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Innovation Project

In the FLL WORLD CLASSSM Innovation Project, your team will:

- Choose a topic that you are passionate about or always wanted to learn.
- Create an innovative solution that improves the learning experience.
- Share your solution with others.

Think About It

You have probably learned so many things in your life that it is hard to count them. You started learning as soon as you were born. You learned to walk, tie your shoes, and how to read this Challenge. You might have learned to dance, paint, or play an instrument. You might even have learned how to kick a soccer ball at the perfect angle to score a goal.

To have fun in many core subjects — like history, science, art, and math — you need to develop specific skills. In fact, skills are your tools to learn at any age. They might include:

- Critical thinking
- Teamwork
- Creativity
- Problem solving
- Communication
- Information literacy (knowing how to find and use the information you need)
- Understanding technology

There is so much to learn, but people do not all learn the same way. Just like there is more than one way to build your robot, there is more than one way to learn most things. We call these different ways of “learning styles.” Most people learn through some combination of watching, listening, reading, writing, moving, and even playing. Do you have a favorite way to learn new knowledge or skills?

No matter what learning style you use most, there are many surprising tricks that might help a person learn. For example:

- Some video games help you understand how the three-dimensional world fits together. This skill is called “spatial reasoning.” It could help you engineer and innovate.
- Singing the rules of a new game might help you remember them more easily than reading them.
- Building with LEGO bricks could help you learn math and engineering concepts. (You probably knew that already – you’re in *FIRST*® LEGO® League!)



Some learning tools or techniques might make learning more exciting, while others help you remember the information for a longer time.

Your Innovation Project mission this season is to find a better or more innovative way to help someone learn.

Identify your FLL WORLD CLASS Question

First, choose a topic and find out how people learn about it today. Researchers, teachers, psychologists, and others are always making new discoveries about how we learn. Like a professional researcher, you will write a “research question” and find your own answer. We will call this your **FLL WORLD CLASSSM Question**

To get started, think about all the topics you have learned about in the last day, week, or month. Make a list. You might have learned something in one of these places, but include topics you learned in other places too:

- Classroom
- Playground or park
- Home
- Museum
- Library
- Internet
- Activity center like a band room, art studio, or karate school
- Natural area like a forest, prairie, or desert

Look at each team member’s list. What did you learn and how did you learn it? Did you have any difficulties learning any particular topic? Did you use any tools or objects to help you learn each one?

AS A TEAM – Select one topic you are passionate about and use it to write down your **FLL WORLD CLASS Question**. You could choose a topic from your own list or something else that interests your team. For the FLL WORLD CLASS Innovation Project, a topic may be very broad (ex: science) or very specific (ex: the different parts of a cell).

Write your **FLL WORLD CLASS Question** using this format: “How could we improve the way that someone learns [your team’s topic]?”

Then research all the ways people learn about this topic today. You might use books, interviews, the internet, radio, TV or lots of other resources to answer questions like:

- How do people usually find out about your topic for the first time?
- What tools or technology do students usually use to learn about it?
- Why is this topic important and who is it important to?
- Does the location or method matter when learning about this topic?

This might be a great time to interview a professional. The professional could be someone who teaches the topic you selected or works with it every day. How did they learn about your topic? Why are they passionate about it? Did they like the topic when they first learned about it? What are the drawbacks to the way people learn about this topic today?

AS A TEAM – After your brainstorming and research, you should have a good idea of the current answers to your team’s **FLL WORLD CLASS Question**. Discuss whether you need any further information before you begin designing your own solution.

Create an Innovative Solution

Now your challenge is to design an innovative solution to your **FLL WORLD CLASS Question – a solution that adds value to society by improving something that already exists, using something that exists in a new way, or inventing something totally new.**

Your solution might improve the learning experience for someone on your team or for someone else.

Think about:

- How can your solution make learning easier or more fun?
- Can it help you learn something yourself? Or help you teach what you know to someone else?
- What could be done better? What could be done in a new way?
- What new tools or processes would help someone remember the information for a longer time?

AS A TEAM – Think about it! Brainstorm! Use your problem-solving skills to think about all the possible solutions. Discuss all your ideas. One team member’s “silly idea” just might inspire the perfect innovative solution.

A great solution might take all the imagination and ingenuity your team can muster. Or, it might seem so obvious that you wonder why we don’t learn that way today.

Using your research, think about how someone could make your solution a reality.

- Is your idea different in some way from all the other solutions to learn about this topic?
- What would your solution cost?
- Do you need any special technology to make your solution?
- Can anyone use your solution or only some people?

Remember, your solution could improve something that already exists, use something that exists in a new way, or invent something totally new.

Share with Others

Once you have a design or plan for your solution, share it!

AS A TEAM – Think about who your solution might help. How can you let them know? Can you present your research and solution to people who learn or teach? Can you share with a professional or someone who helped you learn about your topic? Or other students in your school? Can you think of any other groups of people who might be interested in your idea?

Consider sharing with someone who could provide feedback about your idea. Getting input and improving are part of the design process for any engineer. Don't be afraid to revise your idea if you receive some helpful feedback.

When you present, use the talents of your team members. Find a creative way to explain your **FLL WORLD CLASS Question** and solution. Could you perform a skit? Create a website? Make a comic book? Rap? Write a poem, song, or story? Your sharing can be simple or elaborate, serious or designed to make people laugh while they learn.

And remember, the most important thing is to have fun!

Present Your Solution at a Culminating Event

Finally, prepare a presentation to share your work with other teams, volunteers and/or parents at a culminating event. Your presentation can include posters, slideshows, models, multimedia clips, your research materials, and more. Be creative, but also make sure you cover all the essential information.

1. Identify your team's **FLL WORLD CLASS Question**.
2. Explain your team's innovative solution.
3. Describe how your team shared your findings with others.
4. Meet the presentation requirements:
 - Give your presentation live; you may use media equipment (if available) but only to enhance the live presentation.
 - Include all team members.
 - Set up and complete your presentation in 5 minutes or less with no adult help.



Learning is part of life. You do it every day.

Now YOU have the power to say how you think people should learn something new.

Whether your solution helps you, someone you know, or someone you have never met, helping someone learn can have an impact for the rest of that person's life.

Help FIRST LEGO League make learning a true WORLD CLASS experience!



Robot Game: Field Setup

The field is where the Robot Game takes place.

- It consists of a field mat, on a table with border walls, with mission models arranged on top.
- The field mat and the LEGO® pieces (elements) for building the mission models are part of your Challenge Set.
- The instructions for building the mission models are [here](#).
- The instructions for how to build the table are [here](#).

NOTE: BEGINNING IN 2019-20, THE FIELD MAT SIZE IS DIFFERENT AND WILL HAVE DIFFERENT RULES SURROUNDING ITS PLACEMENT ON THE TABLE.

Mission Model Construction

BUILD THE MISSION MODELS - Use the LEGO elements from your Challenge Set. It will take a single person four to five hours to do this, so it's best done in a work party. For any team members with little or no experience building with LEGO elements, mission model construction is a great way to learn. This step is also a nice time for new team members to get acquainted with each other.

Mission Model Arrangement and Setup

DUAL LOCK™ - Some models are secured to the mat, others are not. Where a model needs to be secured, the connection is made using the re-usable fastening material from 3M called Dual Lock, which comes in the flat clear bag with the LEGO elements in your Challenge Set. Dual Lock is designed to stick or "lock" to itself when two faces of it are pressed together, but you can unlock it too, for ease of transport and storage. The application process for the Dual Lock is only needed once. Later, the models can simply be locked onto the mat or unlocked. To apply Dual Lock:

Step 1 - Stick one square, adhesive side down, on each box you see on the mat with an "X" in it.

Step 2 - Press a second square on top of each of those, "Locking" them on, adhesive side up.

TIP - Instead of using your finger, use a bit of the wax paper the squares came on.

Step 3 - Lower the model onto the squares.

CAUTION - Pay attention... Some models look symmetrical, but do indicate a directional model feature somewhere.

- Be sure to place each square precisely on its box, and each model precisely over its marks.
- When pressing a model down, press down on its lowest solid structure instead of crushing the whole model. Pull on that same structure if later you need to separate the model from the mat.

TIP - For large and/or flexible models, apply only one or two sets at a time. There's no need to do it all at once.

MODELS - (Any details not shown or mentioned are left to chance.)

Scale - Secure as shown.

Search Engine - Secure and as shown, with push-bar all the way west, and loops in exact colors as shown.

Soccer (Football) - Secure net and barrier as shown.

Box - Place loose as shown. The slab (idea) inside has its white edge facing west and yellow bulb facing south.

Community Tree - Secure as shown, and press any loop into it so the sides rise.

Senses - Secure as shown, with slider all the way west, and any loop captured in the grabber.

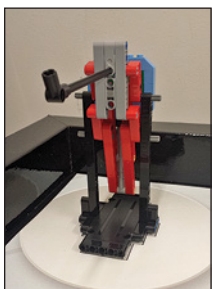
Cloud - Secure as shown, with SD card down/west.

Loops - Place one loose as shown on its mark at south center. Be sure the tubes for all are uniform and parallel.

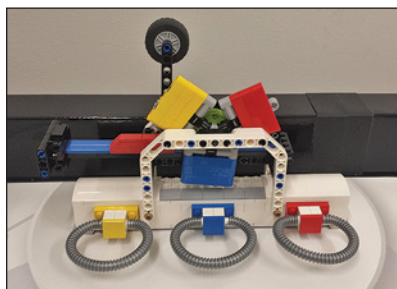
Robotic Arm - Secure as shown, with slider north, and claw closed/capturing any loop.

Engagement - Secure as shown, with yellow section north, a red arm up, and the white dial pointer down/south.

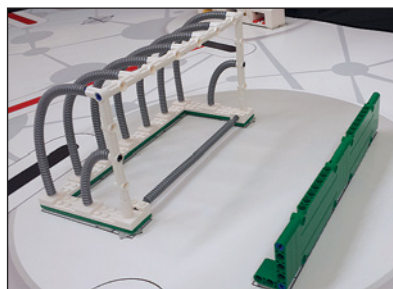
Changing Conditions - Secure as shown, fully settled with south barrier against its stopper.



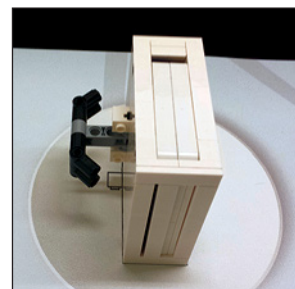
SCALE



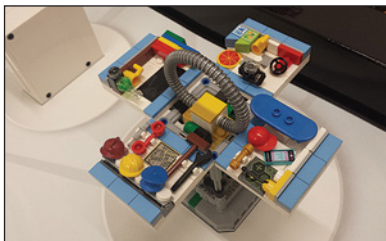
SEARCH ENGINE



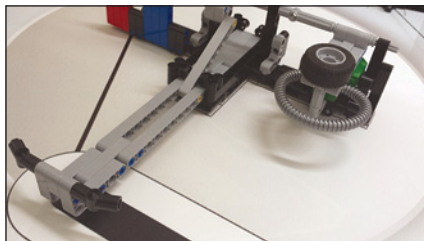
SOCCER



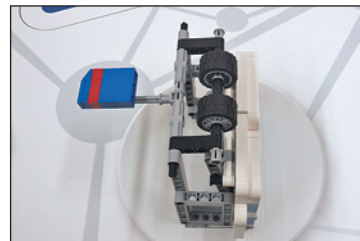
BOX



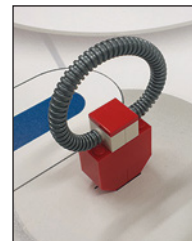
COMMUNITY TREE



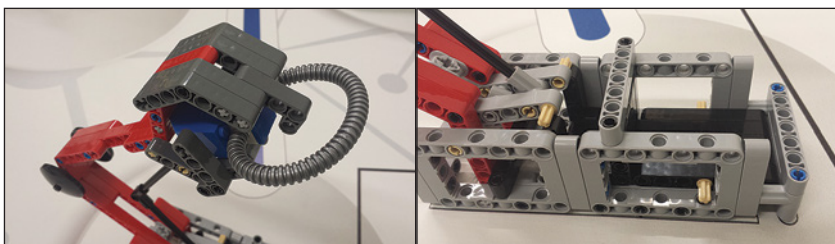
SENSES



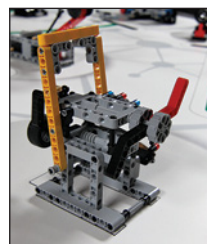
CLOUD



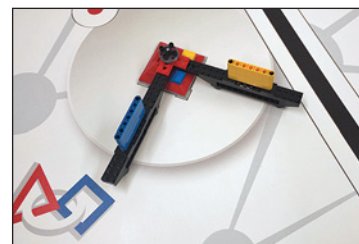
LOOPS



ROBOTIC ARM

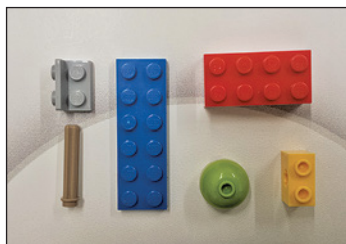


ENGAGEMENT

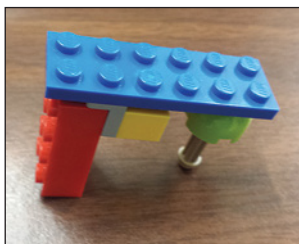


CHANGING CONDITIONS

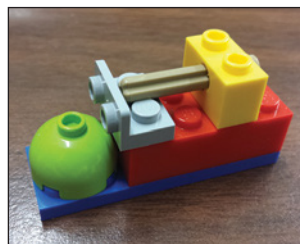
Reverse Engineering - You have several sets of six loose elements. Two of those sets are for the robot field (the rest are related to the *FIRST* LEGO League Innovation Project). Regarding the two robot field sets: ONE set is placed loose in Base. With the OTHER set (all six pieces)... Build your own random or artistic (it doesn't matter) little model, place it in the basket on its mark in the northeast corner of the field, and close the basket's covers as much as possible.



FROM THIS...

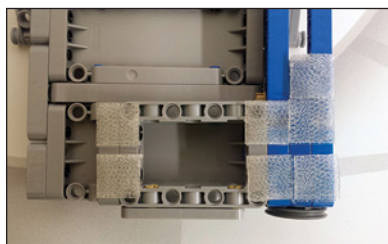


BUILD SOMETHING LIKE THIS (JUST ONE)
THESE ARE JUST EXAMPLES



AND PLACE IT LIKE THIS

Door - This model is secured to the west border wall, north of Base. There are no "X" squares to guide you, but there are marks on the mat, and these pictures show the needed detail... Place the pairs on the door as shown, then press to the wall between the lines. Setup is with the door closed all the way, and the handle lifted.



DOOR - PLACE DUAL LOCK PAIRS



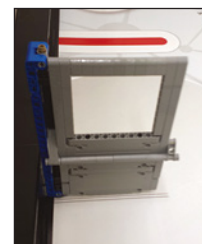
PRESS NORTH OF THESE LINES



PRESS SOUTH OF THIS LINE



DOOR - WALL PATTERN ("ish")



SETUP

Screen And Camera - There are three up-front things to say about this system of models:

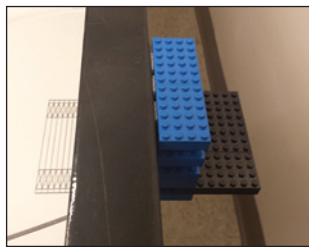
- 1) Both teams (you and your opponent) need to operate this system for it to work.
- 2) This system's full setup takes added care and patience (but really, for anyone doing robotics, it's no big deal).
- 3) You only really need to set up part of the system in order to practice.

Here's how the operation works: Your robot pulls a "camera" model, and by string, it activates a remote "screen" model IF the other team ALSO participates. When both teams participate, both teams score. Since you can't guarantee your opponents will participate and succeed, all you can do is: Get good at pulling your camera model.

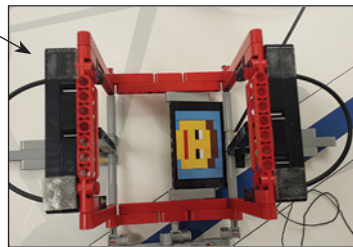
Here's how the setup goes: Step 1 = secure the screen model, Step 2 = secure the camera model, Step 3 = secure the string guides, Step 4 = tie the string, and Step 5 = adjust the system...

Step 1 - Secure The Screen Model - The screen model sits half on your table and half on the other team's table. Since you have only your table, you need to find a way to support the other/far side of the model. You need to rig some sort of dummy FLOOR on the other side of your north border wall. In the example below, a LEGO structure has been Dual Locked outside the table, at just the right height. Have you no extra LEGO elements? Use a wood scrap, a cardboard box, a clipboard...

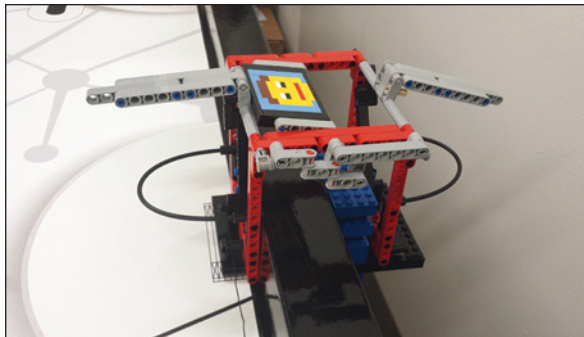
You can do this! Once the dummy floor is built, secure the model as shown.



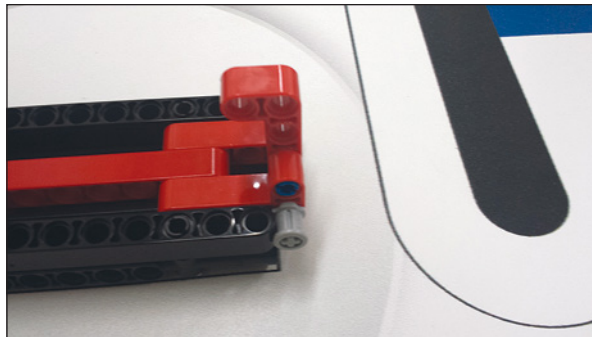
EXAMPLE DUMMY FLOOR



DUAL LOCK GOES HERE (4X)



SECURED SCREEN



SECURED (AND SET) CAMERA

Step 2 - Secure The Camera - Secure as shown, with the slide all the way east.

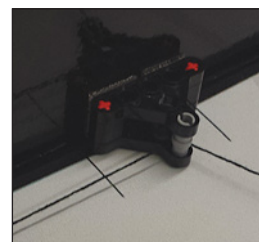
Step 3 - Secure The String Guides - Secure to the walls, with mat lines as guides, like you did for the door...



DUAL LOCK HERE

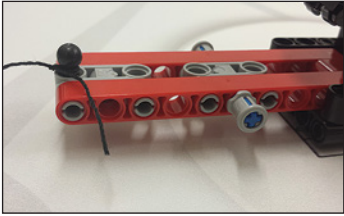


CORNER GUIDE

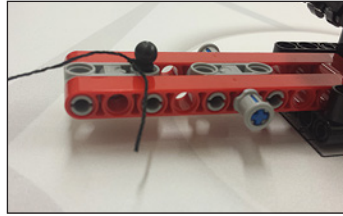


WEST CENTER GUIDE

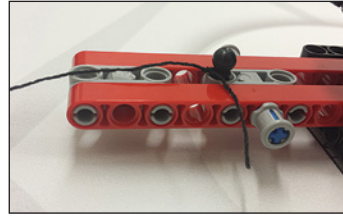
Step 4 - Tie The String - At the camera end, tie to Position 2 (for instructions on the best way to tie the string, type “square knot” into Google Images).



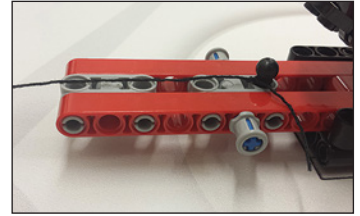
POS 1



POS 2 (Good 1st try)

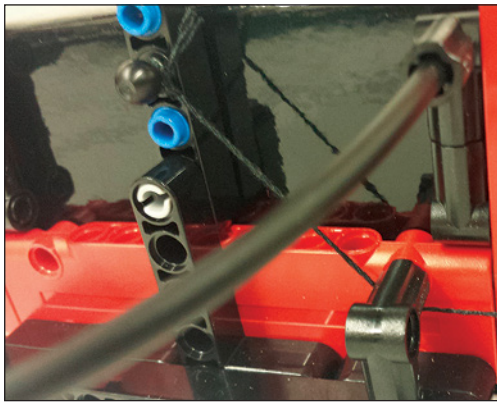


POS 3

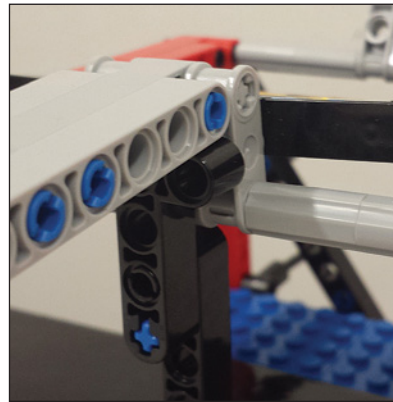


POS 4

At the screen end, route the string under the 90° connector, and tie to the ball pin in the hole between the two blue pins as shown.



SCREEN-END STRING ROUTING



SETUP

To put the camera end in setup position, lift the gray bar, and support it with the L-Beam. Don't push the L-Beam any farther than needed for it to do its job.

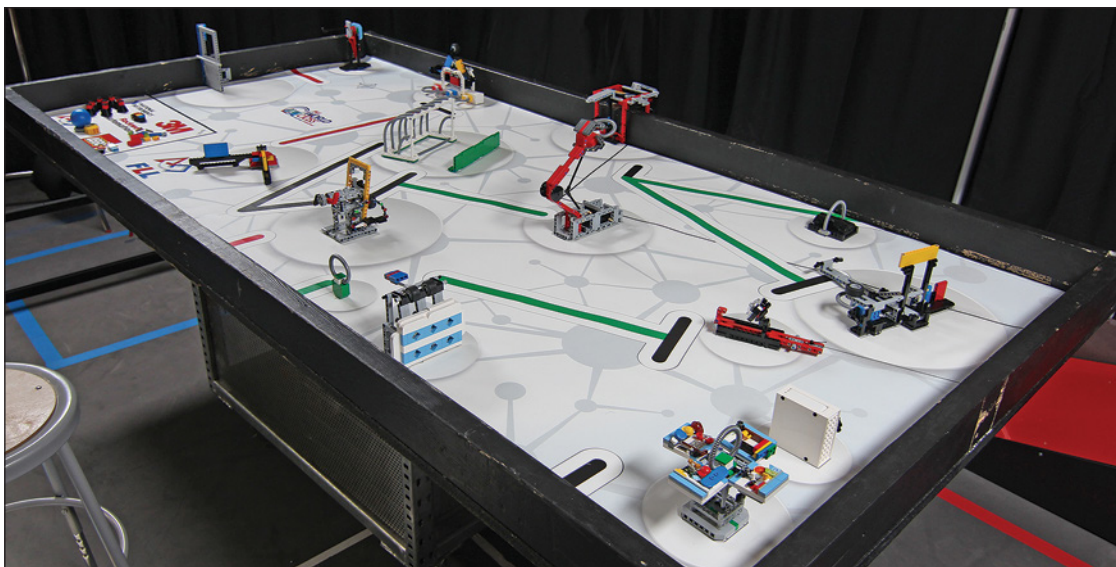
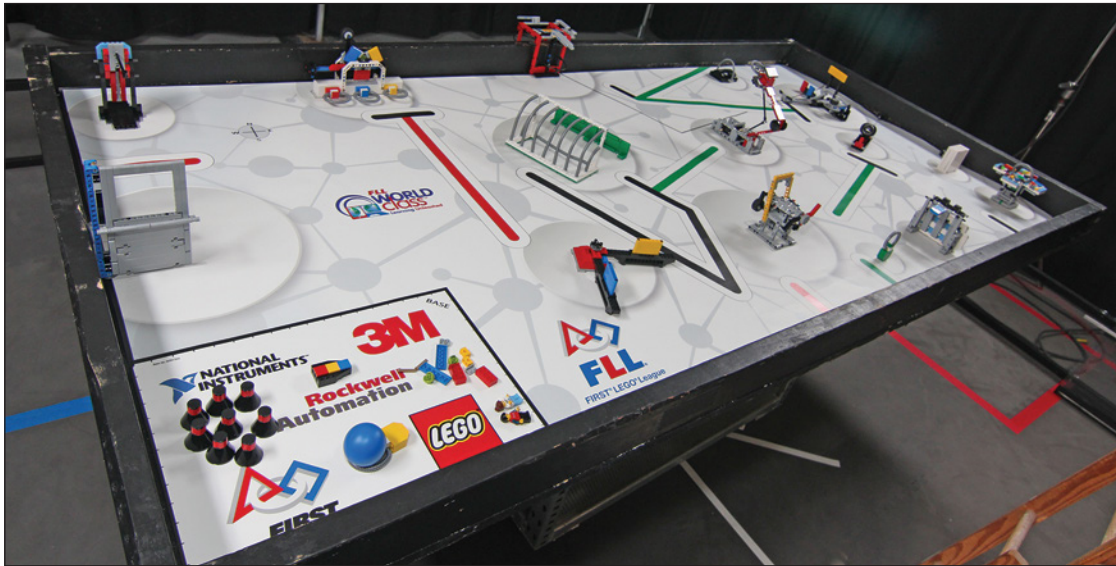
Step 5 - Adjust The System - When the camera model's slider is pulled west from setup position, does the string pull the L-Beam from under the gray bar, allowing the screen to pop up??? If not, move the camera model's ball pin to other positions if needed. If your “sweet spot” can't be found by moving the camera's pin, re-tie the string as needed.

Base - Loosely place in Base: The ball, 8 penalty models, any/one loop, one set of six loose homework elements, the two minifigure people, and the blue/yellow/red robotics insert.



Field Maintenance

- **Border Walls** - Remove any obvious splinters, and cover any obvious holes.
- **Field Mat** - Make sure the mat touches the south border wall, and is centered east to west. Avoid cleaning the mat with anything that will leave a residue. Any residue, sticky or slippery, will affect the robot's performance compared to a new mat (many official events use new mats). Use a vacuum and/or damp cloth for dust and debris (above and below the mat). To get marks off, try a white-plastic pencil eraser. When moving the mat for transport and storage, be sure not to let it bend into a sharp kink point, which could affect the robot's movement. Official events using new mats should unroll the mats as far in advance of the official event day as possible. For control of extreme curl at the east or west edges of the mat, tape is allowed, with a maximum of $\frac{1}{4}$ " (6 mm) overlap. Foam tape is not allowed. Do NOT put Dual Lock under the mat, or use it in any other than securing models as described.
- **Mission Models** - Keep the models in original condition by straightening and tightening solid connections often. Ensure that spinning axles spin freely by checking for end-to-end play and replacing any that are bent.



Robot Game Rules

Guiding Principles

GP1 - GRACIOUS PROFESSIONALISM® You are “Gracious Professionals.” You compete hard against **problems**, while treating **all people** with respect and kindness.

GP2 - INTERPRETATION

- If a detail isn’t mentioned, then it doesn’t matter.
- Robot Game text means exactly and only what it plainly says.
- If a word isn’t given a game definition, use its common conversational meaning.

GP3 - BENEFIT OF THE DOUBT If the referee feels something is a “very tough call,” and no one can point to strong text in any particular direction, you get the **Benefit Of The Doubt**. This good-faith courtesy is not to be used as a strategy.

GP4 - VARIABILITY Our suppliers and volunteers try hard to make all Fields correct and identical, but you should always expect little defects and differences. Top teams design with these in mind. Examples include Border Wall splinters, lighting changes, and Field Mat wrinkles.

GP5 - INFORMATION SUPERIORITY If two official facts disagree, or confuse you when read together, here’s the order of their authority (with #1 being the strongest):

#1 = **MISSIONS** and **FIELD SETUP**

#2 = **RULES**

#3 = **REFEREE** In unclear situations, local referees may make good-faith decisions after discussion, with Rule GP3 in mind.

Definitions

D01 - MATCH A “Match” is when two teams play opposite each other on two Fields placed north to north.

- Your Robot **LAUNCHES** one or more times from Base and tries as many Missions as possible.
- Matches last 2-1/2 minutes, and the timer never pauses.

D02 - MISSION A “Mission” is an opportunity for the Robot to earn points. Requirements are written in the form of

- **RESULTS** that must be visible to the referee at the **END OF THE MATCH**.
- **METHODS** that must be observed by the referee **AS THEY HAPPEN**.

D03 - EQUIPMENT “Equipment” is everything **YOU BRING** to a Match for Mission-related activity.

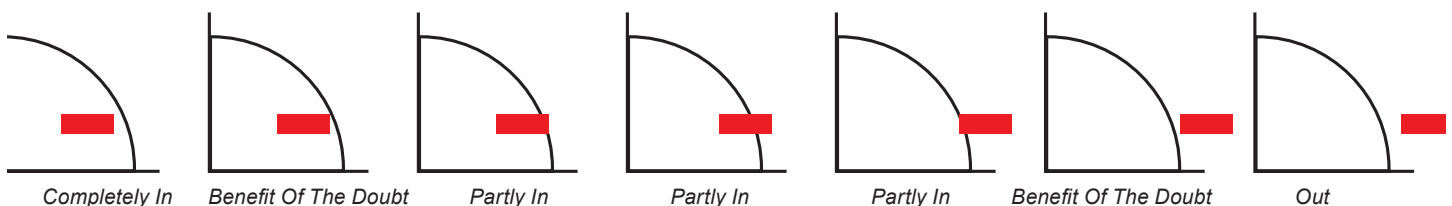
D04 - ROBOT Your “Robot” is your **LEGO® MINDSTORMS®** or **SPIKE Prime** controller and all the Equipment you’ve combined with it by hand which is not intended to separate from it, except by hand.

D05 - MISSION MODEL A “Mission Model” is any LEGO® element or structure **ALREADY AT THE FIELD** when you get there.

D06 - FIELD The “Field” is the Robot’s game environment, consisting of Mission Models on a Mat, surrounded by Border Walls, all on a Table. “Base” is part of the Field. For full details, see FIELD SETUP.

D07 - BASE “Base” is the space directly above the Field’s quarter-circle region, in the southwest. It extends southwest from the outside of the thin curved line TO the corner walls (no farther). The thin line around any scoring area counts as part of that area. When a precise location related to a line is unclear, the outcome most favorable for the team is assumed. (See diagram below.)

D07 - BASE



D08 - LAUNCH Whenever you're done handling the Robot and then you make it GO, that's a "Launch."

D09 - INTERRUPTION The next time you interact with the Robot after Launching it, that's an "Interruption."

D10 - TRANSPORTED When a thing (**anything**) is purposefully/strategically being

- taken from its place, and/or
- moved to a new place, and/or
- being released in a new place,

it is being "Transported." The process of being Transported ends when the thing being transported is no longer in contact with whatever was transporting it.

Equipment, Software, and People

R01 - ALL EQUIPMENT All Equipment must be made of LEGO-made building parts in original factory condition.

Except: LEGO string and tubing may be cut shorter.

Except: Program reminders on paper are OK (off the Field).

Except: Marker may be used in hidden areas for identification.

R02 - CONTROLLERS You are allowed only ONE individual controller in any particular Match.

- It must be from a LEGO Education Robot Set (RCX, NXT, EV3 or SPIKE Prime).
- ALL other controllers must be left in the **PIT AREA** for that Match.
- All remote control or data exchange with Robots (including Bluetooth) in the competition area is illegal.
- This rule limits you to only **ONE** individual **ROBOT** in any particular Match.

R03 - MOTORS You are allowed up to **FOUR** individual motors in any particular Match.

- Each one must come from a LEGO Education Robot Set.
- You may include more than one of a type, but again, your grand total may not be greater than **FOUR**.
- ALL other motors must be left in the **PIT AREA** for that Match, **NO EXCEPTIONS**.

R04 - EXTERNAL SENSORS Use as many external sensors from a LEGO Education Robot Set as you like.

- You may include more than one of each type.

R05 - OTHER ELECTRIC/ELECTRONIC THINGS No other electric/electronic things are allowed in the competition area for Mission-related activity.

Except: LEGO wires and converter cables are allowed as needed.

Except: Allowable power sources are ONE controller's power pack or SIX AA batteries.

R06 - NON-ELECTRIC ELEMENTS Use as many non-electric LEGO-made elements as you like, from any set.

Except: Factory-made wind-up/pull-back "motors" are not allowed.

Except: Additional/duplicate Mission Models are not allowed.

R07 - SOFTWARE You can use any software that allows the Robot to move autonomously – meaning it moves on its own. No form of remote control is allowed.

R08 - TECHNICIANS

- Only two team members, called "Technicians," are allowed at the competition Field at once.
Except: Others may step in for true emergency repairs during the Match, then step away.
- The rest of the team must stand back as directed by tournament officials, with the expectation of fresh Technicians being able to switch places with current Technicians at any time if desired.



Play

R09 - BEFORE THE MATCH TIMER STARTS After getting to the Field on time, you have at least one minute to prepare. During this special time only, you may also

- ask the referee to be sure a Mission Model or setup is correct, and/or
- calibrate light/color sensors anywhere you like.

R10 - HANDLING DURING THE MATCH

- You are not allowed to interact with any part of the Field that's not **COMPLETELY** in Base.

Except: *You may Interrupt the Robot any time.*

Except: *You may pick up Equipment that **BROKE** off the Robot **UNINTENTIONALLY**, anywhere, any time.*

- You are not allowed to cause anything to move or extend over the Base line, even partly.

Except: *Of course, you may **LAUNCH** the Robot.*

Except: *You may move/handle/**STORE** things off the Field, any time.*

Except: *If something accidentally crosses the Base line, just calmly take it back – no problem.*

- Anything the Robot affects (good or bad!) or puts completely outside Base **stays as is** unless the Robot changes it. Nothing is ever repositioned so you can “try again.”

R11 - MISSION MODEL HANDLING

- You are not allowed to take Mission Models apart, even temporarily.
- If you combine a Mission Model with something (including the Robot), the combination must be loose enough that if asked to do so, you could pick the Mission Model up and nothing else would come with it.

R12 - STORAGE

- Anything completely in Base may be moved/stored off the Field, but must stay in view of the referee.
- Everything in off-Field Storage “counts” as being completely in Base and may be placed on an approved holder.

R13 - LAUNCHING A proper Launch (or re-Launch) goes like this:

• READY SITUATION

- Your Robot and everything in Base it's about to move or use is arranged by hand as you like, all fitting “**COMPLETELY IN BASE**” and measuring no taller than 12 inches” (30.5 cm).
- The referee can see that nothing on the Field is moving or being handled.

• GO!

- Reach down and touch a button or signal a sensor to activate a program.

IF FIRST LAUNCH OF THE MATCH – *In this case, accurate fair timing is needed, so the exact time to Launch is the beginning of the last word/sound in the countdown, such as “**Ready, set, GO!**” or **BEEEEEP!***

R14 - INTERRUPTING If you **INTERRUPT** the Robot, you must stop it immediately, *then calmly pick it up for a re-Launch. Here's what happens to the Robot and anything it was Transporting, depending on where each was at the time:

• ROBOT

- Completely in Base: Re-Launch
- NOT completely in Base: Re-Launch + Penalty

• TRANSPORTED THING WHICH CAME FROM BASE DURING THE MOST RECENT LAUNCH

- Always: Keep it

• TRANSPORTED THING WHICH DID NOT COME FROM BASE DURING THE MOST RECENT LAUNCH

- Completely in Base: Keep it
- NOT completely in Base: Give it to the referee

The “PENALTY” is described with the Missions.

IF YOU DON'T INTEND TO RE-LAUNCH – *In this case, you may shut the Robot down and leave it in place.*

R15 - STRANDING If the **UNINTERRUPTED** Robot loses something it was Transporting, that thing must be allowed to come to rest. Once it does, here's what happens to that thing, depending on its rest location:

• TRANSPORTED THING

- Completely in Base: Keep it
- Partly in Base: Give it to the referee
- Completely outside Base: Leave as is

R16 - INTERFERENCE

- You are not allowed to negatively affect the other team except as described in a Mission.
- Missions the other team tries but fails because of illegal action by you or your Robot will count for them.

R17 - FIELD DAMAGE

- If the Robot separates Dual Lock or breaks a Mission Model, Missions obviously made possible or easier by this damage or the action that caused it do not score.

R18 - END OF THE MATCH As the Match ends, everything must be preserved exactly as-is.

- If your Robot is moving, stop it ASAP and leave it in place. (Changes after the end don't count.)
- After that, hands off everything until after the referee has given the OK to reset the table.

R19 - SCORING

- **SCORESHEET** The referee discusses what happened and inspects the Field with you, Mission by Mission.

- If you agree with everything, you sign the sheet, and the scoresheet is final.

- If you don't agree with something, the head referee makes the final decision.

- **IMPACT** Only your **BEST** score from regular Match play counts toward awards. Playoffs, if held, are just for extra fun.

- **TIES** Ties are broken using 2nd, then 3rd best scores. If still not settled, tournament officials decide what to do.

Robot Game Missions

Opening Doors

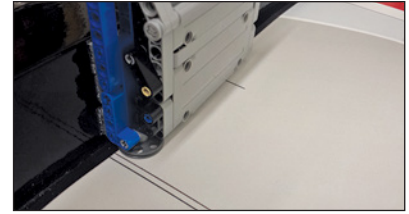
Required condition visible at the end of the match:

- The door must be open enough for the referee to notice.

Required methods, constraints:

- The handle was pushed down.

Value: 15



Cloud Access

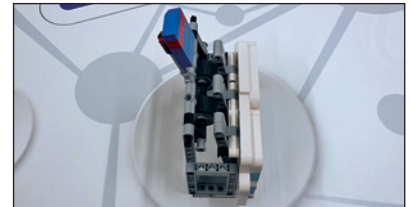
Required condition visible at the end of the match:

- The SD card is up.

Required methods, constraints:

- The correct "key" was inserted in the cloud.

Value: 30



Community Learning

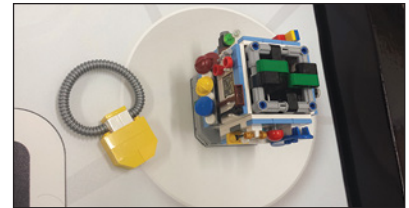
Required condition visible at the end of the match:

- The knowledge & skill (loop) is no longer touching the community model.

Required methods, constraints:

- None.

Value: 25



Robotics Competition

Required condition visible at the end of the match:

- The robotics insert is installed in the place shown.
- The loop is no longer touching the robotic arm model.

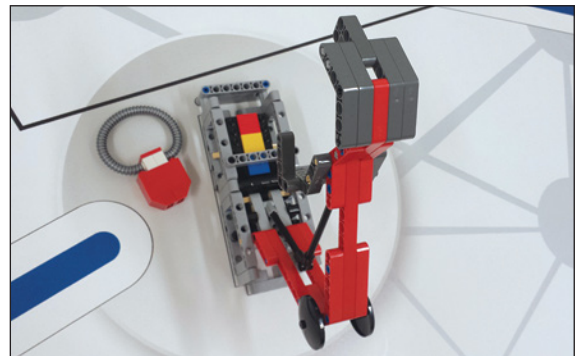
Required methods, constraints:

- No team supplied object is touching the robotics insert.
- The loop was released due to movement of the slider only.

Value/Insert: 25

Value/Insert + Loop: 55

(Possible Scores = 25 or 55)



Using the Right Senses

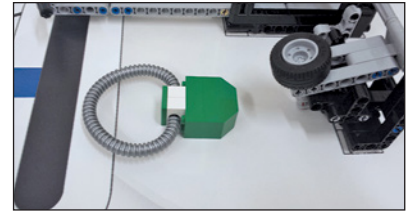
Required condition visible at the end of the match:

- The loop is no longer touching the senses model.

Required methods, constraints:

- The loop was released due to movement of the slider only.

Value: 40



Thinking Outside the Box

Required condition visible at the end of the match:

- The idea model is no longer touching the box model.
- If the idea is no longer touching the model, the bulb faces up.

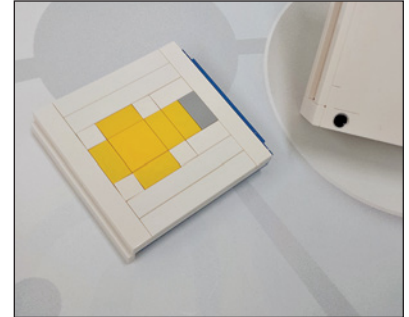
Required methods, constraints:

- The box model was never in Base.

Value/Idea Out, Bulb Down: 25

Value/Idea Out, Bulb Up: 40

(Possible Scores = 25 or 40)



Remote Communications/Learning

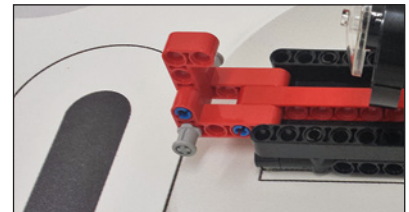
Required condition visible at the end of the match:

- None.

Required methods, constraints:

- The referee has seen the robot pull the slider west.

Value: 40



Search Engine

Required condition visible at the end of the match:

- The color wheel has spun at least once.
- If a single color appears in the white frame, its matching loop is no longer touching the model.
- If two colors appear in the white frame, the remaining color's loop is no longer touching the model.
- Both "not desired" loops must be touching the model, in their holes.

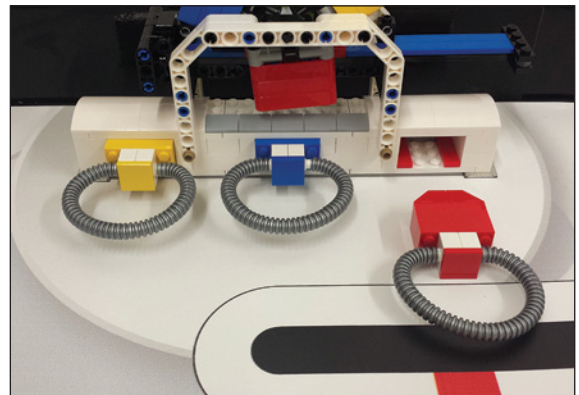
Required methods, constraints:

- Nothing has caused the color wheel to spin except the slider being pushed.

Value/Slider: 15

Value/Slider + Loop: 60

(Possible Scores = 15 or 60)



Sports

Required condition visible at the end of the match:

- The ball is touching the mat in the net.

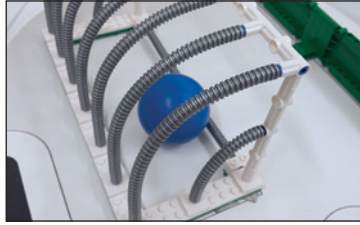
Required methods, constraints:

- All equipment involved with the shot was completely east/north of the “Shot Lines” while sending the ball to the net.

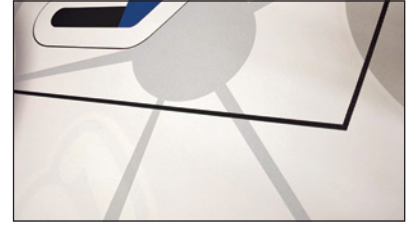
Value/“Took A Shot”: 30

Value/Shot + Goal: 60

(Possible Scores = 30 or 60)



GOAL



SHOT LINES

Reverse Engineering

Required condition visible at the end of the match:

- Your basket is in Base.
- You have built a model “identical” to the one the other team put in your basket. Connections need to be the same, but where rotation is a factor, “close” is okay.
- The model is in base.

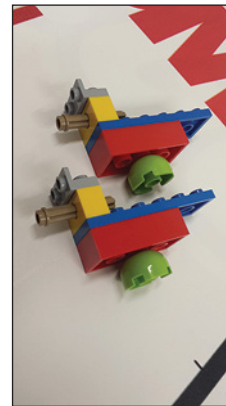
Required methods, constraints:

- None.

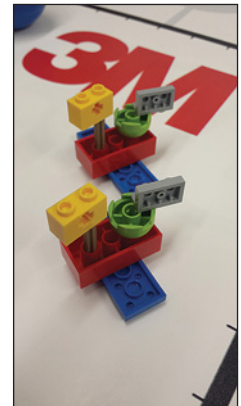
Value/Basket: 30

Value/Basket + Model: 45

(Possible Scores = 30 or 45)



EXAMPLE



EXAMPLE

Adapting to Changing Conditions

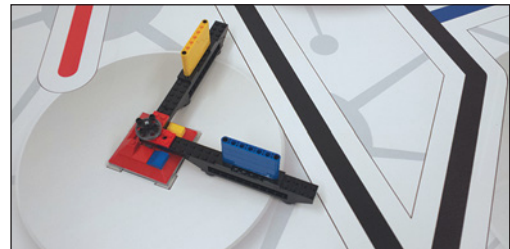
Required condition visible at the end of the match:

- The model is rotated 90° counter-clockwise from its setup position as shown here.

Required methods, constraints:

- None.

Value: 15



Apprenticeship

Required condition visible at the end of the match:

- The people are both bound (any way you like) to a model you design/ supply, which represents a skill, achievement, career, or hobby that has meaning for your team.
- The model is touching the white circle around the scale.
- The model is not in Base.
- Binding mission models is usually not allowed under [R11](#), but we make an exception here.
- The model can be simple or complex, primitive or realistic – it’s up to you.

Required methods, constraints:

- None.

Value/Model: 20

Value/Model Touching Circle: 35

(Possible Scores = 20 or 35)



Engagement

Required condition visible at the end of the match:

- Yellow section is moved south.
- Dial is obviously clockwise of its setup position; see chart for score.

Required methods, constraints

- The dial may only move as a result of the robot turning the pinwheel.
- Between any two starts/restarts (see [R11](#) & [R13](#)), the pinwheel may be turned 180° maximum.

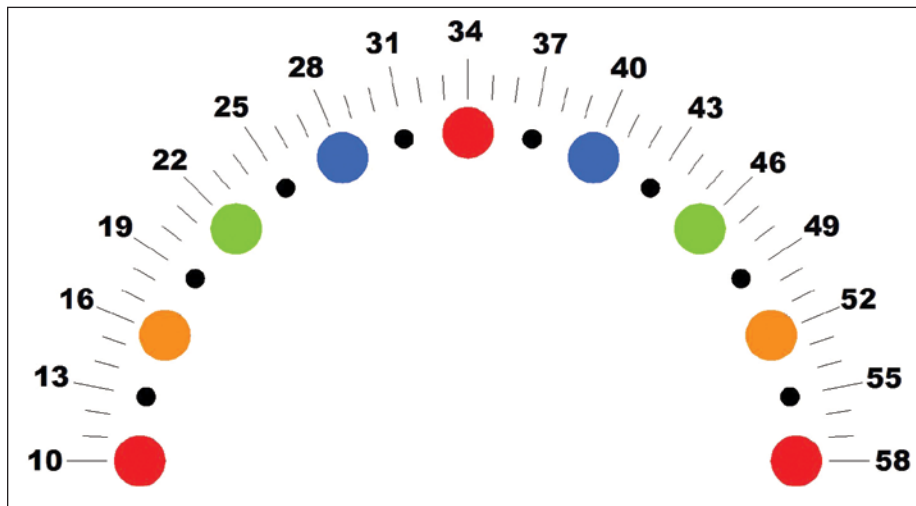
The referee will undo any extras turns.

Value/Engage: **20**

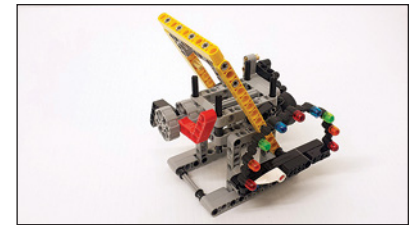
Value/90° Pinwheel Turns: **See Chart For Percentage Added To Your Non-Engagement Mission Score Total**

EXAMPLE: If your score from all other missions is 350, and the robot does one 90° turn, that's worth 35.

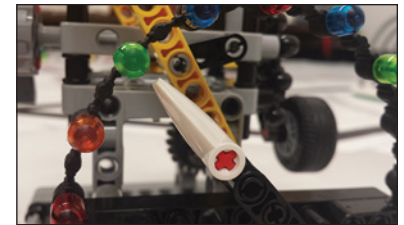
EXAMPLE: If your score from all other missions is 300, and the robot does six 90° turns, that's worth 45.



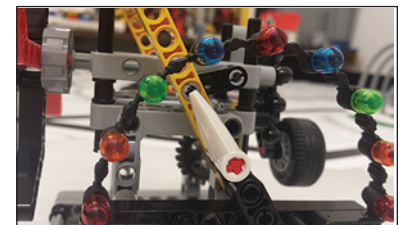
PERCENTAGE ADDED TO NON-ENGAGEMENT TOTAL



ENGAGED



EXAMPLE: 22%



EXAMPLE: 25%

Project-Based Learning

Required condition visible at the end of the match:

- The scale holds loops (representing knowledge and skill) as shown.

Required methods, constraints:

- None.

Value/1st Loop: **20**

Value/More Loops: **10 EACH**

(Possible Scores = 0 or 20 or 30 or 40 or 50 or 60 or 70 or 80 or 90)



Penalties

If a Robot, Sprawl, or Junk penalty earned (as described in the Rules), the referee keeps account by obvious placement of these penalty markers in some manner as to stay out of the way of you and your robot. Loss of cargo is its own penalty.

Robot, Sprawl, or Junk Penalty: -10 EACH

(Max Penalties Of These Types = -80)

Cargo Penalty: Loss Of Cargo



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