

IA158: Real Time Systems

2014

Legoway

For our project we found inspiration in a Segway. The Segway is a two-wheeled, self-balancing, battery-powered electric vehicle invented by Dean Kamen. Computers and motors in the base of the device keep the Segway upright when powered on with balancing enabled. A user commands the Segway to go forward by shifting their weight forward on the platform, and backward by shifting their weight backward. The Segway detects, as it balances, the change in its center of mass, and first establishes and then maintains a corresponding speed, forward or backward. Gyroscopic sensors and fluid-based leveling sensors detect the weight shift. To turn, the user presses the handlebar to the left or the right. You can see a picture of a Segway below.

Lego version of the Segway, further referred as Legoway, will not use any gyroscopic or other special sensors. All the balancing will be based on a light sensor. According to data obtained from the light sensor the Legoway will automatically balance itself using a PID Controller. Because the data provided by the light sensor give the controller only relative difference of tilt and the amount of reflected light received from the ground differs according to the type of surface, getting a good balance is a bit of a challenge.

To avoid hitting obstacles the Legoway will use an ultrasonic sensor. After detecting an obstacle the Legoway will stop. To manage the movement direction of the Legoway remote bluetooth connection will be used.

We are planning to use NXC programming language for the implementation. The robot will use a light sensor, an ultrasonic sensor, a bluetooth connection and two motors. The Legoway schedule must manage three jobs: PID controller, collision detection and remote control. The PID controller job will have a hard deadline. The hard deadline will be determined by the control loop of the controller. The collision detection job and the remote control job will have soft deadlines.

