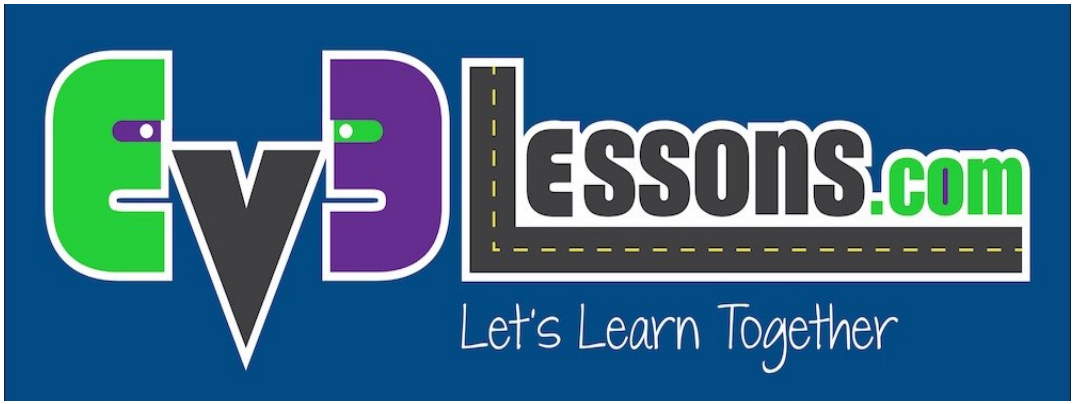
INTERMEDIATE PROGRAMMING LESSON



IMPROVING PROGRAM RELIABILITY

By Sanjay and Arvind Seshan

Lesson Objectives

1. Learn how to make your robot more reliable
2. Learn about common problems you might face
3. Learn some possible solutions

Note: This lesson focuses on reliability issues faced by FIRST LEGO League teams. Many concepts are applicable to non-competition situations, but the terminology in the lesson and the main focus is for competition robots.

Sources of Problems

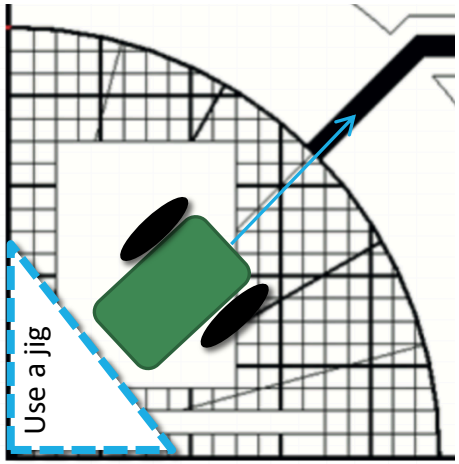
Problem	Impact
Starting alignment varies from run to run	Each run is different and missions sometimes work.
Robots don't travel straight for long or turn exactly the same amount	It is hard to predict the robot location exactly.
Errors accumulate as you travel	Long missions tend to fail. It is hard to do missions far from Launch/Home
Battery levels impact motor performance	Tweaks that work today fail tomorrow

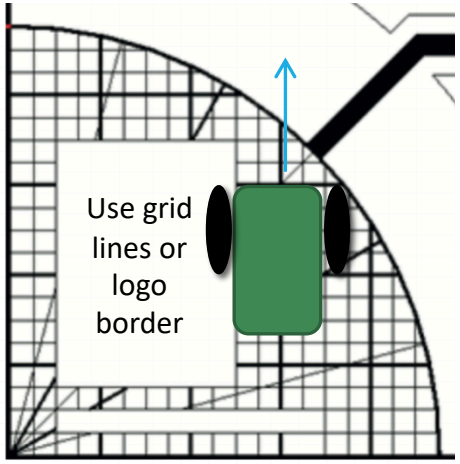
Starting Points in Launch are Critical

In FIRST LEGO League, teams need to figure out where to start in base

- Jigs: a LEGO ruler/wall that your robot can align against them in base
- Same start each time: pick one spot and start there no matter what the mission for easy starts
- Grid/Radial Lines: Use the grid lines to pick a starting spot for each run
- Words: Launch has grid lines and a FIRST LEGO League logo. If you aren't near an inch mark, pick a word or letter to start on.

Even better, try to find a way to align the robot using other techniques (see next page)

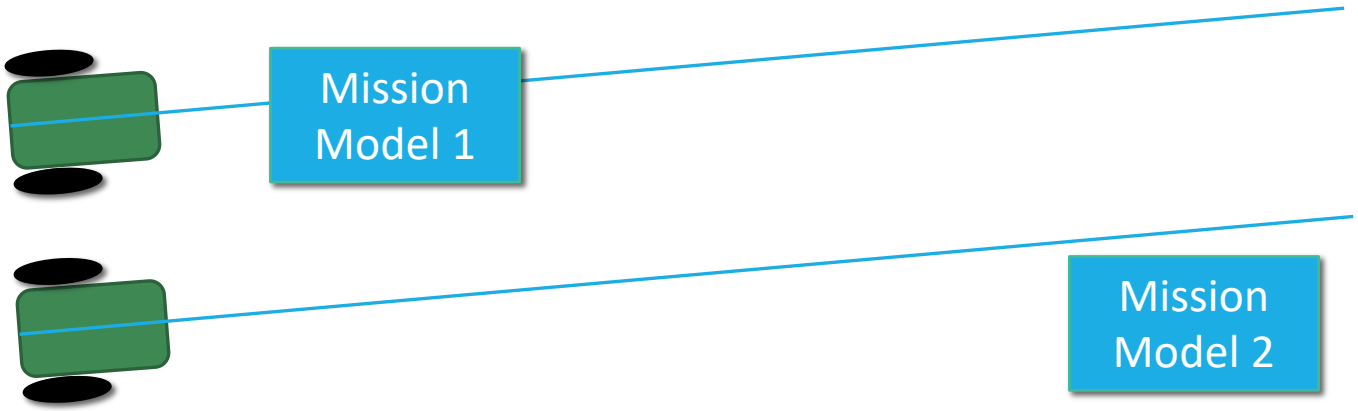




Errors Accumulate Over Time

By the time you get to the far side of the table, you are no longer in the right position

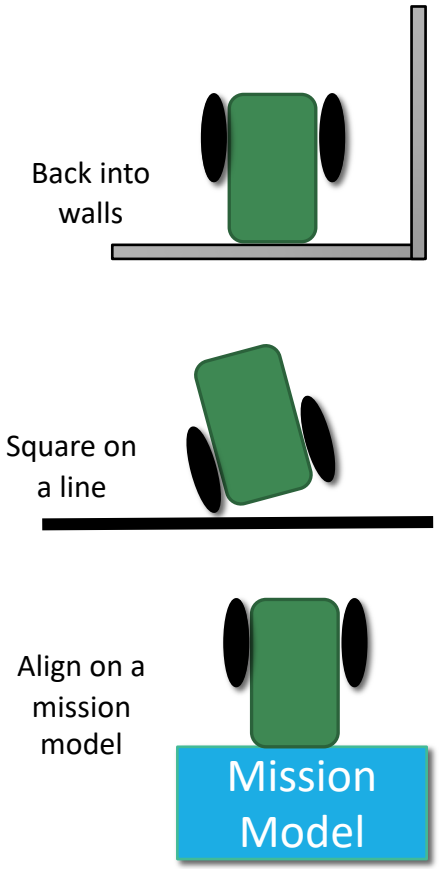
Solution: Repeat alignment techniques multiple times in a run for better reliability (see next slide)



Where Are You on the FLL table?

Consider these alignment strategies that are commonly used:

- Align on walls – deliberately back into a wall to straighten out (note: You may stall doing this. See the Advanced: Stall Detection Lesson)
- Square/Align on lines –If you are moving angled, you can straighten out whenever you see a line. (See Advanced: Squaring Lesson)
- Move until a line – travel until you find a line so you know where you are on the mat (See Beginner: Color Sensor)
- Align on a mission model – Mission models that are stuck in one place can be used to align against



Other Factors in Reliability

Battery life

- If you program your robot when the battery life is low, it won't run the same when fully charged
  - Motors behave differently with low battery
  - But using sensors makes you not as dependent on battery

LEGO pieces come apart over time:

- Squeeze in LEGO pieces in key areas before a run – the pegs get loose which means the sensors may not be in the same place as a previous run
- Push wires in for sensors and motors. They come out!

Motors and sensors don't always match:

- Some teams test motors, sensors and wheels to make sure that they match
- You will never get a perfect match so we recommend use other techniques and accept that they will be different

Credits

This lesson was written by Sanjay and Arvind Seshan

More lessons are available at www.ev3lessons.com