IEEE SoutheastCon 2020
Hardware Competition
March 14, 2020 – 03/14 – Pi Day

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Pi Day is the annual celebration of the mathematical constant pi (represented by the Greek letter π) on March 14, since the date in month/day format, 3/14, corresponds to the first three digits of pi.

Pi Day was first observed in 1988 and became recognized as National Pi Day in 2009 in the United States. Pi Day is observed around the world in a variety of ways, including discussing the significance of the constant pi, competing to recite the most digits of pi, and even eating pi's delicious homophone, pie.

On March 14, 2020, please join us in Raleigh, NC to celebrate Pi Day by holding the first ever pi-themed SoutheastCon hardware robotics competition. In this competition, your robot will demonstrate how many digits of pi it can stack, using a series of Lego Duplo blocks, as well as how many digits it can input on a set of 10 pushbuttons in a three-minute competition.

ARENA LAYOUT

The arena is a single 4'x8' sheet of smooth-sanded ½" (nominal thickness is approximately 15/32") BC grade plywood (B side up) that is surrounded by standard 2"x4" 'stud' lumber (nominal size is approximately 1.5"x3.5") walls that form a frame on top of the plywood sheet (the arena inner dimensions will thus be approximately 93"x45").

(Note that all ½" plywood referenced in the construction of the arena will have a nominal thickness of approximately 15/32" and all 2"x4" 'stud' lumber will have a nominal size of approximately 1.5"x 3.5", and all 1"x2" lumber will have a nominal size of approximately 0.75"x1.5". Standard building material tolerances are expected).

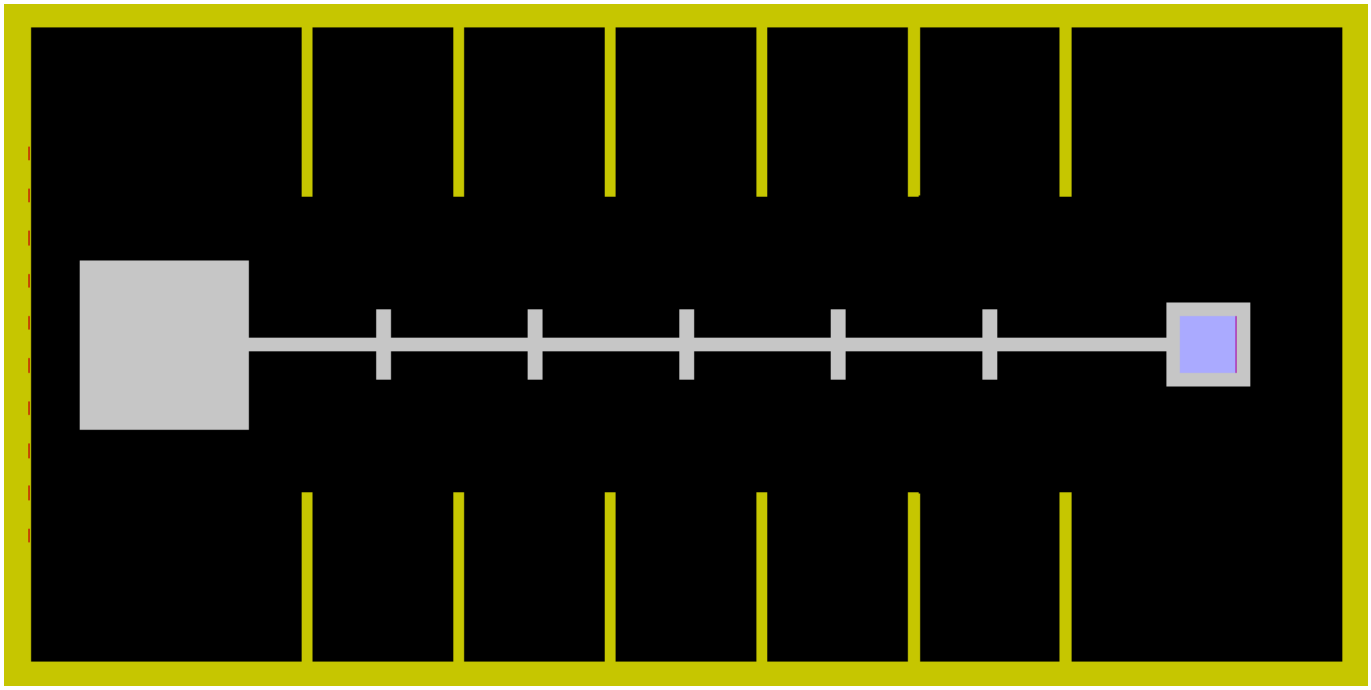
The arena has a 12"x12" starting square on one end with a 1" navigational line

running down the middle of the arena to a 5"x5" hole in the floor on the other end. Additional 1" navigation lines extend 2" from the edge of the main navigational line toward ten rooms, five on each side of the arena, as well as define the edge of the 5"x5" hole that is open to the conference floor below.

Both the starting square and the hole are centered between the two longer 8' sides and 9.5" from the shorter 4' sides of the arena. This puts the starting square edge at 3.5" from the 4' wall and the hole at 7.5" from the other 4' wall.

The rooms are separated by a 1"x2" (nominal size 0.75" by 1.5") dividing wall, each 12" long and attached to the 2"x4" walls extending toward the center of the arena. The 1"x2" walls are oriented so that the 2" (1.5") dimension is vertical. The 1"x2" walls are spaced such that there is 10" of space between each wall, giving a room dimension of 10"x12". The first and last dividing wall is located 19.25” from the inside of the 4' walls.

Along the 4' wall that is closest to the starting square are ten pushbuttons that are centered vertically on the wall (center is 1.75" up from the floor) and horizontally spaced 3" apart with a distance of 9" from each 8' wall and the center of the first and last pushbutton.



The plywood floor is painted flat black. The navigation stripes are gloss white. The exterior and room walls are gloss yellow. We will not be providing exact paint vendor names and manufacturing codes for these paints, so your robot should be able to discern between the flat black and gloss white on the floors without looking for an exact match.

(Note: As past competitors have discovered, colors never look the same under different lighting conditions, so it is never advisable to look for exact colors in a competition. Thus we chose this high-contrast paint scheme as a benefit to you, not as an additional challenge.)

The arena external lighting environment is not specified, nor is it controlled by the contest coordinators, so wide variances in lighting arrangements (intensity, direction of light, shadows, etc) are to be expected by the teams. In addition, no restriction will be placed on the spectators and those present during the competition for use of their cameras and cellphones. As a result, flash photography and infrared range finders on cameras will be permitted and could cause accidental interference of robot range sensors. Intentional interference with the operation of the robots is not allowed and will result in sanctions.

Care will be taken in building of the arenas so they meet the specifications as accurately as possible. However, since building the arenas is a manual process, there is expected to be some minor variances from arena to arena. The physical size of the arena and the wall lengths will vary no more than +/- 0.25” from the specified size, and each buttons will be placed no more than +/- 0.25” up/down/left/right from the specified absolute center location and no more than +/- 0.125” from the specified depth. Robots should be prepared to handle these minor variances.

ROBOT

The robot must be completely autonomous and must fit completely within a 12"x12"x12" cube at the start of each match. The robot must at all times be wholly contained within the playing surface and may reach a maximum of 1" beyond the outside edge of any arena walls. There is no weight restriction on the robot. Aerial or flying robots are not allowed.

The robot may expand beyond the initial size to any size. It may split into multiple independent robots during the competition. If multiple independent

robots are used, they must all start within the same 12"x12"x12" starting space and split after the competition begins.

For the safety of other robots running at the same time and to avoid interference, independent robots must communicate over a wired link, as wireless communication between the various robots is not allowed. This restriction includes any communication by radio, light, sound, or any other non-wired communication channel.

You may not tether or externally control the robot in any way, including wired or wireless tethers, with either two-way or one-way data transmission to or from the robot, with a single exception for the initial start of the robot as explained below.

While multiple switches can exist on the robot for powering up and controlling the various subsystems on the robot, there must be a single, clearly visible, labeled start switch. This switch can be either a pushbutton or a toggle switch and will be actuated by the robot team once the judge indicates the start of the match. All other switches must be configured prior to the start of the match, and only the single start switch is allowed to be activated once the judge indicates the match is ready to begin. If the robot consists of multiple sub-robots, there must be a single start button that starts all the sub-robots at the same time (not one start button per robot). It is possible to use one or more visible LEDs on the robot containing the start button to signal to the other sub-robots that they are to start, but this communication is only for starting and may not be used for any further communication.

It is recommended that the robot have an easily reachable emergency cutoff switch to allow the robot team to disable the robot if necessary (this is to avoid damage to both the robot and the arena in case a sudden stop is required). It is advisable that if the robot splits into multiple independent robots, the single emergency cutoff switch should stop motion of all the robots, but this is not a requirement. It is also recommended that robots automatically stop at the three-minute mark to avoid teams having to manually reach over to stop the robots and accidentally interfering with the stack.

The robot cannot contain any explosives, pyrotechics, toxic or corrosive materials, or flammable liquids or gases. Compressed gas is allowed on the robot as long as the pressure is limited to no more than 30 pounds per square inch at any time. Gases other than air are permitted as long as they do not pose a safety threat if accidentally released.

The robot shall not present any danger to the judges, spectators, playing arena, or neighboring area around the arena. If at any time the judges deem the robot is causing or is likely to cause harm, the judge may terminate the match immediately and will have the discretion of whether any points are awarded for the match and if the robot is allowed to complete in any remaining matches.

It is encouraged that the robot display a flag on the robot representing the school flag or logo, state, territory, or national flag, but the flag must fit within the size constraints of the robot. The flag can be static, or can be raised automatically at any time once the match begins.

COMPETITION

The competition is composed of two challenges that may be executed in any order or in parallel (if multiple robots are used). It is also permissible for a robot to only do one of the two challenges and skip the remaining challenge.

The two challenges are described in the two sections below.

Stacking Pi Digits

In this challenge, the robot's goal is to stack as many digits of pi as possible within the competition match time. Points are awarded both for the total height of the stack and for how many digits of pi that are in the correct order, starting from the bottom and counting up at the end of the match.

Each digit of pi is represented by a single 2x2 Duplo brick (Lego part number #3437), with the color of the brick specifying the digit number using the standard resistor code as shown in the chart below.

Digit	Resistor color	Official Lego color
0	Black	Black
1	Brown	Reddish Brown
2	Red	Red
3	Orange	Orange
4	Yellow	Yellow
5	Green	Bright Green
6	Blue	Blue
7	Violet	Lavender
8	Gray	Dark Gray
9	White	White

For example, for the first 8 digits of pi (3.1415926), the colors for the stack counting up from the floor are: orange=3, brown=1, yellow=4, brown=1, green=5, white=9, red=2, and blue=6. Note that the stack uses only the resistor code for the digits and does not make use of the multiplier or tolerance bands of a resistor code.

The digits must be stacked within the 5"x5" hole at the end opposite the robot's starting position. Teams may stack the blocks directly on the conference hotel floor under the arena, but this is *not* recommended, as we cannot control the surface area of the floor beneath the arena. Instead, teams are encouraged to provide their own bases.

The purpose of the block is to allow a vibration insulation between the floors and walls of the arena and the stacking area, so it is recommended that there be a gap between the block and the arena, but it is up to each student team to design the block that best suits their robot design. The base should not interfere with the judge's view of the stack, as seen from the starting square, at the end of the match.

There is no limitation on the material or design of the base block composition (plastic, wood, metal, combination, etc.) or weight, but the base block cannot extend more than 2" beyond the top of the floor surface. The base can include indentations, alignment pins, Lego blocks/plates or any other alignment aid. Any Lego blocks that are part of the base will not be counted as part of the scoring stack.

The bases can either be placed within the hole before the match begins during the pre-match setup time, or can start out within the starting square and placed by the robot during the 3 minute match time.

The only limitation on the design is if the base is placed in advance, it may not include any processor, motors, beacons, LEDs, switches, or any other active device as this would be considered part of the robot, which must begin the match within the starting square. Active bases can be used, but they must start within the starting square and be positioned in place by the robot after the match begins. It is possible to include non-motorized moving parts (hinges, sliding or rotating pieces, etc) and not be considered an active base as long as no motors are included in the base at the time of the match start.

Teams may also provide supports for the stack, including the robot holding on and supporting the stack, as long as there is a clear view of the stack, as viewed from the starting square, at the time of judging at the end of the match. If a robot obscures the view of the stack and scoring as seen from the starting square, the judge may ask the team to remove the robot out of the way. It is the responsibility of the team to design the robot to automatically move out of the way for judging, or for the team to move the robot without interfering with the stack. If the stack falls during this process, only what is remaining will be counted.

Teams are also responsible for stocking the ten bins during the pre-match setup time before each match and can choose to put any color Duplo block within any bin, but only a single color can exist within a bin (i.e., don't put a blue Duplo block and a red Duplo block in the same bin). The blocks within a bin can be placed in any configuration, including placed in a grid, stacked, on their side, or arranged in any pattern on the bin floor, but they cannot extend out

beyond the edge of the bin rooms as defined by the bin walls (but they can exceed the height of the bin walls). Teams may use an alignment tool or stencil for each bin to help in placing the blocks in a precise location before the competition, but any alignment tools must be removed before the competition begins.

A maximum of fifteen blocks of each color is available to each team, but teams can choose how many (or how few) of the blocks of each color they choose to place within the bins. They may also choose to place differing amounts of each color within the different bins.

The judging of the blocks occurs only at the end of the match, once the robots have stopped moving, and the score is based on what is left standing at that time. Note that if a team accidentally knocks over their stack while stopping their robots, or moving the robot out of the way to allow viewing the stack, the judge will score the stack based on how many blocks are left standing afterwards. Thus teams should take every measure possible to safely stop the robots at the three-minute mark, an automatically positioning it out of the way, to avoid accidentally knocking over the block stack.

Blocks must be oriented with the Lego studs on top to count as being in a stack, but it is not required that the bricks be snapped together to count. If more than one stack exists within the 5"x5" stacking area, the stack that is the highest will be used. If more than one stack of the same height exists, the stack that yields the most points for the team will be used.

(Note: It is not recommended that teams have more than one stack within the 5”x5” stacking area. The preceding information about multiple stacks is designed to give maximum points possible to a team if a stack falls over, breaks into multiple pieces, and multiple stacks are left standing within the stacking area.)

Pressing Buttons

In this challenge, the robot’s goal is to enter as many digits of pi as possible on the 10 pushbuttons within the competition match time. Points are awarded both for the total number of distinct button presses, as well as how many digits of pi are entered in the correct order.

The pushbuttons are 1" diameter white arcade buttons centered vertically 1.75" from the arena floor (in the center of the 3.5" high wall). Each pushbutton is inset so that the button top is 0.125" behind the surface of the wall.

Buttons are centered on the wall at a spacing of 3" between buttons (27" between the '0' and the '9' digit and 9" from the center of the first and last pushbuttons to the nearest 8' long side).

The '0' digit is located on the farthest left position, with the '9' digit in the farthest right position, as viewed from the starting square looking toward the pushbuttons.

At the start of the competition, the '3' pushbutton will illuminate, indicating it is the first button to press. Once it is pressed, the '1' will illuminate, with each digit being lit in succession in order of the digits of pi (excluding the decimal point as a character). If an invalid digit is pressed, all the buttons will flash at the same time and will continue to all flash on each subsequent button press.

Each button press should be at least 50ms in length, and at least 100ms should exist between each button release and the next button press. The button will be scored on press, once the debounce interval is complete (approximately 25ms).

Points are awarded for each correct button press, as long as the button presses are in sequence, until the match is over.

In addition, teams receive a smaller number of points for any button presses beyond the last valid button press. Thus a team will continue to score points for incorrect digit button presses; however, it will be a reduced score. There is also a maximum limit of 100 incorrect button presses that will be scored.

RUNNING THE COMPETITION

There is no limit on team size for the participating team, but each team member should be a member of the same local student branch, and they must all be IEEE Region 3 student members. Only one team per student branch is allowed in the Main competition. Teams that do not fit this qualification (additional teams in the student branch beyond the one allowed in Main, teams including

students from other regions, hobby groups, or non-students, or the robots are not associated with the local student branch) may compete in the Open category, but all team members should be IEEE members. If more than one robot is submitted from a student branch, the student branch must designate which robot will be in the Main category at the time of onsite robot rules qualification at the conference (all teams must be qualified before the captain's meeting, so this means any designation of Main or Open must be made before the captain's meeting). There will be more details on the qualification process and deadlines in the #team-captains Discord channel.

The competition will consist of two preliminary runs, with the scoring of the preliminary rounds based on the highest score of the two preliminary rounds.

The top four highest scoring teams in the preliminary runs will then compete in the final run that will be held during the awards banquet. The final competition placement of the four teams will be determined solely on the points in the final run and does not include any points earned in the preliminary runs.

Each match will last for a maximum of three minutes. The robot team can signal to the judge at any time before the three-minute mark that they are finished with their match. The judge can also stop the match if the robot is acting in a manner that may cause injury to anyone nearby or damage to the arena or itself. If the judge does force a stop in a match, it is the judge's discretion whether the points in that match are counted.

At the start of each run, the judges will require that all robots be sequestered in a special staging area. Once in the staging area, the robots must remain turned off and cannot be touched by students until they are called for their match to begin. The robots cannot be charging during the sequestration period. For each match, the judges will call the names of the teams to run in that match. Once called, teams will have at most two minutes to retrieve their robot from the sequestration area and move it to a pre-match staging area near the arenas. In this area, teams can perform final checks to the robot, make any last-minute adjustments, swap in a new set of batteries, and power it on. This time will overlap with the time another set of teams is competing. Once the current set of teams has completed their matches and cleanup, the judge will call the teams

from the pre-match staging area to the arena to begin their setup.

Once teams have been called from the pre-match staging area to the match, they will have an additional two minutes to get their robots and their arenas ready to begin. During this time, teams should place their robots in the starting area, arrange the Lego Duplo blocks in the ten bins, and optionally place their build plate within the hole in the arena floor. The Lego Duplo blocks will be sorted by color into ten buckets near the arena to make it easy for the teams to collect the colors and quantities that they need.

There is no limit on the number of students allowed in the arena area during setup as long as they can do so without disturbing other nearby arenas. Once the team is ready, all team members but the one designated to initiate the robot start must step away from the arena. That team member then indicates the readiness of the robot to the judge, and the judge begins the match countdown. Once the countdown is complete, the last team member will activate the designated start switch on their robot and back away from the arena. Any other interaction with the robot (additional buttons, touching or adjusting of the robot, etc.) during this time could lead to disqualification.

Once the match is over and the robots have stopped moving, the judge will take a photo of the stack, collect the results for their scoring (height of blocks, number of properly sequenced blocks, number of pushbutton presses, number of properly sequenced pushbutton presses) and then signal to the team that is is okay to remove their robot and to collect any Lego Duplo blocks in the arena. Teams are responsible for returning the blocks to the buckets in preparation for the next team.

The photo of the stack will be taken by a Raspberry Pi (what else would we use on Pi Day?) computer located above the pushbuttons and pointed down the length of the arena at the stack. Teams can choose to stand behind the stack and pose for the photo with their robots. The pictures will be pulled together for the awards banquet on Saturday night, so teams are encouraged to be creative and fun in their poses, but they are not allowed to touch the arena, and poses must be respectful and appropriate. Note that while the judge may ask to review this photo for their judge scoring, doing so is up to the discretion of the arena judge,

and the arena judge has the final decision on scores.

The robot is then returned to the sequestration area until all the robots have completed their matches. At that time, teams will be instructed to retrieve their robots. Teams will be guaranteed at least 60 minutes between the end of the sequestration for a match and the start of the next match for any necessary changes to the robot.

To avoid teams having to turn off their robots at the end of the three-minute period and risking knocking over the stack, it is advisable that teams automatically stop their robots at the three-minute mark. This is not a requirement, but any team that chooses not to do so and then accidentally knocks over their stack will be awarded whatever points (blocks) are left standing when the judge's scoring begins. Scoring will not begin until all robots in the arena have been stopped. The robots shall remain in the arena until the judge scoring is complete.

The judges will work with the teams to make sure each of the steps in the match is run as quickly and as smoothly as possible, including setting up the robots in the sequestration area, preparing the robots in the pre-match arena area, instructing the teams where to get the Lego Duplo blocks for their arena setup, running the match, scoring, and verifying that the arenas are cleaned and ready for the next match. It is the teams' responsibility to follow the judge as quickly as possible so we have time to run both matches during the day.

If a team believes their robot was scored incorrectly, the team captain should first bring it up with the judge immediately upon the end of the match. If the matter cannot be quickly resolved, the judge and team captain will summarize the issue to the arena appeals judge, who will make the final decision about any scoring issues.

When addressing judges with questions, teams are expected to act within the IEEE code of conduct. Note that teams should use caution in filing appeals as unnecessary, unsuccessful appeals could result in loss of 10% of the current match score.

Scoring

Points will be awarded per match for:

- the total number of Lego Duplo bricks that are stacked and sequenced in the correct Pi order, starting with the first brick on the floor (base)
- any additional stacked bricks that are out of order
- the total number of button presses sequenced in the correct Pi order
- any additional button presses out of order, with a maximum of 100x out of order button presses counted

The points awarded per category are:

Description	Number of points
Total stack sequenced correctly	20 * N * N
Additional stack not sequenced correctly	N * N
Total button presses sequenced correctly	10 * N
Additional button presses not sequenced correctly	N (max of 100 counted)

There is no maximum to stacking height (correct or incorrect) other than that imposed by the number of Duplo blocks provided. There is no maximum correct button presses scored, but there is a max of 100 incorrect button presses counted.

Some example robot stacking scores:

- 31415926 = 20*8*8 = 1580
- 3141555555555 = 20*4*4 + 9*9 = 701
- 11111111111 = 11*11 = 121

Some example robot button press scores:

- 31415926 = 10*8 = 80
- 3141555555555 = 10*4 + 9 = 49
- 11111111111 = 11

Obviously, if a robot competes in both challenges, completing stacking and button presses, the independent scores for each will be added together to obtain the total points for that match.

Note: Please note that the scoring may change from the values in the table above, but the final values will be posted before the September 1 freeze date for the basic rules.

IMPORTANT DATES

The dates below are the best estimates of the various milestones leading up to the competition. The plan is to meet or exceed those dates, but if any delay occurs, it will be reported in the 2020 SoutheastCon #hardware Discord channel.

April 14, 2019

Release of the first set of rules at SoutheastCon 2019. The “IEEE SoutheastCon 2020” Discord server will begin allowing teams to join. The rules and arena OpenSCAD design will be posted to the #hw-links-uploads channel.

June 1, 2019

Next release of the software rules to clarify or fix any issues found by the teams after the initial April 14 release.

August 1, 2019

Next release of the rules, and the first official release of the arena electronics for verifying the proper pressing of the pi digit pushbuttons. The code will continue to change and improve after this date, but this version should be sufficient for teams that plan to build their own copies of the arena electronics. The code will be posted to github so that teams can see the code, understand how it works, and leave any comments on issues found.

September 1, 2019

Rules will be officially frozen, with no major changes allowed after this date. Any questions will be answered in a separate FAQ document. Note that if any glaring issues are found after this date, they will be addressed as quickly as possible.

March 7, 2020

This is the deadline for registering your team to compete in the 2020 IEEE hardware competition. This will allow the contest organizers to know how many teams to expect for the competition. The list of registered teams will be

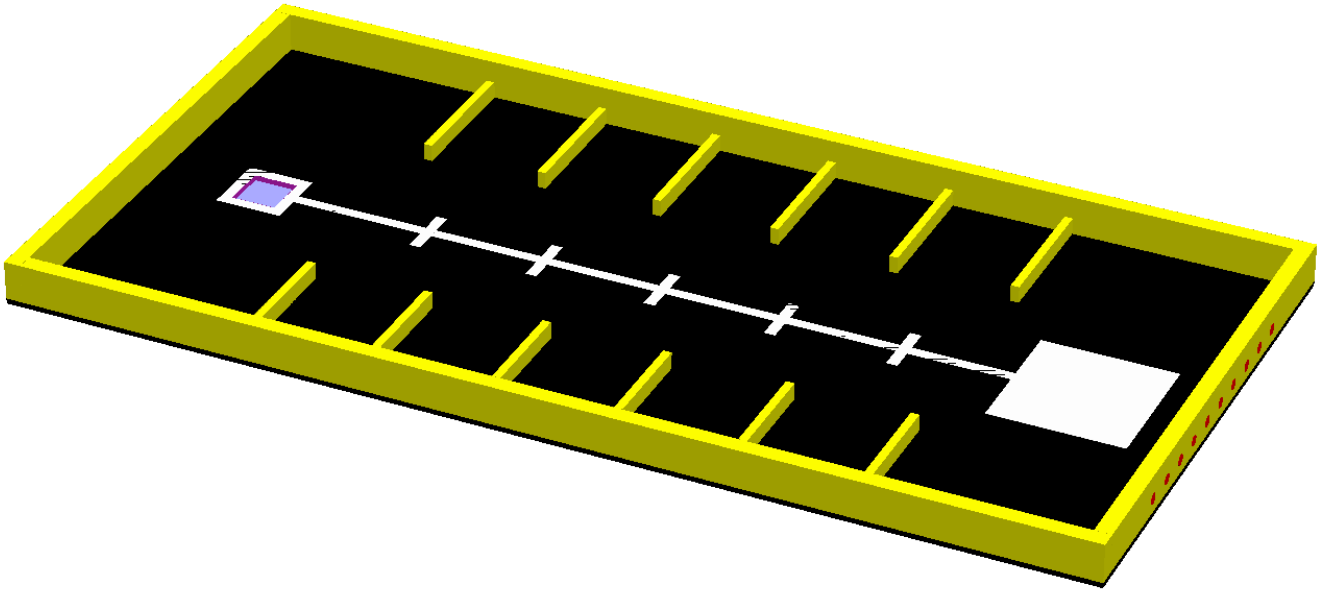
posted regularly to Discord as we get closer to this date to allow teams to know whether they have correctly competed the registration process.

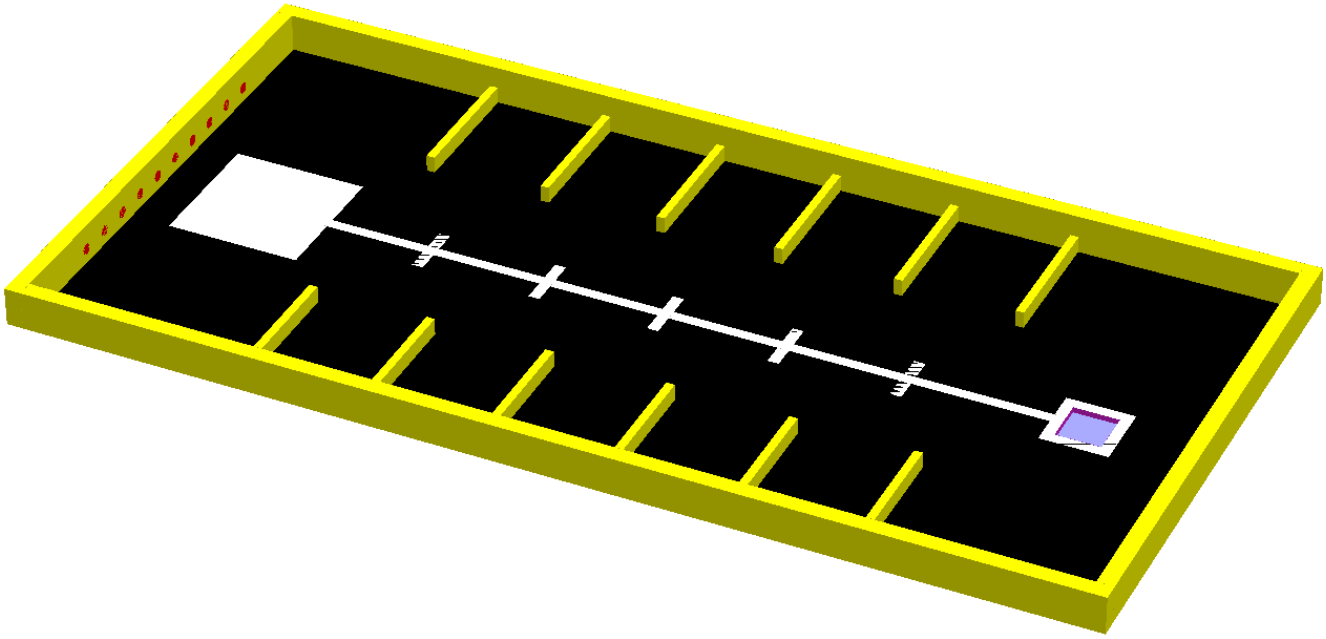
March 14, 2020

Pi Day! It would be *irrational* for you to miss this chance to celebrate with us and bring your robot to the competition. We hope to see you in Raleigh, NC!

ARENA 3D DIAGRAM VIEWS

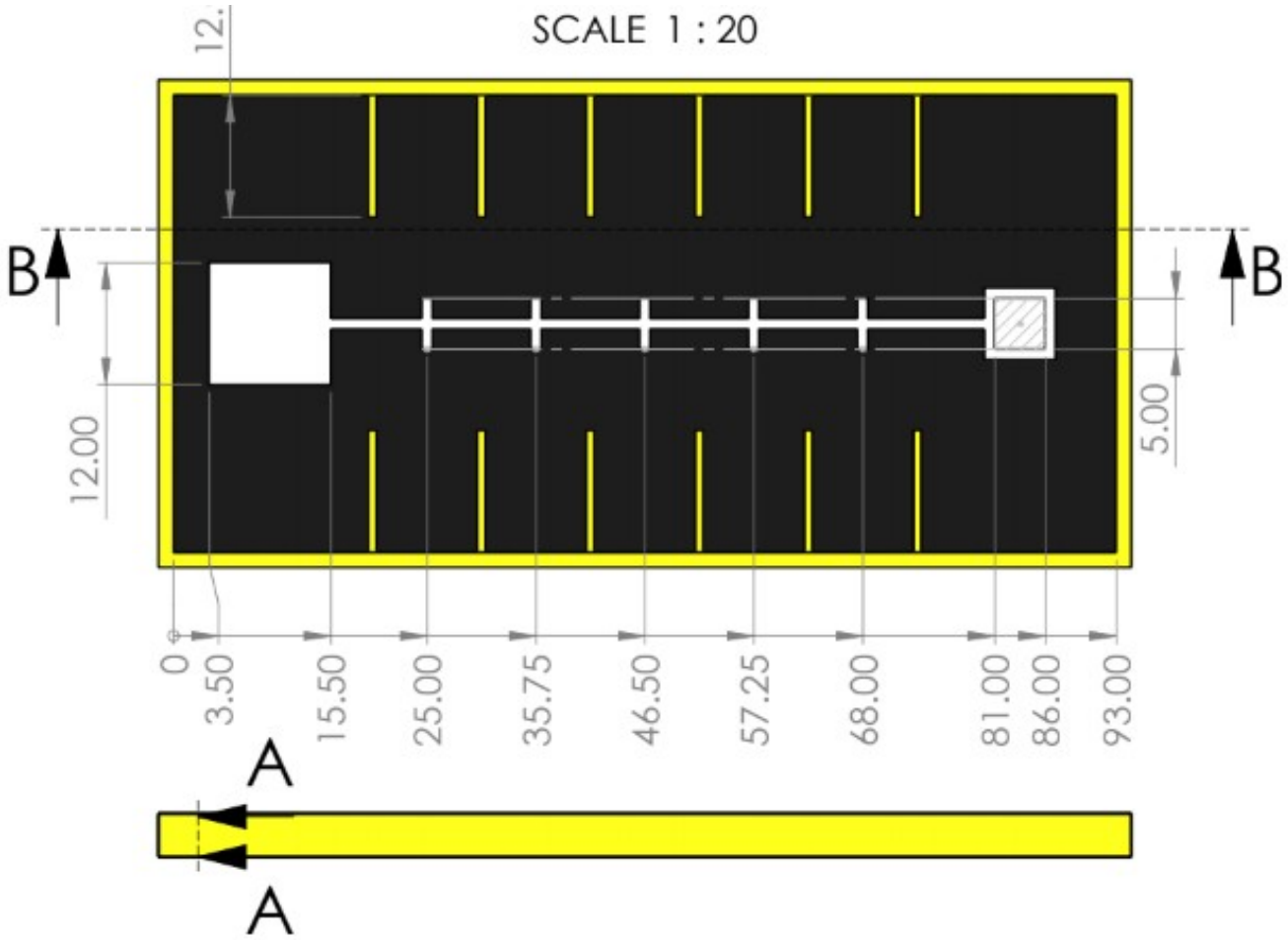
The pushbuttons in the diagram views below are shown in *red* so they are more visible in the drawing, but in the competition they will be *white*.

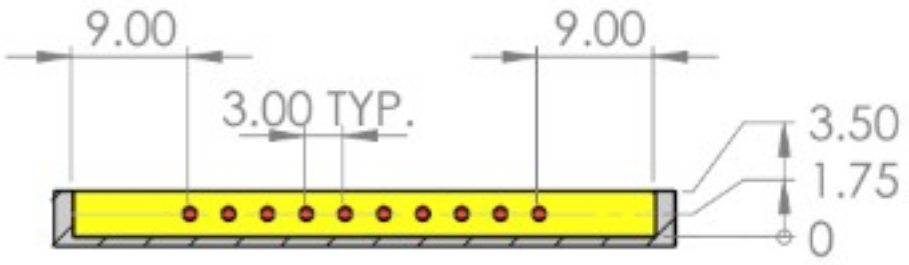




ARENA MEASURED DRAWING

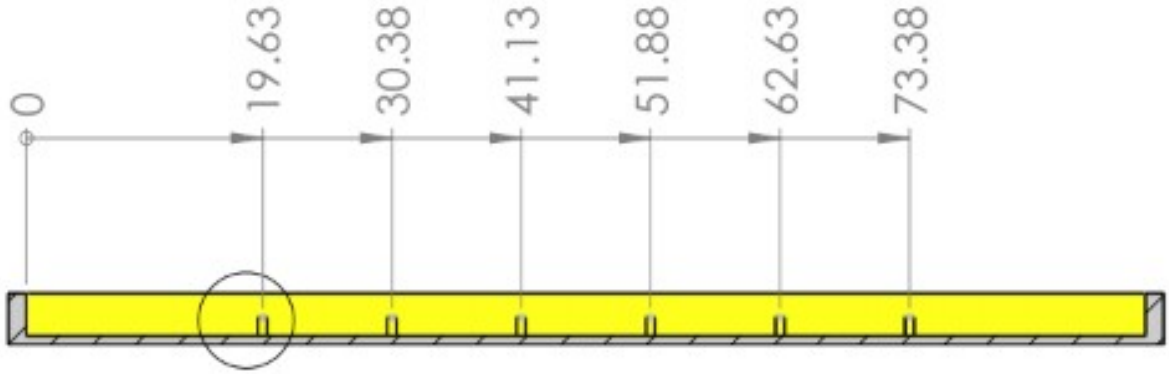
The measured field drawing on this page and the next were created by Discord user '@Will | Clemson', so special thanks to him for his work. The drawings were done in Solidworks 2019, and the 3D file is available in the Discord #hw-uploads channel.



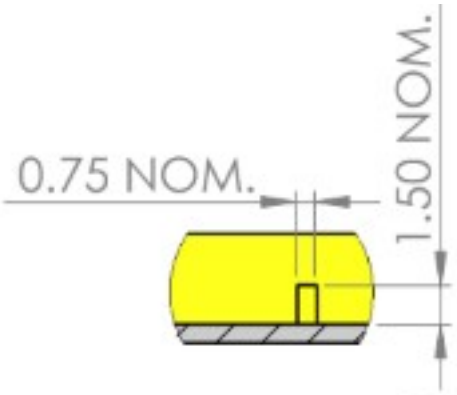


SECTION A-A

SCALE 1 : 20



C SECTION B-B



DETAIL C

SCALE 1 : 10

FAQ

- Where do I find out more about IEEE Southeastcon 2020?

https://attend.ieee.org/southeastcon-2020/

- Where is the SoutheastCon 2020 Discord server and how do I access it?

The Discord server can be found at https://discord.gg/f3VXE74. The Discord server can be accessed directly at that weblink or you can download a client to your computer or smart phone. You will need to create a Discord account to access the server and you can do that within the client, or directly on the Discord website.

Note: Every team is required to have at least one active team member in the Discord server to receive notifications of important rule changes, deadlines, robot qualification requirements, and team captain meetings.

- Where do I find the latest official copy of the rules?

The latest (and only official copy) will always be posted to the following location:

https://attend.ieee.org/southeastcon-2020/student-program

In addition, the rules will be posted (sometimes with discussion) to the #hw-uploads channel of the SoutheastCon 2020 Discord server.

- I see the terms “match,” “run,” and “competition” – what does each mean?

A **match** refers to a single robot running a single time, with the result of a single score. There is one match per run per robot.

A **run** is the collection of matches for all teams to run once. The first two runs are called preliminary runs. The purpose of the preliminary runs is to find the top four teams to compete in the final run. The final run will occur during the awards banquet on Saturday night. During the final run, the only points used to define the final competition placement of the top four teams are the scores from the match in the single final run – no points from the preliminary runs are

carried forward.

- How do I post any questions I have about the competition?

The quickest way for an answer is to post it in the “IEEE SoutheastCon 2020” #hardware Discord channel, and someone should be able to help you with it quickly. However, all official answers must be answered by the SoutheastCon 2020 hardware rules document posted in the official location listed above and not via a comment on a Discord channel. The Discord channels are maintained for students to exchange ideas and information and as a way to quickly distribute information to the students about official changes and clarification of the rules. If any discussion warrants a change or clarification in the rules, the rules will be modified (or the FAQ modified), posted, and then an announcement made to the Discord #hardware channel. If a discrepancy exists between what is stated in the Discord channels and the official website, the official page and rules will be deemed the arbiter. This is to avoid any confusion with multiple threads in Discord leading to wrong or confusing interpretations of the rules.

- If I have a question I would like to ask privately, how do I contact you?

The preferred method is by sending a private message directly to Discord user gadgetry (Rodney Radford) in the SoutheastCon 2020 Discord server. This is preferred to contact via email so there is a single location of all communication with the teams and team members.

- Where can I get a 3D drawing of the field?

The field drawings are available as an OpenSCAD program used for creating the 3D diagrams in this document, and a SolidWorks 2019 file used in creating the “Arena Measured Drawing” diagrams. These files can be downloaded from the Discord #hw-uploads channel.

- Where can I obtain the Duplo blocks for the competition?

The Duplo blocks can be obtained in bulk from a number of online sites, including Lego (always a good choice, but probably the highest cost), Bricklink

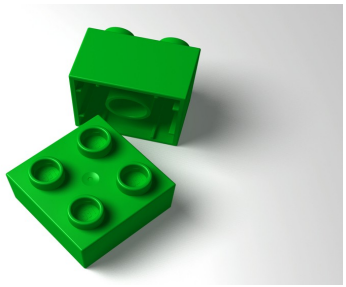
(cheapest per brick, but shipping could be high) or eBay (probably the cheapest option overall). While the official competition will have 15x of each of the colors available at each arena, teams could just buy a single color for their practice rounds and write the number on the side of the brick. This would be cheaper than looking for bricks of the exact color specified, and should be sufficient unless teams are using a vision based method of handling the blocks (not recommended due to variations in lighting, and possibly variations in the bricks).

First 250 Digits of Pi

3141592653589793238462643383279502884197169399375105820974944592307816406286208998628034825342117067982148086513282306647093844609550582231725359408128481117450284102701938521105559644622948954930381964428810975665933446128475648233786783165271201909

Duplo Brick Trivia

A Lego Duplo 2x2 block is 18.2mm high and 31.8mm wide and is twice the size of a standard (non Duplo) Lego block.



How many bricks are needed?

The following table shows how high a stack you can build provided a specific number of each Lego Duplo brick. With the provided 15x of each color, it is possible to build a stack that is 81” above the top of the base!

Bricks/ color	Bricks/ stack	Stack height
1	3	2.1”
2	10	7.2”
3	17	12.2”
4	24	17.2”
5	25	17.9”
6	27	19.3”
7	43	30.8”
8	46	33.0”
9	58	41.0”
10	62	44.4”
11	79	56.6”
12	80	57.3”
13	100	71.7”
14	107	76.7”
15	113	81.0”