* 1. **Project Summary**

**1.1.1 Purpose, Scope, and Objectives**

This document describes the software requirements for a Vehicle Training Simulator to be used for the training of ambulance and emergency rescue vehicle operators. This requirement specification outlines the initial release of this project and aims to encompass the entire system, including both its software and hardware components.

The system will consist of the software and a mechanical device that the driver will sit in. The mechanical device will contain the interface that the driver will use to control the ambulance and a viewing screen. The device will need to be able to realistically mimic the movements of an ambulance under various road conditions and in different situations. In order to do this the software will need to be able to perform large amounts of physics calculations. The system would sync up with a database that would keep track of the statistics of the driver and his performance that could be analyzed later and could show improvements over a period of time. The user interface of the machine could be basically a stripped down ambulance. Parts of the ambulance that need to be manipulated (such as the wheel, gas, brake and clutch pedals, shifter, wipers/lights etc) would now be set up as input devices ready to read the users actions and send the information to be handled by a main physics engine. These same input devices would also need to be output devices to a degree, where pedals would need to lock up and resist in certain conditions, and the wheel would pull toward centering the tires when the ambulance was accelerating. A visual display replacing the mirrors and windows in the car would be output only devices, and the same signal sent to them could also be sent to a monitor outside the simulator so a third party, such as the instructor, could monitor the simulation.

**1.1.2 Assumptions and Constraints**

The authors of this document are expected to complete the project within the Fall 2008 semester. This project will use resources in the form of time and effort that will be spent developing the project deliverables. We will be relying on 3rd party companies to design the physics calculator and all hardware components of the SRS.

**1.1.3 Project Deliverables**

The list of project deliverables is:

* The Project Summary
* References
* Definitions
* Project Organization
* Managerial Process Plans
* Technical Process Plans
* Supporting Process Plans
* Additional Plans

Refer to section 1.1.4 for the expected delivery dates of the project deliverables.

**1.1.4 Schedule and Budget Summary**

**Budget Summary:**

Our basic budget allocation is as follows, listed by module:

Vehicle Control: 72 million (74 staff, user interface hardware, development tools)

Physics Feedback: 250 million (250 staff, purchase of Physics Calculator/system hardware, Consultants, development tools)

Simulation Setup: 4.8 million (5 staff, database servers, development tools)

Simulation Record: 4.8 million (5 staff, development tools)

Audio/Visual Output: 96 million (99 staff, output hardware, development tools)

A detailed budget can be found throughout the remainder of the SPMP.

A tentative schedule is as shown below in table 1.

Figure : Schedule

|  |  |
| --- | --- |
| Item | Due date |
| Project Summary | October 8, 2008 |
| References | October 8, 2008 |
| Definitions | October 8, 2008 |
| Project Organization | October 14, 2008 |
| Managerial Process Plan | October 28, 2008 |
| Technical Process Plan | November 13, 2008 |
| Supporting Process Plan | November 24, 2008 |
| Additional Plans | November 28, 2008 |
| Project Management Plan | December 8, 2008 |

**1.2 Evolution of the SPMP**

The preliminary drafts of the SPMP will be distributed to all contributing members for agreement and subsequently submitted to the supervising authority for approval. Any and all requirement changes will be handled under configuration management as outlined in Section 7.1. Document control and revision distribution will be also within the domain of configuration management.

**2. References**

None

**3. Definitions**

None

**4. Project Organization**

**4.1 External Interfaces**

There will be regular communication through external interfaces to the client, as well as the various consultants, contractors, and suppliers. There will be staff within each module team specifically delegated as responsible for these vital relationships. There will be regular reviews with these parties to ensure management is aware of any issues.

**4.2 Internal Structure**

The internal structure will consist of several tiers of small team managers, each with reviews at regular intervals, as well as required lateral communication where applicable. Each related group of developers will work together in a small group, reporting directly to a supervisor with experience in that field.

**4.3 Roles and Responsibilities**

Vehicle Control Module: This task involves the design of software components that will accept input from the brake pedal, accelerator, gear shifter, and steering wheel and then use those values to compute speed increases, speed decreases, or heading changes, and outputting these values to the physics calculator

Physics Feedback Module: This task is the integration of the physics module into the system as well as software components to generate a feedback response based on the physics engines output and output that response to the feedback module. The team in charge of this task will need to alter the physics engine source code as necessary so that it can accept input of speed change and heading change values, as well as information concerning terrain or weather conditions in the simulation that will factor into the feedback response. The team will also need to develop software components that will take the output from the physics engine and generate a feedback response.

Simulation Setup Module: This task will require the team in charge to develop the interfaces used to select the map and environmental conditions. The team will also be required to develop the map database and the environmental conditions database.

Simulation Records Module: This task involves the creation of software for recording simulation statistics. This will require the development of a driver profile database, an interface to input new driver profiles into the database and selecting the driver profile to be used in the simulation. The team must deliver software to record statistics including average speed, any interaction with the environment that would cause significant damage, reasons for failures, and completion times from the simulation and record them into the driver profile.

Audio/Video output module: This task involves the development of software for audio and video output. The team will need to develop software to render the simulation video and output it to the drivers display and the instructors display. Also audio files will need to be procured and software developed to select the appropriate audio files to play during a simulation

**5. Managerial Process Plans**

**5.1 Project start-up plan**

**5.1.1 Estimation Plan**

Budgets, Schedules and Staffing were evaluated using first-hand project knowledge and assessment along with the COCOMOII model to develop various scenarios. The most likely cause has been chosen and submitted as a portion of this SPMP.

**5.1.2 Staffing Plan**

We will need approximately 435 staff in total, the breakdown is as follows:

A 74 person staff will be needed for the development of the vehicle control module. Members involved in this module will need to be proficient in the assembly programming language. Staff members who have previous experience designing the software for mechanical devices similar to the vehicle control module are preferred for this task.

A 250 person staff will be needed with the integration of the physics calculator. Staff involved with this task will need to be proficient in assembly language. Staff involved will need to have some knowledge of physics, and we will look into hiring some experts as consultants.

A 5 person staff will be needed for the simulation setup module. These staff members will need experience in SQL for the development of the databases as well as C++ experience for developing the interfaces

A 5 person staff will be needed Simulation records module. Staff will need experience in building databases with SQL and knowledge of C++ for the development of the interface

A 99 person staff will be needed for the audio/visual output module. Staff that has previous experience with video rendering will be necessary. In addition staff will also need experience in audio playing software.

**5.1.3 Resource acquisition plan**

Necessary development tools, CASE tools, and software engineering workstations are already in the company’s possession. At startup team leaders will be required to evaluate the resources currently at their disposal and if they feel they are lacking any necessary tools they will be required to submit in writing requests for any tools they need.

**5.1.4 Project staff training plan**

SQL training courses will be available for staff working on the simulation setup module and simulations record module. Any staff not skilled in these fields who will be participating in the development of either of these modules will be required to attend.

C++ training courses will also be available for staff working on the simulation setup module and simulations record module. Any staff that feels they are not skilled enough in C++ will be expected to attend these training courses.

Assembly training courses will be provided for staff involved in the development of the vehicle control module, physics calculator, and audio/visual output module. At startup of project we will determine how many of these courses will be needed based on how many staff feel they need them.

In addition we will also bring on board one or more physics consultants to assist with the modification of the physics engine and the feedback module.

**5.2 Work plan**

**5.2.1 Work activities**

Work activities are outlined in 5.2.2.

**5.2.2 Schedule allocation**

Nominal schedule timeline is as follows:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  | Start Date | Days Completed | Remaining Days |  |
|  | **Tasks** |  |  |  |  |  |
|  | Accelerator pedal |  | 23-Nov-08 | 0 | 35 |  |
|  | Brake pedal |  | 28-Dec-08 | 0 | 35 |  |
|  | Gear shifter |  | 1-Feb-09 | 0 | 35 |  |
|  | Steering Wheel |  | 8-Mar-09 | 0 | 35 |  |
|  | Feedback Module |  | 12-Apr-09 | 0 | 160 |  |
|  | Physics calculator |  | 19-Sep-09 | 0 | 182 |  |
|  | Map database |  | 20-Mar-10 | 0 | 42 |  |
|  | Environmental conditions database |  | 1-May-10 | 0 | 20 |  |
|  | Driver profile database |  | 21-May-10 | 0 | 15 |  |
|  | Map select menu |  | 5-Jun-10 | 0 | 14 |  |
|  | Scenario select menu |  | 19-Jun-10 | 0 | 14 |  |
|  | Dash display |  | 3-Jul-10 | 0 | 35 |  |
|  | Speakers |  | 7-Aug-10 | 0 | 21 |  |
|  | Windshield display |  | 28-Aug-10 | 0 | 21 |  |
|  | Instructor display |  | 18-Sep-10 | 0 | 21 |  |
|  |  |  |  |  |  |  |
|  |  |  | Total Weeks: |  | **91** |  |
|  |  |  |  |  |  |  |

Progress will be monitored and adjusted as needed, as outlined in Section 5.3.2 (Schedule Control Plan) of the SPMP.

**5.2.3 Resource/Budget Allocation**

We will need approximately 435 staff in total, the breakdown is as follows

Vehicle control module:

-A 74 person staff will be needed with experience in assembly programming

-Workstations

-MASM assembler for the assembly programming

-Microsoft office with Visio

Physics calculator:

-250 person staff with assembly experience

-Workstations

-MASM assembler for the assembly programming

-Microsoft office with Visio

Simulation setup module:

-5 person staff with SQL and C++ experience

-Workstations

-SQL\*Plus

-Microsoft visual studio

-Microsoft office with Visio

Simulation records module:

-5 person staff with SQL and C++ experience

-Workstations

-SQL\*Plus

-Microsoft visual studio

-Microsoft office with Visio

Audio/visual output module:

-99 person staff with assembly experience

-Workstations

-MASM assembler

-Microsoft office with Visio

**5.3 Control plan**

**5.3.1 Requirements control plan**

In order to keep requirements changes from causing serious damage to the project, we will not allow any changes to be made to requirements if the module involved in fulfilling those requirements is currently under production. Before we begin work on a module, we will meet with our client to go over the specific set of requirements we will be working on to ensure that we are in agreement about what needs to be done. If a module is not under development and the client wants to make a change it will require agreement by both sides. If a change in requirements is approved, then it will be passed off to a manager who be assigned to handle changing requirements. The manager will be responsible for making sure that any requirement changes that requires alterations of existing modules is implemented. This manager will also be responsible in estimating and reporting how the change will affect the schedule and budget.

**5.3.2 Schedule control plan**

The major milestones for the project will be the completion of:

Vehicle control module

Physics feedback module

Simulation setup module

Simulation record module

Audio/visual output module

Following the completion of each of these, the schedule will be reassessed. If we are behind schedule then we will meet with the client to seek an extension and then rework the schedule accordingly. If we are ahead of schedule then we will rework the schedule accordingly.

**5.3.3 Budget control plan**

Individual team managers will be responsible for budget control. This is will be focal point of reviews with manager staff at regular intervals. Incentives will be built into the managerial pay scale to encourage fiscal responsibility.

**5.3.4 Quality control plan**

Each module that is developed will have a set of requirements from the requirements document that it is meant to satisfy. At the end of a modules development, the module will be assessed to determine whether or not all the requirements were satisfied. If it is determined not all the requirements were satisfied then the module will need to be altered to implement the missing requirements. After it is determined that a module has fulfilled the requirements it can be passed on to testing.

**5.3.5 Reporting plan**

Team leaders will meet with the project manager on a weekly basis on a weekly basis to report their teams’ current progress. They will be required to report on whether or not they are on schedule, if they are falling within the expected budget, and any issues that arise that may affect the quality or delivery time. In addition to the meeting, the team leaders will also be required to submit a weekly written report.

**5.3.6 Metrics collection plan**

Metrics to be collected:

Function Point

Morphology

Cyclomatic Complexity

When a team’s module undergoes significant changes, the team leader will be required to calculate the required metrics and put them into a report to be submitted to the team leader.

**5.4 Risk management plan**

Risk 1: Insufficient technical knowledge

The vehicle simulator project is a complex software project, and the staff lacking the technical knowledge to develop this project is a risk. In order to lower this risk we will need to bring in staffs that have experience working on projects similar to the vehicle simulator, if we are lacking in staff that have the necessary experience we will need to look into hiring additional staff that do in order to minimize this risk

Risk 2: Late delivery of physics calculator

As we will be relying on subcontractors for the physics calculator and the simulator hardware components, we run the risk of them being late on the delivery. As such these subcontractors will be required to submit regular reports to the project manager detailing their current progress.

**5.5 Project closeout plan**

Upon closeout we will perform an evaluation of any new code we generated for reusability. Reusable code will be added to our archive of reusable code.

An evaluation of staff who worked on the project will also take place. In particular we will add what new knowledge or skills staff members have acquired during the project to their personal files so that we know who to use in future projects.

We will also perform an evaluation of any failures that might have occurred, such as events caused a schedule pushback, bugs that were not caught in testing, and requirements that were not fulfilled. We will attempt to determine the reason for these failures so that we can take measures to prevent these mistakes from repeating themselves in future projects.

**6. Technical process plans**

**6.1 Process Model**

Being that the system components are completely dependent on each other the Waterfall Method will be used.

**6.2 Methods, Tools, Techniques**

The workflow will be performed in accordance to the Waterfall Method as noted in 6.1. The construction will be done using C++, assembly languages, SQL and for the database designs. Following the construction will be the delivery of the final product.

**6.3 Infrastructure Plan**

The Vehicle Training Simulator will be deployed as simulator hardware with the training software implemented into its computer system. The software will be designed on systems described in section 5.2.3 Resource allocation. The VTS will run on a system with Microsoft Windows Vista implemented into the hardware simulator.

**6.4 Product Acceptance Plan**

The acceptance of the Vehicle Training Simulator by our client will be achieved by following the Waterfall Method. The system will be tested by the developing team and then by the client for approval.

**7. Supporting process plans**

**7.1 Configuration management plan**

Concurrent Versions System (CVS) will be used throughout for all artifacts as a version control.

**7.2 Verification and validation plan**

All testing will be done before final delivery. The system will be tested by the developing team and then by the client.

**7.3 Documentation plan**

The IEEE standards would be followed for all documentation purposes.

**7.4 Quality assurance plan**

Quality assurance will be provided by working with the client throughout the development. The testing phase will be the most crucial in terms of the quality of the system.

**7.5 Review and audit plans**

Review and Audits would be addressed as a part of the Software Quality Assurance and Verification & Validation Plan that would be developed following recommended departmental standards.

**7.6 Problem resolution plan**

Any problems found during any point of development should be reported immediately for review. Problems should be resolved by working with the client throughout the process.

**7.7 Subcontractor management plans**

Physics calculator subcontractor: We will look to purchase an already built physics calculator that meets our specifications. If we are unable to find an appropriate physics calculator then we will employ a subcontractor with experience in the development of similar products to develop one to our specifications. In order to minimize the risk of a late delivery the subcontractor will be required to provide regular reports to the project manager detailing the current progress and any developments that will delay delivery.

Simulation hardware: We will hire a subcontractor to develop the mechanical components of the simulator including the simulator itself and the feedback module. The subcontractor will be required to have previous experience in the development of similar hardware devices in order to minimize risk. The developer will be required to submit regular reports to the project manager detailing the projects current progress and any developments that will result in delivery being delayed.

**7.8 Process improvement plan**

**Appendix A: COCOMO II Estimation**

