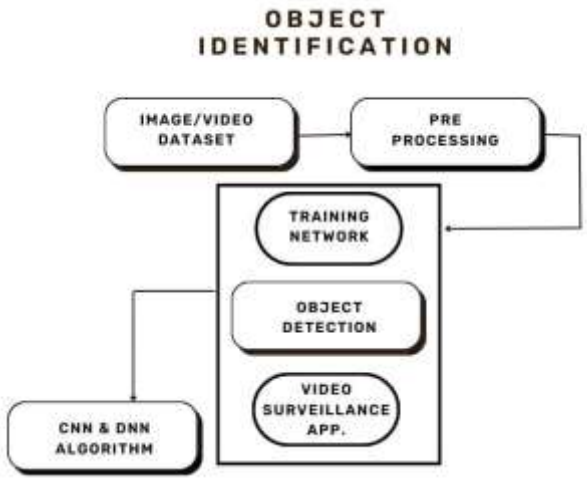

Figure: 6Object identification using CNN and DNN Algorithm

Temperature And Humidity Recognition

This technology allows users to monitor environmental conditions in real-time, enhancing their comfort and safety. In this article, we will explore the working principles, construction using Arduino Uno, and applications of temperature and humidity detection in IoT smart glasses for VPI individuals by using dht 11 sensor. The determined temperature and humidity is displayed on the device connected through bluetooth.

IV. SMART GLASS MODEL IMPLEMENTATION

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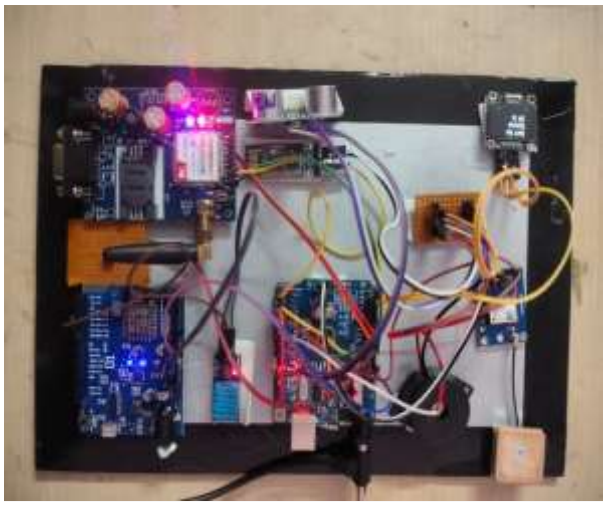

Figure: 7 Interfacing of Sensors and other components with Arduino UNO.

A modular microcontroller called Arduino Uno is used to interface sensors like the HC-SR04 ultrasonic sensor for obstacle detection and the DHT11 temperature and humidity sensor. Additionally, it may be linked to ESP32-CAM, GPS, GSM, Wi-Fi, Bluetooth, and other modules for object recognition, communication, internet connectivity, and seamless device pairing. A built-in buzzer further offers automatic notice notifications. The interoperability and adaptability of the Arduino Uno allow for the creation of Internet of Things (IoT) smart glasses that increase vision, communication, and environmental awareness for people who are physically or visually challenged, encouraging independence and a higher quality of life.

Figure: 8 Object Identification prototype of Web Cam.

Figure: 9Data on Device through Bluetooth

V. RESULTS AND CONCLUSION

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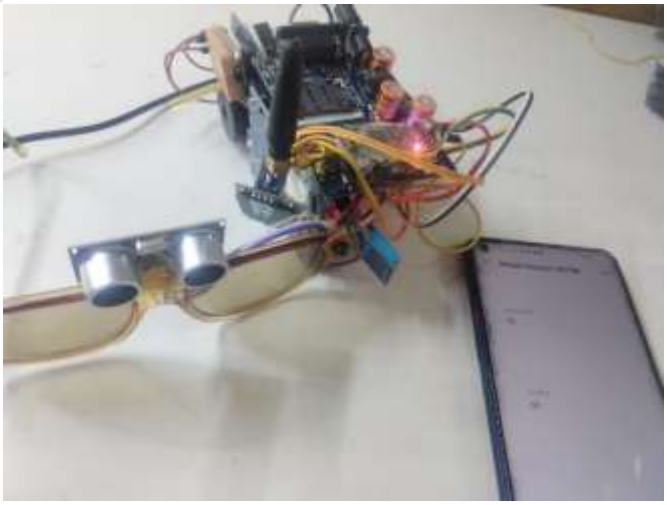

Fig 10. Temperature alert model

Figure: 11 Final Prototype of Smart Glasses (Front)

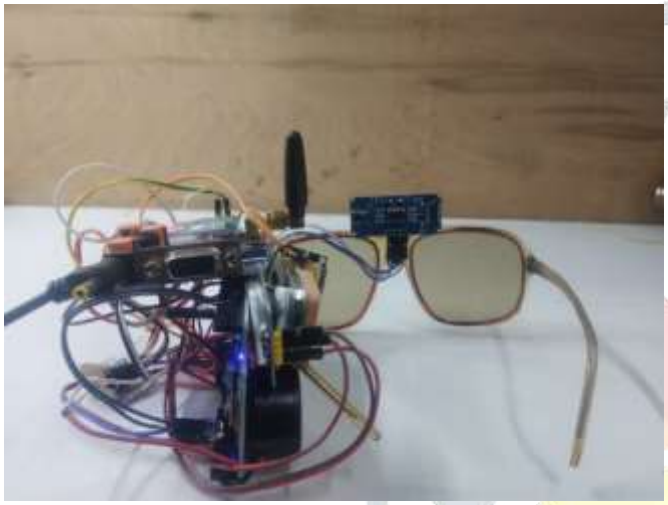

Figure: 11Final Prototype of Smart Glasses (Back)

CONCLUSION

The proposed features were included into the creation of smart glasses, which also have a head-mounted display for real-time information processing that is inexpensive, effective, and extremely effective. To sum up, the project on Internet of Things smart glasses for people who are physically and visually handicapped has shown tremendous promise for improving the lives of people with impairments. These smart glasses have created new opportunities for independence, safety, and connectivity for people with disabilities by integrating a variety of cutting-edge technologies, including obstacle detection, object detection, temperature and humidity sensors, GPS, GSM modules, and a notification alert system using Bluetooth and Wi-Fi technology.

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