Module Guide for Sandlot

Team 29
Nicholas Fabugais-Inaba
Casra Ghazanfari
Alex Verity
Jung Woo Lee

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1 Revision History

Date	Version	Notes
January 13, 2025	1.0	TA Feedback
January 17, 2025	1.1	Rev0
April 1, 2025	1.2	Based on TA feedback: Exact appendix referenced in section 10. Changed sections 7.1 and 7.2 titles to be grammatically correct. Season scheduler module is a SW decision module as it can be replaced with different scheduling algorithms.
April 2, 2025	1.3	Based on TA feedback: References seem to be working appropriately.
April 4, 2025	1.4	Updated names of 'structure' modules to 'record modules' to match new hierarchy diagram. Based on TA feedback: Changed use hierarchy diagram to PDF from image.

2 Reference Material

This section records information for easy reference.

2.1 Abbreviations and Acronyms

symbol	description
AC	Anticipated Change
DAG	Directed Acyclic Graph
M	Module
MG	Module Guide
OS	Operating System
R	Requirement
SC	Scientific Computing
SRS	Software Requirements Specification
Sandlot	Explanation of program name
UC	Unlikely Change

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3 Introduction

Decomposing a system into modules is a commonly accepted approach to developing software. A module is a work assignment for a programmer or programming team (**?**). We advocate a decomposition based on the principle of information hiding (**?**). This principle supports design for change, because the "secrets" that each module hides represent likely future changes. Design for change is valuable in SC, where modifications are frequent, especially during initial development as the solution space is explored.

Our design follows the rules layed out by **?**, as follows:

- System details that are likely to change independently should be the secrets of separate modules.
- Each data structure is implemented in only one module as a 'record module'.
- Any other program that requires information stored in a module's data structures must obtain it by calling access programs belonging to that module.

After completing the first stage of the design, the Software Requirements Specification (SRS), the Module Guide (MG) is developed (**?**). The MG specifies the modular structure of the system and is intended to allow both designers and maintainers to easily identify the parts of the software. The potential readers of this document are as follows:

- New project members: This document can be a guide for a new project member to easily understand the overall structure and quickly find the relevant modules they are searching for.
- Maintainers: The hierarchical structure of the module guide improves the maintainers' understanding when they need to make changes to the system. It is important for a maintainer to update the relevant sections of the document after changes have been made.
- Designers: Once the module guide has been written, it can be used to check for consistency, feasibility, and flexibility. Designers can verify the system in various ways, such as consistency among modules, feasibility of the decomposition, and flexibility of the design.

The rest of the document is organized as follows. Section 4 lists the anticipated and unlikely changes of the software requirements. Section 5 summarizes the module decomposition that was constructed according to the likely changes. Section 6 specifies the connections between the software requirements and the modules. Section 7 gives a detailed description of the modules. Section 8 includes two traceability matrices. One checks the completeness of the design against the requirements provided in the SRS. The other shows the relation between anticipated changes and the modules. Section 9 describes the use relation between modules.

4 Anticipated and Unlikely Changes

This section lists possible changes to the system. According to the likeliness of the change, the possible changes are classified into two categories. Anticipated changes are listed in Section 4.1, and unlikely changes are listed in Section 4.2.

4.1 Anticipated Changes

Anticipated changes are the source of the information that is to be hidden inside the modules. Ideally, changing one of the anticipated changes will only require changing the one module that hides the associated decision. The approach adapted here is called design for change.

AC1: The specific hardware on which the software is running.

AC2: The format of the log in process and data.

AC3: The algorithm used for the season scheduler.

AC4: The constraints on the season schedule.

AC5: The format of a team's season availability data.

AC6: How scheduling conflicts are to be resolved.

AC7: The format of the season schedule.

AC8: The format of the season standings.

AC9: The format of the create player/team account process and data.

AC10: The process of a player requesting to join a team.

AC11: The process of a commissioner making an admin command.

AC12: The process of creating an alert.

AC13: The process of rescheduling a game.

AC14: The method by which alerts are received.

4.2 Unlikely Changes

The module design should be as general as possible. However, a general system is more complex. Sometimes this complexity is not necessary. Fixing some design decisions at the system architecture stage can simplify the software design. If these decision should later need to be changed, then many parts of the design will potentially need to be modified. Hence, it is not intended that these decisions will be changed.

UC1: Input/Output devices (Input: File and/or Keyboard, Output: File, Memory, and/or Screen).

UC2: The system being a web application.

UC3: Player, team, and commissioner account records.

UC4: The goal of the system to generate a season schedule.

5 Module Hierarchy

This section provides an overview of the module design. Modules are summarized in a hierarchy decomposed by secrets in Table 1. The modules listed below, which are leaves in the hierarchy tree, are the modules that will be implemented.

M1: Hardware Hiding Module

M2: Account Module

M3: Player Module

M4: Team Module

M5: Commissioner Module

M6: Account Records Module

M7: Team Records Module

M8: Schedule Records Module

M9: Standings Records Module

M10: Season Scheduler Module

M11: Reschedule Module

M12: Alerts Module

M13: Database Module

6 Connection Between Requirements and Design

The design of the system is intended to satisfy the requirements developed in the SRS. In this stage, the system is decomposed into modules. The connection between requirements and modules is listed in Table 2.

Level 1	Level 2
Hardware-Hiding Module	
Behaviour-Hiding Module	Account Module
	Player Module
	Team Module
	Commissioner Module
	Account Records Module
	Team Records Module
	Schedule Records Module
	Standings Records Module
	Reschedule Module
	Alerts Module
	Database Module
Software Decision Module	Season Scheduler Module

Table 1: Module Hierarchy

7 Module Decomposition

Modules are decomposed according to the principle of "information hiding" proposed by **?**. The *Secrets* field in a module decomposition is a brief statement of the design decision hidden by the module. The *Services* field specifies *what* the module will do without documenting *how* to do it. For each module, a suggestion for the implementing software is given under the *Implemented By* title. If the entry is *OS*, this means that the module is provided by the operating system or by standard programming language libraries. *Sandlot* means the module will be implemented by the Sandlot software.

Only the leaf modules in the hierarchy have to be implemented. If a dash (–) is shown, this means that the module is not a leaf and will not have to be implemented.

7.1 Hardware Hiding Module (M1)

Secrets: The data structure and algorithm used to implement the virtual hardware.

Services: Serves as a virtual hardware used by the rest of the system. This module provides the interface between the hardware and the software. So, the system can use it to display outputs or to accept inputs.

Implemented By: OS

7.2 Behaviour-Hiding Modules

Secrets: The contents of the required behaviours.

Services: Includes programs that provide externally visible behaviour of the system as specified in the software requirements specification (SRS) documents. This module serves as a communication layer between the hardware-hiding module and the software decision module. The programs in this module will need to change if there are changes in the SRS.

Implemented By: –

7.2.1 Account Module (M2)

Secrets: The general functionality of all accounts.

Services: Contains functions to allow the user to create, delete, login, and edit their Sandlot account.

Implemented By: Sandlot

Type of Module: Abstract Object

7.2.2 Player Module (M3)

Secrets: The functionality of a player account.

Services: Contains functions to allow the user to join and leave a team.

Implemented By: Sandlot

Type of Module: Abstract Object

7.2.3 Team Module (M4)

Secrets: The functionality of a team account.

Services: Contains functions to allow the user to submit a game score and access to the Reschedule Module functionality.

Implemented By: Sandlot

Type of Module: Abstract Object

7.2.4 Commissioner Module (M5)

Secrets: The functionality of a commissioner account.

Services: Contains functions to allow the user to perform defined admin commands and send alerts.

Implemented By: Sandlot

Type of Module: Abstract Object

7.2.5 Account Records Module (M6)

Secrets: The format of the account data.

Services: Defines a general account data structure for all accounts, including player, team, and commissioner accounts.

Implemented By: Sandlot

Type of Module: Abstract Data Type

7.2.6 Team Records Module (M7)

Secrets: The format of the team account data.

Services: Defines a team account data records that inherits from the account records module.

Implemented By: Sandlot

Type of Module: Abstract Data Type

7.2.7 Schedule Records Module (M8)

Secrets: The format of the season schedule data.

Services: Defines a season schedule data structure.

Implemented By: Sandlot

Type of Module: Abstract Data Type

7.2.8 Standings Records Module (M9)

Secrets: The format of the season standings data.

Services: Defines a season standings data structure.

Implemented By: Sandlot

Type of Module: Abstract Data Type

7.2.9 Reschedule Module (M11)

Secrets: The function of a team account to request and accept a game reschedule.

Services: Contains functions to allow the user to request and accept a game reschedule.

Implemented By: Sandlot

Type of Module: Library

7.2.10 Alerts Module (M12)

Secrets: The function of a commissioner account to create and send alerts.

Services: Contains functions to allow the user to create and send alerts.

Implemented By: Sandlot

Type of Module: Library

7.2.11 Database Module (M13)

Secrets: The function of storing player, team, commissioner, schedule and standings data.

Services: Defines and maintains a database that stores all relevant data to the Sandlot system. This includes account data for players, teams, and commissioners such as contact information and team player lists. It also includes full game lists for the schedule and game scores. The maintenance includes regular backups and data integrity checks.

Implemented By: Sandlot

Type of Module: Library

7.3 Software Decision Module

Secrets: The design decision based on mathematical theorems, physical facts, or programming considerations. The secrets of this module are *not* described in the SRS.

Services: Includes data structure and algorithms used in the system that do not provide direct interaction with the user.

Implemented By: –

7.3.1 Season Scheduler Module (M10)

Secrets: The algorithm used to generate a season schedule.

Services: The algorithm generates a season schedule using each teams availability and a set of constraints as inputs and outputs a schedule of the form of the data structure defined in the schedule records module.

Implemented By: Sandlot

8 Traceability Matrix

This section shows two traceability matrices: between the modules and the requirements and between the modules and the anticipated changes.

Req.	Modules
FR-1	M9, M10,
FR-2	M4, M13
FR-3	M2, M6
FR-4	M2, M6
FR-5	M2, M6
FR-6	M5, M12
FR-7	M4, M5
FR-8	M3,
FR-9	M10
FR-10	M3, M11
FR-11	M3, M11
FR-12	M3, M11
FR-13	M3, M4
FR-14	M3, M4
FR-15	M3, M4
FR-16	M2
FR-17	M3, M4
FR-18	M5, M10
FR-19	M3, M5, M7
FR-20	M8, M10
FR-21	M7, M8, M10
FR-22	M5, M8, M10
FR-23	M7
FR-24	M2

Table 2: Trace Between Functional Requirements and Modules

AC	Modules
AC1	M1
AC2	M2, M6, M13
AC3	M10
AC4	M8
AC5	M3, M13
AC6	M8
AC7	M8
AC8	M9
AC9	M3, M4, M13
AC10	M3, M4
AC11	M5
AC12	M12
AC13	M3, M11
AC14	M12

Table 3: Trace Between Anticipated Changes and Modules

9 Use Hierarchy Between Modules

In this section, the uses hierarchy between modules is provided. **?** said of two programs A and B that A *uses* B if correct execution of B may be necessary for A to complete the task described in its specification. That is, A *uses* B if there exist situations in which the correct functioning of A depends upon the availability of a correct implementation of B. Figure 1 illustrates the use relation between the modules. It can be seen that the graph is a directed acyclic graph (DAG). Each level of the hierarchy offers a testable and usable subset of the system, and modules in the higher level of the hierarchy are essentially simpler because they use modules from the lower levels.

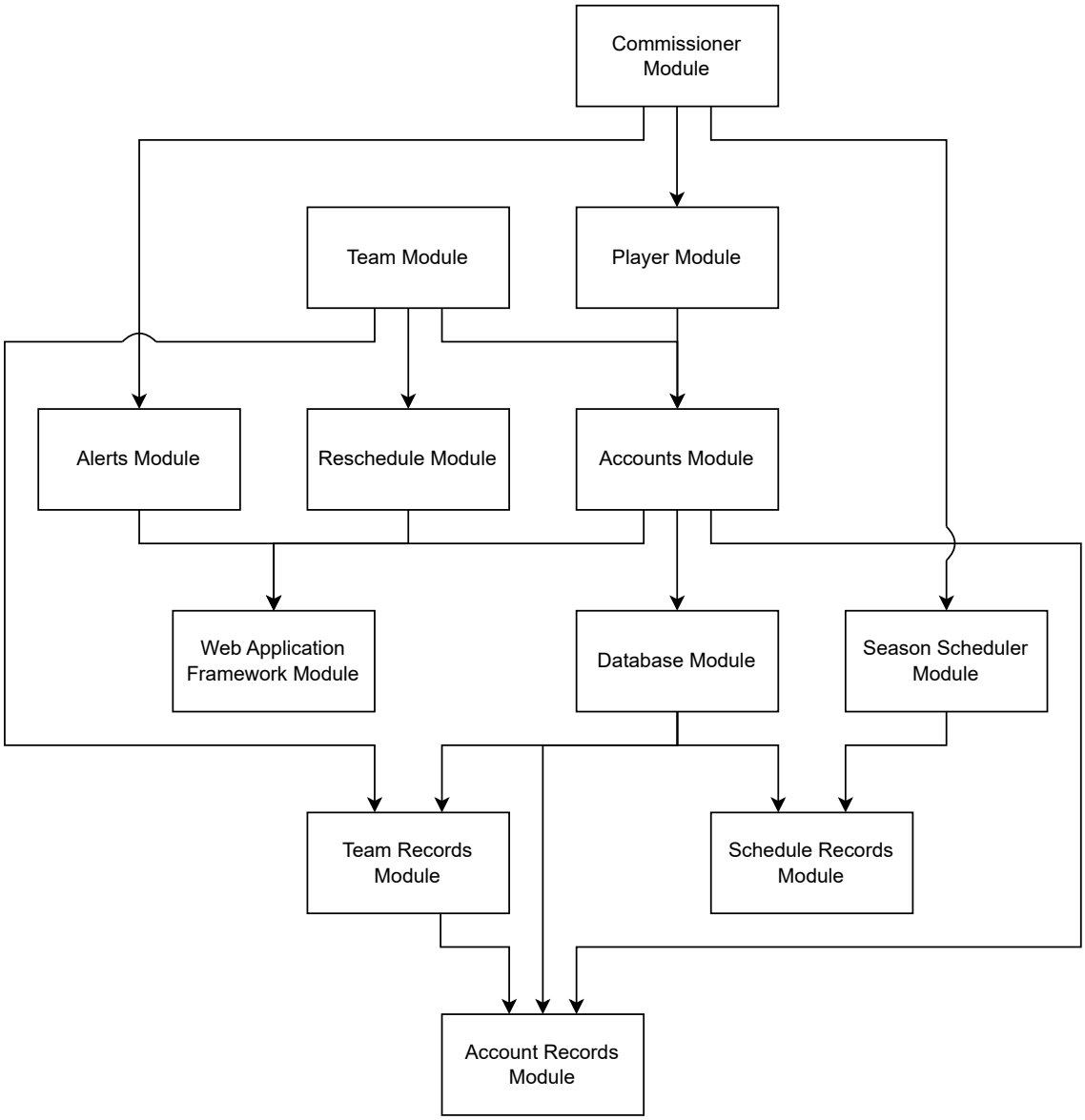

Figure 1: Use hierarchy among modules

10 User Interfaces

Preliminary design of the major user interfaces can be found in the Figma. Screens are also provided in the Appendix.

11 Design of Communication Protocols

The design of the communication protocols define how the modules will interact within the system. where the system will use both synchronous (for real-time interactions like user authentication) and asynchronous (for background operations like logging) communication methods. Key technologies will include HTTP/HTTPS for secure data transmission, REST APIs for resource access, WebSockets for real-time updates, and message queues (e.g., RabbitMQ) for asynchronous communication. Data formats used are JSON for lightweight data exchange and XML for structured configuration files. Robust communication is ensured through error handling and retry mechanisms, managing issues like network failures and invalid data. Security measures include authentication and authorization using tokens (e.g., JWT) and encryption via HTTPS. For example, a POST request may be sent by a user to create an account, where the Account Module would process and store the data, responding with a corresponding account ID.

12 Timeline

The implementation of modules for Rev 0 will follow the detailed timeline below. Daily stand-up meetings will be held to track each team member's progress and address any issues they may have run into, prior to the meeting. Each module will have unit tests to ensure successful functionality, and integration tests will be performed after integrating each module. Final testing will then validate the core functionality, making sure the performance of the system is able to accomplish each module's functions.

- **Week 1 (January 13-19)**: Initial Setup and Planning
  - Create Github issues that team members will assign themselves (All team members)
- **Week 2 (January 20-26)**: Core Module Implementation
  - Implement the account module (Casra Ghazanfari)
  - Implement the player, team, and commissioner modules (Nicholas Fabugais-Inaba)
  - Setup database module for storing different data (Casra Ghazanfari)
  - Create the schedule and standings records modules (Jung Woo Lee)
  - Update season scheduler module to generate an optimal schedule (Alex Verity)
- **Week 3 (January 27-February 2)**: Remaining Modules and Integration
  - Implement alerts module (Alex Verity)
  - Implement reschedule module (Jung Woo Lee)
  - Initial integration testing (All team members)

- **Week 4 (February 3)**: Final Integration and Testing
  - Design and implement the user interface (Nicholas Fabugais-Inaba)
  - Final integration and comprehensive testing (All team members)

13 Appendix

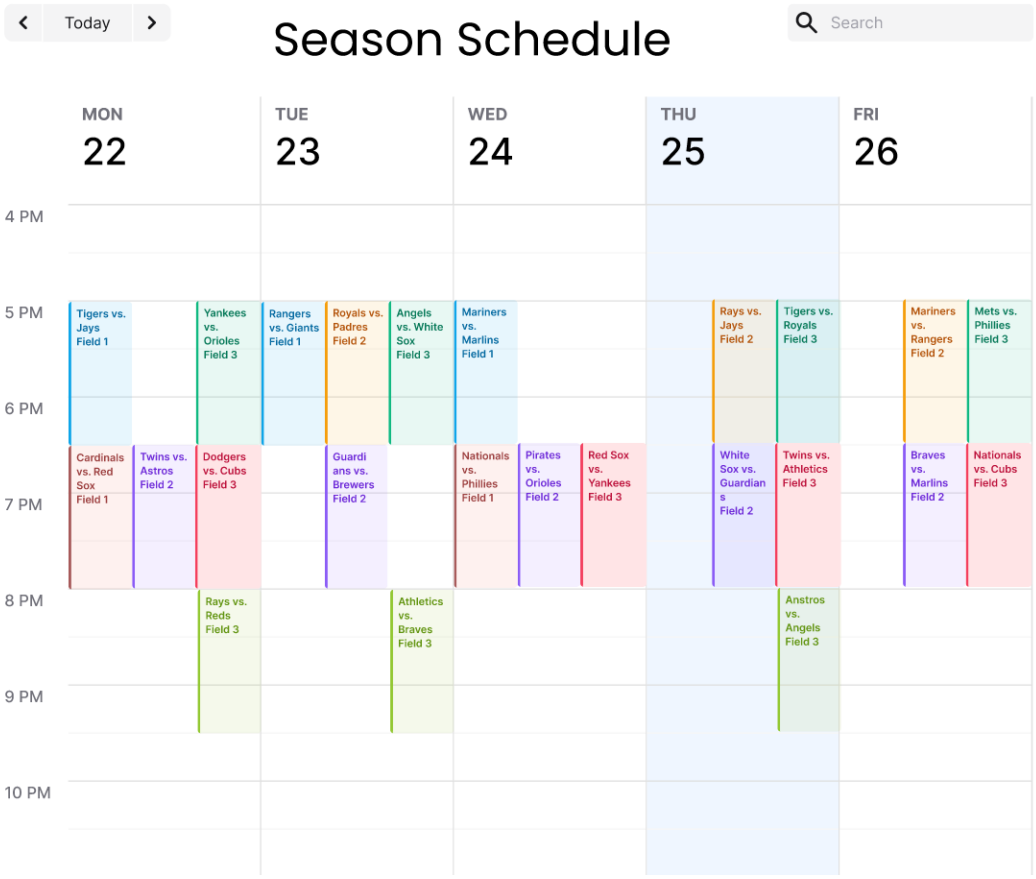

Figure 2: User interface: Season schedule page

Standings

Division A	W	L	T	F	DIFF
Yankees	11	2	2	0	+12
Orioles	9	3	3	0	+8
Jays	9	6	0	0	+9
Rays	4	10	1	0	-7
Red Sox	1	13	0	1	-21

Division B	W	L	T	F	DIFF
Guardians	10	4	0	0	+19
Royals	9	4	1	0	+13
Tigers	9	5	0	0	+2
Twins	5	9	1	0	-1
White Sox	4	10	1	0	-17

Division C	W	L	T	F	DIFF
Astros	9	6	0	0	+6
Mariners	8	7	0	0	+10

Figure 3: User interface: League standings page

Jays

Roster	GP	Hits	Runs
Alejandro Kirk - Captain	103	86	23
Tyler Heineman	6	1	2
Bo Bichette	81	70	29
Ernie Clement	62	114	48
Andrés Giménez	8	11	2
Vladimir Guerrero Jr	159	199	98
Leo Jiménez	63	41	18
Chris Bassitt	41	20	12
Jake Bloss	53	33	14
José Berríos	111	86	37
Ryan Burr	22	15	5
Brandon Eisert	67	52	28
Addison Barger	54	41	20
Steward Berroa	28	7	7
Jonatan Clase	7	4	3
Brendon Little	33	17	9
Nick Sandlin	45	23	13

Upcoming games

Tigers vs. Jays
Monday, June 22
5:00 PM - 6:30 PM
Field 1

Rays vs. Jays
Thursday, June 25
5:00 PM - 6:30 PM
Field 2

Jays vs. Cubs
Thursday, July 2
8:00 PM - 9:00 PM
Field 3

Figure 4: User interface: Team page

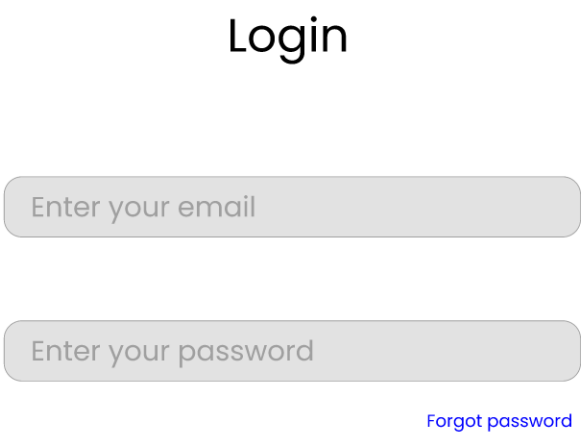

Figure 5: User interface: User log in page