Braitenberg Vehicles

KÕan Group 4a

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Supervisor: José Carlos Castillo Montoya

Students:
Bastian Hauda
Miltiadis Katsimpras
Maria Klokow
Huiyuan Tian
Jiawen Ma

Overview

For the 2014 ShanghAI Lectures Kõan exercise regarding the concept of Braitenberg vehicles our group will implement an interactive web application that will generally be able to present the “aggressor” behavior of a Braitenberg vehicle (see milestones for further description). Simulated sensors of our designed vehicles will be light sensors that enable the agent to interact with a 3D world. We will upscale the abilities of a Braitenberg vehicle by introducing a third axis to its environment. To complete our project successfully, we set several mandatory and additional milestones.

Mandatory milestones:

- Test given Pioneer2 example in Webots
- Create Java Webots Controller
- Set up GitHub and communication channels for the group
- Create website with 3D environment view
- Create feature to control vehicle in first person mode
- Implement Braitenberg 3D Automated Control Code (one code block or modular)
- Create 3D Map objects such as blocks, borders, obstacles (via stl-binary files - files in zip.file)

Additional milestones:

- Implement Shader for engine outputs (particle effect)
- Enhanced lighting implementation
- Texturing of vehicle and 3D world

The milestones are prioritized by significance. The last 3 milestones are optional tasks that

will not be necessary for the application to run properly.

Tasks and milestones we have concluded so far include trying out the Pioneer2 example in Webots, which already presented usual Braitenberg vehicle behaviour in a 3D environment but with only 2 axes. We then translated the code from the controller of the given Webots example into Java assuming we would still be developing with the Webots tool. After further discussion in the local groups we decided not to use Webots as our primary simulation tool but to create our own simulation environment for web browsers. The web platform enables us to share our project with everyone from the ShanghAI Lectures more easily and also offers a new approach of showing the concept of Braitenberg vehicles.
Our next milestone was reached when we set up the Git repository on GitHub and the communication channels to stay in contact with the two local groups and the supervisor. Another task we already finished was to create server access on a website where we are going to display and test our implementation. Milestones we still need to finish until the presentation of our project are implementing the ability to control the Braitenberg vehicles in first person mode, implementing the general “agressor” behavior as well as the 3D automated control code and creating 3D models including light sources, obstacles and borders. The last three milestones listed above are optional and we will try to finish them until the presentation in January. They will not be necessary for the project to work properly though.

Tools

For the group networking we will primarily use e-mail and Skype communication. For the version control of our code we decided to create a GitHub project that can be found on https://github.com/12xU/BrAItenbergs
After complications and restrictions occurred with Google for our Chinese group members we will limit the group’s communication to those tools.

The implementation of our ideas will be done with the programming and script languages Javascript, HTML, PHP and CSS. We are also using a framework implemented by one of the group members (Bastian Hauda), which already offers a lot of functionality that is required for this project to work (e.g. the entire canvas control in the browser). The code of this framework is modular and structured. Experienced group members will try to work with the framework, others will write pseudo code that can easily be translated into Javascript code by one of the more experienced group members. Using this workflow we are not trying to limit anyone’s intention to learn something new but to empower everyone’s existing abilities.

Html and CSS are used for the general layout of the website. Our PHP code collects and sends our necessary Javascript code to the client.
The Javascript code is responsible for the functionality of the website (controlling the 3D environment and its elements). The framework offers functions and mathematical calculation classes that are needed to render the scene and move the vehicles/camera.

Goals

Our main goal is to implement a Braitenberg vehicle in a 3D environment with obstacles, a scene border and a light source. The main goal also includes implementing the

“aggressor” behavior for the Braitenberg vehicle. If there is still enough time at the end of the project, we will try to implement a test case with two Braitenberg vehicles that inherit the already mentioned behavior types. Another possible aspect that we will consider implementing after the mentioned milestones and mandatory goals are reached is the “explorer” behavior, where the vehicle will automatically search for the light source within a given area.
Testing will be done by automated animation on the website. The visible output will be compared to expected behaviour and requirements. It is also possible delegate the testing to one of the less experienced group members.
By the time of the presentation in January we also want the website to be able to let the user interact with the 3D world by moving the light source and letting the vehicle respond to the changes the user actively made in the world. Details for this goal still need to be discussed.

After further discussion we do not want the 3D application to simulate an underwater environment because this would include implementing physical laws like Pascal’s law of fluid mechanics and pressure and we think that there is already a lot of work to do in setting up the models and 3D world (basically from scratch).

Current Status

Problems we are currently working on are the correct matrices calculations for the visualization of the 3D world (e.g. for controlling the rotation of the vehicles) and the first person view of the vehicles.

The current progress of the project can be found under the following link:
http://braitenberg.eurasianfed.square7.net/