Software Design Document

Project: 校园超速监控系统（更改）

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Published on: 2023-06-07

Version: 1.0

Background:

Software design is a process by which the software requirements are translated into a representation of software components, interfaces, and data necessary for the implementation phase. The SDD shows how the software system will be structured to satisfy the requirements. It is the primary reference for code development and, therefore, it must contain all the information required by a programmer to write code. The SDD is performed in two stages. The first is a preliminary design in which the overall system architecture and data architecture is defined. In the second stage—i.e., the detailed design stage—more detailed data structures are defined and algorithms are developed for the defined architecture.

This template is an annotated outline for a software design document adapted from the *IEEE Recommended Practice for Software Design Descriptions*. The *IEEE Recommended Practice for Software Design Descriptions* has been reduced in order to simplify this assignment while still retaining the main components and providing a general idea of a project definition report. For your own information, please refer to IEEE Std 1016[[1]](#footnote-1) for the full *IEEE Recommended Practice for Software Design Descriptions*.

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# Introduction

## Purpose

Identify the purpose of this SDD and its intended audience. (e.g. “This software design document describes the architecture and system design of XX. ….”).

【示例】The purpose of this software design document (SDD) is to provide a detailed description of the design of the campus overspeed monitoring system. The intended audience of this document includes the developers who are responsible for implementing the system and the stakeholders who are involved in the development, testing, and maintenance of the system. This document will provide a comprehensive understanding of the software architecture and system design, functional and data structure, and implementation details that will help in producing test cases and ensuring that the system satisfies the requirements outlined in the SRS document. Additionally, this document will assist in the ongoing maintenance of the system.

本软件设计文档（SDD）的目的是提供校园超速监控系统设计的详细描述。该文档的预期读者包括负责实施系统的开发人员和参与系统开发、测试和维护的利益相关者。本文档将提供软件架构和系统设计、功能和数据结构以及实现细节的全面理解，有助于生成测试用例，并确保系统满足SRS文档中概述的需求。此外，本文档将有助于系统的持续维护。

文档是用来干嘛的，面向的群体有哪些(利益相关者…)

要写 – 参考示例，更改部分内容即可！

## Scope

Provide a description and scope of the software and explain the goals, objectives, and benefits of your project. This will provide the basis for a brief description of your product.

【示例】The developed software is a campus overspeed monitoring system that aims to monitor the speed of vehicles driving within the campus. The system is comprised of multiple speed detectors deployed at key locations around the campus, multiple roadside speed display units, and a back-end management system. The objectives of the system are to improve road safety within the campus by detecting and warning drivers exceeding the safe speed limit, educating offenders through automated SMS notifications, and generating reports for analysis and improvement. The benefits of the campus overspeed monitoring system include reducing accidents caused by over-speeding and improving the overall road safety within the campus. The system also provides an efficient way for the school’s security department to manage traffic violations and educate drivers on safe driving practices. The system can be easily customized to adjust the safe speed limits and the frequency of notifications to meet the specific needs of the school's security department.

该开发的软件是一个校园超速监测系统，旨在监测校园内行驶车辆的速度。该系统由部署在校园关键位置的多个速度检测器、多个路边速度显示单元和一个后台管理系统组成。该系统的目标是通过检测和警示超过安全速度限制的驾驶员，通过自动短信通知向违规者提供教育，并生成报告进行分析和改进，提高校园内的道路安全。校园超速监测系统的好处包括减少超速引起的事故，提高校园内的整体道路安全。该系统还为学校的安保部门提供了管理交通违规行为和教育驾驶员安全驾驶行为的有效方式。该系统可以轻松定制以调整安全速度限制和通知频率，以满足学校安保部门的特定需求。

目标，产生的效益

要写 -- 参考示例，可复用**SRS**的1.2小节“Scope”！

## References

List any documents, if any, which were used as sources of information.

【示例】

[1] "IEEE Standard for Information Technology--Systems Design--Software Design Descriptions," <https://ieeexplore.ieee.org/document/5167255>.

参考文献

可选

## Definitions and Acronyms

Provide definitions of all terms, acronyms, and abbreviations that might exist to properly interpret the SDD. These definitions should be items used in the SDD that are most likely not known to the audience.

【示例】

[1] SMS: Short Message Service

[2] SRS: Software Requirements Specification

定义、缩略词

可选

# System Overview

Give a general description of the functionality, context, and design of your project. Provide any background information if necessary.

【示例】The Campus Overspeed Monitoring System is designed to monitor the speed of vehicles traveling within the campus and identify those that exceed the designated safe speed limit, such as 30km/h. The system comprises multiple speed detectors deployed at critical locations within the campus, along with roadside speed display screens that indicate the safe speed limit. Additionally, there is a backend management system that can be accessed via both PC and mobile devices, with access restricted to authorized users from the campus security department.

The speed detectors record the speed and license plate number of all vehicles passing through critical locations and display them on roadside screens. The system also stores the detection records in the backend management system. If a vehicle exceeds the safe speed limit, the backend management system automatically sends a warning message to the driver (if they are a staff member) and educates them on safe driving practices. For temporary visitors, the system sends a similar warning message based on the registered vehicle information and notifies the relevant personnel within the campus.

The backend management system can periodically perform statistical processing, including notifying responsible unit leaders of staff members who have exceeded the safe speed limit three times or more per month on the last day of each month at noon. It also blacklists any vehicle exceeding the safe speed limit five times or more per quarter on the last day of each quarter at noon, canceling their access to the campus in the following quarter. The designated leader within the campus security department can adjust the safe speed limit and the monthly/quarterly limit for overspeed occurrences using the backend management system. The same person can also view monthly and quarterly reports from various campus units, as well as add or remove ordinary backend management personnel. Ordinary backend management personnel can view detailed records by vehicle, driver, or road section.

All authorized users of the backend management system can also update their personal information, such as phone numbers and addresses. The Campus Overspeed Monitoring System provides an effective solution for ensuring safety within the campus by monitoring vehicle speeds and educating drivers on safe driving practices.

功能、上下文、设计相关的通用性描述

要写 -- 这里可直接放置【**系统描述】**！

类似于**SRS**的1.4小节“Product functions”的文字性功能描述（若写过）

# System Architecture

## Architectural Design

Develop a modular program structure and explain the relationships between the modules to achieve the complete functionality of the system. **This is a high-level overview of how the responsibilities of the system were partitioned and then assigned to subsystems. Identify each high-level subsystem and the roles or responsibilities assigned to it. Describe how these subsystems collaborate with each other in order to achieve the desired functionality.** Don’t go into too much detail about the individual subsystems. The main purpose is to gain a general understanding of how and why the system was decomposed, and how the individual parts work together. **Provide a diagram showing the major subsystems and data repositories and their interconnections.** Describe the diagram if required.

【示例】Speed Detection Subsystem: This subsystem is responsible for detecting the speed of vehicles passing through key locations within the campus. It will consist of multiple speed detectors placed at strategic points in the campus. Each detector will have the ability to capture the vehicle's license plate number and speed, which will be displayed on a nearby speed display board and sent to the backend management system. The data captured by this subsystem will be used to detect vehicles that are exceeding the speed limit.

Vehicle Speed Display Subsystem: This subsystem receives information from the Vehicle Speed Detection Subsystem and displays the detected speed of each vehicle to the driver. This subsystem also includes a mechanism for displaying safe speed limits for the area in which the vehicle is traveling. The display subsystem helps drivers remain aware of their speed while driving on campus.

Backend Management Subsystem: This subsystem is responsible for managing all the data collected by the Speed Detection Subsystem. It can be accessed from both PC and mobile devices, accessible only to authorized personnel from the campus security department. This subsystem will store all the speed detection records sent by the Speed Detection Subsystem. In addition, it will also have features to manage warnings or notifications, generate reports, and maintain a blacklist of vehicles exceeding the speed limit.

系统的高层视图，子系统明确的职责，子系统之间的协作方式、消息通信方式。最好需要一个图

要写 -- 这里放置**【子系统划分】**结果：

1. 所运用的子系统组织准则；// 相当于**Design Rationale**

2. 所识别的子系统及各个子系统的职责描述 🡪 参考示例；

3. 子系统之间的并发通信图。

## Decomposition Description

**Provide a decomposition of the subsystems in the architectural design.** Supplement with text as needed. You may choose to give a functional description or an object-oriented (OO) description. For a functional description, put top-level data flow diagram (DFD) and structural decomposition diagrams. For an OO description, put subsystem model, object diagrams, generalization hierarchy diagram(s) (if any), aggregation hierarchy diagram(s) (if any), **interface specifications**, and sequence diagrams here.

子系统的接口的描述。

要写 -- 这里放置**【子系统设计】**结果：

1. 各个子系统的并发通信图；

2. 所有对象及消息类型的确定依据，如运用的并发任务组织准则等。// 相当于 **Design Rationale**

3. 类/任务的接口设计（不要求每个对象/任务的通信图）-- 因为实体类的操作将在4.1小节给出，这里仅给出实体类以外的其它类/任务的接口。（实体类之外…工作量大）

## Design Rationale

**Discuss the rationale for selecting the architecture** described in 3.1 including **critical issues and trade/offs that were considered**. You may discuss other architectures that were considered, provided that you explain why you didn’t choose them.

可选 -- 除了3.1、3.2小节所给出的设计理由（如子系统组织准则）外，若还有其他重要的体系结构设计选择（如选择顺序性服务设计方案）的理由可放置在这里。

# Data Design

## Data Dictionary

Alphabetically list the system entities or major data along with their types and descriptions. If you provided a functional description in Section 3.2, list all the functions and function parameters. If you provided an OO description, **list the objects and their attributes, methods, and method parameters.**

按字母顺序列出系统实体或主要数据及其类型和说明。如果您在第 3.2 节中提供了功能描述，请列出所有函数和函数参数。如果提供了 OO 说明，请列出对象及其属性、方法和方法参数。

要写 -- 这里放置**【实体类图（属性+操作）】**！

可选 -- 简要描述各个实体类存储的数据信息（如示例）、以及其中较为复杂的属性、操作。

【示例】

The major data or system entities include:

Vehicle information: This includes vehicle registration number, make and model, owner information, and temporary permits for outside vehicles.

Speed detection records: These records contain the details of each vehicle detected by the speed detector, such as registration number, speed, date, time, and location.

Warning messages: These messages are sent to drivers who violate speed limits. There are different types of warning messages depending on whether the driver is a school staff member or an outside vehicle owner, and the number of times they have violated the speed limit.

Blacklist: This list contains the registration numbers of vehicles that have violated the speed limit more than five times in a quarter. These vehicles will not be allowed inside the campus in the next quarter.

## Data Storage

Explain how the information domain of your system is transformed into data structures. Describe how the major data or system entities are stored, processed, and organized. **List any databases or data storage items.**

要写 – 这里放置**【实体类的存储方式】**及**【关系数据库映射】**结果！

对于所有实体类，根据数据存储要求将它们细分为“数据抽象类”或“数据库包装器类”并简要说明缘由；若是需要存储于关系数据库，则给出实体类到关系数据库表的映射。

# Component Design

In this section, we take a closer look at what each component does in a more systematic way. If you give a functional description in section 3.2, **provide a summary of your algorithm for each function listed in 3.2 in procedural description language (PDL) or pseudocode.** If you give an OO description, summarize each object member function for all the objects listed in 3.2 in PDL or pseudocode. Describe any local data when necessary.

要写 -- 这里放置类/任务接口的**【详细设计】**，即每个操作的内部算法（伪代码）、每个并发任务的接口规约和行为规约。**NOTE: 各小组内每位组员任选一个类/任务的接口进行详细设计！**不要求写所有的类和任务！

# Human Interface Design

## Overview of User Interface

Describe the functionality of the system from the user’s perspective. **Explain how the user will be able to use your system** to complete all the expected features and the feedback information that will be displayed for the user.

可选 – 这里对用户使用系统的方式进行描述，如用户的授权登录、功能选择输入、以及系统的信息展示等。此部分的内容等同于**用例描述**，但重点关注人类用户。

【示例】The user interface of the campus overspeed monitoring system allows authorized users to access the system through a PC or mobile device. The authorized user is typically a member of the school security department responsible for managing the traffic within the school campus. By accessing the system, the user will be able to view the real-time speed data displayed on the speed detector screens installed at key locations around the campus. The speed detector screen displays the vehicle's license plate number, speed, and an indicator of whether the vehicle is speeding or not. In addition to the real-time speed data, the user can also view detailed records of vehicle speed violations through the backend management system. They can search by vehicle, driver, or road segment to retrieve the necessary information. Once a speeding violation is identified, the user can send an educational message to the driver through SMS. If the driver is a staff member of the school, their department head will also be notified. The system also provides monthly and quarterly statistical reports for each unit in the school to review their performance in terms of traffic safety. Authorized users can adjust the maximum speed limit monthly and quarterly over-speeding limits and add or remove regular administrative users.

## Screen Images

**Display screenshots** showing the interface from the user’s perspective. **These can be hand­ drawn or you can use an automated drawing tool.** Just make them as accurate as possible. (Graph paper works well.)

可选 -- 这里放置一些系统的GUI页面，可以是手绘或理由自动绘图工具创建的。

可复用SRS的1.3.1小节“User interfaces”的GUI界面（若绘制过）。

## Screen Objects and Actions

A discussion of screen objects and actions associated with those objects.

可选 – 对6.2小节的GUI界面中的屏幕对象及其动作进行说明。

# Requirements Matrix

**Provide a cross­reference that traces components and data structures to the requirements** in your software requirements specification (SRS) document.

Use a tabular format to show which system components satisfy each of the functional requirements from the SWRS. Refer to the functional requirements by the numbers/codes that you gave them in the SWRS.

可选 -- 这里提供SRS中需求/用例与SDD中构件和数据之间的交叉引用，实现需求与设计之间的可追踪性。为此，需要给需求/用例、构件、数据进行标识。

# Appendices

Appendices may be included, either directly or by reference, to provide **supporting details** that could aid in the understanding of the SDD.

可选 -- 类似于SRS的3节“Supporting information”。

**说明：**// *适用于SRS与SDD两份文档！*

1. **凡是“可选”的部分都不作要求，可以写“无”或者将该部分删去；**
2. **凡是“要写”的部分，请参考说明进行内容填充。**

1. <http://ieeexplore.ieee.org/browse/standards/collection/ieee> [↑](#footnote-ref-1)