A Visual Assistance for Complete Blind People

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Abstract**—**

*Keywords- Image Processing, Object Detection, Distance Measurement, Haar Cascade, OCR.*

# Introduction

According to the IOWA-Department for the blind, a person with healthy eyes can see things from 200 feet away whereas a legally blind person can see only from 20 feet away. Visual impairment or vision loss refers to a decreased ability to see to a degree that causes issues not fixable by usual means. An overview from WHO (World Health Organization) brings up facts such as globally it is estimated that approximately 1.3 billion people live with some form of vision impairment. There are two sorts of visually impaired individuals; one is partially blind and another one is complete blind. Partially blind people might experience symptoms like cloudy vision, seeing only shadows, poor night vision or tunnel vision. But a complete blind person doesn’t see anything, not even light. It can be caused by things like genetics, infection, disease or injury. With regards to distance vision, nearly 405 million people have either mild or sever vision impairment and almost 36 million people are completely blind.

For this work, a face to face interaction with blind persons were conducted along with some online research. (Some text will be added here). After analyzing the circumstances, problems were categorized as ‘Environmental Challenges’, Social Challenges and Technological Challenges. Individuals who are totally blind have a troublesome time exploring outside. Traveling or merely walking down a crowded street can be challenging. For these reasons they prefer to travel with a sighted friend or family member, in some cases, trained guide dogs when navigating unfamiliar places. Additionally, blind individuals must remember the area of each obstruction or thing in their home condition. Things like beds, tables and seats must not be moved without notice to avert any kind of accidents. Every individual from the family must be constantly aware about keeping walkways clear and all things in their assigned locations. In case of ‘Social Challenges’ blindness impacts a person’s ability to perform many job functions, which can limit their career options, indicated by the World Health Organization which eventually affect their finance and self-esteem. Complete blindness requires learning new skills such as ‘Braille Reading’.

\*\*Summary of 4 papers in two columns will be added here

# Related Works

Various ways of assisting blind people were introduced by many literature over the years. Due to the technological advancements, they have used extensively wide range of technologies to aid the blind people in terms of their vision, navigation, mobility, reading and communication.

Object detection, obstacle avoidance and warning is commonly used in related works. Sensors are used to detect obstacles and their distances in [2] [6] [9] [10], some Electronic Travel Aids (ETAs) and assistive devices. [6] Used Ultrasonic sensors to detect obstacle near the user (up to 300cm). Ultrasonic sensors generates 40 kHz signal and receives reflected echo. Finally, computes the distance in the form of pulse count. [2] Multi-sensor fusion based obstacle avoiding algorithm where ultrasonic and depth sensors are used. [9] Used RFID to localize obstacles and accelerometer to detect moving objects. [10] Used inferred sensor for detecting objects. Several kinds of camera are also used to detect objects and their distances such as [6] used Webcam, [12] used Google glass camera, [2] used depth camera, [13] used Raspberry Pi 2 camera module, [9] used two cameras from sides, [5] used mobile Kinect. All of them used different libraries or frameworks to process the captured video or image, detect obstacles and their distances such as [7] [11] Used OpenCV. In [9], they have used MATLAB to identify objects. Human detection in [6], by face detection, cloth and skin color texture analysis using C++ algorithm, used to make communications easy for the blind persons. Some of the works are only focused on specific object or pattern recognition, [9] recognizes traffic signal patterns, [7] detects only public signs.

Many of the works focuses to read out any text in front of the blind people. [11] [13] Used Tesserect OCR engine whereas [12] Used Google Cloud Vision API in a Google Glass to read out text out of a captured image from its camera. [13] Used Simulink (MATLAB) for image preprocessing, cropping and detecting text areas and then used Tesseract OCR engine.

To give feedback to the blind people, [7] [11] used voice or audio instruction via headphones or speakers. They are usually done by text-to-speech engines. [6] Sends a beep to let user know there is an obstacle near him/her. Different kind of microprocessors, computational devices used as the main platform to make these devices such as [6] used eBox 2300tm Embedded System, [2] used Google Glass, an expensive wearable computer, [7] [11] used Intel Edison, [2] [9] [10] used micro-controllers as their computational devices. The setup also varies to make prototype such as helmet [6], [2] [12] [11] [7] [13] [9] made their prototype as spectacles.

In our work, we propose a new compact, low-cost, easy-to-use appliance in form of a spectacle which is combined of many features, which we think, is necessary to aid the blind people more effectively, such as detecting objects and obstacles in real time using image processing and ultrasonic transducer, voice driven feedback and also read out any text including documents or books to user as per requirement. This device will help the blind persons to know about the exact distance of an object or multiple objects in front of them that too in real time. For the object detection part, we have used multiple technologies such as Tensor flow, frameworks and libraries like Open Computer Vision (OpenCV) to detect faces and eyes to measure distance based on ‘Haar Cascade Classifier’; Tesseract, which is a free Optical Character Recognition (OCR) engine for various operating systems, was used to extract text from any image. Apart from these, eSpeak, which is a compact open source software speech synthesizer (text-to-speech) English and other languages, was also used to give the voice instruction about what types of objects are there in front of the user, what is the distance of that object from the user. To make our system more adjuvant HC-04 which is an ultrasonic transducer was used so that if some obstacle come near 20 inches or 10 inches our system will give voice alarm by mentioning the distance of that obstacle from the user using the eSpeak speech synthesizer.

# Introduction to Proposed Techniques

## Introduction to TensorFlow

TensorFlow is an open source library for numerical computation and large-scale machine learning application, created by the Google Brain team. It uses Python to provide a convenient front-end API for building applications with the framework, while executing those applications in high-performance C++. TensorFlow can train and run deep neural networks for handwritten digit classification, image recognition, word embeddings, recurrent neural networks, sequence-to-sequence models for machine translation, natural language processing, and PDE (partial differential equation) based simulations. It allows developers to create dataflow graphs—structures that describe how data moves through a graph, or a series of processing nodes. Each node in the graph represents a mathematical operation, and each connection or edge between nodes is a multidimensional data array, or tensor. Tensors are geometric objects that describe linear relations between geometric vectors, scalars, and other tensors. Elementary examples of such relations include the dot product, the cross product, and linear maps. Geometric vectors, often used in physics and engineering applications, and scalars themselves are also tensors.

TensorFlow uses a dataflow graph to represent computation in terms of the dependencies between individual operations. This leads to a low-level programming model in which someone first define the dataflow graph, then create a TensorFlow session to run parts of the graph across a set of local and remote devices. Dataflow is a common programming model for parallel computing. In a dataflow graph, the nodes represent units of computation, and the edges represent the data consumed or produced by a computation.

## Introduction to Open Computer Vision

## Introduction to Optical Character Recognition

## Introduction to Haar Cascade Classifier

## Introduction to Ultrasonic Transducer

# Research Methodology

## Data Collection

## Data Analysis

## Rule Formation

## ANFIS for Academic Performance

## FIS for Academic Performance

## K-Means Algorithm applied for Consistency

# Result analysis

## Validation of the FIS output

## Comparison between ANFIS and FIS on academic Performance

## Finding the Consistency

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