



# Desmistificando controle diferencial com Arduino

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1. Explica PID, de maneira básica
2. Mostra os diagramas do circuito e os esqueminhos
3. Constrói o código lá com a galera da hora
4. Da um tempinho pro pessoal fazer e tentar
5. Propõe algumas melhorias ao código básico construído

No 1 a gente mostra o diagrama de feedback

# Controle de malha aberta



Hey, can you set the water  
temperature to warm?

# Controle de malha aberta



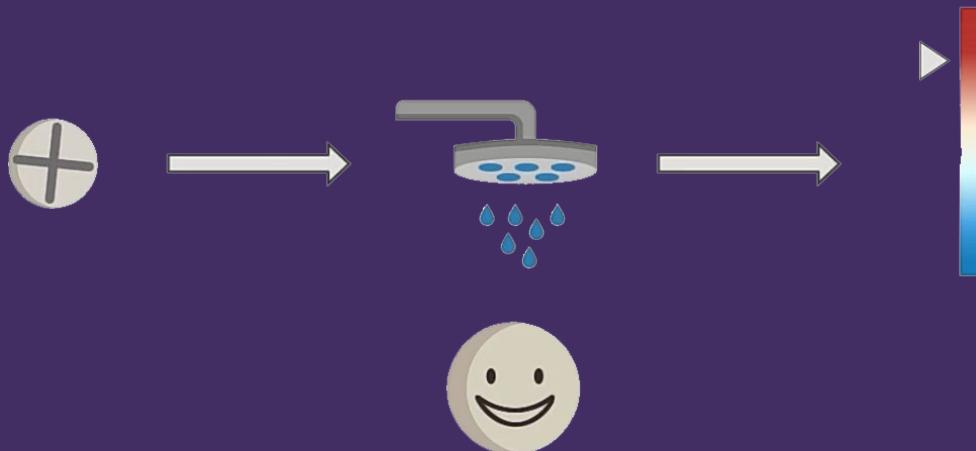
# Controle de malha aberta



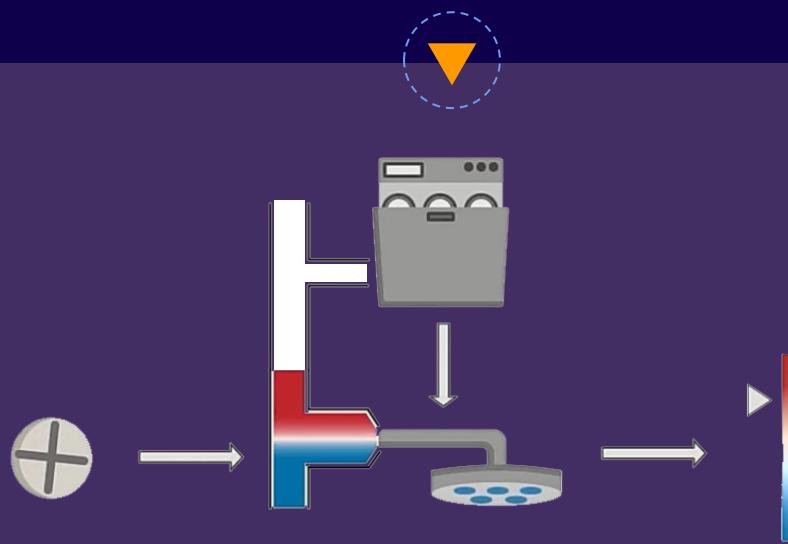
# Controle de malha aberta



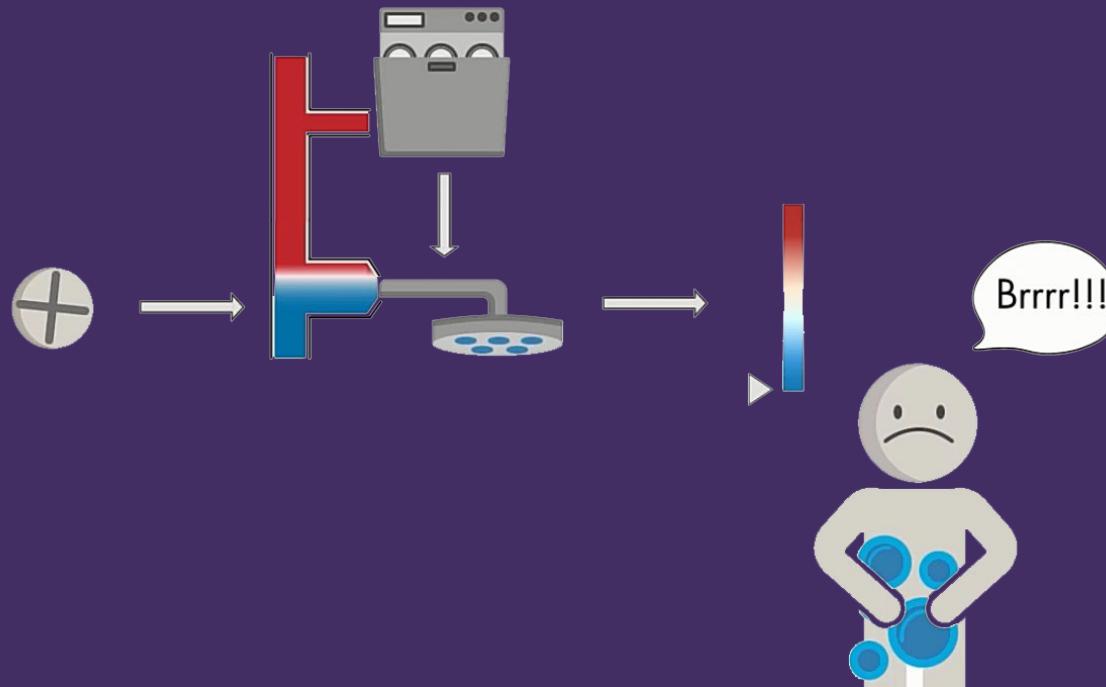
# Controle de malha aberta



# Controle de malha fechada



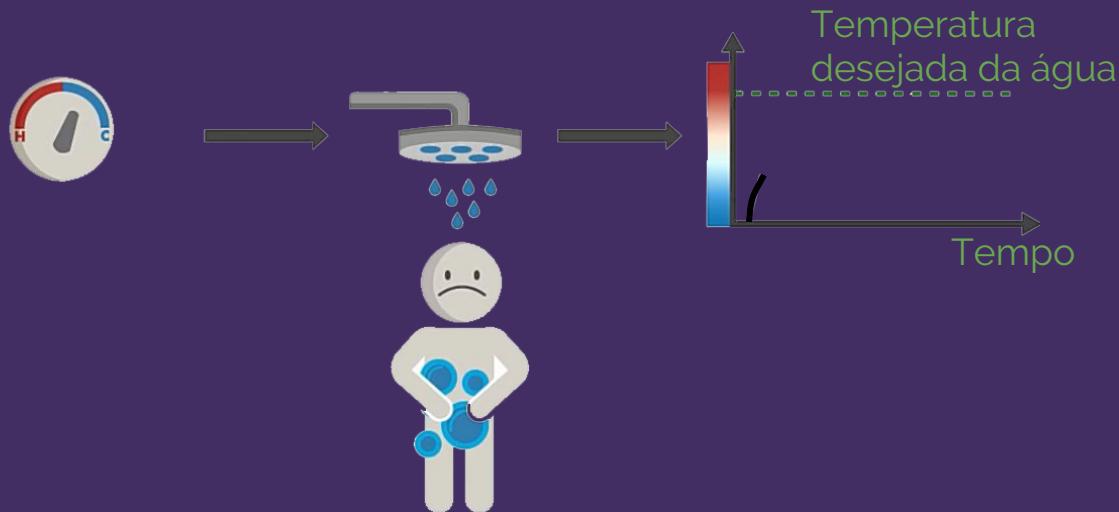
# Controle de malha aberta



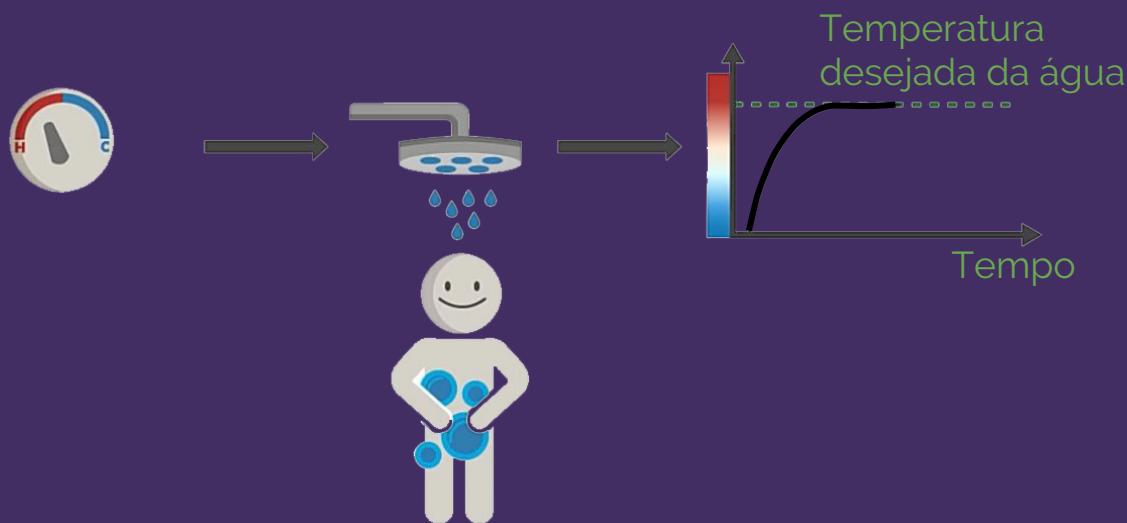
# Controle de malha fechada



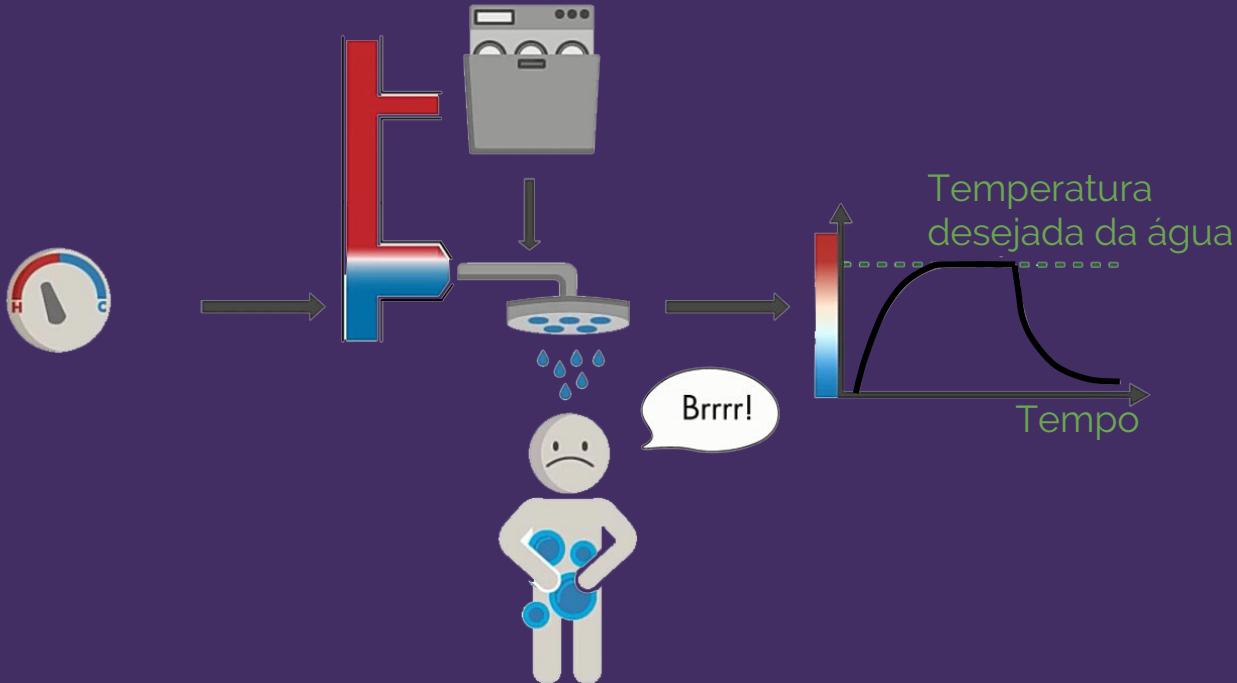
# Controle de malha fechada



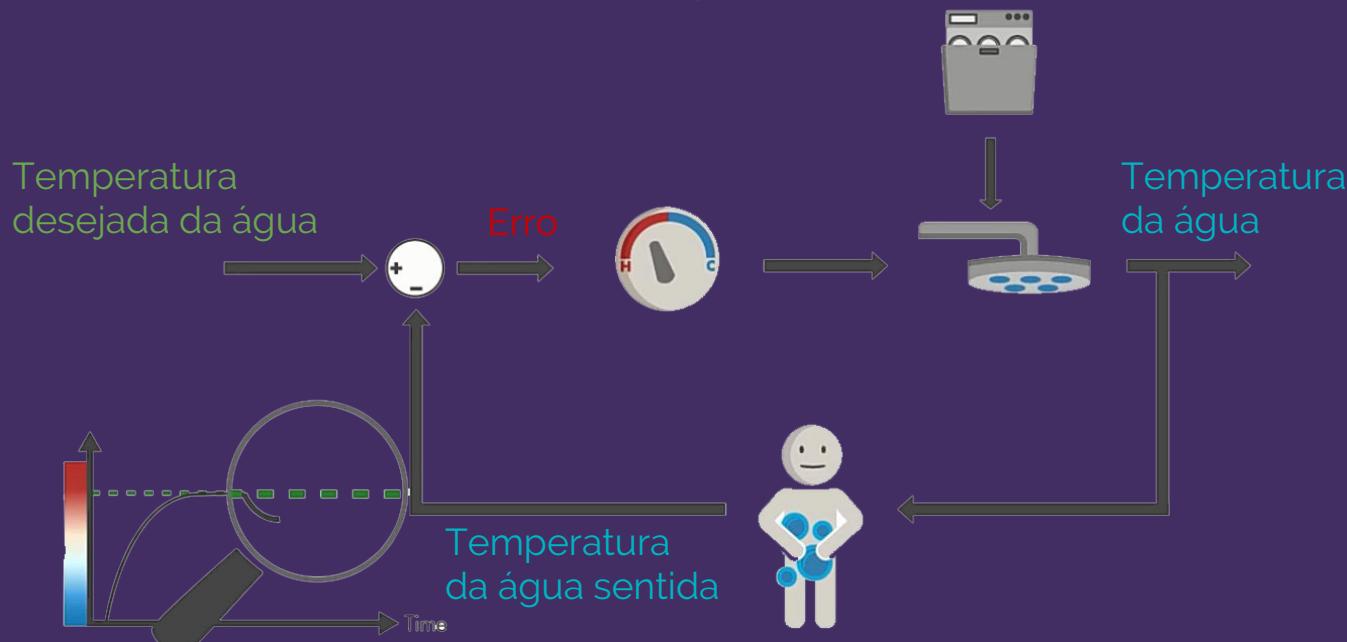
# Controle de malha fechada



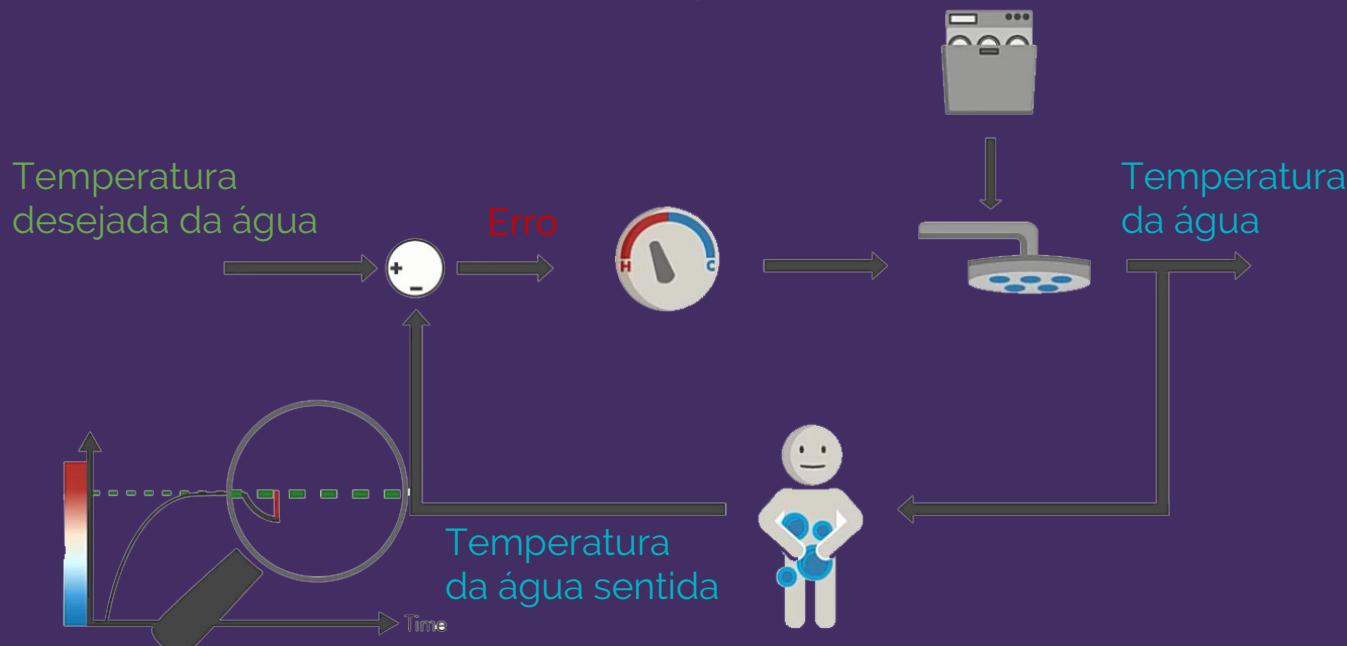
# Controle de malha fechada



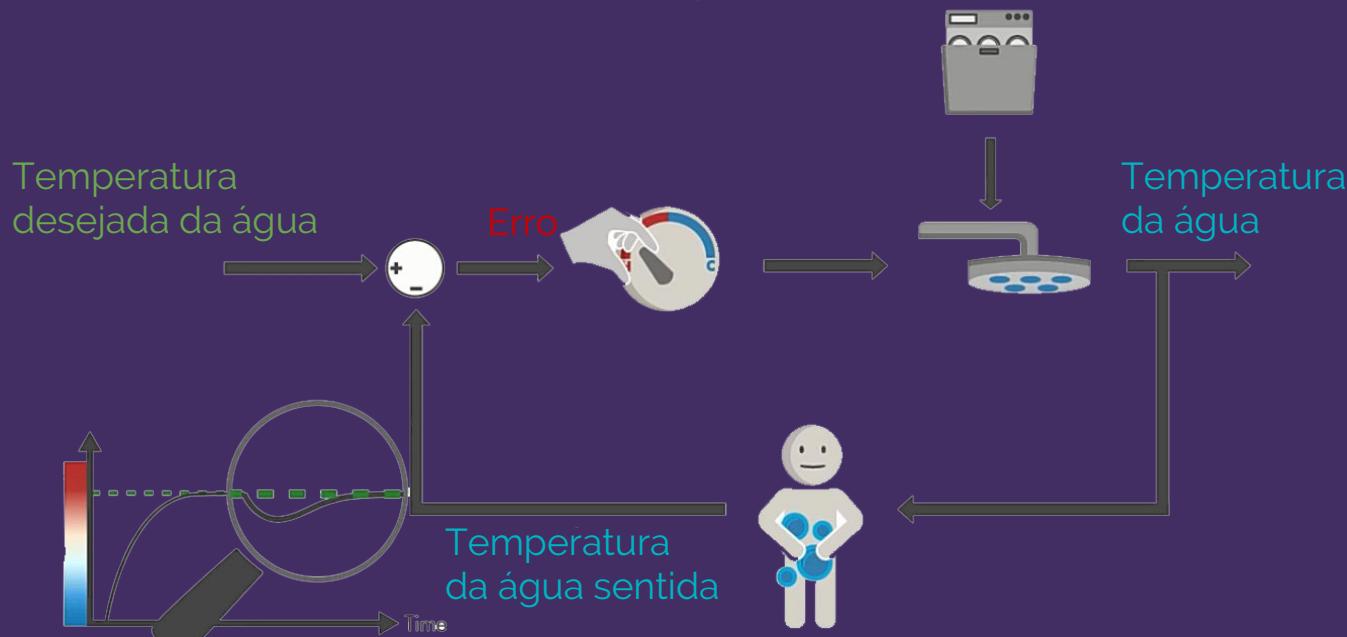
# Controle de malha fechada



# Controle de malha fechada

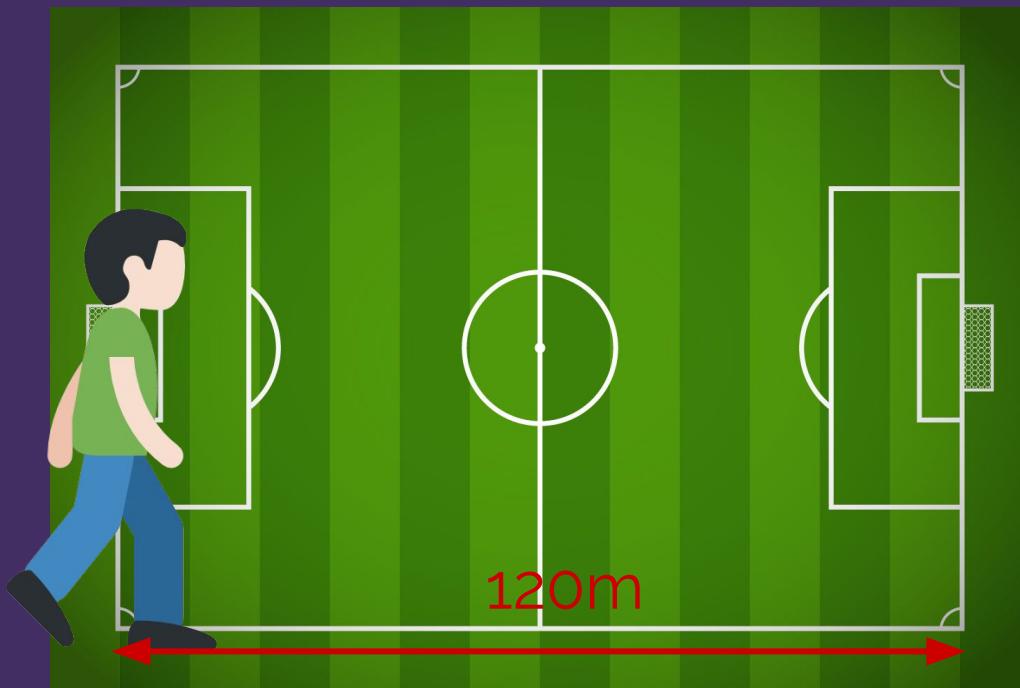


# Controle de malha fechada

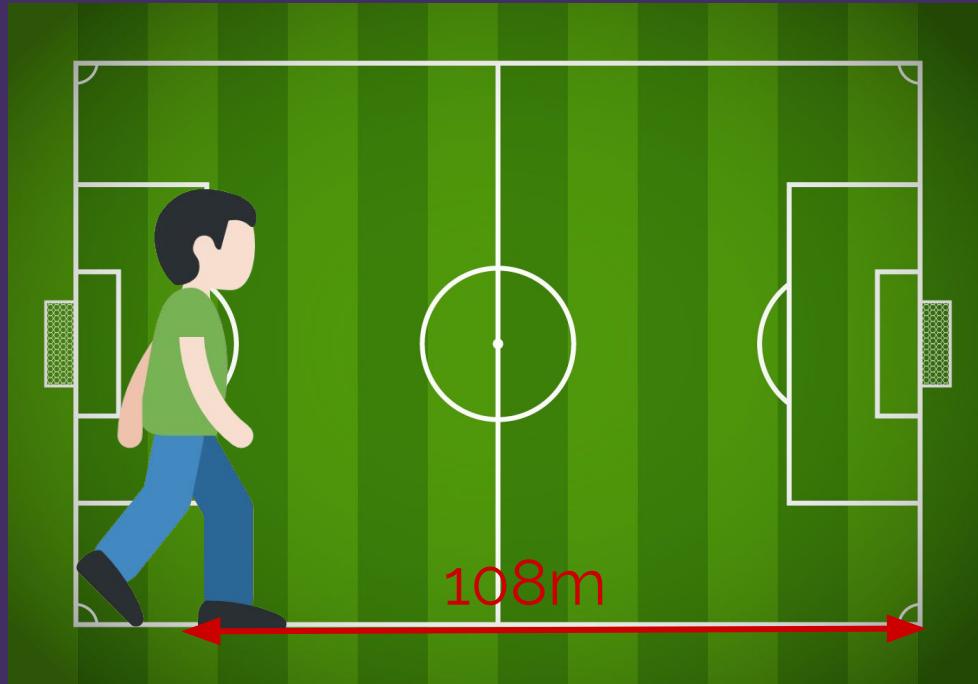


# Controle diferencial

PID

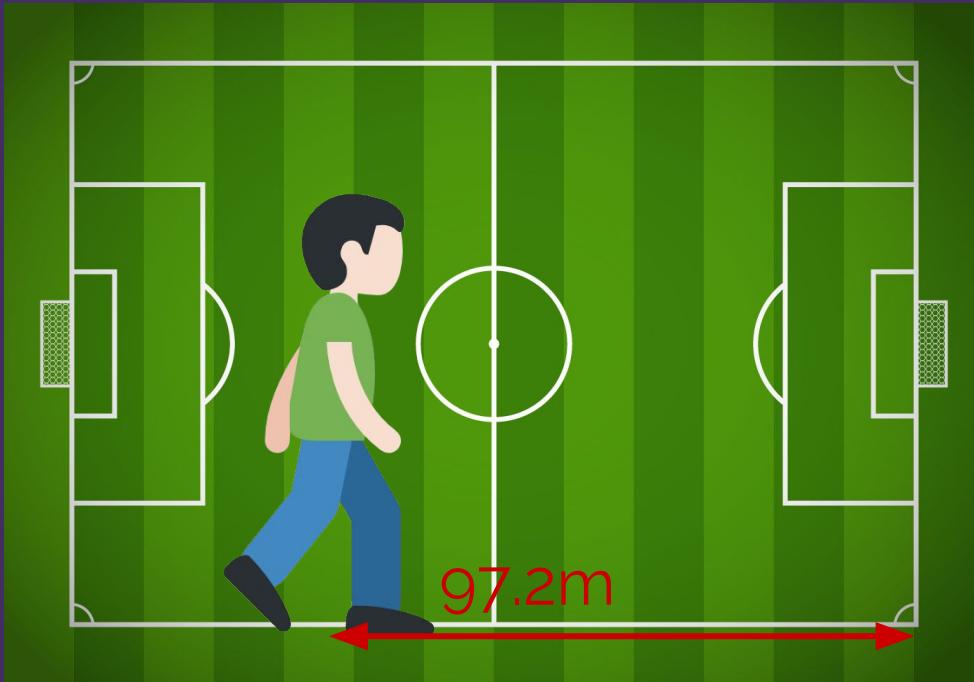


PID

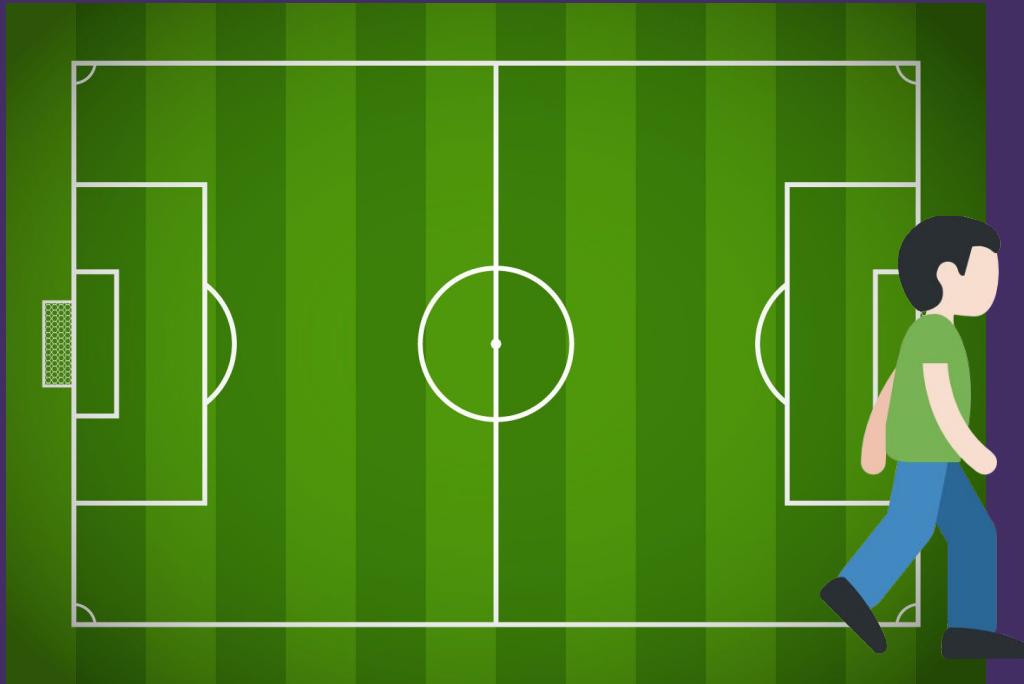


108m

PID



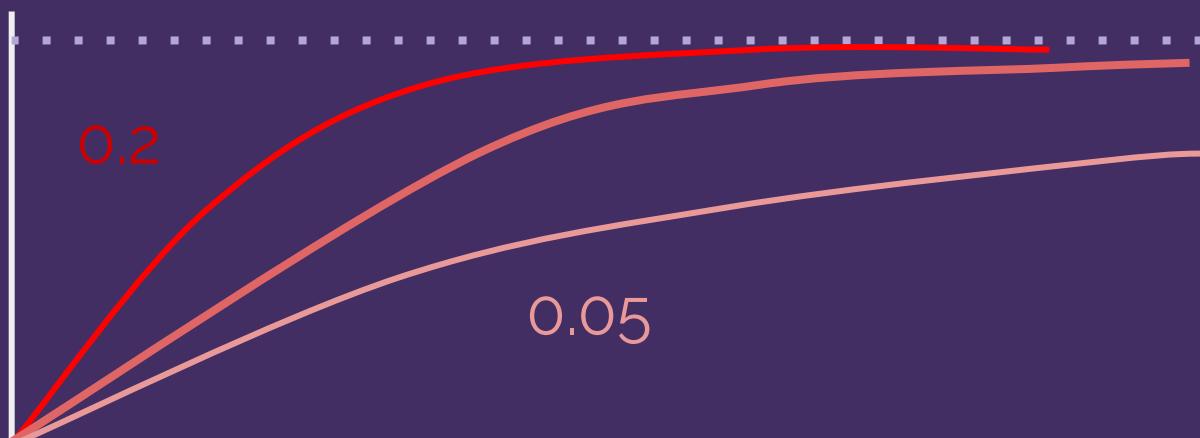
PID



PID



PID

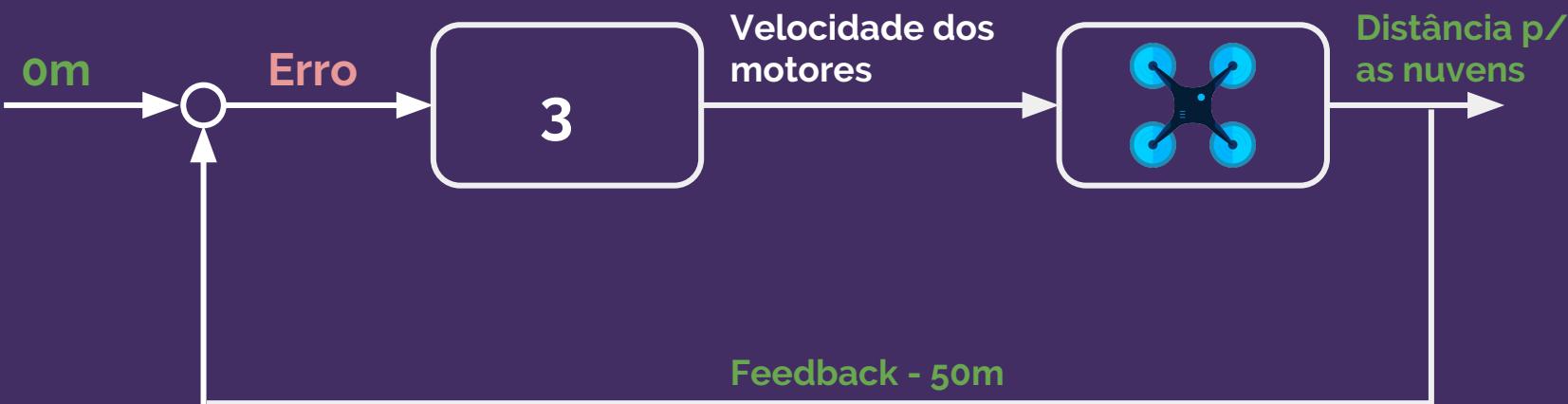


PID



50 m

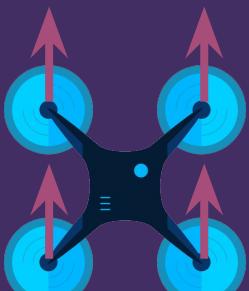
PID



PID



50 m



PID



25 m

PID



PID



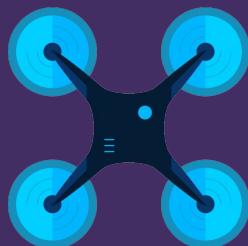
Velocidade

Peso



PID

100 RPM

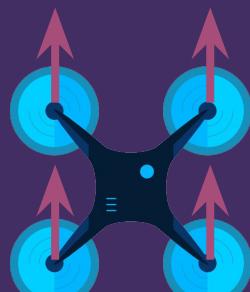


100 RPM < 3 x 50

PID

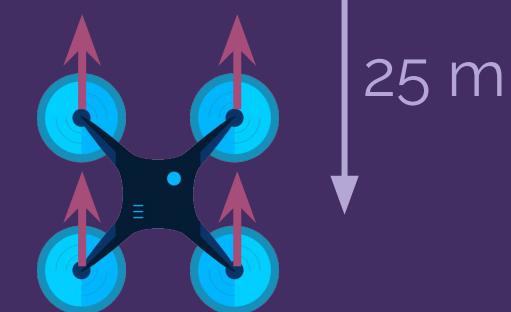


50 m



100 RPM  
 $< 3 \times 50$   
 $> 3 \times 25$

PID



100 RPM  
 $< 5 \times 50$   
 $< 5 \times 25$

PID



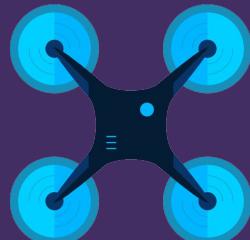
100 RPM  
 $< 5 \times 40$   
 $< 5 \times 25$   
 $> 5 \times 1$

100 RPM  
 $< 100 \times 50$   
 $< 100 \times 25$   
 $= 100 \times 1$

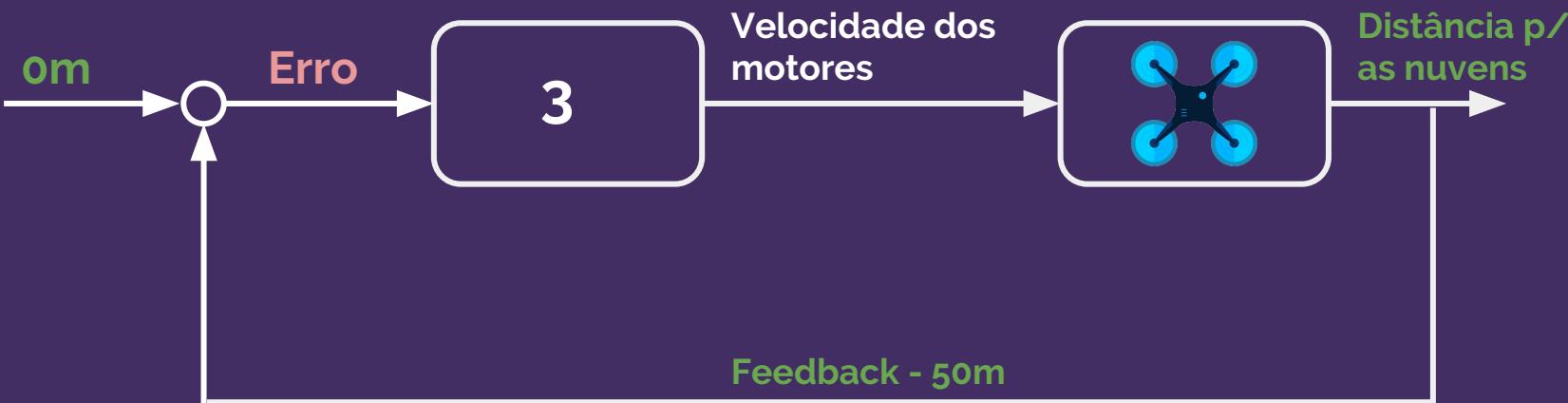
PID

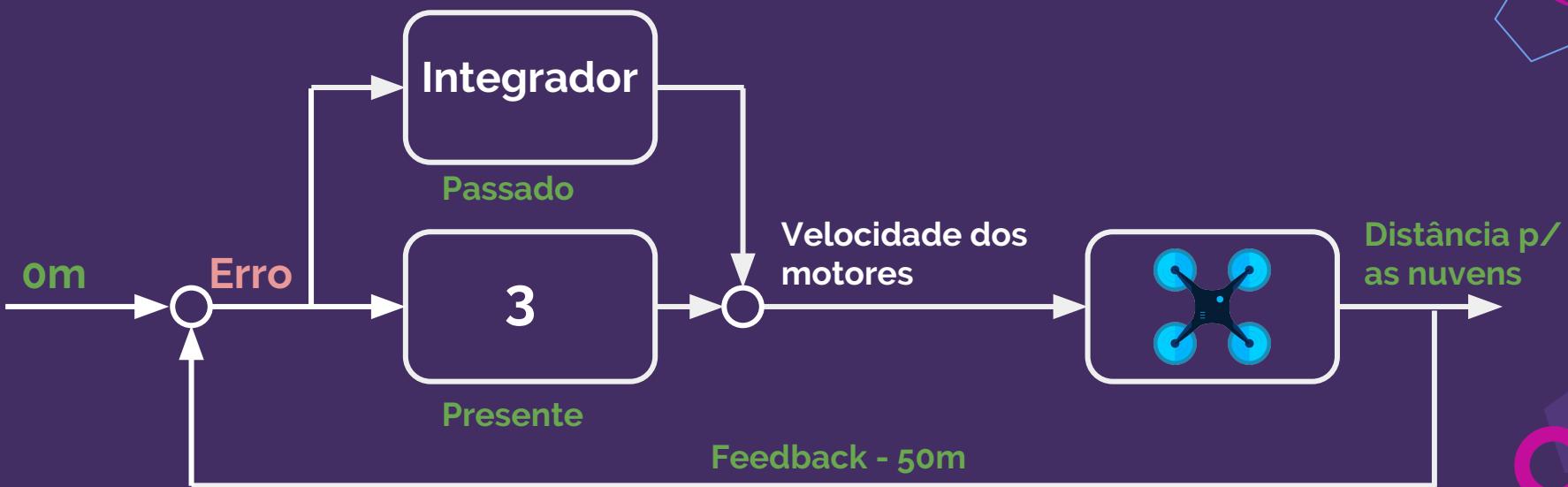


Erro de estado  
estacionário



PID





PID

Erro de  
estado  
estacionário

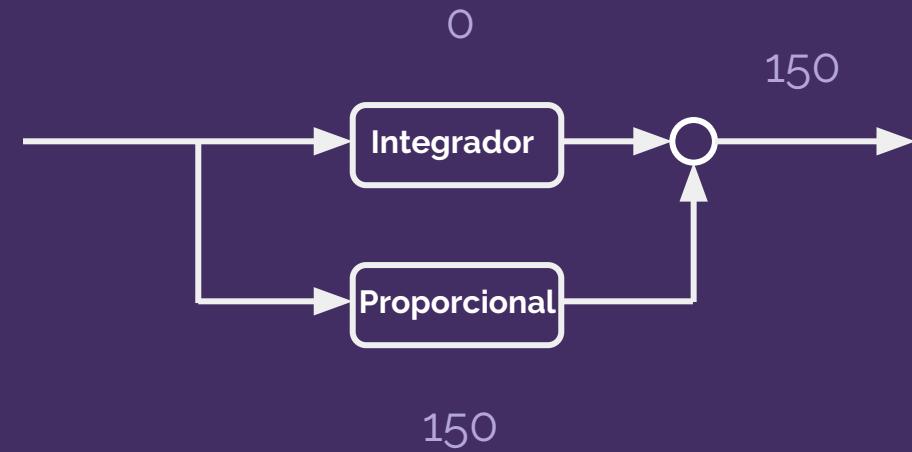


Erro de  
estado  
estacionário



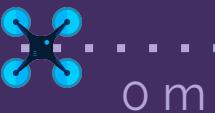
50 m

PID

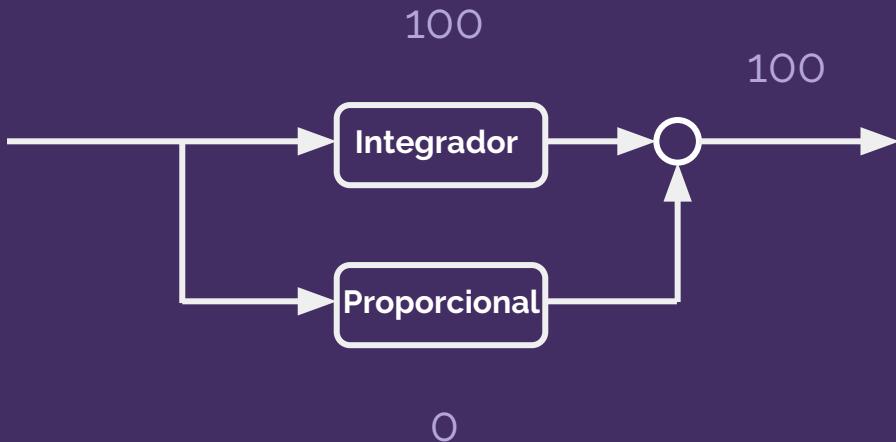


PID

Erro de  
estado  
estacionário



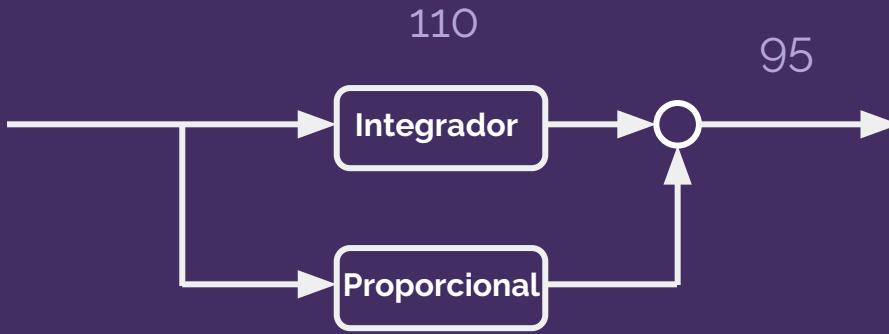
0 m



PID



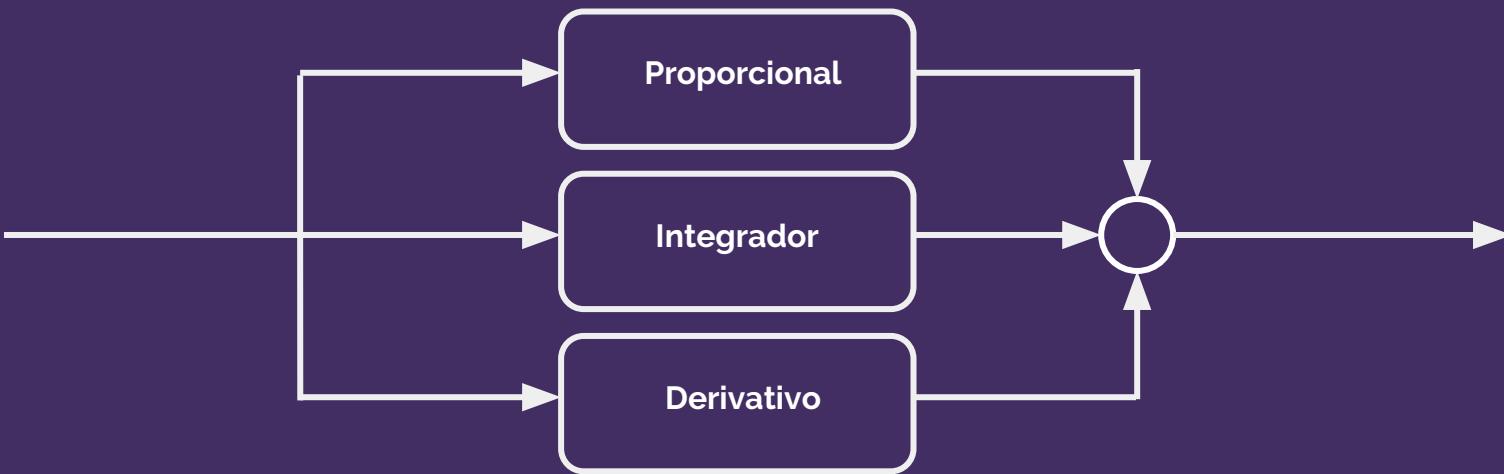
Erro de  
estado  
estacionário



# PID

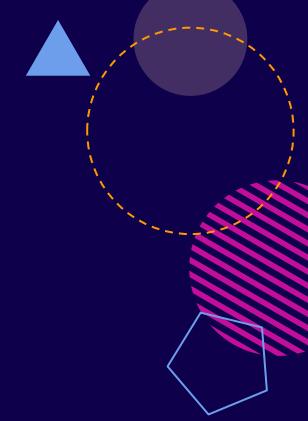
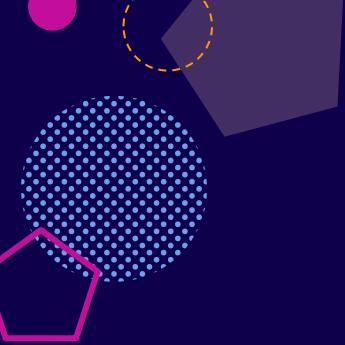


PID

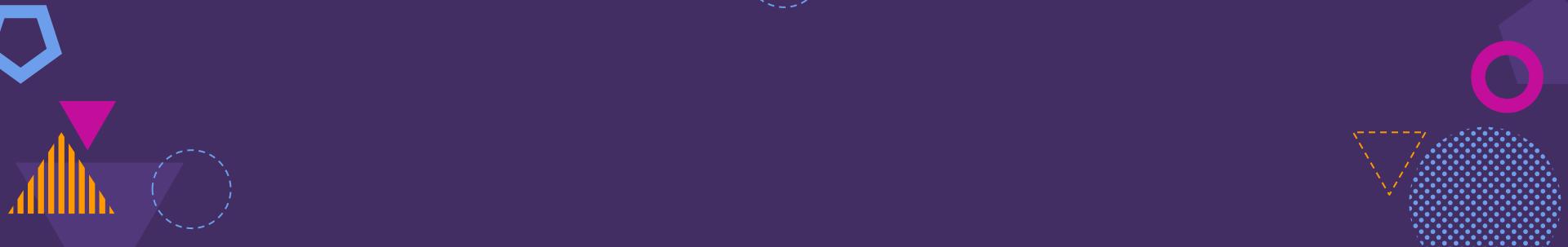


B1c: usos do sinal





Vamos implementar!

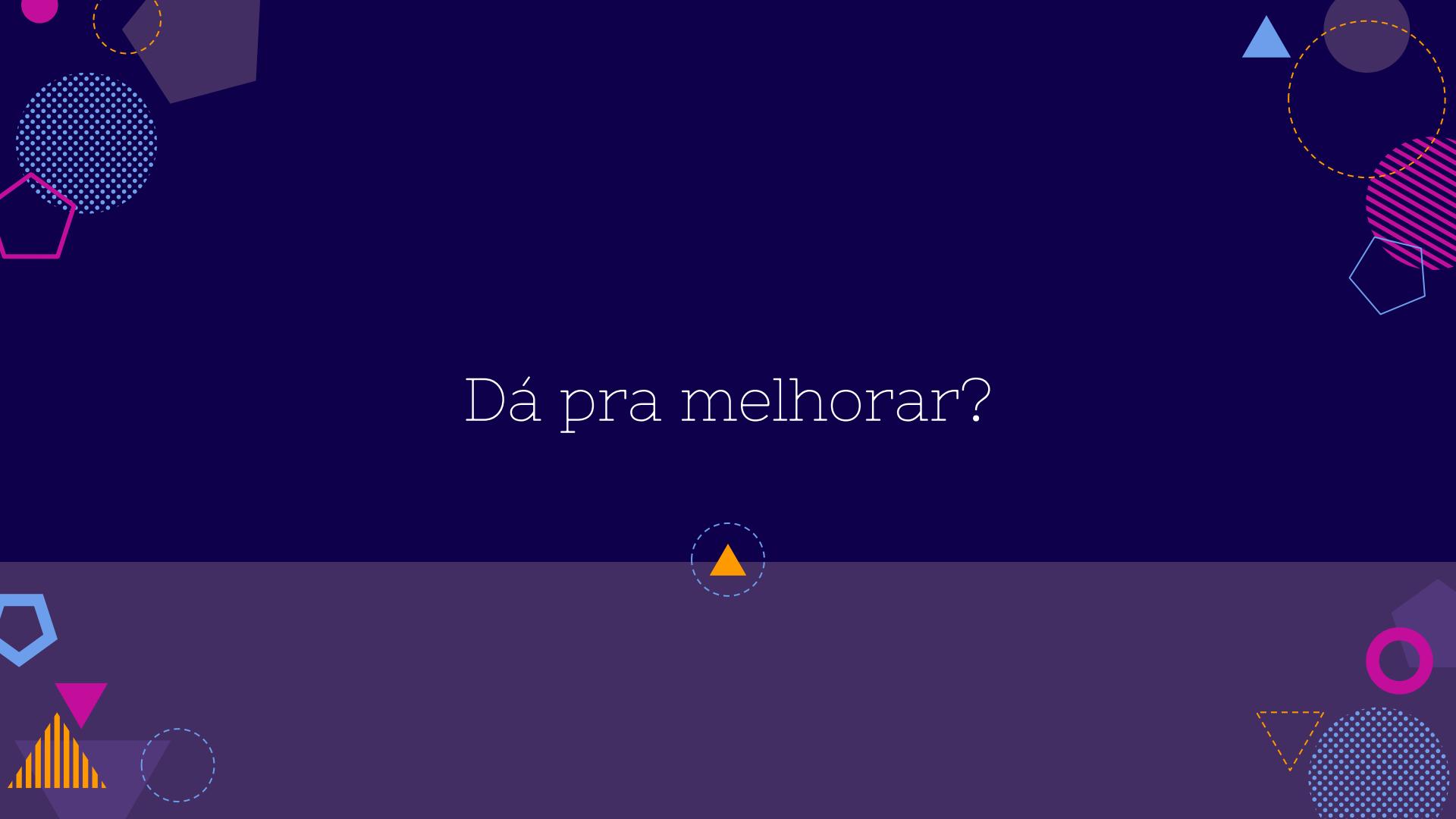


# Desafio

Realizar o controle de uma plataforma com um servo motor de acordo com a distância medida por um ultrassom

# Desafio extra

Modificar o valor alvo  
da distância em tempo de  
execução



Dá pra melhorar?

# Leitura de sensor digital

Prática: Ler ultrassom e imprimir na serial



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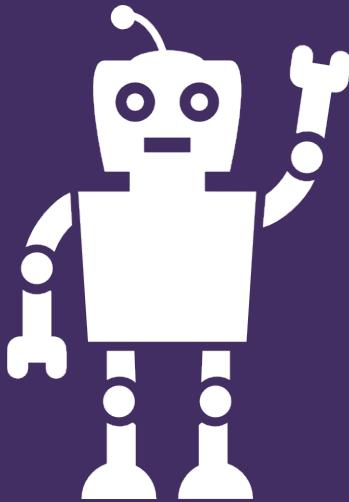
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Obrigado!

# Controlando um servo motor

Prática: Controle de um servo motor