

Introduction To Robotics

BridgewayTech.org – Marlon Samaniego

- What is a robot ?

According to the Oxford dictionary, a robot is “a machine capable of carrying out a complex series of actions automatically, especially one programmable by a computer.”

Robot Examples

- American Visionary Museum – World's First Family of Robots by Devon Smith



Robot Examples - Interactive

- These are the newest commercially available robots designed for positive human interaction



WowWe Fingerlings Monkey



Joy For All Silver Cat

Dog Robot - Interactive



- Joy for All Companion Pet Golden Pup
- Built-in sensors allow dog to respond to touch and sounds
- Soft, lifelike coat and authentic puppy sounds
- Feel the pup's heartbeat with your calming touch
- Responds to your voice with BARKBACK⁴

Robots For Children



Wonder Workshop
Dash & Dot, Ages
5-9



LittleBits Star Wars
Droid. Ages 8-12

Specialized Home Robots

- You may already own one !



iRobot

Automated vacuum cleaner



Amazon Echo (Alexa)

Artificial Intelligence (AI)

Robot In The Classroom

- Vgo - Used for students unable to go to class due to illness



Humanoid Robots



Actroid-DER2 (2015)



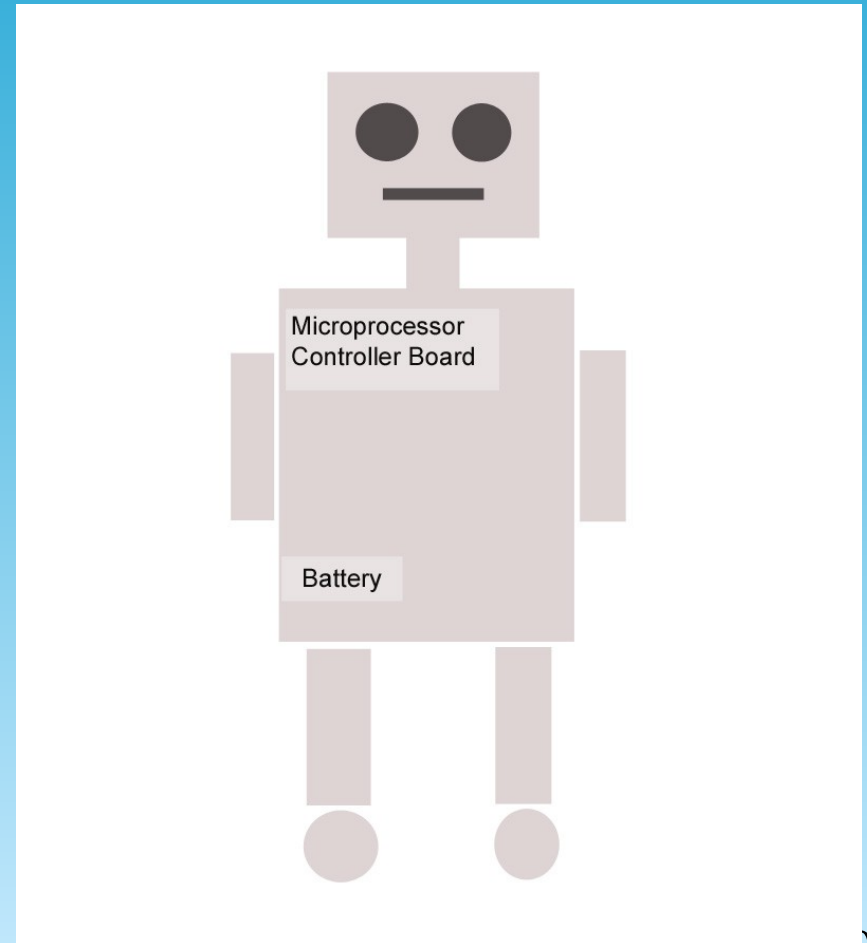
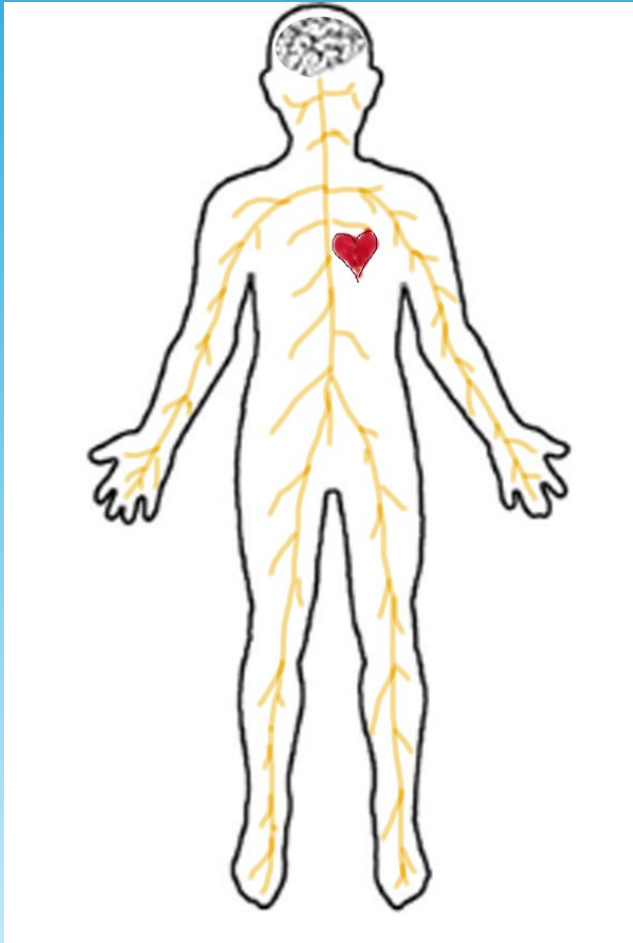
Scarlett Johanson (2016)

- Actroid used as Hotel greeter - speaks, facial expressions
- Scarelett J. robot developed by graphic artist in Japan.

Why Learn Robotics ?

- Fun, creative process
- Understand our world better – technology is all around us.
- Help guide this new frontier – influence legal, social, ethical direction
- STEAM/STEM Learning – Science, Technology, Engineering, Art, Mathematics
- Keep mind active learning new things

Robot Human Body Analogy



Robot Human Body Comparison

- A robot has functions similar to us and other living creatures.
- A computer controlled robot, has a central processing unit (CPU), which is on the microprocessor board, gathers information from its sensors and provides movement, like our brain getting information from our senses (touch, smell, sight), makes decisions and moves our muscles.

Note: In the human diagram the heart represents a power source but the human power system is much more complex, involving the digestive system, circulatory system, respiratory system, endocrine system, cell mitochondrion, etc.

Robot Human Comparison (cont.)

- Our nerves, attached to our muscles and sense organs are similar to wires connecting the robot sensors and motors to the CPU.

Popular Robot Control Systems

- Arduino – Inexpensive, microcontroller designed for students, code similar to C, C++; inexpensive with large world wide support and activities.
- Raspberry Pi – Inexpensive, single board computers designed to teach coding in Python; inexpensive with large world wide support and activities.
- Lego Mindstorm – Robotics set by Lego with an easy to understand language with large US support group and activities.

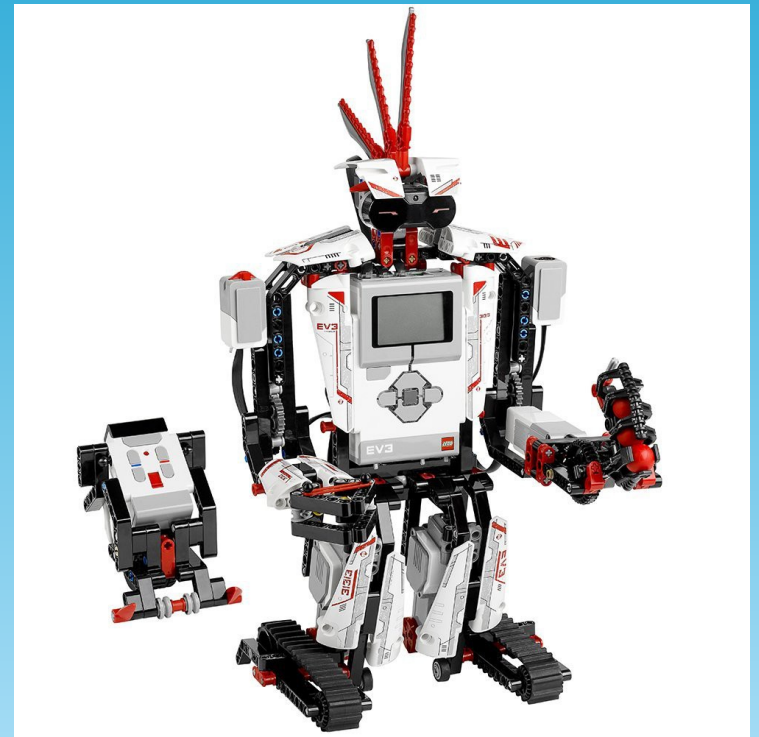
Robot Control Systems Comparison

- **Arduino Uno** – Developed in Italy, microcontroller ATmega328P, 8 bit, 16 MHz, 32 KB Flash memory, 5V Power, requires a computer to program. Lowest power consumption.
- **Raspberry Pi 3 Model B** – Developed in the UK, single board computer, quad-core, 4GHz, 64 bit processor, WiFi, Bluetooth, 4 USB ports, HDMI video, micro SD memory card. Power requirement 5v. Low power consumption.
- **Lego Mindstorms EV3** – U.S. based, TI Sitara AM180832 bit, 300MHz, 64 MB RAM, 16 MB Flash memory. Power requirement 9v.

Robot Control Systems



Arduino Uno



Lego Mindstorms Ev3

Robot Control Systems (cont.)



Raspberry Pi 3 Model B+

Robot Motors

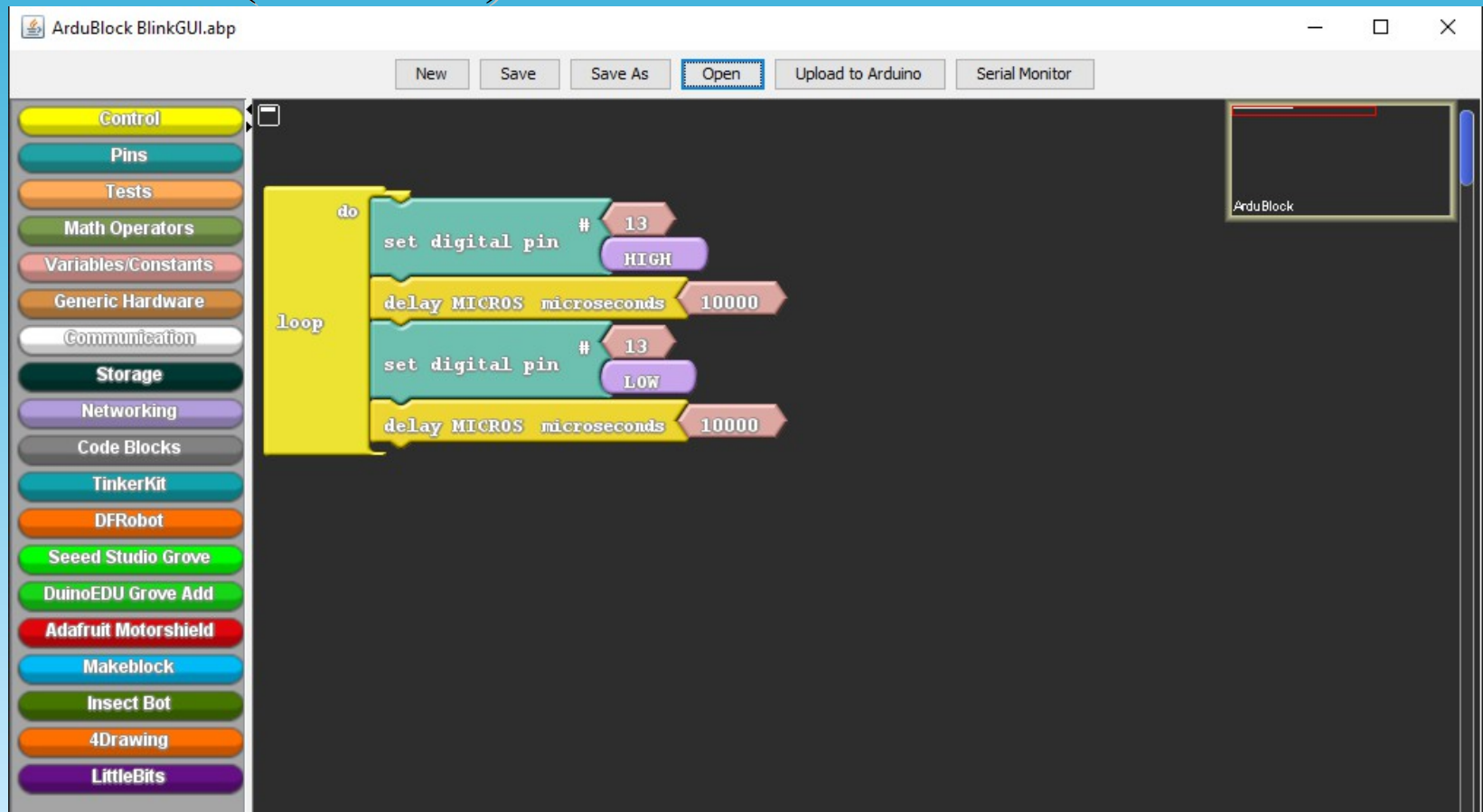
- **Three Main Motor Types Used For Robotics**
 1. **DC Motor** – easy to use, rotates smoothly when DC current is applied.
 2. **Stepper Motor** – moves in discrete steps for more control. Controlled by sending electrical pulses.
 3. **Servo Motor** – able to move to various angular positions, for example 30, 45, 60, 90 degrees.

Popular Sensors and Devices

- **Ultrasonic Sensor** – used to measure distance.
- **PIR (Passive Infra Red) Sensor** – used to detect motion
- **Photo Cell Sensor** – to sense light
- **Camera** – to capture images or video
- **Bluetooth Receiver**– to control the robot with a phone app using bluetooth.

Visual Coding Tools

- **ArduBlock** – visual interface to create Arduino code (sketches)

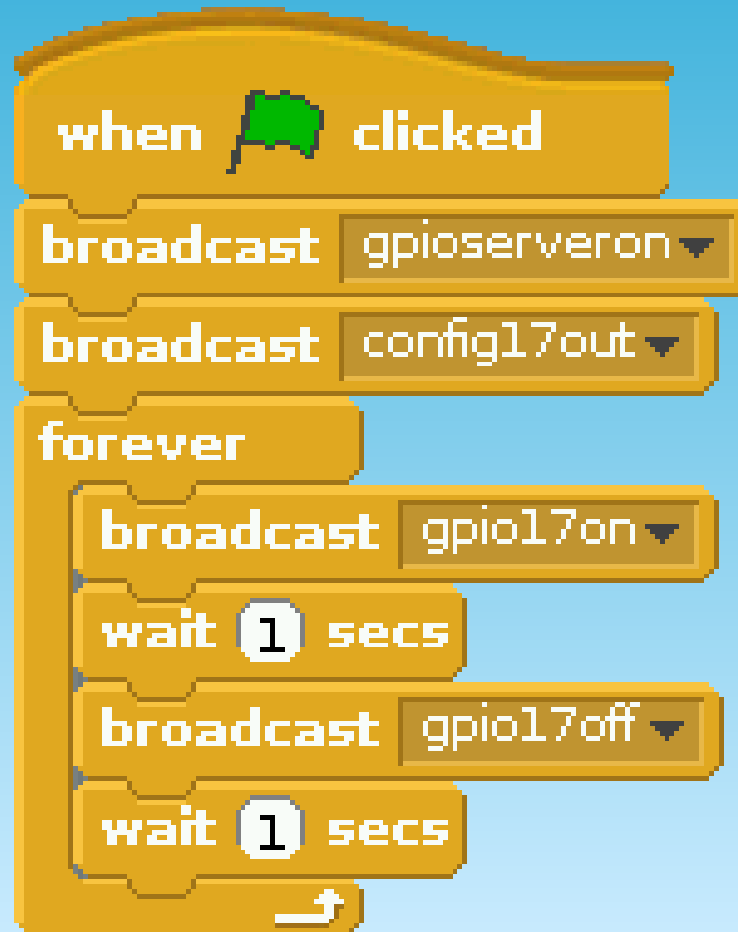


ArduBlock Generated Code

```
void setup()
{
  pinMode( 13 , OUTPUT);
}
void loop()
{
  digitalWrite( 13 , HIGH );
  delay( 1000 );
  digitalWrite( 13 , LOW );
  delay( 1000 );
}
```

Scratch For Raspberry Pi

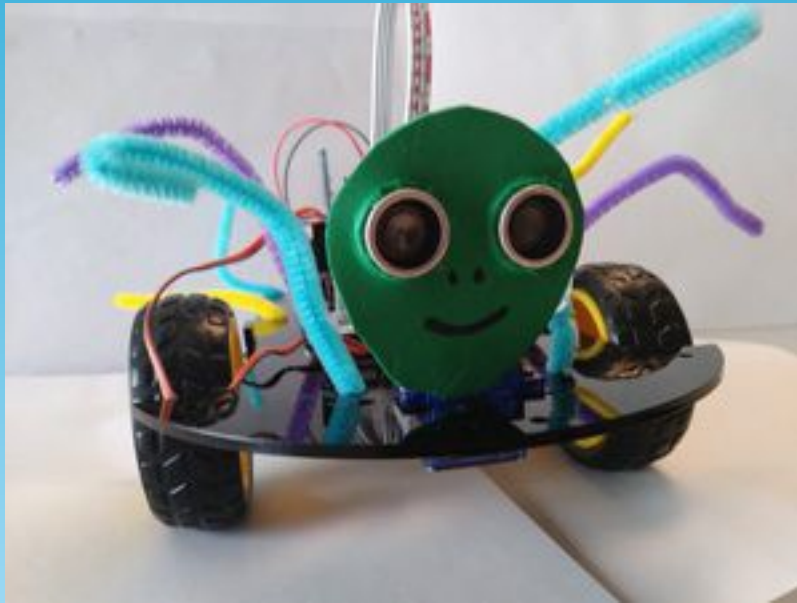
Turn a LED On and Off



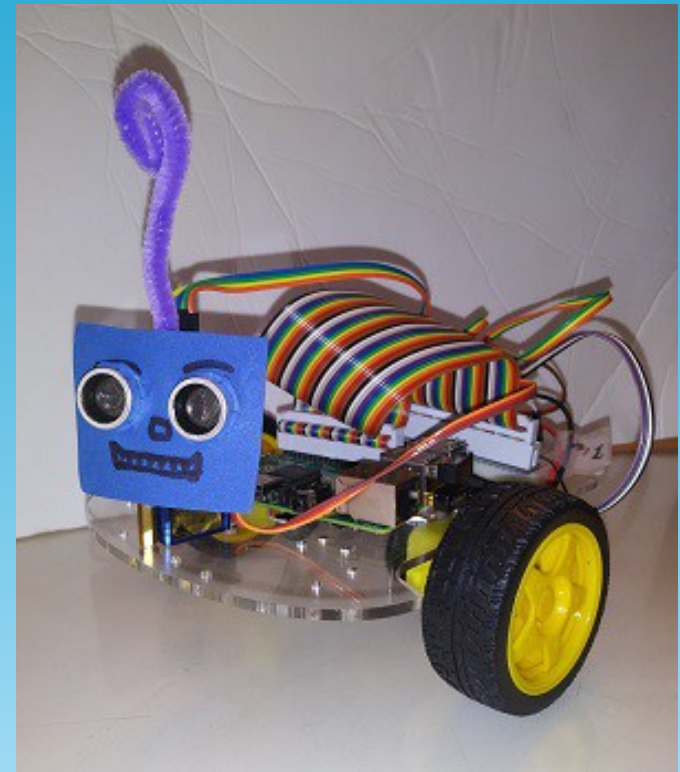
Raspberry Pi Python Code

```
from RPIO import PWM
import RPi.GPIO as GPIO
import RPi.GPIO as GPIO
.....
GPIO.setmode(GPIO.BCM)
GPIO.setup(19,GPIO.OUT)
...
print"controls"
print"1: move forward"
....
while True:
inp= raw_input()
if inp == "1":
fwd()
print"robot moving in fwd direction"
```

Arduino & Raspberry Pi Robots



Arduino Uno Robot



Raspberry Pi Robot

More Robot Examples



Robot Arm Mod



Rover Mod

Mars Curiosity Rover

- NASA Jet Propulsion Laboratory (JPL) has released build plans to build a scaled down model similar to their Mars Curiosity Rover with easily obtained commercial parts using the Raspberry Pi (see RaspberryPi.org)

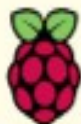
Mars Curiosity Rover Model



GET PHYSICAL WITH COMPUTER SCIENCE



WHAT WILL YOU
CREATE WITH YOUR
COMPUTING SKILLS?



raspberrypi.org/resources

Bridgeway Technology Inc.

- Non-profit to provide fun, STEAM/STEM education to our communities of all ages.
- Partnering with Early Childhood education experts to develop effective and fun Pre-K STEAM/STEM with robotics.
- Plan to create a game coding program
- Plan to create on-line tutorials and support promoting fun, learning with robotics and game coding for all.
- Our book “Introduction to robotics with Arduino and Raspberry Pi” will be completed soon.

My Next Robot Project

- Made of discarded items, like coffee can, bottles and other containers
- Vibrant colors
- Screen to provide facial expressions
- Voice chip to speak and a speaker to make other sounds
- At least one working arm
- Motorized wheels
- Web cam
- Raspberry Pi



Bridgeway Technology Inc.

Fun STEM/STEAM Education with
Robotics and Gaming For All Ages



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