

**University Institute of Information Technology,**

**PMAS-Arid Agriculture University,**

**Rawalpindi Pakistan**

**VisionForBlinds**

***By***

**Anum Areej 19-ARID-785**

**Muhammad Komail Abbas Khan 19-ARID-832**

**Muhammad Rakib Nadeem 19-ARID-835**

***Supervisor*Mr. Suleman Khurram**

***Bachelor of Science in Computer Science (2019-2023)***

**The candidate confirms that the work submitted is their own and appropriate  
 credit has been given where reference has been made to the work of others**.

**DECLARATION**

We hereby declare that this software, neither whole nor as a part has been copied out from any source. It is further declared that we have developed this software documentation and accompanied report entirely on the basis of our personal efforts. If any part of this project is proved to be copied out from any source or found to be reproduction of some other. We will stand by the consequences. No Portion of the work presented has been submitted of any application for any other degree or qualification of this or any other university or institute of learning.

Anum Areej Muhammad Komail Abbas Khan Muhammad Rakib Nadeem

(19-ARID-785) (19-ARID-832) (19-ARID-835)

--------------------------- --------------------------- ---------------------------

**CERTIFICATE OF APPROVAL**

It is to certify that the final year project of **BS (CS)** **“VisionForBlinds”** was developed by **“Anum Areej (19-ARID-785)”**, **“Muhammad Komail Abbas Khan (19-ARID-832)”** and **“Muhammad Rakib Nadeem (19-ARID-835)”** under the supervision of **“Mr. Suleman Khurram”** and that in their opinion; it is fully adequate, in scope and quality for the degree of Bachelors of Science in Computer Science.

---------------------------------------

**(Mr. Suleman Khurram)**

**Supervisor**

---------------------------------------

**External Examiner**

---------------------------------------

**Administrator UIIT**

**Executive Summary**

People see their surroundings through the beautiful sense of sight that is gifted to them. But some people have lost this sense either because of any ailment or due to any other reasons. It becomes difficult for them to live their rest of lives with this disability. They cannot enjoy their lives and perform their daily life activities on their own. They need someone else’s aid to guide them in certain activities and tasks. Due to advancements in technology, the lives of such people have now been eased to some extent. These people can use their smartphones and perform various daily life activities and tasks easily. To create more ease for people having any kind of visual impairment, we have built a mobile application that has various utilities and modules. This mobile application titled **“VisionForBlinds”** will guide its visual impaired users in the best possible way.

Our mobile application **VisionForBlinds** is an Artificial Intelligence based project that would assist its blind and visual impaired users in various ways. Our application has used the technology of **React Native** for developing UI for mobile. Since it is an AI based mobile application, we have used various techniques of Artificial Intelligence, mostly Deep Learning techniques like **Convolutional Neural Networks (CNN)** and **Optical Character Recognition (OCR)** for its utilities and modules. Our mobile application has three important modules including **Image Captioning** and **OCR Detection**, **Currency Detection** and **Color Detection**. If the user wants to use these utilities, they will have to grant camera access to its mobile phone. The proposed solution has used various datasets for training and to predict the best possible outcomes for its users. Since we have developed this application for visually impaired people, we have incorporated the feature of **text-to-speech** with all the working modules.

**Acknowledgement**

All praise is to Almighty Allah who bestowed upon us a minute portion of His boundless knowledge by virtue of which we were able to accomplish this challenging task.

We are greatly indebted to our project supervisor **“Mr. Suleman Khurram”** for personal supervision, advice, valuable guidance and completion of this project. We are deeply indebted to him for encouragement and continual help during this work.

And we are also thankful to our parents and family who have been a constant source of encouragement for us and brought us the values of honesty & hard work.

Anum Areej Muhammad Komail Abbas Khan Muhammad Rakib Nadeem

(19-ARID-785) (19-ARID-832) (19-ARID-835)

--------------------------- --------------------------- ---------------------------

**Abbreviations**

|  |  |
| --- | --- |
| **FYP** | Final Year Project |
| **CNN** | Convolutional Neural Networks |
| **OCR** | Optical Character Recognition |
|  |  |
|  |  |

**Table of Contents**

**Introduction 1**

[1.1 Brief](#_Toc268523777) 1

[1.2 Relevance to Course Modules](#_Toc268523779) 2

[1.3 Project Background](#_Toc268523780) 3

[1.4 Literature Review](#_Toc268523780) 4

[1.5 Analysis from Literature Review](#_Toc268523780) 6

[1.6 Methodology and Software Life Cycle](#_Toc268523782) 6

[1.6.1 Rationale behind Selected Methodology](#_Toc268523787) 7

**Problem Definition** **9**

[2.1 Problem Statement](#_Toc268523795) 9

[2.2 Deliverables and Development Requirements](#_Toc268523796) 10

[2.3 Current Systems](#_Toc268523804) 12

**Requirement Analysis**

[3.1 Functional Requirments](#_Toc268523823)

[3.2 Non – Functional Requirments](#_Toc268523825)

[3.2.1 Usability](#_Toc268523787)

[3.2.2 Reliability](#_Toc268523787)

[3.2.3 Performance](#_Toc268523787)

[3.2.4 Supportability](#_Toc268523787)

[3.2.5 Design Constraints](#_Toc268523787)

[3.2.6 Licensing Requirements](#_Toc268523787)

[3.3 Use cases](#_Toc268523823)

[3.3.1 Use Case Diagarm](#_Toc268523787)

[3.3.2 Use Case and Actors Description](#_Toc268523787)

**The Design**

[4.1 UML Structural Diagrams](#_Toc268523830)

[4.1.1 Component Diagram](#_Toc268523787)

[4.1.2 Package Diagram](#_Toc268523787)

[4.1.3 Deployment Diagram](#_Toc268523787)

[4.2 UML Behavioral Diagrams](#_Toc268523830)

[4.2.1 Activity Diagrams](#_Toc268523787)

[4.2.2 State Machine Diagrams](#_Toc268523787)

[4.3 UML Interaction Diagrams](#_Toc268523830)

[4.3.1 Sequence Diagrams](#_Toc268523787)

[4.4 Node Structure](#_Toc268523830)

[4.5 Communication Design Protocol](#_Toc268523830)

**Implementation**

[5.1 Communication Protocol Implementation](#_Toc268523830)

[5.2 PC Application Implementation](#_Toc268523830)

[5.3 Embedded Application Implementation](#_Toc268523830)

[5.4 Wireless Sensor Application Implementation](#_Toc268523830)

**Testing and Evaluation**

[6.1 Verification](#_Toc268523830)

[6.1.1 Functional Testing](#_Toc268523787)

[6.1.2 Static Testing](#_Toc268523787)

[6.2 Validation](#_Toc268523830)

[6.3 Usability Testing](#_Toc268523830)

[6.4 Unit Testing](#_Toc268523830)

* 1. [Integration Testing](#_Toc268523830)

6.6 [System Testing](#_Toc268523830)

**GUI**

**Future Work**

**References**

**e Design**

[4.1 UML Structural Diagrams](#_Toc268523830)

[4.1.1 Component Diagram](#_Toc268523787)

[4.1.2 System Component Diagram](#_Toc268523787)

[4.1.3 Package Diagram](#_Toc268523787)

[4.1.4 Deployment Diagram](#_Toc268523787)

[4.2 UML Behavioral Diagrams](#_Toc268523830)

[4.2.1 Activity Diagrams](#_Toc268523787)

[4.2.2 State Machine Diagrams](#_Toc268523787)

[4.3 UML Interaction Diagrams](#_Toc268523830)

[4.3.1 Sequence Diagrams](#_Toc268523787)

[4.4 Node Structure](#_Toc268523830)

[4.5 Communication Design Protocol](#_Toc268523830)

**Implementation**

[5.1 Communication Protocol Implementation](#_Toc268523830)

[5.2 PC Application Implementation](#_Toc268523830)

[5.3 Embedded Application Implementation](#_Toc268523830)

[5.4 Wireless Sensor Application Implementation](#_Toc268523830)

**Testing and Evaluation**

[6.1 Verification](#_Toc268523830)

[6.1.1 Functional Testing](#_Toc268523787)

[6.1.2 Static Testing](#_Toc268523787)

[6.2 Validation](#_Toc268523830)

[6.3 Usability Testing](#_Toc268523830)

[6.4 Unit Testing](#_Toc268523830)

* 1. [Integration Testing](#_Toc268523830)

6.6 [System Testing](#_Toc268523830)

**GUI**

**Future Work**

**References**

**List of Figures**

Fig 1.4.1 ColorBlindPal 5

Fig 1.4.2 Cash Reader 5

Fig 1.4.3 KNFB Reader 5

Fig 1.6.1 Agile Methodology Process Diagram 7

Fig 1.6.2 Agile Values 8

Fig 2.3.1 Current System-1 12

Fig 2.3.2 Current System-2 13

Fig 2.3.3 Current System-3 13

**List of Tables**

Table 2.2.1 Deliverables 10

Table 2.2.2 Development Requirements 11

Table 2.3.1 Current Systems Summary 14

**Chapter 2: Problem Definition**

Vision is one of the most important senses that are needed in one’s live to do their tasks and daily activities on their own. But unfortunately, some people lack this sense and become visually disabled, hence becoming completely dependent on other people. These people face various challenges in their lives due to this disability. They always need someone to assist and guide them and can’t even do a single chore on their own due to this visual barrier. Due to the advancements in technology, it has become very easy to develop some assistive technologies for these people.

Our project was developed for the purpose of facilitating its blind users in their routine life activities. This application will try to reduce the gap and will act as a bridge between the environment and its visually impaired users.

# Problem Statement

The percentage of population having visual disabilities has been increasing rapidly. It has become very important to uplift their living standards by improving their confidence towards daily activities. However, assisting is not a sufficient solution for those people having any kind of visual impairment. It has become very hard to navigate in a domestic environment accurately with many difficulties related to vision. Moreover, the incapability to navigate in a domestic environment without getting help creates common issues like anxiety, anger, and depression which lead to poor health conditions. Therefore, it is obvious that assistive technologies should upgrade in a more intelligent manner to make human life more comfortable and healthier.

Most people misunderstand blindness or visual impairment and believe many pre-conceived beliefs that such people cannot live their lives in a normal way just like them due to their visual disabilities. People with visual impairment can live their lives in a normal way and in their own lifestyle but the problem is, they face many difficulties due to inaccessible infrastructure and social environment. One of the biggest problems in their lives is to operate mobile phones on their own. As technology is advancing day by day, there are many ways to improve the lifestyles of these people. By developing some assistive technologies, we can remove various barriers for these people and can make them fully independent in performing their daily activities.

The first and most important problem statement is the inability of visually impaired users to perceive information by the sense of sight. They have to challenge themselves daily in coping with their impaired vision in a universe where majority of the people perceives their environment with vision. These people always need someone in their lives who could assist and guide them about the surroundings. In this way, these people become completely dependent on others. We have developed a mobile application that will try to solve the issue of other people’s guidance and help in their lives. Now, these people could guide them on their own by using this application based on voice output that uses the feature of Text-To-Speech. This application will provide them with an easy UI that would be very easy for them to navigate within the application. Through the use of this application, these people can somehow perceive certain information on their own.

Secondly, people having any kind of visual disability are unable to distinguish between many things like different images, amount of currency notes and different colors. These people cannot recognize any image due to lack of sight. They cannot perceive what kind of information is displayed within the image or what text is written within the image. They also face difficulty in detecting the amount of currency until or unless someone else help them. Similarly, they cannot recognize colors on their own. They need someone’s assistance to guide them about different colors. So, our proposed system has tried to solve the above-mentioned problems.

# Deliverables and Development Requirements

The project report includes all the details for the development of complete software, Software Requirement Specifications (SRS), System Design and other major tasks performed.

Our project provided many deliverables, with the number of estimated days mentioned below.

**Table 2.2.1: Deliverables**

|  |  |  |  |
| --- | --- | --- | --- |
| **Tasks** | **Phases** | **Deliverables** | **Estimated Days** |
| **Project Beginning** | Selection of project, Collection of relevant information. | Project Proposal | 20/09/2022 |
| **Requirement Gathering** | Elicitation |  |  |
| Validation |  |  |
| Specification |  |  |
| Verification |  |  |
|  | Result Report | 31/10/2022 |
| **Requirement Analysis** | Identifying Requirements |  |  |
| Defining Boundaries |  |  |
| Establishing Constraints |  |  |
|  | SRS | 28/11/2022 |
| **Design** | Architectural Design |  |  |
| Interface Design |  |  |
| Component Design |  |  |
|  | UML Diagrams/ Design | 19/12/2022 |
| **Development** | Coding |  |  |
| Integration |  |  |
|  | Implemented System | 29/05/2023 |
| **Testing** | Unit Testing |  | 15 days |
| Integration Testing |  | 8 days |
| System Testing |  | 6 days |
| Acceptance Testing |  | 2 days |
|  |  | Complete System | 29/06/2023 |

Also, the report comprised of all the requirements that were needed for the development of this project that are given below in the table:

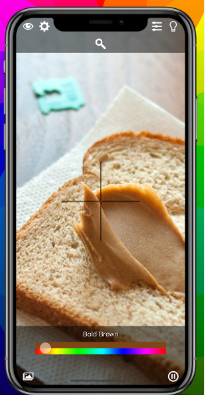
**Table 2.2.2: Development Requirements**

|  |  |  |
| --- | --- | --- |
| **Category** | **Requirements** | **Version** |
| **Hardware** | Android Smartphones | Above 6.0 |
| iOS Smartphones | Above 8.0 |
| **Software** | **Tools** |  |
| Visual Studio Code | 1.71 |
| Android Studio | 2021.3.1 |
| PyCharm | 2022 |
| Google Colab | - |
| **Technologies** |  |
| React Native | 0.70 |
| Python | 3.10.6 |
| TensorFlow | - |
| Keras | - |
| TensorFlow Lite (tflite) | - |

# Current System

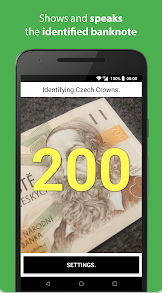
#### There are various existing systems that are relevant to our proposed solution. But our project tried to solve some limitations that were present in the existing systems. A few of them are briefly described below:

#### [1] Color Blind Pal for iOS and Android helps people who are color blind see the colors around them. It also lets people with normal vision see what it's like to be color blind.



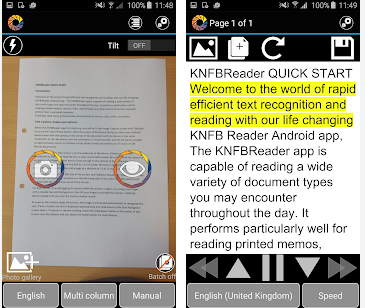
**Figure 2.3.1: Current System-1**

[2] Cash Reader identifies banknote denomination for the largest number of currencies.  
Point your camera to the money in hand and hear, see or feel its value. It is available in free as well as paid versions. The free version detects only a few currency notes. In order to detect every currency note, subscription is mandatory that costs too much.



**Figure 2.3.2: Current System-2**

[3] KNFB Reader is an award-winning mobile app for blind, low-vision, dyslexic, and other print-disabled users that converts text to speech or text to Braille. If you have any visual impairments, total blindness, or perhaps dyslexia, KNFB Reader will allow you to read your own mail, brochures, receipts, and restaurant menus without any assistance. It will give you a true sense of independence and freedom.



**Figure 2.3.3: Current System-3**

**Table 2.3.1: Current Systems Summary**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sr. No.** | **Name** | **Function** | **Development** | **System** | **Limitations** |
| 1. | Color Blind Pal | Detects colors. | Using application. | Application | Does not provide Text-To-Speech feature. |
| 2. | Cash Reader | Detects amount of currency note. | Using application. | Application | Limited detection for free. Requires subscription. |
| 3. | KNFB Reader | Detects text from images. | Using application. | Application | Too costly. Requires subscription to access full features. Does not provide image captioning. |