

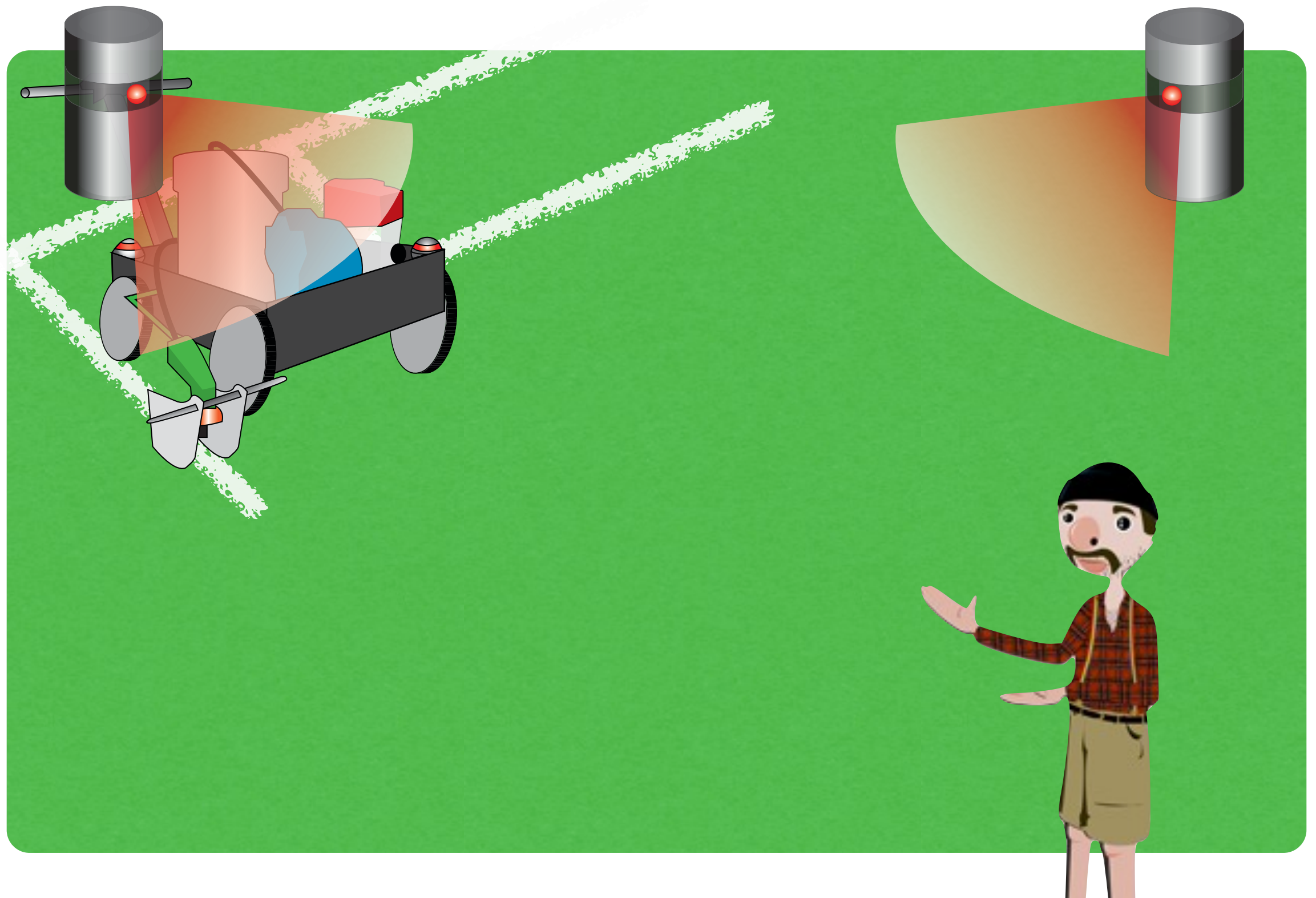


/Linus

team silver b

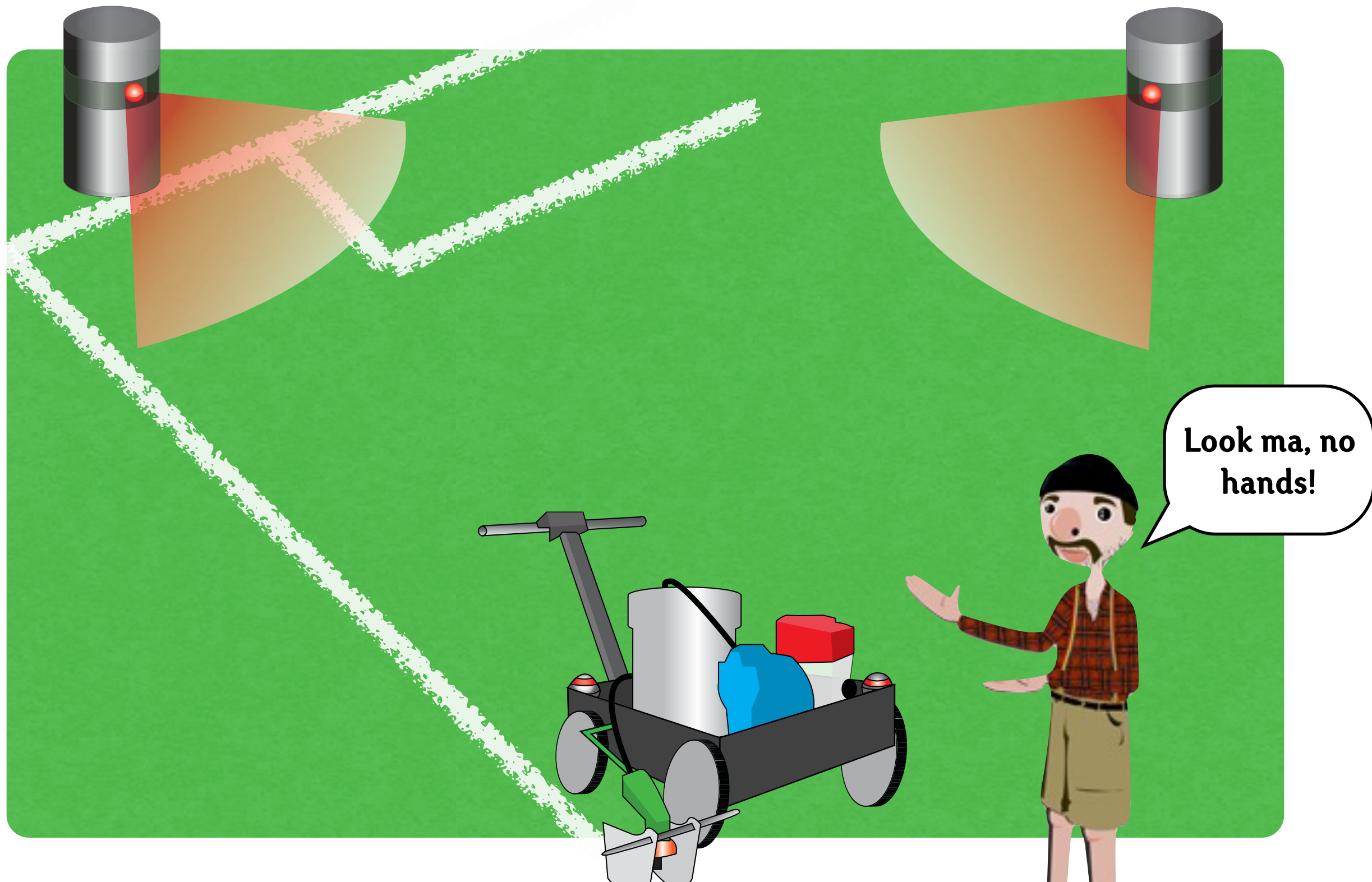
Introducing Linux:

autonomous field liner with 2 home bases



Introducing Linus:

autonomous field liner with 2 home bases



The Problems:

the hassle of field-lining

- time consuming
- human error
- labor intensive



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\$1600



\$3600 of labor costs/year

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\$3600 of labor costs/year



\$2500

Customer Feedback:

MIT Athletic Maintenance Staff: Christel

“...let’s set it and forget it.”

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MIT Athletic Maintenance Staff: Christel



“...let’s set it and forget it.”

Customer Needs

Intended Customers: Athletic Facilities Departments
Market: Sports Field Maintenance

Customer Need	Product Attributes	Engineering Specification
Easy and intuitive set-up	ease of use	5-10 minutes for full set up
Accurate, geometric field lines	accuracy	maximum error of 3 inches

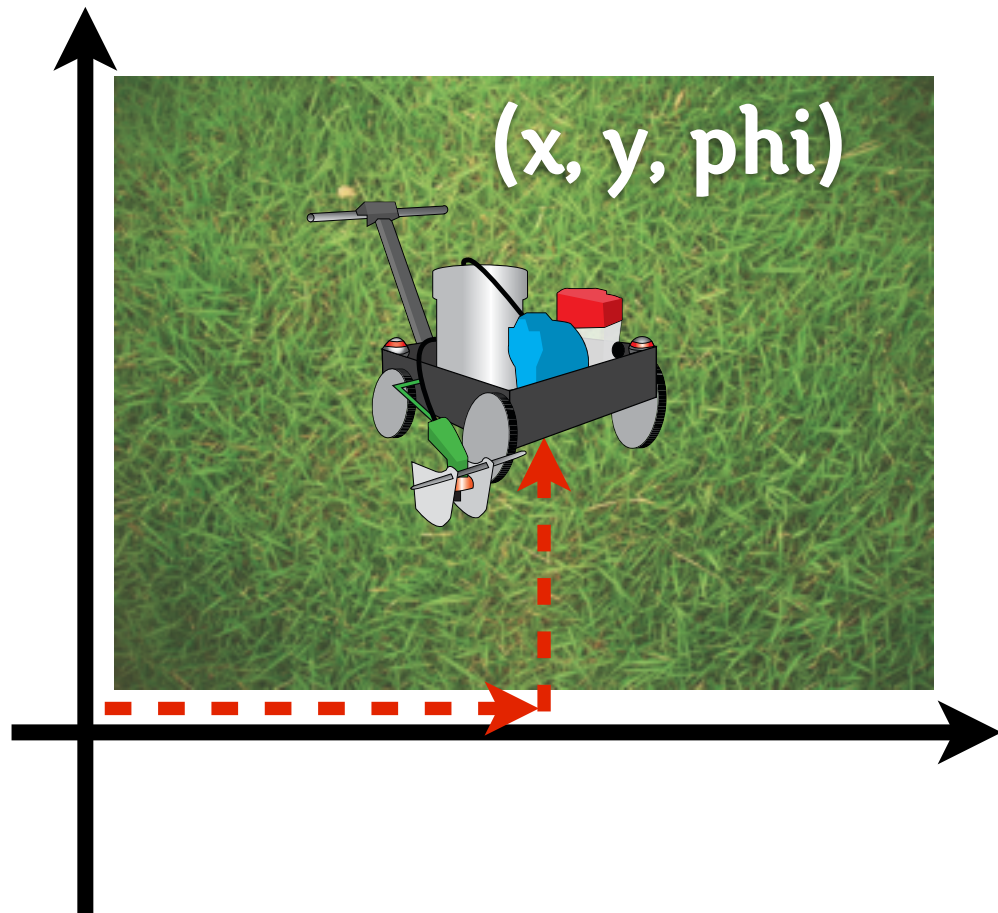
The Risks:

components tested in the mock-up

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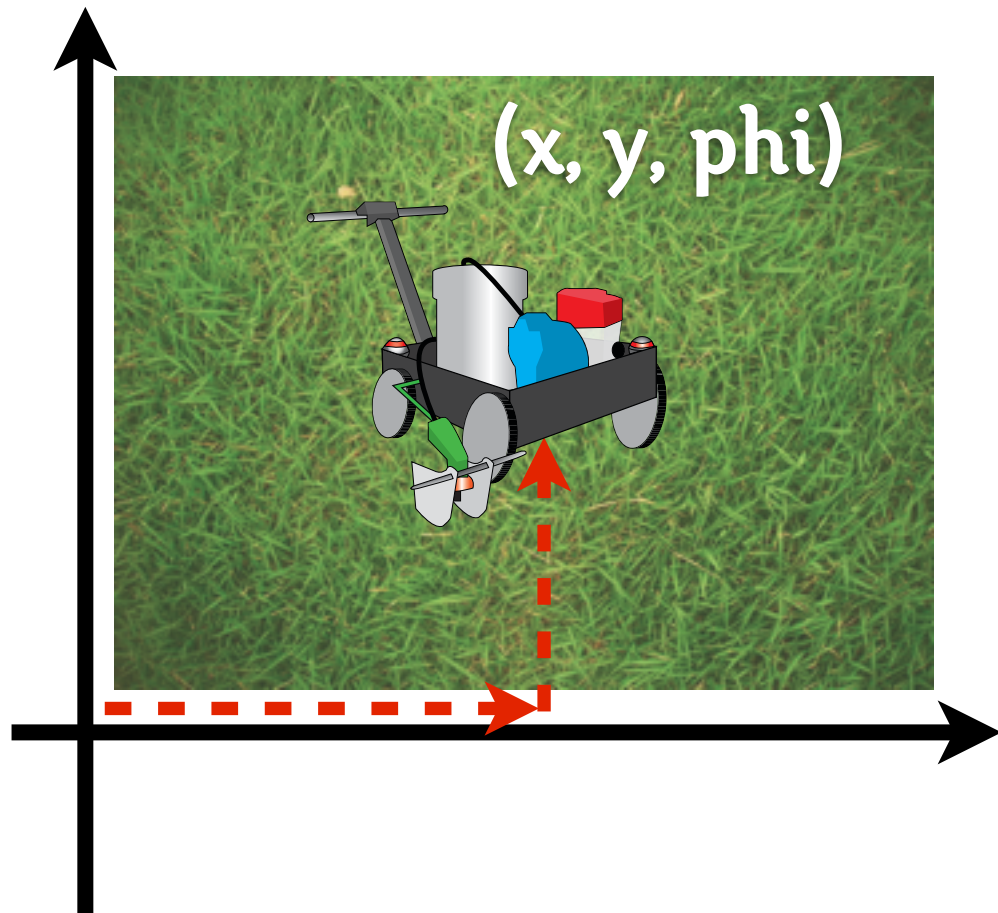
Accurate Positioning



The Risks:

components tested in the mock-up

Accurate Positioning



Motor Controls

A screenshot of an Arduino IDE window titled "Ex_Step_Draw_XY_2 | Arduino 0017". The code is as follows:

```
// Read data from the serial and turn ON or OFF a light depending on the value
//and control stepper motor on RepStrap
char val; // Data received from the serial port
int ledPin = 13; // Set the pin to digital I/O 13

#define XstepPin 10
#define XdirPin 7

#define YstepPin 2
#define YdirPin 3

void setup() {
  pinMode(ledPin, OUTPUT); // Set
  pinMode(XstepPin, OUTPUT);
  pinMode(XdirPin, OUTPUT);
  pinMode(YstepPin, OUTPUT);
  pinMode(YdirPin, OUTPUT);
  Serial.begin(9600); // Start serial communication at 9600 bps
}

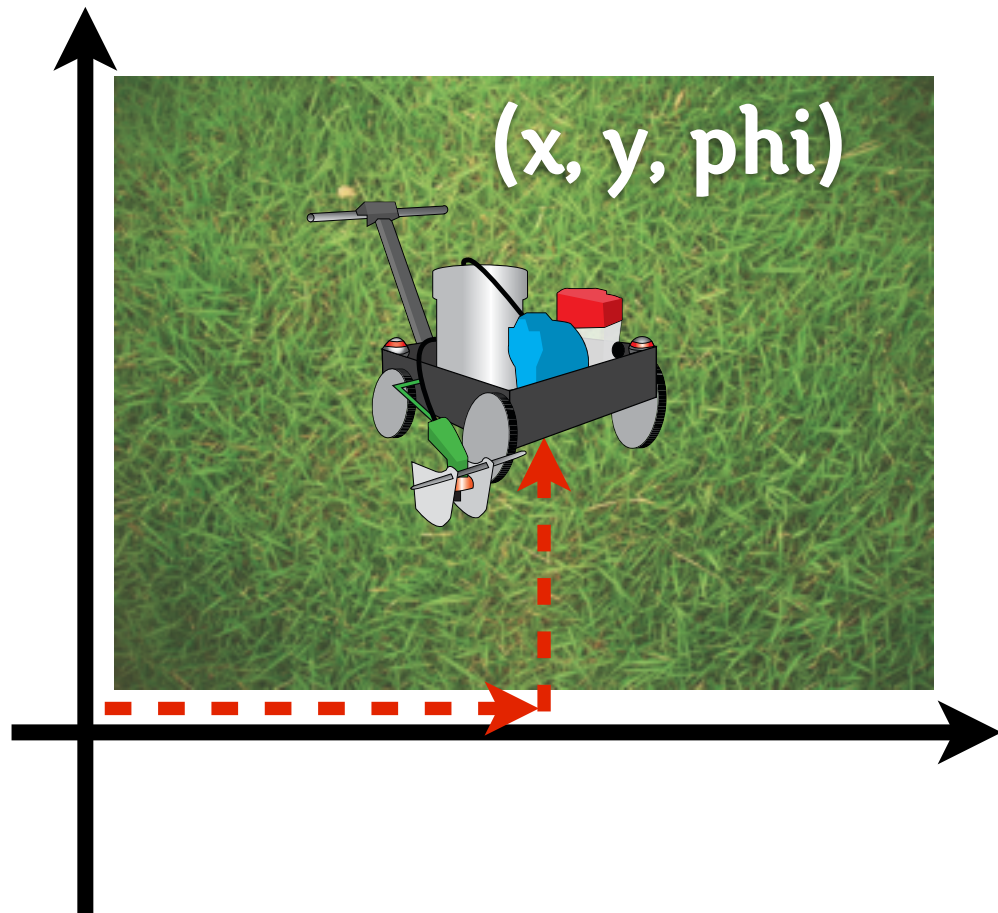
void loop() {
  if (Serial.available()) { // If data is available to read,
    val = Serial.read(); // read it and store it in val
  }
}
```

A speech bubble with the text "turn left" is pointing to the code. The IDE status bar at the bottom shows "Done compiling." and "Binary sketch size: 2556 bytes (of a 14336 byte maximum)". The name "marc.cryan" is visible in the bottom right corner.

The Risks:

components tested in the mock-up

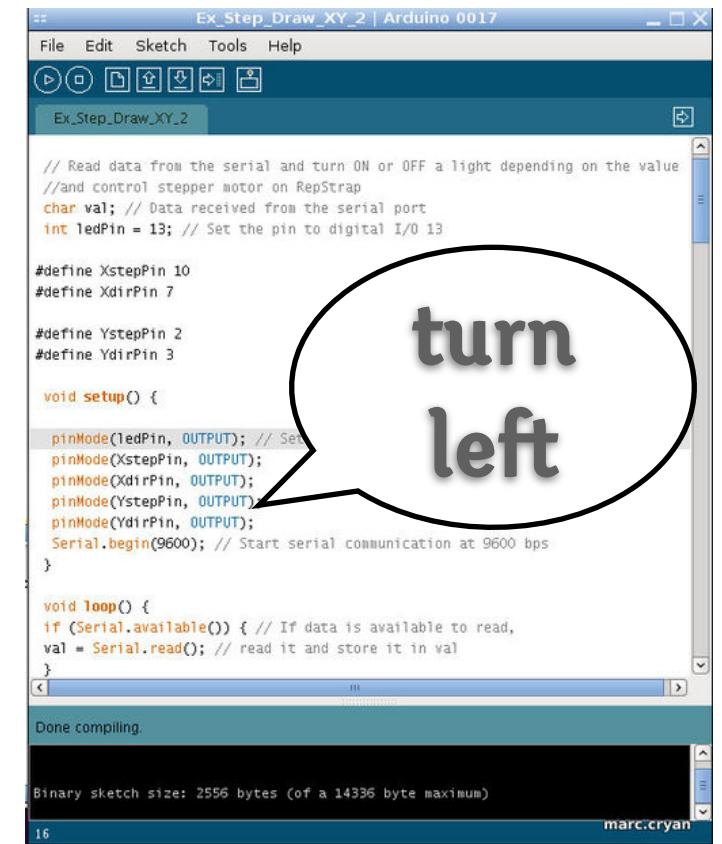
Accurate Positioning



Communication

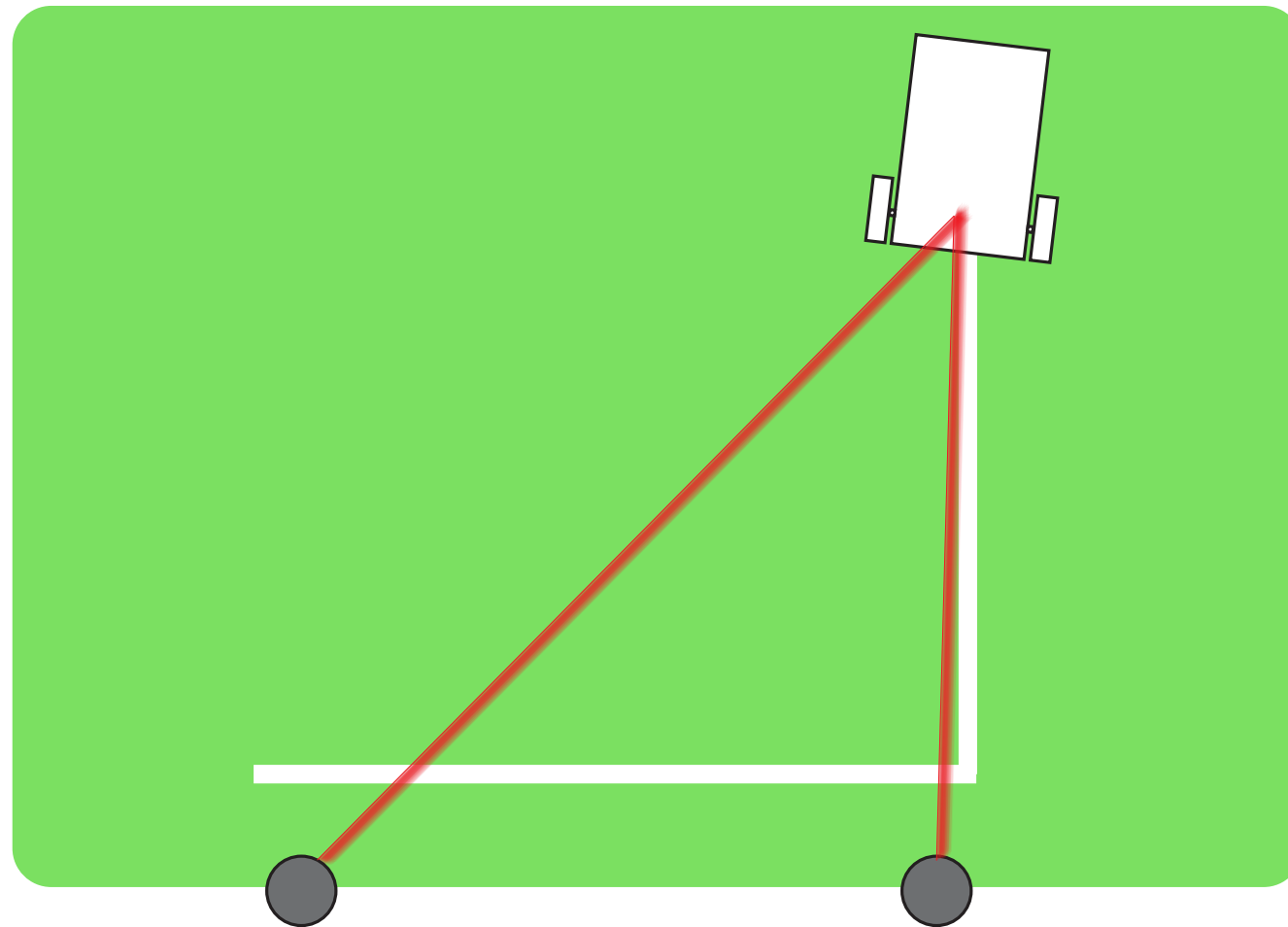


Motor Controls



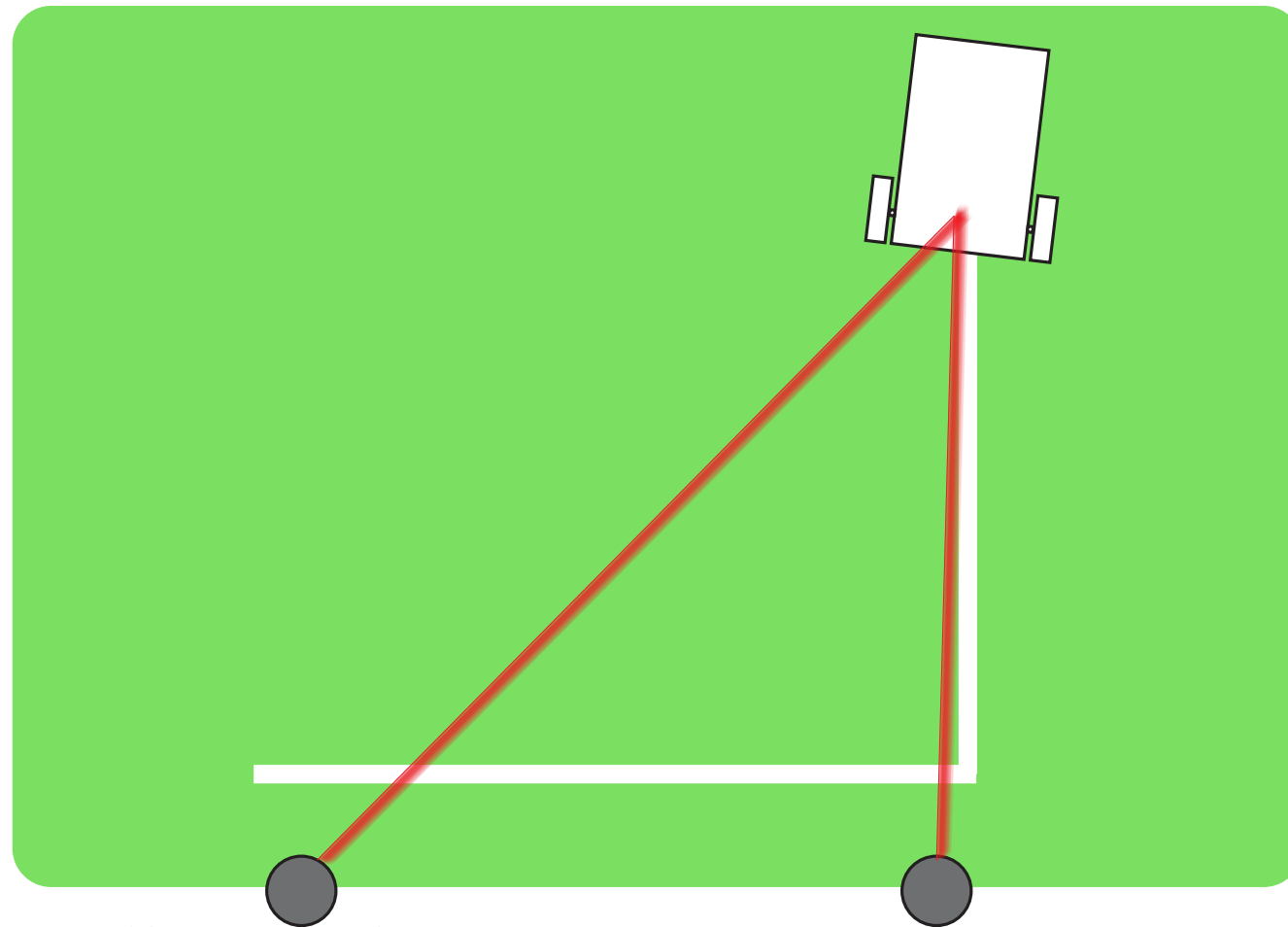
Risk 1: Communication

using XBees and Arduinos



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using XBees and Arduinos



Complex feedback loop

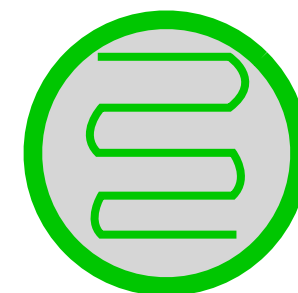
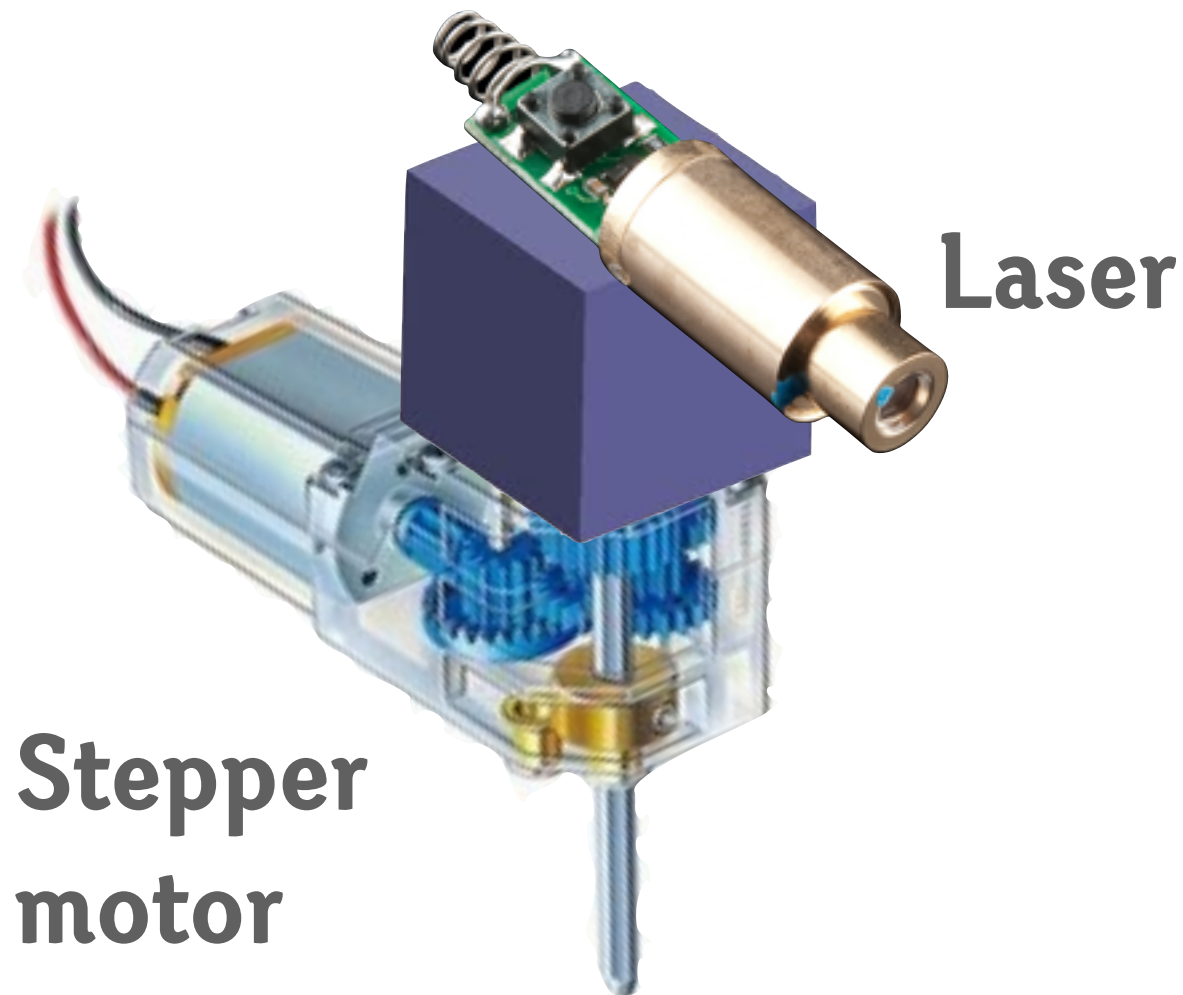
Linus: “Home Base, What’s my angle?”

Home Base : “You’re at 2 degrees.”

Linus : “Ok, Motor Controls, get me back to 0 degrees.”

Risk 2: Accurate Positioning

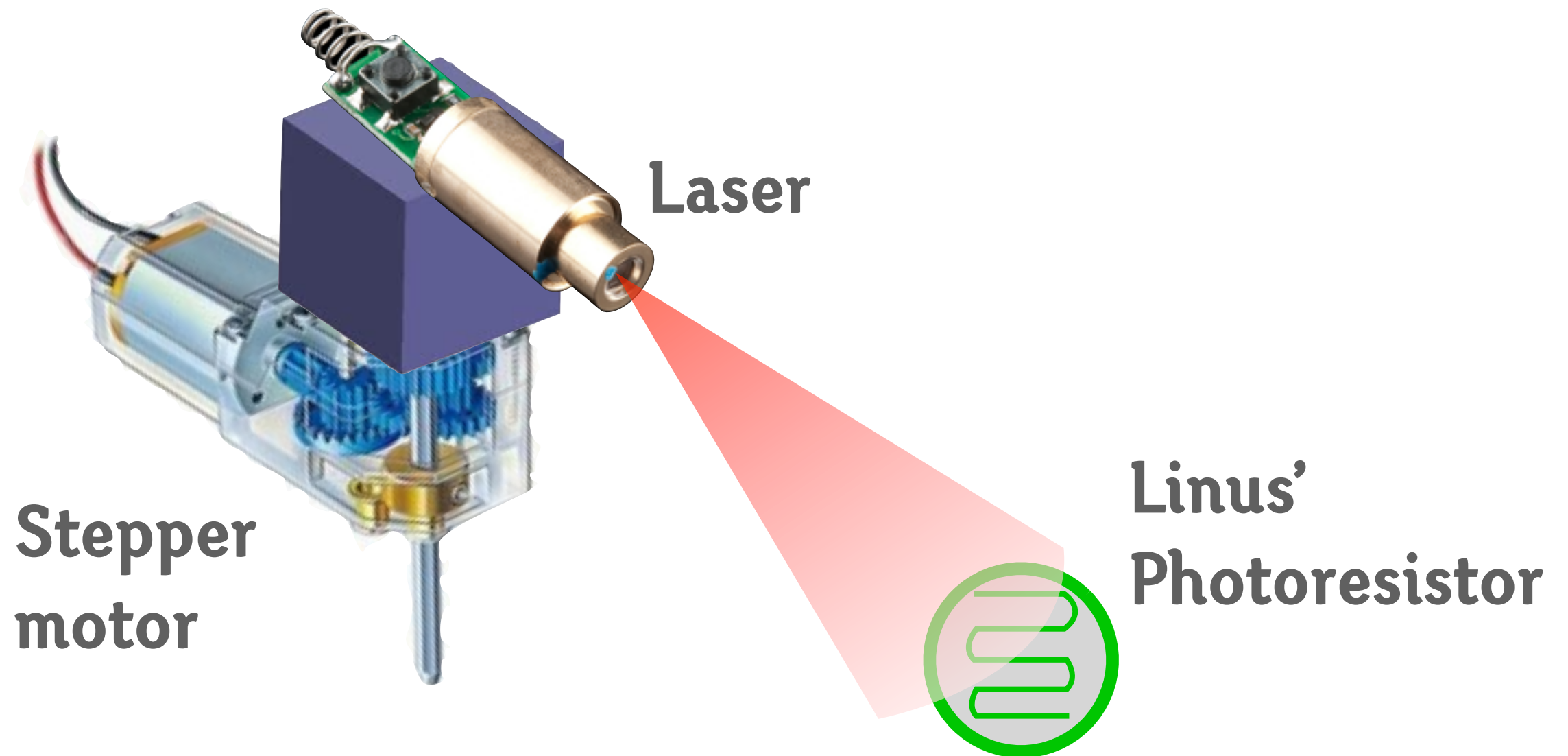
triangulation with stepper motors and laser sweeps



Linus'
Photoresistor

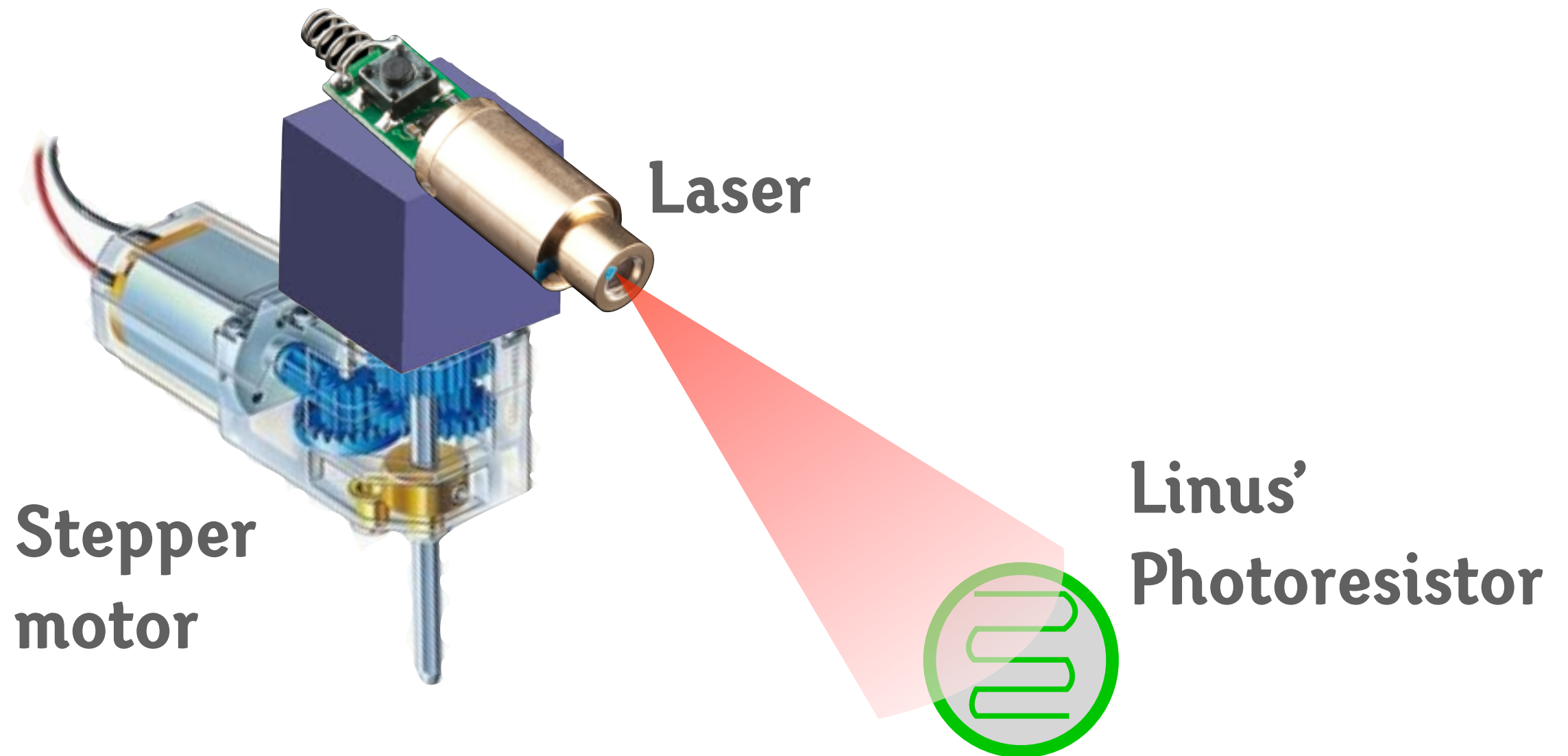
Risk 2: Accurate Positioning

triangulation with stepper motors and laser sweeps



Risk 2: Accurate Positioning

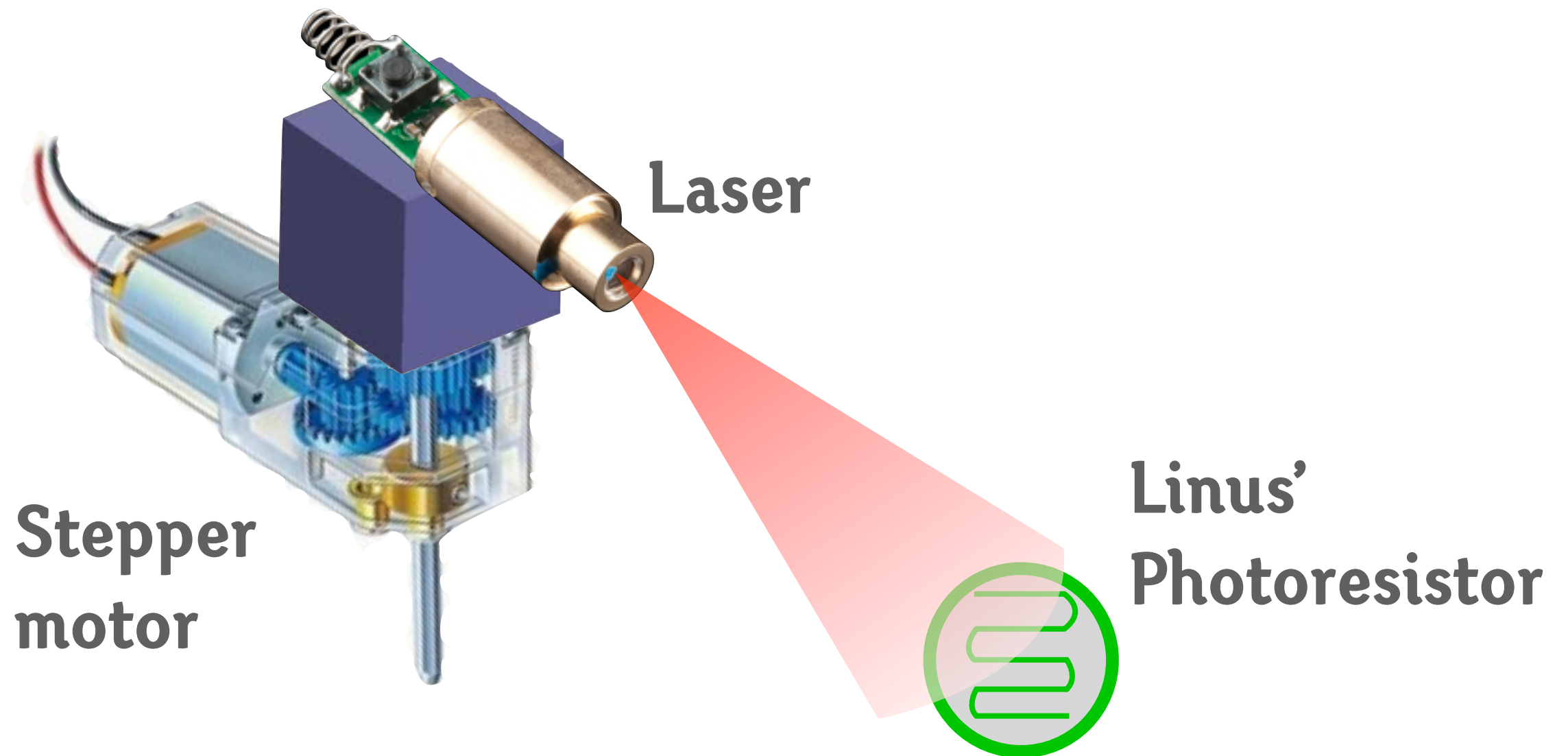
triangulation with stepper motors and laser sweeps



2 home bases →

Risk 2: Accurate Positioning

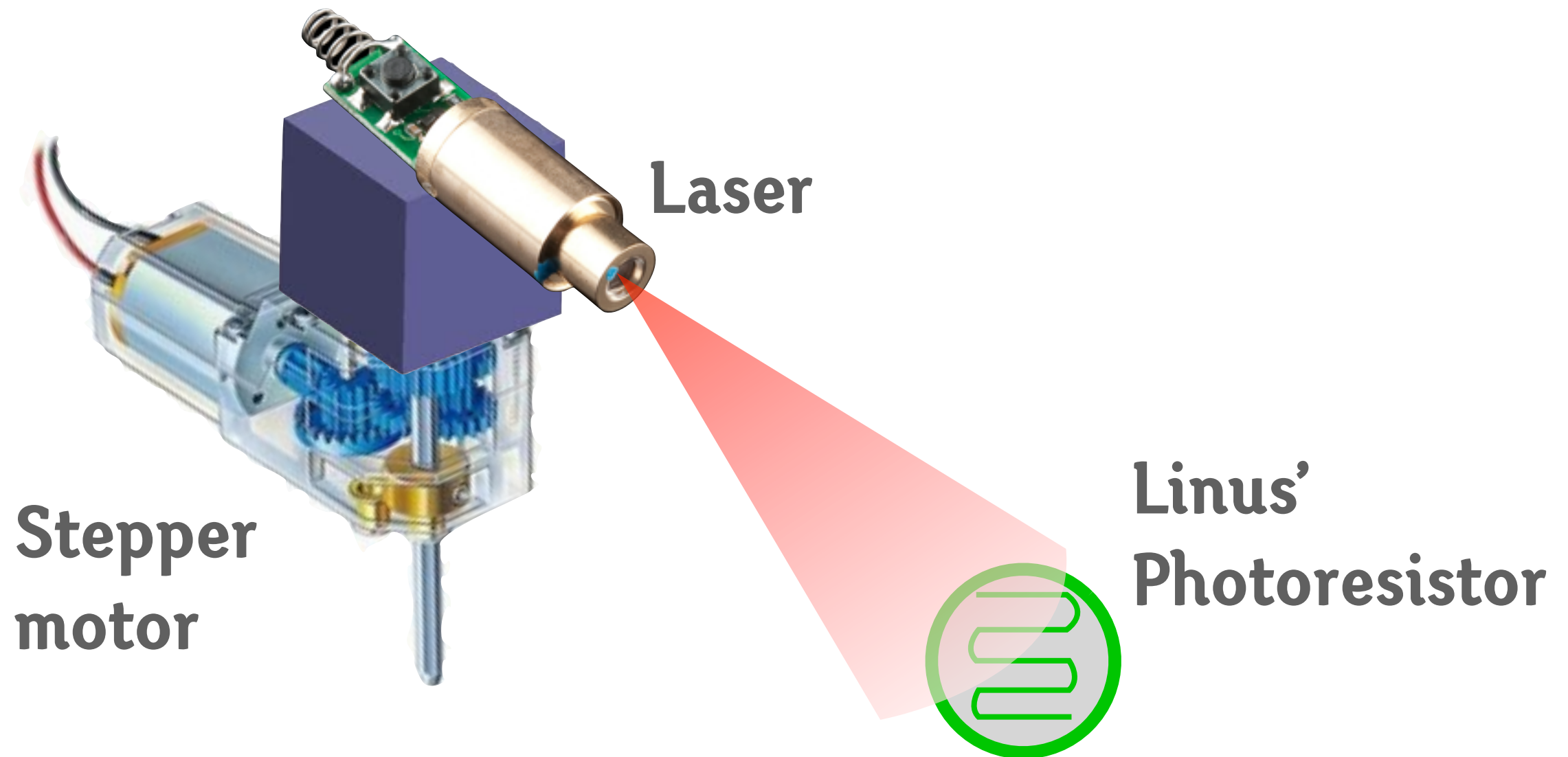
triangulation with stepper motors and laser sweeps



2 home bases → 2 angles →

Risk 2: Accurate Positioning

triangulation with stepper motors and laser sweeps



2 home bases → 2 angles → Calculate coordinates

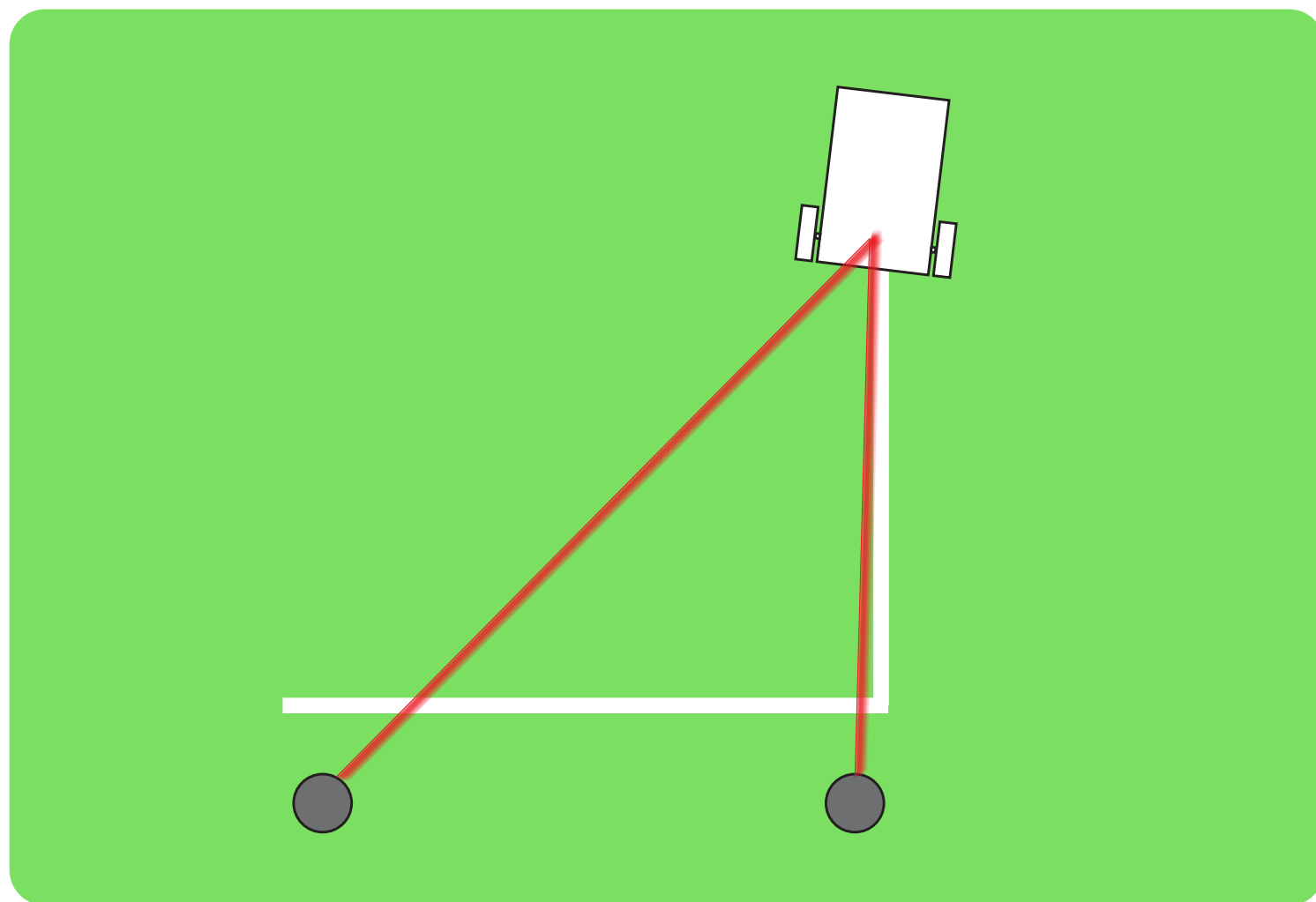
Risk 3: Motor Controls

Getting from point A to point B

Position
Orientation



Controls velocity
of wheels

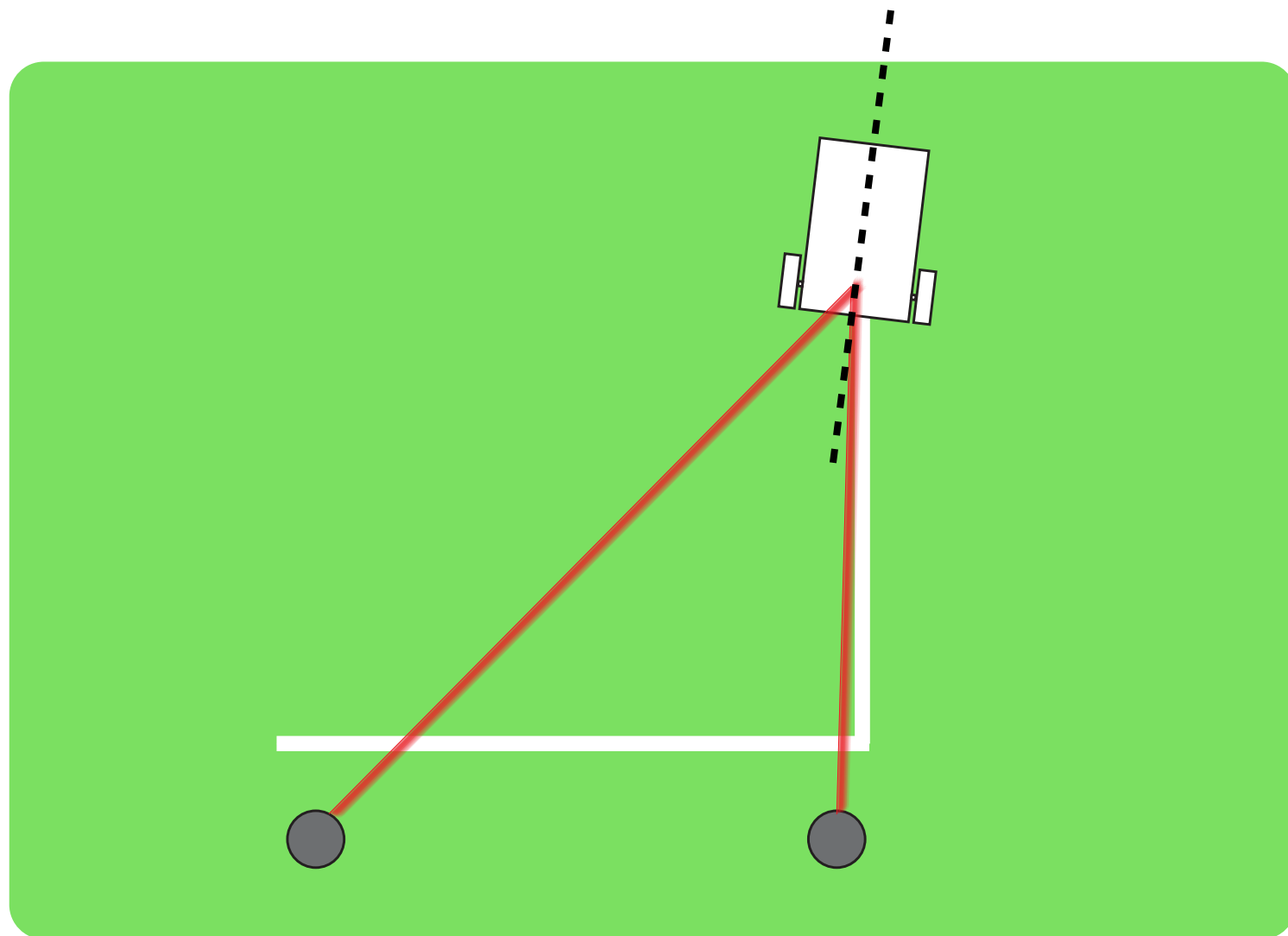


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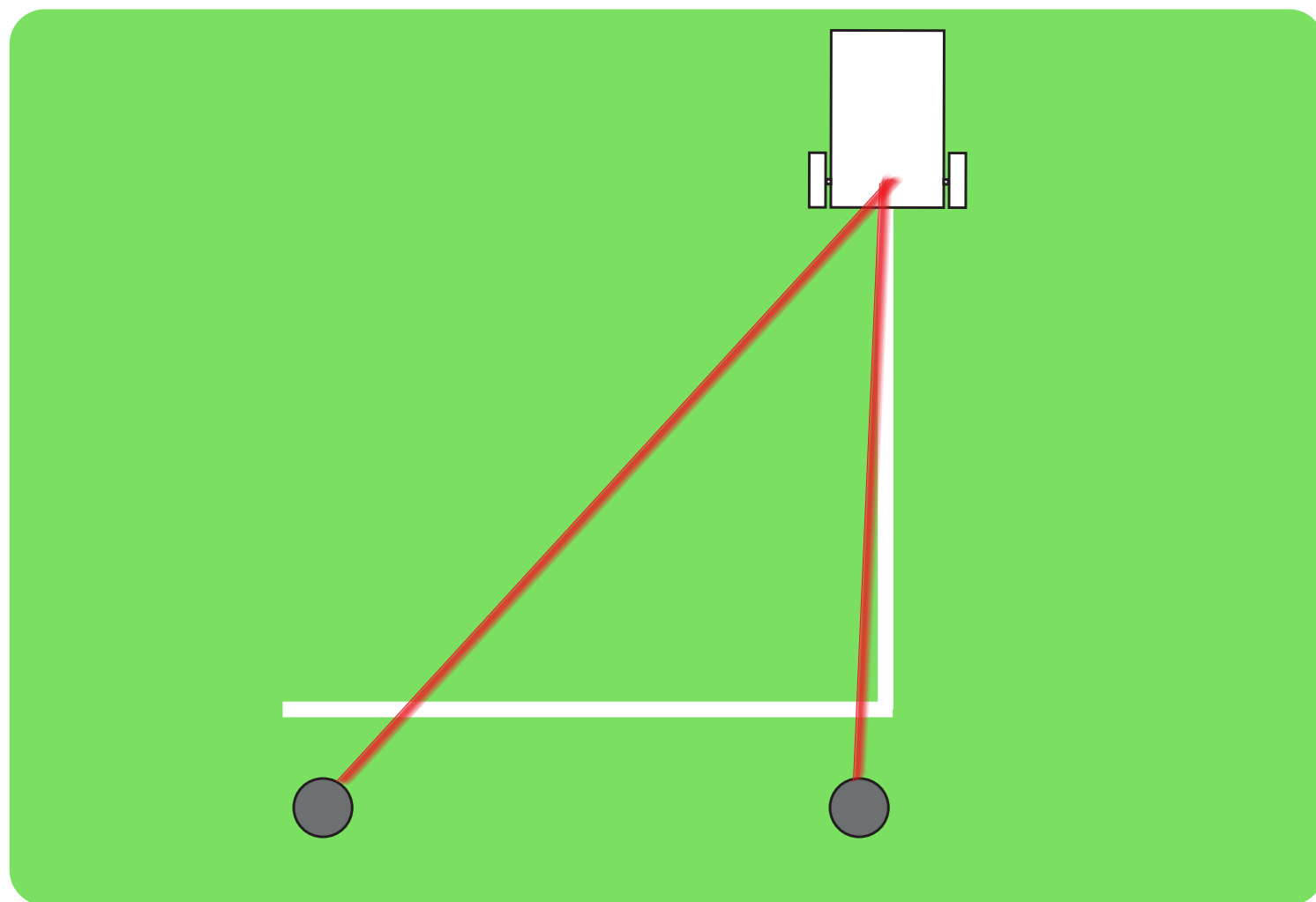
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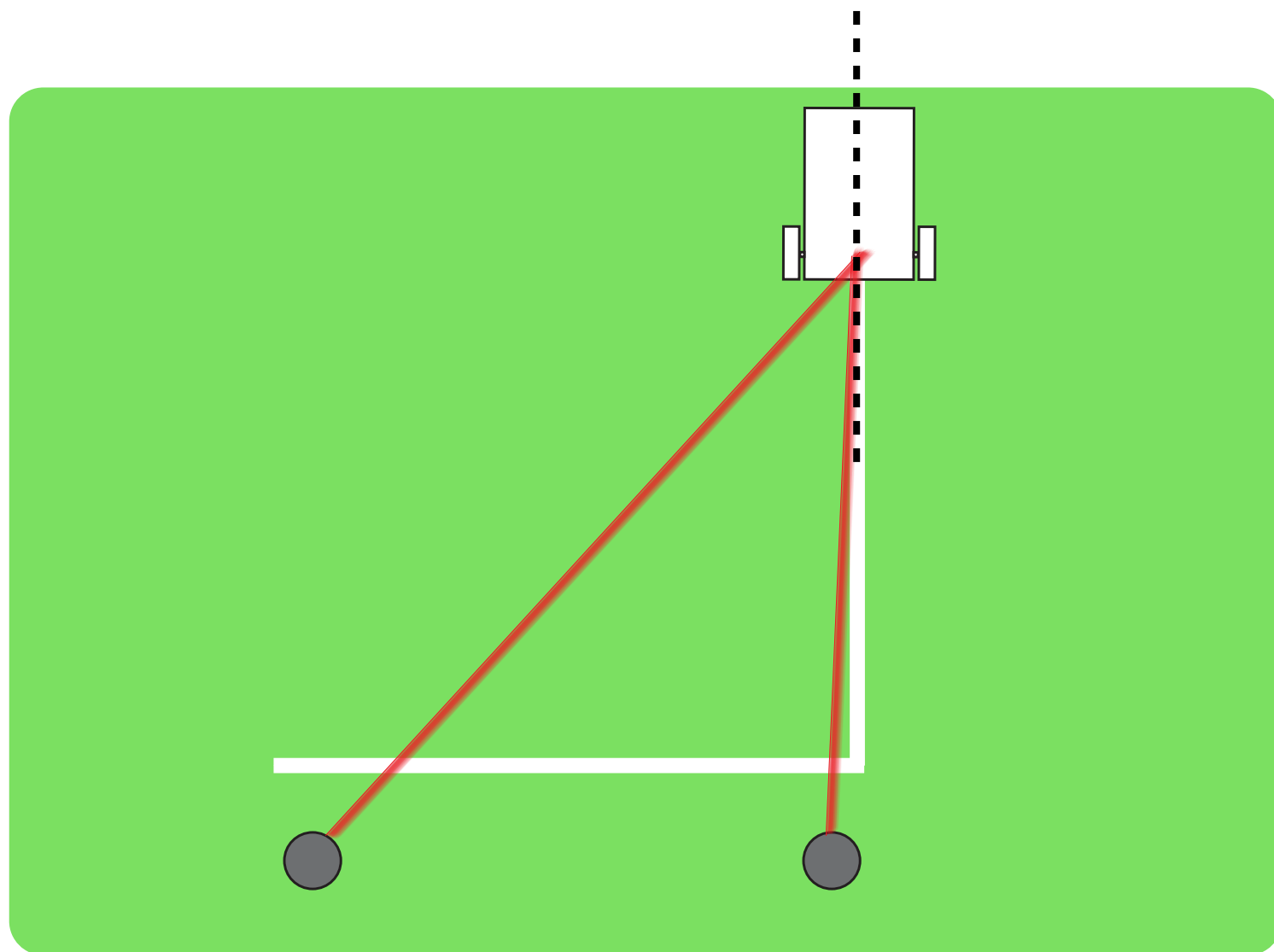


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What we learned & future steps

Findings	Future Steps
sweep too slow	higher speed or high resolution stepper motors
laser too dim at long distances	more reflective material for laser sweep
need accurate orientation reading	Gyroscope or 2 photoresistors on Linus

Thanks!
See you in lab!

Thanks!
See you in lab!

-silver b