71 Things to do with LEGO Mindstorms and Data

 The 2007 LEGO Engineering Symposium held at Tufts University specifically focused on how the data collection capabilities of LEGO Mindstorms can create powerful learning experiences for students.  Participants in the symposium spent 3 days thinking about inspirational ideas that engage students in learning and teach powerful ideas from math, science, technology, engineering, and more.   The following list summarizes the ideas that came out of the 2007 LEGO Engineering Symposium.

 1. Explore
• Go on a light sensor scavenger hunt
• Log temperature measurements while you go on a walk
• Investigate the voltage at various points on a circuit
• Measure and record the pH, dissolved oxygen and turbidity of different water samples
• Collect data from entire class from one computer (NXT Bluetooth)
• Students giving instant feedback to teacher (using NXT to communicate answer to a class question)

2. Build understandings
• Collect acceleration data
o while driving in a car
o in a football being thrown across the room
o while riding on a roller coaster
o jumping off a table
• Take light and temperature readings overnight and compare the graphs
• Compare the number of motor rotations needed to drive 1 meter with wheels of different sizes
• Compare the time it takes cars with different gear ratios to travel 1 meter.
• Examine fluorescent and incandescent light frequencies (powered by AC currents)
• What’s a spring constant? Investigate Hooke’s Law using a spring and a light or ultrasonic sensor.
• Swarming robots (similar to ants or other insects where 1 NXT can communicate with 3 others and so on)
• Measure small distances
• Measure period of a pendulum
• Measure compression
• Measure a force
• Measuring the turbidity of water with a light sensor.

3. Answer Questions
• What’s the warmest place in this classroom?
• What’s the noisiest room in the school?
• Make your own voting booth - Do more people like chocolate or vanilla ice cream?
• How often does the classroom guinea pig take a drink of water? How much does she run on her wheel?
• What door did a burglar with a flashlight enter through?
• What’s the best heat insulator for a cup of hot chocolate?
• Is the speed of a fan related to how fast things cool down?
• What’s the best noise insulator for a room?
• How far has my robot traveled? How fast does my robot move?
• Finding a hidden letter real-time using Bluetooth
• Whodunit games where partner leaves room with NXT with sensors and the other partner has to guess what they are sensing
• Calculate how much time it takes for a ball to drop from a height of 4 ft.
• How long does it take to dissolve an egg in vinegar? (monitor light that can pass through with a light sensor)
• Do different colors of paper reflect different amounts of light?
• Where is the best place in a room to put a fan? (Temperature explorations)
• What’s the best type of insulation? (Temperature explorations)
• What time of day does the most traffic pass by our classroom?  (using sound sensor)

4. Monitor experiments
• Track the temperature and light levels for plants in different experimental conditions
• Compare the reflex times of classmates before and after lunch
• Develop a device to track how the lengths of shadows change during the day. 7

5. Put sensors in motion
• Build a boat to drive out to the middle of a pond and take pH readings all day
• Build your own Mars Rover to take light and temperature readings in a “remote” location
? Send Mars Rover Sensor information remotely back to another NXT or computer
• Build an archeology robot that will explore a hidden ‘tomb’ and identify potential hazards within the tomb
• Use a touch sensor to make a bumper-car that will map an area in the room, based on how often it runs into obstacles.
• Create a CSI-bot to investigate staged crime scenes and gather evidence.
• Launch a submarine robot to determine dissolved oxygen content of a water supply what areas should be targeted for remediation.
• Use a robot to determine the topography of an elevation map or model.

6. Design your own sensing system
• Build a device to monitor how many people walk through a door
• Create a method of measuring frictional losses in flow in tubes
• Build a device to measure rainfall
• Create an anemometer to measure wind speed
• Build a LEGO Brick separator and record the force needed to pull apart different LEGO bricks
• Traffic monitor (sound sensor near street sending information to classroom computer)
• Door alarm or monitor (with data recording)
• Security dog (1 NXT has all sensors and is “guarding prized object” once a sensor is triggered by burglar another NXT is alerted via Bluetooth to go rescue)
• Build a sundial and log light data
• Create a vehicle that can log magnetic fields and map out a minefield
• Battleship type game with a rover.
• Make a device to monitor water level (using an ultrasonic sensor or light sensor)
• Monitor bird calls using a sound sensor
• Create a sensor to monitor an arm wrestling game. Students have to look at the data to find out who won
• Developing swarming robots that will identify overheating servers in a computer room.

7. Monitor your engineered creations
• Data log how quickly your Hot Chocolate Blower 2000 cools down a cup of hot chocolate
• Build a system to keep the temperature in mini green house at a temperature ideal for optimal growth of your favorite plant.
• Measure the turbidity of water that’s been through your newly designed water filtration system
• What’s the maximum acceleration that your newly designed NXT –car seatbelt fails at?
• Design a seat belt system and measure the acceleration needed to trigger it
• Build a walking robot – attach and log rotation sensor data to see how it moves
• Through detecting the weight and shape of LEGO bricks, build a robotic arm to sort LEGO bricks.  Data log the types of bricks that have been sorted.
• Design a restaurant robot that will ensure your coffee is made just the way you like it. Keep a running log of temperature or pH data to make sure you robot is working properly.