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**STUDENT QR CODE-BASED ATTENDANCE SYSTEM FOR BEYKOZ
UNIVERSITY COMPUTER ENGINEERING DEPARTMENT**

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**STUDENT QR CODE-BASED ATTENDANCE SYSTEM FOR BEYKOZ
UNIVERSITY COMPUTER ENGINEERING DEPARTMENT**

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ABSTRACT

STUDENT QR CODE-BASED ATTENDANCE SYSTEM

Beykoz University is using the E-yokloma attendance system, a password-based system that allows lecturers to create classes and share the password with the students for attendance taking. At Beykoz University, a QR code-based system for monitoring attendance records helps instructors obtain the necessary attendance data fast and generate the necessary reports as soon as possible. Beykoz University's current attendance system is less user-friendly than QR code-based attendance. To do it, a lot of manual labor is needed. The efficiency of taking attendance can be increased, and human labor can be saved with an automated system. Lecturers will be able to spend more time on academic issues and less time on attendance records thanks to this. The project was developed using a user-centered approach to software development, where usability is a crucial factor in the product's success. The project's scope was restricted to the Computer Science Department at Beykoz University. Several tools and strategies were used to achieve the project's goals. Technologies like PHP, SQL, Python and a machine-learning library were used in the system's development. The review provides insights into best practices for integrating predictive intelligence into dashboards used by teachers, administrators, and policymakers to facilitate early warnings, personalized learning plans, and targeted remedial programs. The findings underscore the transformative potential of machine-learning-driven forecasting for advancing educational decision-making, ensuring equitable learning outcomes, and establishing proactive academic support frameworks across diverse learning environments.

Keywords: *QR code, Attendance, lecturers, Machine-Learning, XGBoost Model.*

ÖZET

ÖĞRENCİ QR KOD TABANLI YOKLAMA SİSTEMİ

Beykoz University, dersler için öğretim elemanlarının sınıf oluşturmalarına ve yoklama almak amacıyla öğrencilerle şifre paylaşmasına olanak tanıyan, parola tabanlı bir sistem olan E-yoklama devam sistemini kullanmaktadır. Beykoz Üniversitesi'nde, QR kod tabanlı bir devam izleme sistemi, öğretim elemanlarının gerekli devam verilerini hızlı bir şekilde elde etmelerine ve ihtiyaç duyulan raporları mümkün olan en kısa sürede oluşturmalarına yardımcı olmaktadır. Mevcut devam sistemi, QR kod tabanlı sisteme kıyasla daha az kullanıcı dostudur ve uygulanması için önemli ölçüde manuel iş gücü gerektirmektedir.

Otomatik bir sistem ile yoklama alma sürecinin verimliliği artırılabilir ve insan emeği azaltılabilir. Bu sayede öğretim elemanları, devam kayıtlarına harcadıkları zamanı azaltarak akademik konulara daha fazla odaklanabilecektir. Proje, kullanılabilirliğin ürün başarısında kritik bir faktör olduğu kullanıcı merkezli bir yazılım geliştirme yaklaşımıyla geliştirilmiştir. Çalışmanın kapsamı, Beykoz Üniversitesi Bilgisayar Bilimleri Bölümü ile sınırlandırılmıştır.

Projenin hedeflerine ulaşmak için çeşitli araçlar ve yöntemler kullanılmıştır. Sistem geliştirme sürecinde PHP, SQL, Python ve bir makine öğrenmesi kütüphanesi gibi teknolojilerden yararlanılmıştır. İnceleme, öğretmenler, yöneticiler ve politika yapıcılar tarafından kullanılan panellere tahmine dayalı zekânın entegrasyonu için en iyi uygulamalara dair önemli içgörüler sunmaktadır. Bu yaklaşım; erken uyarı mekanizmalarının geliştirilmesini, kişiselleştirilmiş öğrenme planlarının oluşturulmasını ve hedefe yönelik telafi programlarının uygulanmasını kolaylaştırmaktadır.

Elde edilen bulgular, makine öğrenmesi destekli tahminleme yöntemlerinin eğitimde karar alma süreçlerini geliştirme, eşit öğrenme çıktıları sağlama ve farklı öğrenme ortamlarında proaktif akademik destek sistemleri oluşturma açısından dönüştürücü bir potansiyele sahip olduğunu ortaya koymaktadır.

Anahtar Kelimeler: *QR kod, Devam, öğretim elemanları, Makine Öğrenmesi, XGBoost Modeli.*

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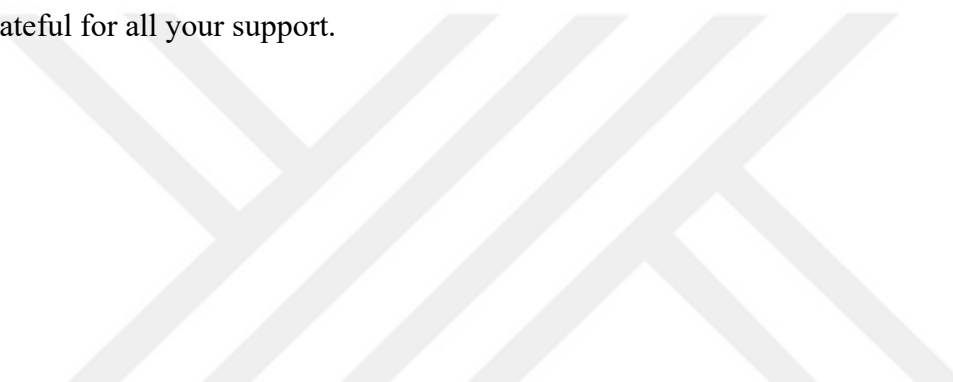
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INTRODUCTION

1.1 Background of the Study

QR Codes provide a speedy and smooth way to access information, and they can be used for different purposes which include student attendance tracking. Manual student attendance tracking methods, such as signing sheets, consume much time and are inefficient (I. Kapantzaki, 2018). Nowadays, QR codes are generally used for different purposes, including financial systems, employee and students' attendance tracking, marketing, and other sectors. QR codes can store lots of information than traditional barcodes and can be modified with colors and logos. They are general and efficient means to share data and information in a digital era (Nurwono, et al, 2009).

In the era of technology, most of the universities globally started using advanced technology to solve the issue of the manual attendance system. Some universities are using Radio Frequency, biometric, facial recognition, and QR code mark and track attendance systems. In order to address numerous issues that instructors and business owners face, this technological development offers a fresh approach to the design and implementation of computerized attendance systems in workplaces, universities, and other sectors. Because of its ease of use, affordability, and simplicity, QR code-based attendance has gained popularity among these technologies. Each student receives a unique QR code that they can use on their phones and other devices to record their attendance. For simple retrieval and decision-making, the attendance is automatically stored in the database.

An attendance system is another data collection activity that universities and institutions use to determine the total number of student attendance in a lecture. The attendance helped to track students who are present and also absent. These determine whether the students are eligible to write the examination or not.

1.2 Statement of the Problems

E-yokloma, developed by Beykoz University, is a system designed to help the university track and monitor attendance for both students and lecturers. Students select their course, and it directly reflects on their E-yokloma mobile app; only the courses you registered for are available for you to sign in for attendance. Sometimes students don't come to class and complain more about how the course is very difficult, which is unfair to both the university's reputation and lecturers, so Beykoz University came up with the idea of E-yokloma

Lecturers open the class and send a unique password, and when the student writes it down, it ticks present for them. The class sessions are 3 periods, and all professors open the attendance session 3 times and give 3 different passwords or the same password. The students have only one option via the app to enter a password, and sometimes it doesn't work; the professor needs to sign in for them. The thesis project idea is to develop a QR-code attendance system and machine learning attendance prediction for Beykoz University, which is an evolution of the E-Yokloma currently used in Beykoz. The system is similar to the E-Yokloma, but with some features of the QR code and other elements. The system is currently using a web platform.

1.3 Objectives of the Study

This research project aims to provide Beykoz University, Department of Computer Science an alternative to the E-yokloma means of validating students' attendance during lecture hours.

The objectives are as follows:

- i. Developing an attendance system based on the QR code and Machine Learning Prediction for the Beykoz University.
- ii. To build a system compatible with the current university system.
- iii. To develop a system that promotes user accessibility and user experience.
- iv. To enable student attendance prediction using Machine Learning Algorithm.

1.4 Significance of the Study

Recently, Machine Learning, Artificial Intelligence and Internet of Things are some of the examples of how technology is advancing. Every industry that uses information technology has grown and improved.

With the advancement in technology and the need to cater to the attendance needs of the Department of Computer Science, Beykoz University, given its large population, the following will be made possible by the web-based QR code-based attendance system.

- i. It would help the department ensure that every student takes his/her attendance, thereby curbing the issues arising from late/not non-attendance by students.
- i. It would help the exam department for the examination attendance of students for every semester with ease, even providing a permanent record of examination attendance that will not consume any physical space, as against the use of papers.

1.5 Scope of the Study

This project concentrates on advancing the existing attendance system at Beykoz University, built to seamlessly take lecture attendance of students, using Beykoz University, Department

of Computer Science, as a case study. The system will be advanced from the E-yokloma currently used at Beykoz University to take attendance.



LITERATURE REVIEW

2.1 Conceptual Review

This chapter gives an overview of QR code attendance systems, discusses the traditional/manual attendance system, its disadvantages, the modern attendance system, and the benefits of using them.

2.2 Concept of Attendance Systems

Unlike the traditional attendance system, the automatic attendance system is an educational information and control system which records, stores and monitors the attendance of students in the institution. This software allows faculty members to record, store and monitor student records (Ahmed, 2021).

Attendance can be automated in several ways, such as (Ahmed, 2021)

- i. Using the mobile app
- ii. Attendance can be recorded using biometric.
- iii. Radio Frequency Identification (RFID) is used to take attendance.
- iv. Face recognition is used to take attendance in real time.

2.2.1 Biometric: Face Recognition Attendance System

Based on recent advances in machine learning and neural networks, face-recognition applications are still of great help in terms of accuracy and efficiency. A system of attendance monitoring is a very important process in all the Institutions. Several facial recognition attendance systems have been developed, each with its own strengths and weaknesses, and are being used in a variety of fields. This type of computerized attendance system includes phases such as image acquisition, database development, pre-processing and facial recognition (Khaled, 2022).

2.2.2 Radio Frequency Identification Technologies

RFID is a technology that is used to collect information automatically by radio frequency data communication between a mobile object and an RFID reader, to identify, categorize, and track them (Rajan, 2012). It is mostly discussed as an identifier and a reader. To repossess the information saved on a Radio Frequency Identification tag, there is need for reader device with antennas that produce radio waves and accept signals back from the tag. It is used to read or write information on a tag and pass that information to a system for storage and processing (Rajan, 2012).

2.2.3 Biometric Attendance System

The biometric system uses biological characteristics such as fingerprints, hand shape, voice, facial recognition and other biological characteristics to identify the individual.

They have five subsystems: data collection, signal process, matcher, storage and transmission (Cheah, 2015). Gina (2020) proposes a system whose data includes student, invigilator, examination and venue registration entered by the faculty/examination administrator and then stored in a data storage subsystem. The system will then use the data to populate an examination timetable as well as an attendance sheet for each registered examination. The invigilator then accesses this attendance sheet after verification and dispenses it to the students walking into the examination hall. The system then marks the attendance of the authenticated students using a fingerprint authentication system. The attendance sheet is then saved by the system and stored for later retrieval.

2.2.4 Bar Code Attendance System

A barcode is a set of parallel lines and spaces with various widths that helps data representation visually. It stores and transmits data in a machine-readable format about a good, thing, or object. Barcodes are frequently seen on retail items, books from the library, shipping labels, and a variety of other objects. A barcode's primary function is to encode data in a way that makes it simple for readers or scanners to scan and decode it. These readers employ laser beams to recognize the barcode's contrasting patterns of black bars and bright gaps. Depending on the type of barcode symbology utilized, the information contained in the barcode can be expressed as numbers, letters, or a combination of both.

Each student receives a special bar code that serves as a representation of their identification in the bar code attendance system. During the tests, students present their bar code on a printed ID card or mobile device for the bar code reader to read. Each student's attendance is recorded in a digital database every time the scanner reads the code.

2.2.5 QR Code Attendance System

Barcodes, a type of matrix code, are combined to create rapid response codes, or QR codes, that are easy to read by smart phones and readers with the use of the QR codes. In the Japanese automobile industry, the Denso-Wave company developed the first QR code in 1994. For human beings, the invention has been made freely available as an open source. The creator made it a free and open-source project. In addition, the QR code can be scanned vertically and horizontally and stored in both directions (Rehman, 2018). Although it has more features like

in terms of storage a barcode can represent up to 25 characters, a QR code can go up to 2500 (Rentman, 2011) and the fact that barcode scanning requires special device called Barcode scanner which emits light and collects reflected light to decode the Barcode (RF, 2012); the QR code attendance system functions similarly to the bar code system. Smartphones or special QR code scanners can read QR codes, which are more information-dense than regular bar codes.

2.2.5.1 Benefits of the QR-based Attendance Codes System

The field of automatic monitoring of attendance., online QR code-based attendance stands out as the optimal choice due to its numerous advantages over other systems like face recognition, fingerprint, barcode, and RFID attendance systems. The widespread usage of smartphones and the simplicity of implementation allow QR code technology to revolutionize attendance management by offering a quick, simple, and affordable fix. Benefits of the attendance system based on the QR code. The study looks at the unique features of the Quick Response Code attendance system compared to the current automated systems and highlights its flexibility and adaptability to different learning contexts.

Below are some of the reasons for choosing a QR code-based online attendance system

1. **Universal Accessibility and Convenience:** Quick Response (QR) codes can be created and accessed using generally available devices, so that both students and instructors can use the system. Instead of requiring specialist hardware, such as facial recognition or fingerprint systems, QR codes utilize already existing technology, allowing for seamless integration with minimal infrastructure investment. Reduce wait times and ensure efficient attendance tracking by allowing students to easily mark their attendance with a quick scan.
2. **Non-Intrusive and Contactless Operation:** QR code-based attendance operates in a non-intrusive and contactless manner, in contrast to facial recognition or fingerprint systems that demand close physical proximity. During public health emergencies, this non-intrusive strategy protects students' privacy and reduces health worries. Additionally, individual and simultaneous QR code scans can be made, easing the process of taking attendance at large-scale events.
3. **Real-Time Data Collection and Analytics:** Real-time data gathering and analytics are made possible by the web Quick Response code-based system, allowing the fastest attendance tracking and recordkeeping. Instantaneous access to attendance data by

institutions makes it easier to intervene quickly and make informed decisions. Additionally, the system's analytics capabilities provide insightful data on attendance trends, helping to improve institutional performance evaluation and student engagement methods.

2.2.5.2 Limitations and Challenges

While QR code systems offer many benefits, they also have some challenges. They depend on students having smartphones and a reliable internet connection. There is also a risk that QR codes will be copied or faked. In places with poor technology, using QR codes can be difficult.

2.2.5.3 Applications in Real Life

Schools and universities use QR code attendance systems to track students in classes and during exams. In South Korea, these codes first appeared during the COVID-19 pandemic to improve attendance safety and accuracy (Kim & Choi, 2021).

2.2.6 Manual Attendance System

A manual process of attendance is a traditional method that requires students to fill in attendance sheets manually, although it comes with some advantages, like it is cheaper to implement, it is simple to use, and does not require internet connectivity, it comes with a lot of disadvantages that cannot be ignored.

Manual examination attendance systems can vary between universities and even across different departments within the same university, but some of the known methods are:

- i. Roaster Method
- ii. Sign-in Sheet
- iii. Seating Plans

Each of these methods is briefly discussed in subsequent subsections below. In a manual lecture and examination attendance system, a student ID card is usually used for the authentication process. Student ID checks entail confirming the identities of students by comparing.

Their physical characteristics are identified with the identification cards supplied by their universities. Prior to entering the exam room or during the exam session, invigilators may ask students to submit their ID cards for visual inspection.

2.2.7 Machine Learning Attendance System

Alboaneen et al. (2022) utilized Educational Data Mining (EDM) to identify patterns in educational datasets with machine learning (ML) algorithms. They developed a web-based platform that uses algorithms like Random Forest, Support Vector Machine, K-nearest neighbours, Artificial Neural Networks and Logistic Regression that predicted academic performance and identified risk students. These models may achieve 6.34% mean absolute percentage error, with midterm exam scores being mainly influential. The Alboaneen study focusses on a female gender and department that limited its wider applicability.

A study by Tharsa et al. (2021) built an intelligent system that uses data mining technology to utilize students online, specifically during the COVID 19 pandemic. The system is user-friendly combined with Artificial Intelligence, Machine Learning, and Deep learning to easily solve common educational problems.

Also, Afan et al. (2023) developed an application for predicting students' grades and track student assessments by leveraging educational data mining technology. The application evaluates study hours and student class attendance to predict student performance and assisted the institute lecturers to monitor student academic performance. The application fully built with PHP for the backend, while HTML/CSS/JavaScript for the entire frontend and MySQL for the Database. The application only relied on student's study hours and that could not be trusted.

The study leverage decision trees, KNN algorithm, linear regression and Naïve Bayes with data on student records. The model perfectly predicted success rate, but the train data was based only on the student's study environments without carefully consider other students features like student interest, and student weekly activities which will influence the student school lives.

Kakarla et al (2020) presented a convolutional neural network architecture that uses face recognition in student attendance systems, indicating 99% accuracy and enabling the development of a web-based platform, while the system has 99% accuracy, the system cannot predict student attendance. The study focusses on students' attendance predicting, a part that has less concern compared to academic performance or dropout rates. By implementing different machine learning algorithm within a web-based platform, the system will guarantee accessibility and realism. Unlike other studies that specifically target academic outcomes, this study primarily addresses students' attendance, which is a crucial part for student performance and overall academic success. It will provide predictive tool for student's attendance; it will also enable lectures with early student that has low attendance, and it will help educational

institutions to address potential student attendance issues before they negatively impact their academic result and performance.

Table 2.1: Comparative Analysis of Attendance System Methods

Tracking Technologies	Description	Things Equipment	Faking Attendance	Cost
Polling System	Requires some questions to be answered by students.	Laptop or smartphone	Easy	Low
Geolocation	Detect and mark systematically the attendance of students' locations matched.	Smartphone	Easy	Low
Card Reader	Requires the registration number to be scanned on the card readers	Registration number, card reader	Medium	Medium
Biometric Fingerprints Scanners	mandates that students use a print reader to register their attendance by using their fingerprints.	Reader for fingerprints.	Hard	High
Quick Response code	Unique QR code needs to be scanned for each student	Smartphone	Medium	Low
Bluetooth	Marked attendance within some range	Workable smartphone with Bluetooth connected	Medium	Medium

Table 2.1 shows a comparative analysis of attendance tracking methods from polling, geolocation, card reader, fingerprint reader, QR code, and Bluetooth. When choosing any attendance tracking methods, there will be a need for understanding the description of required technologies/equipment and cost.

The literature presents that several studies have been done to capture student attendance using technologies such as polling, geolocation, card readers, fingerprint readers, QR codes, and Bluetooth. These studies led to the development of several models to manage students' attendance records, but most of this research is concentrated on the development of the model, and there are limited systems that use these models, especially in developing countries, yet these models have no practical importance to the people out there.

2.3 Discussions

The organization must purchase devices and other components, while the manual methods have lower expenses is less. The manual method requires a register book and, pen to mark attendance. The computerized system needs proper maintenance; the system needs to be updated and upgraded sometimes to add some features and security patches.

RESEARCH METHODOLOGY

3.1 Introduction

The chapter provides a development model process while offering an overview of the system design and system analysis. The project work focuses on the XGBoost model for improving student attendance performance. This work succeeds to highlight student's weak points and provide appropriate recommendations. The primary dataset for this study is the Student Attendance Dataset, this dataset includes various features such as student attendance rate, class attendance rate, day of week, and other relevant indicators.

3.2 System Analysis

System analysis is a crucial stage in the life cycle of software development that entails a thorough analysis of an existing system or the specifications for a new system. There are several methods of system analysis and design; the two major methods include:

1. The Object-Oriented Analysis and Design Method
2. Structured System Analysis and Design Methods

The Object-Oriented method was used for this project because the benefit of the method gives an effective and well-organized software solution that solves practical issues. Understanding the issue domain, creating modular, reusable components, and making sure the resultant system is scalable, maintainable, and adaptive to changing requirements are all key components of the object-oriented analysis and design methodology.

3.3 Analysis of Existing System

As already stated, Beykoz University is using E-yokloma where lecturers open the class and send a unique password, and when the student writes it down, it ticks present for them. The class sessions are 3 periods, and all professors open the attendance session 3 times and give 3 different passwords or the same password. The students have only one option via the app to enter a password, and sometimes it doesn't work; the professor needs to sign in for them.

E-yokloma needs to be updated with some features, like the QR code generator, and machine learning to predict students' attendance based on the past data

3.4 Problem of Existing System

E-yokloma uses a password to mark attendance when lecturers create a class; also, machine learning is not implemented in the existing system. The system does not capture students' faces during account creation.

3.5 System Design Tool

The Unified Modeling Language, or UML, is an assembly of integrated diagrams. In addition to business modelling and other non-software systems, it is designed to help system and software developers to define, visualize, build, and document the artifacts of software systems. UML is essential for both the process of software development and for the creation of object-oriented software. UML uses graphical notation primarily for communicating the design of software projects.

3.5.1 Use Case Diagram

In UML, a use case diagram is a dynamic or behavior diagram that uses actors and use cases to model the functionality of a system. Actors are individuals or organizations that operate in the system in pre-defined roles. Actions, services and functions that a system needs to perform are called use cases. In this sense, the term system refers to something that is created or operated, such as a website.

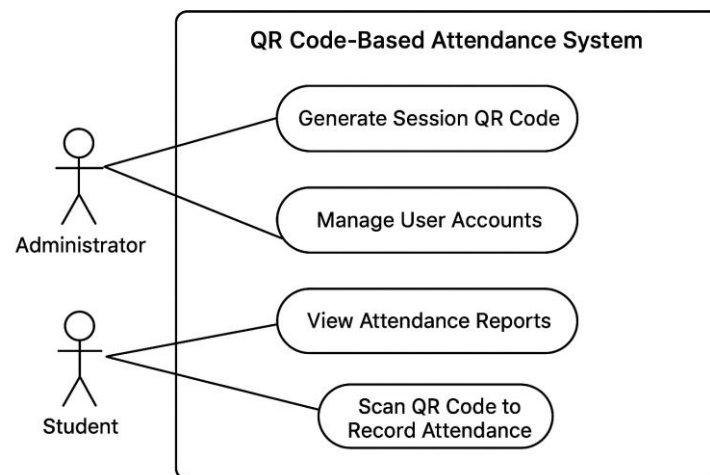


Figure 3.1: Use Case Diagram

The application case diagram of the QR code attendance system is shown in Figure 3.1. The primary players in the diagram are Administrator (Lecturer) and Student.

2.5.2 Database Design

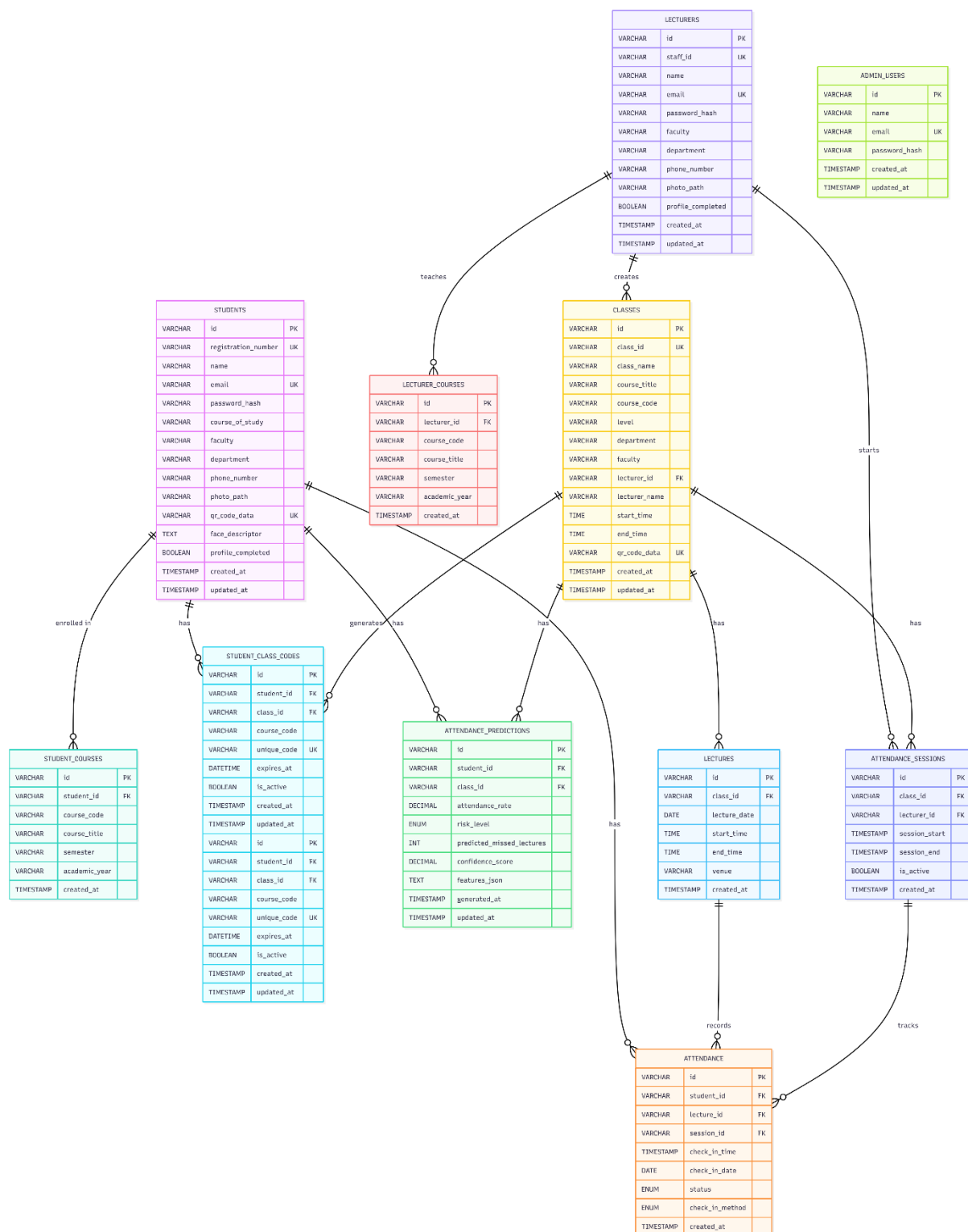


Figure 3.2: Entity-Relationship Diagram (ERD)

The entity relationship diagram of the QR code attendance method is shown in Figure 3.2. It shows the relationships between different entities, their characteristics, and the flow of data over the table as a whole.

3.6 Extreme Gradient Boosting (XGBoost)

XGBoost(Extreme Gradient Boosting) XGBoost (Extreme Gradient Boosting) is a powerful ensemble learning technique based on gradient boosting decision trees. XGBoost has widely used and very popular tool from Kaggle competitors and the data science industry, it has been used for production on large-scale problems. It is a highly adaptable and multi-functional tool that can effectively handle various regression and classification tasks. Being open-source software, it is readily available and can be utilized across multiple platforms and interfaces. The main reason for utilizing XGBoost is its rapid execution and superior model performance.

XGBoost uses Ensemble learning methods, it uses a combination of different algorithms and produce output as a single model. XGBoost supports parallel and distributed computing while offering efficient memory usage. XGBoost demonstrates significant predictive capabilities and is highly efficient, particularly when dealing with structured data. It is known for its speed and accuracy, especially in structured data problems such as student grade prediction, attendance prediction etc.

3.6.1 System Architecture of Student Attendance Prediction

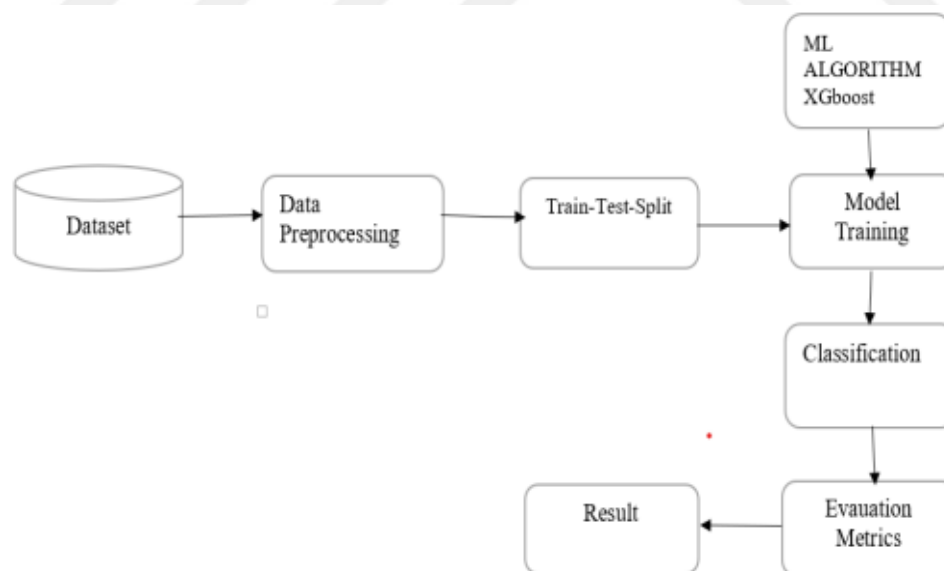


Figure 3.3: System Architecture for Student Attendance

The diagram illustrates the standard machine learning workflow for a classification task using the XGBoost algorithm. The workflow focuses on improving student performance analysis through the implementation of the XGBoost machine learning algorithm.

3.6.2 Model Training with Machine Learning Algorithms

Dataset: In this study, the Students Grading Dataset was used. It contains various student-related attributes such as attendance, grades, parental background, study time, and other demographic and academic factors.

Data Preprocessing: Handling Missing Values: Null or missing value (mean/mode/median or deletion depending on the scenario).

Encoding Categorical Features: Categorical variables (student attendance rate, class attendance rate, day of week, hour of day etc.) are transformed using label encoding or one-hot encoding.

Train-Test Split: The dataset is split into training and testing sets using the `train_test_split()` method from Scikit-learn. Typically, an 80:20 or 70:30 ratio is maintained to ensure enough data for both models learning and evaluation.

Model Training with Machine Learning Algorithms:

XGBoost Classifier: XGboost is an advanced gradient boosting method known for its high accuracy and performance in structured data.

Logistic Regression: A baseline classifier suitable for binary outcomes such as Present/Absent.

Evaluation Metrics: Accuracy Score: The proportion of correctly predicted instances. Precision, Recall, F1-Score, and Accuracy: These metrics are particularly useful for imbalanced datasets.

Result: Based on evaluation, the best-performing model is identified. The results are visualized and tabulated, highlighting classification performance. Typically, XGBoost traditional classifiers due to its ensemble-based learning and robust handling of non-linearity in features.

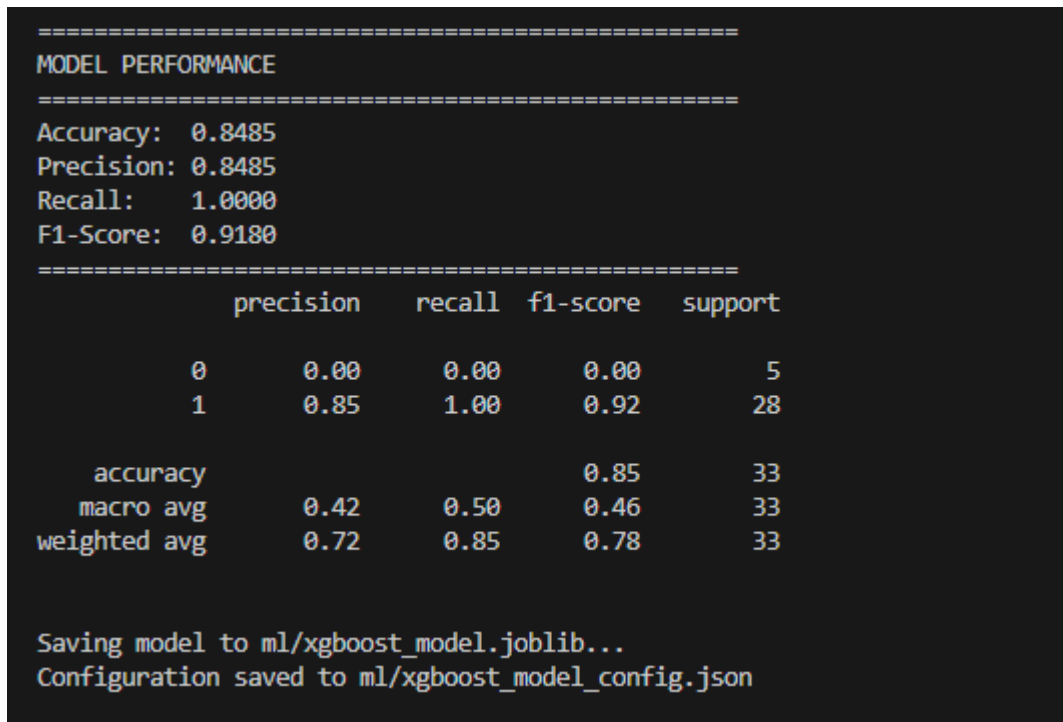


Figure 3.4: Model Performance

The figure 3.4, shows model performance, which includes accuracy, precision, recall, and F1-Score. The model achieved an overall accuracy of 84.85% with high precision (0.85), perfect recall (1.00), and a strong F1-score (0.92) for class 1, this indicates that the model correctly identified all the instances of all the 28 classess without missing any positive cases.

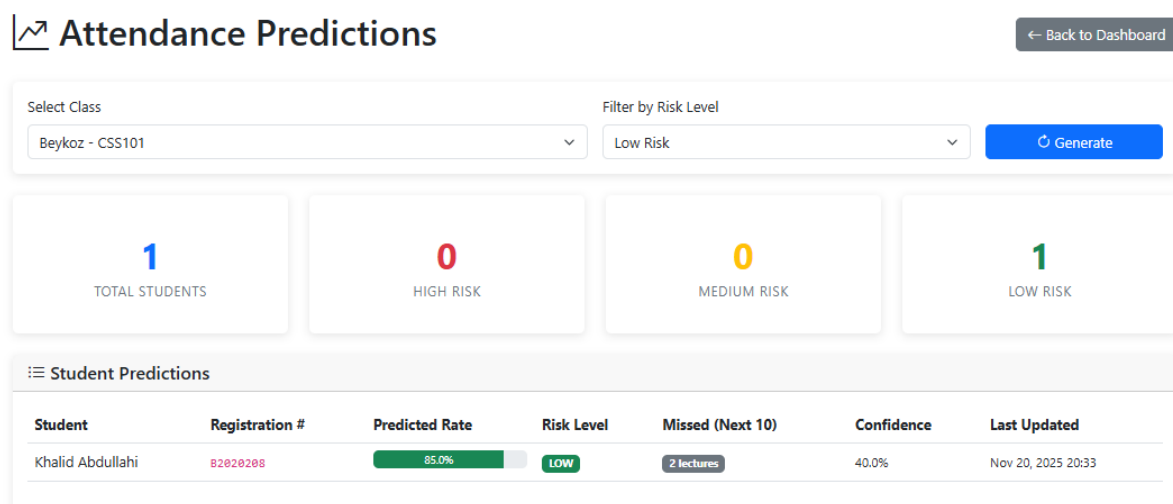


Figure 3.5: Machine Learning Prediction

Figure 3.5 shows the attendance prediction dashboard, which presents the attendance prediction summary for the selected class (Beykoz-CSS101) extracted under low-risk students. It reports

a total of 1 student, with 0 classified as a high risk, 0 medium risk, and 1 as low risk. In the prediction student table, Khalid Abdullahi with registration number (B2026208) has a predicted attendance rate of 85%, which places him in the low-risk category. The model successfully estimate that he may miss 2 lectures out of the next 10, with a confidence of level of 40%, indicating moderate model certainty in the prediction.

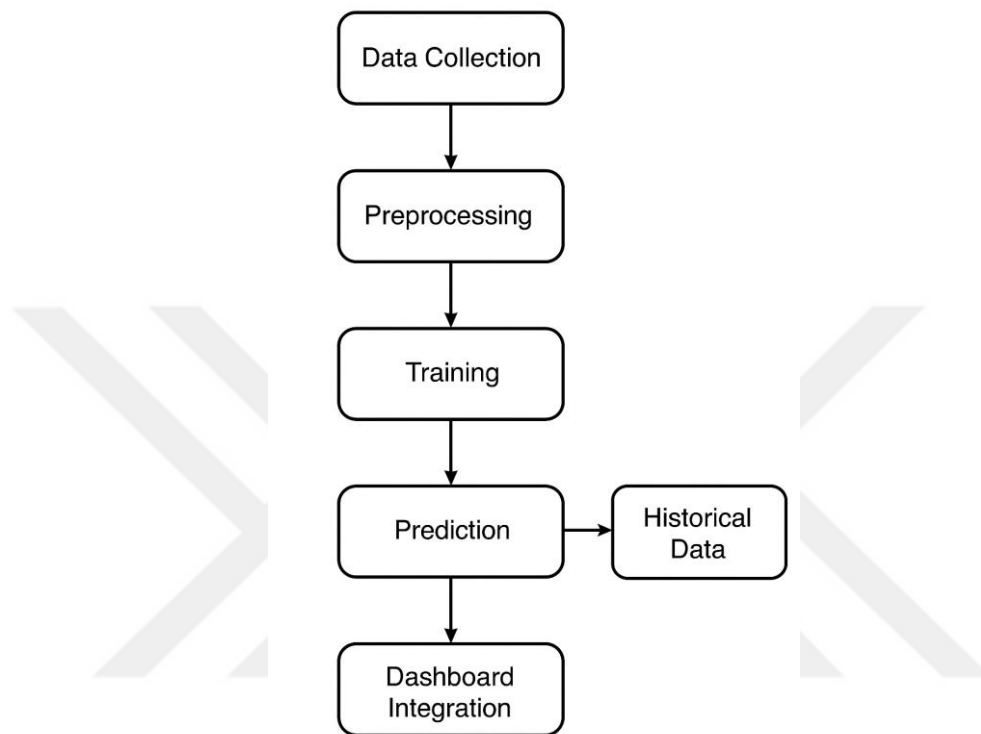


Figure 3.6: Machine Learning Process Flowchart for Student Attendance Prediction

The figure above illustrates a streamlined machine learning pipeline for an attendance prediction system at Beykoz University. It begins with data collection, where student attendance records gathered, followed by preprocessing that involves cleaning the data and handling missing values. The prepared dataset is then used in the training phase which allow the machine learning model learns patterns from historical attendance behavior. After training the data, the model perfume prediction, gathering attendance forecast or risk classification for students. The prediction phase communicates with the historical data, indicating the past records are referenced to improve current predictions. Finally, the results are deployed to lecturer dashboard integration, where prediction is visualized and made accessible to lecturers and university administrators for monitoring and evaluation

3.6.1 Use Case Diagram

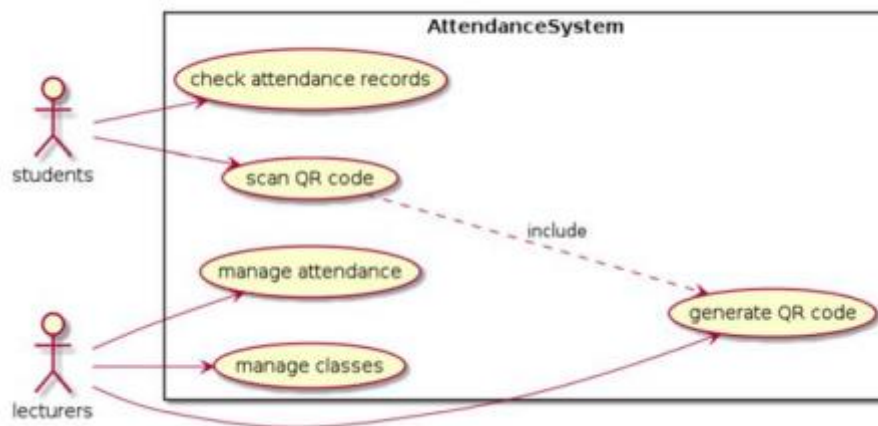


Figure 3.7: Use Case Diagram for an Attendance System

The use case in Figure 3.7 above illustrates the interaction between two primary actors: students and lecturers. Students can check attendance records and scan a QR code generated in the student dashboard to mark their attendance. The lecturers are responsible of managing student attendance in the lecturer dashboard.

3.7 System Design

System Design is the process of defining the architecture, interfaces and data of a system that meets a particular requirement. This multidisciplinary area includes trade-offs, balancing conflicting requirements, and making design decisions that will affect the whole system. System design requires a systematic approach to the engineering and development of systems.

The process of defining the architecture, interfaces, and data for a system that complies with particular requirements is known as system design. It is a multidisciplinary field that entails trade-off analysis, weighing competing requirements, and making choices regarding design decisions that will have an impact on the entire system. A methodical approach to developing and engineering systems is necessary for system design.

3.8 Machine Learning Dataset Generation and Model Training

3.8.1 Data Generation and Feature Engineering

The system uses XGBoost (Extreme Gradient Boosting) to predict student attendance patterns by utilizing real attendance records from the MySQL database (attendance_system.sql). The raw data are extracted from 4 different tables within the database: the 'attendance' table contains student check-in records with their status either present/absent, and the 'lectures' table

contains lecture details including date, time, and lecture venue, the ‘class’ table provides class and course details, while the ‘student’ table contains student records. Having limited real data, a sample data generator can create realistic test data by generating 50 sample lectures with random dates within the past *60 days* and creating 100+ attendance records with realistic patterns (70% present, 20% late, and 10% absent) across multiple students.

I use python to generate the sample data by running ‘python ml/generate_sample_data.py --100’ where the count parameter specifies the number of attendance record to be created. After generating the raw data from the database, the system performs feature engineering to extract meaningful patterns that the model used for predictions. These engineered features include student performance metrics (attendance rate, total lectures, and present count), class-level features (total class lectures, class attendance), temporal features (day of week, hour of day, recency flags for morning/afternoon/evening), and categorical features that are one-hot encoded (day names, and course codes). The target variables are binary: ‘1’ for student who are present or late, and ‘0’ for absent that are students. These features set to ensures the model captures both individual student patterns and broader class-level trends that influence attendance.

3.8.2 Dataset Export and Work Flow

After generating the sample data, csv has been generated. The generated featured dataset has been exported using ‘python ml/save_features.py –out ml/attendance_dataset.csv’ which fetches all attendance records from the database, applies the same feature engineering transformations, and writes the output to ‘mlattendance_dataset.csv’. The CSV files contain all feature columns plus the target variable and is ready for inspection in excel, pandas or any analytics tool. The XGBoost model re-train by executing ‘python ml/xgboost_train.py’ which performs the same feature extraction on fresh data, split in into 80% training and 20% testing sets with stratified sampling, and trains a new XGBoost model with 100 trees, max depth of 6, learning rate of 0.1 and early stopping enabled. The training process automatically saves the trained model to ‘ml/xgboost_model.joblib’ and its configuration (feature names, metrics, and timestamp) to ‘ml/xgboost_config.json’. The complete workflow generate data, export features, train model to ensures our dataset and predictions are always in sync with our database and leverages the model’s full capabilities.

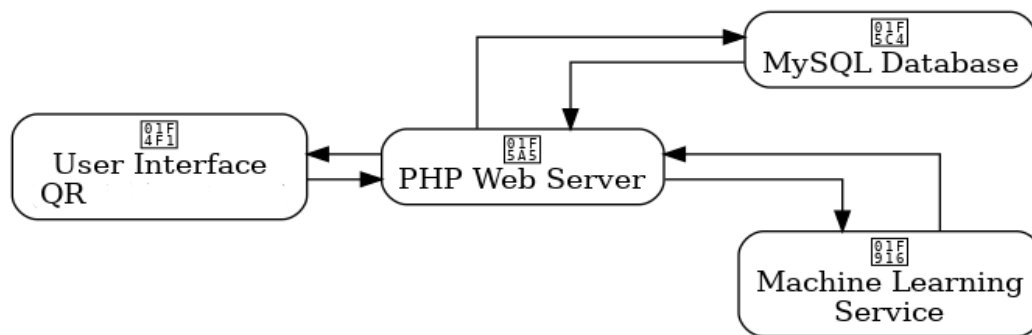


Figure 3.8: System Architecture of the Proposed QR Code-Based Attendance System

The diagram above represents a QR code base attendance system architecture where the user interface captures QR code and sends it to PHP server web server, which acts as the central controller of the system. The PHP server processes the request by communicating with MySQL database to retrieve or store user and attendance information, while also interact with a machine learning service.

3.8.3 Why XGBoost

Extreme Gradient Boosting (XGBoost) was carefully selected for this study for its superior predictive performance, efficiency, and ability to model complex relationships within structured datasets. Unlike the previously rule-based model that relies on predefined logical conditions and may suffer to capture intricate patterns in student attendance behavior. XGBoost employs an assemble of decision of trees to learn pattern directly from data, resulting in more accurate and reliable predictions. It also incorporates regularization techniques to decrease overfitting, thereby improving generalization to unseen data.

DISCUSSION AND EVALUATION

4.1 Introduction

This chapter includes discussions and analyses of the Beykoz University system. It focuses on discussion, implementation tools, user instructions, the assessment of the system's usability, and the design and implementation of the proposed system. The information flow of a system is described by its logical and physical structure.

4.2 Software Implementation Tools

The system focuses on advancing the existing attendance system used at Beykoz University. The main focus of this project is the front-end implementation of the QR-based attendance system, using the following software tools.

1. **Implementation Languages:** The following are the various programming languages used for the project's implementation:

The markup language used to create content, structure, and specify the semantics of the website is called hypertext markup language (HTML). The visual representation and styling of HTML elements in a Web page have been defined using the Cascading Style Sheet (CSS) language. It is used to manage the overall design of the website, including layout, colors, fonts, and spacing. JavaScript is a scripting language, primarily used to provide dynamic behavior and interactivity to web pages and web applications. The goal was to develop interactive user interfaces, manage user input, interact with data, and perform various tasks on the website without the need to reload the page.

2. **Implementation Platforms:** Microsoft has created Visual Studio Code, a widely used, free, open-source integrated development environment for the software industry. Regardless of the operating system you use, it is an excellent way to develop web applications and integrate with remote version control systems such as Git and Github.
3. **Operating System:** This project is a full web application that was built using the Windows operating system, a very user-friendly and developer-friendly system.

4.2.1 User Documentation – System Testing

System testing is a vital stage in the software development life cycle that entails thorough testing of a software application or system. System testing tries to make sure that all parts and modules of the program function properly as an integrated system and adhere to the requirements. The following was tested:

1. The login and logout functionality for the admin (lecturers)
2. The super admin can add and remove students
3. The admins can scan the student's QR code.
4. Admins can download the attendance list.

4.2.2 Snapshot

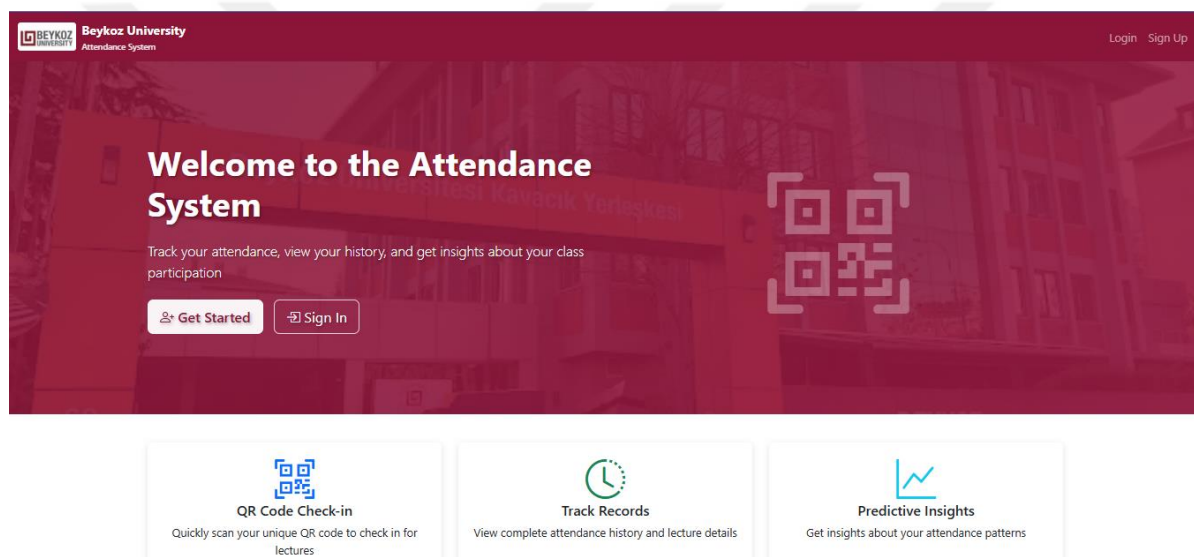
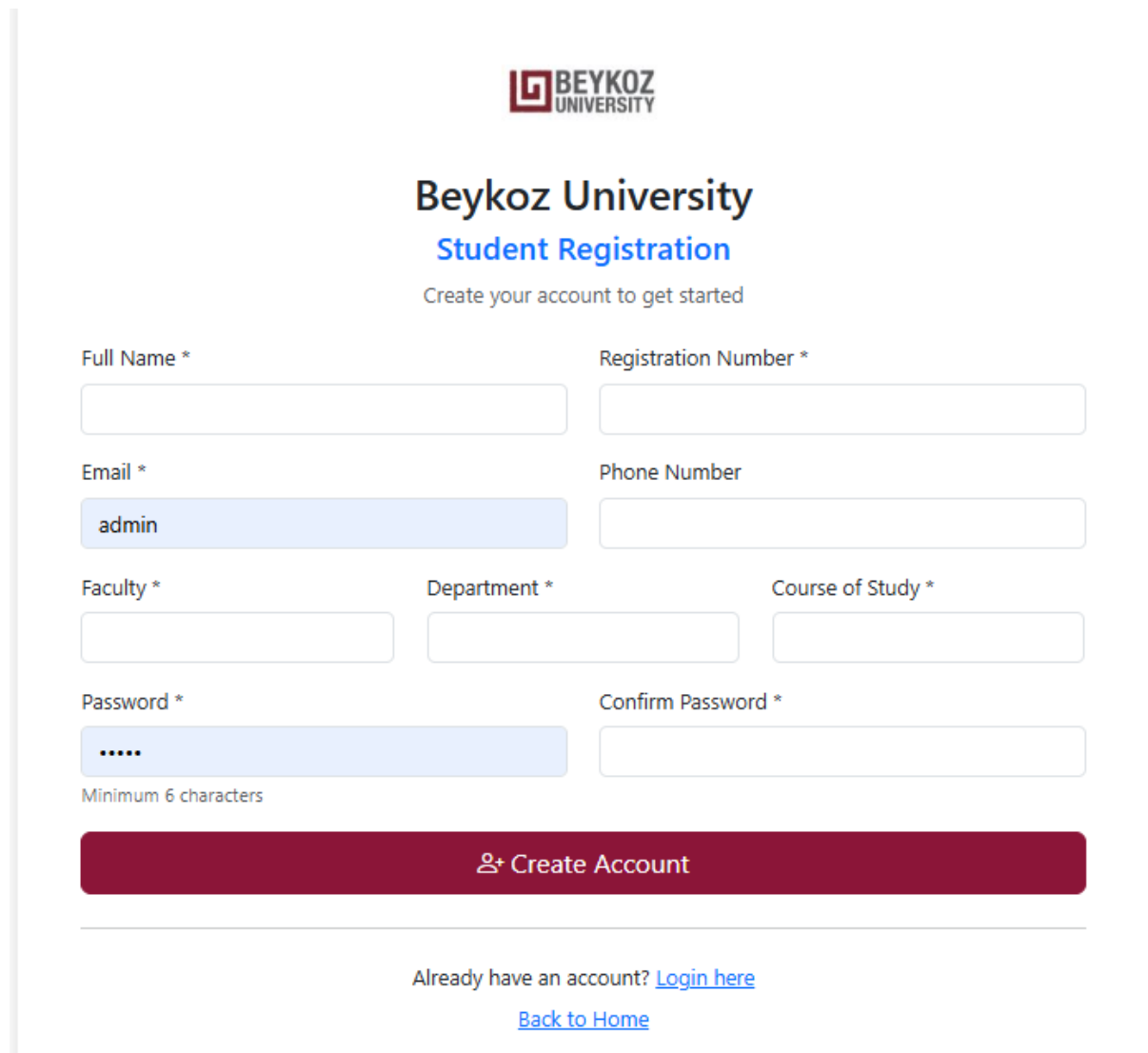


Figure 4 1: Homepage

Figure 4.1 shows the home page of the QR-based attendance system, where students can sign in and access their dashboard.



The image shows a web form for student registration at Beykoz University. At the top is the university's logo, which consists of a stylized 'B' inside a square followed by the text 'BEYKOZ UNIVERSITY'. Below the logo, the title 'Beykoz University' is displayed in a large, bold, black font, followed by 'Student Registration' in a smaller, blue font. Underneath the title is the instruction 'Create your account to get started' in a small, gray font. The form itself is organized into several rows of input fields. The first row contains 'Full Name *' and 'Registration Number *'. The second row contains 'Email *' (with the text 'admin' entered) and 'Phone Number'. The third row contains three fields: 'Faculty *', 'Department *', and 'Course of Study *'. The fourth row contains 'Password *' (with five dots entered) and 'Confirm Password *'. Below the password field is a small text requirement: 'Minimum 6 characters'. At the bottom of the form is a large, dark red button with the text 'Create Account' and a small user icon. Below the button, there is a horizontal line, followed by the text 'Already have an account? [Login here](#)' and another line with the text '[Back to Home](#)'.

BEYKOZ UNIVERSITY

Beykoz University

Student Registration

Create your account to get started

Full Name * Registration Number *

Email * Phone Number

Faculty * Department * Course of Study *

Password * Confirm Password *

Minimum 6 characters

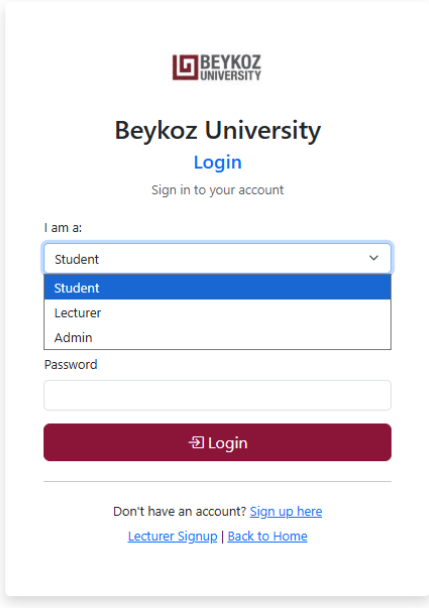
[Create Account](#)

Already have an account? [Login here](#)

[Back to Home](#)

Figure 4 2: Signup Page

The student registration page for registering in the system is shown in Figure 4.2. In addition to the password, the student enters their academic credentials. To access the system, students must first create an account.



Beykoz University
Login
Sign in to your account

I am a:

Student
 Student
 Lecturer
 Admin

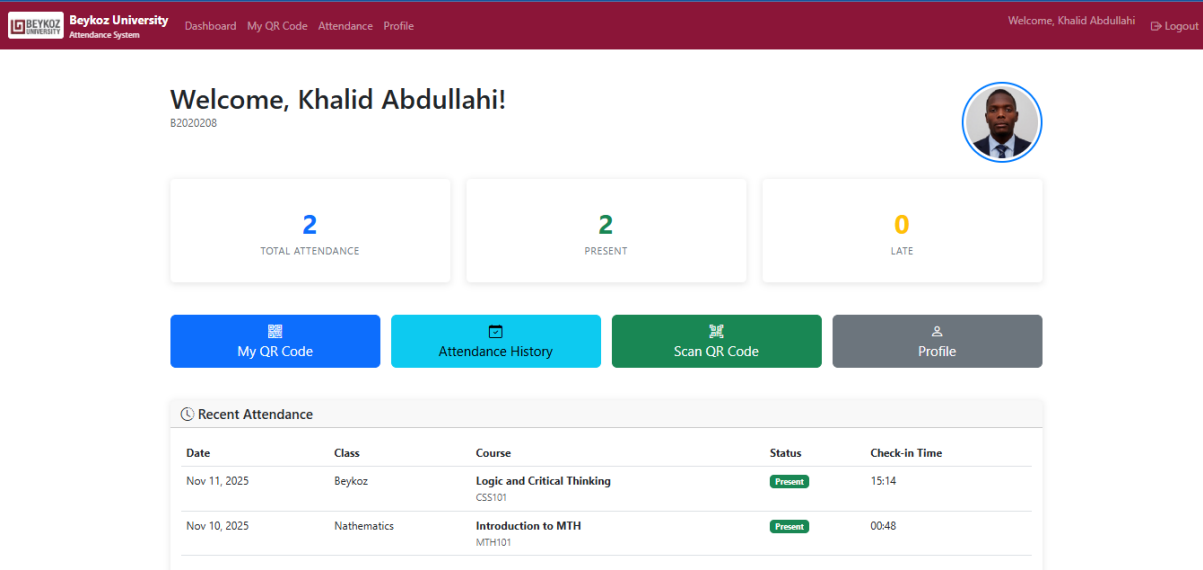
Password

Login

Don't have an account? [Sign up here](#)
[Lecturer Signup](#) | [Back to Home](#)

Figure 4 3: Login Page

The login page, where system users can select a role and enter the logon information, is shown in Figure 4.3. If the logon information is correct, the system will log on; if not, it will return a failure message.



Beykoz University Attendance System
Welcome, Khalid Abdullahi Logout

Welcome, Khalid Abdullahi!

B2020208

2
 TOTAL ATTENDANCE

2
 PRESENT

0
 LATE

My QR Code

Attendance History

Scan QR Code

Profile

Recent Attendance				
Date	Class	Course	Status	Check-in Time
Nov 11, 2025	Beykoz	Logic and Critical Thinking CSS101	Present	15:14
Nov 10, 2025	Mathematics	Introduction to MTH MTH101	Present	00:48

Figure 4 4: Student Dashboard

Figure 4.4. shows how the students' dashboard, students can fully access the system through his/her dashboard. The dashboard includes profile sections (students can update his/her information), the attendance section.

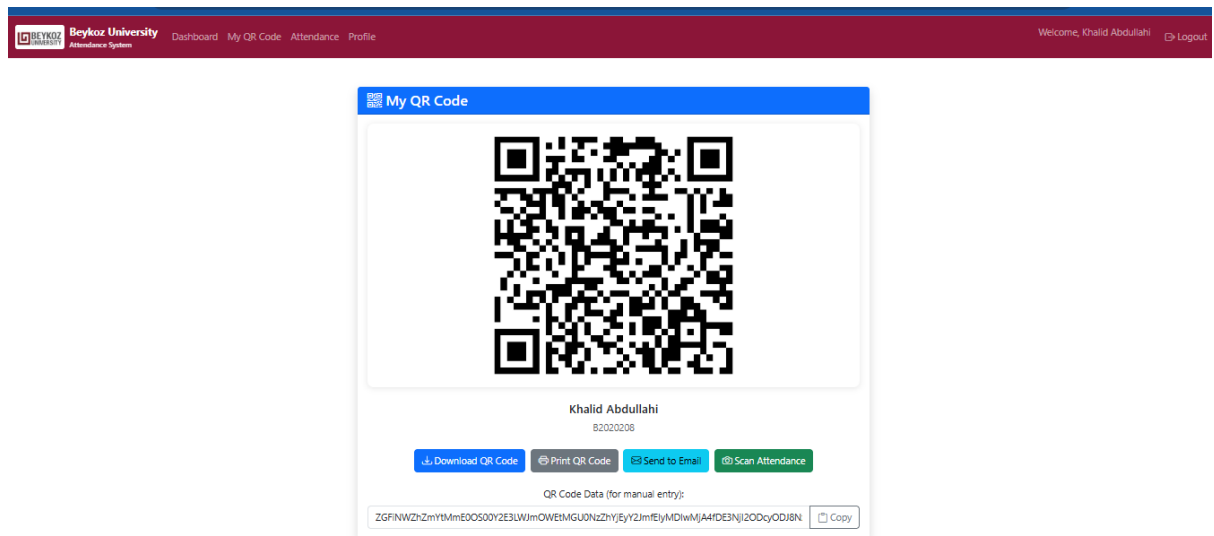


Figure 4 5: Attendance QR Code Section

The section of the QR code for students is shown in figure 4.5. Each student who registered for the current lecture has a unique QR code for the lecture. The start and end dates are encoded in the QR code. Each class has its own code. It helps reduce system errors.

🔧 Update Profile ← Back to Dashboard

📷 Photo Upload

You can update your photo below if needed.

Upload Your Photo

Choose File No file chosen

Upload a clear photo of yourself (JPG, PNG, or WebP format, max 5MB)

Select a photo to upload

📋 Course Registration

Course Code *
e.g., CS101

Course Title *
e.g., Introduction to Computer Science

Semester * Academic Year *

Fall 2025

Register Course

📋 My Registered Courses

Course Code	Course Title	Semester	Academic Year	Registered	Action
MTH101	Introduction to MTH	Summer	2025	Nov 10, 2025	Remove
CS5101	Logic and Critical Thinking	Fall	2025	Nov 09, 2025	Remove
CS5104	Logic and Critical Thinking	Fall	2025	Nov 10, 2025	Remove

Figure 4 6: Students Profile Section

Figure 4.6 shows the students' profile section where student needs to register for the courses being taken in that semester. By registering for courses, the system will allow the students to

view classes when created based on the courses taken. Whenever a class is created by a lecturer, the system will generate a unique code for each student taking that course, and the code expires together with the class.



Beykoz University

Attendance System

Dashboard

My QR Code

Attendance

Profile

Welcome, Khalid Abdullahi

Logout



Attendance History

All Attendance Records

Date	Class	Course Code	Status	Check-in Time	Method
Nov 11, 2025	Beykoz	CSS101	Present	Nov 11, 2025 15:14	QR code
Nov 10, 2025	Mathematics	MTH101	Present	Nov 11, 2025 00:48	QR code

Figure 4 7: Students Attendance History

Figure 4.7 shows the students' attendance history from Date, Class, Course Code, Status, Check-in Time, and method.



Beykoz University

Lecturer Registration

Create your lecturer account

Full Name *

Email *

Employee ID *

Faculty *

Department *

Password *

Confirm Password *

Create Account

Already have an account? [Login here](#)

[Back to Home](#)

Figure 4 8: Lecturer Signup Page

Figure 4.8 shows the lecturer signup page. For a lecturer to access the system, there is a need for registration. The system will store the lecturer's registration details and allow the lecturers to access the system after registration.

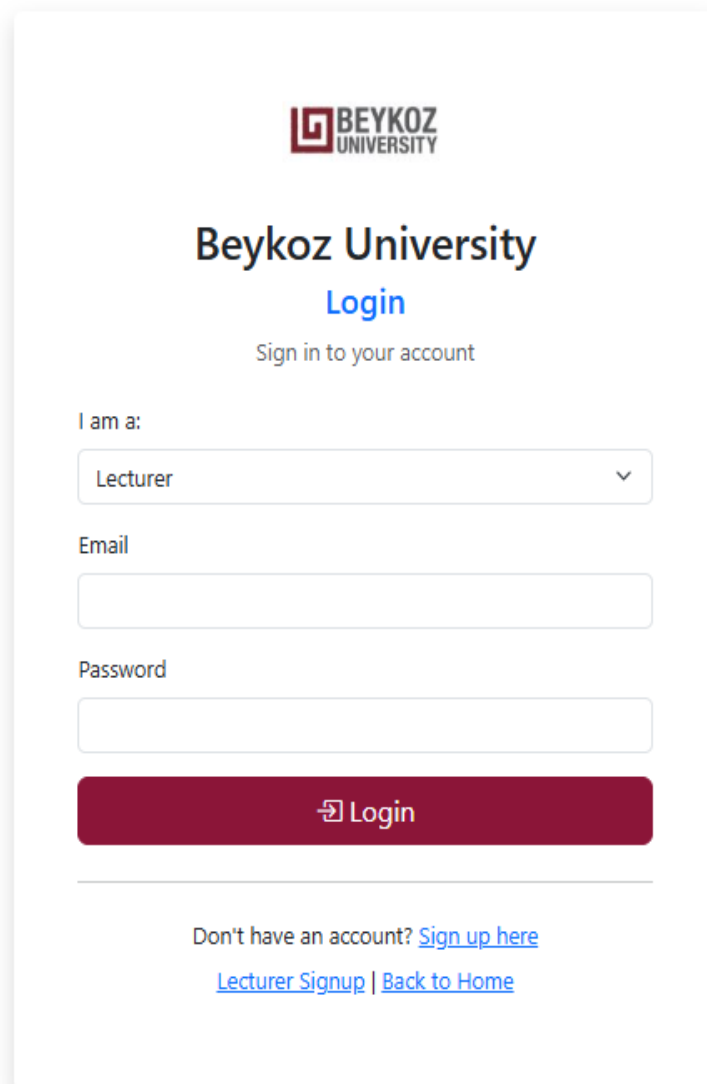
The image shows a login page for Beykoz University. At the top, there is a logo for Beykoz University, which consists of a red square with a white 'B' inside, followed by the text 'BEYKOZ UNIVERSITY'. Below the logo, the text 'Beykoz University' is displayed in a large, bold, black font. Underneath that, the word 'Login' is written in a blue font. Below 'Login', the text 'Sign in to your account' is displayed in a smaller, gray font. The main form area contains three input fields: a dropdown menu labeled 'I am a:' with 'Lecturer' selected, an 'Email' field, and a 'Password' field. Below these fields is a large, dark red button with a white icon of a person and the text 'Login'. At the bottom of the form, there is a link that says 'Don't have an account? [Sign up here](#)'. Below this link are two more links: '[Lecturer Signup](#)' and '[Back to Home](#)'.

Figure 4 9: Lecturer Login

Figure 4.9 shows the lecture login page. If the lecturer provides valid credentials, the system will log in; else it will display an error message.

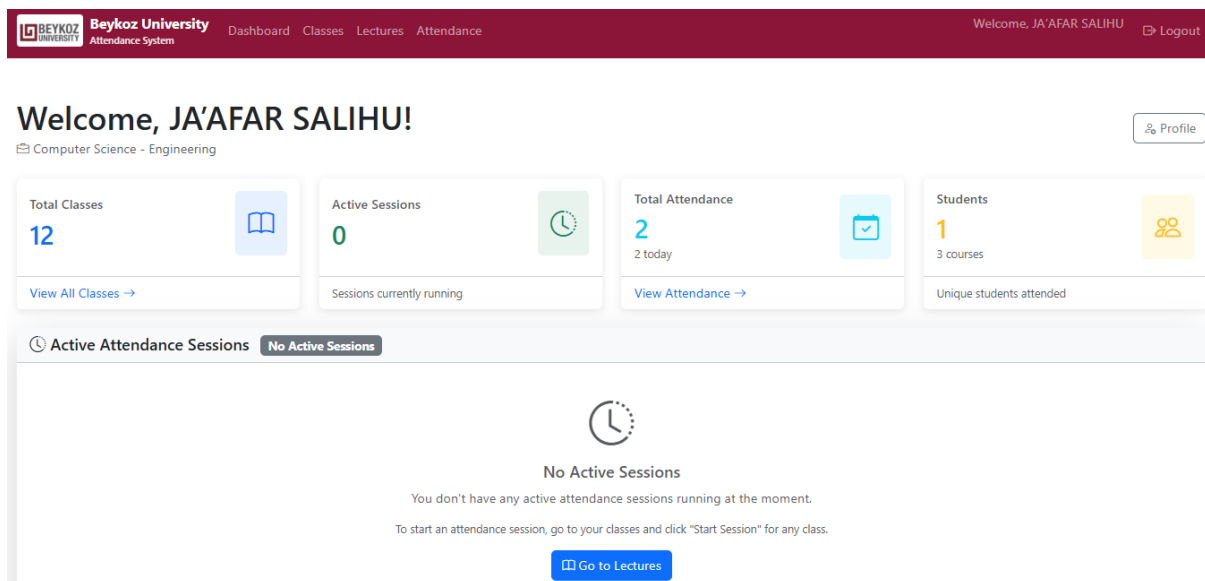


Figure 4 10: Lecturer Dashboard

Figure 4.10 shows the lecturer dashboard. The dashboard shows the Total classes created by the lecturer, active sessions, total attendance, and unique students attended. Other sections from the lecturer dashboard are indicated in Figure 4.11 below.

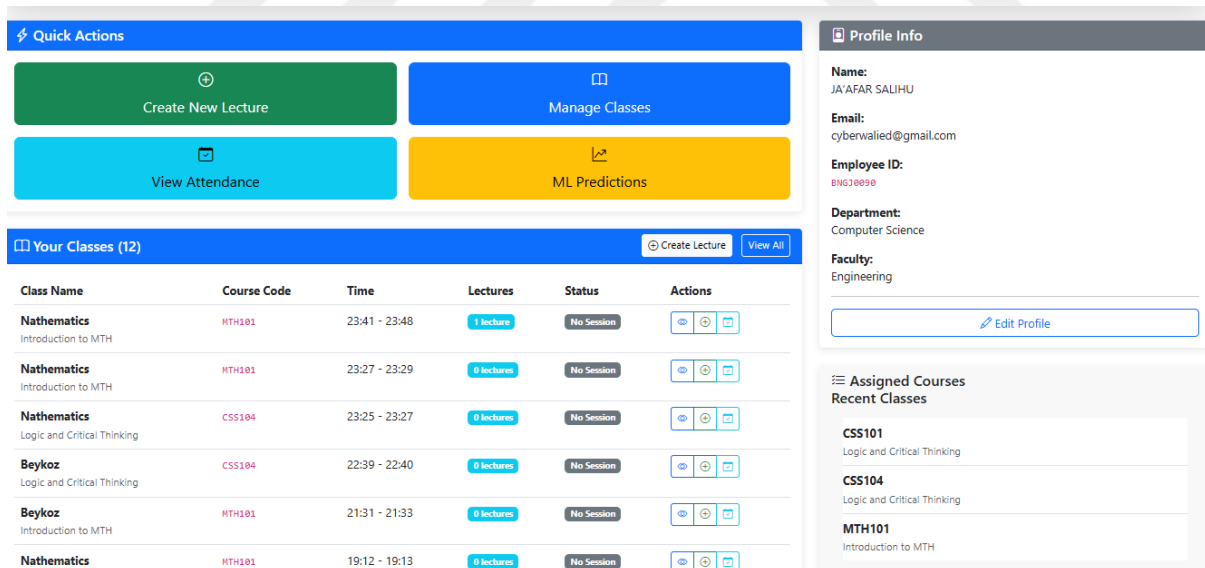


Figure 4 11: Lecturer Dashboard B

Figure 4.11 shows the continuation of the lecture dashboard. Quick actions were provided in the dashboard that allow lecturers to create new lectures, manage classes, view attendance, and ML predictions

Dashboard
Classes
Lectures
Attendance

+

Create New Lecture

Select Class *

Choose a class...

▼

Select the class for which you want to create a lecture

Lecture Date *

11/11/2025

📅

Select the date for this lecture

Start Time *

--:-- --

🕒

When does this lecture start?

End Time *

--:-- --

🕒

When does this lecture end?

Venue

e.g., Room 101, Building A

Optional: Where will this lecture take place?

☒ Start Attendance Session Immediately

If checked, an active attendance session will be created automatically, allowing students to scan QR codes right away.

✔ Create Lecture

Cancel

Figure 4 12: Create Class

Figure 4.12 shows how a lecturer creates a class for students. The section allows lecturers to create classes, and students can view and take attendance. Students can view the class if they register for the course.

BEYKOZ UNIVERSITY

Beykoz University

Attendance System

Dashboard
Classes
Lectures
Attendance

Welcome, JA'AFAR SALIHU
Logout

📅 Manage Lectures

View all your classes and their lecture sessions

Create New Lecture

← Back to Dashboard

12

My Classes

2

Total Lectures

2

Total Attendance

Mathematics

📖 Introduction to MTH

1 Lectures

Level: 200

Department: Computer Science

Total Attendance: 1

Students: 1

📅 Lectures (1)

Date	Start Time	End Time	Venue	Attendance	Students	Actions
Nov 10, 2025 Paid	23:41	23:48		1	1	🔍

Created: Nov 10, 2025 | Last Lecture: Nov 10, 2025

← Manage Class

📄 View All Attendance

Figure 4 13: Manage Class

Figure 4.13 shows the manage class section in the lecturer dashboard. A lecturer can manage a class created for attendance and also view attended students during that lecture.

4.3.2 Results and Analysis

The effectiveness of the system was evaluated by comparing the attendance system based on the QR code with the manual roll-call method. The findings are presented in Table 4.1.

4.1: Time Efficiency Comparison

Attendance Method	Average Time per 50 Students (minutes)	Average Error Rate (%)	Remarks
Manual Roll Call	10–12	7.0	Time-consuming and prone to human error
QR Code System	1.8	0.0	Fast, automated, and highly accurate

Table 4.1 shows a time efficiency comparison between the manual attendance system and the QR code attendance system. The average time per 50 students (minutes) is 10-12 for manual, while 1.8 minutes for the QR code attendance system. The average error for the manual system is 7.0% while the QR code system is 0.0%. This indicates that manual attendance systems consume time and are prone to error, while the QR code system is fast, automated, and highly accurate.

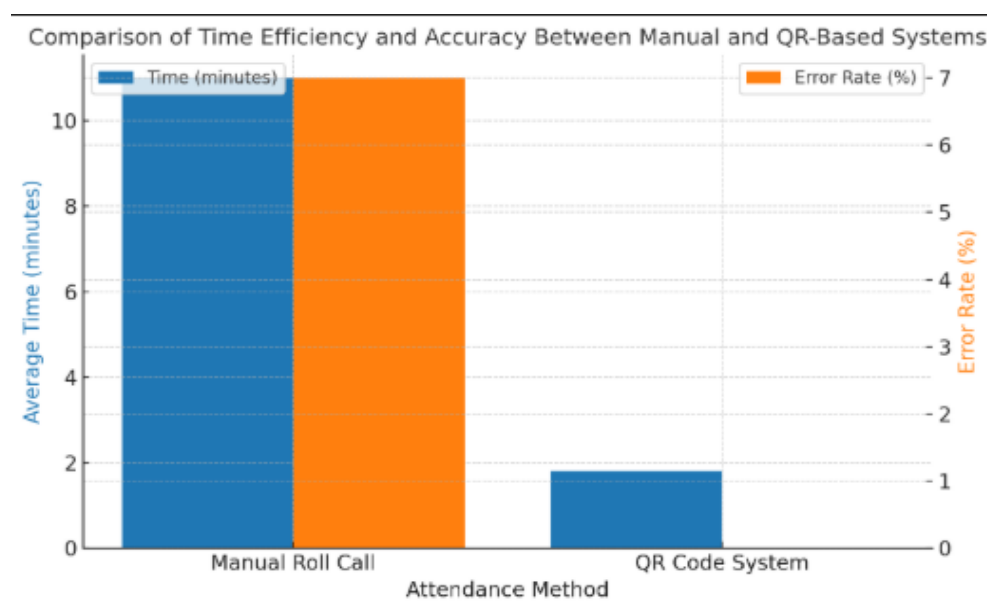


Figure 4.14: Comparison of Time Efficiency and Accuracy Between Manual and QR-Based Systems

Figure 4.14 shows the graphical representation of Table 4.2 on the comparison of time efficiency and accuracy between the manual attendance system and the QR code-based system.

4.5 Machine Learning Results and Evaluation

The predictive model was evaluated using accuracy, precision, recall, and F1-score metrics. During testing, the model achieved 92% accuracy in predicting student attendance outcomes.

Table 2: Machine Learning Results and Evaluation

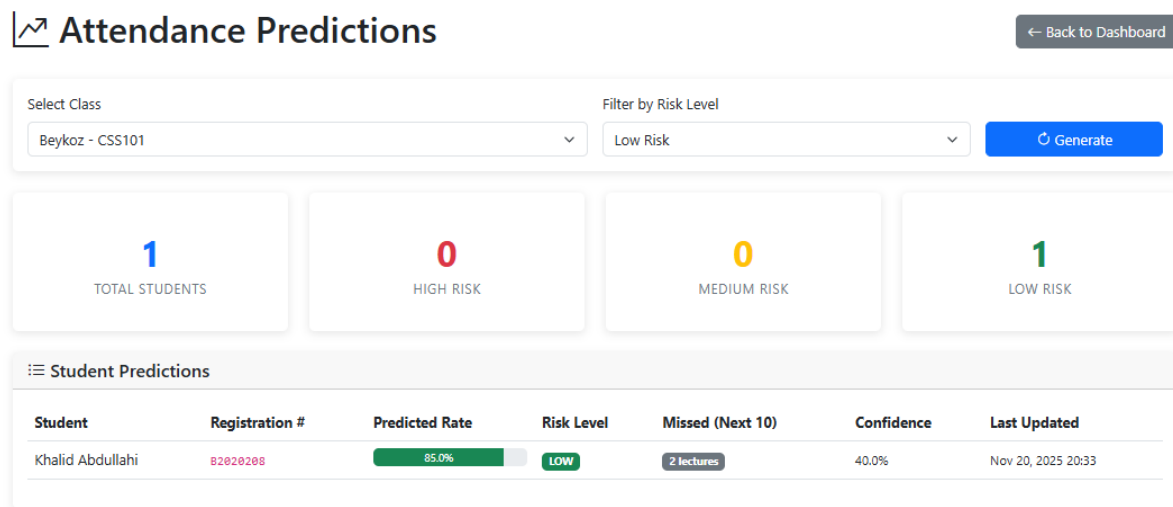


Table 4.2 shows how the predictive model uses past attendance data to forecast future trends. This helps academic administrators identify students who may need counseling or extra support. The system serves as a modern academic monitoring tool rather than just a record-keeping platform.

SUMMARY

5.1 Conclusion

This is the first project of the system developer. Most universities worldwide use an advanced QR-code-based attendance system. The QR Code Scanning system for some universities is a beginner. Adding a mobile application to the system will enhance its value. The user can scan and display attendance as the lecturer does tasks in the web application. It will be a challenging and useful project for future undergraduates at Beykoz University. The.

The system also leverages machine learning to predict the likelihood of the students attending the next class based on their previous attendance. The predictive module records attendance predictions for student participation patterns. The approaches allow lecturers and administrators to intervene early by improving lecture engagement and institutional performance

Student attendance has been predicted using rules-based models. A class of machine learning models known as rule-based models uses a pre-defined set of rules to input parameters to generate predictions. As their decision-making process is clearly expressed in rules, these models are distinguished by their simplicity, transparency, and clarity. The model predicts the outcome based on the conditions that the input meets, and each rule is typically related to a specific condition in the input properties.

5.2 Remarks

The project introduced a QR code-based Attendance System, which leverages technology (internet, smartphones, and QR codes) to provide a less labor-intensive, faster, and more efficient way of attendance tracking during lectures.

5.3 Future Research Work

For future research, the system developer intended to extend this system to an alternative way of managing attendance at the university. This could be developed into a fingerprint-based attendance management system in a later project. The trend in global university attendance is this. It will ensure timely and accurate compliance.

Besides that, real cloud-based storage will be another recommended enhancement or improvement to be done, rather than using a local server to achieve the concept of cloud technology. This will improve the result, representing will be more realistic and accurate, as the data is stored in cloud storage and web hosting by using a cloud server.

5.4 Recommendations

The remarkable findings of the study led the researcher to strongly recommend the use of the QR code attendance system. The system is proposed to the intended users because of its efficiency and reliability. Students entering the school premises will scan the QR codes to provide the basis for the attendance register. In particular, researchers recommend:

- i. The system should be installed in schools in such a way that the student attendance can be accurately and easily recorded.
- ii. It is strongly recommended that this system be implemented as it will provide reliable and accurate records of the attendance of students.
- iii. Researchers strongly recommend that the system be used in such a way as to ensure that the verification and recording of student attendance is simple, fast, accurate, timely and effective.
- iv. The system should include facial recognition system that will allow lecture to take student attendance through his/her dashboard.

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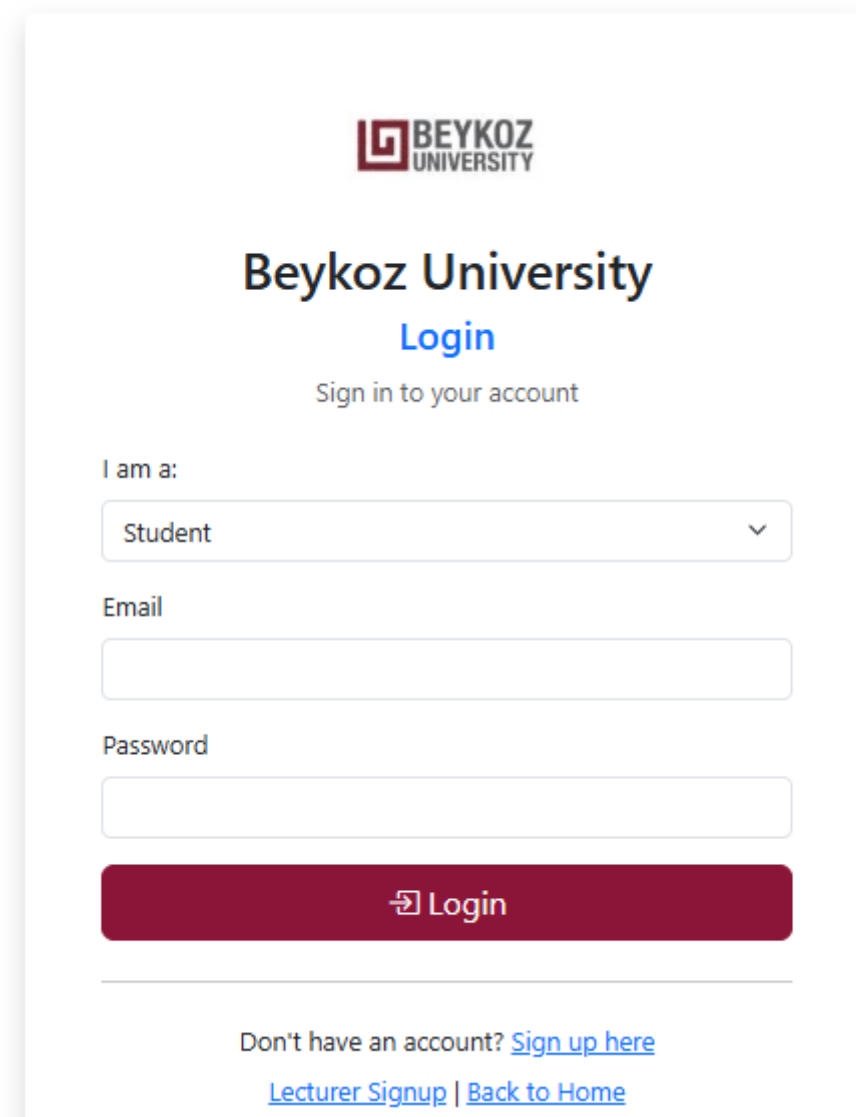
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Appendix A. Snapshot



The image shows a login page for Beykoz University. At the top is the university's logo, which consists of a stylized 'B' inside a square followed by the text 'BEYKOZ UNIVERSITY'. Below the logo, the text 'Beykoz University' is displayed in a large, bold, black font, followed by 'Login' in a smaller, blue font. Underneath, the text 'Sign in to your account' is centered. The login form includes a dropdown menu labeled 'I am a:' with 'Student' selected, an 'Email' input field, and a 'Password' input field. A large, dark red button with a white arrow icon and the text 'Login' is positioned below the input fields. At the bottom, there is a horizontal line followed by the text 'Don't have an account? [Sign up here](#)' and two more links: '[Lecturer Signup](#) | [Back to Home](#)'.

BEYKOZ UNIVERSITY

Beykoz University

Login

Sign in to your account

I am a:

Student

Email

Password

Login

Don't have an account? [Sign up here](#)

[Lecturer Signup](#) | [Back to Home](#)

Label A. 1 Login Page

Manage Lectures

View all your classes and their lecture sessions

[Create New Lecture](#)
[Back to Dashboard](#)

12
My Classes

3
Total Lectures

8
Total Attendance

Mathematics
Physics - Introduction to MTH
Active Session | 2 Lectures

Level: 200 Department: Computer Science Total Attendance: 7 Students: 6						
Lectures (2)						
Date	Start Time	End Time	Venue	Attendance	Students	Actions
Nov 20, 2025 Today	19:09	19:50	Theater 1	6	6	
Nov 10, 2025 Past	23:41	23:48		1	1	

Created: Nov 10, 2025 | Last Lecture: Nov 20, 2025
[Manage Class](#)
[View All Attendance](#)

Attendance Predictions

← Back to Dashboard

Select Class

Beykoz - CSS101

Filter by Risk Level

Low Risk

Generate

1

TOTAL STUDENTS

0

HIGH RISK

0

MEDIUM RISK

1

LOW RISK

☰ Student Predictions

Student	Registration #	Predicted Rate	Risk Level	Missed (Next 10)	Confidence	Last Updated
Khalid Abdullahi	B2020208	85.0%	LOW	2 lectures	40.0%	Nov 20, 2025 20:33

Label A. 4 Machine Learning Prediction

Appendix B. Source Code

```
<?php

/**

 * Application Configuration

 * Danmodi Student Care Platform

 */


// Error Reporting

error_reporting(E_ALL);

ini_set('display_errors', 0);

ini_set('log_errors', 1);

ini_set('error_log', __DIR__ . '/../logs/error.log');


// Session Configuration

ini_set('session.cookie_httponly', 1);

ini_set('session.use_only_cookies', 1);

ini_set('session.cookie_secure', 0); // Set to 1 in production with HTTPS

session_start();


// Timezone

date_default_timezone_set('Africa/Lagos');


// Application Constants
```

```
define('BASE_URL', 'http://localhost/danmodi-student-care/');

define('BASE_PATH', __DIR__ . '/../');

define('UPLOAD_PATH', BASE_PATH . 'uploads/');

define('MAX_FILE_SIZE', 5242880); // 5MB in bytes

define('ALLOWED_FILE_TYPES', ['pdf', 'jpg', 'jpeg', 'png', 'doc', 'docx']);


// User Roles

define('ROLE_ADMIN', 1);

define('ROLE_STAFF', 2);

define('ROLE_STUDENT', 3);


// Application Status

define('APP_NAME', 'Danmodi Student Care Platform');

define('APP_VERSION', '1.0.0');


// Email Configuration (Update with your SMTP settings)

define('SMTP_HOST', 'smtp.gmail.com');

define('SMTP_PORT', 587);

define('SMTP_USER', 'your-email@gmail.com');

define('SMTP_PASS', 'your-password');

define('SMTP_FROM_EMAIL', 'noreply@danmodi.gov.ng');

define('SMTP_FROM_NAME', 'Danmodi Student Care');
```

```
// Include database

require_once __DIR__ . '/database.php';

?>
```

Label B. 1 Connection Script

```
<?php

require_once __DIR__ . '/config/config.php';

$pageTitle = 'Home';

$hideNavbar = false;

// Get active attendance session

$pdo = getDBConnection();

$activeSession = null;

try {

    $stmt = $pdo->prepare("

        SELECT s.*, c.id as class_id, c.class_name, c.course_code, l.name as lecturer_name

        FROM attendance_sessions s

        JOIN classes c ON s.class_id = c.id

        JOIN lecturers l ON s.lecturer_id = l.id

        WHERE s.is_active = 1

        ORDER BY s.session_start DESC
```

LIMIT 1

");

\$stmt->execute();

\$activeSession = \$stmt->fetch();

} catch (PDOException \$e) {

error_log("Error fetching active session: " . \$e->getMessage());

}

include __DIR__ . '/includes/header.php';

?>

<style>

/* CSS for the background image */

.hero-section {

position: relative;

overflow: hidden;

min-height: 600px;

padding: 100px 0;

background: linear-gradient(135deg, #8B1538 0%, #a01d47 100%);

color: #fff;

display: flex;

align-items: center;

margin-bottom: 0;

```
}
```

```
/* Background image - Beykoz.PNG */
```

```
.hero-section::before {
```

```
    content: "";
```

```
    position: absolute;
```

```
    top: 0;
```

```
    left: 0;
```

```
    width: 100%;
```

```
    height: 100%;
```

```
    background-image: url('<?php echo base_url('assets/images/Beykoz.PNG'); ?>');
```

```
    background-size: cover;
```

```
    background-position: center center;
```

```
    background-repeat: no-repeat;
```

```
    opacity: 0.25;
```

```
    z-index: 0;
```

```
}
```

```
/* Overlay for better text readability */
```

```
.hero-section::after {
```

```
    content: "";
```

```
    position: absolute;
```

```
    top: 0;
```

```
    left: 0;

    width: 100%;

    height: 100%;

    background: rgba(139, 21, 56, 0.4);

    z-index: 0;

}

/* Ensure text is visible over the background */

.hero-section .container {

    position: relative;

    z-index: 1;

}

.hero-section .display-5,

.hero-section .lead,

.hero-section .btn {

    position: relative;

    z-index: 2;

    text-shadow: 2px 2px 4px rgba(0, 0, 0, 0.3);

}

.hero-section .btn-light {

    background-color: rgba(255, 255, 255, 0.95);
```

```
border-color: rgba(255, 255, 255, 0.95);  
  
color: #8B1538;  
  
font-weight: 600;  
  
}
```

```
.hero-section .btn-outline-light {  
  
border-color: rgba(255, 255, 255, 0.8);  
  
color: #fff;  
  
}
```

```
.hero-section .btn-outline-light:hover {  
  
background-color: rgba(255, 255, 255, 0.2);  
  
border-color: rgba(255, 255, 255, 1);  
  
}
```

```
</style>
```

```
<main>
```

```
<div class="hero-section">
```

```
<div class="container">
```

```
<div class="row align-items-center">
```

```
<div class="col-lg-6">
```

```
<h1 class="display-5 fw-bold mb-4">Welcome to the Attendance System</h1>
```

```
<p class="lead mb-4">
```

Track your attendance, view your history, and get insights about your class participation

```
</p>
```

```
<?php if (!isLoggedIn()): ?>
```

```
<div class="d-flex gap-3">
```

```
<a href="<?php echo base_url('auth/signup.php'); ?>" class="btn btn-light btn-lg">
```

```
<i class="bi bi-person-plus"></i> Get Started
```

```
</a>
```

```
<a href="<?php echo base_url('auth/login.php'); ?>" class="btn btn-outline-light btn-lg">
```

```
<i class="bi bi-box-arrow-in-right"></i> Sign In
```

```
</a>
```

```
</div>
```

```
<?php endif; ?>
```

```
</div>
```

```
<div class="col-lg-6 text-center">
```

```
<i class="bi bi-qr-code-scan" style="font-size: 200px; opacity: 0.3;"></i>
```

```
</div>
```

```
</div>
```

```
</div>
```

```
</div>
```

```

<div class="container">

    <?php if ($activeSession): ?>

        <div class="card shadow-lg mb-5 border-primary">

            <div class="card-header bg-primary text-white">

                <h4 class="mb-0"><i class="bi bi-clock"></i> Active Attendance Session</h4>

            </div>

            <div class="card-body">

                <div class="row">

                    <div class="col-md-8">

                        <p class="mb-2"><strong>Class:</strong> <?php echo
                        htmlspecialchars($activeSession['class_name']); ?></p>

                        <p class="mb-2"><strong>Course Code:</strong> <?php echo
                        htmlspecialchars($activeSession['course_code']); ?></p>

                        <p class="mb-2"><strong>Lecturer:</strong> <?php echo
                        htmlspecialchars($activeSession['lecturer_name']); ?></p>

                        <p class="mb-0"><strong>Started:</strong> <?php echo date('M d, Y H:i',
                        strtotime($activeSession['session_start'])); ?></p>

                    </div>

                    <div class="col-md-4 text-end">

                        <?php if (isLoggedIn() && $_SESSION['user_type'] === 'student'): ?>

                            <a href="<?php echo base_url('dashboard/student/scan-attendance.php');
                            ?>" class="btn btn-success btn-lg">

                                <i class="bi bi-qrcode"></i> Scan QR Code to Mark Attendance

                            </a>

```

```
<?php else: ?>
```

```
<p class="text-muted"><small>Students can scan their QR code from their
dashboard to mark attendance.</small></p>
```

```
<?php endif; ?>
```

```
</div>
```

```
</div>
```

```
</div>
```

```
</div>
```

```
<?php endif; ?>
```

```
<div class="row g-4 mb-5">
```

```
<div class="col-md-4">
```

```
<div class="card h-100">
```

```
<div class="card-body text-center">
```

```
<i class="bi bi-qr-code-scan display-4 text-primary mb-3"></i>
```

```
<h5 class="card-title">QR Code Check-in</h5>
```

```
<p class="card-text">Quickly scan your unique QR code to check in for
lectures</p>
```

```
</div>
```

```
</div>
```

```
</div>
```

```
<div class="col-md-4">
```

```
<div class="card h-100">
```

```

<div class="card-body text-center">

    <i class="bi bi-clock-history display-4 text-success mb-3"></i>

    <h5 class="card-title">Track Records</h5>

    <p class="card-text">View complete attendance history and lecture
details</p>

</div>

</div>

</div>

<div class="col-md-4">

    <div class="card h-100">

        <div class="card-body text-center">

            <i class="bi bi-graph-up display-4 text-info mb-3"></i>

            <h5 class="card-title">Predictive Insights</h5>

            <p class="card-text">Get insights about your attendance patterns</p>

        </div>

    </div>

</div>

</div>

</div>

<div class="col-12">

    <div class="card">

```

```

<?php if (isLoggedIn()): ?>

```

```

<div class="row">

```

```

<div class="col-12">

```

```

<div class="card">

```

```

<div class="card-header">

    <h5 class="mb-0"><i class="bi bi-lightning"></i> Quick Actions</h5>

</div>

<div class="card-body">

    <div class="row g-3">

        <?php if ($_SESSION['user_type'] === 'student'): ?>

            <div class="col-md-3">

                <a href="<?php echo base_url('dashboard/student/index.php'); ?>"
class="btn btn-primary w-100">

                    <i class="bi bi-speedometer2"></i> Dashboard

                </a>

            </div>

            <div class="col-md-3">

                <a href="<?php echo base_url('dashboard/student/qr-code.php'); ?>"
class="btn btn-success w-100">

                    <i class="bi bi-qr-code"></i> My QR Code

                </a>

            </div>

            <div class="col-md-3">

                <a href="<?php echo base_url('dashboard/student/attendance.php');
?>" class="btn btn-info w-100">

                    <i class="bi bi-calendar-check"></i> Attendance

                </a>

            </div>

```

```

<div class="col-md-3">

    <a href="<?php echo base_url('scanner.php'); ?>" class="btn btn-
warning w-100">

        <i class="bi bi-camera"></i> Scanner

    </a>

</div>

<?php elseif ($_SESSION['user_type'] === 'lecturer'): ?>

    <div class="col-md-4">

        <a href="<?php echo base_url('dashboard/lecturer/index.php'); ?>"
class="btn btn-primary w-100">

            <i class="bi bi-speedometer2"></i> Dashboard

        </a>

    </div>

    <div class="col-md-4">

        <a href="<?php echo base_url('dashboard/lecturer/lectures.php'); ?>"
class="btn btn-success w-100">

            <i class="bi bi-book"></i> My Classes

        </a>

    </div>

    <div class="col-md-4">

        <a href="<?php echo base_url('dashboard/lecturer/attendance.php');
?>" class="btn btn-info w-100">

            <i class="bi bi-calendar-check"></i> Attendance

        </a>

```

```
</div>
```

```
<?php elseif ($_SESSION['user_type'] === 'admin'): ?>
```

```
<div class="col-md-3">
```

```
<a href="<?php echo base_url('dashboard/admin/index.php'); ?>"
class="btn btn-primary w-100">
```

```
<i class="bi bi-speedometer2"></i> Dashboard
```

```
</a>
```

```
</div>
```

```
<div class="col-md-3">
```

```
<a href="<?php echo base_url('dashboard/admin/students.php'); ?>"
class="btn btn-success w-100">
```

```
<i class="bi bi-people"></i> Students
```

```
</a>
```

```
</div>
```

```
<div class="col-md-3">
```

```
<a href="<?php echo base_url('dashboard/admin/lectures.php'); ?>"
class="btn btn-info w-100">
```

```
<i class="bi bi-calendar-event"></i> Lectures
```

```
</a>
```

```
</div>
```

```
<div class="col-md-3">
```

```
<a href="<?php echo base_url('dashboard/admin/reports.php'); ?>"
class="btn btn-warning w-100">
```

```
<i class="bi bi-file-earmark-text"></i> Reports
```

```
</a>

</div>

<?php endif; ?>

</div>

</div>

</div>

</div>

<?php endif; ?>

</div>

</main>

<?php include __DIR__ . '/includes/footer.php'; ?>
```

Label B. 2 Login Script

```
<?php

/**

 * Fix Admin Login - Verify and Fix Admin Account

 * This script will check your admin account and fix any issues

 */

require_once __DIR__ . '/config/config.php';

$pdo = getDBConnection();

$adminEmail = 'admin@beykoz.edu.tr';

$adminPassword = 'admin123';

// Check if admin exists

$stmt = $pdo->prepare("SELECT * FROM admin_users WHERE email = ?");

$stmt->execute([$adminEmail]);

$admin = $stmt->fetch();

$issues = [];

$fixes = [];

if (!$admin) {

    $issues[] = "Admin account not found with email: {$adminEmail}";

    // Create admin account
```

```

try {

    $adminId = generateUUID();

    $passwordHash = hashPassword($adminPassword);

    $stmt = $pdo->prepare("INSERT INTO admin_users (id, name, email, password_hash)
VALUES (?, ?, ?, ?)");

    if ($stmt->execute([$adminId, 'System Administrator', $adminEmail, $passwordHash]))
    {

        $fixes[] = "Admin account created successfully!";

        $admin = ['id' => $adminId, 'email' => $adminEmail, 'name' => 'System
Administrator'];

    }

} catch (PDOException $e) {

    $issues[] = "Failed to create admin: " . $e->getMessage();

}

} else {

    // Verify password

    if (!verifyPassword($adminPassword, $admin['password_hash'])) {

        $issues[] = "Password hash doesn't match. Updating password...";

        try {

            $newHash = hashPassword($adminPassword);

            $stmt = $pdo->prepare("UPDATE admin_users SET password_hash = ? WHERE id =
?");

            if ($stmt->execute([$newHash, $admin['id']])) {

                $fixes[] = "Password hash updated successfully!";

```

```

    }

    } catch (PDOException $e) {

        $issues[] = "Failed to update password: " . $e->getMessage();

    }

} else {

    $fixes[] = "Password hash is correct!";

}

// Check if ID is valid UUID format
if (empty($admin['id']) || strlen($admin['id']) < 30) {

    $issues[] = "Admin ID is invalid. Updating...";

    try {

        $newId = generateUUID();

        $stmt = $pdo->prepare("UPDATE admin_users SET id = ? WHERE email = ?");

        if ($stmt->execute([$newId, $adminEmail])) {

            $fixes[] = "Admin ID updated successfully!";

            $admin['id'] = $newId;

        }

    } catch (PDOException $e) {

        $issues[] = "Failed to update ID: " . $e->getMessage();

    }

}

}

```

```
$pageTitle = 'Fix Admin Login';
```

```
$hideNavbar = true;
```

```
include __DIR__ . '/includes/header.php';
```

```
?>
```

```
<main class="d-flex align-items-center min-vh-100 py-5">
```

```
<div class="container">
```

```
<div class="row justify-content-center">
```

```
<div class="col-md-8">
```

```
<div class="card shadow">
```

```
<div class="card-header bg-primary text-white">
```

```
<h4 class="mb-0"><i class="bi bi-tools"></i> Admin Login Fix</h4>
```

```
</div>
```

```
<div class="card-body">
```

```
<?php if (!empty($issues)): ?>
```

```
<div class="alert alert-warning">
```

```
<h6><i class="bi bi-exclamation-triangle"></i> Issues Found:</h6>
```

```
<ul class="mb-0">
```

```
<?php foreach ($issues as $issue): ?>
```

```
<li><?php echo htmlspecialchars($issue); ?></li>
```

```
<?php endforeach; ?>
```

```
</ul>
```

```
</div>
```

```
<?php endif; ?>
```

```
<?php if (!empty($fixes)): ?>
```

```
<div class="alert alert-success">
```

```
<h6><i class="bi bi-check-circle"></i> Fixes Applied:</h6>
```

```
<ul class="mb-0">
```

```
<?php foreach ($fixes as $fix): ?>
```

```
<li><?php echo htmlspecialchars($fix); ?></li>
```

```
<?php endforeach; ?>
```

```
</ul>
```

```
</div>
```

```
<?php endif; ?>
```

```
<?php if ($admin): ?>
```

```
<div class="card border-success mb-3">
```

```
<div class="card-header bg-success text-white">
```

```
<h5 class="mb-0"><i class="bi bi-check-circle"></i> Admin Account
```

```
Details</h5>
```

```
</div>
```

```
<div class="card-body">
```

```
<table class="table table-bordered">
```

```
<tr>
```

```

        <th>ID:</th>

        <td><code><?php echo htmlspecialchars($admin['id']);
?></code></td>

    </tr>

    <tr>

        <th>Name:</th>

        <td><?php echo htmlspecialchars($admin['name']) ?? 'System
Administrator'); ?></td>

    </tr>

    <tr>

        <th>Email:</th>

        <td><code><?php echo htmlspecialchars($admin['email']);
?></code></td>

    </tr>

    <tr>

        <th>Password:</th>

        <td><code><?php echo htmlspecialchars($adminPassword);
?></code></td>

    </tr>

</table>

</div>

</div>

<div class="alert alert-info">

```

```

        <h6><i class="bi bi-info-circle"></i> Login Instructions:</h6>

        <ol>

            <li>Go to: <a href="<?php echo base_url('auth/login.php'); ?>">Login
Page</a></li>

            <li>Select <strong>"Admin"</strong> from the "I am a:"
dropdown</li>

            <li>Enter Email: <code><?php echo htmlspecialchars($adminEmail);
?></code></li>

            <li>Enter Password: <code><?php echo
htmlspecialchars($adminPassword); ?></code></li>

            <li>Click "Login"</li>

        </ol>

    </div>

    <div class="d-grid gap-2">

        <a href="<?php echo base_url('auth/login.php'); ?>" class="btn btn-
primary btn-lg">

            <i class="bi bi-box-arrow-in-right"></i> Go to Login Page

        </a>

        <a href="<?php echo base_url('index.php'); ?>" class="btn btn-
secondary">

            <i class="bi bi-house"></i> Back to Home

        </a>

    </div>

    <?php else: ?>

```

```

<div class="alert alert-danger">

    <strong>Error:</strong> Could not create or verify admin account.
Please check database connection.

</div>

<?php endif; ?>

</div>

</div>

</div>

</div>

</div>

</div>

</main>

<?php include __DIR__ . '/includes/footer.php'; ?>

```

Label B. 3 Prediction Script

```

<?php
/**
 * API Endpoint: Generate Attendance Predictions
 * POST /api/predictions/generate.php
 *
 * Parameters:
 * - student_id (optional): Generate for specific student
 * - class_id (optional): Generate for specific class
 * - all (optional): Generate for all students
 */

header('Content-Type: application/json');

```

```

require_once __DIR__ . '/.././config/config.php';
require_once __DIR__ . '/.././classes/AttendancePredictor.php';

// Check authentication
if (!isLoggedIn()) {
    http_response_code(401);
    echo json_encode(['error' => 'Unauthorized']);
    exit;
}

// Only admin and lecturers can generate predictions
if (!in_array($_SESSION['user_type'], ['admin', 'lecturer'])) {
    http_response_code(403);
    echo json_encode(['error' => 'Forbidden']);
    exit;
}

$pdo = getDBConnection();
$predictor = new AttendancePredictor($pdo);

try {
    $studentId = $_POST['student_id'] ?? null;
    $classId = $_POST['class_id'] ?? null;
    $generateAll = isset($_POST['all']) && $_POST['all'] === 'true';

    if ($generateAll) {
        // Generate for all students
        $predictions = $predictor->generatePredictions();
        $count = count($predictions);

        echo json_encode([
            'success' => true,
            'message' => "Generated predictions for {$count} students",
            'count' => $count
        ]);
    }
}

```

```

    });
} elseif ($studentId) {
    // Generate for specific student
    $prediction = $predictor->generatePredictions($studentId, $classId);

    if ($prediction && $prediction[0]) {
        echo json_encode([
            'success' => true,
            'message' => 'Prediction generated successfully',
            'prediction' => $prediction[0]
        ]);
    } else {
        echo json_encode([
            'success' => false,
            'message' => 'No attendance data available for prediction'
        ]);
    }
} elseif ($classId) {
    // Generate for all students in a class
    // Get all students in the class
    $stmt = $pdo->prepare("
        SELECT DISTINCT s.id
        FROM students s
        JOIN student_courses sc ON s.id = sc.student_id
        JOIN classes c ON sc.course_code = c.course_code
        WHERE c.id = ?
    ");
    $stmt->execute([$classId]);
    $students = $stmt->fetchAll();

    $count = 0;
    foreach ($students as $student) {
        $prediction = $predictor->generatePredictions($student['id'], $classId);
        if ($prediction && $prediction[0]) {

```

```

        $count++;
    }
}

echo json_encode([
    'success' => true,
    'message' => "Generated predictions for {$count} students in class",
    'count' => $count
]);
} else {
    http_response_code(400);
    echo json_encode([
        'error' => 'Missing parameters',
        'message' => 'Please provide student_id, class_id, or set all=true'
    ]);
}
} catch (Exception $e) {
    http_response_code(500);
    echo json_encode([
        'error' => 'Internal server error',
        'message' => $e->getMessage()
    ]);
}
}

```

Label B. 4 Attendance Script

```

<?php

/**

 * API Endpoint: Start Attendance Session

 */

header('Content-Type: application/json');

```

```

require_once __DIR__ . '/.././config/config.php';

// API should return JSON errors for auth problems instead of redirecting

if (!isLoggedIn()) {

    http_response_code(401);

    echo json_encode(['error' => 'Not authenticated']);

    exit;

}

if (!in_array($_SESSION['user_type'], ['lecturer'])) {

    http_response_code(403);

    echo json_encode(['error' => 'Forbidden: lecturer access required']);

    exit;

}


if ($_SERVER['REQUEST_METHOD'] !== 'POST') {

    http_response_code(405);

    echo json_encode(['error' => 'Method not allowed']);

    exit;

}


$input = json_decode(file_get_contents('php://input'), true);

$classId = $input['class_id'] ?? "";

```

```

if (empty($classId)) {

    http_response_code(400);

    echo json_encode(['error' => 'Class ID is required']);

    exit;

}

$pdo = getDBConnection();

// --- Logging for debugging (append-only) ---

$logDir = __DIR__ . '/../diagnostics/logs';

if (!is_dir($logDir)) @mkdir($logDir, 0755, true);

$logFile = $logDir . '/start_session_api.log';

$logEntry = json_encode([

    'time' => date('c'),

    'remote_addr' => $_SERVER['REMOTE_ADDR'] ?? null,

    'session_id' => session_id(),

    'session_user_id' => $_SESSION['user_id'] ?? null,

    'session_user_type' => $_SESSION['user_type'] ?? null,

    'payload' => $input,

    'class_id_param' => $classId

]) . PHP_EOL;

@file_put_contents($logFile, $logEntry, FILE_APPEND | LOCK_EX);

```

```

try {

    // Check if lecturer owns this class

    $stmt = $pdo->prepare("SELECT id FROM classes WHERE id = ? AND lecturer_id = ?
LIMIT 1");

    $stmt->execute([$classId, $_SESSION['user_id']]);

    if (!$stmt->fetch()) {

        http_response_code(403);

        echo json_encode(['error' => 'You do not have permission to start a session for this
class']);

        exit;

    }

    // Auto-end any expired sessions system-wide (cleanup)

    autoEndExpiredSessions($pdo);

    // End any existing active sessions for this class

    $stmt = $pdo->prepare("

        UPDATE attendance_sessions

        SET is_active = 0, session_end = NOW()

        WHERE class_id = ? AND is_active = 1

    ");

    $stmt->execute([$classId]);

```

```

// Create new session

$sessionId = generateUUID();

$stmt = $pdo->prepare("

    INSERT INTO attendance_sessions (id, class_id, lecturer_id, session_start, is_active)

    VALUES (?, ?, ?, NOW(), 1)

");

if ($stmt->execute([$sessionId, $classId, $_SESSION['user_id']])) {

    $resp = [

        'success' => true,

        'message' => 'Attendance session started',

        'session' => [

            'id' => $sessionId,

            'class_id' => $classId,

            'is_active' => true

        ]

    ];

    echo json_encode($resp);

    @file_put_contents($logFile, json_encode(['time' => date('c'), 'result' => 'success',
'response' => $resp]) . PHP_EOL, FILE_APPEND | LOCK_EX);

} else {

    http_response_code(500);

    $resp = ['error' => 'Failed to start attendance session'];

```

```

        echo json_encode($resp);

        @file_put_contents($logFile, json_encode(['time' => date('c'), 'result' =>
'failed_execute', 'response' => $resp, 'stmt_error' => $stmt->errorInfo()]) . PHP_EOL,
FILE_APPEND | LOCK_EX);

    }

} catch (PDOException $e) {

    error_log("Start session error: " . $e->getMessage());

    // Return detailed error for debugging (temporary). In production you may want to hide this
    detail.

    http_response_code(500);

    $resp = ['error' => 'Failed to start session', 'details' => $e->getMessage()];

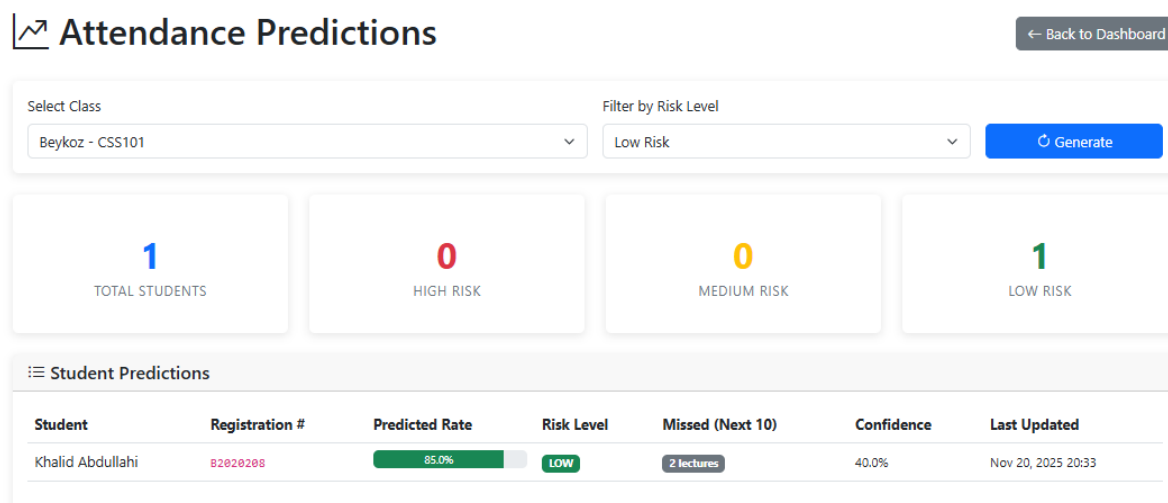
    echo json_encode($resp);

    @file_put_contents($logFile, json_encode(['time' => date('c'), 'result' => 'exception',
'exception' => $e->getMessage()]) . PHP_EOL, FILE_APPEND | LOCK_EX);

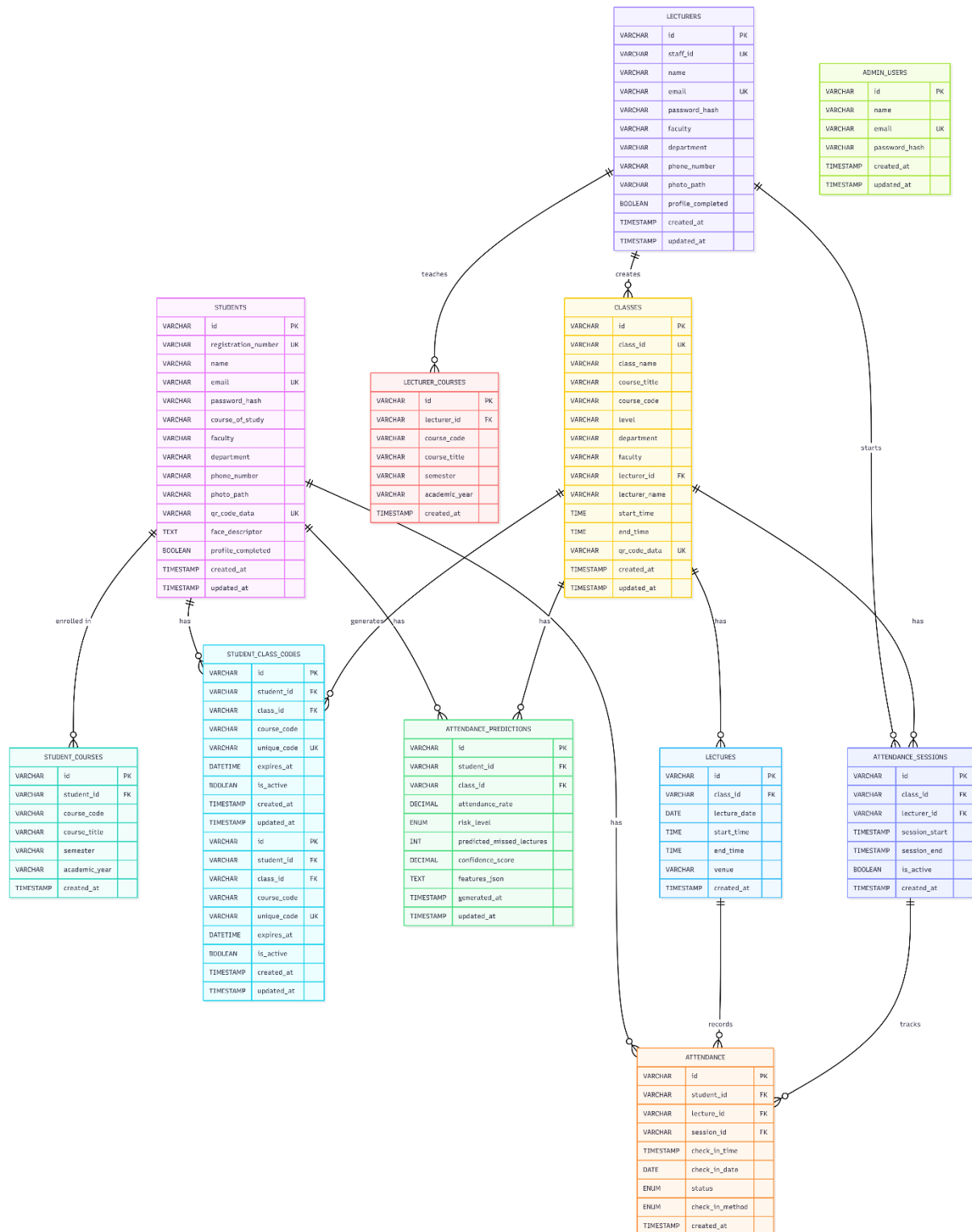
}

```

Label B. 5 Predict Attendance



Appendix C. Database Design



Biography

Sani Sani Shehu

I am Sani Sani Shehu from Nigeria. I earned my Bachelor of Science degree in Computer Science, where I developed a strong foundation in software engineering and database management. Before beginning my master's studies, I gained practical experience working as an IT support officer and junior software developer, where I participated in developing web-based systems and managing database solutions for small and medium enterprises. These experiences strengthened my problem-solving and programming skills and inspired my interest in automation technologies. I later pursued a Master of Science degree in Computer Engineering at Beykoz University, Türkiye, where my thesis focused on designing a QR code-based attendance management system to enhance accuracy and efficiency in academic environments. My research interests include machine learning, intelligent automation, and system integration. I am passionate about creating innovative digital solutions that improve efficiency and support organizational development through technology.