Robot Erwin Peary

Digital Compass Car

Technology Student Association
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Cornerstone Academy
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Description of Robot Erwin Peary

Digital Compass Car

The Robot Erwin Peary is an autonomous robot that finds north or any other compass direction depending on the program, and then travels forward indefinitely by making course corrections. We named it Robot Erwin Peary in honor of the first person who claimed to reach the North Pole, who was named Robert Erwin Peary. The robot uses a digital compass which outputs active lows that allows the LEDs to light. The PIC microcontroller is programmed to drive servos and to take the input from the digital compass. The PIC microcontroller is tied into the active lows, and depending on which pins are active lows, the program reacts to turn servo motors. We used a bumper and touch sensors to create obstacle avoidance, and when the bumper is hit, the PIC microcontroller reacts and turns the servos backwards, then right, and then forward for two seconds. After that it will continue going north. The servos we use are hacked, or modified so that they will turn endlessly instead of stopping at a certain point.

Parts List

Compass Circuit:

- Dinsmor 1490 Digital Compass Sensor (1)
- Red LEDs (4)
- 78L05 Voltage Regulator
- 560 Ohm Resistors (4)
- 0.1 micro-Farad Capacitor (1)
- 9V Battery (1)
- 10 micro-Farad Capacitor
- SPDT Switch

PIC Microcontroller Circuit:

- 16F84A PIC Microcontroller (1)
- 78L05 Voltage Regulator (1)
- 47K Ohm Pull-Up Resistors (5)
- 1K Ohm Resistor (1)
- 4 MHz Crystal (1)
- 10 micro Farad Capacitor (1)
- 9V Battery (1)
- Futaba S3004 Servos (2)
- SPDT Switch
- 0.1 micro-Farad Capacitor
- Touch Sensor (2)
- Piezo Buzzer (2)

Real Life Applications

One real life application for the Robot Erwin Peary would be to add it to a GPS. We believe that someday cars are going to be hands free, and you will be able to just punch in your destination, and the car will automatically go there. The robot finds and travels north so if you could make it known where everything is, in relation to north, it could go almost anywhere.

There are many applications with this robot that apply to cars, but it also could be used for enjoyment of children. We added an obstacle avoidance feature, and made it go indefinitely forward, so when it hits an obstacle, it would go backwards and go some desired direction away from the obstacle. The children would be able to chase it, or perhaps play with it in other creative ways.

Time Log

Florida TSA

1/11/07
Thursday: 8am-12pm (4 hours) Total: 4 hours
Heartbeat project makes voltage reading based on the heart beat and voltage drops. And increases built circuit and tested the infrared to get a voltage reading. Not enough voltage differential...Need more sensitive infrared LED and Phototransistor.

1/15/07
Monday: 2pm-3pm (1 hour) Total: 5 hours
Built another heartbeat transducer to only find out we need a PNP phototransistor.

1/18/07
Thursday: 8am-1pm (5 hours) Total: 10 hours
We abandoned the heart beat project, and went to a digital compass reader. It turns a robot to face north, even when you set it facing south or any other direction. We built the circuit with LEDs instead of motors. Began learning PIC Basic, a programming language.

1/22/07
Monday: 2pm-3pm (1 hour) Total: 11 hours
We learned to program inputs with PIC Basic.

1/25/07
Thursday: 8am-1pm (5 hours) Total: 16 hours
Learned some servo PIC Basic commands. Built and wrote servo program for compass robot. Did not work, we are confused, and troubleshot with the circuit for about 2 hours.

2/1/07
Thursday: 8am-12pm (4 hours) Total: 20 hours
Learned about active highs and active lows, got the electrical servo circuit to work
and learned more PIC Basic.

2/8/07
Thursday: 8am-12pm (4 hours) Total: 24 hours
Continued working on the program and circuit.

2/15/07
Thursday: 8am-12pm (4 hours) Total: 28 hours
Finally got the circuit and program to work, designed the layout for the car.

3/1/07
Thursday: 8am-2:30pm (6 and ½ hours) Total: 34 ½ hours
Changed the design for the layout of the car, started building it. Figured out that
The circuit needs two batteries, one for the compass circuit and one for the microcontroller circuit and one common ground.

3/9/07
Friday: 2pm-5pm (3 hours) Total: 37 ½ hours
Built the car body, got everything but the wheels mounted

3/12/07
Monday: 2pm-3pm (1 hour) Total: 38 ½ hours
We worked on the wheels, and almost finished one.

3/15/07
Thursday: 8am-2pm (6 hours) Total: 44 ½ hours
Finished robot, wheels and circuit, and PIC program

3/19/07
Monday: 2pm-3pm (1 hour) Total: 45 ½ hours
Worked on the schematic

3/22/07
Thursday: 8am-2pm (6 hours) Total: 51 ½ hours
We made the schematic with Eagle Layout Editor. We worked on our poster board.

3/26/07
Monday: 2pm-3pm (1 hour) Total:52 ½ hours
Worked on documentation, and the poster board

3/29/07
Thursday: 8am-2pm (6 hours) Total: 58 ½ hours
Worked on poster board, report, and documentation

4/11/07
Wednesday: 8am-1pm (5 hours) Total: 63 ½ hours
Worked on documentation, and decided on the title, the Robot Erwin Peary.

4/12/07
Thursday:8am-2pm(6 hours) Total: 69 ½ hours
Final editing of Florida TSA notebook.

National TSA

Thursday April, 26
8am-12pm (4 hours) Total: 4 hours
John: Research on telemetry and the hand held design.
David: Programming the LCD screen.

Monday April, 30
8am-3pm (7 hours) Total: 11 hours
John: more research on hand held device. Hand held device failed due to having to learn C. Finished design of robot including LCD screen and body. Worked on front bumper.
David: finished LCD programming. Worked on servo holders.

Monday May, 7
8am-3pm (7 hours) Total: 18 hours
John: finished front bumper. Worked on battery holders.
David: finished servo hold. Worked on mounting on robot.

Thursday May, 10
8am-2pm (6 hours) Total: 24 hours
John: tested bumper and redesign.
David: programming.

Monday May, 14
8am-2pm (6 hours) Total: 30 hours
John: worked on bumper.
David: programming.

Thursday May, 17
8am-2pm (6 hours) Total: 36
John: finished on bumper.
David: worked on programming. We tried to use one chip for both the LCD, beeping, and servos.

Thursday May, 24
8am-2pm (6 hours) Total: 42 hours

John: finished circuit.

David: worked on programming and breadboarding the one chip circuit. For some reason, the chip could not get enough power to the servos. We went back to the two chip design.

Tuesday May, 29
8am-3pm (7 hours) Total: 49 hours

David: worked on programming the servo chip, to get it doing what it has always done.

Thursday May, 31
8am-2pm (6 hours) Total: 55 hours

John: made different circuit.

David: programming, breadboarding. We had the touch sensors working and the beeping also working. The bumper is done. We are now trying to get the LCD program and circuit working.

Monday June, 4
8am-2pm (6 hours) Total: 61 hours

John: worked on circuit.

David: finished circuit and program.

Note: Abandoned LCD program due to time.

Thursday June, 7
8am-2pm (6 hours) Total: 67 hours

John: worked on report and board

David: worked on report and board

Monday June, 11
8am-4pm (8 hours) Total: 75 hours

John: Documentation

David: Documentation

Tuesday June, 12
9:30am-4pm (6 ½ hours) Total: 81 ½ hours

John: new bumper

David: Documentation, poster board, and the report. Also wrote and tested a new program that would make the robot go south and then west

Grand Total: 151 hours

Team Member Contributions

John Marchand

- Body design and assembly
- Made one battery holder
- Mounted a wheel to a hacked servo
- Documentation
- Wired up the final circuit
- Poster board layout
- Bumper design and assembly

David Spencer

- Wrote and tested *North* program
- Wrote and tested *South* program
- Made one battery holder
- Mounted a wheel to a hacked servo
- Poster board layout
- Servo mounts
- Body design and assembly
- Troubleshot the circuit

References and Resources

1. Web Pages
    - Imagesco.com - Pin configuration for the digital compass
    - Cornerstonerobotics.org – example servo programs

2. Books
    - Robots, Androids, and Animatrons
      John Iovine, 2002
    - PicBasic Pro Compiler
      microEngineering Labs, Inc., 2003
    - Robot Building for Beginners
      David Cook, 2002