

Introduction to Robotics 101

Why do Robots need to move?

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Robot definition

- **Sensory Input** – a robot has to take in information about its environment.
- **Plan/Programming** – a robot has to use this information to make a decision.
- **Action** – a robot needs moving parts to carry out commands.
- **Design** – the build of the robot coordinates with the robot's action.

How do robots move?

- Rotate
- Convey
- Walk
- Swim
- Fly
- Reach
- Bend
- Poke
- Roll

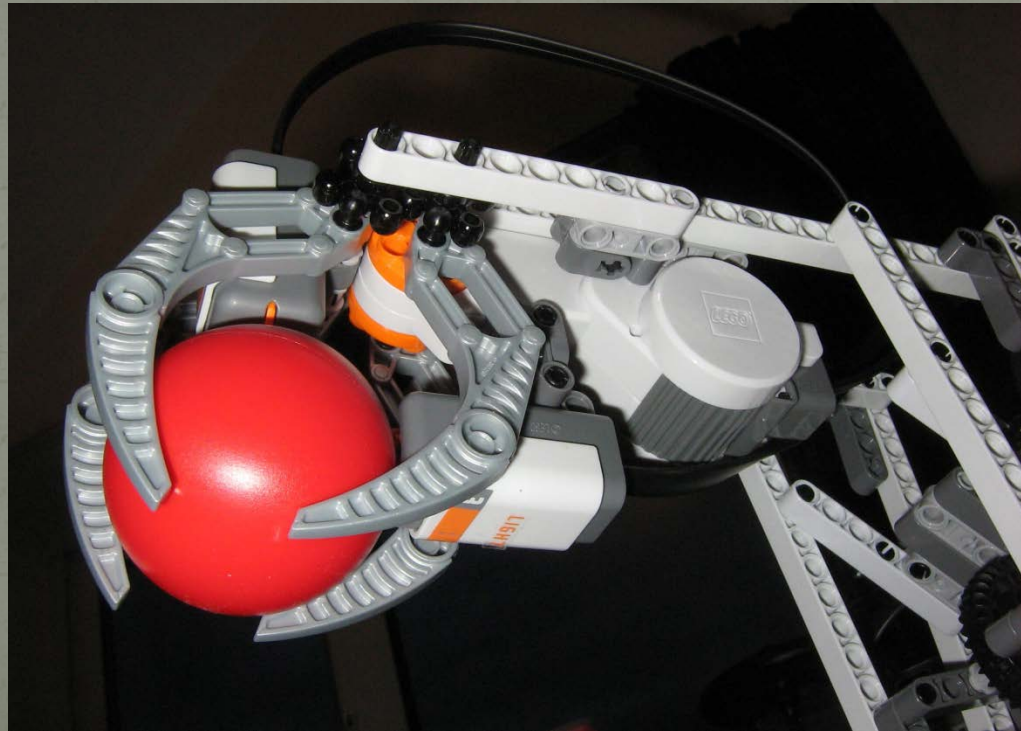


- Remote
- Grasp
- Spin
- Gear ratio



Manipulate Objects and Movement

- Your NXT robot will use arms, belts, or other designs to move objects from place to place.



Mobility:

Why robots go from place to place?

- Transport Goods and Materials
- Carry Messages
- Get places faster
- Complete task while moving from place to place.
- Collect information (sensory input)
- Get away from something

Mobility:

Most robots roll to get around.

- Walking- hard, requires balance.
- Swimming- only works in water
- Flying- requires a lot of speed and energy
- Wheels and treads make moving over uneven ground easier
- They provide stability with multiple points at which contact with ground is made.

How do rolling robots work?

- Sensors
- Motors
- Wheels
- Programming!



Main Components of Robotics

- **Build** – Mechanics, Mathematics, Physics
- **Program** – Building behaviors
- **Test** – Multiple trials
- **Communicate** – What did you work on or accomplish? What conclusions did you come to?
- **Modify & Test Again!**

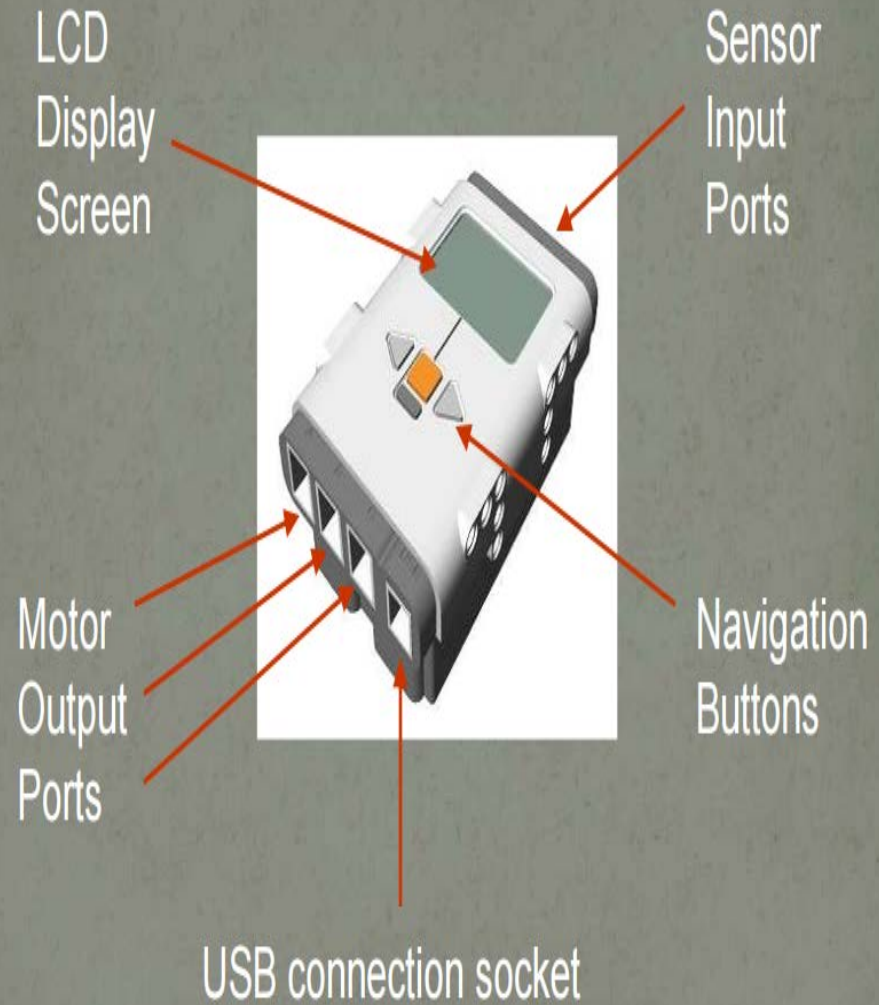
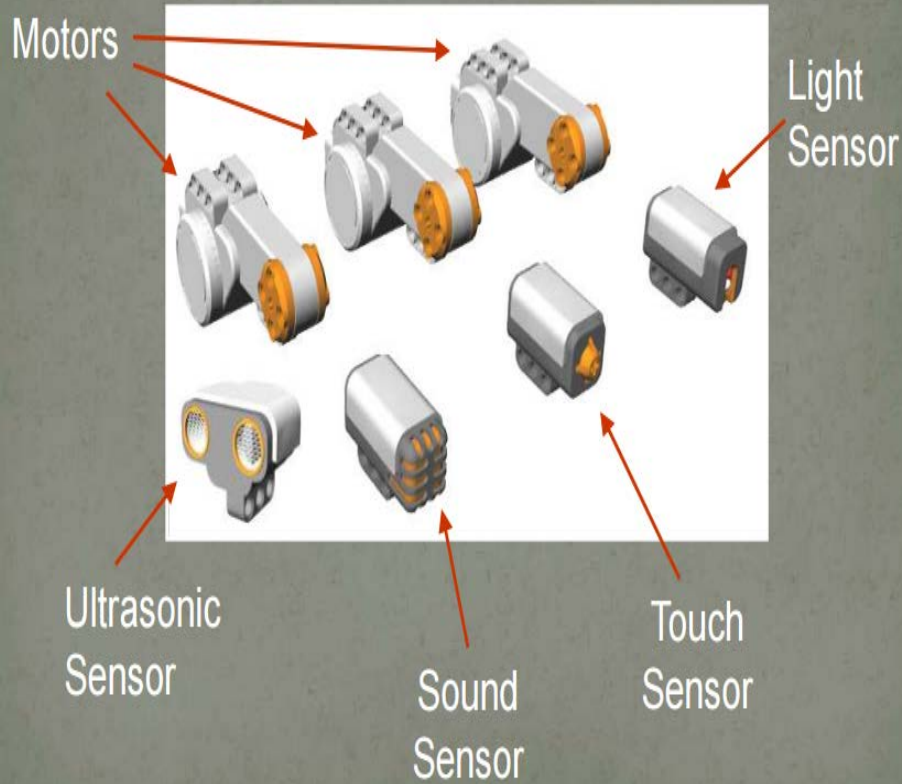
Building

We will be using LEGO® pieces to build our robots

- Gears and axles
- Beams and connectors
- Motors and wheels
- Sensors and wires
- NXT programmable brick

Building *LEGO® NXT*

Building *LEGO® Motors and Sensors*



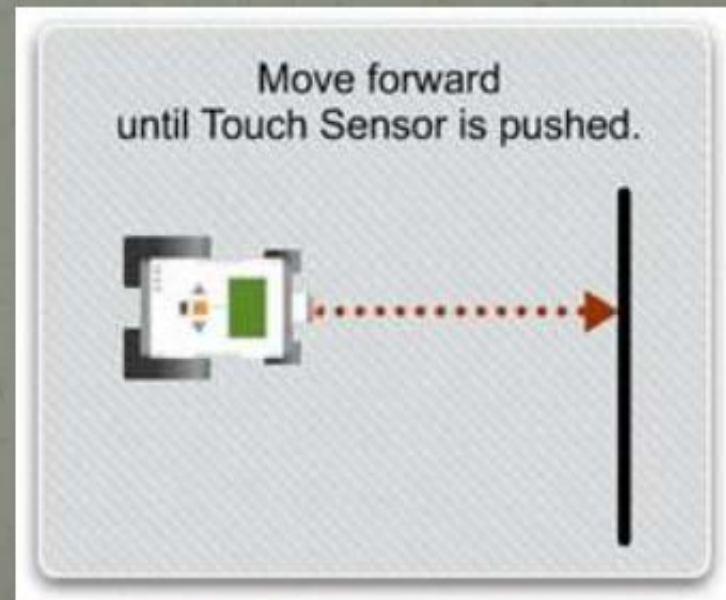
Programming Behaviors

- Giving the robot behaviors
- Complex behaviors are built from simple ones

The basic behavior...

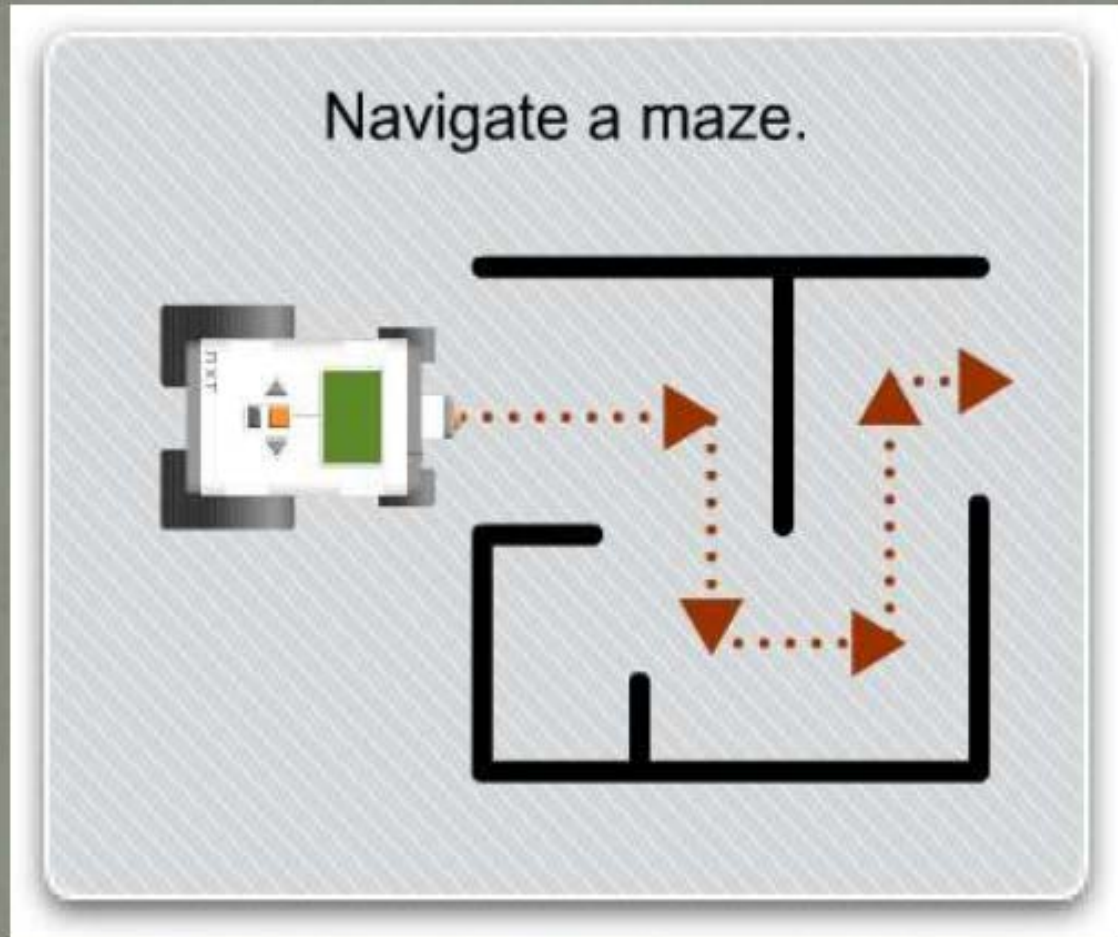


is used in the simple behavior:



Programming

...which is used in the complex behavior:



Programming Screen Interface

Blocks



The screenshot displays a programming environment with a menu bar (File, Edit, Tools, Help) and a toolbar. A 'User Profile' dropdown is set to 'Default'. The main workspace is a grid labeled 'Programming Area'. On the left, a 'Common' block palette contains various icons: a gear, a red arrow, a speaker, a monitor, a document, a refresh symbol, and a search icon. In the center of the grid, two motor blocks are connected in sequence. The first block is green and labeled 'B', and the second is blue and labeled 'C'. Both blocks have a gear icon and a play button. At the bottom, a 'Properties Area' is visible, containing a 'Motor Block' description: 'This block allows for precise control of one motor's speed. You can "ramp up" to a set speed or "ramp down" to a stop. By de-selecting "wait for completion," your program can move on to the next block once the Motor block has started a motor.' A 'More help >' link is provided at the end of the text.

Properties Area

Motor Block

This block allows for precise control of one motor's speed. You can "ramp up" to a set speed or "ramp down" to a stop. By de-selecting "wait for completion," your program can move on to the next block once the Motor block has started a motor.

[More help >](#)

Testing *Why do we test?*

- Make sure it works!
- Understand what it can do
- Test everything multiple times to determine the repeatability
- Use the robot to test other phenomena

Testing

- When we test, we take data (numbers)
- We write our numbers down in organized charts
- We write down everything we can about the experiment
- Look at our data after we're finished

What is Engineering?

- Problem solving
- Teamwork
- Time management
- Testing
- Doing it over if it doesn't work correctly the first time!