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Building Interactive gadgets 207

Assignment 2

1) Explain the relationship between current, voltage and resistance WITHOUT using an equation

(i.e. V=IR)

Voltage is a product of a current flow and a resistance of the all of the components in a circuit. When a current flow or a resistance is increased it is affecting voltage in a direct proportion to the change.

What is the total resistance of each of the following circuits (NOTE: Circuit D is extra credit! It's a tough one!!)?

2) In a serial type of connection current is equal trough out the circuit and to calculate a total resistance of circuit we simply add together values of the inline resistors.

A) R(Total)=R1+R2+R3

R(Total)=220+30+10=260Ohms

B) In a parallel type of connection voltage is equal at the each of the parallel branches.

To calculate total circuit resistance, we should add reciprocals of each resistors and take reciprocal of that sum.

1/R(Total)=1/220 + 1/220=1/2/220=220/2=110Ohms

R(Total)=110Ohms

C) Same rules apply to a segment of hybrid circuit.

R(Total)=R10+1/(1/(R6 + R7) + 1/(R8 + R9))

R(Total)=R10+1/(1/(220 + 220) + 1/(220 + 220))

R(Total)=R10+1(1/440 +1/440)

R(Total)=R10+1/2/440

R(Total)=R10+440/2

R(Total)=220 + 220

R(Total)= 440 Ohms

D) The principle of conservation of electric charge implies that: At any node (junction) in an electrical circuit, the sum of currents flowing into that node is equal to the sum of currents flowing out of that node.

R16 + R15 = R15,16 = 440 Ohms (Because they are connected in a serial)

**R- delta = Rp / R opposite**

**Rtt = R14R15,16 + R15,16R12 + R12R14 / R15,16**

For the top loop**:**

R(TotalTop) = (220 \* 440 + 440 \* 220 + 220 \* 220) / 440 = 96800 + 96800 + 48400 / 440 = 550 Ohms

For the bottom loop:

**Rtb = R11R13 + R13Rtt + RttR11 / R13**

R(TotalBottom) = (220 \*220 + 220 \* 550 + 550 \* 220) / 220 = 48400 + 121000 + 12000 / 220 = 1320 Ohms = 1.32kOhms

3) Find three interactive hardware projects that others have done online that you might be Interested in making!

Project candidate 1:

RFID Cat Door

<http://www.instructables.com/id/RFID-cat-door/>

A small summary of what was made (1 paragraph)

1. This project was created to allow a cat or a dog to leave and come back inside a house at any time. Design itself is very simple in its nature. Two solenoids and a hall effect sensor are in charge of a door control. Proximity sensor was used to monitor a pat approaching from the inside and a radio frequency antenna to allow a secure return of our pat. Overall design is simple and effective to carry on with its main function. Controlling access through the pat door.
2. A way you might improve upon their design (1 paragraph).

Main parameter to improve here is the use of a proximity sensor. Using RF antenna to exit and enter would lower the cost and increase reliability of this DIY project. Hall effect sensor is also not obligational in this setup. We could give our cat more time to open and close the door or install an optical encoder. But I like the idea of using a hall effect sensor to make sure the door is in the right position before closing solenoids locks. Additionally, we can attach a food and water dispensary and connect Arduino to the Wi-Fi. So, we can satisfy our pats biological needs remotely or at the prescheduled time intervals.

1. If you think this is a feasible project to do in about a month and a half (because that's all the more time you'll have!)

Yes, it is a very easy project to replicate and I already have some of the components required. Considering my developed programming skills and an overall simple design I would like to conclude that this project has nothing that would slow down development or a build time in any significant way. As I mentioned before we can mount food and water distribution system directly on the door surface. Incorporating water and a food tank directly around the electronics used to control a cat door.

Project candidate 2:

International Space Station Pin ISS Pin

<https://learn.adafruit.com/iss-pin/overview>

1. A small summary of what was made (1 paragraph)

This project utilizing Particle Photon with Headers and Adafruit Particle/Spark NeoPixel Ring Kit. Main purpose of this mini project is to track international space station and to alarm owner each time an ISS passes over the head. This hardware components are a very small and a light weight that allowing to build a very interesting wearable microelectronics. IFTTT website connectivity allowing some flexible applets to act as a trigger for a specific action. Luckily Photon's Wi-Fi capability allowing a fast and easy way of connecting to the world’s internet web. Overall this project deserves a second place by the complexity.

1. A way you might improve upon their design (1 paragraph).

I would try attaching a GPS module to this project. Main flaw of this design is that you need to readjust your exact geographical position each time you visit a new country or a city. Secondary comment is to install a small touchscreen to expand functionality of this ISS pin basically turning it into a smart watch. Additional voice control could be implemented to create Start Tack like communication device which would work over WI-FI, Bluetooth or a short-wave radio.

1. If you think this is a feasible project to do in about a month and a half.

It is a very easy project in its wiring diagram and a coding part. Mainly because of the internet connectivity this project moves to the second level of complexity among chosen projects. Also because of a small formfactor all of the components. But it is also fusible. All of the parts need to be purchased online. Additional complication can be in a connectivity with a local WI-FI. As a part solution, it can be connected to a cellphone to insure stable connection. Perhaps adding a round LCD screen would be a great idea to. I think it is possible considering how much time do we have.

Project candidate 3:

Multifunctional clock

https://www.hackster.io/15532/multifunctional-clock-86d165

1. Summary. This is the last and the most complex build I will attempt. Using Arduino to collect air quality and to get traffic updates is a great idea in my opinion. They are using Wi-Fi shield 101 to make sure they have internet and ALLThingTalks IOTOPIA Rapid development kit. The last one includes air quality grove sonsor, Grove Buzzer and a grove base shield. Those components is in a heart of this amazing interactive clock.
2. I want to add a solar panel and a charging invertor for a common set of AA rechargeable batteries. I would deviate from their Grove kit into a favor of AtMega 2560 and a sensor shield.

Additional modification would require to upgrade WI-FI shield to a Mega compatible. Plus, a large touchscreen LCD for the front face frame. Solar panels on the top and a gyroscope to turn it off with a firm shake. Plus a few USB ports for charging and syncing of a cellphone.

Plus, near field communication with an inductive charging for a generation two.

1. Yes, I think it is possible to take their code for a base and to make a certain change in a code to accommodate a new hardware. Especially a new interface. I think I may fall behind with a code part if I choose to do it from a scratch. But if I choose to go without google services to begin with, then it is possible to do it in time. 3D Printed box along would take a good share of a designing time.