FBISD ROBOTICS COMPETITION

Storyline: Factory Automation

To make the competition interesting, a storyline is woven within the jobs. As you read each job, you should pay attention to what skills the robot will need to complete the job successfully. Do not get caught up in the storyline where you miss steps or requirements for the job.

As technology evolves, many jobs that were once done by humans are being replaced by robots. For this competition you are a programmer for a factory that has a robot that runs on the floor in the evening doing tasks to get the factory ready for the next day. From picking up trash to loading a delivery truck, these robots can do a variety of jobs. Be sure to read each job carefully and use the various sensors and parts to complete the jobs.

A team's robot will compete in separate jobs around the floor of the factory. There are three jobs for elementary teams to complete and four jobs for middle school teams to complete on the competition mat. Events must be attempted in numeric order (job 1, job 2, etc.) and a reasonable effort made to complete each job before proceeding to the next one. The points for each event will be assessed as the competition is carried out. Design, build, and program a robot to master each job.

Jobs

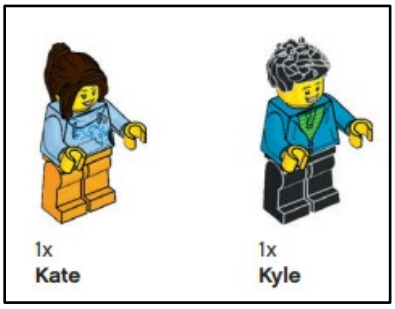
A team's robot will have five minutes to complete various jobs. Not all jobs must be attempted or completed, but they must be done in order (1,2,3,4). Remember that each floor completed by the robot accumulates points, and the points for each floor will be assessed as the floor is completed. Floors allow for the opportunity to earn partial points and students should be encouraged to allow the robot to run its program rather than resetting multiple times, as they may still earn points. For Middle School, the additional job, #4, comes after jobs 1-3.

Obstacles and Task Elements

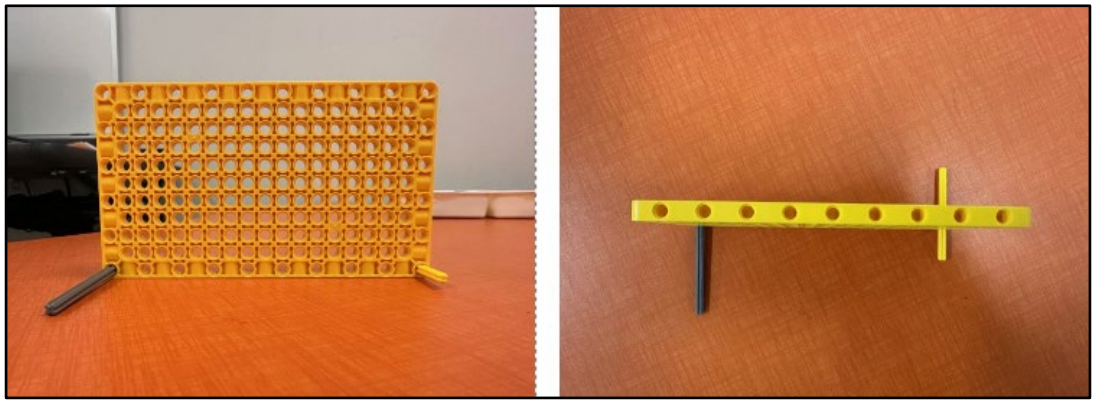
During the competition the robot must avoid various obstacles or use specific elements for the jobs.

The first type of obstacle is created by placing a ping pong ball on top of the PVC coupling. This obstacle is considered touched if the ping pong ball is knocked off the PVC coupling. Neither the PVC coupling nor the ping pong balls should be altered, glued, or modified in any way to prevent them from falling off.

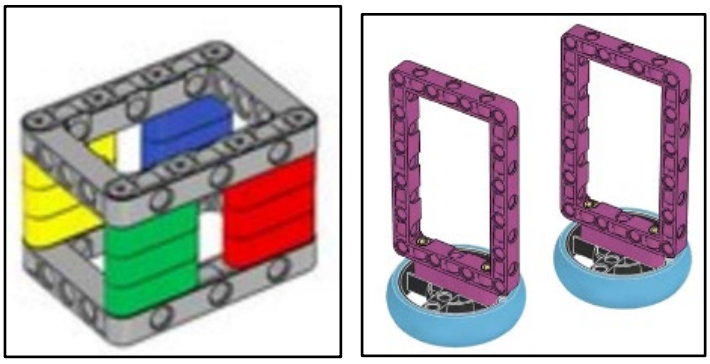
The next element that will be utilized will be the two Lego figurines from the Spike kit. If your campus cannot locate the two figurines from the kit, alternative figurines from other Lego sets may be used. The campus must check with the judges that the figurines are acceptable. Alternative figurines should be a standard size and be able to stand and sit.



The third type of obstacle is a barrier. It is made using the yellow Lego plate and axel rods to support it in standing up. Depending on what parts are used to build the robot, you should have a few axel pieces left over and may use two of them to build the barrier. The barrier should stand up on the long side. Under normal circumstances, this barrier should not be touched but the robot may need to use various sensors to interreact with it during a job. Unless the job states otherwise, the barrier should not be touched. A touch would be considered if there is visible movement of the barrier.



A fourth element that will be used is the EV3 cuboid or Spike block. It does not matter which is used, so teams may decide which element to use for their robot. Directions for making the cuboid or block are found withing the build directions. The color of the blocks does not matter, but at times there could be challenges that require a sensor to be used, so that should be taken into consideration when building the elements.

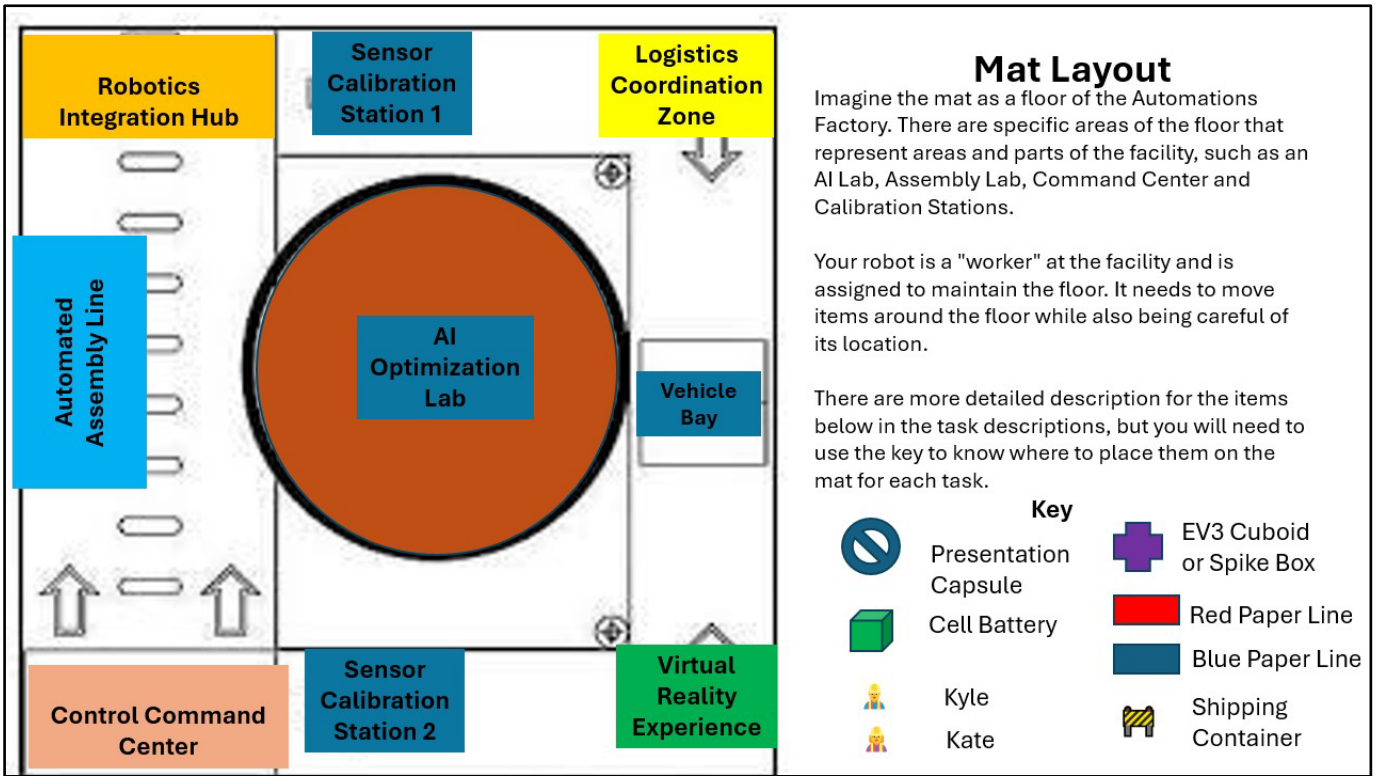


Key and Item Description

Equipment or map locations	On map named	Represented on map by
Starting Point	Control Command Center	See map for location
Wooden Blocks	Cell Battery	
PVC and Ping-Pong Obstacle	Presentation Capsule	
Cuboid or Spike Box	Cuboid or Spike Box	
Barrier	Shipping Container	
Lego figurines	Kate and Kyle (factory workers)	

Starting Point

The starting point is where your robot will start and finish all events unless directions call for something different. The various areas of the mat are shown in the map layout graphic. To begin each floor, robots must have both drive wheels touching within the starting point to be considered "in". At times, if the robot must return to the starting point, it is considered "in" if one wheel is in the area. This is true for other areas of the mat as well. One wheel must remain on the mat at all times. If both wheels leave the mat, the team will receive a point deduction. **Note:** In some jobs the judges will let you know the placement of specific items, if necessary.



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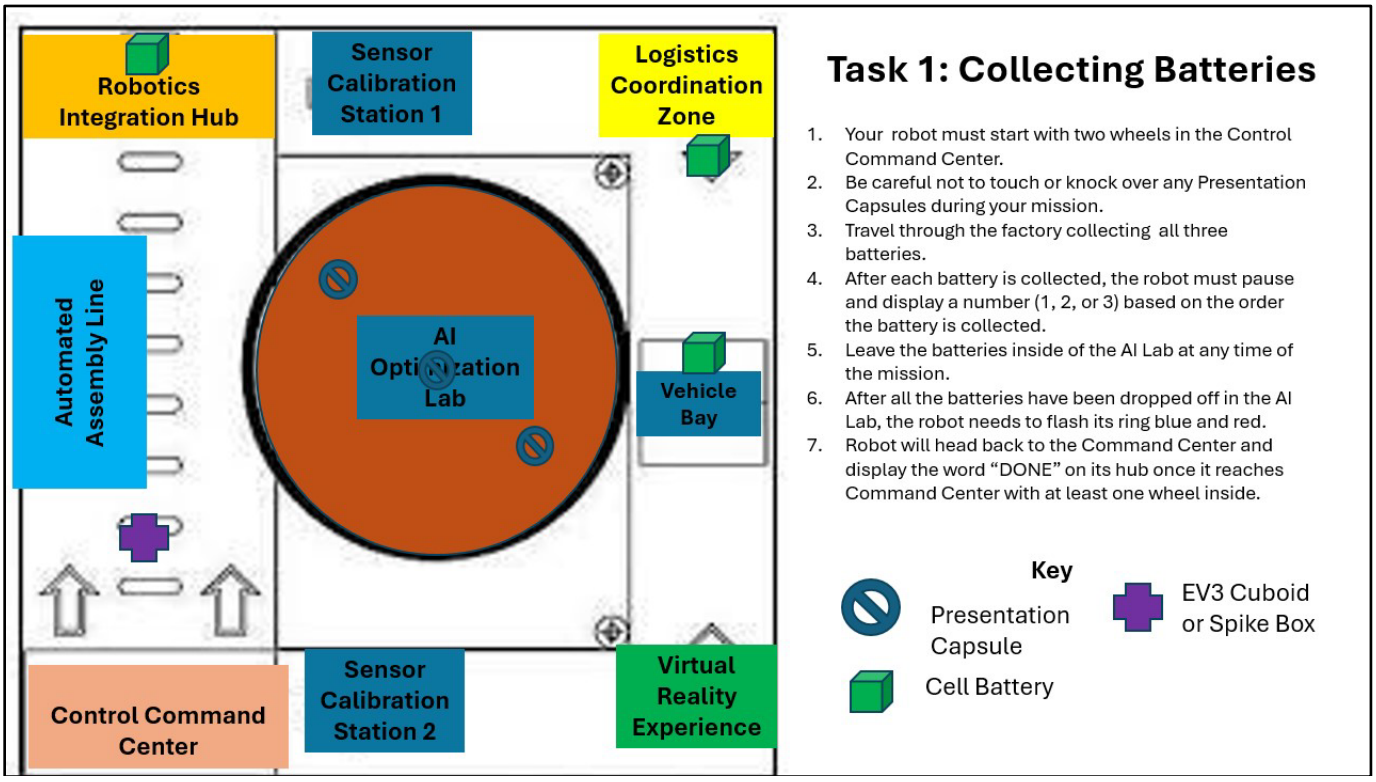
Task 1: Collecting Batteries

When the previous shift left, they forgot to pick up the batteries and return them to the AI Optimization Lab for charging. Without the batteries being charged the shipment of magnets scheduled for the next day won't be able to occur. Your task as the robotic programmer is to program your robot to complete the following task:

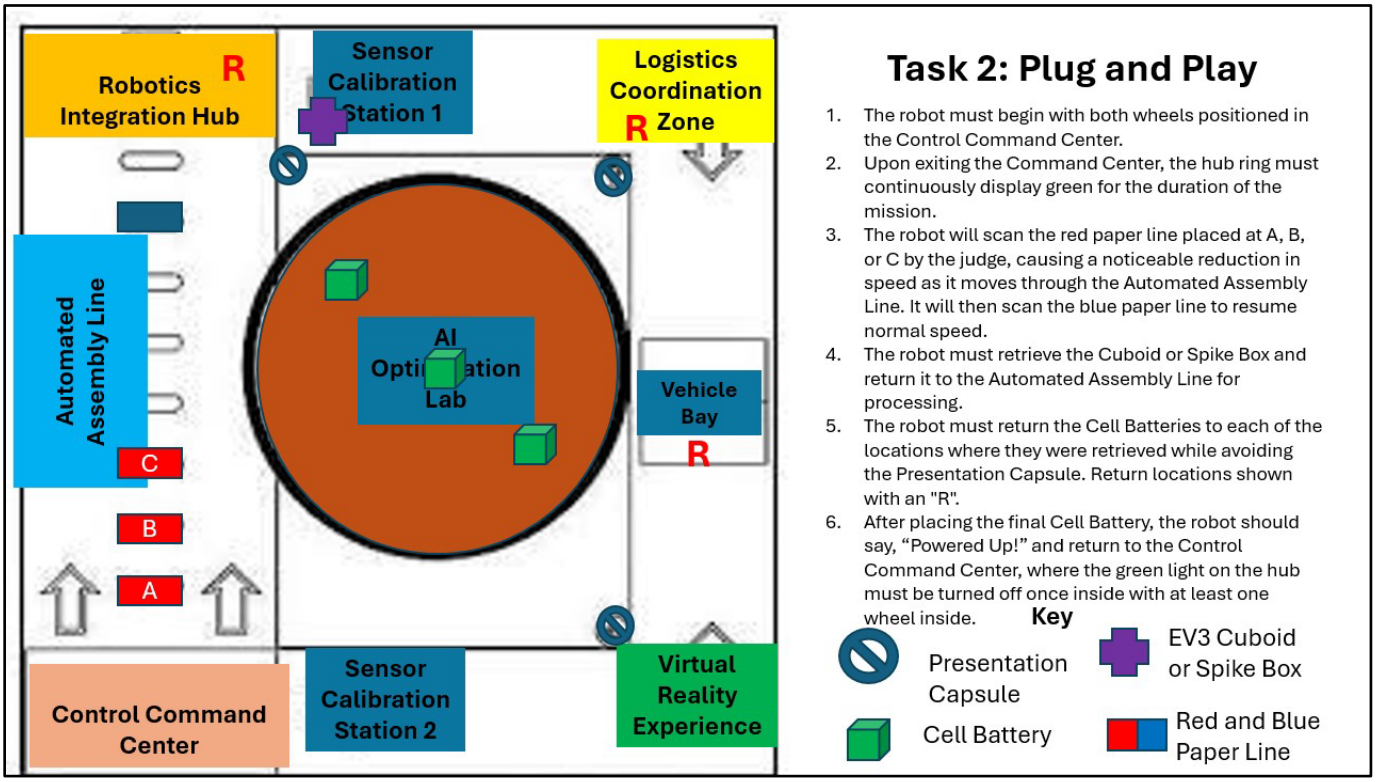
Your robot must begin with two wheels inside the Control Command Center. As the robot moves around the warehouse it must be careful to avoid the Presentation Capsules. The robot must collect three batteries that are around the warehouse floor, based on the location shown on the map. The robot may collect all the batteries in one run or in multiple runs. After the robot collects a battery, it must display a number showing which battery is being collected (1, 2, or 3). It must do this for each battery before moving on in the task. Then they must deliver each battery to the AI Optimization Lab. All batteries must be taken to the AI Optimization Lab and once the last battery is delivered the robot must flash blue and red (Spike) or display the words blue and red (EV3) on its screen. Then the robot will return to the Command Center and stop with at least one wheel inside and display the word Done on the hub.



Task 2: Plug and Play

The robot is now ready to charge the devices that the batteries were taken from. To do this the robot will need to return the batteries from the lab back to their original spots. The batteries must be placed inside the AI Optimization Lab on the three circles for the start of the job, but they must then be returned to the locations shown on the map. It does not matter which battery goes to which location; a battery just needs to be delivered.

The robot must begin with two wheels inside the Control Command Center. As it exits the Command Center it must display green on the hub (Spike) or on its display (EV3) to show that it is in delivery mode for the length of the job. It must then scan the red line, placed at spot A, B, or C by the judge (see map), before driving through the Automated Assembly Line. The speed should be reduced from this scan until it reaches the blue line, and then it may return to normal speed. The robot must then travel to the Sensor Calibration Station 1 to retrieve the Cuboid or Spike Box and return it to the Assembly Line. Next, the robot must deliver each of the Cell Batteries from the AI Optimization Lab back to the various locations shown on the map. Note that each battery is on a circle in the AI Lab. After returning the final battery the robot should say "Powered Up!" and return to the Command Center with at least one wheel inside the area and where the green light/word on the robot will then shut off. Throughout the task, the robot should avoid hitting the Presentation Capsules (see map for location).

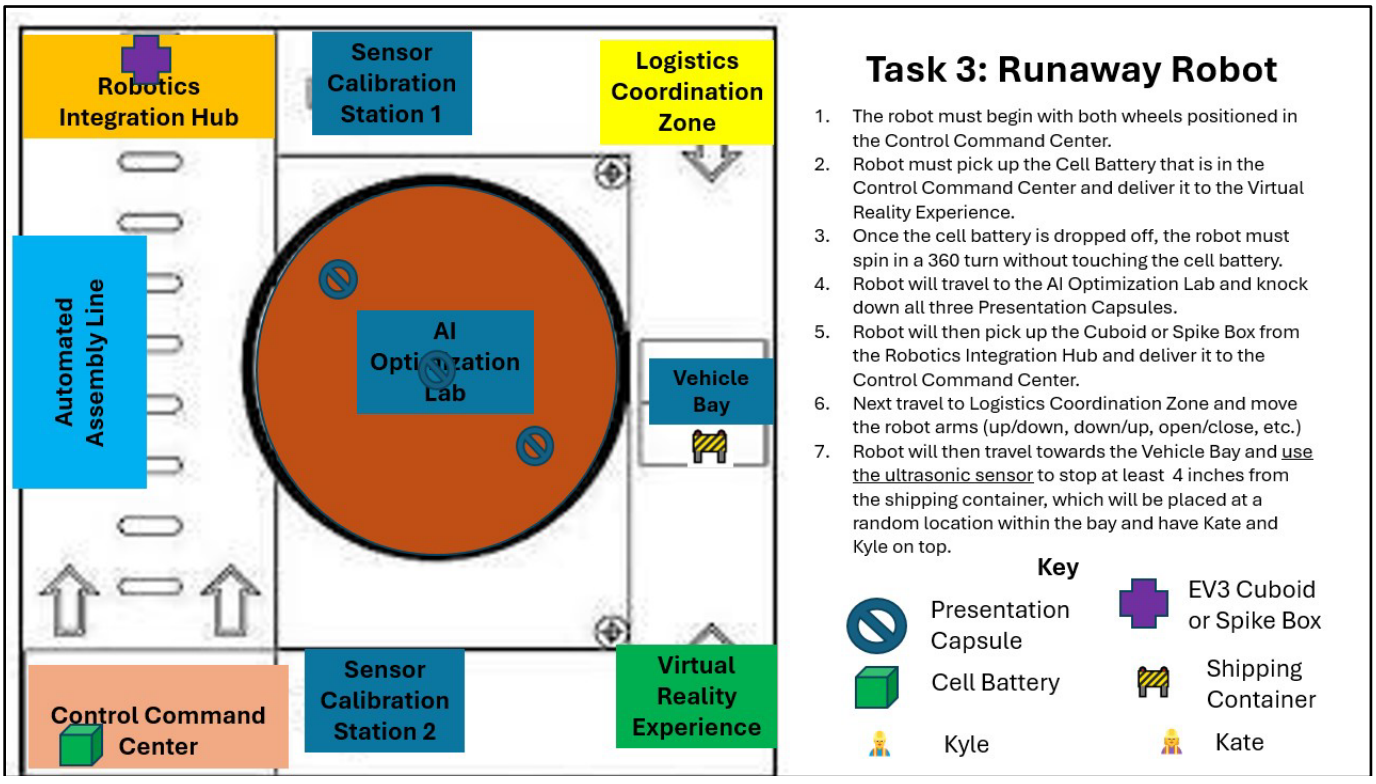


FBISD ROBOTICS COMPETITION

Task 3: Runaway Robot

Oh no! A leak in the roof has gotten the robot wet and it is out of control. It is going all over the warehouse and causing problems while completing tasks. Hopefully it will be able to complete the tasks before it causes too much damage to the warehouse or itself.

The task begins with both wheels inside the Control Command Center. It must retrieve the Cell battery, which must be placed to the right or the left of the robot to begin and deliver it to the Virtual Reality Experience room. The robot then does a 360 degree turn after dropping off the battery but must be sure to avoid touching the battery after it is delivered. The robot then enters the AI Optimization Lab and must knock over each of the Presentation Capules. To be considered knocked over the ping pong ball must be separated from the PVC pipe. Robot will pick up Cuboid or Spike Box from Robotics Integration Hub and return it to the Command Center. Then the robot will travel to the Logisitics Coordination Zone and complete a movement with the robot arms. Movement could be up/down, down/up, open/close but it needs to be evident that movement has occurred. Then the robot will travel to the Vehicle Bay where it encounters a shipping container. The robot must use the ultrasonic sensor to stop within 4 inches of the container. The location for the container will be told by the judges before the task is started. Kate and Kyle should both be placed on top of the container and should not be knocked off during the task. This task will end at this final location.



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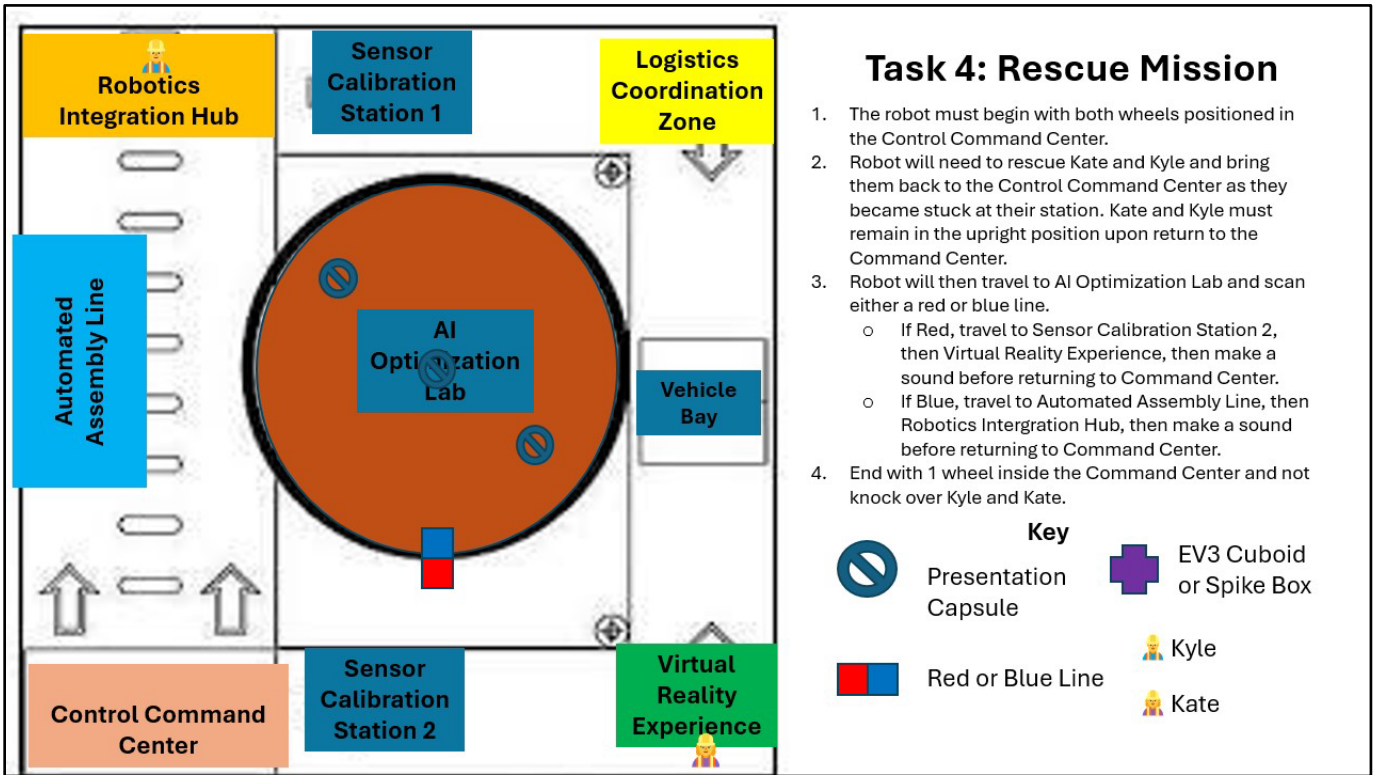
Task 4: Rescue Mission

Some workers are stuck in the factory. The robot is tasked with finding and returning them to the Command Center.

The robot must start with both wheels inside the Control Command Center and travel around the warehouse to return Kate and Kyle to the Command Center. Both Kate and Kyle should be returned while still in the upright position. An upright position means that they are either standing or sitting and not on their side. Then, the robot should travel to the AI Optimization Lab where there will be either a red or blue strip of paper (see map for location). Based on the color of the paper the robot must do one of the following.

- If red, travel to Sensor Calibration Station 2, then Virtual Reality Experience, then make a sound before returning to Command Center. Ending with 1 wheel inside the Center and not knocking over Kyle or Kate
- If blue, the robot must travel to the Automated Assembly Line, then the Robotics Integration Hub then make a sound before returning to Command Center. Ending with 1 wheel inside the Center and not knocking over Kyle or Kate.



School_____ Team_____ Judge_____

Scoring for Robotic Competition

Time Limit: Each team is allowed 5 minutes to complete the three main chores (4 if middle school). At the 5-minute mark, scoring will stop and only the chores completed at that time will be scored.

Tiebreaker Procedure: In the event of a tie, the first tiebreaker is the fewest number of restarts/resets; second tiebreaker is the total number of jobs completed, and the final tiebreaker is total time to complete adventures.

Challenges: As technology evolves, many jobs that were once done by humans are being replaced by robots. For this competition you are a programmer for a factory that has a robot that runs on the floor in the evening doing tasks to get the factory ready for the next day. From picking up trash to loading a delivery truck, these robots can do a variety of jobs. Be sure to read each job carefully and use the various sensors and parts to complete the jobs.

Floor 1 – Collecting Batteries

When the previous shift left, they forgot to pick up the batteries and return them to the AI Optimization Lab for charging. Without the batteries being charged the shipment of magnets scheduled for the next day won't be able to occur. Your task as the robotic programmer is to program your robot to complete the following task:

Your robot must begin with two wheels inside the Control Command Center. As the robot moves around the warehouse it must be careful to avoid the Presentation Capsules. The robot must collect three batteries that are around the warehouse floor, based on the location shown on the map. The robot may collect all the batteries in one run or in multiple runs. After the robot collects a battery, it must display a number showing which battery is being collected (1, 2, or 3). It must do this for each battery before moving on in the task. Then they must deliver each battery to the AI Optimization Lab. All batteries must be taken to the AI Optimization Lab and once the last battery is delivered the robot must flash blue and red (Spike) or display the words blue and red (EV3) on its screen. Then the robot will return to the Command Center and stop with at least one wheel inside and display the word Done on the hub.

5 points for each Presentation Capsule not touched while collecting batteries (3 X 5 =15 pts)	___/15
5 points for each battery touched during the job (3 batteries X 5 = 15 pts)	____/15
5 points for each battery delivered and remaining inside the lab (3 batteries X 5 = 15 pts)	_____/15
5 points for each number displayed on device (3 numbers X 5 = 15 pts)	_____/15
5 points for flashing/displaying blue and red after last battery is placed in lab.	___/5
5 points for returning to Command Center with at least one wheel inside.	___/5
5 points for displaying the word "Done" on the device.	_____/5
Penalty points: -5 points for each reset, -5 for both wheels off mat	
Maximum Points Awarded for this adventure: 75 points	___/75

School_____ Team_____ Judge_____

Floor 2 – Plug and Play

The robot is now ready to charge the devices that the batteries were taken from. To do this the robot will need to return the batteries from the lab back to their original spots. The batteries must be placed inside the AI Optimization Lab on the three circles for the start of the job, but they must then be returned to the locations shown on the map. It does not matter which battery goes to which location; a battery just needs to be delivered.

The robot must begin with two wheels inside the Control Command Center. As it exits the Command Center it must display green on the hub (Spike) or on its display (EV3) to show that it is in delivery mode for the length of the job. It must then scan the red line, placed at spot A, B, or C by the judge (see map), before driving through the Automated Assembly Line. The speed should be reduced from this scan until it reaches the blue line, and then it may return to normal speed. The robot must then travel to the Sensor Calibration Station 1 to retrieve the Cuboid or Spike Box and return it to the Assembly Line. Next, the robot must deliver each of the Cell Batteries from the AI Optimization Lab back to the various locations shown on the map. Note that each battery is on a circle in the AI Lab. After returning the final battery the robot should say "Powered Up!" and return to the Command Center with at least one wheel inside the area and where the green light/word on the robot will then shut off. Throughout the task, the robot should avoid hitting the Presentation Capsules (see map for location).

5 points for displaying green on the device	____/5
10 points for scanning the red line and reducing the speed as it travels through the assembly line	____/10
10 points for returning to normal speed after scanning blue line.	____/10
5 points for traveling to Sensor Calibration Station 1	____/5
5 points for touching the Cuboid or Spike box	____/5
10 points for returning Cuboid or Spike box to Assembly Line	____/10
30 points for returning the batteries to the various locations on the map (3 locations X 10 pts = 30 pts)	____/30
10 points for saying "Powered Up!"	____/10
10 points for returning to Command Center with at least one wheel inside.	____/10
5 points for green light shutting off	____/5
	____/
	_____/
Penalty points: -5 points for each reset, -5 for both wheels off mat	
Maximum Points Awarded for this chore: 100 points	_____/100

School_____ Team_____ Judge_____

Floor 3 – Runaway Robot

Oh no! A leak in the roof has gotten the robot wet and it is out of control. It is going all over the warehouse and causing problems while completing tasks. Hopefully it will be able to complete the tasks before it causes too much damage to the warehouse or itself.

The task begins with both wheels inside the Control Command Center. It must retrieve the Cell battery, which must be placed to the right or the left of the robot to begin and deliver it to the Virtual Reality Experience room. The robot then does a 360 degree turn after dropping off the battery but must be sure to avoid touching the battery after it is delivered. The robot then enters the AI Optimization Lab and must knock over each of the Presentation Capules. To be considered knocked over the ping pong ball must be separated from the PVC pipe. Robot will pick up Cuboid or Spike Box from Robotics Integration Hub and return it to the Command Center. Then the robot will travel to the Logisitics Coordination Zone and complete a movement with the robot arms. Movement could be up/down, down/up, open/close but it needs to be evident that movement has occurred. Then the robot will travel to the Vehicle Bay where it encounters a shipping container. The robot must use the ultrasonic sensor to stop withing 4 inches of the container. The location for the container will be told by the judges before the task is started. Kate and Kyle should both be placed on top of the container and should not be knocked off during the task. This task will end at this final location.

5 points for touching the Cell battery inside the Command Center.	_____/5
5 points for arriving at the Virtual Reality Experience room.	_____/5
5 points for delivering the Cell battery to the Virtual Reality Experience room.	_____/5
10 points for completing a 360-degree turn.	_____/10
5 points for not touching the Cell battery while turning 360 degrees.	_____/5
30 points for knocking down each of the Presentation Capsules. (3 x 10 = 30 pts)	_____/30
10 points for traveling to Integration Hub	_____/10
10 points for touching the Cuboid or Spike Box.	_____/10
20 points for returning Cuboid or Spike Box to Command Center	____/20
10 points for traveling to Logisitics Coordination Zone.	____/10
10 points for completing an action with the robot arms	_____/10
10 points for traveling towards the Vehicle Bay.	____/10
30 points for stopping within 4 inches of the Shipping Container.	____/30
15 points for arriving in Vehicle Bay (5 pts) and not knocking off Kate and Kyle from Shipping Container (5 pts each).	____/15
Penalty points: -5 points for each reset, -5 for both wheels off mat	
Maximum Points Awarded for this chore: 175 points	_____/175
Total points for all events	_____/350
Time for all events	

School_____ Team_____ Judge_____

Middle School Round: Rescue Mission

Some workers are stuck in the factory. The robot is tasked with finding and returning them to the Command Center.

The robot must start with both wheels inside the Control Command Center and travel around the warehouse to return Kate and Kyle to the Command Center. Both Kate and Kyle should be returned while still in the upright position. An upright position means that they are either standing or sitting and not on their side. Then, the robot should travel to the AI Optimization Lab where there will be either a red or blue strip of paper (see map for location). Based on the color of the paper the robot must do one of the following.

- If red, travel to Sensor Calibration Station 2, then Virtual Reality Experience, then make a sound before returning to Command Center. Ending with 1 wheel inside the Center and not knocking over Kyle or Kate
- If blue, the robot must travel to the Automated Assembly Line, then the Robotics Integration Hub then make a sound before returning to Command Center. Ending with 1 wheel inside the Center and not knocking over Kyle or Kate.

10 points for returning Kate and Kyle to the Command Center (2 people X 5 points = 10 pts)	_____/10
15 points for Kate and Kyle being upright. (15 pts for both upright, 10 pts for 1 upright, 0 pts for none upright)	_____/15
10 points for arriving in AI Optimization Lab	_____/10
15 points for completing assigned scenario based on color scanned **Scenario I:** • If red, travel to Sensor Calibration Station 2 (5 pts), then Virtual Reality Experience (5 pts), then make a sound (5 pts) before returning to Command Center (5 pts). Ending with 1 wheel inside the Center and not knocking over Kyle or Kate **Scenario II**: • If blue, the robot must travel to the Automated Assembly Line (5 pts), then the Robotics Integration Hub (5 pts), then make a sound (5 pts) before returning to Command Center (5 pts). Ending with 1 wheel inside the Center and not knocking over Kyle or Kate.	_____/15
Penalty points: -5 points for each reset, -5 for both wheels off mat, -5 points for knocking over Kate/Kyle	
Maximum Points Awarded for this chore: 50 points	_____/50