**Proposal for Facial Recognition Locker System for Library Asset Management**

**Introduction:**

Libraries are repositories of valuable resources, including books, electronic devices, and personal belongings. However, managing these assets efficiently while ensuring security remains a challenge. Traditional locker systems require physical keys or various combinations of security measures, which can be lost or stolen.

Also, It has been observed that students often face difficulty in finding an available locker space to store their valuables. They have to go through the lengthy process of opening each locker one by one, which can be time-consuming. Similarly, when retrieving their valuables, they have to search through each locker, which is also a time-consuming process.

To solve the problems related to managing library assets, we suggest creating a Facial Recognition Locker System. This system will use facial recognition technology to scan the faces of students or library users and allocate an available locker space with ease. The system will also use facial recognition to allow users to retrieve their valuables when returning them.

**Aims and Objectives:**

This study aims to build a facial recognition system to reduce the long delay for students to find available locker space to keep their valuable and also to reduce the delay at times when trying to find the locker in which used by them in the case when they forget

**The objectives is more specific to:**

- Implement a secure locker system that utilizes facial recognition technology for user authentication.

- Design an intuitive interface for users to register their faces and access lockers.

- Develop an intelligent scheduling algorithm to allocate available locker space efficiently.

- Integrate real-time monitoring to track locker usage and availability.

- Evaluate the system's performance in terms of security, efficiency, and user satisfaction.

**Scope of Study:**

The scope of this study encompasses the design, development, and implementation of a Facial Recognition Locker System tailored specifically for library asset management. The system aims to address the challenges associated with traditional locker systems by leveraging facial recognition technology to enhance security, efficiency, and user experience in library facilities.

**Methodology:**

Research methodology simply refers to the practical “how” of a research study. More specifically, it’s about how a researcher systematically designs a study to ensure valid and reliable results that address the research aims, objectives and research questions by Derek Jansen and Kerryn Warren (June 2020), *What Is Research Methodology? A Plain-Language Explanation & Definition (With Examples).* Retrieved from [**https://gradcoach.com/what-is-research-methodology/**](https://gradcoach.com/what-is-research-methodology/)

The following are the systematic steps to create a methodology for research

* **System Design and Architecture:**

Conduct a thorough analysis of existing locker systems and facial recognition technologies to inform the design process.

Collaborate with stakeholders, including librarians and potential end-users through requirements gathering and analysis processes. This can be done by asking questions and conducting a research survey, to gather requirements and feedback for system design.

Design a robust and scalable architecture for the Facial Recognition Locker System, considering factors such as hardware requirements, network connectivity, and data storage.

* **Facial Recognition Technology Integration:**

Research and select appropriate facial recognition algorithms and software libraries for integration into the system.

Develop and test facial recognition modules for face detection, feature extraction, and comparison with stored templates to check the recognition accuracy of the system.

Optimize the facial recognition algorithms for accuracy, speed, and reliability in real-world library environments.

* **User Interface Development:**

Design an intuitive and user-friendly interface for facial registration, locker allocation, and retrieval processes to make the users know what is going on without any confusion.

For now, a simple liquid crystal display (LCD) will be used to display some pieces of information to the user

* **Locker Management System Implementation:**

Develop a centralized locker management system to handle locker assignments, availability tracking, and access control.

Implement an intelligent scheduling algorithm to dynamically allocate lockers based on availability and user demand.

Integrate real-time monitoring capabilities to track locker usage, detect anomalies, and generate alerts for administrators.

* **Testing and Evaluation:**

Conduct comprehensive testing of the Facial Recognition Locker System in simulated and real-world library environments.

Evaluate the system's performance in terms of accuracy, efficiency, and user satisfaction through user feedback surveys and usability testing.

Identify and address any issues or challenges encountered during testing, such as false positives/negatives, system downtime, or user interface issues.

* **Deployment and Maintenance:**

Deploy the Facial Recognition Locker System in selected library facilities, ensuring proper installation, configuration, and training for library staff and users.

Provide ongoing technical support and maintenance to address any issues or updates required post-deployment.

Continuously monitor system performance and user feedback to identify opportunities for further optimization and enhancement.

**Features:**

* **Facial Registration:** Users will be able to register their faces securely in the system by just standing at a particular distance from the camera system for future authentication.
* **Locker Allocation:** The system will dynamically assign lockers based on availability and user demand after successful face identification and registration.
* **Real-time Monitoring:** Administrators can monitor locker usage and receive alerts for any suspicious activities and also have more access control to perform some operations, especially in the case of the troubleshooting process.
* **Security Protocols:** Implement robust security measures to prevent unauthorized access and ensure data privacy through a secure and intelligent facial recognition system and scheduling algorithm.

**Expected Resource/Outcomes:**

* **Improved Security:** Implementation of the Facial Recognition Locker System will enhance security by providing a reliable authentication mechanism, reducing the risk of unauthorized access and theft of library assets.
* **Enhanced Efficiency:** Automation of locker allocation and retrieval processes will streamline asset management operations, saving time for both users and library staff.
* **User Satisfaction:** The user-friendly interface and convenient access methods offered by the system will increase user satisfaction and engagement, leading to a positive user experience in library facilities.
* **Cost Savings:** Minimization of theft and loss of assets will result in cost savings for library administrators, reducing the need for replacement and maintenance of lost or stolen items.
* **Data Insights:** The system will generate valuable data insights into locker usage patterns, user behavior, and asset demand, which can inform future decision-making and resource allocation in library management.

**CHAPTER TWO**

**LITERATURE REVIEW**

**Authors:**

**Vohra, S., Khattar, S., & Kumar, A. (2012). Microcontroller based automatic face recognition attendance system. *International Journal of Applied Information Systems (IJAIS),* 4(8), 32-37.**

This paper describes an automatic face recognition attendance system designed to mark student attendance. The system utilizes OpenCV, a library of programming functions for real-time computer vision. OpenCV provides pre-defined functions for face detection and Eigenfaces, the algorithm used for recognition.

The remainder of the review can stay the same, referencing Vohra et al. (2012) where appropriate for the Eigenfaces algorithm and OpenCV library.

While Vohra et al. (2012) mention hardware components like webcams, lens systems, servo motors, and an Arduino microcontroller, they do not provide a specific bill of materials list.

**CHAPTER THREE**

**METHODOLOGY**

Implementing a Facial Recognition Locker System for library asset management involves several stages, each requiring specific methodologies. Below is a proposed methodology for implementing the system:

**1. Requirements Analysis:**

* Conduct a survey with stakeholders such as library administrators, staff, and users to gather requirements and understand their needs and challenges experienced with the current locker system being used.
* Analyze existing locker systems and identify pain points and areas that can be reviewed for a better improvement.
* Define functional and non-functional requirements for the Facial Recognition Locker System.

**2. Technology Selection:**

* Research and evaluate facial recognition technologies, considering factors such as accuracy, speed, scalability, and compatibility with existing infrastructure. This can also be done by analyzing existing technologies and devices
* Select hardware components (facial recognition cameras or devices) and software solutions (facial recognition algorithms, locker management software) based on requirements and evaluation results.

**3. System Design:**

* Design the architecture of the Facial Recognition Locker System, including hardware setup, software components, and data flow (A data flow diagram will be used to show how the data is captured by the camera, and processed by the system).
* Define the user interface design for

- Facial registration

- Locker allocation, and

- Retrieval processes.

* Develop algorithms for facial recognition, locker allocation, and real-time monitoring.

**4. Implementation:**

* Develop and configure hardware components, including facial recognition cameras or devices, and ensure their proper installation in library facilities.
* Implement software modules for facial recognition, locker management, and user interface based on the defined system design.
* Integrate hardware and software components to create a cohesive system.

**5. Testing:**

* Conduct unit testing to verify the functionality and correctness of individual software components.
* Perform integration testing to ensure seamless communication and interaction between hardware and software components.
* Conduct system testing in simulated and real-world environments to evaluate the system's performance, reliability, and accuracy.

**6. Deployment:**

* Deploy the Facial Recognition Locker System in selected library facilities, ensuring proper installation, configuration, and calibration of hardware and software components.
* Provide training sessions for library staff and users to familiarize them with the system's operation and features.
* Monitor the system during the initial deployment phase to address any issues or challenges that arise.

**7. Evaluation:**

* Evaluate the system's performance based on predefined metrics, including accuracy of facial recognition, efficiency of locker allocation, and user satisfaction.
* Gather feedback from library staff and users through surveys, interviews, and usability testing sessions.
* Analyze the collected data to identify strengths, weaknesses, and areas for improvement for better acceptability

**8. Maintenance and Optimization:**

* Provide ongoing maintenance and support for the Facial Recognition Locker System, addressing any issues or bugs identified during evaluation.
* Continuously monitor system performance and user feedback to identify opportunities for optimization and enhancement.

**MATERIALS**

**Conclusion:**

Through the integration of facial recognition technology with locker management systems, the proposed solution aims to enhance security by providing a reliable authentication mechanism, streamlining asset management operations, and improving the overall user experience in library facilities. The system's ability to dynamically allocate lockers based on availability and user demand, coupled with real-time monitoring capabilities, promises to optimize resource utilization minimize the risk of unauthorized access or theft, and also reduce the time spent by library users in getting space allocation manually for their valuable resources.