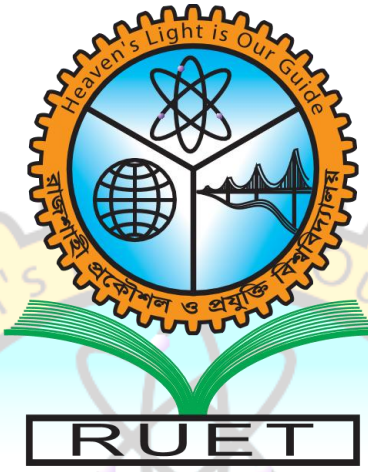
"HEAVEN'S LIGHT IS OUR GUIDE"

Rajshahi University of Engineering and Technology



Dept. of Electrical & Computer Engineering

Course Title:

Control System and Robotics Sessional

Course No:

MTE 4118

Lab Report 1

Submitted To:	**Submitted By:**
Md. Faisal Rahman Badal	Dibakar Roy
Assistant Professor	Roll: 2010056
Department of MTE, RUET	Session: 2020-21

Experiment No: 01

Experiment Name: Pick and Place operation

Objectives:

- To understand the control architecture of a basic robotic system.
- To develop and execute robot control commands to perform a "Pick and Place" task.
- To integrate sensor input and actuator control (robot arm and conveyor belt) in a sequential program.
- To analyze how robot controllers interact with real-world peripherals using simulation software and physical models.

Theory:

Robotic control systems translate human instructions into precise, repeatable mechanical actions. At the heart of these systems lies the robot controller, which receives high-level commands and coordinates the actuators, sensors, and interfaces to accomplish tasks. In industrial automation, these systems are used to perform repetitive processes such as material handling, assembly, or packaging. [1] [2]

In this experiment, the **roboTEK II** robotic workstation was used. This platform includes:

- A robotic arm with four controlled joints (base, shoulder, elbow, jaw).
- Sensors: Part sensor and hole sensor to detect object position.
- A conveyor belt system for transporting objects.
- A control interface (software GUI) that accepts BASIC-style movement and actuator commands. [3]

The robot was programmed to execute a sequence of moves that simulate the Pick and Place task, involving the following steps:

1. Move to the object location and close the jaw to grasp it.
2. Lift and rotate to the conveyor position.
3. Release the object onto the conveyor.
4. Activate the conveyor to move the object toward the "store room".

Working Principle:

The robot control used in the experiment:

```
MOVE B45 S35 E10 J100     ' Move to initial position with jaw open
MOVE B45 S33 E10 J20      ' Lower to pick and close jaw
MOVE B45 S70 E10 J20      ' Lift the object
MOVE B5 S70 E10 J20       ' Rotate towards conveyor
MOVE B5 S67 E1 J20        ' Lower towards conveyor
MOVE B5 S44 E1 J20        ' Lower further near conveyor
MOVE B5 S44 E1 J100       ' Release object (open jaw)
MOVE B5 S71 E1 J100       ' Return to home position
WAIT 2000                 ' Wait before activating conveyor
CONVEYOR_ON               ' Start conveyor
WAIT 5000                 ' Let conveyor run for 5 seconds
```

```
CONVEYOR_OFF                ' Stop conveyor
```

Each MOVE command sets the position of each joint (Base, Shoulder, Elbow, Jaw) simultaneously. Commands like CONVEYOR_ON and WAIT control the non-arm components. These were entered through the GUI interface as shown in the simulation software.

Result:

- The robot successfully picked up a part from the production area.
- The part was released precisely onto the conveyor belt.
- The conveyor transported the part toward the storage bin.
- The control sequence executed without errors, demonstrating proper synchronization between robot motion and conveyor actuation.

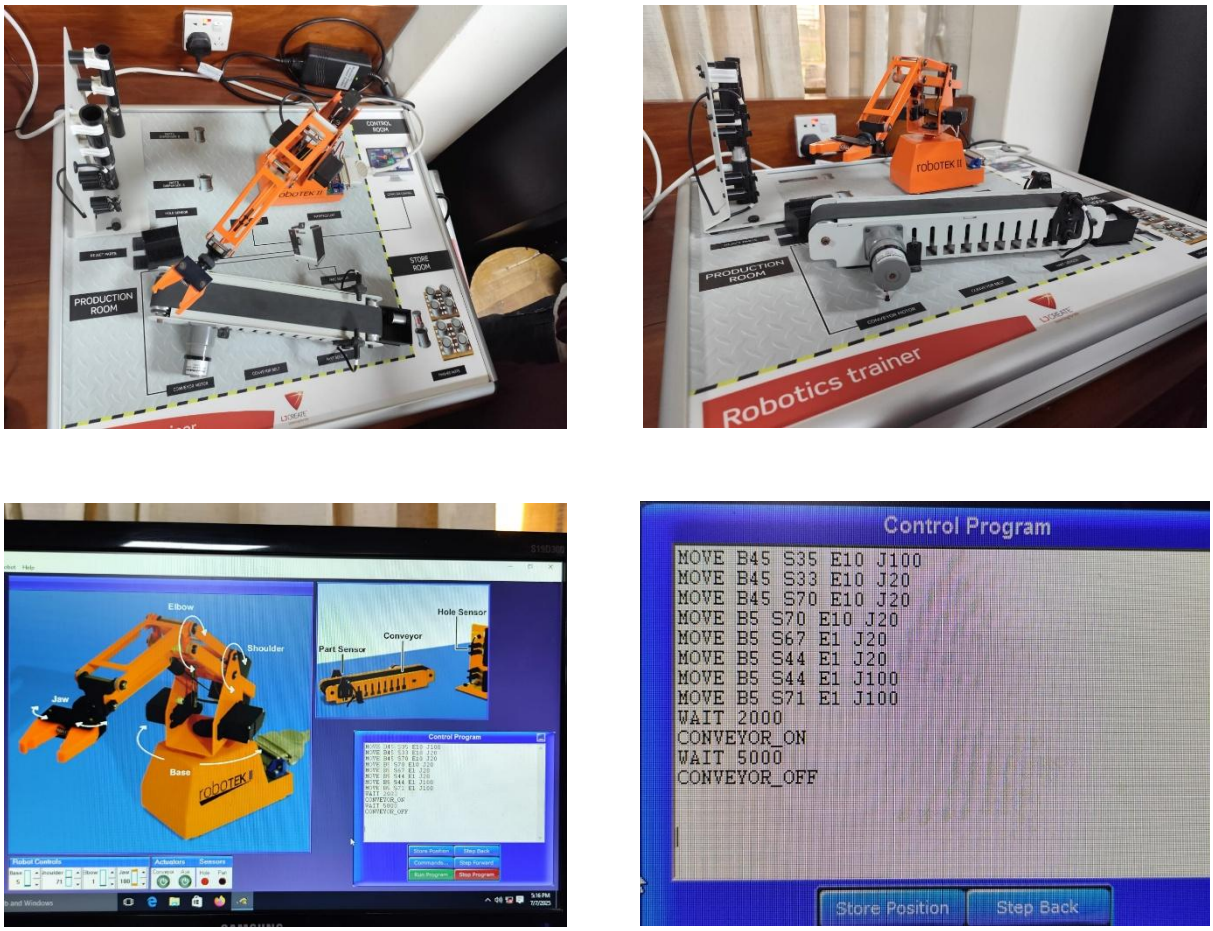


Figure: roboTEK II prototype and simulation code

The real-time visualization (GUI) and physical model both verified successful task completion.

Discussion:

This experiment emphasized the importance of robot programming and control, not just mechanical design. The use of simple, structured command sets allowed full control of the robot and peripheral devices. Commands were executed in a timed sequence to coordinate actions like gripping, lifting, rotating, and transferring.

Sensors like the Part Sensor and Hole Sensor were included in the setup but were not directly used in this task. However, their presence highlights the potential for adding autonomous feedback-based control in future labs.

Through this experiment, students learned how software instructions translate into real-world motion, and how timing and order of execution are essential in robotic task planning.

Conclusion:

The lab provided practical insights into robotic control systems. Students were able to simulate and execute a complete "Pick and Place" task using the **roboTEK II** platform. The control logic, written in a BASIC-like format, demonstrated the fundamentals of sequencing, actuator control, and robot-program interaction. This experiment lays the foundation for more advanced studies in robotics and automation.

References

[1] J. J. Craig, in *Introduction to Robotics: Mechanics and Control*, Pearson Education International, 2005.

[2] "tutorialspoint," [Online]. Available: https://www.tutorialspoint.com/robotics/index.htm. [Accessed 18 July 2025].

[3] "LJcreate," [Online]. Available: https://ljcreate.com/wp-content/uploads/2021/08/240-01-Robotics-Trainer.pdf. [Accessed 18 July 2025].