CSC-40045

Distributed Intelligent Systems

Practical 2:

Lego Mindstorms Robots and Reactive Autonomous Agents

Coursework Part 1.2

Q2.1. Study and summarise the key functional features of the EV3 or Robot Inventor brick and its programming blocks or code. You should also comment on emerging alternative programming languages for Lego Mindstorms robots.

Ans: Lego Mindstorms EV3 is a popular robotics kit that will help to build and program robot models.

Following are the key functional features of the EV3:

- EV3 has a powerful ARM9 CPU processor
- Programmable bricks can be combined to build an advanced robot model.
- EV3 programmable bricks consist of motors, sensors, and rechargeable batteries
- Sensors used: Touch, Color, Infrared, and gyroscopic sensor.
- EV3 can be connected to a PC using USB cable or Bluetooth and can preload the program into it.
- While talking about programming aspects, we can use the drag and drop blocks feature instead of using any programming language. Additionally, we can use the conventional programming language too.

All these features help to build a robot that can traverse and communicate efficiently.

Scratch 3.0 is an emerging alternative programming language for Lego Mindstorms robots. It is a block-based programming language, which makes coding easier for beginners.

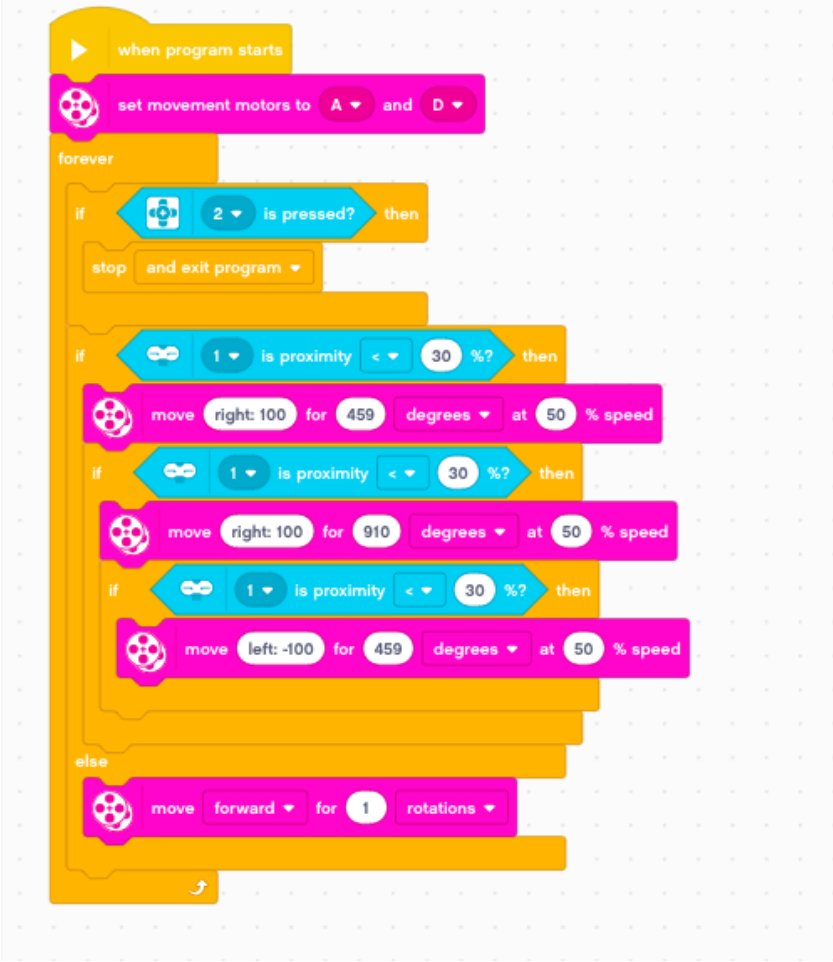
Q2.2. Use pseudocode, a flowchart or actual EV3 programming blocks or Robot Inventor Scratch code, to describe an example robotic activity that encapsulates Brooks' subsumption architecture (see Lecture_3 slides or Brooks (1986)).

Ans: I would like to describe a maze puzzle-solving robot that encapsulates Brook's subsumption architecture. Because just like Brook's subsumption architecture in this example we will identify the obstacles, monitor the environment, explore, wander, and avoid obstacles and finally reach our goal.

When we start the program, the robot will start moving forward forever. If the touch sensor on the robot's hand is pressed, then it will stop moving further. To solve the maze here, we adopted the turn right approach i.e., whenever the proximity sensor found a hindrance within 30 cm it will turn right. If this action causes another obstacle, then we need to turn 180 degrees right else it will move to initial path and if this action is also causing another obstacle that means it is a dead-end the then we need to

take the left to turn backwards and explore other paths. By repeating this in the end robot will exit the maze

Corresponding Scratch code snippet:



Q2.3. Describe briefly, a real example application or simulation in which reactive autonomous agents can be applied. Justify your answer.

Ans: Reactive autonomous agents can carry out simple tasks in a reflexive manner by consuming limited environmental knowledge with the help of Sensors. It can collect data from these hazardous environments. Because unlike humans, they can survive this harsh environment. They can collect objects from these places and can study them for future research purposes. They have sufficient autonomy to take command of these situations and operate freely.

So, we can deploy reactive autonomous agents to replace humans for carrying out dangerous exploration tasks. Space exploration, Undersea study, Volcano eruption study and monitoring deadly poisonous and radioactively contaminated areas are just a few examples of dangerous exploration tasks. In all these use cases, it is possible to relay an autonomous agent to do most of the dangerous parts of the task with the indirect involvement of humans. So, it is better for the safety of humans, and we can avoid deadly situations.