Software Requirement Specification (SRS)

1. Introduction

1.1 Purpose

The purpose of this project is to develop a CCTV-based Automatic Number Plate Recognition (ANPR) System that detects vehicles, recognizes license plates, and logs their entry and exit times at the college gate. The system should be resilient to real-world challenges such as traffic congestion, varying lighting conditions, and adverse weather.

1.2 Scope

This system will integrate with existing CCTV infrastructure to:

- **Capture vehicle images in real-time.**
- **Detect and extract license plates.**
- **Perform Optical Character Recognition (OCR) on license plates.**
- **Store and manage vehicle entry and exit logs.**
- **Automatically delete data older than 3 months.**
- **Ensure data integrity during power outages.**

1.3 Definitions, Acronyms, and Abbreviations

- **ANPR - Automatic Number Plate Recognition**
- **OCR - Optical Character Recognition**
- **UPS - Uninterruptible Power Supply**
- **AI - Artificial Intelligence**
- **ML - Machine Learning**

1.4 References

- **OpenCV Library for Image Processing**
- **Tesseract OCR for Character Recognition**
- **YOLO/Faster R-CNN for Object Detection**
- **SQL Database for Data Management**

1.5 Overview

This document details the functional and non-functional requirements of the ANPR system, including system features, constraints, and design considerations.

2. General Description

2.1 Product Perspective

The system is an AI-powered extension of CCTV surveillance, enabling automated vehicle tracking through license plate recognition. It will run as an independent software module connected to a central database.

2.2 Product Functions

- **Vehicle Detection: Identifies vehicles in CCTV footage.**
- **License Plate Extraction: Detects and isolates the number plate.**
- **Character Recognition: Uses OCR to extract alphanumeric data.**
- **Time Logging: Records vehicle entry and exit timestamps.**
- **Database Management: Stores and manages vehicle logs.**
- **Data Retention Policy: Deletes data older than 3 months.**

2.3 User Characteristics

- **Security Personnel: Monitor and verify vehicle logs.**
- **College Administration: Access entry-exit reports.**
- **System Administrator: Manage system settings and maintenance.**

2.4 Constraints

- **Must work in varying weather conditions (rain, fog, low light).**
- **Must handle fancy number plates and partially obstructed plates.**
- **System should operate in real-time with minimal processing delays.**
- **Data should be retained for exactly three months before deletion.**
- **Power backup must prevent data loss during outages.**

2.5 Assumptions and Dependencies

- **The CCTV cameras are high resolution and properly installed.**
- **The system will be deployed on a local server or cloud.**
- **The database and software will be regularly maintained.**

3. Specific Requirements

3.1 Functional Requirements

3.1.1 Vehicle Detection

- **The system shall detect vehicles entering and exiting the college gate.**
- **It shall differentiate between moving and parked vehicles.**

3.1.2 License Plate Recognition

- **The system shall identify license plates from detected vehicles.**
- **It shall extract characters using OCR.**

3.1.3 Data Logging

- **The system shall store the vehicle number, entry time, and exit time in a database.**
- **The data shall be accessible through a user-friendly interface.**

3.1.4 Data Retention and Deletion

- **The system shall automatically delete records older than 3 months.**
- **Deleted data should not be recoverable.**

3.1.5 System Administration

- **Admin users shall be able to configure camera feeds and database settings.**
- **The system shall provide logs and alerts for critical events.**

3.2 Non-Functional Requirements

3.2.1 Performance Requirements

- **The system shall process a vehicle entry/exit event in under 2 seconds.**
- **OCR accuracy should be at least 90% under normal conditions.**

3.2.2 Reliability and Availability

- **The system shall have 99.9% uptime.**
- **UPS shall ensure continuous operation during power cuts.**

3.2.3 Security Requirements

- **Only authorized users shall access the database.**
- **Data should be encrypted to prevent unauthorized access.**

3.2.4 Maintainability

- **The system should be modular for easy updates and bug fixes.**
- **Logs should be maintained for at least 6 months for audit purposes.**

4. Appendices

- **Sample database schema.**
- **API documentation for integrating with third-party systems.**