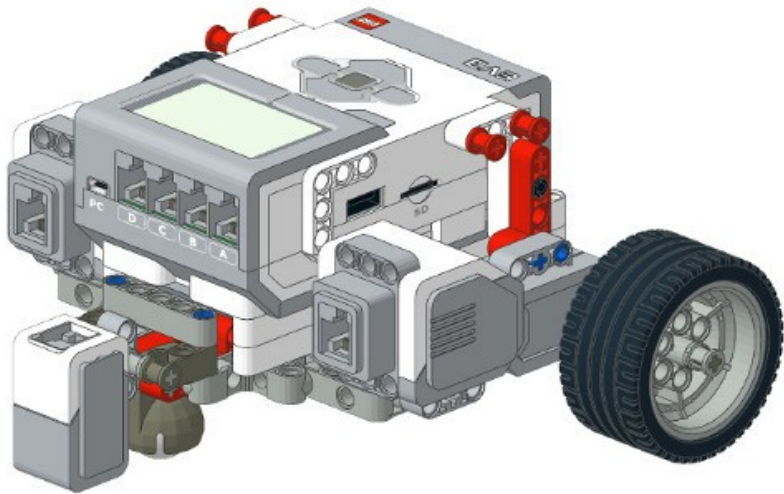




MINDSTORMS
EV3

Alignment

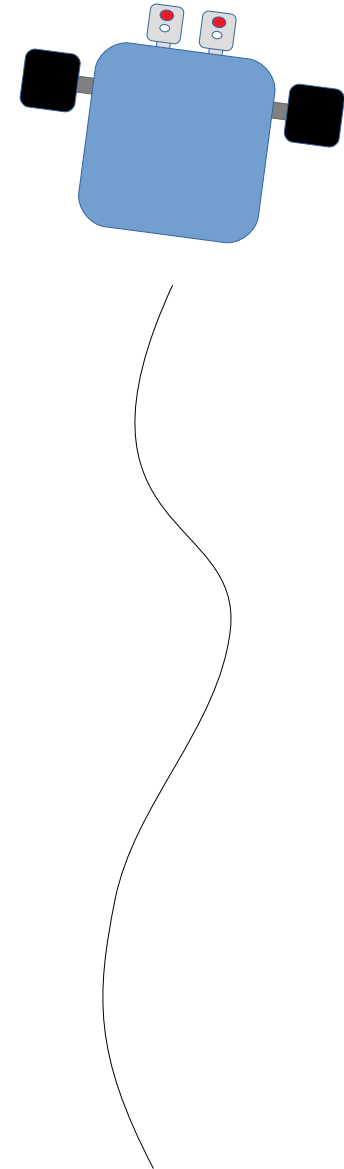


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Why Align?

- **Inconsistent** robot movement
- Differences in map (eg. table not perfectly flat)
- Differences in mission model (eg. mounting position)
- **If your robot is inaccurate, but consistently so, you don't need to align**

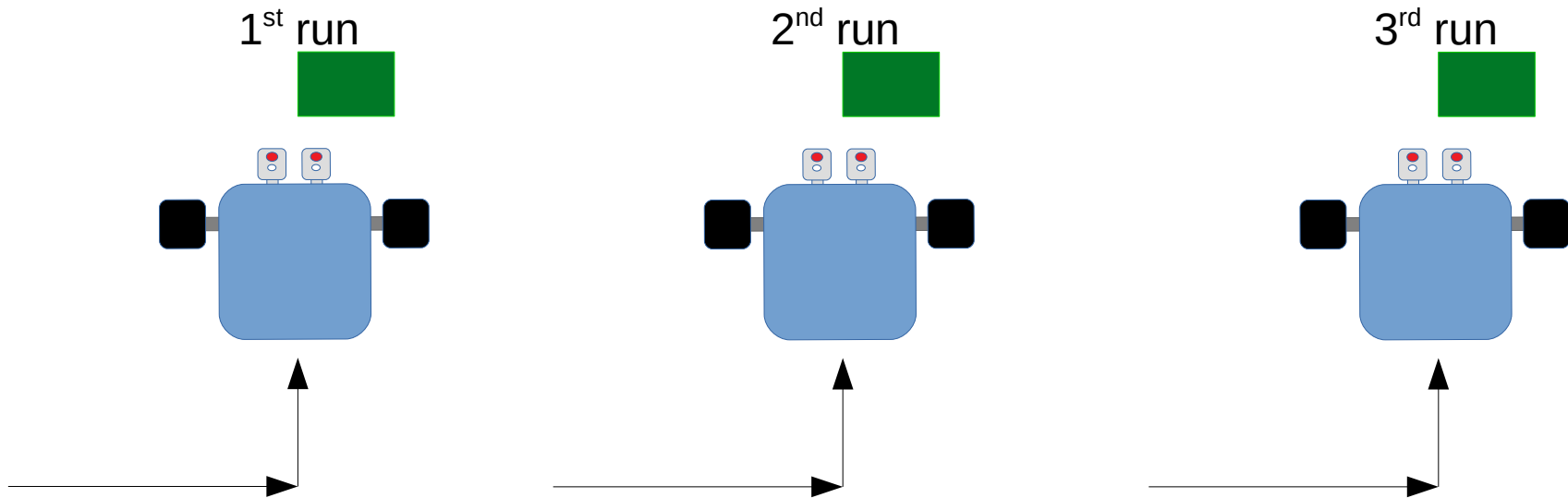


Ways to Align

- Provided Lines
 - Walls
 - Mission Model
 - Images on Map
(* Not recommended)
-
- **Important! The closer you align to your target, the more accurate it'll be.**

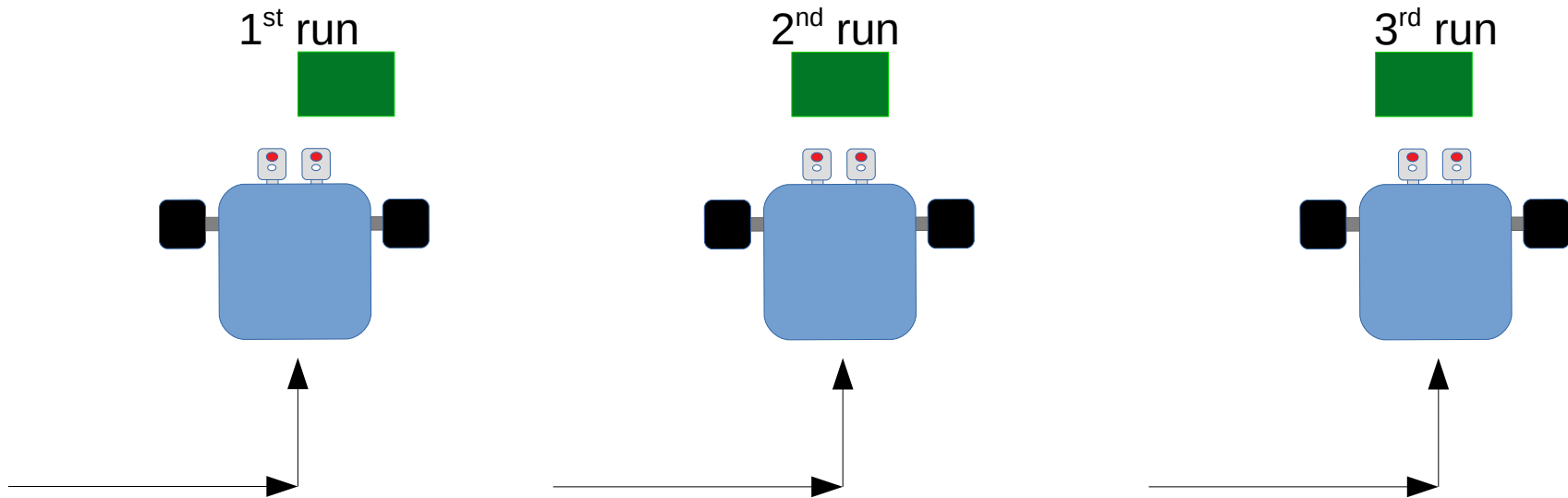


When to Align



- Inaccurate
- Always slightly to the left of the target
- **Don't need to align**
- **Just change your movement**

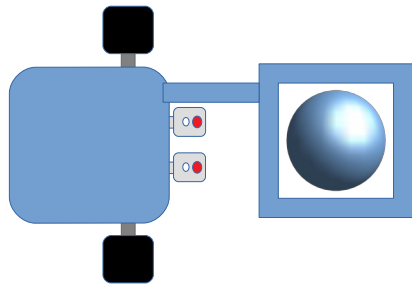
When to Align



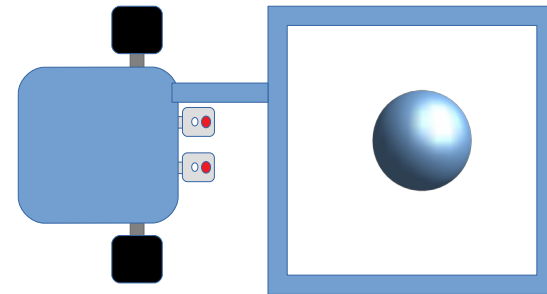
- Sometimes on target
- Not consistent
- **Need to align**

When NOT to Align?

- Before aligning, ask yourself...
 - Can I change the design to make accurate movement less important?
 - If I need to grab an object, can I make my grabber bigger?
 - If I need to push an object, can I make my pushing mechanism wider?



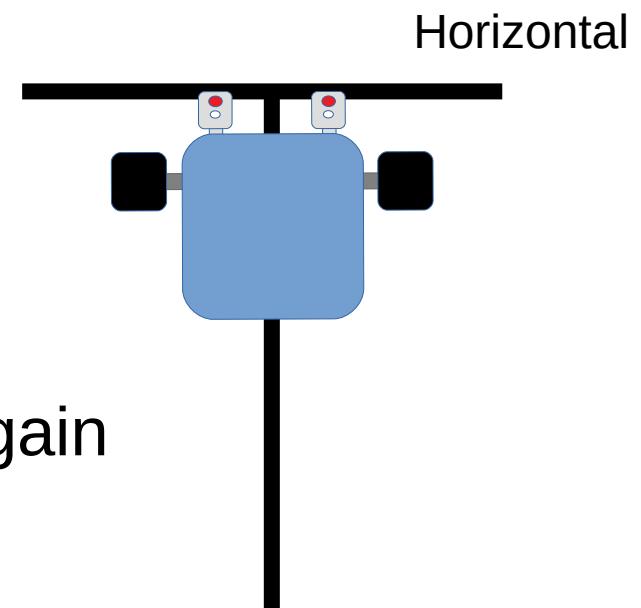
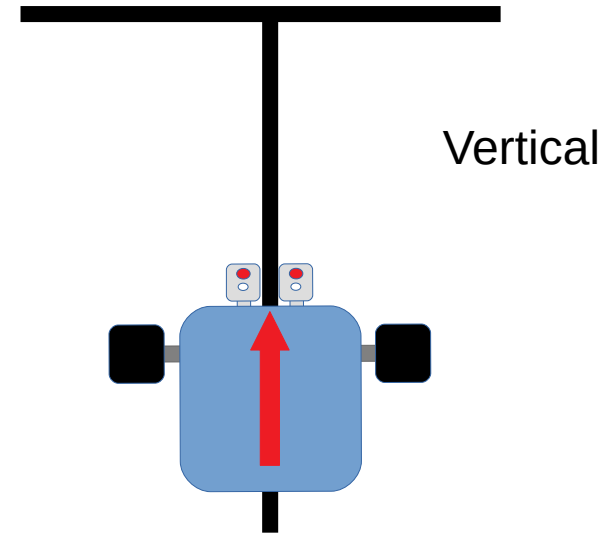
Accuracy is important



Accuracy is not important

Aligning to Line

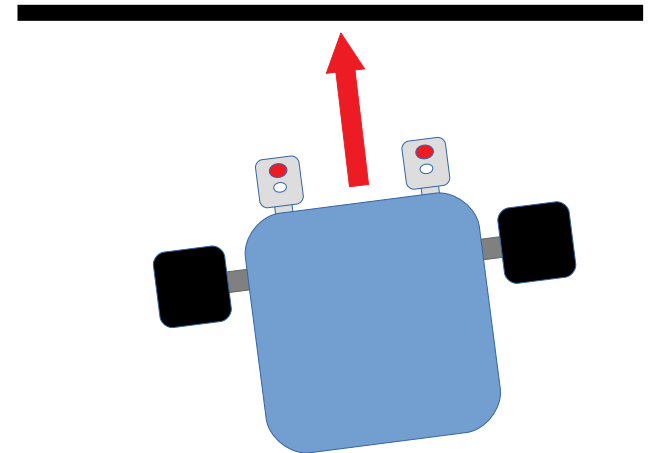
- Two common ways
 - Vertically
 - Horizontally
- Vertical alignment is hard
 - Proof:
 - Make a line following program...
 - Get the robot to follow a straight line...
 - Notice how much it wobbles?
 - If you must, use a “P” control with low gain



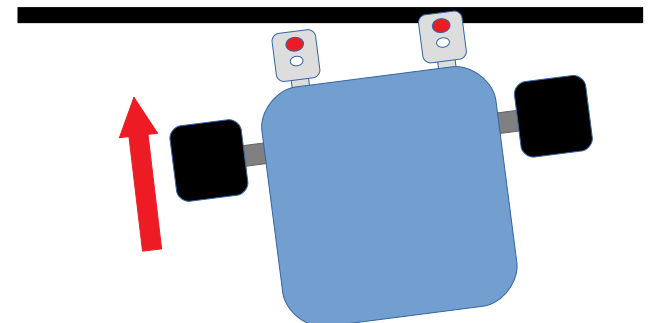
Aligning to Line

- Horizontal
 - Simple algorithm:
 - Both wheels forward until right sensor sees black
 - Left wheel forward until left sensor sees black
 - Reverse left/right depending on angle of approach
 - **May not be perfectly straight to the line after alignment...**
 - **...but it doesn't matter as long as it is consistent!**

Move forward until right sensor sees black

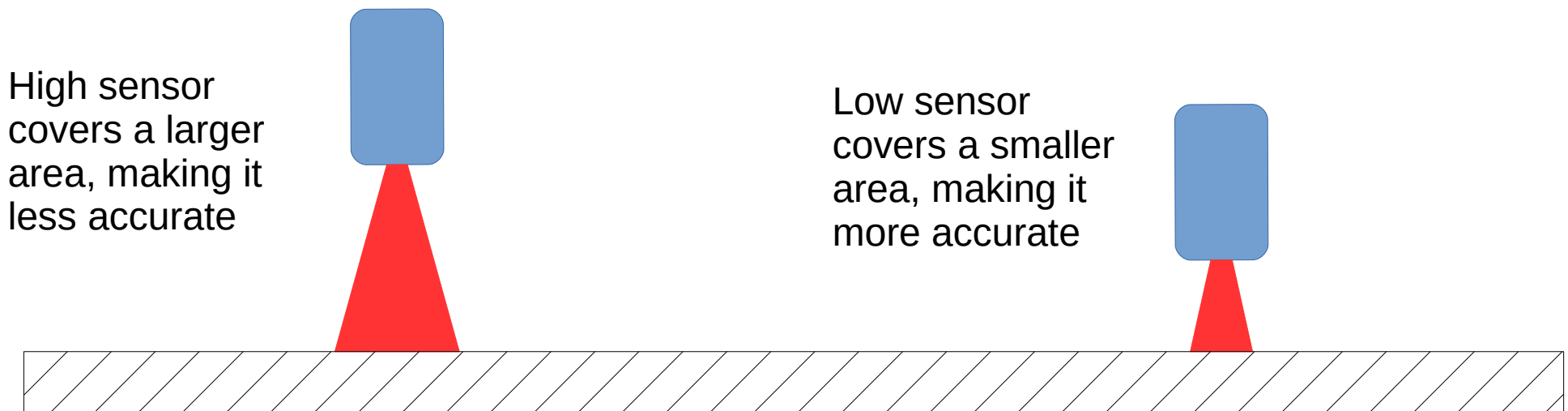
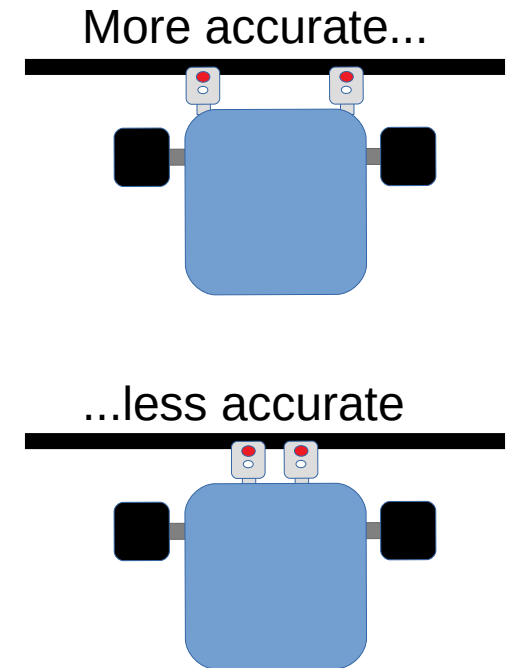


Left wheel forward until left sensor sees black



Aligning to Line

- Tips
 - Keep the sensors as far apart as possible
 - Always turn in the same direction
 - Keep the sensors close to the ground
 - Calibrate your sensors!

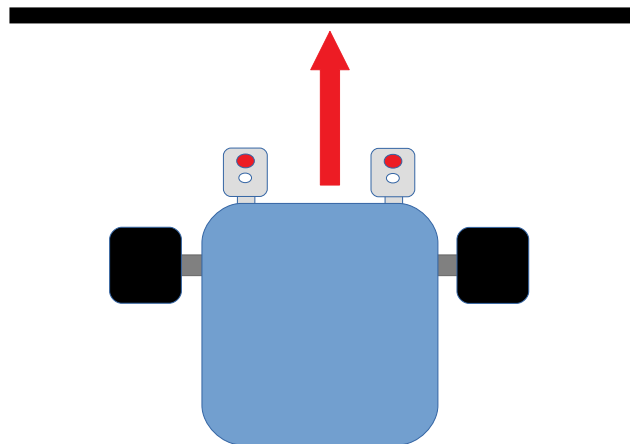


Aligning to Line

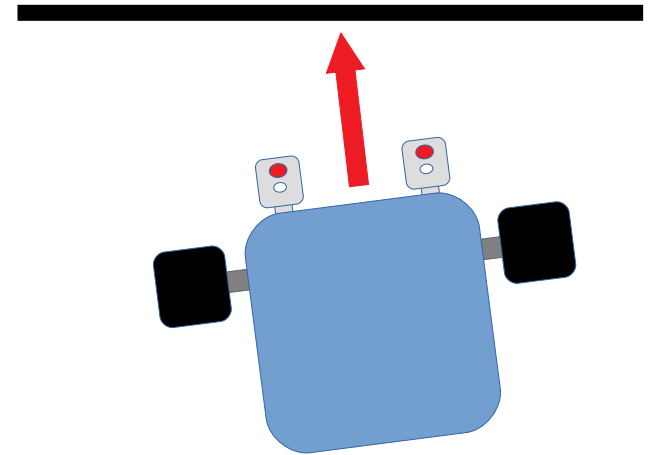
- Tips

- Approach the line **slowly** at an **angle**
- Approaching straight will give inconsistent results depending on which sensor sees black first

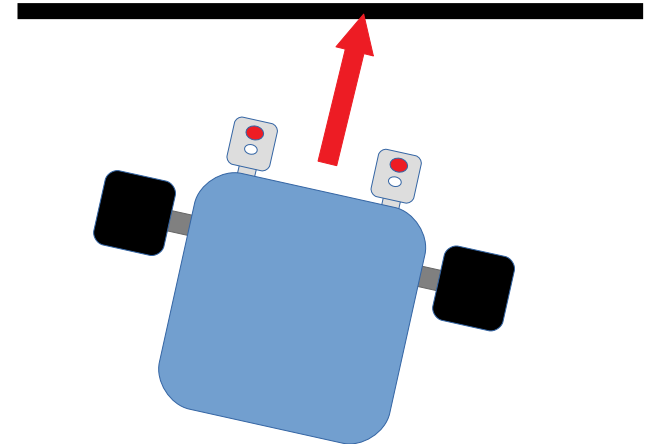
Avoid this...



Move forward until right sensor sees black...

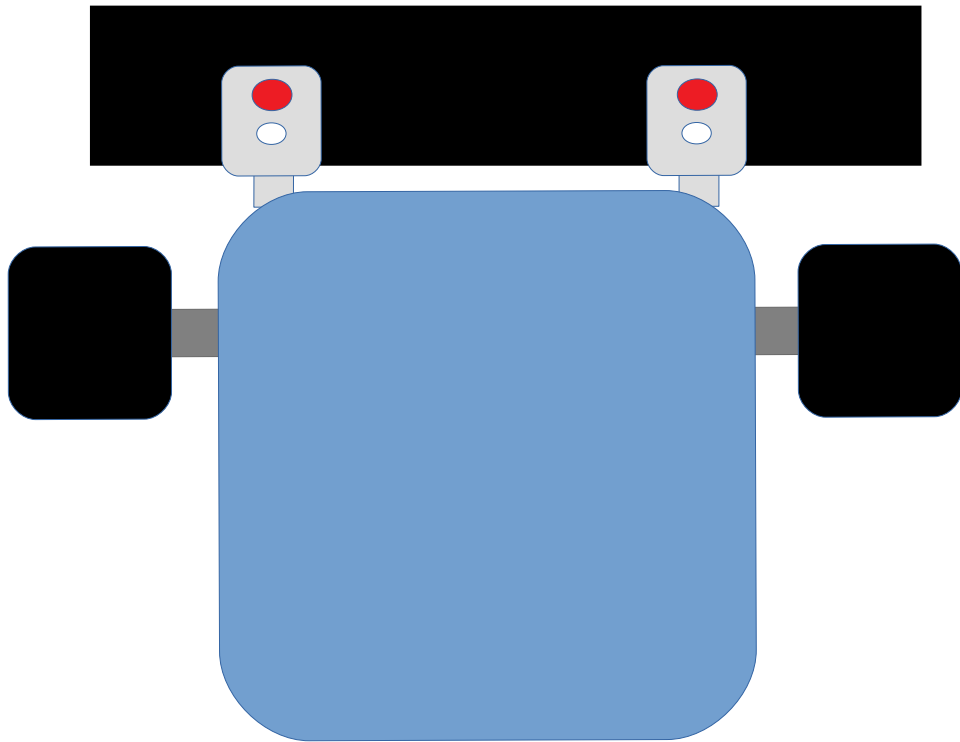


...or move forward until left sensor sees black

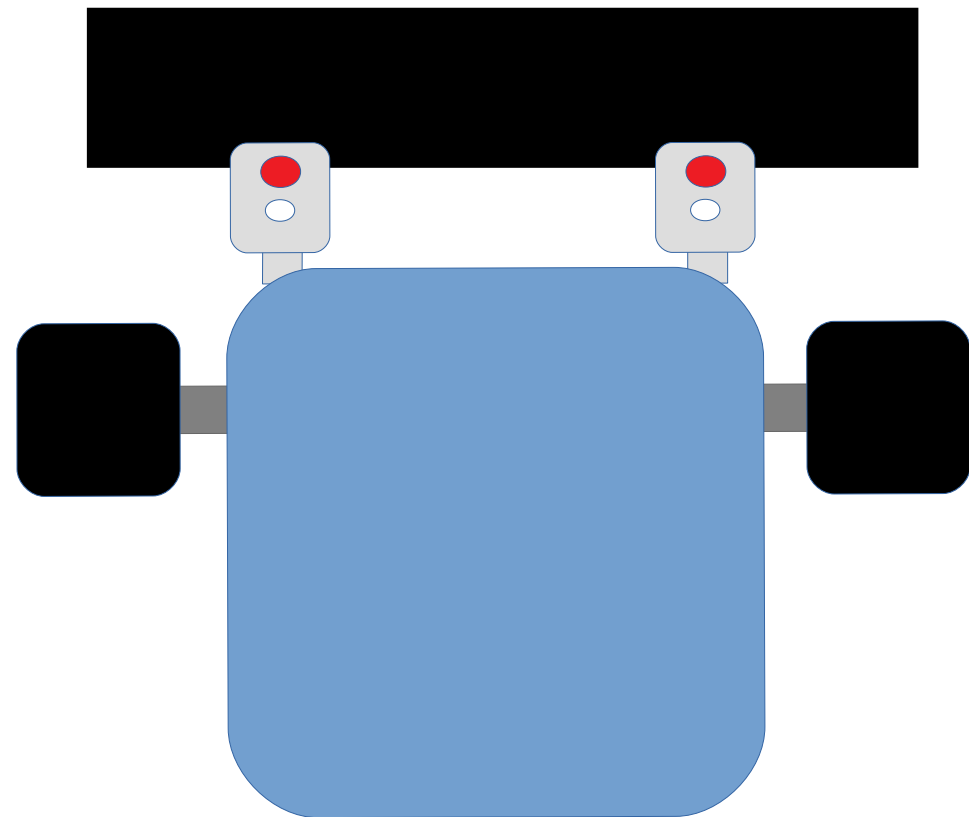


Aligning to Line?

Aligning to black line



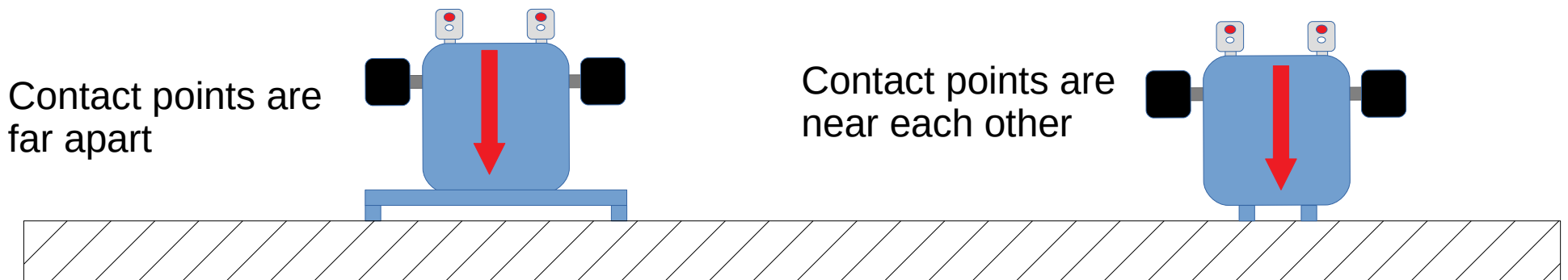
Align to edge between black and white



Which is more accurate?

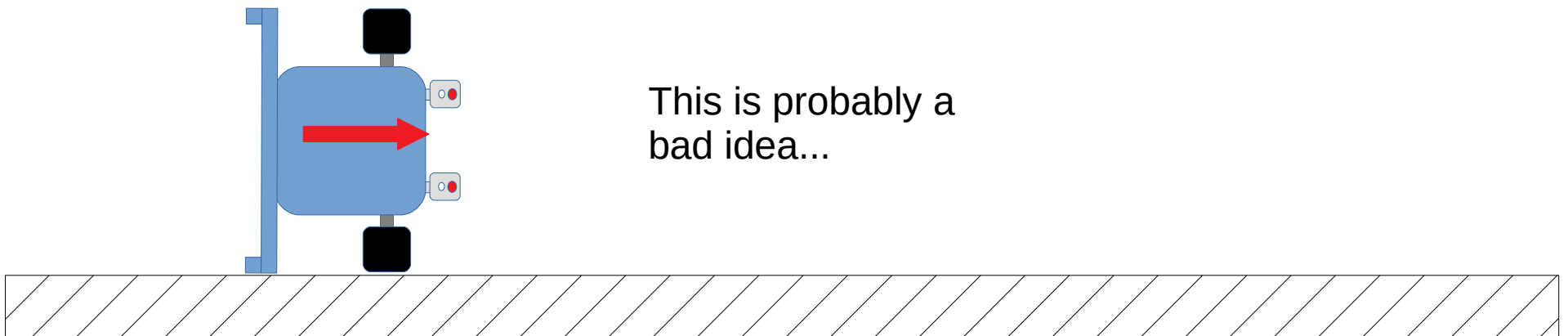
Aligning to Wall

- Push against a wall to align the robot
- Keep contact points far apart
- **Don't use move degrees / rotation, program may hang if wheels cannot turn**
- Use move seconds or better still, unregulated motors (with a wait block)



Aligning to Wall

- Try not to glide against the wall
- Will have difficulties turning...
- ...unless you don't need to turn (ie. only going straight forward and back)



Aligning to Mission Model

- Just like aligning to wall, but push against the mission model instead
- Allows you to align very close to the target, making accuracy very high
- Eliminates errors from inaccurate placement of mission models
- **Often the best option!**
- **...just make sure you don't break the mission model**

Aligning to Images on Map

- Use areas where there is a sharp transition in brightness or color
- Can be difficult to detect, and may require use of special RGB blocks
- Not recommended



Summary

- If possible, **change your design to make accuracy less important**
- Perform alignment if the robot movement is **inconsistent**
- Align as **close to the target as possible**
- Avoid vertical line alignment
- When doing horizontal line alignment, **keep the sensors far apart**

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