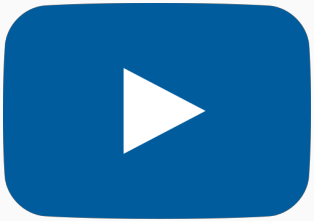
Criando Um Time de Futebol de Robôs Com Python

Johnathan Fercher da Rosa

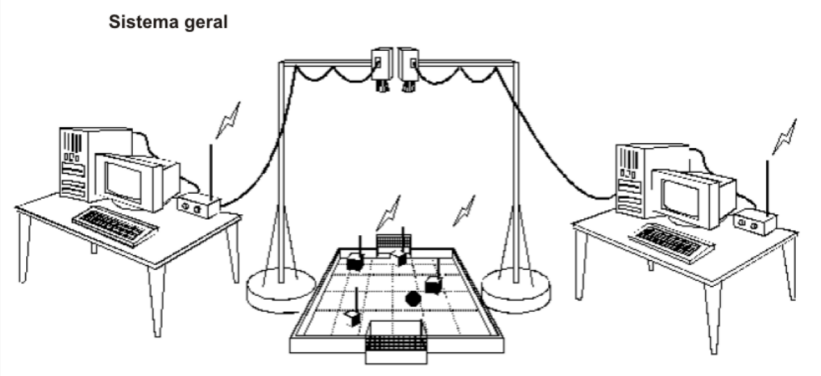
Sumário

Futebol de Robôs

Futebol de Robôs

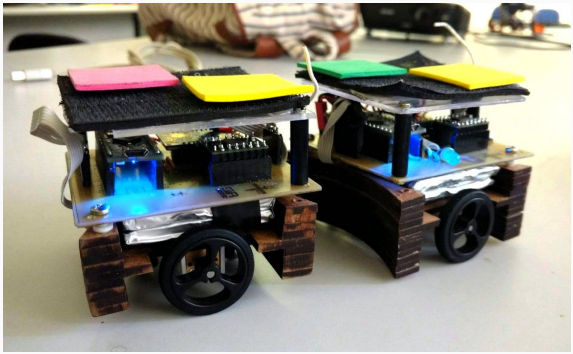


IEEE Very Small Size Soccer



- Software de inteligência em servidores;
- Localização utilizando câmeras;
- Comunicação via radio, bluetooth ou wi-fi;

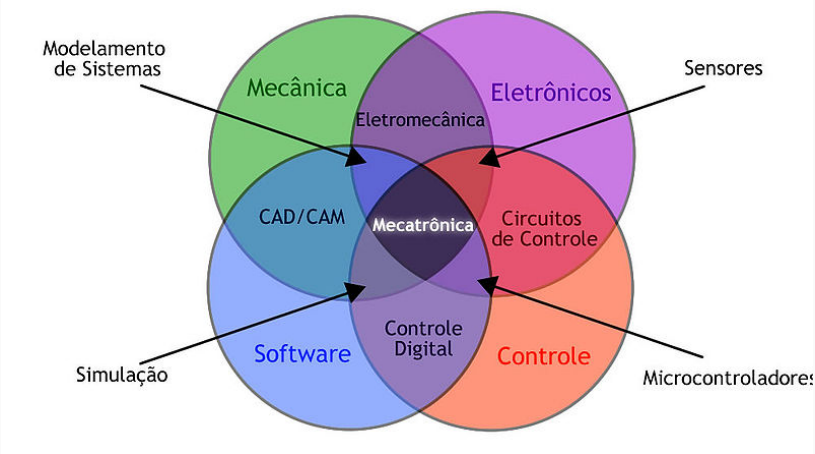
Robôs



- Robôs com dimensões restritas a **8cm x 8cm x 8cm**;
- Padrões de cores definidos por regra;

Competição Brasileira de Robótica
Competição Latino-Americana de Robótica

Robótica é complicado...

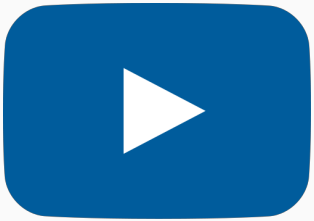


Criando um Time

VSS-SDK

- VSS-Vision: Sistema de Visão Computacional;
- VSS-Simulator: Simulador de Partidas de Futebol;
- VSS-Viewer: Visualizar e Controlador de Partidas;
- VSS-Joystick: Controlador de Robôs via Joystick USB/Bluetooth.
- VSS-Samples: Exemplos de como utilizar o VSS-SDK.
  - Python;
  - C++;
  - Rust;
  - Go;

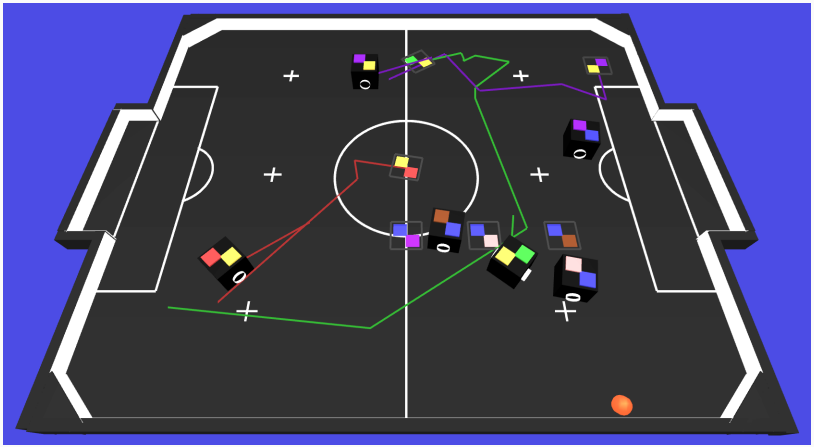
VSS-SDK



Por onde começar?

- Robôs são caros;
- Muitas variáveis correlacionadas;

VSS-Viewer + VSS-Simulator



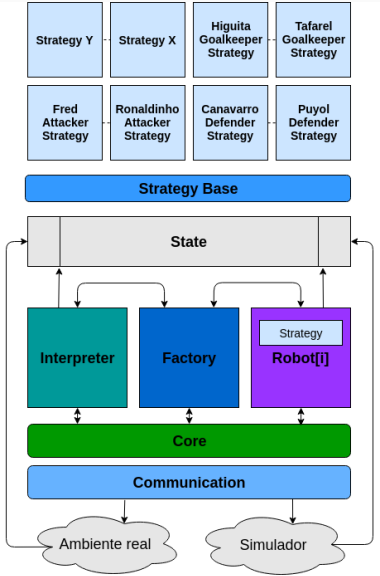
VSS-SamplePy

```
class Kernel(object):

    def loop(self):
        self.state_receiver = StateReceiver()
        self.command_sender = CommandSender()

        while True:
            state = self.state_receiver.receive_state()
            command = self.__build_command()
            self.command_sender.send_command(command)

    def __build_command(self):
        command = Command()

        command.wheels_commands.append(WheelsCommand(10, -10))
        command.wheels_commands.append(WheelsCommand(10, -10))
        command.wheels_commands.append(WheelsCommand(10, -10))

        return command
```

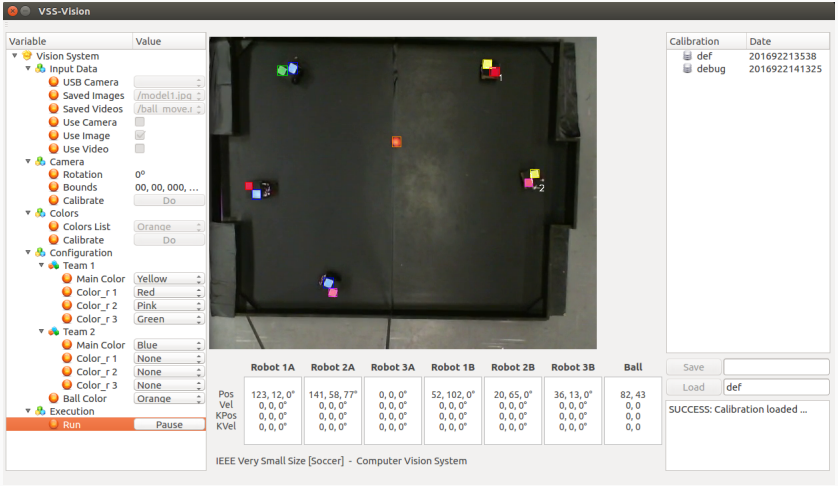
Executando :D

Muito simples :)

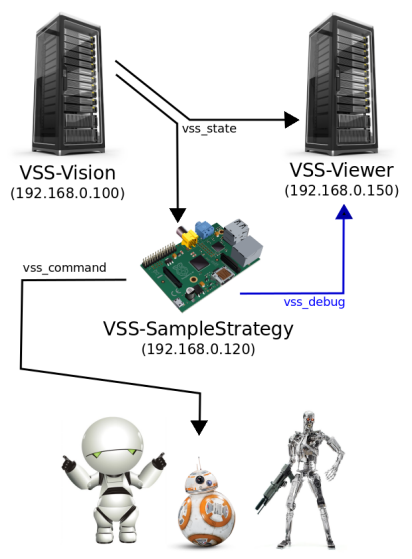
Algo mais inteligente...



VSS-Vision

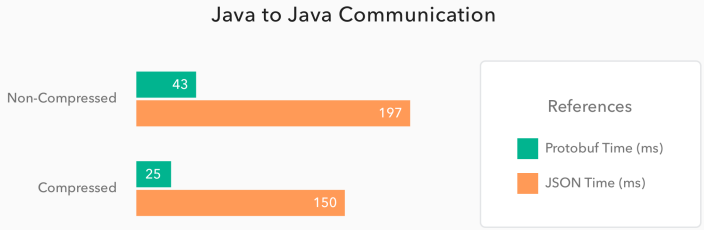

VSS-Vision
Variable
Value
Vision System
Input Data
USB Camera
Saved Images
/model1.jpg
Saved Videos
/ball_move.
Use Camera
Use Image
Use Video
Camera
Rotation
0°
Bounds
00, 00, 000, ...
Calibrate
Do
Colors
Colors List
Orange
Calibrate
Do
Configuration
Team 1
Main Color
Yellow
Color_r 1
Red
Color_r 2
Pink
Color_r 3
Green
Team 2
Main Color
Blue
Color_r 1
None
Color_r 2
None
Color_r 3
None
Ball Color
Orange
Execution
Run
Pause
Calibration
Date
def
2016922213538
debug
2016922141325
Robot 1A
Robot 2A
Robot 3A
Robot 1B
Robot 2B
Robot 3B
Ball
Pos
Vel
KPos
KVel
123, 12, 0°
0, 0, 0°
0, 0, 0°
0, 0, 0°
141, 58, 77°
0, 0, 0°
0, 0, 0°
0, 0, 0°
0, 0, 0°
0, 0, 0°
0, 0, 0°
0, 0, 0°
52, 102, 0°
0, 0, 0°
0, 0, 0°
0, 0, 0°
20, 65, 0°
0, 0, 0°
0, 0, 0°
0, 0, 0°
36, 13, 0°
0, 0, 0°
0, 0, 0°
0, 0, 0°
82, 43
0, 0
0, 0
0, 0
Save
Load
def
SUCCESS: Calibration loaded ...
IEEE Very Small Size [Soccer] - Computer Vision System

Distribuído

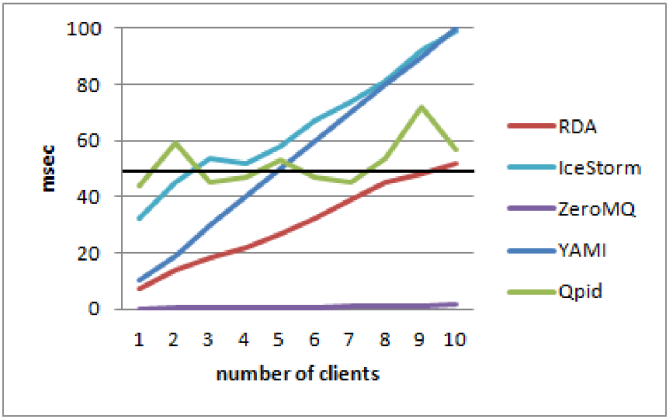


Serialização e Comunicação

Benchmark Protobuf x JSON



Benchmark ZMQ



Serialização e Comunicação

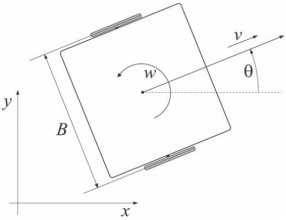
- **Delay em localhost**: 0.00035 segundos (350 microsegundos)

Instituições que Utilizando o VSS-SDK

- IME;
- UFOP;
- FAETERJ;
- UFPel;
- UFABC;
- UFES;
- ...

Nem Tudo São Flores

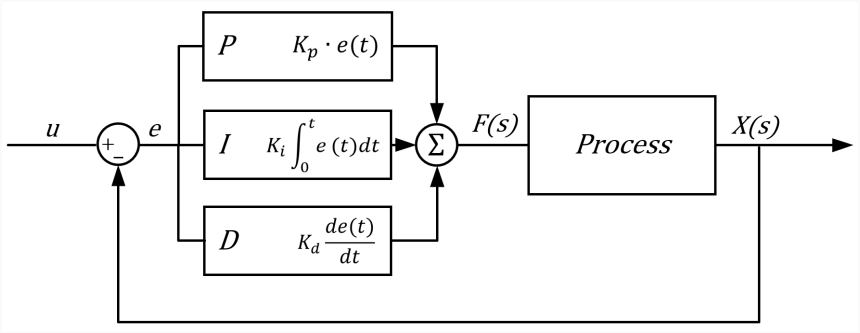
Não da para fugir de mecânica...



$$\dot{q} = \begin{bmatrix} \dot{x} \\ \dot{y} \\ \dot{\theta} \end{bmatrix} = \begin{bmatrix} \cos\theta & 0 \\ \sin\theta & 0 \\ 0 & 1 \end{bmatrix} \begin{bmatrix} v \\ w \end{bmatrix}$$

$$v_R = v + \frac{wB}{2} \quad \text{and} \quad v_L = v - \frac{wB}{2}$$

Nem de elétrica...



$$e(t) = set(t) - act(t) \tag{1}$$

O Poder do Python

- OpenAI Gym: Aprendizado por reforço.
- Scikit-learn: Aprendizado de máquina.
- TensorFlow: Redes neurais;
- Deap: Algoritmos evolutivos;
- simple-pid: Controle PID;
- ...

Conclusões

Conclusões

- É simples criar um time de futebol de robôs utilizando o VSS-SDK com a linguagem Python. Porém, ainda sim são necessários conhecimentos além de programação.

VSS-SDK: https://vss-skd.github.io/

Obrigado