

Weekly Log:

- Write down a short sentence of what you've done today or discussed in a meeting.
- Please immediately fill it in after you've done a task.
- This will be used for reports and to see how many times we've tested stuff etc.

Thursday 6th Feb:

Rebecca:

Done the first version of the 3D model of the trapdoor and the car.

Friday 7th Feb:

Summary from Sakib:

Just to clear everything up. The hardware team is now split into two further sub-teams. One for modelling the LEGO car and tray with the exact dimensions of the current one, which includes myself, Rebecca and Zhao. The other team, consisting of everyone else will be working on a system for allowing the car to know where it is on the track. As we will have more than two bins as well as the magnetic door to trigger the ML system.

This has been done to ensure that no work will become obsolete on completion of the 3D printed car and that designs that are made with LEGO can be quickly abstracted to the new robot. The hardware team will also be adding a screen to add some user feedback e.g. bin1 is full. The tray of the trapdoor is currently being printed to check if the sizes line up. I hope that everyone is clear on what they must do.

Tasks for 3D Printing/Modelling Team include:

- Model the Recyclotron exactly
- 3D print the model and attach motors and see if it works the same
- Scale up the design and reprint (for a larger tray/platform)
- Model more components as other hardware sub team creates prototypes.
- (As more of the 3D modelling is complete more people will move over to the Rail Tracking/Feedback System Team)

Tasks for Rail Tracking/Feedback System Team include:

- Playing around and testing the best method to allow the car to know where it is on the track/which bin it is currently over (using lasers, ultrasonic sensors, etc)
- Getting a small touch screen from Gary to display whether an item is recyclable or not, and other important information (we want to increase user interactivity)
- Create some sort of door on top of the chamber, so that when the door is open and closed the system knows there is an item within the chamber and detection can begin.

Work progression:

- Zhao and Martin: retrieved GrovePi+ kit from Gary, tested LCD with Arduino board and got it working
- Zhixing created a web server to collect images and sort them into categories (for creating our own testing set); with Shivamm - creation of a new model (random forest), adjusted the machine learning model to use 4 classes and a function to adjust the output depending on the number of bins that are set up. - Waiting for more images for us to test to see how we can improve the model.
- Shivamm & Zhixing:
 - 1. created an interface to collect images which makes the storing of images into the database easier
 - 2. Created another classifier - random forest and testing it out with the testing data - 84% accuracy
 - 3. 4 bins we are using - recyclable, nonrecyc, metal, and cardboard
 - 4. Tested it on 4 categories, got a hundred percent accuracy on both nonrecyc and metal (however, there were less than 100 images in each category so we need more)

Saturday 8th Feb:

- Main data source: <https://www.dexterindustries.com/GrovePi/get-started-with-the-grovepi/updating-firmware/>
- **Sakib:** Finished printing first version of trap door, but without any “dots”. Thus there is no way to add teeth to the lining. I have asked Rebecca to add a lining of dots so that we can attach teeth to the edge of the tray.
- Zhao and Martin: installed dependencies for GrovePi+ so we can use it with the PI - reason: a lot of useful ports and sensors are cheap, would solve a lot of our issues
- Datasheet for ultrasonic: Port: **Any digital ports**

Parameter	Value/Range
Operating voltage	3.2~5.2V
Operating current	8mA
Ultrasonic frequency	40kHz
Measuring range	2-350cm
Resolution	1cm

- Zhao and Martin: current situation - LCD work with GrovePi+ shield (any **i2c port**), ultrasonic sensor does not <- main task for today and tomorrow. Final log for today:
 - might have to build firmware, will attempt tomorrow
 - Or the ultrasonic sensor is faulty, in this case, talk to the experts on Monday.

Sunday 9th Feb:

Rebecca: Finish with the version 2 of the trapdoor, add “dots” on top to fit the teeth.

Martin, Zhao, Anshul:

- The dependency added today:
 - GrovePi lib from **Dexter** (third-party driver may not word) url: <https://github.com/Dexter/GrovePi>
 - Manually installed package: sudo apt-get install libncurses5
 - Large package involved: Scipy
- Pseudo-code:
 - Wait for magnetic button (too weak as I known)
 - Run the ML
 - Give output of which bin to the screen with certainty percentage
 - If not confident, ask for input by running the buzzer

- If no input in 30 seconds, drop in non-recyclable
- For moving:
 - Check immediate and target position and move towards destination
- Check if the bin is full before dropping
 - If the recyclable is full, dump in non-recyclable.
 - If non-recyclable is full, run the buzzer
 - If the bin is 70% full, run the buzzer, but drop the trash in.
 - Display cause of the buzzer's noise.

Monday 10th Feb:

- Rebecca and Flora: Worked on the magnet door to make sure the lid will not open when the recycling car is in progress.
 - Need to confirm the time of when to start and finish (getting signal from Pi)
 - Perhaps need to solve the problem of not enough voltage support
- **Sakib:** I have started the print on the new version of the tray, with dots along the edges so that we can attach teeth. This will make it so we can use this tray with motors cogs.

Tuesday 11th Feb:

- Fraser: Uploaded trash photos from Facebook to server and relabeled some existing data.
 - Require a definitive mapping of items -> category to justify decisions
- Anshul: coded more or less everything in the pseudocode I had written above.
 - Need to work with the touchscreen sensor for IO and feedback.

Wednesday 12th Feb:

- Martin+Fraser: 2h workshop on quantitative analysis -> useful information for report and demos
- Shivamm: added information to the slides and the pdf document regarding the ML process

Thursday 13th Feb:

- Rebecca and Flora: Done the lego model for chamber.
- Flora: Digged holes on 3D model for motors.

Friday 14th Feb:

- Fraser: Research result of mis recycled items. This information could be used to justify the classifiers decision boundaries.
- Shivamm, Zhixing, Zhao: we worked on improving the model, tested different confidence intervals and different ways of splitting the data - also we added a feedback mechanism, if the item is below the threshold value, the user is asked for the input.
- Rebecca: Changed the chamber lid to fit the user well.
- Flora: Checked the location and size for each hole.

Saturday 15th Feb:

- Martin & Anshul: improved code and tested some scenarios. Waiting to integrate the magnetic sensors and electromagnets.
- Will order the magnetic sensors on monday.
- Rebecca: Finished the 3D model of the chamber lid. Put the handle on the lid with electromagnet in it.
- Flora: Finished the 3D model of the recycling car body. Added the front board, the car boot and the place for magnet.
- **Sakib**: Tried to print the body of the car but the print failed due to problems with material, new material being purchased.

Monday 17th Feb:

- Fraser: Added to the Machine Learning Technical Details document.
- Flora: Sended the 3D model for car body to Sakib.

Tuesday 18th Feb:

- **Zhixing, Shivamm and Zhao:**
 - Introduced the new method of trash classification using Tensorflow dNN
 - Gathered about 4 million images of trash in many categories
 - Labelled the data and removed the unusable data
 - Constructed the dNN model using Tensorflow.Keras
 - Train the model with partial labelled data
- **Sakib:** Received model for chamber lid from Flora. Attempting to print at home however print failed due to the base of 3D printer not being level, will try again tomorrow.

Wednesday 19th Feb:

- **Sakib:** Finally started the 3D printer on the main body of the system as well as chamber lid which has space for electromagnets. This printing job will take 3 days and 1 day for the body and lid, respectively. This puts us behind schedule.
- **Martin:** Worked on answering hardware questions

Thursday 20th Feb:

- **Martin:** Rationalizing the decisions made for hardware in preparation for QnA at demo 2
- **Zhixing, Zhao:** ????

Friday 21st Feb:

- **Sakib:** Chamber lid printed
- **Zhixing:** Fine tuned the dNN model with thresholds. Further increase the accuracy.
- **Davy:** report report report. Used martin's answers, and added some of Zhixing's explanations too.
- **Rebecca & Flora:** worked on the electromagnet.
- **Flora:** labelled each part of the recycling car.

Saturday 22nd Feb:

- **Davy:** tidied up report, waiting on graphs from Fraser, (also need to do budget) and then send off report to Sam for checking.

Sunday 23rd Feb:

- Anshul and Zhao worked on rewriting and the code for the motors and sensors. Zhao also took the code and integrated it into the main code complex simultaneously.
- Davy: finalised report, sent it off to Sam for checking
- Rebecca & Flora: remade the lid by LEGO for backup, left place for top camera, electromagnet, magnet sensor and made a handle for opening the lid.

Monday 24th Feb:

- DAVY: **REPORT** away, redid bits of presentation, and added more slides
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Tuesday 25th Feb:

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Wednesday 26th Feb:

- **DEMO**

<i>Component</i>	<i>Cost</i>
3D Printed Body & Lid	£65
3 Electromagnets	£4
2 Ultrasonic Sensors and LCD Screen (GroovePI Kit)	£10
2 LEDs	£3
2 Webcams	£15
5 EV3 Motors	£130

2 Steel Railings	£10
Higher End Rapsberry Pl	£50
<i>Total Cost</i>	<i>£287</i>
<i>Total Spent</i>	<i>£97</i>