ME3500J SU24 Project

Guideline of the Term Project

Main Task

Nowadays, the human footprint has covered nearly every corner of the earth, and we are still moving on. However, there are some regions we cannot easily reach (such as the moon), and we need detectors and robots to finish the preliminary exploration work for us. They should be able to cross deserts, climb mountains, pass through tunnels, and conquer other terrains. They should be capable of automatically detecting obstacles and dealing with the situation. Also, they need to stop at a certain position for us to collect information and recycle devices. And this is what we are trying to simulate in ME3500J: an automatic complex-terrain vehicle.

Requirement for the prototype

Create a vehicle that can start rolling, climb steps and a sandbox, move on sand, descend from the sandbox, shrink to pass through a restriction bar, turn according to a sign, and stop in a parking area.

- Cost: Maximum Budget - 1000 RMB/Group
  - JI will reimburse you with invoice at the end of the semester.
- Use transformable wheels (or other mechanisms) and sensors
  - Automatically self-control (NO remote control)
  - No use of parts from commercial toys
  - Consider your vehicle size according to the game zone setup
- Raspberry Pi with camera (low-end Machine vision)
  - Arduino is NOT allowed
  - Camera module is required to determine the direction of turning
  - Other sensors on remaining judgements (e.g. distance and lines detection) are free to choose

Task to accomplish

- Design: Conduct a conceptual design to implement the function of a machine that can detect obstacles, cross different terrains, and stop at a desired position.

- Prototyping: Manufacture a prototype of the designed concept using the provided components, raw materials, and mechanical structures discussed in the lectures.
- Presentation: Make an oral presentation after the mid-term exam. By then we expect ~70% of progress on the project.
- Competition: Before the final exam, you have a chance to demonstrate the performance of your device through the game shown below.
- Report: Write a final report for this project, including all the conceptual designs and prototyping details. (The maximal page length of the final report is 10.)

On the Project Competition

Game Zone Setup

The following figure presents the game zone setup.

For the whole game zone, the width of the track is about 0.65m.

For the starting lines, it varies from groups in which lots will be drawn before the game starts. There are three different starting lines and there are accordingly three different ending lines to make sure that each group goes through the same path length. The red line settled at starting line 1 indicates there is a height restriction pole of 0.09m.

After going through the starting line 1, there is a flat ground of 0.45m. Then, there is a step of 0.06m height. After the step, comes a sand box whose edge height is 0.12m, which means the height difference between the step and the sand box is also 0.06m. After coming out of the sand box, it needs to walk down a slope with a height difference of 0.12m and a length of 0.35m. There is another height restriction pole of 0.09m you need to go through.

After going through the pole, there is a turning sign which you need to recognize and turn your vehicle in the right way. Then, you need to go through the ending line which matches your starting line.

Finally, you need to turn after the ending line and stop your car inside the parking area.

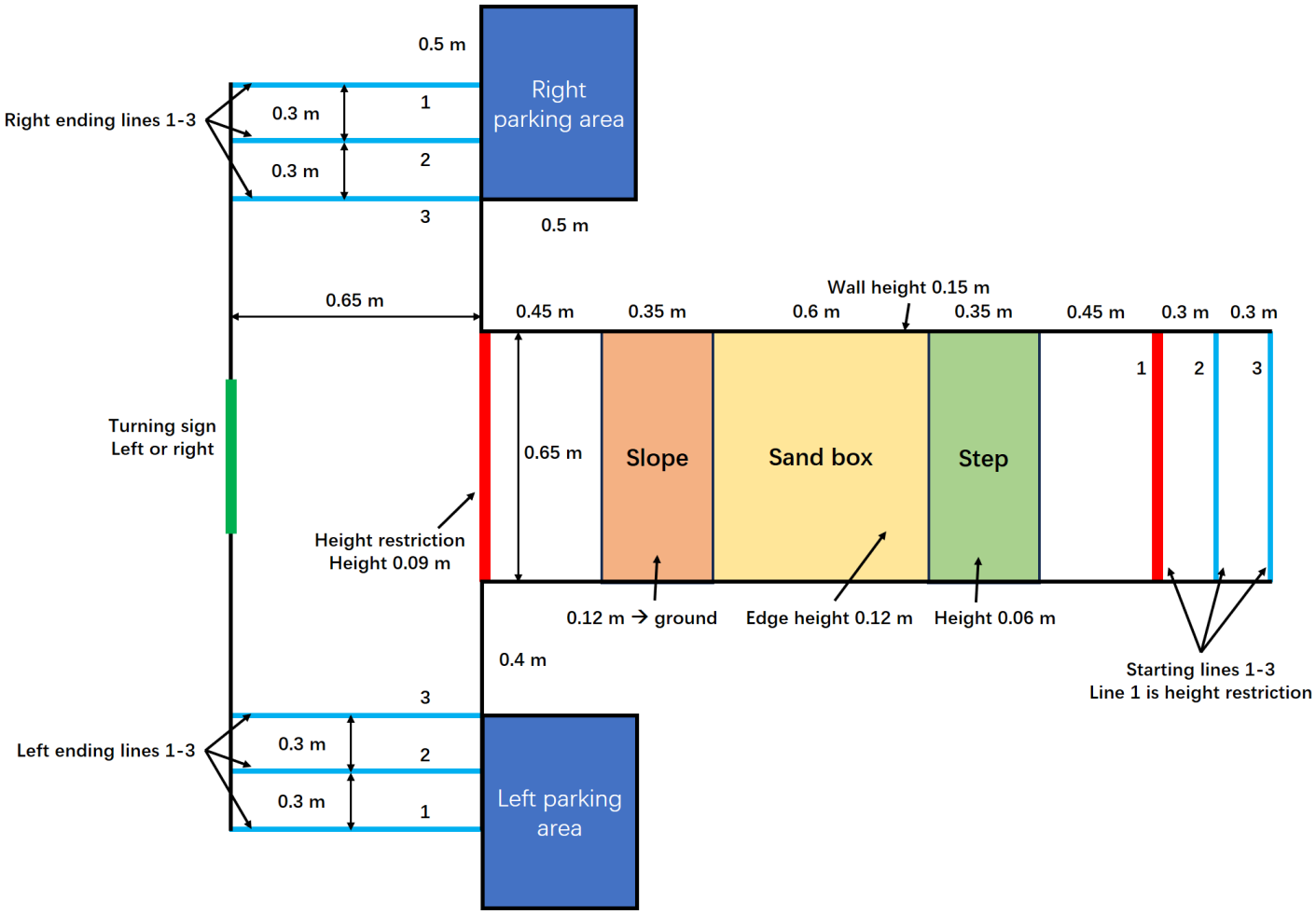

Figure. Game Zone Setup

Game Rules

Before the game, each group needs to send a representative to draw lots to determine the sequence. After the determination, the teaching group will post it on the screen.

The game will have two rounds. In each round, groups come in sequence.

Before the game, you must come aside prepared and take the lottery for the starting line when the group before you is on the game track.

When the previous group finishes, you need to put your vehicle on the track and turn on the switch. Time will start to record after the front of your vehicle goes through your starting line and stops after the front of your vehicle goes through your ending line. Then, after your vehicle stops in the parking area, you need to take your car away and wait for the next round or claim to abandon the other chances and leave the gamday.

Game points

- Have a switch +20

This requirement means you need to have a switch for your vehicle. This vehicle should be functional, which means you can put your vehicle on the track, directly turn on the switch and it

can run.

- Turn to the correct direction +40

This requirement means your vehicle turns to the direction showing on the turning sign.

- Cross your ending line +60

This requirement means your vehicle goes through the whole game track and passes the ending line.

- Stop in the parking area +20

This requirement means your vehicle stops in the parking area.

- Time: by ranking (max 30)

The time is recorded and ranked among all groups. The way to record is indicated in the game rules.

- Hit any obstacle once -10

Each time your vehicle hits any obstacle, which includes walls, edges of steps and sand boxes, and height restriction poles.

Design points:

Maximum + 20

It will be determined according to the neatness, novelty and creativeness of your design.