User Manual
Swarm Shooters

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Introduction and objectives

This user manual describes the functions, dependencies, hardware, and software parts of the Swarm Shooters robots and tends to describe and help users to rebuild this entire system using the implemented code.

The objective of the robots is to map a certain given arbitrary area, while scanning the sky looking for a target to shoot after evaluating the distance.

Thus, we have two robots (Master & Slave) that communicate and cooperate together. The first is static and is the "head", the "headquarter" of operations, ordering the Slave to shoot the target. The Slave is the skykeeper of this team, mapping the area and scanning the sky, and communicating information to the headquarter . It also receives the order from Master to shoot, then it shoots the target.

Figure 1 : Lego EV3 Brick
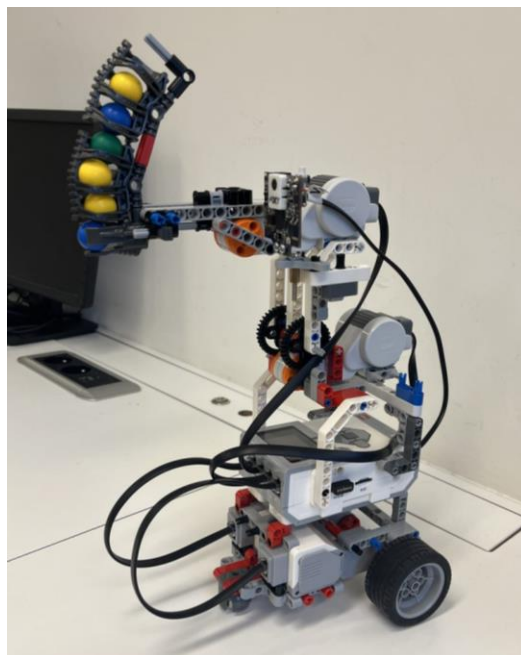
Figure 2 : Master Robot

Figure 3 : Slave Robot

I.   REQUIREMENTS

1. Marking the Search Area

The robot scans the sky along a pre-defined pattern within a boundary of 1*1 sqr metres. This boundary is depicted by applying black tape on the floor as shown in the figure below. Care must be taken to ensure that the floor is free from any sort of dirt.
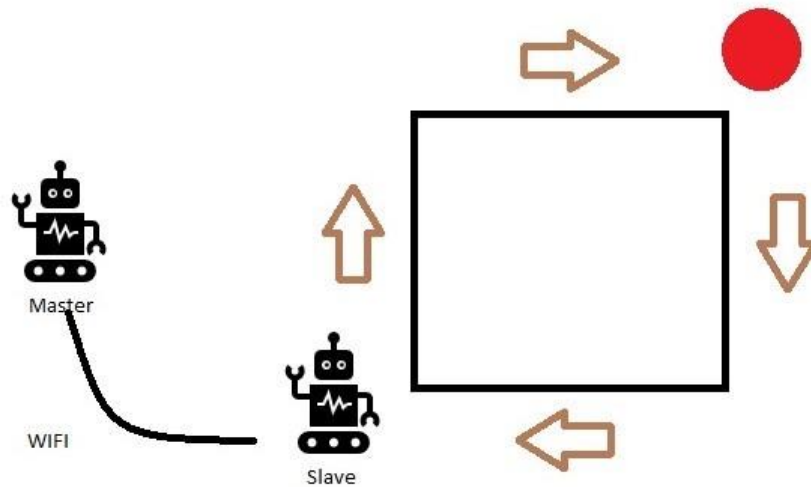
Figure 4 : Slave detecting target and sending information to Master, in a 1meter square area

2. Building of Robot

The Lego EV3 set comes with an EV3 brick, many useful sensors, motors, assembly manual, and many necessary parts for the building of robots. Select the appropriate parts required for the proper assembly of the robot.

Figure 5 : Lego kit

II. HARDWARE

1. Vehicle Design

Referring the manual, 2 motors are placed on each side of the vehicle in order to drive the rear wheels of the vehicle. An idler wheel is centred on the front of the robot, to make it turn and move without wheels.

The EV3 brick is on top in a horizontal position and is interconnected by means of appropriate connectors and joints available in the Lego set. Above the EV3 brick, a shooter is placed, 2 motors were used : one for the shooter and one to control the elevation of the shooter.
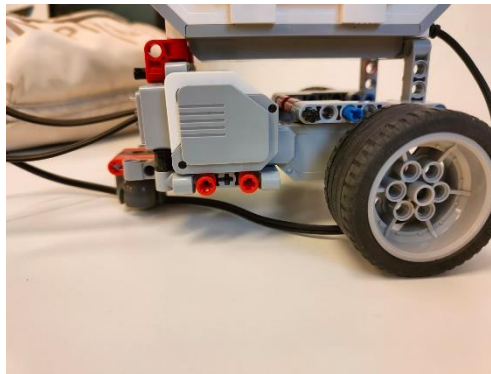

Figure 6 : Left wheel motor
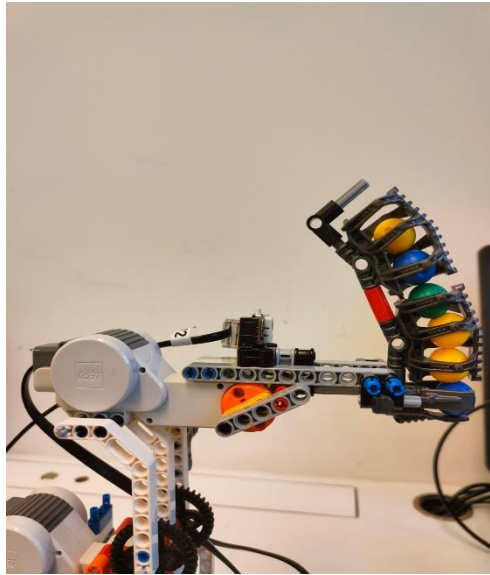

Figure 7 : Right wheel motor
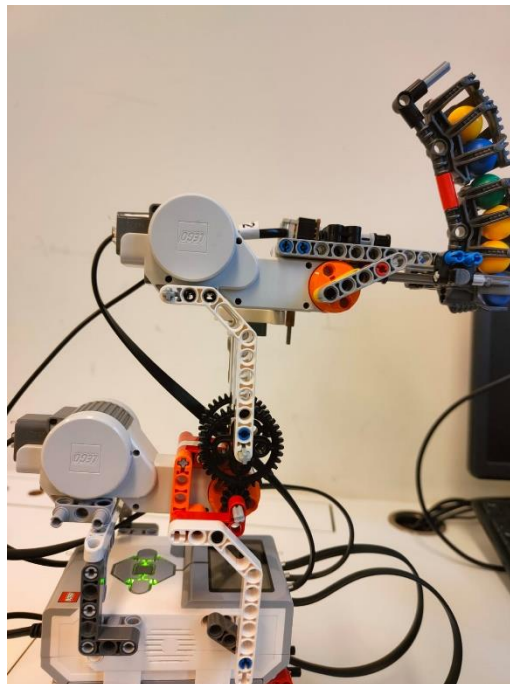
Figure 8 : Shooter motor

Figure 9 : Elevation motor

2. Sensors

One sensor are used in this vehicle: Pixy camera.

To detect a red coloured object, we passed a red ball in front of the camera lens while pressing the button at the top of the camera. This sensor is mounted above the

EV3 brick and next to the shooter, to consider the same elevation and orientation when shooting a target.

Figure 10 : Pixy2 Camera sensor

3. Connections

In total, there are :

- 4 motors connected to :
    - port A : left wheel
    - port B : elevation
    - port C : shooting
    - port D : right wheel

Figure 11 : Output ports in EV3 for connecting motors

- 2 sensors connected to :
    - port 1 : Pixy camera

Figure 12 : Input ports in EV3 for connecting sensor

- 2 Wi-fi dongles, 1 for each Slave & Master, for connection to the same access point

Figure 13 : Wi-Fi dongle connected to EV3

III.   SOFTWARE

1. First initialisation
For the very first step, you must follow each step described in the ev3dev website: https://www.ev3dev.org/docs/getting-started/ . Then, the Lego Brick is functional.

2. Installation of the Development Environment
On your computer (No matter the OS : Linux, Windows or MacOS), you must download the latest version of Visual Studio Code.

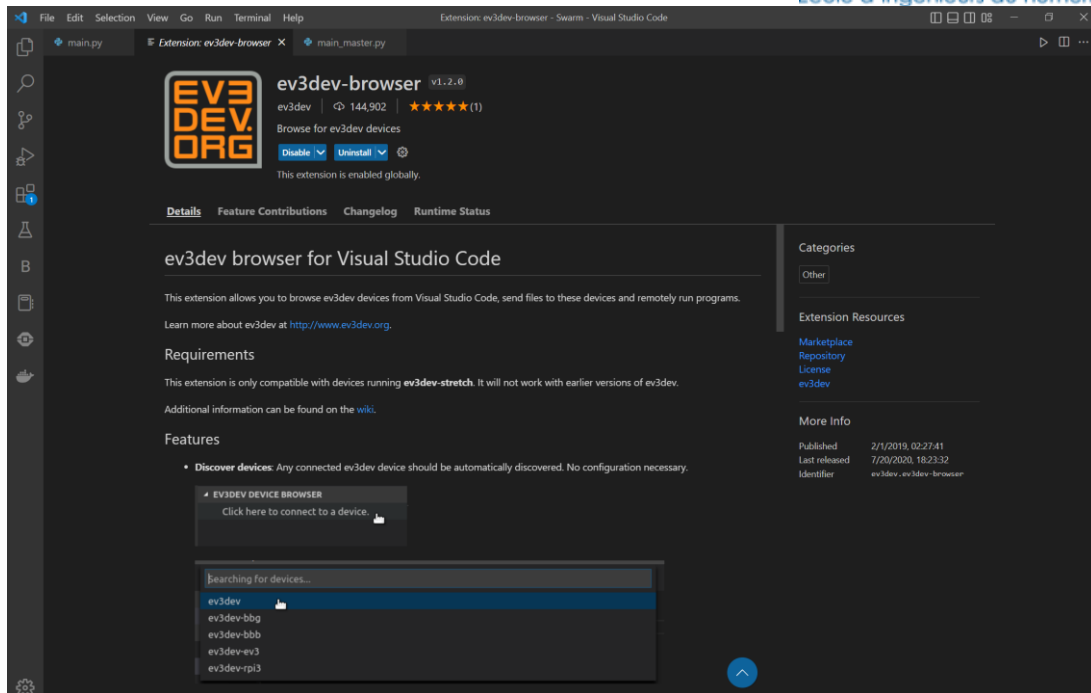Then, install the "ev3dev-browser" extension on VS Code :

Figure 14 : Extension to install

3. Code pulling and launching

To download your code on your computer, open a command prompt and run this command "git clone https://github.com/Yassine-94/Swarm-shooters.git". This command allows you to download the whole repository on your computer.

You must have the latest version of python installed on your computer (python3…)

After this step done, you should send the whole and SAME code on both robots. To do so :

- Connect to your device (ev3dev) on VS Code and send the workspace :

Figure 15 : Connection to the device

- Repeat this step for the other robot : disconnect then reconnect to the other device (ev3dev-2)

Finally, to run code, you have to :
- On Master Robot :
    - Connect to the Master device (ev3dev) by ssh in a command prompt, running this command "ssh robot@ev3dev". The password is "maker"
    - Go to Swarm directory : "cd Swarm"
    - Run main_master.py : "python3 main_master.py"
    - To stop the code : ^C (Ctrl + C)

Figure 16 : SSH connection to Master Robot

- On Slave Robot :
    - Connect to the Slave (ev3dev-2) on you VS Code like shown before
    - Run the main.py : F5 on VS Code
    - To stop the code : Maj + F5