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Machine Learning: School Uniform Detection System

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Abstract: The rapid increasing demand in advent of technology needing to adopt to real-world instances, had led to the development of AI solutions for SEAIT in response for school uniform compliance. This study employs Machine Learning – School Uniform Detection System utilizing Incremental Process Model, an Agile Methodology that ensures systematic and adaptive presentation to system development. The system utilizes Machine Learning techniques, particularly camera vision, to accurately detect and fragment and confirm students' uniforms in real time. By increasingly innovating and refining the model, the development process enhances system acceptability and accuracy while answering challenges such as variations in lighting, posture, and uniform designs. The study involves image pigmentations, feature extraction, and deep learning algorithms, allowing efficient uniform detection with less human intervention. The system assists school admin in enforcing school policies, reducing manual workload. Future innovations may include integrating facial recognition for customized monitoring and improving model with a more extensive dataset. Thus, this study must be implemented.

Keyword: *Machine Learning, School Uniform Detection, Incremental Process Model, Computer Vision, Deep Learning, Feature Extraction, Image Processing, AI in Education, Uniform Compliance, Automated Monitoring.*

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I. INTRODUCTION

A. Rationale of the Study

The School Uniform Detection system aims to provide accurate and automated outfit detection, dress code compliance checking, and scalability. The outfit detection function of the system involves detecting specific colors, patterns, or logos associated with the school outfit, ensuring that the students are wearing the correct school uniform. The dress code compliance checking function of the system allows the system to check if the student's outfit is compliant with the school's dress code policy and flag any violations, providing a reliable and consistent solution for dress code enforcement in schools. The scalability function of the system ensures that it can scale to accommodate large numbers of students and multiple locations, as well as future upgrades and improvements to the system, making it flexible and adaptable for the changing needs of the school. Overall, the proposed system will provide a highly accurate and automated solution to the problem of dress code enforcement, which can benefit school administrators, teachers, and students alike.

Currently, the South East Asian Institute of Technology relies on manual inspections by teachers or staff members to ensure that students comply with the school's uniform policies. This process can be time-consuming, particularly in large schools with many students, and can result in inconsistent enforcement of the dress code policy. This can lead to some students violating the policy without consequences, while others are penalized. Additionally, some students may wear clothing that is not appropriate for a school setting, which can be disruptive to the learning environment and make other students feel uncomfortable. The implementation of a machine learning school outfit detection system can provide a more efficient, reliable, and consistent solution to enforce the school's uniform policies and dress code, ensuring a positive and equitable learning environment for all students.

South East Asian Institute of Technology faces several challenges when it comes to enforcing uniform policies and dress codes. (1) This inconsistency can lead to some students violating the policy without consequences, while others are penalized. (2) Some students may wear clothing that is not appropriate for a school setting, which can be disruptive to the learning environment and make other students feel uncomfortable. (3) These issues can negatively impact the school's learning environment, creating an unequal and potentially hostile atmosphere. (4) Schools struggle to gather data on how many students are inside the school campus which affects them to optimize the security measures. (5) The school lacks a comprehensive system that utilizes machine learning and advanced technology to monitor and analyze student uniform compliance and attendance effectively.

The proposed machine learning school outfit detection system offers several benefits for the South East Asian Institute of Technology Firstly, the system provides a highly accurate and automated solution to the problem of dress code enforcement, eliminating the need for time-consuming manual inspections. This can free up staff members' time for other tasks, ultimately increasing productivity and efficiency. Secondly, the system can ensure consistent enforcement of dress code policies, creating a fair and equitable learning environment for all students. This can prevent any feelings of inequality or discrimination arising from different interpretations of the dress code policy. Finally, the system can help prevent disruptive behavior and ensure that all students are adhering to the school's dress code policies, creating a more positive learning environment for everyone. Overall, the implementation of the proposed machine learning school outfit detection system can have a significant impact on the school's operations, improving productivity, consistency, and creating a positive and fair learning environment for all students.

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B. Objectives of the Study

➢ *General Objectives*

The Researcher aims to study and develop the Machine Learning – School Uniform Detection System for South East Asian Institute of Technology, Inc.

➢ *Specific Objectives:*

- The system will be able to perform real-time school uniform detection.
- The system will be able to classify uniforms by gender.
- The system will be able to count the number of people entering and exiting the school.
- The system will be able to detect anomalies, such as non-uniformed individuals.
- The system will be able to provide dashboard analytics for compliance and population trends.

C. Scope and Limitation of the Study

➢ *Scope of the Study*

- Real-time School Uniform Detection: The system can detect in real time whether a student is wearing a school uniform or not.
- Uniform Classification: The system classifies uniforms by type, distinguishing between boys' and girls' uniforms.
- People Counter: Integrated with the detection system, the system includes a people counter to track the number of individuals within the school premises, ensuring accurate and real-time data on school occupancy.
- Scalability: The system is designed to scale efficiently, ensuring that it can accommodate the growth in the number of students and locations while maintaining its performance and accuracy.
- Anomaly Detection: The system is capable of identifying irregularities or anomalies, such as students not wearing the required uniform, even under suboptimal conditions like poor lighting or image angles.

D. Limitations of the Study

The proposed system may face limitations in detecting compliance with dress code policies that do not rely on a specific uniform pattern. Additionally, training custom YOLOv8 models cannot be performed easily, as it requires thorough data gathering, meticulous data annotation, and extensive training. YOLOv8 also requires a decent CPU and GPU to perform detections accurately and efficiently, especially for maintaining a high frame rate (FPS) during live webcam feeds. And also, environmental factors such as lighting, camera angles, and image quality can affect the system's accuracy, potentially leading to false positives or false negatives. Furthermore, implementing the system may require substantial hardware and software resources, which could result in high costs.

E. Significance of the Study

The machine learning school uniform detection system is a significant tool for schools to enforce dress code policies. By automating the process of dress code enforcement, the system provides a reliable and consistent solution to ensure that students are adhering to the school's dress code policies, and it will help to give advantages to the following:

- **South East Asian Institute of Technology, Inc.:** The system will enhance the school's ability to enforce uniform compliance among students, fostering a more disciplined and respectful learning environment. By integrating advanced computer vision technology, the school can effectively monitor adherence to dress code policies, promoting a sense of unity and identity among students.
- **School Guards:** The system will streamline the identification process, allowing school guards to monitor uniform compliance efficiently. This will enhance overall school management and ensure that students adhere to dress codes.
- **Students:** The system will promote a sense of belonging and identity among students by enforcing uniform policies. Additionally, students will benefit from improved organization and creating a more focused learning environment.
- **Researchers:** The development of this system offers researchers an opportunity to explore advanced computer vision techniques, such as YOLOv8, in a practical context. It serves as a platform for investigating the applications of machine learning in educational settings, contributing to academic knowledge and professional growth.
- **Future Researchers:** The system can serve as a valuable foundation for future research in the areas of computer vision, machine learning, and educational technology. The system's architecture, algorithms, and data analysis techniques can be adapted and expanded upon to develop more sophisticated and advanced applications.

F. Flow of the Study

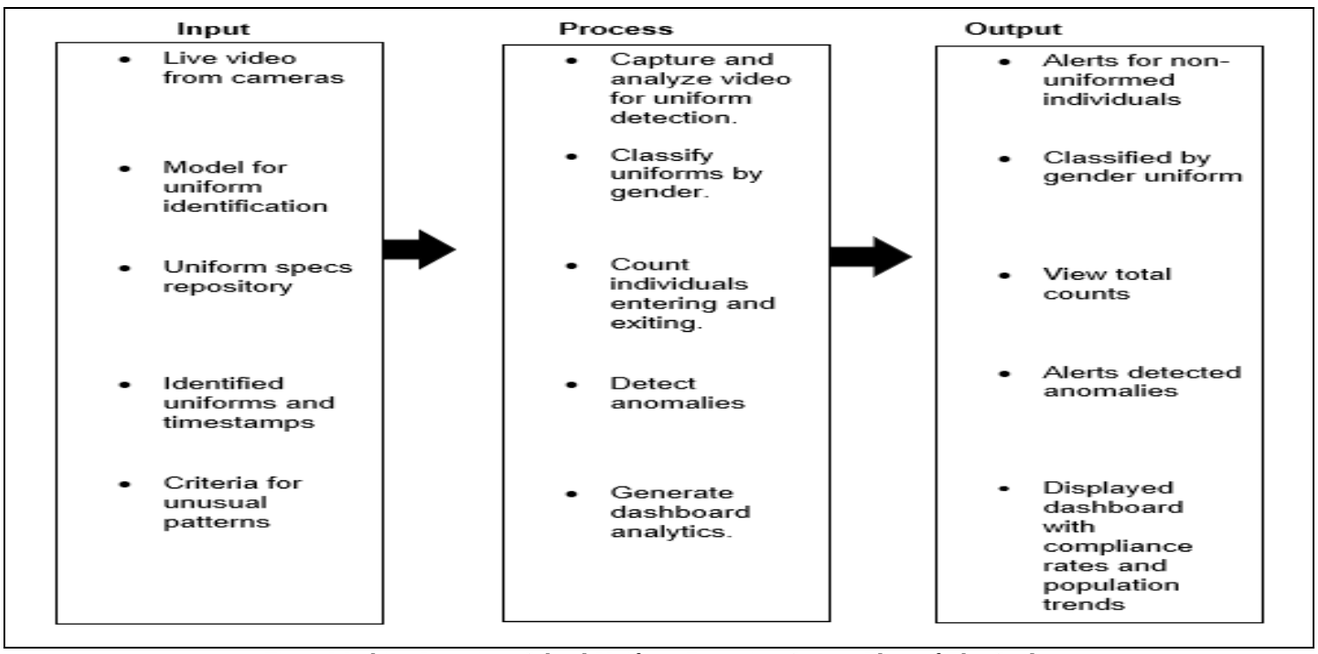

Fig 1: Machine Learning- School Uniform Detection System Flow of The Study.

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G. Definition of Terms

This section provides clear and concise explanation of key concepts, terminology, or specialized terms used throughout the paper. This section serves to establish a shared understanding of the language and terminology specific to the research topic.

- **Back End** – is the data and infrastructure that make your application work. It stores and processes application data for your users.
- **Central Processing Unit (CPU)** - is the processor that orchestrates the flow of data and instructions between different computer components.
- **Computer Vision** - is a field of artificial intelligence (AI) that uses machine learning and neural networks to teach computers and systems to derive meaningful information from digital images, videos and other visual inputs—and to make recommendations or take actions when they see defects or issues.
- **Front End** - is what your users see and includes visual elements like buttons, checkboxes, graphics, and text messages. It allows your users to interact with your application.
- **Graphics Processing Unit (GPU)** - is a specialized electronic circuit initially designed for digital image processing and to accelerate computer graphics.
- **Machine Learning (ML)** - is a subset of artificial intelligence that enables a system to autonomously learn and improve using neural networks and deep learning, without being explicitly programmed, by feeding it large amounts of data.
- **Object Detection** - is a technique that uses neural networks to localize and classify objects in images. This computer vision task has a wide range of applications, from medical imaging to self-driving cars.
- **Real-Time Processing** - is the process of analyzing data to create insights in real time. When raw data is received, it is immediately processed to empower near-instant decision-making.
- **Training Data** - is the data you use to train an algorithm or machine learning model to predict the outcome you design your model to predict.
- **YOLOv8** - is a cutting-edge object detection model known for its impressive speed and accuracy. It stands for “You Only Look Once,” meaning it can identify all objects in an image with just a single forward pass.

II. REVIEW OF RELATED LITERATURE AND STUDIES

This chapter presents the various related studies and professional literature to provide the background for discussion and analysis of the findings of the present investigation made use of books, publications, studies that have some bearings on our course.

A. Foreign Literature

➢ *Monitoring Attendance and Checking School Uniforms Using YOLOv8*

The performance of students is affected by various factors, including attendance tracking and school uniform checking. This study develops a system for automatically tracking student attendance and checking school uniforms using the pre-trained YOLOv8-based models. The system consists of six models: YOLOv8Students for detecting humans, YOLOv8Face and ArcFace for identifying students, YOLOv8Shirts and YOLOv8Pants for detecting and predicting types of shirts and pants, respectively, and YOLOv8Card for detecting student ID cards. Our research addresses practical concerns in educational institutions. The experimental results show that the models perform fairly well in optimal lighting conditions. (Khang Lam, 2023)

➢ *Verification of Student Uniform by Convolutional Neural Network through Images*

According to (Long Hoang, 2024) school uniforms have been present for a long time in countries worldwide as a distinctive cultural feature within educational environments. In Vietnam, school uniforms have also been in existence for a consider- able period, particularly in major cities, gradually becoming widespread across the country. The act of students wearing uniforms not only signifies a cultural beauty within educational institutions but also encapsulates various meanings. Uniforms foster a sense of camaraderie among students, demonstrating a spirit of unity within a collective. Therefore, adhering to the uniform policy has become a mandatory regulation in Vietnamese schools. Artificial Intelligence (AI) is a forefront technological domain, crucial in aiding humans to address numerous issues across various sectors such as manufacturing, healthcare, education, and more. It stands out for its ability to learn autonomously and enhance accuracy through self-gathering data without requiring explicit programming. Relying solely on object features, AI can provide precise identification and classification results through real-life image capture. Currently, the inspection of student uniforms is manually conducted using the naked eye. This process consumes a lot of time, effort, and productivity is not high. Applying technology, especially artificial intelligence, to automate the inspection of student uniforms is an optimal solution to address the current issue. Therefore, we have developed an algorithm to recognize and detect whether students are wearing their uniforms correctly or not. Real world evaluations have shown that the accuracy of the algorithm reaches 91% and it can be further developed for practical applications.

➢ *Detection of CIT-U Engineering Students Uniform in Video Sequences in a Controlled Environment*

According to (Gerbo Notsil, 2024) Implementing a dress code or school uniform policy can help prevent the display of gang colors, thereby reducing associated conflicts and fostering a safer environment. It also contributes to decreasing violence and theft by promoting a unified appearance, which minimizes competition over fashion. By instilling discipline among students, these policies encourage a sense of respect and responsibility. Additionally, they reduce the need for administrators and faculty to act as "clothes police," allowing them to focus on education rather than monitoring attire. Such policies also reduce distractions in the classroom, helping students concentrate on their studies. A dress code or uniform can foster a sense of community, as it promotes equality and belonging. Lastly, it helps schools quickly recognize individuals who may not belong on campus, enhancing security.

B. Local Literature

➢ *A Machine Learning Pipeline for Aiding School Identification from Child Trafficking Images*

Child trafficking in a serious problem around the world. Every year there are more than 4 million victims of child trafficking around the world, many of them for the purposes of child sexual exploitation. In collaboration with UK Police and a non-profit focused on child abuse prevention, Global Emancipation Network, we developed a proof-of-concept machine learning pipeline to aid the identification of children from intercepted images. In this work, we focus on images that contain children wearing school uniforms to identify the school of origin. In the absence of a machine learning pipeline, this hugely time consuming and labor-intensive task is manually conducted by law enforcement personnel. Thus, by automating aspects of the school identification process, we hope to significantly impact the speed of this portion of child identification. Our proposed pipeline consists of two machine learning models: i) to identify whether an image of a child contains a school uniform in it, and ii) identification of attributes of different school uniform items (such as color/texture of shirts, sweaters, blazers etc.). We describe the

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data collection, labeling, model development and validation process, along with strategies for efficient searching of schools using the model predictions. (Anthony C. Roman, 2022).

- *A Machine Learning Approach for Uniform Intrusion Detection*

The "machine Learning Approach for Uniform Intrusion Detection" highlights the critical need for effective intrusion detection systems capable of identifying various types of cyber-attacks, including Denial of Service (DoS), Probe, Remote to Local (R2L), and User to Root (U2R) attacks. It emphasizes the potential of machine learning techniques to significantly enhance detection accuracy and provide a uniform approach to addressing cybersecurity threats. The research aims to develop a model that not only improves detection rates but also adapts to evolving attack patterns, thereby offering a robust solution for network security. In the context of increasing cyber threats, the introduction underscores the necessity for advanced detection methodologies to safeguard networks effectively. (Saurabh Devulapalli, 2021).

- *Uniform Detection*

The Uniform Detection project focuses on enhancing school security systems by identifying individuals on campus as students, staff, or outsiders based on their uniforms. It leverages computer vision technology to improve the identification process, which is crucial for maintaining a secure educational environment. By utilizing this model, schools can effectively monitor and manage access to their premises, ensuring that only authorized individuals are present. This approach not only helps prevent unauthorized access but also contributes to a safer atmosphere for students and staff, highlighting the importance of uniform detection in enhancing school safety through advanced technological solutions. (Roboflow Universe, 2021)

III. RELATED STUDIES

A. Foreign Studies

- *Uniform Detection Using Image Recognition Techniques*

In a study by (Zhao et al. 2021) image recognition and deep learning algorithms were used to automatically identify specific attire in surveillance footage to ensure compliance with dress codes in workplace environments. Their system utilized convolutional neural networks (CNNs) to identify patterns, colors, and shapes associated with uniforms, achieving an accuracy rate of 92% in identifying compliance. The findings from this study highlight the feasibility of using image recognition for uniform detection, demonstrating the potential for similar approaches to be applied within school environments to enforce uniform policies.

- *Real-Time Video Processing for Security Monitoring*

(Nguyen and Tran, 2021) developed a system that analyzes live video feeds to detect specific actions or items. Their system was used to monitor retail environments for potential shoplifting by detecting suspicious behavior. The research demonstrates that real-time video processing and image recognition can be used to detect specific visual cues, suggesting similar techniques could be adapted for a School Uniform Detection System. This approach could ensure that students entering the school are adhering to uniform policies without the need for manual checks.

- *Facial Recognition and Attendance Systems in Schools*

(Chen and Wang, 2020) implemented a facial recognition-based attendance system in a high school to automate roll-call processes and enhance security. Their system used deep learning to identify students and track their attendance automatically, proving effective in reducing errors and saving time. The study provides a foundation for integrating multiple AI-based functions, such as uniform detection alongside attendance tracking, to streamline various monitoring tasks within schools. A combined system could potentially enhance overall school management and policy enforcement.

B. Local Study

- *Developing Image Recognition Tools for School Security in Public Schools*

This study, conducted in partnership with the Department of Education in Bulacan, tested an image recognition system for security purposes, designed to detect unauthorized entry onto school campuses. The system used CCTV feeds to identify students and staff, flagging unfamiliar individuals. Although the focus was on security, the study's findings support the broader application of image recognition for school policy enforcement, such as monitoring uniform compliance. (Romero, C., & De Guzman, S. 2021)

- *AI-Enhanced Surveillance for Campus Safety in Philippine Schools*

This study implemented an AI-based surveillance system at a university in Quezon City, aiming to improve campus safety and security. Using object detection and facial recognition, the system could identify unauthorized individuals and monitor adherence to campus rules, including wearing student IDs. While the primary focus was security, the research highlighted the potential for adapting similar AI-based surveillance to enforce dress code policies, suggesting its application for uniform detection in high schools. (Garcia, L., & Reyes, E. 2021).

- *Automated Uniform Compliance in Secondary Schools using Image Recognition*

(Dela Cruz, A., & Santos, M. 2021) developed a prototype system for detecting school uniform compliance in public high schools in Metro Manila using image recognition technology. The system utilized a basic convolutional neural network (CNN) model trained on images of students in uniform to identify cases of non-compliance. With an accuracy of 85%, the study demonstrated the potential for image recognition to automate uniform monitoring, significantly reducing the workload of school staff. This research provides a foundational approach to the use of AI in enforcing uniform policies within local school settings.

IV. RESEARCH AND METHODOLOGY AND DESIGN

This chapter described the methodologies used by the researchers to carry out the study. Methodology is a guiding approach for solving a problem, with specific components such as phases, tasks, methods, techniques and tools.

A. Environment

- *The Setting of the Study*

The study was conducted at South East Asian Institute of Technology, Inc., Tupi, South Cotabato.

B. Software Engineering Methodology

Incremental Process Model - The Agile Incremental Process Model was chosen as the initial methodology for developing the Machine Learning- School Uniform Detection System as its stages fit its development requirements.

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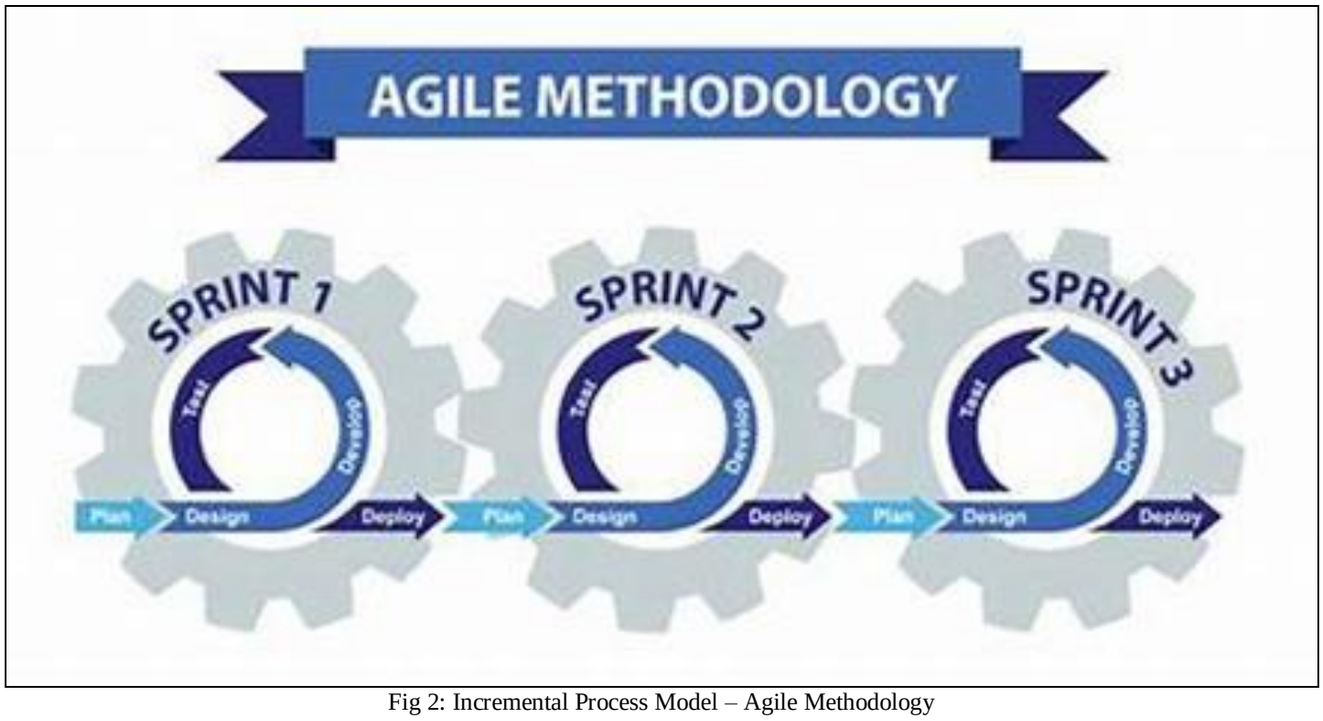

Fig 2: Incremental Process Model – Agile Methodology

The researchers identified the problem and found out that those problems need various features already enhanced in an existing web system. The researchers created a project title, and made objectives, scope, and schedules of the project.

➢ *Incremental Requirements*

The model will focus on developing the foundational elements of the system. The primary goal here is to build a simple machine learning model that can distinguish between students wearing school uniforms and those in casual attire. This will involve gathering a labeled dataset of student images, training a basic machine learning model (likely a convolutional neural network), and achieving initial classification. Alongside this, a basic user interface will be developed to allow users to upload images and see the results of the uniform detection. At this stage, the model will aim for a minimum detection accuracy of 70%, and the UI will be basic, focusing solely on functionality.

In addition, the focus will shift towards improving accuracy and incorporating a feedback mechanism. School administrators will be given the ability to provide feedback on the system's classifications, marking images as correct or incorrect. This feedback will be used to retrain and improve the machine learning model, refining its accuracy and performance over time. Additionally, this increment will involve optimizing the model through methods such as hyperparameter tuning and using a larger, more diverse dataset. The user interface will be enhanced to support the feedback loop, and overall system performance will be monitored to ensure incremental improvements in detection accuracy.

Moreover, the researchers will focus on expanding the system's capabilities and scaling it for broader use. At this stage, the system could be enhanced to handle multiple types of uniforms (e.g., summer and winter uniforms, or gender-specific variations). The system could also detect partial compliance, such as whether students are missing specific uniform components (e.g., shoes or ties). Additionally, batch processing for uploading and analyzing multiple images at once could be introduced. The user interface will undergo further refinements, making it more user-friendly and efficient. By the end of this increment, the system should be capable of handling a wide range of scenarios with higher accuracy and provide useful insights and reports for school administrators.

- *Build 1: Real-Time School Uniform Detection*

In the design and development of the real-time School Uniform Detection System, the primary focus will be on building a machine learning-based solution capable of accurately identifying and classifying school uniforms in live video streams. The design will center around the development of a robust architecture that can process video frames in real-time, using computer vision and deep learning techniques like convolutional neural networks (CNNs) to detect uniforms. The system will be designed to integrate with school security cameras, allowing for continuous monitoring at entry points, hallways, and other areas of the school.

During development, the ML model will be trained on a diverse dataset of images that include students wearing various uniform styles from different angles, lighting conditions, and environments. The system will process these images in real time, using video processing pipelines to break down video feeds into frames and feed them into the model. The architecture will prioritize low-latency processing, ensuring that detection is nearly instantaneous to provide timely alerts. Efficient GPU acceleration and optimization techniques, such as model pruning or quantization, will be employed to maintain high accuracy while minimizing computational costs.

The system will also be designed to allow for future expansion. For example, updates to the model or the system architecture can be rolled out seamlessly, ensuring that the system remains capable of handling new uniform styles or variations. Additionally, the system will include a user-friendly dashboard that displays real-time detection results, providing school administrators with immediate insights into compliance levels, while also enabling manual verification of detected anomalies.

- *Build 2: Gender-Based Uniform Classification*

The design and development of the gender-based uniform classification system will focus on enabling the machine learning model to not only detect uniforms but also classify them based on gender-specific designs. The design will incorporate additional classifiers that can distinguish between male and female uniform types, based on features such as uniform style, color, and associated accessories. The system must also handle cases where uniforms are ambiguous or gender-neutral, ensuring accurate classification while maintaining flexibility.

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For development, the machine learning model will be trained using a labeled dataset containing images of male and female uniforms. Feature extraction techniques, such as shape detection, color patterns, and garment type identification, will be employed to teach the model how to differentiate between genders. The development process will include fine-tuning the model to account for various uniform variations, such as different skirt or pant styles for females and males, and handling uniforms from different schools with unique designs.

Once the system is fully developed, it will be integrated into the larger real-time detection architecture, ensuring that gender classification occurs simultaneously with the uniform detection. The system's design will include a reporting feature that displays the number of male and female students detected in real-time, providing school administrators with important data for monitoring uniform compliance across different demographics.

- *Build 3: Counting People Entering and Exiting the School*

For the design and development of the people counting system, the focus will be on integrating a computer vision module that tracks individuals entering and exiting the school premises. The design will use a combination of object detection algorithms and tracking technologies to monitor foot traffic through designated entry points. This system will need to accurately detect and count individuals even in crowded settings, ensuring that it can differentiate between students and non-students, such as staff or visitors, based on detected uniforms.

The development process will involve creating a counting mechanism that leverages object tracking algorithms like Deep SORT or YOLO (You Only Look Once) to follow each person as they move through the camera's field of view. The system will be able to identify individuals entering and exiting specific zones, logging entry and exit events in real-time. The model will be optimized for accuracy, ensuring it can handle overlapping individuals and occlusions without double-counting or missing people.

The system will also incorporate an interface that provides real-time counts to school administrators, allowing them to monitor traffic flow at key locations like gates, doors, or hallways. The design will ensure that this data is securely logged and available for review, helping the school track attendance trends, monitor security, and identify any unusual patterns, such as large groups entering or exiting unexpectedly.

- *Build 4: Anomaly Detection (Non-Uniformed Individuals)*

In the design and development of the anomaly detection feature, the system will be able to identify individuals who are not wearing the required school uniform. The design will rely on the machine learning model's ability to differentiate between uniformed and non-uniformed individuals. The system will be trained to recognize a variety of uniform patterns and styles, while also flagging any deviations from these patterns as potential anomalies, such as students wearing casual clothes or unauthorized individuals entering the premises.

During development, the model will be enhanced to include an anomaly detection module that focuses specifically on identifying clothing that does not match the predefined uniform patterns. This will involve training the system on a wide range of clothing types that are not considered part of the school uniform, ensuring that the model can accurately detect deviations, even in complex environments. In real-time scenarios, the system will provide alerts when an anomaly is detected, allowing school staff to investigate further.

Additionally, the system will be designed to handle edge cases, such as students partially wearing uniforms (e.g., jackets or accessories covering the uniform). The development team will implement a threshold system that determines when an individual is sufficiently non-compliant to trigger an alert, ensuring that the system remains accurate and does not generate excessive false positives. This feature will integrate into the real-time dashboard, where school officials can view flagged individuals and take immediate action.

- *Build 5: Dashboard Analytics on Compliance and Population Trends*

The design and development of the dashboard analytics system will focus on providing school administrators with detailed insights into uniform compliance and population trends. The dashboard will be designed to present real-time data in a user-friendly, visual format, with key metrics such as the percentage of students wearing uniforms, the gender breakdown of uniforms, and the total number of individuals entering or exiting the school each day. Additionally, the dashboard will offer historical data for trend analysis, allowing administrators to track compliance over time.

During development, the system will be integrated with data visualization tools such as charts, graphs, and heatmaps to make the data easy to interpret. The dashboard will pull real-time data from the detection system, displaying key compliance statistics alongside population counts, gender classification, and anomaly reports. The development team will ensure that the system supports custom reporting, allowing administrators to filter data based on specific timeframes, locations, or categories, and export reports for further analysis or compliance checks.

The analytics dashboard will also include alerts and notifications, automatically flagging any periods of non-compliance or unusual activity. For example, if a significant number of students are detected not wearing uniforms, the system will generate an alert that can be escalated to school authorities. This ensures that the system not only provides valuable data but also acts as a proactive tool for maintaining uniform policies and monitoring school population dynamics.

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C. Planning/ Conception-Initiation Phase

- *Business Model Canvas*

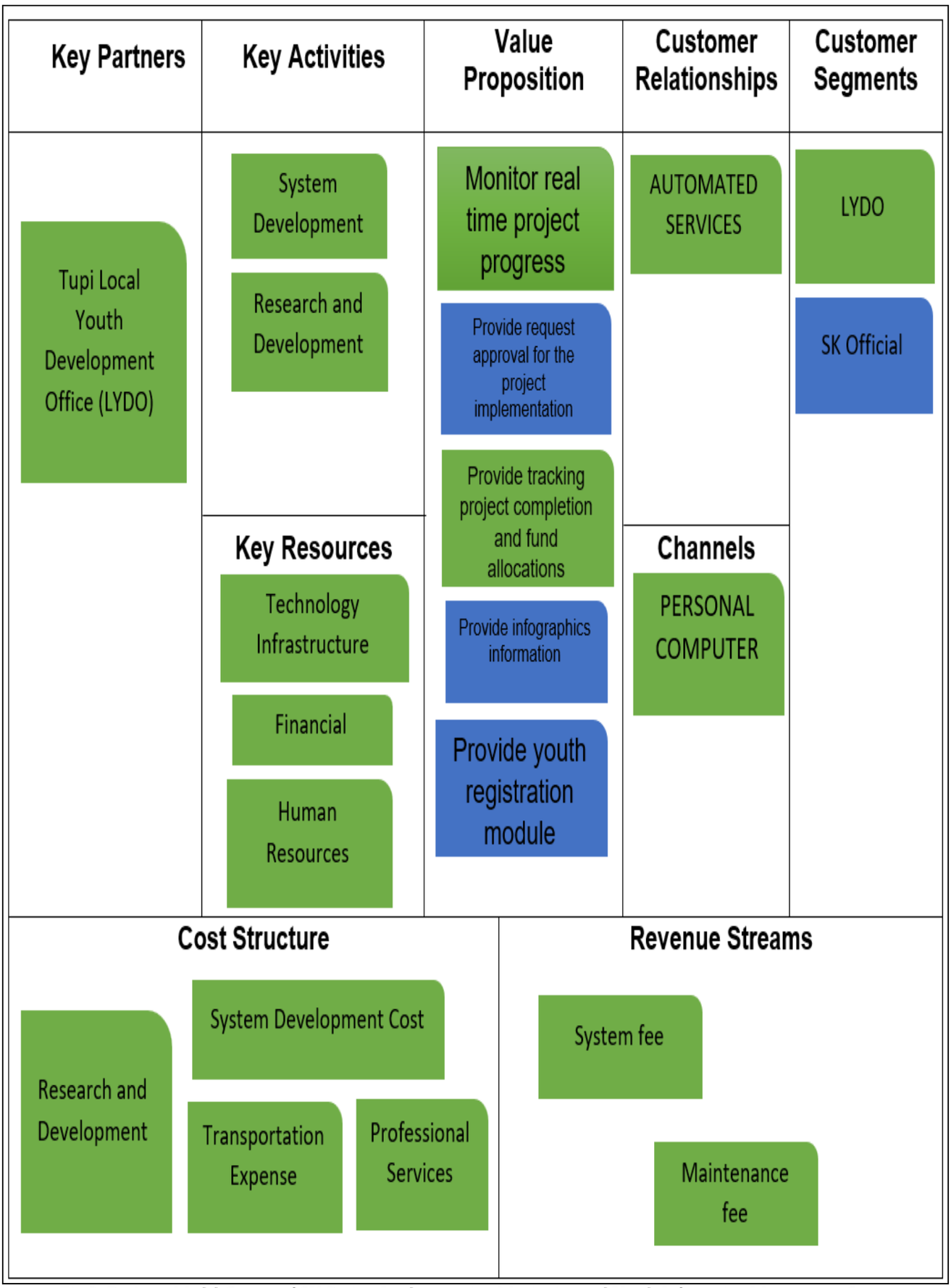

Fig 3: Business Model Canvas of SK Project Implementation Monitoring and Youth Information Management System

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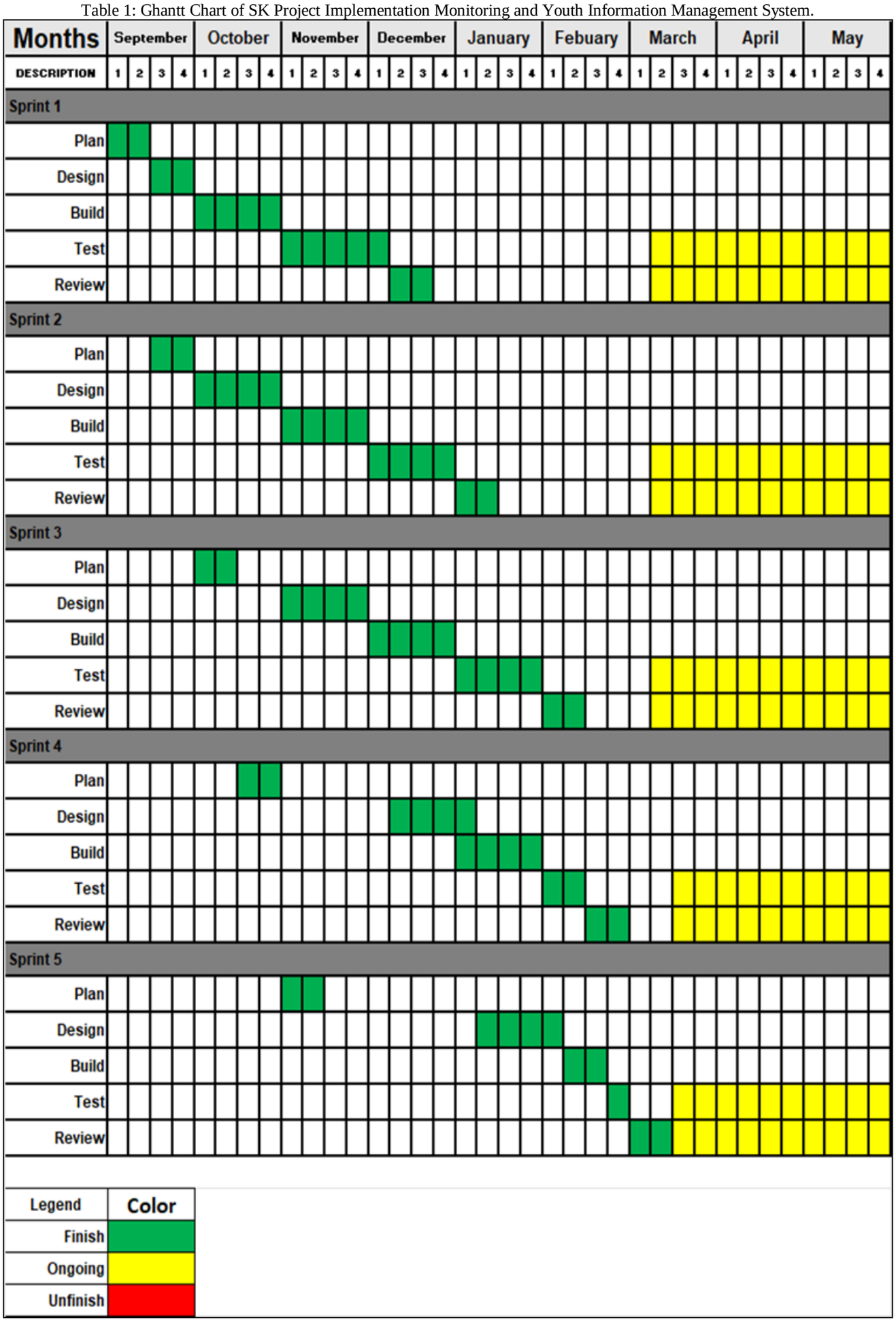
D. Gantt Chart

Table 1: Ghantt Chart of SK Project Implementation Monitoring and Youth Information Management System.



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E. Functional Decomposition Diagram

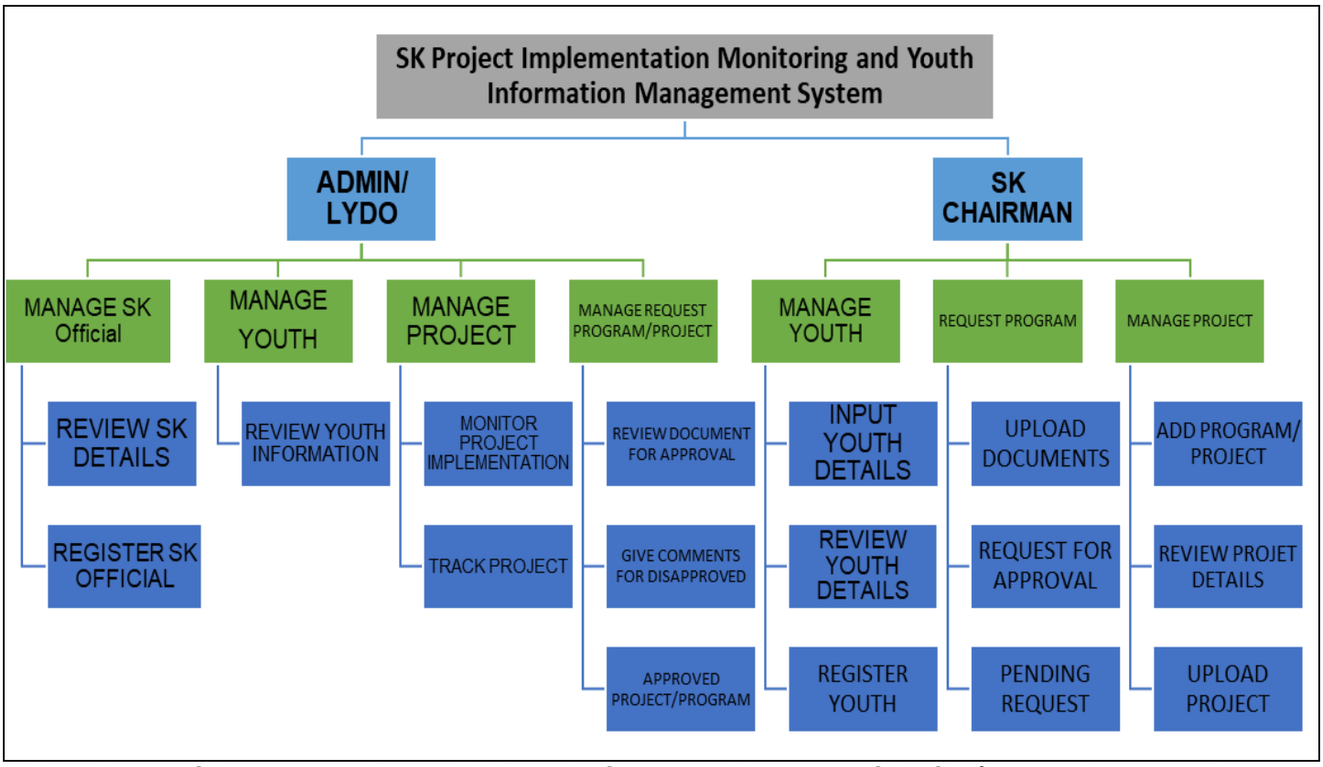

Fig 4: Functional Decomposition Diagram SK Project Implementation Monitoring and Youth Information Management System.

F. Analysis-Design Phase

➢ *Use Case Diagram*

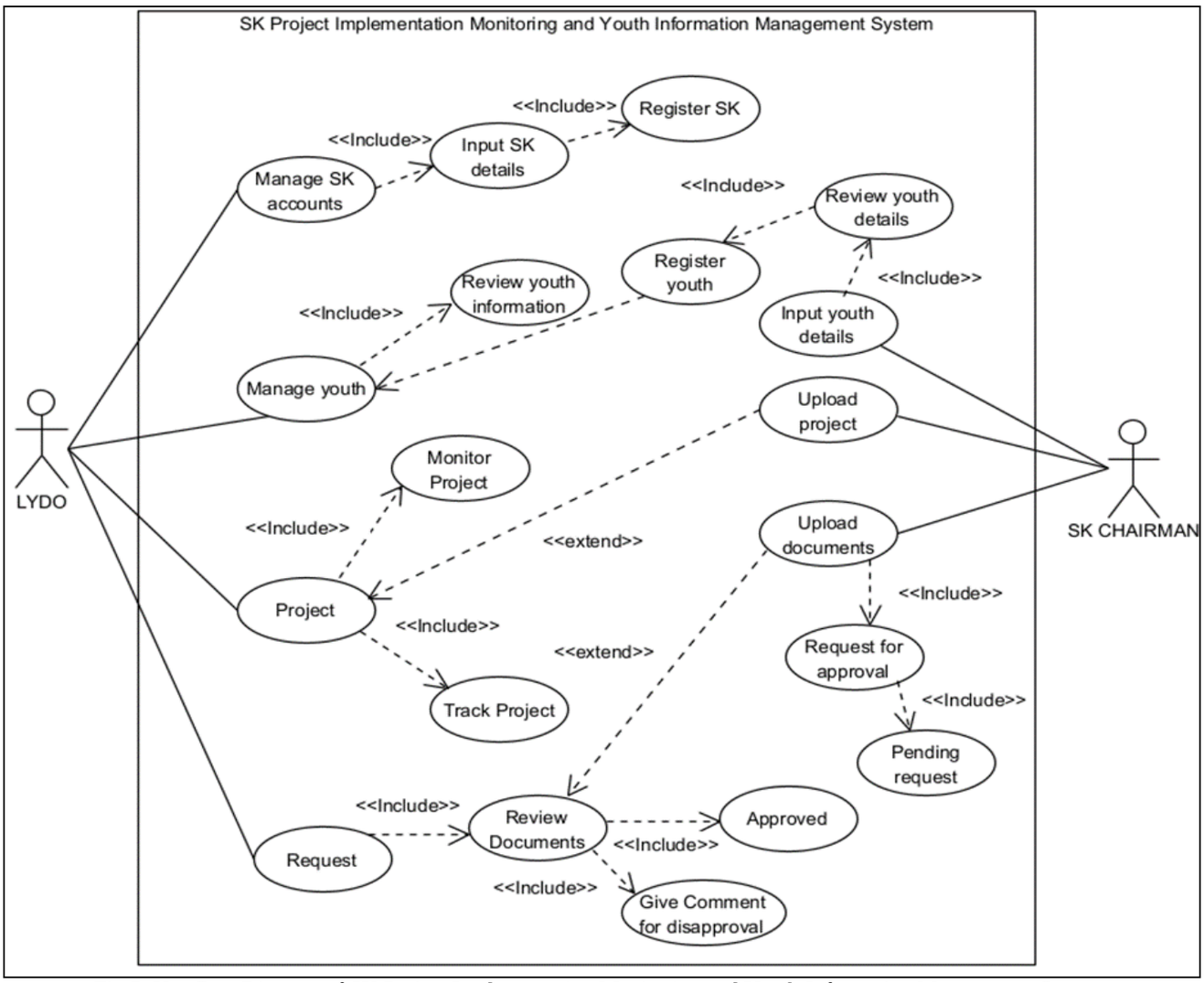

Fig 5: Use Case Diagram of SK Project Implementation Monitoring and Youth Information Management System.

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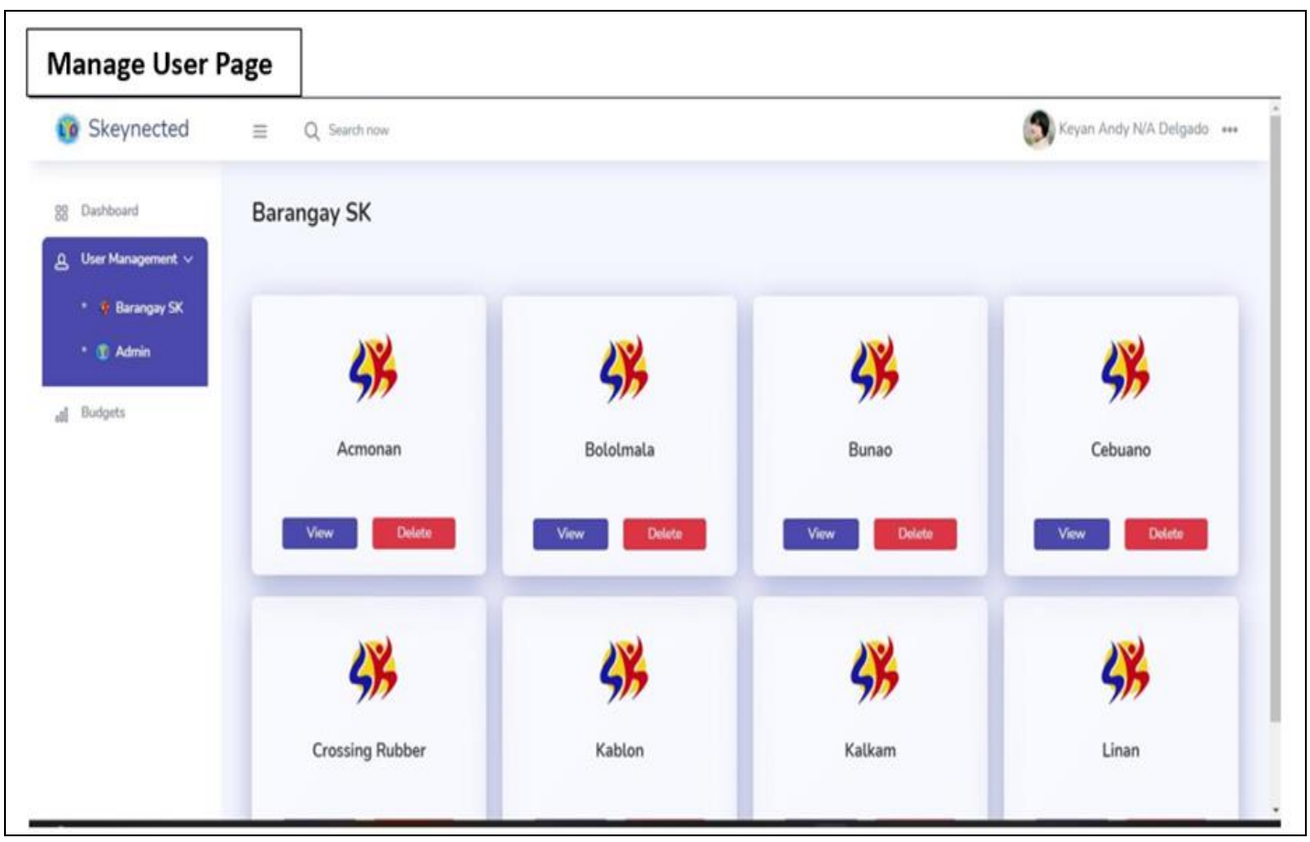
➢ *Use Case Matrix*

Table 2: SK Project Implementation Monitoring and Youth Information Management System Use Case Matrix

GENERAL CHARACTERISTICS	
Intent	To identify the purpose of the features that SK Project Implementation Monitoring and Youth Information Management System.
Scope	The scope of this Use Case is only intended for LYDO and SK.
Level	Administrative
Author	Hannah Michaela Gatinao, Gemma Marabiles and Francis Tinggal.
Last Update	October 10, 2024
Status	On Going
Primary Actor	Admin/LYDO
Secondary Actor	SK Chairman
Precondition	None
<Dynamic Precondition>	The admin must explore the system for them to memorize all the functions that run without having a problem.
Assumptions	All the Dynamic Preconditions are already running successfully
Triggers Event	Stored youth information Generate project for tracking and monitoring Provide access permission.
Success Post Condition	After the admin registered SK, all the function and features that based on the current problem was running successfully.
Basic Flow	Start wed system using Monitor program and project.
Failed Post Condition	SK Project Implementation Monitoring and Youth Information Management System 30-50% running.
<Model>	Use Case Matrix
Operation Concepts	In implementing this system, the system must run according to the features that the developers gathered while observing the current problem in the LYDO. Those function will be going to help the LDYO and SK to do their work and to reach the goals in recording the SK project monitoring and other modules.
Overview	All Characteristics are already functioning, analyzing all those common errors will make this system run successfully before implementing it.

G. Storyboard

➢ *LYDO Page*



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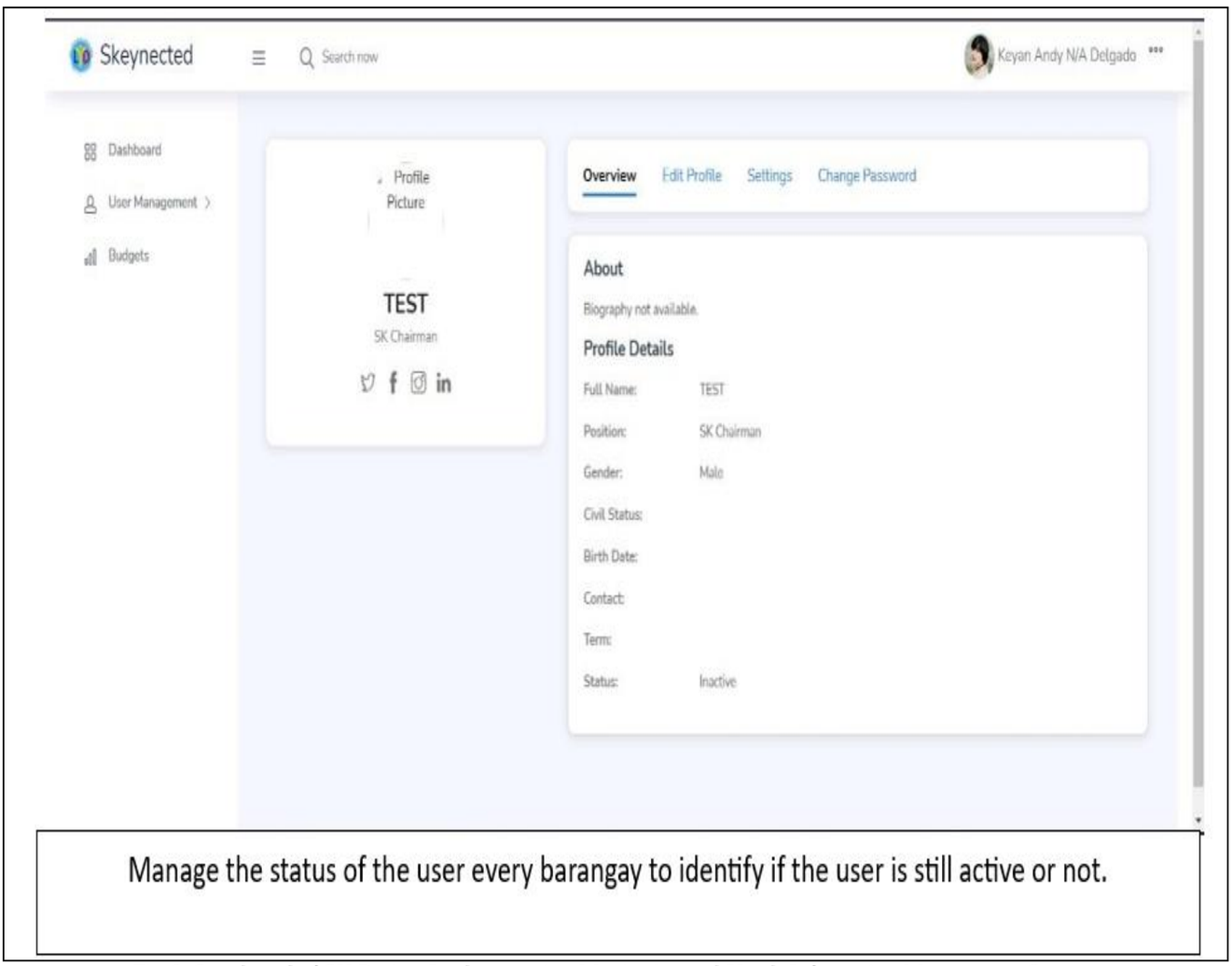

Fig 6: Storyboard of SK Project Implementation Monitoring and Youth Information Management System. Dashboard is a Visual Representation of Important Information

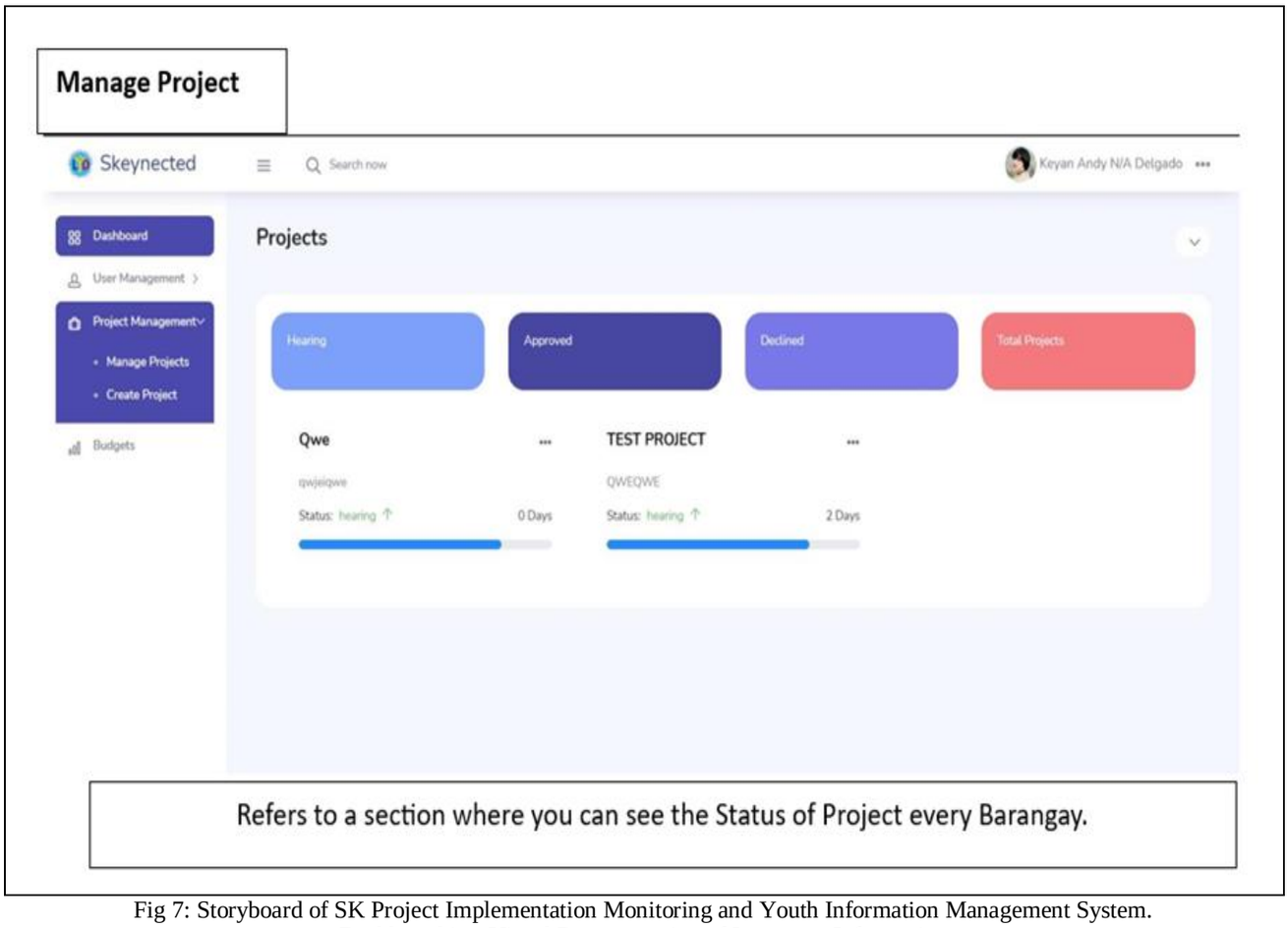

Fig 7: Storyboard of SK Project Implementation Monitoring and Youth Information Management System. Dashboard is a Visual Representation of Important Information

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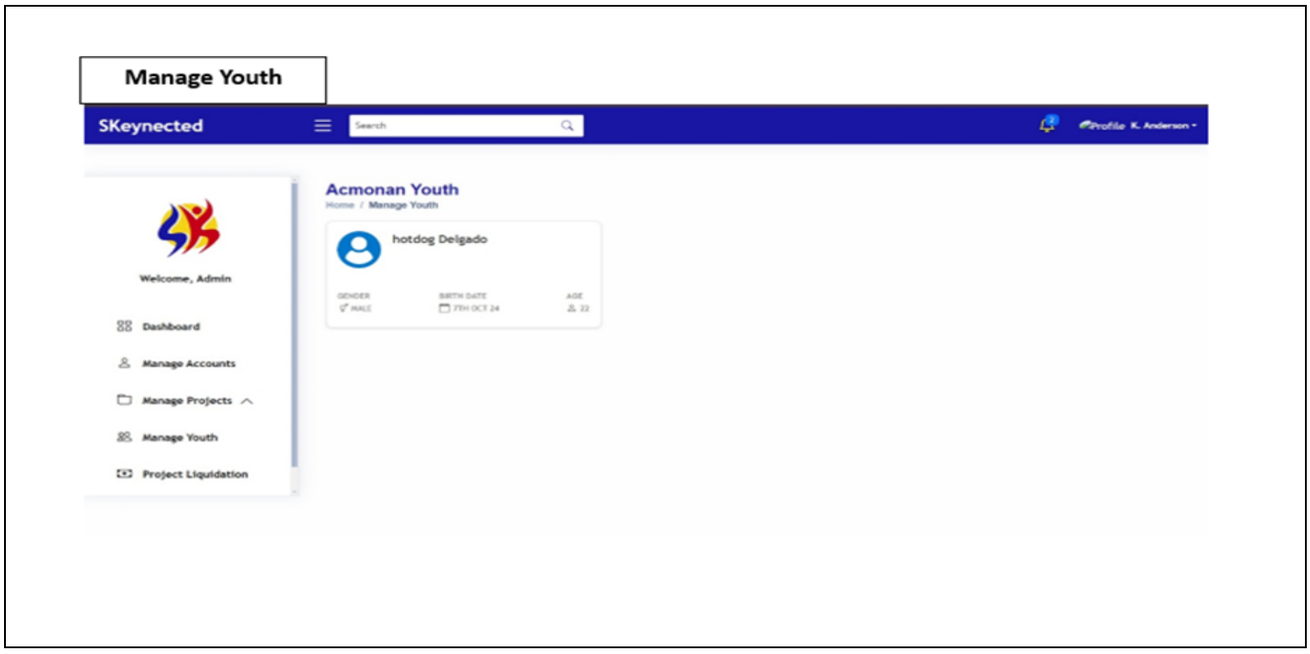
➢ *SK Page*



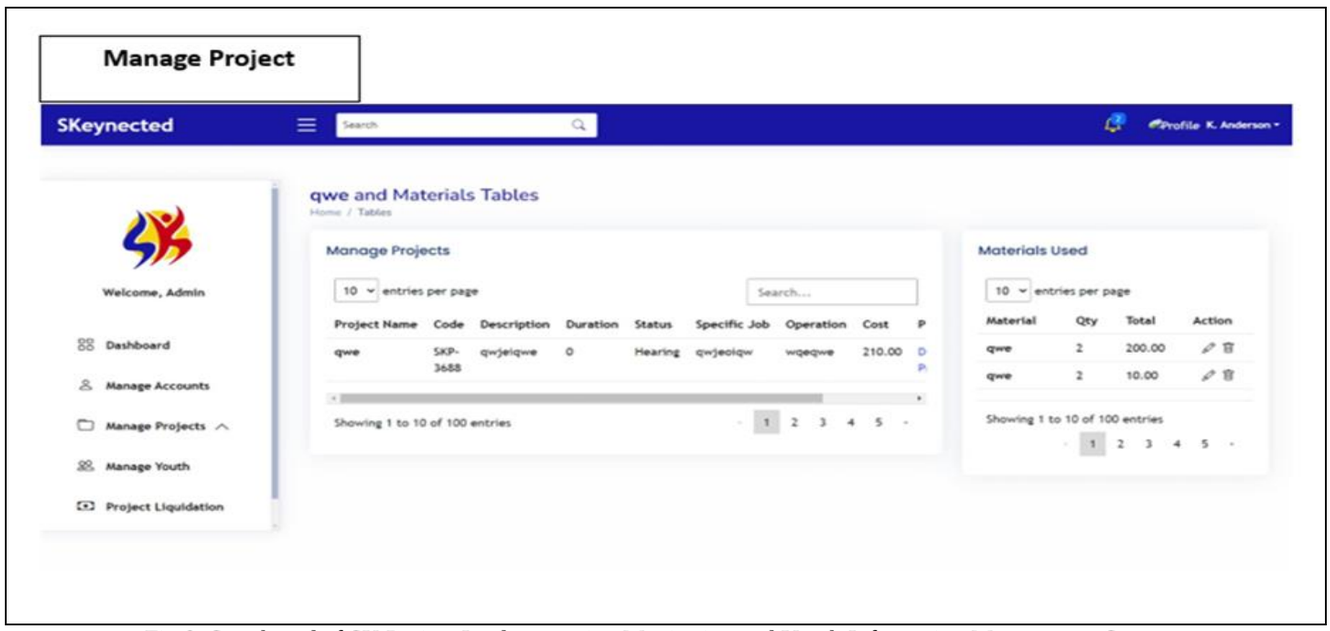


Fig 8: Storyboard of SK Project Implementation Monitoring and Youth Information Management System. Dashboard is a Visual Representation of Important Information

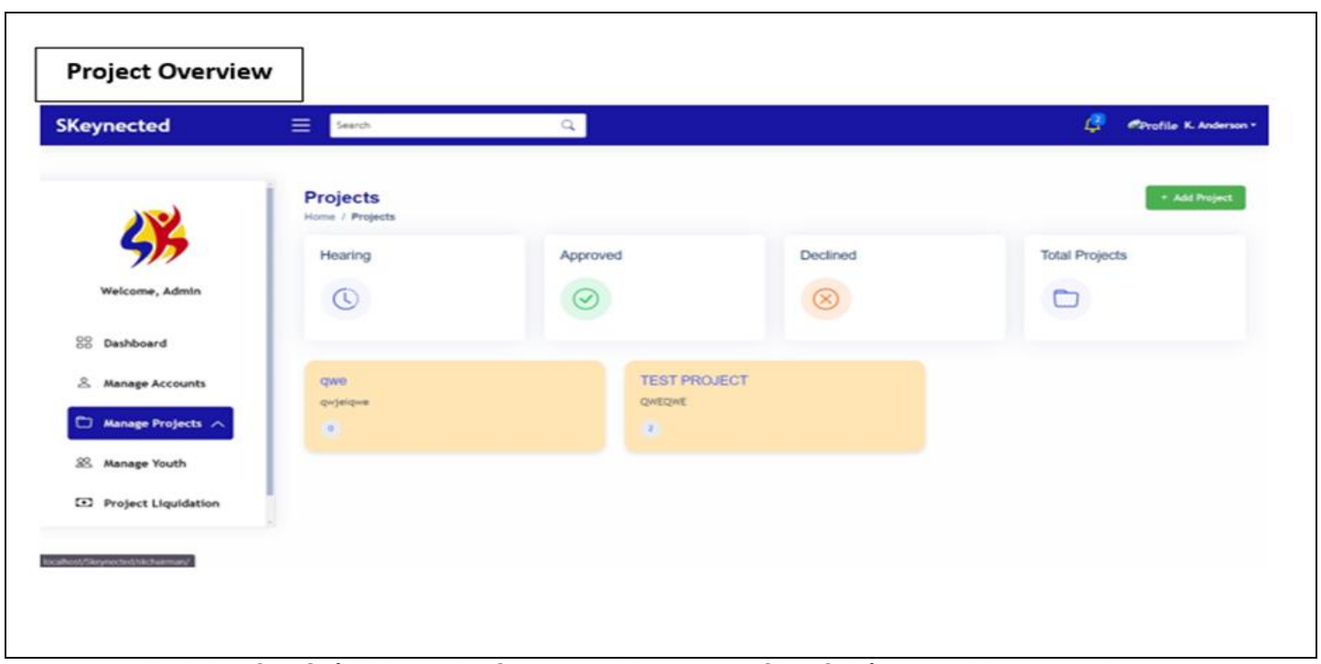


Fig 9: Storyboard of SK Project Implementation Monitoring and Youth Information Management System. Dashboard is a Visual Representation of Important Information

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➢ *Registration Forms Page*

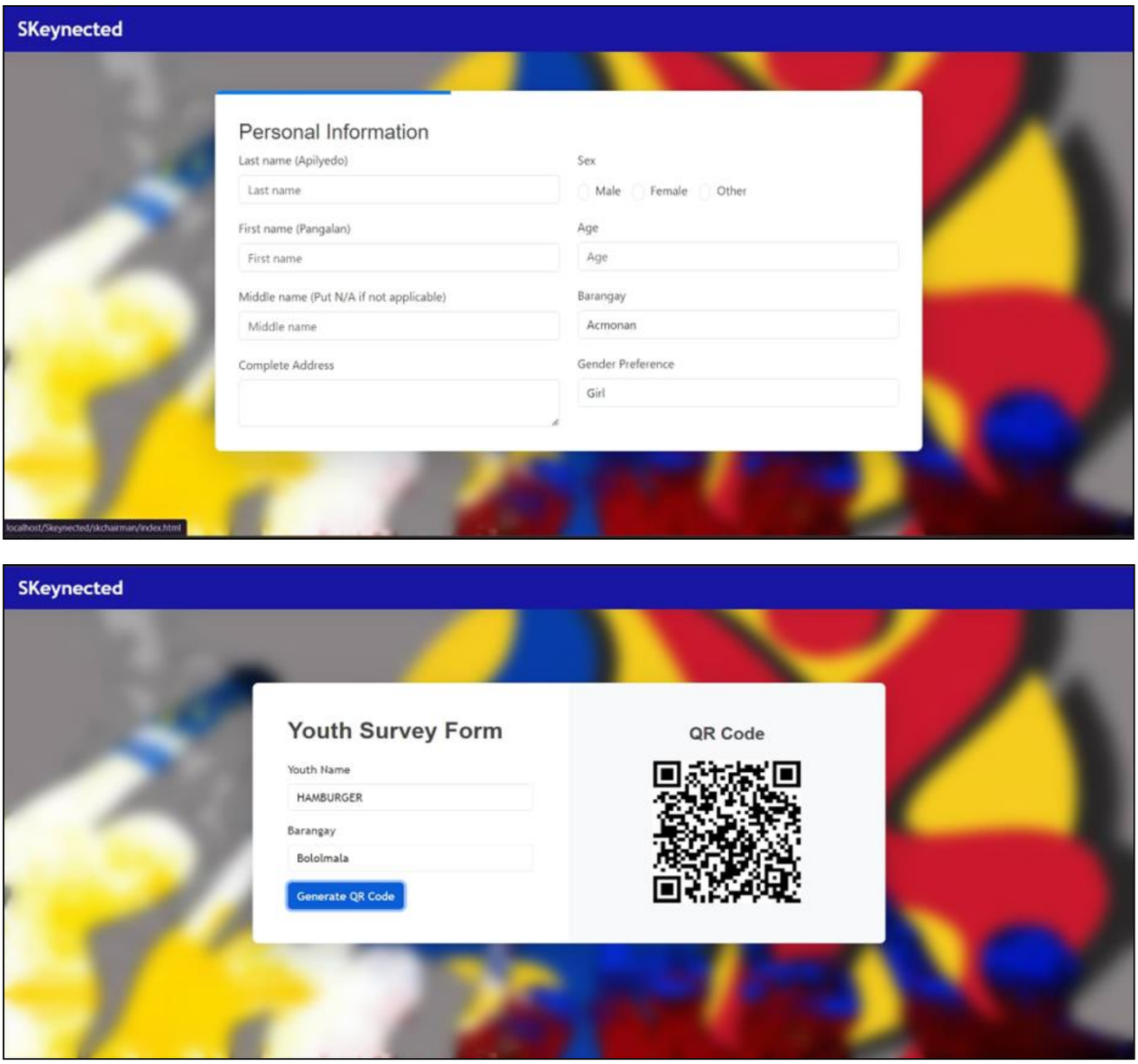
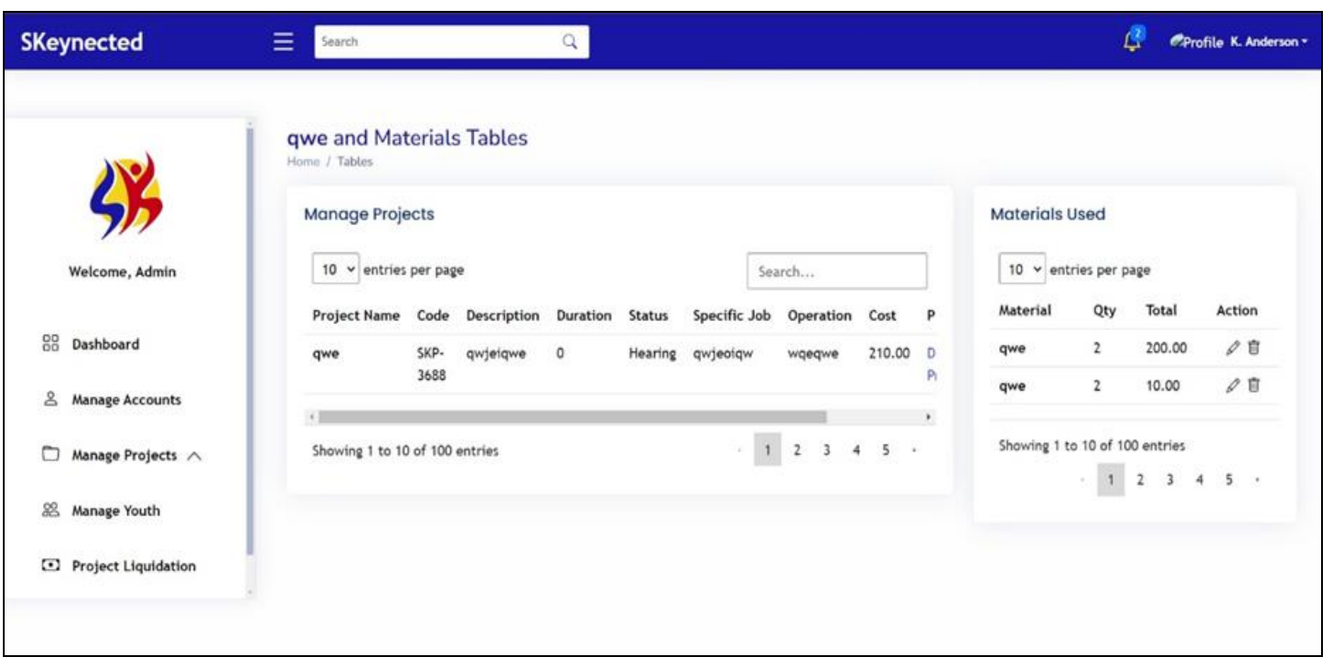


Fig 10: Registration Form Pages

➢ *Reports*



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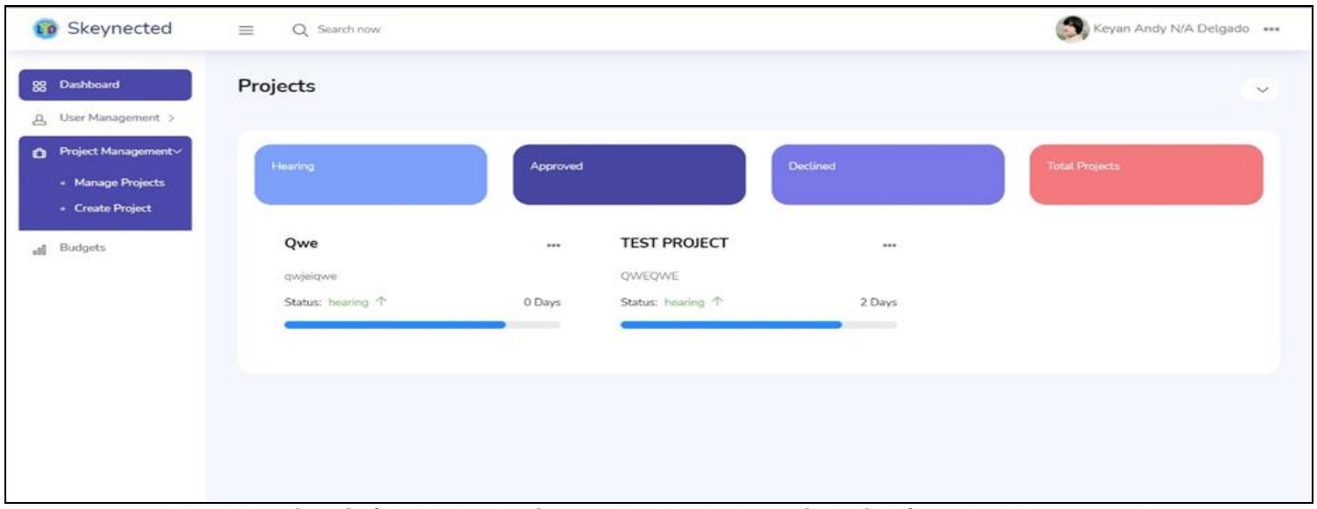

Fig 11: Storyboard of SK Project Implementation Monitoring and Youth Information Management System. Dashboard is a Visual Representation of Important Information

H. Class Diagram

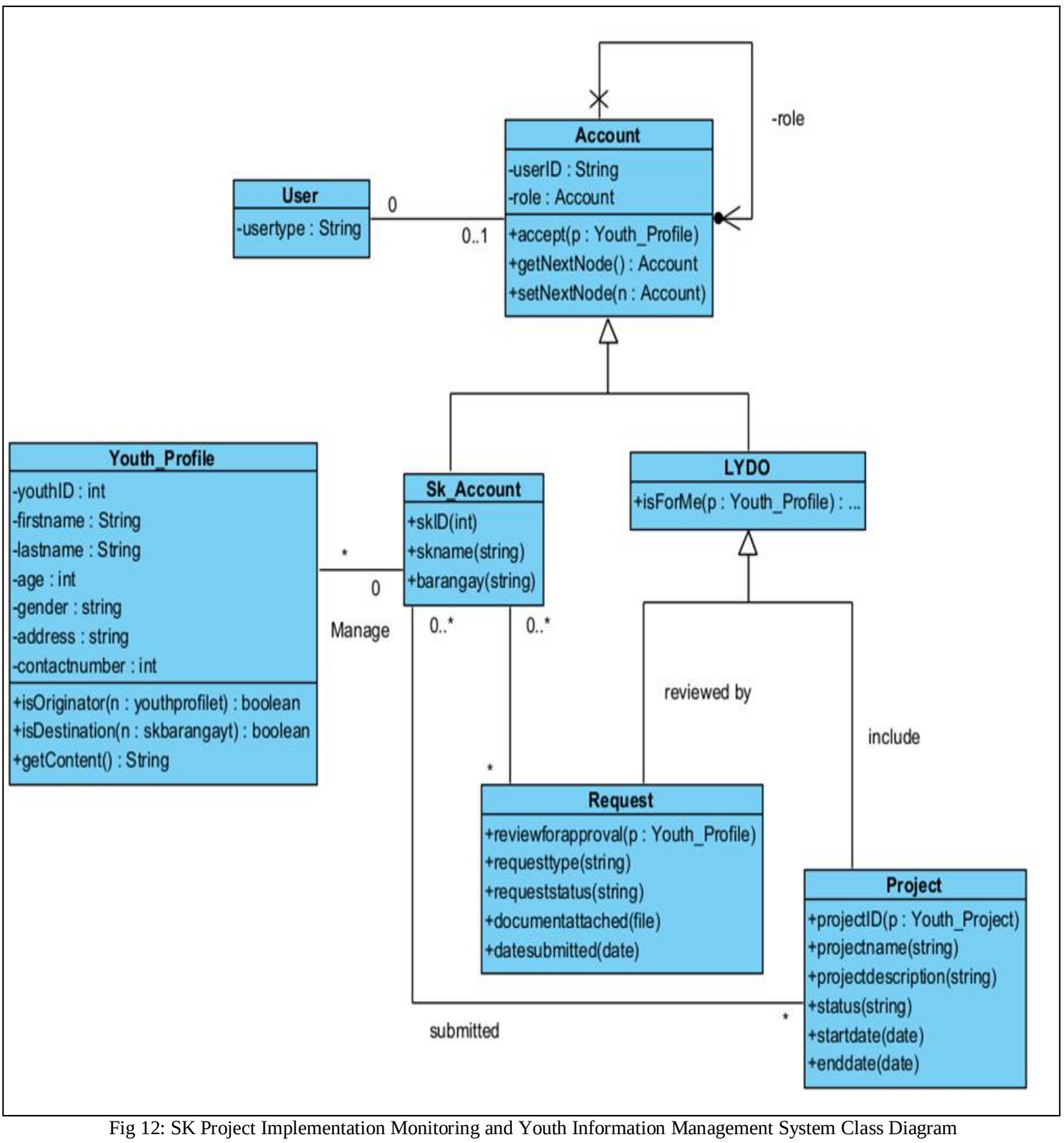

Fig 12: SK Project Implementation Monitoring and Youth Information Management System Class Diagram

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I. Sequence Diagram

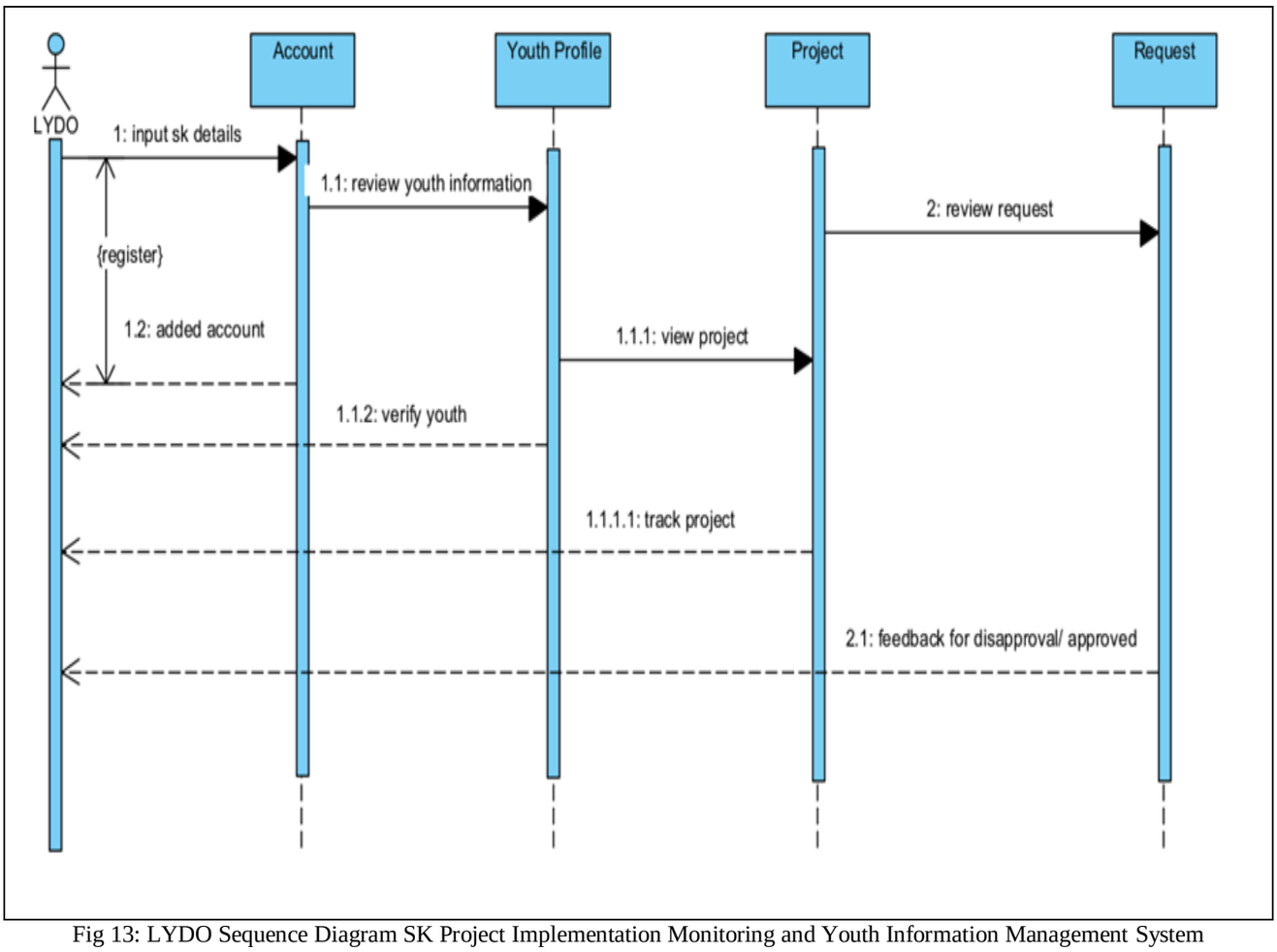

Fig 13: LYDO Sequence Diagram SK Project Implementation Monitoring and Youth Information Management System

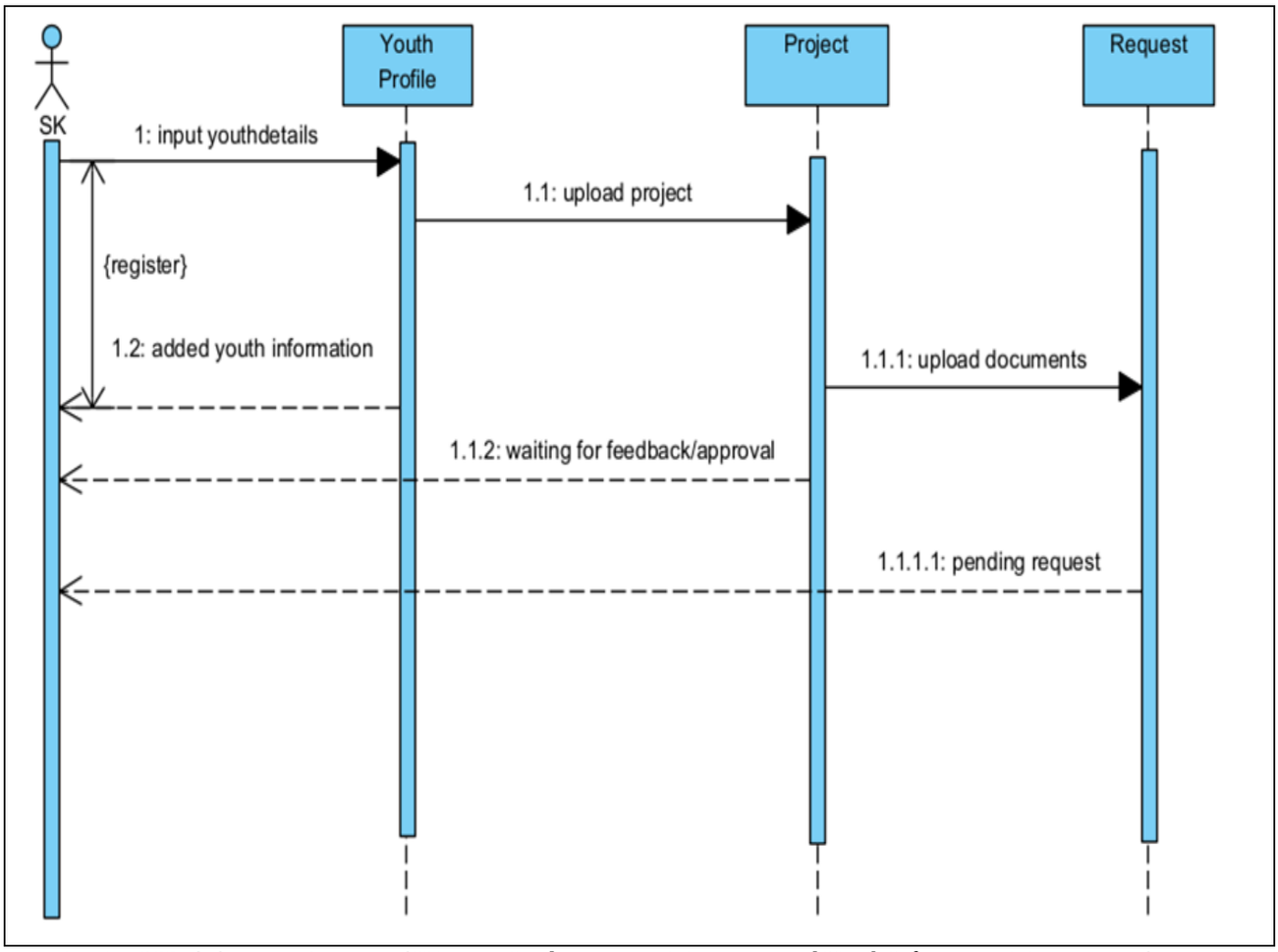

Fig 14: LYDO Sequence Diagram SK Project Implementation Monitoring and Youth Information Management System

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J. Activity Diagram

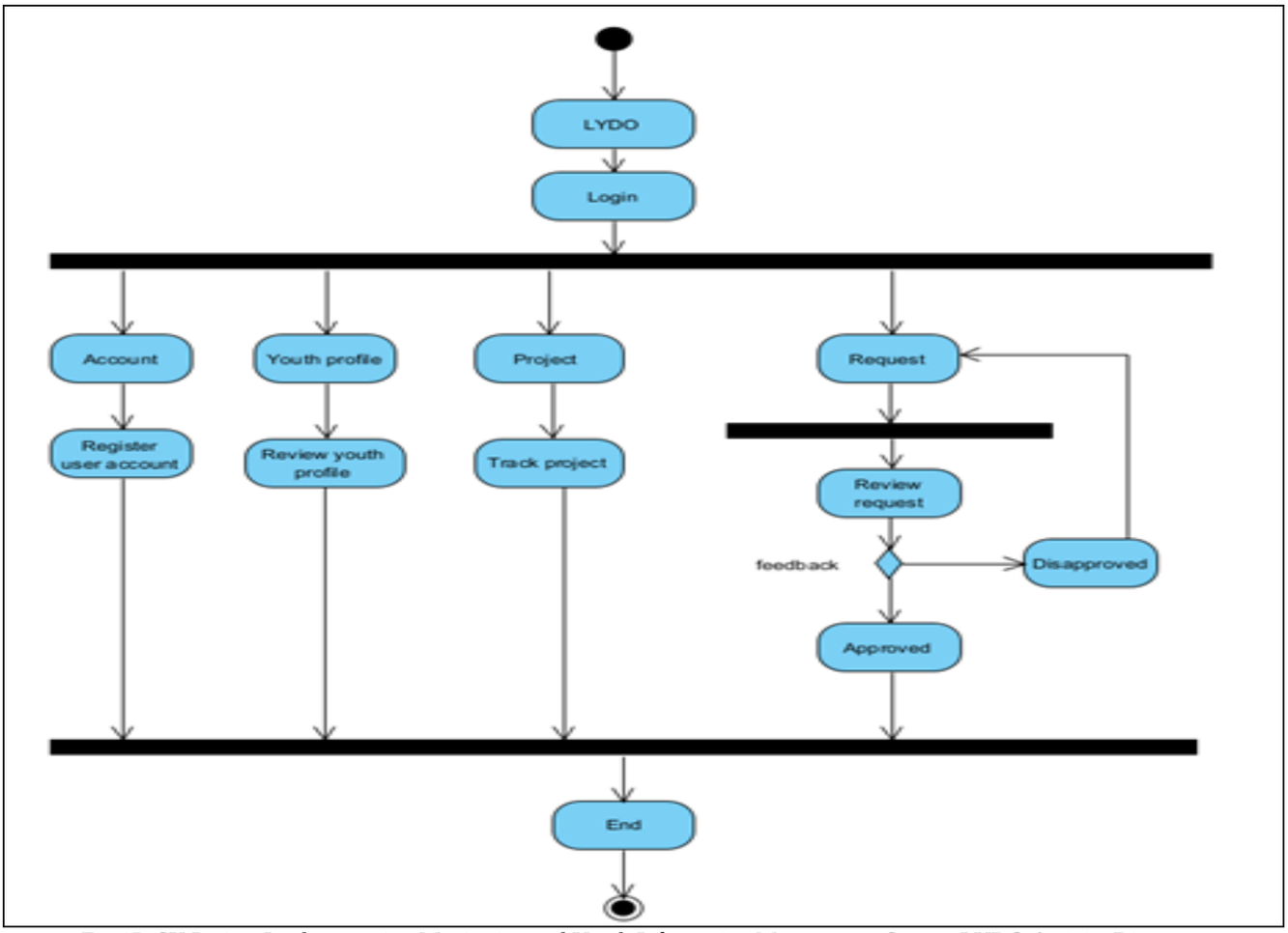

Fig 15: SK Project Implementation Monitoring and Youth Information Management System LYDO Activity Diagram

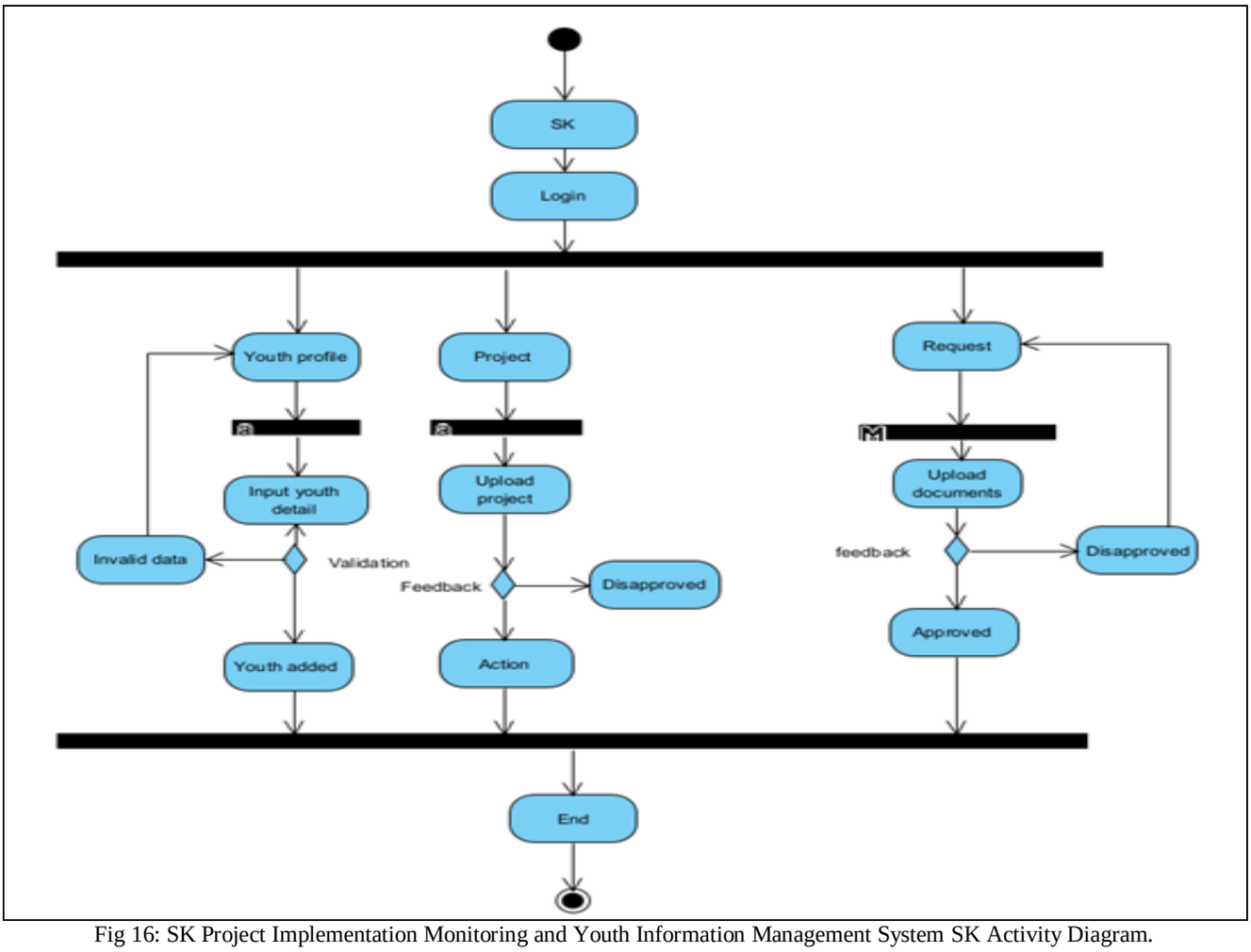

Fig 16: SK Project Implementation Monitoring and Youth Information Management System SK Activity Diagram.

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➢ *Database Design*

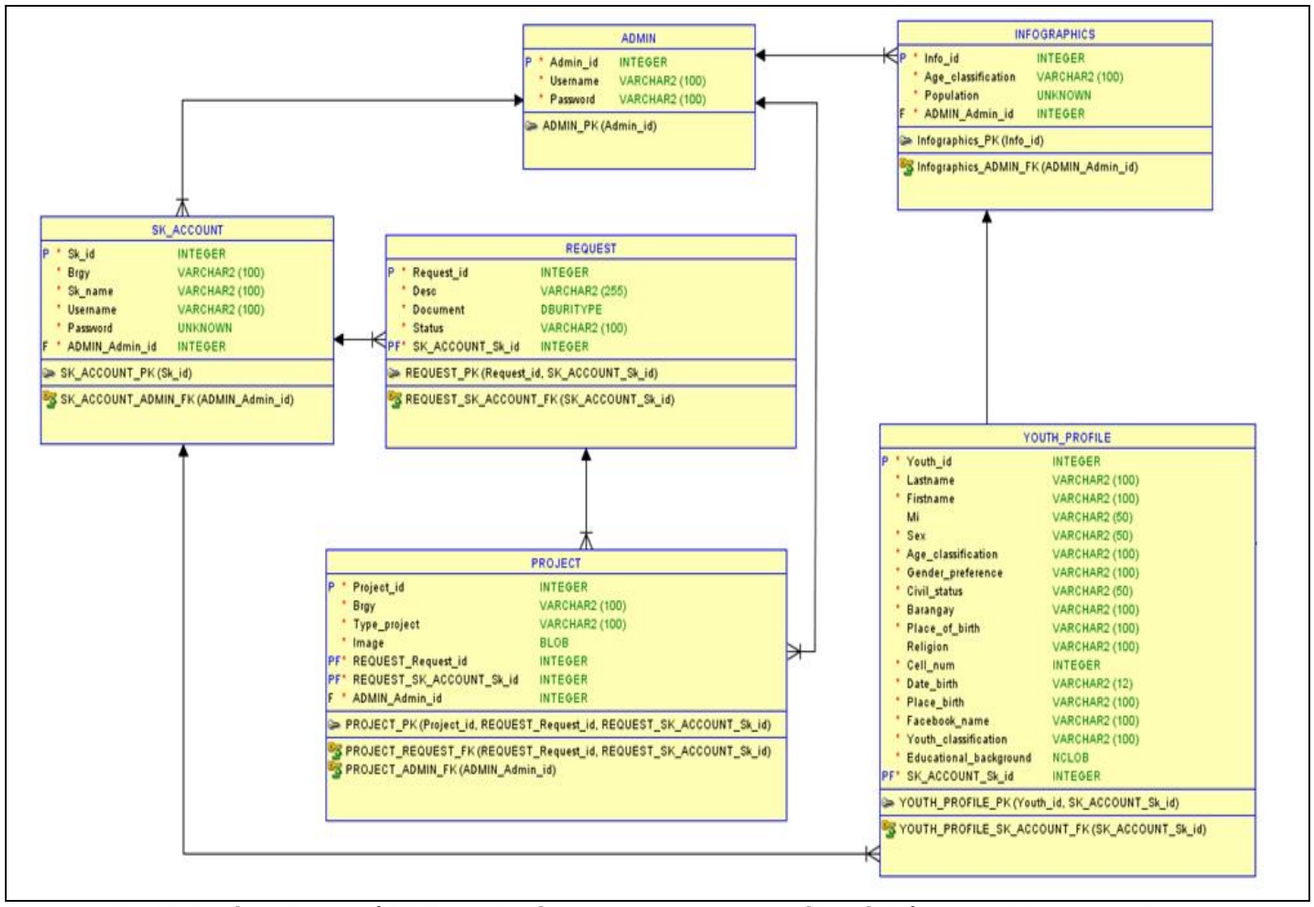

Fig 17: Database Design of SK Project Implementation Monitoring and Youth Information Management System

K. Entity Relationship Diagram

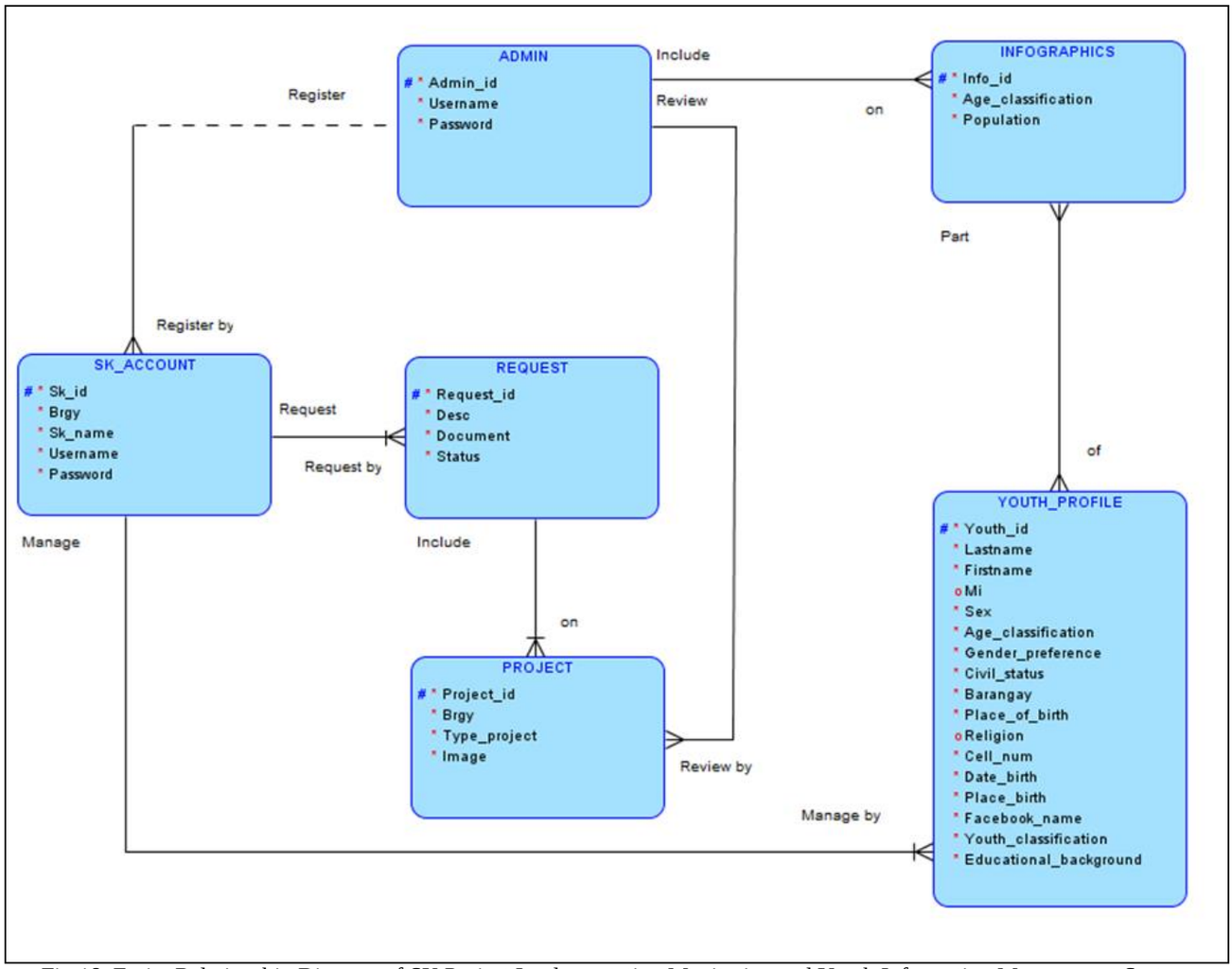

Fig 18: Entity Relationship Diagram of SK Project Implementation Monitoring and Youth Information Management System

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L. Data Dictionary

Table 3: Data Dictionary of SK Project Implementation Monitoring and Youth Information Management System

Table name	**ADMIN/GUARD**	
Attribute	**Type**	**Description**
Admin_id (PK)	INT(11)	Unique identifier assigned to each category in the system.
Username	VARCHAR(100)	Indicate the username.
Password	VARCHAR(100)	Indicate the password.

Table 4: Data Dictionary of SK Project Implementation Monitoring and Youth Information Management System.

Table name	**SK_ACCOUNT**	
Attribute	**Type**	**Description**
Sk_id (PK)	INT(11)	Unique identifier assigned to each user in the system.
Brgy	VARCHAR(100)	Barangay of the SK registered.
Sk_name	VARCHAR(100)	Full name of the SK, typically including both first and last names.
Username	VARCHAR(100)	Assigned SK username.
Password	VARCHAR(100)	Assigned SK password.

Table 5: Data Dictionary of SK Project Implementation Monitoring and Youth Information Management System

Table name	**PROJECT**	
Attribute	Type	Description
Project_id (PK)	INT(11)	Used as a primary key to distinguish and reference individual entries.
Brgy	VARCHAR(100)	Name of the barangay.
Type_project	DBURITYPE(100)	Type of the project.
Image	BLOB	Indicate the photo of upload project.
Sk_id (FK)	INT(11)	Indicate the id of the SK.

Table 6: Data Dictionary of SK Project Implementation Monitoring and Youth Information Management System.

Table name	**REQUEST**	
Attribute	**Type**	**Description**
Request_id (PK)	INT(11)	Used as a primary key to distinguish and reference individual entries.
Desc	VARCHAR(100)	Document description.
Document	DBURITYPE(255)	Upload document.
Status	VARCHAR(100)	Indicate the status of upload documents.
Sk_id (FK)	INT(11)	Indicate the id of the SK.

Table 7: Data Dictionary of SK Project Implementation Monitoring and Youth Information Management System.

Table name	**INFOGRAPHICS**	
Attribute	Type	Description
Info_Id	INT(11)	Unique identifier assigned to each log history in the auto number table
Age_classification	VARCHAR(100)	Unique identifier of student
Population	VARCHAR(100)	Time in and out of the students.

Table 8: Data Dictionary of SK Project Implementation Monitoring and Youth Information Management System.

Table Name	**INFOGRAPHICS**	
Attribute	Type	Description
Youth_Id	INT(11)	Unique identifier assigned to each log history in the auto number table
Lastname	VARCHAR(100)	Indicate the last name of the youth
Firstname	VARCHAR(100)	Indicate the first name of the youth
Mi	VARCHAR(50)	Indicate the middle name of the youth
Sex	VARCHAR(50)	Indicate the sex of the youth
Age_classification	VARCHAR(100)	Indicate the age classification of the youth
Gender_preference	VARCHAR(100)	Indicate the gender preference of the youth
Civil_status	VARCHAR(50)	Indicate the civil status of the youth
Barangay	VARCHAR(100)	Indicate the barangay of the youth
Place_of_birth	VARCHAR(100)	Indicate the birth of place of the youth
Religion	VARCHAR(100)	Indicate the religion of the youth
Cell_num	VARCHAR(11)	Indicate the cell number of the youth
Date_birth	VARCHAR(100)	Indicate the birth date of the youth
Place_birth	VARCHAR(50)	Indicate the birth place of the youth
Facebook_name	VARCHAR(100)	Indicate the Facebook name of the youth
Youth_classification	VARCHAR(100)	Indicate the youth classification of the youth
Educational_background	NCLOB	Indicate the educational background of the youth

M. Network Model

The network design for the School Uniform Detection System employs a star topology, connecting IP cameras to a central local server through a switch and a router for internet access. The cameras capture real-time video footage of students, which the server processes using machine learning algorithms to detect uniforms. Client devices, such as computers and tablets, access a user-friendly dashboard for monitoring and management. Security measures include a firewall, encryption for data transmission, and user authentication to protect against unauthorized access and ensure data integrity.

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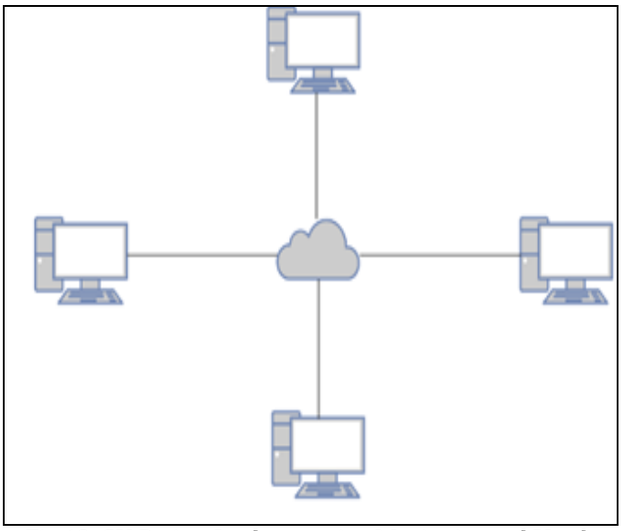

Fig 19: SK Project Implementation Monitoring and Youth Information Management System network design.

N. Network Topology

The star topology for the School Uniform Detection System connects IP cameras, a local server, and client devices to a central switch, which then links to a router for internet access. This centralized structure ensures easy management, scalability, and fault tolerance, as devices like cameras and monitoring tools can be added or removed without affecting the rest of the network. The local server processes real-time video feeds for uniform detection, while client devices access a dashboard for monitoring, with the network design providing robustness and uninterrupted functionality.

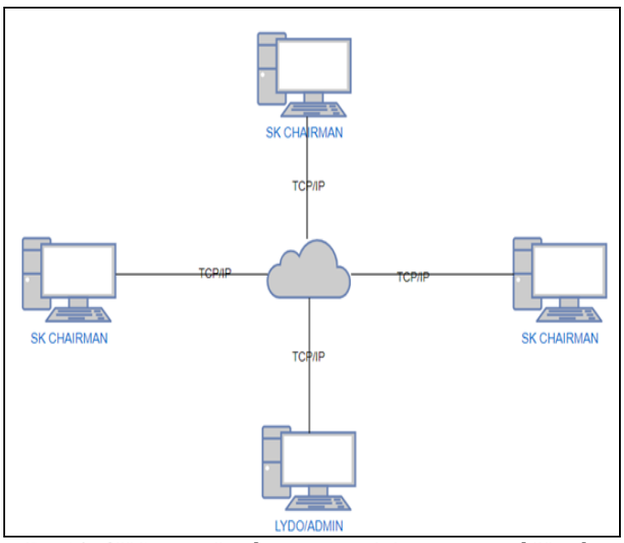

Fig 20: SK Project Implementation Monitoring and Youth Information Management System Network Topology

O. Development/ Construction/ Build Phase

➢ *Technological Stack*

- *Technology Stack (Development)*

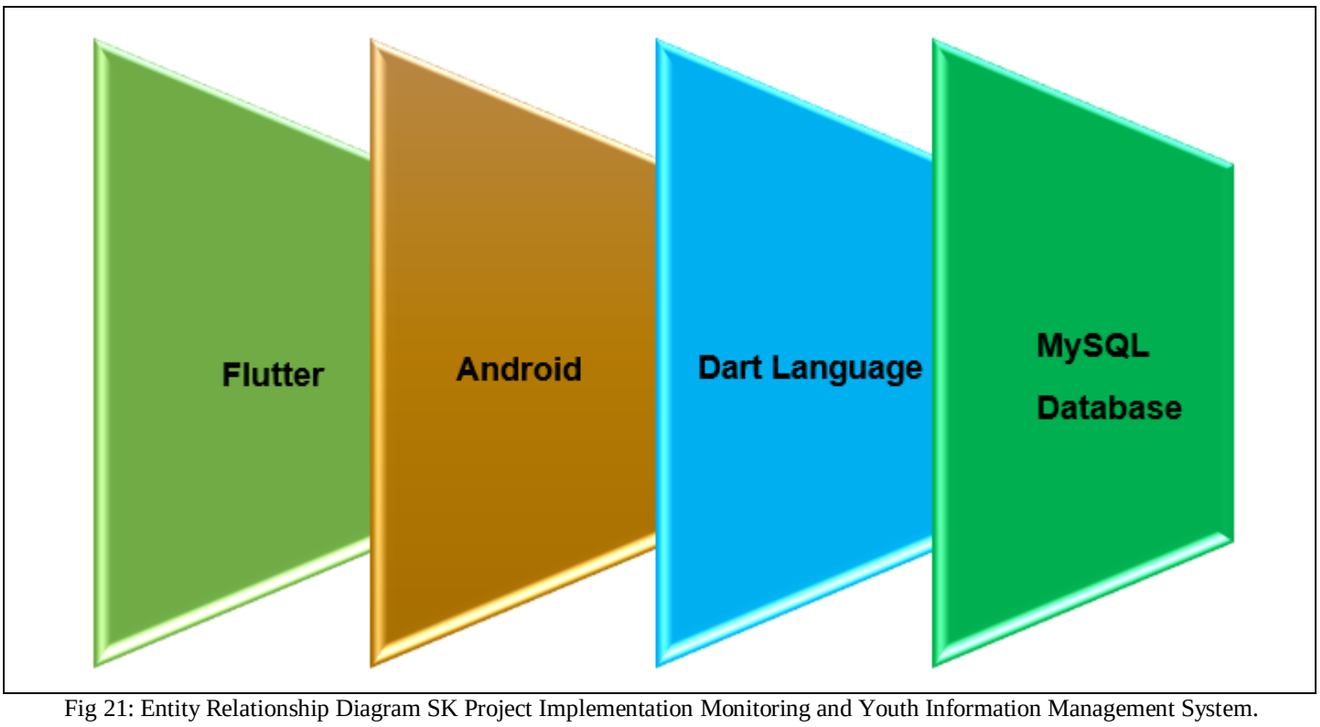

Fig 21: Entity Relationship Diagram SK Project Implementation Monitoring and Youth Information Management System.

➢ *Software Specification*

- Language : PHP
- Technology : HTML, CSS AND PHP
- Database : MySQL WAMP Server
- IDE : Visual Code Studio
- Operating System : Microsoft Windows 10

➢ *Hardware Specification*

- Processor : Inter® Core™ i3-6006U
- Hard Disk : 464GB
- RAM : 8192MB

➢ *Program Specification*

- Language : PHP
- Database : MySQL Wamp Server
- IDE : Visual Code Studio

P. List of Modules

➢ *Real-time School Uniform Detection*

This feature allows the system to instantly identify whenever a student is wearing a school uniform. It uses

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YOLOv8 for object detection, recognizing patterns and colors associated with uniforms. The system processes video feed or images in real-time.

➢ *Uniform Classification*

The system classifies the type of uniform. For example, it differentiates between boys' and girls' uniforms, enabling more detailed reporting or analysis of the student population based on their attire.

➢ *People Counter*

This feature counts the number of individuals detected within the camera's field of view. It can be used to monitor and track how many people are inside the school in real time, providing valuable data.

➢ *Integration with School Security*

The system integrates with the school's security infrastructure, such as an automatic gate opener or an ID QR code scanner. This allows seamless access control, ensuring that only students wearing proper uniforms can enter the premises. It can also cross-reference ID scans to verify students' identities, adding an extra layer of security.

➢ *Offline Functionality*

This feature ensures the system can continue functioning even without an internet connection. The core detection and classification processes are performed locally, ensuring reliable performance in environments where connectivity might be an issue, like remote areas or during network outages.

Q. Testing/Quality Assurance Phase

➢ *Unit Testing*

ML School Uniform Detection System is a web-based system runnable on a browser. It is a server-side system depicting a light and optimize module through the following QA forms:

- **Accessibility:** let the admin users to evaluate the key variables of the software modules if it is working well. It also let them to decide whether it fits with the user interface design connects well with the system.
- **Accuracy:** let the users to evaluate the performance in terms of speed and correctness of the data initiated and encoded and evaluates forms and reports by which all information that the software products are aligned with the standard format requirement of the software.
- **Functionality:** let the users to evaluate the system of its modules functions. Detailing whether all specific objectives was met and properly done.

➢ *Integration Testing*

The researchers are testing all the system modules that are integrated logically and tested application project. focuses on testing the interactions between different components or modules of the system to ensure they work together as intended. This type of testing is crucial because it helps identify issues that may not be apparent during unit testing, such as problems with data flow, interface mismatches, and integration.

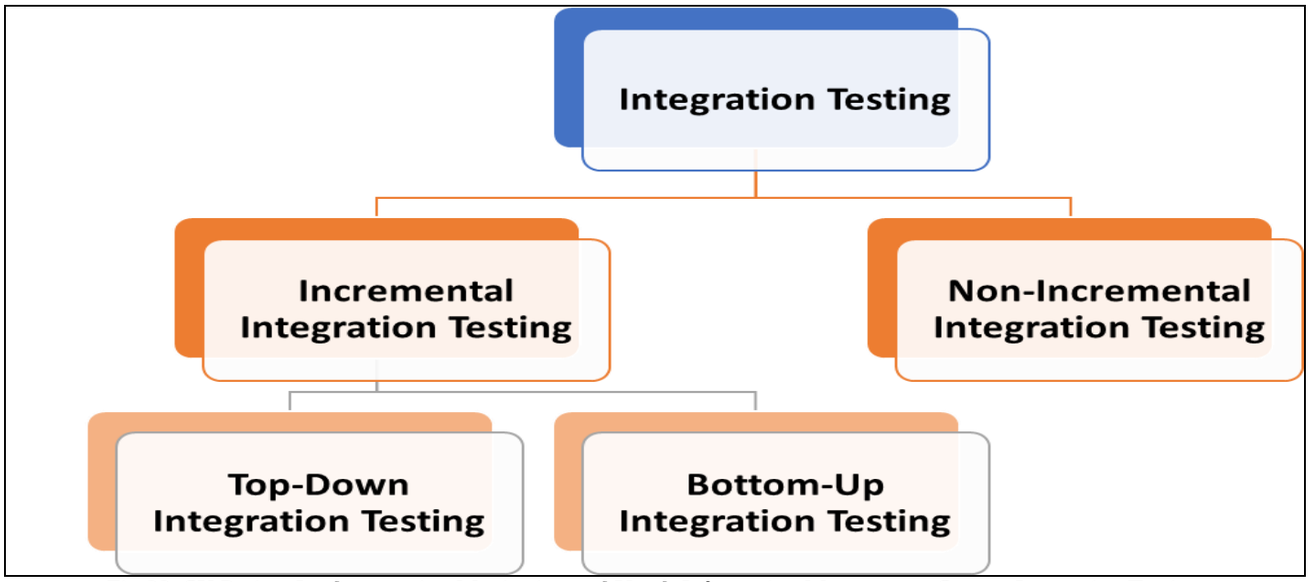

Fig 22: SK Project Implementation Monitoring and Youth Information Management System Integration Testing

➢ *Integration Testing: Bottom-Up Integration Approach*

Table 9: Integration Testing Test Case Table

	Test Case Objective	Test Case Description	Expected Result
	monitor project progress in real time;	Review related to youth activities.	Display project.
	Manage youth information management;	Centralized system for managing project implementation.	Provide project records.
	track project completion and fund allocations;	Review and track project completion and fund allocations.	Display fund allocation.
	view infographics used in the SK project and youth information by simplifying visual data presentations related to the SK project; and	Review infographics used in the SK project and youth information.	Generate report.
	youth registration module and member identification.	Display client reports and information for evaluation.	Generate youth information.

➢ *Alpha Testing*

The researchers are conducting alpha testing on the School Uniform Detection System to identify and fix any bugs or inconsistencies before full deployment. This initial testing phase ensures that the detection functionality, user interface, and real-time performance of the system align with the intended objectives. The goal is to verify that the machine learning model accurately detects students in uniform and that the system performs reliably across different scenarios such as varying lighting conditions and background noise.

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➢ *Evaluation Methodology*

Evaluation is a critical phase in the system development process to determine whether the system meets its design requirements and performs as expected. This study adopted a descriptive-developmental research method to assess the system's functionality, usability, and reliability. The researchers evaluated how effectively the machine learning model performs in uniform detection and how accessible and acceptable the system is for real-world school settings.

➢ *Respondent of the Study*

The study involved two main groups of respondents: (1) School Faculty or Administrators, and (2) ICT/Technical Support Staff.

To collect relevant feedback and assess the system's effectiveness, two instruments were used:

- Checklist Form – This was used to validate the system's core functions, such as image processing, detection accuracy, alert triggering, and report logging.
- Rating Scale Questionnaire – This instrument allowed respondents to rate the system's ease of use, responsiveness, and practical application in a school environment.
- The gathered responses were analyzed using frequency counts and percentage calculations to determine the system's success in meeting its objectives.
- Weighted Mean – This statistical tool was applied to summarize the overall level of satisfaction and perceived effectiveness from the respondents.

Table 10: Interpretative Scale used to interpret the Weighted Mean

CODE	Mean Range	Description
5	4.20-5.00	Strongly Agree
4	3.40-4.19	Agree
3	2.60-3.39	Moderately Agree
2	1.80-2.58	Disagree
1	1.00-1.79	Strongly Disagree

➢ *Acceptance Testing*

- *System Usability Scale (SUS) Summary*

- *SUS Score Interpretation Guide*

✓ Number of Respondents: 5
✓ Average SUS Score: 80.2

Table 11: Machine Learning – School Uniform Detection System Interpretative Scale

SUS Score Range	Usability Rating	Percentile Rank	Grade
85 - 100	Excellent	96^{th} – 100^{th}	A
70 - 84	Good to Excellent	70^{th} – 95^{th}	B
50 – 69	Marginally Acceptable	40^{th} – 69^{th}	C/D
Below 50	Poor	Below 40^{th}	F

The table shows that a SUS score of 80.2 reflects a high level of user satisfaction indicating that the system is generally perceived as user-friendly and effective. This score places the system in the 'Good to Excellent' usability category, suggesting that it could have improvements that could made.

R. Implementation/Deployment Phase

➢ *Deployment Diagram*

Fig 3.17: Machine Learning- School Uniform Detection System Deployment Diagram

S. Human Resources Specification

The successful deployment and operation of the Machine Learning – School Uniform Detection System require a structured team with specific roles and responsibilities. Below is a breakdown of the key personnel involved in the development, deployment, and maintenance of the system.

➢ *Project Manager*

- *Responsibilities:*

✓ Oversees the entire system development and implementation.
✓ Ensures the project stays within budget and timeline.
✓ Coordinates between development, testing, and end users.

- *Required Skills:*

✓ Strong leadership and project management experience.
✓ Knowledge of machine learning systems and IT infrastructure.

CONCLUSION AND RECOMMENDATION

A. Conclusion

This study addresses the growing need for automated school uniform compliance by proposing a Machine Learning-based system developed through the Incremental Process Model, an Agile Methodology.

By leveraging camera vision, image preprocessing, feature extraction, and deep learning algorithms, the system efficiently detects uniform adherence in real time while mitigating challenges such as varying lighting conditions, student postures, and uniform designs.

It is recommended that the school provide proper orientation and training for staff and administrators on how to use the system efficiently, particularly the dashboard and real-time monitoring features. Furthermore, to maintain and enhance system performance, regular updates and improvements should be implemented, including retraining the model with updated datasets and incorporating feedback from users.

B. Recommendation

Based on the findings and successful implementation of the Machine Learning–Based School Uniform Detection System, the researchers strongly recommend the adoption of this technology by the South East Asian Institute of Technology, Inc. and similar educational institutions. The system has proven effective in automating uniform compliance monitoring, reducing the need for manual inspections, and ensuring fairness in dress code enforcement.

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For long-term sustainability, the school is also encouraged to explore system integration with existing attendance monitoring and security systems to maximize its functionality. Additionally, expanding the system to support other forms of compliance monitoring—such as ID-wearing, visitor identification, or behavior tracking—could further strengthen school safety and discipline.

REFERENCES

[1]. Chen, L., & Wang, M. (2020). Facial Recognition-Based Attendance Systems in High Schools. Journal of AI and Education, 33(6), 300-314. Retrieved from https://www.jaiejournal.org/issues/2020/facial-recognition-attendance

[2]. Dela Cruz, A., & Santos, M. (2022). Automated Uniform Compliance in Secondary Schools using Image Recognition. Philippine Journal of Computer Vision, 10(2), 45-59. Retrieved from https://www.pjcv.org/articles/2022/uniform-compliance

[3]. Devulapalli, Saurabh. A Machine Learning Approach for Uniform Intrusion Detection. 23 July 2021, hammer.purdue.edu/articles/thesis/A_Machine_Learning_Approach_for_Uniform_Intrusion_Detection/15032184, https://doi.org/10.25394/pgs.15032184.v1

[4]. Garcia, L., & Reyes, E. (2021). AI-Enhanced Surveillance for Campus Safety in Philippine Schools. Journal of Philippine Educational Technology, 7(4), 120-134. Retrieved from https://www.jpet.org/articles/2021/ai-surveillance

[5]. Gerbo Notsil. "Uniform Detection Using Image Processingrev." Scribd, 2024, www.scribd.com/presentation/350736129/Uniform-Detection-Using-Image-Processingrev

[6]. Hoang, Long, et al. Verification of Student Uniform by Convolutional Neural Network through Images. International Journal of Novel Research and Development (IJNRD), Vol. 9, no. 5, 2024, p. 659, www.ijnrd.org/papers/IJNRD2405375.pdf

[7]. Lam, Khang Nhut, et al. "Monitoring Attendance and Checking School Uniforms Using YOLOv8." Communications in Computer and Information Science, 31 Oct. 2023, pp. 200–207, https://doi.org/10.1007/978-981-99-7649-2_15

[8]. Machine Learning. "Uniform Detection Dataset." Roboflow, 2023, universe.roboflow.com/machine-learning-2cn96/uniform-detection-gilyg

[9]. Nguyen, K., & Tran, B. (2021). Real-Time Video Processing for Security Monitoring in Retail Environments. Computer Vision in Industry, 18(9), 210-225. Retrieved from https://www.cvijournal.com/articles/2021/real-time-security-monitoring

[10]. Roman, Anthony C. "A Machine Learning Pipeline for Aiding School Identification from Child Trafficking Images." ArXiv (Cornell University), 9 Sept. 2021, https://doi.org/10.1145/3462203.3475924. Accessed 8 Feb. 2024

[11]. Romero, C., & De Guzman, S. (2021). Developing Image Recognition Tools for School Security in Public Schools. Philippine Journal of School Security Technology, 9(6), 201-215. Retrieved from https://www.pjsst.org/issues/2021/image-recognition-security

[12]. Saurabh Devulapalli. A Machine Learning Approach for Uniform Intrusion Detection. 23 July 2021, hammer.purdue.edu/articles/thesis/A_Machine_Learning_Approach_for_Uniform_Intrusion_Detection/15032184, https://doi.org/10.25394/pgs.15032184.v1

[13]. Zhao, L., Chen, M., & Lee, T. (2021). Uniform Detection Using Image Recognition Techniques in Surveillance Systems. Journal of Computer Vision and AI, 45(3), 101-115. Retrieved from https://www.jcvai.org/articles/2021/uniform-detection