



# Visitor Identification and Smart Tracking Assistant

Dr. Shubha P<sup>1</sup>, Rohith Kumar H S<sup>2</sup>, Tejas K V<sup>3</sup>, Uday Shankar K<sup>4</sup>, Vishak P M<sup>5</sup>

Associate Professor, Dept. of EIE, Dr. Ambedkar Institute of Technology, Bengaluru, Karnataka, India<sup>1</sup>

UG Student, Dept. of EIE, Dr. Ambedkar Institute of Technology, Bengaluru, Karnataka, India<sup>2,3,4,5</sup>

**ABSTRACT:** The Visitor Identification and Smart Tracking Assistant (VISTA) is a new project built using IoT technology to make office work easier in college departments. In many colleges, the Head of Department (HOD) is very busy and often gets interrupted by visitors, which makes it hard to focus on important tasks. This project solves this by using Internet of Things (IoT) technology by using a Raspberry Pi as the main brain of the system, along with a camera and a 7-inch touchscreen. When a person walks up to the office, the system uses a camera and the FaceNet algorithm to recognize their face and identify who they are. It consists of a simple website/GUI and a screen interface using Python Flask for the backend part and HTML and CSS for the frontend part. This system enables the HOD to easily view a list of visitors, manage records of students and staff, and display important announcements on a screen from any location. It also shows whether the HOD is available or busy and allows visitors to book meetings automatically. By handling these activities digitally, VISTA eliminates the need for paper registers and traditional manual processes. As a result, the overall functioning of the department becomes more efficient, and the HOD can focus on work without frequent interruptions.

**KEYWORDS:** Internet of Things, Facial Recognition, Raspberry Pi, FaceNet Algorithm, Python Flask, Smart Tracking.

## I. INTRODUCTION

In many colleges, the Head of Department (HOD) has a busy schedule and is often interrupted by students and staff throughout the day. These unexpected visits can make it difficult to complete important tasks on time. Currently, most departments rely on paper registers or manual methods to record visitor details, which can be slow and do not clearly indicate whether the HOD is available or occupied. To solve this issue, we developed a system called VISTA (Visitor Identification and Smart Tracking Assistant) using IoT technology. The system uses a Raspberry Pi along with a camera to recognize visitors through facial identification. It also includes a simple touchscreen interface where visitors can view announcements or check the HOD's availability. By automating these processes, VISTA helps the HOD manage time more effectively and reduces unnecessary interruptions. This project demonstrates how basic technology can improve efficiency and bring better organization to everyday office tasks.

## II. LITERATURE SURVEY

The researchers [1] developed an innovative deep learning framework for facial recognition known as FaceNet. Departing from conventional feature extraction techniques, this methodology trains a neural network to directly map facial features into a compact, high-dimensional vector space where images of the same individual are mapped in close proximity to one another, while images of different people are distinctly separated. This spatial arrangement is optimized via a triplet loss function, an optimization strategy that evaluates three distinct inputs simultaneously—an anchor, a positive, and a negative sample allowing the system to successfully capture subtle, identity-defining variations. When evaluated against benchmark datasets like Labelled Faces in the Wild, FaceNet demonstrated exceptional accuracy, eclipsing several contemporary alternatives while generating highly compressed mathematical representations that operate with minimal computational and memory overhead. Ultimately, the research confirms that FaceNet provides a dependable, high-performance option for biometric identification, offering significant utility for real-world setups like automated access points and security surveillance.

The Authors [2] present an IoT-based visitor management system aimed at replacing traditional paper registers used in offices. The system is built using a Raspberry Pi and a web-based interface, allowing visitor details to be recorded and stored digitally. This makes it much easier to organize and retrieve information compared to manual record-keeping. One of the key advantages of the proposed system is that it allows office staff to access and monitor visitor data remotely through the internet. This improves both convenience and efficiency, especially in environments where multiple entries are handled daily. However, the system mainly focuses on basic data management and does not include more advanced features such as facial recognition or automated approval processes. Overall, the study shows that moving from manual to digital systems using IoT technology can significantly improve the way visitor information is managed, making the process more structured and reliable.

To address the complexities of property valuation, researchers [3] introduced an online platform designed to forecast housing market values using machine learning strategies. By leveraging the Random Forest algorithm, the setup evaluates a diverse set of variables including geographic location, square footage, and neighbourhood perks to generate reliable pricing estimates. This predictive engine is coupled with a Python Flask backend, delivering an intuitive user interface that yields instantaneous evaluation results. The findings highlight that migrating from conventional manual appraisals to computational modelling significantly minimizes discrepancies and human bias. Furthermore, when contrasted with standard linear regression, this ensemble-based framework demonstrates far greater consistency and dependability. Ultimately, the project illustrates how merging sophisticated data models with accessible web architectures can yield highly practical tools, empowering stakeholders to navigate financial choices within the property market with greater confidence.

In paper [4] authors have discussed on how modern web technologies like HTML5 and CSS3 can be used to build efficient and visually appealing user interfaces. The study focuses on how these technologies handle complex design elements while keeping the code simple and manageable. Through comparison and testing, the authors show that using HTML5 and CSS3 can reduce page loading time and improve performance across different devices and platforms. They also point out that HTML5 provides better structure and accessibility, making web pages easier to design and understand. The paper emphasizes that using built-in browser features reduces the need for heavy external tools or plugins. Overall, this work highlights the importance of HTML5 and CSS3 in developing fast, scalable, and user-friendly web applications.

The authors [5] compare the performance of standard SQLite with higher-level database frameworks such as Room. The study mainly looks at factors like execution speed and memory usage to understand how each approach performs in real applications. The results show that direct use of SQLite offers better performance, especially for simple and frequently executed operations. The authors also point out that SQLite's serverless design makes it well suited for systems with limited memory and resources. Based on their analysis, the study concludes that using SQLite directly can reduce delays and improve the overall responsiveness of data-driven applications. This work provides useful insights for selecting efficient database solutions, particularly for systems that need reliable offline performance.

### III. METHODOLOGY

The VISTA system (shown in figure 1) is built by combining a Raspberry Pi 4 Model B, a camera module, and a 7-inch touchscreen display along with supporting software. The Raspberry Pi acts as the main controller, connecting all the components and running the required programs. The camera is used to capture images of visitors, while the touchscreen provides an easy way for users to interact with the system. A web-based interface is developed using Flask [6], along with HTML and CSS [7], to enable communication between the hardware and the user interface. All these components work together to carry out visitor identification, display information, and manage records in real time.

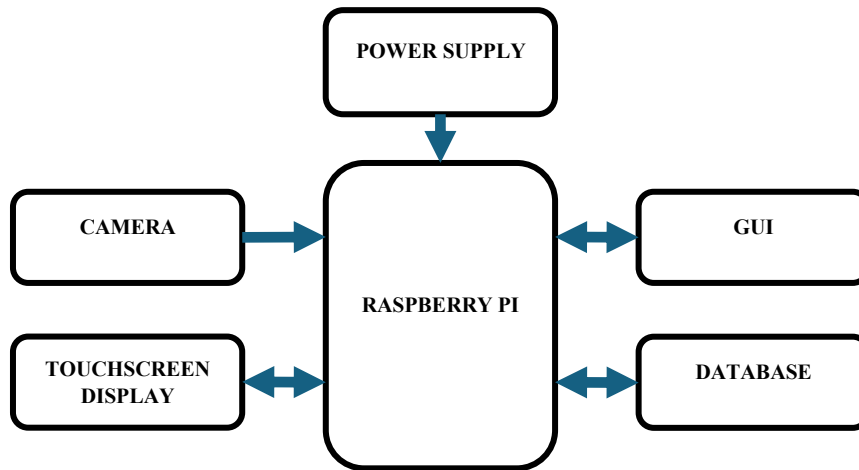


Figure 1: Block Diagram

A local SQLite [8] database is used to store visitor information such as names, entry time, and captured images. Since the database is stored directly on the Raspberry Pi, it allows quick access to data and does not rely on an internet connection. This makes the system more reliable and ensures that all visitor records are maintained properly. The stored data can also be accessed later whenever required, making it easier to track previous visits without using manual registers.

For identifying visitors, the system uses the FaceNet [9] algorithm. When a visitor stands in front of the camera, their image is captured and processed to extract facial features. These features are converted into a numerical format, which is then compared with the existing data stored in the database. If a match is found, the visitor is recognized as a registered user. If no match is found, the system treats the person as a new visitor and allows them to enter their details through the touchscreen. This method helps in achieving accurate and efficient identification.

### FaceNet Algorithm

A FaceNet [1] is a face recognition algorithm (shown in figure 2) is a deep learning–based algorithm developed by Google Research. This is widely used because of its high accuracy and robustness in real-world conditions. Instead of directly classifying faces, it converts each face image into a numerical representation called a facial embedding. Each embedding uniquely represents a person’s face in a high-dimensional space.

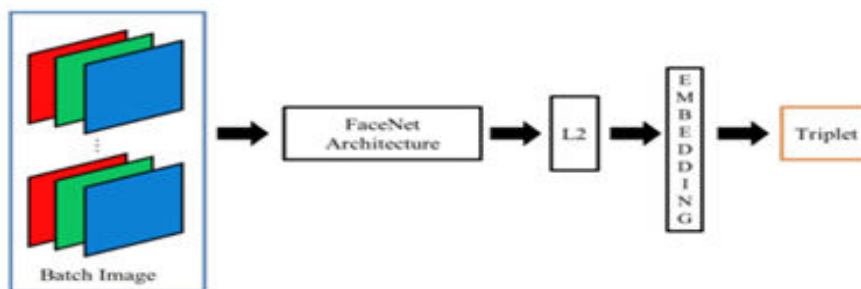


Figure 2: Block diagram of FaceNet architecture [10]

The working of the algorithm begins with face detection (shown in figure 3), where the system captures an image of the visitor and detects the face region. This detected face is then pre-processed by resizing, aligning, and normalizing it to ensure consistent input quality. The pre-processed face image is passed through a deep convolutional neural network, which extracts important facial features and converts them into a fixed-length numerical vector known as an embedding, typically of 128 dimensions. This embedding acts as a unique signature for the person’s face.

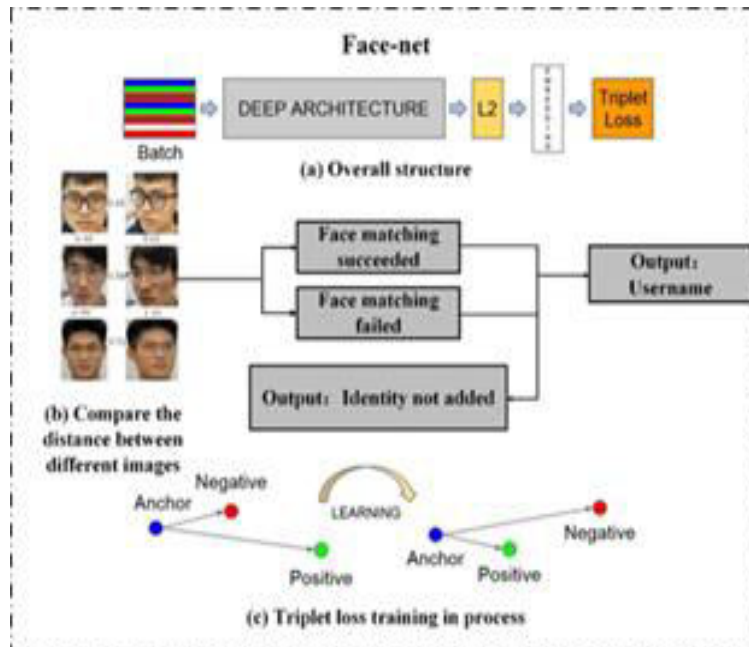


Figure 3: Schematic of a person identification using FaceNet algorithm

Once the embedding is generated, it is compared with the embeddings stored in the database using distance measurement techniques such as Euclidean distance or cosine similarity. If the distance between the embeddings is below a predefined threshold, the visitor is recognized as a known person. If the distance exceeds the threshold, the visitor is classified as unknown.

FaceNet algorithm provides a high recognition accuracy and performs reliably even under varying lighting conditions, facial expressions, and pose changes. It is faster than traditional methods during recognition since it only compares numerical vectors rather than entire images. Additionally, FaceNet is scalable, making it easy to add new faces to the database, and it is suitable for real-time applications on embedded platforms such as Raspberry Pi. These advantages make this algorithm an ideal choice for an intelligent, real-time visitor identification system. The FaceNet algorithm is used in the project for face recognition because of its accuracy, efficiency, and reliability. By transforming facial images into numerical embeddings and comparing them using distance measures, the system can identify visitors effectively while improving automation and security.

The working of the proposed face recognition-based visitor management system is represented in following two stages.

1. Visitor arrival and process initiation.
2. HOD Dashboard access.

**Working of visitor arrival and process initiation**

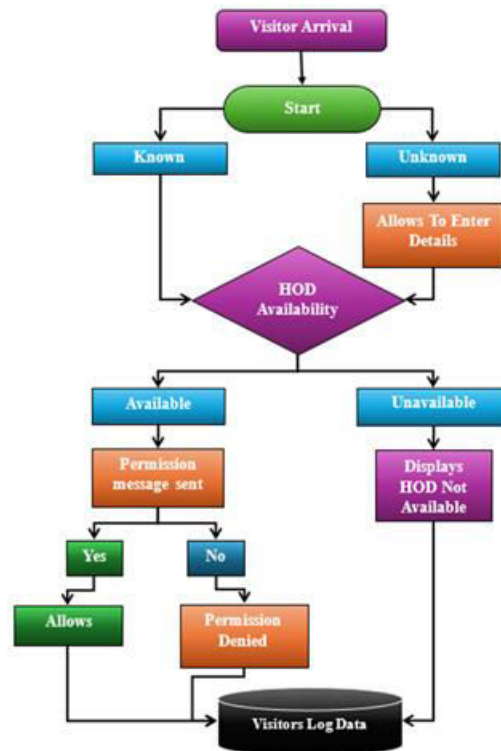


Figure 4: Flow Chart of Visitor Arrival and Process Initiation

**Visitor Arrival and Process Initiation**

The system workflow begins when a visitor arrives at the smart kiosk or terminal placed at the entrance (shown in Figure 4). To begin the process, the visitor taps the “Start” button on the screen. This action activates the camera module and starts the facial recognition process for identifying the visitor.

**Visitor Identification: Known vs Unknown**

Once the recognition process starts, the system checks whether the visitor is already registered or not. If the facial recognition system successfully matches the face with an existing record in the database, the visitor is treated as a known person. In this case, the system skips the manual data entry step and directly moves to checking the Head of Department (HOD) availability. If the system is unable to recognize the face or no matching record is found, the visitor is considered a new or unregistered user. A form is then displayed on the touchscreen, where the visitor is asked to enter basic details such as their category (student, staff, or visitor), name, and purpose of visit. Once the information is submitted, it is stored in the local database for future reference and recognition. After this step, the visitor is directed to the HOD availability check stage.

**HOD Availability and Access Decision**

At this stage, both known and new visitor processes come together for checking the HOD’s availability. If the system indicates that the HOD is busy, unavailable, or away, a message such as “HOD not available” or “Please visit later” is shown on the screen. In this case, no request is sent to the HOD, and the process ends there. If the HOD is available, the system sends a permission request along with the visitor’s details. The HOD can then choose to accept or reject the request. If permission is granted, a message like “Permission granted. You may proceed” is displayed, and the visit is recorded in the database. If the request is denied, the system shows “Permission denied,” but the visitor’s details are still stored for record-keeping and security purposes.

Working of HOD Dashboard access

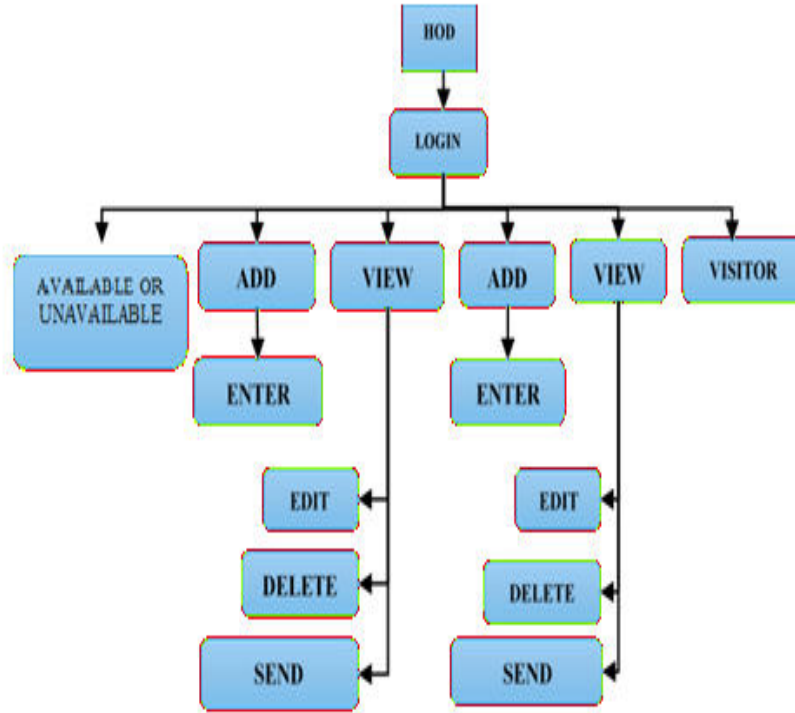


Figure 5: Flow Chart of Visitor HOD Dashboard Access

**Access Level**

The system is designed mainly for use by the Head of Department (HOD). To ensure security, access to the dashboard is restricted through a login mechanism, requiring the HOD to authenticate before using any features. This helps prevent unauthorized access and keeps the system secure. The overall process flow is illustrated in Figure 5.

**Main Dashboard Functions**

After logging in, the HOD is directed to the main dashboard, which provides access to six key functional modules. One of the main features is the availability control, which allows the HOD to set their status as available or unavailable. The dashboard also includes options to add new student records, view existing student details, add staff information, view staff records, and check visitor logs. Together, these features help the HOD manage administrative tasks efficiently and keep track of all activities in an organized way.

**Sub-Processes & Actions**

The system provides separate modules for managing both students and staff, and both follow a similar structure. In the student management module, the HOD can add new student details such as name, USN, phone number, email ID, branch, and semester. The “View Students” section allows the HOD to access the stored records and perform actions like editing information, deleting entries, or sending email notifications to selected students.

#### IV. EXPERIMENTAL RESULTS



Figure 6: VISTA Model

Figure 6 shows the physical model of the VISTA system developed for this project. The setup consists of a Raspberry Pi connected to a camera module and a touchscreen display, all mounted on a custom-built stand. The camera is placed at an appropriate height to capture the visitor's face clearly, while the touchscreen is positioned for easy interaction. This arrangement allows visitors to stand in front of the system, get identified through facial recognition, and interact with the interface without any assistance. The compact and structured design makes the system suitable for placing at the entrance of a department.

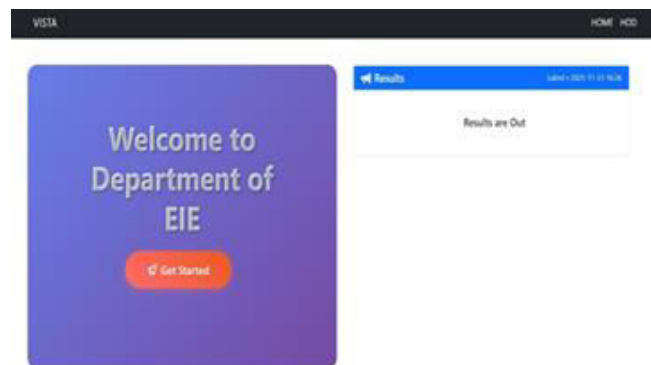


Figure 7: Welcome Interface

#### Welcome Interface:

As shown in Figure 7, the home screen presents a clear welcome message on the left side, displaying "Welcome to Department of EIE." A "Get Started" button is provided below the message, allowing visitors to begin the verification process easily.

#### Announcements:

The right side of the screen is used to display announcements. It works like a digital notice board, showing important updates and information for visitors in real time.

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 Visitor Alert!

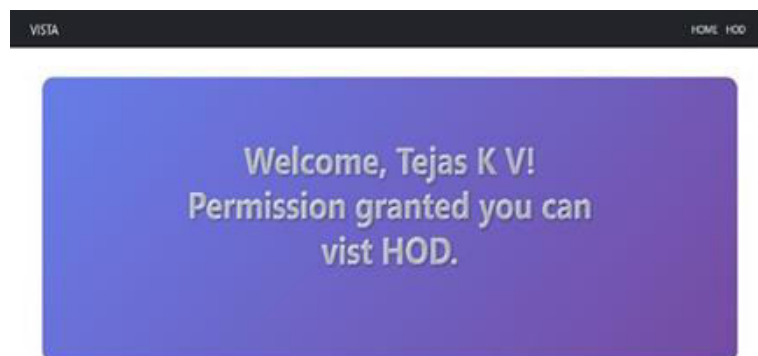
Category: Students  
Name: Tejas K V  
Phone: 9141922290  
Email: [tejas0004@gmail.com](mailto:tejas0004@gmail.com)  
Branch: CSE  
Semester: 7

Please respond with 'yes' or 'no' to grant access.

08:33

**Figure 8: Message sent to HOD**

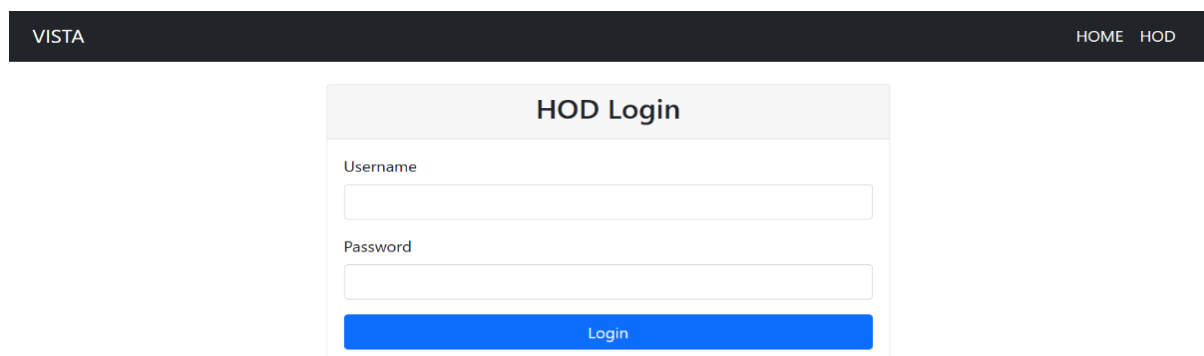
After facial recognition, the system sends the visitor's details to the HOD through Telegram (shown in Figure 8).



**Figure 9: Permission Granted**

After the visitor's details are sent to the Head of Department (HOD), the HOD reviews the request and responds with either "yes" or "no." This response determines whether the visitor is allowed to proceed or not.

If the HOD approves the request by selecting "yes," the system displays a confirmation message and allows the visitor to continue (shown in Figure 9). If the response is "no," the visitor is not permitted to proceed.



**Figure 10: HOD Login Interface**

Figure 10 shows the login interface, where the HOD must enter a username and password to access the administrative dashboard. After logging in, the HOD can also update their availability status.

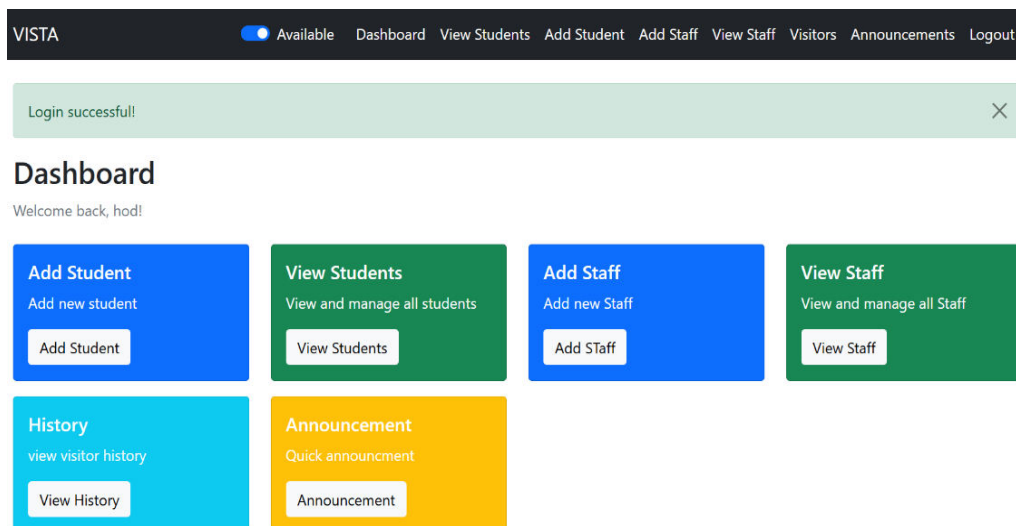


Figure 11: HOD Dashboard

Figure 11 shows the HOD dashboard interface of the VISTA system after a successful login. A notification message is displayed at the top to indicate that the login was successful. Once logged in, the HOD is taken to the main dashboard, where different administrative features are available. From this dashboard, the HOD can add and view student details, manage staff records, check visitor history, and post announcements. The navigation bar provides easy access to all these sections, along with options for announcements and logout. This interface helps the HOD manage departmental activities efficiently and maintain proper control over visitor interactions.

## V. CONCLUSION

The Visitor Identification and Smart Tracking Assistant (VISTA) was successfully designed and implemented to improve the existing manual visitor management system in academic departments. By combining IoT technology with facial recognition, the system automates the visitor handling process and reduces the need for manual intervention. The system was able to reliably identify both known and new visitors, providing a secure and smooth entry process. It also checks the real-time availability of the Head of Department (HOD), which helps in reducing unnecessary interruptions by allowing visits only when the HOD is available. In addition, the GUI dashboard offers a centralized platform for managing student and staff records, as well as maintaining digital logs of all visitor activities. This improves record-keeping and makes it easier to track and review information when needed. Overall, VISTA shows how simple automation can make a significant difference in academic environments by improving efficiency, security, and organization.

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