STEAMbot V2.0 User Guide

Introduction

Welcome to the world of STEAMbot robot kits! We at The STEAM Train want to thank you for getting a STEAMbot robot kit. We believe that any child that wants a robot should be able to get one, no matter their socio-economic background. This kit will help you learn more about Science, Technology, Engineering, Art, and Math (STEAM). We hope you will have lots of fun putting your robot together and learning how to program it. Your efforts will be rewarded and give you opportunities for a better future.

This guide has the following chapters:

1. Assembly of Your STEAMbot – provides the steps of how to assemble your STEAMbot robot.
2. STEAMbot User Interface – describes the user interface of the STEAMbot. Via the home page you can control your STEAMbot, change the operating modes of your STEAMbot, mange the WiFi networks it connects to, calibrate the motors of your STEAMbot, update the firmware of your STEAMbot and finally, you can program your STEAMbot.
3. Appendices

Documentation Updates

Although every attempt has been made to ensure that this document is correct, we are not perfect. Be sure to periodically check our web site for updates to this document.

Warning

Although the STEAMbot has been carefully designed and manufactured, the STEAMbot has fragile components. Dropping it or pushing on the Ultrasonic Sensor Bracket may cause it to

crack or break. In addition, the header pins of the STEAMbot Controller can pierce your skin if you are not careful. The pins are also easy to bend. So please handle your STEAMbot with care.

Identity

Each STEAMbot robot has its own unique identifier (or ID[1]). The ID consists of the phrase "STEAMbot-" followed by a 6-digit <u>hexadecimal</u> number. The 6-digit number should be taped onto the top of the controller. The ID serves as WiFi name.

Web Server

When powered on, your STEAMbot robot runs a web server. All you need to control or program your STEAMbot is a WiFi-enabled device that runs modern web browser.

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[1] In the Appendices, there is a Glossary with all the acronyms used in this document.

Assembly of Your STEAMbot

Parts

Figure 1 shows you all the major parts that should be in your kit apart from the chassis. The chassis and screws are listed separately. If any part is missing, please email us at support@thesteamtrain.cc.
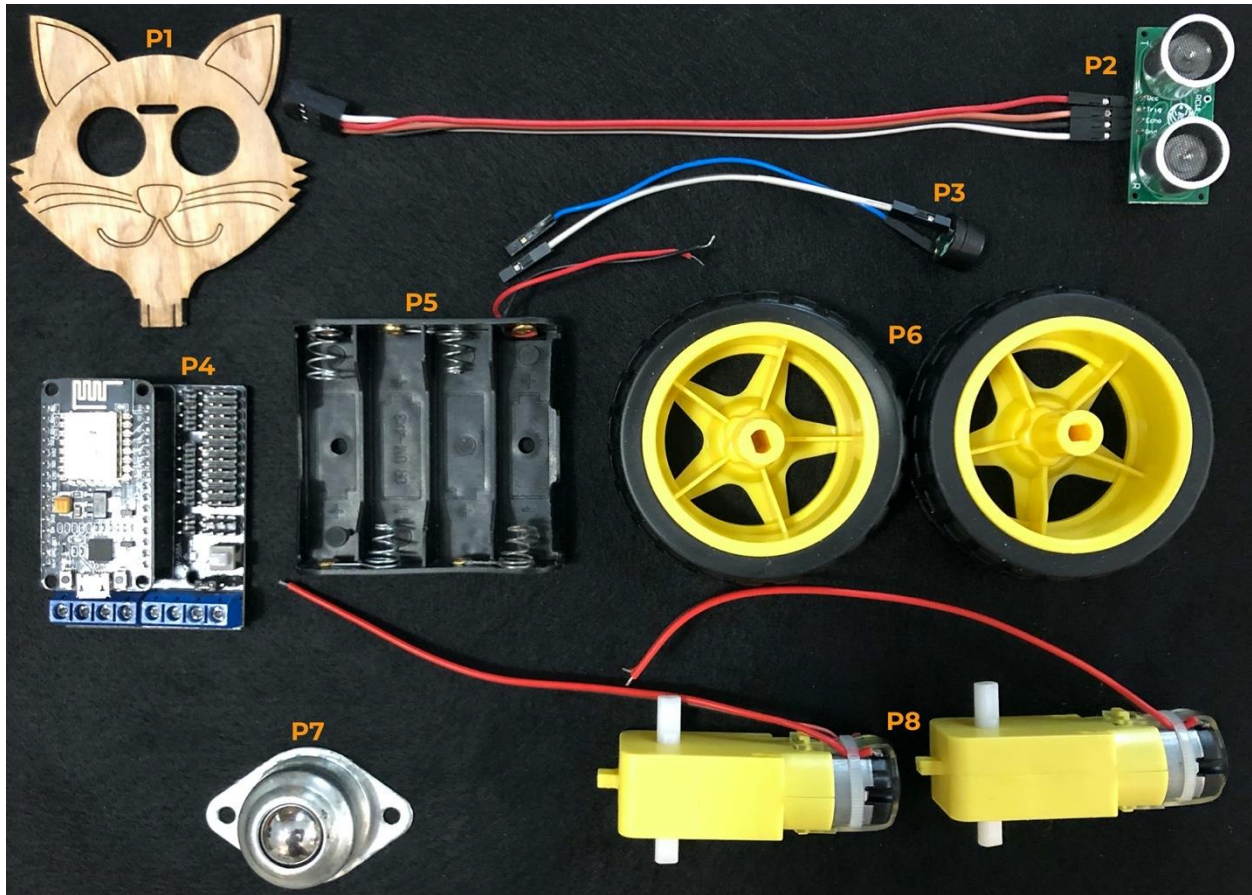

Figure 1, STEAMbot Robot Kit Parts

The following table lists the parts of the kit (except for the chassis and screws).

Table 1, STEAMbot Parts List

Number	Name	Quantity
P1	USS Bracket (see note below)	1
P2	Ultrasonic Sensor	1
P3	Speaker	1
P4	Controller	1
P5	Batter Holder	1
P6	Wheels	2

Number	Name	Quantity
P7	Roller Ball	1
P8	DC Motors	2

Note: The shape of the USS Bracket may be different, depending on what you ordered.

The STEAMbot chassis is laser cut from plywood. The chassis parts should be in a plastic bag. Figure 2 shows all the parts of the chassis.
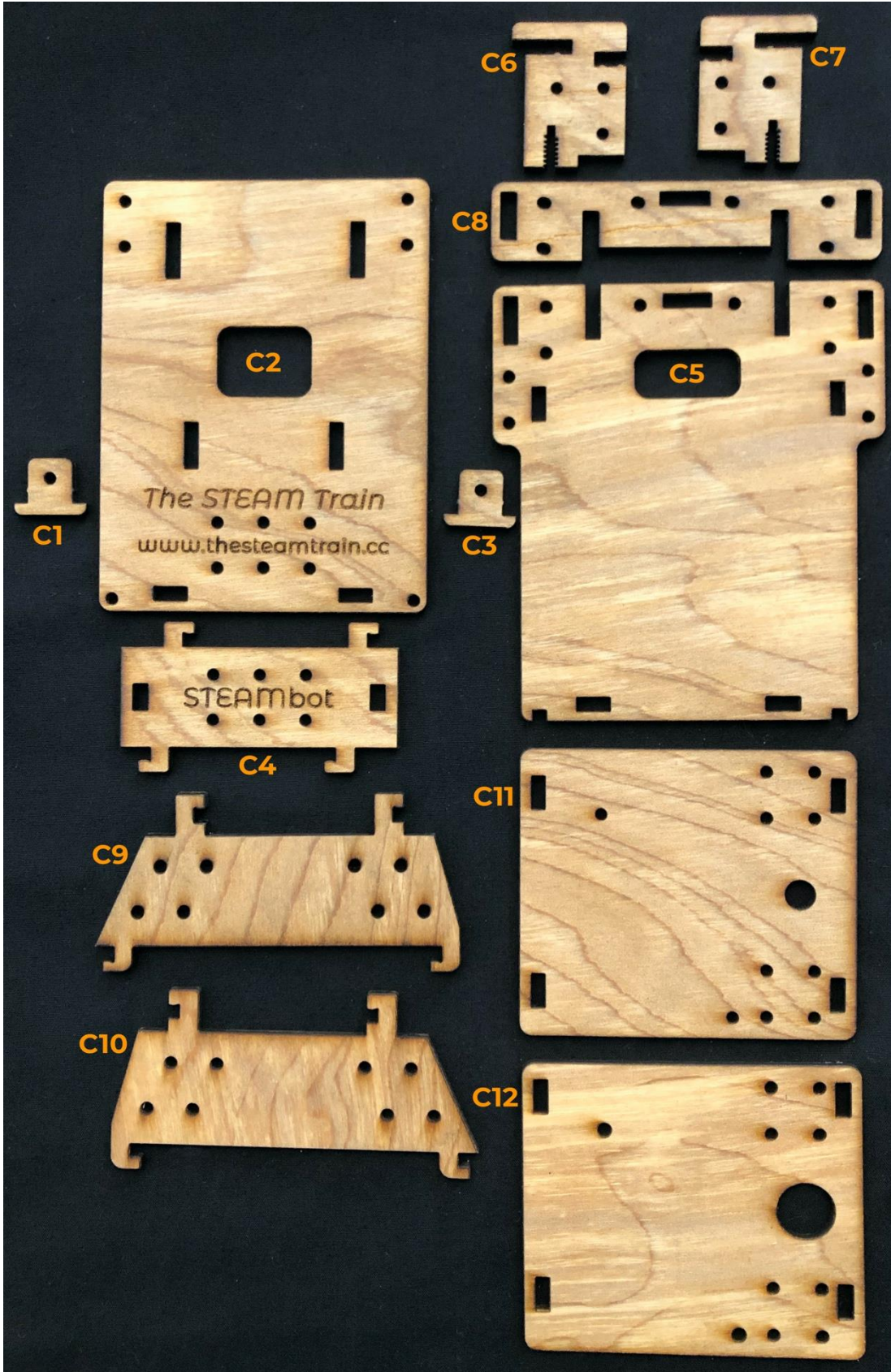
Figure 2, STEAMbot Chassis

The following table lists the parts of the chassis.

Table 2, STEAMbot Chassis Parts List

Number	Name
C1	Left Motor Mount
C2	Bottom Plate
C3	Right Motor Mount
C4	Back Wall
C5	Top Plate
C6	Left Support
C7	Right Support
C8	USS Support
C9	Left Wall
C10	Right Wall
C11	Bottom Cover
C12	Top Cover

Finally, there is a small plastic bag with six #4 machine screws. There should be two 1-inch screws and four 3/8-inch screws.

Parts Not Included

The following parts are needed but are not included in the kit:

- Four AA batteries – One of the Appendices covers the details for the batteries.
- One #1 Philips Screwdriver – they are available at Dollar Tree or other hardware store.
- Optional: A modern computing device with WiFi and a web browser that supports HTML5. The device may be a computer (Linux, Mac or Windows are supported), a cell phone or a tablet.

Assembly Process

The first step to building your STEAMbot is to assemble the chassis. Click on the link below to watch a video on YouTube:

STEAMbot Chassis Assembly Video

The video only shows how the left motor mount, supports and left wall are assembled. The right motor mount, right motor support and right wall are assembled in a similar manner. After viewing the video, you should read through all the steps below, so you are familiar with the process. For the most part, the STEAMbot chassis will "snap" together and be held together by friction.

These are the steps to assemble your STEAMbot:

1. Place the bottom plate (C3) with the words facing down on a flat surface like a table or desk.

2. Insert the left motor mount (C1) into the bottom plate (from the bottom). Push the mount until it snaps in place.
3. Insert the right motor mount (C3) into the bottom plate (from the bottom). Push the mount until it snaps in place.
4. Place the back wall (C4) to the bottom plate. Push the back wall until it snaps in place.
5. Place the top plate (C5) onto the back wall. Push the top plate until it snaps in place.
6. Place both the left and right supports (C6, C7) in the slots of both the bottom and top plates.
7. Push the USS support (C8) into the slots of the left and right supports.
8. Place the left wall (C9) onto the top plate. Push the left wall until it snaps in place.
9. Place the right wall (C10) onto the top plate. Push the right wall until it snaps in place.
10. Place the bottom cover (C11) onto the tabs of the left and right walls. The bottom cover does not snap in place.
11. Place the top cover (C12) over the bottom cover and onto the tabs of the left and right walls. Push the top cover until it snaps in place. Your chassis should now look like the following photo:
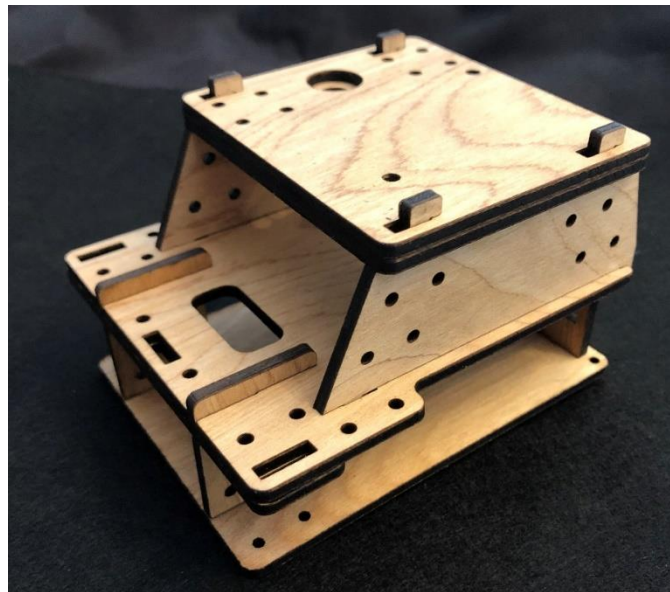

Figure 3, Completed Chassis

12. Flip the chassis over.
13. Take the roller wheel (P7) and place it towards the front, aligning the two holes on the wheel with the holes on the bottom plate. Take one 3/8-inch screw and start tightening it (but do not completely tighten it). See the following figure.

Figure 4, Roller Wheel

14. Take a 3/8-inch screw and insert it into the other hole and start tightening the second 3/8-inch screw.
15. Tighten both screws so the roller ball is fixed in place. BE VERY CAREFUL NOT TO STRIP THE WOODEN THREADS.
16. Flip over the STEAMbot chassis again.
17. If the wheels are attached to the DC motors, remove the wheels by pulling them from the motor. The wheels fit tightly so be careful when pulling on the wheel to not break the axel.
18. Take one DC motor (P8) and place it between the top and bottom plates. The tab on the back of the motor goes into the hole in the back wall as shown in the following figure.
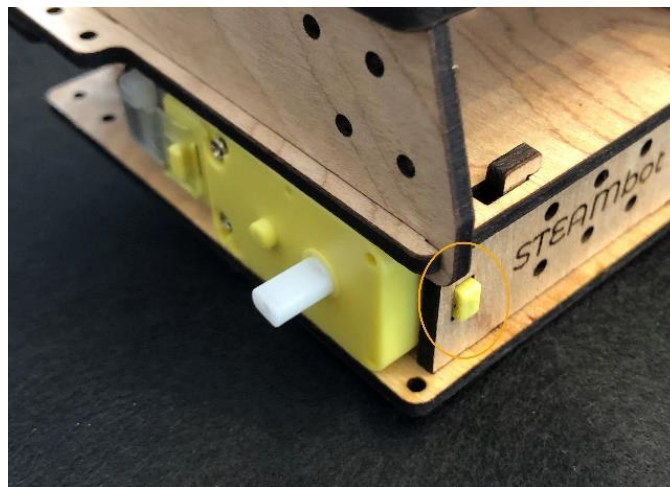

Figure 5, Left motor and back wall

19. Make sure the wire from the left motor is going through the hole in the top plate. Take one 1-inch screw and insert it in the left motor as shown in the following figure.
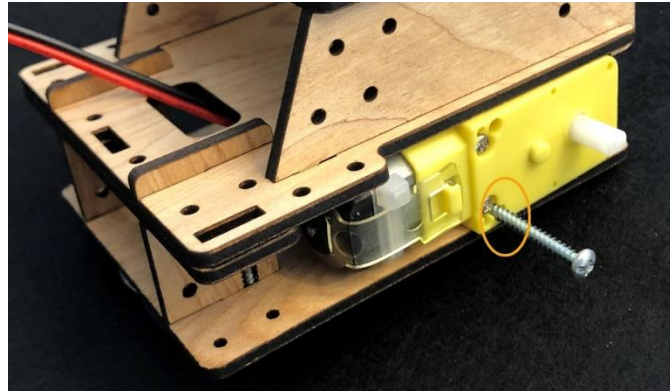
Figure 6, Bottom Plate with Motors

20. Tighten the screw, remembering to being careful not to strip the wooden thread.
21. Repeat steps 17 – 20 for the right DC motor (P8).
22. Attach both wheels to the left and right motors (P6).
23. Flip the STEAMbot chassis so it is resting on both wheels and roller wheel.
24. Place the controller board (P4) on top of the top cover and align it against the tabs of the left wall as shown in the following figure.
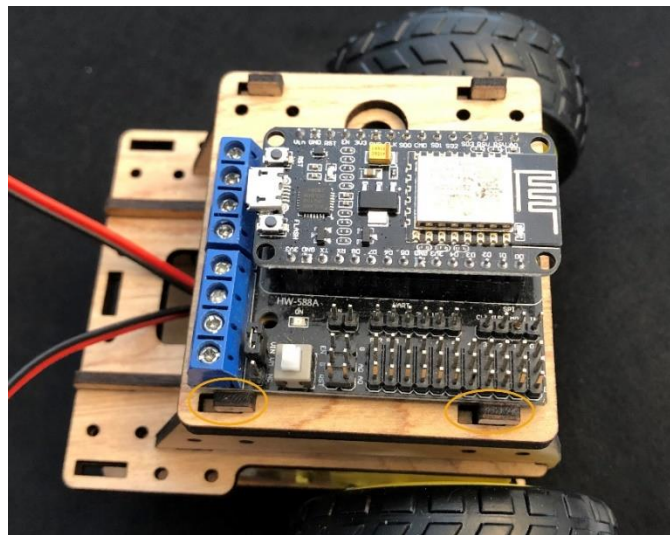

Figure 7, Controller placement

25. Take one 3/8-inch screw and place it in the hole towards the upper left of the controller as shown in the following figure.
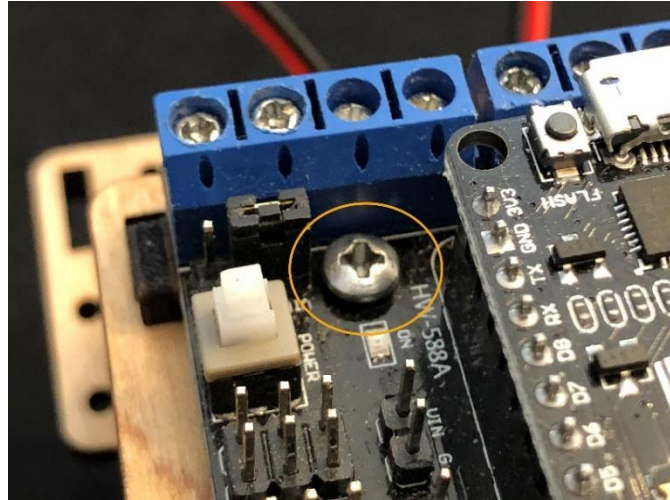
Figure 8, First controller screw placement

26. Tighten the screw until the controller is snug in place. Remember not to strip the wooden threads.
27. Take the last remaining 3/8-inch screw and place it in the lower right hole of the controller as shown in the following figure.
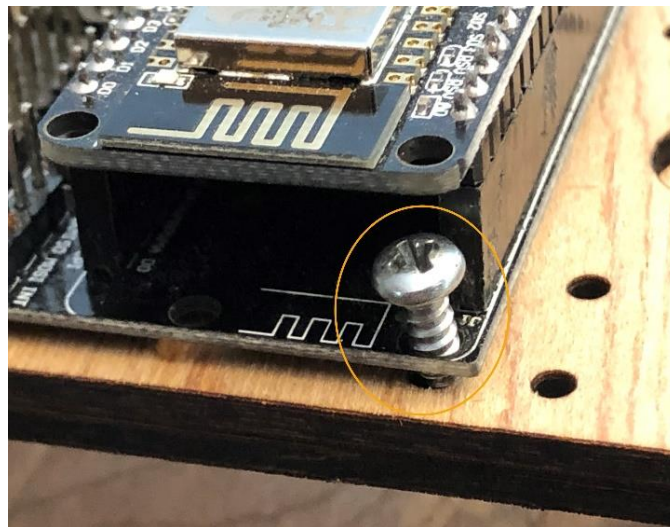

Figure 9, Second controller screw placement

28. Carefully insert the screwdriver through the hole in the top lower right corner of the controller and tighten the second screw as shown in the figure below. Remember not to strip the wooden threads.
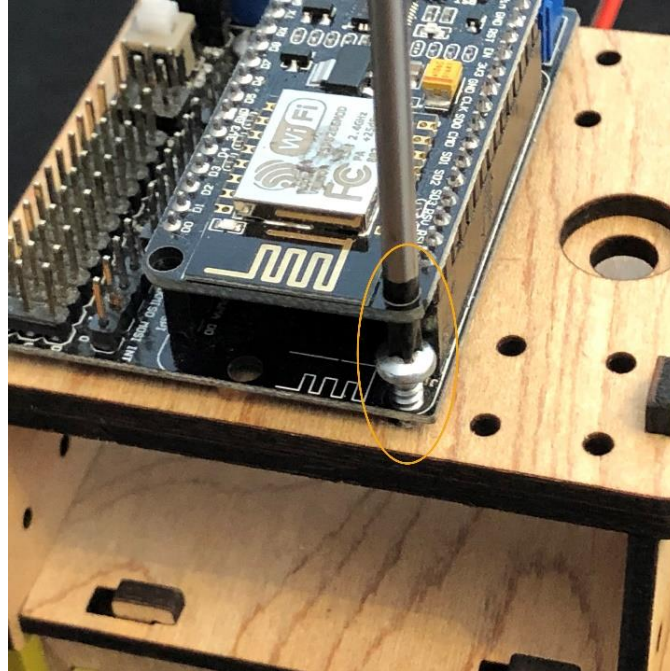
Figure 10, Tightening the 2nd controller screw

29. Loosen all the screws in the terminal block of the controller except for the one labeled VM and the one next to it labeled GND.
30. With the roller wheel facing you and the other two wheels away from you, insert the wires from the right motor into the left most wire terminals, labeled A- and A+. The wiring will depend on the tips of the wires. If the wires from the motor look like the following figure, the red wire goes in the A- position and the black wire A+ position.
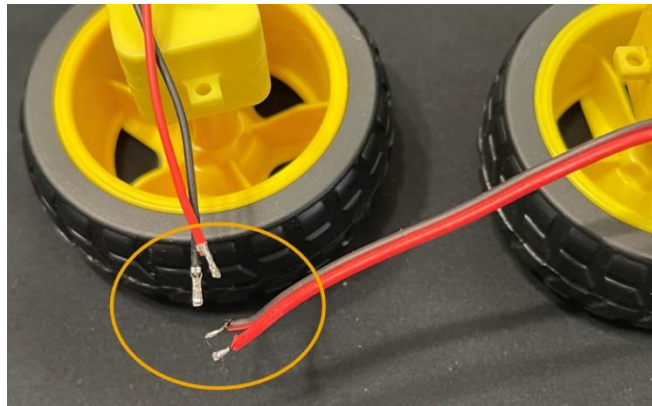

Figure 11, Motor wiring 1

If the wires from the motor look like the following figure, the black wire goes in the A- position and the red wire in the A+ position.
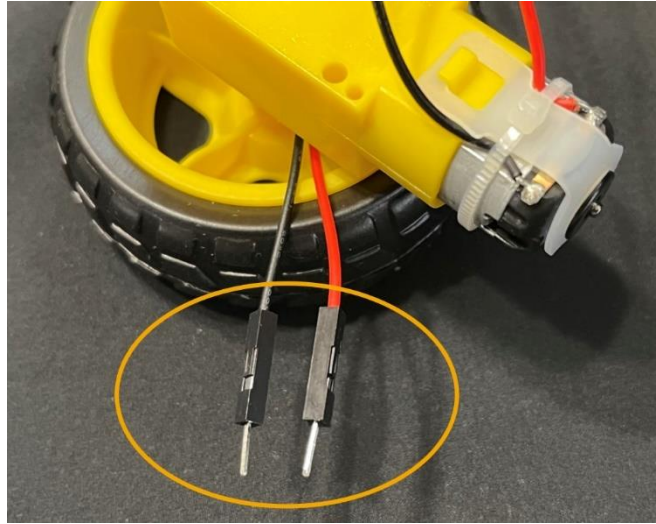
Figure 12, Motor wiring 2

31. Repeat step 30 for the left motor. The wiring should look like one of the following figures.
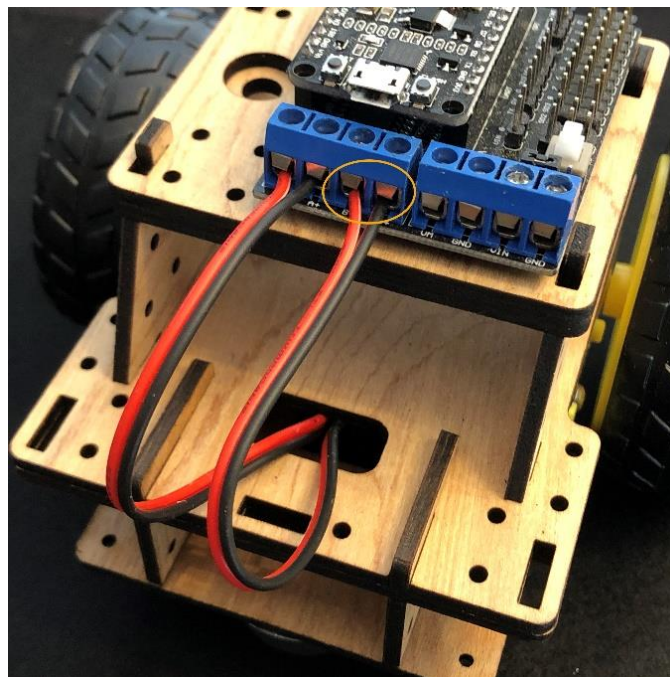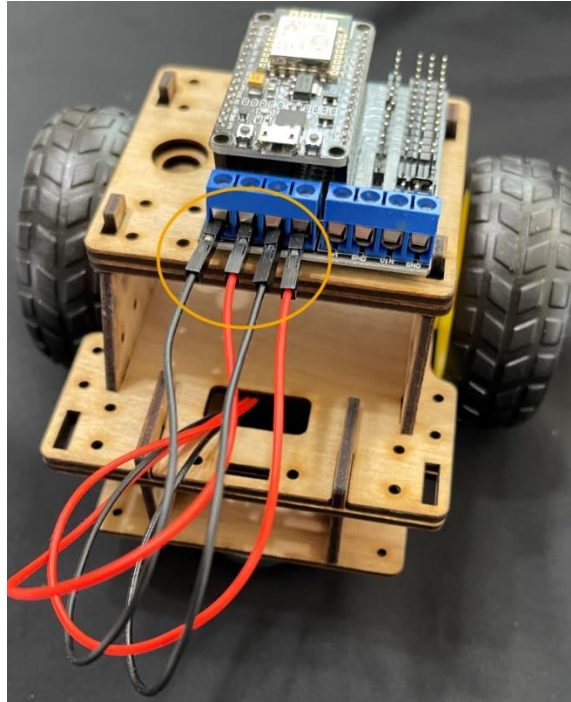

Figure 13, Motor wiring 1

Figure 14, Motor Wiring 2

32. Optional: You can push in the wires for both motors through the hole in the top plate as shown in the following figure.
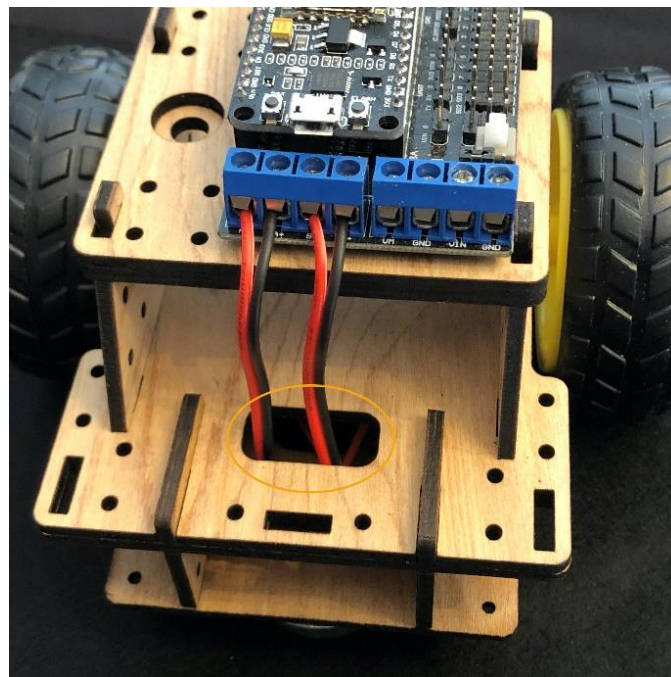
Figure 15, Cleaned up motor wiring

33. Add 4 AA batteries to the battery holder (P5) as shown in the following figure. Make sure that the positive and negative ends match.

Figure 16, Batteries

34. Place the battery holder on the top plate as shown in the following figure. Note where the wires from the holder go.

Figure 17, Battery Holder

35. Insert the wires from the battery holder to the rightmost terminal posts as shown in the following figure. Make sure that the red wire is in the post labeled VIN and the black wire is in the post labeled GND.
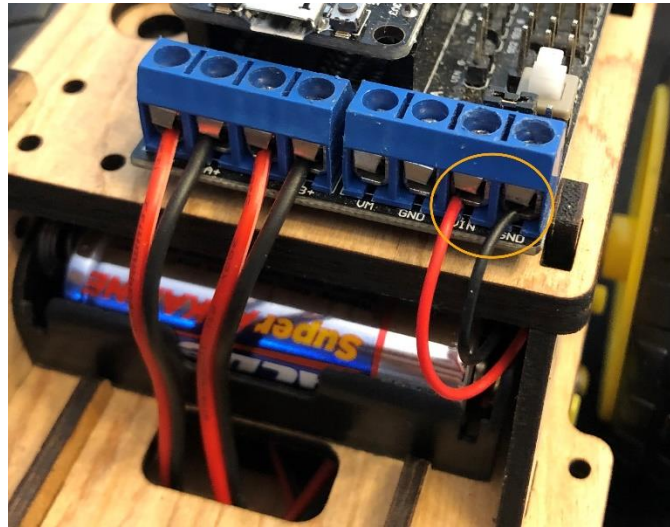
Figure 18, Battery wiring

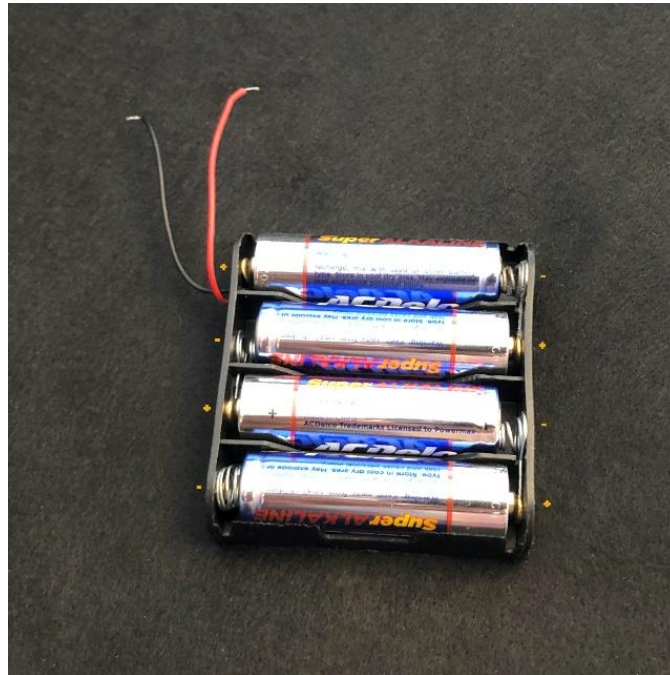36. Insert the ultrasonic sensor (P2) into the USS bracket (P1), being careful not to push in the protective grill. Insert the USS bracket into the front of the top plate as shown in the following figure.
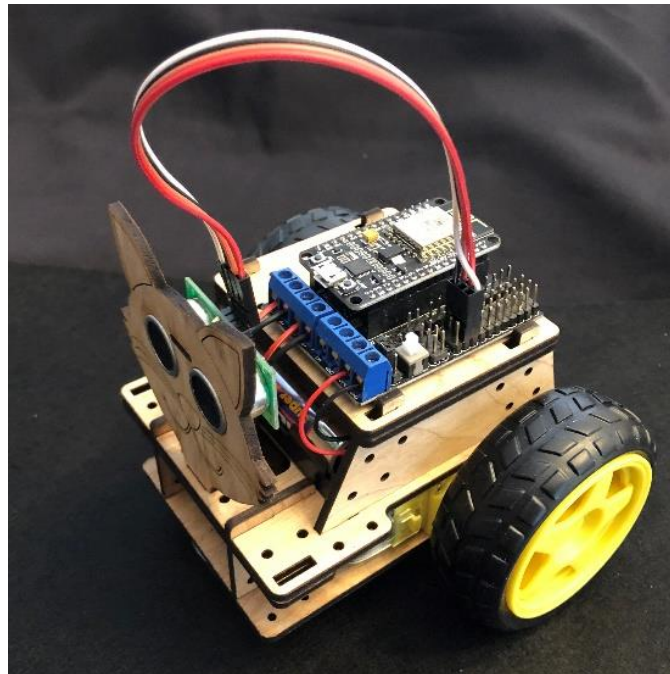
Figure 19, USS bracket placement

37. Take the lose end of the wire from the ultrasonic sensor and plug the connector into the pins of the controller as shown in the following figure. The colors of the wires may be different.
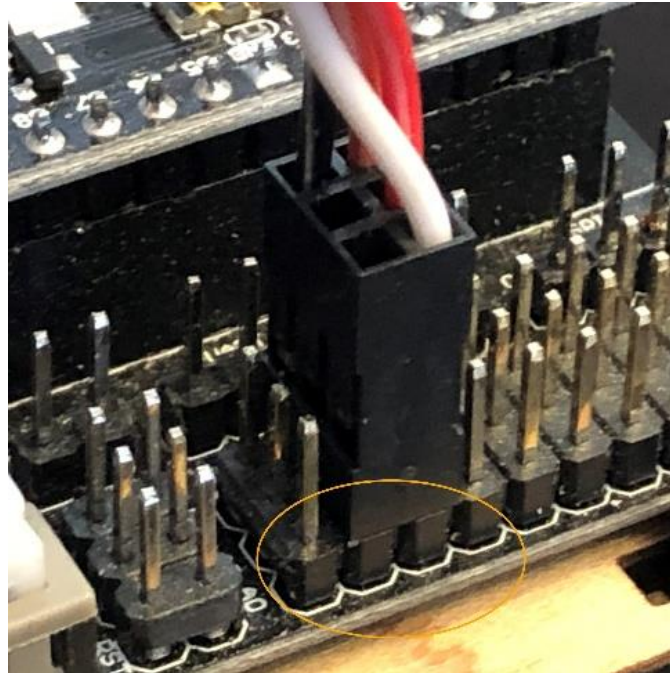
Figure 20, Ultrasonic wiring

38. Take the speaker (P3) and insert it into the hole of the top cover as shown in the following figure.

Figure 21, Speaker placement

39. Take the two wires from the speaker (P3) and connect them to the row 7 of the controller as shown in the following figure. The colors do not matter, just that one wire goes to the leftmost pin of the row and the other wire to the rightmost pin.
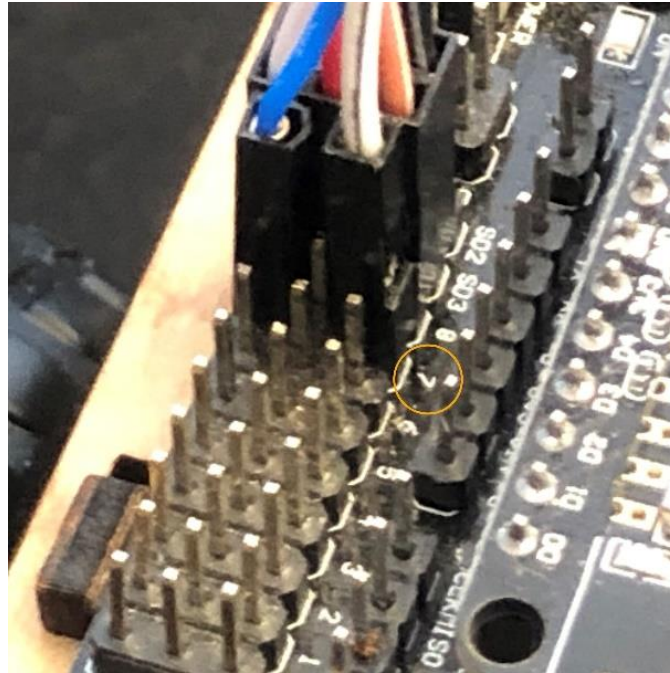
Figure 22, Speaker wiring

40. Your STEAMbot should now look like the following figure.
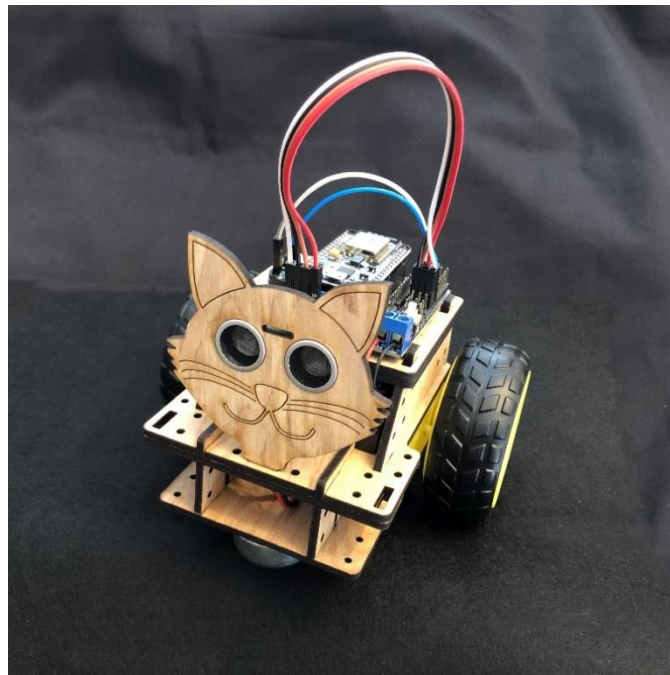
Figure 23, Assembled STEAMbot

41. Push the power button on the controller board. Your STEAMbot should beep once and then in a few seconds beep three times.
42. Turn on your computing device and open the WiFi settings.
43. Search for a WiFi network called "STEAMbot-hhhhhh" and select it. "hhhhhh" is the hexadecimal number printed on the back of the controller board.

44. When asked for a password, enter "steambot".
45. Open a browser and enter "sb.com" in the address bar of the browser. You should see the following web page:
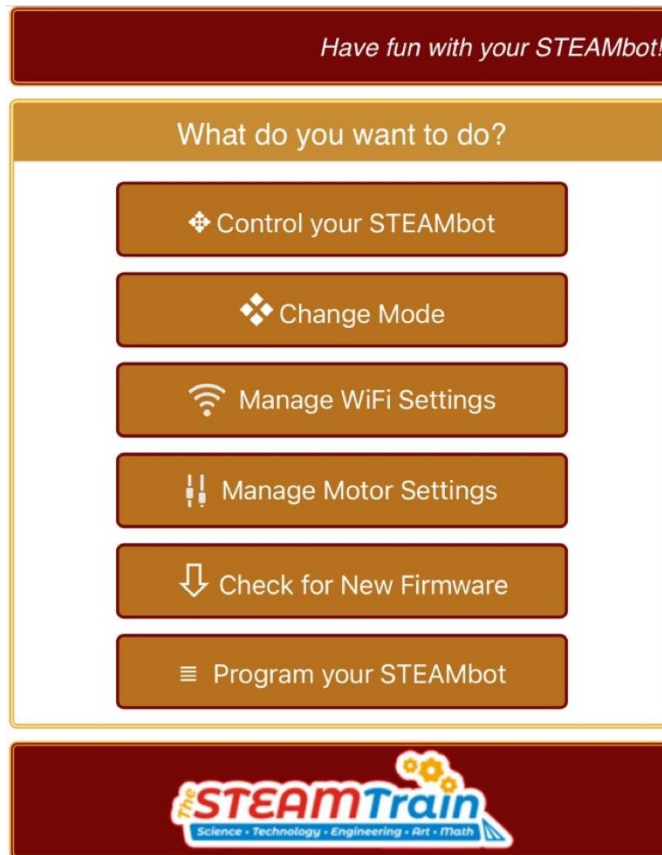
Figure 24, STEAMbot Main Web Page

46. Optional: Place your STEAMbot on the floor to make sure it does not fall off your work area.
47. Click on "Control your STEAMbot". You should see the following web page:
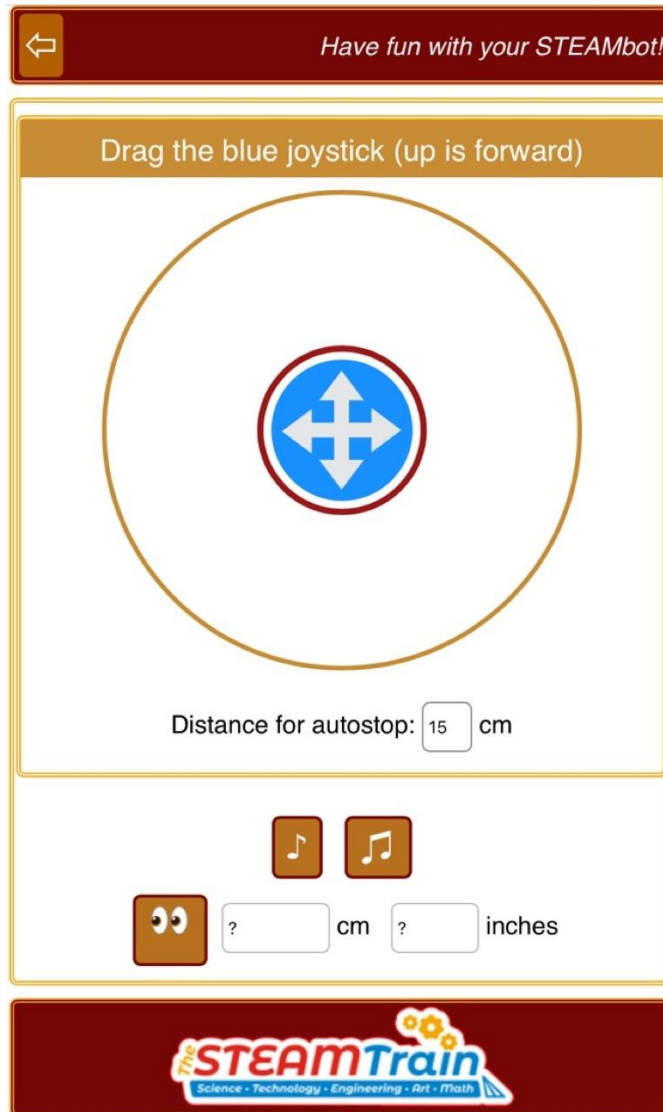
Figure 25, STEAMbot Control Web Page

48. You can now drive your STEAMbot by dragging the blue "joystick" around. Remember, dragging up moves your STEAMbot forward, in the direction of where the USS is facing.
49. You can read the remainder of this document to learn more about your STEAMbot.

STEAMbot User Interface

STEAMbot Home Page

The following figure shows your STEAMbot's home page[2].
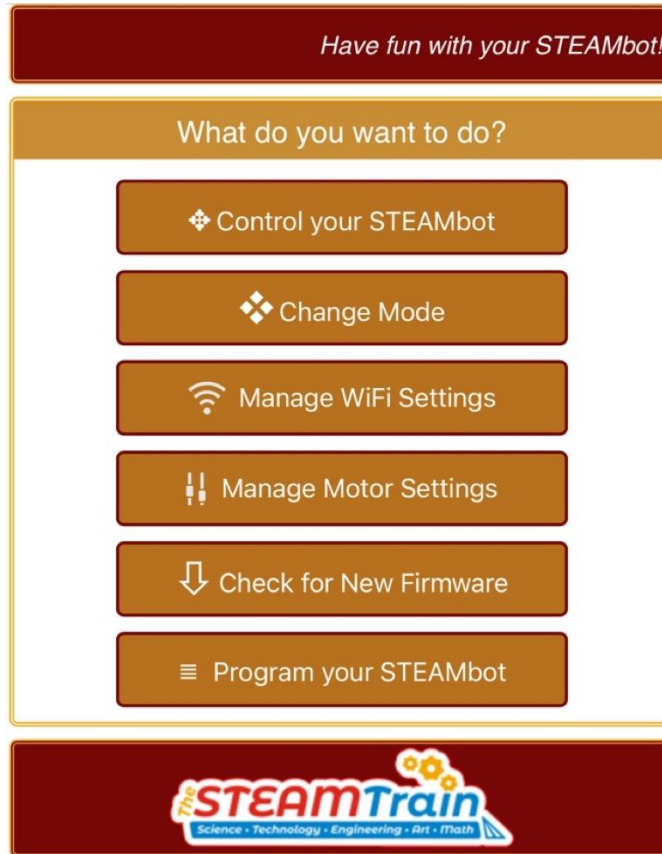
Figure 26, STEAMbot Home Page

Each button represents a set of functions that are supported by your STEAMbot. These are described in the following sections below.

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[2] Note: although the *look & feel* of the web pages may change without notice, the functionality will remain the same.

Control Your STEAMbot

When you click on the Control Your STEAMbot button, the following page appears.
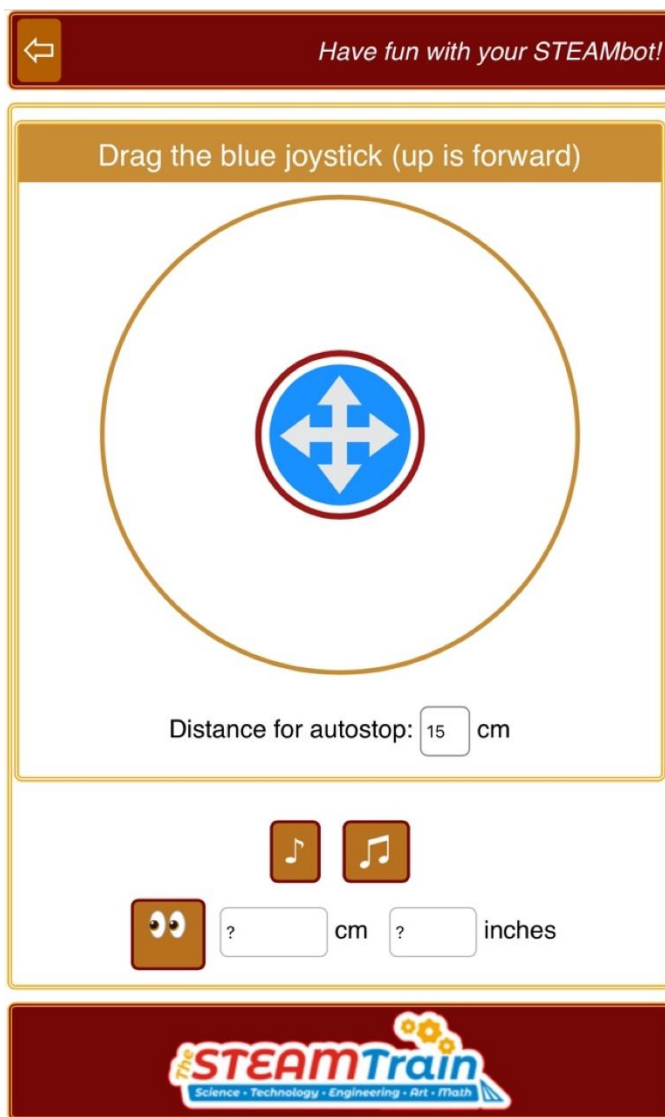
Figure 27, Control Your STEAMbot

To move your STEAMbot, just drag the blue joystick. Your STEAMbot will in the direction that you drag the joystick. Forward is always from the viewpoint of your STEAMbot and NOT from your viewpoint. The further away you drag the joystick from the center, the faster your STEAMbot will move.

If the "Distance for autostop" is not 0, then the STEAMbot will automatically stop when an obstacle is detected within the specified distance. Note that the speed at which the STEAMbot is moving affects how the distance is measured.

Clicking on the single note will make your STEAMbot make a "beep". Clicking on the double notes will make your STEAMbot play a builtin melody.

Clicking on the "eys" will make your STEAMbot measure the distance to any object that is in front of your STEAMbot. If no object is detected, the distance fields will display a "?".

Change Mode

When you click on the Change Mode button, the following page appears.
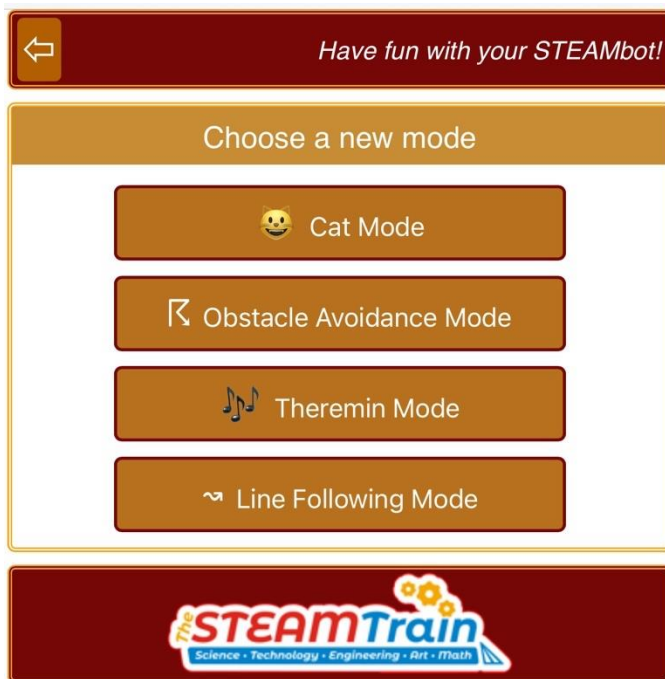
Figure 28, Change Mode

Besides the remote-control mode, your STEAMbot supports the following additional modes of operation:

- Cat Mode – in this mode, your STEAMbot will act like a cat. If your STEAMbot detects an object between 15 and 45 cm (6 and 18 inches), your STEAMbot will move forward. If your STEAMbot detects an object closer than 10 cm (4 inches), it will move backwards.
- Obstacle Avoidance Mode – in this mode, your will move forward until it detects an object in front of it. When it does, it will randomly turn to avoid the obstacle.
- Theremin Mode – in this mode, your STEAMbot function like a theremin. If you put an object (like your hand) in front of your STEAMbot, it will play a note. The closer you move the object, the lower the pitch of the note and the farther away, the higher the pitch.
- Line Following Mode – this mode requires installation of the "Line Following Kit" (which is not including with the kit). In this mode, your STEAMbot will follow a black line on the ground. The Line Following Kit will be available soon.

To change modes, click one of the mode buttons. Will change color while that mode is active. Clicking a different mode button will change to that new mode.

To return to the home page, click the left arrow in the upper left corner of the page.

Manage WiFi Settings

When you click on the Manage WiFi Settings button, the following page appears:
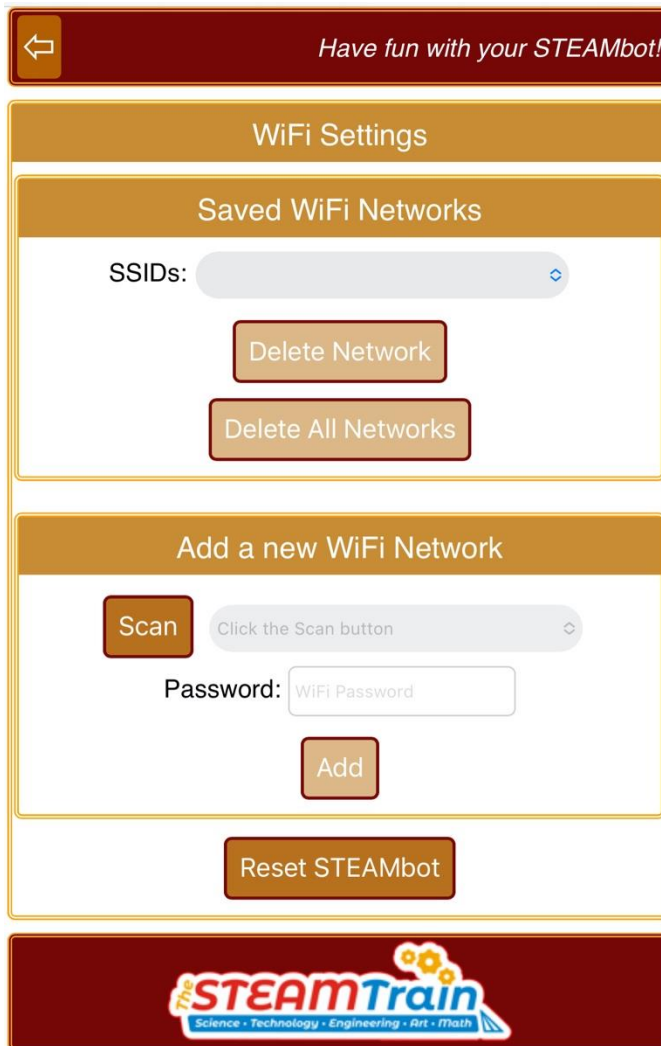
Figure 29, Manage WiFi Settings

As shown, there are two subsections: 1) Saved WiFi Networks and 2) Add a new WiFi Networks. These are described below.

Saved WiFi Networks

This subsection shows you which WiFi networks you have added. The first time you turn on your STEAMbot after you have put it together or after deleting all the WiFi networks, the SSIDs field will be empty.

Click on the SSIDs pulldown field to see all the saved networks. Clicking the Delete Network button will ask for a confirmation. Clicking OK will delete the network setting for the displayed network. Clicking on Cancel will cancel the deletion. Clicking the Delete All Networks button

will first ask for a confirmation to delete all the WiFi settings. Click on OK to delete all the WiFi settings. Click on Cancel to cancel the deletion.

An alternative way to delete all the saved WiFi networks is to use the button on top of the controller labeled "FLASH". As soon as you push it, you will hear a beep and the blue LED on the controller will start flashing fast. If you continue to hold it down for more than 5 seconds, all the saved WiFi networks will be deleted and your STEAMbot will reboot. You should hear 3 beeps indicating that your STEAMbot's WiFi is in AP mode.

Add a new WiFi Network

This subsection allows you to add an existing WiFi network. First click on the Scan button. Your STEAMbot will scan for all the WiFi networks it can detect. After scanning, the pulldown field will be populated with the detected WiFi networks. Click on the pulldown field and chose the WiFi network you want to add. If the network requires a password, fill it in the Password field. Click Add and the WiFi network is save in your STEAMbot.

Resetting Your STEAMbot Robot

After adding any WiFi network, you should click on the Reset STEAMbot button. This will cause your STEAMbot to reboot and follow the procedure described in the Connectivity section on page 33. You must confirm (by click OK) that you want to reset your STEAMbot.

To return to the home page, click the left arrow in the upper left corner of the page.

Manage Motor Settings

When you click on the Manage Motor Settings button, the following page appears:
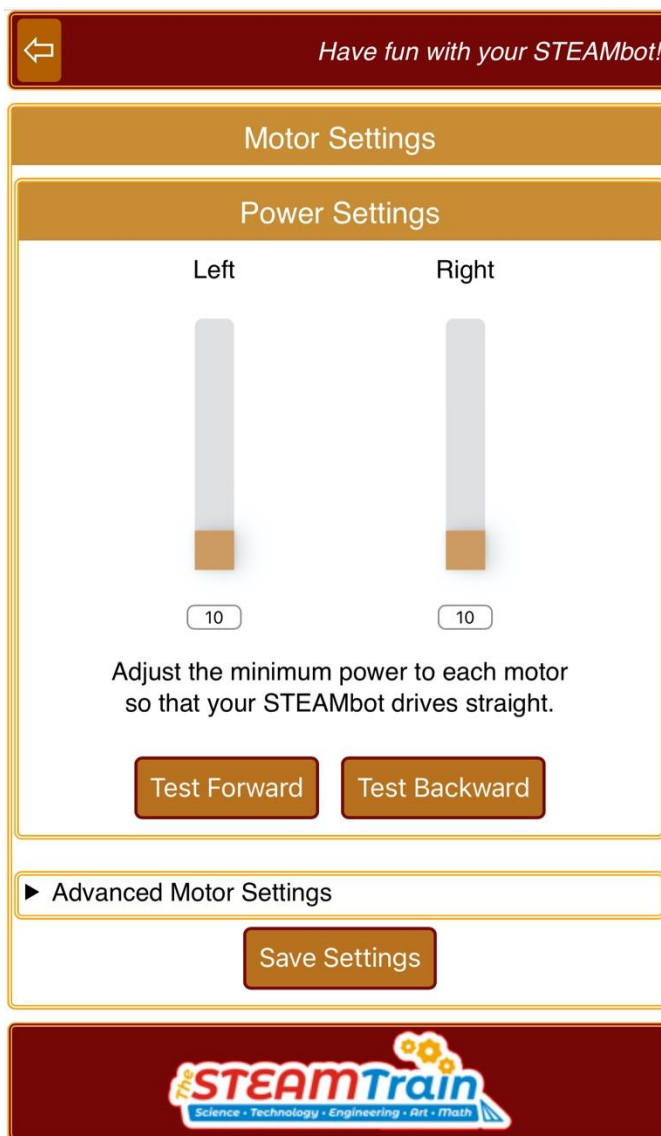
Figure 30, Manage Motor Settings

The purpose of the motor power settings is to calibrate the power applied to the motors so your STEAMbot moves straight. Sometimes the motors are slightly different and will turn at speeds even though they are both getting the same voltage. Also, each motor requires a certain amount of voltage before moving. Place your STEAMbot on a flat surface with room to move forward and backwards. The function of the three buttons are:

- Test Forward – clicking this button causes your STEAMbot to go forward for one second.
- Test Backward – clicking this button causes your STEAMbot to go backward for one second.

- Update Settings – clicking this button will save the current setting on your STEAMbot. If you make changes to the power settings and do not click this button, your STEAMbot will forget the settings when you turn it off.

Calibration

Click the Test Forward button. Your STEAMbot will move forward for one second. If your STEAMbot moves straight, then there is no need to make any further adjustments.

If your STEAMbot tends to go left, then move the Left motor slider up to increase the power to the left motor. Click the Test Forward button and see how it moves. If it goes straight, click the Update Settings. If it goes left, repeat this step. If it goes right, then move the Left motor slider down and click the Test Forward. Keep repeating this step until your STEAMbot moves straight.

If your STEAMbot tends to go right, then move the Right motor slider up to increase the power to the right motor. Click the Test Forward button and see how it moves. If it goes straight, click the Update Settings. If it goes right, repeat this step. If it goes left, then move the Right motor slider down and click the Test Forward. Keep repeating this step until your STEAMbot moves straight.

You can repeat the above steps using the Test Backward button.

When you are satisfied with how your STEAMbot is moving forward and backward, make sure to click the Update Settings to save your changes.

To return to the home page, click the left arrow in the upper left corner of the page.

Update STEAMbot Firmware

When you click on the Update STEAMbot Firmware button, your STEAMbot will try to communicate with a special server on the Internet to see if there is a new firmware version and show the following page:

Figure 31, Update STEAMbot Firmware

If your STEAMbot cannot communicate with the special server, you will first get an error message stating "Error getting the latest version number. Make sure you have Internet access."

This page will display the current version of your STEAMbot's firmware. If there was no communication error, the version of the firmware on the server will also be displayed. If they are different and you would like to update the firmware on your STEAMbot, then click the Update Firmware button. Be aware that the firmware update will take 1 - 2 minutes during which the blue LED on your STEAMbot will flash very rapidly. During this time, do NOT turn off your STEAMbot or your STEAMbot can become corrupted and not function correctly. This may require shipment back to the factory. After your STEAMbot has been updated, it will automatically restart. You will have to refresh your browser to reload the STEAMbot home page.

Program Your STEAMbot

If you are using a mobile device with a small screen and you click the Program your STEAMbot button, you will get a warning message that you must use a computer or tablet to program your STEAMbot.

If you are using a computer or a tablet and you click the Program your STEAMbot button, you will get the following page.
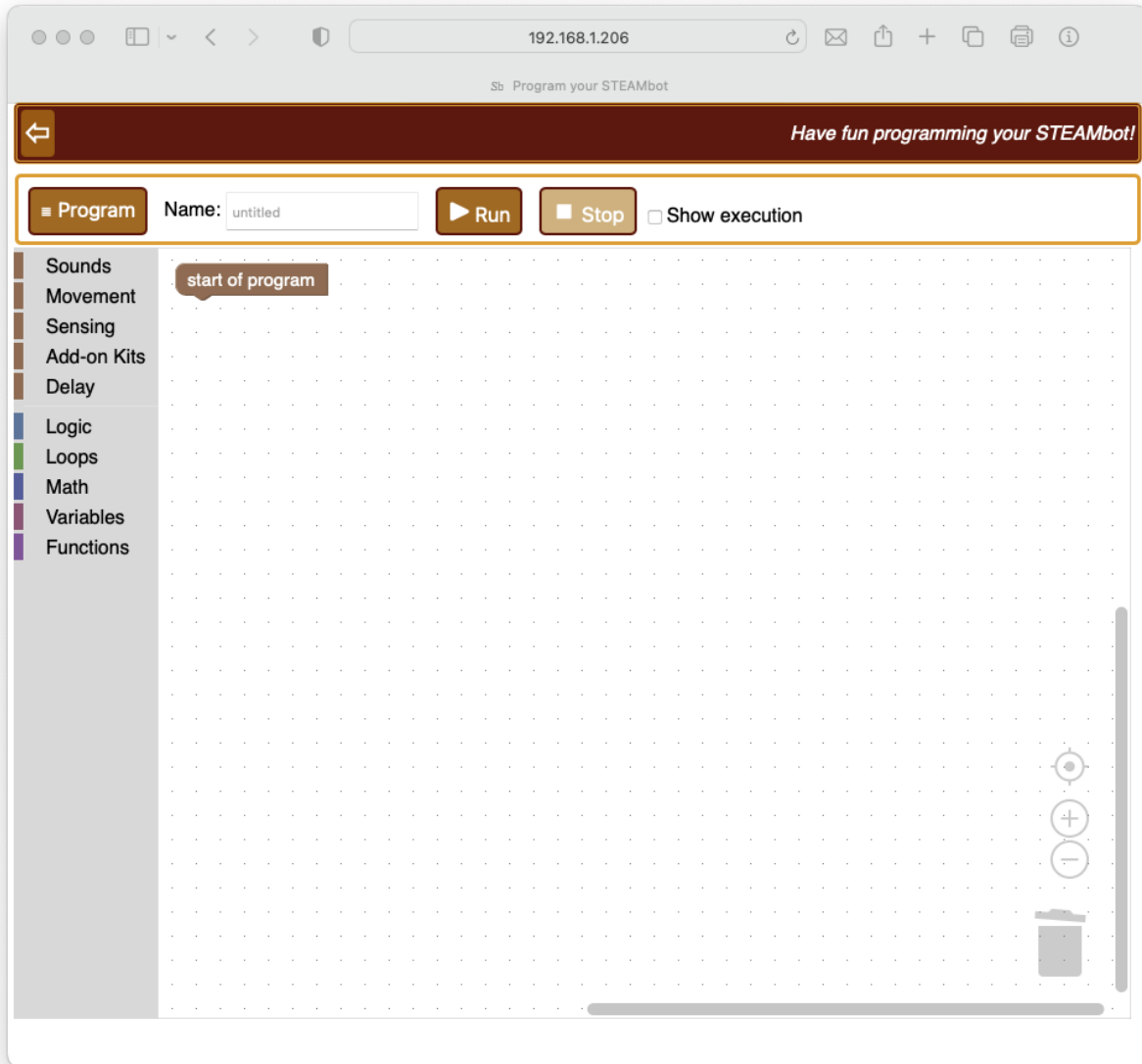
Figure 32, Program your STEAMbot

This is the programming environment for your STEAMbot and it is based on technology from Google called Blockly. Clicking on the categories on the left will show different instructions that you can use in your program. The first four categories contain STEAMbot specific blocks. The following figure shows the Sounds category.
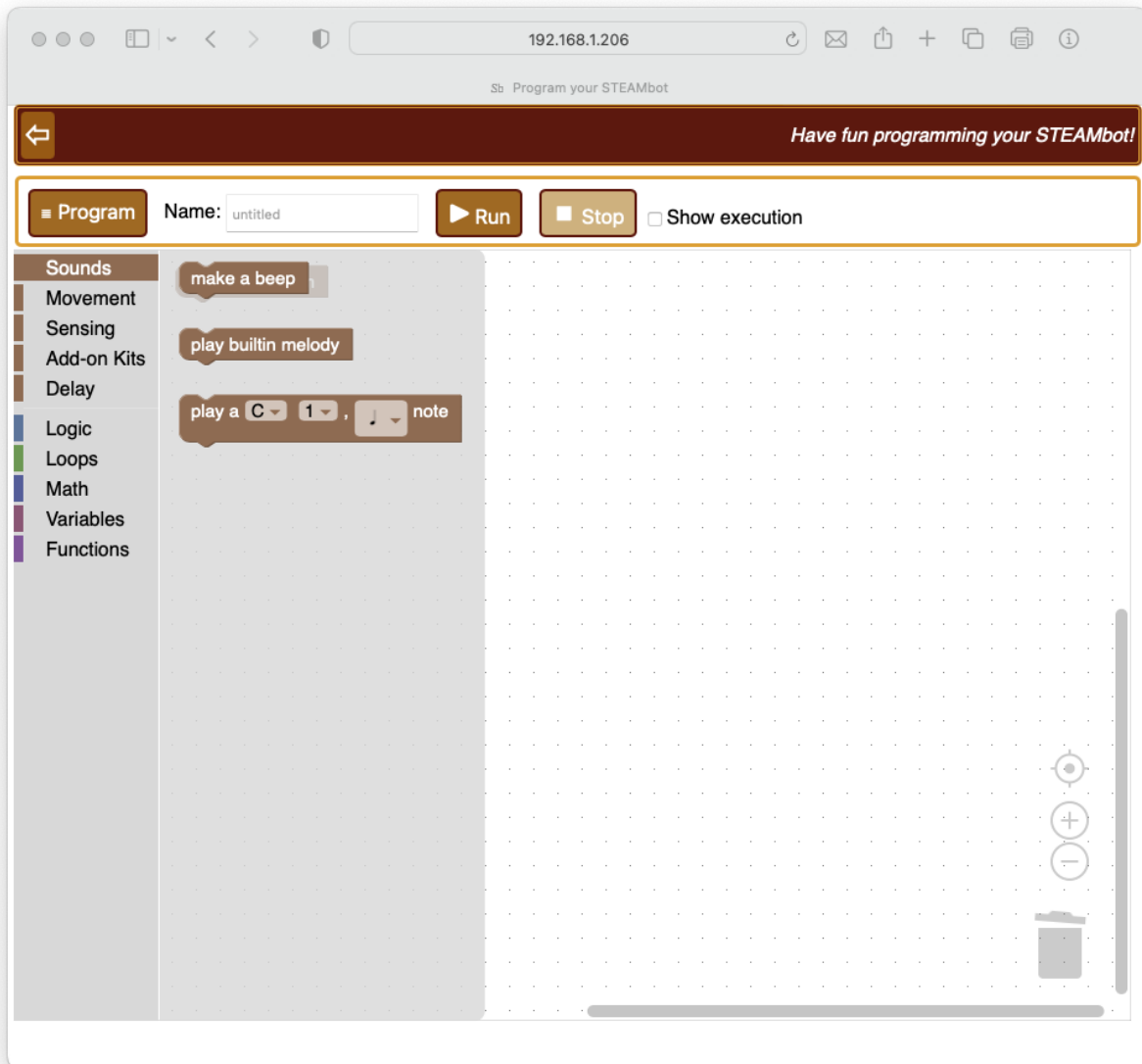
Figure 33, Sounds Category

If you click on the *play builtin melody* block, it will appear in the right area. Drag the block until it snaps to the *start of program* block as shown below.
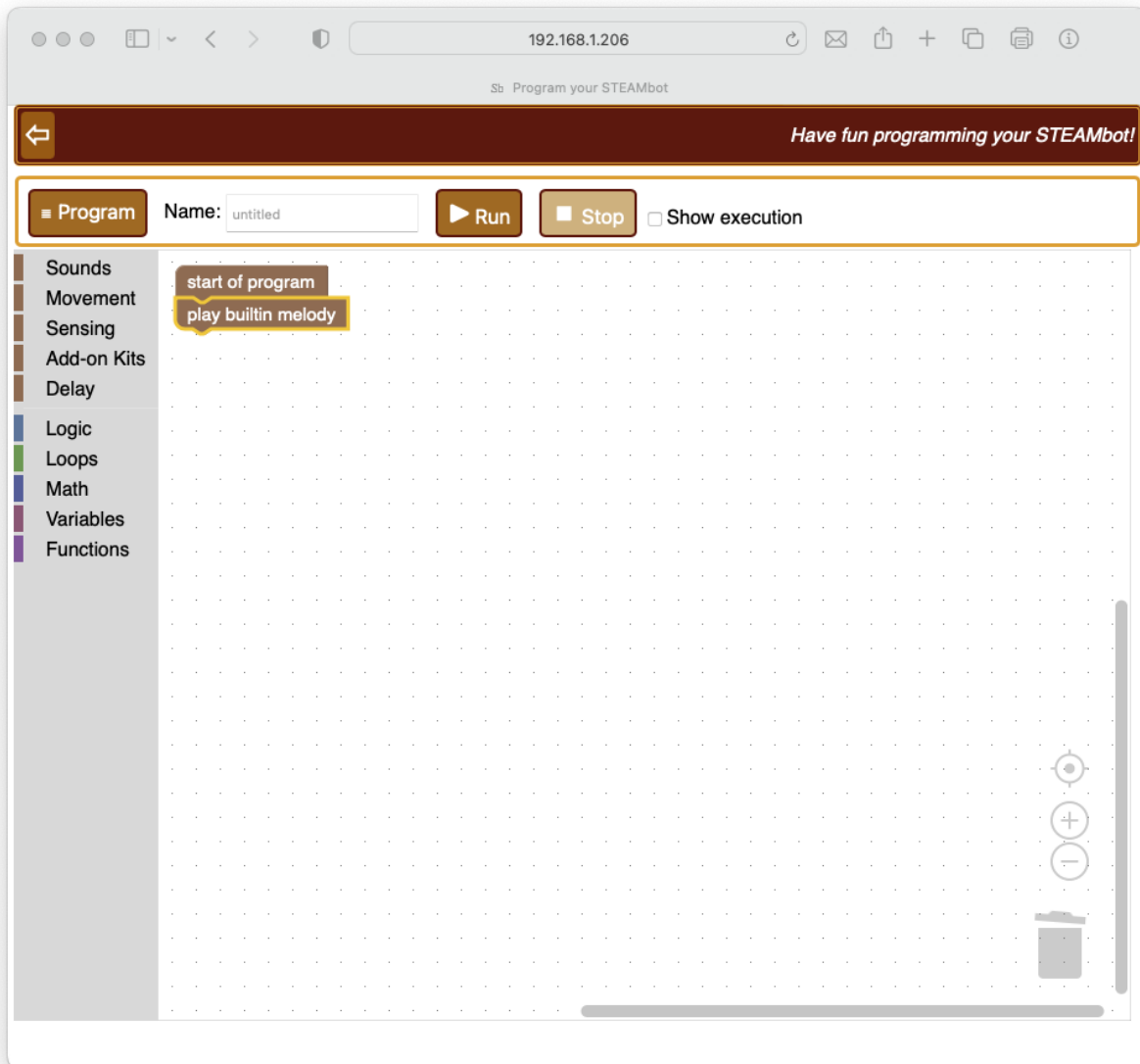
Figure 34, Play Builtin Melody

If you click the Run button, your STEAMbot will play its builtin melody.

In a similar fashion, you can drag blocks from the different categories on the left and snap them onto the area to create a program that will be executed by your STEAMbot.

Here are the descriptions of the Program area:

- New – clicking this button will remove all the blocks from the right area and just leave the *start of program* block.
- Load – clicking this button will allow you to load a previously saved STEAMbot program
- Name – this field contains the name of the program that you just loaded or that you want to save.

- Save – clicking this button will save the program in the right area to your computer or tablet[3].

Here are the descriptions of the Execution area:

- Run – clicking this button will execute your STEAMbot program. If you programmed your STEAMbot to move, make sure it will not fall of the edge of a table or desk and break. This button is only enabled when no program is being executed.
- Stop – clicking this button will stop the execution of any program that is being executed. This button is only enabled when a program is being executed.
- Highlight Execution – if this box is checked, then every block will be highlighted as it is executed.

A comprehensive STEAMbot Programming Guide is being developed and will be available soon. To learn more about programming in the Blockly environment see this tutorial. While it has no specific information about your STEAMbot, it will help you understand the programming concepts that you can use to program your STEAMbot. Note that not all the tutorials will be applicable to programming your STEAMbot.

One of the appendices has some programming challenges for you to try.

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[3] If you are using an iPad tablet, you may have issues saving your programs. We are working hard to resolve this issue.

Appendices

Glossary

The following terms are used in this document.

Table 3, Glossary

Term	Meaning
WiFi	Wireless communications network
AP	WiFi Access Point
DC	Direct Current
Device	Either a computer or a mobile device used to connect to a STEAMbot
Firmware	Software that runs on your STEAMbot and can be remotely updated
LED	Light Emitting Diode
PCB	Printed Circuit Board
STA	WiFi Station
USS	Ultrasonic Sensor
Vin	Voltage input, the same as VIN.
VIN	Voltage Input, the same as Vin

WiFi Connectivity

Your STEAMbot operates over a WiFi connection. The STEAMbot configures itself either as a standalone WiFi Access Point (AP) or as a station (STA) connected to an existing WiFi network. Once the WiFi is configured, a blue LED on the controller will blink, waiting for a connection from a device. On power up (or reset), the STEAMbot follows the following steps to configure the WiFi:

1. Beep once and setup the WiFi in STA mode.
2. Was the STEAMbot previously connected to a WiFi network? If No, proceed to step 4.
3. Try to connect to the previous WiFi network. If the connection is successful, beep twice and proceed to step 6.
4. Are there any WiFi networks saved in the STEAMbot? If No, proceed to step 6.
5. For each WiFi network saved, try to connect to that network. If the WiFi connection is successful, beep twice and proceed to step 7.
6. Set up the WiFi in AP mode with the network name of "STEAMbot-hhhhhh" (the ID of the STEAMbot). Beep 3 times.
7. Your STEAMbot is now ready for a connection from one of your devices. The procedure to connect a device is described below and the procedure depends on what type of device and operating system you have.

AP Mode

If you heard 3 beeps, then your STEAMbot has configured its WiFi to be an Access Point. In this case, you must connect your device's WiFi to your STEAMbot's WiFi network. To do this, open

the WiFi settings on your device. Scan for WiFi networks and click[4] on the network which has the name "STEAMbot-hhhhhh" (corresponding to your STEAMbot's ID). Connect to that network using the password "steambot". Open a web browser on your device and enter "sb.com" in the address bar. Proceed to the STEAMbot Home Page below on page 20.

STA Mode

If you heard 2 consecutive beeps, then your STEAMbot connected to an existing WiFi network as a station (STA). To communicate to your STEAMbot, your device must be on the same WiFi network as your STEAMbot. In addition, you must find out what IP address was assigned to your STEAMbot. How you find the IP address will depend on the type of device and what operating system your device runs. The processes are described below based on the device types.

Android Device or Chromebook

If you have an Android device, we recommend that you install the Bonjour Browser app. When you run the app, it will display a list of available web servers. Find the server with the name of "STEAMbot-hhhhhh" that matches your STEAMbot ID. Tap on it and your default browser will open to your STEAMbot's home page.

iOS Device

If you have an iOS device, we recommend that you install either Bonjour Search for HTTP app or the Hola Browser app. When you run the app, it will display a list of available web servers. Find the device with the name of "STEAMbot-hhhhhh" that matches your STEAMbot ID. If you are using Bonjour Search for HTTP, tapping on the STEAMbot ID will open your default browser to your STEAMbot's home page. If you are using the Hola Browser, it will use an internal browser and open to your STEAMbot's home page. There is an icon to use an external browser.

Windows Computer

We have only tested with Windows 10. While earlier versions of Windows may work, this has not been tested. There are several options to find the IP address of your STEAMbot. These are as described below.

Windows Network

If you open the Windows File Explorer and select the Network on the left pane, your STEAMbot should show up under "Other Devices" with the name of "STEAMbot-hhhhhh". Double click on it and your default web browser will open to your STEAMbot's home page.

All My Lan App

You may install the application "All My Lan" (free from the Windows Store app). You can find your STEAMbot via either via "UPnP" or mDNS Services. These options are on the left side of the app.

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[4] This document assumes you are using a mouse. If you have a touch device, substitute "tap" when you see "click".

The UPnP option is the easiest to use. Click on UPnP. After a few seconds the ID of your STEAMbot should appear. Below it you will see it's IP address. Open your browser and enter your STEAMbot's IP address in the browser's address bar. The STEAMbot's home page will appear.

If you chose the mDNS option, click on the icon. After a few seconds a list of mDNS services will appear. Click on the one labeled "http.tcp.local". After a few seconds, you will see the "Found Devices" and your STEAMbot should be there. Click on your STEAMbot ID and the IP address will be shown. Open your browser and enter your STEAMbot's IP address in the browser's address bar. The STEAMbot's home page will appear.

Command Line or Terminal Window

Open a command line or Terminal window (type "cmd" in the search bar or run PowerShell). Enter "dns-sd -B _http.tcp". You will see a list of services like the following:

```
C:\Users\xxxx> dns-sd -B _http.tcp
Browsing for _http.tcp
Timestamp     A/R Flags if Domain                Service Type          Instance Name
 9:09:33.364  Add    2 23 local.                  _http.tcp.           STEAMbot-hhhhhh
 9:09:34.081  Add    2 23 local.                  _http.tcp.           EPSON WF-7720
```

Run your web browser and in its address bar, enter "steambot-hhhhhh.local". The STEAMbot's home page will appear.

Apple Computer

There are several options to find the IP address of your STEAMbot on an Apple computer. These are as described below.

Discovery – DNS-SD Browser App

You may install the application "Discovery" (free from the Apple App store). When it is run, the app will display a list of services. Click on the triangle for the "_http._tcp" service. A list of devices offering the _http._tcp service will be displayed, including your STEAMbot. Click the triangle next to the STEAMbot ID and it's IP address will be shown. Open up your web browser and either 1) enter "steambot-hhhhhh.local" or 2) enter the IP address. The STEAMbot's home page will appear.

Terminal Window

Open a Terminal window. Enter "dns-sd -B _http._tcp". You will see a list of services similar to the following:

```
C:\Users\xxxx> dns-sd -B _http._tcp
Browsing for _http._tcp
Timestamp     A/R Flags if Domain                Service Type          Instance Name
 9:09:33.364  Add    2 23 local.                  _http._tcp.          STEAMbot-hhhhhh
 9:09:34.081  Add    2 23 local.                  _http._tcp.          EPSON WF-7720
```

Run your web browser and in its address bar, enter "steambot-hhhhhh.local". The STEAMbot's home page will appear.

Batteries

Your STEAMbot robot requires batteries for power. The kit comes with a holder for four AA batteries. The following table lists the different types of AA batteries along with their pros and cons.

Table 4, AA Size Batteries

Type	Voltage	Total Voltage	Pros	Cons
Regular (non-alkaline)	1.5V	6V	Lowest initial cost	Lowest capacity, cannot be recharged.
Alkaline	1.5V	6V	Higher capacity than regular	Higher cost than regular, cannot be recharged.
Ni-Cd	1.2V	4.8V	Rechargeable, lowest cost rechargeable, good capacity	Suffers from "memory" issue, a smaller number of recharges, higher initial cost than regular/alkaline
Ni-MH	1.2V	4.8V	Large number of recharges, medium cost rechargeable, very good capacity	Higher initial cost.
Ni-Zn	1.6V	6.4V	Higher voltage	High initial cost, lower capacity than Ni-CD or MH.
Li-ion	3.7V	7.4V	Highest voltage, needs only two batteries, very good capacity	Highest initial cost, requires a different battery holder.

The following table lists alternatives to using AA sized batteries.

Table 5, Alternative Batteries

Type	Total Voltage	Pros	Cons
9 Volt	9V	Only one battery needed	Low capacity, cannot be recharged.
Rechargeable 9 Volt	9V	Only one battery needed	Higher cost than regular 9-volt, low capacity.
USB Power Bank	5V	Large number of recharges, good capacity	Relative high cost, special USB cable is required.

The electronics of your STEAMbot robot uses 3.3V. All the batteries (except for the USB Power Bank) must be connected to the VIN/GND terminal posts. The voltage on the VIN terminal is connected to a voltage regulator which regulates the voltage down to 3.3V. The maximum voltage that can be applied to the VIN terminal is 10V. ***Exceeding this voltage will damage the electronics!***

A USB power bank can be connected via a special cable to the VIN/GND terminal posts or via a micro USB cable. The disadvantage of the USB cable is that you must plug in the cable to the controller board to turn on the STEAMbot or remove the cable to turn it off. You can find right angle micro USB cables which make it a little bit easier.

Normally the motors are driven from the voltage applied to the VIN terminal. The higher the voltage on the VIN terminal, the faster your STEAMbot will move. The exception is if a USB cable is connected to the controller in which case the motors run from the USB voltage (normally 5V). In all cases, as the voltage of the batteries

Programming Challenges

Challenge 1

Program your STEAMbot to do the following:

1. Play a beep.
2. Move forward six inches.
3. Play the builtin melody.

Note that the only distance control you have is how long your STEAMbot moves forward. You will have to do a trial and error with the time variable until your STEAMbot moves six inches.

Challenge 2

Program your STEAMbot to go around a six-inch square so that it ends up near the same place where it started from. You can have your STEAMbot play a beep before it starts moving and the builtin melody when it stops. The following figure gives you the basic outline for this challenge without any sounds. You will need to modify it to make it work correctly.
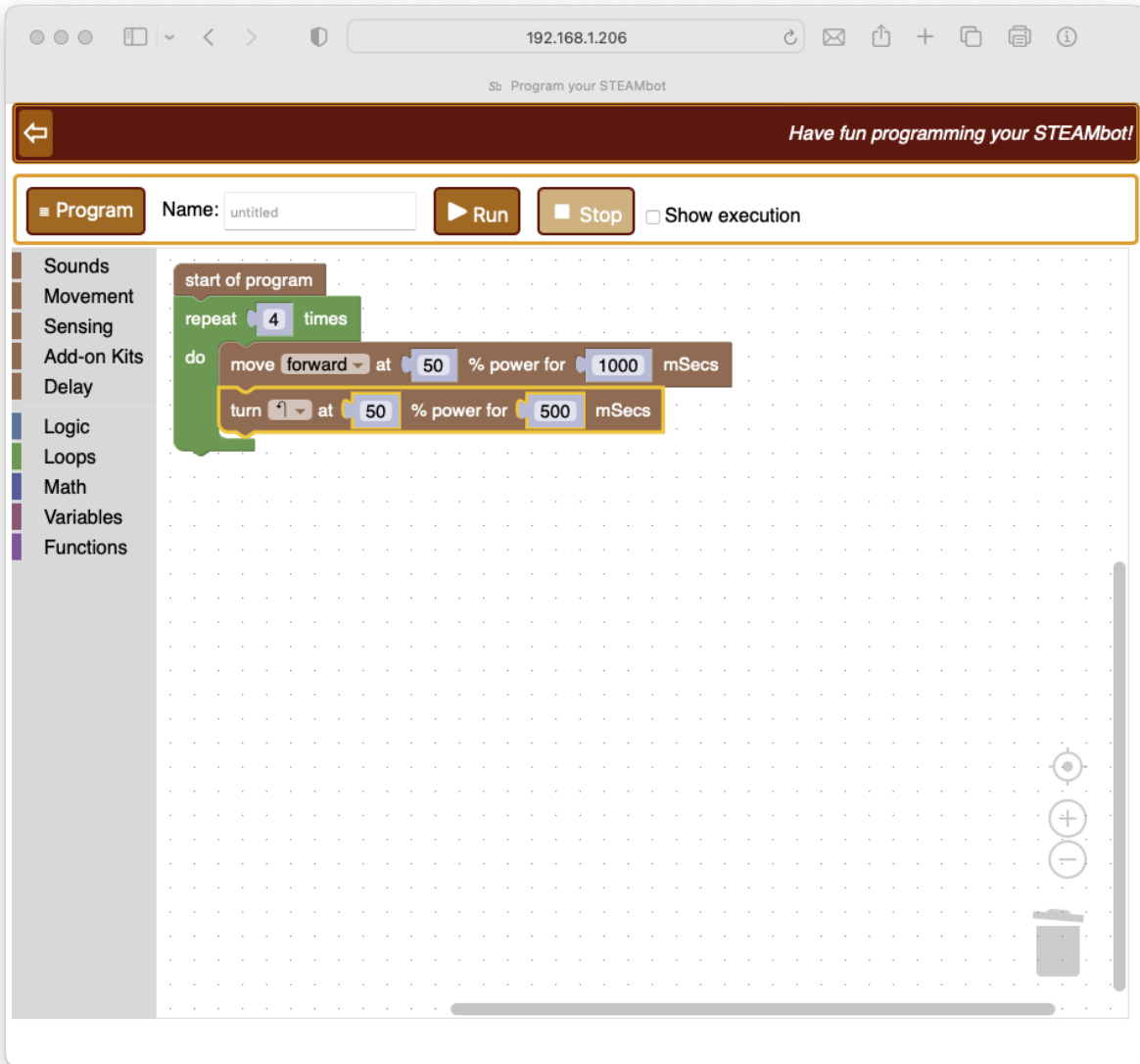
Figure 35, Go Around A Square

Challenge 3

Program your STEAMbot to go forward until it detects an object at around ten cm (4 inches). When the object is detected have your STEAMbot stop and beep twice.