

Hippautonomous Team

Advance Mechatronics Operator's Manual

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Before Starting the Game:

Lighting

All operations of vehicle, training of camera, and related actions need to be in a well-lit area.

PIXY 2 Camera

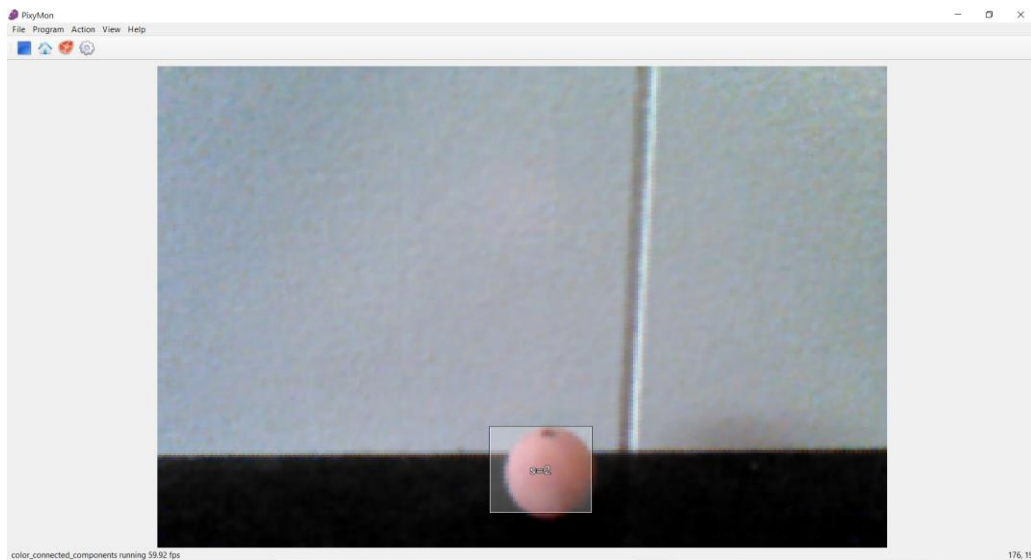
1. Download [PixyMon](https://pixycam.com/downloads-pixy2/) (<https://pixycam.com/downloads-pixy2/>) software to your computer. The link provides detailed instructions for installing PixyMon.
2. Connect the Pixy2 camera to the computer via the USB cable (Figure 1).

Figure 1



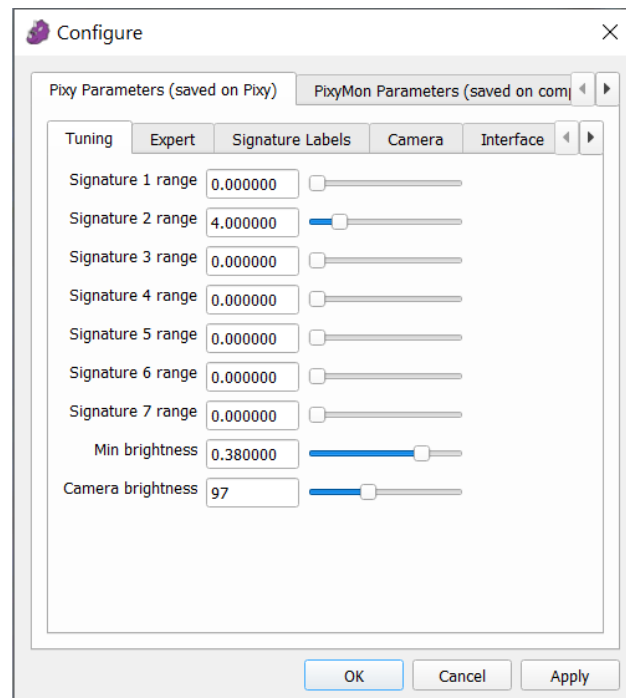
3. Open the PixyMon software and it will display the video image from the Pixy2 camera.
4. Ensure the Pixy2 camera in the correct mode:
 - a. In the PixyMon go to *Program* and choose *color_connected_components*
5. Check if the Pixy2 identifies the balls by placing a ball in front of the Pixy2 camera (Figure 2). The square around the ball indicates that the Pixy2 has identified it (Figure2). If the Pixy2 identifies the ball, then jump to Step 7.

Figure 2



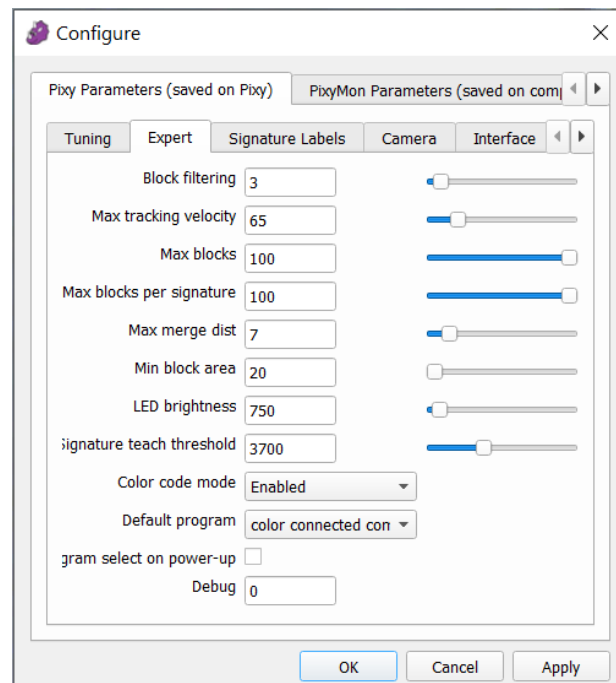
6. If the Pixy2 camera does not identify the ball, the operator needs to train the Pixy2 camera:
 - a. Place one ball in the center of the video image in the well-lit play area.
 - b. Go to *Action* menu and choose the “*Set Signature 2*”. Note: the video image will freeze.
 - c. Select the ball in the video image using your mouse: left click and drag to outline the ball. Note: the square selection should only cover the ball.
 - d. Release the mouse button.
 - e. Check that the label inside the square reads $s=2$, (Figure 2). If it does not, then repeat Step 6.
7. If the video image shows squares or rectangles around objects besides the balls, the Pixy2 camera will need to be fine-tuned following these steps. (*Note: the Hippautonomous will not be able to perform correctly if there are squares or rectangles around objects other than the balls in the Pixy2 image of the play area.*)
 - a. Go to *File* menu and choose *Configure*. A Configure window will pop up.
 - b. Select the *Tuning* tab
 1. Set *Signature 1 range* and *Signatures 3-7 range* to zero (Figure 3).
 2. Adjust *Signature 2 range* until the Pixy2 camera can detect the ball that is placed 0.7 meters away from the Hippautonomous. The *Signature 2 range* value is recommended to be between 3.3 and 4.2. *Note: If issues are encountered, adjustment of the play area lighting is recommended.*
 3. Along with *Signature 2 range* adjustment, adjust the *Min brightness* and *Camera brightness* until there are no “undesired squares and rectangles” inside the play area.

Figure 3



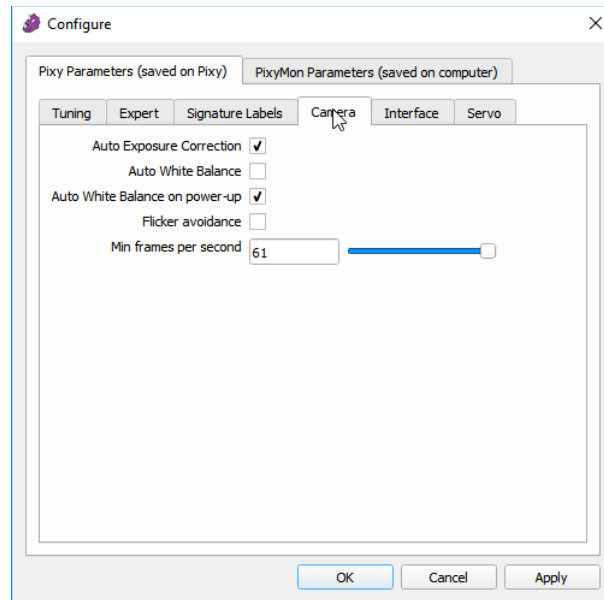
- c. Select the *Expert* tab, adjust the settings to match those shown in Figure 4:

Figure 4



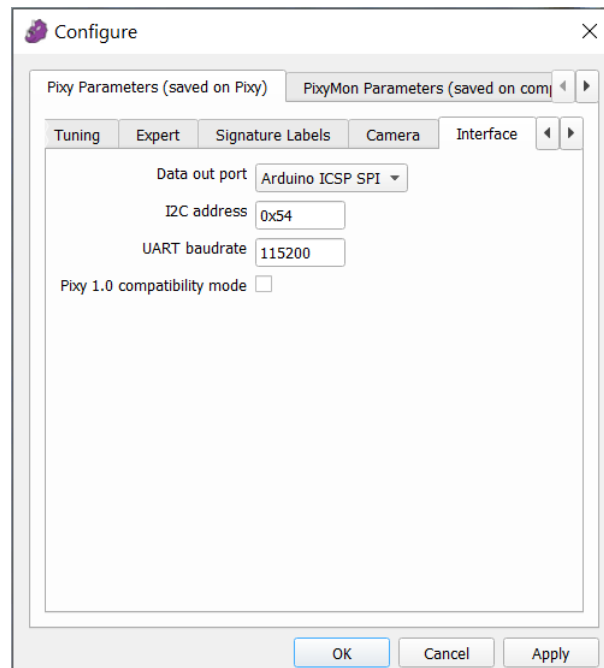
- d. Select the *Camera* tab, adjust the settings to match those shown in the Figure 5:

Figure 5



- e. Select the *Interface* tab, adjust the settings to match those shown in the Figure 6:

Figure 6

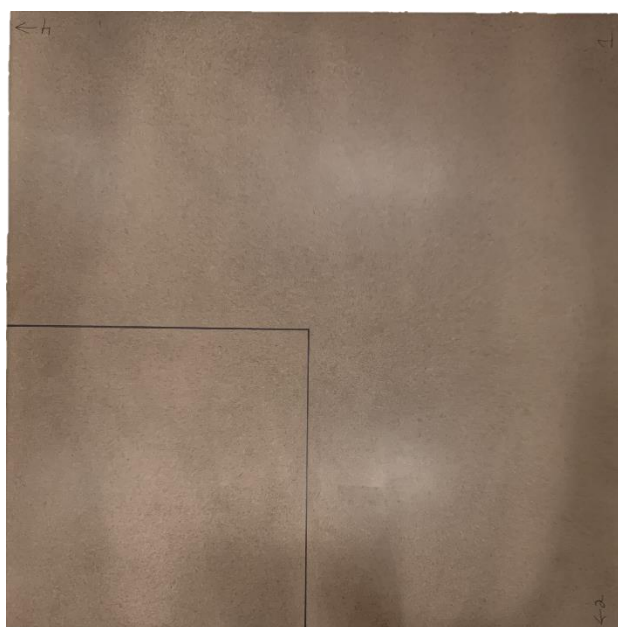


Play Area Assembly (optional assembly sold separately)

- The optional Play Area Assembly is not required when a smooth flat surface with a minimum of 2.5mx2.5m clearance is available for use.
- The provided boards are labeled with three numbers, two with arrows and one corner number. The number without the arrow is that board's designated identifier.

Optional Play Area Assembly Instructions

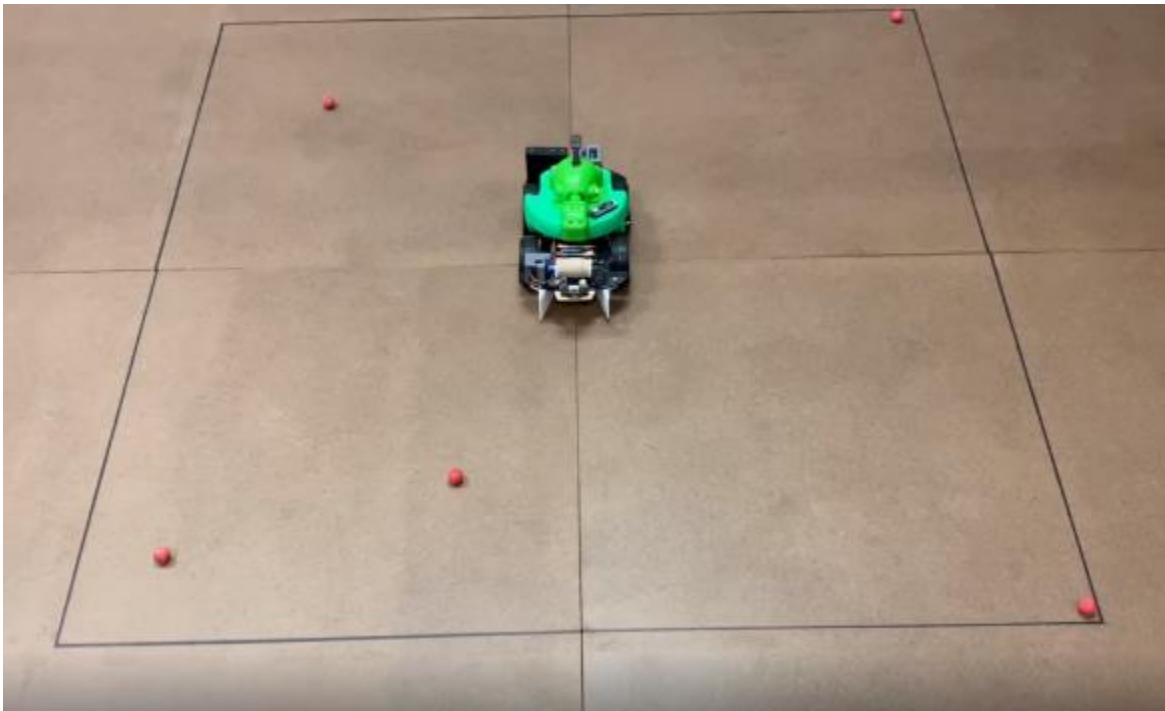
1. Lay all four boards down in a square formation, such that boards are sequential.
 - a. The arrowed numbers indicate which boards a given board should be connected to. Below is a picture of one of these boards with its identifying number in the top left corner. The table following the image shows the desired orientation of the boards



Board 4	Board 1
Board 3	Board 2

2. Once all four boards are in the correct order, begin adjusting so that the black ball play-area lines line up, creating an inner square (Figure 7).
 - a. Optional step: if the surface is uneven or shifts during gameplay, secure boards to each other with duct tape on the underside. *Note: Do not place tape on top of the play area as it will affect the movement of the Hippautonomous car.*

Figure 7



Battery Replacement

- If you notice that the Hippautonomous car is acting sluggish, is returning to the center of the play area less often, or is not moving, it might be time to replace the batteries.

Battery Replacement Instructions

1. Flip the system switch to the off position (down position).

Note: Take care when replacing the batteries.

- a. When removing the green hippo to access the batteries on top of the Hippautonomous car, take care not to pull against the wires that connect the LEDs to the controller.*
 - b. The plastic enclosures are hot-glued to the chassis and can break off, given enough force. If this happens, simply, remove the old glue and replace with new glue.*
2. If the Hippautonomous car seems to be running slow, replace the “Motor batteries”, which are denoted by the green squares shown in Figures 8 and 9.
 3. If the Arduino does not function, or the LED lights of the hippo are dim, replace the “System Batteries”, which are denoted by the purple square shown in Figure 10.
 4. If the gates do not function properly, replace the “Gate Batteries”, which are denoted by the blue squares shown in Figures 8 and 9.

Figure 8 Top View

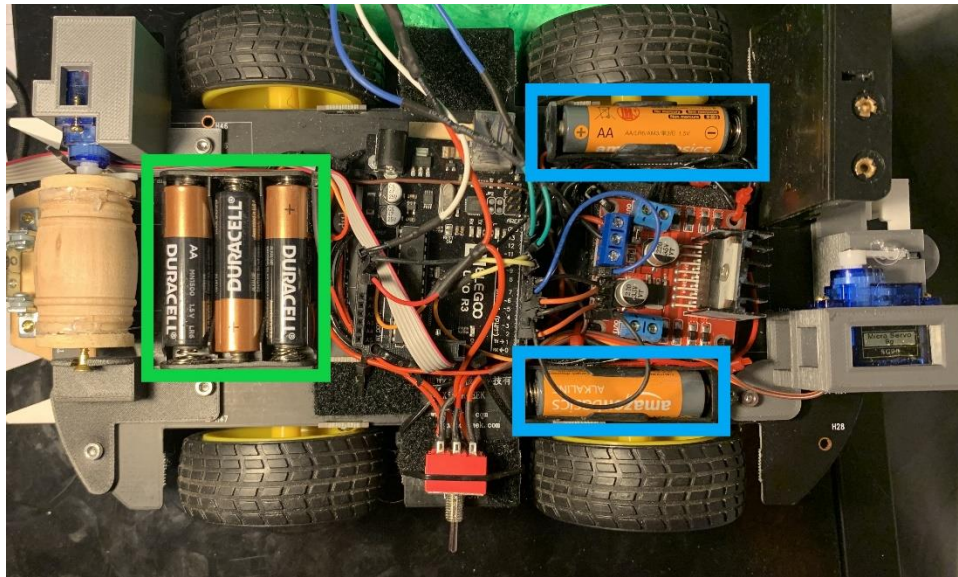


Figure 9 Bottom View

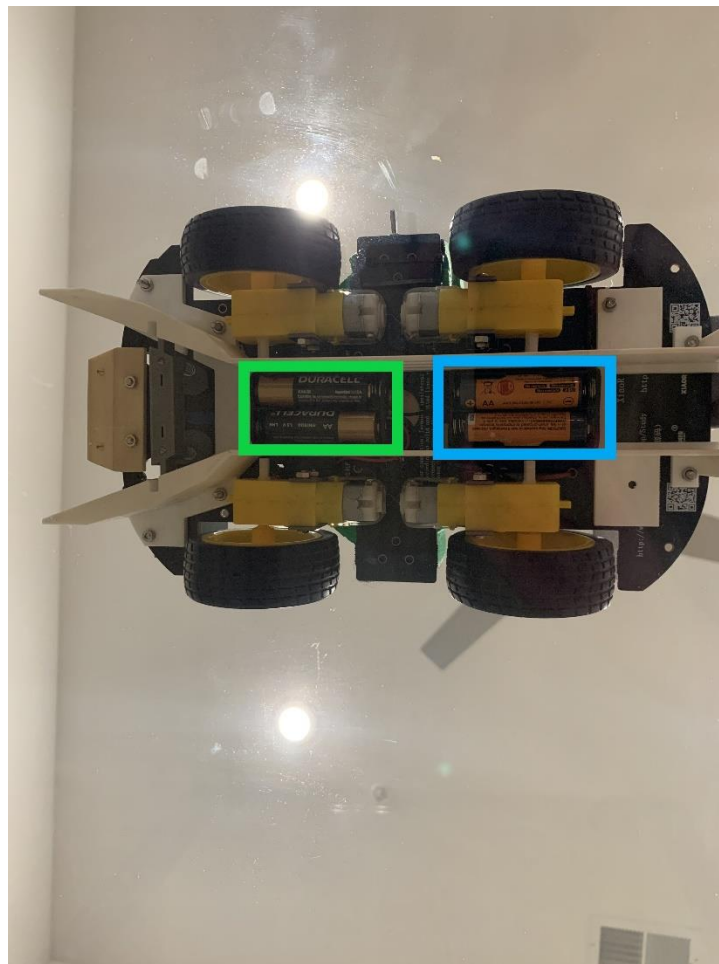
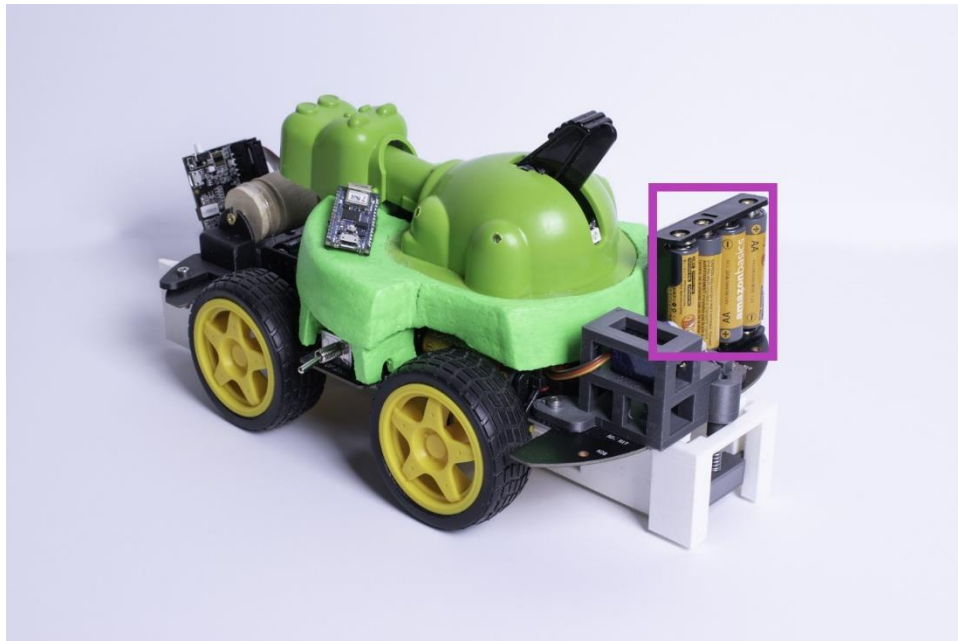
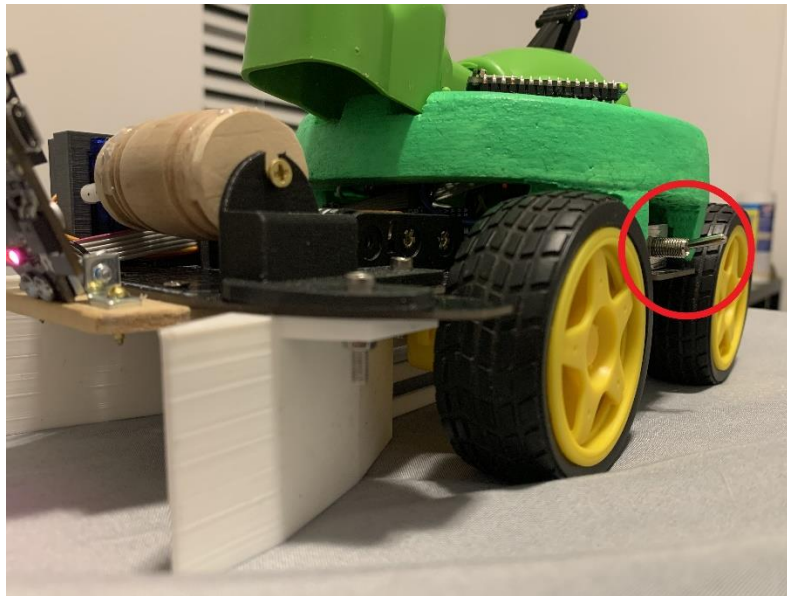


Figure 10 Rear View

**Let's have fun:**

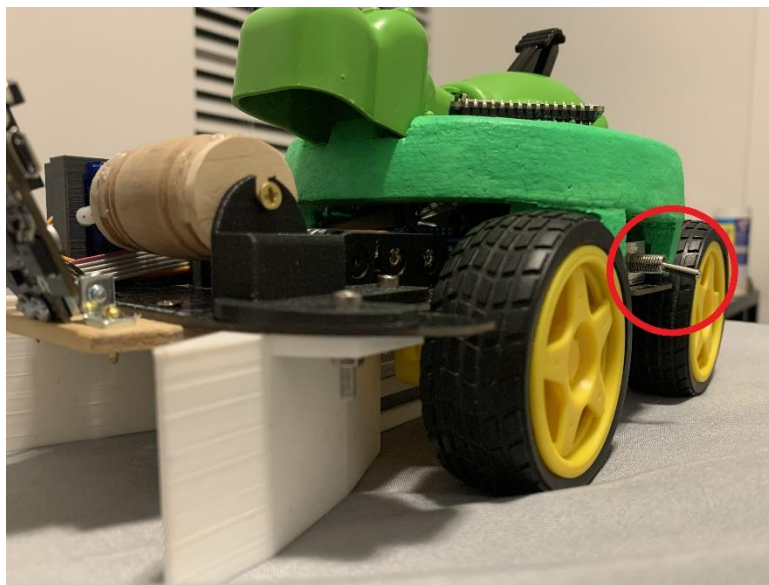
1. Place the Hippautonomous car in the center of the play area with the wheels down. The neck of the hippo should be centered in the play area.
2. Place the balls inside the ball play area, so that they are no less than 45 cm from the center and no more than 60cm from the center.
 - *Note: the balls need to be placed no less than 15cm away from each other.*
 - *Note2: if using the optional Play Area Assembly, the ball play area is denoted by the black square.*
3. Turn the switch ON, which is the up position (Figure 11)

Figure 11



4. Step away from the Hippautonomous car and play area. All observers should be a minimum of one foot away from the edge of the play area to avoid scaring the hippo.
5. The Hippautonomous car will wait five seconds after being switched before it starts hunting.
6. Watch the Hippautonomous car collect the balls!
7. Be sure to turn the switch to the off position, which is the down position (Figure 12) after the car has stopped moving and released the captured balls.

Figure 12



Caution:

1. Do not drop the Hippautonomous car.
2. Make sure the play area is clear of non-game objects before turning on the switch.
3. When the Hippautonomous car is in motion, it does not respond to people or objects in the play area. Therefore, it is advised to remain clear of the play area until the Hippautonomous car has finished the game.
4. It is advised to turn off the switch at the end of each game to increase the lifetime of the batteries.
5. Game balls present a choking hazard to young children, so supervision of anyone 5 or under who is near the play area is required.
6. Game balls present a tripping hazard, so it is advised to maintain a safe distance from balls when possible.