Assisted-Balance Bicycle

A universal addition to bicycles to help assist a rider with balancing

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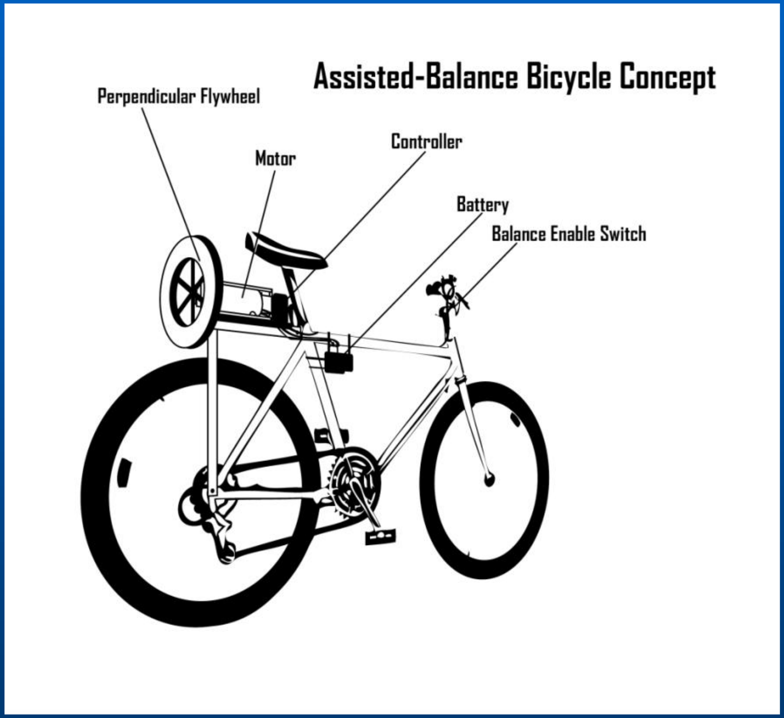
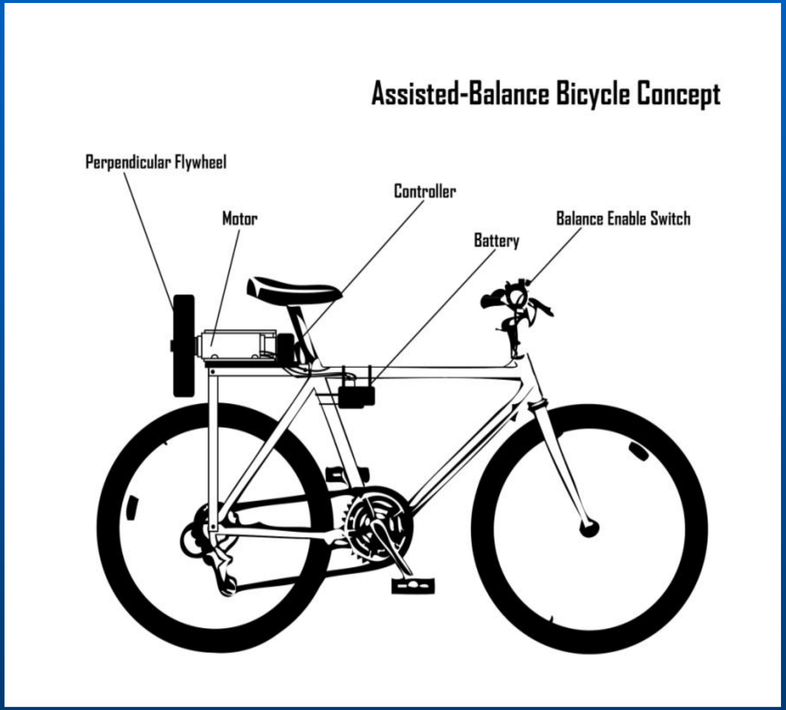
2D Prototype Model

	
Rear-Angle View	Side View

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Project Goals

- Balance an unmanned stationary bicycle
- Assist in balancing a manned bicycle
- Function for minimum of 20 min/charge
- Universal mounting
- Able to turn balancing system on/off during bicycle usage

Applications

- Children's bicycle – after training wheels
- Assist the elderly in riding
- Safer physical therapy for people who have had catastrophic injuries

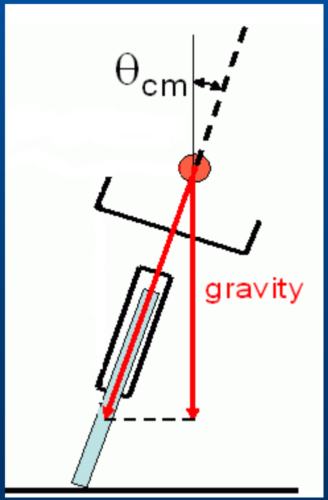
The Challenge

- Mechanical Aspects of flywheel/motors
- Real-time balancing control system
- Universal mounting scheme
- Lightweight design
- Power system design

Mechanical Aspects

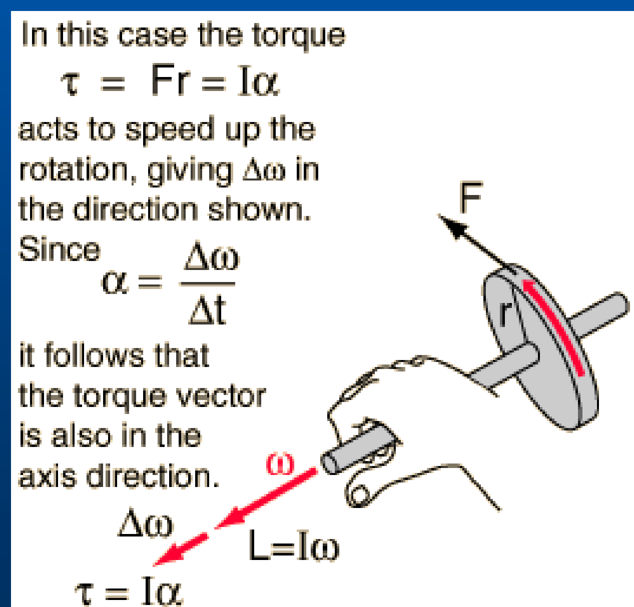
- A center of mass must be found for the entire bike
- The bike can then be modeled as a force acting on

  the center of mass



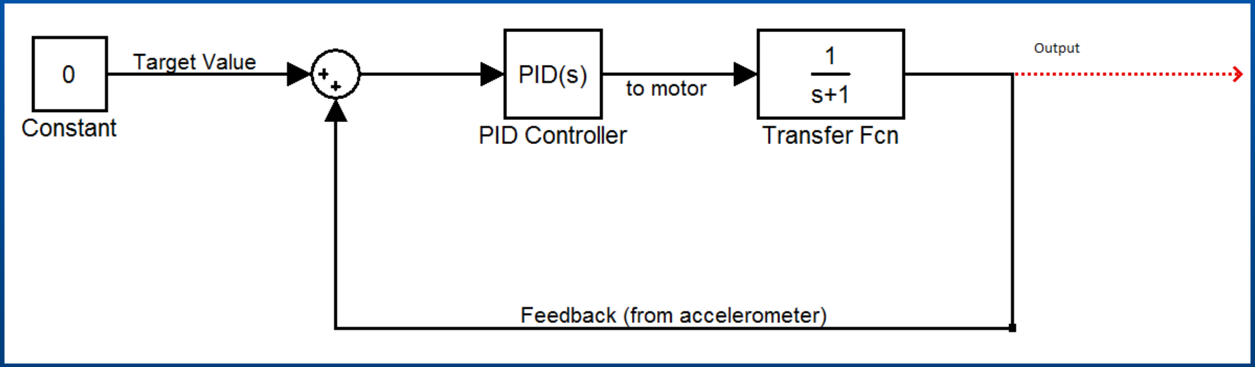
Mechanical Aspects

- Once the torque for the falling bike is known, that force can then be compensated for by accelerating the flywheel



Control System

- PID Controller
- Feedback from accelerometer



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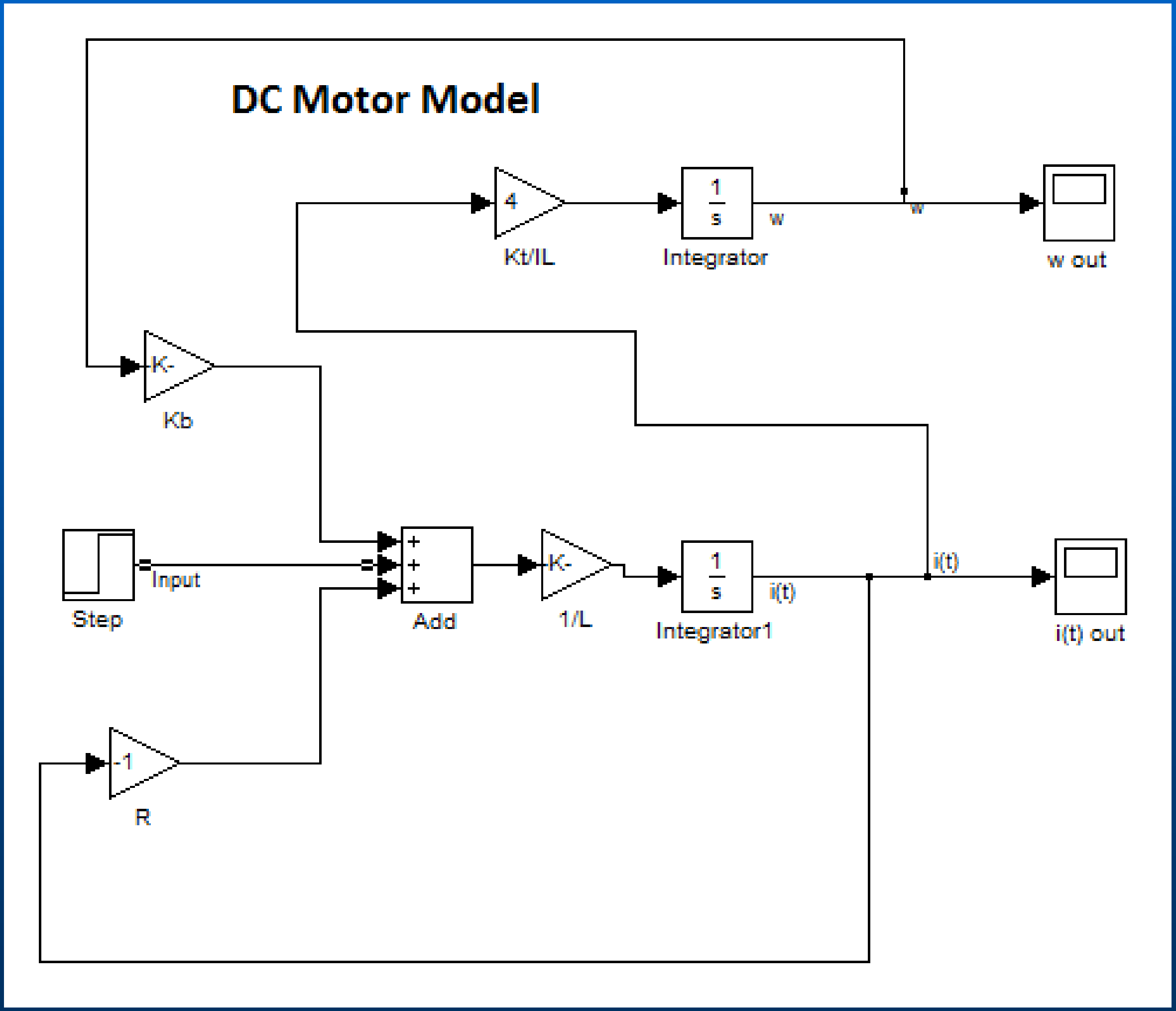
Control System

- Model the motor (plant) using differential equations:

$$\frac{d\omega(t)}{dt} = \frac{K_T}{I_L} i(t) \qquad \frac{di(t)}{dt} = \frac{1}{L}\left[V_s - Ri(t) - K_b\omega(t)\right]$$

- KT, IL, R, L, and Kb are parameters of the motor

Control System



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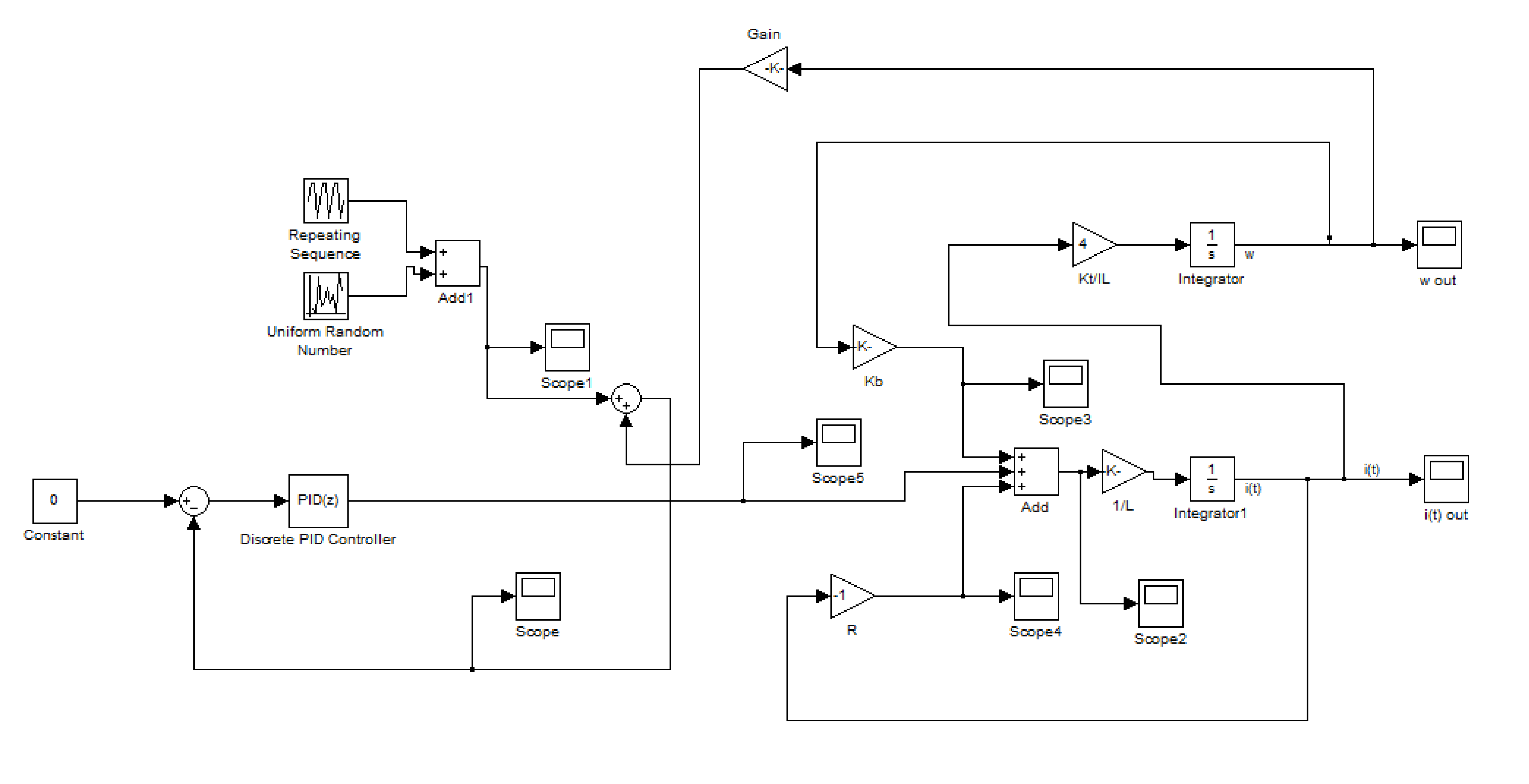
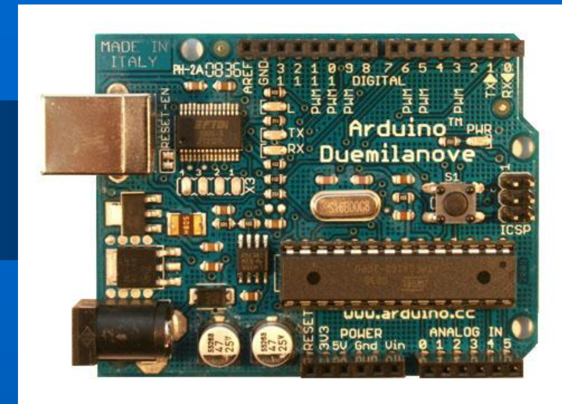
Integrated Control System



Demonstration

Hardware

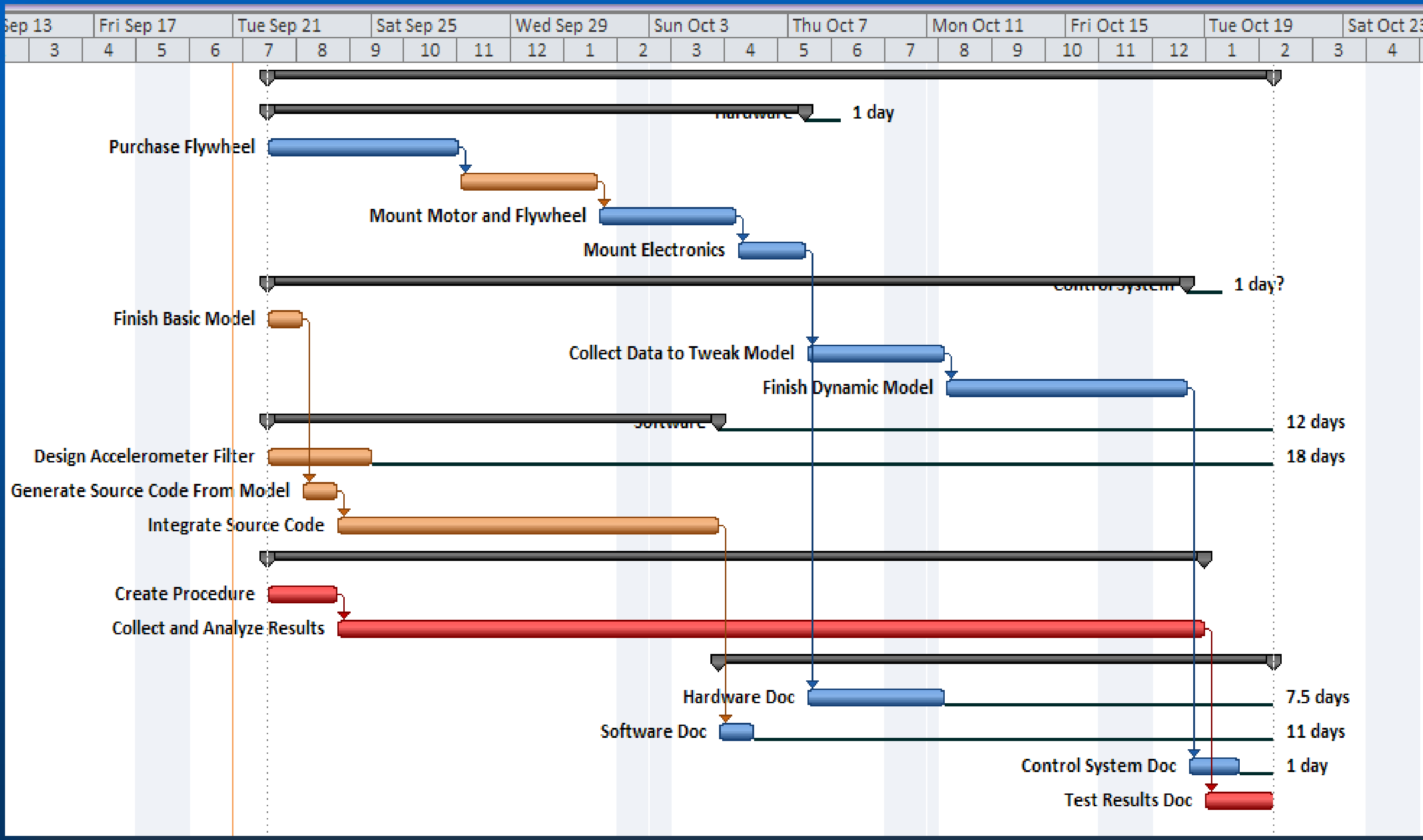


- Hardware List
  - Arduino Duemilanove Microcontroller
  - Memsic 2125 Dual Axis Accelerometer
  - Bosch Cordless Drill Motor/Batteries/Charger
  - Bike
  - Mounting Hardware
  - Flywheel

Duration and Cost

- Design/Build time: 1 Semester
- Estimated total cost for prototype: $461.47
  - Motor/Batteries/Charger: $153.49
  - Flywheel and shaft: $50
  - Mounting Hardware: $45
  - Accelerometer: $32.99
  - Microcontroller: $29.99
  - Developmental expenses: $100
  - Bicycle: $50

Timeline



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Questions?