

# **FIRST® LEGO® League**

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### LESSON 2: BUILDING A ROBOT THAT NAVIGATES WELL

SESHAN BROTHERS

# WHAT FEATURES DO YOU NEED

- In the last lesson, we discussed being able to navigate reliably



# NAVIGATING RELIABLY IN FIRST LEGO LEAGUE

- Good navigation will use some or all of these techniques
  - Move straight for a distance
  - Turning robot by degrees
  - Aligning in base
  - Wall follow
  - Aligning on lines
  - Aligning on walls
  - Aligning on mission models
  - Line following
- Each of these techniques requires that your robot design to have specific features



# KEY ROBOT FEATURES

- Outer walls
  - Makes it possible to align on flat surfaces (walls and mission models)
  - Keeps wheels well supported → improves accuracy of moving straight and turns
- Two color sensors that are aligned but separated by some distance
  - Makes it possible to align on lines
- Color sensors that are “in front” of the drive wheels
  - Makes it possible to line follow
- Wall-riding wheels
  - The quality of the walls in contests can vary greatly (different textures, wood knots, holes, etc.). Wheels improves the ability to wall follow and align on walls
- While every team’s robot should be different, most successful designs have the above features

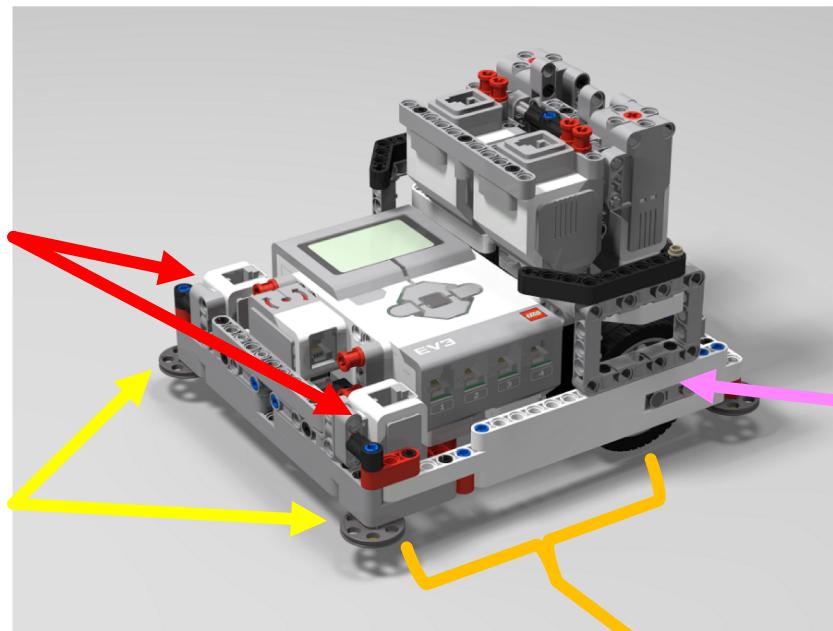
# DROIDBOT MODEL C

- This robot has the key features for good navigation

\*\* Shielding of color sensors is not needed in practice. See lesson on color sensor placement.

Two well-separated, aligned color sensors

Wall riding wheels



Low center of gravity

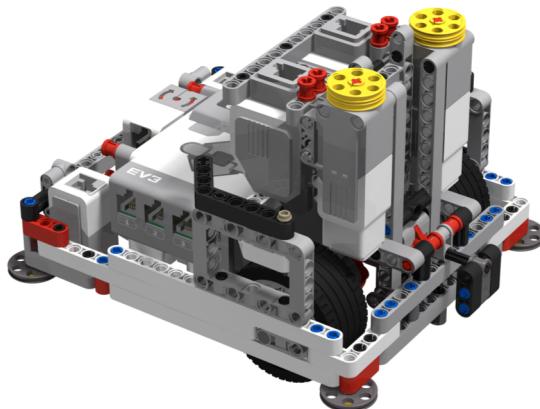
Outer walls that support wheels

Color sensors well in front of driving wheels

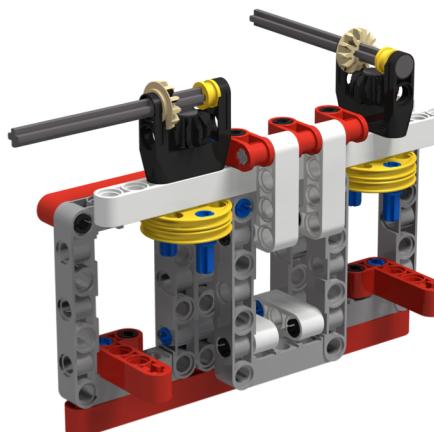
Level construction – notice caster is level with drive wheels

# ADDITIONAL FEATURES TO CONSIDER

- Quick, inter-changeable attachments that let you complete missions on many sides of the robot
- Adding the attachment should not cause weight distribution issues on the robot
- Can be made with minimal parts – DroidBot Model C is made with a single kit plus just 2 additional parts



Pulley wheels added to motors for easy attachments



Pulley wheels and pegs on attachment connect quickly to motors on the robot. This attachment slides into DroidBot Model C.

## WHAT'S NEXT

- As you build your team's robot, take these into consideration
- There are some alternative designs available on FLL Tutorials that you can try and learn from

# CREDITS

- This tutorial was created by Sanjay Seshan and Arvind Seshan
- More lessons at [www.ev3lessons.com](http://www.ev3lessons.com) and [www.flltutorials.com](http://www.flltutorials.com)



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