Robotics Exploration

Workshop

For NJIT Summer Group

By Storming Robots

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OUTCOME OF THE WORKSHOP

Upon completion of today's workshop, you should:

1. Have a correct understanding about what a robot is;
2. Know the difference in programming behaviors : simple to complex
3. Be able to conduct basic motion navigation using Mindstorms Technology
4. Have rudimentary level of understanding in robotics programming using RobotC including:
    - motor control
    - simple program flow
    - simple programming flowchart (Tentative)
    - light sensor feedback control (Tentative)
    - simple loop structure

A.2- TASKS

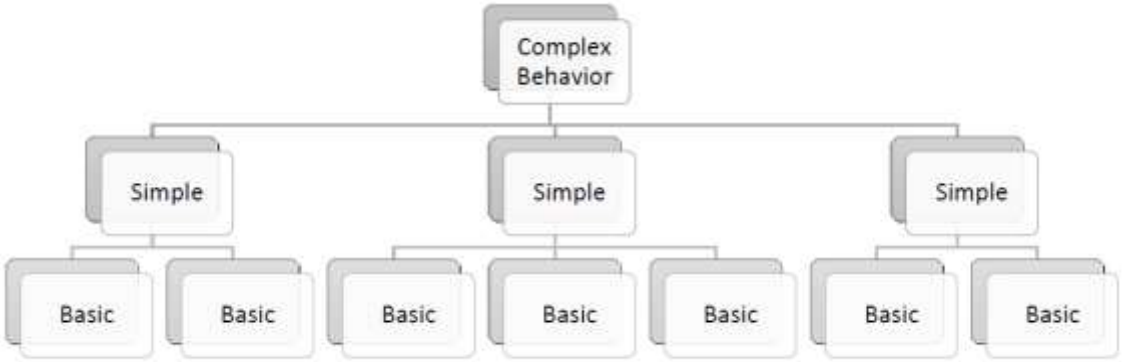
1. A short Math/Logic Evaluation.
2. Discuss programming behaviors.
3. Learn Programming Structure
4. Build your robot
5. Learn Basic Motion Navigation
6. Learn about Flowchart Design(Tentative)
7. Practice Basic motion navigation.
8. Learn about using reflective sensor feedback (Tentative)
9. Mini-Contest
10. Review your day – a simple engineering journal

A. SIMPLE TO COMPLEX BEHAVIORS

A behavior is really anything that your robot does:

- Turning on a single motor is a behavior
- Moving forward is a behavior
- Tracking a line is a behavior
- Navigating a maze is a behavior

There are three main types of behaviors – Basic, Simple, and Complex. In order to program efficiently, it is important to break behaviors from complex down to basic. This will save you a lot of headaches when issues arise.



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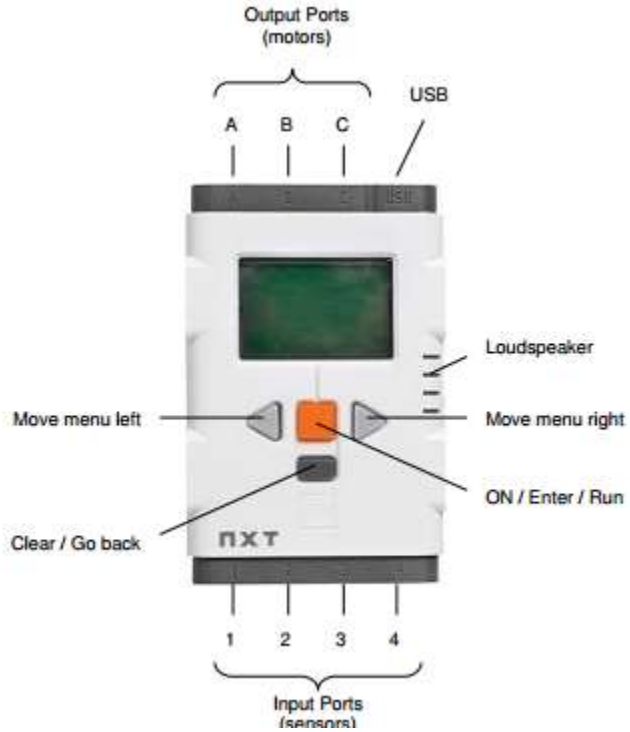
MEET THE ROBOT CONTROLLER (THE BRAIN)



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BASIC BUILDING TIPS

- Interlocking
- Triangular bracing vs Rectangular bracing
- Using Gear System to transmit motion.

Go on http://bi.stormingrobots.com

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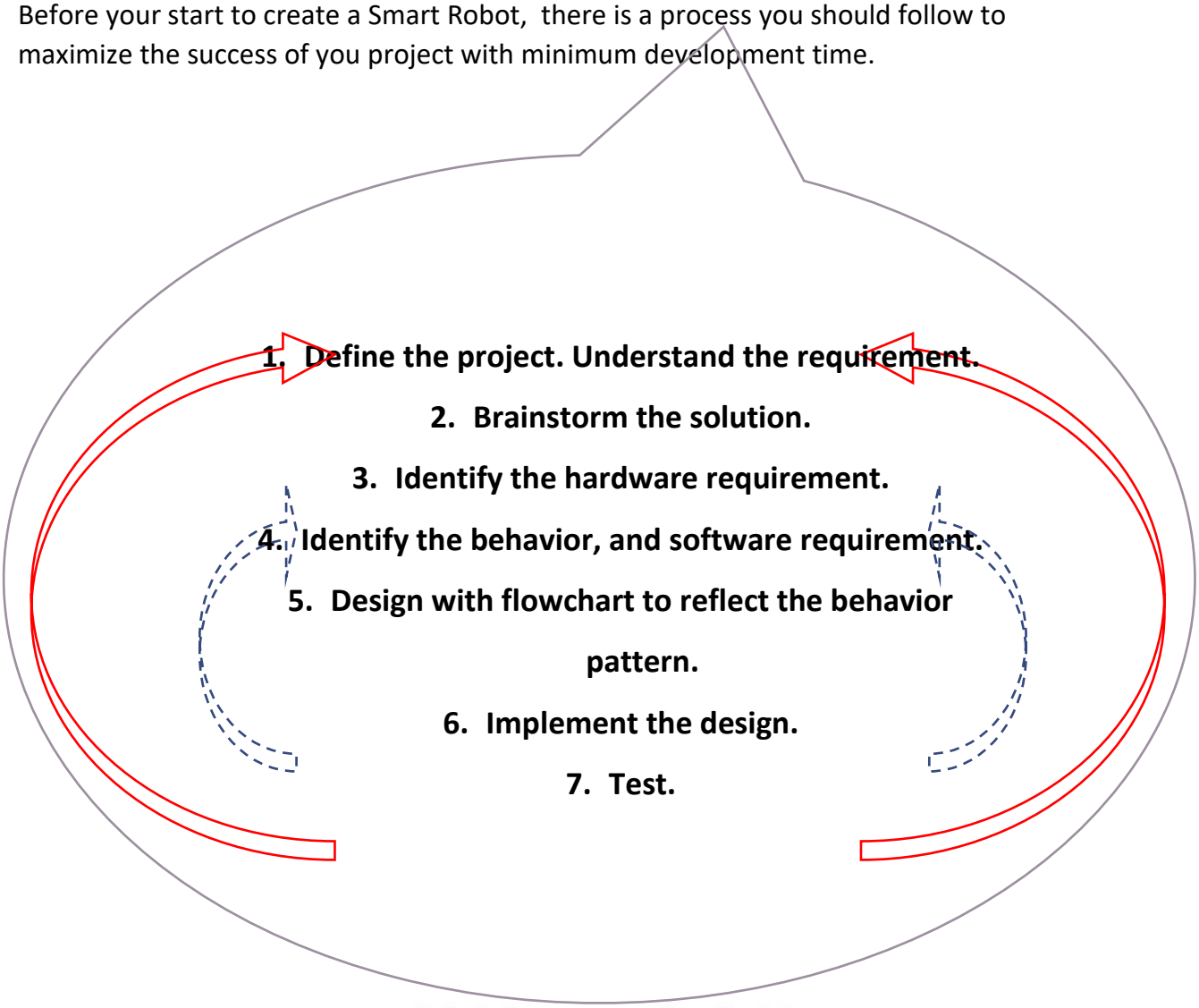
THE ENGINEERING PROCESS

Before your start to create a Smart Robot, there is a process you should follow to maximize the success of you project with minimum development time.



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DESIGN WITH FLOWCHART

This is for the step 5 from the engineering Process.

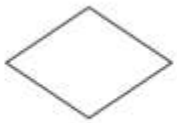
E.1- WHAT IS A FLOWCHART?

A flowchart illustrates the steps in a process. It is a *diagram of the "flow" of the process*. By visualizing the process, a flowchart can quickly help identify bottlenecks or **inefficiencies** where the process can be streamlined or improved.

Flowcharts use special shapes to represent various tasks, decisions, and steps in a process. Lines and arrows represent the sequence of the steps, and the relationship among them.

There are many symbols in traditional flowcharting. However, for simplicity and practicality, we shall only use some of the common ones.

A flowchart visually represents and organizes the steps used to write the program. When programmers write code, they need to give the robot instructions that are both sequential and specific. Flowcharts enable programmers to work these steps out before needing to translate their behaviors into code.

				
Start / End	Process/Action	Conditions/Decisions	Flow Line	Wait /Sleep
This symbol can be also called a terminator which marks the starting or ending point of the system. It usually contains the word "Start" or "End".	This can represent a single step, such as "go forward", or a sub-process, such as "make a 90 degrees left turn"	This can be called a decision or branching point. Lines representing different decisions emerge from different points of the diamond.	Lines indicate the sequence of steps, the direction of flow. Sometimes, you can use this to indicate "loops".	This indicates a delay in a process, such as "wait for second"

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WHY FLOWCHART IS IMPORTANT FOR WRITING SMART PROGRAM?

- Will shorten your development time in a long run.
- Clarify the logic.
- Help you to break down the logic into smaller parts (Modularize!)
- Immense help in troubleshooting/debugging
- Spot problematic parts more effectively
- Increase accuracy
- Help to build test cases

I can go on and on for its advantages…. Last but not least…. SAVE YOUR SANITY especially when your project becomes more complex!

B. Development Process for Programming

Before you program your robot, you need to the know the proper steps to follow for tackling a challenge

	1. Define the objective a. What is the main goal you are trying to achieve
	2. Analyze the logic: a. What is required b. Steps to follow
	3. Design Flowchart a. Put logic in symbols b. Hand check the logic i.e. Examine the objective of the program and see how the program may reflect your robot's behavior
	4. Programming Complete your program at the computer. Download the program to the robot.
	5. Execute ⌖ Run your program. (e.g. Put the robot on the floor, then press "Run" button.)
	6. Test/Trouble-Shoot Possible questions that you will ask yourself when result does not meet the requirement: Hardware: ⌖ Check the connections of the motors. ⌖ Are you assigning the correct motors and/or sensors? Software: ⌖ Clearly define the symptom of an issue ⌖ Focus on Cause and Effect.

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CHALLENGE FOR TODAY

Game: Don't Run Over the LEGO Man

Scoring:

- Everyone starts with 50 points
- Distance from the LEGO man after robot stops: -5 points per centimeter.
- If the LEGO Man is knocked, all 50 points will be removed.

Your robot runs as fast as possible… but watch out for the LEGO Man!

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