ISEP Dynamics

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USER MANUAL

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INTRODUCTION

We are going to build a robot, which can search and find a defined object and rescue it.

ISEP Dynamics aims to solve unmanned rescue operation in small defined areas once and for all.

COMPONENTS USED :

- EV3 Brick
- Large and Medium Motors
- Gyroscope sensor
- Ultrasonic sensor
- Wheels
- Graber

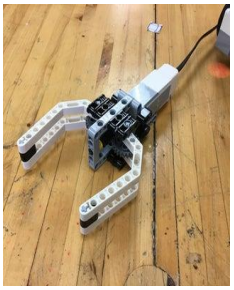
EV3 Brick

Ultrasonic Sensor

Large & Medium Motors

Color Sensor

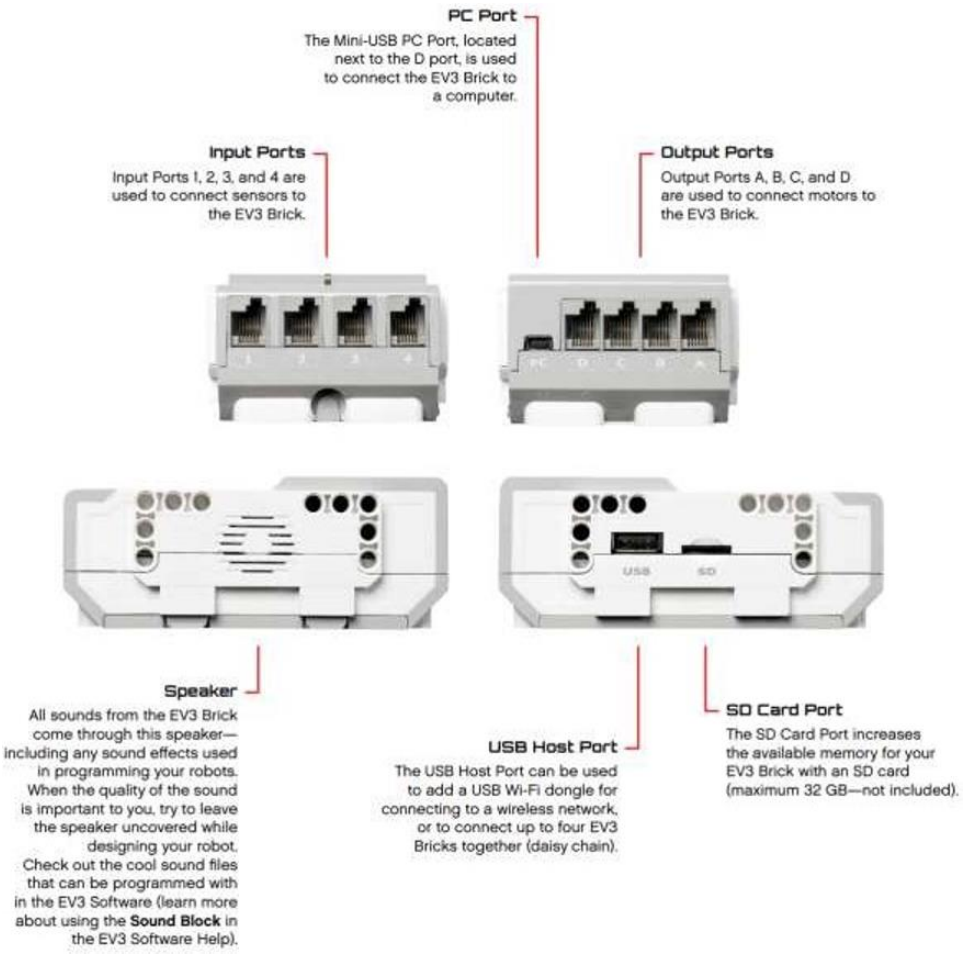
Gyroscopic sensor



Graber

EV3 Brick :

- The Display shows what is going on inside the EV3 Brick and enables you to use the Brick Interface
- It also allows you to add text, number or graphic responses into your program or experiments.
- The Brick Buttons allow you to navigate inside the EV3 Brick Interface
- Operating System - LINUX
- 300 MHz ARM9 Controller
- Flash Memory - 16 MB and RAM - 64 MB
- Brick Screen Resolution—178x128/Black & White
- USB 2.0 Communication to Host PC—Up to 480 Mbit/sec + USB 1.1 Host Communication—Up to 12 Mbit/sec
- Micro SD Card - Supports SDHC, Version 2.0, Max 32 GB
- Motor and Sensor Ports, Connectors - RJ12 + Support Auto ID + Power - 6 AA batteries



Large and Medium Motor:

- Both the large and medium servo motors are equipped with a built-in Rotation Sensor with 1-degree resolution for precise control. The rotation sensor is used to measure how far a motor has turned (or has been turned). Rotation sensors can detect the amount of rotation in degrees or full rotations. You can also use the rotation sensor to find out what power level a motor is currently running at. Both motors are Auto ID supported.
- The Large Motor runs at 160 - 170 rpm, with a running torque of 20 Ncm and a stall torque of 40 Ncm (slower, but stronger)
- The Medium Motor runs at 240–250 rpm, with a running torque of 8 Ncm and a stall torque of 12 Ncm (faster, but less powerful).

GYROSCOPE SENSOR

- The Gyro Sensor is a digital sensor that detects rotational motion on a single axis. If you rotate the Gyro Sensor in the direction of the arrows on the case of the sensor, the sensor can detect the rate of rotation in degrees per second.
- The sensor can measure a maximum rate of spin of 440 degrees per second. In addition, the Gyro Sensor keeps track of the total rotation angle in degrees. You can use this rotation angle to detect, for example, how far your robot has turned.
- This feature means you can program turns (on the axis the Gyro Sensor is measuring) with an accuracy of +/- 3 degrees for a 90-degree turn.

Wheels:

Two large wheels are attached to the back with two large motors for the movement of the Robot. A universal wheel is attached to the front to move freely and to help the arm to pick accordingly.

Color Sensor:

The Color Sensor can detect the color or intensity of light that enters the small window on the face of the sensor. The Color Sensor can be used in three different modes: Color Mode, Reflected Light Intensity Mode, and Ambient Light Intensity Mode.

Ultrasonic Sensor:

EV3 Ultrasonic Sensor generates sound waves and reads their echoes to detect and measure distance from objects. It can also send single sound waves to work as sonar or listen for a sound wave that triggers the start of a program.

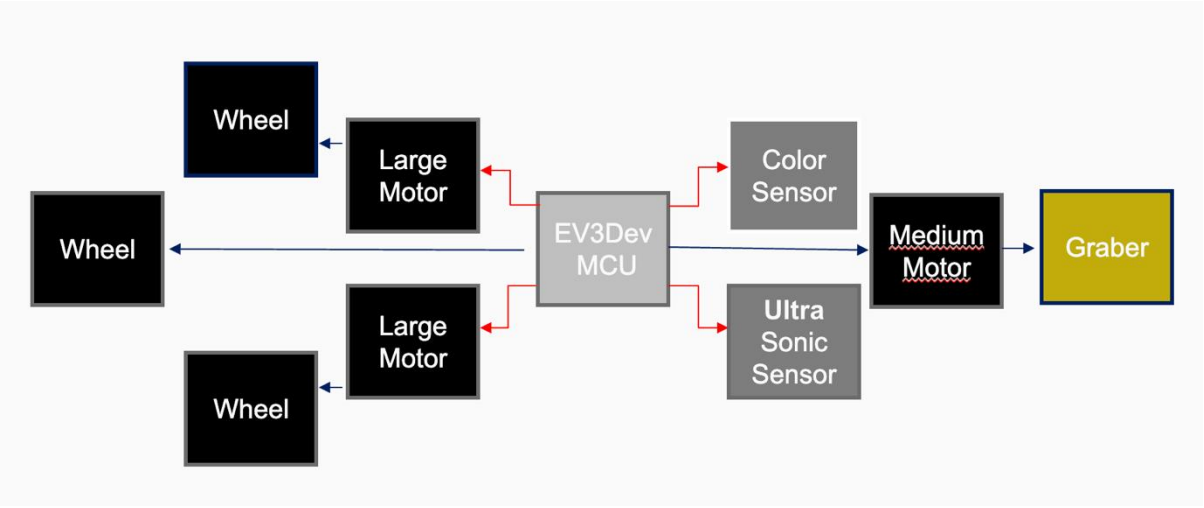
Connections:

Sensors and Motors:

Motors and sensors must be connected to the EV3 Brick using the flat black Connector Cables, link sensors to the EV3 Brick using Input Ports 1, 2, 3, and 4. If you create programs while your EV3 Brick is disconnected from your device, the software will assign sensors to the following default ports: Port 1: Touch Sensor , Port 2: No sensor , Port 3: Color Sensor .

Port 1	Color sensor
Port 2	Ultrasonic sensor
Port 3	NC
Port 4	Gyro sensor
Port A	Large motor
Port B	Large motor
Port C	Medium motor

HARDWARE DESIGN :



EV3 Brick to Your Computer:

We can connect the EV3 Brick to your computer by USB Cable or wirelessly using either Bluetooth or Wi-Fi. In our project, we connect EV3 brick using WIFI.

Wi-Fi:

First, we need Wi-Fi USB dongle to begin the setup. You must have access to a wireless network and to know the network's name and its password.

- Insert the Wi-Fi USB dongle into the EV3 brick's USB port.
- Turn on the EV3 brick and go to the "Wi-Fi" menu in the EV3 brick's settings. Select "Connect to Network" and enter the name and password of the wireless network you want to connect to.
- Once connected, you should be able to communicate with the EV3 brick from your computer using the EV3 programming software.
- Before you start programming, you should check the IP-address of the EV3 brick, this will be necessary to establish a connection between your computer and the EV3 brick.
- Once you have the IP-address, open the EV3 programming software on your computer, and enter the IP-address of the EV3 brick in the software to establish a connection.
- Once the connection is established, you can start programming your EV3 brick. Send your program to the brick, control the brick's motors and sensors, and more.

SOFTWARE:

Operating Procedure

Process Overview

- The following section provides a step-by-step guide to the operating procedure of the system as illustrated by the flowchart.

Stage 1: Initialization

Start:

- The operation begins when the system is powered on.
- Initialization: The system performs self-checks to ensure all components are functioning properly.

Input and Decision Making

Input Command:

- The user is prompted to input a number between 1 and 5. This number corresponds to a specific command for the system to execute.

Stage 2: Execution

Direction 5 (Perform default search pattern):

- If the input number is 5, the system will perform a border check to ensure it is operating within its designated area.
- If the system is approaching a boundary, it will enter 'Sleep' mode to conserve energy and prevent any potential errors.
- If no boundary is detected, the system will proceed to 'Grab' an object. Details of this operation are system-specific and are explained in Handling the objects

Directions 1-4 (Control tests):

- For inputs 1 through 4, the system will execute different debug routines. 1 is a test to turn right, 2 to turn left, 3 to open the arm and 4 to close the arm.

Direction 6 (Move for distance):

- Select a distance in centimeters that the robot will drive for.

Stage 3: Completion

Go Home:

- After completing the 'Grab' or ‘Control tests' tasks, the system will return to its home position or state, ready for the next operation.

End:

- The process concludes until a new input is provided, or the system is turned off.

Handling Objects (Grab)

- This section should only be referred to when the input command is 5 and no boundary is detected.

- The Grab function is activated to pick up or manipulate the object the system is designed to handle. Details on how the system interacts with objects are as follows:
- Approach the object carefully.
- Align the grabbing mechanism with the object.
- Secure the object firmly.
- Transport the object back to the designated 'Home' location.

- The following are the images of the robot performing several operations like changing and turning the direction from left to right.

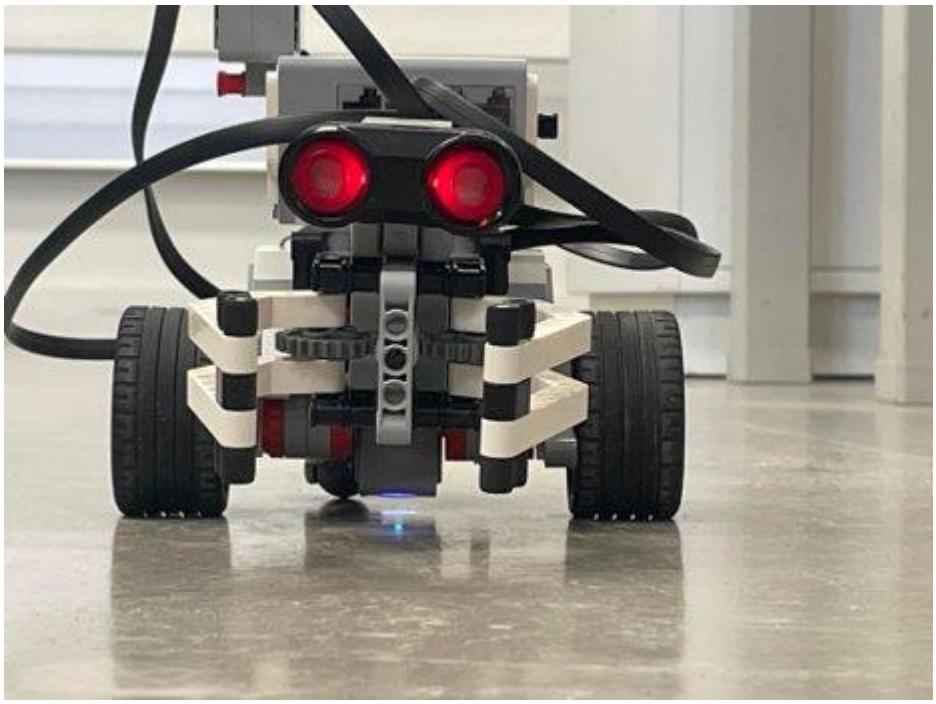


Figure1 : The robot performing several operations

Figure2 : The robot grabs the object and returns to the destination

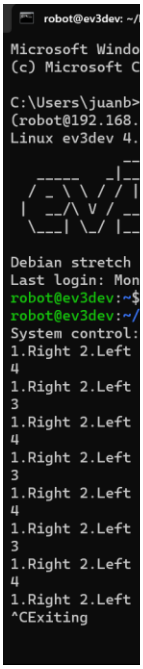


Figure3 : The login and IP address for connecting to the EV3 robot.

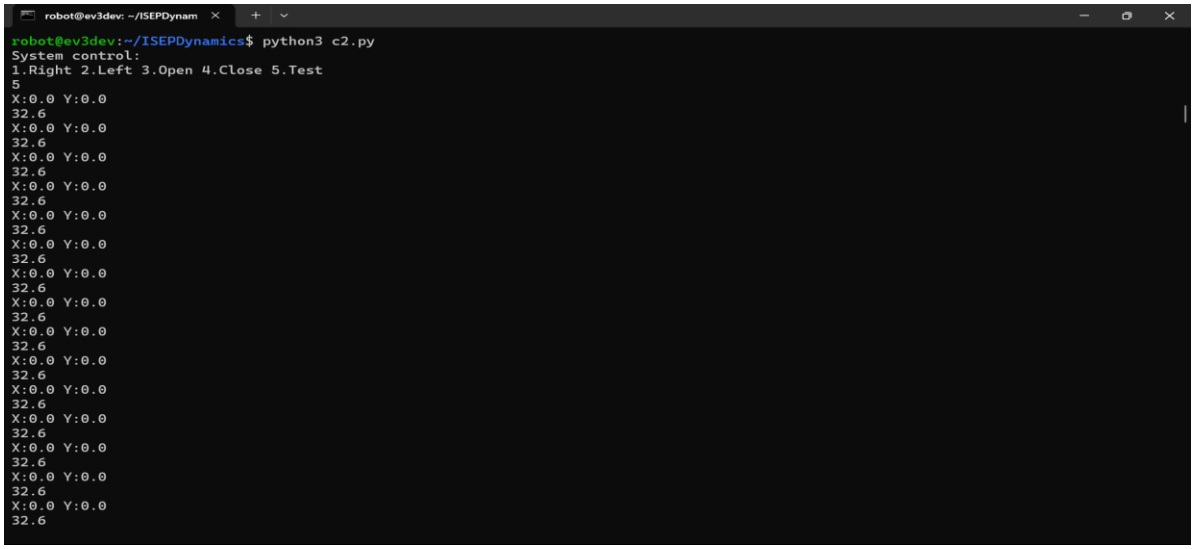


Figure4 : Step-by-step demonstration of operations performed in the GUI