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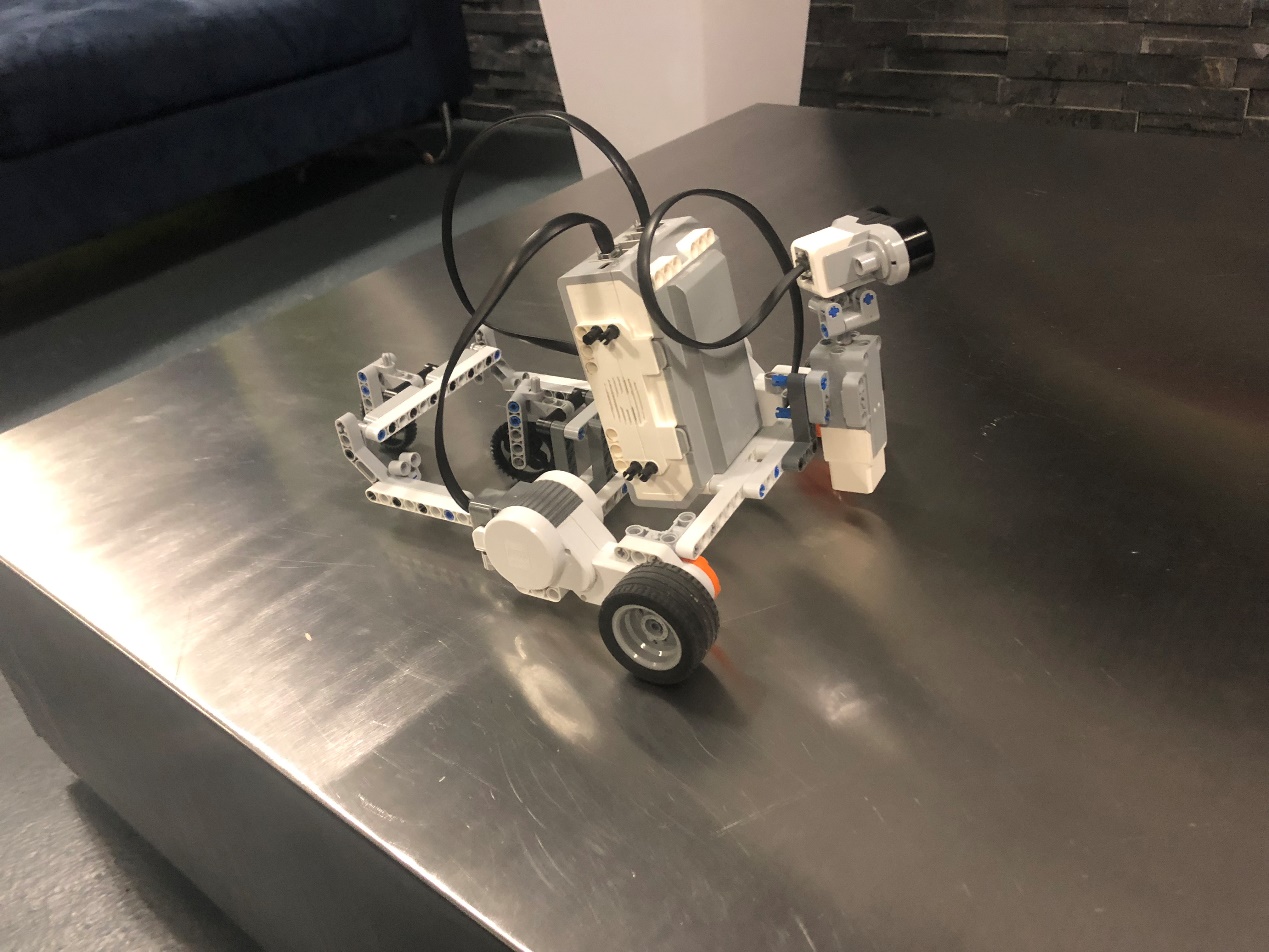
Group:51

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# Report for wall-following robot

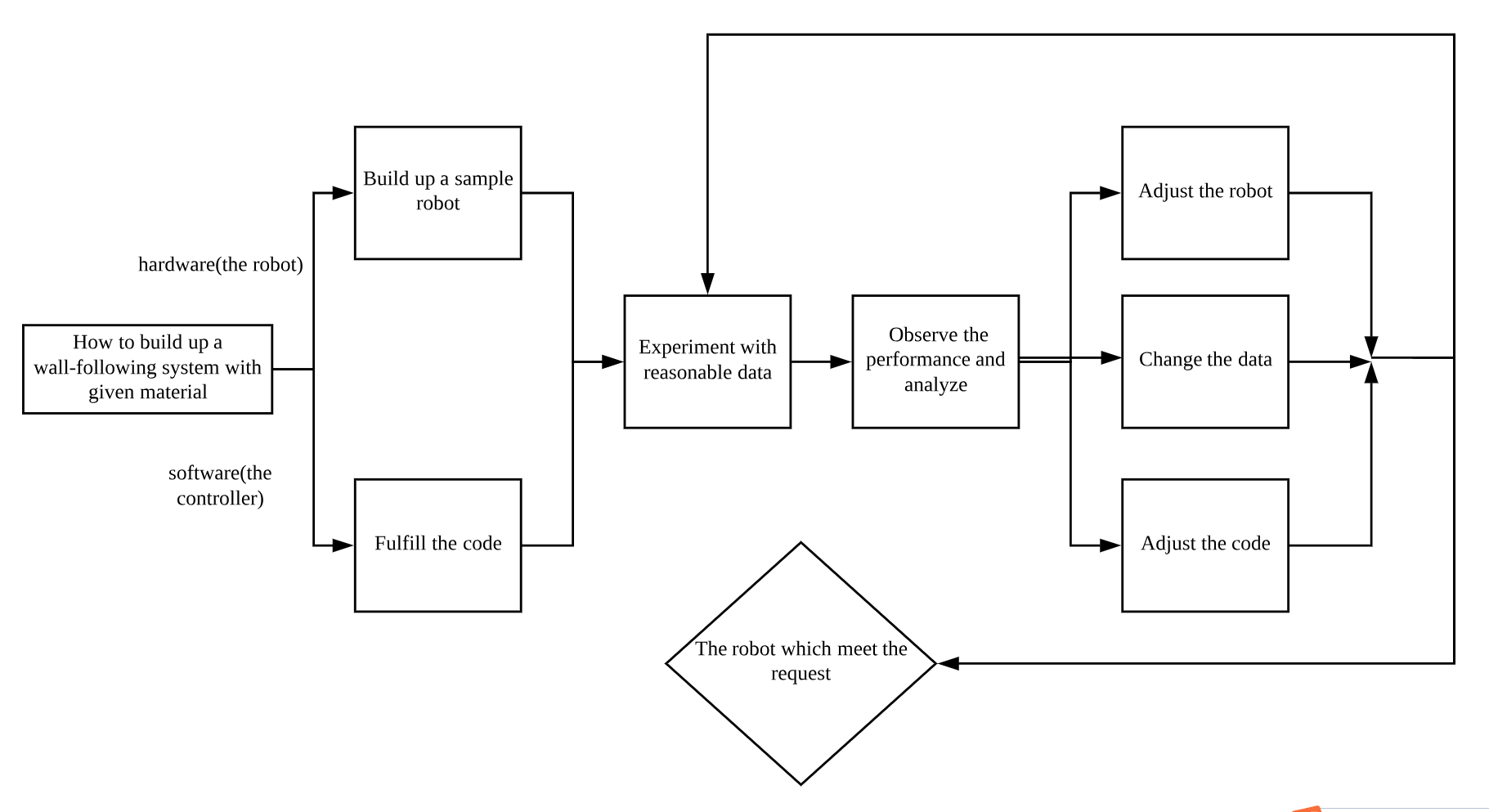
**Design evaluation**

The robot as well as its controller are specifically designed for implementing the wall-following system.



The robot is driven by two motors on both sides of the EV3 Brick. There’s two direction-control wheels at the tail of the robot. They can also help with balance the robot. By using the ultrasonic sensor, the robot can measure its distance to the wall, which data will be supplied as reference to implement the speed-changing process to one of or both motors in order to keep the robot away from the wall at a constant distance approximately.

Before reaching the final hardware design, we considered about changing the position of EV3 Brick but failed. The direction-control wheel occupies the space between motors so the brick needs to be suspended above the wheel. It may spend to many blocks to achieve the goal and the supporting block seems a little bit fragile. As a result, we finally chose the initial design.



**Test data**

**Test analysis**

***What happens when your P-type constant is different from the one used in the demo?***

***How much does your robot oscillate around the band center?***

***Did it ever exceed the bandwidth? If so, by how much?***

***Describe how this occurs qualitatively for each controller.***

**Observations and Conclusions**

***Based on your analysis, which controller would you use and why?***

***Does the ultrasonic sensor produce false positives (detection of non-existent objects) and/or false negatives (failure to detect objects)? How frequent were they? Were they filtered?***

**Further improvements**

***What software improvements could you make to address the ultrasonic sensor errors? Give 3 examples.***

***What hardware improvements could you make to improve the controller performance? Give 3 examples.***

-Lower the height of ultrasonic sensor so that it could measure the distance more accurately. Or we can use some other kind of sensors that are more precise.

-The position where the EV3 lies could be changed in order to lower the center of mass so that the robot could be more stable. For example, the EV3 brick could lie down at the center of those wheels. If not doing so, the robot may have the risk to rollover when implementing bang-bang controller.

-The distance between the two motors can be reduced in order to decrease the radius of rotation, which will lead to a more frequent speed-changing process in both bang-bang controller and p-type controller. This means the robot could move along the wall more smoothly and keep its distance from the wall in a smaller threshold.

***What other controller types could be used in place of the Bang-Bang or P-type?***