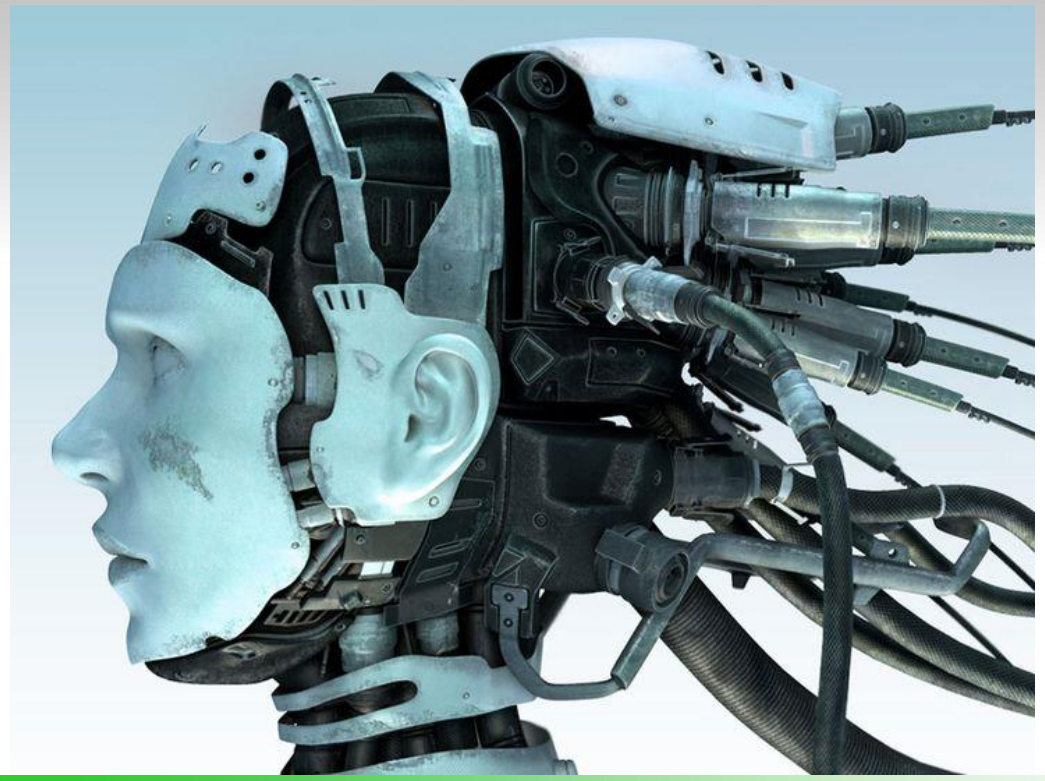
MECHATRONICS: RUBE GOLDBERG WORKSHOP



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WHO IS MR. BURNHAM?

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HELLO....

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CLEARS THROAT....

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MR. BURNHAM IN 60 SECONDS....

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I WAS BORN IN LOS ANGELES CALIFORNIA

http://www.kaiserpermanentehistory.org/wp-content/uploads/2011/10/sunset.jpg

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When I was 6 months old we moved to Bogotá Colombia

- My Dad worked for the Accounting Firm Ernst and Young

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WHEN I WAS JUST TURNING 5 YEARS OLD WE MOVED TO BRUSSELS BELGIUM

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When I was just turning 12 years old we moved to Cleveland Ohio

- Where I vividly remember staying up for 2 Lunar Eclipses
- And meeting John Glenn

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Then at 16 my dad changed jobs…

- Bank in London?
- Bank in San Francisco?
- Bartlesville Oklahoma?

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HE PICKED OKLAHOMA...

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THEN LIFE SPED UP…

- Year of College @ BYU
- 2 Years in Chile
- Semester at OSU
- Married High School Sweetheart
- 4 more Years @ BYU for an Electronics Engineering Technology BS

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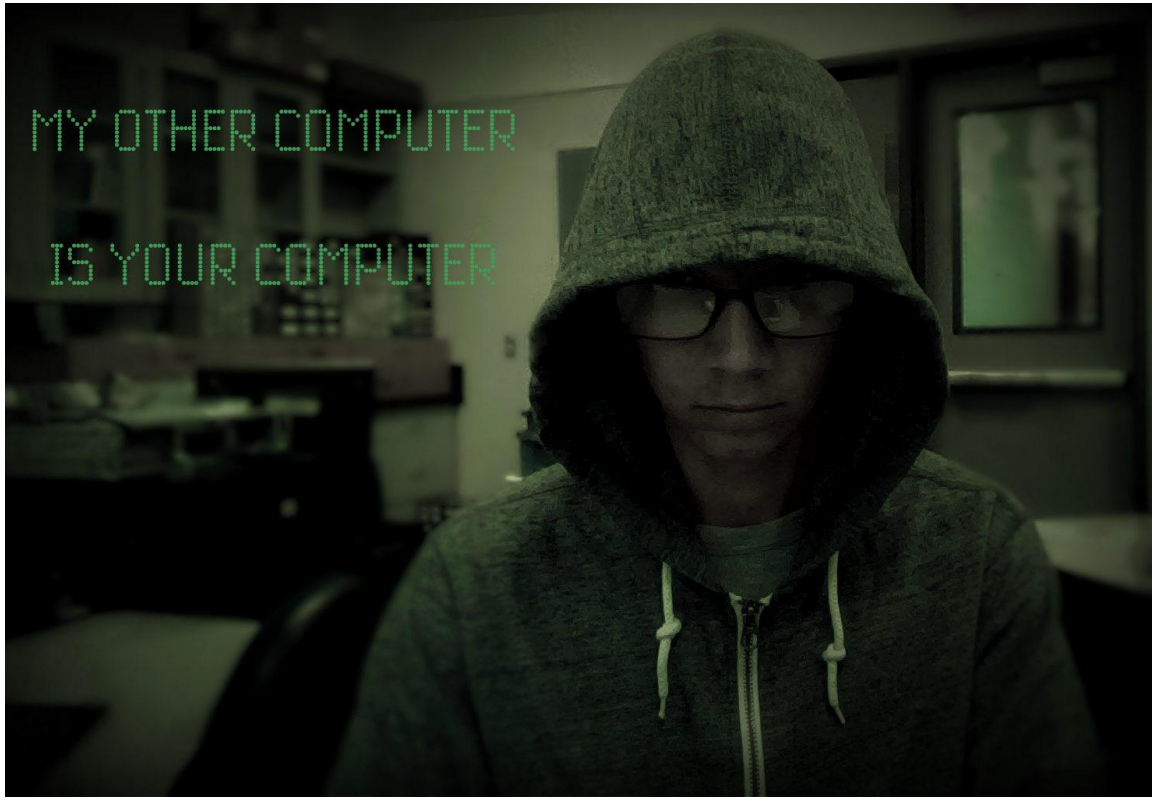
Life as an Engineer…

- Summer Internship, with Beehive Telephone in Wendover Nevada
- Then Amdahl in Sunnyvale CA
- Then for the last 20+ years I worked for Xilinx in San Jose CA
- Last Year I taught Cybersecurity…



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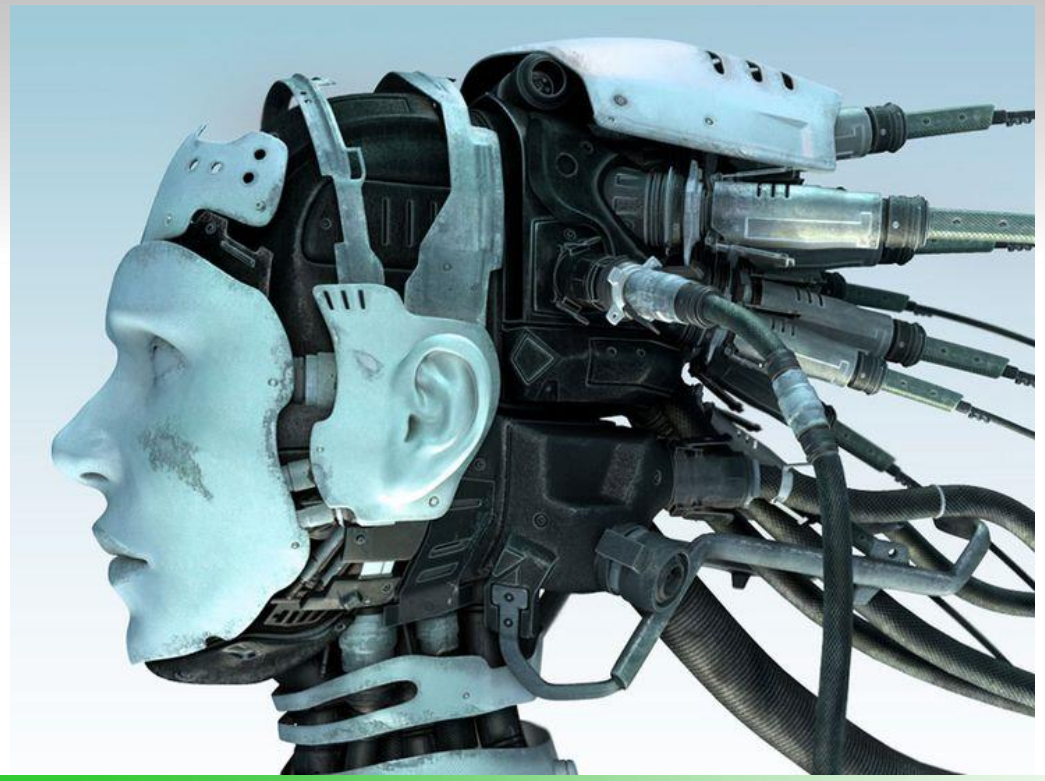
AND NOW I'M A MECHATRONICS INSTRUCTOR AT SILICON VALLEY CTE



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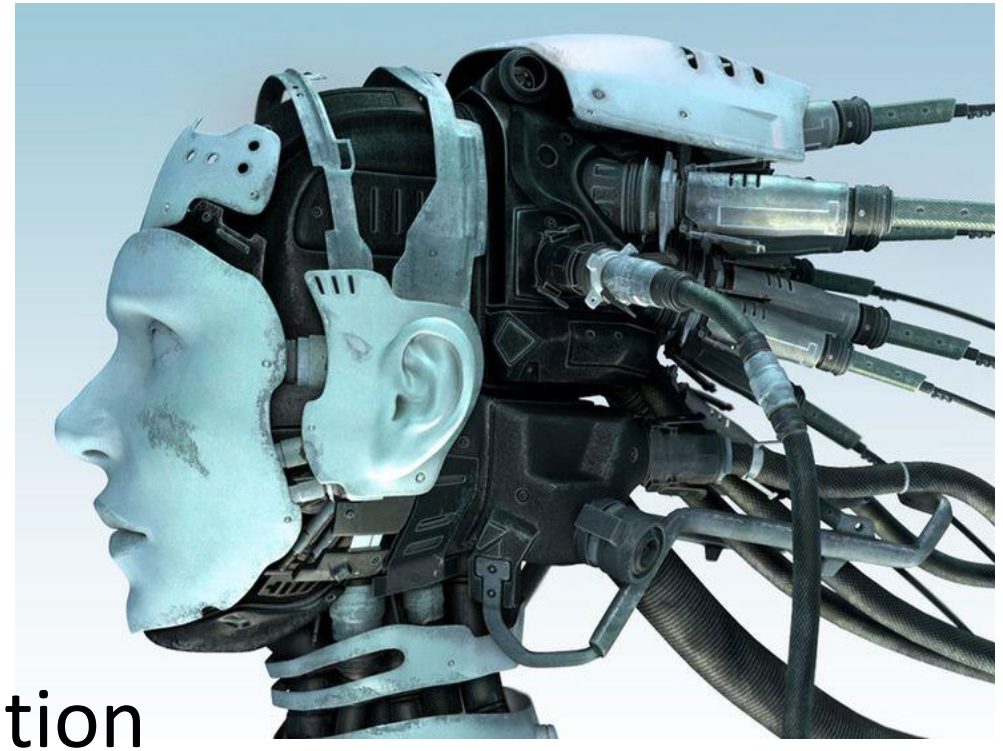
MECHATRONICS - WHAT WILL YOU LEARN?

- Hands on Physics <-- this is planned to be interleaved as part of the other modules, but to satisfy the A-G "D" Science requirement
- AC/DC Electronic Fundamentals
- Digital Electronic Fundamentals
- Programing with Microcontrollers
- Mechanical 3D Design & Printing
- Pneumatic Systems
- Programmable Logic Controllers
- Industrial Robotic Theory & Application



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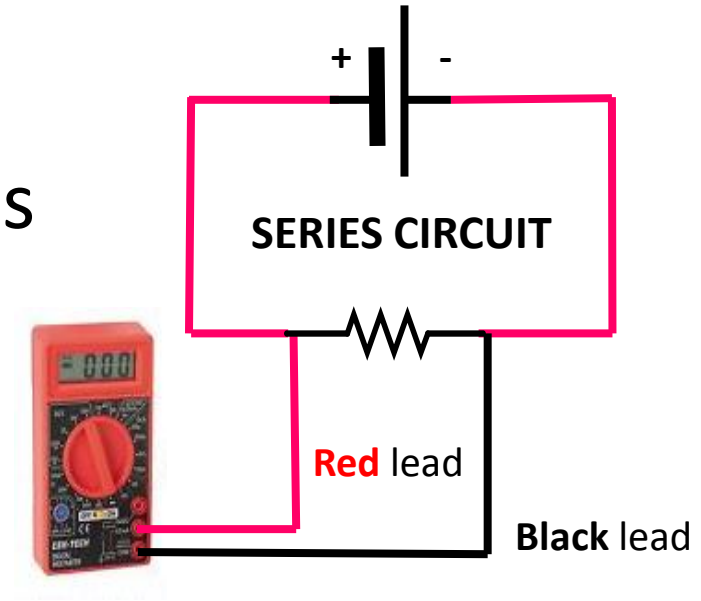
MECHATRONICS - WHAT WILL YOU LEARN?

- Introduction to DC /AC & Digital Electronic Circuits
  - Ohms Law
  - Serial and Parallel Circuits
  - Digital Logic
- Programming with Microcontrollers
  - Arduino & Raspberry Pi
  - Learn Linux Command Line
- Programming in C++ & Python
  - CPA Programming Essentials In C++
  - Learn Python




```
class GameOverScene : public cocos2d::CCScene {

public:
    GameOverScene():_layer(NULL) {};
    ~GameOverScene();
    bool init();

    //SCENE_NODE_FUNC(GameOverScene);

    static GameOverScene* node()
    {
        GameOverScene *pRet = new GameOverScene();

        //Error: undefined reference to `GameOverScene::init()'
        if (pRet && pRet->init())
        {
            pRet->autorelease();
            return pRet;
        }
        else
        {
            //Error: undefined reference to `vtable for GameOverScene'
            delete pRet;

            pRet = NULL;
            return NULL;
        }
    };

    CC_SYNTHESIZE_READONLY(GameOverLayer*, _layer, Layer);
};
```

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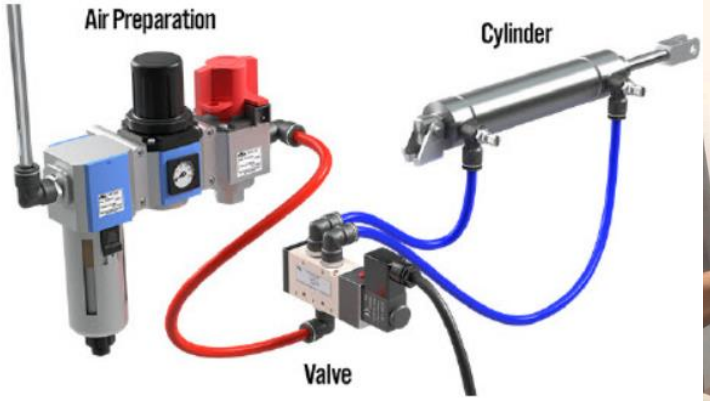
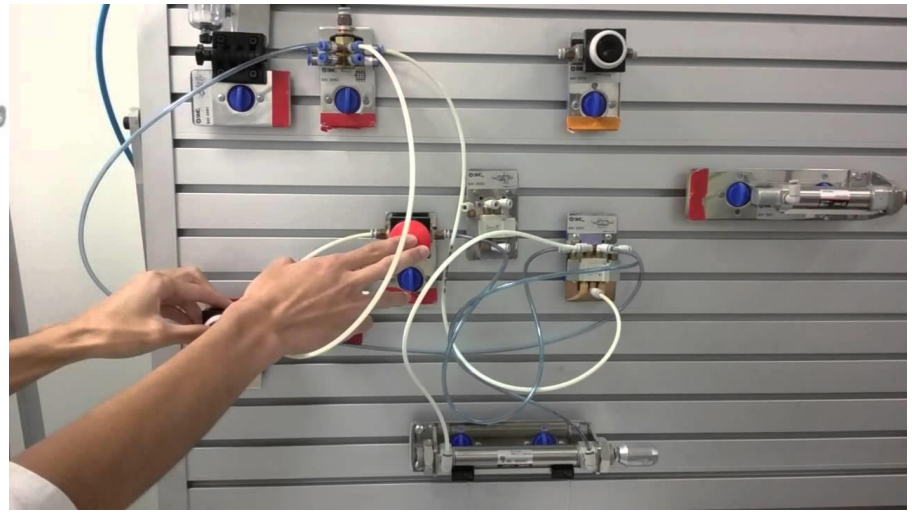
MECHATRONICS - WHAT WILL YOU LEARN?

- Mechanical 3D Design & Printing
  - 3D Design
  - Mechanical Interaction

- Pneumatic Systems





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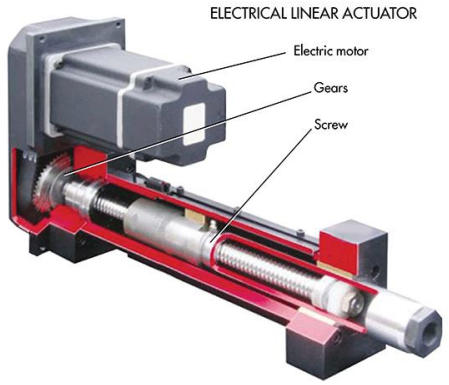
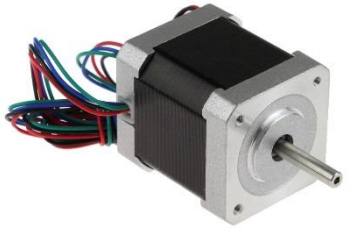
MECHATRONICS - WHAT WILL YOU LEARN?

- Programmable Logic Controllers
  - Ladder Logic
  - PLC Programming & Control
- Industrial Robotic Theory & Application
  - FANUC LR-MATE Robot
  - Stepper, Servo & DC Motors
  - Linear Actuators





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WE ARE ALL ABOUT "HANDS ON" & PROJECT BASED LEARNING

Project Examples

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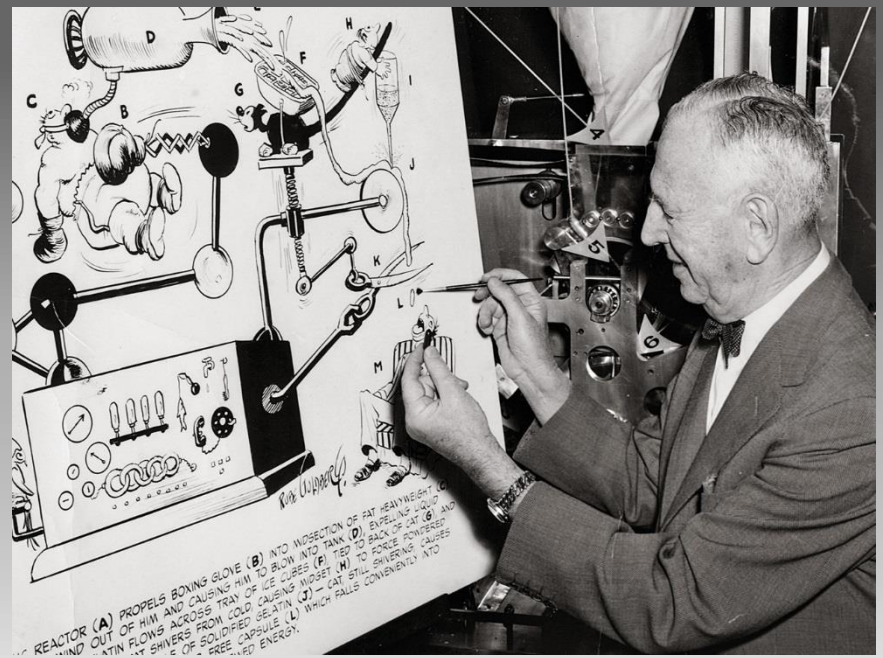

http://cbsnews1.cbsistatic.com/hub/i/2014/01/24/921e8beb-d03f-42a5-9ff2-feac76a8dbc7/Art%20of%20Rube%20Goldberg_20a.jpg

ARDUINO RUBE-GOLDBERG

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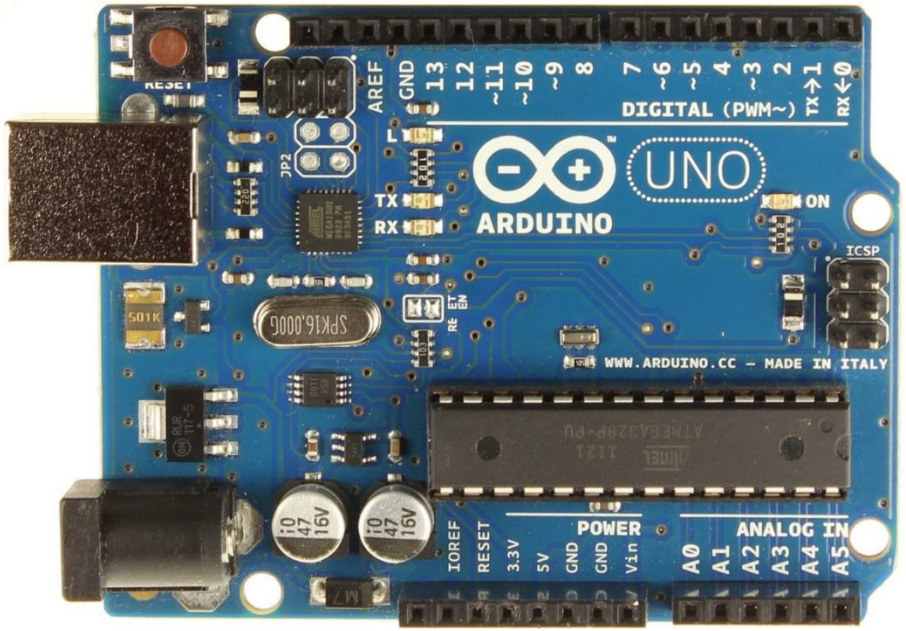
Learning C++ Using the Arduino

- Arduino Is An Open-source Electronics Platform
  - With easy to use hardware & software.
  - Intended for anyone making interactive projects
- Arduino Can Sense & Control It's Environment
  - Receiving information from sensors on input pins
  - Affecting it's surroundings by controlling lights, motors, actuators, etc on output pins
- You Tell Your Arduino What To Do
  - Writing code in the Arduino programming language
  - Using the Arduino development environment



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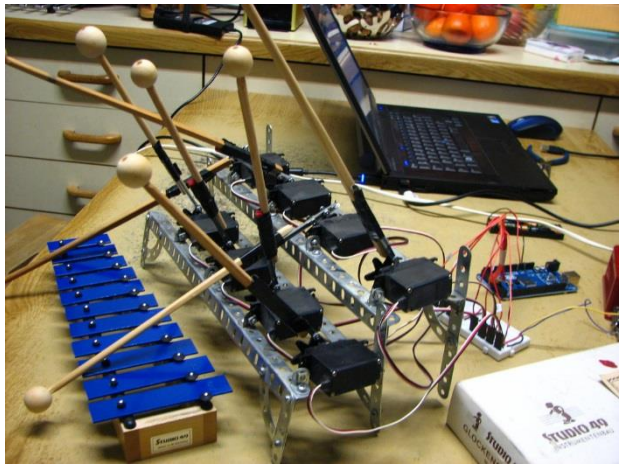
ARDUINO RUBE GOLDBERG

- Control with an Arduino
- Use 1 or more mechanical devices, like motor, solenoid or servo
- Use 1 or more sensors, like a switch, PIR, motion sensor, IR, magnet, etc…
- Make Stuff Move…

https://www.pinterest.com/explore/rube-goldberg/?lp=true



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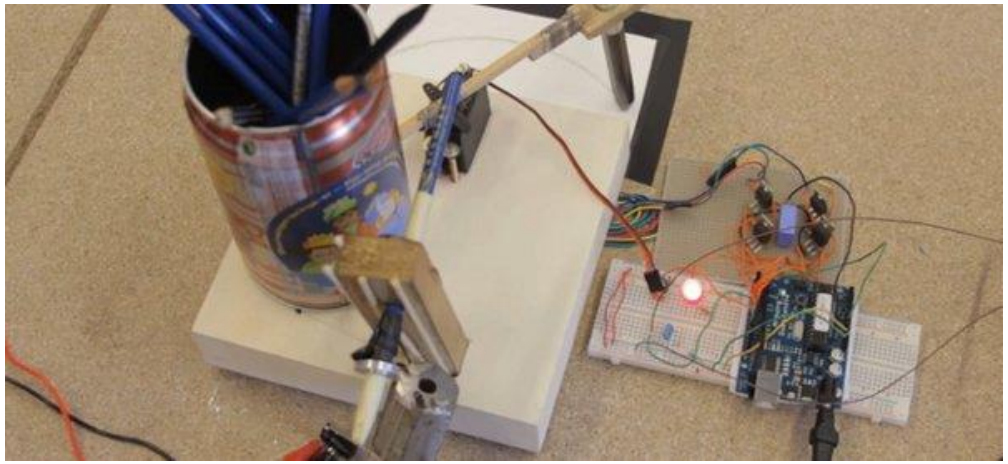

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RUBE GOLDBERG – STUDENT DELIVERABLES

- Completed section in Rube Goldberg “chain of events”
- Collaborate & Negotiate with teams before & ahead in the “chain”
- Development Log Book
  - Design process
  - What worked? / Didn’t work? / How you Solved it?
- Source code for
  - Any webserver, scripts, apps, exe that are needed to run their “section” of the chain of Rube Goldberg events
- Teaching Presentation
  - Team presentation to show how their section worked & interacted with others

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MEET MY STUDENTS…

- They come from all over San Jose and Silicon Valley
- Some know they are going to College right after High School
- Many are the first in their family to consider College
- About ½ don't know what the future is after High School
- A few tentatively asked, "Will there be a lot of MATH?"

But they decided to take a chance on Me and my Mechatronics class

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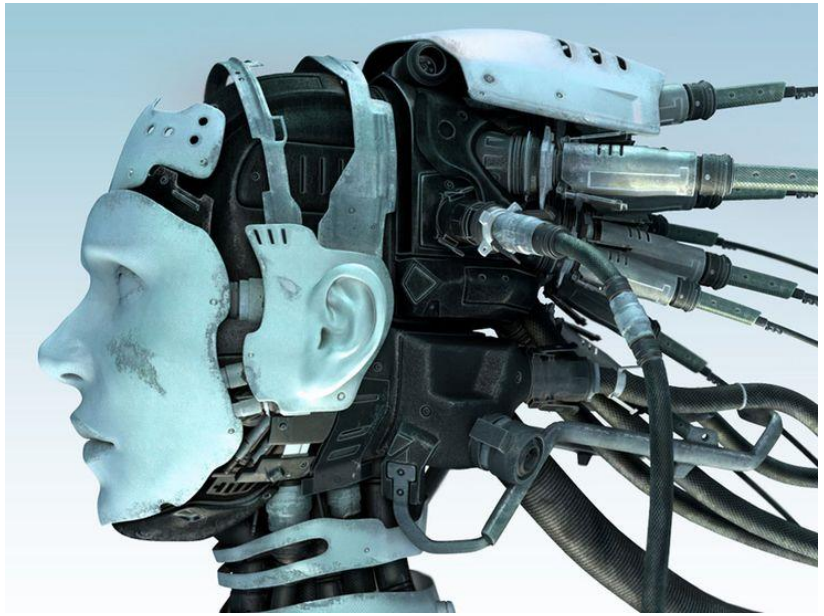
MY HOPE FOR THEM…

- Expose them to Hands on Engineering
  - Electronics and Programming
  - Fanuc Robot Tool Handling Certification
  - Exposure and Training with Programmable Logic Controllers and Industrial Automation
  - Prep them for a CPA C++ Certification
- Strong Pathway to College Engineering
  - Electrical Engineering
  - Mechanical Engineering
  - Mechatronics Engineering
  - Computer Science



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