Robotics Study Session Notes

* Tasks that robots perform:
  + Automated tasks
  + Precise tasks
  + Consistency/repetition
  + When it’s cheaper than human labor
  + Dangerous situations
* Ethical issues
  + Replacing human jobs
  + Robots don’t have emotion/always do what they’re told, no matter what
  + AI stealing work from people
* Lego Sensors
  + Gyro
  + Ultrasonic
  + Light/color
  + Touch
  + Motors
* Simple Machines
  + Screw
  + Inclined Plane
  + Pulleys
  + Wedge
  + Wheel and axel
  + Gears
  + Lever
* Mechanical Advantage
  + MA = F out/F in
    - MA: Mechanical Advantage
    - F out: Force Out
    - F in: Force In
  + W = F \* D
    - W: Work
    - F: Force
    - D: Distance
  + D in = MA \* D out
    - D = Distance
* Kinetic Vs Potential Energy
  + Potential is stored energy/potential to move
  + Kinetic is energy in motion/is moving
* Fundamental vs Derived Units
  + Fundamental units represent a fundamental physical property
  + Derived represent multiple properties
  + Fundamental Units:
    - Distance
    - Time
    - Mass
    - Electrical Charge
  + All other units are derived units
* Principals of designing a catapult
  + Good Foundation
  + Placement of fulcrum/rubber band
  + Keep the direction of the force at 90 degrees
  + Launch Angle 45 degrees
* Computer Security
  + Worm is a type of virus that tries to infect every computer it can
  + Trojan Horse is a virus in disguise
  + Viruses Spread themselves from computer to computer
* Programming Flow Charts
  + Oval = Start/End
  + Rectangle = Process
  + Diamond = condition
  + Rhombus = Input
  + Data = Round Rectangle
* Processing
  + Multiple Processors allow for multiple tasks to be executed from the queue at once
  + This way you can have multiple queues of tasks and can multitask much easier
* Sensors
  + Errors
    - Human
    - Systematic – Accuracy errors
    - Random – Precision errors
  + Precision vs Accuracy
    - Precise is consistency, but less accurate. Generally, it needs to be rebuilt
    - Accuracy is close to the target, but less consistent. Can be fixed with calibration
  + Parts of a sensor
    - Transducer – turns input to electrical signal
    - Signal Conditioner – processes the electrical signal into digital data
    - Display – Shows an output
  + Digital and Analog conversion
    - Takes an analog input and converts it to digital
  + Types of sensors
    - Thermocouple - measures temperature
    - Sound
    - Touch
    - Ultrasound - Distance
    - Photodiode – light sensor
* Actuators
  + Types of gears
    - Worm
    - Standard
    - Chain Drive
  + Efficiency
    - E = P out / P in
      * E = Efficiency
      * P = Power
    - The output will almost always be smaller than the input
  + Hydraulics
    - P = F in / A in = F out / A out
      * P = Pressure
      * F = Force
      * A = Area
    - Pressure is transferred through the entirety of the fluid
  + Electromagnets and Motors
    - A motor works the same way as a generator, but in reverse
    - The motor takes electrical energy and turns it into physical force
    - Generator takes physical force and turns it into electrical energy
    - Servo Motors are very precise
  + Internal combustion
    - Gasoline motors use a spark plug to ignite the fuel
    - A diesel motor ignites the fuel with compression
* Feedback loops
* Two Position control
  + A switch with 2 positions, such as on and off
  + A deadband gives a range that the switch doesn’t activate, so it doesn’t constantly turn on and off again
* Proportional Control
  + The response is proportional to the input
  + An example would be a steering wheel, where the amount the car turns increases based off how much you turn the wheel