EV3 Robotics Study Guide (CISC 1003)

Why Robots Need Sensors

Sensors allow a robot to gather information about its environment so it can make decisions.

Examples:
- Color sensor: detects light intensity or color
- Ultrasonic sensor: measures distance
- Touch sensor: detects physical contact

Without sensors, a robot would blindly execute commands without reacting.

Robot System Overview

A robot is made of several connected subsystems:

Actuators: Motors that create movement.
Perception: Sensors that gather data.
Control: EV3 brick and program logic.
Power: Battery pack supplying energy.
Communication: Data transfer (USB, Bluetooth).

Control Types

Deliberative Control:
Sense → Think → Act
Robot builds a model and plans actions.

Behavior-Based Control:
Direct reaction to sensor input. Faster but less complex.

Feedback Control:
Robot continuously adjusts actions based on sensor data.

Programming Concepts

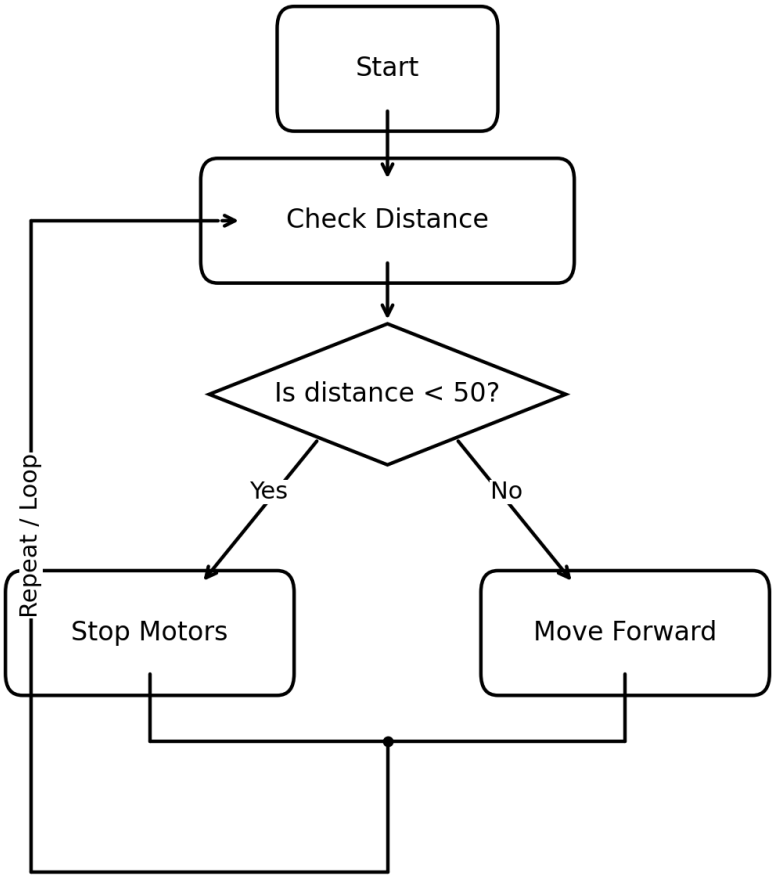
Switch (IF/ELSE): Makes decisions based on conditions.

Loops:
- Conditional loop: Runs until condition changes
- Infinite loop: Runs forever

Algorithm: A step-by-step solution to a problem.

Flowchart Example

Example: Move forward until obstacle detected



Gears and Mechanics

Gears are used to change speed and torque.

Small gear → large gear = more torque, less speed
Large gear → small gear = more speed, less torque

Locomotion

Ways robots move:
- Wheels (most common)
- Tracks (more traction)
- Legs (complex but flexible)

Stability

Static Stability: Stable when stopped.
Dynamic Stability: Stable while moving.

Multitasking

Robots can perform multiple actions at once, such as moving while monitoring sensors.
This improves efficiency and responsiveness.

Sensor Calibration

Sensors must be calibrated to match the environment.
Lighting and surfaces can affect readings, especially for color sensors.

Robot Teams

Benefits:
- Faster task completion
- Ability to solve complex problems
- Redundancy if one robot fails

Coordination:
- Coexisting: independent robots
- Tightly coupled: robots depend on each other

Control:
- Centralized: one controller
- Distributed: each robot decides

Kin Recognition:
Robots identify teammates to coordinate properly.