# PROJECT ANCS 2024

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Research & Development

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# INTRODUCTION

## BACKGROUND

In an era where technology drives progress, integrating advanced solutions is no longer optional—it is essential for achieving efficiency, accuracy, and operational excellence. Our mission extends beyond traditional goals; we strive to foster innovation, sustainability, and a better future. By addressing key challenges such as environmental impact and operational inefficiencies, we contribute to long-term success and well-being.

To meet the demands of today's rapidly evolving technological landscape, traditional methods must evolve. Introducing **PROJECT ANCS**—an Automated Number Plate Capture System designed to transform processes through innovation, precision, and reliability.

## PROBLEM STATEMENT

Traditional methods for vehicle monitoring and management face several challenges, including:

- **Verification Issues:** Difficulty in ensuring the accurate identification and presence of vehicles.
- **Fraudulent Practices:** Manipulation of data compromises the reliability of the system.
- **Transparency Gaps:** Lack of visual proof and traceability reduces trust and accountability.

These challenges undermine operational efficiency and hinder the effectiveness of systems in areas such as parking management, regulatory compliance, and vehicle-related services.

## OBJECTIVES

### PROJECT ANCS is strategically designed to:

- Ensure accurate identification and presence verification of vehicles.
- Capture high-resolution images of vehicles and license plates for reliable visual documentation.
- Prevent fraudulent activities and ensure data integrity.
- Enhance accuracy and transparency across all stages of vehicle management processes.
- Streamline operations through automated reporting, record-keeping, and compliance facilitation.

## SCOPE

The scope of **PROJECT ANCS** encompasses the implementation of an intelligent automated system capable of:

- Capturing real-time high-resolution images of vehicle license plates and corresponding data.
- Automating the recording and processing of test results with minimal human intervention.
- Integrating seamlessly with regulatory databases for efficient data management and auditing.
- Operating reliably across diverse environmental conditions to ensure consistent performance.

## VISION STATEMENT

### "Shaping the Future Through Technology."

With PROJECT ANCS, we are not just implementing advanced technology—we are paving the way for innovative solutions that redefine vehicle management and monitoring. Our commitment to precision, transparency, and progress drives us to create systems that contribute to a smarter, more efficient, and sustainable future.

Project ANCS
THARUSHA BIMSARA
15.12.2024

# WHY IS THIS ANCS SYSTEM EFFECTIVE?

In our Automated Number Plate Capture System (ANCS), we are able to capture both the vehicle's full image and its registration number plate using any camera, including web cameras, mobile phone cameras, CCTV cameras, IP cameras. Unlike traditional systems, which may require expensive equipment, our ANCS system provides flexibility in choosing the input device, making it more cost-effective.

## COST COMPARISON WITH HIKVISION ENTRANCE/EXIT CAPTURE CAMERA UNIT

The Hikvision entrance/exit capture camera unit costs around LKR 275,000. However, this system has its limitations. It is designed to capture vehicle number plates and images, but it cannot handle motorcycles or three-wheelers, limiting its coverage.

## IN CONTRAST, OUR ANCS SYSTEM OFFERS:

- **Flexible camera options:** Any camera can be used, and we are currently using a **IP camera** (which costs only **LKR 12,000**).
- **Full vehicle and number plate capture:** Our system can capture the number plate and vehicle image, including for **three-wheelers**, which the Hikvision system cannot do.
- **Advanced features:** The ANCS system includes features like **adjustable camera settings**, **retake time adjustments**, and the ability to use **RTSP** for streaming. This offers better customization and flexibility in capturing the vehicle number plate.
- **Security:** Our system has built-in **login security**, ensuring that only authorized personnel can access and make changes to the system.
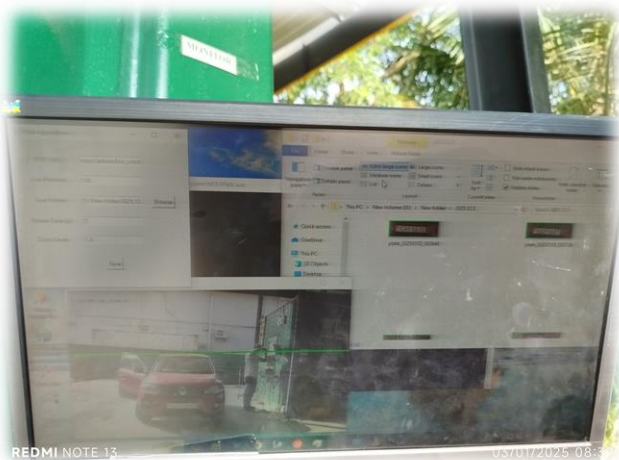


**Automated Number Plate Capture System**



**Hikvision Entrance/Exit Capture Camera Unit**

## COST GAP:

- Hikvision System: LKR 275,000
- Our ANCS System (using a Hikvision IP camera): LKR 12,000

## Cost Difference (Gap): LKR 263,000

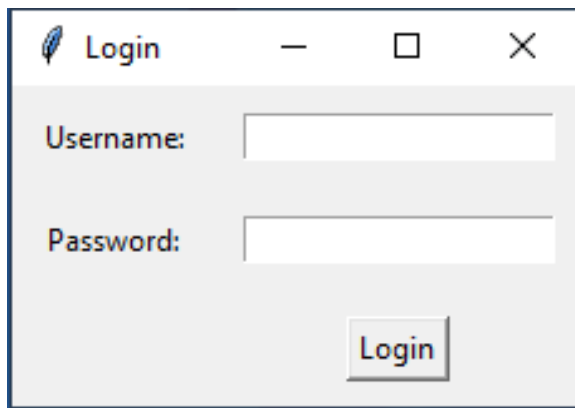This means, with our ANCS system, we save LKR 263,000 while gaining all the features and flexibility required for number plate capture, even for three-wheelers. This significant cost difference makes our ANCS system a highly effective and affordable solution for vehicle number plate recognition.

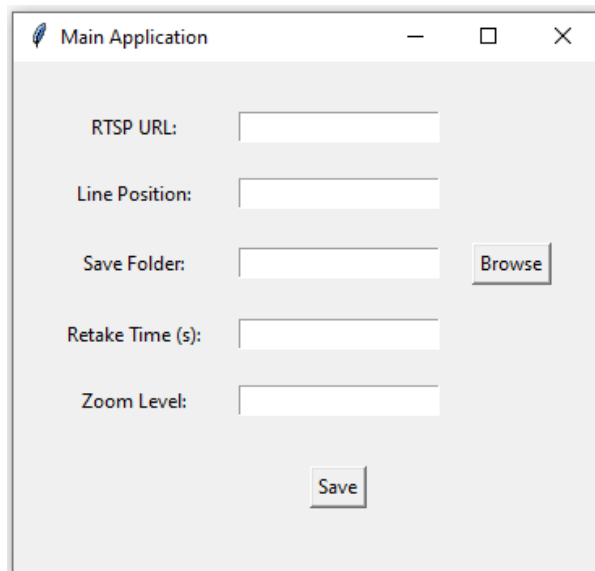# AUTOMATED NUMBER CAPTURE SYSTEM INTERFACE

## Login Interface of ANCS





## User Interface of ANCS

# USE CASES AND APPLICATIONS

### 1. Automated Vehicle Identification

The Automated Number Plate Capture System (ANCS) ensures seamless identification of vehicles entering a facility. By automatically capturing high-resolution images of license plates, the system verifies vehicle authenticity and reduces the risk of unauthorized or fraudulent entries.
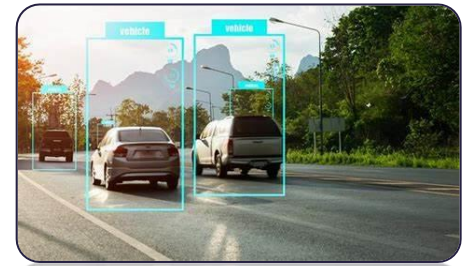


### 2. Blacklisted Vehicle Detection

With integration into a centralized database, ANCS can instantly detect blacklisted vehicles attempting to access a facility. This proactive approach enhances security, ensures compliance with regulations, and prevents unauthorized vehicles from exploiting the system.



### 3. Verification of Genuine Service

The ANCS ensures that each service is conducted with a genuine, physically present vehicle. This eliminates instances of fraudulent practices, such as manipulated results or fake entries, ensuring accurate and authentic service procedures.



### 4. Automatic Vehicle Registration and Check-in

Upon arrival at the facility, vehicles are automatically registered into the system using their license plate numbers. For pre-registered vehicles, the system retrieves existing data, minimizing manual input, speeding up the check-in process, and improving overall operational efficiency.



### 5. Real-Time Monitoring and Record-Keeping

Every stage of the testing process is documented with visual evidence, providing a clear record that can be audited at any time. This ensures full transparency and supports compliance with relevant regulations.
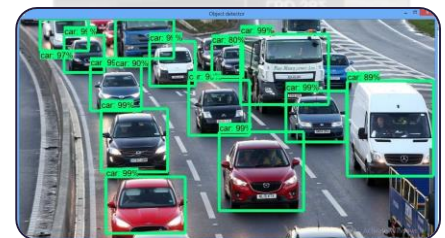
# BENEFITS AND IMPACT

## OPERATIONAL BENEFITS

- **Increased Efficiency:** Automates vehicle check-in and verification, reducing delays and manual workload.
- **Improved Accuracy:** Ensures error-free data capture and vehicle identification.
- **Streamlined Processes:** Seamlessly integrates testing stages with minimal human intervention.

## ECONOMIC BENEFITS

- **Cost Reduction:** Reduces operational costs related to manual data entry and verification.
- **Resource Optimization:** Automates repetitive tasks, allowing staff to focus on critical responsibilities.
- **Long-term Savings:** Prevents fraudulent practices, ensuring financial resources are used effectively.

## SOCIAL IMPACT

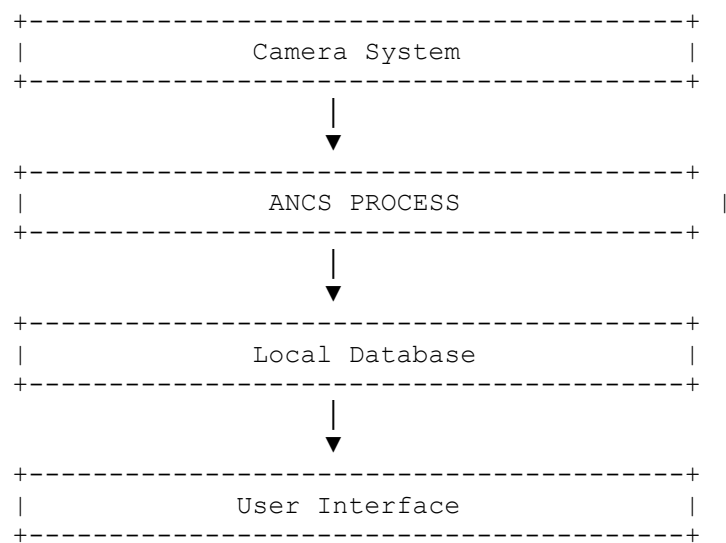- **Enhanced Customer Satisfaction:** Faster and smoother vehicle testing processes create a positive experience for customers.
- **Improved Employee Satisfaction:** Reduces workload on staff, allowing them to focus on higher-value tasks.
- **Genuine and Transparent Services:** Builds trust with customers and regulatory bodies by ensuring every service is conducted fairly and transparently.

# TECHNICAL ARCHITECTURE

## SYSTEM ARCHITECTURE OVERVIEW

1.  Camera System
    - o  Captures high-resolution images of vehicles and number plates.
    - o  Sends image data to the local database.
2.  Sensors
    - o  Detect vehicle entry and trigger the camera system.
    - o  Provide real-time status updates to the processing unit.
3.  Local Database
    - o  Stores vehicle images, number plate data, timestamps, and relevant metadata.
    - o  Ensures secure data storage on the computer's hard drive.
4.  User Interface (UI)
    - o  Provides an interface for administrators to view and monitor captured data.
5.  Processing Unit
    - o  Acts as the central hub coordinating all subsystems.
    - o  Validates and ensures smooth data flow between components.

## DIAGRAM STRUCTURE PLAN

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+------------------------------------------+
|                Camera System             |
+------------------------------------------+
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                     ▼
+------------------------------------------+
|                ANCS PROCESS              |
+------------------------------------------+
                     |
                     ▼
+------------------------------------------+
|                Local Database            |
+------------------------------------------+
                     |
                     ▼
+------------------------------------------+
|                User Interface            |
+------------------------------------------+
```

- **Arrows (→)** represent data flow between components.
- The **Processing Unit** (ANCS) acts as the central point, ensuring smooth interaction.

# KEY COMPONENTS

1. **Cameras and Sensors:**
   - High-resolution cameras capture vehicle images and license plates.
   - Sensors detect vehicle entry, movement, and exit from the testing premises.
2. **Data Storage and Retrieval System:**
   - Secure database stores vehicle details, test results, and captured images.
   - Enables quick retrieval of records for audits and compliance checks.
3. **User Interface (UI/UX):**
   - Intuitive dashboard for operators to monitor vehicle entries, test results, and alerts.
   - Real-time data visualization and reporting tools for better decision-making.

# DATA FLOW EXPLANATION

1. **Vehicle Entry:** Sensors detect vehicle presence; cameras capture images and license plates.
2. **Verification:** The system verifies whether the vehicle has physically arrived at the premises or if there are attempts to manipulate the process, such as presenting only the number plate or using photos/videos via mobile devices.
3. **Storage:** All captured data, including images and test results, are securely stored.
4. **Display:** Operators view the data through a user-friendly interface for monitoring and reporting.

This architecture ensures **seamless integration, scalability, and security** across all system components.

# IMPLEMENTATION DETAILS

## PHASES OF DEVELOPMENT

1. **Planning:**
   - Defined project goals, system requirements, and milestones.
   - Conducted feasibility studies and resource allocation.
2. **Design:**
   - Created technical blueprints and system diagrams.
   - Designed the user interface for clarity and ease of use.
3. **Development:**
   - Built core functionalities, including image capture and data storage modules.
   - Integrated APIs, XML  and ensured seamless communication between hardware and software components.
4. **Testing:**
   - Conducted system testing to ensure accuracy in data flow and integration.
   - Performed stress tests to validate performance under peak loads.
5. **Deployment:**
   - System installed and configured at testing facilities.
   - Provided training sessions for operators and administrators.

## CHALLENGES ENCOUNTERED AND SOLUTIONS

- **Hardware Integration:** Ensured smooth synchronization between cameras and the processing module.
- **Scalability:** Designed the database to handle large volumes of records efficiently

## TOOLS AND FRAMEWORKS USED

- **Programming Languages:** Python, JavaScript
  - **Python:** Used for backend services, automation scripts, and real-time processing (e.g., camera capture).
- **Database:** Local Storage
  - **Local Storage:** Used for storing captured data (number plate images) locally on the computer.
- **Frontend Framework:** Tkinter
  - **Tkinter:** Used for building the graphical user interface (GUI) of the application.
- **Backend Framework:** Python
  - **Python:** Used for real-time processing and controlling th camera capture.

# FUTURE SCOPE AND RECOMMENDATIONS

The Automated Number Plate Capture System (ANCS) has demonstrated strong potential in capturing vehicle registration plates and images using a wide variety of cameras. As the project progresses, there are several improvements and upgrades that can enhance its functionality and effectiveness.

## POTENTIAL IMPROVEMENTS AND UPGRADES

1. **AI and Machine Learning Integration:**
   - One of the key areas for future enhancement is integrating **Artificial Intelligence (AI)** and **Machine Learning (ML)** models to improve the accuracy and speed of number plate recognition. AI can enable the system to learn from new data, improving its predictive capabilities and handling more complex scenarios, such as vehicles with obstructions or unclear number plates.
   - **Predictive Analytics**: By using AI, the system could predict high-traffic areas, anticipate vehicle types, or even optimize camera angles for better recognition. This could be particularly useful in environments like parking lots or toll booths.

2. **Cloud Integration:**
   - Storing captured data (images and number plates) in the **cloud** could enhance accessibility, ensure data backup, and allow for real-time analytics across multiple locations. Cloud-based systems would also provide the flexibility to scale and integrate with other systems.

3. **Smart Notification and Alert System:**
   - Implementing a **real-time notification system** that alerts authorized personnel whenever specific vehicle types or number plates are captured (e.g., blacklisted vehicles or vehicles approaching restricted zones). This can improve security and automation.

4.  **Vehicle Type Recognition:**
    - o  Expanding the system's capabilities to **recognize different vehicle types** (e.g., cars, trucks, motorcycles, three-wheelers) and associate each type with specific actions (such as sending alerts for vehicles that are not normally allowed in certain areas) will broaden the system's utility.

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5.  **Blacklisted Vehicle Detection:**
    - o  Integrating **blacklisted vehicle detection** functionality. When a vehicle enters the monitored area, the system will capture the vehicle's license plate and automatically check it against a **blacklist database**. If the vehicle is flagged, an alert will be sent to security or relevant personnel for further action.
    - o  This system can be used for tracking stolen vehicles or vehicles with outstanding legal issues, enhancing security and monitoring at key locations.

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6.  **Automatic Vehicle Registration and Check-in:**
    - o  Implementing an **automatic vehicle registration and check-in process**. When a vehicle arrives at a monitored location, the system will identify the vehicle's number plate and check if it is already registered in the system.
    - o  If the vehicle is already registered, the system will **automatically fill in the relevant data**, bypassing the need for manual input by data operators. This reduces human error, speeds up the registration process, and ensures a smoother experience for the vehicle owner.

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7.  **Mobile App Integration:**
    - o  Developing a **mobile application** for remote monitoring and control of the ANCS will allow users to view captured data, manage settings, and receive real-time alerts from anywhere.

# CONCLUSION

The **Automated Number Plate Capture System (ANCS)** is a powerful, cost-effective solution for real-time vehicle recognition and image capture. By using flexible camera options and integrating advanced features such as adjustable camera settings, retake time adjustments, and robust security protocols, the ANCS provides a competitive alternative to existing solutions, such as the Hikvision entrance/exit capture camera system, at a fraction of the cost.

Key takeaways from this report include:

- **Cost-effective camera options**: The ANCS allows the use of any camera, including affordable CCTV and IP cameras, for capturing vehicle images and registration plates. This significantly reduces the overall system cost when compared to expensive alternatives like the Hikvision system.
- **Flexibility in vehicle types**: Unlike traditional systems such as Hikvision, which cannot handle three-wheelers, the ANCS can capture the number plates of a variety of vehicles, making it a more versatile solution.
- **Enhanced security and access control**: The ANCS includes a login security system, ensuring that only authorized personnel can manage and make changes to the system, enhancing its reliability and safety.
- **Cost Gap**: The Hikvision entrance/exit capture camera system costs approximately **LKR 275,000**, while the ANCS system can be implemented with a camera priced at **LKR 12,000**, resulting in a significant cost difference of **LKR 263,000**. This makes the ANCS a highly affordable solution for businesses and government entities seeking a cost-effective alternative.

As the ANCS system continues to evolve, its integration with **Artificial Intelligence (AI)**, **cloud-based solutions**, and **mobile applications** will further expand its capabilities, enabling applications in areas such as security monitoring, parking management, and traffic monitoring. Additionally, its scalable and modular design ensures it can meet the growing needs of businesses, government entities, and various sectors.

In conclusion, the **ANCS project** demonstrates great potential for success due to its **cost-effectiveness**, **flexibility**, and **expandability**, making it an ideal solution for modern number plate capture systems.

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# RESULTS OF ANCS SYSTEM
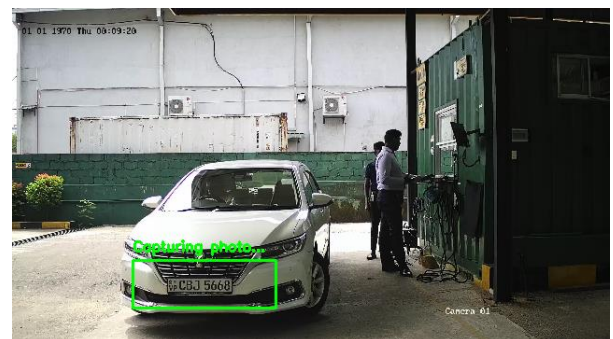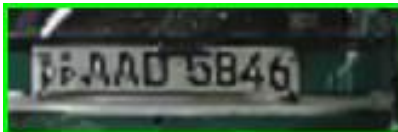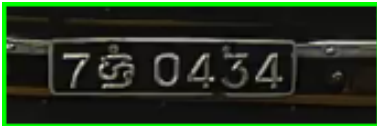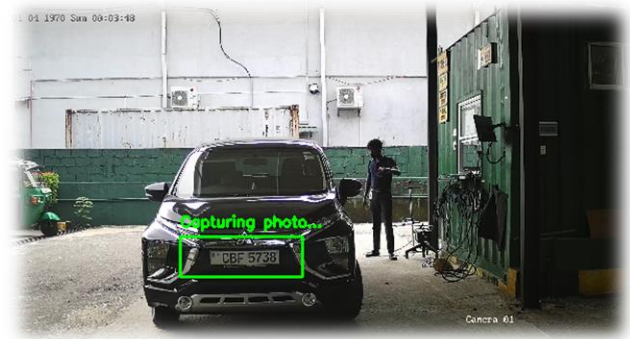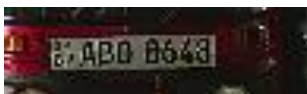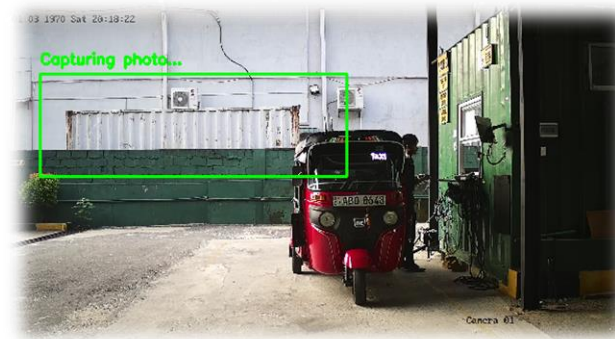
# We Build Trust

## OUR CURRENT PARTNER



We are proud to have Laugfs Eco Sri (PVT) Ltd as one of our official partners, utilizing our Automated Number Plate Capture System (ANCS) to optimize their vehicle management processes.

## Project Verification

This project has been developed with the guidance and support of our Head of Department (HOD) and Chief Executive Officer (CEO), whose leadership has been instrumental in its success. For further verification, HOD is available for reference:

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Darshana Gajaweera

Head of R & D Department

Laugfs Eco Sri