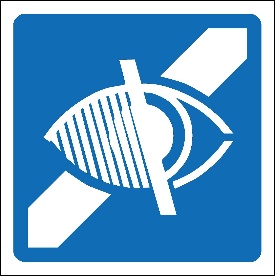


Cairo University

Faculty of Engineering

Department of Computer Engineering

**Pocket Lens**



A Graduation Project Report Submitted

to

Faculty of Engineering, Cairo University

in Partial Fulfillment of the requirements of the degree

of

Bachelor of Science in Computer Engineering.

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12/06/2023

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**General Guidelines**

* The document is intended to be a template for the graduation project report in the department of Computer Engineering, Cairo University
* After reading this page, you have to remove it from the report
* Red texts should be removed and replaced by similar ones, related to your project
* The color of the cover page should be green
* Throughout your text, use the font type, font size, and spacing, as in this template. In general, Arial font should be used. Chapter headings should be of size 24. Sections should be of size 18, and regular text should be of size 12. Your text should be justified on both left and right sides.
* The reference list should be written using a font size of 10. Ensure that the references are written correctly and all fields are included. References should be ordered according to their appearance in the text “[1], [2], [3] … etc”
* The table of content is a tentative one. You could add more sections as required. However, the mentioned sections should be included in your report
* For the appendices, add any appendix you see necessary. Remove any appendix that is not applicable to your project. However, the feasibility study and user guide should be included
* Ensure that the report is clear and self-contained, such that any future interested reader could completely understand your project “to the extent of building another one similar to yours”
* Use figures as much as possible to clarify and enrich your discussion. You have to draw all figures yourself. Ensure that the figures are clear and their size is suitable.
* Any figure caption should be inserted below the figure. Figures within any chapter should be numbered starting from 1. For example, the first figure of chapter 2 should be “Figure 2.1”. Similarly, the fourth figure of chapter 3 should be “Figure 3.4”
* Any table caption should be inserted above the table. Tables within any chapter should be numbered starting from 1. For example, the first table of chapter 4 should be “Table 4.1”. Similarly, the seventh table of chapter 5 should be “Table 5.7”
* Copy and paste from any other source is not allowed by any shape. Even for the background knowledge, you have to use your own wording.
* The complete report should be submitted 48 hours before the final project demonstration day. Ensure that you would meet this deadline to avoid any late penalty

# Abstract

Even though many mobile devices today include accessibility features available for visually impaired and blind users, many of these users are reluctant to use them. This is because either the features are not very beneficial for the user or the interface is mainly designed for sighted people. The latter is caused by the fact that the main input and output methods on mobile devices are tactile or visual in nature. However, in recent years, there have been many innovative applications that assist VIB users in navigating their environment. Programmers have made use of technological advances regarding gyroscope sensors and vibration feedback to make communication possible.

The proposed system relies on input images and videos provided by the user’s device camera to allow daily life navigation without the need to use such sensors. It makes communication between VIB users and their devices possible using speech/text conversion techniques.

The approach that is followed to solve this problem is to use artificial intelligence to analyze images captured by the device's camera, and provide feedback to the user through speech synthesis. The output of this project is a mobile app that can run on both Android and iOS devices, and that can be customized according to the user's preferences and needs.

The summary of testing results shows that the app is effective, accurate, and reliable in performing the intended functions, and that it has a positive impact on the user's independence and quality of life.

# الملخص

على الرغم من أن العديد من الأجهزة المحمولة اليوم تتضمن ميزات للمستخدمين المكفوفين وضعاف البصر، إلا أن العديد من هؤلاء المستخدمين يترددون في استخدامها. هذا لأن الميزات ليست مفيدة جدًا للمستخدم أو أن الواجهة مصممة بشكل رئيسي للأشخاص ذوي البصر السليم. مشكلة الواجهات المصممة هي كون طرق الإدخال والإخراج الرئيسية على الأجهزة المحمولة تكون عن طريق اللمس و استخدام حاسة البصر. ومع ذلك، في السنوات الأخيرة، ظهرت العديد من التطبيقات المبتكرة التي تساعد المستخدمين المكفوفين وضعاف البصر في التنقل في بيئتهم. قام المبرمجون باستخدام التطورات التكنولوجية المتعلقة بحساسات الجايروسكوب والاهتزاز لجعل التواصل ممكنًا. النظام المقترح يعتمد على صور وفيديوهات إدخال يقدمها كاميرا جهاز المستخدم للسماح بالتنقل في الحياة اليومية دون الحاجة إلى استخدام مثل هذه الحساسات. يجعل التواصل بين مستخدمي VIB وأجهزتهم ممكانًا باستخدام تقنيات التحويل من/إلى نص/كلام.

الطريقة التى يتبعها النظام لحل هذه المشكلة هى استخدام الذكاء الإصطناعى لتحليل الصور التى يلتقطها كاميرا جهاز وتقديم ملاحظات للمستخدم من خلال توليف الكلام. ناتج هذا المشروع هو تطبيق جوال يعمل على كلاً من أجهزة Android و iOS، والذى يمكن تخصيصه وفقًا لتفضيلات واحتياجات المستخدم. تظهر ملخص نتائج اختبارات أن التطبيق فعال و دقیق و موثوق في أداء الوظائف المقصودة، وأن لديه تأثير إيجابى على استقلالية المستخدم و جودة حياته.

# ACKNOWLEDGMENT

We would like to express our sincere gratitude to Allah for giving us the opportunity and the strength to complete this graduation project.

We would also like to thank Dr. Mona Farouk, our supervisor and mentor, for her invaluable guidance, feedback and encouragement throughout this journey. She has been a source of inspiration and motivation for us, and we have learned a lot from her expertise and experience. We are truly grateful for her support and kindness.

Ahmed, Moaz, Mostafa and Nader

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# List of Abbreviation

|  |  |
| --- | --- |
| Abbreviation | Definition |
| AI | Artificial intelligence |
| VIB | Visually impaired and blind |
| WHO | World Health Organization |
|  |  |
|  |  |
|  |  |
|  |  |

# List of Symbols

# Contacts

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# Introduction

According to the WHO, around 2 billion people are visually impaired or blind. This is not a minority. Nevertheless, very little has been done to help them throughout their day. Mobile phones offer accessibility features for them, but these features are not enough for day-to-day activities.

The proposed system offers a mobile application that uses AI to help VIB people complete their daily tasks. It captures images from the user’s camera as input and gives the user feedback through a text-to-speech module.

## Motivation and Justification

VIB users are often put at a disadvantage regarding their visually able peers. Technological advancements have always been concerned with providing better and easier to use solutions. These efforts have been largely directed toward the use of sensors, which can in many are not available to every user.

Moreover, many of the applications that can be found in the market are not particularly easy to use. They often require some degree of tactile interaction, which VIB users will most probably not be able to provide. Some of these applications are designed to be used by sighted people alongside VIB users, which can come as impractical.

The before mentioned reasons led us to consider using AI and Machine Learning techniques to create a mobile application that can serve as an assistant to VIB people. We will be addressing these previous problems by rendering the contact between the application and the VIB user purely vocal as much as the desired features allow for it. In other words, the user will communicate with the chatbot through speech.

## The Essential Question

The essential question is how to use AI and Machine Learning techniques to create a mobile application that can serve as an assistant to visually impaired and blind (VIB) people. This is relevant to the Vision and Mission of the Faculty of Engineering at Cairo University as it aligns with their goal of using technological advancements to provide better and easier-to-use solutions for everyone.The proposed system aims to address previous problems by rendering the contact between the application and the VIB user purely vocal, allowing for easier communication and interaction.

## Project Objectives and Problem Definition

The problem being addressed is the disadvantage faced by visually impaired and blind (VIB) users in comparison to their visually able peers. The objective of the project is to use AI and Machine Learning techniques to create a mobile application that can serve as an assistant to VIB people. The application aims to address previous problems by rendering the contact between the application and the VIB user purely vocal, allowing for easier communication and interaction.

## Project Outcomes

The outcome of the project would be a mobile application that uses AI and Machine Learning techniques to serve as an assistant to visually impaired and blind (VIB) people.

## Document Organization

In this section, you have to give the organization of the report and a quick description of the following chapters.

# Market Visibility Study

The project market is an innovative virtual assistant designed specifically for visually impaired and blind individuals. This cutting-edge technology aims to improve the quality of life for those with visual impairments by providing them with a tool that can assist them in their daily lives. With its advanced features and user-friendly interface, the project market is set to revolutionize the way visually impaired and blind people interact with the world around them.

## Targeted Customers

The system is intended for VIB people. They can greatly benefit from the system by using the mobile application to make their day-to-day operations easier.

## Market Survey

In this section, list the competitive products to your work. Similar commercial tools/platforms should be mentioned and discussed. Write a subsection for everyone of them and explain its pros and cons in that subsection

### Competitive Project 1

Explain and discuss each competitive project

### Competitive Project 2

Explain and discuss each competitive project

## Business Case and Financial Analysis

In this section you describe the success of establishing a company to sell your product (or service)

Two Aspects must be addressed

Business Case: Based on Market survey above you should anticipate how many products you will sell over the next 5 years and how will you set your price to counter the competition.

Financial Analysis: Based on the business case we must anticipate

1. The Capex (Capital Expenditure): These are one-time spending that you pay for development and buying things for the company
2. The Opex (Operational Expenses): These are recurring payments for salaries and marketing and … etc.

Then you create what we call a cash flow table (on an excel sheet). In this sheet you put down your monthly capex and opex on a set of rows and your reveneus (money you get back from selling product/services) on another set of rows.

The difference between both sums is your profit before tax.

It is likely that this difference is negative at beginning until your sales increase and counter the expenses.

From this cash flow analysis you find the date of the break even point wbich is the date at which all the money you get back equals the money you spent. From that date onward you will be making true profit ☺.

# Literature Survey

This chapter consists of two parts. In part one, give any necessary engineering and non-engineering backgrounds that you see important for the complete understanding of your project. These backgrounds include, but are not limited to, facts, theory, formulas, algorithms and techniques. In other words, any pivotal knowledge to your project should be given, discussed, and properly defined. In part two give a short literature review of the latest publications related to your project within past three years if applicable. Specially in this chapter, avoid lengthy unrelated discussion. More important, copy-and-paste should never be used. You have to write everything with your style and wording.

In this space, before the first section, write an introductory paragraph to describe the topics and organization of the chapter

## Background on Topic 1

Give this section a title related to the topic you cover and then write the related information as explained above.

## Background on Topic 2

Similar to the previous section, give this section a title related to the topic you cover and then write the related information as explained above.

Just choose the most two important topics however you make sure to cover all necessary facts, theory, formulas, algorithms and techniques.

## Comparative Study of Previous Work

In this section give a comparative, classified short literature review of the latest publications the latest publications related to your project within past three years if applicable

## Implemented Approach

Conclude this chapter by this section stating the approach chosen from those reviewed, **but more important your justification why you chose this approach** along with any modifications added to the approach.

Notice, you may be implementing several techniques however you must illustrate the general framework for your approach.

# System Design and Architecture

This chapter represents the main body of your project. It should describe the project in full details. This chapter should answer the questions: “what has been done?” and “how it has been done?”. As such, the steps you went through to realize the project should be highlighted and properly discussed. Your scientific approaches and methodologies should be clarified. The discussion should adopt a logical flow starting from the whole block diagram, to coarse modules, and finally to fine modules. While writing this chapter, try to give as much details as possible, such that an interested reader could easily replicate your work and improve it.

In this space, before the first section, write an introductory paragraph on how you design and build your project

## Overview and Assumptions

In this section, introduce how you design you system and develop its underlying architecture. Any employed assumptions should be clearly enumerated and justified.

## System Architecture

The architecture of your system should be given in this section. This architecture should be first represented as a block diagram (subsection 5.2.1), which clarifies different project modules and the connections between them. You may add more subsections to properly explain your design. If possible, flowcharts are better included to ensure that the big picture and the interaction between different modules are very clear to the reader. Thereafter, each module should have a separate subsequent section to clearly describe and discuss it.

### Block Diagram

Draw the block diagram of your architecture and generally discuss its modules. After reading this subsection, interested audience should have understood the big picture of your system design and architecture. The interaction between modules should also be conveyed in this subsection

## Module 1

Each module within your architecture should have a distinct section to explain the design of the module itself. Again, give as much details as possible, so that the reader could easily understand how the module is designed and what are the constraints that affect its design?

### Functional Description

Explain the functional description of the module

### Modular Decomposition

Explain the modular decomposition of the coarse module into smaller fine ones

### Design Constraints

Explain the constraints that affect the design of the module

### Other Description of Module 1

Give any other necessary discussion of the module to ensure that it is clearly described.

## Module 2

Each module within your architecture should have a distinct section to explain the design of the module itself. Again, give as much details as possible, so that the reader could easily understand how the module is designed and what are the constraints that affect its design?

**4.4.1. Functional Description**

Explain the functional description of the module

**4.4.2. Modular Decomposition**

Explain the modular decomposition of the coarse module into smaller fine ones

**4.4.3. Design Constraints**

Explain the constraints that affect the design of the module

**4.4.4. Other Description of Module 2**

Give any other necessary discussion of the module to ensure that it is clearly described.

# System Testing and Verification

In this chapter, you have to explain all the steps you carried out to ensure that project outcomes are realized correctly. Your testing setup, strategy and environment should therefore be described. Your efforts for unit testing as well as integrated system testing should be given. Finally, the results from different testing scenarios should be highlighted and discussed.

In this space, before the first section, write an introductory paragraph on how you test and verify the correct operation of your system

## Testing Setup

Explain the setup you are using in testing your project

## Testing Plan and Strategy

Explain the methodology you follow while testing your project in details

### Module Testing

Explain the steps you carried out to test different modules within the project. Give and discuss the results obtained from the testing of these modules

### Integration Testing

Explain the steps you carried out to test the integrated system of your project. Give and discuss the results obtained from this whole project testing

## Testing Schedule

Mention your testing schedule

## Comparative Results to Previous Work

Give a summary of comparative results to previous work in Tabulated and or Graphical form along with a short commentary.

# Conclusions and Future Work

This chapter should summarize the whole project, it features and limitation. Moreover, you should give directions for future work

In this space, before the first section, write an introductory paragraph for the chapter

## Faced Challenges

Mention all the problems/challenges that you faced while working with the project and how you overcome them

## Gained Experience

Mentioned the experience/skills that you gained from working with the project

## Conclusions

Write your conclusions regarding the project. Mention its features and limitations

## Future Work

Give possible extensions, enhancements and future work of you project, such that subsequent students could build on your work and develop larger systems/platforms.

# References

The references should be ordered according to their appearance in the text. Ensure that all references are cited throughout your report text. The following are examples of how to write different types of references “[1] Book, [2] Journal/magazine articles, [3] conference paper, [4] website, [5] thesis”. Replace the fields with those of your used references. Question marks “??” should be replaced by the corresponding number

1. Author1, Author 2,…, “Book title,” name of publishing firm, edition, year
2. Author1, Author2,…., “Title of journal article,” name of the journal, vol. ??, no. ??, pp. ??, year of publication
3. Author1, Author2,…, “Title of conference paper,” in proceedings of conference name, city, country, date, year, pp. ??
4. Author or Corporation name, “Title,” year, link for the website, last accessed: date of last access
5. Author, “Thesis title,” M.Sc./Ph.D. thesis, Department, University, year

**Appendix A: Development Platforms**

**and Tools**

This appendix explains used tools, platforms, and hardware kits. Any ready-made module should be mentioned and discussed in this appendix. The appendix is divided into two main sections; one for the hardware and the other is for software. Within each section, you could add as much subsections as needed, according to the number of tools and platforms that you use in your project.

In this space, before the first section, write an introductory paragraph to the appendix

**A.1. Hardware Platforms**

A description of any used hardware platforms/kit should be written in this section. Each platform/kit is better described in a separate subsection. (A1.1..)

**A.2. Software Tools**

A description of any used software tool/package should be written in this section. Each tool/package is better described in a separate subsection (A2.1,..)

**Appendix B: Use Cases**

Include all your use cases

**Appendix C: User Guide**

Prepare a user guide for your project. Ensure that the guide is clear, detailed and easy for an ordinary customer to use your project. Employ figures and charts as needed to facilitate the use of your guide

**Appendix D: Code Documentation**

Your code or parts of the code you feel necessary could be included here (optional) however for one copy of this report an attached CD with all of the code is a must.

Remember you will deliver three copies of this report.

**Appendix D: Feasibility Study**

Give a detailed feasibility study of your project