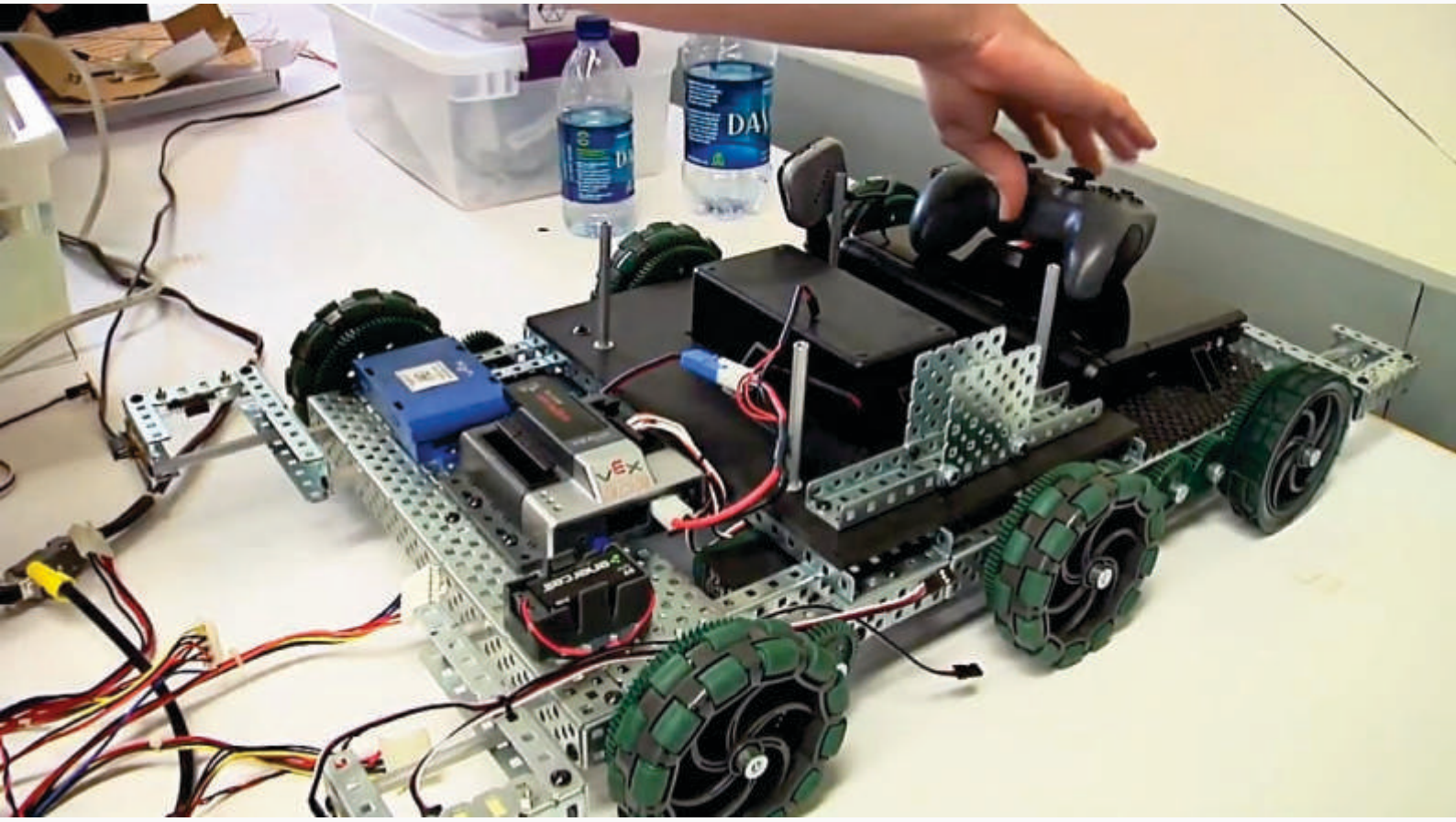
Fundamentals of Robotics



Training Outline

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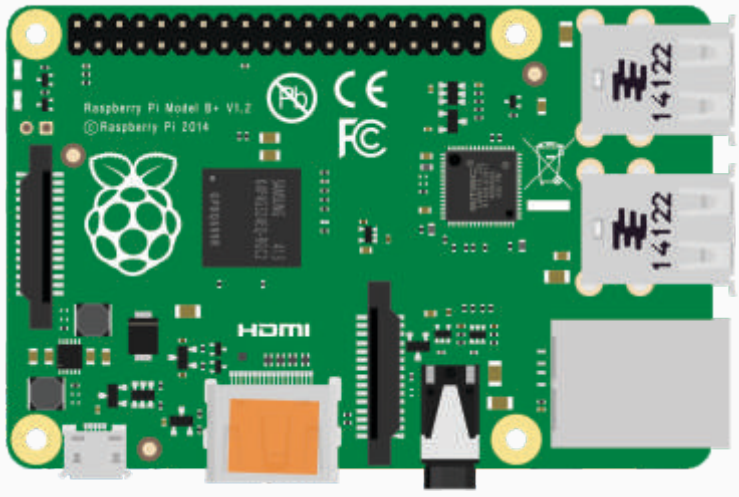
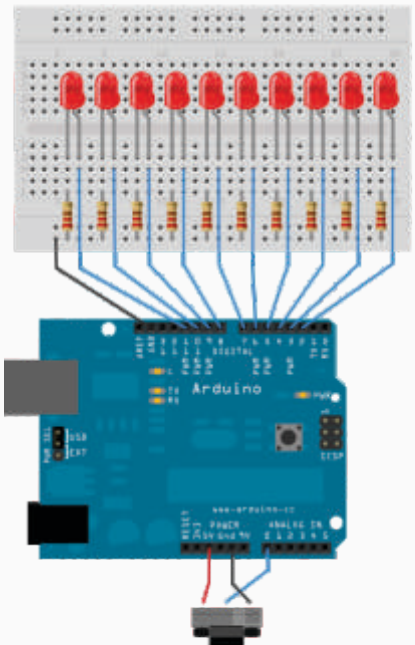
> We're fascinated with robots because they are reflections of ourselves.
>
> **Ken Goldberg**

```
import RPi.GPIO as gpio
import time

gpio.setmode(gpio.BCM)
gpio.setup(18, gpio.OUT)

while True:
   gpio.output(18, gpio.HIGH)
            passcode = raw_input("What is pi?: ")

            if passcode == "Awesome":
               gpio.output(18, gpio.LOW)
                        time.sleep(4)

            else:
               gpio.output(18, gpio.HIGH)
                        print("Wrong Password!")
```





ARDUINO

Master Module

Arduino
Python
Raspberry Pi

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Arduino

Arduino is an open-source platform, Arduino boards are able to read inputs and turn it into an output. Reading inputs- lights on senor, pressing a button or something else and turning to output- turning on an LED, rotating the motor etc.

Learn to control your arduino board by learning hands-on practical.

Libraries & Serial Monitor (approx. 30 mins)

- Install the Arduino Libraries and update as needed
- Learn about the serial monitor and configure it

Training Tools: PC, Arduino, USB cable

Blink

- Learn about the Arduino board and its parts
- Make the onboard LED blink

Training Tools: PC, Arduino, USB cable

LED

- Learn about the breadboard and its use for prototyping
- Connect an external LED and blink it

Training Tools: PC, Arduino, USB cable, breadboard, LEDs, Resistors, jumper wires

RGB LED

- RGB LED and how to connect it properly to the Arduino
- PWM and how it is used to mix the different LED's to make colors

Training Tools: PC, Arduino, USB cable, breadboard, LEDs, Resistors, jumper wires

Digital Input

- Digital input techniques using push buttons
- Use push buttons to turn on & off LED

Training Tools: PC, Arduino, USB cable, breadboard, RGB LEDs, Resistors, jumper wires, push switch

Active Buzzer

- Difference between active and passive buzzers
- Use an active buzzer to make sounds

Training Tools: PC, Arduino, USB cable, breadboard, jumper wires, Active buzzer

Weather Station

- Analogue sensors, including thermistors and photoresistors
- Use the SD card module to collect temperature and light level data

Training Tools: PC, Arduino, USB cable, breadboard, capacitors, resistors, jumper wires, SD card module, TMP-36 thermistor, and photoresistor

Python

One of the most powerful programing languages, python is an excellent first scripting language for intermediate or older students looking to program. Used in web and internet development, the scientific community for modelling and analysis, used by big companies like Google, Facebook, NASA, and Dropbox! With python students will learn to program computers, create games in a fun and highly interactive series of projects

Basic commands & introduction

- Motivate the use of Python as a programming language
- Become familiar with the Repl.it online IDE
- Instantiate the first turtle and learn basic movement commands

Creating their first turtle art

- Use sequential commands to draw a house
- Use simple for loops to implement repetition

Divide and conquer

- Learn to think like a programmer
- Decompose a complex programming problem into a list of smaller tasks
  - Draw a flower by first creating curved lines, then petals, then flower

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Functions and for loops

- Learn to use simple functions in Python
- Use function calls to draw multiple flowers and polygons
- Additional details regarding for loops, i.e. nested iterations

Randomness

- Learn basic methods of Python's random module
- Generate a random walk using turtle graphics

Variables and data

- Learn to define variables in Python
- Learn about common data types, including integers and strings
- Use basic accumulator pattern with loops
  - Variable reassignment, i.e. x = x + 1
  - Compute perimeter circumference of polygons

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Print functions, input and mathematical operations

- Use variables and strings to print simple messages on the screen
- Create a basic calculator

Decision-making in Python

- Implement simple decision trees using if-elif statements and mathematical operators
- Create a number guessing game

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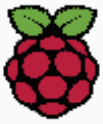
Raspberry Pi



Everyone has used a computer, but has your student built one from scratch? Well with this Raspberry Pi course students will learn to assemble a collection of scrap parts into a fully working computer! While exploring RAM, I/O busses, CPU and other terminology students will learn and expand python programming needed to develop their raspberry pi into an incredible machine.

Raspberry Pi Exploration

- Explore Raspberry Pi interface and navigation
- Try out various pre-installed Raspberry Pi programs
- Know locations of pertinent documentation and resources

Training Tools: Raspberry Pi, SD card with Raspbian installation, mouse, keyboard, HDMI cable, HDMI-enabled monitor

Multi-LED project

- Learn about the GPIO headers on Raspberry Pi
- Introduction to Python while loops
- Use basic GPIO output commands to light a series of LEDs using Python

Training Tools: Raspberry Pi, SD card with Raspbian installation, mouse, keyboard, HDMI cable, HDMI-enabled monitor, breadboard, jumpers, resistors, LEDs

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Digital Input on the Raspberry Pi

- Use push-buttons to control software and hardware on the Raspberry Pi
- Introduce the Python time module and create a stopwatch program that can be controlled via button presses

Training Tools: Raspberry Pi, SD card with Raspbian installation, mouse, keyboard, HDMI cable, HDMI-enabled monitor, breadboard, jumpers, resistors, push-buttons

Pi Garden

- Create a comprehensive and self-contained gardening system using the Raspberry Pi
- Learn to log soil moisture data using the Raspberry Pi moisture sensor
- Operate light and water pump on user-defined schedule

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