IEEE Control Systems Society Education and Outreach @ UTSA

Day #1

Introduction to LEGO Mindstorms, Sensors, Motors, and Car racing

This handout can also be found on this weblink: http://tiny.cc/ieee_day1

Day 1, Session 1: 10:00 AM – 12:00 PM

Task 0: Getting ready

Teaming up

Team up with your friends into groups of 4 or 5 (4 is ideal). If you are not able to find a group call the TA and she/he will help you. Give your team a name. Remember if you have any concerns or issues anytime, please seek the help from the TA and she/he will help you out.

Logging into UTSA machines

The teaching assistant will provide you with a username and password. This will get you access to the UTSA computer. IMPORTANT: Periodically save you work (lego files) to an email account because your work will get deleted the moment you log off the computer.

Complete the pre-camp survey

IMPORTANT: Please complete this short pre-camp survey. Each student should complete the survey independently. https://goo.gl/gm932P

Task 1: Understanding what's in the box given to you

The equipment given to you includes:

- **Boxes:** 1 LEGO Core set. Information about parts is here https://education.lego.com/en-us/products/lego-mindstorms-education-ev3-core-set-/5003400 (If the link is dead search for LEGO Core Set). See Figures 1.

- **Computer:** 1 NXT Brick and 1 USB cable to connect brick to your computer.

- **Actuators:** 2 large motors and 1 medium size motor.

- **Sensors:** 1 Color sensor, 1 Gyro sensor, 1 Ultrasonic Sensor, 1 Infraredsensor, 1 Touch Sensor, Cables to connect sensors to bricks

- **Battery:** 1 Rechargeable battery and charger

Question: Can you identify the different sensors and motors in Fig. 1 (bottom picture)?

Task 1: Take a blank piece of paper from the TA and write the name of your team and names of team members. Tape the paper to the inside of the box. That way when we return the box to you tomorrow, you can easily identify your box.

HINT: Look at this link: http://www.lego.com/en-us/mindstorms/products/mindstorms-ev3-31313 (If the link is dead search for LEGO Mindstorms EV3).
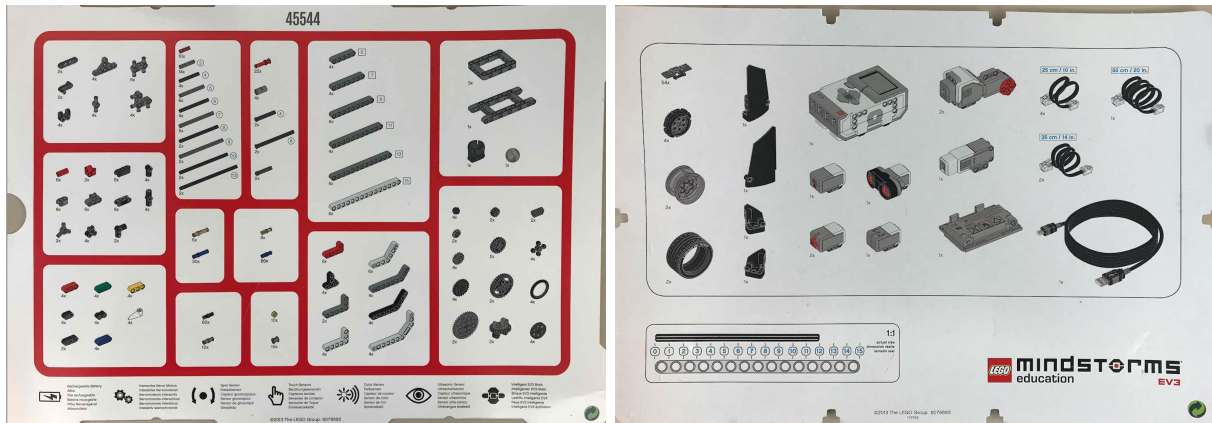

Figure 1: This picture shows descriptions of components in the boxes.

Task 2: Introduction to brick programing

This video shows how to write a basic program that plays a sound using the brick.
Video: https://youtu.be/81hctQt6Cp8 (Duration: 4 min 29 sec)
Task 2: Follow the video and show your work to the teaching assistant.

Task 3: Introduction to sensors

Programming the touch sensor

This video shows you how to program a touch sensor
Video: https://youtu.be/QYHYA-_d-8M (Duration: 5 min 17 sec).
Task 3a: Follow the video and show your work to the teaching assistant.

Programming color sensor

Program the brick so that when the color sensor is shown one of the three colors; red, green, and blue; it is displayed on the brick. The TA will test the program by showing one of the three colors to the color sensor. Ask the TA to give you the color chart.
Task 3b: Call the TA once you are ready to demonstrate.

Day 1, Session 2: 1:00 PM – 2:30 PM

Task 4: Introduction to motors

Programming motors

The video shows you how to make a motor move. At the end of this video you will be able to control the speed (magnitude and duration), and also control the angle of spin.
Video: https://youtu.be/liKa_I55ADM (Duration: 4 min 58 sec).
Task 4: Show this to the teaching assistant.

Develop a mobile car

1. Build the car shown here: https://youtu.be/HsLqiShzP0k or use the booklet provided to you in the box (Duration 2 min 42 sec).

2. Program the car to move in the following fashion: (1) move straight for 2 seconds; (2) take a 90 turn to the right; (3) move straight for 2 seconds; (4) come to a stop. *HINT:* See the tutorial here. https://youtu.be/8C01X72_Xfk (Duration: 3 min 29 sec).

Day 1, Session 3: 3:00 PM – 4:15 PM

Task 5: Car racing

Reacting to sensor measurements

The next task is a race that will be played by all teams together as shown in Fig. 2. The goal is to program your car to move from start to end as shown. The moment the TA says "Go" you will press a button on the brick initiating your car to move in a straight line towards the a red line as shown. The car which comes to a complete stop on the red line (color sensor on the car should be above the red line) first will be declared a winner.
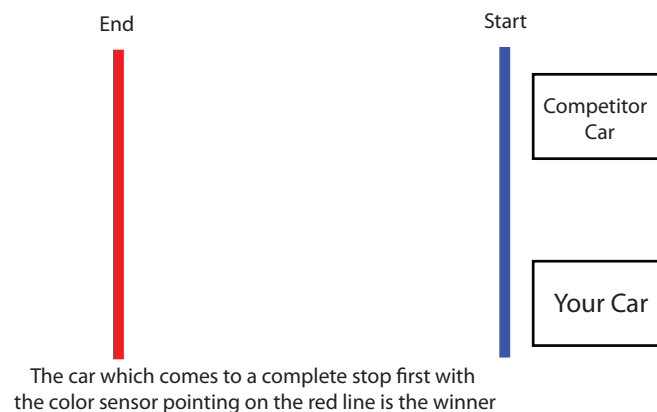

Figure 2: Car racing conceptual diagram.

Packing up

Do not dis-assemble your car robot. You will need it tomorrow. Please ensure that your team's name and team member names are inside the box. Please return the box to the TA.