Project Management Plan

Autonomous Referee - Autoref

Professional Doctorate in Engineering

2021 Mechatronic Systems Design team

Department of Mathematics and Computer Science

03 February 2022

Document Change History		
Date	**Release**	**Change Description**
03/03/2022	1.0	Initial version

Contents

1. Introduction

The Autonomous Referee (Autoref) is an in-house project part of the PDEng program in Mechatronic Systems Design which aims to develop an autonomous referee to assist the human referee in a robot soccer game. While human referees are currently used, TU/e believes that new technological developments will enable our team to develop a solution following the basis for the autonomous referee system according to the stakeholders' concerns and needs.

TU/e robotics department and MSD PDEng trainees have been successfully developing autonomous robots in recent years. From 2016 to 2020 Autoref was based on cameras equipped with autonomous drones to use as referees in the RoboCup Middle Size League (MSL). However, the project did not have continuity through the years and a similar project was developed every year without consideration to incorporate prior efforts. Therefore, the main task of the 2021 MSD team is to ensure continuity in the contribution to the project by building from previous work and further facilitating continuity for the future of project.

A considered number of requirements were already defined and implemented by the 2020 MSD team, however the implementation of these requirements was realized in a simulation environment and not real hardware. The 2021 MSD team has freedom to define the scope of the project and to use all available tools to deliver the project according to the stakeholders' needs.

2. Project Management Framework

The project manager, Guilherme Pagatini, has the overall responsibility for managing and executing this project according to this Project Plan. The project team will consist of MSD trainees with functions from leadership to technical design. The project manager will work with all resources to perform project planning. The entirety of the project and its tasks will be reviewed and approved by the stakeholders representing academic and technological interests.

The Project Plan uses guidelines from the Project Management Body of Knowledge (PMBOK) to define the scope and the overall structure of this document. The topics that the Project Manager considered not essential for this project will not be mentioned in the planning.

To avoid any miscommunication between the team members and stakeholders, the terminology for all documentation delivered will be related to the file "Practical Project Management Glossary".

3. Project lifecycle model

The Agile iteration approach will be used to guide the development procedure from requirement engineering until the system validation. Due to the particularity of the project, some details of the Agile model have been changed. A Scrum approach will be used during the system development, the design of the software, and its testing. This approach will make the project more flexible and efficient.

All meetings related to the Scrum approach, like daily meetings, perspective, and planning will be the responsibility of the Scrum Master of the project. The Scrum work containing the user stories and the Scrum board will be registered using the student version of the platform "Monday". The Scrum Master is responsible for organizing the Scrum platform.

4. Collect user needs and requirements

Requirements gathering starts from the definition of the project goals and objectives. The user needs will be collected via structured interviews with stakeholders previously defined and by means of brainstorming sessions with the system engineering portion of the team. Afterwards, requirements gathering sessions will be used to bring key stakeholders together to approve the requirements. Moreover, requirements previously created by the 2020 MSD team will be considered and added to the project.

The decision-making technique that will be used to collect requirements is voting. In case there is no clarity to define the requirement, the autocratic decision making will be used, and the Architect Engineer will be the responsible to decide whether the requirement will be implemented or not.

The Architect Engineer and the Project Manager are responsible for approving the requirements according to their scope (measurable and testable) and consistency. Furthermore, all requirements must be approved by stakeholders during weekly meetings or via email. All requirements will be recorded and tracked in the document entitled "Requirements Register".

5. Project Scope

The scope of the 2021 MSD Autoref project includes the planning, design, development and testing of an autonomous referee for robot soccer. This project will meet or exceed standards and requirements established in the project charter. Project completion will occur when the software and all documentation packages have been successfully executed and approved by the stakeholders. All the deliverables are listed below:

- Translation of skills and tasks into system components.
- Software of the proposed solutions.
- Midterm presentation.
- Demo by the end of project.
- A Wikipage documenting the project and providing a repository for the software developed.
- One minute long video illustrating the work.
- 5 minute long video with the actual game, the remote referee visualizations and the audience screen visualizations.
- System architecture.

The 2021 MSD team received these deliverables from the document entitled "Autoref_2122" containing the goal, input and output of the stakeholders of the project. Moreover, the deliverables from the 2020 MSD were also provided by the stakeholders with the condition that they be used to continue the development made by the previous team.

The entirety of the Autoref project will be performed internally by PDEng MSD trainees and no portion of the project will be outsourced. The MSD trainees will have full access to the Laboratory of Robotics at TU/e to perform the tasks defined in the Work Breakdown Structure (WBS). Stakeholders will be contacted to clarify user needs and technological issues during the project.

Project Termination

The procedure of terminating the Autoref project will be carried out as follow:

- Close outstanding agreements with stakeholders
- Release all documentation
- Accept (reject) all the deliverables by the stakeholders

6. Stakeholders Identification

All stakeholders are internal members of TU/e and have direct connection to the team members. The stakeholders' names and roles in the project are listed below.

Name of stakeholder	Role in the project	Contact
Erjen Lefeber	Product owner and Human referee	a.a.j.lefeber@tue.nl
René van de Molengraft	Project Sponsor and Technical Consultant	m.j.g.v.d.molengraft@tue.nl
Riske Meijer	People manager	r.meijer1@tue.nl
Harold Weffers	Program Manager coordinator	h.t.g.weffers@tue.nl
RoboCup Middle Size League manager	Rules creation	N.A
Tech United team	Technical consultant	N.A
Next MSD generation		N.A
Han Schaminee	Technical consultant	Han.schaminee@gmail.com
Robert Deckers	Technical consultant	Robert.deckers@atomfreeit.com
Design team	Team members	N.A

Table 1 - Stakeholders Identification

7. System Architecture

The ISO/ IEC/ IEEE 42010 is considered as a reference standard to draft the Architecture Description (below fig: Level 0) of the system (Autonomous Referee). The Architecture Description is a document containing information about the System Environment, Stakeholders, their concerns and the architecture model addressing their viewpoints.

The architecture description will be broken down (top-down) into several smaller blocks and the smaller blocks will be individually realized and then integrated as chapters in the document entitled "Architecture Description".

System Environment:

The System Environment contains all the information about the system and the components that interact with the system. The system environment also contains all the information about the existing system and its capabilities. The main entities considered for environment are:

- Existing System
- Human referee
- Tech United group
- Turtle Soccer Robots

Stakeholders:

There are multiple stakeholders who are interested in the system that is to be designed. Therefore, the stakeholders' identification will be important to design and realize the system.

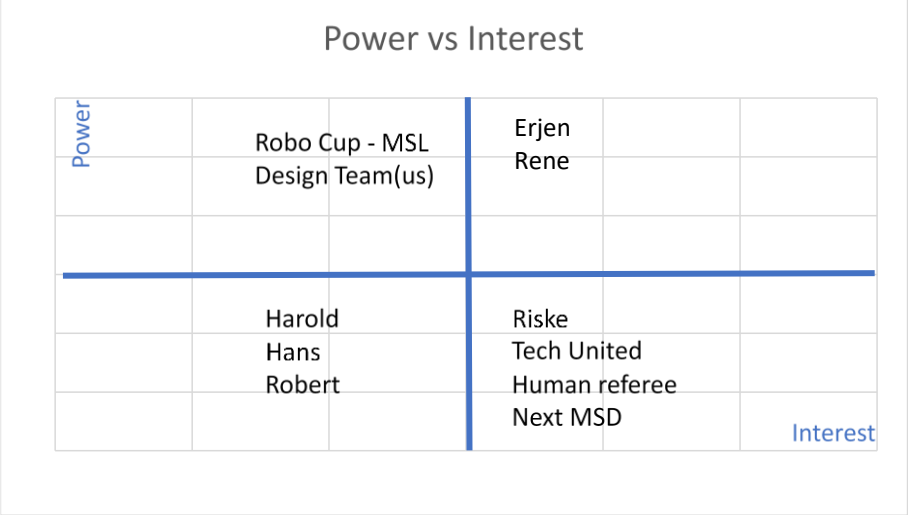

Figure 1 - Stakeholder analysis with respect to the power vs. interest theory.

The high-power high-interest stakeholders are considered to be the most important, and their concerns are addressed below.

Concerns:

The stakeholders express one or more concerns that needs to be addressed in the system design. The key stakeholders and their concerns are described below to facilitate realization of these concerns in the design.

1. Erjen
    1. To have a 5 mins match with 2 vs 2 turtle robots.
    2. AutoRef to get positive feedback from the human referee.
    3. To log and show the evidence for violation of rules.
    4. To build on previous work.
    5. Structured Software delivery at the end of the project.
    6. Structured documentation delivery at the end of the project.
    7. Individual learning goals of the trainees.
2. Rene
    1. To have a structured approach to the problem.
    2. To work on right technical abstraction level to achieve autonomy.
    3. To have a 5 mins match with 2 vs 2 turtle robots.
    4. AutoRef to get positive feedback from the human referee.
    5. To log and show the evidence for violation of rules.
3. Human Referee
    1. AutoRef can eventually lead to loss of his/ her job.
    2. To be assisted in rules that are difficult to interpret.
    3. To log and show the evidence for violation of rules.
    4. To have communication with the AutoRef.

View:

The concerns can have one or multiple views, therefore the design must capture all the views and concerns in order to satisfy the stakeholders.

Architecture:

The Architecture or Model describes the view. In other words, how the design solves the concerns including all the views from the functional and the technical perspectives.

State-Flow charts, UML diagrams, Dependency Structure Matrix (DSM), State Diagrams will be used to model and analyze the architecture models.

8. Milestone List

The below chart lists the major milestones for the Autoref project. This list comprises just the main project milestones such as completion of project phase or gate review. Smaller milestones are not included in this list and will be included in the Work Breakdown Structure (WBS). Any approved changes in this list will be communicated to the project team by the project manager.

Milestone	Description	Date
Complete requirements	All requirements for Autoref on which to base the design must be determined	03/03
Complete Autoref design	This is the conceptual design for the software and its functionality	10/03
Software development and integration	All coding completed and integrated resulting in software prototype	18/03
Deliverables documents	Completed software and documentation	24/03

Table 2 - Milestones for AutoRef project

9. Work Breakdown Structure

To accomplish the final goal of the project, more detailed tasks were defined in the form of a Work Breakdown Structure.

The WBS for the Autoref Project is comprised of work packages which do not exceed 120 hours of work for each team member. Work packages were developed through close collaboration among project team members with input stakeholders. The WBS is susceptible to changes at any stage of the project, unless such change is not approved by stakeholders.

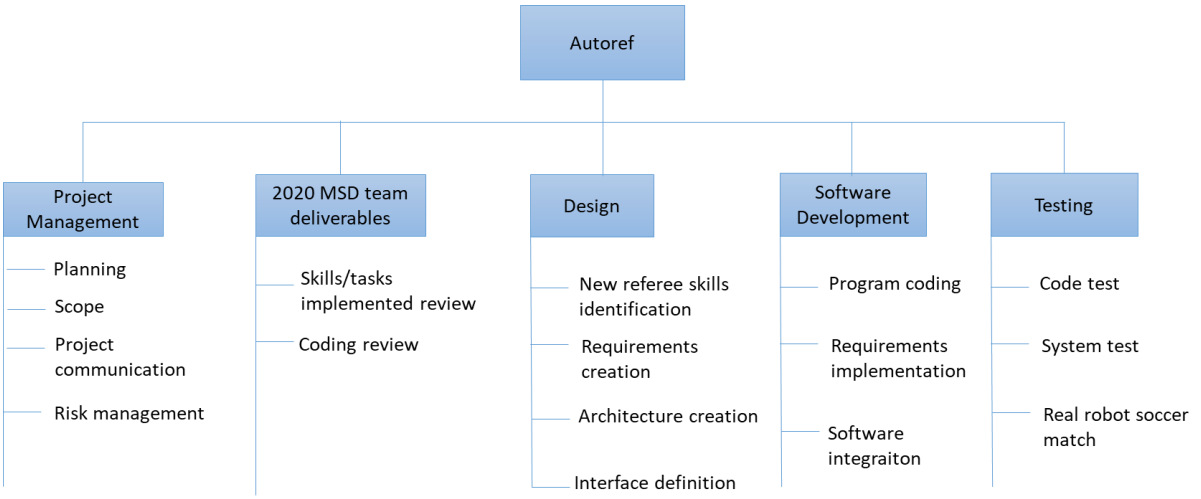

Figure 2 - WBS for the AutoRef project

10. Project Schedule

A project schedule for the AutoRef Project will be created using MS Excel starting with the main deliverables identified in the project's Work Breakdown Structure (WBS). Activity definitions will identify the specific work packages which must be performed to complete each deliverable. The project starts on the 10th of February and finishes on the 25th of March. The main activities for the development of the project are as follows:

Project activities schedule	Week					
	1	2	3	4	5	6
	10/02-17/02	17/02-24/02	24/02-03/03	03/03-10/03	10/03-17/03	17/03-24/03
Project Management Plan creation						
2020 MSD project documents review						
Hardware and software options evaluation						
Project scope definition						
New requirements creation						
System architecture definition						
Software creation						
Software integration						
Systems test						
Real robot soccer match simulation						
Documentations and main delivarables fnished						

Table 3 - Project Schedule

11. Change Management Plan

The changes will be divided in two main categories: minor and major changes. For changes classified as minor, the implementation can be done by any team member after the approval of the Project Manager. The following steps comprise the change control that will be utilized in case of major changes:

Step #1: Identify the need for a change (Any Stakeholder or team member)

Requestor will submit a change request via e-mail to the project manager

Step #2: Log change in the change request register (Project Manager)

The project manager will maintain a log of all change requests for the duration of the project

Step #3: Conduct an evaluation of the change (Project Manager, Architect Engineer and Scrum Master)

The project manager will conduct an evaluation of the impact of the change to risk, schedule, and scope

Step #4: Implement change (Project Manager)

If a change is approved, the project manager will communicate this to the team and stakeholders. The implementation team will be responsible for implementing the change.

Any team member or stakeholder may submit a change request for the Autoref Project. The Autoref Product Owner will have to agree via e-mail to the major changes in the project. All change requests will be logged in the change control register by the Project Manager and tracked through to completion whether approved or not.

12. Communication Management Plan

The Project Manager will take the lead role in ensuring effective communications on this project. The communications requirements are documented in the Communications Matrix below. The Communications Matrix will be used as the guide for what information to communicate, who is to do the communicating, when to communicate it, and to whom to communicate.

Communication Type	Description	Frequency	Format	Participants/ Distribution	Deliverable	Owner
Weekly Status Report and Technical Design Review	Weekly meeting with stakeholders to present the status of the project and technical consultation	Weekly	In person	PM, Scrum Master, Architect Engineer and Stakeholders	Minute meeting	Project Manager
Daily Project Team Meeting	Meeting to review action register and status	Daily	In Person	Team	N.A	Scrum Master
Weekly Project Team Meeting	Sprint planning	Weekly	In person	Team	Tasks allocation	Scrum Master
Weekly Project Team Meeting	Sprint retrospective	Weekly	In person	Team	N.A	Scrum Master

Table 4 - Project meetings

Weekly Status Report and Technical Design Review:

The Project Manager will distribute a meeting agenda at least 1 day prior to any scheduled meeting and all participants are expected to review the agenda prior to the meeting. During all project meetings the timekeeper will ensure that the group adheres to the times stated in the agenda and the recorder will take all notes for distribution to the team upon completion of the meeting.

The project manager will nominate a responsible party to create the meeting minutes at the end of every meeting with stakeholders. This document will contain the main points discussed and

the output. The team member responsible for the meeting minutes will be also responsible for sending the document via email to all team members and concerned stakeholders.

While informal communication is a part of every project and is necessary for successful project completion, any issues, concerns, or updates that arise from informal discussion between team members must be communicated to the Project Manager so the appropriate action may be taken.

All documents relevant to the success of the project will be stored in a repository of Github created by the team members. Other general documents containing general information for the team will be shared via MS Teams.

13. Risk Management Plan

The approach for managing risks for the Autoref Project includes a methodical process by which the project team identifies, scores, and ranks the various risks. Every effort will be made to proactively identify risks ahead of time in order to implement a mitigation strategy from the project's onset. The most likely and highest impact risks will be added to the project schedule to ensure that the team takes the necessary steps to implement the mitigation response at the appropriate time during the schedule.

The risks will be recorded in the document "Risk Register".

14. Resources

The team resources will be divided into two main work forces, System Engineering and Implementation, according to each member's learning goals and will be recorded in the document "Learning Goals". All team members and stakeholders containing the email and role in the project are recorded in the document entitled "resources-register".