**Tracking Gm Equipment Usage**

**(TGEU)**

**cs3337 Software Engineering**

**Software Requirements, Software Design and Software Test Plan Document**

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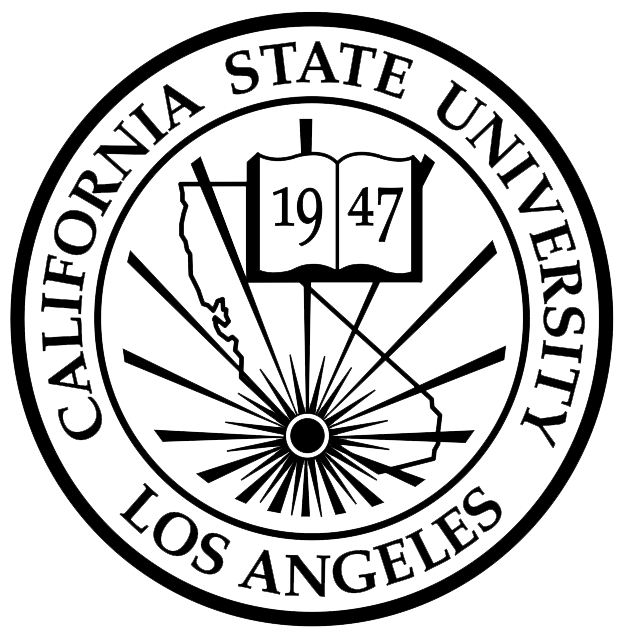
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October 24, 2016

CALIFORNIA STATE UNIVERSITY

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Los Angeles, California

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**Document Change Log**

|  |  |  |
| --- | --- | --- |
| **Update** | **Date Released** | **Changes** |
| Draft #1 | 10/8/2016 | Setting up the SRD from the template / Adding elements of implementation / Adding to acronyms and dictionary / Replacing all acronyms and project names |
| Draft #2 | 10/15/2016 | Adding module descriptions |
| Draft #3 | 10/17/2016 | Adding functional requirements |
| Draft #4 | 10/19/2016 | Adding more functional requirements, non functional requirements, and hardware requirements / Adding figures 1.1 and 2.1 / Updated the acronyms |
| Draft #5 | 10/22/2016 | Adding functional requirements validation matrix / fixing functional requirements |
| Final Draft |  | Uploaded to CSNS |

# List of TBD Items

|  |  |  |  |
| --- | --- | --- | --- |
| Page | **Item** | **Description** | **Status** |
| 5-1 | Modules 2.1-2.10 | coding for the modules | in progress |
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**Table of Contents**

**1.0 INTRODUCTION**

1.1 Purpose 1-1

1.2 Scope 1-1

1.2.1 Document Organization 1-1

1.2.2 Relationship to Other Documents 1-3

1.3 **TGEU** System Architecture 1-4

1.3.1 Context Diagram (Level 0 DFD)

1.3.2 Description of **TGEU** Major Units

1.5 Requirement Development Process 1-9

1.6 References 1-11

1.6.1 Controlling Documents 1-11

1.6.2 Applicable Documents 1-11

1.6.3 Standards

**2.0 DETAILED FUNCTIONAL DESCRIPTION OF THE *TGEU***

2.1 Detailed Functional Description 2-1

2.1.1 Higher Level DFDs

2.1.2 Detailed Functional Description of Major Sub-Units

**3.0 TGEU REQUIREMENTS**

3.1 TGEU FUNCTIONAL REQUIREMENTS 3-1

3.1.1

3.2 TGEU NON-FUNCTIONAL REQUIREMENTS 3-

3.2.1

**4.0 TGEU DETAILED DESIGN**

4.1 Introduction 4-1

4.2 TGEU External Interface Descriptions

**5.0 TGEU ELEMENTS OF IMPLEMENTATION**

5.1 Introduction 5-1

5.1.1 Assumptions and Constraints 5-

5.2 Implementation Goals

**6.0 TGEU TEST PLAN**

6.1 External Peer Reviews 6-1

**6.2.** Functional and Performance Requirements Validation Matrix

**A. ACRONYMS** A-1

**B. DATA DICTIONARY** B-1

**List of Figures**

Figure 1-1 Context Diagram (Level 0 Data Flow Diagram)

Figure 2-1 Level 1 Data Flow Diagram

**List of Tables**

None.

**1. INTRODUCTION**

**1.1 Purpose**

The purpose of this document is **four-fold**:

a) Completely define a full set of requirements for the **TGEU – Section 3.0**.

(These sections correspond to a Software Requirements Document, SRD).

b) Completely define the design for the **TGEU – Section 4.0**.

(These sections correspond to a Software Design Document, SDD).

c) Define and partially implement feasible modules for the **TGEU – Section 5.0**.

(These sections correspond to the Software Implementation Document, SID).

d) Completely define the Test Plan for the **TGEU – Section 6.0**.

(These sections correspond to a Software Test Plan, STP).

The complete definition of all **TGEU** requirements provides the source requirement inputs for the development of the subsequent supporting software subsystems documents.

**1.2 Scope**

The documentation developed as part of this cs3337 class, starts with the SRD including elements of Software Design and parts of a Test Plan.

The scope of this document includes the following:

* All functional and non-functional requirements on the **TGEU** are captured. This includes Verification & Validation (V&V) requirements, as well as inter-software subsystems requirements.
* A complete set of **TGEU** Requirements. These requirements are organized by key **TGEU** functional units shown on the Level 1 DFD. The Level 1 DFD is shown on page 10.
* A trace matrix, relating all **TGEU** functional requirements to functional subunits as expanded in lower level DFDs. Level 2 and higher DFDs are provided on pages not applicable.
* The functional requirements defined in the **TGEU** Requirements section have been expanded to include more specific hardware requirements.

**1.2.1 Document Organization**

The organization of this document provides a natural flow or allocation of requirements to each succeeding section.

Details regarding the overall document are given in sub-section 1.5 below.

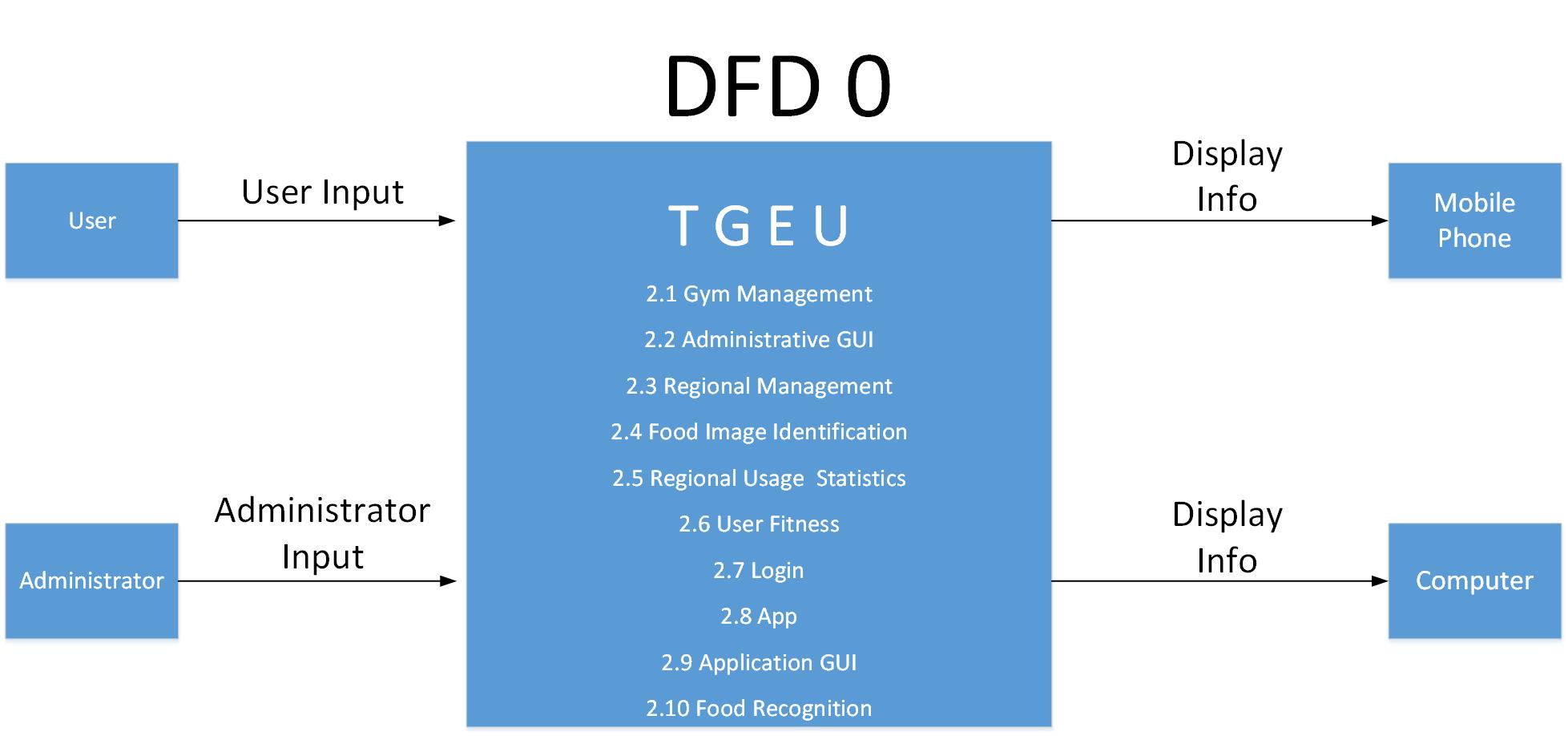
**1.2.2 Relationship to Other Documents**

The **TGEU** SRD/SDD/STP/SID is a complete self contained document. Some relationships to other documents in the literature are indicated below in sub-section 1.5.

**1.3 TGEU Architecture**

1.3.1 Detailed Context Diagram (DFD Level 0)

The **TGEU** architecture is summarized in the Context Diagram (DFD Level 0) given below. A more complete Functional Description is given in Section 2 of this document. The Context Diagram provides the overall structure of the software modules and all its inputs and outputs. The notation used corresponds to that defined for any Data Flow Diagram (DFD).



**Figure 1.1: Level 0 DFD**

**1.3.2** Description and major functions of the **TGEU**

TGEU is a multipurpose software system designed to make fitness and nutrition decisions easier for users. The Gym Management module allows a specific gym to track its equipment usage during normal business hours. The Administrative GUI allows administrators of that gym to access the data or usage statistics corresponding to their gym. The Regional Management module aggregates the data from various gyms within a region and stores it into the appropriate databases. The Food Image Identification module allows the identification of a user’s food image, and provides nutritional data corresponding to the identity of the food. The Regional Usage Statistics is responsible for the storage and retrieval of all data relating to the various gyms within a region. The User Fitness module keeps track of user fitness and nutrition activity, while the Login module allows users to access their personal data. The App module is the vehicle for users to access gym, regional, and personal data, while the Application GUI is the user interface that the user interacts with. Finally, the Food Recognition module allows users to take pictures of their food for identification and retrieval of nutritional information.

**1.4 Documentation Development Process**

The **TGEU** detailed functional description is documented in section 2.0. Basically, Section 2 is a succinct software description document. The overall detailed functional description is based on higher level DFDs (above level 1). All major functional units are described in detail in this part of the document.

In general, all requirements affecting **TGEU** are captured in Section 3.0 of this document. These requirements are a refinement and completion of requirements first collected as part of this Software Engineering project. The document is cited in Section 1.2.2. This section is the one worked in most detail to become a reasonably complete Software Requirements Document (SRD). It includes both functional and non-functional software requirements together with several detailed “rational” paragraphs whenever necessary to complete the understanding of each requirement.

Section 4 is the detailed **TGEU** Software Design Description Document (SDD). This part of the document includes all higher level DFDs as described in section 2 plus all interface units. The document is highly technical and it is based on section 2 descriptions. An important component is the addition of a SIS (software interface specification) document in sub-section 4.2.

Section 5 includes elements of a partial implementation of **TGEU**. This section includes the various constraints that effectively limit the implementation as well as the sub-units that will be coded. The implementation goals are defined and the code and pseudo code are included as an attachment to this section.

Section 6 is the last major section in this document and includes the overall Test Plan (TP) of the **TGEU**. The test plan details the various techniques used to test the requirements and it also includes a Validation Matrix where each requirement specified in section 3 is listed with its corresponding validation method. The validation methods may include Testing, Analysis and Demonstration, and possible other V&V methods. In addition, the TP specifies the mandated peer reviews needed to validate the stakeholders part of the requirements.

**1.5 References**

All references used in the creation of this document are listed below.

**1.5.1 Controlling Documents**

1) There is no document controlling this document.

**1.5.2 Applicable Documents**

1) No additional applicable document has been used in the production of this document.

**1.5.3 Standards**

No Standard has been used in the creation of this document. However, some Standards described in textbooks have been examined as a reference. In particular, the IEEE standard has been briefly discussed in class.

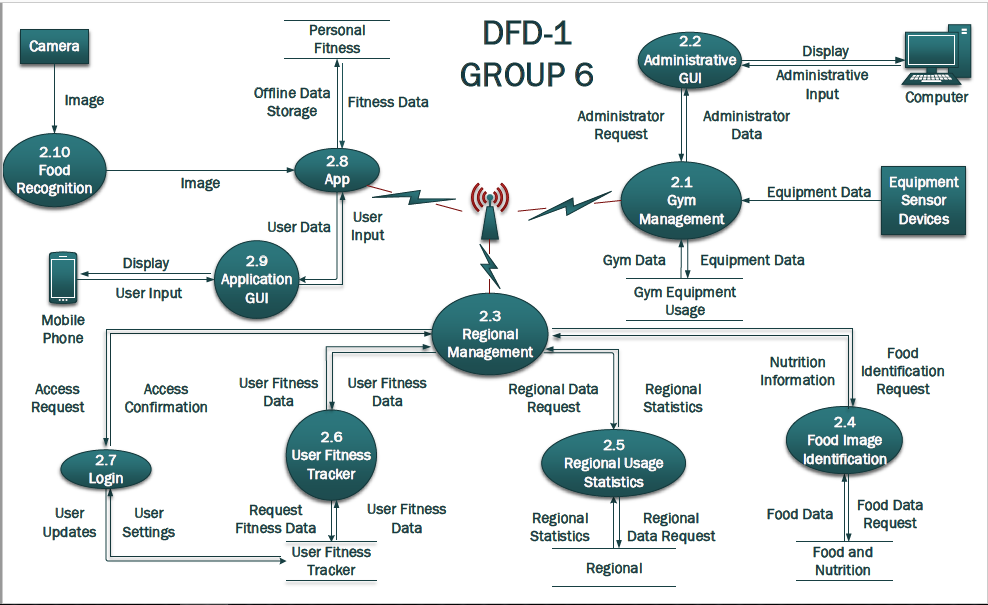
**2.0 DETAILED FUNCTIONAL DESCRIPTION OF THE *TGEU***

2.1 Detailed **TGEU** Functional Description.

The major tool used to design **TGEU** is the Data Flow Diagram, DFD. The rational behind the selection of DFDs as the preferred design tool, was their simplicity and versatility. In the future more sophisticated tools may be used particularly if a correlation from Design to Requirement to Implementation and Testing is found to be a necessary addition.

2.1.1 Higher Level Data Flow Diagrams.

The **TGEU** major functional design components are shown in the DFDs below.



**Figure 2.1: Level 1 DFD**

2.1.2 Detailed Description of **TGEU** Major Sub-Units

The **TGEU** major functional subunits shown in the DFDs in the previous sub-section, are described in detail below.

**Gym Management**

The Gym Management module receives input from the equipment sensor devices and stores the data in the Gym Equipment Usage database. It handles all the data from a specific gym, and sends it to the Regional Management module. The data are then added to their respective databases. Access to this module is restricted to the gym administrators.

**Administrative GUI**

The Administrative GUI is the user interface that the administrator uses to login to access the Gym Management module. It displays relevant information about a particular gym, and provides access to the Regional Management and constituent modules.

**Regional Management**

The Regional Management module is the main controller of the TGEU software. It handles data being sent and received between itself, the App, and Gym Management modules. It is responsible for the Login, User Fitness Tracker, Usage Statistics, and Food Image Identification modules, as well as the databases corresponding to each module.

**Food Image Identification**

The Food Image Identification module receives an image from the Food Recognition Module and identifies what type of food is displayed in the image. It then returns the identity of the food, as well as its nutritional data, to the App module.

**Usage Statistics**

The Usage Statistics module receives input from the Gym Management module for every gym within a region, and stores the data in the Regional database. It is also responsible for sending the gym equipment usage data to the App module for a user to view statistics with respect to his or her desired gym.

**User Fitness Tracker**

The User Fitness Tracker module sends and receives user data, which is stored in the User Fitness database per user. User data may include the duration of specific equipment use, number of miles completed, average heart rate, and nutritional data.

**Login**

The Login module receives the login credentials from both the Gym Management and App modules. It verifies the login and returns user data from the User Fitness Tracker database to the App module, thereby allowing access to user-specific data.

**App**

The App module accessible via a mobile device and is primarily responsible for user-specific data. It receives information from the User Fitness Tracker and Regional Usage Statistics modules. Additionally, it stores user-specific data offline in the Personal Fitness database. It also sends login and food recognition data to the Regional Management module.

**Application GUI**

The application GUI is the interface that allows a user to interact with the App module. It displays the login procedure and allows the user to login. Additionally, it is responsible for displaying all information relating to fitness data or regional statistics via graphs.

**Food Recognition**

The food recognition module receives images from the mobile phone camera, and sends the image data to the Food Image Identification module to get nutritional information.

**3.0 *TGEU* REQUIREMENTS**

3.1 TGEU Functional Requirements

This Section collects all **TGEU** Functional Requirements. The Section includes the complete set of functional requirements with explanation and rational where the statement of the requirement was deemed insufficient or needing additional background/justification. All requirements relate to the design modules described in Section 2. An effort has been made to standardize the correlation between the design modules and the requirements to make their access and organization more consistent. For example, module 2.1 requirements are labeled 3.1, sub-module 2.1.1 requirements are labeled 3.1.1 and so on. The list of requirements follows.

|  |  |
| --- | --- |
| Requirements Related to Design Module 2.1: Gym Management | |
| Requirement No. | Requirement Description |
| 3.1-1 | Gym Management shall connect to the Regional Management module wirelessly |
| 3.1-2 | Gym Management shall receive data from the Equipment Sensor Devices |
| 3.1-3 | Gym Management shall receive input from the Administrative GUI |
| 3.1-4 | Gym Management shall relay regional data from the User Fitness Tracker module to the Administrative GUI. |
| 3.1-5 | Gym Management shall relay regional data from the Regional Usage Statistics module to the Administrative GUI. |
| 3.1-6 | Gym Management shall relay regional data from the Food Image Identification module to the Administrative GUI. |
| 3.1-7 | Gym Management shall send gym data to the Regional Management module for storage in the Regional database. |
| 3.1-8 | Gym Management shall send gym data to the Regional Management module for storage in the Food and Nutrition database. |

**MODULE 2.2 Requirements Not Implemented**

|  |  |
| --- | --- |
| Requirements Related to Design Module 2.2: Administrative GUI | |
| Requirement No. | Requirement Description |
| 3.2-1 | Administrative GUI shall display all gym-specific data |
| 3.2-2 | Administrative GUI shall display all regional data |
| 3.2-3 | Administrative GUI shall receive administrative input from the computer |
| 3.2-4 | Administrative GUI shall send administrator request to the Gym Management module |
| 3.2-5 | Administrative GUI shall receive Administrator data from Gym Management module |
| 3.2-6 | The Administrative GUI shall include a tab for regional equipment usage |
| 3.2-7 | The Administrative GUI shall include a tab for regional gym statistics |
| 3.2-8 | The Administrative GUI shall include a tab for regional user fitness data |

|  |  |
| --- | --- |
| Requirements Related to Design Module 2.3: Regional Management | |
| Requirement No. | Requirement Description |
| 3.3-1 | Regional Management module shall connect to the App module wirelessly. |
| 3.3-2 | Regional Management module shall connect to the Gym Management module wirelessly. |
| 3.3-3 | Regional Management module shall send food identification requests to the Food Image Identification module. |
| 3.3-4 | Regional Management module shall receive nutrition information from the Food Image Identification module. |
| 3.3-5 | Regional Management module shall request regional data from the Regional Usage Statistics module. |
| 3.3-6 | Regional Management module shall receive regional statistics from the Regional Usage Statistics module. |
| 3.3-7 | Regional Management module shall receive user fitness data wirelessly from the App module. |
| 3.3-8 | Regional Management module shall send user fitness data wirelessly to the App and Gym Management modules. |
| 3.3-9 | Regional Management module shall request User Fitness Data from the User Fitness Tracker Module |
| 3.3-10 | Regional Management module shall receive User Fitness Data from the User Fitness Tracker Module |
| 3.3-11 | Regional Management module shall request access to user data via the Login module. |
| 3.3-12 | Regional Management module shall send access confirmation to the App module upon verification of credentials via the Login module. |

**MODULE 2.4 Requirements Not Implemented**

|  |  |
| --- | --- |
| Requirements Related to Design Module 2.4: Food Image Identification | |
| Requirement No. | Requirement Description |
| 3.4-1 | The FII shall receive image data from the Food Recognition module |
| 3.4-2 | The FII shall send a food data request to the Food and Nutrition database |
| 3.4-3 | The FII shall retrieve food data from the Food and Nutrition database |
| 3.4-4 | The FII shall send the nutrition information to the App module |
| 3.4-5 | The FII shall send the nutritional information from the Food and Nutrition database to the Gym Management module |

|  |  |
| --- | --- |
| Requirements Related to Design Module 2.5: Regional Usage Statistics | |
| Requirement No. | Requirement Description |
| 3.5-1 | The Regional Usage Statistics shall receive gym-specific data from the Gym Management module for each gym |
| 3.5-2 | The Regional Usage Statistics shall store regional data to the Regional database |
| 3.5-3 | The Regional Usage Statistics shall retrieve data from the Regional database |
| 3.5-4 | The Regional Usage Statistics shall create statistics using the data from the Regional database |
| 3.5-5 | The Regional Usage Statistics shall receive regional data requests from the App module |
| 3.5-6 | The Regional Usage Statistics shall receive regional data requests from the Gym Management Module |
| 3.5-7 | The Regional Usage Statistics shall send regional statistics to the App module |
| 3.5-8 | The Regional Usage Statistics shall send regional statistics to the Gym Management module |

|  |  |
| --- | --- |
| Requirements Related to Design Module 2.6: User Fitness Tracker | |
| Requirement No. | Requirement Description |
| 3.6-1 | The User Fitness Tracker shall receive user fitness data for each user from the Gym Management module |
| 3.6-2 | The User Fitness Tracker shall store user fitness data to the User Fitness Tracker database |
| 3.6-3 | The User Fitness Tracker shall retrieve data from the User Fitness Tracker database |
| 3.6-4 | The User Fitness Tracker shall receive user fitness data requests from the App module |
| 3.6-5 | The User Fitness Tracker shall receive user fitness data requests from the Gym Management module |
| 3.6-6 | The User Fitness Tracker shall send user fitness data to the App module |
| 3.6-7 | The User Fitness Tracker shall send user fitness data to the Gym Management module |

|  |  |
| --- | --- |
| Requirements Related to Design Module 2.7: Login | |
| Requirement No. | Requirement Description |
| 3.7-1 | Login module shall provide security access services |
| 3.7-2 | Login module shall return user settings from the User Fitness Tracker upon verification of login credentials |
| 3.7-3 | Login module shall send user updates to the User Fitness Tracker database |

|  |  |
| --- | --- |
| Requirements Related to Design Module 2.8: App | |
| Requirement No. | Requirement Description |
| 3.8-1 | The App shall send offline data to the Personal Fitness database |
| 3.8-2 | The App shall retrieve offline fitness data from the Personal Fitness database |
| 3.8-3 | The App shall receive an image from the Food Recognition module |
| 3.8-4 | The App shall receive user input from the Application GUI |
| 3.8-5 | The App shall receive nutrition data from the Food Image Identification module |
| 3.8-6 | The App shall send user data to the Application GUI |

|  |  |
| --- | --- |
| Requirements Related to Design Module 2.9: Application GUI | |
| Requirement No. | Requirement Description |
| 3.9-1 | The Application GUI shall allow the user to choose their gym location |
| 3.9-2 | The Application GUI shall include a tab for equipment usage |
| 3.9-3 | The Application GUI shall include a tab for personal user fitness data |
| 3.9-4 | The Application GUI shall include a tab for food recognition |
| 3.9-5 | The Application GUI shall include a tab for equipment statistics |
| 3.9-6 | The equipment usage tab shall display the states of all equipment in the selected gym location |
| 3.9-7 | The personal user fitness data tab shall display the user’s repetitions |
| 3.9-8 | The personal user fitness data tab shall display the user’s calories burned |
| 3.9-9 | The personal user fitness data tab shall display the user’s nutritional data |
| 3.9-10 | The food recognition tab shall allow the user to take a picture of their food |
| 3.9-11 | The food recognition tab shall display the picture of their food |
| 3.9-12 | The food recognition tab shall display the nutritional value of their food |
| 3.9-13 | The equipment statistics tab shall display a graph showing the daily percent gym capacity. |
| 3.9-14 | The equipment statistics tab shall display a chart for the usage of all equipment in the selected gym location |

|  |  |
| --- | --- |
| Requirements Related to Design Module 2.10: Food Recognition | |
| Requirement No. | Requirement Description |
| 3.10-1 | The Food Recognition module shall receive images from the mobile phone camera |
| 3.10-2 | The Food Recognition module shall send image data to the Food Image Identification module |
| 3.10-3 | The Food Recognition module shall employ algorithms to correctly identify the food in the image data |
| 3.10-4 | The Food Recognition module shall use the identity of the food to find the appropriate nutrition information |

**MODULE 2.2 Requirements Not Implemented**

|  |  |  |
| --- | --- | --- |
| Requirements Related to Design Module 2.2: Administrative GUI | |  |
| Requirement No. | Requirement Description | Reasons Not Met |
| 3.2-9 | The Administrative GUI shall have an administrator login | lower priority |
| 3.2-10 | The Administrative GUI shall have a user text field | lower priority |
| 3.2-11 | The Administrative GUI shall have a password field | lower priority |
| 3.2-12 | The Administrative GUI shall display data received from the Regional Management | lower priority |

**MODULE 2.9 Requirements Not Implemented**

|  |  |  |
| --- | --- | --- |
| Requirements Related to Design Module 2.9: Application GUI | |  |
| Requirement No. | Requirement Description | Reasons Not Met |
| 3.9-15 | The Application GUI shall have a user login | lower priority |
| 3.9-16 | The Application GUI shall have a user text field | lower priority |
| 3.9-17 | The Application GUI shall have a password field | lower priority |
| 3.9-18 | The Application GUI shall display data received from the Regional Management | lower priority |

**3.2 *TGEU* Non-Functional Requirements**

This Section collects all the TGEU Non-Functional Requirements. All non-functional requirements are numbered “NF – n” where “n” indicates the nth requirement.

NF - 1 TGEU requires gyms to have equipment sensor devices on all equipment

NF - 2 TGEU requires gyms to have a Gym Management server

NF - 3 TGEU requires the Gym Management server to be connected to all equipment sensor devices

NF - 4 TGEU requires equipment sensor devices to be functional during business hours of the gym

NF - 5 TGEU requires gym management server to be functional during business hours of the gym

NF - 6 TGEU requires the regional management server to be functional at all times

**3.3 *TGEU* Hardware Requirements**

This Section collects all the TGEU Hardware Requirements. All hardware requirements are numbered “H – n” where “n” indicates the nth requirement.

H - 1 The equipment sensor devices must run on standard microcomputer hardware

H - 2 The equipment sensor devices must track usage of gym equipment

H - 3 The equipment sensor devices must connect to the Gym Management server wirelessly

H - 4 The equipment sensor devices must send requested information to the Gym Management server wirelessly

**4.0 *TGEU* DETAILED DESIGN**

In this section the **TGEU** described in Section 2 with requirements listed in Section 3 will be designed in detail possibly including higher level DFDs. Each major module detailed design is included in correspondence with the design sections defined in Section 2 and responding to the requirements listed in its correlated sub-section in chapter 3.

Higher level DFDs were not necessary in this project.

**5.0 *TGEU* ELEMENTS OF IMPLEMENTATION**

In this section (some of) the modules designed in Section 4 with requirements listed in Section 3 will be implemented initially at least at the level of pseudo code. Where possible, actual code will be provided. Each module is implemented in correspondence with the design sections defined in chapter 2 and responding to the requirements listed in its correlated sub-section in chapter 3.

5.1 Gym Management 2.1

TBD

5.2 Administrative GUI 2.2

This module was not implemented.

5.3 Regional Management 2.3

This module was not implemented.

5.4 Food Image Identification 2.4

This module was not implemented.

5.5 Usage Statistics 2.5

TBD

5.6 User Fitness Tracker 2.6

TBD

5.7 Login 2.7

This module was not implemented.

5.8 App 2.8

TBD

5.9 Application GUI 2.9

TBD

5.10 Food Recognition 2.10

TBD

**6.1 INTRODUCTION**

In this section the testing methodology to be used to V&V each of the requirements listed in section 3.0 has been identified. At points some additional testing may be required and they shall be documented as an attachment to this document.

The methodologies and testing strategies identified at this point include four major approaches: TESTING, DEMONSTRATION, INSPECTION, and ANALYSIS with various variations to adapt to the ***TGEU*** characteristics:

* **Testing** using additional ad-hoc created software including a correlation testing unit.
* **Demonstration** of the specified capability
* **Inspection** of the software code possibly using additional inspection techniques
* **Analysis** of the specific code operation/algorithm to prove functionality.

**6.2 FUNCTIONAL REQUIREMENTS VALIDATION MATRIX**

The *TGEU* Functional and Performance Requirements Validation Matrix is given below.

|  |  |  |
| --- | --- | --- |
| V&V Related to Design Module 2.1 | | |
| Requirement No. | Requirement Description | V&V Methodology |
| 3.1-1 | Gym Management shall connect to the Regional Management module wirelessly | Demonstration |
| 3.1-2 | Gym Management shall receive data from the Equipment Sensor Devices | Demonstration |
| 3.1-3 | Gym Management shall receive input from the Administrative GUI | Demonstration |
| 3.1-4 | Gym Management shall relay regional data from the User Fitness Tracker module to the Administrative GUI. | Demonstration |
| 3.1-5 | Gym Management shall relay regional data from the Regional Usage Statistics module to the Administrative GUI. | Demonstration |
| 3.1-6 | Gym Management shall relay regional data from the Food Image Identification module to the Administrative GUI. | Demonstration |
| 3.1-7 | Gym Management shall send gym data to the Regional Management module for storage in the Regional database. | Demonstration |
| 3.1-8 | Gym Management shall send gym data to the Regional Management module for storage in the Food and Nutrition database. | Demonstration |

|  |  |  |
| --- | --- | --- |
| V&V Related to Design Module 2.2 | | |
| Requirement No. | Requirement Description | V&V Methodology |
| 3.2-1 | Administrative GUI shall display all gym-specific data | Demonstration |
| 3.2-2 | Administrative GUI shall display all regional data | Demonstration |
| 3.2-3 | Administrative GUI shall receive administrative input from the computer | Demonstration |
| 3.2-4 | Administrative GUI shall send administrator request to the Gym Management module | Demonstration |
| 3.2-5 | Administrative GUI shall receive Administrator data from Gym Management module | Demonstration |
| 3.2-6 | The Administrative GUI shall include a tab for regional equipment usage | Demonstration |
| 3.2-7 | The Administrative GUI shall include a tab for regional gym statistics | Demonstration |
| 3.2-8 | The Administrative GUI shall include a tab for regional user fitness data | Demonstration |
| 3.2-9 | The Administrative GUI shall have an administrator login | Demonstration |
| 3.2-10 | The Administrative GUI shall have a user text field | Demonstration |
| 3.2-11 | The Administrative GUI shall have a password field | Demonstration |
| 3.2-12 | The Administrative GUI shall display data received from the Regional Management | Demonstration |

|  |  |  |
| --- | --- | --- |
| V&V Related to Design Module 2.3 | | |
| Requirement No. | Requirement Description | V&V Methodology |
| 3.3-1 | Regional Management module shall connect to the App module wirelessly. | Demonstration |
| 3.3-2 | Regional Management module shall connect to the Gym Management module wirelessly. | Demonstration |
| 3.3-3 | Regional Management module shall send food identification requests to the Food Image Identification module. | Demonstration |
| 3.3-4 | Regional Management module shall receive nutrition information from the Food Image Identification module. | Demonstration |
| 3.3-5 | Regional Management module shall request regional data from the Regional Usage Statistics module. | Demonstration |
| 3.3-6 | Regional Management module shall receive regional statistics from the Regional Usage Statistics module. | Demonstration |
| 3.3-7 | Regional Management module shall receive user fitness data wirelessly from the App module. | Demonstration |
| 3.3-8 | Regional Management module shall send user fitness data wirelessly to the App and Gym Management modules. | Demonstration |
| 3.3-9 | Regional Management module shall request User Fitness Data from the User Fitness Tracker Module | Demonstration |
| 3.3-10 | Regional Management module shall receive User Fitness Data from the User Fitness Tracker Module | Demonstration |
| 3.3-11 | Regional Management module shall request access to user data via the Login module. | Demonstration |
| 3.3-12 | Regional Management module shall send access confirmation to the App module upon verification of credentials via the Login module. | Demonstration |

|  |  |  |
| --- | --- | --- |
| V&V Related to Design Module 2.4 | | |
| Requirement No. | Requirement Description | V&V Methodology |
| 3.4-1 | The FII shall receive image data from the Food Recognition module | Demonstration |
| 3.4-2 | The FII shall send a food data request to the Food and Nutrition database | Demonstration |
| 3.4-3 | The FII shall retrieve food data from the Food and Nutrition database | Demonstration |
| 3.4-4 | The FII shall send the nutrition information to the App module | Demonstration |
| 3.4-5 | The FII shall send the nutritional information from the Food and and Nutrition database to the Gym Management module | Demonstration |

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| V&V Related to Design Module 2.5 | | |
| Requirement No. | Requirement Description | V&V Methodology |
| 3.5-1 | The Regional Usage Statistics shall receive gym-specific data from the Gym Management module for each gym | Demonstration |
| 3.5-2 | The Regional Usage Statistics shall store regional data to the Regional database | Demonstration |
| 3.5-3 | The Regional Usage Statistics shall retrieve data from the Regional database | Demonstration |
| 3.5-4 | The Regional Usage Statistics shall create statistics using the data from the Regional database | Demonstration |
| 3.5-5 | The Regional Usage Statistics shall receive regional data requests from the App module | Demonstration |
| 3.5-6 | The Regional Usage Statistics shall receive regional data requests from the Gym Management Module | Demonstration |
| 3.5-7 | The Regional Usage Statistics shall send regional statistics to the App module | Demonstration |
| 3.5-8 | The Regional Usage Statistics shall send regional statistics to the Gym Management module | Demonstration |

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| V&V Related to Design Module 2.6 | | |
| Requirement No. | Requirement Description | V&V Methodology |
| 3.6-1 | The User Fitness Tracker shall receive user fitness data for each user from the Gym Management module | Demonstration |
| 3.6-2 | The User Fitness Tracker shall store user fitness data to the User Fitness Tracker database | Demonstration |
| 3.6-3 | The User Fitness Tracker shall retrieve data from the User Fitness Tracker database | Demonstration |
| 3.6-4 | The User Fitness Tracker shall receive user fitness data requests from the App module | Demonstration |
| 3.6-5 | The User Fitness Tracker shall receive user fitness data requests from the Gym Management module | Demonstration |
| 3.6-6 | The User Fitness Tracker shall send user fitness data to the App module | Demonstration |
| 3.6-7 | The User Fitness Tracker shall send user fitness data to the Gym Management module | Demonstration |

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| V&V Related to Design Module 2.7 | | |
| Requirement No. | Requirement Description | V&V Methodology |
| 3.7-1 | Login module shall provide security access services | Demonstration |
| 3.7-2 | Login module shall return user settings from the User Fitness Tracker upon verification of login credentials | Demonstration |
| 3.7-3 | Login module shall send user updates to the User Fitness Tracker database | Demonstration |

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| V&V Related to Design Module 2.8 | | |
| Requirement No. | Requirement Description | V&V Methodology |
| 3.8-1 | The App shall send offline data to the Personal Fitness database | Demonstration |
| 3.8-2 | The App shall retrieve offline fitness data from the Personal Fitness database | Demonstration |
| 3.8-3 | The App shall receive an image from the Food Recognition module | Demonstration |
| 3.8-4 | The App shall receive user input from the Application GUI | Demonstration |
| 3.8-5 | The App shall receive nutrition data from the Food Image Identification module | Demonstration |
| 3.8-6 | The App shall send user data to the Application GUI | Demonstration |

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| V&V Related to Design Module 2.9 | | |
| Requirement No. | Requirement Description | V&V Methodology |
| 3.9-1 | The Application GUI shall allow the user to choose their gym location | Demonstration |
| 3.9-2 | The Application GUI shall include a tab for equipment usage | Demonstration |
| 3.9-3 | The Application GUI shall include a tab for personal user fitness data | Demonstration |
| 3.9-4 | The Application GUI shall include a tab for food recognition | Demonstration |
| 3.9-5 | The Application GUI shall include a tab for equipment statistics | Demonstration |
| 3.9-6 | The equipment usage tab shall display the states of all equipment in the selected gym location | Demonstration |
| 3.9-7 | The personal user fitness data tab shall display the user’s repetitions | Demonstration |
| 3.9-8 | The personal user fitness data tab shall display the user’s calories burned | Demonstration |
| 3.9-9 | The personal user fitness data tab shall display the user’s nutritional data | Demonstration |
| 3.9-10 | The food recognition tab shall allow the user to take a picture of their food | Demonstration |
| 3.9-11 | The food recognition tab shall display the picture of their food | Demonstration |
| 3.9-12 | The food recognition tab shall display the nutritional value of their food | Demonstration |
| 3.9-13 | The equipment statistics tab shall display a graph showing the daily percent gym capacity. | Demonstration |
| 3.9-14 | The equipment statistics tab shall display a chart for the usage of all equipment in the selected gym location | Demonstration |
| 3.9-16 | The Application GUI shall have a user login | Demonstration |
| 3.9-17 | The Application GUI shall have a user text field | Demonstration |
| 3.9-18 | The Application GUI shall have a password field | Demonstration |
| 3.9-19 | The Application GUI shall display data received from the Regional Management | Demonstration |

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| V&V Related to Design Module 2.10 | | |
| Requirement No. | Requirement Description | V&V Methodology |
| 3.10-1 | The Food Recognition module shall receive images from the mobile phone camera | Demonstration |
| 3.10-2 | The Food Recognition module shall send image data to the Food Image Identification module | Demonstration |
| 3.10-3 | The Food Recognition module shall employ algorithms to correctly identify the food in the image data | Analysing |
| 3.10-4 | The Food Recognition module shall use the identity of the food to find the appropriate nutrition information | Analysing |

**A. ACRONYMS**

**TGEU Tracking Gym Equipment Usage**

**GUI Graphical User Interface**

**FII Food Image Identification**

**DFD Data Flow Diagram**

**SRD System Requirement Document**

**B. DATA DICTIONARY**

Fitness Data- a person’s basic information regarding fitness such as how many reps they can do, how long they can run, and their nutritional data.

Nutritional Data - the data from the foods they eat such as calories and nutritional values.