

INTERNET OF THINGS

AN INTRODUCTION TO THE WORLD OF CONNECTED DEVICES
THROUGH EXPLORATION OF MICROCONTROLLER-BASED PROJECTS

Funding for this project is provided by the AEP Foundation and the US
Department of Energy (DOE) PORTSfuture grant

TIMETABLE

- 3:15 – 3:20 → Introduction, About Us
- 3:20 – 3:40 → What do you know?
- 3:40 – 4:20 → LittleBits Build
- 4:20 – 4:35 → 15 Min Break
- 4:35 – 4:50 → Example Videos
- 4:50 – 5:10 → Reflection on Material
- 5:10 – 5:30 → Closing



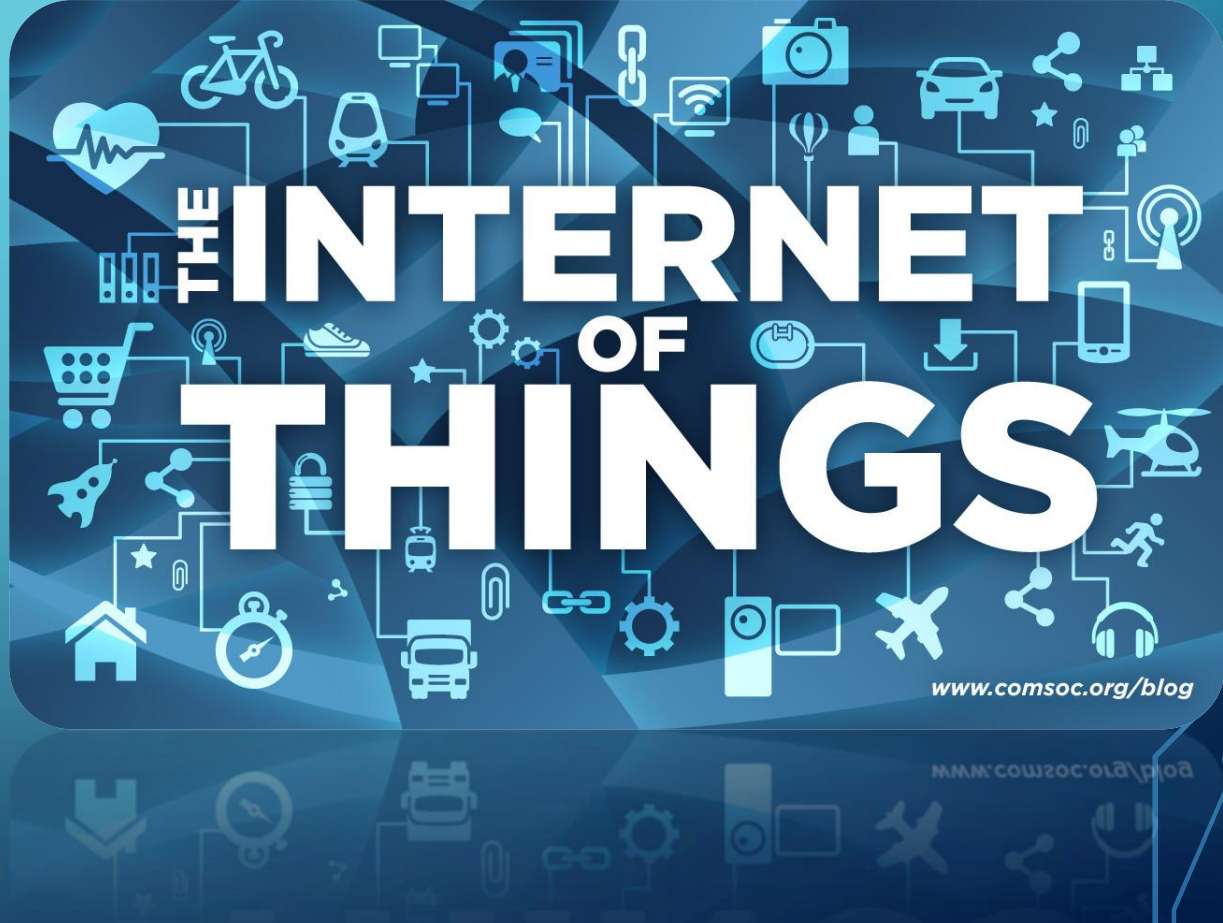
INTRODUCTION

- Elkan Kim – Senior Computer Software and Data Visualization Engineer
- Zane Simon – IoT System Design Engineer
- Marsha Lewis, MPA, PhD - Associate Professor and Sr. Associate Dean

About us

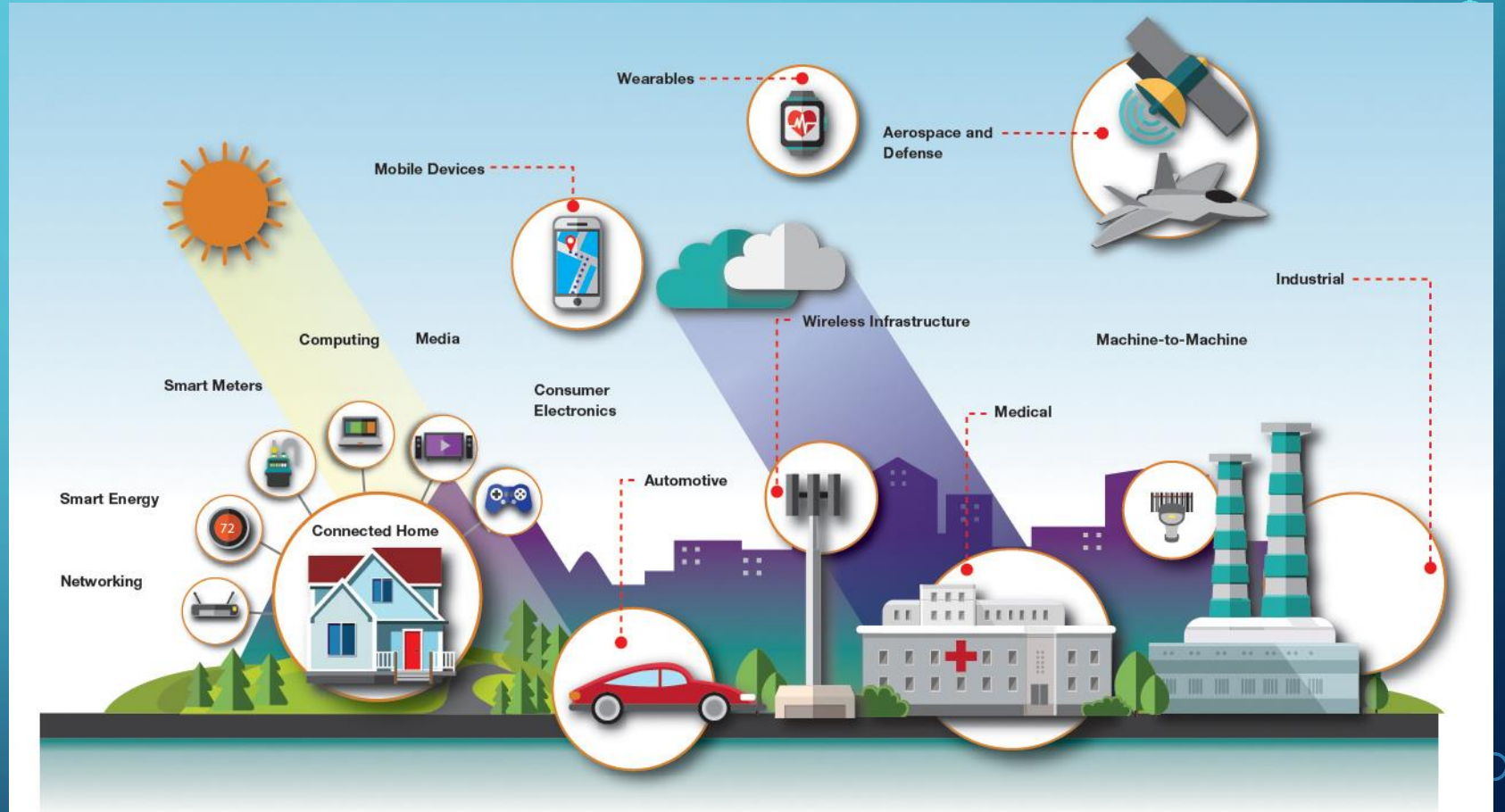
INTERNET OF THINGS

- **IoT** = Internet of Things
- IoT is a system of interrelated computing devices that all communicate with each other for various applications.
- Some examples include pace makers, smart watches, and smart appliances like fridges and microwaves

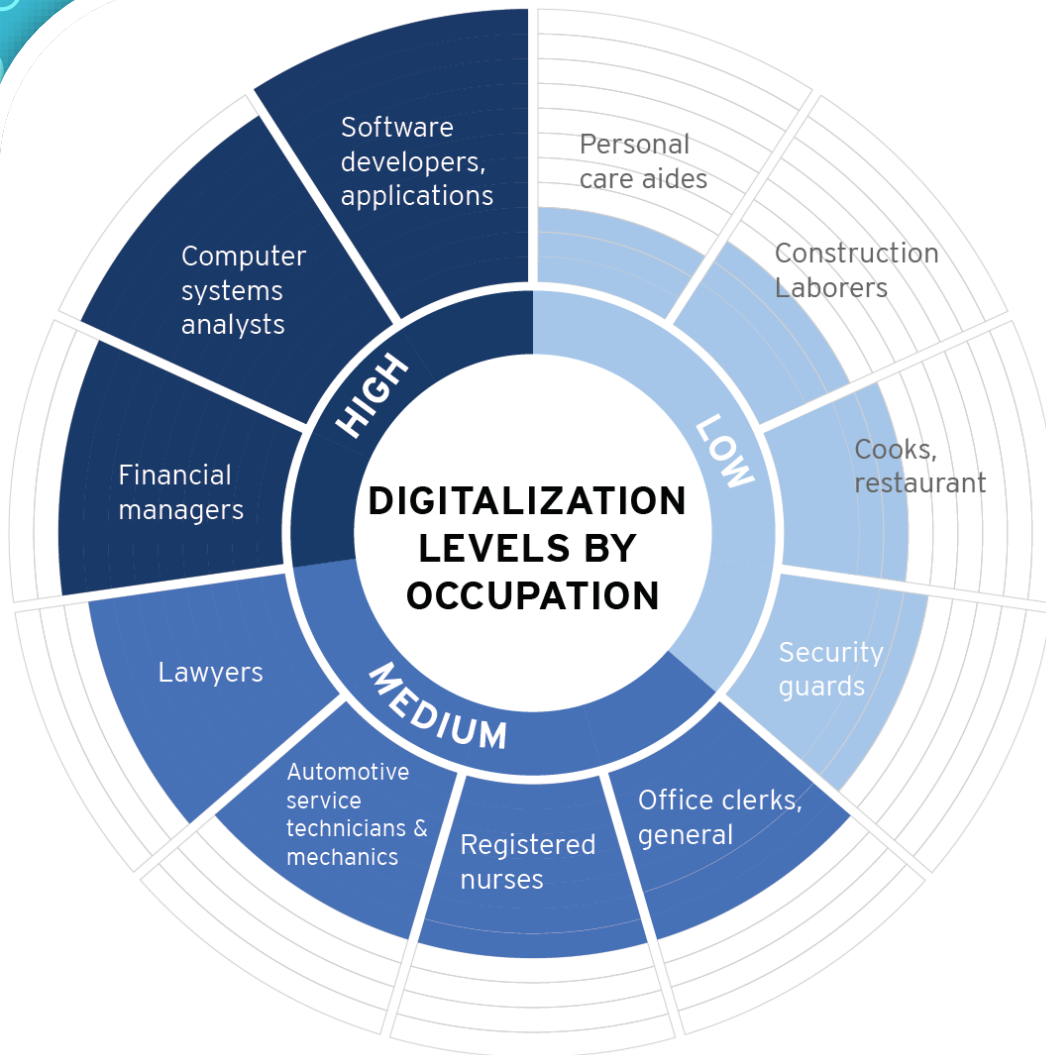


EXAMPLES OF IOT IMPELNTATION

- Mobile Devices
- Smart Energy Meters
- Smart Cars
- Networking
- Media
- Computing
- Wearables
- Medical
- Artificial intelligence (AI)



AMERICAN WORKFORCE



HOW MUCH WORKERS EARN

\$72,896

in **high** digital occupations

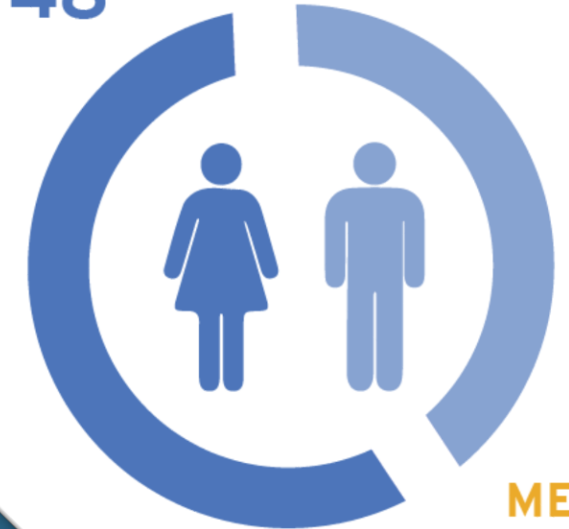
\$48,274

in **medium** digital occupations

\$30,393

in **low** digital occupations

WOMEN
48



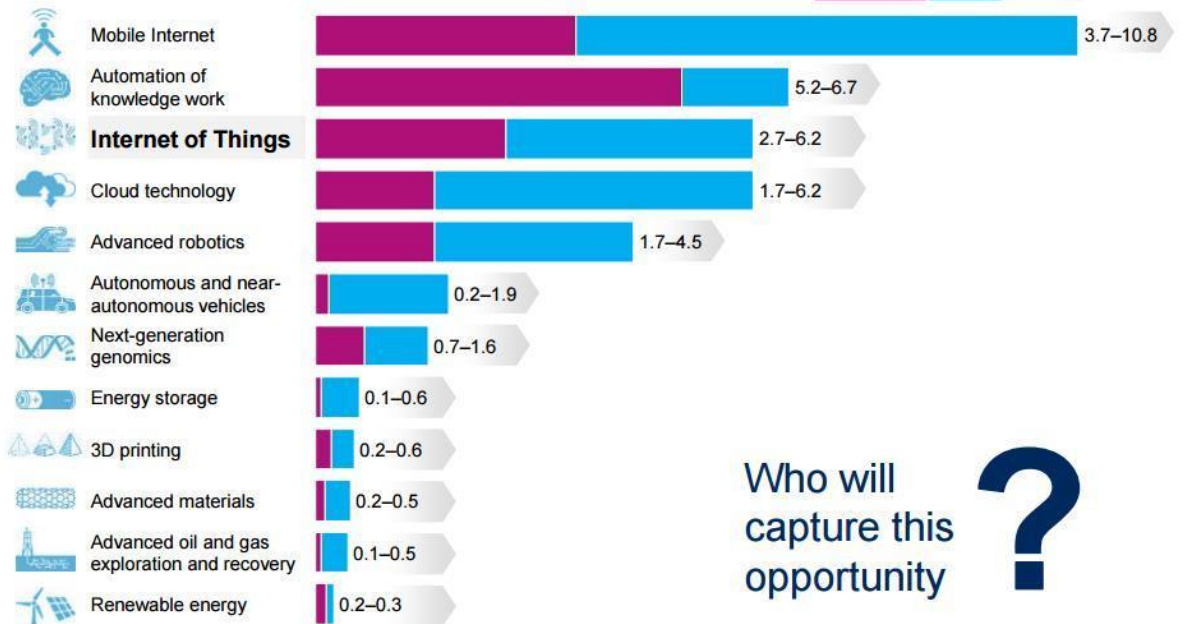
MEN
45

IOT FORECASTS AND MARKET ESTIMATES

THE IoT PLATFORM OPPORTUNITY

The Internet of Things (IoT) has a potential economic impact of 2.7-6.2 trillion USD until 2025

\$ trillion, annual



SOURCE: McKinsey Global Institute analysis

McKinsey & Company

There are currently **607,708** open computing jobs nationwide, but only **42,969** computer science students graduated into the workforce last year (code.org).

By **2018**, **51%** of all **Science, Technology, Engineering, and Math (STEM)** jobs are projected to be in computer science-related fields, according to the White House (**FACT SHEET**).

LITTLEBITS – FOUNDER: AYAH BDEIR

- <https://www.youtube.com/watch?v=8H91YN8Wg1o>



LIFE SIMPLIFIED WITH CONNECTED DEVICES

- <https://www.youtube.com/watch?v=IsiHUflpNGY>



LITTLEBITS – WHAT ARE THEY?

- The **littleBits** platform teaches how devices can connect and communicate with each other without the worry of wiring and soldering components
- Projects can be put together in seconds with the easy ‘snap-together bits’ that come in each littleBits kit!
- All ‘bits’ are color-coded to match their usage and functionality

The logo for littleBits is displayed within a purple square with a white border. The text 'littleBits' is in a white, lowercase, sans-serif font, with a small trademark symbol (TM) to the upper right of the 's'.

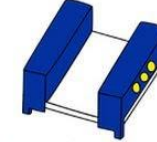
littleBits™

LITTLEBITS – COLOR CODE

- **POWER (Blue):** Power Bits, plus a power supply, run power through your circuit
- **INPUT (PINK):** Input Bits accept input from you or the environment and send signals that affect the Bits that follow.
- **OUTPUT (GREEN):** Output Bits ‘do something’ – light up , buzz, move, etc...
- **WIRE (ORANGE):** Wire Bits connect to other systems and let you build circuits in new directions.

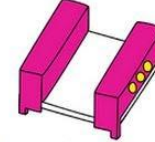
What types of bits are there?

Power



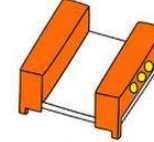
Bits modules with blue connectors are the ones that provide the juice to get you up and running! You'll need one of these Power modules in every creation you make.

Input



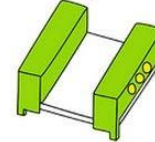
Input Bits modules are pink. They are buttons, switches and sensors: the eyes + ears of the system. They interpret their surroundings to make things happen.

Wire



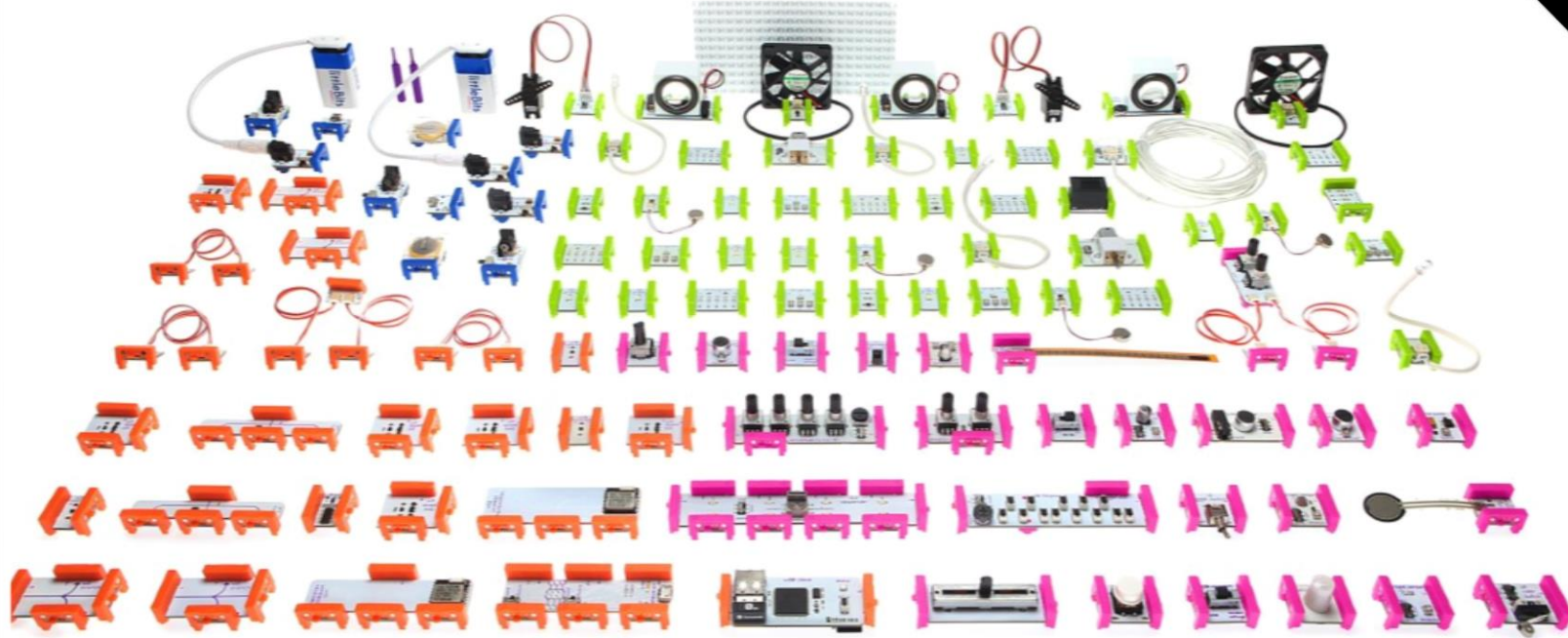
Orange Bits modules are Wires that help you extend + branch out. You don't always need one, but they give you options for linking and adding intelligence to your creations.

Output



Blink it! Buzz it! Shake it! Turn it! Green Bits modules are Outputs. These lights and motors convey the visual, physical + audible, and just generally make stuff happen.

LITTLEBITS – EXAMPLE BITS



LITTLEBITS – SENSORS AND MODULES



bargraph



buzzer



dimmer



Makey Makey



power



servo



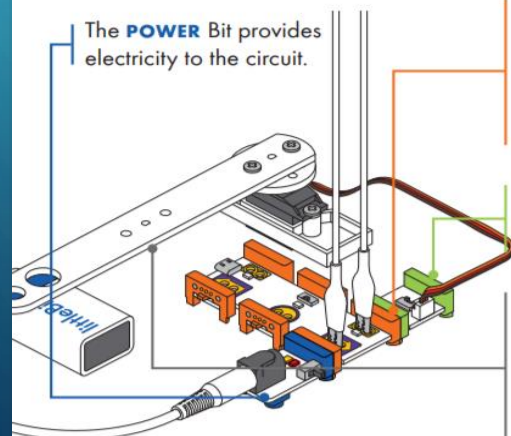
sound trigger

DEMONSTRATION AND BUILD

- We will now demonstrate a littleBits project that uses a servo motor, dimmer, bargraph led, and MakeyMakey bit
- This will project causes an arm to launch the paper ball when the alligator clips are connected together after each reset of the circuit.
- Time to build your first littleBits



HOW IT WORKS



The **POWER** Bit provides electricity to the circuit.

The **MAKEY MAKEY** Bit sends an **ON** signal when the **LEFT ARROW** pad and **EARTH** pad are connected. This happens when the drawer opens and the two pieces of foil touch, allowing electricity to flow through the circuit.

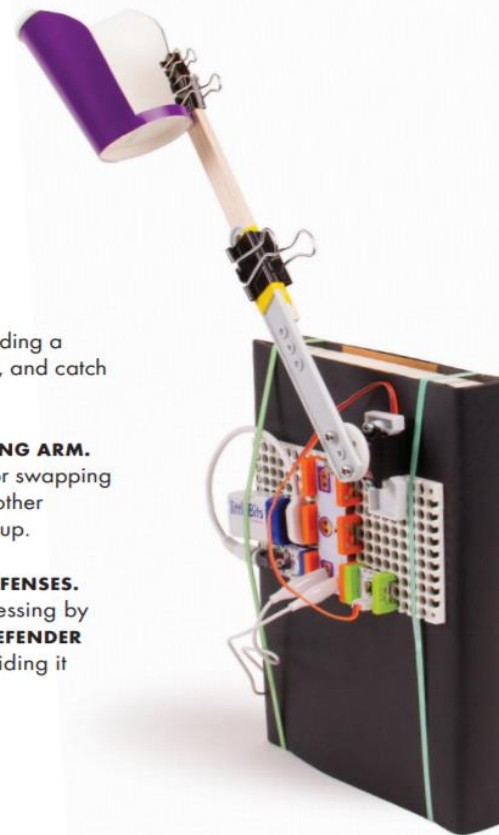
When the **SERVO** receives the signal, it turns, rotating the arm and throwing the projectile.

MECHANICAL ARM: As the bucket gets farther from the hub, it also takes more force to move it. If your arm gets too long it will overpower the servo motor and will be hard to move. This relationship between distance and force is called torque.

REMIX

TRY SOME OF THESE IDEAS TO CUSTOMIZE YOUR INVENTION. THEN COME UP WITH YOUR OWN!

- A ADD AN ALARM.** Try adding a buzzer to your defenses, and catch your intruders in the act!
- B IMPROVE THE LAUNCHING ARM.** Try extending the arm, or swapping the bucket template for other materials, like a paper cup.
- C CAMOUFLAGE YOUR DEFENSES.** Keep your intruders guessing by placing the **DOMAIN DEFENDER** in different places, or hiding it behind other objects.



SHARE

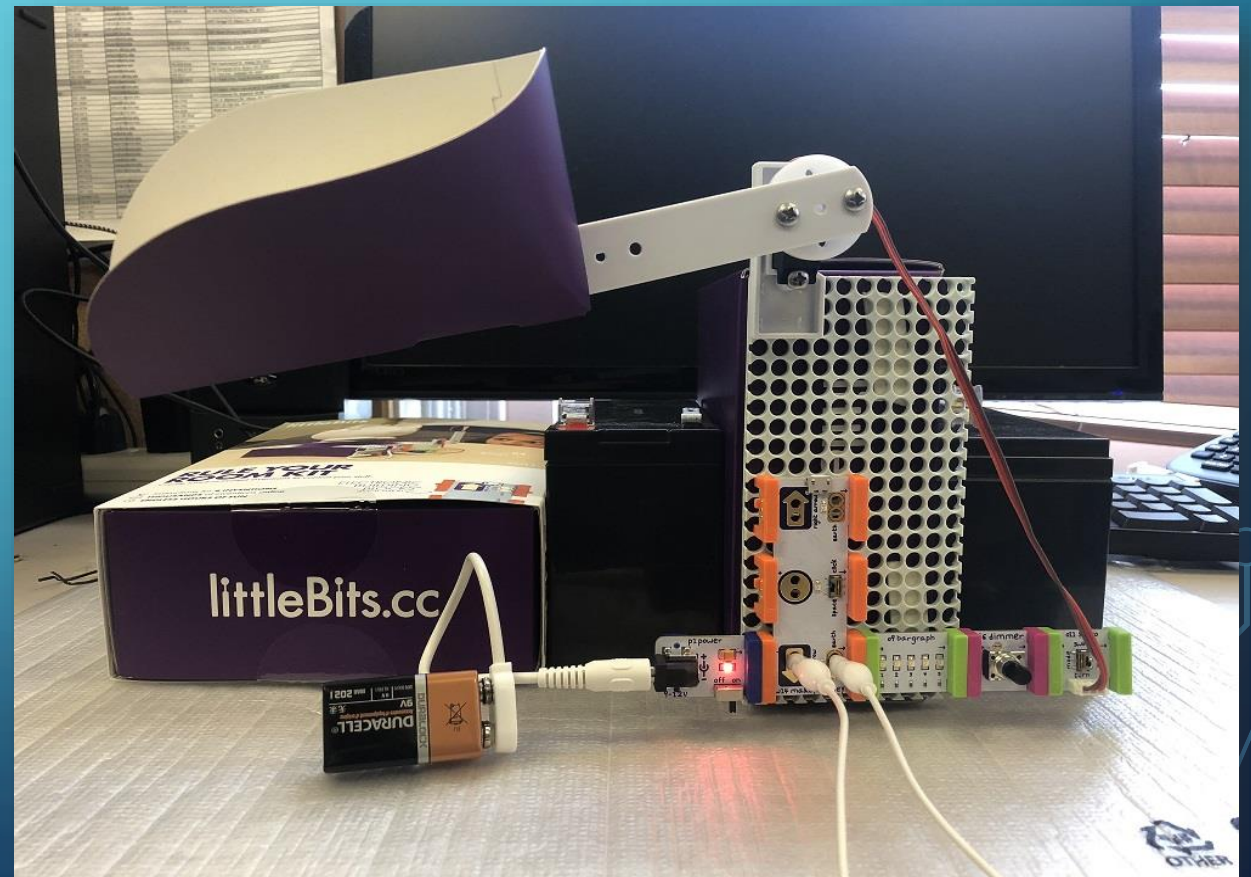
SHARE YOUR INVENTION ON THE LITTLEBITS™ INVENT APP

MAKE A REACTION VIDEO OF YOUR WOULD-BE BURGLAR, THEN SHOW THE COMMUNITY HOW YOU PROTECTED YOUR SECRET STASH ON THE LITTLEBITS INVENT APP!

LITTLEBITS BUILD – SETUP!

- 1) Gather all required bits
 - MakeyMakey bit
 - Power bit
 - Bargraph bit
 - Dimmer bit
 - Servo bit
- 2) Connect the bits like in the image → → →
- 3) Adhere the placement board onto the LittleBits box
- 4) Turn on power and test!
 - The servo arm should launch the paper that was placed inside of the purple holder!

LittleBits Project Connections Example



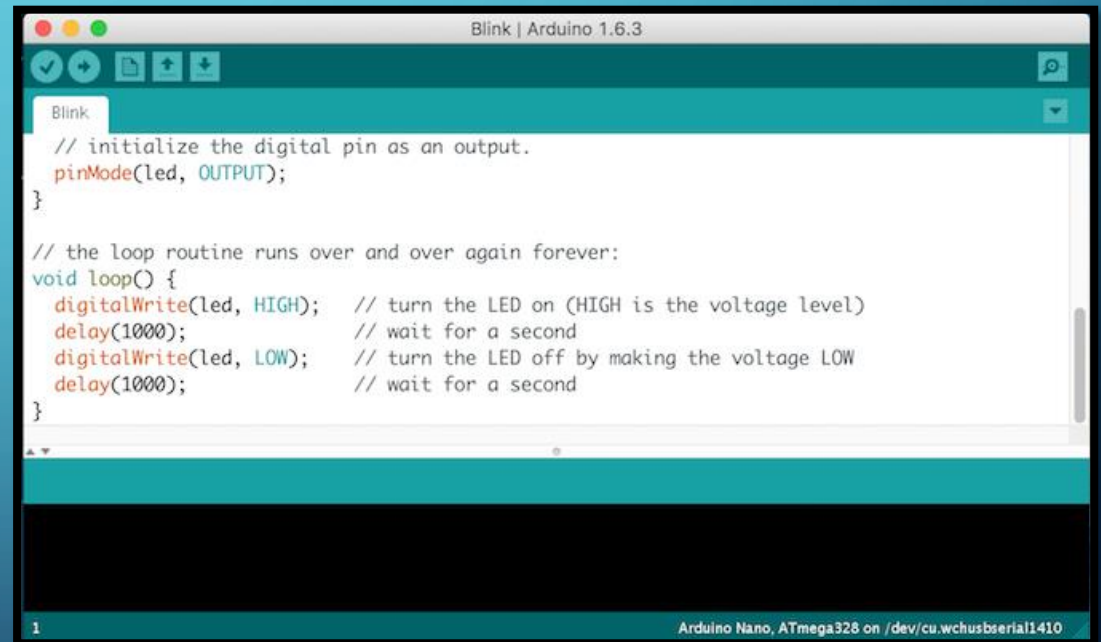
ARDUINO VS LITTLEBITS

LittleBits® - system with very intuitive magnet connectors. It is an easy way to build an electric system with all the components, without the need for wiring or soldering!

Arduino® - you need to program in a special language, very similar to C++. Can be connected by USB to a computer to transfer and run the program.



Arduino IDE
(Integrated Development Environment)



```
Blink | Arduino 1.6.3

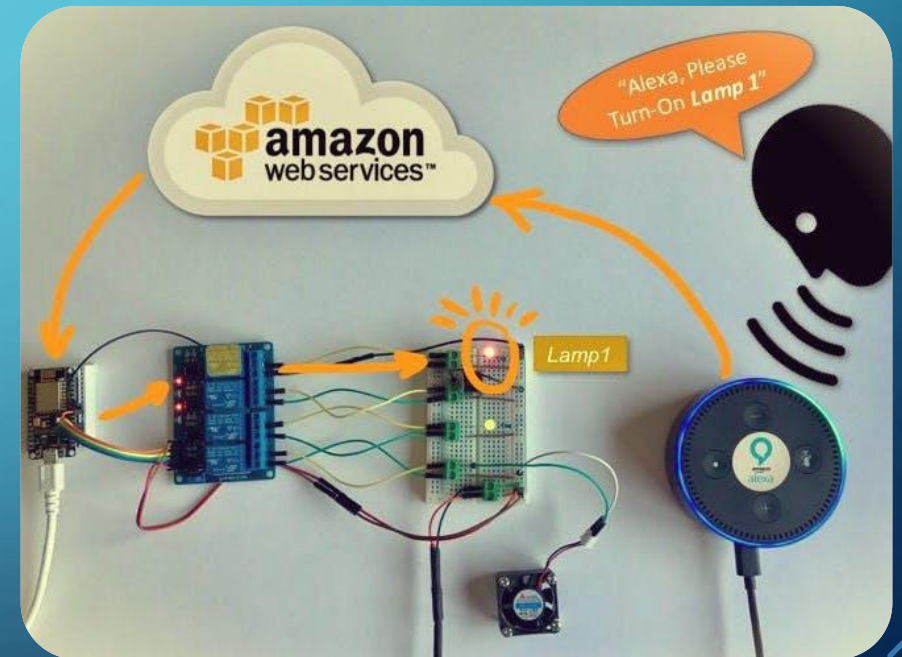
// initialize the digital pin as an output.
pinMode(led, OUTPUT);
}

// the loop routine runs over and over again forever:
void loop() {
  digitalWrite(led, HIGH); // turn the LED on (HIGH is the voltage level)
  delay(1000);             // wait for a second
  digitalWrite(led, LOW);  // turn the LED off by making the voltage LOW
  delay(1000);             // wait for a second
}

1 Arduino Nano, ATmega328 on /dev/cu.wchusbserial1410
```

ARDUINO DEMO

- Using Amazon Alexa to Control Arduino
- Combining Amazon Alexa and Arduino allows us to control devices like sensors and LEDs!
- We will demonstrate a quick implementation of Alexa by controlling 3 LED lights



ARDUINO DEMO

- Programmable Smart Car Kit



Wifi



Bluetooth



Line Tracking



IR Control



Ultrasonic



Obstacle Avoidance

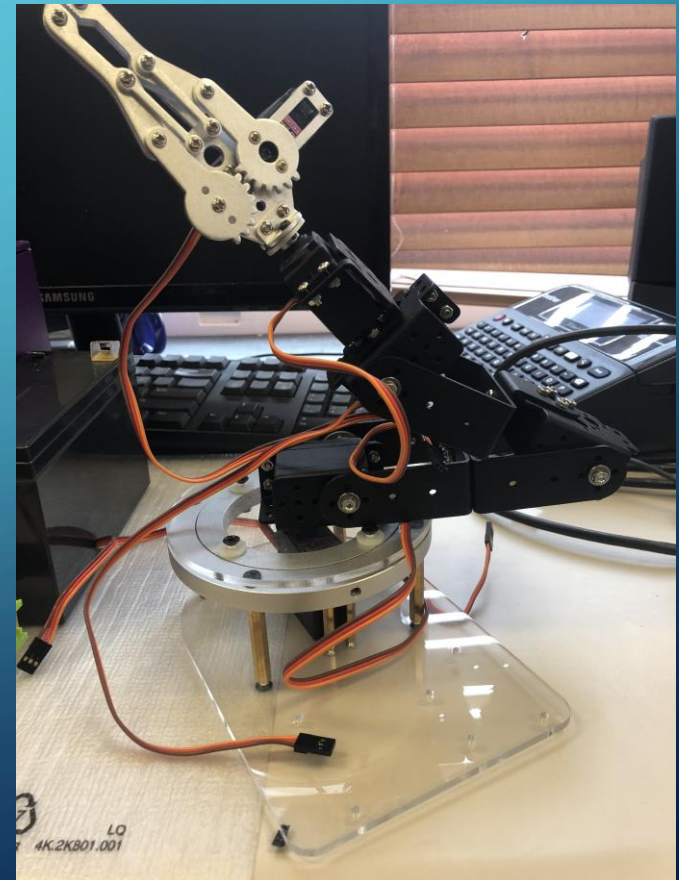
PLENTY OF MORE IOT DESIGNS AND IDEAS!

JUST THE BEGINNING

There are many more different ways you can use Arduino and IoT to control smart devices!

- Another example would be a robotic arm that can perform tasks that you can choose and program!
- Use your imagination & what you've learned to think of other ways you can integrate IoT into your life with these kinds of devices/projects!

Arduino Servo Controlled Robot Arm



REFLECTION/DISCUSSION

Discussion

- What do you think is most interesting about the Internet of Things?
- What are your thoughts on Littlebits?
- What kind of projects do you enjoy?
- Did learning more about the Internet of Things give you any ideas?
- What would you like to gain from this program?

