2018 Illinois 4-H Robotics Challenge: Envirobot

“If you want to learn about the health of a population, look at the air they breathe, the water they drink, and the places where they live.”
– Hippocrates, the Father of Medicine, in the Fifth Century B.C.

This year’s challenge revolves around one of the most important issues our world faces, environmental health. With major bodies like the World Health Organization estimating that over 12 million deaths are attributable to unhealthy environments annually, it is important that we begin to tackle this issue today for the sake of our future. As a result, each task this year will revolve around EH, and will help illuminate the challenges we face in dealing with EH related issues. For more information on Environmental Health related issues, check out the National Environmental Health Association website at https://www.neha.org/, the Center for Disease Control and Prevention site at https://www.cdc.gov/nceh, the National Institute of Environmental Health Sciences website at https://www.niehs.nih.gov/health/topics/index.cfm, as well as The World Health Organization site at www.who.int/phe/en/, and the Environmental Health Association site at https://www.epa.gov/.

This year’s Competition will take place at the Orr Building on the Illinois State Fairgrounds in Springfield, IL on Saturday April, 21 2018. Team registration will open the first week of February.

This year, the competition will consist of three parts including a new Project Judging Section (outlined below).

Content

Teams will compete in three events: 1) Table Performance Judging, 2) Technical Judging, and 3) Project Judging. Due to the size of the event, this year the Technical and Project judging will be a single 30 minute combined judging session with Project and Technical judges observing both.

I. Performance Judging, Three Rounds (10 minutes each)- 35% of total score

Teams will have until April 21, 2018 to design and program a robot that is able to complete as much of the Envirobot Challenge as possible. This challenge covers information contained in the 4-H Robotics Platforms curriculum. It is not expected that teams will achieve perfect scores in the Performance Judging, but rather that team members design a robot and program that reflects their current level of learning. The challenge is designed to be open-ended and includes a lot of room for creativity.

The rules for the performance judging are as follows:

1. Team members at the performance table will have approximately 10 minutes to position their mat and prepare their robot for tournament play.
2. Teams can use the setup time to run several practice runs before the performance run. The performance run will start at the time indicated on the schedule. Teams may use the time after the previous team clears the table until their performance time to practice – this should be a minimum of 10 minutes. Judges will alternate between the A and B Tables.

4. While the robot is in action, the team members must not touch the performance table or robot. Any touches will result in a touch penalty of 10% with 5 maximum touches.

5. Each team will have three rounds of performance judging, with time in between to make adjustments. The best score of the three rounds will be used.

A note on variability: Remember that lighting and sound may differ at the competition from the conditions in which you tested your Envirobot program. Consider covering your light and color sensors from surrounding light, and be prepared to make on-site adjustments as needed. Please note that there are several large overhead windows in the Orr Building. Also note that any materials can be used to modify the robot; materials do not have to be made using LEGO® elements.

II. Technical Judging, 10 minutes- 45% of total score
A team may provide a demonstration of the robot and its program to the judges. Teams will be allowed to bring their field into the judging room, however robot tables will not be provided so the field will need to be set up on the floor. If your team decides to do a presentation, it should be at the beginning of the session. Only team members are allowed in the judging room, no coaches, parents or siblings. This requirement is primarily a space issue – up to six teams will be in each judging room. The judges will wish to view your team’s robot and ask you about its design. YOUR TEAM SHOULD BRING CODE DOCUMENTATION FOR YOUR HEALTHBOT. See the video at this link for tips on printing programs for an NXT robot.
https://uofi.box.com/CommentingCode

The team members should answer the judges’ questions. For the robot design judging, points will be awarded based on assessment of the teams’ technical understanding and not on the performance of their robot.
NEW! III. Project Judging (Replacing Teamwork Judging) 20% of total score

This year, each team will be required to identify one Environmental Health issue, and propose a potential solution or product to help mitigate the negative effects posed by that particular issue. Teams will then be given 15 minutes to present their solution to the judges using a PowerPoint presentation. Teams will be judged based on the following categories and sub categories:

1. **Research**: Defining the Problem, Connecting with EH related professional, Sources of Information, Problem Analysis, review of Existing Solutions

2. **Strategy and Innovation**: Team Solution, Design Process, Innovation, market Testing, Potential Implementation

3. **Group Presentation**: Advocate in Community, Creativity, Presentation Effectiveness

4. **Team Work**: Effectiveness, Efficiency, Kids do the Work

5. **Motivation**: Discovery/ Issue, Integration

6. **Professionalism**: Inclusion, Respect, Cooperation

7. **Judges Questions**: Thoroughness

It is expected that each team will spend a good deal of time researching and developing a specific solution to the problem they choose. If the solution is a product, your team is encouraged to go as far in the engineering design process as possible, all the way up to actually prototyping your solution. If your solution is nonphysical, you are still expected to go as far as possible in the engineering design process.

Scoring rubrics and a standard Envirobot Challenge Power Point Template will be made available the first week of February, 2018.
General Rules:

1. Teams must consist of at least three youth with a maximum of ten youth aged 8-18. To Participate youth MUST BE AN ENROLLED MEMBER OF 4-H PRIOR TO THE EVENT.

2. Any commercially available or homemade robot may be used and any material may be used in the construction of the robot and field. This is also your opportunity to be creative in designing your field and robot.

3. The playing field is a standard FIRST® LEGO® League (FLL®) table constructed using a 4'x8' sheet of plywood with 2x4 walls, resulting in a 45" x 93" playing surface. Alternatively, teams can practice and design without a table, however at the competition event, robots must be able to run on a field with walls. It is suggested that teams that are practicing without a table use boxes, 2x4s or a wall to simulate the competition table walls to be sure robots stay within the bounds of the field. A playing area can be made on a floor using two 2x4s 96" long and two pieces 43" long - basically a table without the plywood.

4. While you may use up to two Envirobots to complete many of the tasks, only one Envirobot may be scoring at a time. This means that only one Envirobot can be performing a task that yields points at a time (with the exception of tasks 5 and 6). At the competition there will only be one judge with one set of eyes on your playing field. Envirobot 2 can be moving into position to begin a task while Envirobot 1 is working on a task, but Envirobot 2 cannot begin the task until Envirobot 1 has completed its task. For your points to be considered, each action must be done in succession (not necessarily in order). This means that you do not have to do task 1 then task 2, but rather can complete each task in whatever order you want. However, you must complete each task in full before doing work on the next task (with the exception of tasks 5 and 6). This is true of all tasks except those that require both Envirobots to be synchronized (Global Warming Dance) or tasks in which both Envirobots are performing an activity.

5. The robots will have 3 minutes to complete their programmed tasks. Once the robot(s) and timer have started, human team members cannot touch any robots or
anything on the field. Depending on time available, teams may have one or two
practice runs at the table before the “real” run. No remote control will be allowed.

6. Before the first table run, teams’ fields will be inspected by the judges. Any field
element that does not meet the specifications will cause the team to incur a
technical penalty. Teams will be given a “pass / fail” card which will be used by the
judges to record the penalties. If teams can modify their field to pass inspection,
then they will receive a “pass” card.

7. Teams will incur a technical penalty each time they contact the robot or directly
influence its path. Each technical penalty removes 10% of a team’s score, with a
maximum of 5 penalties.

8. All Envirobots must start the table run touching a wall at least 6” from the first task.

9. Items MUST begin at least 12” from the target (ie. the building pieces from the
Asbestos treatment facility).

10. You may only use one programmable brick per robot.

11. When transporting, taking, placing and/or delivering objects from one location to
another, as long as there are NO GUIDERAILS, it is okay to use completely flat
ramps, slides, bridges, etc. as conduits to complete the mission. Anything
designed to keep the object in/on the conduit is not allowed. As in FLL, the robot
DOES NOT need to be in contact with the object for the entire task, as long as the
robot initiates the task.

12. Each target building or drop-off location must be separate and distinct. No one
building may have dual purposes (e.g. the recycle facility may not be the space
debris facility). All destinations must be defined by a 2D outline on the mat and
must be labeled. (Exception: The bonus points for a 3D destination for task #12)

13. Items must be delivered individually.

14. Items do not need to physically look like what they represent but must be clearly
labeled for the judge (e.g. small Lego brick cube labeled flashlight).
**Tasks (485 Maximum Total Points):**

1. **Decoration:** Decorate your Envirobots as something affected by climate change or environmental factors that your team has a personal interest in (i.e.: an oil-covered duck or a polar bear, etc.)
   - 5 points each Envirobot
   - 10 POINTS MAX
     - 1. This task may be completed individually by two (2) Envirobots.

2. **Asthma Smoke Stack:** Install a scrubber cover on a smokestack. The smokestack must be 12” tall and at least 2” wide at the top (exterior diameter, whether round or square). The scrubber cover must be less than 4” wide (interior diameter, whether round or square).
   - 30 POINTS
     - 1. This task can be completed only once and by one (1) Envirobot.

3. **Unplug and Admire Nature:** Stop and admire nature for five seconds in one location. To score additional points, navigate through a forest of between 1 and 5 trees, placed in a straight line, using sensors for obstacle avoidance. To score points, your Envirobot must clearly navigate around a tree that is in its path of motion, essentially weaving through the trees. Simply navigating past a tree will not score you points. If the Envirobot comes in contact with a tree, that tree will not be included in the calculation of the additional points.
   - 5 points for stopping and admiring nature
   - 1 tree=5 points, 2 trees=10 points, 3 trees=15 points, 4 trees=20 points, 5 trees=25 points
   - 10 bonus points for successful navigation through a 5 tree forest
   - 40 POINTS MAX
     - 1. Each Tree in your forest must be avoided individually and cannot be counted twice.
     - 2. This task can be completed only once and by one (1) Envirobot.

4. **Survival / Emergency Preparedness Kit:** Gather water, nonperishable food, a flashlight, a hand crank radio, and a first aid kit and place the items in an emergency kit.
   - 5 points per item – 10 bonus points if all 5 items are delivered to the kit
   - 35 POINTS MAX
     - 1. This task can be completed only once and by one (1) Envirobot.

5. **Hurricanes / Floods:** Rebuild a house or structure that has been devastated by a natural disaster. Each house or structure may be made up of 2-5 pieces.
   - 2 pieces=10 points, 3 pieces=15 points, 4 pieces=20 points, 5 pieces=35 points
   - 5 bonus points if completed using two Envirobots
   - 40 POINTS MAX
     - 1. Structure pieces must be 3D, and must start at least 12” from the building site (including the inspection location in task #6).
2. If done in conjunction with task #6, for each individual piece you may bring the piece from the building site to the inspection location, have the piece checked, return the piece to the building site, and add it to the construction.

3. This task can be completed only once using one (1) Envirobot by itself or two (2) Envirobots working together at the same time.

6. Asbestos or Lead Based Paints: Take the pieces of the house that is being built (Hurricane/Flood task) to an inspection location at least 12” away from the building site to have them checked for asbestos and/or a lead based paint. You do not need to be rebuilding the house (task #5) to complete this task.

5 points per piece – 10 bonus points if 5 pieces are checked
35 POINTS MAX

1. Pieces do not need to be dropped on the mat to be checked at the designated inspection location.
2. If done in conjunction with task #5, for each individual piece you may bring the piece from the building site to the inspection location, have the piece checked, return the piece to the building site, and add it to the construction.
3. This task can be completed only once using one (1) Envirobot by itself or two (2) Envirobots working together at the same time.

7. Conservation: Turn off a light switch or faucet to conserve energy/resources. If your Envirobot is turning off a light switch, the switch must travel at least 90° from up (On) to down (Off). If your Envirobot is shutting off a faucet, the handle must travel at least 90° horizontally from Open to Closed.

10 points per Envirobot – 20 POINTS MAX

1. The light switch must be clearly marked with On/Off.
2. The faucet must be clearly marked with Open/Closed.
3. One Envirobot can turn off only one item.
4. This task may be completed individually by two (2) Envirobots – one Envirobot turning off one item, the other Envirobot turning off the other item.

8. Space Junk/Debris: Reclaim a satellite from “space” and place in a space debris facility.

20 points if the satellite begins 15”-25” above the mat
45 points if the satellite begins more than 25” above the mat
45 POINTS MAX

1. This task can be completed only once and by one (1) Envirobot.

9. Water Quality: Filter water using multiple colored particles to denote impurities and separate the bad from the good. Using red, yellow, green, blue, and black colored bricks, remove ALL colors but blue from the water purifier. Particles will be randomly ordered in the location of your choosing by the judges.

5 points per impurity removed – 5 bonus points if all four impurities are removed
0 points if the blue brick is removed
25 POINTS MAX
1. The removed “impurities” do not need to be placed in any particular location after being “filtered” but the blue brick must remain inside the defined water purifier. This task can be completed only once and by one (1) Envirobot.

10. **Wildfires**: Bring two tanks of water to help put out a fire, traveling the 8’ length of the table four times (two laps). Your Envirobot must start each lap by touching a fire hydrant at one end of the table to gather water, turn around and drive forward to the other end and touch a blazing wildfire to help put it out, turn around again and drive forward to return to the fire hydrant.  
   20 points per Envirobot – 40 POINTS MAX  
   1. This task may be completed individually by two (2) Envirobots.

11. **Emergency Water Delivery**: Take a pallet of water bottles from a warehouse and take it to the rebuilt house.  
   10 points per Envirobot – 20 POINTS MAX  
   1. Items must be delivered within 6” of the rebuilt home, or within 6” of the building site.  
   2. This task may be completed individually by two (2) Envirobots

12. **Illegal Dumping/ E Waste**: Take up to 5 pieces of trash to a landfill or take 5 pieces of electronic waste to a recycling facility.  
   5 points per item – 10 bonus points if the recycling facility is 3D  
   35 POINTS MAX  
   1. This task can be completed only once using one (1) Envirobot by itself or two (2) Envirobots working together at the same time.

13. **Extreme Cold/Heat**: Take a blanket or sunglasses to another Envirobot.  
   10 points if the item ends up within 6” of the recipient Envirobot  
   20 points if both Envirobots are touching the item at the end of the task  
   30 points if one Envirobot successfully places the delivery directly on the other Envirobot  
   30 POINTS MAX  
   1. This task must be completed using two (2) Envirobots.

14. **Radiation Exposure**: Take an x-ray of a patient by having the Envirobot turn a crank on an x-ray machine two times clockwise, and two times counterclockwise.  
   20 points – 10 bonus points if another Envirobot is on an exam table for the x-ray  
   30 POINTS MAX  
   1. Crank must turn at least two full revolutions (720 degrees) in each direction.  
   2. Mark the crank so the judges can tell if you completed the task.  
   3. This task can be completed only once using one (1) Envirobot by itself or two (2) Envirobots working together at the same time.

15. **Fracking (Drilling for oil)**: Move a fracking drill to a specified disposal site and move a solar panel to the drill’s original location.  
   15 points if completed using one Envirobot
30 points if one Envirobot moves the drill and another Envirobot moves the solar panel
30 POINTS MAX
1. The disposal site must be at least 12” from the drill site.
2. Both the drill site and the disposal facility cannot be larger than a 4”x4” square.
3. This task can be completed only once using one (1) Envirobot by itself or two (2) Envirobots working together at the same time.

10 points if completed using one Envirobot
10 bonus points if the dance is synchronized with another Envirobot
20 POINTS MAX
1. Dance must use both sound and motion.
2. Dance must last at least five (5) seconds.
3. Synchronizing the start of the dance can be done by Bluetooth but is not required.
4. This task can be completed only once using one (1) Envirobot by itself or two (2) Envirobots working together at the same time.