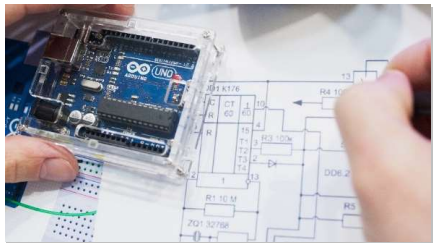


COMPLETE

pathways to engineering technology employment

Kickoff Workshop 7/30/19

LOUISIANA DELTA COMMUNITY COLLEGE

NSF

LOUISIANA DELTA
COMMUNITY COLLEGE

DISCLAIMER & USAGE

- This material is based upon work supported by the National Science Foundation's Advanced Technological Education Program under Grant No. 1801177.
- Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Welcome!

Ice Breaker

Grant & Instrumentation Overview

Why are you here??

- Someone at your school sees value in providing students with career pathways in instrumentation/controls.
- That person nominated you!
- Sparksters are most likely to teach electricity.
- Connectors are most likely to help students find a career fit.
- Full course vs. partial implementation

What is instrumentation?

Measures a physical characteristic like temperature

Controlling the characteristic using a setpoint

Instrumentation + Control = Automation

Complete system with no* human interaction

Take 5!

More examples of automation in your home or everyday life?

Workforce History

The Four Industrial Revolutions

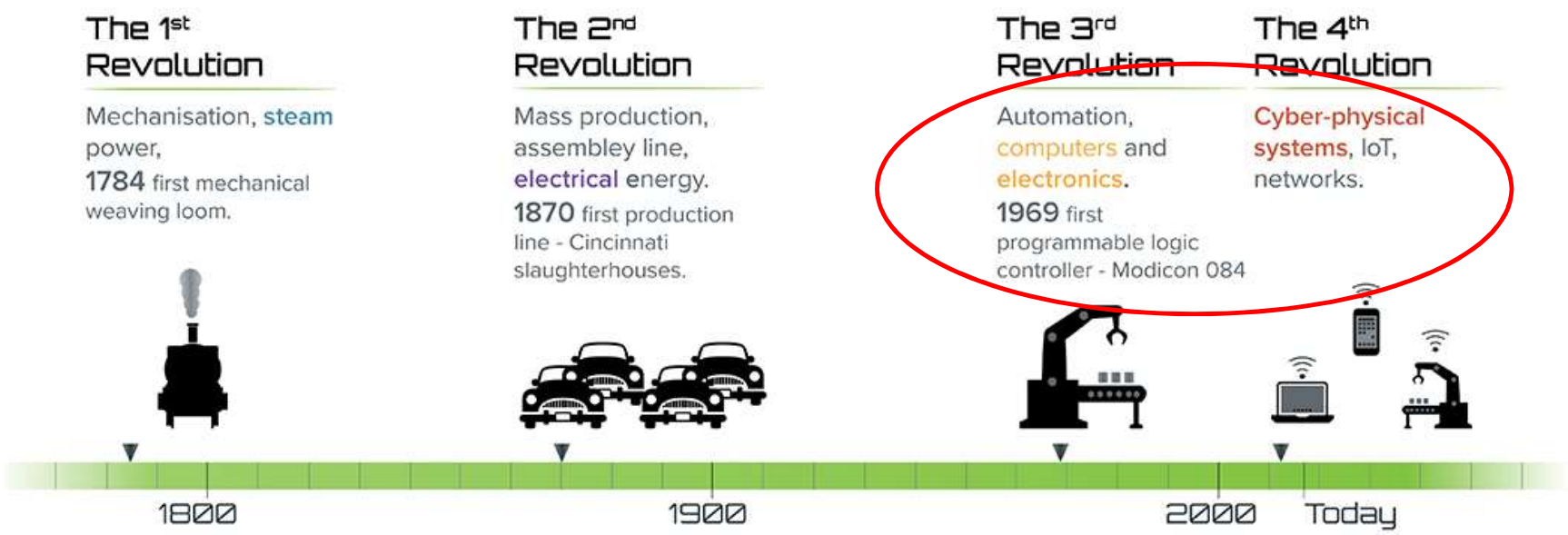
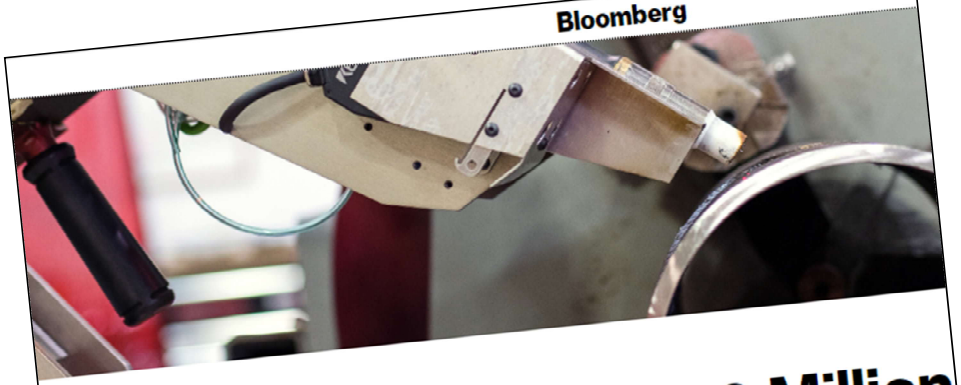


Image from: www.betasolutions.co.nz

https://www.bloomberg.com/news/videos/2019-04-25/automation-could-wipe-out-half-of-all-jobs-oecd-warns-video

Bloomberg



Economics

Robots May Displace 20 Million Manufacturing Jobs by 2030

By Catherine Bosley
June 25, 2019, 6:00 PM CDT

- Lower-income areas in developed nations are most at risk
- Services jobs for displaced workers are also being taken over

LISTEN TO ARTICLE

▶ 2:27

Robots are on track to wipe out almost a tenth of the world's manufacturing jobs with the brunt borne by lower-income areas in developed nations, Oxford Economics says.

Forbes

Billionaires Innovation Leadership Money Consumer Industry Life

28,215 views | Sep 18, 2018, 08:05am

Artificial Intelligence To Create 58 Million New Jobs By 2022, Says Report

Amit Chowdhry Contributor
Consumer Tech
Tech enthusiast, born in Ann Arbor and educated at Michigan State

Machines and algorithms in the workplace are expected to create 133 million new roles, but cause 75 million jobs to be displaced by 2022 according to a new report from the World Economic Forum (WEF) called "The Future of Jobs 2018." This means that the growth of artificial intelligence could create 58 million net new jobs in the next few years.

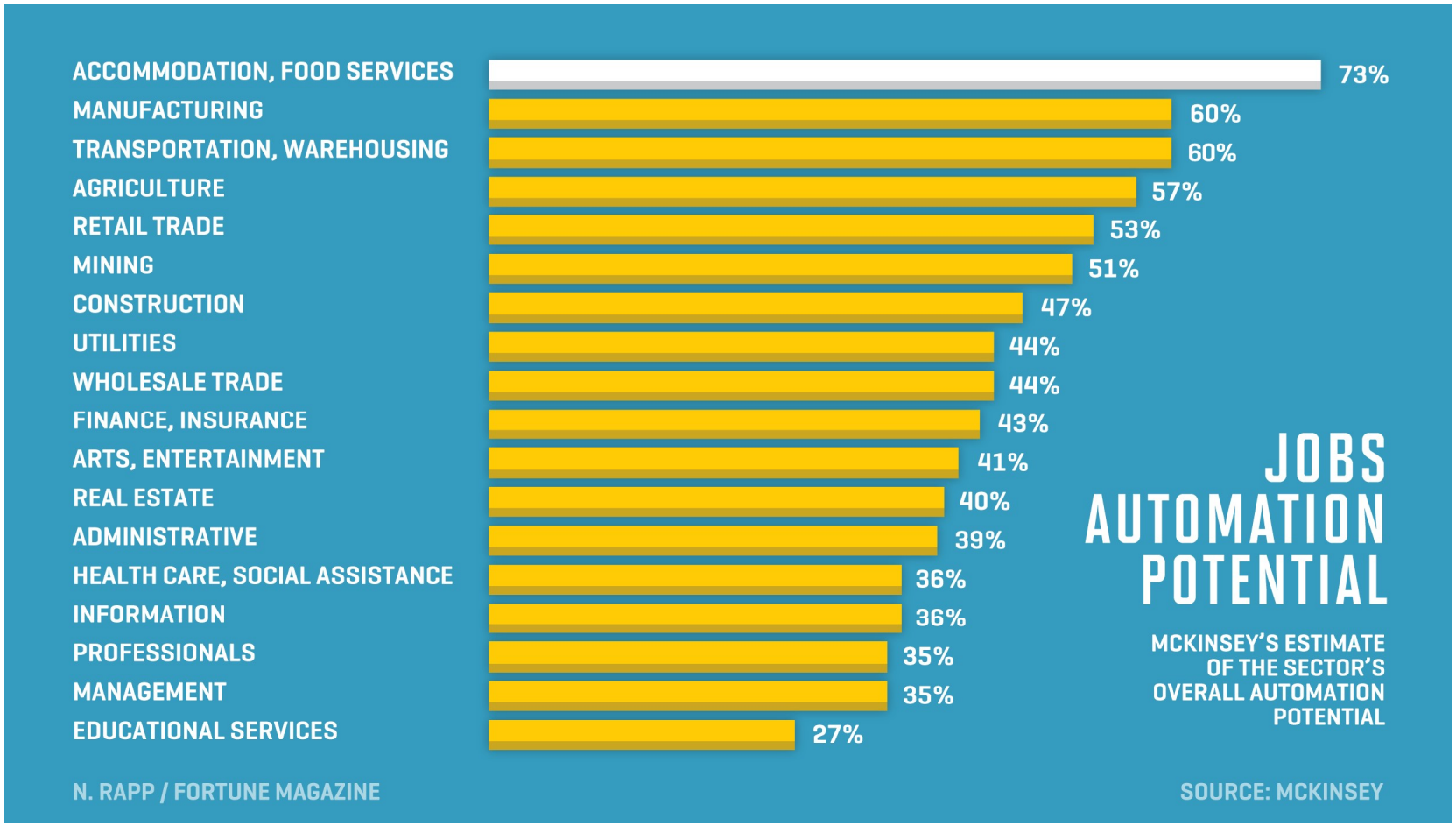
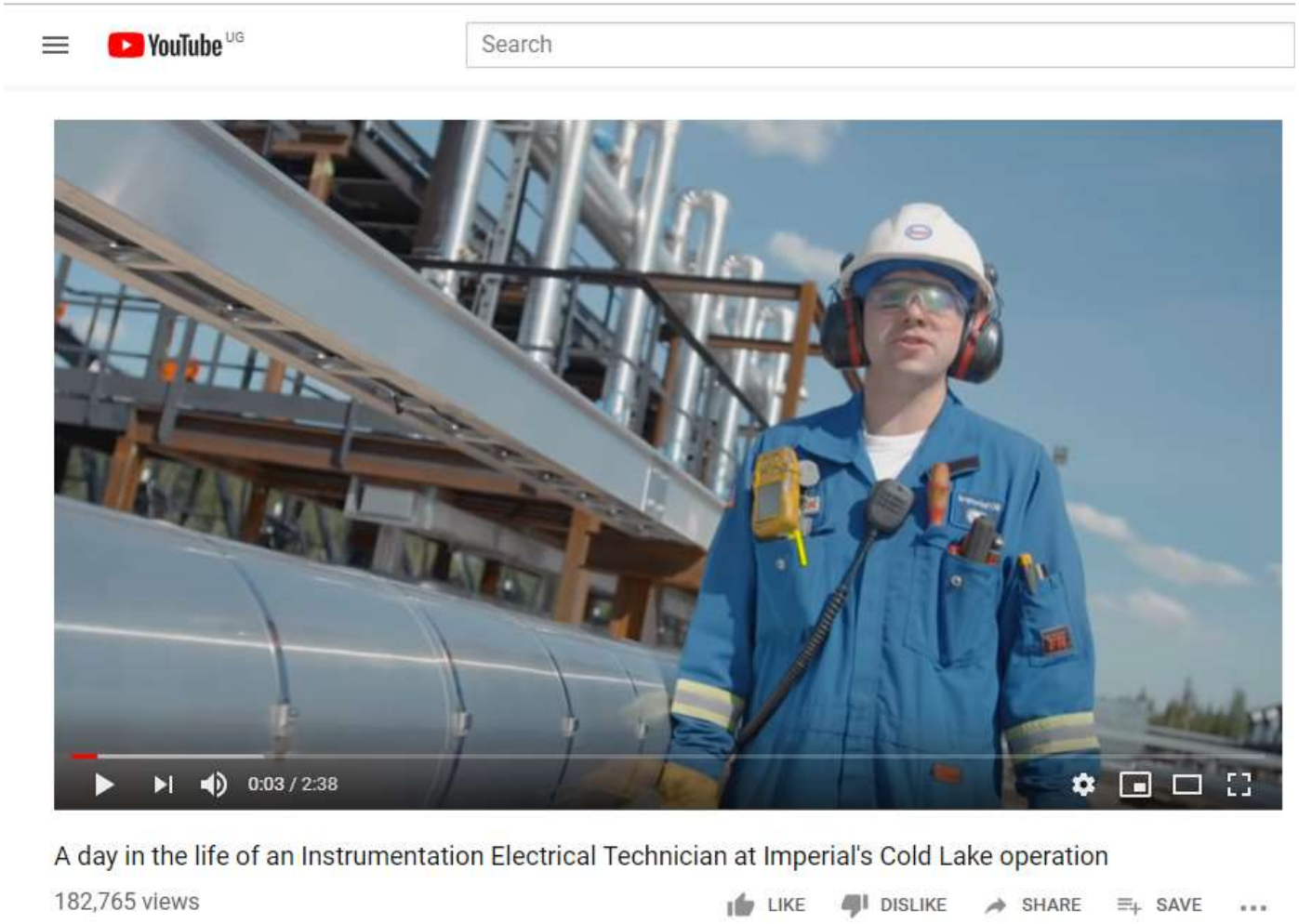


Image from: www.fortune.com

Routine jobs are at risk!



https://www.youtube.com/watch?v=0oOaG9iJ6UA

Louisiana Economic Development Key Industries

ADVANCED MANUFACTURING

AEROSPACE

AGRIBUSINESS

AUTOMOTIVE

ENERGY

ENTERTAINMENT

PROCESS INDUSTRIES

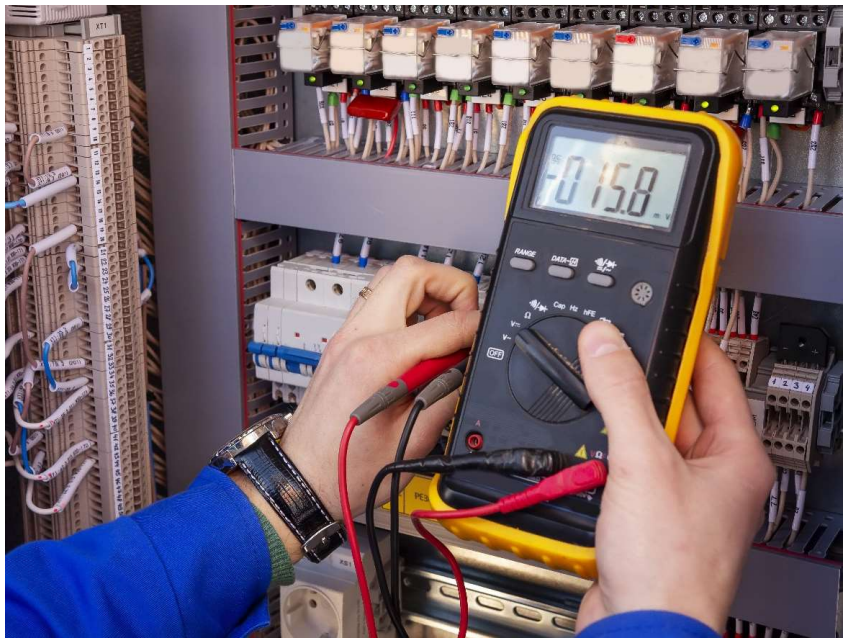
SOFTWARE DEVELOPMENT

WATER MANAGEMENT

Benefits to Students

Why a career in instrumentation?

- In the future of work, automation creates instrumentation jobs!
- Multiple pathways (Certificate, 2-year, or 4-year degrees)
- Your skills are transferrable to different industries in different locations. If you get bored, you can move!



Why a career in instrumentation?

- You are the one who “knows” the equipment. People who used to “know” are retiring!
- You bring value to your company
  - Example – in automotive manufacturing, **1 minute of downtime costs $22,000!** You will make up your annual salary if you get the equipment running within 3 minutes!
- Median salary is $27.78 per hour (compared to $19.71 for welding).

Image: www.autonews.com

Q&A w/
Matt Pullin, PE
PCI Electric

- 18 years in instrumentation field
- Experience as both a technician and an engineer
- Past employers include KBR, SNC-Lavalin, Smurfit-Stone Hodge Paper Mill, Turner Industries, WPS Industries, Hunt Guillot & Associates, and Eagle Project Services

Take 5!

Project Kit Overview

Grant Details

Grant Program Highlights

- Controlling, Operating, and Measuring: Pathways for Learners to Engineering Technology Employment (Project COMPLETE)
- Goal to expand instrumentation workforce pathways for 500 North Louisiana high school students over 3 years
- Collaboration between Louisiana Delta Community College and Louisiana Tech University

LOUISIANA DELTA
COMMUNITY COLLEGE

COMPLETE

What is “engineering technology?”

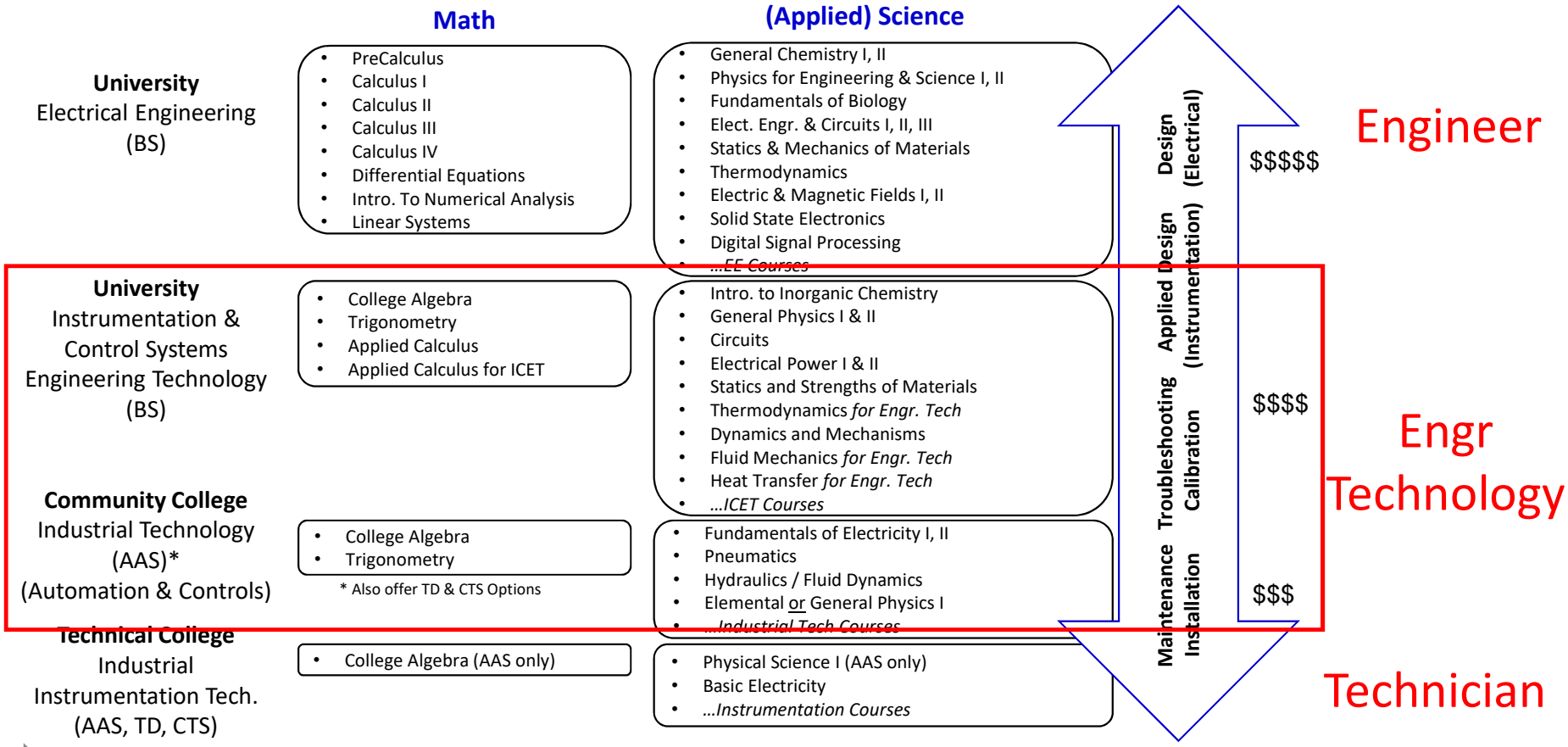
Understanding
Designing process

Understand what’s going on, but also get your hands on the equipment!

Troubleshooting!

Observing process
Replacing equipment

What is “engineering technology?”

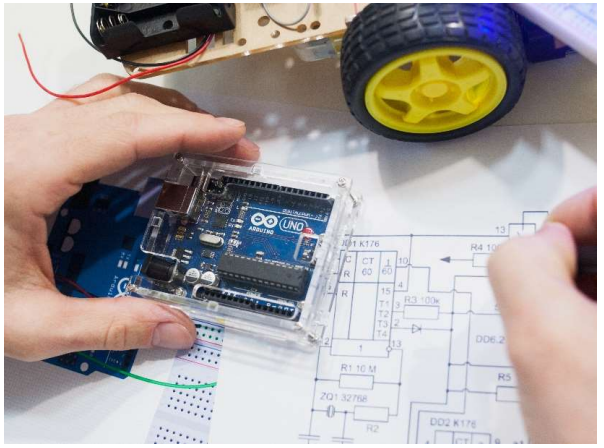


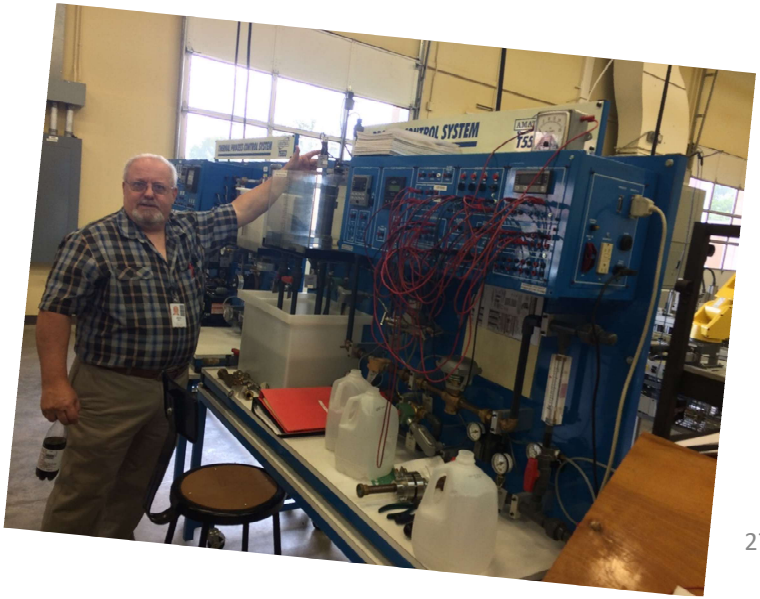
Which students are a good fit for advertising?

- Jump Start students currently in Algebra I
- Students who will go into College Algebra (Math ACT ≥ 19)
- Students in the “middle” – not interested in full trades or full engineering route
- Robotics teams, cyber lit classes

Grant Program Components

- Lesson materials
  - Meet standards in Physical Science, STEM, and Technology Education
  - Math requirement Algebra I
  - Hands-on, project-based “instrumentation and controls”
- Hands-on project kits
- Industry field trips and lunch-and-learns
- Scholarships
- Workshops twice a year for Sparksters/Connectors
- Full course implementation
  - Jump Start
  - Dual enrollment and articulation agreements
  - Pathways to LDCC and/or LA Tech University





Next Steps

Let's talk about this slide

Resource	Next Step	Responsible
Lessons	Post at www.completepathways.com	Dr. Corbett
Kits	Assemble and deliver/ship to schools	Dr. Swanbom / Juliette?
Scholarships	We will be in touch later in the year!	Juliette
Winter Workshop	We will be in touch later in the year!	Juliette
Jump Start	Choose a Jump Start course code (only for schools implementing full course this year)	Your principal?
Dual Enrollment	Work with LDCC Dual Enrollment Coordinator to get course added and agreement signed	Alicia/Gerry
Field Trips	Sign up for NLEP Manufacturing Week, to be held 9/30-10/11. http://www.nlep.org/Workforce/Manufacturing-Week.aspx	Sparkster? Or whoever will be taking students on the field trip.

MENU

north louisiana economic partnership

Manufacturing Week

My Favorites Add Page Print Share

Workforce | Workforce Data | Finding Your Workforce | Higher Education | Manufacturing Week | Relocation Assistance | Internships | Workforce Reports

North Caddo High School students tour Allen's Electric Motor Services in Vivian, LA during Manufacturing Week, an award-winning workforce initiative coordinated by North Louisiana Economic Partnership

In 2018:
1,600 students
68 tours
27 manufacturing plants
6 training programs
10 parishes

Manuf ek Toolkits

azine

2017 Manufacturing Week Magazine

Project Example

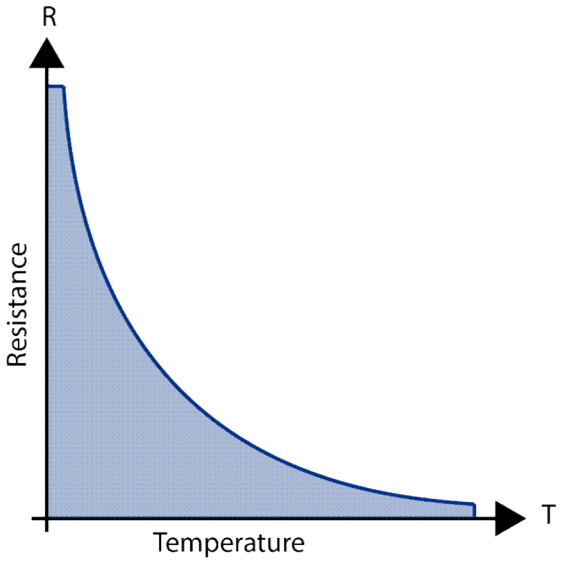
Making a Sous Vide:
Instrumentation and Control Project

Let’s Make a Sous Vide!

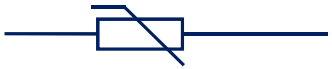
- Cooking device that maintains an elevated temperature in a vessel
- Gives us practice:
  - Devising and reading a temperature sensor using a microcontroller
  - Controlling a high-current device (heating element) using the microcontroller

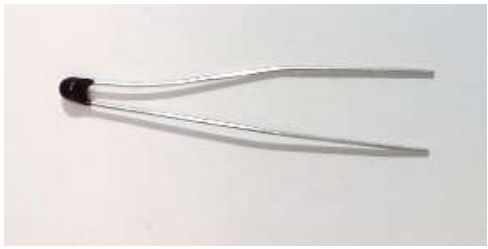
What is a Thermistor?

- Measures electrical resistance changes with temperature
  - Resistance decreases as temperature increases

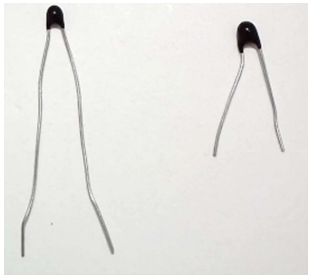


Circuit Diagram Symbol:

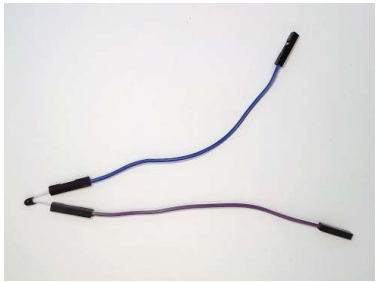




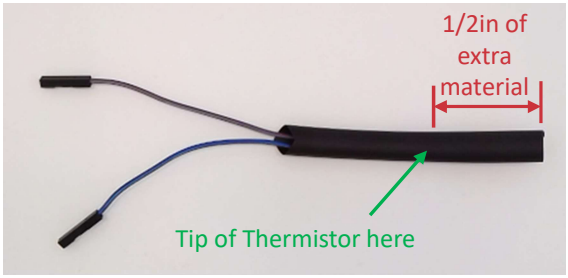
Waterproofing Thermistor



Clip approx. 1/2in off of thermistor legs

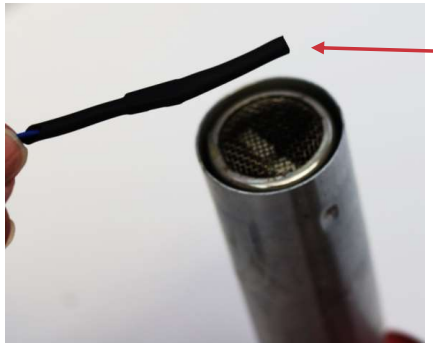


Attach wire extensions to each leg



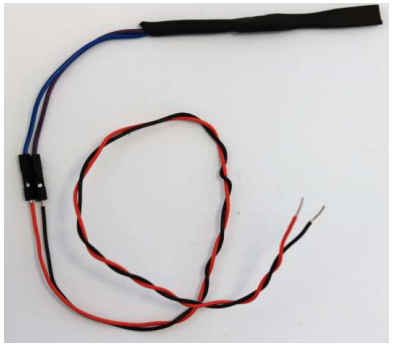
Cut heat shrink material to approx. 3in and slide it over the thermistor

Note: Leave approx. 1/2in of material passed the thermistor to be used as for a seal



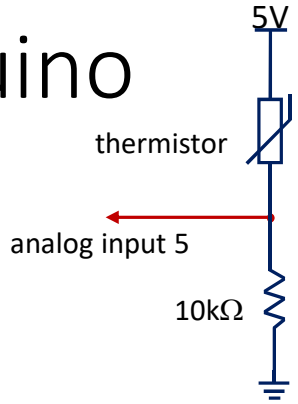
Shrink material using heat gun

Clamp end of heated material to seal in the thermistor
Be sure to not crush the thermistor when clamping material



Strip wires jumper wires and connect them to wire extensions

Interpreting Signal Using Arduino



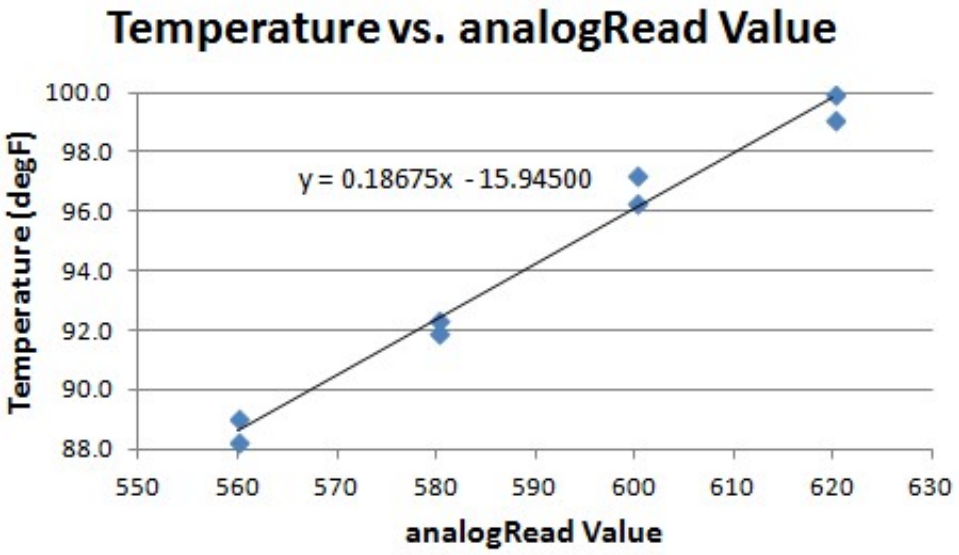
- analogRead values can be converted to voltage drop across the 10kΩ resistor

$$voltage = \texttt{analogRead}\ value \cdot \frac{5\ volts}{1023}$$

- analogRead values can also be calibrated to temperatures using a curve fit

```
temp = 0.18675*sensorValue - 15.945
```

	analogRead Value	Temperature (degF)
rising temp	560	89.0
	580	91.9
	600	97.2
	620	99.9
falling temp	620	99.1
	600	96.3
	580	92.3
	560	88.2



What are relays?

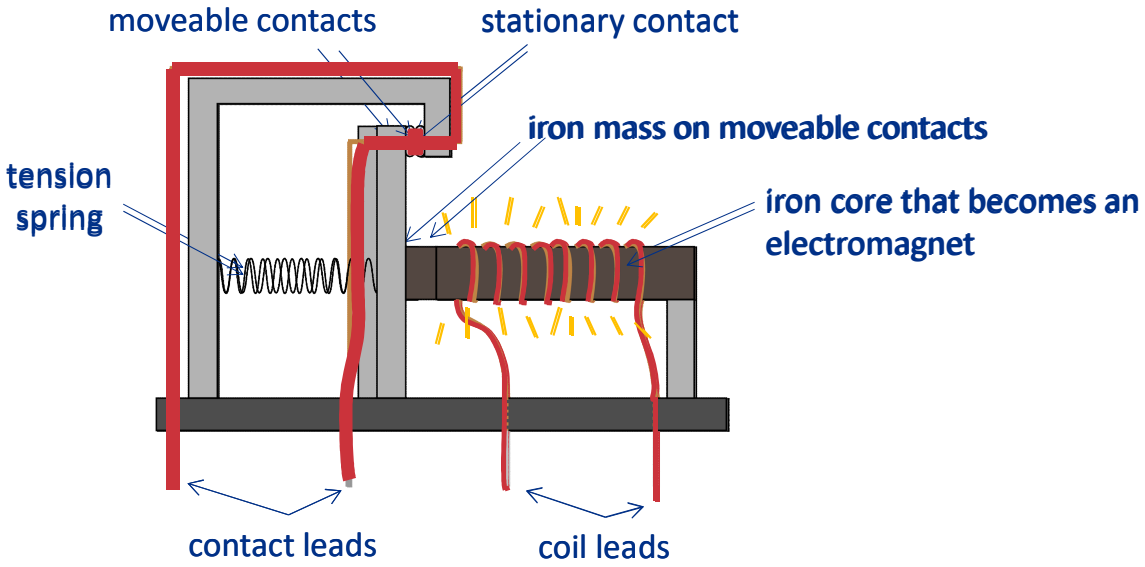
- Relays are switches that are turned on and off using electricity
- Relays allow a low-power signal to control a large amount of power
- Relays are all around us

Automobiles

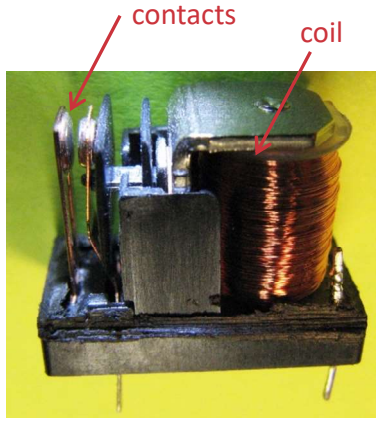
Refrigerator - turns on compressor when temp gets low

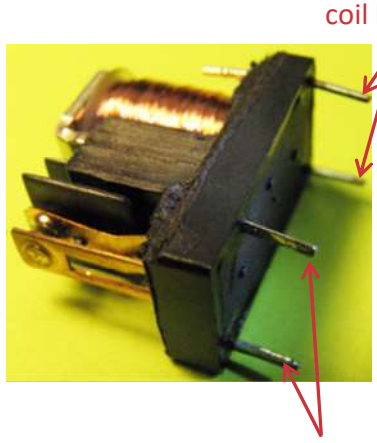
How do relays work?

- Relays pass a small current through a coil which causes the iron core to become magnetized
- This electromagnet attracts an iron mass on the moveable contact causing it make contact with the stationary contact
- With the contacts touching, a much larger current can pass to drive the load of the circuit



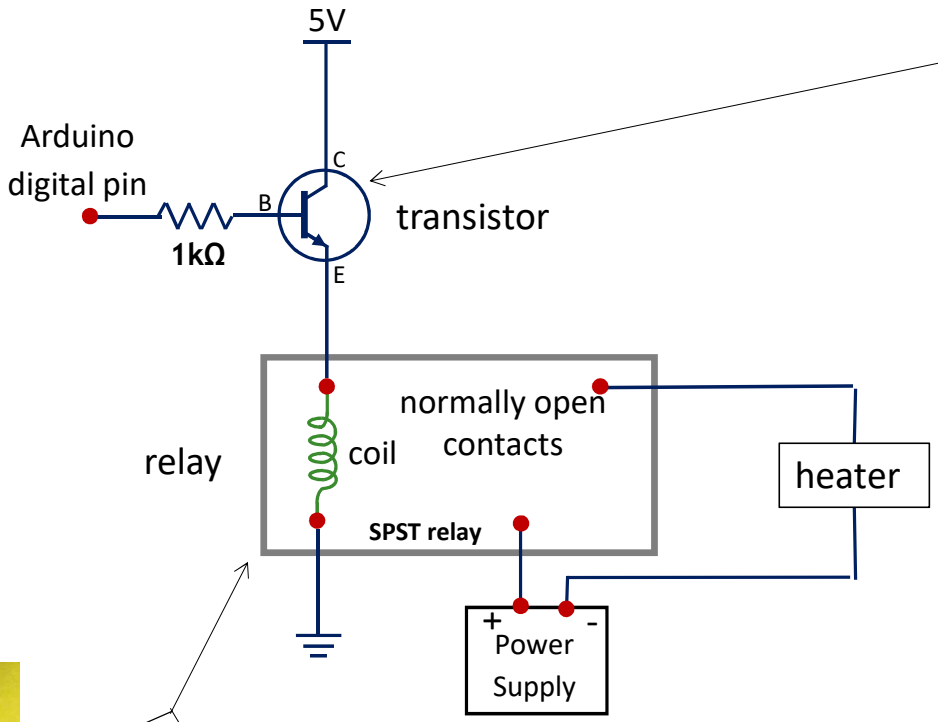
Inside the relay used here

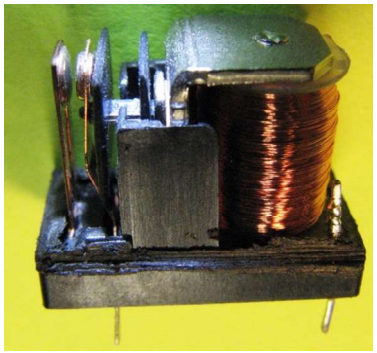


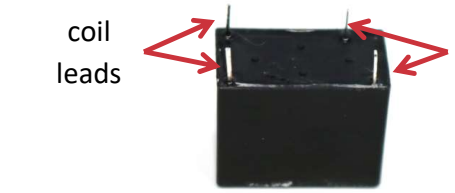


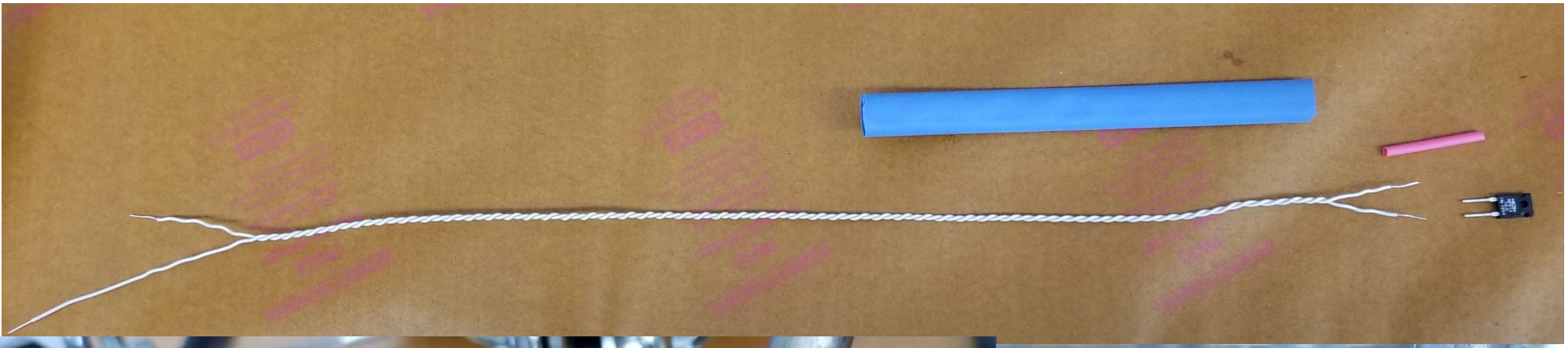
Wiring

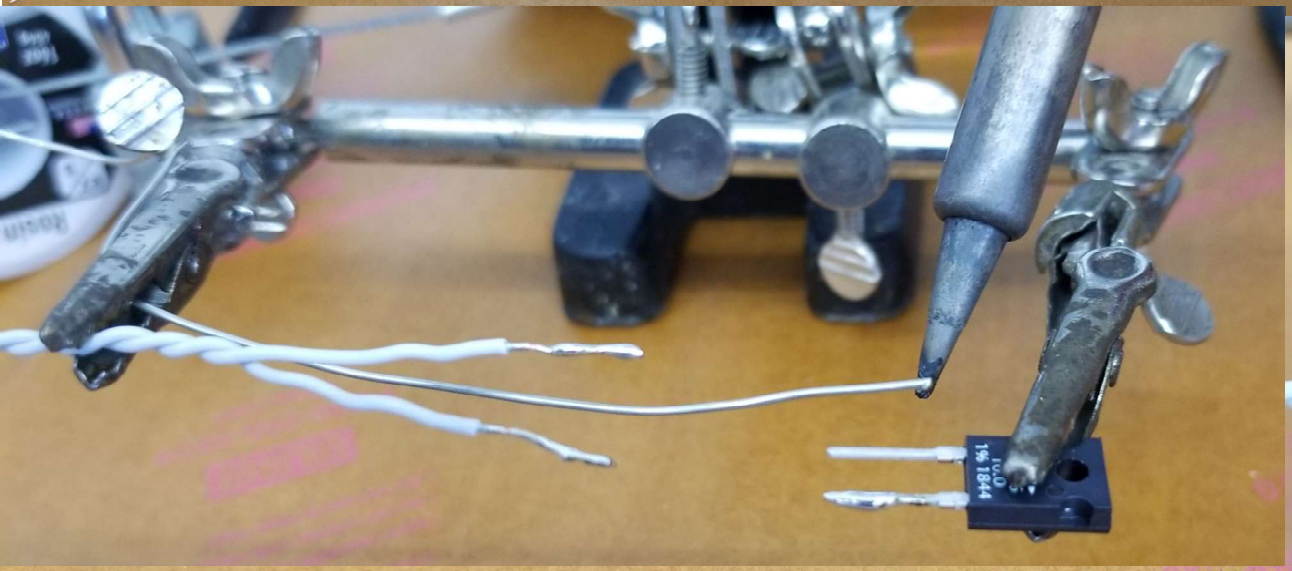
- Setting the digital output on the Arduino to HIGH switches **on** the transistor
- The transistor allows current to flow through the relay coil, closing the relay contacts
- Power from power supply energizes the heater, heating the water

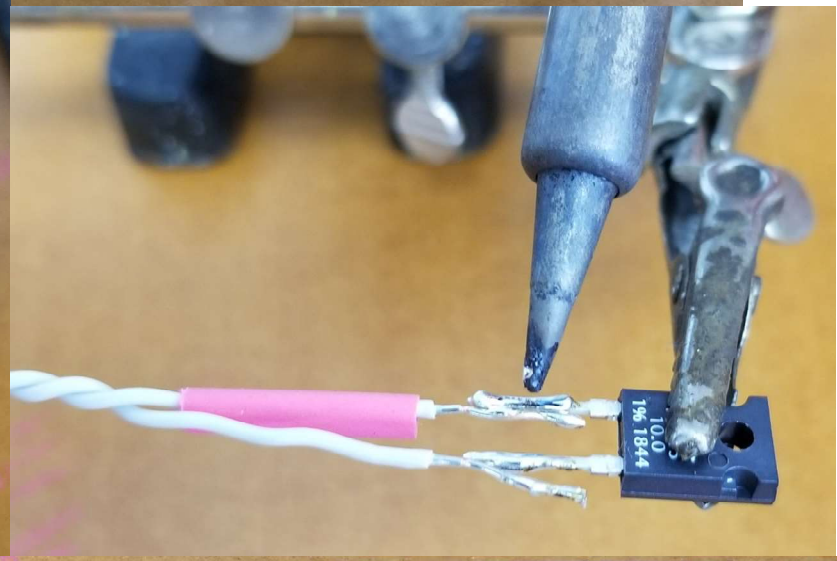


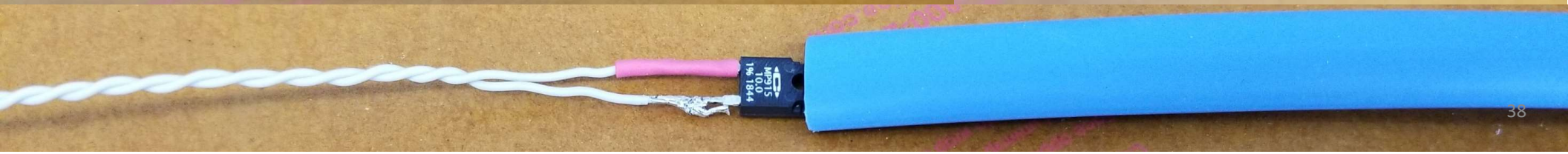




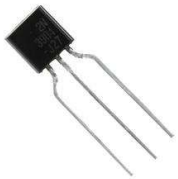








Power Considerations



1. Power to switch transistor
   - source: Arduino digital I/O pin
   - max current per digital I/O pin: 20 mA

2. Power to switch relay
   - source: 5V from Arduino (from the on-board voltage regulator)
   - max current from the voltage regulator: 800 mA
   - coil current for relay: 40 mA

3. Power to heater
   - source: 9V power supply
   - max current: Up to 2A

Arduino Program

- Senses the voltage input on analog pin 0 and stores as a number between 0 and 1023
- Computes decimal voltage value and temperature value
- Sends values back to the computer to show in the “serial monitor”
- Decides if heater needs to be turned on or off
- Sends heater state to serial monitor
- Waits 5 seconds and repeats

```
void loop() {

  sensorValue = analogRead(A0);

  voltage = sensorValue * (5.0 / 1023.0);
  temp = 0.18675*sensorValue - 15.945;

  Serial.print(sensorValue);
  Serial.print("  ");
  Serial.print(voltage);
  Serial.print("  ");
  Serial.print(temp);
  Serial.print("  ");

  if (sensorValue<589) {
    digitalWrite(9, HIGH);
    heaterState = 1;
    }
  else if (sensorValue>599) {
    digitalWrite(9, LOW);
    heaterState = 0;
    }

  Serial.print(heaterState);
  Serial.print("  ");

  if (heaterState == 1) {Serial.println("ON");}
  else                  {Serial.println("OFF");}

  delay(5000);
}
```

Wrap Up

Q & A

Breakout Sessions

Sparkster Track
Connector Track

(workshop to be dismissed at 2:00 PM)

Thank you for being a part of Project COMPLETE!

References

- “Key Industries.” Louisiana Economic Development. https://www.opportunitylouisiana.com/key-industries.
- Advanced Technology Services, Inc. “Downtime Costs Auto Industry $22k/Minute – Survey.” *Thomas*, 2006. https://news.thomasnet.com/companystory/downtime-costs-auto-industry-22k-minute-survey-481017.
- “Occupational Employment Statistics.” Electro-Mechanical Technicians and Welding, Soldering, and Brazing Workers. Bureau of Labor Statistics, 2018. https://www.bls.gov/oes/current/oes_nat.htm.