Coimbatore Institute of Technology

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New Delhi and Affiliated to Anna University, Chennai - 600025.

CIT SPARK GRANT PROGRAM

CIT Smart Gate Pass: Automated Student Entry – Exit and Outing Management System

Applicants:

Name: Thirumaran S L

Roll No: 2403717624321055

Email: 2403717624321055@cit.edu.in

Phone No: 9363915238

Name: Kiruthika K

Roll No: 2403717624322024

Email: 2403717624322024@cit.edu.in

Phone No: 7200239667

Faculty Supervisor:

Ms. K. Kalaivani M.E.

Assistant Professor

B. Tech Artificial Intelligence and Data Science

1. Abstract

At CIT, the current process of managing student movement in and out of campus and hostels relies on manual handwritten registers. This approach often leads to long queues, crowding at entry and exit points, delays, and increased workload for security staff. It also makes it difficult to track students in real time and notify parents or tutors quickly in case of delays or emergencies.

This project, **CIT Smart Gate Pass**, introduces an automated, technology-driven solution to replace manual registers with a secure digital platform. Using Bar-coded student ID cards, students simply scan their IDs at the gate to log entry or exit automatically. The system stores these records in a central database, providing accurate, timestamped logs that can be easily searched and audited.

The platform includes role-based dashboards: students can view their own outing history and request permissions; wardens can approve or reject outing or home-return requests; security staff can see who is approved to go out, reducing manual checking; and administrators can monitor trends, generate reports, and ensure compliance.

To strengthen safety, the system automatically sends SMS or email alerts to tutors and parents if a student has not returned by the approved time, ensuring quick awareness and response. The proposed solution reduces gate congestion, improves operational efficiency, increases accountability, and enhances student safety. It is scalable, low-cost, and can be piloted at CIT before being expanded to cover the entire campus. This not only streamlines student flow and minimizes entrance congestion but also significantly reduces the dependency on watchmen for gatekeeping and manual checks

2. Project Summary

The project, **CIT Smart GatePass**, is designed to replace the manual, paper-based gate-pass process for hostel students with an automated, secure, and efficient digital platform. Currently, hostellers who wish to go home or leave campus for outings must fill out registers, get approvals manually, and wait at gates for verification. This creates delays, congestion, and stress for both students and staff, while offering little visibility into who is out, who has returned, or who may be delayed.

The goal of this project is to **streamline the home and outing approval process** by enabling students to scan Bar-coded ID cards at the gate to automatically log their movement in a secure, central database. Wardens can approve or reject requests digitally, security staff can instantly verify a student's status without searching through registers, and tutors and parents receive automated alerts if a student does not return by the approved time. By achieving this, the project aims to **reduce waiting times**, **minimize human error**, **improve student safety**, **enhance operational efficiency**, and contribute to CIT's vision of a **smart, technology-driven campus environment**

Addressing Problem or Pursuing Opportunity

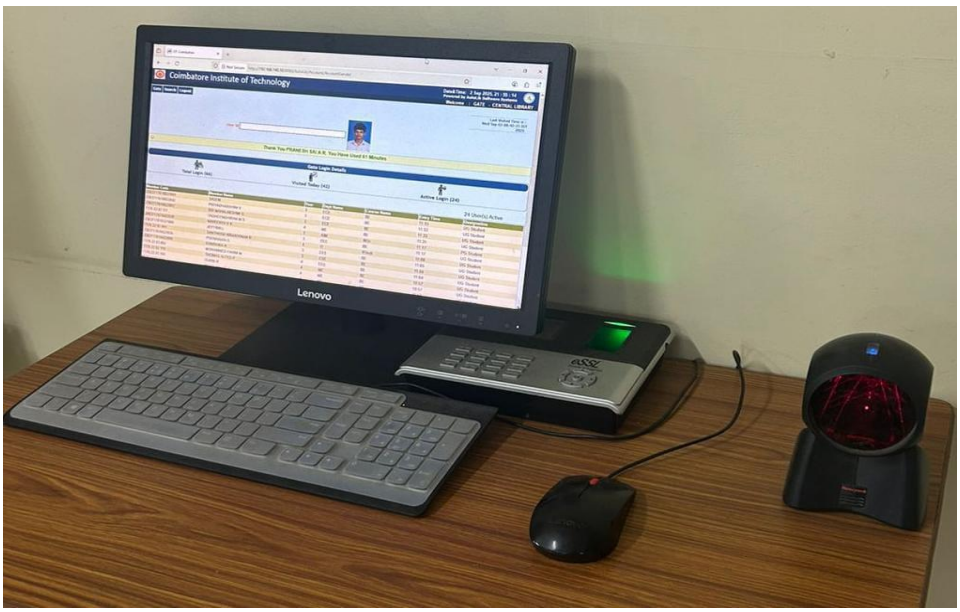
At CIT, hostel students who wish to go home or leave campus for outings must currently use a manual gate-pass system. The process involves writing their details in registers, obtaining signatures, and waiting at hostel or campus gates for verification. This leads to

crowding, delays, and inconvenience for both students and staff, especially when many students move in or out around the same period.

Now:

Overcrowded at main gate

Solution:



Bar code Scanner

The manual process is slow, error-prone, and lacks real-time tracking. If a student does not return within the approved time, parents and tutors are not notified promptly, creating safety risks. This situation presents a strong opportunity: by automating home and outing permissions, approvals, and gate logging, CIT can provide a faster, safer, and more accountable system. The proposed solution will reduce waiting times, ease staff workload, improve student safety, and serve as a scalable step toward a smart, technology-enabled campus.

Innovative Aspects

- **Complete automation:** Converts manual gate-pass and outing processes into a fully digital workflow.
- **Instant verification:** Security staff can verify student approval status in seconds at the gate.
- **Safety alerts:** Automatic SMS/email notifications if a student fails to return on time.
- **Role-based dashboards:** Separate, secure access for students, wardens, security, and administrators.
- **Low-cost, scalable design:** Uses affordable hardware (Bar-code scanner) and common software frameworks.
- **Audit-ready reporting:** Generates clean, searchable logs and downloadable reports for compliance and analysis.

Potential Impact

- **Reduced congestion:** Faster processing at hostel and campus gates will eliminate long queues and waiting times.
- **Improved student safety:** Real-time tracking and automated alerts will ensure quick response if a student is delayed or missing.
- **Less workload for staff:** Wardens and security staff will spend less time checking registers and signing approvals.
- **Higher accuracy and accountability:** Digital logs will reduce human error, provide clear records, and make audits easier.
- **Better parent and tutor confidence:** Automated updates build trust by keeping guardians informed about student movement.
- **Supports CIT's smart campus vision:** Demonstrates how digital tools can modernise routine operations and set an example for other institutions.
- **Scalable beyond CIT:** Once validated, the same solution can be adopted by other hostels, departments, or partner colleges.

3. Project Description

Background and Literature Review

- **Current practice:**
    - Hostel gate-pass systems rely on handwritten registers and manual approvals.

    - Causes congestion, delays, human error, and no real-time visibility of student movements.
    - No instant alert if a student fails to return on time, creating safety gaps.
- **Relevant research (global):**
    - Kumar et al. (2022, India): IoT-enabled RFID hostel attendance system; improved tracking accuracy and reduced manual logging.
    - Lee & Park (2021, South Korea): QR code–based smart campus access; simplified verification, reduced operational cost by 40%.
    - Santos et al. (2020, Brazil): Mobile-based gate-pass app with cloud services; improved real-time monitoring and parental notifications.
- **Identified gap:**
    - Existing solutions focus on attendance and access, not hostel home/outing permission workflows.
    - Lack of automated alerts for tutors and parents.
- **Opportunity at CIT:**
    - CIT Smart GatePass combines proven digital tracking technologies with customised features for hostel outing and home-return management.
    - Integrates automated approvals, secure logging, and real-time notifications in a single platform tailored to CIT's operational needs

Methodology / Approach

We will develop a scanner-based entry/exit management system with the following modules:

1. Student ID Scanning System

Features:

- Students scan their college ID card (RFID/Barcode/QR).
- System automatically records:
    - Student ID
    - Name
    - Timestamp
    - Status (IN / OUT)
- Very fast (1–2 seconds), reducing queues.

Workflow:

- Student taps/scans ID card at gate scanner.
- System checks last status (inside/outside).
- Updates log accordingly.
- No need for manual register writing.

2. Security Module

Features:

- Display real-time logs on a connected screen/monitor.
- Quick search option by ID card.
- Replace physical registers with auto-updated digital log.

Workflow:

- Security supervises scanning only. So, security count is reduced.
- If needed, they can verify student details via system screen.
- Reduces workload and speeds up gate management.

3. Local Database & Storage

Features:

- Simple local database (MySQL) to store records.
- Fields: Register number, Name, IN/OUT status, Timestamp, Contact.
- Automatic toggling between IN and OUT.

Workflow:

- Every scan entry is saved instantly.
- Records can be extracted anytime for checking.
- Acts as a digital replacement for manual registers.

4. Admin Access (College Authorities)

Features:

- Authorities can periodically view logs on a computer system connected to the scanner.
- Generate daily/weekly/monthly reports.
- Export to Excel for record-keeping.

Workflow:

- Logs are automatically synced on local system.
- Reports can be shared with higher authorities when required.

5. Notifications & Alerts (Basic, Offline)

For Security/Admin:

- **Alert pop-up on screen if:**
    - Student hasn't returned within a set time limit.
    - Duplicate/invalid ID card scanned.

For Parents:

- Optional SMS/Email notification when:
    - Student exits the campus.
    - Student fails to return within allowed time.
- Helps improve transparency and peace of mind for families.

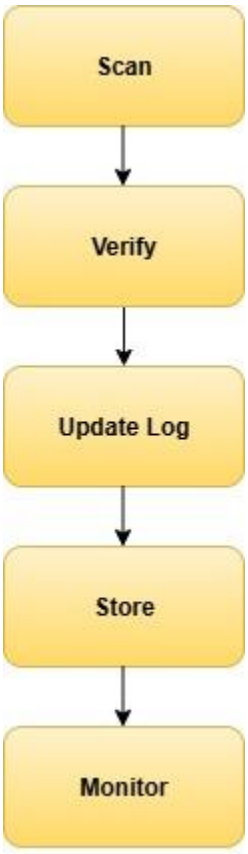
For Tutors:

- Periodic summary report of students under their guidance.
- Alert if a student repeatedly comes late or stays outside for long durations.
- Tutors can use this data to monitor attendance and discipline.

Workflow:

- Every scan generates a log in the system.
- If certain conditions (like overtime outside) are triggered, the system sends alerts to registered parents/tutors' contacts automatically.
- Ensures a safety loop between college, parents, and faculty.

Flow Chart:



Future Scope

1. **Security Dashboard –** A live digital display for security staff to monitor real-time entry/exit logs and verify student details quickly.
2. **Admin Panel (Warden) –** An advanced panel for authorities to generate reports, filter records, and track student movement more effectively.
3. **Student Permission Module –** A digital permission system where students request outing approval online, and only approved students can scan and exit.

Tech Stack

1. Hardware Interfaces

Modules Covered: Student ID Scanning, Data Logging

- **Scanner:** Barcode Scanner (USB-connected to PC).
- **Computer System:** Acts as the central processing unit.
- **Monitor/Display:** Shows logs for watchman to supervise**.**

2. Data Processing (Computer System)

Modules Covered: Scan Handling, IN/OUT Status, Log Management

- **Programming Language:** Python (easy hardware integration + database handling).
- **Logic:**
  - Scanner reads Student ID → Sent to computer.
  - Computer checks last status (IN/OUT).
  - Updates log with ID, Name, Timestamp, Status, Contact.

3. Database & Storage

Modules Covered: Entry/Exit Records, Daily Logs

- **Database:**
  - **SQLite** – lightweight, file-based (best for MVP).
  - **MySQL (future)** – scalable for multi-user access.
- **Data Stored:** Student ID, Name, Timestamp, Status (IN/OUT), Contact.
- **Export:** Excel for reports.

4. Security & Access

Modules Covered: Secure Use by Watchman/Admin

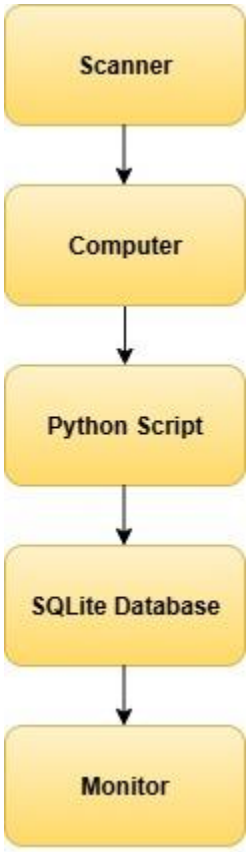
- **Local Security:** Logs accessible only from authorized PC.
- **Data Safety:** Password-protected system + backups.
- **Future Scope:** Role-based access (Security, Admin, Tutors).

5. Notifications & Alerts

Modules Covered: Student Safety & Monitoring

- **MVP (Offline): On-screen pop-up alerts if:**
  - Student hasn't returned in permitted time.
  - Invalid card scanned.
- **Notifications:**
  - SMS/Email alerts to parents.
  - Summary reports to tutors.

Flow chart:



Timeline for project completion with key milestones:

Month 1 – System Design & Setup

Modules Covered:

- Student ID Scanning System
- Database Design (Student Records, IN/OUT Logs)
- Workflow Diagrams & Architecture

Milestones:

- Setup Bar code scanner and connect to computer system.
- Design database schema (Student, Entry/Exit logs, Permissions).
- Create basic Python script to capture and store scan data.

Month 2 – Core Backend Development

Modules Covered:

- Entry/Exit Logging System
- Data Processing (IN/OUT toggle)
- Basic Log Viewer (on computer system for watchman)

Milestones:

- Implement backend logic for scanning and logging.
- Develop functions for IN/OUT tracking.
- Create simple UI for real-time logs display.
- Test with a small group of student IDs.

Month 3 – Module Development & Integration

Modules Covered:

- Security Dashboard
- Parent & Tutor Notification

Milestones:

- Build Watchman Dashboard (live entry/exit monitoring).
- Develop Admin Panel (report generation, analytics).
- Add Parent/Tutor notifications (Email/SMS).
- Conduct end-to-end workflow testing.

Month 4 – Testing, Deployment & Finalization

Modules Covered:

- Notifications & Reports
- Deployment Setup
- Documentation

Milestones:

- Conduct full-scale testing with multiple users.
- Fix bugs, optimize performance.
- Enable daily/weekly/monthly report exports (CSV/Excel).
- Deploy system on local server/computer.
- Prepare documentation (User Manual + Technical Report).
- Final presentation/demo.

Flow chart:

Budget:

Item	Estimated Cost (INR)	Details / Justification
Bar-code scanner	3,000	For scanning student ID cards at entry/exit.
Computer System	15,000	A computer to store and display the data log while scanning the IDs
Web/App development Tools &hosting	2,000	Cloud hosting or server space for deploying backend APIs and database. Stores student records, requests, logs, and ensures the system is accessible to multiple users securely.
Notifications & Messaging APIs	1,500	Email/SMS alerts to parents/tutors about entry/exit.
Pilot Deployment & Maintenance	1,500	Testing at main gate, minor fixes, documentation, printing.
Miscellaneous	1,000	Covers unexpected expenses such as replacement cables, additional adapters, or minor hardware upgrades.

Total Estimated Budget: ₹24,000

If computer already exists budget reduces to **₹9,000**

5. Team Bios

Kiruthika K

Background & Projects: Worked on **MineSense**, a smart helmet for miner safety, and **Smart Grocery**, a Python-based inventory management system.

Skills/Expertise: Python programming, IoT integration, sensor interfacing, and database management.

Thirumaran S L

Background & Projects: Developed a **Depression Detector** (IoT + AI) for mental health monitoring, a **Password Generator** for secure credential creation, **Stego Hide** for data security using steganography, and several **Python-based games** to strengthen programming logic.

Skills/Expertise: Python programming, IoT integration, basic AI/ML applications, data security techniques, and problem-solving through software development.