Software Requirements Specification

for

Titanium Girl Computerized flight control system

Version 1.0

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Revision History

Name	Date	Reason For Changes	Version
Olamide Luke	*04/01/2024*	*Initial Version*	*1.0*

1. Introduction

1.1 Purpose

This SRS describes the software functional and nonfunctional requirements for release 1.0 of the Titanium Girl (TG) computerized flight control system. This document is intended for use by the members of the project management team that will implement and verify the correct functioning of the system. Unless otherwise noted, all requirements specified here are high priority and committed for release 1.0.

1.2 Document Conventions

The Titanium Girl (TG) computerized flight control system will allow the user to take off, steer and land the Titanium Girl using limb movement and voice activated controls. Section 3 in this document describes the features that are scheduled for full implementation in this release.

1.3 Intended Audience and Reading Suggestions

This document is for the project management team, developers, and the QA personnel.

1.4 Product Scope

The Titanium girl (TG) computerized flight control system described in this document covers the functionalities required to fly the aircraft. The user will be able to take off, steer and land the aircraft with the limb and voice activated system.

1.5 References

Transcript of the Antoinette Interview - SWEN 645 9041 Software Requirements (2242) (umgc.edu)

Transcript of Toni's Follow-up Interview - SWEN 645 9041 Software Requirements (2242) (umgc.edu)

2. Overall Description

2.1 Product Perspective

The Titanium Girl (TG) is an equipment/suit that falls in between a one-person aircraft and a suit of armor. The embedded computerized flight control system will give the user control over the thrust, steering, and visual display of the equipment.

2.2 Product Features

The following list highlights the features required by the user.

• Power up system
• Initiate Takeoff
• Control steering
• Adjust speed
• Pan and zoom control
• Send message to ground base
• Initiate and control landing

2.3 User Classes and Characteristics

The main user of the Titanium Girl computerized system is Antoinette Stark (Toni), who possesses the necessary skills to operate the flying suit effectively.
The secondary users are technical personnel for suit maintenance and updates.

2.4 Operating Environment

OE-1: The system shall operate within a prefabricated suit of armor.
OE-2: The system shall be compatible with real time operating systems.

2.5 Design and Implementation Constraints

DC-1: The software shall be resource efficient and optimal in performance.
DC-2: The system shall be designed to adapt to future suit enhancements and updates from the user.

2.6 User Documentation

UD-1: The system shall include user manuals, training materials, and online help resources for operating the flight control system in the most appropriate and efficient manner.

2.7 Assumptions and Dependencies

AS-1: The Titanium Girl flight control system assumes the compatibility of the hardware and software components to the Titanium girl suit.
DE-1: The flight control system is dependent on the motion sensors, GPS and satellite feeds for real time navigation, takeoff, and landing.

3. System Features

3.1 Power up system

This function initiates the activation sequence, turning on all essential systems required for flight operations.

3.2 Initiate takeoff

This function allows the user to initiate takeoff by the computerized system via a jumping motion with the legs.

3.3 Control steering

This function allows the user to control the steering through finger and wrist movements, providing maneuvering after takeoff and during flight operations.

3.4 Adjust speed

This feature allows the user to control the flight speed with foot movement.

3.5 Send message to ground base

This feature enables the user to transmit information, updates, or requests to ground personnel for coordination, assistance, or environmental awareness.

3.6 Satellite pan, zoom and band control

This feature allows the user to adjust the viewing angle, zoom level and spectral bands of satellite imagery displayed on the avionics heads-up display (HUD) dashboard.

3.7 Initiate and control landing

This feature enables the user to land with a controlled descent to the ground.

4. External Interface Requirements

4.1 User Interfaces Overview

UI-1: The user shall have a clear interface with the voice recognition system, allowing the user to issue commands and interact with the flight control system using voice commands.

UI-2: The heads-up display (HUD) technology shall be simple to understand and clearly visible to the user.

4.2 Hardware Interfaces

HI-1: The onboard sensors shall transmit signals to the altimeters, satellites and GPS receivers for monitoring of flight conditions, temperature and emergencies.

HI-2: The flight control system shall interface with the motion sensors to transmit and interpret limb movement for steering control and airspeed.

HI-3: The system shall interface with the 2-way frequency synthesized radio transmitter to send and receive messages in real time.

4.3 Software Interfaces

4.3.1 Navigation Systems

SI-1.1: The flight control system shall communicate with the navigation software modules for route planning, waypoint tracking and landing assistance.

4.3.2 Voice recognition system

SI-2.1: The flight control system shall have interaction with the voice recognition module, to take voice commands from the user and interpret the information.

5. System Features/Modules

5.1 Power up system

5.1.1 Description

The Titanium Girl flight control system is activated by issuing a voice command, "Hello, Alfred." This command initiates the activation sequence, turning on all essential systems required for flight operations.

5.1.2 Stimulus/Response Sequences

Stimulus: The user issues the voice command “Hello, Alfred.”
Response: The system’s voice recognition module detects the command and activates the system, prompting a greeting and a request for destination details.

Stimulus: The user verbally indicates the destination by address or geographical coordinates.
Response: The system initiates the activation sequence for the avionics display dashboard, which displays the default altitude through the GPS altimeter, airspeed, navigation data, satellite imagery, flight orientation, the communication system, ATC public radar and the system fuel status.

5.1.3 Functional Requirements

REQ-1.1: Upon the user issuing the voice command “Hello Alfred”, the system shall detect the command using the voice recognition module, prompting a greeting and a request for destination details.

REQ-1.2: Upon the user indicating the destination by address or geographical coordinates, the system shall initiate the activation sequence for the avionics display dashboard which shall display the GPS altimeter, flight orientation, the two-way communication system, satellite imagery, navigation data and the system fuel status.

REQ-1.3: The voice recognition module shall be able to detect the voice of the primary user, which is Antoinette Stark (TS) and any approved technical personnel.

REQ-1.4: The heads-up display technology (HUD) shall be utilized for the avionics display dashboard.

REQ-1.5: The system shall be equipped with an altimeter integrated with the Global Positioning System (GPS) technology to determine the flight altitude.

REQ-1.6: Upon the user activating the avionics display, the system shall display the flight orientation using the auto horizon or 8-ball technology.

REQ-1.7: The navigation system shall be equipped with the Global Positioning System Augmented by the Wide Area Augmentation System (WAAS).

5.2 Initiate takeoff

5.2.1 Description

The user initiates takeoff by the computerized system via a jumping motion with the legs.

5.2.2 Stimulus/Response Sequences

Stimulus: A suited-up user recognized by the system executes a jumping motion with the legs, indicated by a rapid upward motion with a minimum threshold of twelve inches.

Response: The jumping motion activates the motion sensors in the system.

Stimulus: The motion sensors send a signal to the thrust propulsion system.

Response: The thrust propulsion system is activated, providing the force to lift the user and initiate the flight.

5.2.3 Functional Requirements

REQ-2.1: Upon the user executing a jumping motion with the legs, the motion sensors in the system shall be activated.

REQ-2.2: Upon the transmission of signals from the motion sensors to the thrust propulsion system, the system shall be activated to lift the user by a force of twelve inches off the ground, initiating flight.

5.3 Control steering

5.3.1 Description

The user can control the steering through finger and wrist movements, providing maneuvering after takeoff and during flight operations.

5.3.2 Stimulus/Response Sequences

Stimulus: The user applies the finger and wrist movements to indicate the intended direction or orientation.
Response: The steering commands are captured by the motion sensors.

Stimulus: The motion sensors transmit the steering commands to the control mechanism system.
Response: The control mechanism is activated and proceeds to mimic the steering gestures given by the user.

5.3.3 Functional Requirements

REQ-3.1: Upon detection of the user-initiated steering commands resembling the movements of Superman's fingers and wrists, the motion sensors shall capture the input.
REQ-3.2: Upon the motion sensors transmitting the input, the control mechanism shall be activated, based on the magnitude and direction of the pilot's input, mimicking, and adjusting the direction and orientation of Titanium girl.

5.4 Adjust speed

5.4.1 Description

This feature allows the user to control the flight speed with foot movement.

5.4.2 Stimulus/Response Sequences

Stimulus: The user performs a “toes up” motion.
Response: The system’s motion sensors detect the user’s foot movement and adjusts the speed, decelerating flight speed.
Stimulus: The user performs a “toes down” motion.
Response: The system’s motion sensors detect the user’s foot movement and accelerate flight speed.

5.4.3 Functional Requirements

REQ-4.1: Upon the user performing the “toes up” motion, the system shall detect the foot movement using the motion sensors and decelerate flight speed.

REQ-4.2: Upon the user performing the “toes down” motion, the system shall detect the foot movement using the motion sensors and accelerate flight speed.

5.5 Send message to ground base

5.5.1 Description and Priority

This feature enables the user to transmit information, updates, or requests to ground personnel for coordination, assistance, or environmental awareness.

5.5.2 Stimulus/Response Sequences

Stimulus: The user issues a voice command to “Alfred” to send a message to ground base.
Response: The system detects the voice command, and requests for the message content.

Stimulus: The user relays the message via the voice command.
Response: The system utilizes the frequency-synthesized radio transmitter to modulate and transmit the message signal to the designated ground base.

5.5.3 Functional Requirements

REQ-5.1: Upon the user issuing a voice command to “Alfred” to send a message to ground base, the system shall detect the voice command and request for the message content.
REQ-5.2: Upon the user relaying the message via voice command, the system shall utilize the 2-way frequency synthesized radio transmitter to transmit the message signal to the designated ground base.
REQ-5.3: The system shall support various message formats including voice format or message template for `quick communication.
REQ-5.4: The two-way radio communication system shall support dual communication, allowing concurrent transmission and reception.

5.6 Satellite pan, zoom and band control

5.6.1 Description and Priority

This feature allows the user to adjust the viewing angle, zoom level and spectral bands of satellite imagery displayed on the avionics heads-up display (HUD) dashboard.

5.6.2 Stimulus/Response Sequences

Stimulus: The user issues a voice command to “Alfred” to pan or adjust the viewing angle of the satellite imagery.
Response: The system detects the command and transmits the input to the satellite feed, known as “Turtles.” The satellite feed transmits the adjusted viewing angle which is displayed on the HUD.

Stimulus: The user issues a voice command to “Alfred” to adjust the zoom level.
Response: The system detects the command and transmits the input to the satellite feed, known as “Turtles.” The satellite feed transmits the adjusted zoom level which is displayed on the HUD.

Stimulus: The user issues a voice command to “Alfred” to adjust the spectral bands of the satellite imagery.

Response: The system detects the command and transmits the input to the satellite feed, known as “Turtles.” The satellite feed transmits the adjusted spectral band which is displayed on the HUD.

5.6.3 Functional Requirements

REQ-6.1: Upon the user issuing a voice command to “Alfred” to pan or adjust the viewing angle of the satellite imagery, the system shall detect the commands and transmit the input to the satellite feed. The system shall display the adjusted viewing angle on the HUD.

REQ-6.2: Upon the user issuing a voice command to “Alfred” to adjust the zoom level of the satellite imagery, the system shall detect the commands and transmit the input to the satellite feed. The satellite feed shall transmit the adjusted zoom level which shall be displayed on the HUD.

REQ-6.3: Upon the user issuing a voice command to “Alfred” to adjust the spectral band, the system shall detect the commands and transmit the input to the satellite feed. The satellite feed shall transmit the adjusted spectral band which shall be displayed on the HUD.

REQ-6.4: The HUD shall be able to support the spectral band options which include the visual, infrared and radiofrequency (RF) displays.

5.7 Initiate and control landing

5.7.1 Description and Priority

This feature enables the user to land with a controlled descent to the ground.

5.7.2 Stimulus/Response Sequences

Stimulus: The user performs a knee action, simulating landing after jumping from a height between 21 – 24 inches (third stair up).

Response: The motion sensors detect and recognize the knee position, initiating the landing sequence. The system prepares for landing.

Stimulus: The system detects critical fuel levels and provides audible requests to the user to land.

Response: The user performs the knee action and simulates landing after jumping from a height between 21-24 inches (third stair up).

5.7.3 Functional Requirements

REQ-7.1: Upon the user performing the knee action to simulate landing after jumping from a height between 21-24 inches (third stair up), the system shall recognize the action using the motion sensors and initiate the landing sequence.

REQ-7.2: Upon the system detecting critical fuel levels, the system shall audibly notify the user to initiate the landing sequence through the limb action.

REQ-7.3: The system shall be able to detect critical fuel levels and give audible warnings at two levels. “Bingo” shall signal to the user that there is only enough fuel left to return to the starting point. “Dry” shall indicate that there is only 2 minutes of fuel left.

6. Nonfunctional Requirements

6.1 Performance

NF-1.1: The system shall adapt to varying flight conditions, including changes in altitude, airspeed, and weather conditions.
NF-1.2: The system shall establish a communication channel within five hundred milliseconds of the user-issued voice command.
NF-1.3: Voice messages shall be clear and intelligible, with minimal distortion or interference.
NF-1.4: Altitude updates shall occur automatically as the flight is in operation, with a minimum refresh rate of once per second.

6.2 Security

NF-2.1: The system shall be embedded within the suit to withstand extreme weather conditions.
NF-2.2: The system shall not be activated unless the user is recognized and accepted by the voice recognition module.