



Palm Island

Robot to the Rescue - Robot Virtual World



**LUAU
EDITION**
Palm Island
RESCUE BOTS TRAINING GROUND



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Frequently Asked Questions (FAQs)

- ▶ **What are Robot Virtual Worlds?**
(See *What are Robot Virtual Worlds*, [page 6](#))
- ▶ **What is Palm Island?**
(See *What is Palm Island*, [page 7](#))
- ▶ **Can Palm Island Run on Older Computers?**
(See *Optimizing my Computer's Performance*, [page 10](#))
- ▶ **Can my computer run Robot Virtual Worlds?**
(See *System Requirements*, [page 5](#))
- ▶ **How do I install the Palm Island?**
(See *Installation*, [page 5](#))
- ▶ **How do I program my Palm Island Robots?**
You can find training materials at:
Carnegie Mellon's Robotics Academy - www.education.rec.ri.cmu.edu
ROBOTC's Website - www.robotc.net
or from the Computer Science Student Network - www.cs2n.org
- ▶ **How do I navigate and use Palm Island?**
(See *Printable World Map*, [page 11](#), *Game Controls*, [page 12](#),
Camera Controls, [page 13](#), *Measurement Toolkit*, [page 14](#),
Heads Up Display, [page 14](#), *the In-game Map*, [page 16](#))
- ▶ **What is the Best Way to Solve the Challenges**
(See *Use Mathematical Solutions*, [pages 17 & 18](#), *Taking Advantage
of Start-Points*, [page 19](#), and *Breaking Programs into Behaviors*, [page 20](#))

Checklist

- Before you commit to using Palm Island, make sure that your computers have the capacity to run the Robot Virtual World (RVW) software by checking your computer's specifications against the system requirements, see System Requirements, [page 5](#).

Note: If you are unsure, you can always download a trial copy and test it on your computers.

- Adjust your computers for optimal RVW performance. RVW software allows you to adjust the graphics in the game based on your computer's performance. Slower computers can be set to lower graphics, [page 10](#).
- Learn how to login and save your progress when using the RVW software. Make sure that you know how to log in, save your progress, and log out, [page 8](#).

System Requirements

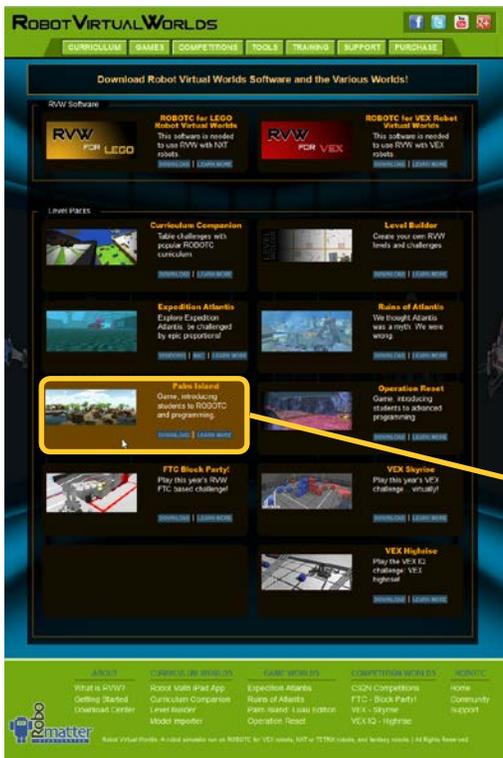
- PC Compatible OS: Windows XP, Windows Vista, Windows 7, or Windows 8
- Processor: Intel Core 2 Duo processor family or better, AMD Athlon X2 processor family or better
- Memory: 2 GB RAM
- Graphics: NVIDIA® GeForce® 8800GTS or better, ATI Radeon™ HD 3850 or better
- DirectX®: DirectX® 9.0c and DirectX® 10
- Hard Drive: 250 MB free hard drive space
- Sound: Standard audio device

Robot Virtual Worlds may run on older computers, but it is highly recommended that computers have a dedicated graphics card for superior performance.

Installation

1. You will need Administrator Level Access to the computer to install the Palm Island Virtual World.
2. Palm Island can be downloaded and installed as part of a **Robot Virtual World Bundle**, designed to simplify the setup process for classrooms, or as a **standalone level pack**, meant for classrooms using ROBOTC (or updating individual worlds).

To learn more go to: www.robotvirtualworlds.com



You will find the Palm Island download at:

<http://www.robotvirtualworlds.com/download/>

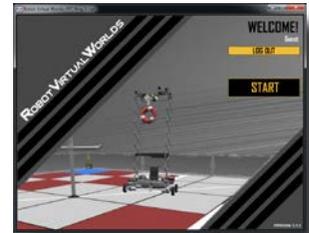
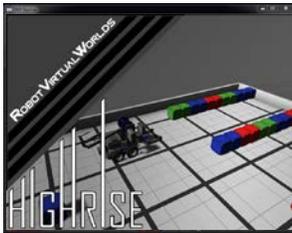


What are Robot Virtual Worlds (RVWs)?

Robot Virtual Worlds are simulation environments designed to help you learn how to program.

The beauty of the RVW solution is that you can use the same programming language on your virtual or your physical LEGO® or VEX® robot. The RVW environment is available in:

Competition environments



You can begin modeling your autonomous programs before your robot is complete. You can host your own virtual robotics programming competition.

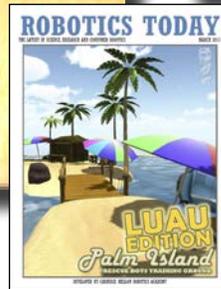
Fantasy environments



The Ruins of Atlantis



Palm Island



Operation Reset



Classroom environments



Research has shown that learning to program in the RVW environment is more efficient than learning to program using physical robots.

Directly below are papers and articles that they've written on learning with Robot Virtual Worlds.

Liu, A., Schunn, C. D., Flot, J., & Shoop, R. (October, 2013) *The role of physicality in rich programming environments..* Computer Science Education, 23(4), 315-331.

Liu, A., Newsom, J., Schunn, C., Shoop, R. (March, 2013) *Students Learn Programming Faster through Robotic Simulation.* Tech Directions , 16-19.

Liu, A., Newsom, J., Schunn, C., Shoop, R. (May/June 2013) *Learn to program in half the time!. Robot Magazine,* 49-51.

Download copies of the articles at: <http://www.cs2n.org/teachers/research>



What is Palm Island?

Palm Island is a RVW designed to provide new programmers with an interesting and fun programming environment.

The level design of Palm Island features a path that includes collectible objects and additional starting points making it ideal for teaching introductory programming concepts such as:

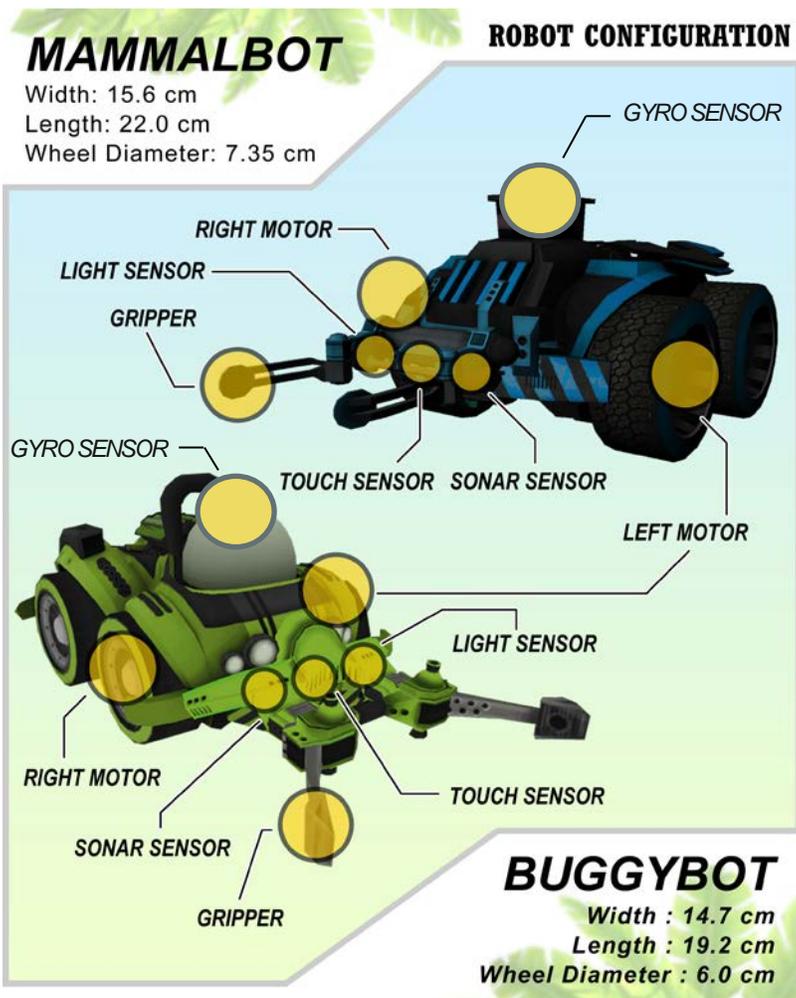
- path planning,
- encoder based movements,
- and sensor controlled movements.



Pictured below are large coconuts that the robot collects.



At the right is a robot setting the lobster trap by pushing it off the deck and into the water.



The game includes two different robots, their sensor types and locations, and the physical size of each robot.

Logging In and Saving Progress

When the Palm Island virtual world opens, you will be presented with the user interface below. The following pages will familiarize you with many of the controls and game mechanics of Palm Island.

How you log in determines how your progress is saved. **Make sure that you log in to save your progress in the game**



1 Log into CS2N (*Teacher Note*)

If a teacher wants to track all of her students' progress on one screen, then they will want their students to setup CS2N accounts. When students log in with their own CS2N account, their progress is tracked and stored via the CS2N network. This lets students continue their progress, even on a different computer.

Create a CS2N account at <http://www.cs2n.org/signup> (users will need an email address)

For teachers to see all of their student's progress they will need to create a CS2N Group. Learn more at www.cs2n.org/teachers/groups

2 No Internet - Log in locally

A local log in allows you to save your progress on a local machine. You will need to use the same computer every day to take advantage of this feature.

3 Log in as guest

Within the LOCAL button, there is an option to log in as guest. Logging in as a guest allows you to preview or demonstrate the game, but once the game is closed no progress will be saved. You typically will not want to use this option, as all progress will be lost if the application is closed, even accidentally.

Tracking Your Performance

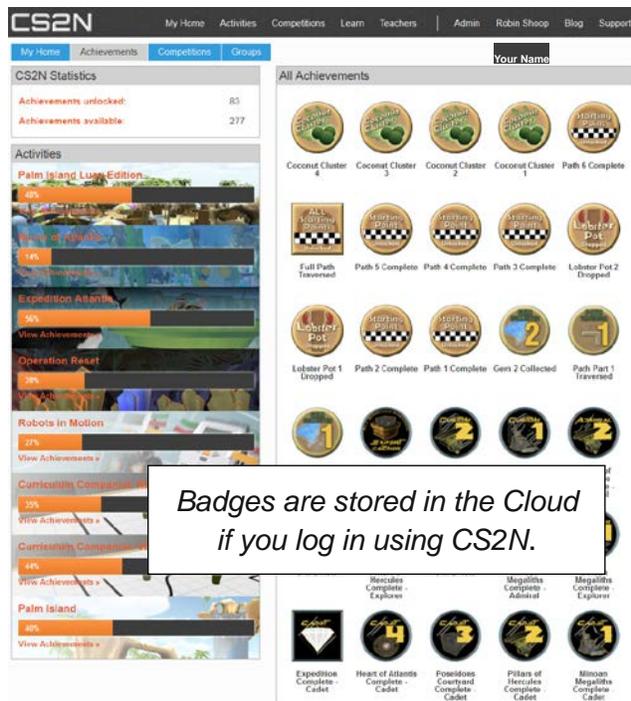
Badges and Achievements

The Computer Science Student Network (CS2N) contains free activities, courses, and resources for you to learn about Robotics and Programming.

Teacher Note: Teachers can use CS2N to create a Group and keep track of their students progress.

Robot Virtual Worlds give out badges upon completing certain tasks or behaviors.

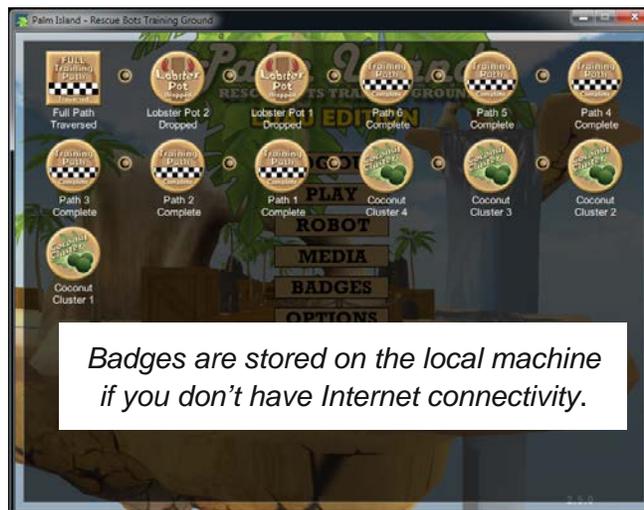
CS2N is able to keep track of your Robot Virtual Worlds Achievements (or badges) once a CS2N account is created. Go to CS2N.org to create an account and begin getting achievements.



No Internet connection?

Achievements can also be obtained by creating a Local account. This is useful for computers that are not connected to the Internet. You can do this by simply selecting the "Create Local Account" option.

Your achievements are stored on the local computer and viewable in the BADGES menu. From there you can also generate a PDF of your achievements which can be saved and printed.



Palm Island Badges



Optimizing for Computer Performance

Robot Virtual Worlds are built using a simulated physics and gaming engine, and have similar computer processing demands as a video game. To allow the RVWs to be run on a wider variety of computer hardware, graphics quality settings are included. You'll find these controls in the OPTIONS menu.



VISUAL EFFECTS: This toggle controls whether the game plays certain animations, such as the water effects and seagulls. Toggle it off if your computer has limited graphics processing power, or your notice inconsistency in your robots behavior.

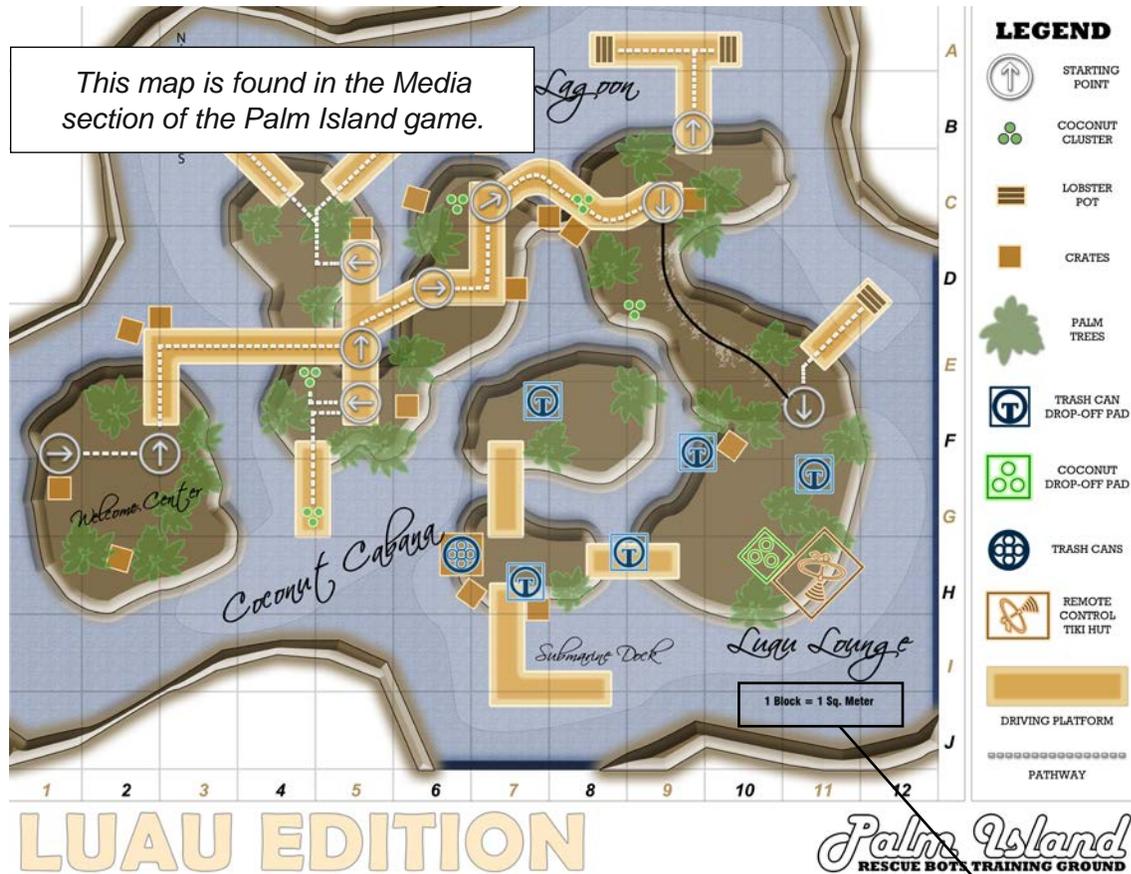
SOUND EFFECTS: This toggle controls the in-game sounds. We recommend toggling this off if your computer lab does not have headphones for each station.

GRAPHICS QUALITY:

- **LOW (FASTER)** - Reduces the visual quality of the virtual world. Better for computers with limited graphics processing power
- **MEDIUM** - Default setting. Balances the visual quality of the virtual world with graphics processing demands.
- **HIGH (SLOWER)** - Improves the visual quality of the virtual world. Better for computers with sufficient graphics processing power

Printable World Map

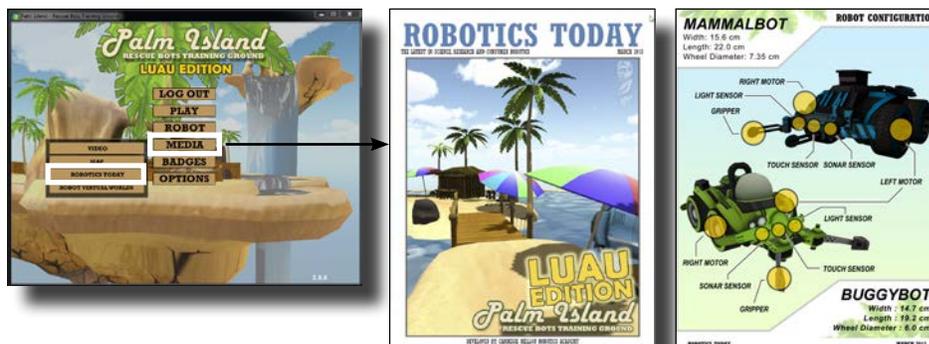
In the MEDIA section of the menu, you'll find a high resolution, printable map of Palm Island. The map contains key information such as the distances and angles the robots will need to move and the physical characteristics of their robots. This information allows you to make informed decisions as you program.



The scale of the map.

Robot Sizes

Robot sizes and sensor locations can be found in the *Robotics Today* magazine located in the media section.



User Interface: Game Controls

Every Robot Virtual World includes Game Controls. The Game Controls allow you to choose when the programs you download are run by the virtual robot, to reset the virtual robot to a starting point, and to return to the main menu. In Palm Island, they are located in the lower-left corner of the screen.



 Play / Pause: This button will run the program currently selected (or most recently downloaded) to your programming software. Once a program is running, it will switch to a Pause symbol; press it to halt a running program.

 Reset: This button will stop a running program and reset the robot to its original starting point and orientation.

 Home: This button will stop a running program and return you to the main menu of Palm Island

User Interface: Camera Controls

Every Robot Virtual World includes Camera Controls. The Camera Controls allow you to change your view of the virtual world. In Palm Island, they are located in the lower-right corner of the screen.



 Camera 1: This is the default game camera. It will “follow” the robot from behind as it moves in the virtual world. You can zoom in and out using the scroll wheel on your mouse.

 Camera 2: This provides a static, top-down view of the robot in the virtual world.

 Camera 3: Like Camera 1, this camera will follow the robot as it moves in the virtual world. Using Camera 3, you can also click-and-drag in the virtual world to change your viewing angle of the robot.

User Interface: Measurement Toolkit

Every Robot Virtual World includes the Measurement Toolkit. The Measurement Toolkit allows you to obtain key distances and angles from the virtual environment, crucial for robot path planning, by placing markers in the world.

In Palm Island, they are located on the lower-left-center of the screen.



SHOW Show: This button toggles the Measurement Toolkit on and off. You must press it to enable the Measurement Toolkit. If there are key objects in the environment, such as gems, the distance and angle to them from the robot will be displayed automatically.

ADD Add: Press this button to put your cursor in “marker adding mode”. Click anywhere in the virtual world to add a marker, which will display its distance and delta angle from the robot. A series of up to 3 markers can be added at a time.

CLEAR Clear: Pressing this button will remove the markers you have placed in the virtual world. Right-clicking while in “marker adding mode” will also remove the most recently created point.

User Interface: Heads-Up Display

As you explore Palm Island, you will encounter coconuts, lobster traps, and trash cans. As you collect or move the items, one of the round shapes in the Heads-Up Display will fill in allowing you to track how many coconuts, lobster pots, or trash cans you have collected. The robot collects coconuts by driving into them, sets lobster pots by pushing them into the water, and scores trash cans by moving them into their correct positions.



If you are logged in locally or via CS2N, you will be awarded an achievement for every item collected. In the example above the player has collected four coconut clusters and set two lobster pots. They are about to pickup a trash can and move it to an assigned area on the island.

User Interface: In-game Map

As you explore Palm Island, your robot will unlock additional “Start-Points” along the path. Locked Start-Points appear as white circles with an arrow, and switch to yellow once they are unlocked. The robot unlocks the Start-Points by driving over them.



Pictured at the left is an in-game locked Start-Point



Once a Start-Point has been unlocked, it can be selected from the in-game map. Clicking one of the blue start-point buttons will transport the robot to the corresponding location in the world. This is a very useful tool, as programming the robot to move through the world can be a tedious process if you have to start at the beginning every time.

If you are logged in locally or via CS2N, you will be awarded an achievement for every Start-Point unlocked. Unlocked Start-Points are saved across sessions.

Use Mathematical Programming Solutions

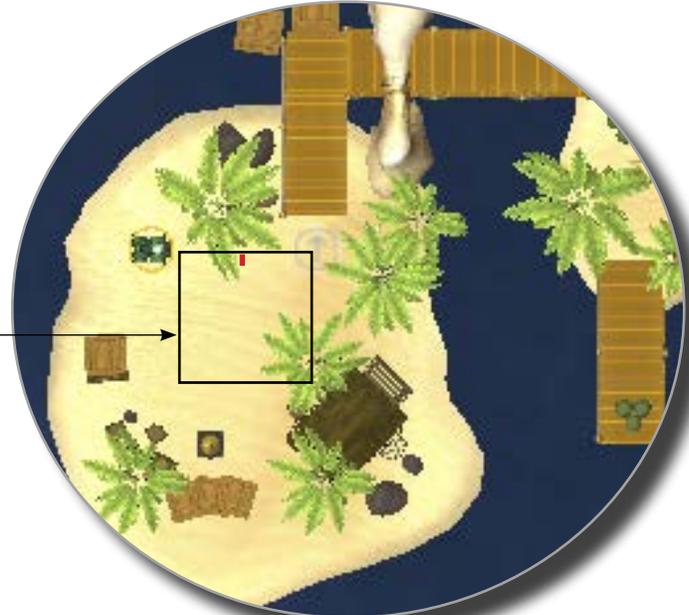
Picture below is the Palm Island map.



Each grid is approximately 100cm by 100cm.

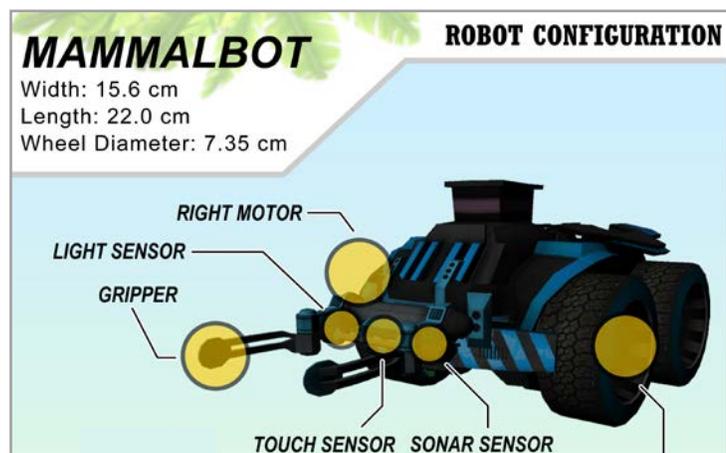


Pictured above (blue) is an in-game zoomed-out plan view of Palm Island.



Pictured above are the two types of maps found in Palm Island. Note that the printable map is broken into grids. Use a combination of the dimensions on the map, each robot's physical size, and the Measurement Toolkit for path planning.

Robot sizes can be found in the media section in the Robotics Today magazine.

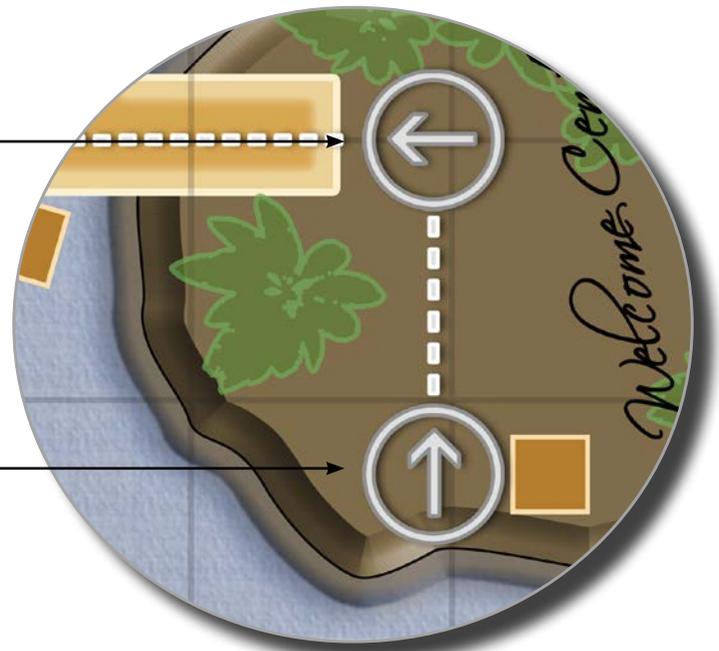


Use Mathematical Programming Solutions



The first Start-Point to unlock is here

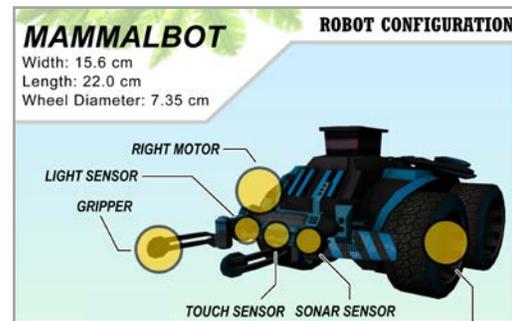
Buggybot robot starts here



The picture above left is a zoomed-out in-game top view of the first challenge, unlock the first Start-Point.

Pictured at the right is the Grid Map which will provide you with approximate distances. Using the in-game Measurement Toolkit tells us that the distance is around .82 meters away or 82 cm.

Each grid on the map is 100cm by 100 cm.



Robot Specifications - wheel dia. 7.35 cm

The example problem uses the Mammalbot robot. Its specifications tell us that it has a 7.35 centimeter wheel diameter. With this information we can find the circumference of the wheel and then how many rotations it will take to move the 82 centimeter distance. See the calculations below:

$$\begin{aligned} \text{Circumference} &= \pi * \text{Diameter} \\ \text{Circumference} &= 3.14 * 7.35 \text{ cm} \\ \text{Circumference} &= \mathbf{23.07 \text{ cm}} \end{aligned}$$

$$\frac{82 \text{ cm distance}}{23.07 \text{ cm circumference}} = \mathbf{3.5 \text{ wheel rotations}}$$

Mammalbot will have to travel **about 3.5 wheel rotations** to move from the start point to the new start point.

Use Start-Points to Solve the Programming Problem

Robot Virtual World games saves your game state (where you left off in the programming challenge) as long as you log in correctly.

If you log into CS2N, or if you create a local account, your progress will be stored.

There are ten different Start-Points that can be unlocked in the game. This page shows how you can break the journey from the Palm Island Welcome Center to the other side of the Island into five smaller programs that can be solved in multiple sittings.



1. You made it to the first start point!



In the picture above, potential Start-Points are indicated by the circles with white arrows in them.



2. Select the map button and you will find that you can choose start in two different spots.



3. Select the new Start-Point to begin your next programming challenge.



4. Your robot is now ready to enter the boardwalk.

Break Programs into Behaviors



Complex Program Are Made Up of Small Behaviors

The first programming challenge was to drive your robot straight for a controlled distance. The second challenge is to drive your robot on the boardwalk. This consists of three programmed behaviors:

1. Drive straight
2. Turn 90 degrees
3. Drive to the new Start-point



Begin by opening the Measurement Toolkit to see how far the robot needs to travel. Write that code and test it. If the code doesn't work, find your mistake, fix it, and test it again.