IT Technology

Introduction:

I will start with a short story of my nephew (6 years). While visiting me once, he came near my computer desk and said, “Alexa, turn on computer”. I was shocked. I do not have Alexa at my home. So, he started crying for Alexa. His dad has Alexa in their home. She was missing Alexa. Then, I turned on the wake-on LAN in my computer, and created a port forwarding on my router, then turned on my computer with a magic packet from my phone, to prove that Alexa listened to him. Then, I introduced him to Siri, his new mate.

The reason I started with this story is because, our next generation is getting exposure to IoT and other technologies from an early age, which is good according to me. We are moving to a smarter generation. For my nephew, Alexa is just like his pet. The upcoming generation will be relying on IoT devices a lot; there will robots in the offices, homes, and fields. Human will interact more with the robots and computers.

Future of robotics:

Robotics are being used in a lot of industries. In future we will see shard rise of robotics in below sectors:

Restaurant/Hospitality: Pudubot is a robot waiter. Robots are being used to serve customers in Melbourne restaurants and ice-cream parlours. (Ref 1, 2, 3, 4)

Agriculture: RIPPA and VIIPA, the University of Sydney's agricultural robots. Photo: University of Sydney.(Ref 5)

Robotics in space: Perseverance, Ingenuity, curiosity, pathfinder. NASA have a 3D model of the Perseverance, which is very educational to me. As I can learn about different component just by clicking on them. This is the link for the 3D model. (Ref 6)

Construction: Shimizu corporation has deployed construction robots for building a high-rise hotel in Shin-Osaka. (Ref 7)

Treatment/Surgeries: Many hospitals nowadays use robots to perform complex surgeries with precision and minimal (Ref 8)

Increase Human life expectancy: Nanobots (Size of blood cell) in future will be able to rejuvenate our cells and keep us healthy and we can live much longer. Some research was already done on rats. (Ref 9)

Terraforming a planet: Robots can be a solution for terraforming a planet instead of human. (Ref 10, 11)

References:

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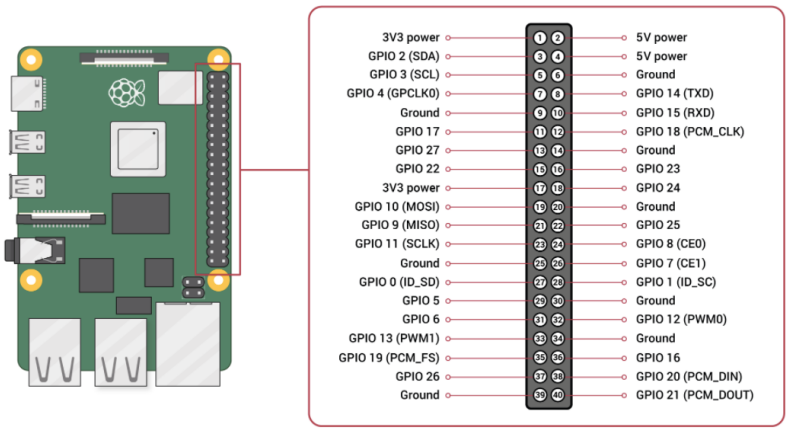
3. *< Author - Rushani Epa, Thursday 22nd April 2021, Timeout https://www.timeout.com/melbourne/news/get-served-by-a-robot-at-this-hot-pot-restaurant-042221 - Tan Hot Pot, a Restaurant on Bourke St. using robot waiter>*
4. *<Author - JNS Robotics, 4th February 2021, Youtube https://youtu.be/QiiujJVevYo - Dooboo, Restaurant on Swanston St>*
5. *<Author – Engineers Australia https://www.engineersaustralia.org.au/News/future-agriculture-robotic-farmers>*
6. *< Author - NASA/JPL. https://mars.nasa.gov/mars2020/spacecraft/rover/>*
7. *<Author – Ani, 27th December, 2018, Business Standard https://www.business-standard.com/article/news-ani/shimizu-corporation-introduces-robots-for-civil-construction-118122700469_1.html>*
8. *<Author – Mayo Clinic https://mayocl.in/3hHxKRQ >*
9. *<Author – Ray Kurzweil, 22nd November 2007, The Guardian https://www.theguardian.com/commentisfree/2007/nov/22/comment.comment >*
10. *<An inspirational video of terraforming a planet with robots, Video creator - Richard Mans, The Verge https://www.theverge.com/2014/8/25/6065179/watch-robots-terraform-an-alien-world-in-this-wordless-short-film >*
11. *<Robots can be a solution for terraforming mars, Author – Graham Phillips 26th November 2018, Sydney Morning Herald, https://www.smh.com.au/national/send-robots-not-people-to-mars-20181123-p50i0n.html >*

Raspberry Pi:

I chose to write about raspberry Pi/Arduino and robotics because I have passion for that. There are many other alternatives such as: banana Pi, orange Pi etc. Raspberry Pi is my cup of tea. Python/wiring Pi can be used.

We can simply import the RPi.GPIO (OPi/Bpi for orange/banana pi) to control the GPIO pins. A GPIO chart is very helpful for controlling the pins.



<Table from Raspberry pi official website https://www.raspberrypi.org/documentation/usage/gpio/ >

GPIO – 3.3v, maximum current draw 16mAmp

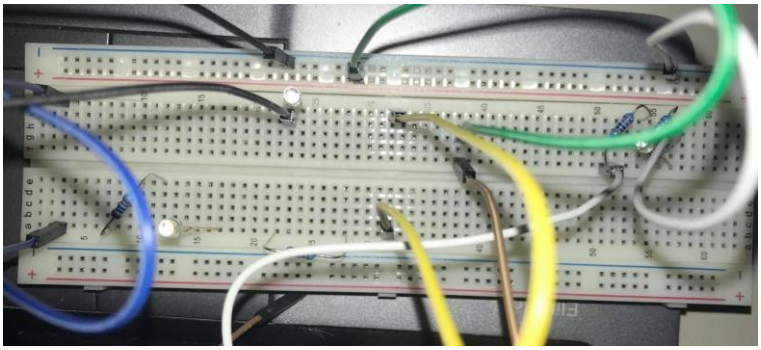
GPIO 27, 28 – Reserved for advanced use, often used by HAT boards

GND – Ground pin

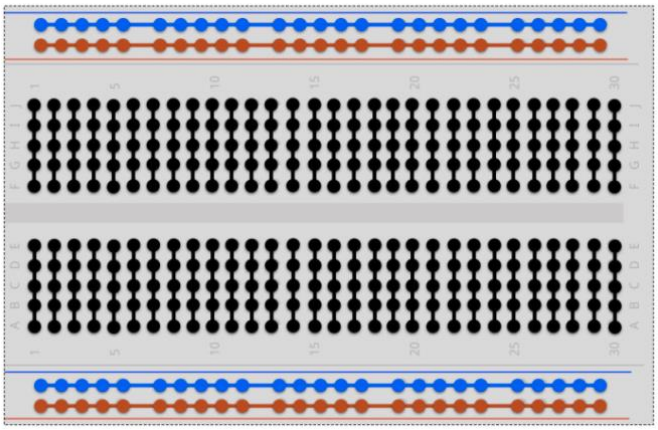
GPIO 1 – Static pin (3.3v, Maximum current draw 16mAmp). Used for supplying extra power.

GPIO 2, 4 – Static pin (5v, Maximum current draw 1A/2A). These 2 pins are directly connected to the power supply of the raspberry pi. With a 3A adapter we can expect to draw minimum 1A current.

Breadboard:



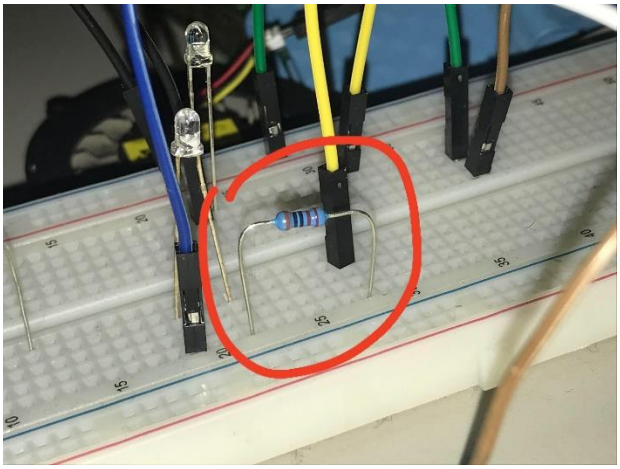
A breadboard is recommended for prototypes. It has circuits, we can just connect the equipment and supply power to them using circuits.



<Image collected from https://images.ctfassets.net/ >

This is a simple layout of the breadboard. In the middle 2 rows we can make our circuits with lights/motors, resistors, transistors etc. On both side we have the power rail and ground rail. The blue rail is negative, and the red rail is positive. It can be used interchangeably.

Resistors:



Resistors are crucial for any electronics. They can reduce the amount of current that a electrical equipment can draw. For example: a 5mm blue LED will withdraw at an amount of 3.4v and needs 30mAmp of power supply. But a GPIO pin max supply rate is 3.3v and maximum withdrawal limit is 16mAmp. If the blue light is directly connected to the Raspberry pi, it will try to pull 30mAmp at 3.4v rate. It will gradually or instantly damage the pin. So, we need a minimum 220 Ohm resistance in the circuit, so the LED cannot pull more current than raspberry Pi can supply.

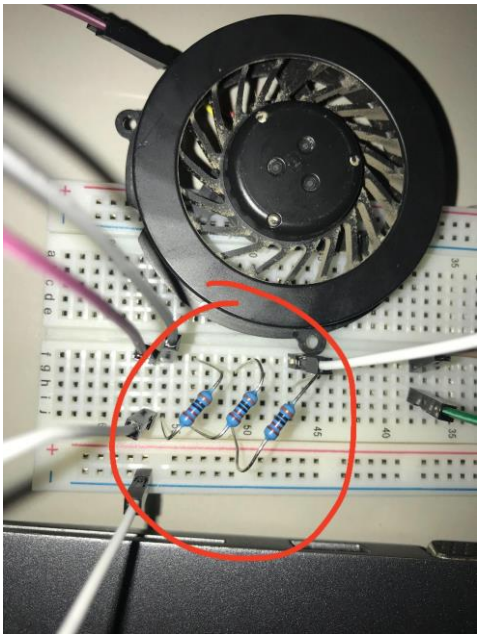
Ohm's law "V = I X R" or "R = V/I" *<Ref https://en.wikipedia.org/wiki/Ohm%27s_law>*

V = Volt, R = Resistance and I = current (NB. the current needs to be in Amp, not mAmp).

Tweaks and tricks:

Increase resistance:

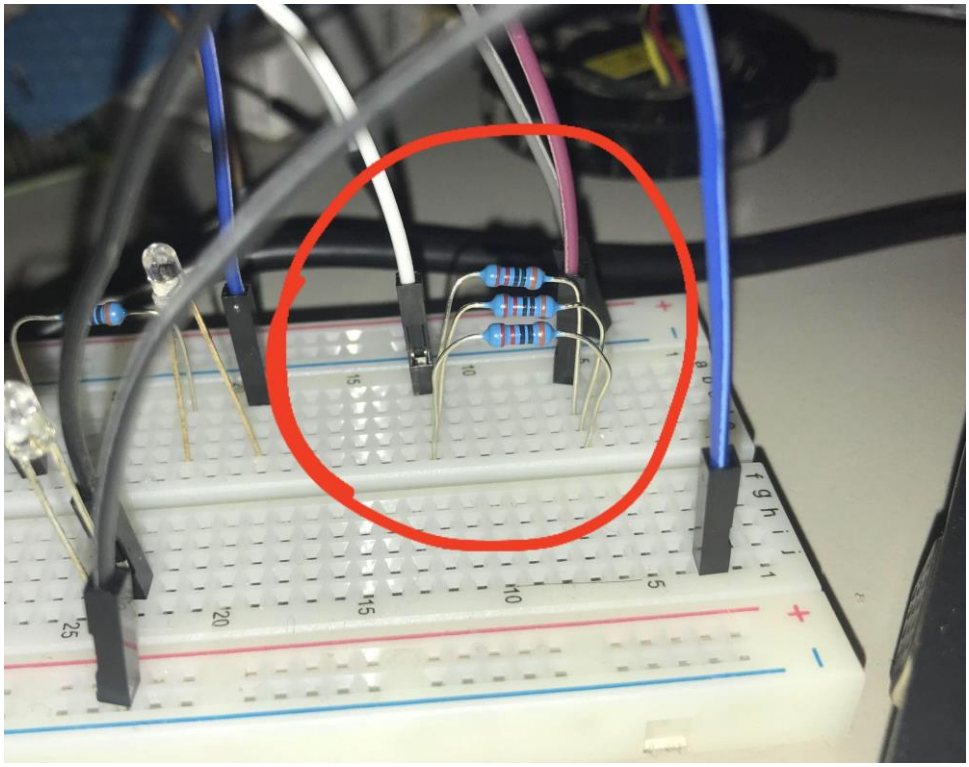
We can increase the resistance by putting multiple resistors on a circuit.



In the above image, I have 3 X 220 Ohm resistors. So, each of them can provide 220 Ohm resistance. In total they will provide 660 Ohm resistance in the circuit. A transistor can be used as a trigger/switch for the motor. Please see the transistor part for explanation.

Decrease resistance:

We can decrease the resistance by using the resistors in a parallel circuit.

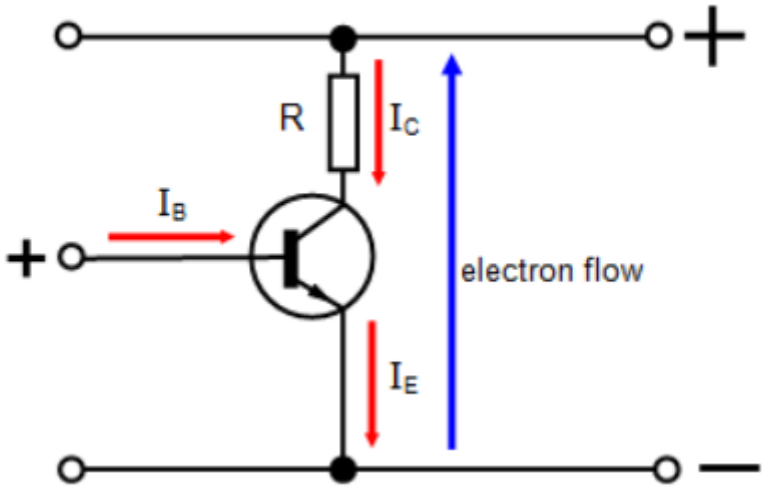


In simple words, if we think in this way, a 220 Ohm resistor resists 220 Ohm current, but it also carries 1 unit current from one end to another end. So, 3 resistors will carry 3 units of current from one end to another end. Because they are in a parallel circuit, so they collect electricity from the same rail and pass it to the same rail, so the collective electricity after resistance is being passed to the negative rail. The resistance is not decreased in reality, it just increases the electricity supply in a circuit, so the resistor just becomes less efficient. In this way, we can decrease the resistance of a circuit.

Transistor:

Transistors are like switches. It has 3 pins. There are many different types of transistors. I will write about NPN transistor

This is a transistor. The middle pin is base then on the sides we have emitter and collector. Collective is more positive than emitter. So, the electricity flow from collector to the emitter end when the circuit is closed. The base is used for closing circuits.

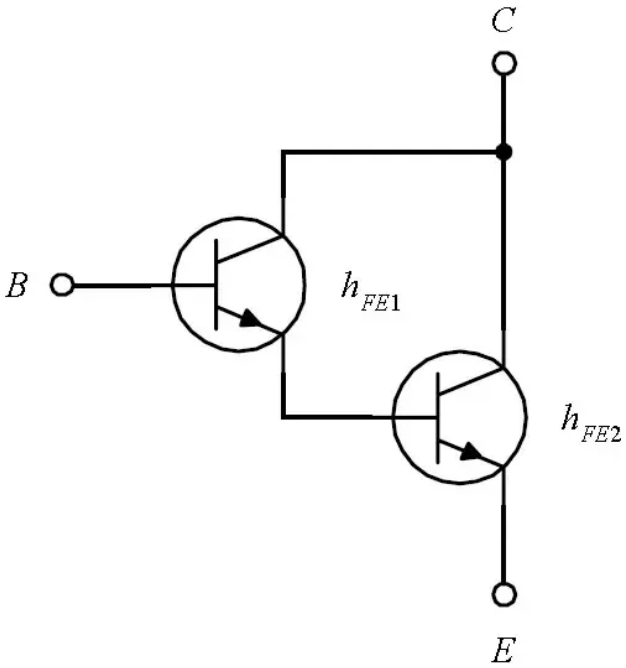


In the above picture, positive end is collector and negative end is emitter. The middle pin is base/positive. When a small amount of electricity is passed to the base/middle pin, the circuit is closed and current flow from collector to emitter.

Transistors are used mostly for equipment that requires lot of electricity such as: 5v motors or 12v motors or a servo motor. Little bit of electricity can be passed to the base from Raspberry Pi GPIO and the circuit is closed so, the motor can pull electricity from a powerful battery.

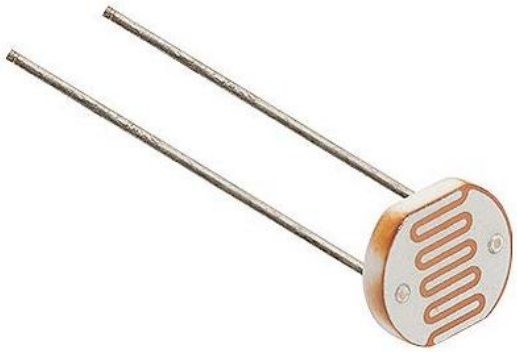
Darlington pair:

Transistors can be used for amplifying power supply. In this case, we can use 2 transistors. The second transistor's base connects to the first transistor's emitter. As the base is connected, the circuit of the second transistor is also closed, so it has an increased power supply to the equipment.



LDR resistor (Photoresistor):

This is another type of resistor. It reacts to the light. When there is light on the resistor then the material absorbs the light and conductivity of the material increases, so the equipment starts. When the light is gone the conductivity of the material is decreased so it acts like a resistor and decrease electricity flow. It can be used in an interplanetary exploration rover. For example: on a summer day temperature on Mars can be around 20-degree Celsius near the equator. Which is okay for a rover to operate. But at night the temperature can plummet to –73 degrees Celsius, which is not a suitable time for exploration as the rover needs a lot of power to keep itself warm so the sensitive component can be protected. The LDR can sense day light and at night can increase the resistance or fully stop electricity flow to the unnecessary parts.

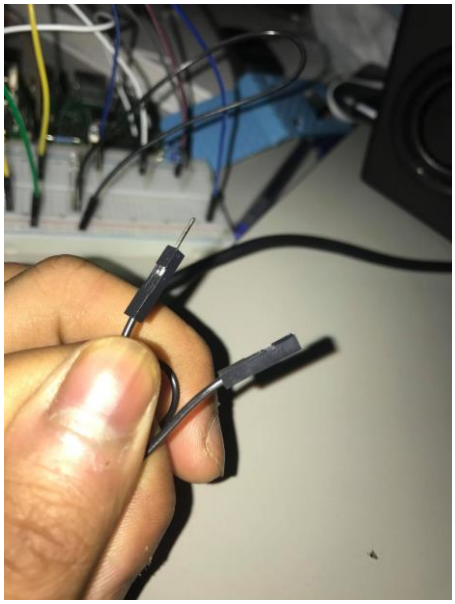


Capacitor:

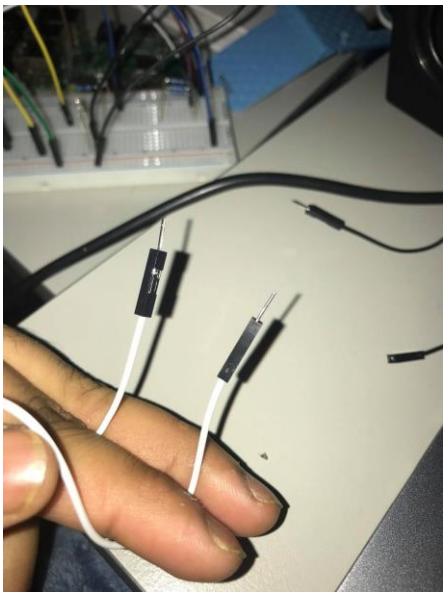
It charges itself and discharges electricity in the circuit when necessary. Capacitors can be used to block the DC current, which can be hazardous and let AC flow in circuit which is safer.

Jumper cable:

Male to female: Can connect from GPIO to the Breadboard



Male to male: Can connect from breadboard to breadboard



Sonar Sensor:

It uses ultrasonic waves and with the reflection of the wave it can provide a reading of the echo. Based on that echo we can set a limit, which help the robot to determine that there is an obstacle, and it needs to detour.

LIDAR:

Lidar is a good sensor too. It is similar to radar. LiDAR uses laser to identify surroundings and create a map. IPhone 12 Pro and iPhone 12 Pro Max uses LiDAR. It is useful for a robot to map an area and plan route from point A to point B.

OpenCV:

OpenCV is used for identifying different object. That is more useful for A.I. but it can also be incorporated with robotics as I see future robots will be intelligent. No doubt that robots will be using OpenCV in future.