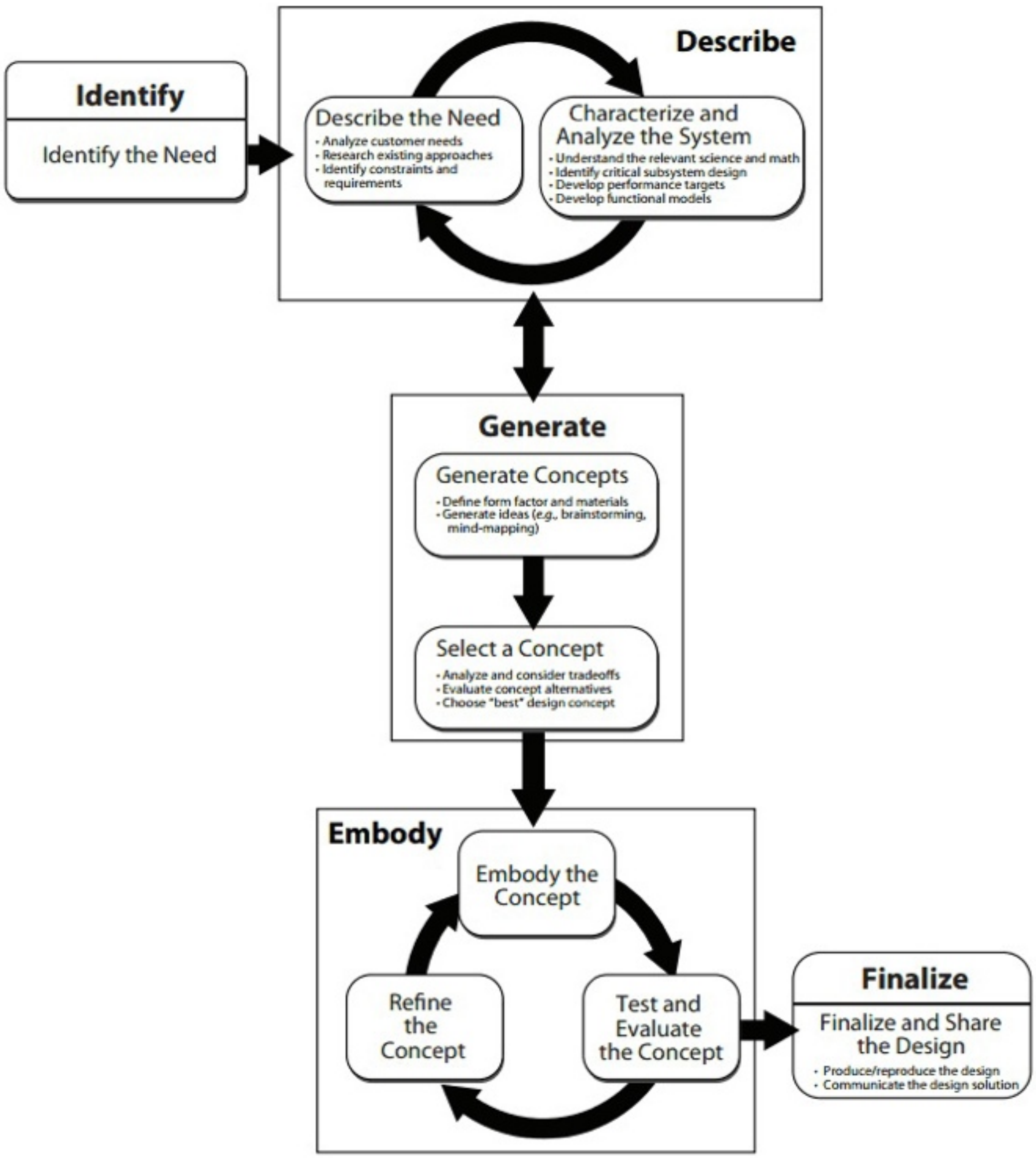

Identify
Identify the Need
Describe
Describe the Need
· Analyze customer needs
· Research existing approaches
· Identify constraints and requirements
Characterize and Analyze the System
· Understand the relevant science and math
· Identify critical subsystem design
· Develop performance targets
· Develop functional models
Generate
Generate Concepts
· Define form factor and materials
· Generate ideas (e.g., brainstorming, mind-mapping)
Select a Concept
· Analyze and consider tradeoffs
· Evaluate concept alternatives
· Choose "best" design concept
Embody
Embody the Concept
Test and Evaluate the Concept
Refine the Concept
Finalize
Finalize and Share the Design
· Produce/reproduce the design
· Communicate the design solution

# Generate

## Ways to correct drift

### Hardware - eliminate problem

Tank drive

6-wheel

Fix omnibase

### Software - correct drift

Four encoders on all sides - compare reading

Two perpendicular encoders - do trig and compare

Two track balls

Compare with other sensors

## Pugh chart categories

- Ease of testing
- Universality (can it be implemented into any robot)
- Likely effectiveness
- Space efficiency
- Instinct factor

| | Ease of testing ×10% (5= short amount of time) | + | Universality ×30% (5= completely universal) | + | Likely effectiveness ×25% (5= completely effective) | + | Space efficiency ×15% (5= no interference with other functions) | + | Instinct factor ×20% | = | Total 100% |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Tank drive | 3 | | 1 | | 4 | | 5 | | 3 | | |
| 6-wheel | 4 | | 2 | | 5 | | 5 | | 3 | | |
| Fix omnibase | 4 | | 1 | | 2 | | 5 | | 3 | | |
| Four encoders on all sides | 2 | | 3 | | 4 | | 2 | | 1 | | |
| Two perpendicular encoders | 3 | | 4 | | 4 | | 3 | | 5 | | |
| Two track balls | 1 | | 4 | | 3 | | 3 | | 2 | | |
| Compare with other sensors | 4 | | 5 | | 2 | | 4 | | 1 | | |

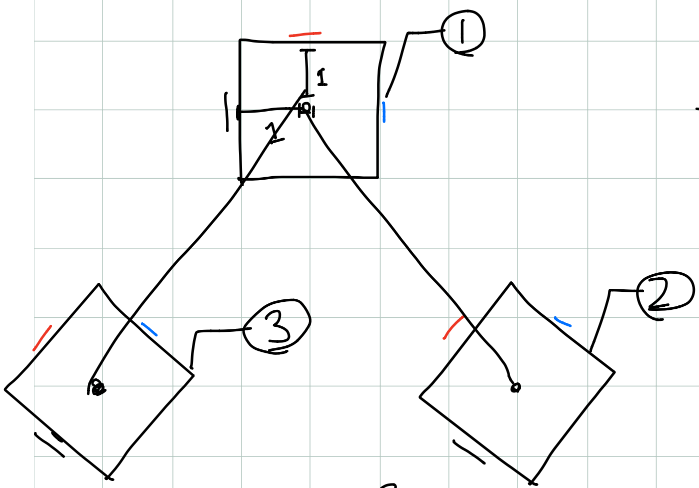
Entach Pugh Chart

| | | | | | | |
|---|---|---|---|---|---|---|
| **Tank drive** | 3 | 1 | 4 | 5 | 3 | 2.95 |
| **6-wheel** | 4 | 2 | 5 | 5 | 3 | 3.6 |
| **Fix omnibase** | 4 | 1 | 2 | 5 | 3 | 2.55 |
| **Four encoders** | 2 | 3 | 4 | 2 | 1 | 2.6 |
| **Two encoders** | 3 | 4 | 4 | 3 | 5 | 3.95 |
| **Two trackballs** | 1 | 4 | 3 | 3 | 2 | 2.9 |
| **Sensor integration** | 4 | 5 | 2 | 4 | 1 | 3.2 |

Let's build the 6-wheel base first

# Track location all the time

- When another robot rams into you




$\Delta ① \to ② = \begin{matrix} x=3 \\ y=4 \\ \theta=45° \end{matrix}$

What encoders would say:

— $1 \times \frac{\pi}{2} + \sqrt{3^2+4^2} = 6.57$

— $1 \times \frac{\pi}{2} + \sqrt{\cancel{3^2+4^2}} =$

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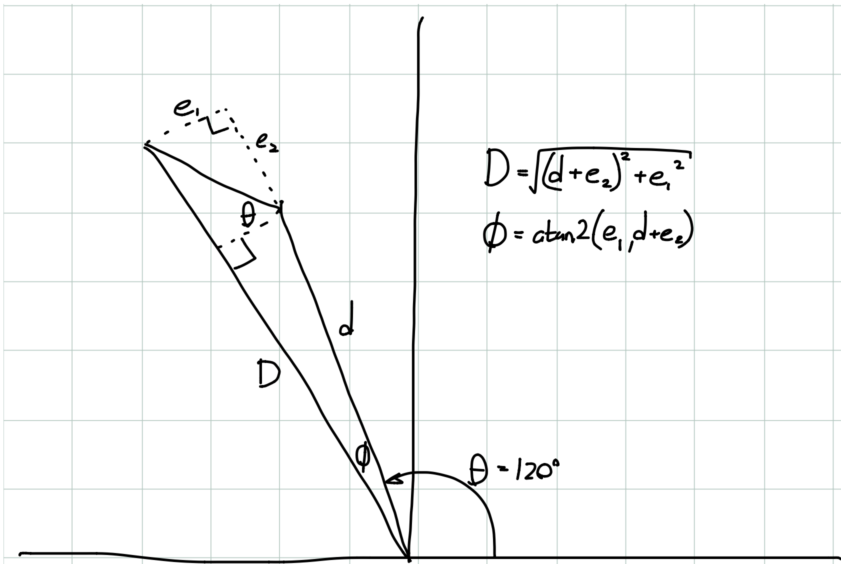
— $1 \times \frac{\pi}{2} + \sqrt{3^2+4^2} = 6.57$

— $1 \times \frac{\pi}{2} + \sqrt{\cancel{3^2+4^2}} =$

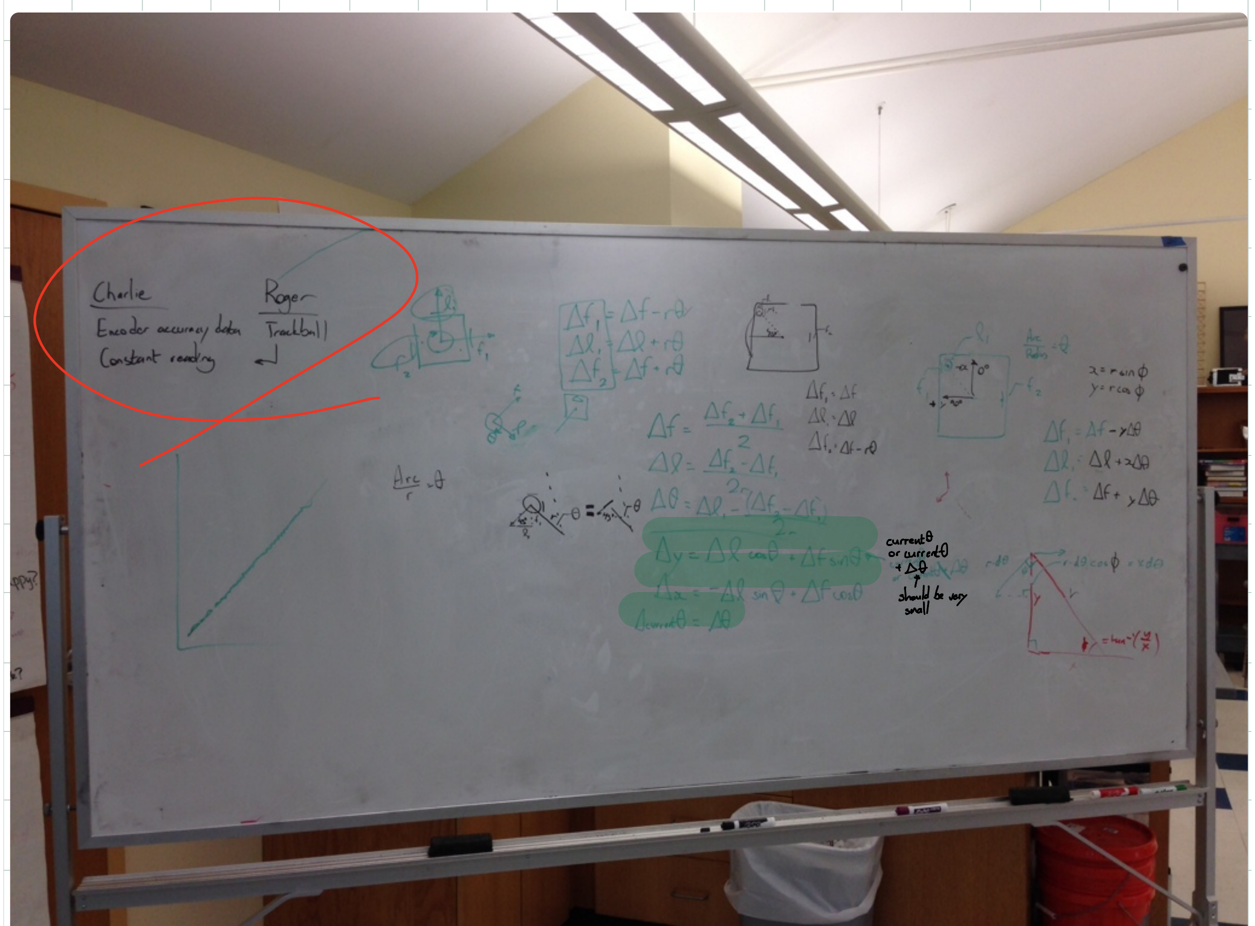
Use calculus, use small vectors

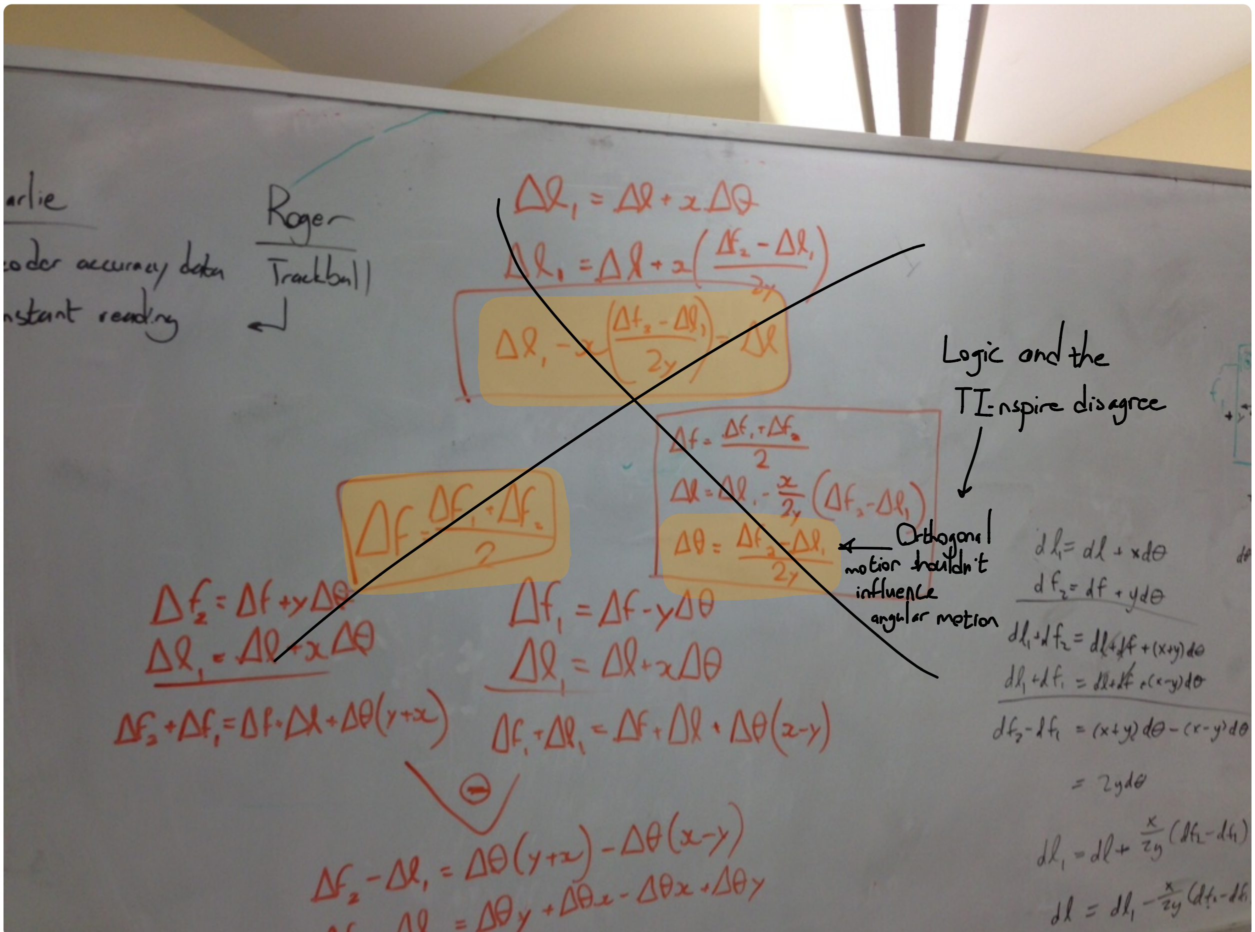
Diameter of wheel = $2 \frac{3}{16}$"




$$D = \sqrt{(d+e_2)^2 + e_1^2}$$

$$\phi = \mathrm{atan2}(e_1, d+e_2)$$






$x$ & $y$ are weird ?

$$\Delta f = \frac{\Delta f_1 + \Delta f_2}{2}$$

$$\Delta l = \frac{x}{2y}(\Delta f_1 - \Delta f_2) + \Delta l_1$$

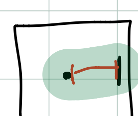
$$\Delta\theta = -\frac{\Delta f_1 - \Delta f_2}{2y}$$

$$\Delta f_1 = \Delta f - y\Delta\theta$$

$$\Delta l_1 = \Delta l + x\Delta\theta$$

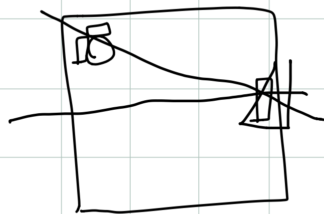
$$\Delta f_2 = \Delta f + \underbrace{c\Delta\theta}_{\text{Arc}}$$

$$\frac{\text{Arc}}{\text{Radius}} = \theta \quad \therefore \quad c =$$



$$y = r\cos\phi$$

$$x = r\sin\phi$$



To do list

- Build a track ball
- Test how good the encoders really are - it is ok to get encoder data as fast as you can
- Design and code pathing algorithms
- Assemble a compatible robot
- Based on encoder precision and accuracy data, set delta sampling method
- Test new equations on the robot

Three next steps for me:

- Expected vs. Actual position
- Obstacle detection (differentiates between drift and obstacles)
- Field array storage