Electromagnetic Braking System

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Outline

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- Design Alternatives
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Executive Summary

- Objective: Design an electromagnetic braking system
  - Replacing the conventional braking system
  - Less cost with greater performance
  - No need for maintenance and/or replacement
- Research: Other types of electromagnetic braking system
  - Electromagnetic braking system with brake pads
  - Eddy-current braking system

Product Requirements

- Overall
  - Power supply to power the system
  - Hub and spindle assembly to simulate the actual spinning of the rotor
  - Custom made rotor with metal arranged for the most effective result
  - Brake pedal to simulate the real environment
  - Three electromagnets to generate braking force

Product Requirements (cont'd)

- Hardware and Software
  - 8051 microcontroller
    - Reading the braking level from pedal
    - Varying the braking force through duty cycle
  - Custom built circuit board
    - Regulating input voltage
    - Powering up the 8051 µC
    - Amplifying the output voltage to electromagnets

Design Alternatives

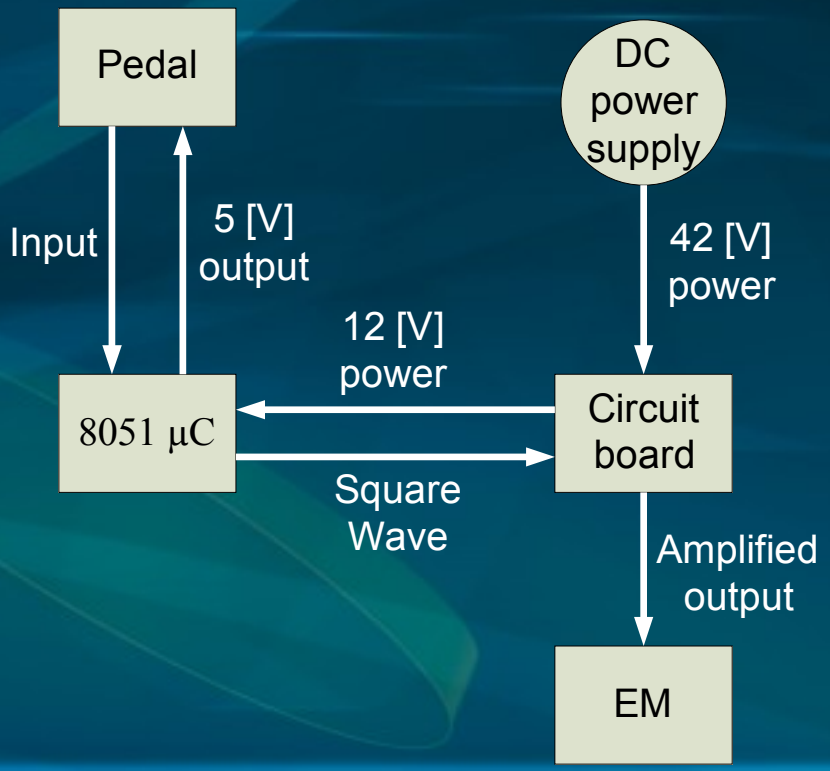
- Permanent magnets mounted on the wheel
  - Cleaning issue
  - Magnet arrangement issue
  - Electromagnetic field around other mechanical components issue
- Metallic material region all around the wheel
  - Electromagnetic field dispersion issue
  - Not enough braking force

Design Specifications

- Mini-Max 51-C2 8051 Microcontroller
- 2001 Toyota Corolla hub and spindle assembly
- Three GP-2030/24VDC electromagnets
- MC2 Microcon pedals

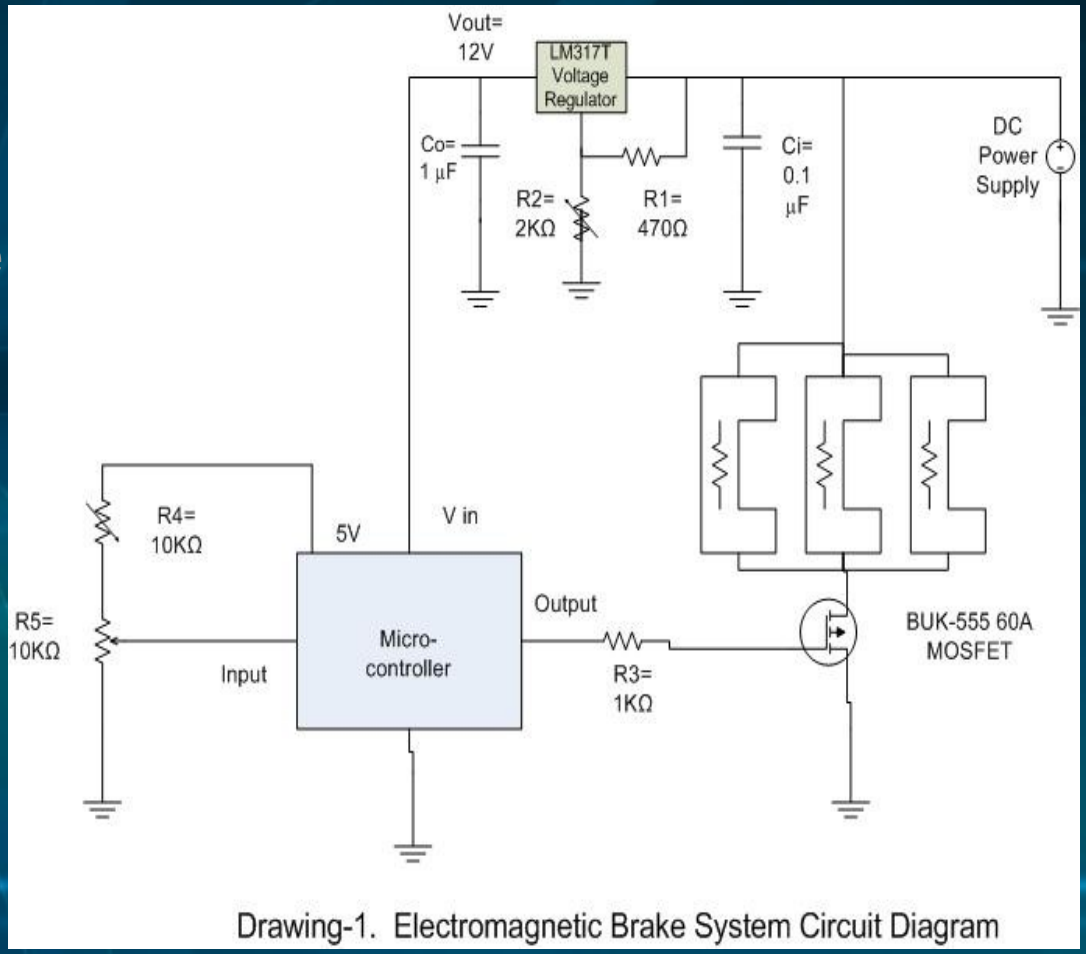
Design Specifications (cont'd)

- General view
  - Pedal
  - 8015 Microcontroller
  - Circuit board
  - Electromagnets
  - DC power supply



Design Description

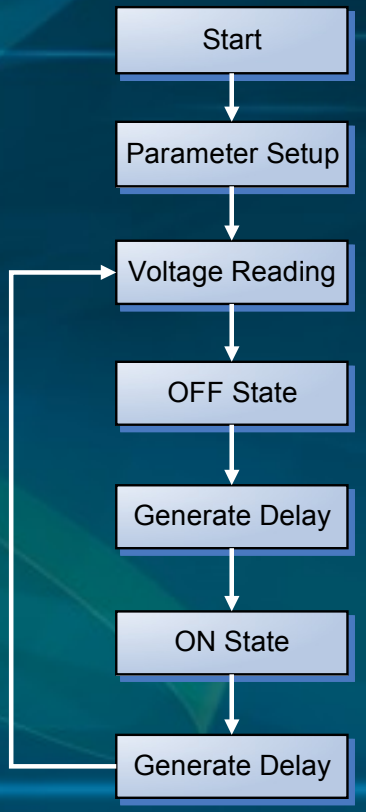
- Circuit board
  - LM317T voltage regulator to regulate input voltage
  - BUK-555 60A MOSFET as a switch



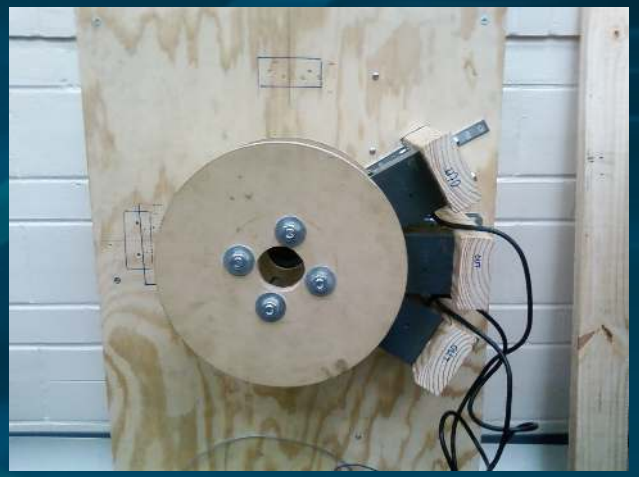
Drawing-1. Electromagnetic Brake System Circuit Diagram

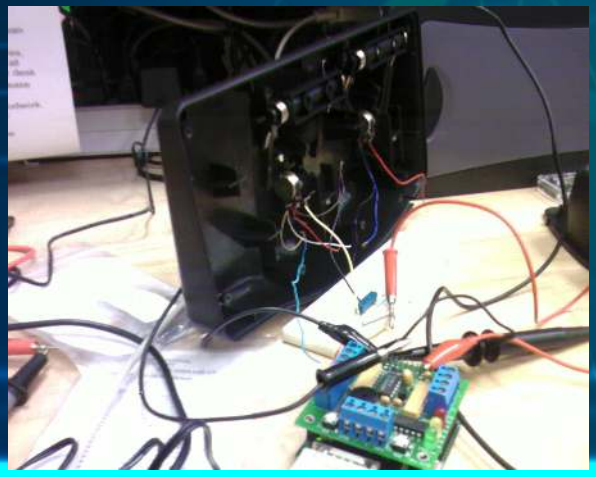
Design Description

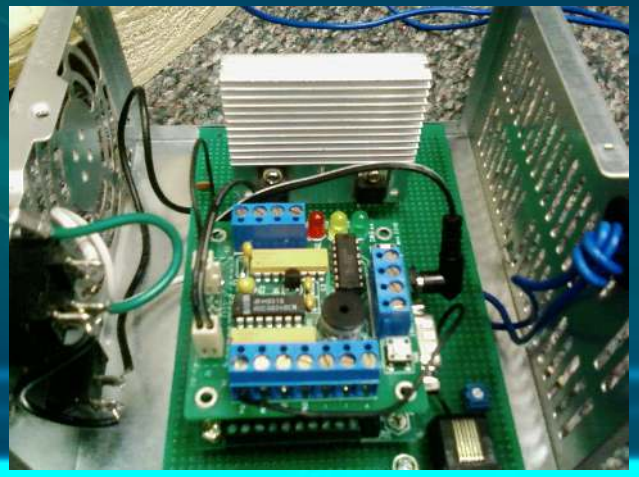
- Programming
  - Voltage reading by ADC
  - ADC by convert() function
  - ON and OFF state by setbit() and clrbit()
  - Generate delay by generate_delay() function



Construction Details

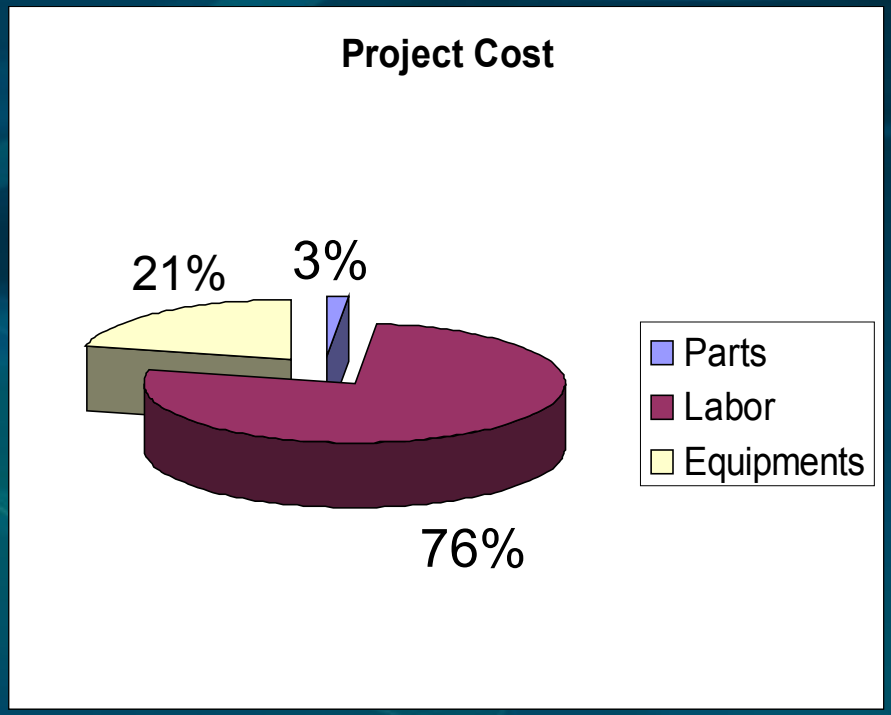






Costs

Category	Cost
Parts	$ 627.35
Labor	$15,000.00
Equipments	$ 4,183.43
Total	$19,810.78



Conclusions

- Project was completed on schedule and within budget thanks to donations
- Supplier issues caused the purchase of weaker magnets than intended for design
- Good results with current design, a larger budget would improve performance
- The project proves the theory and shows the potential for a full functional system

Questions & Comments