



FINAL YEAR PROJECT (FYP) PROPOSAL

FLY THROUGH FACES

Airport Check-In System Based On Face ID

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Scientific Field	Computer Vision		
Sustainable Goal(s)	SDG 8, SDG 16 SDG 9, SDG 11 SDG 12		
Project Platform	The System will be Desktop Based and all the relevant devices will be connected through a Local Area Network. An e-Passport will be used as an ID which holds personal information of a person and it will be inserted in the machine while verifying.		
Primary Goal	<ul style="list-style-type: none">• security• less waiting in lines for verification• sustainable infrastructure• responsible consumption and production• economic growth and job creation		
Project Abstract	This project aims to develop a system that can verify the identity of a person using their e-passport and a camera. The system will capture an image of the person using a camera, send it to a server, and compare it with the image on their e-passport to determine whether they are the same person. The project will involve developing software for image capture and processing, as well as implementing machine learning algorithms for facial recognition.		

Contents

1. Introduction	1
1.1. Project Rationale	1
1.2. Relevance to Existing Work	2
1.3. Novel Aspects and Major Contributions	4
1.4. Project as a Product	4
1.5. Project Utilization and Target Audience	5
2. Aims and Objectives	5
3. Requirement Analysis and Specifications	6
4. Project Scope and Deliverables	8
5. Implementation and Testing	9
5.1. Data Acquisition	9
5.2. Proposed System Design and Methodology	9
5.3. Hardware and Software Resources Required	10
5.4. Validation and System Testing	11
5.5. Deployment and User Acceptance Testing	12
6. Constraints in Project Implementation	13
7. Project Breakdown and Work Plan	15
8. Technological Breakthrough and Follow-on Funding	19
9. Ethical Issues	22
10. FYP-I Mids Evaluation G13	24
References	26

1. Introduction

The implementation of facial recognition technology at airports can contribute to achieving several **Sustainable Development Goals** (SDGs). It can promote economic growth and job creation, improve infrastructure and innovation, enhance security measures, reduce waste, and ensure safe and peaceful travel. The technology can optimize workforce and resources, improve accuracy and efficiency of security checks, and streamline the travel process for passengers. Overall, facial recognition technology can improve the travel experience while contributing to SDGs related to innovation, sustainable infrastructure, responsible consumption and production, and peace and security.

1.1. Project Rationale

- **Explanation of why the proposed project is important?**

The use of e-passports and facial recognition technology has become increasingly important in today's world, particularly in the context of airport security and border control. This project will contribute to enhancing the accuracy and efficiency of these processes by automating the verification of a person's identity, thereby reducing the potential for errors and improving security. The system could also have wider applications in areas such as law enforcement, where facial recognition technology can be used to identify suspects and prevent crime. Ultimately, the project has the potential to enhance the safety and security of individuals and communities, while also improving the efficiency of various processes that rely on identity verification.

- **What is High Risk/What is High Gain?**

The high-risk aspect of the project could be related to the potential for errors or malfunctions in the facial recognition technology, which could lead to false positives or false negatives in the identification process. This could result in security breaches or delays at border control and airport security checkpoints, potentially putting individuals and communities at risk.

The high-gain aspect of the project could be related to the potential for enhanced accuracy and efficiency in the identity verification process, leading to improved security and safety for individuals and communities. The automation of identity verification using facial recognition technology could also free up personnel resources and reduce costs associated with manual identity verification processes.

It is important for the project to undergo thorough testing and evaluation to minimize the risk of negative outcomes and maximize the potential for positive outcomes. It is also

important to address any ethical concerns related to the use of facial recognition technology and ensure that the project respects individuals' privacy and civil liberties.

1.2. Relevance to Existing Work

- **Description of the existing products, tools, or research work relevant to the proposed project with adequate referencing?**

Face recognition technology can be implemented in various public places, including:

1. **Airports:** Face recognition can be used to verify the identity of passengers during check-in and boarding processes, and to detect any suspicious or unauthorized individuals.
2. **Banks:** Face recognition can be used to verify the identity of customers during ATM transactions and other banking services.
3. **Retail stores:** Face recognition can be used to identify VIP customers and to detect shoplifters or fraudulent activities.
4. **Hotels:** Face recognition can be used to identify guests during check-in and to provide personalized services, such as room preferences and amenities.
5. **Stadiums and Arenas:** Face recognition can be used to enhance security measures and to detect any potential threats or unauthorized individuals.
6. **Public Transportation Systems:** Face recognition can be used to verify the identity of passengers during ticket purchases and boarding processes, and to detect any suspicious or unauthorized individuals.

There are many airports around the world that have implemented face check-in technology for their passengers. Here are a few examples:

1. **Changi Airport, Singapore:** The airport has implemented a facial recognition system for self-service check-in, bag drop, and immigration clearance.
2. **Orlando International Airport, USA:** The airport has implemented a facial recognition system for passengers arriving from some international flights, to expedite the customs and immigration process.
3. **Sydney Airport, Australia:** The airport has implemented a facial recognition system for international passengers departing from Terminal 1, to streamline the check-in process.

4. **Heathrow Airport, UK:** The airport has implemented facial recognition technology for some passengers on flights to and from the US and Canada, to speed up the boarding process.
5. **Schiphol Airport, Netherlands:** The airport has implemented facial recognition technology for some passengers on flights to and from the US, to expedite the boarding process.

There are several existing products, tools, and research works that are relevant to the proposed project of using facial recognition technology for identity verification using e-passports and cameras.

1. **Biometric Passport Readers:** Biometric passport readers are electronic devices that are used to read e-passports and verify the identity of the passport holder using facial recognition technology. These readers are used in airports and border control checkpoints to ensure that the person presenting the passport is the same person whose photo is stored in the passport. Examples of biometric passport readers include the Gemalto Document Reader AT9000 MK2 and the 3M CR5400 Double-sided ID1 Reader.
2. **OpenCV (Digital Image Processing):** OpenCV is a popular open-source computer vision library that can be used to develop software for facial recognition and image processing. OpenCV offers a range of features for face detection, facial landmark detection, and face recognition. It is widely used in academic and commercial research for developing facial recognition systems.
3. **FaceNet (Face Features):** FaceNet is a deep neural network-based model for face recognition developed by Google researchers. The model uses a triplet loss function to learn a mapping of faces to a high-dimensional Euclidean space, where the distance between face embeddings can be used to measure similarity between faces. The FaceNet model has achieved state-of-the-art performance on several benchmarks for face recognition, including the Labeled Faces in the Wild dataset.
4. **The Biometrics Institute:** The Biometrics Institute is an independent international organization that promotes the responsible use of biometric technology. The organization offers guidelines and best practices for the ethical use of facial recognition technology, including recommendations for the protection of privacy and civil liberties.

1.3. Novel Aspects and Major Contributions

- **Explanation of the major contributions and innovative aspects of the project?**

The major contribution of this project is the development of a system that can automate the process of identity verification, which is currently a manual and time-consuming process. By using advanced image processing techniques, the system can accurately compare the person's photo with the one in their e-passport and provide a quick and reliable verification result.

The innovative aspect of this project is the use of advanced image processing techniques, which include facial recognition and machine learning algorithms. These techniques enable the system to analyze and compare facial features such as the distance between the eyes, nose, and mouth, and use this information to determine if the person is the same as the one in their e-passport.

1.4. Project as a Product

- **Explanation of the commercial aspects of the project as a marketable product?**

The proposed project has several potential commercial aspects that could make it a marketable product. The system can be sold as a standalone product to airports or other organizations that require identity verification, or it can be integrated into existing security systems.

One of the main advantages of this system is its ability to automate the process of identity verification, which can significantly reduce the time and resources required for manual verification. This feature makes it particularly attractive to airports and other high-security locations where quick and accurate verification of identity is crucial.

The system can also be customized to meet the specific needs of different organizations. For example, it can be configured to work with different types of passports or identity documents, or it can be integrated with other security systems such as access control or surveillance systems.

In terms of revenue streams, the system can be sold as a one-time purchase or as a subscription-based service, with fees based on the number of users or transactions. Additional revenue streams can be generated through maintenance and support services. Overall, the proposed system has strong commercial potential as a marketable product due to its ability to improve security and efficiency in identity verification processes. It can be customized to meet the needs of different organizations, and its automated features can provide significant cost savings and time efficiencies.

1.5. Project Utilization and Target Audience

- **Explanation of the Target Audience aspects of the project as a marketable product?**

Airports and border control agencies are the primary target audience for this product since they have a high demand for identity verification due to the large volume of people passing through their facilities. The system can help these organizations improve their security and efficiency by automating the process of identity verification and reducing the time and resources required for manual verification.

In addition to airports and border control agencies, the system can also be targeted to other organizations that require identity verification, such as banks, government agencies, and other high-security locations. For example, banks can use the system to verify the identity of customers opening new accounts or applying for loans, while government agencies can use it for background checks or other security purposes.

2. Aims and Objectives

- **Project Goal: What is the desired outcome that you wish to achieve at the end of the project?**

Ultimately, the goal of the project is to provide a reliable and automated solution for identity verification that can be deployed in airports and other high-security locations. The system should be able to reduce the time and resources required for manual verification and improve the overall efficiency and security of identity verification processes.

- **Project Objectives: Objectives should be SMART, i.e., specific statements that define measurable outcomes, e.g., what steps will be taken to achieve the desired outcome?**

The following are specific objectives that will be pursued to achieve the project aims:

1. Develop a camera module that can capture high-quality photos of individuals in different lighting conditions, at various angles, and distances.
2. Develop software that can extract the photo from an e-passport and perform image processing to enhance the quality of the image.
3. Develop software that can compare the photo from the camera module with the one in the e-passport to verify the individual's identity accurately and efficiently.

4. Develop software that can handle different types of e-passports and identity documents from various countries, ensuring compatibility with international standards.
5. Develop a user-friendly interface for security personnel to manage the verification process, handle exceptions, and generate reports.
6. Implement robust security measures to ensure the protection of individuals' data and prevent unauthorized access.
7. Conduct testing and validation of the system using a large dataset to evaluate its accuracy and efficiency, and refine the software accordingly.
8. Develop user documentation and provide training to ensure that users can operate and maintain the system effectively.
9. Deploy the system in a real-world environment and evaluate its performance in different scenarios, including high-volume traffic, varying lighting conditions, and different types of identity documents.
10. Continuously monitor and update the system to ensure it remains reliable and effective, incorporating user feedback and improving performance as necessary.

3. Requirement Analysis and Specifications

Identification of the stakeholder(s) involved in the project and their roles in specifying the project requirements?

Stakeholders involved in the project and their roles in specifying the project requirements:

1. **Government agencies** responsible for border control and security, who have a significant interest in ensuring that the system meets strict standards of accuracy and efficiency. They may be involved in specifying the functional and non-functional requirements, particularly those related to security and data privacy.
2. **Airport authorities**, who have a vested interest in reducing waiting times for travelers and ensuring smooth operations in high-volume areas such as immigration and customs. They may be involved in specifying the functional requirements related to system efficiency and user experience.
3. **System integrators or technology providers**, who are responsible for developing the system and ensuring that it meets the required specifications. They will play a crucial role in specifying both the functional and non-functional requirements of the system.

4. **End-users, such as immigration officers**, who will be interacting with the system daily. They may provide input on the usability and user interface of the system.

3.1. Functional Requirements

- **Explanation of the functional requirements in line with the goal and objectives?**

Functional requirements of the project may include:

1. Capturing a high-quality photo of an individual using a camera module.
2. Extracting the photo from an e-passport or identity document and performing image processing to enhance image quality.
3. Comparing the photo from the camera module with the one in the e-passport to verify the individual's identity accurately and efficiently.
4. Handling different types of e-passports and identity documents from various countries.
5. Providing a user-friendly interface for security personnel to manage the verification process and handle exceptions.
6. Integrating the system with existing border control and security infrastructure.

3.2. Non-Functional Requirements

- **Explanation of the non-functional requirements in line with the goal and objectives?**

Non-functional requirements of the project may include:

1. Security measures to ensure the protection of individuals' data and prevent unauthorized access.
2. System availability and reliability, with minimal downtime or disruption to operations
3. Scalability to handle high volumes of traffic during peak periods.
4. Compliance with international standards and regulations, including those related to data privacy and security.
5. Ease of maintenance and support, with the ability to update and improve the system as needed.

4. Project Scope and Deliverables

- **Project scope defines the boundaries of a project and lists down the items that must be delivered in order for the project to be considered successful and complete. Scope should also define what the team will work on and create boundaries for where the edges of the project fall. This section must outline the project deliverables/expected outputs in line with the requirement analysis and specifications?**

The project scope includes the following deliverables/expected outputs:

1. A camera module capable of capturing high-quality photos of individuals in various lighting conditions, at different angles, and distances.
2. Software for extracting the photo from an e-passport and performing image processing to enhance the image quality.
3. Software for comparing the photo from the camera module with the one in the e-passport to verify the individual's identity accurately and efficiently.
4. Software for handling different types of e-passports and identity documents from various countries, ensuring compatibility with international standards.
5. A user-friendly interface for security personnel to manage the verification process, handle exceptions, and generate reports.
6. A secure system architecture and infrastructure to ensure the protection of individuals' data and prevent unauthorized access.
7. A comprehensive testing and validation process to evaluate the accuracy and efficiency of the system, including testing under various scenarios, such as high-volume traffic and varying lighting conditions.
8. User documentation and training materials to ensure that users can operate and maintain the system effectively.

The project scope defines the boundaries of the project and lists down the items that must be delivered for the project to be considered successful and complete. These deliverables align with the project requirements and specifications and have been defined to meet the needs of stakeholders. The project team will work within the defined scope and ensure that the project is delivered on time and within budget.

5. Implementation and Testing

This section elaborates the strategy and proposed method for implementation of the project and its testing. It is further sub-divided into the following sub-sections?

5.1. Data Acquisition

- **Explanation of the data required for experimentation and how the data will be collected?**

The data for the project will be collected in the following ways:

1. **Passport images:** The passport images will be obtained from the e-passport inserted into the machine by the user. The images will be extracted from the passport chip using the necessary protocols and stored securely for use in the identity verification process.
2. **Live capture images:** Live capture images will be obtained using the camera module. The camera module will be capable of capturing images of individuals in a variety of lighting conditions, and from different angles and distances. The images will be stored securely on the server for use in the identity verification process.
3. **Testing data:** The testing data will be generated using a combination of real-world scenarios and synthetic data. The testing data will be used to evaluate the performance of the identity verification software under a range of conditions, such as different lighting conditions, facial expressions, and angles.

5.2. Proposed System Design and Methodology

- **Explanation of the proposed system design and framework/methodology that will be adopted for implementation of the project, with the help of diagrams?**

The proposed system design for the identity verification project will consist of three main components: the user interface, the identity verification software, and the database.

The user interface will be designed to provide a simple and intuitive experience for users, enabling them to insert their e-passport into the machine, and to capture their live image using the camera module.

The identity verification software will be responsible for processing the images captured by the camera module, and comparing them to the passport image extracted from the e-passport chip. The software will use advanced facial recognition algorithms to perform

the identity verification, and will provide a binary output indicating whether the user's identity has been verified or not.

The database will store the passport images extracted from the e-passport chip, as well as the live capture images captured by the camera module. The database will be designed to be secure and scalable, with appropriate backup and recovery procedures in place.

The proposed methodology for implementation of the project will consist of the following steps:

1. **Requirement Analysis:** Identify the requirements for the system, based on the needs of the stakeholders, as well as regulatory requirements.
2. **System Design:** Develop the system design, including the user interface, identity verification software, and database, using appropriate tools and techniques.
3. **Development:** Implement the system design, using appropriate programming languages, frameworks, and libraries.
4. **Testing:** Test the system to ensure that it meets the specified requirements and is free from defects.
5. **Deployment:** Deploy the system in the target environment, ensuring that it is secure and scalable.
6. **Maintenance:** Provide ongoing maintenance and support for the system, including bug fixes and updates.

5.3. Hardware and Software Resources Required

- **Explanation of what tools and equipment will be used for the proposed project, and how will they be acquired/managed?**

Here are some of the tools and equipment that may be required for the proposed project:

1. **Camera:** A high-quality camera will be required to capture the photo of the person. This can be a digital camera or a webcam.
2. **Passport scanner:** A passport scanner will be required to read the e-passport inserted in the machine. This can be a specialized scanner or a regular document scanner that is compatible with e-passports.
3. **Server:** A server will be required to store and process the data. This can be a physical server or a cloud-based server.

4. **Software:** Specialized software will be required to process the images and verify the person's identity. This may include facial recognition software, OCR software for reading the passport data, and other security software.

5.4. Validation and System Testing

- **Explanation of how the project/system will be tested and evaluated at different stages during and after implementation?**

Testing and evaluation are critical components of the project implementation process, as they help to ensure that the system is working as intended and meets the desired objectives. Here is an overview of how the project/system can be tested and evaluated at different stages:

1. **Design phase:** During the design phase, the system can be evaluated through a series of design reviews, where stakeholders provide feedback on the design and suggest improvements. Additionally, simulations and prototypes can be created to test the system's functionality and usability before it is built.
2. **Development phase:** During the development phase, the system can be tested through unit testing, integration testing, and system testing. These tests will ensure that each component of the system is working correctly and that the system as a whole is functioning as intended.
3. **Implementation phase:** During the implementation phase, the system can be tested through user acceptance testing (UAT), where end-users are invited to test the system and provide feedback on its functionality, usability, and performance.
4. **Post-implementation phase:** After the system has been implemented, ongoing testing and evaluation can help identify and address any issues that arise. This can include performance testing, security testing, and usability testing, among others.

- **Explanation of the evaluation metrics to test the outcome(s) of the project?**

Evaluation metrics are used to measure the effectiveness of a project or system and determine whether it has achieved its desired outcomes. Here are some evaluation metrics that could be used to test the outcome(s) of the project you described:

1. **Accuracy:** This measures the percentage of correct identifications made by the system. This metric is essential in evaluating the effectiveness of the facial recognition technology used in the system.

2. **Speed:** This measures the time it takes for the system to capture and verify a person's identity. A fast system is crucial for ensuring that the process is efficient and does not cause delays.
3. **False Positive Rate:** This measures the percentage of incorrect identifications made by the system, where it incorrectly identifies someone as someone else. A low false positive rate is essential to avoid any potential security issues.
4. **False Negative Rate:** This measures the percentage of times when the system fails to identify someone who should have been identified. A low false negative rate is crucial to ensure that the system does not miss any potential security threats.
5. **User satisfaction:** This measures the satisfaction of end-users with the system's functionality and usability. A high level of user satisfaction is crucial to ensure that the system is adopted and used effectively.
6. **Cost-effectiveness:** This measures the cost of implementing and maintaining the system relative to its effectiveness in achieving its desired outcomes. A cost-effective system is essential for ensuring that resources are used efficiently.

These metrics can be measured and evaluated during and after implementation to ensure that the system is performing as expected and meeting its desired objectives. Additionally, it is essential to establish clear benchmarks and goals for each metric to determine whether the system is meeting its intended outcomes.

5.5. Deployment and User Acceptance Testing

- **Explanation of how the project will be deployed and the user acceptance/experience testing will be performed?**

The deployment of the project involves the installation of the system in the actual environment where it will be used. Here is an overview of how the project can be deployed and how user acceptance/experience testing can be performed:

1. **Pre-deployment preparations:** Before deployment, it is important to ensure that the system is fully functional and ready for use. This includes testing the system thoroughly to ensure that it meets all the requirements and specifications. Additionally, it is important to ensure that the staff who will be using the system are trained and familiar with how it works.
2. **Deployment process:** The deployment process can involve the physical installation of the equipment and the software configuration necessary to connect the different components of the system. This process can be performed in phases

or all at once, depending on the complexity of the system and the resources available.

3. **User acceptance testing:** Once the system is deployed, it is important to test its usability and functionality from the perspective of end-users. User acceptance testing involves inviting end-users to test the system and provide feedback on its performance, functionality, and usability. This feedback can be used to make any necessary adjustments or improvements to the system.
4. **User experience testing:** User experience testing involves testing the overall user experience of the system, including how easy it is to use, how well it performs, and how well it meets the needs of end-users. This can involve a variety of testing methods, including surveys, interviews, and usability testing.
5. **Post-deployment support:** After the system is deployed and tested, it is important to provide ongoing support and maintenance to ensure that it continues to perform as expected. This can include software updates, hardware maintenance, and user training.

Overall, the deployment of the project and the user acceptance/experience testing process are critical components of ensuring that the system meets the needs of end-users and achieves its desired objectives. It is important to involve end-users in the testing process to ensure that the system is easy to use and meets their needs effectively. Additionally, ongoing support and maintenance are necessary to ensure that the system continues to perform as expected in the long term.

6. Constraints in Project Implementation

- **Explanation of the challenges that lie ahead in the implementation of your proposed project and how these challenges may affect the project scope?**

The implementation of any project comes with its own set of challenges that can potentially impact the project scope. Here are some potential challenges that may be encountered during the implementation of your proposed project and how they may affect the project scope:

1. **Technical complexity:** The implementation of the project may involve complex technical components, such as facial recognition algorithms, image processing, and database management. The complexity of these technical components can increase the risk of technical issues, delays, and cost overruns.
2. **Integration challenges:** The project may involve integrating different components, such as hardware, software, and networking, which can create challenges in

ensuring that they work seamlessly together. Integration challenges can cause delays and may require additional resources to address.

3. **Privacy concerns:** The use of facial recognition technology raises privacy concerns, particularly in public spaces where individuals may not be aware that their image is being captured and processed. These concerns may lead to legal or ethical challenges that need to be addressed during implementation.
4. **Cost overruns:** The implementation of the project may require significant resources, including hardware, software, personnel, and ongoing maintenance. Cost overruns can occur if resources are not allocated effectively or if unexpected issues arise during implementation.
5. **User acceptance:** The success of the project will depend on the acceptance and adoption of the system by end-users. If end-users are not satisfied with the system's functionality or usability, it may lead to resistance or low adoption rates.
6. **System reliability:** The system needs to be reliable and function without errors or downtime. If the system experiences technical issues or downtime, it can disrupt operations and impact user confidence.

▪ **What are the remedies to cope with the project constraints?**

Here are some potential remedies to cope with the project constraints that may arise during the implementation of your proposed project:

1. **Technical complexity:** To cope with technical complexity, it may be necessary to engage with technical experts or consultants who have experience with the technology or components involved in the project. Additionally, it may be necessary to allocate additional time or resources to ensure that technical issues are addressed effectively.
2. **Integration challenges:** To cope with integration challenges, it may be necessary to allocate additional time and resources to ensure that the different components of the system work seamlessly together. Testing and validation of the system can help to identify and address any integration issues before deployment.
3. **Privacy concerns:** To cope with privacy concerns, it is important to ensure that the system adheres to relevant laws and regulations, such as data protection and privacy laws. Additionally, it may be necessary to consult with legal experts or privacy advocates to ensure that privacy concerns are addressed effectively.
4. **Cost overruns:** To cope with cost overruns, it may be necessary to carefully manage the project budget and resources to ensure that they are allocated effectively. Additionally, it may be necessary to consider alternative solutions or technologies that are more cost-effective.

5. **User acceptance:** To cope with user acceptance issues, it is important to involve end-users in the design and testing of the system to ensure that it meets their needs and expectations. Additionally, providing user training and support can help to ensure that end-users are able to use the system effectively.
6. **System reliability:** To cope with system reliability issues, it may be necessary to engage with technical experts or consultants to ensure that the system is designed and implemented effectively. Additionally, regular maintenance and testing can help to identify and address any technical issues before they become critical.

Overall, effective project management, risk assessment, and contingency planning can help to cope with project constraints and ensure that the project stays on track to achieve its desired objectives. It is important to remain flexible and adaptable throughout the implementation process to ensure that the project can adapt to any unexpected challenges that may arise.

7. Project Breakdown and Work Plan

- **Explanation of different work packages involved in the project with a WBS diagram?**

A Work Breakdown Structure (WBS) is a hierarchical decomposition of the project scope into smaller, more manageable work packages. Here is an example of a WBS diagram for a project involving the implementation of a facial recognition system for e-passport verification:

1. Project
 - 1.1. Initiation
 - 1.1.1. Define project objectives
 - 1.1.2. Identify project stakeholders
 - 1.1.3. Develop project charter
 - 1.2. Planning
 - 1.2.1. Define project scope
 - 1.2.2. Develop project plan
 - 1.2.3. Define project budget
 - 1.3. Execution
 - 1.3.1. Hardware procurement
 - 1.3.2. Software development
 - 1.3.3. Database development
 - 1.3.4. System integration
 - 1.3.5. Testing and validation
 - 1.3.6. User training and support
 - 1.4. Monitoring and Control

- 1.4.1. Project monitoring and reporting
- 1.4.2. Risk management
- 1.4.3. Change management
- 1.5. Closeout
 - 1.5.1. Final testing and validation
 - 1.5.2. System deployment
 - 1.5.3. Project documentation

The above WBS diagram breaks down the project into five major categories - Initiation, Planning, Execution, Monitoring and Control, and Closeout. Each category is further broken down into smaller work packages.

- **Activities involved in each of the work packages?**

Here are some possible activities involved in each of the work packages in the WBS diagram provided in the previous answer:

Initiation

- 1.1. Define project objectives
 - Conduct a needs assessment
 - Identify stakeholders and their objectives
 - Develop a clear and concise project objective statement
- 1.2. Identify project stakeholders
 - Conduct stakeholder analysis
 - Identify roles and responsibilities of each stakeholder
 - Develop a stakeholder management plan
- 1.3. Develop project charter
 - Develop a high-level project plan
 - Define project scope, objectives, and deliverables
 - Define project governance structure and roles

Planning

- 2.1. Define project scope
 - Develop a detailed project scope statement
 - Define project boundaries and exclusions
 - Define project constraints and assumptions
- 2.2. Develop project plan
 - Develop a detailed project schedule
 - Define project resources (e.g. personnel, equipment, materials)
 - Develop a project budget and financial plan
- 2.3. Define project budget
 - Develop a project cost estimate
 - Develop a cost management plan
 - Develop a project funding plan

Execution

- 3.1. Hardware procurement
 - Identify hardware requirements
 - Research and select hardware vendors
 - Procure hardware and equipment
- 3.2. Software development
 - Design software architecture
 - Develop software code and functionality
 - Test and debug software
- 3.3. Database development
 - Design database architecture
 - Develop database schema and queries
 - Test and debug database
- 3.4. System integration
 - Integrate hardware, software, and database components
 - Test and debug integrated system
 - Identify and resolve integration issues
- 3.5. Testing and validation
 - Develop testing plan and test cases
 - Conduct system testing and validation
 - Identify and resolve system defects and issues
- 3.6. User training and support
 - Develop user training materials
 - Conduct user training sessions
 - Provide ongoing user support and assistance

Monitoring and Control

- 4.1. Project monitoring and reporting
 - Monitor project progress and status
 - Develop progress reports and status updates
 - Identify and address project issues and risks
- 4.2. Risk management
 - Identify project risks and vulnerabilities
 - Develop a risk management plan
 - Monitor and mitigate project risks
- 4.3. Change management
 - Develop a change management plan
 - Monitor and control project changes
 - Update project plan and scope as necessary

Closeout

5.1. Final testing and validation

- Conduct final system testing and validation
- Identify and resolve any remaining issues or defects

5.2. System deployment

- Develop a deployment plan
- Deploy the system to production environment
- Provide user support and assistance during deployment

5.3. Project documentation

- Develop project documentation (e.g. user manuals, technical manuals)
- Archive project documentation and deliverables
- Conduct project post-mortem analysis and evaluation

Note that the specific activities involved in each work package may vary depending on the scope and objectives of the project.

▪ Relationship between work packages, project milestones, and project deliverables?

Based on the project discussed above, the relationship between work packages, project milestones, and project deliverables can be explained as follows:

The project involves the following work packages:

- Design and development of the system
- Testing and verification of the system
- Deployment and user acceptance testing of the system

Each work package can be broken down into specific activities and tasks. For example, the "Design and development of the system" work package may include activities such as:

- Conducting a needs analysis
- Designing the system architecture
- Developing the software
- Integrating the camera and other hardware components
- Developing a verification algorithm

Each work package is associated with one or more project deliverables. For example, the "Design and development of the system" work package may have deliverables such as:

- System architecture design document
- Software codebase
- Verification algorithm

Project milestones are significant points in the project timeline that mark the completion of a specific phase or the achievement of a key objective. In this project, some possible project milestones could include:

- Completion of the system design phase
- Successful verification of the system
- Deployment of the system in the target environment

The completion of each work package and the associated deliverables will contribute to the achievement of project milestones. For example, the completion of the "Design and development of the system" work package and its associated deliverables will contribute to the completion of the "System design phase" milestone.

▪ **Gantt chart for proposed project scheduling?**

Task Name	Duration	Semester	Dependencies
Project Initiation	3 weeks	6th	None
Needs Analysis	2 week		Project Initiation
System Design	4 weeks		Needs Analysis
Software Development	8 weeks	7th	System Design
Hardware Integration	2 weeks		Software Development
Verification Testing	4 weeks		Hardware Integration
Deployment	3 weeks	8th	Verification Testing
User Acceptance Testing	4 weeks		Deployment
Project Closure	2 week		User Acceptance Testing

8. Technological Breakthrough and Follow-on Funding

▪ **Implications of your proposed project on technology and industry?**

The proposed project of developing an automated e-passport verification system can have several implications on the technology and industry:

1. **Advancement in technology:** The development of an automated e-passport verification system would require the use of advanced technologies such as computer vision, machine learning, and artificial intelligence. The implementation of

these technologies would lead to the advancement of these fields and their application in other areas.

2. **Increased efficiency and accuracy:** The use of an automated e-passport verification system would eliminate the need for manual verification and reduce the time required for the verification process. This would increase efficiency and accuracy in the verification process.
3. **Improved security:** An automated e-passport verification system can improve security by reducing the risk of human error in the verification process. It can also provide additional security features such as facial recognition and fingerprint scanning to ensure that the person holding the passport is the same person in the photo.
4. **Impact on the travel industry:** The implementation of an automated e-passport verification system would have a significant impact on the travel industry, as it would streamline the check-in process and reduce wait times for passengers. This could lead to increased customer satisfaction and repeat business for airlines and other travel companies.
5. **Cost savings:** An automated e-passport verification system can result in significant cost savings for airlines and other travel companies by reducing the need for manual labor and increasing efficiency in the verification process.

▪ **Expected results and significance for relevant works?**

The expected results and significance of the proposed project of developing an automated e-passport verification system are as follows:

1. **Increased efficiency and accuracy:** The implementation of an automated e-passport verification system is expected to result in increased efficiency and accuracy in the verification process. This would reduce wait times for passengers and improve customer satisfaction.
2. **Improved security:** An automated e-passport verification system would provide additional security features such as facial recognition and fingerprint scanning to ensure that the person holding the passport is the same person in the photo. This would enhance the security of the travel industry and reduce the risk of identity fraud.
3. **Cost savings:** The implementation of an automated e-passport verification system can result in significant cost savings for airlines and other travel companies by reducing the need for manual labor and increasing efficiency in the verification process.

4. **Advancements in technology:** The development of an automated e-passport verification system would require the use of advanced technologies such as computer vision, machine learning, and artificial intelligence. This would lead to advancements in these fields and their application in other areas.
 5. **Increased competitiveness:** The implementation of an automated e-passport verification system would make the travel industry more competitive by reducing wait times and enhancing customer satisfaction. This could lead to increased business for airlines and other travel companies.
- **Plan to get follow-on funding for your proposed project to further transform it into a startup?**

To transform the proposed project of developing an automated e-passport verification system into a startup, the following plan can be put in place to secure follow-on funding:

1. **Develop a comprehensive business plan:** A detailed business plan should be developed, outlining the market opportunity, target customers, revenue model, and growth potential. The plan should also include a detailed financial forecast, outlining the funding requirements and potential return on investment.
2. **Establish partnerships:** To attract follow-on funding, it is essential to establish partnerships with industry leaders, investors, and other stakeholders. This will help to build credibility and create opportunities for collaboration and investment.
3. **Participate in startup accelerator programs:** Startup accelerator programs provide funding, mentorship, and resources to help startups grow and scale. Participating in such programs can help to establish credibility, build networks, and attract follow-on funding.
4. **Showcase the product:** Demonstrating the capabilities of the automated e-passport verification system to potential investors and customers is crucial in securing follow-on funding. This can be done through presentations, demonstrations, and pilot programs.
5. **Seek venture capital funding:** Venture capital firms are a common source of funding for startups. To attract venture capital funding, it is essential to have a solid business plan, a strong team, and a proven track record of success.
6. **Build a strong team:** A strong team is critical to the success of any startup. Building a team with a diverse skill set, experience, and expertise is essential in attracting follow-on funding and scaling the business.

9. Ethical Issues

Ethical issues must be considered in the proposed project: All potential ethical, security-related, or regulatory aspects of the proposed project and the planned handling of those issues must be discussed separately. In particular, the benefits and burdens arising from the experiments and their effects on the test subjects/objects should be explained in detail. Applicants must also provide a brief explanation in cases where no ethical issues must be considered?

The proposed project of developing an automated e-passport verification system raises several ethical, security-related, and regulatory issues that need to be considered. Some of these issues are:

- **Privacy and Data Protection:** The system will capture and process personal data, such as biometric information and passport details, raising concerns about privacy and data protection. The system must comply with relevant data protection laws and regulations to ensure that personal data is collected, processed, and stored securely.
- **Bias and Discrimination:** The system's algorithms may be biased against certain groups, leading to discriminatory outcomes. The system must be developed in a way that avoids bias and discrimination, and regular audits should be conducted to ensure that the system is fair and impartial.
- **Security and Fraud Prevention:** The system must be secure to prevent unauthorized access, tampering, and fraud. Appropriate security measures, such as encryption and access controls, should be put in place to protect against these risks.
- **User Experience:** The system's user experience must be taken into account to ensure that users can easily and efficiently use the system. This includes considerations such as ease of use, speed, and accessibility for users with disabilities.

To address these ethical, security-related, and regulatory issues, the project team will implement appropriate measures such as:

- Ensuring that the system's algorithms are tested for bias and discrimination, and taking steps to mitigate any identified risks.
- Implementing appropriate security measures such as encryption, access controls, and intrusion detection systems.
- Conducting user testing and incorporating user feedback into the design of the system to ensure that it is user-friendly and accessible.

10. FYP-I Mids Evaluation G13

1. Project is currently proposing face recognition-based identity verification at the airport. Being an AI problem, just face recognition is not enough for the FYP?

Following are offering of this project::

- Making of E-Passport (**Making Frontend in PQT-5**)
- AirPort Check In through Face ID while passport is Plug-In (**AI**) (RESNET-50,FaceRecognition)
- Where user Stand for Check-IN (**Making Frontend in PQT-5**)
- Making record of Person as well as its HHistory of traveling (**Backend SQL**)
- Storing and Evaluating Traveling Pattern (**AI**)
- Face-Spoofing Technique (**AI**)
- Homomorphic Encryption for E-Passport (**PySEAL**)
- Real-time Video Analytics for Inappropriate Act (**AI**)
- Bag Scanning could be part only if the sensors were provided to capture those Heat-Map and Magnetic Resonance Imaging.

Explanation for Addition

Consider incorporating machine learning algorithms that can learn to recognize faces from different angles, lighting conditions, and facial expressions, which would improve the accuracy and reliability of the system. You could also explore techniques for detecting and preventing **spoofing attacks**, where an individual attempts to trick the system by using a fake or manipulated image or video.

PySEAL Serialization and deserialization for saving and loading ciphertexts.

2. Weapon detection or detection of any other abnormal event at the airport through the camera?

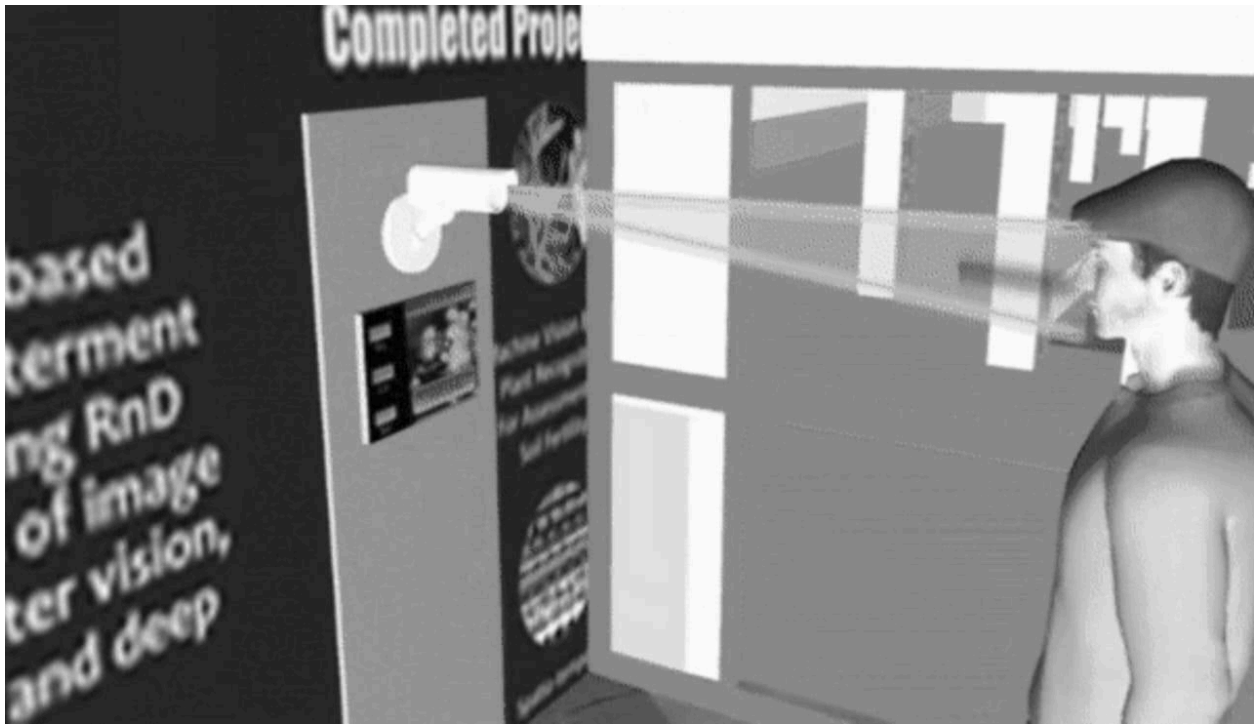
The system will be deployed inside the airport not at the entrance like at the point where your passport is verified so the weapon or any illegal detection will be done before that at the entrance.

3. How will the data be collected from the airport environment? If it is not the airport data, how is it different from a conventional, straightforward face recognition project?

The Data is available online for generating the weights for the Neural Network. For example **LFW,MS-Celeb-1M,MegaFace** and others are mentioned above.

4. Identify the camera that can be used and provide the openaccess stream in Python?

The streaming of video and from this will be controlled through opencv library.



5. It is critical to focus on how the project will be demonstrated at the end of FYP-III, i.e., through an edge device, server based system, or some other way?

For FYP purposes a laptop will be placed on the rostrum and the usb type **E-Passport** will be inserted into the laptop and that the whole process will go on.

6. How will the project UI be developed, or will it be an agent based system?

As mentioned above the GUI will be in QT-5 as this is a powerful tool for cross platform development.

7. Cost for Preparing for the real time airport deployment?

Following Cost will be accumulated

- Camera
- 1x6 meter hard cardboard
- 3D printing of passport
- Modem and wires for network connection

References

- [1] M. Chen and Y. Sun, "A face recognition algorithm based on LBP and SIFT," in 2016 13th International Computer Conference on Wavelet Active Media Technology and Information Processing (ICCWAMTIP), Chengdu, 2016, pp. 180-183, doi: 10.1109/ICCWAMTIP.2016.7543268.
- [2] P. Li, X. Zhao and Y. Li, "Research and design of e-passport identification system based on machine vision," in 2018 IEEE International Conference on Applied System Innovation (ICASI), Chiba, 2018, pp. 316-320, doi: 10.1109/ICASI.2018.8394105.
- [3] J. Cao, Y. Zhao and F. Zhang, "Research on e-Passport Reader Authentication Technology Based on Machine Vision," in 2020 3rd International Conference on Smart Grid and Smart Cities (ICSGSC), Xiamen, 2020, pp. 8-11, doi: 10.1109/ICSGSC49642.2020.9170524.
- [4] R. Al-Otaibi, A. Al-Abdulwahab and A. Al-Shoshan, "Automated passport checking system based on machine vision," in 2017 9th International Conference on Information Technology (ICIT), Amman, 2017, pp. 30-35, doi: 10.1109/ICITECH.2017.7890765.
- [5] S. A. I. Zaidi, S. S. Bokhari and A. R. Anjum, "Automated border control system using machine learning," in 2020 5th International Conference on Computing, Mathematics and Engineering Technologies (iCoMET), Sukkur, 2020, pp. 1-6, doi: 10.1109/iCoMET49275.2020.9115774.
- [6] International Civil Aviation Organization, "ICAO 9303: Machine Readable Travel Documents," https://www.icao.int/publications/Documents/9303_p3_cons_en.pdf, accessed on April 8, 2023.
- [7] International Organization for Standardization, "ISO/IEC 19794-5:2011 Information technology - Biometric data interchange formats - Part 5: Face image data," <https://www.iso.org/standard/52506.html>, accessed on April 8, 2023.
- [8] Gemalto. (2021). Document Reader AT9000 MK2. [Online]. Available: <https://www.gemalto.com/govt/document-reader/at9000-mk2>.
- [9] OpenCV. (2021). [Online]. Available: <https://opencv.org/>.
- [10] Schroff, F., Kalenichenko, D., & Philbin, J. (2015). FaceNet: A unified embedding for face recognition and clustering. arXiv preprint arXiv:1503.03832.