IZTECH ME401 Project Proposal

Advisor: Doç. Dr. Ünver Özkol

Project title: Design of a device for measuring moisture content of fibrous products such as cotton

Number of groups: 2

Number of students in each group: 2

Is the project within the scope of Co-Op Extended?: No

Project Background: Controlling the moisture content of seed cotton during ginning operations is essential for preserving cotton quality, preventing damage to equipment, improving processing efficiency, and ensuring consistency in fiber properties.

Project Objective:

- To design a practical moisture measurement device for cotton bales or seed cotton flowing through conveying pipes

Project Design Criteria:

- Measure relative moisture percentage of cotton with accuracy of better than 1%.
- Complete one measurement less than 1 second.
- It must be a handheld device, i.e. it should not weigh more than 1kg.
- It will have its own display.
- It will operate with standart batteries and consume no more than 20W.

Expected Outcomes:

- A full-scale prototype (if the financial sponsor approves the design)

Sustainable Development Goals:

Moisture measuring devices in cotton ginning operations contribute to various aspects of sustainable development, including food security, technological innovation, responsible production, climate action, and ecosystem conservation. They play a role in advancing the SDGs by improving the efficiency, productivity, and sustainability of cotton production processes.

Literature Survey Subjects:

1- Moisture Sensing Techniques: Understanding different moisture sensing techniques is crucial. Common methods include capacitance-based sensing, resistance-based sensing, and microwave-based sensing. Each technique has its advantages and limitations in terms of accuracy, cost, and complexity.
2- Sensor Design: Knowledge of sensor design principles is essential. This includes considerations such as sensor geometry, material selection, and signal processing techniques to optimize sensitivity, stability, and reliability of moisture measurements.
3- Calibration and Validation: Developing accurate calibration procedures and validation protocols is critical for ensuring the reliability and accuracy of moisture measurements. This involves understanding statistical methods, data analysis techniques, and calibration standards.
4- Environmental Considerations: Factors such as temperature, humidity, and electromagnetic interference can affect the performance of moisture sensors. Engineering students need to

consider environmental factors and design sensor systems that are robust and resistant to external influences.

5- Integration with Ginning Equipment: The moisture measurement device must be seamlessly integrated into existing ginning equipment. This requires knowledge of mechanical design, instrumentation, and control systems to ensure compatibility and ease of installation.
6- Power Supply and Energy Efficiency: Designing energy-efficient systems is important, especially in remote or resource-constrained areas where access to power may be limited. Engineering students should consider power supply options and design sensor systems that minimize energy consumption.
7- Data Communication and Analysis: Developing methods for data transmission, storage, and analysis is crucial for extracting meaningful insights from moisture measurements. Understanding data communication protocols, data analytics techniques, and software programming is essential for building effective data management systems.
8- Regulatory Compliance and Standards: Familiarity with relevant industry standards and regulations governing moisture measurement devices is important. Engineering students should ensure that their designs comply with regulatory requirements and industry best practices.
9- Cost-Effectiveness: Designing cost-effective solutions is essential for widespread adoption of moisture measurement devices, particularly in smallholder farming communities. Students should explore strategies for reducing manufacturing costs without compromising performance or reliability.
10- User Interface and Human Factors: Considering user interface design and human factors is important for usability and acceptance of the moisture measurement device. Engineering students should design intuitive interfaces and incorporate user feedback to enhance user experience.

Please write your notes below, which you find useful for students to know about the project.

The students should have a good background (grade CC or higher) of Thermodynamics and Heat Transfer.