Segway
Two Wheel Self Banlanced Vehicle

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Abstract- The analysis gives us the idea that we are successful in developing and performing our project that is Segway. The Segway is a self-balancing, two-wheeled upright transport vehicle. The patrol and community capabilities of the Segway have now been proved by some of the largest police forces in the United States, and the environmental profile of the product enables agencies to reduce fuel costs and vehicle emissions. The software we used is a open source software. Robot C and Win avr. The Hardwares are ArduinoUno board and Accelero and gyro sensor and sabertooth motor driver. are easy to use, easy to transport, and cheap to run.

Keywords— Segway, self banlanced, Aurdino UNO,Sabertooth Motor Driver

I. INTRODUCTION

• Designed to maneuver how people walk
– Maneuver in any direction
– Easy to use

– Ride through standard doors
• Uses existing infrastructure – one

product, many applications

– Ride on all kinds of terrain, indoors and out
– Charge anywhere, anytime
• Low cost electric power; zero emissions
• Self-balancing “dynamic stabilization”
• Low operational & maintenance costs
• Safe for both rider and pedestrian
• Excellent speed, range, and visibility
• Portable

II. HARDWARE

The motors, wheels, chain, gears and batteries came from electric scooters like the one to the right. You need hardware from two since the electric scooters only have one motor and gear setup. The motors are some cheap china unbranded ones. They are rated as 350W 24Volt, 2750 rpm

The gearing is made in one step from the small gear on the motor to the bigger gear head on the wheel. The ratio is approx6:1, a higher ratio would be preferred to get a better torque and a lower top speed. Now the motors have to work pretty hard and currents above 30A(in total from both motors) have been registered since the fuse burned.

The fasting of the gear on the 12" wheel was based on a freewheel mechanism therefore I had to open up the freewheel and remove all the grease and then use epoxy to make it possible to drive it in both directions.In the picture below you can see the freewheel after ithas been filled with epoxy as well as a tool made to be able to open it up.
There is one fixed axle on which both wheels rotate, this axle is attached with three aluminum blocks which fixates the axle with 5mm set screws.

Steering, to be able to turn left and right by just tilting the handlebar a rigid joint was needed, the design was made in SolidWorks and then produced in a CNC mill. The transfer from the CAD drawing to the machine instructions (g-code) was made with CAMBAM. The same method was used to produce the box for the electronics and the assembly for the emergency brake.

The handlebar is a normal bicycle handlebar, the pipe on which it is connected is a 25mm hollow steel pipe. To keep the pipe centered and to give some force feedback two springs are attached with steel wires. On the handlebar there is also an emergency button which is connected to a standard car relay which directly cuts the power to the motors. Two 12V 12Ah lead batteries are used in series since the motors run at 24V

III. ELECTRONICS

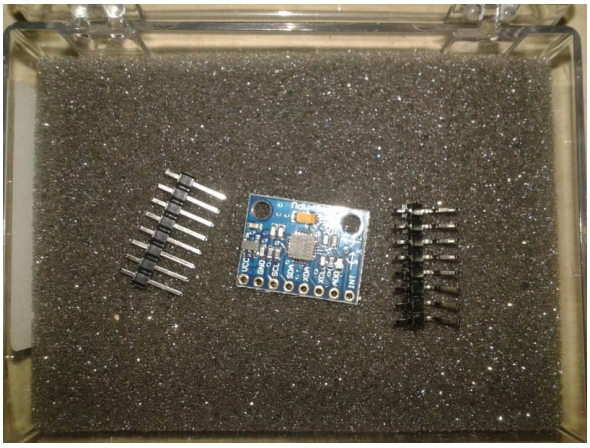
Arduinouno board

All PCBs are custom made, the main board (top left in image above) takes care of the computation, gathers data from sensor such as gyro(ADXRS614), accelerometer(ADXL203) and a trim potentiometer which is modified and positioned in the steering joint to detect in which direction you want to turn. The main processor is an AVR AtMega168. The communication to my laptop is made over Bluetooth using a RN-41 from Roving Networks (the same is used in SparkfunsBlueSMiRF Gold).
The two H-bridges (right-hand side in the image) which convert the control signals from the main board to the power to the motors are designed by friendnamed Benjamin Vedder.

Each H-bridge also have an AtMega328p, the communication between the boards is done via UART, originally I2C was used but due to the high currents produced by the motors too much noise was generated and was influencing the I2C communication. All the electronics run on a separate battery.

sabertooth motor driver

To have easy access for charging the batteries, programming the main board and changing parameters to the control loop a small box with several connectors, a switch to turn on and off the power to the electronics and trim potentiometer is positioned on the top side.



Accelero and gyro sensor

IV. ADVANTAGES AND DISADVANTAGES

1. Become more productive: more work can be done by using the product versus walking

2. Become more recognizable: Riders stand an additional eight inches off the ground, allowing you to be better seen and giving the rider better sight lines, over cars in a parking lot or boxes in a warehouse.
3. low operating costs: no need for gas and inexpensive battery charging (A complete cycle charge will take eight to ten hours)
4. reduce fatigue caused by walking

5. a clean, green, eco-friendly machine! (zero emission)
1. slow, having a max speed of 12.5 mph
2. does not exactly say how far the Segway will go with riders of different masses
3. heavy, weighing around 100lbs
4. unlike bicycles, a drained Segway cannot be pedaled home or a charger
5. expensive, which costs around $3000-$5000.

APPLICATIONS

- The Segway Patroller is being deployed by a growing number of government agencies and military bases in an effort to increase the efficiency and responsiveness of security patrols, flight operations and maintenance crews, IT staff and public service personnel. The application of the Segway Patroller in these environments:Helps staff in various roles to travel throughout large bases and vast facilities quickly

Allows riders to easily travel indoors, outdoors, through doorways and into elevators
Elevates the visibility, responsiveness and productivity of critical staff
• Base Security / Police
• Logistics

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