SDP Process Report

Group 19

February 17, 2017

Contents

1 Introduction

The aim of this report is to discuss the organisation process of Group 19, otherwise known as Victorious Secret, mentored by Stephen Graham. The report will mainly cover our team management and communication choices and discuss the alternatives we considered. We present a clear picture of the milestones we identified and how we're planing to achieve them while working towards our final goal: winning the final tournament. Moreover, we will outline the tasks and problems we acknowledge and how we plan to act on them.

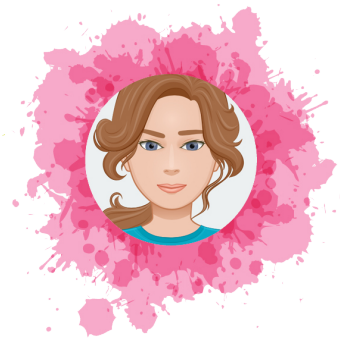
Throughout this semester, we will build an autonomous football playing robot. Our team's robot is based on the design built by Team Fred in 2016. Following their documentation and examples, we are trying to improve the design and software, hoping to achieve even better results. While the original Fred was the defense robot in their team, we are trying to build an attacker robot.

2 Team Organisation

Working in groups or teams can be extremely challenging as many people are at their best when they can work on their own. A group made up of people from different backgrounds, views and strengths will always need some time to calibrate its inner dynamics and workings. For this reason, establishing roles, an open environment for communication and clear goals are key for achieving high team performance.

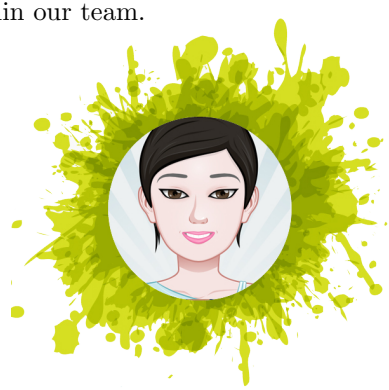
2.1 Roles

As a team coming from different backgrounds, we understand how important it is to correctly work together. Consequently, each member of our team plays a number of different roles. Some of them were established from the beginning while the rest have developed during our tasks allocation. Thus, each member could see where their particular role fits with the objectives of the SDP group as a whole.



Andreea - Lead Angel

Having had previous experience managing large projects, Andreea will be our team leader. She is persistent, hardworking and inspiring, promoting a sense of unity within our team.



Cynthia - Meticulous Angel

As the "mother" of our robot, she cares about its physical integrity, making sure it is in top form for each game. She is always pushing us to find even better solutions for our problems.

Perry - Minutes Angel

Perry keeps our work well documented, making it easier to track our progress on a daily bases. He is also the main responsible person for our firmware.

Lorena - Serious Angel

Lorena is very creative and talented, as it is obvious from all the avatars and graphs in the report. She is always striving for better results, identifying future points of action.

Dabal - Circuits Angel

Dabal is an Electrical Engineering major and his experience is very useful to our team. He helped everyone get comfortable with hardware and pushed himself and the team until we reached the desired design.

Amrit - Determined Angel

When Amrit has an idea, he plans carefully and is determined to prove that it works. Scoring one goal is not enough, he wants our robot to consistently be above everyone else's.

Tomas - Goofy Angel

Tomas is patient, attentive to details and willing to spend time on understanding complex concepts. He always has a fun penguin fact ready to throw at you.

Sumit - Angel Angel

Sumit always brings a relaxing and harmonic atmosphere to the team. He inspired our identity **Victorious secret**, and introduced the team to the traditional Nepalese cuisine.

The roles above give us a clear idea of what everyone does and how we fit into the team at a functional level, but all of us will actively work as developers. For the first two weeks, we mainly used pair programming, thus developing collective ownership of the project. This also highly relates to the risk assessment process discussed later in Chapter 4. It is extremely important that all of us have a good understanding of the code base in case of unforeseen circumstances.

2.2 Communication and Progress Tracking

A key factor of working successfully as a team is communicating effectively. This can help build relationships between ourselves, creating warm and productive environment. We have considered a lot of different means of communication for our SDP team such as Slack, Facebook Messenger, Whatsapp or email. During the first two weeks, we tried to figure out which method would be most suitable for our team.

2.2.1 Team Interactions

Facebook Messenger turned out to be the most appropriate communication channel for all of our team members. Features like sharing media, stickers and even photos, videos or documents help us easily communicate our progress. Since each of us is using Facebook on a daily basis, checking the messages did not involve adding an extra task to our routines. This way, everyone is easily reachable online.

2.2.2 Task Management

Working in a large team, we had to make sure we were keeping track of the tasks that needed solving and how we were going to split them between us. We agreed that we needed an easy-to-use and efficient software application that would include tools for work allocation and communication such as Asana. Asana's great list management feature allows us to split bigger tasks into small problems that can be solved quickly. By assigning each of them to a specific person, we can easily keep track of who is doing what. After setting up a task, it gets automatically added to the team's calendar, which helps us meet our deadlines.

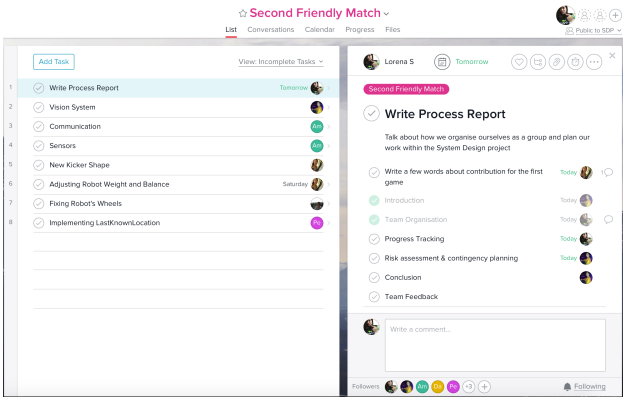


Figure 1: Asana SDP Workspace

2.2.3 Meetings

We are aiming to meet twice a week for the duration of the project. One of the meetings should be a longer, more comprehensive meeting where we identify the tasks that need to be completed during the week and assign them to the right team member. Halfway through the week, we plan to meet up for a quick catch up, just to see if we're making progress or if anyone needs help.

After the second friendly match, we will have weekly meetings with Group 20. We aim to work together on our strategy software and possibly share our vision system. A first meeting with them resulted in deciding on the role each robot will play: Group 19 will be the attacker and Group 20 will be the defender.

2.2.4 Github

We are using Github as our version control system. We will open an Issue for each problem we need solved, outlining the description of the problem and a scenario where the problem has been solved. Each member has been added to the repository and will create a new branch for each new feature they want to implement. After testing and peer review from the other team members, feature branches will be merged to our master branch. Hence, we will always have a working version in place. Should any merge conflicts occur, we agreed that these will be solved by the team members who wrote the conflicting files.

3 Milestones

Our project goal is to win the final tournament. Hence, we set ourselves some milestones that we want to achieve in the meantime. This will help break down the work into smaller, more manageable tasks. In this way, we can easily see our progress and understand where we need to improve. Figure 2 is a representation of the most important steps we need to take to achieve our goals.

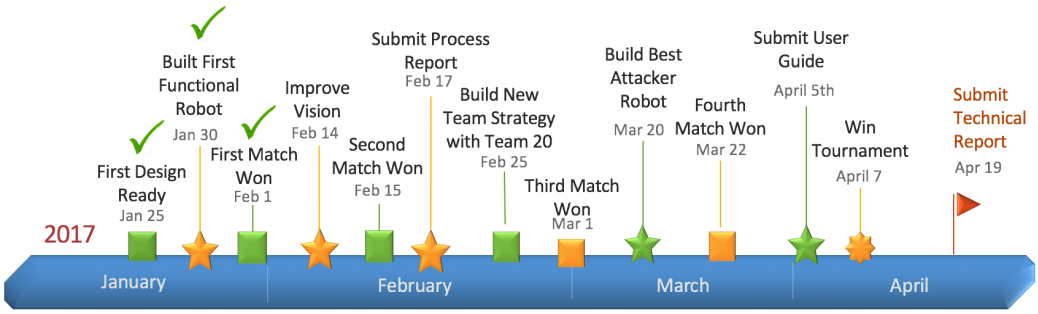


Figure 2: Milestones

3.1 Before first match

The start of the project was challenging. Working with a team of new people and building on an existing, unfamiliar code base is never easy, but we believe we managed well. During the first team meeting, we identified what everyone would be most comfortable working on. Since there was a lot of work to be done, it was more effective to have people focus on one thing at a time for the time being, rather than looking into multiple areas. Figure 3 shows a clear picture of how we split our work into small tasks and how we worked to tight deadlines to achieve our goals.

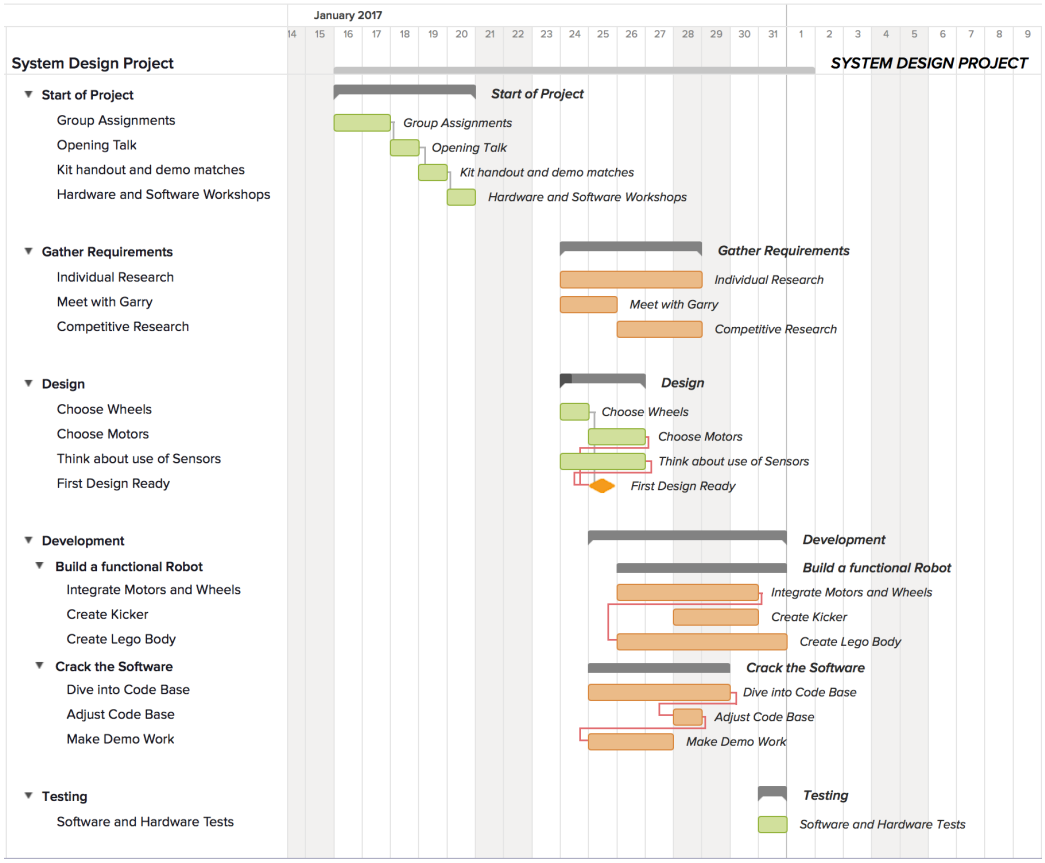


Figure 3: Gantt Chart - Version 1

At the very start, none of us was very sure what the project will involve, so we decided to split tasks between Hardware, Firmware, and Software, allowing each team to split smaller tasks amongst themselves.

3.1.1 Hardware

Cynthia and Dabal worked on assembling the robot and designing the kicker. After attending the Hardware workshop and discussing different options with Garry, they decided on which components were best to use for our design. When testing our robot, we noticed that, at higher speeds, the wheels would often fall off. To prevent this, Cynthia built a frame around the wheels to keep them in place.

3.1.2 Firmware

Andreea and Perry had a look at the micro-controller software. Working closely with both the hardware and software groups, they were responsible for making sure that every component was connected to the right pin and that the software was indeed getting the expected responses.

3.1.3 Software

The rest of our team spent the two weeks prior to the first game familiarizing themselves with the extensive code base and creating documentation for everyone else to refer to. We had a look at both the Python and the Java code base, trying to identify which one would work better for our purposes.

3.2 Problems identified and proposed solutions

Following the first friendly match, we had a short feedback meeting on the day and a longer team meeting on the following day. This helped us reflect on our performance and identify the problems that we needed to take immediate action on for the next match. Regarding our group organisation approach, we realised we did not have enough catchups with the whole team. To correct this, we decided to have shorter meetings more often, to go over what tasks have been completed and what is yet to be done. In respect to our overall game performance, we were pleased with it, having won one out of four matches. However, we identified some problems that we plan to fix for the next game, hoping for even more wins.

3.2.1 Communication Issues

During one friendly game and sometimes during practice, our RF stick couldn't receive a signal back from the Arduino. Tomas was assigned the task of reading more on this subject and looking into whether something can be done on our side.

3.2.2 Vision Issues

During 3 of the 4 matches, our vision system could not identify our robot in the corners of the pitch. During the meeting, we came up with some possible solutions and asked people to look into them. Andreea, Dabal and Lorena are looking into a way to add heuristics to the current system. We are thinking of implementing an edge detection method and using a probabilistic system to try and identify our robot on the pitch, as well as differentiate between the robot and the ball. Perry is looking into implementing a way to find the last known location of the robot and using that to bring it back to a point of visibility.

3.2.3 Implementing Sensors

Amrit suggested the use of sensors to prevent the robot from hitting the walls or other robots. This might also help with getting the location of the robot when the vision system fails. He is considering different approaches of mounting sensors on the robot, taking into account our design.

3.2.4 Unbalanced Weight and Stuck Wheels

As the pitch is uneven, our robot does get stuck in the carpet. We suspect this is either because of the weight or because the motors are not powerful enough. Cynthia's responsibility is to come up with a new, lighter design for the robot. At the same time, Sumit is trying to find a software solution to identify when the robot is stuck and send commands that will get it moving again. One such example would be moving all 4 wheels until the robot is no longer on the uneven bit of the floor.

3.2.5 Kicker Accuracy

While our robot can successfully identify the ball and kick it, it unfortunately doesn't kick straight. Hence, it needs a few attempts at kicking the ball, chasing it on the pitch between each kick, until the angle is right for getting it into the goal. Cynthia and Dabal will be responsible for finding a way to make the robot position itself behind the ball before kicking.

3.2.6 Report Writing

As the deadline to submit the Process Report was approaching, we had to consider a way to let everyone contribute. We decided to use Overleaf, a collaborative latex-based editor and every team member was asked to write a few words about their contribution and plans for the next milestone. Andreea and Lorena will put all the information together, while Cynthia will be responsible for proof-reading the draft.

4 Risk Assessment

We considered potential risk factors and how we can minimise their impact, should things go wrong. This will help ensure the success of our project.

4.1 Human Resources Risk

4.1.1 Bus Factor

While breaking tasks down and giving people ownership of their own part of the project is important to encourage everyone to do their best, we also need to keep track of what is happening with the project as a whole. Should anything happen to our team members, we need to make sure there is somebody who can pick up. Hence, we decided to assign tasks to groups of people rather than individuals, often shifting our responsibilities as we achieve our milestones. In this way, everyone gets a chance to experiment with different aspects of the project and we eliminate the risk of stagnation due to unforeseen personal circumstances.

4.1.2 Providing proper documentation

Following the example set by Team Fred last year, we are thoroughly documenting our work. All the information resulting from our individual research is shared with everyone in the team through our communication channels. In addition, we are filming short explanatory videos of the most critical parts: getting the software up and running on a new machine, calibrating the system and controlling the robot. This will help on match days, as it is possible that our designated Operator might not be able to make it.

4.1.3 Version Control

While working on the project and making changes to the code, it will often happen that our changes will not have the desired effect. To ensure that this will not backfire on the success of the whole project, we are using Git as our version control system. New features will be implemented in a separate branch. Pull requests will be approved after a peer review and thorough testing, meaning that the master branch of our project will always be the working version of the code.

4.2 Budget Planning

One of the most important lessons of SDP is that hardware does break, either on its own or due to being mishandled. We are making sure that our robot is in fully working order for the final tournament by accounting for any emergency purchases we might need to make. After the first match, we concluded that motors are the most uncertain elements of our design, so we set aside an emergency budget of £20. This is enough to purchase 2 new motors, which is reasonable for the duration of our project.

4.3 Health and Safety

To reduce health and safety risks, we ensure that whenever we are performing risky tasks, like soldering or working with electrical components, there are at least two team members present and that Garry is aware of it happening.

4.4 Hardware Risks

4.4.1 RF Stick not working

Before the first match, we often had problems getting a response from the Arduino on the RF channel. We assigned the task of looking into this to Tomas and Amrit and hope we will find a way to prevent this.

4.4.2 Weight distribution not balanced

Because of the shape of our kicker, it is quite hard to distribute the weight of the other components inside the robot's case. This can impede the robot's movement and prevent it from going straight. The Handler will be responsible for the correct placement of the battery during games.

4.5 Software Risks

4.5.1 Calibration failure

Due to different lighting levels, it may often happen that the calibration settings we have used for testing and training purposes are slightly off. This will stop our vision system from correctly identifying our robot on the pitch. To minimise the negative impact of this, our Operator will recalibrate the vision system before the game, if needed.

4.5.2 Vision failure

We noticed that, due to light reflection, our vision system may sometimes lose track of the robot during the game. In order to reduce the risk of this happening, we are looking into improving our vision system by adding some heuristics to help bring the robot back into the field of view when we lose track of it.

5 Conclusion

In conclusion, we understand the importance of working together to reach our goals. We have set up effective communication channels and arranged regular check-ins to make sure the project is heading in the right direction. We are always willing to take a step back and analyze the bigger problem, breaking it down into smaller problems that can be solved more practically. Having a clear idea of what success looks like is key to achieving it.

We believe we have carefully considered all aspects of the project. We understand the risks involved and planned accordingly. As the project requires a great amount of work, we are confident that our commitment, combined with good analytic spirit and a problem solver attitude will be very helpful along the way.