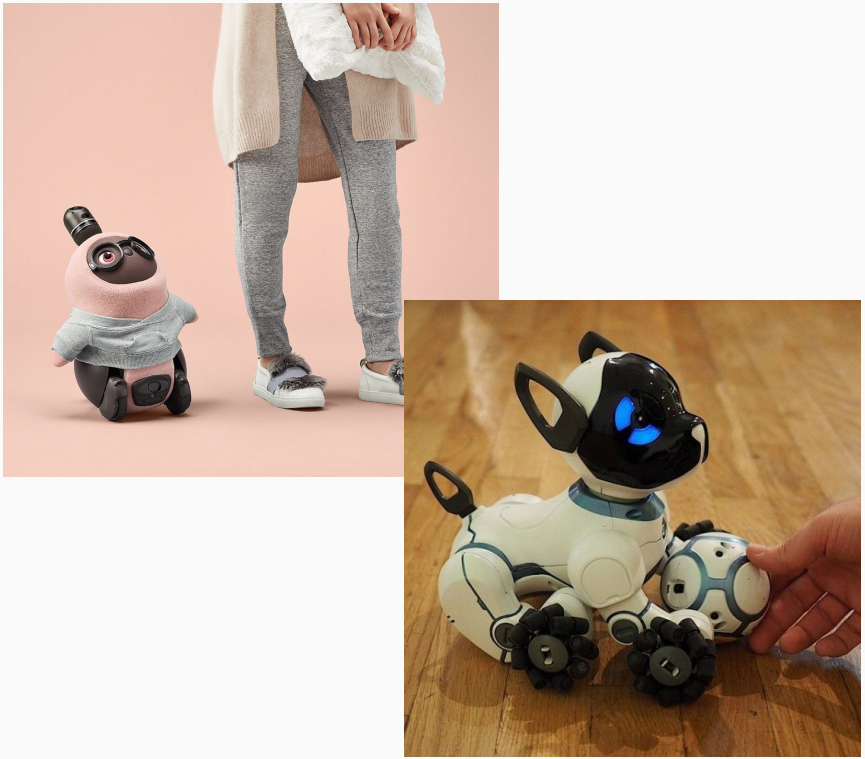
Chase-Bot

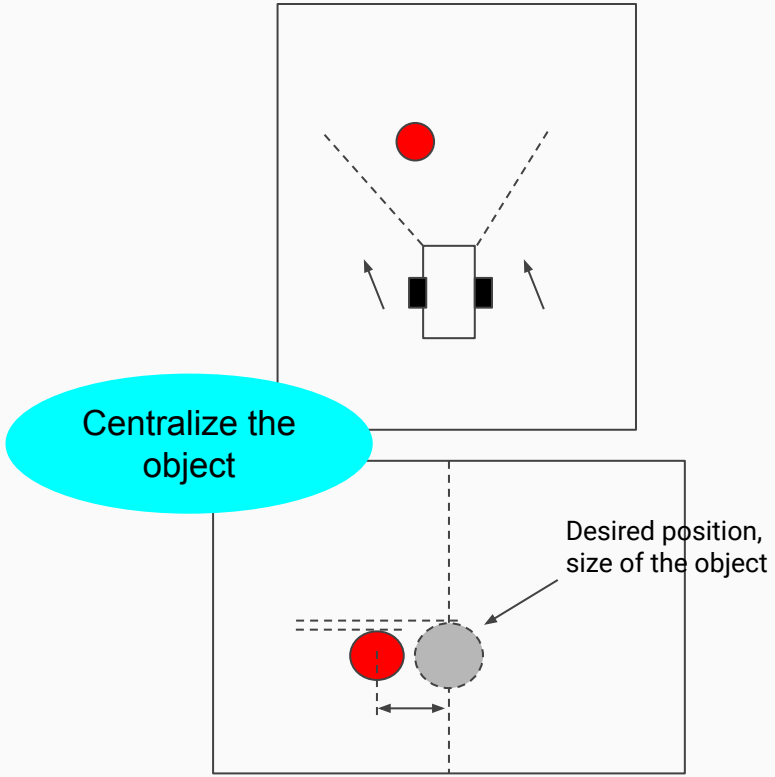
Emmanuel and Shuto

Project Overview

❖ *Motivation*

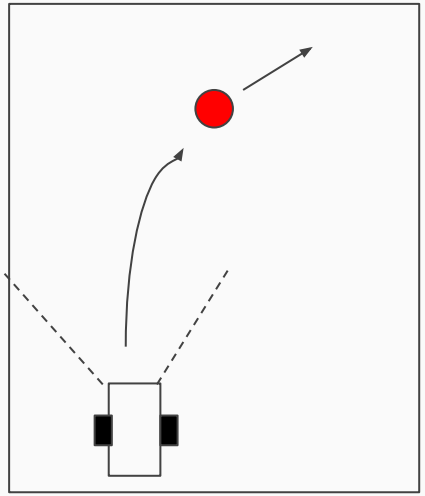


❖ *Method*

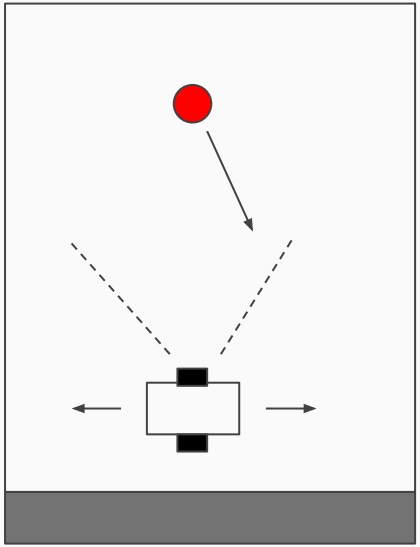


Project Overview

- ***Features***
  - ***Chasing***
  - ***Goalkeeping***

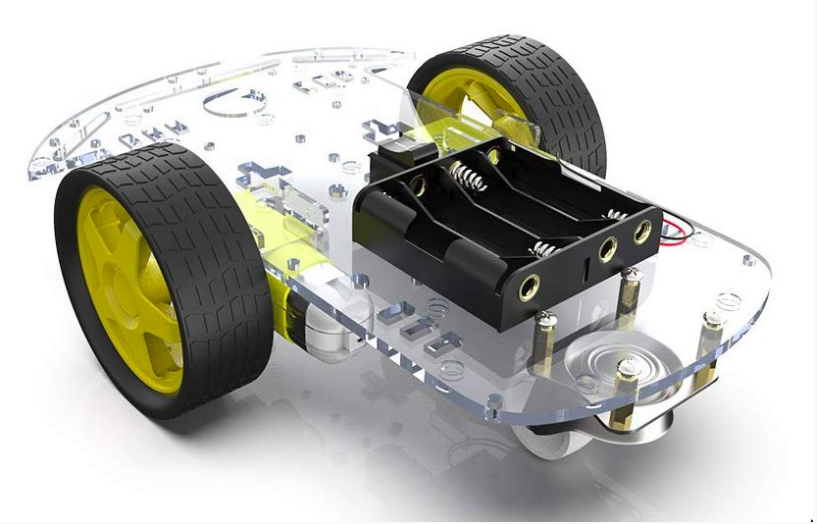


Same Algorithm!!

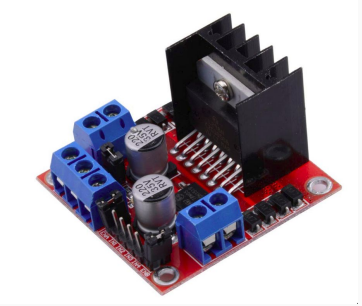


Hardware

2WD Smart Robot Car Chassis Kit

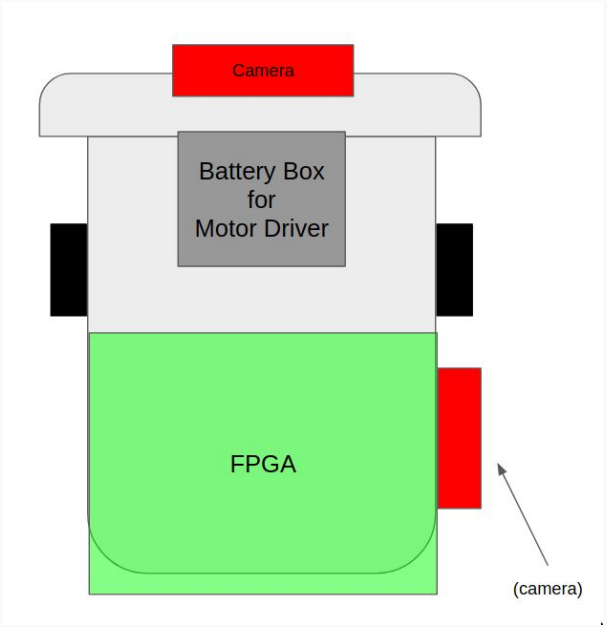


L298N Motor Driver

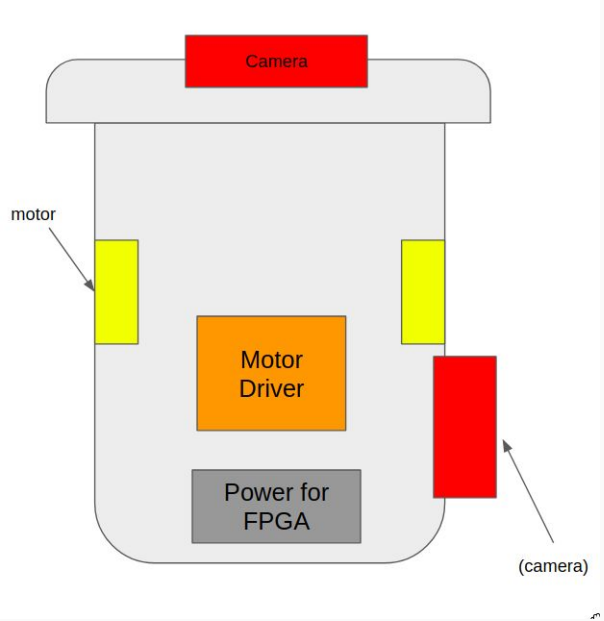


OV7670 Camera

Hardware



Upper view of the car



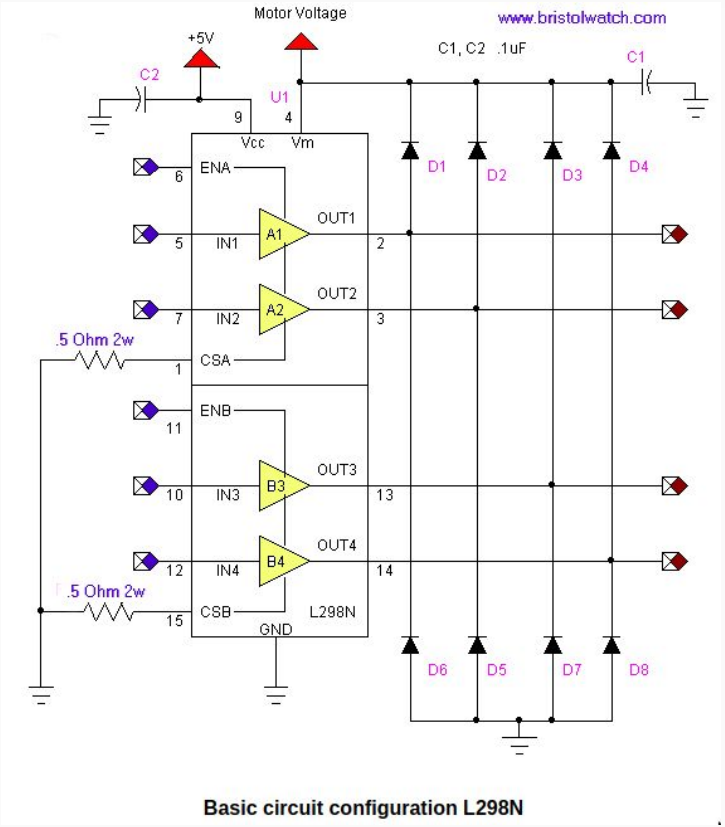
Back view of the car

Hardware

L298N Motor Driver

Pulse Width Modulation(pwm)

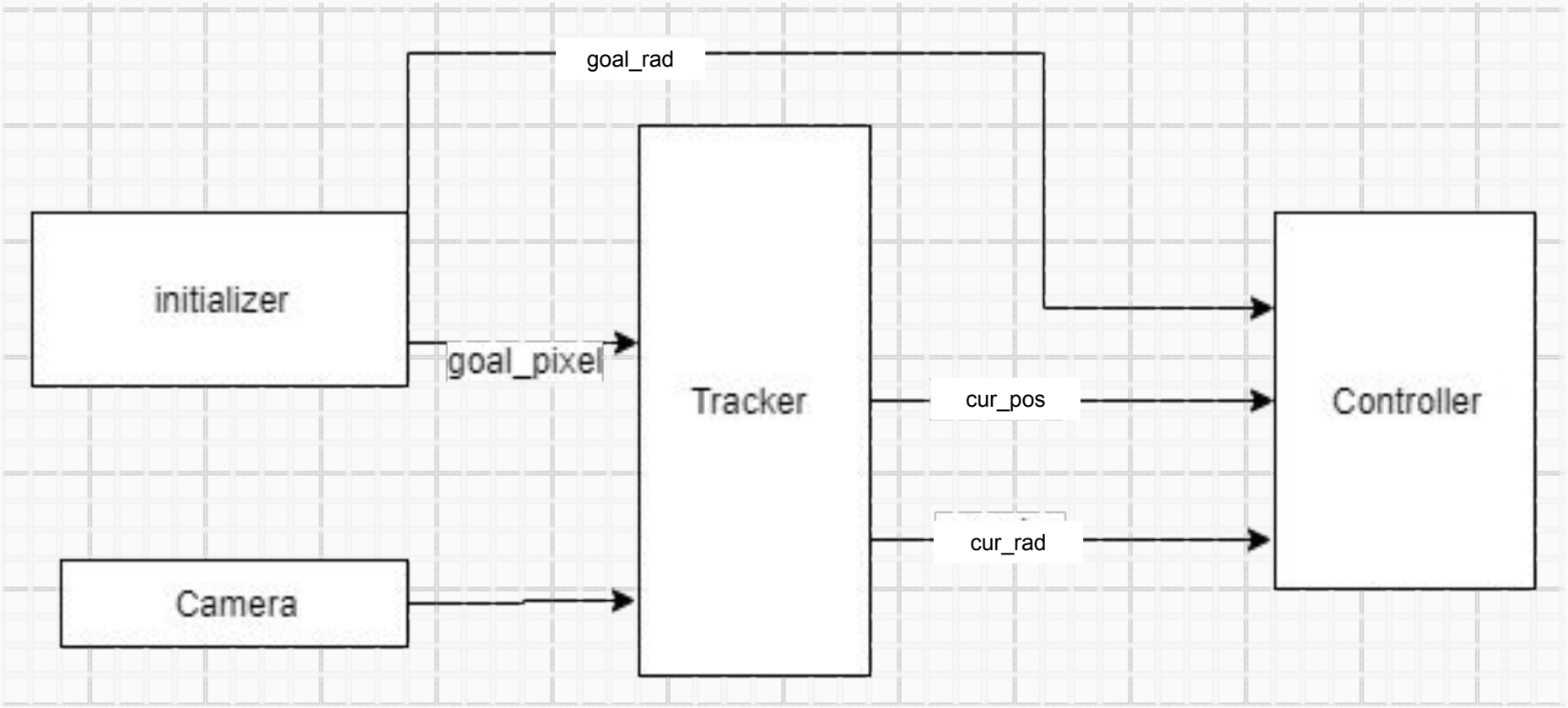
https://www.electronics-tutorials.ws/blog/pulse-width-modulation.html



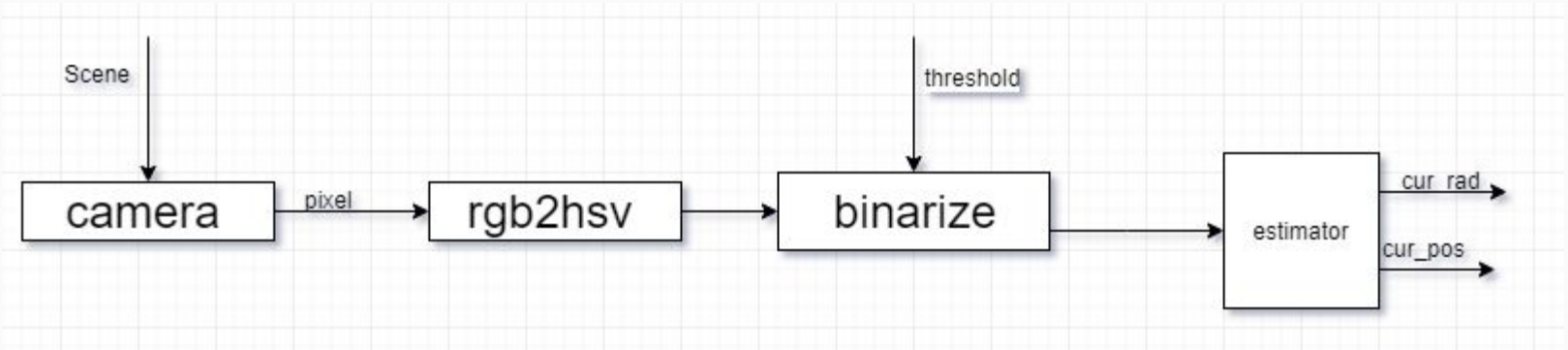
Basic circuit configuration L298N

http://www.bristolwatch.com/L298N/index.htm

High Level BLOCK DIAGRAM

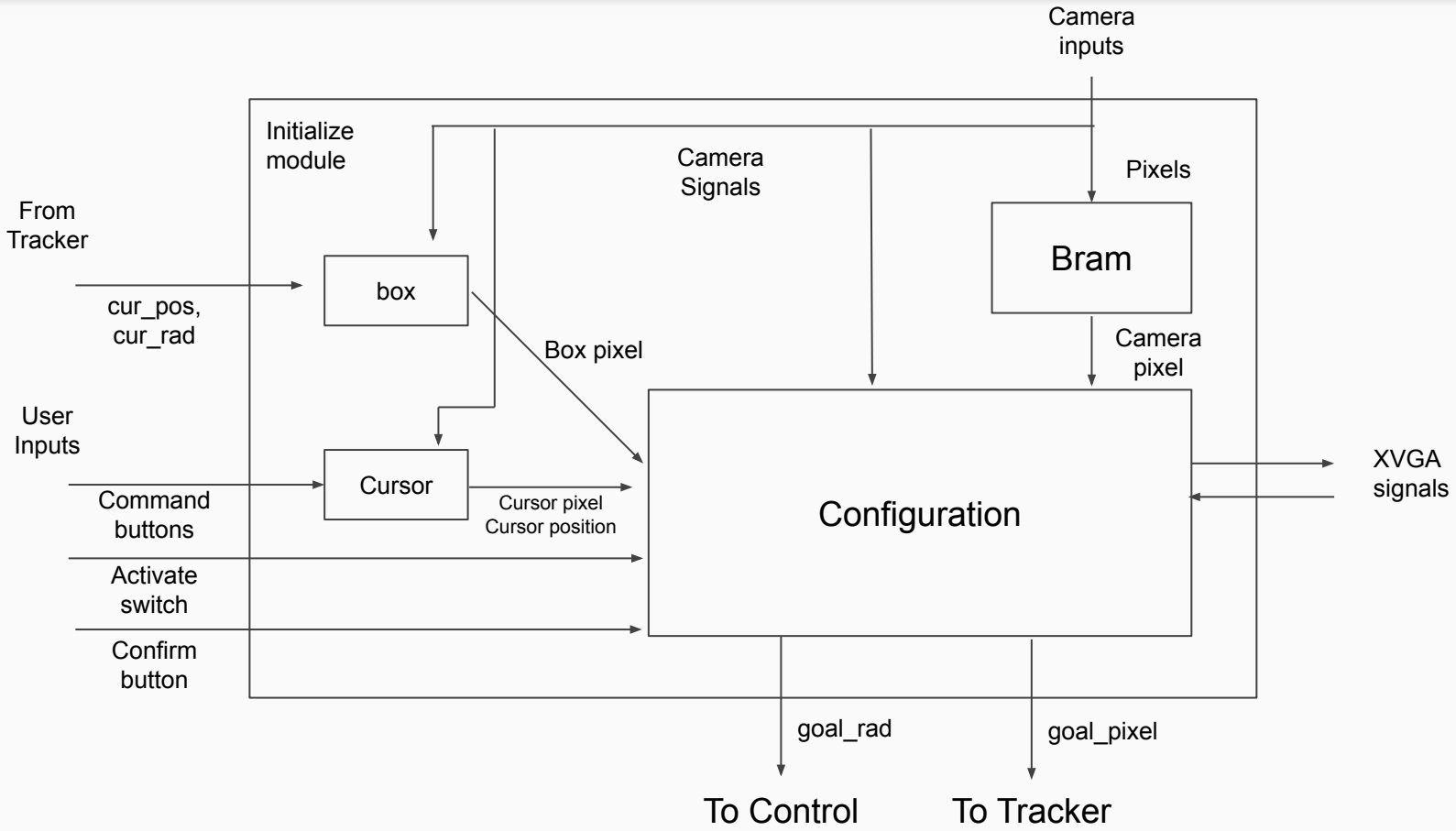


Tracker Module



- Camera get Image
- RGB2HSV
  - To easily threshold in color
- Binarize
  - To easily count inside pixels inside the ball
- Estimator
  - Radius of all 1's in a circular ball
  - Average of positions of pixels with value

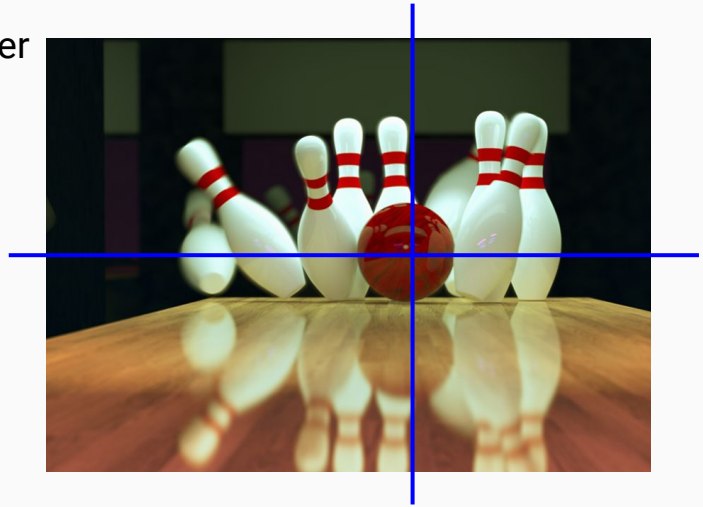
Initializer



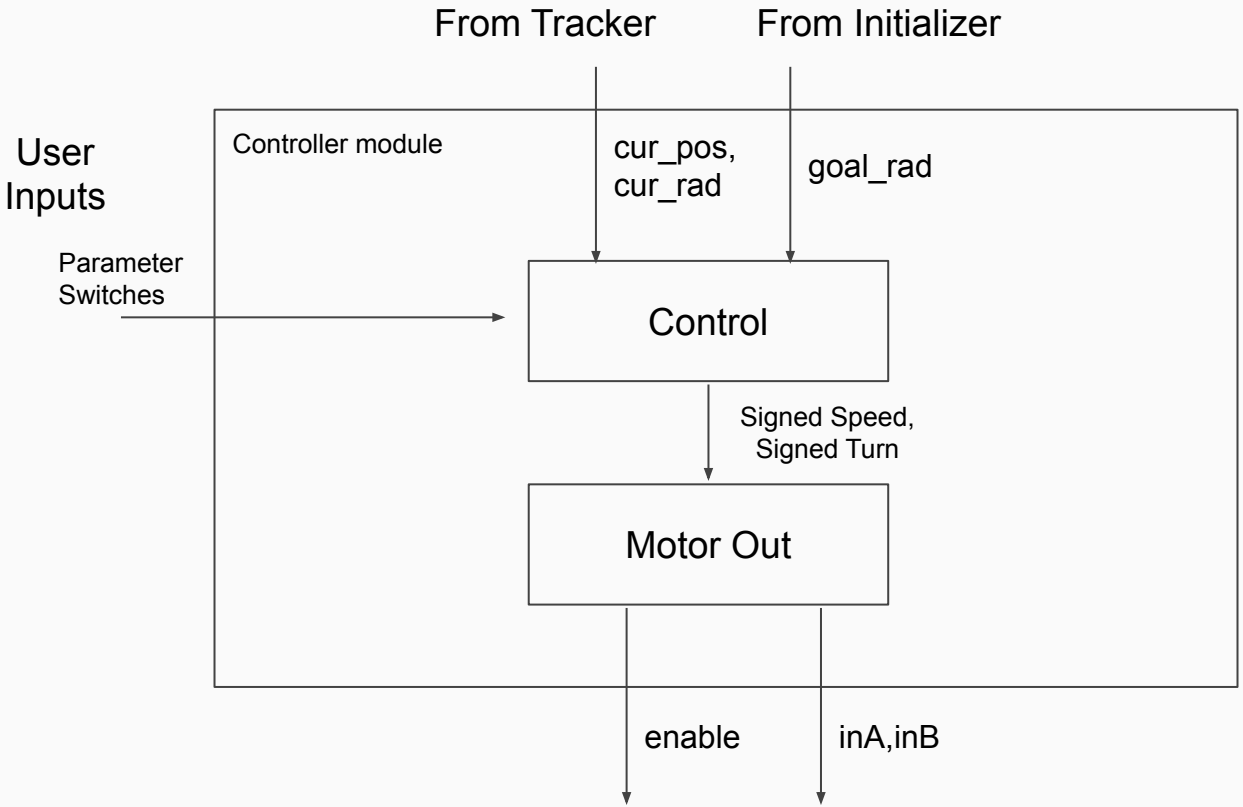
Initializer

Configuration module

- IF ACTIVATE SWITCH
  - Initializing mode
    - Cursor active
    - Select pixel
  - Confirm mode
    - Confirm initial position and radius from tracker
- ELSE
  - Activate control module
  - Deactivate cursor



Controller

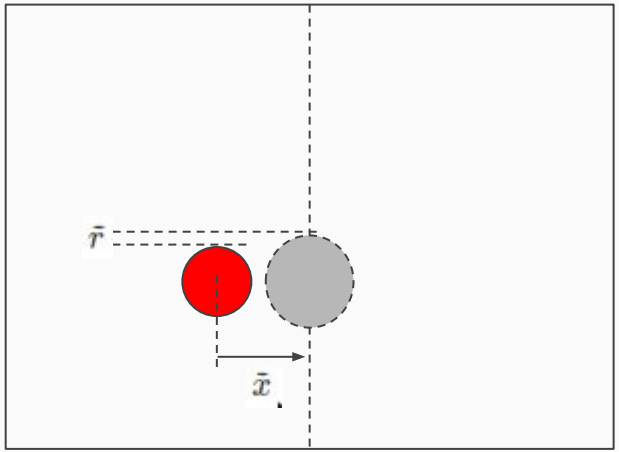

From Tracker
From Initializer
User Inputs
Controller module
cur_pos, cur_rad
goal_rad
Parameter Switches
Control
Signed Speed, Signed Turn
Motor Out
enable
inA,inB

Controller

Control module

Inputs
Current position and radius,Goal radius

Outputs
speed, turn



$$\bar{r} = r_{des} - r$$
$$\bar{x} = x_{des} - x$$
$$\delta\bar{r} = \bar{r_n} - \bar{r_{n-1}}$$
$$\delta\bar{x} = \bar{x_n} - \bar{x_{n-1}}$$
$$speed = K_{sp} * \bar{r} + K_{sd} * \delta\bar{r}$$
$$turn = K_{tp} * \bar{x} + K_{td} * \delta\bar{x}$$

Equations for chasing

$$\bar{x} = x_{des} - x$$
$$\delta\bar{x} = \bar{x_n} - \bar{x_{n-1}}$$
$$speed = K_{sp} * \bar{x} + K_{sd} * \delta\bar{x}$$
$$turn = 0$$

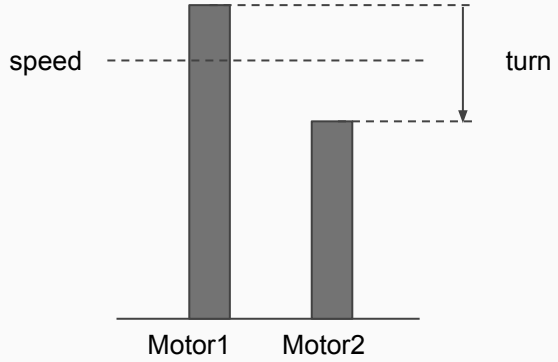
Equations for Goalkeeping

Motor Out module

Inputs
speed,turn

Outputs
enable,inA,inB for each motors

Converts the pixel space speed and turn into the motor outputs as needed for the motor driver.



Conversion from car speed to motor speed

	InA	InB	Enable
forward	HIGH	LOW	HIGH(pwm)
backward	LOW	HIGH	HIGH(pwm)

Motor inputs and direction

Goals

- Baseline & Expected goals
  - Initialize which object to follow through an interface
  - Chasing Task
  - Goalkeeping task

- Ideas for stretched goals
  - Generalize the object
  - Fetching the object
  - Self-estimation using the speed encoder information
  - Future prediction of the ball trajectory
  - Calculating the real distance

Timeline

	Emmanuel	Shuto
11/04 - 11/10	Camera	Hardware
11/11 - 11/17	Tracking Module	Controller Module
11/18 - 11/24	Tracking Module	Controller & Initializer Module
11/25 - 12/01	Initializer, Tuning	Initializer, Tuning
12/02 - 12/08	Debug, Report	Debug, Report

Thank you !