Physical Computing

Module 3, COMS 1002: Arts

Topics today

What is IoT?

Microprocessor vs microcontroller

Sensors

Examples of embedded systems

Serial Communication

https://threatpost.com/top-10-iot-disasters-of-2019/151235/

Internet of Things

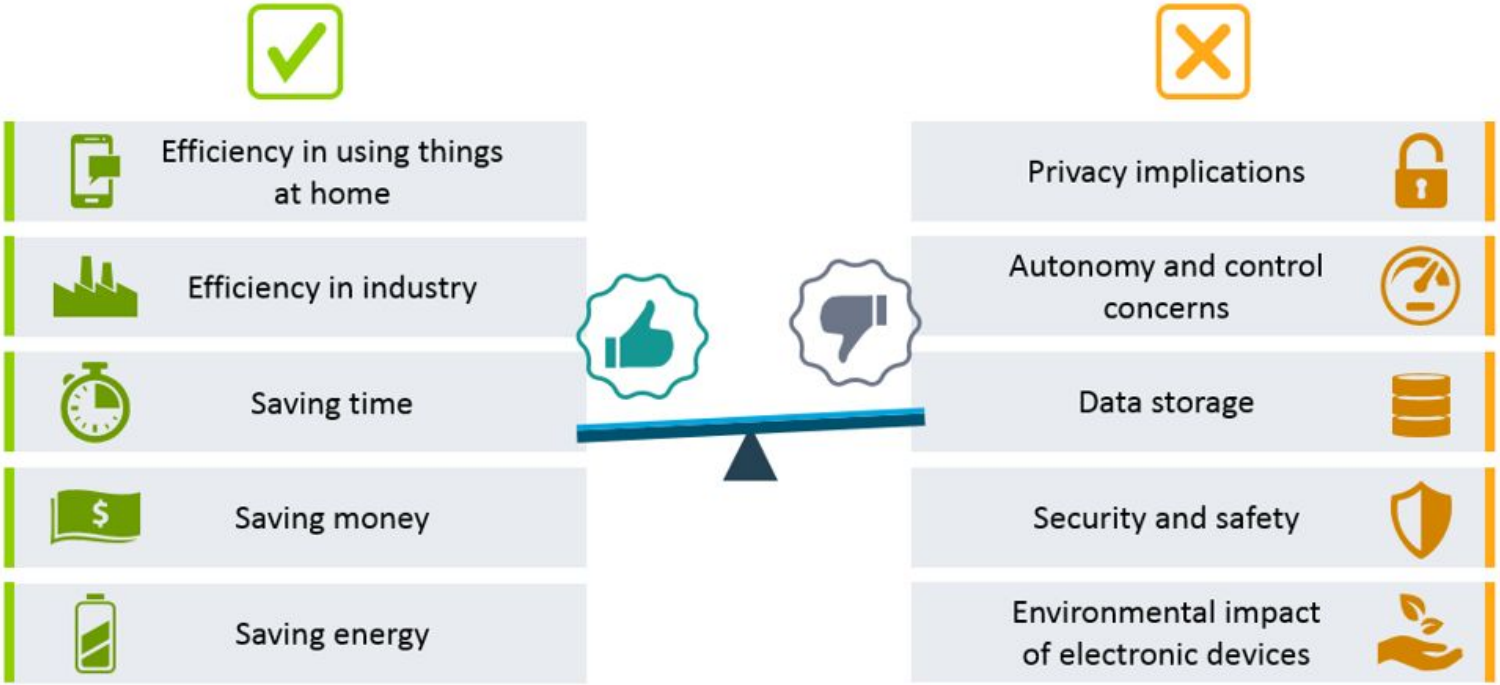
B2C: Smart home (Alexa), Smart appliances, Elderly care

Infrastructure: Smart City (IoT trash cans)

Industry & Farming: Environmental monitors (the tree outside Lerner hall and Journalism)

Commerce: Medical/healthcare, Transportation, Building automation (auto blinds)

Internet of Things



Issues of privacy and security

Fridge, security camera, microwaves, Alexa, ...

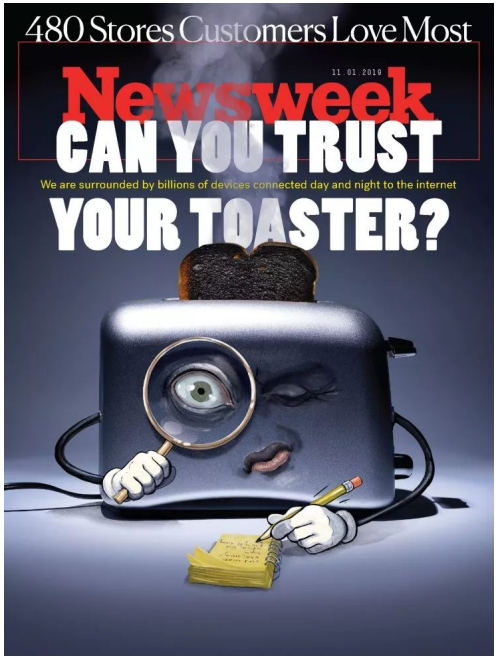
Cyberattacks Discovered on Vaccine Distribution Operations

IBM has found that companies and governments have been targeted by unknown attackers, prompting a warning from the Homeland Security Department.


By David E. Sanger and Sharon LaFraniere

Dec. 3, 2020 Updated 12:15 p.m. ET

A series of cyberattacks is underway aimed at the companies and government organizations that will be distributing coronavirus vaccines around the world, IBM's cybersecurity division has found, though it is unclear whether the goal is to steal the technology for keeping the vaccines refrigerated in transit or to sabotage the movements.



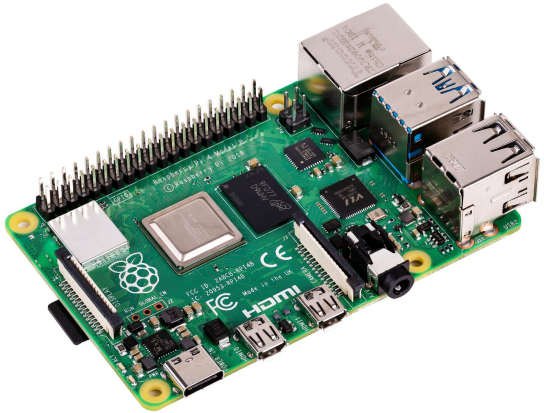
Boston Mooninite panic of 2007

Microprocessor vs Microcontroller

Raspberry Pi

vs

Arduino/micro:bit



Sensors

How we extend computation to the physical world

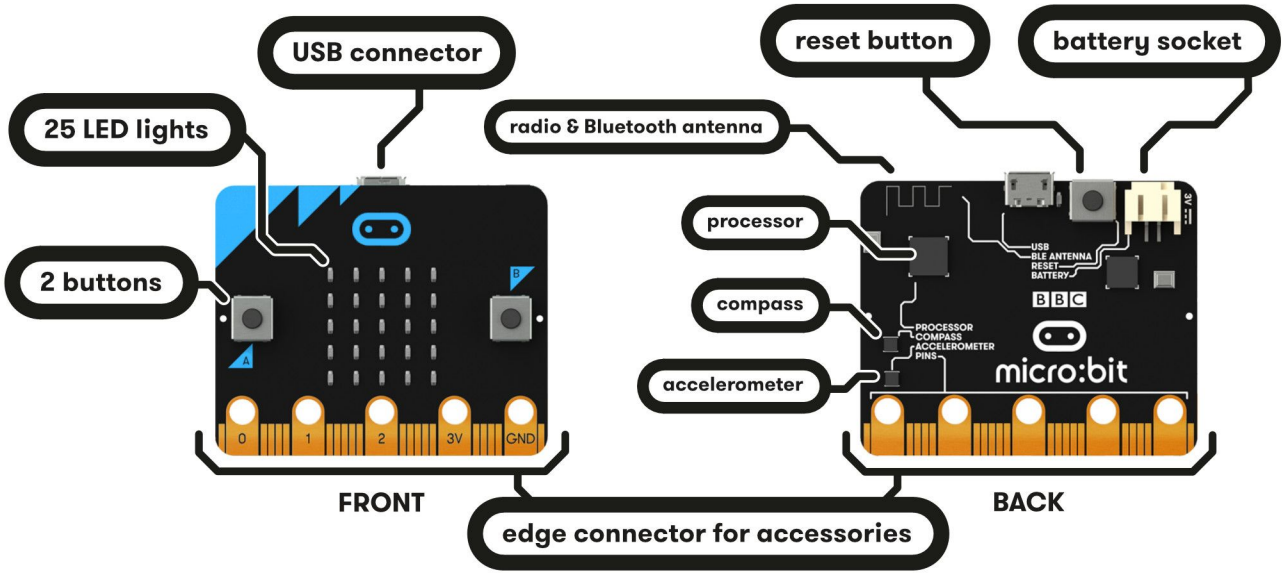
Types of sensors:

Accelerometer, gyroscope, temperature, compass,
camera, lidar distance, light sensor, color
microphone
flex, capacitive touch,
moisture, radiation

Micro:bit

A well packaged, easy-to-program microprocessor

https://microbit-micropython.readthedocs.io/en/v1.0.1/microbit_micropython_api.html



Why should I care? I already have a phone...

microcontrollers:

- cheap (~$1 - $20)
- sensor-rich
- re-programmable

Imogen Heap and those "magic gloves"

They can be yours for the paltry sum of $3,370.00 <3 :D <3

https://mimugloves.com/

Controls (inputs) include:
finger-gesture (force-bend/flex), axial tilt (accelerometer), button.

Feedback: vibrator/motor, LED

https://www.youtube.com/watch?v=6btFObRRD9k&t=930s

Communication

How do we connect microcontrollers to more powerful machines (phone/laptop)?

Many communication protocols

- TCP/UDP (internet)
- Bluetooth
- Serial
- and more!

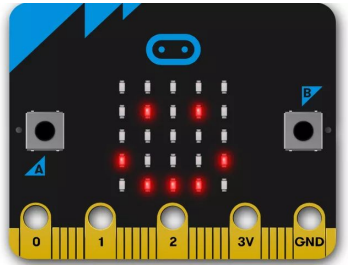
Serial is the most “basic”

Serial Communication

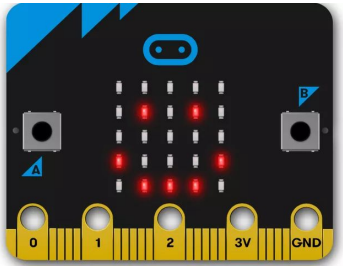
Allows us to sent data back and forth between processes on different machines

In our case sent over USB cable

Requires TWO code files - one on each device



Serial Communication



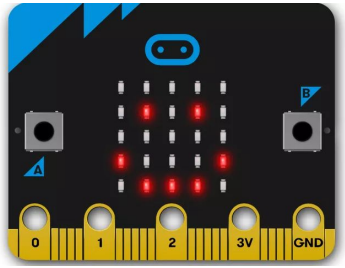
micro:bit online code editor

uses “micropython”

https://python.microbit.org/v/2

our old friend processing.py

Serial Communication



Demo Time

Project 3

Connect your micro:bit to Processing using serial communication to create an interactive physical+digital art piece

More here: http://marksantolucito.com/COMS1002/3/#project3

If you don’t have a micro:bit, order one right now and maybe you won’t get a Zero

Bonus: how its made

https://www.youtube.com/watch?v=24ehoo6RX8w