



Article Title: Vision Companion AI Mate

Vision Companion AI Mate

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ABSTRACT

This project acts as an important role in saving life of human beings and which is also its main aim. In order to complete day-to-day activities effectively and efficiently, Technology plays vital role in human life. Especially, Assistive Technology devices support to differently abled people, in order to live their life very comfortably. Realizing the importance of Assistive Technology, this product idea gives comprehensive solution for the blind people and provide them an end to end solution. With the power of embedded systems and advanced Artificial Intelligence techniques applied to the field of computer vision we aim to make a Hat/cap that can help the blind perceive the world around them. VISION COMPANION AI MATE the power of AI to describe people, text and objects. It can tell visually impaired persons, what is around them. The project titled “VISION COMPANION AI MATE “is an android application. This application provides a facility for OCR (Optical Character Recognition- It is also recognized as a text, then it will be converted to a voice message), Object Detection (To detect objects using Tensor Flow Lite for Android), Currency Detection (To detect the currency then it converted to voice) and Color detection (To pick the dominant colour of uploaded image or captured image) .Which are easily accessible to everyone and it is the power of AI to describe people, text and objects

1 Introduction

The era of mobile technology opens the windows to the android app. The websites are vanishing and the mobile phones are emerging. It's the time to change from conventional websites to apps, which have become part of our daily routine. In the scenario of the assignment, we were required to develop an android application on Smart Technology. So, we introduce ‘VISION COMPANION AI MATE’ the android application. The project titled “VISION COMPANION AI MATE “is an android application. This application provides a facility for OCR (Optical Character Recognition- It is also recognized as a text, then it will be converted to a voice message), Object Detection (To detect objects using TensorFlow Lite for Android), Currency Detection (To detect the currency then it converted to voice) and Color detection (To pick the dominant color of uploaded image or captured image)



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.Which are easily accessible to everyone and it is the power of AI to describe people, text and objects. In this Project including mainly 4 features they are,

1. Currency Detection: This feature enables the application to detect and recognize different types of currencies by analyzing images of banknotes.
2. Color Detection: This feature allows the application to detect and identify specific colors present in an image.
3. Object Detection: This feature enables the application to detect and recognize different objects within an image, such as people, animals, or vehicles.
4. Optical Character Recognition (OCR): This feature allows the application to extract text from an image and convert it into a machine-readable format.

All these features use computer vision and machine learning techniques to analyze images and extract information from them. These features can be useful in various industries, including finance, retail, and security.

2 System Analysis

System analysis is the detailed investigation of the various operations performed by the existing system. It involves gathering of information and using structured tools for analyst. It includes finding out how the system works and what it does. I also includes finding out in more details, what the system problems are, and uses require of new or changed system.

2.1 Preliminary Investigation

The preliminary is the initial study of the current or existing system by carefully addressing each dimension of the information system. To purpose of preliminary study is to determine the initial feasibility of the project. At present the election system facing many security problems. So this website provides more security.

2.2 Feasibility Study

Feasibility study includes an overall analysis of alternatives system through cost benefit analysis and other methods so that most feasible desirable system can be selected for the development. The feasibility is the evaluated on the basis of economic, technological and operational feasibility. The results proved that system will save the users a lot of money.

2.3 Technical feasibility

The main objective of feasibility study is to test the technical, social and economic feasibility of developing a system. Investing the existing system in the under investigation and area generating ideas about the new system does this. Feasibility study has been done to gather required information. Training, experience and commonsense are required for collection of the information. Data was gathered and checked for completeness and accuracy. Analyzing



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the data involved identification of the components of the system and their inter relationship and identifying the strength and weakness of the system.

The main points that are considered to prove that the project is technically feasible are:

- The proposed system provides adequate response to the user.
- The system can be expanded and developed.
- The project outputs given are reliable and it is easy to access.

2.4 Economically feasibility

Economic and Financial analysis is used for evaluating the effectiveness of the candidate system. Our project is technically and operationally feasible. Considering the financial conditions the system is cost effective also, since Android Studio is free software.

2.5 Operational feasibility

There is no difficulty in implementing the system. The proposed system is effective, user-friendly and functionally. The user of the system must be completely unaware of the internal working of the system so that the users will not face any problem with using the system. The system thus reduces the responsive time of computer thereby, the system is found to be operationally feasible

3 Existing System

The study of existing system is the evaluation of current system without the proposed system. To identify the problems related to the current system and to obtain the baseline measures of the problems. At present condition there are a lot of applications available in the software markets.

4 Proposed System

At the present time, the fast development in IT software field, all People going to use the software and web products. Now a days all people familiar with computer systems and networks. The aim of our project is to develop and realizing the importance of Assistive Technology, this product idea gives comprehensive solution for the blind people and provide them an end to end solution

5 Purpose

Now all of us use personal computers. So many websites and applications are developed for us. But still there is no software or application for implementing all functionalities like OCR, colour detection, Currency detection and Object Detection in one app. The project is developed with the power of embedded systems and advanced Artificial Intelligence techniques applied to the field of computer vision we aim to make a Hat/cap that can help the blind perceive the world around them. VISION COMPANION AI MATE the power of AI to describe people, text and objects. It can tell visually-impaired persons, what is around them.



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6 Scope

A study of function, performance and constraints may improve the ability to create an acceptable system. Technical feasibility is frequently the most difficult area to achieve at the stage of product engineering process. Considering that are normally associated with the technical feasibility include

- Development risk
- Resource availability
- Technology

Technical feasibility study deals with the hardware as well as software requirements. The scope was whether the work for the project is done with the current equipment's and the existing software technology has to be examined in the feasibility study. The outcome was found to be positive. In the proposed system, data can be easily stored and managed using database management system software. The reports and results for various queries can be generated easily. And for development of project it uses only existing software technology. Therefore, the system is technically feasible

2.5 Fundamental Requirements

2.5.1 Functional specification.

The functional specification phase checks all the functions are working correctly. In this software application we use many functions, first we check if the activities are correctly classified. And checks the users are correctly added to the database. Adjust the date and time on the PC is not set accurately. Test all activities to check if any force-close occurs. So we get the correct activity through this application.

7 Functional Requirements

Functional requirements are the specific actions and behaviors that a system must be able to perform in order to meet the needs of its stakeholders. Here are some functional requirements that could be considered for the "VISION COMPANION AI MATE" project:

OCR (Optical Character Recognition): The system must be able to accurately recognize and extract text from images, and convert it to speech.

Object Detection: The system must be able to detect objects in images using TensorFlow Lite, and provide an audio description of the objects detected.

Currency Detection: The system must be able to recognize and identify currency in images, and convert the amount to speech.

Color Detection: The system must be able to pick the dominant color of an image and provide an audio description of the color.

- **User Interface:** The system must have a user-friendly interface that allows users to upload images, capture images using their device's camera, and access the OCR, object detection, currency detection, and color detection features.
- **Audio Output:** The system must be able to provide audio output for the results of the OCR, object detection, currency detection, and color detection features.



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- Error Handling: The system must be able to handle errors and provide meaningful error messages to the user.
- These functional requirements provide a high-level description of the expected behavior of the application. They should be detailed and refined as part of the development process, to ensure that the final product meets the needs of its stakeholders.

8 Hardware and Software Requirements

8.1 Software Requirements

SOFTWARE FRONT END:	VERSION
JDK	17.0.1
IDE	Android Studio
Android SDK	Android 22.0.4
BACK END:	
Database	MYSQL
Operating System	Windows 7 ultimate(Pc), windows 8.1 and

Higher, Android Lolipop or above (smart phone) and required

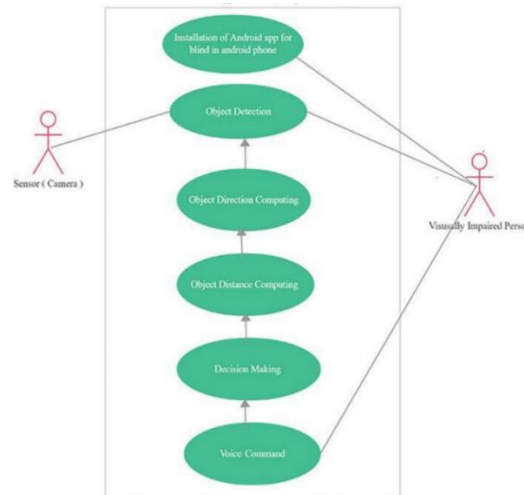
8.2 Hardware Requirements

Processor	:Intel i3 or above
RAM	:2GB or more
Hard Disk Drive	:20GB or more
Keyboard	:Standard
Monitor	:64 bit color monitor
Mouse	: Serial mouse
Mouse port	:PS/2 Compatible

8.3 USE Case Diagram



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9 Software Design

9.1 Architectural Design

➤ Android

Android is a Linux-based operating system designed primarily for touch screen mobile devices such as smart phones and tablet computers. Initially developed by Android, Inc. Android consist of a kernel based on Linux kernel version 2.6 and, from Android 4.0 Ice Cream Sandwich onwards, version 3.x, with middleware, libraries and ASPs written in C, and application software running on an application framework which includes Java- compatible libraries based on Apache Harmony. Android uses the Dalvik virtual machine with just-in-time compilation to run Dalvik ‘dex-code’ (Dalvik Executable), which is usually translated from Java byte code. The main hardware platform for Android is the ARM architecture. Android application package file (APK) is the file format used to distribute and install application software and middleware onto Google’s Android operating system. To make an APK file, a program for Android is first compiled, and then all of its parts are packaged into one file.

Android is a mobile operating system (OS) based on the Linux kernel that is currently developed by Google. With a user interface based on direct manipulation, Android is designed primarily for touchscreen mobile devices such as smartphones and tablet computers, with specialized user interfaces for televisions (Android TV), cars (Android Auto), and wrist watches (Android Wear). The OS uses touch inputs that loosely correspond to real-world actions, like swiping, tapping, pinching, and reverse pinching to manipulate on-screen objects, and a virtual keyboard. Despite being primarily designed for touchscreen input, it also has been used in game consoles, digital cameras, and other electronics.

9.2 Android Architecture



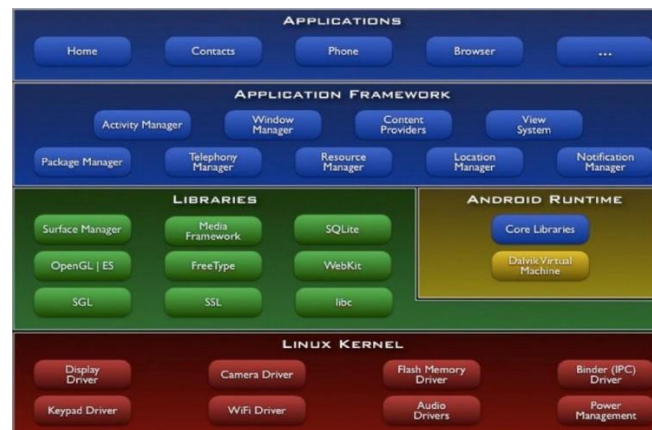
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The software stack is split into Four Layers: -

- The application layer
- The application framework

The libraries and runtime

The kernel



Linux Kernel

- The architecture is based on the Linux2.6 kernel.
- This layer is core of android architecture. It provides service like power management, memory management, security etc.
- It helps in software or hardware binding for better communication.

Native Libraries

Android has its own libraries, which is written in C/C++. These libraries cannot be accessed directly. With the help of application framework, we can access these libraries. There are many libraries like web libraries to access web browsers, libraries for android and video formats etc.

Android Run Time:

Dalvik virtual machine- The Android Runtime was designed specifically for Android to meet the needs of running in an embedded environment where you have limited battery, limited memory, limited CPU.

Dalvik is the process virtual machine in Google's android operating system. It is the software that runs the apps on android devices. Dalvik is thus an integral part of android, which is typically used on mobile devices such as mobile phones and tablet computers.

Programs are commonly written in java and compiled to byte code. This is in blue, meaning that it's written in the Java programming language.

- The core library contains all of the collection classes, utilities, IO, all the utilities and tools that you've come to expected to use.



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Application Framework

These applications include the ones that come with a phone like the home applications, or the phone application.

It includes applications written by Google, and it includes apps that will be written by you.

So, all apps use the same framework and the same APIs.

10 Database Design

Database Design- The overall objective in the development of the database technology has been to treat data as an organization resource and as an integrated whole database management system allows data to be protected and organize separately from other resources. Database is an integrated collection of data. The most significant of data as seen by the programs and data stored on the direct storage devices.

A database is a collection of interrelated data stored with minimum redundancy to serve many users quickly and efficiently. Database design is the process of producing a detailed data model of database. This logical data model contains all the needed logical and physical design choices and physical storage parameters needed to generate design in a Data Definition Language, which can then be used to create a database. A fully attributed data model contains detailed attributes for each entity. The general objective of database design is to make data access easy, in expensive and flexible to the user.

10.1 Input Design

The input design is the one of the important task in the software development, since it helps to reduce the user work and select the correct data entry. Any system needs data for its working. How the data is fed into the system has to be determined so that the data is error free and is specific. The ways in which the data is to be fed into the system is decided during the input design stage.

10.2 Output Design

Output design is a process that involves designing necessary outputs in the form of reports that should be given to users according to the requirements. Efficient, intelligible output design should improve the systems relationship with the user and help in decision making.

10.3 Data Flow Diagram

A Data Flow Diagrams a network that describes the flow of data and processes that change or transform data throughout the system. This network is constructed by using a set of symbols that do not imply a physical implementation. It is a graphical tool for structured analysis of the system requirement DFD model is system by using external entities from which data flow to a process, which transforms the data and creates output-data-flows which go to other processes or external entities or files.

Data in files may also flow to processes as inputs.

10.4 DFD



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The basic elements of DFD are:

Bubbles: used to represent functions

DFD for Currency Detection

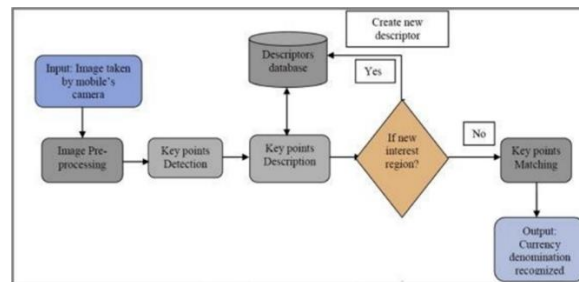


Figure 1: Data Flow Diagram Level 0

DFD for Object Detection

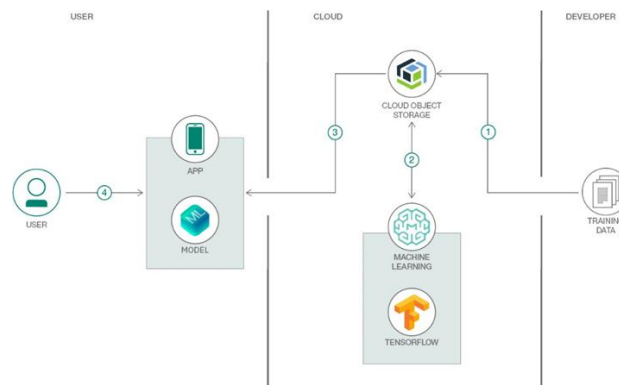


Figure 2: Data Flow Diagram Level 1

DFD for OCR

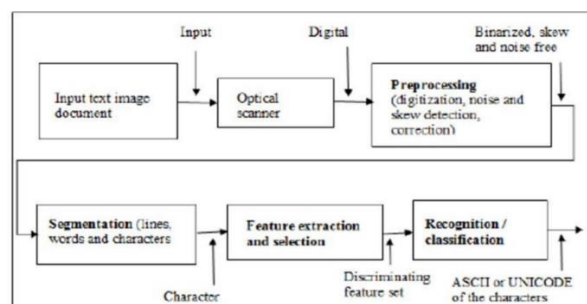


Figure 3: Data Flow Diagram Level 2

DFD for Color Picker



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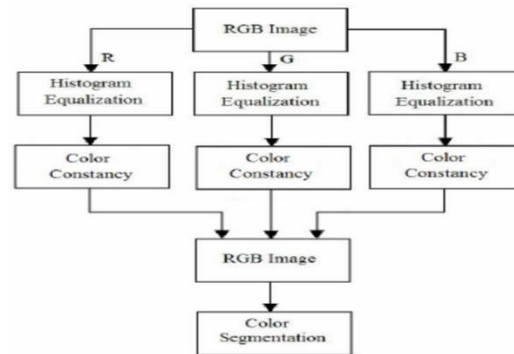


Figure 4: Data Flow Diagram Level 3

11 System Development

11.1 Module Description

Software system is always divided into several subsystems that make it easier for the development. A software system that is structured into several subsystems makes it easy for the development and testing. The different subsystems are known as the modules and the process of dividing an entire system into a subsystem is known as Modularization or decomposition.

➤ **OCR** (Optical Character recognition) –

This module is responsible for recognizing text in images and converting it to an audio message. It uses OCR technology to extract text from images and then converts the text to speech using Text-to-Speech technology.

➤ **Object Detection**

This module is responsible for detecting objects in images using TensorFlow Lite for Android. It uses machine learning algorithms to analyze the image and identify the objects present in it.

➤ **Currency Detection**

This module is responsible for detecting currency in images and converting it to an audio message. It uses image processing techniques to identify the currency in the image and then converts it to speech using Text-to-Speech technology.

➤ **Color Detection**



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This module is responsible for picking the dominant color of uploaded images or captured images. It uses image processing techniques to analyze the image and identify the dominant color present in it.

11.2 System Implementation

The conversion of the new design into operation is called implementation this involves installing the requisite hardware/software and providing training the staff in this phase, use training is critical for minimizing the reluctance to switch over to the newly installed system. Implementation includes all those activities that take place to convert from old system to new. The new system may be totally new replacing an existing system manual or automated or it may be major modification to an existing system.

We can implement this application very easily. Just run the system in software panel. There is no need to train the user, for how the application works.

11.3 Implementation Methods

There are several methods for handling the implementation and consequent conversation from the Id to new automated system. The most secure for this conversion is to run the old and new system in parallel. This method offers high security but the cost for maintaining the two systems in parallel is very high. Another method is direct cut over the existing system to automated system. The chance may take place within a week or within a day.

11.4 Implementation Phase

It included a description of all activities that most occur to implement the new system and put into operation it consists of the following steps.

List all files required for the implementation

Identify all data required to build new tiles during the implementation

12 System Testing

System testing is an expensive but critical process that can take as much as 70% of the budget for program development, the common view of testing hold by users that is performed to prove that there is no error in the program. However, this is virtually impossible since analysis cannot prove that software is free and clear of errors. Testing is a process of executing a program with explicit intention of finding errors.

12.1 Testing Objectives

Testing is a process of executing a program with the intent of finding an error. A good test case is one that has a high probability of finding an as yet undiscovered error. A successful test is one that uncovers an as yet undiscovered error. The above objective is to design tests that systematically uncover different classes of errors and do so with minimum amount of time raised effort.



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If testing is conducted successfully, it will uncover errors in the software. As the secondary benefit, testing demonstrates that software functions appear to be working according to specification and that testing is conducted provides a good indication of software reliability and some indication of software quality as a whole. Testing cannot show the absence of defects, it can show that software errors are present.

12.2 Testing Methods

Black-Box testing focuses on the functional requirements of the software. It enables the software engineer to derive sets of input conditions that will fully exercise all functional requirements for a Program it is a complementary approach that is likely to uncover a different class of errors.

12.3 Black Box Testing

Black box testing attempts to find errors in the following categories:

Incorrect or missing

- 12.3.1.1 Interface errors
- 12.3.1.2 Errors in the data structures or external data base access
- 12.3.1.3 Performance error
- 12.3.1.4 Initialization and termination errors

We have applied Black box testing in our project. During this testing, the errors due to the speed of data connection and processor can be occurred. Also, the incorrect path of running our system makes errors during this testing.

12.4 White-Box Testing

White Box Testing (also known as Clear Box Testing, Open Box Testing, Glass Box Testing, Code-Based Testing or Structural Testing) is a software testing method in which the internal structure/design/implementation of the item being tested is known to the tester. The tester chooses inputs to exercise paths through the code and determines the appropriate outputs. Programming know-how and the implementation knowledge is essential. White box testing is testing beyond the user interface and into the nitty-gritty of a system. This method is named so because the software program, in the eyes of the tester, is like a white/transparent box; inside which one clearly sees. In our project the procedural control structures are used to design the test cases.

The control Structures control the form code at the execution of loop statements and in bit statements.

12.5 Integration Testing



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Integration testing is a software testing methodology used to test individual software components or units of code to verify interaction between various software components and detect interface defects. Components are tested as a single group or organized in an iterative manner. After the integration testing has been performed on the component they are readily available for system testing. Integration is a software development life cycle (SDLC) strategy. Generally, small software systems are integrated and tested in a single phase, whereas larger systems involve several integration phases to build a complete system, such as integrating modules into low level subsystems for integration with larger subsystems. Integration testing encompasses all aspects of a software systems performance, functionality and reliability.

Most unit tested software systems are comprised of integrated components that are tested for error isolation due to grouping. Module details are presumed accurate, but prior to integration testing; each module is separately tested via partial component implementation, also known as a stub".

The three main integration testing strategies are as follows:

Big Bang: Involves integrating the modules to build a complete software system. This is considered a high risk approach because it requires proper documentation to prevent failure

Bottom-Up: Involves low level component testing, followed by high level components. Testing continues until all hierarchical components are tested Bottom-up testing facilitates efficient error detection

Top-Down: Involves testing the top integrated modules first. Subsystems are tested individually. Top-down testing facilitates detection of lost module branch links.

12.6 Validation Testing

The process of evaluating software during the development process or at the end of development process to determine whether it satisfies specified business requirements.

Validation testing ensures that the product actually meets the clients needs it can also be defined as to demonstrate that the product full fills its intended use when deployed on appropriate environment. Validation testing can be best demonstrated using V-Model. The software product under test is evaluated during this type of testing.

13 Conclusion

The "VISION COMPANION AI MATE" project is a useful and innovative application that utilizes the power of Artificial Intelligence to provide users with easy access to information about text, objects, currency, and color in images. With the OCR, object detection, currency detection, and color detection modules, this application provides a comprehensive solution for image analysis and information extraction. This project has the potential to improve accessibility and make it easier for people to understand the information contained in images,



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especially for those with visual impairments. Additionally, the use of TensorFlow Lite for Android makes it possible for this application to run on a wide range of devices, making it accessible to a larger audience. In conclusion, the "VISION COMPANION AI MATE" project is a well-designed and well-implemented solution that provides a convenient and user-friendly way to extract information from images using the power of AI. With its comprehensive set of features and its ease of use, this application has the potential to make a positive impact on people's lives and improve their ability to access and understand information in images.

14 Future Enhancement

The programming technique used in the design of the system provides scope for future expansion and implementation changes, which may occur in future. This project is designed for any future addition so that any user requirements can be made easily. Through it can be modified whenever we needed. And in future we can modify the application with further faster working algorithms since the easiest and efficient software is upcoming. Security checkups may include be stronger.

Here are some potential future enhancements for the "VISION COMPANION AI MATE" project:

- **Improved OCR Accuracy:** The accuracy of the OCR module can be improved by incorporating advanced techniques such as deep learning algorithms to enhance the recognition of text in images.
- **Object Recognition:** The object detection module can be enhanced to recognize a wider range of objects, including smaller or less well-defined objects.
- **Multilingual Support:** The application can be extended to support multiple languages, making it accessible to a wider audience.
- **Integration with Other Applications:** The "VISION COMPANION AI MATE" project can be integrated with other applications to provide users with a more comprehensive solution for information extraction from images.
- **Improved User Experience:** The user experience can be improved by incorporating features such as customization options, the ability to save and share analyzed images, and an intuitive and user-friendly interface.
- **Increased Efficiency:** The performance and efficiency of the application can be improved by optimizing the algorithms used in the various modules.
- **Enhanced Security:** The security of the application can be enhanced by incorporating measures such as encryption and secure data storage to protect user data.

These are just a few potential future enhancements for the "VISION COMPANION AI MATE" project. By continuously improving and expanding the features of this application, it



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can be developed into a powerful tool for extracting information from images and providing users with easy access to the information they need.

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Here are some references that might be useful for further research on the topics covered by the "VISION COMPANION AI MATE" project:

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