



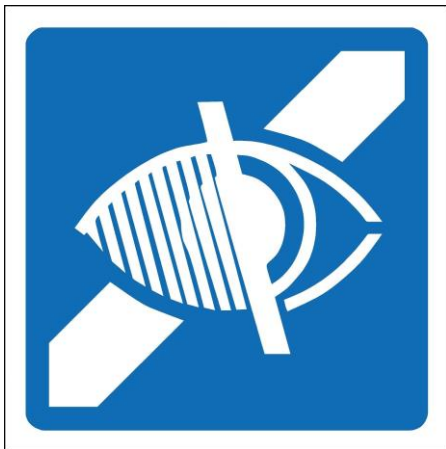
Credit Hours System

CCEN480 – GP1



Cairo University

Faculty of Engineering



GP 1 REPORT

VIRTUAL ASSISTANT FOR VISUALLY IMPAIRED PEOPLE

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Table of Contents

1. Introduction	1
2. Surveying.....	1
2.1. VoiceOver	1
2.2. TalkBack	1
2.3. Microsoft Soundscape	1
2.4. Seeing AI.....	2
2.5. Facing Emotions.....	2
2.6. LookTel Money Reader	2
2.7. Google Assistant	2
3. Features.....	3
4. Research Papers	4
4.1. Cost-effective and collaborative methods to Author Video’s scene Description for Blind People.....	4
4.2. Virtual Assistant for blind people	5
4.3. A Smartphone-Based Mobility Assistant Using Depth Imaging for Visually Impaired and Blind.....	6
4.4. An insight into smartphone-based assistive solutions for visually impaired and blind people: issues, challenges, and opportunities	7
4.5. Blind- Sight: Object Detection with Voice Feedback.....	8
4.6. Handwriting Recognition using Artificial Intelligence.....	9
4.7. Emotion Detection Algorithm Using Frontal Face Image	10
4.8. Currency Detection and Recognition Based on Deep Learning	11
4.9. A Survey on Pixel-Based Skin Color Detection Techniques.....	12
4.10. A Review of Various Handwriting Recognition Methods	13
4.11. iGenda: An Event Scheduler for Common Users and Centralised Systems	14
iGenda: An Event Scheduler for Common Users and Centralised Systems.....	14
4.12. Smart Personal Task Scheduler	15
4.13. A Smart Mobile App For Blind Users.....	16
4.14. Smartphone apps for visually impaired persons.....	17
4.15. Voice recognition system: speech-to-text.....	18
4.16. Speech to text Conversion using Deep Learning Neural Net Methods.....	19
4.17. Machine Learning for Handwriting Recognition	20

4.18.	Smartphone-Based Obstacle Detection for the Visually Impaired.....	21
4.19.	Clothing matching for visually impaired persons.....	22
4.20.	Real-Time Walk Light Detection with a Mobile Phone.....	23
5.	References	24

GRADUATION PROJECT REPORT

1. Introduction

The project idea is about implementing a virtual assistant for visually impaired/ blind people to help them with their daily tasks and make their lives easier.

The interface will be in the form of an application. The user will communicate with a chatbot through speech.

2. Surveying

The following are the already existing applications/technologies that try to achieve the same purpose.

2.1. VoiceOver

It is a mobile application available in App Store that has the following features:

- Enunciate emails or other textual messages aloud
- Use braille for those who have a braille keyboard.
- Describes all the elements on the screen such as app icons.

2.2. TalkBack

Same as VoiceOver however for android users.

2.3. Microsoft Soundscape

Microsoft Soundscape is a product from Microsoft Research that explores the use of innovative audio-based technology to enable people to build a richer awareness of their surroundings

2.4. Seeing AI

A Multipurpose app that permits reading and describing all documents placed under the smartphone camera such as banknotes or product barcodes. [Link](#)

2.5. Facing Emotions

It is an app that translates seven major emotions on the human face: anger, fear, disgust, happiness, sadness and surprise.

2.6. LookTel Money Reader

This app allows visually impaired users to accurately count their money.

2.7. Google Assistant

Google Assistant is a virtual assistant that help people in a variety of ways from controlling their home (set temperature, adjust lighting) to helping them with day-to-day operations (sending texts, scheduling an event).

3. Features

Our final application will provide the following features/channels/modules:

- Short Text: speaks text as soon as it appears in front of the camera
- Documents: Provides audio guidance to capture a printed page and recognizes the text, along with its original formatting then speaks the document
- Products: audio beeps to help locate barcodes and then scans them to identify products
- Person: Recognizes friends and describes people around you, including their emotions
- Scene: Describes the scene around you
- Currency: Identify currency bills when paying with cash
- Light: Generate an audible tone corresponding to the brightness in your surroundings
- Color: Describes the perceived color to help the user in tasks such as color matching for clothes.
- Handwriting: Reads handwritten text
- Note Taker: Takes notes for you
- Event Scheduler: Schedules events for you.

4. Research Papers

4.1. Cost-effective and collaborative methods to Author Video's scene Description for Blind People

Paper Title	Cost-effective and collaborative methods to Author Video's scene Description for Blind People
Date of publication	April 29 – May 5 2022
Place of publication	CHI '22 Extended Abstracts -, New Orleans, LA, USA
Volume number and year	-
Authors	Rosiana Natalie
Link To Paper	Link

Summary:

This article discusses the need to provide accessibility of online video content for blind through audio descriptions. Earlier, we used to rely on professionals to author audio descriptions, but their service is costly and not readily available.

In this paper, they introduce four threads to create tools that are both time and cost-effective in providing good-quality audio descriptions which are:

- The development and evaluation of a mixed-ability collaboration authoring tool
- The formative study to uncover the feedback pattern from the reviewer
- The evaluation and generation of real-time supports for novice authors to write AD
- The design, development and evaluation of a system that demonstrates the utility of semi-automatically authoring AD.

Audio description (AD) verbally explains visual events that are not audible to blind users.

This research paper works toward making every video that has been and will be created in the future accessible for blind people using CV and NLP.

4.2. Virtual Assistant for blind people

Paper Title	Virtual Assistant for blind people
Date of publication	May 2021
Place of publication	International Journal of advance scientific research and engineering trends.
Volume number and year	Volume 6 Issue 5 May 2021 ISSN (Online) 2456-0774
Authors	Avanish Vijaybahadur Yadav, Sanket Saheb Verma, Deepak Dinesh Singh
Link To Paper	Link

Summary:

This project proposes to use AI, ML, Image, and Text recognition to assist people who are blind or visually impaired. The concept is realized using an Android mobile App that includes features such as voice assistant, image recognition, currency recognition, e-book and chatbot.

It is a visual-based project consisting of few main components such as a camera, raspberry Pi, Sensors, Microphones and vibrators mounted together.

4.3. A Smartphone-Based Mobility Assistant Using Depth Imaging for Visually Impaired and Blind

Paper Title	A Smartphone-Based Mobility Assistant Using Depth Imaging for Visually Impaired and Blind
Date of publication	9 March 2022
Place of publication	Applied Science
Volume number and year	-
Authors	Aaron Raymond See, Bien Grenier Sasing and Welsey Daniel Advincula
Link To Paper	Link

Summary:

In this research, they made use of a mobile phone with a depth camera function for obstacle avoidance and object recognition. It includes a mobile app that is controlled using voice and gesture controls to assist in navigation

. The proposed system gathers depth values from 23 coordinate points that are analyzed to determine whether an obstacle is present in the head area, torso area, or ground area, or is a full body obstacle. In order to provide a reliable warning system, the research detects outdoor objects within a distance of 1.6 m. Subsequently, the object detection function includes a unique interactable feature that enables interaction with the user and the device in finding indoor objects by providing an audio and vibration feedback, and users were able to locate their desired objects more than 80% of the time.

4.4. An insight into smartphone-based assistive solutions for visually impaired and blind people: issues, challenges, and opportunities

Paper Title	An insight into smartphone-based assistive solutions for visually impaired and blind people: issues, challenges and opportunities
Date of publication	4 July 2020
Place of publication	Springer-Verlag GmbH Germany, part of Springer Nature 2020
Volume number and year	-
Authors	Akif Khan, Shah Khusro
Link To Paper	Link

Summary:

The paper reviewed research avenues in smartphone-based assistive technologies for blind people, highlighted the need for technological advancements, accessibility-inclusive interface paradigm, and collaboration between medical specialists, computer professionals, usability experts and domain users to realize the potential of ICT-based interventions for blind people.

It analyzes a comprehensive review of the issues and challenges for visually impaired and blind people with the aim to highlight the benefits and limitations of the existing techniques and technologies.

4.5. Blind- Sight: Object Detection with Voice Feedback

Paper Title	Blind- Sight: Object Detection with Voice Feedback
Date of publication	March-April-2021
Place of publication	International Journal of Scientific Research & Engineering Trends
Volume number and year	Volume 7, Issue 2, March-April-2021, ISSN (Online): 2395-566X
Authors	A. Annapoorani, Nerosha Senthil Kumar, Dr. V. Vidhya
Link To Paper	Link

Summary:

. Image classification techniques are used to identify the features of the image and categorize them into their appropriate class. The text description of the recognized object will be sent to the Google Text-to-Speech API using the gTTS package. Voice feedback on the 1st frame of each second will be scheduled as an output to help the visually impaired hear what they cannot see.

The following Modules are implemented: Image Capture, Feature Extraction, Object Classification and Speech synthesis

4.6. Handwriting Recognition using Artificial Intelligence

Paper Title	Handwriting Recognition using Artificial Intelligence
Date of publication	2020
Place of publication	(IJACSA) International Journal of Advanced Computer Science and Applications
Volume number and year	Volume 11, No. 7
Authors	Sara Aqab, Muhammad Usman Tariq
Link To Paper	Link

Summary:

An artificial neural network is used to recognise handwritten digits and characters and convert them to an electronic format or a machine-encoded form. A neural network is used because it simulates how the human brain works when reading handwriting in a more simplified form. This paper focuses on artificial intelligence networks, machine learning, Hidden Markov Model, and the Support Vector Machine.

The modules used are image acquisition and digitization, preprocessing, segmentation, feature extraction, and recognition.

4.7. Emotion Detection Algorithm Using Frontal Face Image

Paper Title	Emotion Detection Algorithm Using Frontal Face Image
Date of publication	2 nd June 2005
Place of publication	Institute of Control, Robotics and Systems
Volume number and year	-
Authors	Moon Hwan Kim, Young Hoon Joo, and Jin Bae Park
Link To Paper	Link

Summary:

This paper proposes an emotion detection algorithm using a frontal facial image. There are three stages: image processing, facial features extraction and emotion detection. In image processing stage, the face region and facial component is extracted by using fuzzy color filter, virtual face model, and histogram analysis method. The features for emotion detection are extracted from facial component in facial feature extraction stage. In emotion detection stage, the fuzzy classifier is adopted to recognize emotion from extracted features.

The modules used are image processing, facial features extraction and emotion detection.

4.8. Currency Detection and Recognition Based on Deep Learning

Paper Title	Currency Detection and Recognition Based on Deep Learning
Date of publication	2018
Place of publication	IEEE International Conference on Advanced Video and Signal Based Surveillance (AVSS).
Volume number and year	-
Authors	Qian Zhang and Wei Qi Yan
Link To Paper	doi:10.1109/avss.2018.8639124

Summary:

This paper proposes a method for currency detection. It uses CNN as a feature extractor under the framework of Single Shot Multi Box Detector (SSD) model. The image of the currency is first filtered and sent to the MLP layer for currency classification, finally the currency recognition is done.

The modules used here are image filtering, feature extraction and classification.

4.9. A Survey on Pixel-Based Skin Color Detection Techniques

Paper Title	A Survey on Pixel-Based Skin Color Detection Techniques
Date of publication	-
Place of publication	-
Volume number and year	-
Authors	Vladimir Vezhnevets, Vassili Sazonov, Alla Andreeva
Link To Paper	Link

Summary:

This paper discusses methods for detecting skin. This is extremely helpful in face detection. The paper discusses pixel-based skin detection methods. IT first discusses the different color spaces used. Then, it discusses the existing skin color modelling methods. Finally, it compares all of them together.

4.10. A Review of Various Handwriting Recognition Methods

Paper Title	A Review of Various Handwriting Recognition Methods
Date of publication	2018
Place of publication	International Journal of Applied Engineering Research
Volume number and year	Volume 13, Number 2
Authors	Salma Shofia Rosyda and Tito Waluyo Purboyo
Link To Paper	Link

Summary:

This paper discusses methods for recognizing handwriting. The image is first preprocessed. Then, the preprocessed image is passed to one of the recognition methods. The paper discusses the difference between them. Also, the paper discusses a method for correcting slope and slant as well as segmenting characters. It discusses a total of eight methods.

4.11. iGenda: An Event Scheduler for Common Users and Centralised Systems

Paper Title	iGenda: An Event Scheduler for Common Users and Centralised Systems
Date of publication	2010
Place of publication	Springer, Berlin, Heidelberg
Volume number and year	Volume 73
Authors	Costa, Â., Laredo, J.L., Novais, P., Corchado, J.M., Neves, J.
Link To Paper	Link

Summary:

This paper summarizes the need for a scheduler assistant in our daily life as world is walking towards an aged society as a consequence of the increasing rate of longevity in modern cultures and with age comes the fact that memory decreases its efficiency and memory loss starts to surge. That's why iGenda is used to help the user keep track of their daily routine and activities as well as manage their health by including a Centralized Management System (CMS) on the side of a hospital-like institution.

4.12. Smart Personal Task Scheduler

Paper Title	Smart Personal Task Scheduler
Date of publication	2010
Place of publication	Springer, Berlin, Heidelberg
Volume number and year	Volume 265
Authors	Sai Swaroop Krishna, N., Krishna Tej, A., Suchithra, M.
Link To Paper	https://doi.org/10.1007/978-981-16-6482-3_44

Summary:

The paper proposes the development of an efficient task scheduler. What makes it different from other virtual assistants such as Google Assistant, Alexa, Siri, is the fact that it takes into consideration world factors like traffic. This can be done by tracking the user current location of the user while managing the user schedule and reminding the user about an event.

The software uses technologies like Dialogflow and Google Maps APIs

4.13. A Smart Mobile App For Blind Users

Paper Title	A Smart Mobile App for Blind Users
Date of publication	July - August 2016
Place of publication	International Journal of Computer Techniques
Volume number and year	Volume 3 Issue 4, July - Aug 2016
Authors	Ms. Kalpanagayathri M., Ms. Sangeetha Lakshmi G
Link To Paper	Link

Summary:

This paper introduces the concept of “Low vision Mobile App Portal”, which provides a way to access mobile apps specifically designed for visually impaired users. It describes some aspects of the design and shows preliminary results. The paper discusses what Universal Design means and questions whether everyday mobile apps are really designed to be used by everyone, shedding light on accessibility options of visually impaired people.

4.14. Smartphone apps for visually impaired persons

Paper Title	Smartphone apps for visually impaired persons
Date of publication	January 2019
Place of publication	Kerala Journal of Ophthalmology
Volume number and year	-
Authors	John Davis Akkara, Anju Kuriakose
Link To Paper	Link

Summary:

This paper highlights the fact that while many low-vision aids products may be available in the market for visually impaired people to use, they are not generally used as one would expect. Other than the factors of affordability and accessibility, social stigma and denial are other factors. However, a smartphone is often available and the ability to use a smartphone can empower the visually impaired. Most of these apps do not require any extra hardware and many are free. There are apps designed to read out loud from the smartphone menus, voice control, read out books, and even read out text from photographs clicked by the phone. Some apps can identify colors, objects, and money

4.15. Voice recognition system: speech-to-text

Paper Title	Voice recognition system: speech-to-text
Date of publication	November 2015
Place of publication	Journal of Applied and Fundamental Sciences
Volume number and year	-
Authors	Pranab Das, Vijay Prasad
Link To Paper	Link

Summary:

This paper discusses voice recognition systems. The system consists of two components , first component is for processing acoustic signal which is captured by a microphone and second component is to interpret the processed signal, then mapping of the signal to words. Model for each letter is built using Hidden Markov Model(HMM). Feature extraction is done using Mel Frequency Cepstral Coefficients(MFCC). Feature training of the dataset is done using vector quantization and Feature testing of the dataset is done using viterbi algorithm.

4.16. Speech to text Conversion using Deep Learning Neural Net Methods

Paper Title	Speech to text Conversion using Deep Learning Neural Net Methods
Date of publication	2021
Place of publication	Turkish Journal of Computer and Mathematics Education
Volume number and year	Vol.12 No.05 (2021), 2037-2042
Authors	Babu Pandipati, Dr. R.Raveen Sam
Link To Paper	Link

Summary:

This paper intends to explore the various methods for conversion of speech-to-text that can be utilized in an email system that is based on voice. This method is built on the interactive voice response. The goal is to research and evaluate the different methods that are used in STT conversions, and find the most efficient method that is able to be adapted to both conversion processes. In the end, a model that uses HMM and ANN techniques to convert STT conversion is suggested.

Speech to Text conversion receives input from a microphone as speech, and later transformed into text which is displayed on the desktop. Speech processing is the research of signals and the different methods utilized for processing them. In this process, a variety of applications like speech coding, speech synthesizer, speech recognition and technology for recognition of speakers that use speech processing are employed. Among the mentioned above, speech recognition may be the most crucial one.

4.17. Machine Learning for Handwriting Recognition

Paper Title	Machine Learning for Handwriting Recognition
Date of publication	2020
Place of publication	International Journal of Computer (IJC)
Volume number and year	Vol.12 No.05 (2021), 2037-2042
Authors	Preetha S, Afrid I M, Karthik Hebbar P, Nishchay S K
Link To Paper	Link

Summary:

This paper aims to understand training computers to read handwritten letters and numbers. It also offers the distinction between Online character recognition and Offline character recognition. While Offline character recognition involves parsing image of document to series of texts and words, Online character recognition is a bit complicated process as it is a dynamic process. It involves of recognizing character data at the time of writing itself. It needs specialized writing pad and an electric pen. On the basis of movement of pen, the written character is recognized

4.18. Smartphone-Based Obstacle Detection for the Visually Impaired

Paper Title	Smartphone-Based Obstacle Detection for the Visually Impaired
Date of publication	2015
Place of publication	International Journal of Computer (IJC)
Volume number and year	vol 9279
Authors	Caldini, A., Fanfani, M., Colombo, C.
Link To Paper	https://doi.org/10.1007/978-3-319-23231-7_43

Summary:

This paper involves around exploiting the hardware and software of smartphones. It uses computer vision to extract images 3D representation of the scene and detect possible obstacles. images are captured by the smartphone camera and processed with a modified Structure from Motion algorithm that takes as input also information from the built-in gyroscope. Thus, the software is able to estimate the obstacles' location and label them to avoid the user colliding with these obstacles.

4.19. Clothing matching for visually impaired persons

Paper Title	Assistive Clothing Pattern Recognition for Visually Impaired People
Date of publication	2014
Place of publication	IEEE
Volume number and year	vol. 44, no. 2, pp. 234-243
Authors	X. Yang, S. Yuan and Y. Tian
Link To Paper	doi: 10.1109/THMS.2014.2302814

Summary:

As we all know matching clothes is one of the important steps when deciding what to wear but since visually impaired people face difficulties when it comes to color, this paper focuses on recognizing clothing patterns in four categories (plaid, striped, patternless, and irregular) and identifies 11 clothing colors. A camera mounted upon a pair of sunglasses is used to capture clothing images. The clothing patterns and colors are described to blind users verbally. This system can be controlled by speech input through microphone.

4.20. Real-Time Walk Light Detection with a Mobile Phone

Paper Title	Robust traffic lights detection on mobile devices for pedestrians with visual impairment
Date of publication	2016
Place of publication	ScienceDirect
Volume number and year	vol. 148, no. 2, pp. 123-135
Authors	Sergio Mascetti, Dragan Ahmetovic, Andrea Gerino, Cristian Bernareggi, Mario Busso, Alessandro Rizzi,
Link To Paper	https://doi.org/10.1016/j.cviu.2015.11.017

Summary:

This paper contributes in helping pedestrians facing visual problems to cross streets when traffic light is safe to cross. The software uses image processing and recognition, it proposes a robust setup for image capture that makes it possible to acquire clearly visible traffic light images regardless of daylight variability due to time and weather. The technique is also practical in supporting road crossing.

5. References

[13 Must-have Apps for Blind or Visually Impaired People in 2022](#)

[26 Best Apps for the Visually Impaired](#)