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**CSE461**

Introduction to Robotics Lab

Lab No. : 05

Group : 03

Section : 08

Semester : Summer\_2025

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Submitted to -

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**Project Title: Transistor Tester using Arduino Uno**

1. **Objectives:** Build the tester hardware on a breadboard using minimal, common components.
2. **Scope:** Detects component type and measures characteristics such as resistance, capacitance, inductance and more.
3. **Significance:** Alternative to commercial component testers.

**Functionality Breakdown:**

Functionality 1: Component Detection

* Overview: Identify the type of electronic component connected such as transistor, diode, resistor, capacitor, etc.
* Working: Arduino applies test signals and analyzes the response to determine the component type.

Functionality 2: Pinout Identification

* Overview: Find the correct pin configuration of the tested component.
* Working: The Arduino systematically switches test points, measures responses, and assigns roles

Functionality 3: Parameter Measurement

* Overview: Measure electrical values of the component.
* Working: The system calculates values such as resistance, capacitance, inductance and then displays them on the LCD.

1. **Equipments:**

* Microcontroller:Arduino Uno
* Actuators:
  + 16\*2 LCD Display
  + LED
  + Push Button
* Body/Chassis: Breadboard
* Additional Components : Resistor, IC, Jumperwires, Battery

1. **Experimental Setup:**

(**Picture + Explanation**)

1. **Code: (If Applicable)**

| # Enter Code Here |
| --- |

1. **Results (Output of the experiment):**

* Arduino applies test signals and analyzes the response to determine the component type.
* The Arduino systematically switches test points, measures responses, and assigns roles.
* The system calculates values such as resistance, capacitance, inductance and then displays them on the LCD.

1. **Discussions/Answers:**

The present project aims at the construction of an effective and cost-efficient device capable of automatically detecting and evaluating electronic parts. The gist is that a microcontroller Arduino Uno serves as the brain. It applies small, non-hazardous electrical currents through the component of interest that you wish to test (such as a transistor). With a close dosing of the reaction of the component to these signals, the Arduino is able to determine:

* What the component is.
* Components pinout.
* Components name and value.

After it calculates it, it presents all the results in a clear display in the 16x2 LCD display.

1. **Potential Challenges:**

* **Technical:** Calibration and noise can affect measurement accuracy.
* **Design:** Wiring complexity may cause unstable connections.
* **Integration:** Managing detection, measurement, and display together.

**Project proposal on the real-world domain**

**1. Societal Impact Analysis:**

**Democratization of Technology:** It offers students, hobbyists and technicians in the developing world a less costly substitute to costly commercial component testers (which can cost 5-10 times as much). This reduces the diversity threshold to electronics education and innovation.

**Educational Advancement:** In a well set-up of an academic institution (such as a course in your university), it is a wonderful pedagogical application. By constructing the tester students can discover not only how to use the tester, but also the concepts behind electronics and microcontroller programming.

**Education of a Repair Culture:** In an e-waste-dominated world, these tools will enable individuals and small repair shops to troubleshoot and repair electronic items and thereby extend their lifespan, as well as encourage sustainability. This compliments the right to repair movement.

**Economic Impact:** It has the ability to boost local economies by facilitating small scale electronics industries and repair services who could not afford to use high-end laboratory equipment.

**2. Health and Safety Considerations:**

**Electrical Safety:** The Arduino Uno uses 5V DC, which is typically safe, and does not present a risk of electric shock. Nonetheless, the equipment is made to test components that could be employed in far higher voltage systems. There must be a distinct warning to the effect that the tester is only used with low-power components and not on components that are still connected to a high-voltage circuit or mains power.

**Battery Safety:** In case the device is powered by a battery (as stipulated in components) then standard precautions when handling lithium or alkaline batteries should be observed, to prevent short circuiting to result in overheating or fire.

**Ergonomics:** There are wires and components that are exposed in the design (on a breadboard). This is dangerous for small cuts or accidental shorts when not handled carefully. The end product would be enhanced with an appropriate enclosure to guard both the user and the circuitry.

**Eye Strain:** The LCD display of 16x2 is small and of low resolution. Extended use may lead to eye strain to some users though this is a minor issue.

**3. Legal and Ethical Compliance:**

**Intellectual Property (IP):** It is possible that the project will be based on the available open-source algorithms and code libraries to identify components and measure them. Ethically and legally, proper attribution to original authors must be done and their licenses should be adhered to. Otherwise, it would be plagiarism and against open-source licensing.

**Liability, and Disclaimers:** The device is a diagnostic device, not a certified measurement device. It would be vital that we have a clear statement on a disclaimer that these readings are intended to be read only as educational and hobbyist reading and should not be used as a safety-critical or commercial certification reading. This constrains the liability under the law in the event that a user reacts upon its readings.

**Regulations on Consumer Safety:** In case of mass production and sale, the device would be subject to the requirements of the regional standards, such as electromagnetic compatibility regulations. But this is not an issue now, as a prototype in the university.

**4. Cultural Sensitivity and Adaptation:**

**Language and Interface:** The output is mostly numerical and standard electronic symbols, a universal language of engineering. The LCD text-only display is readily customized, where necessary, but does not pose cultural challenges.

**Portability:** The interface presupposes that the user is able to observe the LCD screen and press the button. The system cannot be accessed by users who are visually impaired. In a subsequent version, audio output can be added to make it more inclusive.

**Global Relevance:** Electronic component testing is a need. The low cost of the project renders it highly applicable and adaptable to the cultures and economies that have limited financial means to acquire expensive test equipment.