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CHENNAI

CSE3086 – NOSQL DATABASES

J COMPONENT REPORT

DIGITAL CHECK-IN CHECK-OUT SYSTEM

A PROJECT REPORT

Submitted by

SHIVA SINDHU PERLA | 20MIA1104

ANUKEERTHI R | 20MIA1160

SARATH SAI | 20MIA1120

in partial fulfillment for the award of the degree of

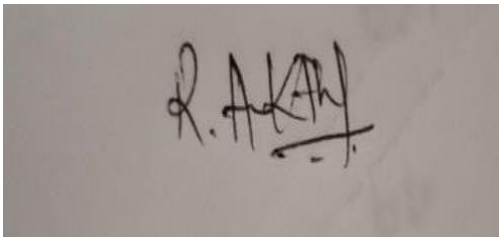
Master of Technology
in
Business Analytics (5 Year Integrated Programme)

Submitted to

Dr. JOE DHANITH

DECLARATION

I hereby declare that the report titled "**DIGITAL CHECK-IN CHECK-OUT SYSTEM**" submitted by us to VIT Chennai is a record of bona-fide work undertaken by me under the supervision of **Dr. JOE DHANITH**, School of Computer Science and Engineering, Vellore Institute of Technology, Chennai.



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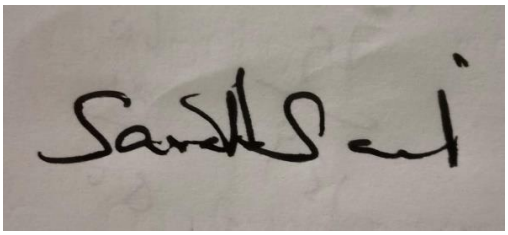

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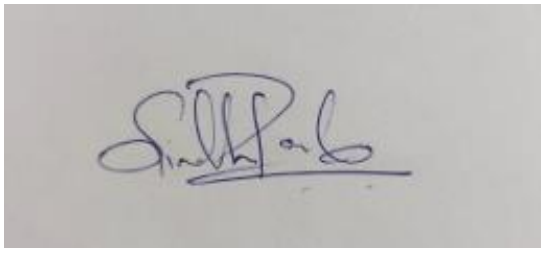

SHIVA SINDHU PERLA – 20MIA1104

CERTIFICATE

Certified that this project report entitled "**DIGITAL CHECK-IN CHECK-OUT SYSTEM**" is a bonafide work of **ANUKEERTHI R** (Reg. No. **20MIA1160**), **SARATH SAI** (Reg. No. **20MIA1120**) and **SHIVA SINDHU PERLA** (Reg. No. **20MIA1104**) and they carried out the Project work under my supervision and guidance for NOSQL DATABASES.

PROFESSOR

Dr. JOE DHANITH

SCOPE, VIT Chennai

HOD

Name: Dr. Sivabalakrishnan M

(Seal of SCOPE)

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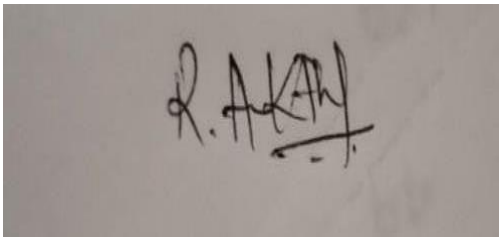

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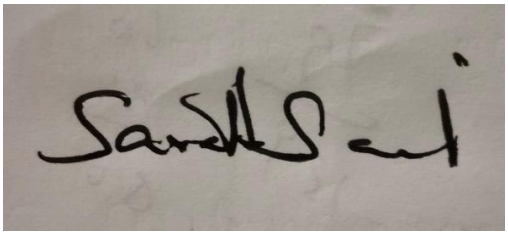

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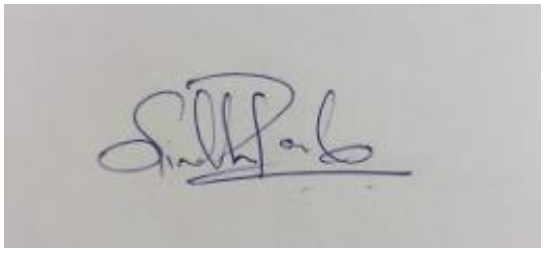

SHIVA SINDHU PERLA – 20MIA1104

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Abstract - This project introduces a pioneering system that merges MongoDB, a NoSQL database, with smart ID card technology to automate attendance and leave management in educational institutions. Its goal is to replace laborious manual processes, providing real-time data insights for improved administrative efficiency and precise data handling. The paper details the system's design, development, and implementation, emphasizing its pivotal role in refining institutional operations. Technical aspects cover MongoDB integration, data model intricacies, and seamless interaction with smart ID cards, showcasing the system's adaptability to evolving institutional needs. This integration represents a significant leap for educational institutions, addressing manual workflow challenges while offering immediate insights and adaptability. The system drastically improves administrative efficiency and data accuracy, expediting informed decision-making. Its inception signifies a critical milestone in embracing digital transformation in education, emphasizing the necessity for institutions to adopt such cutting-edge solutions for sustained competitiveness and an enhanced educational experience.

Keywords: RFID Technology, MongoDB Atlas, Flask Framework, Credit-Based Access, API Endpoints, Check-In/Check-Out Workflow.

1. INTRODUCTION

In the traditional landscape of educational institutions, the process of tracking student attendance and managing leave requests has long been a labour-intensive and error- prone endeavour. Manual logbooks, with their inherent limitations and vulnerabilities, have been the norm, requiring administrative staff to painstakingly record each entry. This manual approach not only consumes valuable time and resources but also presents challenges in maintaining data accuracy and accessibility.

Recognizing the need for a modern, automated solution, this project harnesses the capabilities of NoSQL databases, with a particular focus on MongoDB, to revolutionize the way student attendance and leave management is handled. NoSQL databases excel in handling unstructured or semi-structured data, making them ideal for accommodating the diverse and dynamic information associated with student records. By integrating MongoDB into our system architecture, we embark on a journey to digitize and automate the processes of attendance tracking and leave management. The heart of the system lies in the smart ID card technology that students carry with them.

Embedded within this card is an RFID/NFC chip capable of securely storing student registration numbers and other relevant data. When a student taps their card on a reader strategically placed at various checkpoints throughout the university, the system retrieves the registration number from the card and initiates a sequence of actions.

This includes real-time communication with a central server, which, in turn, connects to the university's student database. Herein lies the key innovation: MongoDB serves as the database backbone, facilitating the seamless storage and retrieval of student information. The server, powered by MongoDB, not only identifies students based on their registration numbers but also accesses their historical attendance records and leave requests.

Importantly, this process occurs without the need for traditional password-based authentication, enhancing both user convenience and security. Furthermore, MongoDB's flexibility allows us to store structured student data, real-time check- in/check-out timestamps, and comprehensive leave history. As a NoSQL database, MongoDB excels in handling these varied data types, enabling the system to provide administrators with real-time insights into present, returned, and on-leave students. This paper outlines the technical details of our system, delving into the design of APIs, the development of a web-based dashboard, and the implementation of real-time updates. Through the use of MongoDB and smart ID card technology, our project bridges the gap between manual logs and an automated, data-rich solution. By doing so, it offers the promise of increased administrative efficiency, data accuracy, and user convenience, marking a significant step towards modernizing student attendance and leave management in educational institutions.

2. LITERATURE SURVEY

Sl no	Title	Author / Journal name / Year	Technique	Result
1.	A Low-Cost Portable Smart Card Based Attendance System	Vibin Mammen Vinod Govindasamy Murugesan Mekala V, Thokaiandal S, Vishnudevi M, Siddharth S M Avinash Bharadwaj, Brinda Ashar Journal of Intellent Systems, 2022	GSM Network with Fingerprint Technique Raspberry pi RFID based Technology Comparative study between different machine learning algorithms.	The system utilizes both RFID tag and biometric fingerprint authentication to enhance exam security and prevent forgery. AdaBoost showed the maximum accuracy mor e than 90% in various splits.

2.	Multi-Purpose Student Card System Using Smart Card Technology	S. Ornar and H. Djuhari, IEEE Conference Publication, 2009	**Smart card technology:** The system uses smart cards to store student data and monetary value. **Encryption:** The student data and monetary value on the smart cards are encrypted to protect them from unauthorized access. **PIN authentication:** Users must enter a PIN number to authenticate themselves before they can use the system. **Database management:** The system uses a database to store student data and transaction records.	The system can be used to improve the efficiency and security of student card management. The system is more versatile and secure than traditional student card systems. The system is cost-effective to implement and maintain.
3.	Student perceptions and adoption of university smart card systems	N. Debiec, Journal of Information Technology Education: Research, 2009	**Focus groups:** The authors conducted three focus groups with students to gather their perceptions and attitudes towards university smart card systems. **Survey:** The authors also conducted a survey of students to collect quantitative data on their perceptions and attitudes. **Unified Theory of Acceptance and Use of Technology (UTAUT):** The authors used the UTAUT framework to analyze the data from the focus groups and survey.	The paper found that student perceptions of university smart card systems varied significantly depending on their international status, willingness to load funds, gender, and university level. The paper also found that students were more likely to adopt university smart card systems if they perceived the systems to be useful, easy to use, and convenient.

4.	Students Smart Card using RFID	Navaneeth S., Megha P. M., Sruji N. M., Anusha T. R., Haritha S., IOSR Journal of Electronics and Communication Engineering, 2020	**RFID technology:** The system uses RFID tags to carry student data. **Microcontroller:** The microcontroller is used to authenticate users and display student data. **Display device**: The display device is used to show student data.	The system can be used to prevent time delays and rush during registration. The system can help students avoid moving from one access point to another. The system can help students access their data at a single point.
5.	Appraising the Smart Card Technology Adoption; Case of Application in University Environment	Hamed Taherdoost, 10th International Conference Interdisciplinarity in Engineering, INTER-ENG 2016, 2016	**University Smart Card Technology Acceptance Model (USCTAM):** The paper develops a model to understand the factors that influence the adoption of smart card technology in university environments. **Online survey:** The paper conducts an online survey to collect data on student perceptions of smart card technology. **SPSS software:** The paper uses SPSS software to analyze the data collected from the survey.	The paper concludes that the USCTAM model can be used to understand the factors that influence the adoption of smart card technology in university environments. The model can be used to help universities to design and implement smart card systems that are more likely to be adopted by students.

6.	COLLEGE STUDENT SMART CARD	Vaishali Dehure, Pritesh Patel, Ansari Gulam Zilani, Tanzeem Sayed, International Journal of Innovative Technology and Exploring Engineering (IJITEE), 2021	**QR/Barcode:** The system uses QR/Barcode to store student data. **Wallet:** The system uses a wallet to store student funds. **Recharge:** The system allows students to recharge their cards through various channels. **Payment:** The system allows students to use their cards to make payments for various services within the college.	The system can be used to ease the workload of students. The system can be used to store student data and funds securely. The system can be used to make payments for various services within the college.
7.	Smart Attendance and Leave Management System Using Fingerprint Recognition for Students and Employees in Academic Institute	Md. Humaun Kabir, Sujit Roy, Md. Tofail Ahmed, Mahmudul Alam, IJSTR (International Journal of Scientific & Technology Research), 2021	**Fingerprint recognition:** The system uses fingerprint recognition to identify students and employees. **Web-based application:** The system is implemented as a web-based application. **Laravel Framework:** The system is implemented using the Laravel Framework. **JavaScript:** JavaScript is used to improve the user interface of the system. **MySQL:** MySQL is used to store the data of the system.	The system can be used to track student attendance in each class and monitor the check-in and check-out time of each employee. The system can be used to generate automated attendance reports for students and employees. The system can be used to save time and improve efficiency in attendance management.

8.	Adaptive Electronic-Leave Management System	A.J. Ikuomola, Journal of Information Systems Engineering and Management (JISEM), 2020	**PHP:** PHP is used as the server-side scripting language. **MySQL:** MySQL is used as the database. **JQUERY:** JQUERY is used for client-side scripting. **BOOTSTRAP:** BOOTSTRAP is used for responsive web design. **JAVASCRIPTS:** JAVASCRIPTS is used for dynamic web pages. **HTML:** HTML is used to create the structure of the web pages. **AJAX:** AJAX is used to make asynchronous calls to the server.	The system is efficient and effective in managing leave requests. The system promotes a paperless office concept and reduces wastage of time, manpower, and money. The system is adaptive and can be used on any device.
9.	Sensors-enabled smart attendance systems using NFC and RFID technologies	Cheah Boon Chew, Manmeet Mahinderjit-Singh, Kam Chiang Wei at.el, International Journal of New Computer Architectures and Their Applications, 2015	**NFC:** NFC is used to read and write data from tags. **RFID:** RFID is also used to read and write data from tags. **Comparative study:** The paper conducts a comparative study between NFC and RFID technologies.	NFC is more convenient and has a lower infrastructure cost than RFID. Both NFC and RFID can be used to develop efficient and effective attendance systems.

10.	Automated Attendance system with RFID through SMART CARD	Vaishali Ghodekar, Aboli Kute, Swati Patil, Prof.Ritesh Thakur, International Journal of Innovative Technology and Exploring Engineering (IJITEE), 2017	**RFID technology:** The system uses RFID technology to track student attendance. **Smart card:** The system uses a smart card to store student data. **Biometrics:** The system uses biometrics to enhance security.	The system can be used to track student attendance in real time. The system can be used to generate attendance reports. The system can be used to send warning messages to parents if their child is absent.

3. DATASET DESCRIPTION AND DATABASE SPECIFIC TOOL USED

Dataset Name: University Student Records Dataset

Description: This dataset contains information about university students, their registration details, attendance records, and leave requests.

It includes the following fields:

- **Student ID**: A unique identifier for each student.
- **Student Name**: The full name of the student.
- **Registration Number:** The student's unique registration number (to be stored on the smart ID card).
- **Program/Course:** The academic program or course in which the student is enrolled.
- **Semester/Year**: The current semester or academic year.
- **Attendance Records**: Daily or session-wise records indicating whether the student attended a class or event.
- **Leave Requests**: Records of leave requests made by students, including the leave type (e.g., medical, personal), start date, end date, and status (approved, pending, denied).

Database-Specific Tools:

Based on the dataset description provided, here are some database-specific tools and technologies that could be relevant for our project:

- **MongoDB:** MongoDB is a NoSQL database that can efficiently handle semi-structured data like attendance records and leave requests. It is a suitable choice for storing student records and allows for flexible schema design.

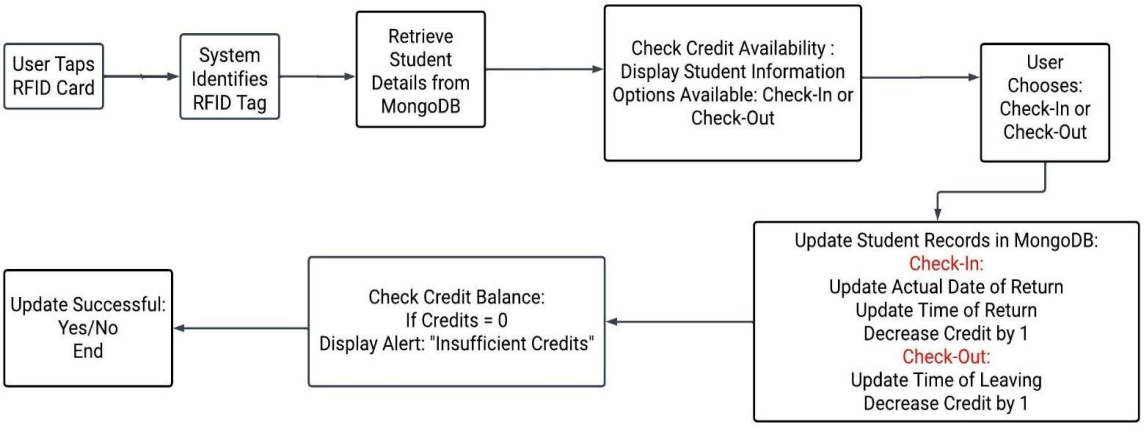
4. EXISTING SYSTEM

The RFID-Based Check-In, Check-Out System (RFID-CICO) is designed to overhaul traditional attendance and access control methods within college premises. Its core aim is to simplify entry and exit procedures, optimizing campus security and operational efficiency. Utilizing RFID technology, this system eliminates manual attendance recording, ensuring swift and automated tracking of student and staff movements. RFID-CICO addresses challenges inherent in manual attendance systems, especially in large student populations, guaranteeing accurate and efficient tracking while reducing administrative burdens. Beyond operational efficiency, it offers real-time monitoring, granting administrators immediate access to attendance data for swift response to security or attendance-related issues. This technology-driven solution not only modernizes processes but also fosters a cohesive and secure environment. It empowers administrators with crucial data for proactive measures. By integrating RFID technology, RFID-CICO aligns with the college's commitment to technological advancement, enhancing operational effectiveness, and prioritizing campus safety and well-being.

5. PROBLEM STATEMENT

The current manual attendance and access control system in the college poses significant challenges and limitations. Its inefficiency leads to inaccuracies in attendance records, causing discrepancies that affect both academic and administrative functions. The time-consuming manual processes burden students and staff, causing delays and hindering daily operations.
Additionally, the absence of robust security measures leaves sensitive areas vulnerable to unauthorized access. Scalability issues arise as the student and staff population grows, affecting record maintenance and entry processing. Moreover, the lack of a streamlined club selection process creates information overload for students, hampering effective engagement in extracurricular activities. To address these challenges, implementing an RFID-based check-in and check-out system is crucial. This technology aims to automate attendance tracking, enhance access control, bolster security, and simplify the selection process for extracurricular activities, optimizing efficiency and decision-making in the college environment.

6. PROPOSED SYSTEM



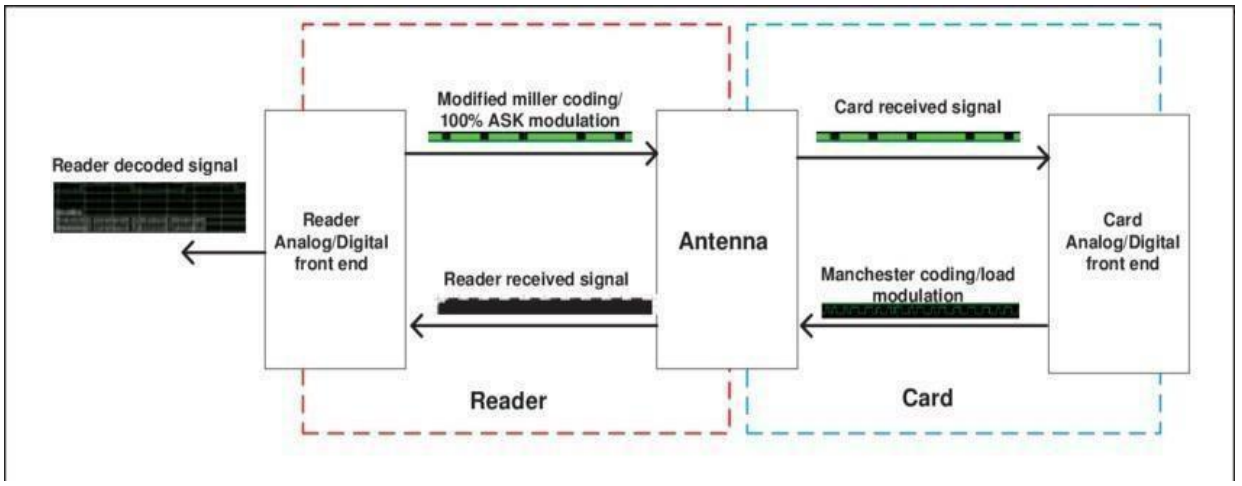


Fig (1). A Data Flow Map showing the working of Proposed Framework.

7. IMPLEMENTATION

The implementation process for the ID card tapping and storage system in MongoDB involves a series of crucial algorithms and techniques. To begin, data extraction from the ID cards necessitates employing Optical Character Recognition (OCR) algorithms like Tesseract and OpenCV to extract vital information such as names, ID numbers, and birth dates.
Subsequently, the extracted data needs to be formatted into JSON serialization, enabling structured handling and seamless passage through HTTP requests.

For the system's functionality, API development using Flask becomes imperative, establishing endpoints to manage HTTP requests from the data capture component. These endpoints handle the reception of ID card data through POST requests and potentially facilitate data retrieval or updates via GET and PUT requests. Database operations revolve around MongoDB, leveraging its drivers or libraries to execute CRUD operations, primarily focusing on data insertion using the 'insert One' method.

Critical considerations for data validation and security include stringent input validation to ensure compliance with required formats and constraints, along with data sanitization to prevent security vulnerabilities such as SQL or NoSQL injections. Quality assurance measures entail rigorous testing methods, including unit testing for individual component functionality, integration testing to ensure seamless interaction between components, and load testing to gauge system scalability under increased request loads.

Furthermore, the implementation incorporates robust logging mechanisms to document system activities, errors, and significant events, while monitoring tools are deployed to oversee system performance, resource usage, and potential security incidents. Finally, deployment to a production environment is followed by setting up auto-scaling mechanisms, ensuring the system efficiently handles heightened workloads when necessary.

8. PSEUDOCODE:

1. **Flask Initialization:**

- The Flask app is initialized with Flask(__name__).
- It sets up routes for handling incoming HTTP requests.

2. **MongoDB Connection:**

- The script connects to a MongoDB cluster using MongoClient from the pymongo library.
- It specifies the database ("Project") and the collection ("Students") to work with.

3. **Endpoints and Functions: @app.route("/") - Home Page:**

- Renders the "home.html" template, presumably for the user interface.

@app.route("/api/students", methods=["GET"]) - Get Student Endpoint:

- Handles GET requests to fetch student details based on registration number (reg_no).
- Retrieves student details from the MongoDB collection based on the provided registration number.
- Converts the ObjectId to a string before returning the student details as JSON.

@app.route("/api/students/update",methods=["POST"])–UpdateStudentDetails Endpoint:

- Manages POST requests to update student details for check-in or check-out actions.
- Receives data from the frontend containing the registration number (reg_no) and the type of update (update_type).
- Retrieves the current date and time using datetime.now() for timestamping the update.
- Constructs update_fields to be applied to the MongoDB document based on the check-in or check-out action.
- Decreases the credit count in the student's document in the database and updates the relevant fields.

- Updates the MongoDB document using update_one() method.
- Fetches the updated document to include the current credit count in the response JSON.
- Returns JSON responses indicating success or failure of the update process.

4. Endpoints Explanation: "/" - Home Page:

- Renders the HTML template for the home page, which is likely where the user interacts with the system.

"/api/students" - Get Student Endpoint:

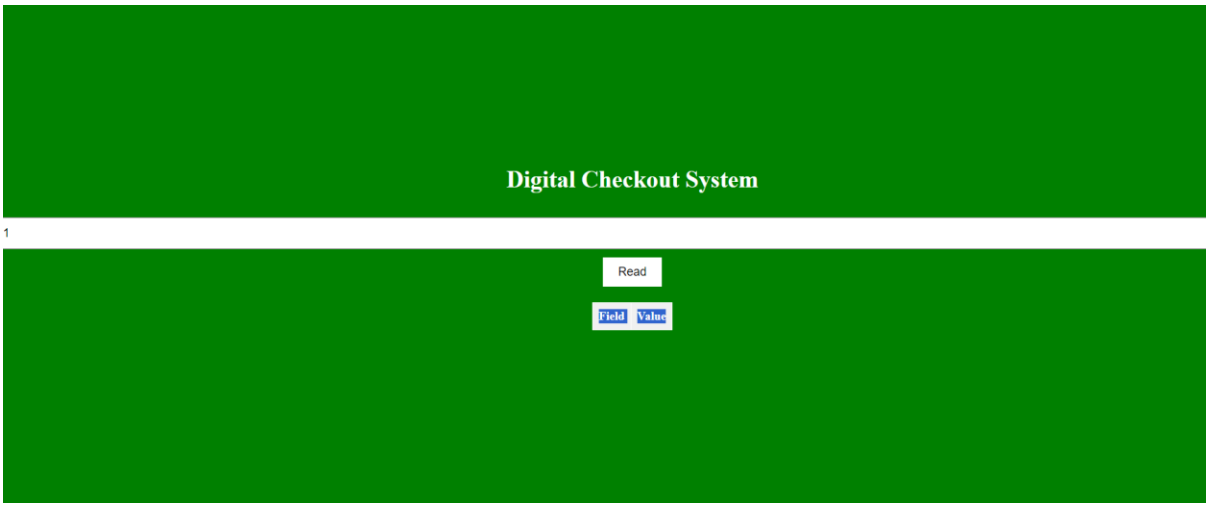
- Handles GET requests to fetch student details.
- Expects a query parameter reg_no to retrieve student data based on registration number.

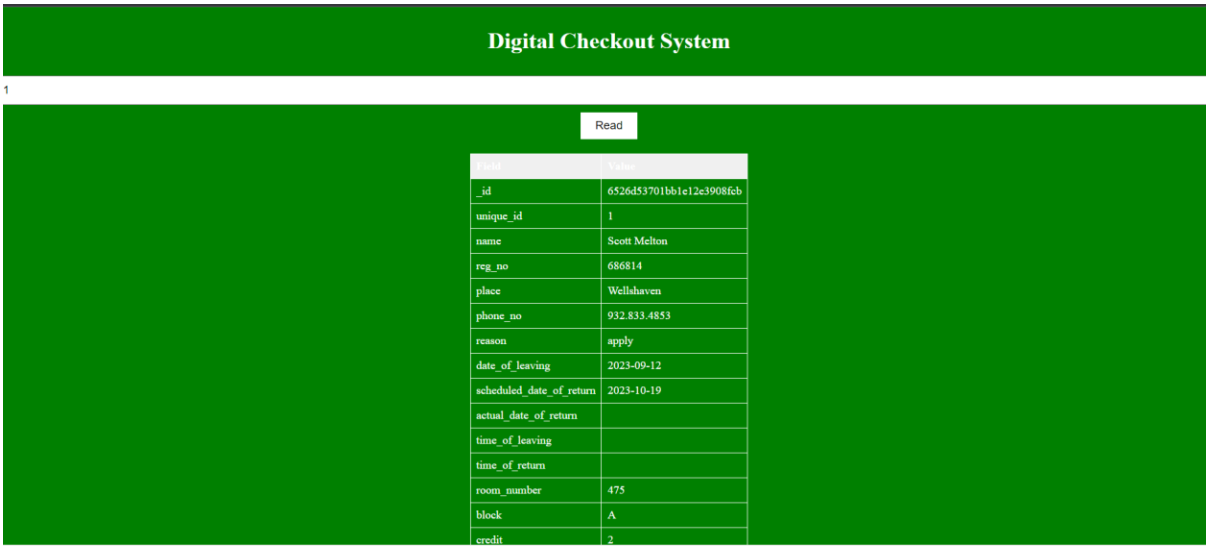
"/api/students/update" - Update Student Details Endpoint:

- Manages POST requests to update student details for check-in/check-out.
- Expects reg_no and update_type data via form submission.
- Updates student records in the MongoDB collection based on the specified action and records the time of update.

9. RESULTS

The Digital Check-In Check-Out System, utilizing RFID cards and MongoDB in a Flask framework, modernizes attendance tracking and access control at the college level. Students simply tap their RFID cards for entry and exit, significantly reducing manual effort and expediting the process. Leveraging MongoDB, the system maintains precise, real-time student records, crucial for administrative oversight. Efficiently managed within MongoDB, the system ensures swift data retrieval and updates, optimizing performance. Credit-based access control regulates student movements, ensuring adequate credits for exits. Its user-friendly interface enhances engagement, offering seamless interactions for students and staff. Robust error handling and testing reinforce stability, providing clear guidance during errors. Security measures automate access control and real-time tracking, enhancing campus safety. Its adaptable design allows for expansion to accommodate future needs, marking a pivotal step toward a more efficient and secure college environment.





10. CONCLUSION

In the genesis of the Digital Check-In Check-Out System, the project embarked on an intricate journey rooted in meticulous planning and foundational setup. At its onset, the focus pivoted towards establishing the framework necessary for the efficient execution of the system's functionalities. The initial phase laid a robust groundwork, primarily centered around database design, backend configuration, and the inception of an intuitive user interface.

Central to this phase was the careful crafting of the database schema, a blueprint intricately detailing the structure to accommodate and manage student information seamlessly. This schema encompassed essential fields encompassing unique identifiers, student particulars, temporal records for check-ins and check-outs, alongside the integral credit count feature.

Simultaneously, the inception of Flask routes within the backend architecture commenced, fostering a pivotal infrastructure for managing HTTP requests, handling data retrieval, and updating student records.Concurrently, the environment setup and integration of MongoDB Atlas within the Flask app were pivotal milestones.

This integration ensured a reliable connection to the cloud-based database, setting the stage for secure and efficient data transactions. Alongside, the project's frontend blueprint began to take shape with the creation of user-centric HTML templates. These templates were meticulously designed to present student information comprehensibly and pave the way for a user-friendly interface. Additionally, the development of input forms streamlined the check-in and check-out processes, empowering the system to capture crucial data for updating student records seamlessly. This foundational groundwork laid the bedrock for subsequent developmental phases, setting a solid foundation for the efficient functioning and holistic implementation of the Digital Check-In Check-Out System.

11. REFERENCES

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