Balancing Robot

Project Proposal

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Introduction

Because new and exciting automated devices make life easier, people are fascinated with robotics and artificial intelligence. This is why I propose to build a robot that balances on two wheels. It will resemble an inverted pendulum and there will be wheels at the base of the robot to keep it vertical. If the center of gravity moves off center, the robot will move itself so it will not fall over. Also, if anything gets too close, it will move away until it is in an open area again. The boundary for its range of movement will be the edge of a table.

Project Description

The robot frame will be built out of k’nex. It will house the microcontroller, power supply, and the sensors (Figure 1.) There will be two servo motors and wheels on the base of the frame, which will be controlled by the PWM of the microcontroller.

IR LEDs and sensors will check to see if something gets too close. The sensors will be positioned to check the front and back of the robot. The sides will be left open to give me an area where I can get close to it. There will also be sensors aimed at the floor to make sure it will turn or stop when it reaches an edge.

Everything must be located in the frame of the robot so batteries will be used to power the microcontroller, motors, and sensors.
Tilt sensors are really expensive so I decided to improvise and build my own. One possibility is using an IR rangefinder to check the distance from the floor. However, the robot can only stand still on a perfectly level surface. So, I decided to use gravity as a reference without the expensive tilt sensors. I will build a small pendulum and attach it to the wiper of a potentiometer. The microprocessor will monitor the position of the pendulum and the amount of power to the motors to calibrate its initial equilibrium point.

A block diagram of the system is below (Figure 2.)
Benefits

This robot could be used as an interactive learning device or a toy. People who want to build their own balancing robot can purchase an educational kit and learn how electronics and microcontrollers work. It could also be a toy for a pet. One can let their pet chase after it and try to knock it over, until the robot runs out of power.

Product Comparison

Currently there are not any toy robots that balance on two wheels for sale. This is possibly because there is not a demand for anything like it. I know other people have built these robots because I have seen web pages of people describing their projects. Some of the projects use expensive tilt sensors and gyroscopes to help balance the robot. Others use DC motors but they need a motor controller to help with changing directions.
Development and Demonstration

A method will need to be designed to mount the components to the frame or add a small breadboard into the frame. Depending on how much power everything is going to need, I will choose the right kind of battery pack. Normal rechargeable batteries or a battery pack from a remote control car will be used so I don’t have to buy new batteries. If I still can’t find a cheap tilt sensor, then I will use the pendulum.

For the demonstration, I will let the robot stand by itself and show how the proximity sensors can make it move. It will move until it reaches the edge of the table and turn then stop. Since I will be building the frame, I will leave it open so everybody can see the components that went into the robot and how the tilt sensor works.