

Group 4 Project Diary

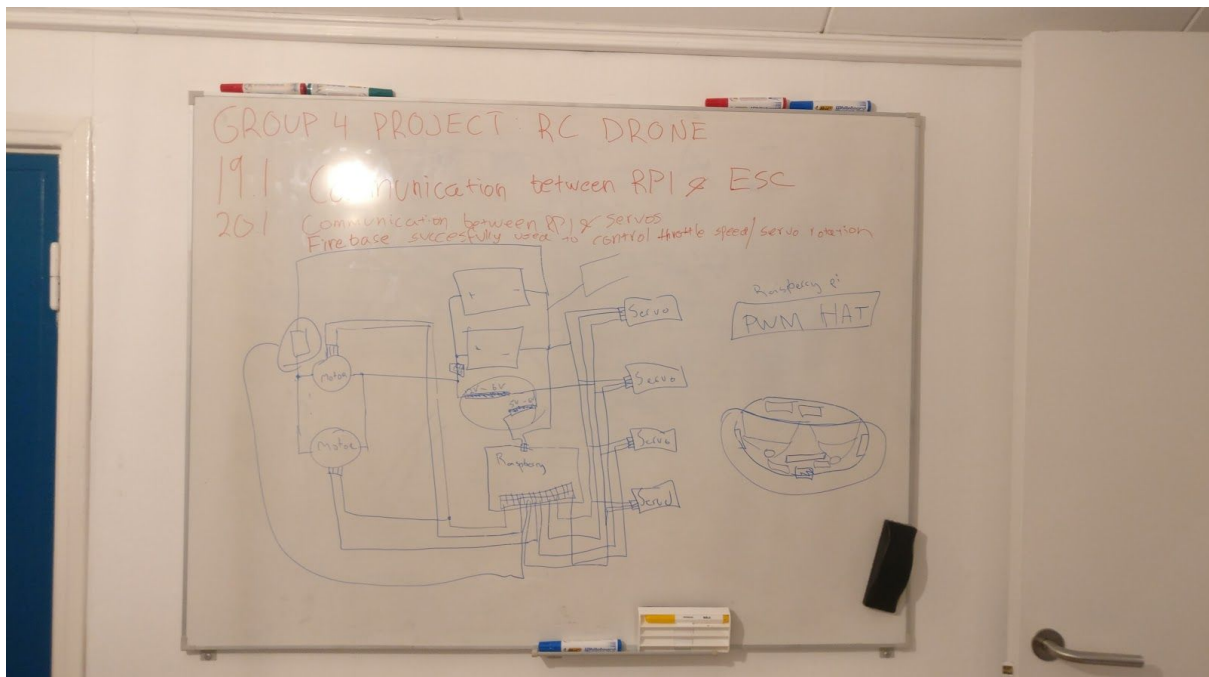
27.12.2018: Vilhelm and Arimo had a meeting where they discussed what we could do for our Group four project. They came up with three different choices which we could choose from: RC car, RC airplane, or a drone.

From these options, we chose to go with the RC drone.

10.1.2019: We had a second meeting in Metso, during which Vilhelm briefed our group with the prototypes of the parts of the drone. During this meeting, we also looked up the possible parts for the drone, which we added to our excel file linked below.

<https://docs.google.com/spreadsheets/d/1qGYfMcGFxqz-1TrrB2TnaCYY2p7-NcQoGJRcxABeM9o/edit?usp=sharing>

19.1.2019: During our third meeting we had the parts at our disposal for the first time. Aapo and Vilhelm tested the connection between the raspberry pi, the ESC and the motor. After working on it for a considerable amount of hours they finally got it working at around 12:30 am.





20.1.2019: Next morning progress was made as the boys were able to control 2 motors at the same time as well as test the connection between the raspberry pi and the servos which also proved to be successful. Arimo arrived in the morning and started working on this diary. Niilo arrived three-quarters of an hour later and worked

on the design of the mobile app for controlling the drone and also on the color scheme of the drone. With intense programming, Vilhelm and Aapo, through some struggles accessing the database with the raspberry pi, were able to control the motors and servos through the internet. On the first try using the motors they both turned on but with a slight delay relating to each other which needed to be removed. Aapo was able to do that by making a function that controls both of the motors at the same time instead of having a function repeat for each of the motors individually. After that, we were happy with our work and wrapped up for the day.





23.1.2019: Late at night Vilhelm was able to finish the 3 days modelling of the parts. According to the software, it took him a bit over 120 hours to model the parts. A lot of time was wasted on the countless errors that he made during the modelling process and it took him some time to learn how to use the software.

24.1.2019: The next day the boys started to 3d print the parts. At first, the plan was to construct the body from just two parts, the bottom part, and a top lid, but because of long printing times and the difficulty of the assembly, the boys decided to split the bottom body into two separate pieces.

The boys had arranged a meeting 27.1.2019, so the printer capacity had to be maximized. At most, there were four separate printers working on our parts, one in Hacklab, two in Valmet, and one in TTY!

The printing was not a success at first. The first two wings failed due to wrong parameters sent to the printers. The third and fourth attempts were successful with the wings. The print time of the bottom parts was at first around 17h but after adding some fine details and decreasing the layer height, the print times increased to 44h and 42h! The first print attempts of the body parts were as unlucky as the first wing attempts; after just three layers, the nozzles jammed and stopped printing.

26.1.2019: Update: In the morning, the boys noticed the problems in the body prints, so they restarted them. $\frac{3}{4}$ wings successfully printed. The boys had to cancel their meeting because the body parts would not be ready by Sunday.

29.1.2019: After our English exam on Tuesday three of the boys (Aapo, Vilhelm, Niilo) went to get the body of the drone and two of the wings, as the printer had printed them. The boys went to Vilhelm's home to clean the pieces from the extra material that was printed inside of the pieces. Aapo worked on the Gyro we had bought for the drone, as he got tired of cleaning the pieces. This cleaning of the pieces took a long time which why the boys didn't have much time to do anything else.

3.2.2019: On Sunday Aapo, Vilhelm and Arimo continued work on the drone after the exam week. They got many things done during this day. They got the Servo Hat to work, they fitted the motors to the body and tested that they work ok. Arimo fine-tuned the wings and made adjustments to the propellers. Vilhelm connected the two motors to the Raspberry Pi with some difficulties due to the wires. In the evening Vilhelm 3d modelled a couple of pieces that had gone wrong in the earlier printings.

4.2.2019: In the morning before the Economics exam went to start the printing of the last pieces. After the exam, all of the boys went to Vilhelm's home to continue the project. Arimo and Niilo made some fine tunings to the body of the drone and Vilhelm continued to work on the application that controls the drone. Aapo worked on the communication between Firebase Database and Servo Hat.

5.2.2019: We were able to work on the drone for almost the whole day as we had done our mathematics exam earlier. Niilo started working on the video we were

going to show to our classmates on February 7th. Arimo worked on an animation of the 3d model of our drone, that was going to be part of our video. Also, we had printed new parts that needed to be prepared for inclusion in the drone. We were able to put the servos into their mounts. Vilhelm made progress on the control app and Aapo worked on the connection between the app and the Firebase database.

7.2.2019: This was the day we needed to present our projects to our classmates. As we were not ready for a maiden flight yet we prepared a small presentation, a video and a demonstration with the motors on and controlled by the app. We had about four hours to work on our project before the presentation. Niilo finished the video and made the presentation. Vilhelm made the app smoother and prepared the drone for the demonstration. Arimo finished the animation that was included in the video.

16.2.2019: Work was done on the video that was going to be entered into the StarT-competition. Vilhelm and Arimo filmed their parts at Vilhelm's house. Aapo filmed his part at his house.

17.2.2019: Niilo recorded his part of the video at home and finalized this learning diary. Aapo finished the video after he got the animations Vilhelm and Arimo had done over the weekend.

After we had sent the video to StarT we got to test our drone to see if it would fly. To our disappointment, the drone would not fly. This was because our propellers were too small so we ran into the problem that the motors reached the max rpm but, not the max power, so the drone would not fly. We were all very disappointed and decided to have a break from building the drone.

Now the StarT competition was getting closer and we had done nothing to our project. We had other school work to concentrate on and three of our group members went to Cambridge for a week, which is why in the end we were in a hurry to complete our project.

1.4.2019: We now had three days to build and finish our second model for the StarT competitions. Vilhelm had finished the modeling of the second model and was ready to start printing it. After school, he went to put the first half of the second model to start printing.

2.4.2019: After school Arimo and Aapo went to Vilhelm's house to work on the drone. Aapo worked on the gyroscope and the live stream for the drone and Vilhelm worked on the motors and the app that controls the drone. Arimo worked on the funnels that would go on the new drone. Around 8 pm the first half of the drone was

done printing and Arimo got to start cleaning it from the excess 3d printed plastic. We worked hard until half past 1 and then stopped, and went to relax into the sauna.

3.4.2019: In the morning Arimo and Vilhelm went to get the last two of the funnels that were done printing, after which we went to put two new pieces to print. We also got the second half of the drone from printing. Niilo came in the morning to help us, he started to clean the second half of the body, while Vilhelm worked on the motors trying to fix some contact problems. After Niilo had cleaned the body he glued the four funnels to the drone. At around 4 pm the two pieces were ready and Arimo went to pick them up. Arimo came back at around 7 pm and started working on the first half of the body since some modifications had to be made to it. Aapo worked still on the gyroscope and the live stream since he had some problems with it. After Arimo was done with the gluing of the top part to the first half of the body, he started to put the two body parts together. At around 1:30 am Vilhelm accidentally deleted the app that controlled the drone and could not recover it so he had to start doing it again. When he had finished that and Arimo had finished the connection between the body parts we tested that could we fit the hardware inside the drone. At 4 am we stopped and cleaned up ready for the morning and went to sleep.

4.4.2019: We woke up at 7 am took a shower and got ready to go to the competition.

16.4.2019: Out of the 650 teams that attended StarT science competition, we were chosen to be in the top 10. At the same time, we were asked invited to a science competition in Macao China 20.7-26.7.

20.4.2019: The boys bought a 3d printer so that it would now be easier and faster to make prototypes. The 3d printer arrived a few days later.

25.4.2019: We got an email that we were chosen to be in the top three in the StarT competition, and we were invited to a awards ceremony in Jyväskylä 6.6.