



# IEEE SoutheastCon 2023

## *Hardware Competition Arena Build*



# The Hardware Competition Arena Build

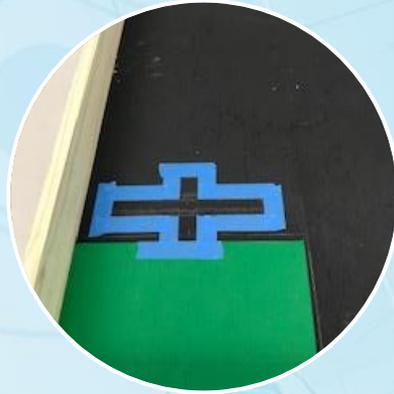
## *Valencia College IEEE Student Chapter*



# The Paint Color Scheme



*We purchased the paint at The Home Depot. We used Glidden flat indoor paint. Colors Onyx Black, Red Gumball, Blarney Stone, Stunning Sapphire, and Delicate White as seen in the pictures. For one arena a quart of the black and half quart of the other 4 colors are needed.*



## Painting the Arena

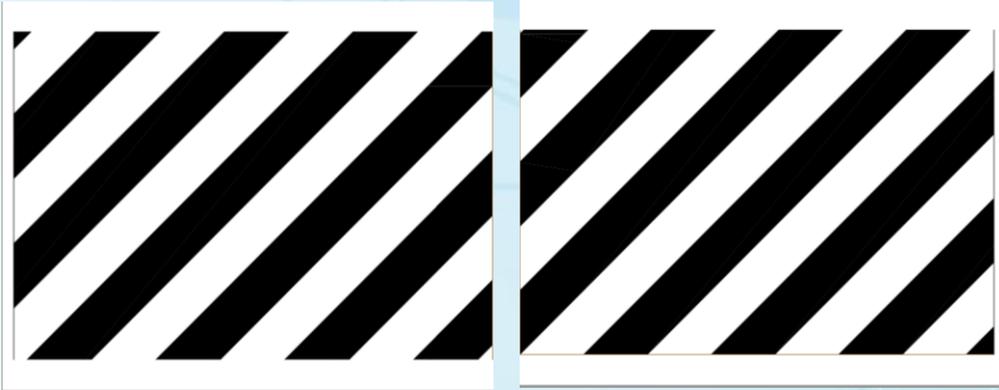
*We painted the plywood black first after sanding and vacuuming the wood. I would not recommend this and we will be painting everything else first before the black background. I recommend sanding and vacuuming the plywood first. Then adding your sides. Then using painters tape to tape off the specific areas after you mark them with a pencil. Then painting the all other areas first then painting the black back ground last. I would paint the white areas first then let them dry then move on to the other colors. I have to go back with a small paintbrush to touch up the lines and edges around the circles. Using paint brushes of different sizes from small to larger hand size brushes will be necessary for this build. Patience is also needed for painting. The squares should be easy enough to paint just by using painters tape as seen in the picture above so no templates for those areas.*



# Issues and Tips & Tricks

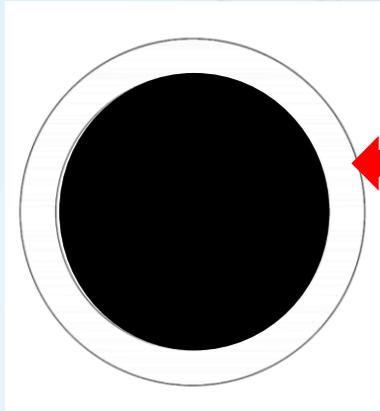


# The Recycle Area



The recycle area is 1'9"0r 21" x 9'. There are templates to use to check the area. If you print them on 11'x17' paper to get the sizing correctly and then place them together but you would need to over lap them. Place them on top of your area when you get the painters tape down to verify the spacing. There are no stencils for this area for obvious reasons. Unless you need the exact design of the recycle area for your robot to read, you could have any design for a practice arena on your own arena. The lines are difficult to paint. Your choice either way. This is just how the official arena recycle areas are finished. We used 1' painters tape at a 45 degree angle spaced 1' apart from each other.

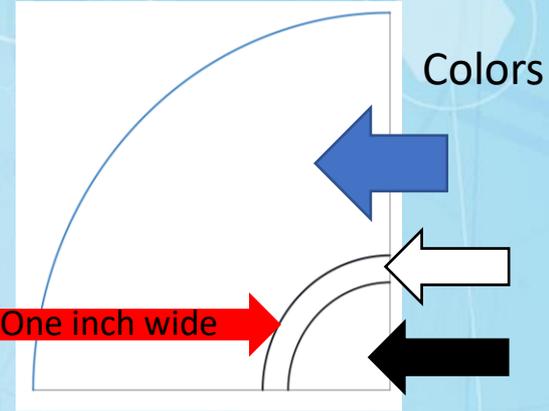
# The Circles



One inch wide



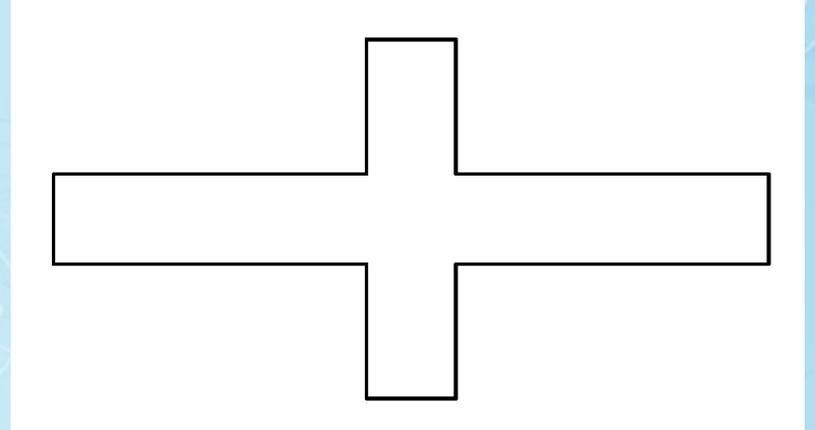
One inch wide



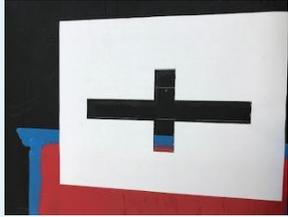
Colors

***We used a small compass for the smaller 4" and 5" circles and the large compass pictured for the 14" circle. There are templates for the circles with the pdf's. The large circle is pictured as a ¼ section. The inner two circles of the large circle is the exact same as the two smaller 4" and 5" circles as seen with the red arrows above. Painting the white 1" circle is the trickiest part. Use 1" painters tape and cover the 4" inner circle which will be black and then do the outline of the 5 inch circle. A small paint brush like artist use for wall paintings will be needed for the 1" white circle in the 3 areas on the board.***

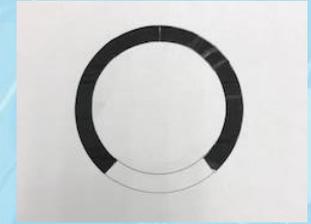
# The Cross Road



***The cross road is 1" wide each direction. 8" on the long side and 4" on the short side. It is painted white. Use painters tape to tape it off before painting. Using the pdf templates as a stencil did not work with paper. I will have to touch up the lines. Best practice use a pencil and mark the areas then use painters tape before painting. You can make a stencil out of the pdf.***



# Templates and Stencils



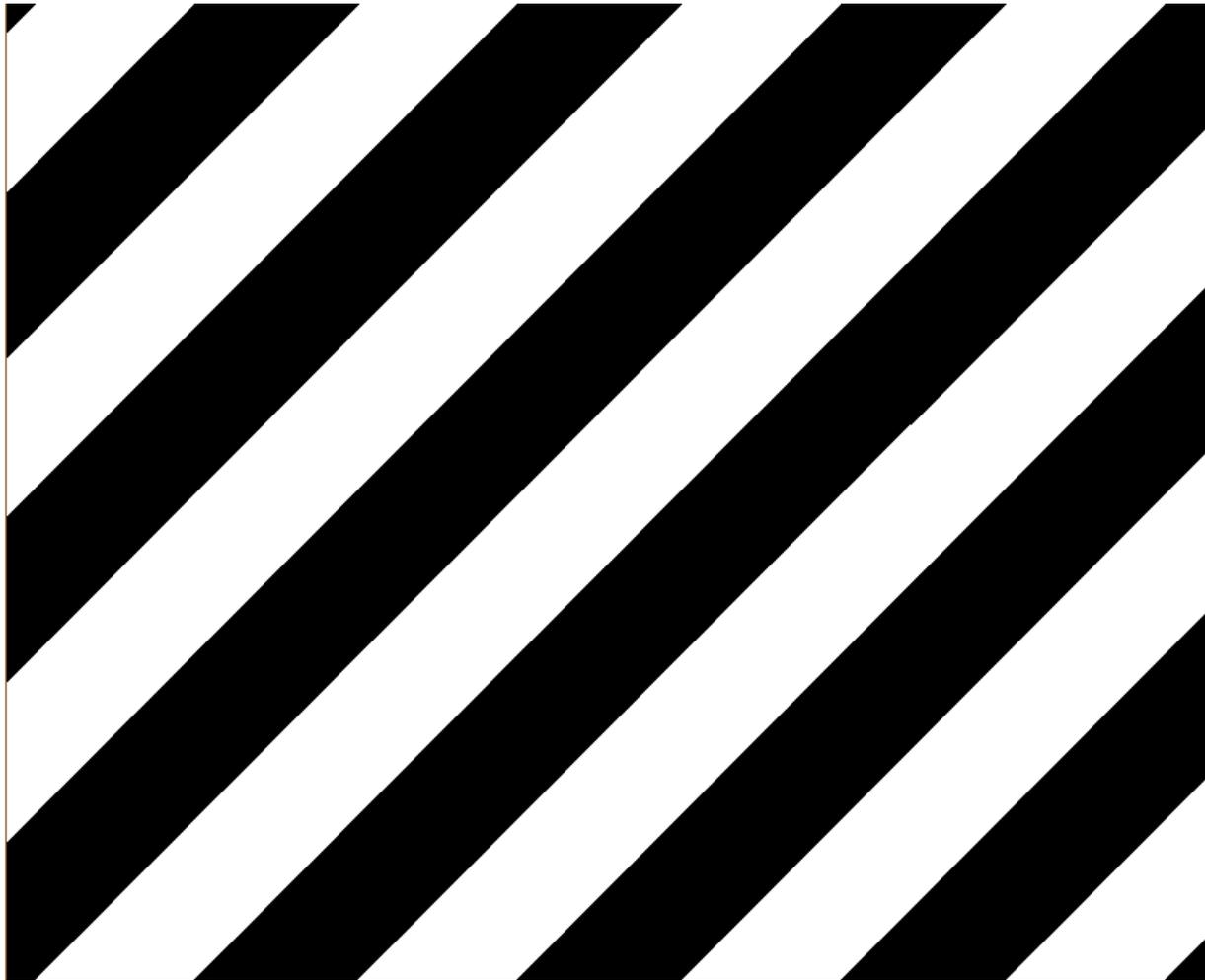
***We included pdf files for templates if you use card stock to print them and get creative by cutting out specific areas. You could use a laser cutter or a 3D Printer and print up a stencil from the pdf templates for the circles and cross road.***

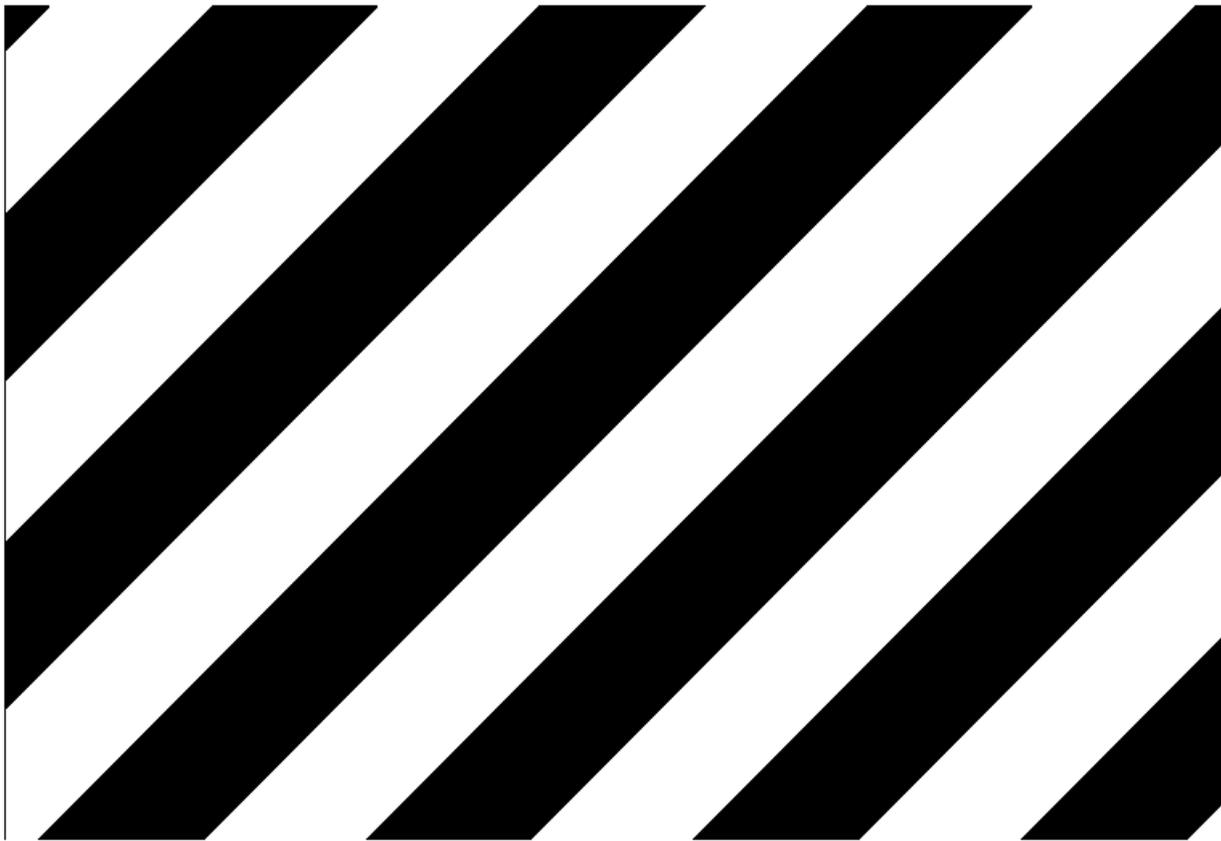
***We tried using the templates and cutting them out to paint but paper does not hold up. The paint will run underneath the templates. A stencil from the templates would work nicely. Or you can just use the templates to lay on top of the painters taped area to verify the sizing of an area is correct before you paint.***

***The first arena was challenging painting due to circles and coming up with exact dimensions. We are aware of painting issues with the first build and I will address them shortly. The first arena will be a practice arena and it is where we learned through the build.***

***The Templates follow this slide for the Recycle area,  $\frac{1}{4}$  Large Circle, Small Circles, and the Cross Road.***

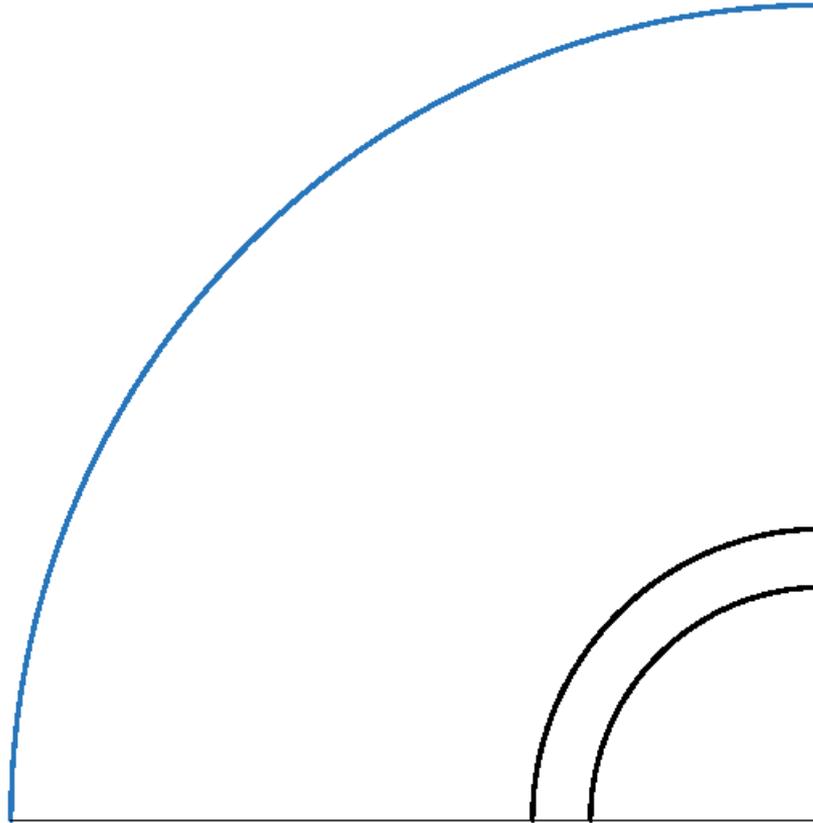
Left



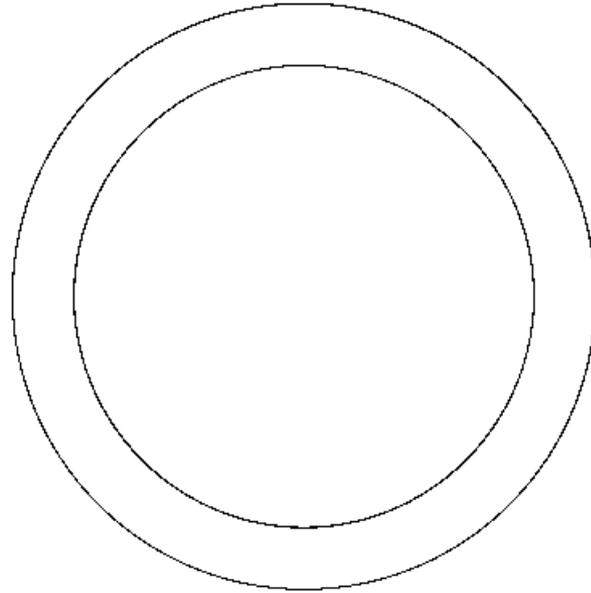


Right

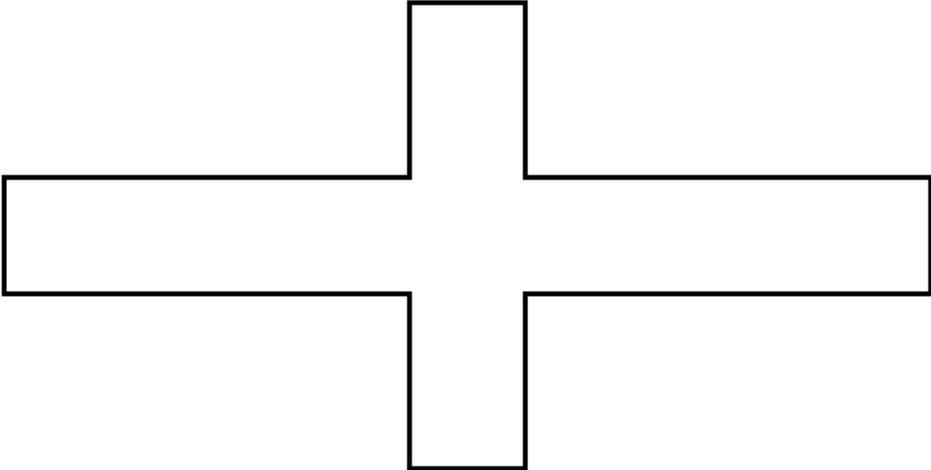
$\frac{1}{4}$  Large Circle



Small Circles



Cross Road



# Ducks, Pedestals and Food Chips



## ***The Yellow Ducks***

Measures 3-1/2"L x 3"W x 3"H

<https://www.amazon.com/Classic-Yellow-Rubber-Ducky-Schylling/dp/B000K21D4K>

## **The Food Chips**

Green and Red

1.5 x 0.1 x 1.5 inches

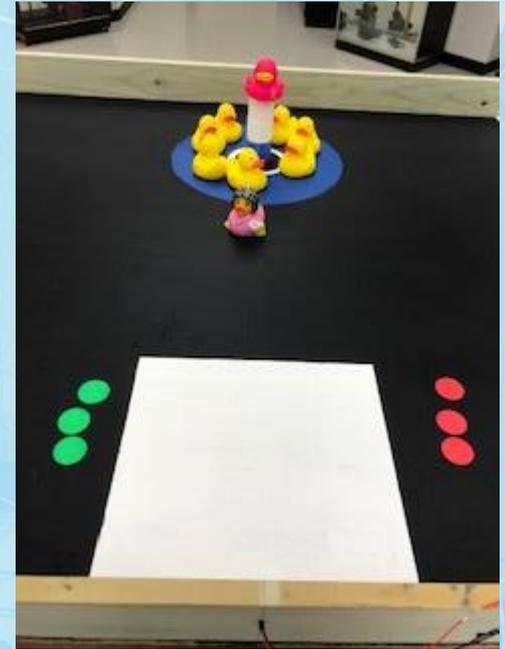
[https://www.amazon.com/Fun-Express-59-3086-Stackable/dp/B005HPXAFA/ref=sr\\_1\\_7?keywords=counting+chips+1%2F2+inch&qid=1648758996&sprefix=counting+chips%2Caps%2C98&sr=8-7](https://www.amazon.com/Fun-Express-59-3086-Stackable/dp/B005HPXAFA/ref=sr_1_7?keywords=counting+chips+1%2F2+inch&qid=1648758996&sprefix=counting+chips%2Caps%2C98&sr=8-7)

## **The Pedestals**

Colors: Red, Green, and White

Material TPU 1.75 mm diameter filament

<https://www.thingiverse.com/thing:4869571>



# The Pedestals

## ***TPU Filament Source List***

### ***White TPU***

[https://www.amazon.com/dp/B07VGVW546/ref=cm\\_sw\\_r\\_oth\\_api\\_glt\\_i\\_W6VNWB9A54MNY1XF7N4W?encoding=UTF8&pldnSite=1&th=1](https://www.amazon.com/dp/B07VGVW546/ref=cm_sw_r_oth_api_glt_i_W6VNWB9A54MNY1XF7N4W?encoding=UTF8&pldnSite=1&th=1)

### ***Green TPU***

[https://www.amazon.com/Filament-Vacuum-Flexible-Dimensional-Accuracy/dp/B08CDV1CTG/ref=sr\\_1\\_11?keywords=tpu%2Bfilament%2B1.75&qid=1648758537&s=industrial&srefix=tpu%2B%2Cindustrial%2C93&sr=1-11&th=1](https://www.amazon.com/Filament-Vacuum-Flexible-Dimensional-Accuracy/dp/B08CDV1CTG/ref=sr_1_11?keywords=tpu%2Bfilament%2B1.75&qid=1648758537&s=industrial&srefix=tpu%2B%2Cindustrial%2C93&sr=1-11&th=1)

### ***Red TPU***

<https://www.amazon.com/YOYI-Flexible-Filament-Tolerance-Red/dp/B01MAWJOWJ/ref=sr?th=1>

***\*Disclaimer we used PLA pedestals until we just recently received the TPU filament from Amazon. That is why only 2 white ones were pictured. WE will be testing once we finish all 3 TPU pedestal colors.***

# Pink Ducks

***We are testing with two types of pink ducks because we cannot find a normal pink duck the same size as the yellow ducks. Once we verify that color sensors can distinguish these from the red alligator area we will go with the best choice.***



3 x 3 x 3 inches



3 1/4 inch X 3 1/4 inch x 3 inch

[https://www.amazon.com/gp/product/B075J6K5H4/ref=ppx\\_yo\\_dt\\_b\\_asin\\_title\\_o03\\_s00?ie=UTF8&th=1](https://www.amazon.com/gp/product/B075J6K5H4/ref=ppx_yo_dt_b_asin_title_o03_s00?ie=UTF8&th=1)

[https://www.amazon.com/gp/product/B08LHKRCDZ/ref=ppx\\_yo\\_dt\\_b\\_asin\\_title\\_o07\\_s00?ie=UTF8&th=1](https://www.amazon.com/gp/product/B08LHKRCDZ/ref=ppx_yo_dt_b_asin_title_o07_s00?ie=UTF8&th=1)



# The Finished Practice Arena

*Here is a one minute video of the arena.*

***Disclaimer\**** Remember a hurricane hit the area. :P

*\*Yes we are aware of areas we need to touch up and the dip from a tool dropping. I will fix everything and the next arenas will be a lot better since we learned from this first arena build.*

# The Fireworks Display

*Here is a quick video of a fireworks display on the Raspberry Pi on my laptop. The code is Python but I am also working on a better display with sounds in JAVA. I used a CanaKit Raspberry Pi 3 Model B+ with a 32 GB EVO+.*

*I am troubleshooting what the light switch actually does. I am trying to program the switch to start the fireworks program on the Raspberry Pi instead of turning on the Pi and then running the program. The Raspberry Pi like other computers takes time to boot up before a program can be run. So turning on the Pi that way will take too long.*

*Worse case scenario is to have the switch turn on the display and have the fireworks display running in a loop. But I am confident we should be able to just have the switch activate the program while the Pi is already on waiting.*

*If you plan on writing a Python or JAVA Code for Fireworks and then submitting a MPEG video of your display as expressed in the rules please keep in mind the display is powered by a Raspberry Pi. The code would have to be loaded and tested to use during matches. I believe this will have to be something the Student Activities Chair will have to look at before a final decision is made.*



# Red LED Start



Red LED



The links for the red pre wired LED and the Battery holder with a on/off switch is below. The LED is 2 & 1/2" from the top of the plywood as seen in the pictures.

[https://www.amazon.com/gp/product/B07PWSKDNX/ref=ppx\\_od\\_dt\\_b\\_asin\\_title\\_s05?ie=UTF8&th=1](https://www.amazon.com/gp/product/B07PWSKDNX/ref=ppx_od_dt_b_asin_title_s05?ie=UTF8&th=1)

[https://www.amazon.com/gp/product/B07YBZ18VS/ref=ppx\\_yo\\_dt\\_b\\_asin\\_title\\_o01\\_s00?ie=UTF8&th=1](https://www.amazon.com/gp/product/B07YBZ18VS/ref=ppx_yo_dt_b_asin_title_o01_s00?ie=UTF8&th=1)

# The outlet with the wall plate



Switch is on.

## Switch

Home Depot purchases \*The Home Depot and Lowes carry similar items for the switch outlet

1-Hampton Bay Perry 1 Gang toggle steel wall plate-white  
SKU# 1003404696 \$3.97

1-Leviton 15 Amp Preferred switch, white SKU# 912399  
\$1.59

1-Steel City 4' 2-1/8" handy box with 3/4" knockouts  
SKU#592042 \$3.50

The Switch plate is flush with the top of the wood. Instead of cutting the 2x4's in 4 pieces to fit the box, I opted to cut into the two 2x4's once they are screwed together to inset the box to give the arena more stability.



The first arena pictured is sitting on top of a Arena table to get it up off the floor in case anyone is wondering.

This build had its challenges and I am happy to answer any questions. Please keep in mind this was the first arena built and it is not perfect.

As I move forward I will take the lessons learned from this build and apply them to the future arena build and also touch this practice arena up.



Thank you, Thomas Dillen  
tdillen7@ieee.org

# Arena Parts list

## **Paint: The Home Depot**

Paint was purchased at The Home Depot *\*If you are building only one board you can buy less paint. A quart of black and a half quart of the other colors will suffice.*

1-Glidden flat interior Onyx Black Gallon SKU# 603283 \$19.98

1-Glidden flat interior Delicate White Quart SKU# 601435 \$9.98

1-Glidden flat interior Stunning Sapphire Quart SKU# 604471 \$9.98

1-Glidden flat interior Red Gumball Quart SKU# 604471 \$9.98

1-Glidden flat interior Blarney Stone Quart SKU# 604471 \$9.98

## **Switch: The Home Depot**

*\*The Home Depot and Lowes carry similar items for the switch outlet*

1-Hampton Bay Perry 1 Gang toggle steel wall plate-white SKU# 1003404696 \$3.97

1-Leviton 15 Amp Preferred switch, white SKU# 912399 \$1.59

1-Steel City 4' 2-1/8" handy box with 3/4" knockouts SKU#592042 \$3.50

## **Wood: The Home Depot**

*\*The Home Depot and Lowes depending on where you are in the country will have similar prices on wood.*

Count 3 - 1 in. x 4 in. x 8 ft. Premium Kiln-Dried Square Edge Whitewood Common Board  
\$8.73 each

Count 1 – 2 in. x 4 in. x 10 ft. #2 Prime Ground Contact Pressure-Treated Lumber \$8.38

Count 1 – 23/32 in. x 4 ft. x 8 ft. BC Sanded Pine Plywood \$55.38

**Screws and Brad Nails: The Home Depot** *\*We are building 7 Arenas so you will not need as many*

Grabber #7 2” Philips Bugle head wood deck screw \$13.48

DEWALT 1-1/2 in. x 15-Gauge Glue Collated Angled Bright Finish Nails (1,000 per Box)  
\$18.98

## ***Sand Paper and Misc.: The Home Depot***

*RYOBI 7-Piece 5 in. Random Orbit Sand Paper Assortment Set - 80, 120, and 220 Grit \$5.47*

*Linzer6-Piece High-Density Polyester Knit Paint Tray Kit \$10.97*

*Start LED with Switch: Amazon*

*DaierTek 3pcs 9V Battery Holder with ON Off Switch Cover Lead Wires 9 Volt Battery Case Connector \$6.99*

*EDGELEC 50pcs 12 Volt 5mm Red LED Lights Emitting Diodes, Pre Wired 7.9 Inch DC 12V LED Light Diffused Colored Lens Small LED Lamps \$8.49*

# Total Board Cost

***Total Price of one single Arena build around \$200 for paint, wood, switch, screws, and brad nails. We purchased all the ducks, food chips, and enough TPU for 7 arenas. The expensive part is the Raspberry Pi. If you shop around you may find them priced around \$50-100. I am using the ones that I have already in my school programs we purchased for projects.***

***Example of one Google search for a Raspberry Pi:***

*Raspberry Pi \$47.07 plus shipping from one site*

[https://www.rublequinn.com/products/Raspberry-Pi-4-Model-B-4-GB?currency=USD&variant\\_sku\\_code=2062061-0-0-0-0-0](https://www.rublequinn.com/products/Raspberry-Pi-4-Model-B-4-GB?currency=USD&variant_sku_code=2062061-0-0-0-0-0)

