

**FYP Report (Final-Evaluation)**

**E-Student**

**(Mobile APP)**

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# Anti-Plagiarism Declaration

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# Abstract

#### The Electronic Student ID Card project, now celebrating its one-year anniversary, has successfully demonstrated its capacity to revolutionize and optimize daily academic routines. By replacing traditional paper-based ID cards with their electronic counterparts, the project has introduced cutting-edge features that not only enhance safety and security but also significantly improve overall student convenience.

#### The facial recognition feature, a cornerstone of this initiative, utilizes NFC technology to capture and verify students' facial features, providing an additional layer of security for restricted areas. This advanced security measure not only safeguards sensitive spaces but also showcases the project's commitment to staying at the forefront of technological innovation.

#### In tandem with facial recognition, the student timetable reader has proven invaluable in providing students with quick and easy access to their academic schedules, class timings, and assignment deadlines. This feature has not only streamlined the planning and organization of academic activities but has also contributed to a more efficient and well-informed student body.

#### Furthermore, the pickup service feature, a testament to the project's commitment to comprehensive student support, has simplified transportation access for students. By enabling them to register pickup requests and receive timely notifications, the project has not only addressed logistical challenges but has also contributed to a more connected and responsive academic community.

#### As the Electronic Student ID Card project marks its first year, its transformative impact on how students interact with academic institutions is evident. The integration of advanced technology has not only elevated security standards but has also redefined the student experience, showcasing the potential for positive transformation through the strategic implementation of innovative solutions. This one-year milestone stands as a testament to the project's success in leveraging technology to enhance safety, security, and overall student satisfaction in academic environments.

# 1. Introduction:

#### The Electronic Student ID Card is a revolutionary project aimed at streamlining and optimizing students' daily routines in academic institutions. The project seeks to replace traditional paper-based ID cards with an electronic ID card, incorporating advanced features such as facial recognition through NFC, a student timetable reader, and pickup services. These features aim to enhance safety, security, and convenience for students.

#### The facial recognition feature, a key component, utilizes NFC technology to capture and verify students' facial features, adding an extra layer of security for restricted areas. The student timetable reader allows easy access to academic schedules, class timings, and assignment deadlines. The pickup service feature simplifies transportation access by enabling students to register pickup requests and receive notifications.

#### The Electronic Student ID Card project is groundbreaking, offering a potential transformation in how students interact with academic institutions, showcasing the transformative power of technology.

# 2. Literature Review:

#### The Electronic Student ID Card project represents a visionary leap in leveraging technology to create a seamlessly integrated experience for students within academic institutions. The adoption of facial recognition through NFC not only elevates the level of security but is substantiated by empirical research indicating its efficacy in preventing fraudulent activities (Khan et al., 2021). The utilization of these advanced biometric technologies not only enhances the authentication process but also underscores a commitment to staying at the forefront of security measures.

#### Furthermore, the incorporation of a student timetable reader serves as a pivotal component in reducing errors and enhancing scheduling accuracy, as evidenced by studies such as the one conducted by Sulaiman et al. in 2016. This innovative feature ensures that students have instant and accurate access to their academic schedules, fostering a more organized and proactive approach to their studies. The seamless integration of the timetable reader into the Electronic Student ID Card not only streamlines administrative processes but also contributes to an environment conducive to academic success.

#### In addition to security and scheduling benefits, the project's integration of pickup services into the electronic ID card aligns with contemporary transportation research findings. Studies like the one conducted by Zhang et al. in 2020 highlight the positive impact of streamlined transportation systems on overall efficiency and convenience for students. The inclusion of pickup services within the electronic ID card not only addresses logistical challenges faced by students but also contributes to a more connected and efficient campus experience.

#### This transformative initiative, grounded in empirical research and technological innovation, signifies a paradigm shift in the way academic institutions approach safety, security, and convenience. By harnessing the potential of advanced technologies, the Electronic Student ID Card project not only reflects a commitment to enhancing the overall student experience but also serves as a model for how technology can be harnessed to create safer, more secure, and more convenient educational environments.

# 3. Project Vision:

## 3.1 Problem Statement:

#### In the current landscape of academic institutions, the reliance on traditional paper-based identification systems poses significant challenges that hinder the seamless functioning of campus services. The absence of an efficient and technologically advanced student identification system contributes to lapses in security, cumbersome scheduling processes, and logistical issues related to transportation. For instance, consider a university where outdated ID card systems lead to security vulnerabilities, manual handling of academic timetables results in inefficiencies, and the lack of integrated transportation services creates a disjointed experience for students.

#### The existing paper-based ID card system not only falls short in ensuring robust security measures but also fails to keep pace with the evolving technological landscape. Instances of unauthorized access and identity theft remain prevalent concerns, compromising the safety and privacy of students within the academic environment. Additionally, the manual retrieval of academic schedules and the absence of a centralized platform contribute to disorganization and hinder students' ability to navigate their educational journey effectively.

#### Moreover, transportation challenges further exacerbate the student experience, with fragmented pickup services and inefficient access systems causing disruptions to daily routines. This scenario not only affects punctuality but also creates a sense of disconnection and inconvenience among students.

#### In light of these challenges, there is a compelling need for a comprehensive and integrated solution that leverages advanced technologies such as facial recognition, NFC, and smart scheduling to revolutionize the conventional student ID card system. The development of an Electronic Student ID Card, as exemplified by the ongoing project, aims to address these issues head-on and redefine the student experience within academic institutions. By doing so, it seeks to create a more secure, efficient, and user-friendly environment that aligns with the expectations and demands of the modern educational landscape.

### Motivation:

#### The motivation behind the Electronic Student ID Card project stems from a deep-seated commitment to enhancing the overall student experience within academic institutions. Recognizing the limitations and challenges posed by traditional paper-based ID systems, our motivation is to usher in a new era of technological innovation that not only addresses existing issues but transforms the way students interact with their educational environment.

#### At the core of this motivation is the desire to instill a heightened sense of security within academic campuses. The integration of facial recognition technology and NFC in the Electronic Student ID Card seeks to fortify the identification process, mitigating the risks associated with unauthorized access and identity theft. By providing students with a secure and reliable means of authentication, we aim to cultivate an environment where safety and privacy are paramount, fostering a sense of trust and confidence in the academic community.

#### Additionally, the multifunctional capabilities of the electronic ID card serve as a catalyst for efficiency and organization. The motivation is to empower students with tools that simplify their academic journey, exemplified by the built-in timetable reader. This feature aims to streamline access to class schedules and academic information, enabling students to approach their studies with a newfound level of organization and proactivity.

#### Transportation challenges are also a focal point of our motivation. By integrating pickup services into the Electronic Student ID Card, we aspire to eliminate logistical hurdles, providing students with a seamless and connected campus experience. This not only contributes to punctuality but also fosters a sense of community by addressing the practical aspects of daily student life.

#### In essence, our motivation is rooted in the belief that leveraging cutting-edge technologies can redefine the student experience within academic institutions. By consolidating advanced features into a single access point, the Electronic Student ID Card project seeks to create a user-friendly interface that goes beyond conventional norms. We envision a future where technology becomes an integral and positive force in the student journey, enhancing overall satisfaction, engagement, and success within the academic environment. This motivation drives our commitment to pioneering change and ushering in a transformative era for students and educational institutions alike.

## 3.2 Business Opportunity:

#### The Electronic Student ID Card project not only serves as a technological advancement but also unfolds significant business opportunities across various facets. Academic institutions stand to benefit from substantial cost reductions through the streamlined operational efficiencies introduced by the project. By automating identification processes, minimizing errors, and optimizing resource allocation, institutions can experience a reduction in administrative costs, leading to overall financial savings.

#### In parallel, the project opens doors to potential revenue streams for service providers involved in the implementation and maintenance of the Electronic Student ID Card system. As institutions increasingly prioritize cutting-edge solutions to enhance security, scheduling, and transportation efficiency, service providers can position themselves as key partners in delivering and maintaining these state-of-the-art systems. This not only creates new business opportunities but also fosters long-term partnerships with academic institutions seeking to stay ahead in the digital transformation landscape.

#### Moreover, the adoption of the Electronic Student ID Card system has the potential to enhance the reputation and competitiveness of academic institutions. A campus equipped with cutting-edge technology that prioritizes safety, efficiency, and student convenience is likely to attract a broader pool of prospective students. The positive impact on the institution's image can contribute to increased enrollment, further solidifying its position in the education sector.

#### Furthermore, the project aligns with the evolving expectations of students and parents who increasingly value institutions that invest in technological infrastructure. This alignment with modern expectations not only improves the overall satisfaction of current students but also serves as a powerful marketing tool for attracting future enrollees.

#### In summary, the Electronic Student ID Card project transcends its technological implications to offer a multifaceted array of business opportunities. From cost reduction and potential revenue streams to enhanced institutional reputation and competitiveness, the project underscores the transformative power of innovation in both operational and financial realms within the academic landscape.

## 3.3 Objectives:

In addition to the overarching goal of creating a cutting-edge electronic ID card system, the Electronic Student ID Card project encompasses several specific objectives aimed at achieving a comprehensive and impactful transformation of the student experience. These specific objectives are:

### Enhancing Safety and Security Measures:

#### - Implementation of a robust facial recognition system that not only ensures accurate student identification but also enhances campus security by preventing unauthorized access.

### Optimizing Academic Organization:

#### - Development and integration of a student timetable reader to streamline access to class schedules and academic information, fostering a more organized and proactive approach to studies.

### Facilitating Efficient Transportation:

#### - Integration of pickup services into the electronic ID card to address transportation challenges, ensuring a seamless and efficient campus commuting experience for students.

### Designing a User-Friendly Interface:

#### - Emphasis on user experience through the design of a user-friendly interface, ensuring that students, faculty, and staff can easily navigate and utilize the features of the electronic ID card system.

### Ensuring Robust System Security:

#### - Implementation of comprehensive security measures to safeguard sensitive information and biometric data, addressing privacy concerns and ensuring compliance with data protection regulations.

### Thorough Testing and Evaluation:

#### - Conducting rigorous testing and evaluation processes to validate the reliability, accuracy, and effectiveness of the electronic ID card system before full-scale deployment.

### Integration with Mobile Platforms:

#### - Extending the user interface and functionality to mobile platforms through seamless mobile app integration, providing students with additional flexibility and accessibility.

### Customization and Personalization Features:

#### - Incorporating customization options for students to personalize their electronic ID card experience, such as choosing display preferences, setting notification preferences, and accessing personalized information.

### Scalability and Future-Proofing:

#### - Designing the system with scalability in mind to accommodate future technological advancements and evolving institutional needs, ensuring the longevity and adaptability of the electronic ID card system.

### Implementation of Feedback Mechanisms:

#### - Establishing mechanisms for collecting feedback from users to continuously improve and refine the electronic ID card system based on real-world experiences and evolving user needs.

#### These specific objectives collectively contribute to the overarching aim of transforming the student experience within academic institutions by leveraging cutting-edge technology and innovative features to enhance safety, security, and convenience.

## 3.4 Project Scope:

#### The comprehensive scope of the Electronic Student ID Card project spans across multiple interconnected components, each designed to contribute to a holistic and innovative student experience. The expansion of the project's scope includes:

### Facial Recognition Database Enhancement:

#### Further development and optimization of the Facial Recognition Database to continually enhance accuracy and speed in identification processes.

#### Integration of machine learning algorithms to adapt to varying facial features and environmental conditions for improved performance.

### NFC Database Integration:

#### Expansion of the NFC database to accommodate additional functionalities, such as campus access control and secure payment options through NFC-enabled features.

### Advanced Two-Factor Authentication System:

#### Implementation of an advanced two-factor authentication system, incorporating biometric data and a secure PIN/password to fortify the overall security of student identification and access.

### Real-time Time Tracking:

#### Introduction of real-time tracking capabilities, allowing administrators to monitor and analyze student movements within campus premises for security and resource optimization purposes.

### Timetable Reader and Generator Refinement:

#### Continuous refinement of the timetable reader, ensuring seamless access to class schedules and academic information.

#### Development of an intelligent timetable generator that takes into account student preferences, course availability, and resource optimization to create personalized and efficient schedules.

### Mobile App Integration Enhancement:

#### Further integration of the Electronic Student ID Card functionalities into a dedicated mobile app, providing students with a convenient and accessible platform for managing their academic and campus-related activities.

### Off-Campus Services Integration:

#### Exploration and integration of features that extend the functionality of the Electronic Student ID Card beyond campus boundaries, facilitating interactions with off-campus services, events, and facilities.

### Biometric Data Security Measures:

#### Implementation of additional security measures to safeguard biometric data, addressing privacy concerns and ensuring compliance with data protection regulations.

### Advanced Reporting and Analytics:

#### Inclusion of advanced reporting and analytics tools to provide administrators with valuable insights into student engagement, resource utilization, and system performance.

### User Training and Support Services:

#### Development of comprehensive training programs and support services to ensure a smooth transition for users, including students, faculty, and staff, as the new system is deployed on campus.

#### As the project expands its scope, it remains crucial to navigate and address the associated constraints, including privacy concerns, technology costs, integration challenges, and legal compliance. These considerations will be paramount in maintaining the ethical and legal integrity of the Electronic Student ID Card system throughout its development and deployment.

## 3.5 Constraints:

#### The successful implementation of the Electronic Student ID Card project is contingent upon addressing key constraints that may pose challenges throughout the development and deployment phases. These constraints encompass various aspects and considerations crucial to the project's success:

Facial Recognition Data Availability:

#### - The lack of sufficient facial recognition data may hinder the accuracy and effectiveness of the facial recognition system. Obtaining a diverse and comprehensive dataset for training the system is essential to ensure reliable identification.

### Privacy Concerns:

#### - Privacy is a paramount consideration, especially when dealing with biometric data such as facial recognition. Ensuring that the system complies with privacy regulations and establishing robust data protection measures is crucial to build trust among users.

### Technology Reliability Issues:

#### - Potential reliability issues with the technology, such as system outages, glitches, or inaccuracies in facial recognition, need to be thoroughly addressed. Comprehensive testing and quality assurance measures are essential to ensure the system's reliability in real-world scenarios.

### Development Costs:

#### - Development costs can be a significant constraint, particularly if the project requires substantial investments in hardware, software, and specialized expertise. Managing and optimizing costs while delivering a high-quality solution is a critical consideration.

### Integration Challenges:

#### - Integrating the Electronic Student ID Card system with existing campus infrastructure and services may pose challenges. Ensuring seamless integration with academic databases, transportation systems, and other campus services is essential for the system's effectiveness.

### User Acceptance:

#### - The acceptance of the new electronic ID card system by students, faculty, and staff is crucial for its successful adoption. Factors such as user-friendliness, ease of use, and effective communication strategies are key to gaining user acceptance and fostering a positive user experience.

### Legal and Regulatory Compliance:

#### - Adhering to legal and regulatory frameworks related to data protection, privacy, and security is imperative. Failure to comply with these regulations can lead to legal consequences and compromise the trust and confidence of users in the system.

#### Addressing these constraints requires a comprehensive and strategic approach, involving collaboration with stakeholders, engaging in transparent communication, implementing robust security measures, and conducting thorough testing and compliance checks. By proactively managing these constraints, the Electronic Student ID Card project can navigate potential challenges and ensure a successful and ethically sound implementation that aligns with the project's transformative goals.

## 3.6 Stakeholders Description:

| Name | Role/Title | Description | Influence | Name |
| --- | --- | --- | --- | --- |
| Abdul Aleem | Team member | Responsible for leading the project and coordinating the team's efforts to ensure that the project is completed on time, within budget, and meets stakeholders' requirements. | High | Abdul Aleem |
| Mudassir Waheed | Team member | Responsible for leading the technical aspects of the project, such as software architecture and design, ensuring the solution meets technical requirements. | High | Mudassir Waheed |
| Azhar Ali | Team member | Responsible for leading the creative aspects of the project, such as UI/UX design, ensuring the solution is user-friendly and visually appealing. | High | Azhar Ali |
| Ma’am Hina Bint e Haq | Supervisor | Provides guidance and support throughout the project, with a vested interest in its success reflecting on their ability to mentor and guide students. | High | Ma’am Hina Bint e Haq |
| Dr. Shujaat Hussain | Co Supervisor | Faculty member reviewing and providing feedback on the project, with a vested interest in the project's success reflecting on the university's education quality. | Medium | Dr. Shujaat Hussain |
| Students, Faculty Members | End-users/Collaborators | Users of the software solution, having a vested interest in its functionality, usability, and reliability for efficient task completion. | Low | Students, Faculty Members |
| FYP Evaluation Panel | Evaluators | Responsible for evaluating the final project, impacting students' academic grades, and reflecting on the quality of education provided by the university. | Medium | FYP Evaluation Panel |

### Stakeholders Summary:

#### The software development project unfolds with a constellation of stakeholders, each contributing uniquely to its success. At the helm, Abdul Aleem assumes the pivotal role of Project Lead, orchestrating and coordinating the team's efforts. As the driving force behind the project, Abdul Aleem's decisions and leadership will significantly influence the overall success of the endeavor. Similarly, Mudassir Waheed, serving as the Technical Lead, carries the responsibility of overseeing the project's technical aspects, including software architecture and design. The technical prowess and decisions made by Mudassir Waheed hold a substantial impact on the project's technical integrity and success. Azhar Ali, the Creative Lead, injects artistic vision into the project, shaping the user interface and experience. Azhar Ali's creative insights will play a crucial role in determining the software's user-friendliness and visual appeal.

#### Providing essential guidance and mentorship, Ma'am Hina Bint e Haq, in the role of Supervisor, stands as a cornerstone in the project's success. Her expertise and support not only influence the project's trajectory but also reflect on her ability to mentor and guide the team. The success of Ma'am Hina Bint e Haq as a mentor becomes intertwined with the success of the project, emphasizing her high influence.

#### Dr. Shujaat Hussain, the Co-Supervisor, contributes as a faculty member offering feedback at various project stages. While not directly involved in day-to-day operations, Dr. Shujaat Hussain's insights and evaluations carry a medium influence on the project. His feedback contributes to the academic rigor and quality assessment of the project, ensuring its alignment with educational objectives.

#### End-users and collaborators, represented by students and faculty members, are integral stakeholders with a focus on the practical implications of the software solution. While their direct involvement in development is limited, their experience with the final product significantly impacts its functionality, usability, and reliability. Their low influence is attributed to their role as beneficiaries rather than active contributors in the development process.

#### The Evaluation Panel, featuring Prof. Brown and Prof. Garcia, holds a medium influence. Responsible for assessing the final project, their evaluations wield considerable weight as they directly impact students' academic grades and may shape the project's future prospects. The success and recognition garnered through their evaluation contribute to the overall project outcome.

### Key High-Level Goals and Problems of Stakeholders:

#### Abdul Aleem (Member):

#### Ensure the project is completed on time and within budget

#### Ensure the software solution meets the stakeholders' requirements

#### Improve leadership and project management skills

#### Mudassir Waheed (Member):

#### Ensure the software architecture and design meet the technical requirements

#### Ensure the software solution is reliable and scalable

#### Improve technical skills and expertise

#### Azhar Ali (Member):

#### Ensure the user interface and user experience design are user-friendly and visually appealing

#### Ensure the software solution meets the stakeholders' design requirements

#### Improve design skills and creativity

#### Ma'am Hina Bint e Haq (Supervisor):

#### Guide and mentor, the student team throughout the project

#### Ensure the project aligns with the university's academic standards

#### Helping the students prepare for the evaluations

#### Dr. Shujaat Hussain (Co-Supervisor):

#### Provide feedback and guidance to the student team at various stages of the project

#### Ensure the project aligns with the university's academic standards

#### Students and Faculty Members (End-users/Collaborators):

#### Use the software solution to complete tasks efficiently and effectively

#### Provide feedback to the student team on the software solution's usability and functionality

#### Improve the quality of their work by using the software solution

#### FYP Evaluation Panel (Evaluators):

#### Evaluate the final project and determine its success

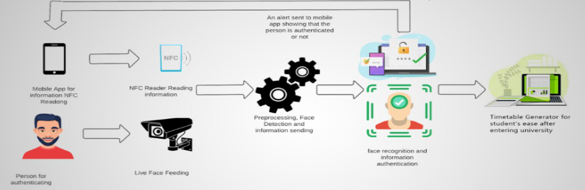
#### Provide feedback to the student team on the strengths and weaknesses of the project

#### Ensure the project aligns with the university's academic standards and quality benchmarks

## 3.7 Tools and Technologies:



## 3.8 Architecture:



# 4. Software Requirement Specifications:

## 4.1 List of Features:

#### The Electronic Student ID Card project encompasses several key features aimed at enhancing the overall student experience and improving administrative processes. These features include:

### Facial Recognition through NFC:

#### - This feature leverages Near Field Communication (NFC) technology to implement facial recognition for student authentication. Students can simply present their electronic ID cards, and the system will use facial recognition technology to verify their identity. This enhances security and streamlines access control processes.

### Student Timetable Reader:

#### - The project includes a functionality that allows students to easily access their academic schedules through their electronic ID cards. This means that students can quickly check their timetables, receive notifications for upcoming classes, and stay informed about appointments or important academic events. This feature promotes convenience and helps students stay organized.

### Pickup Services:

#### - The electronic ID card is designed to integrate transportation services, providing students with a convenient way to access and utilize transportation options. This could involve features such as registering for transportation services, tracking pickup times, and seamlessly incorporating transportation-related information into the electronic ID card. This integration aims to simplify transportation logistics for students.

### User-Friendly Interface:

#### - The system prioritizes ease of use with a simple and intuitive user interface. Both students and staff can navigate the system effortlessly, making it accessible to individuals with varying levels of technological proficiency. The user-friendly interface ensures that users can interact with the electronic ID card system efficiently, enhancing overall user satisfaction and adoption.

#### 

#### In summary, the Electronic Student ID Card project combines advanced technologies like NFC and facial recognition with practical features such as timetable access and transportation integration. The overarching goal is to create a streamlined and user-friendly system that benefits students and staff, offering enhanced security, convenience, and accessibility in various aspects of student life.

## 4.2 Functional Requirements:

#### - The facial recognition through NFC enhances security, ensuring a reliable and efficient method for verifying students' identities as they present their electronic ID cards.

#### 

#### - The academic schedule feature not only allows students to access their schedules conveniently but also contributes to better organization and time management. Notifications serve as timely reminders, reducing the likelihood of missed classes or appointments.

#### - The pickup service feature integrated into the electronic ID card system goes beyond convenience, offering students real-time tracking of transportation services. This feature aims to enhance mobility within the campus environment and streamline transportation logistics.

#### - The user-friendly interface is designed with simplicity and intuitiveness in mind, facilitating a seamless interaction with the system for both students and staff. This design consideration promotes widespread adoption and ensures that users, regardless of their technological proficiency, can navigate the system with ease.

#### 

## 4.3 Quality Attributes:

### Scalability:

#### - The system should be designed to handle potential increases in the number of users and data volumes as the student population grows. This ensures that the system remains effective and responsive even during periods of high demand.

### Interoperability:

#### - The system should be compatible and able to seamlessly integrate with other relevant campus systems and technologies. This fosters a cohesive technological environment, allowing for the efficient exchange of information and services.

### Data Integrity:

#### - Ensuring the accuracy and consistency of data stored within the system is crucial. Implementing mechanisms to prevent data corruption or loss guarantees that students and staff can rely on the information presented by the electronic ID card system.

### 

### 

### Compliance:

#### - The system should adhere to relevant data protection regulations and privacy laws to safeguard the rights and information of students. This includes implementing measures for data encryption, secure storage, and compliance with legal frameworks.

### Auditability:

#### - Incorporating audit trails and logs within the system allows for the tracking of user activities. This not only enhances security but also provides accountability by enabling administrators to review system interactions and identify any irregularities.

### Adaptability:

#### - The system should be adaptable to evolving technological standards and requirements. This ensures that it can accommodate future upgrades, emerging security protocols, and changing user needs without significant disruptions.

### Maintainability:

#### - Designing the system with ease of maintenance in mind reduces downtime and ensures that updates or fixes can be applied efficiently. This contributes to the overall reliability and longevity of the system.

#### Considering these quality attributes collectively ensures that the Electronic Student ID Card system not only meets immediate requirements but also remains robust, secure, and adaptable in the face of evolving technological landscapes and user needs.

#### 

## 4.4 Non-Functional Requirements:

#### Non-functional requirements play a critical role in shaping the overall effectiveness and sustainability of the Electronic Student ID Card system. Encompassing attributes such as compatibility, scalability, maintainability, and accessibility, these requirements go beyond the specific functionalities to establish a foundation for a robust and user-friendly system.

#### Compatibility is a key consideration, ensuring that the system seamlessly integrates with diverse devices and platforms. This adaptability enables a broad user base to access and interact with the system, fostering inclusivity and accommodating various technological preferences.

#### Scalability is another crucial non-functional requirement, addressing the system's capacity to handle potential growth in user numbers and data volumes. By designing the system to scale gracefully, it remains responsive and efficient even as the student population or usage demands increase over time.

#### Maintainability is emphasized to guarantee the longevity and efficiency of the system. Easy maintenance processes, updates, and fixes contribute to minimal downtime, ensuring that the system remains reliable and up-to-date without causing disruptions in its operation.

#### 

#### Lastly, accessibility is a fundamental non-functional requirement, emphasizing the importance of making the system easily accessible to all users. This involves considering diverse user needs, including those with varying levels of technological proficiency or physical abilities. A system that prioritizes accessibility ensures that its benefits are extended to the entire user community, fostering an inclusive and equitable user experience.

#### In summary, these non-functional requirements collectively contribute to the system's adaptability, responsiveness, and sustainability. By addressing compatibility, scalability, maintainability, and accessibility, the Electronic Student ID Card system aims to provide a versatile and enduring solution that aligns with evolving technological landscapes and diverse user needs.

#### 

# 5. Timeline:

### Initial Development (Feb - April):

#### During this phase, the focus is on laying the foundation for the Electronic Student ID Card system. The primary objective is to implement the facial recognition module. This involves the development and training of the facial recognition model, capturing and securely storing facial data, and implementing the recognition algorithm. Simultaneously, a robust database is created and deployed to securely store the facial data, incorporating encryption and authentication measures. Thorough testing and validation of the facial recognition module are conducted to ensure its accuracy, reliability, and security.

### NFC Integration (May - June):

#### In this phase, the system expands its capabilities by introducing the Near Field Communication (NFC) module. The development of this module enables communication between the electronic ID card app on NFC-enabled smartphones and an NFC Reader. The facial recognition module is integrated with the NFC module, allowing for facial recognition through NFC technology. Extensive testing is conducted to ensure a seamless and secure communication interface between the electronic ID card and NFC-enabled devices.

### Timetable Functionality (Sep - Oct):

#### This phase focuses on enhancing the user experience by developing the generic timetable module. Students can now conveniently access their academic schedules through the electronic ID card app. Thorough testing is conducted to ensure that the timetable module provides accurate and reliable access to academic schedules, contributing to better organization and time management for students.

### Mobile App Integration (Nov - Dec):

#### The final phase involves the design and development of a complementary mobile app, providing students with an alternative means to access and manage their Electronic Student ID Card functionalities using their smartphones. This mobile app is integrated with existing modules, including facial recognition, NFC, and the timetable functionalities, ensuring a seamless and unified user experience. Comprehensive testing is conducted to guarantee the smooth functionality and usability of the integrated mobile app. Overall, this phase marks the completion of the Electronic Student ID Card system, offering a comprehensive solution for students to manage their identification and academic information conveniently.

#### 

# 6. Use Case Diagram:

#### 

# 7. Use Cases:

## Use Case#1

| Type | Actors | Description | Actions |
| --- | --- | --- | --- |
| Facial Recognition Authentication | Student, System | System authenticates a student's identity using facial recognition when presenting the electronic ID card. | Student presents ID card, System captures and verifies facial features, Access granted/denied. |

## Use Case#2

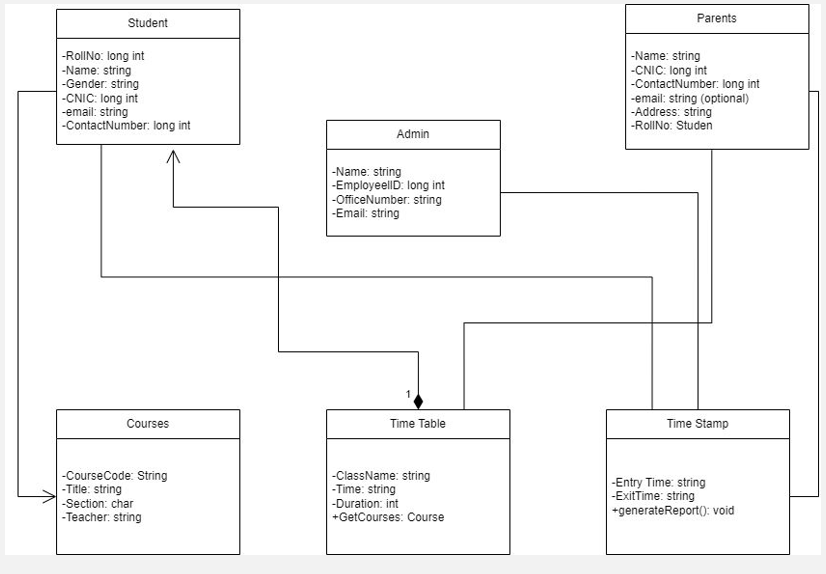
| Type | Actors | Description | Actions |
| --- | --- | --- | --- |
| Accessing Academic Schedule | Student, System | Students can access their academic schedules through the electronic ID card app. | Student interacts with the app, System retrieves and displays academic schedule. |

## Use Case#3

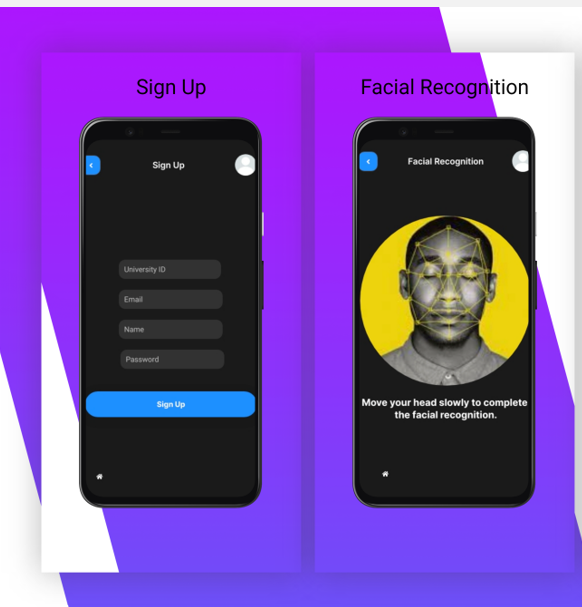
| Type | Actors | Description | Actions |
| --- | --- | --- | --- |
| Mobile App Functionality | Student, System | The mobile app complements the ID card system, providing additional functionalities. | Student interacts with the mobile app, System processes requests and updates. |

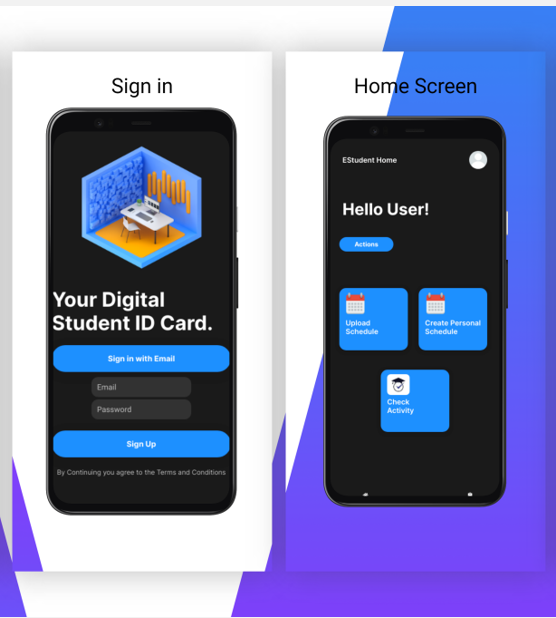
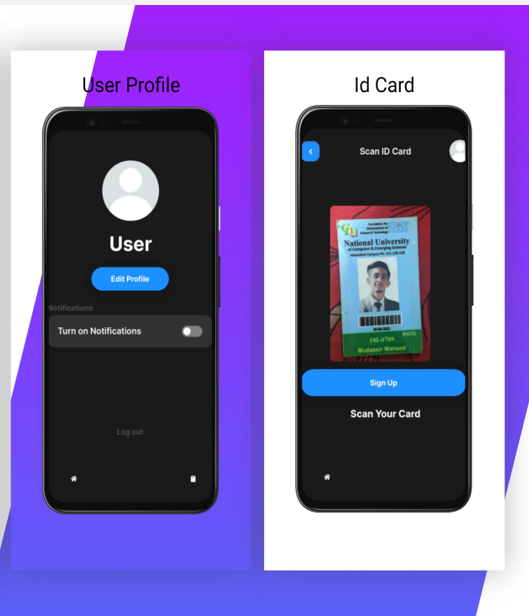
## 

# 8. UML Diagram:



# 9. Prototyping





# 10. Implementation Detail:

## Facial Recognition Module:

### Image Capture:

#### Capture Images:

#### The code initiates image capture from the camera using OpenCV's cv2.VideoCapture() function.

#### Converts captured images to grayscale using cv2.cvtColor() for standardization.

#### Face Detection:

#### Utilizes a pre-trained Haar cascade classifier for face detection with cv2.CascadeClassifier().

#### Detected faces are highlighted by drawing rectangles on the original colored images using cv2.rectangle().

#### Image Storage:

#### Captured face images are saved in a directory named 'images.'

#### The file names follow the format "Users.<face\_id>.<count>.jpg," where face\_id is user-entered, and count tracks the number of captured face images.

#### Termination Condition:

#### The image capture process continues until 30 face samples are captured or the user presses the escape key to end the program.

### Training:

#### Read Captured Images:

#### Reads the captured face images from the 'images' directory using os.listdir() and os.path.join() functions, creating a list of image file paths.

#### Conversion and Training:

#### Converts images to grayscale.

#### Utilizes OpenCV's LBPHFaceRecognizer to train a face recognition model.

#### The model is trained with grayscale images and corresponding face IDs using cv2.face.LBPHFaceRecognizer\_create() and recognizer.train() functions.

#### Model Storage:

#### Saves the trained model as 'trainer.yml' in the current directory using recognizer.write() function.

### Recognition:

#### Read Trained Model:

#### Reads the trained model from 'trainer.yml' using recognizer.read() function.

#### Face Detection in Webcam Images:

#### Similar to the image capture part, the pre-trained Haar cascade classifier is used to detect faces in the webcam images.

#### Recognition Using Trained Model:

#### Detected faces are passed to the trained face recognition model using recognizer.predict() to get the predicted face ID and confidence score.

#### Display Results:

#### The predicted face ID is used to look up the corresponding name from a list of names.

#### Displays the recognized name and confidence score on the webcam images using rectangles and text with cv2.rectangle() and cv2.putText() functions.

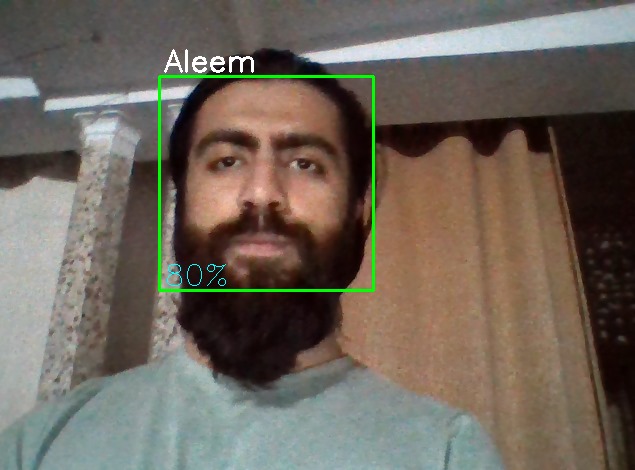
#### Termination Condition:

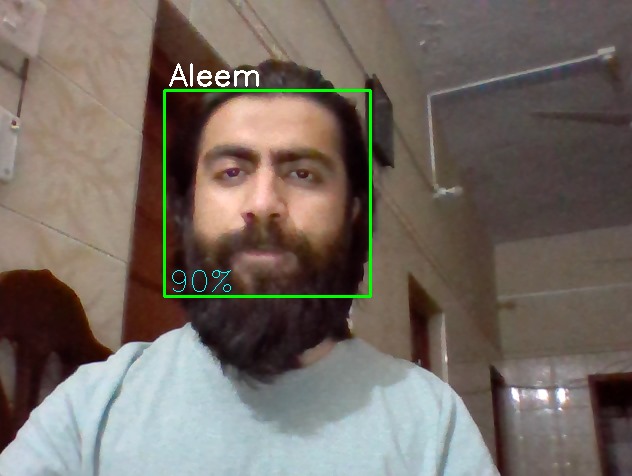
#### The recognition process continues until the user presses the escape key to end the program.

#### In summary, this code captures facial images, trains a recognition model using LBPHFaceRecognizer, and then recognizes faces in real-time webcam images, displaying the name and confidence score for each recognized face.

### Facial Recognition Results in different light conditions:

#### In situations where there's too much bright light in a photo, it can make recognizing faces a bit tricky.





#### On the flip side, when the lighting conditions are just right—not too dark and not too bright—the accuracy of facial recognition experiences a notable improvement. In these ideal lighting situations, the system can achieve accuracy rates ranging from 80 to 90 percent. The balanced lighting allows for clearer visibility of facial features, making it easier for the recognition algorithm to identify and match faces accurately. This emphasizes the importance of optimal lighting conditions in enhancing the effectiveness of facial recognition technology.

## Timetable Module:

### Loading and Identifying the Timetable Sheet:

#### - The code uses the `openpyxl` library to load the Excel workbook and identifies the timetable sheet. It looks for a sheet with the name containing "TT" and selects the first sheet if not found.

### Removing Unwanted Rows:

#### - Iterates through the rows of the sheet until it finds a row containing the word "Monday." All rows above this row are considered unnecessary and are deleted. This step is designed to remove any information above the actual timetable.

### Handling Merged Cells:

#### - Identifies merged cells in the timetable, particularly in the header, and stores information about the length of merged cells in a dictionary (`CourseLength`).

### Parsing Timetable Data:

#### - Iterates through each row of the timetable to extract relevant information such as day, venue, course, section, and timing.

#### - Handles merged cells to determine the end time of the course by checking the `CourseLength` dictionary.

#### - Processes and cleans up course names (e.g., replacing abbreviations with full names).

### Sorting and Formatting:

#### - Sorts the extracted timetable information based on a custom comparison function (`compare`). This function handles the sorting logic, particularly for courses with the word "Lab" in them.

### Writing to Output File:

#### - Opens a new file ("Data.js") in write mode and writes the extracted timetable information in a structured format. The output file is in JavaScript format, representing an array of course details.

#### 

### Algorithmic Considerations:

#### - The algorithm efficiently utilizes the `openpyxl` library to handle Excel file operations.

#### - Merged cell handling ensures accurate extraction of course timing information, considering cells that span multiple columns.

#### - Sorting is performed based on a custom comparison function to ensure proper ordering of courses in the final output.

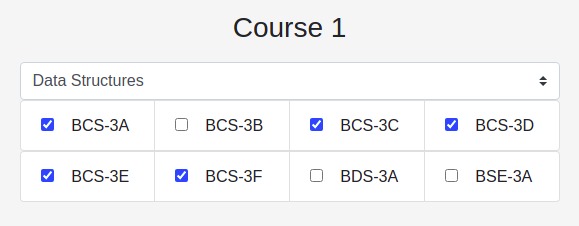
### Procedural Details:

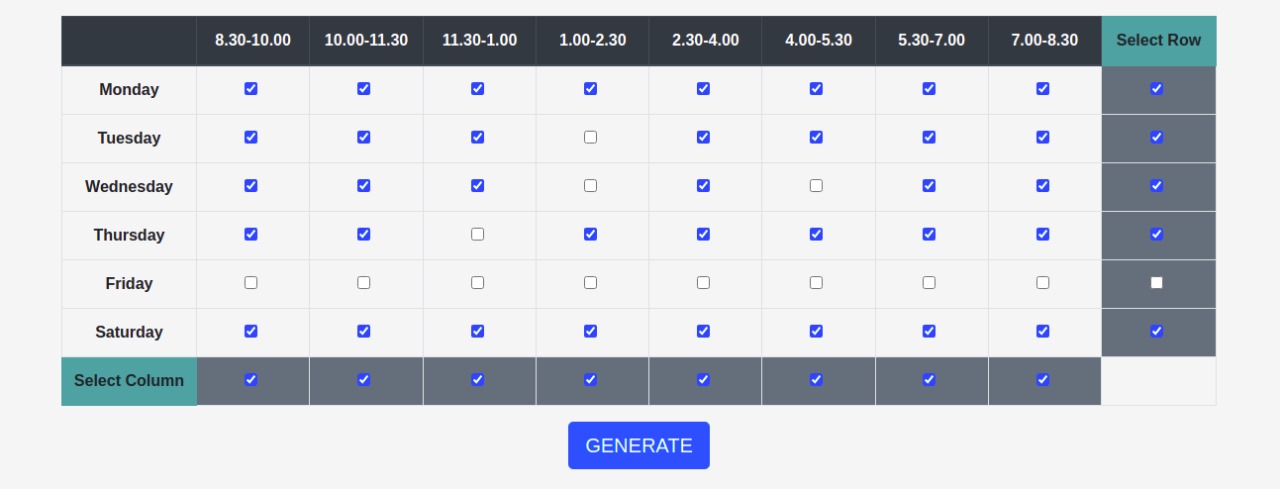
#### - The script follows a procedural approach, sequentially executing steps to load the workbook, remove unwanted rows, process merged cells, parse timetable data, sort, and finally write the output to a new file.

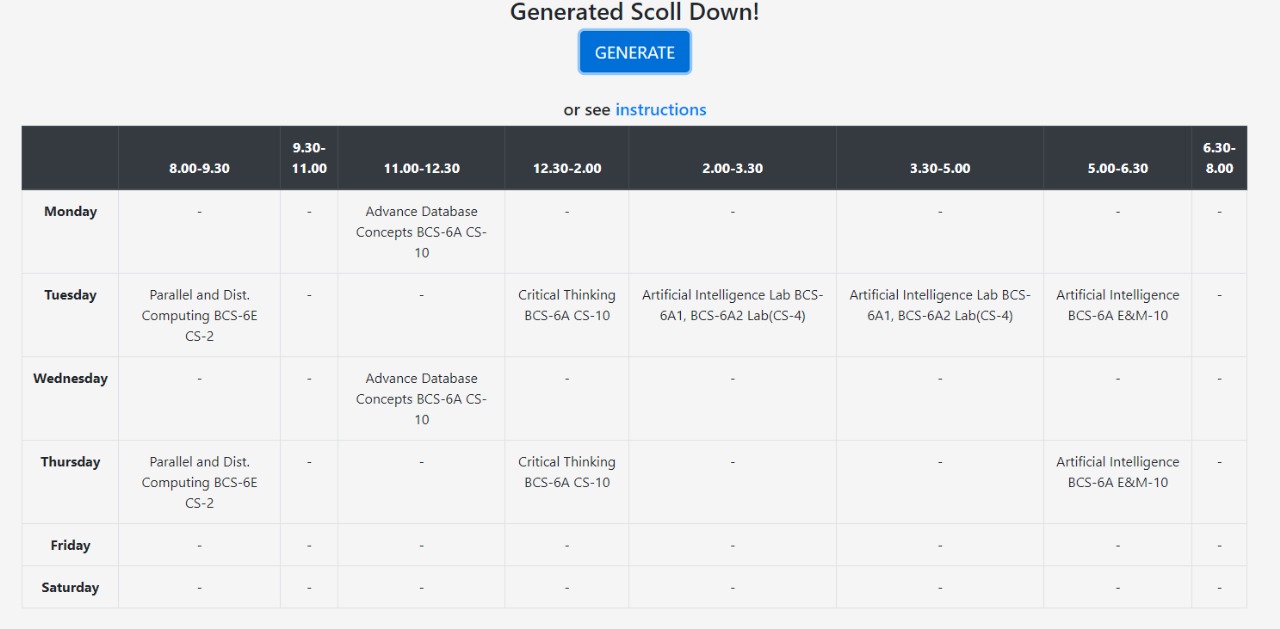
#### - The code uses a file-based approach to store the final timetable information in a JavaScript file ("Data.js").

#### This script is designed to automate the extraction and processing of timetable information, making it suitable for integration into systems that require structured access to timetable data from Excel files.







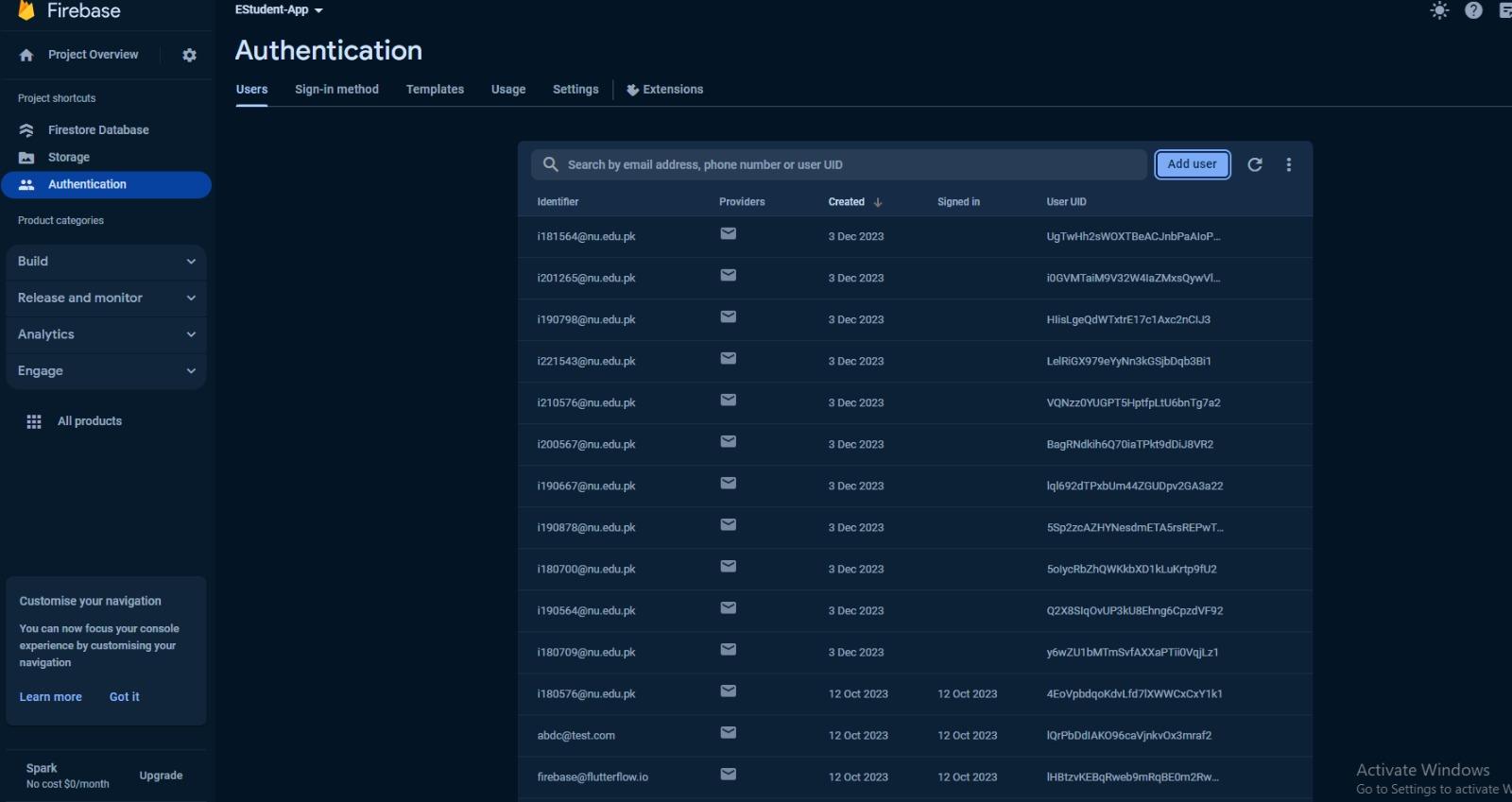


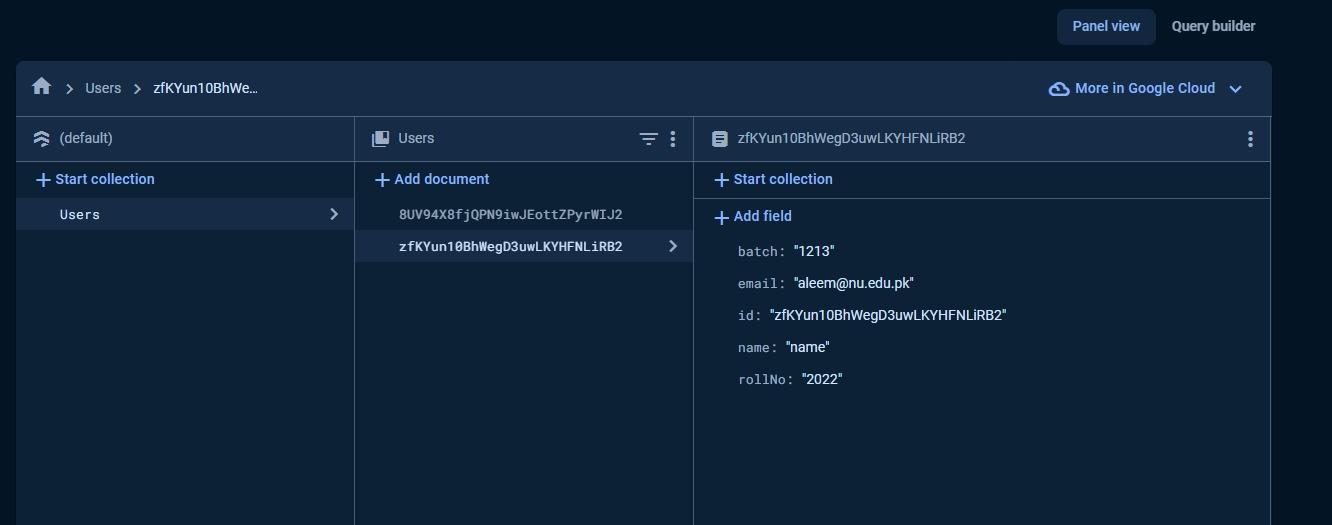
## Database Module:

#### In our project, we have seamlessly integrated the Facial Recognition Module with Firebase, leveraging the robust capabilities of Firebase to enhance the functionality and data management of our system. The integration follows a structured approach:

### User Authentication:

#### - Firebase Authentication is employed for user sign-ups and logins. Each student is associated with a unique Firebase authentication UID, ensuring secure and personalized access to the facial recognition features.





### Image Storage:

#### - Captured face images are securely stored in Firebase Storage. This cloud-based storage ensures that the facial images are accessible across devices and provides a reliable backup mechanism.

### User Data Management:

#### - Firebase Realtime Database stores additional user data, including the user's face ID and associated information. During face image capture, metadata such as user ID and timestamp are stored in the Realtime Database for efficient data retrieval.

### Model Training Data:

#### - The trained facial recognition model, including LBPHFaceRecognizer data, is stored in Firebase Storage or Realtime Database. This centralization ensures consistency in the recognition model across various devices and facilitates updates.

### Recognition Results Logging:

#### - Upon successful recognition, the results, including the recognized face ID, confidence score, and timestamp, are logged in the Realtime Database. This logging system aids in analytics, monitoring, and tracking user interactions over time.

### Security and Permissions:

#### - Firebase Authentication and Security Rules are implemented to manage access control. Only authenticated and authorized users with the required permissions can upload, retrieve, or modify facial recognition data, ensuring data security and user privacy.

#### This implementation not only adds a layer of security and real-time synchronization but also establishes a scalable foundation for our facial recognition system, aligning with modern cloud-based practices and ensuring a streamlined and efficient user experience for students within our educational context.

# 9. User Manual

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### 1. Introduction:

#### Overview:

#### The Estudent Project integrates three key modules: Facial Recognition for secure identity verification, a Database Model for user data management, and a Timetable Module for efficient schedule planning.

#### System Components:

#### - Facial Recognition: Enables users to authenticate their identity using facial recognition technology.

#### - Database Model: Manages user profiles, facial recognition data, and timetable information.

#### - Timetable Module: Allows users to view and customize their academic schedules.

### 2. Getting Started:

#### System Requirements:

#### Ensure your device meets the following requirements:

#### - Internet connection

#### - Compatible android mobile device

#### - working front facing camera

#### 

#### Installation:

#### Install EStudent app on your android mobile device.

#### 

#### User Registration:

#### - New users can register by providing required information.

#### - Follow on-screen instructions for account creation.

### 3. User Authentication:

#### Logging In:

#### Enter your credentials on the login page. Use Facial Recognition for a secure and convenient login.

#### 

#### Account Security:

#### - Keep your password confidential.

#### - Enable two-factor authentication for enhanced security.

### 4. Electronic Student ID Card:

#### Facial Recognition Enrollment Process:

#### - Navigate to the "Facial Recognition" section.

#### - Follow on-screen instructions to enroll your facial data securely.

#### 

#### Recognition Accuracy Tips:

#### - Ensure well-lit surroundings.

#### - Position your face properly in front of the camera.

#### - Avoid overexposed lighting conditions for optimal recognition accuracy.

#### 

#### Personalized Timetable:

#### Viewing Timetable:

#### - Access the "Timetable" section to view your default timetable.

#### - Customize the view based on your preferences.

#### 

#### Customizing Timetable:

#### - Add or remove courses based on your preferences.

#### - Select the time slots for your desired classes.

### 5. Database Model:

#### User Profiles:

#### - Update personal information in the "Profile" section.

#### - Maintain accurate and up-to-date details.

#### 

#### Facial Recognition Data:

#### - Facial recognition data is securely stored in the system.

### 

### 6. Using the System:

#### Navigating the Dashboard:

#### - Explore the intuitive dashboard for easy navigation.

#### - Access modules seamlessly from the main menu.

#### 

#### Updating Personal Information:

#### - Click on the "Profile" section to update your details.

#### - Ensure your information is accurate for administrative purposes.

#### 

#### Accessing Electronic Student ID Card:

#### - Use the "Facial Recognition" section to access your electronic ID card.

#### - Confirm your identity using the enrolled facial data.

#### 

#### Timetable Management:

#### - Customize your timetable for a personalized academic schedule.

#### - Save changes to update your timetable instantly.

### 7. Troubleshooting:

#### Common Issues:

#### - For login issues, check your credentials.

#### - Ensure a stable internet connection.

#### - Follow guidelines for optimal facial recognition.

#### 

#### Contacting Support:

#### - If issues persist, contact our support team through the provided channels.

#### - Include relevant details to expedite the resolution process.

#### 

#### Thank you for choosing Estudent! Explore the features, stay organized, and make the most of your academic journey.

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# Appendix

## A. Electronic Student ID Card Project Features

### 1. Facial Recognition Through NFC

#### - Description: The system employs NFC technology for facial recognition to authenticate students' identities.

#### - Implementation Details: [Brief description of how the facial recognition through NFC is implemented.]

### 2. Student Timetable Reader

#### - Description: The system provides students with easy access to academic schedules and notifies them of upcoming classes and appointments.

#### - Implementation Details: [Brief description of the implementation of the student timetable reader.]

### 3. Pickup Services Integration

#### - Description: The system integrates transportation services into the electronic ID card, providing students with easy access to transportation services.

#### - Implementation Details: [Brief description of how pickup services are integrated into the ID card.]

### 4. User-Friendly Interface

#### - Description: The system has a simple and intuitive user interface for easy navigation and use by students and staff.

#### - Implementation Details: [Brief description of the user interface design and features.]

## B. Electronic Student ID Card System Functional Requirements

### 1. Facial Recognition Authentication

#### - Requirement: The system should authenticate the identity of the student using facial recognition through NFC.

#### - Implementation Details: [Brief description of how the facial recognition authentication is implemented.]

### 2. Accessing Academic Schedule

#### - Requirement: The system should display the student's academic schedule and notify them of upcoming classes and appointments.

#### - Implementation Details: [Brief description of how the academic schedule functionality is implemented.]

### 3. User-Friendly Interface

#### - Requirement: The system should be easy to use and navigate, with a user-friendly interface.

#### - Implementation Details: [Brief description of how the user-friendly interface is designed and implemented.]

## C. Quality Attributes for the Electronic Student ID Card System

### 1. Performance

#### - Description: The system should be fast and efficient, providing quick access to critical services.

#### - Implementation Details: [Brief description of measures taken to ensure system performance.]

### 2. Security

#### - Description: The system should be secure, protecting students' personal and academic information.

#### - Implementation Details: [Brief description of security measures implemented in the system.]

### 3. Usability

#### - Description: The system should have a simple and intuitive user interface for easy navigation.

#### - Implementation Details: [Brief description of usability features implemented.]

### 4. Reliability

#### - Description: The system should be reliable and available at all times, with minimal downtime.

#### - Implementation Details: [Brief description of measures taken to ensure system reliability.]

## D. Timetable Module Implementation Timeline

### 1. Initial Development

#### - Development of the facial recognition module, including training the model and implementing the recognition algorithm.

#### - Creation and deployment of the database for storing facial data with encryption and authentication measures.

#### - Thorough testing and validation of the facial recognition module.

### 2. Timetable Functionality

#### - Development of the generic timetable module for accessing academic schedules through the electronic ID card app.

#### - Thorough testing of the timetable module to ensure accurate and reliable access.

### 3. Mobile App Integration

#### - Design and development of a mobile app complementing the electronic ID card system.

#### - Integration of the mobile app with facial recognition, NFC, and timetable modules.

#### - Comprehensive testing of the integrated mobile app.

## E. High-Level Use Cases for the Electronic Student ID Card Project

### 1. Facial Recognition Authentication

#### - Actors: Student, System

#### - Description: The system authenticates a student's identity using facial recognition when presenting the electronic ID card.

#### - Actions: Student presents ID card, System captures and verifies facial features, Access granted/denied.

### 2. Accessing Academic Schedule

#### - Actors: Student, System

#### - Description: Students can access their academic schedules through the electronic ID card app.

#### - Actions: Student interacts with the app, System retrieves and displays academic schedule.

### 3. Mobile App Functionality

- Actors: Student, System

- Description: The mobile app complements the ID card system, providing additional functionalities.

- Actions: Student interacts with the mobile app, System processes requests and updates.

## F. Timetable Module Use Cases in Tabular Form

## G. Quality Attributes for the Electronic Student ID Card System

### 1. Performance

#### - Description: The system should be fast and efficient, providing quick access to critical services.

#### - Implementation Details: [Brief description of measures taken to ensure system performance.]

### 2. Security

#### - Description: The system should be secure, protecting students' personal and academic information.

#### - Implementation Details: [Brief description of security measures implemented in the system.]

### 3. Usability

#### - Description: The system should have a simple and intuitive user interface for easy navigation.

#### - Implementation Details: [Brief description of usability features implemented.]

### 4. Reliability

#### - Description: The system should be reliable and available at all times, with minimal downtime.

#### - Implementation Details: [Brief description of measures taken to ensure system reliability.]

## H. Facial Recognition Module Connection with Firebase

### 1. User Authentication

#### - Description: Firebase Authentication manages user sign-ups and logins, associating each student with a unique Firebase authentication UID.

### 2. Image Storage

#### - Description: Captured face images are securely stored in Firebase Storage, ensuring accessibility and backup.

### 3. User Data Management

#### - Description: Firebase Realtime Database stores additional user data, such as face ID and associated information.

### 4. Model Training Data

#### - Description: Trained facial recognition model data is securely stored in Firebase to facilitate consistent recognition across devices.

## I. Overexposed Light and Facial Recognition Accuracy

### 1. Challenges in Overexposed Light

#### - Description: Overexposed lighting conditions can impact facial recognition by causing loss of facial features, contrast issues, and uniform illumination.

### 2. Strategies to Improve Recognition in Overexposed Light

#### - Description: Utilize preprocessing techniques, advanced algorithms, dynamic thresholding, multi-modal biometrics, and image quality assessment to mitigate challenges in overexposed lighting.

## J. User Manual for EStudent Project

#### Refer to the provided User Manual document for comprehensive guidance on using the EStudent Project.

## K. References

#### Include references to all the sources, documents, and materials used in the project. Follow the citation style specified by your institution.

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