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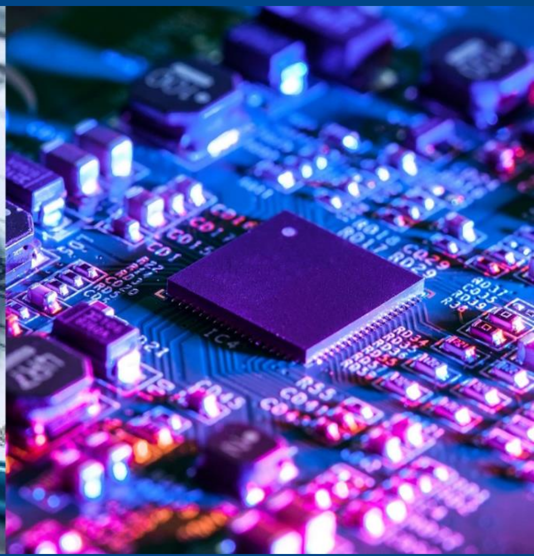
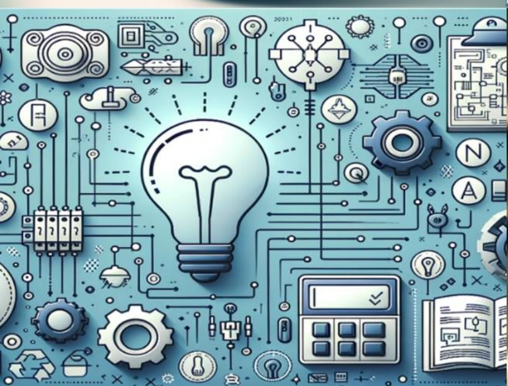


International Journal of Multidisciplinary Research in Science, Engineering and Technology

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)



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Material Dimension Analysing Robot

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ABSTRACT: To ensure accuracy, consistency, and efficiency when measuring material dimensions in manufacturing settings, the Material Dimension Analyzing Robot (MDAR) was created. Traditional manual measuring methods frequently become ineffective and prone to human error as manufacturing companies demand faster production cycles and improved product quality. This robot measures important material characteristics including length, width, thickness, and shape precisely and in real time using sophisticated sensors, robotics, and data processing algorithms. The MDAR's main goals are to increase measurement precision, boost operational effectiveness, and smoothly integrate into current manufacturing lines. The robot improves quality control and speeds up production by automating the dimension analysis process, which also decreases manual labour, minimizes faults, and enhances throughput. The creation of this system is a major step in improving quality control, modernizing manufacturing procedures, and simplifying the production process as a whole.

KEYWORDS: Mechanical Design, Productivity, dimensions, analyses, robot, material, accuracy, precision, error.

I. INTRODUCTION

The MDAR integrates advanced sensors, such as laser or ultrasonic measurement instruments, with robotic arms to enable precise material handling. These sensors capture crucial dimensions including length, width, thickness, and occasionally surface characteristics with a high degree of accuracy. The system's sophisticated algorithms detect any discrepancies between the material dimensions and the necessary specifications by analyzing real-time data, ensuring that only materials that meet strict quality standards proceed through the manufacturing process.

OBJECTIVES: To ensure that crucial metrics like length, width, thickness, and occasionally even shape are measured with the least amount of deviation, the robot strives to give high-accuracy measurements of material dimensions. This results in higher-quality products by lowering faults and improving the consistency of the materials used in manufacturing. Before the materials move on to the next phase of manufacturing, even the smallest changes in dimensions are found and fixed thanks to the employment of high-resolution sensors and accurate actuators.

II. METHODOLOGY

1. **Requirement gathering:** Measure the length, width, thickness, and form of materials automatically in manufacturing environments. high level of accuracy while measuring dimensions. Processing and input in real time.
2. **System design :** Select materials with great strength, such aluminum and stainless steel, to guarantee durability and resistance to corrosion. To ensure dependability and durability, do a material stress assessment. Assemble, cut, and weld the system's parts, including the collection bins, sorting mechanism, and conveyor belt. To guarantee structural integrity and adherence to design specifications, conduct quality control tests at every stage of manufacture. Make sure the design is modular to facilitate the easy replacement and upgrading of components.
3. **Experimental Testing:** Test the system with various frond samples to determine its accuracy, speed, and efficiency. Real-time modifications can be made to improve conveyor speed and stick separation efficiency. Analyze performance indicators including consistency, error rate, and processing speed. Perform multiple test cycles with different input conditions to confirm the system's durability and flexibility. Test findings should be recorded and examined in order to enhance performance and streamline operations.
4. **Sensor Integration and Automation:** Test the system with various frond samples to determine its accuracy, speed, and efficiency. Real-time modifications can be made to improve conveyor speed and stick separation efficiency. Analyze performance indicators including consistency, error rate, and processing speed. Perform multiple test cycles with different input conditions to confirm the system's durability and flexibility. Test findings should be recorded and examined in order to enhance performance and streamline operations.

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5. **Safety Features and Maintenance:** To avoid mishaps, install safety features including fail-safe systems, protective guards, and emergency stop buttons. To find possible risks and take proactive measures to resolve them, conduct risk assessments. Create a regular maintenance plan that includes inspections, moving part lubrication, and material replacement for worn-out components. Create a maintenance guide that outlines preventative and troubleshooting techniques. To provide a safe working environment, train operators on safety measures and emergency response techniques.
6. **Deployment & Training:** To guarantee a smooth integration with current processes, implement the system in agricultural processing facilities and conduct on-site assessments. Operators should get thorough instruction on system operation, troubleshooting techniques, and maintenance procedures. To aid in the transfer of knowledge, produce training videos and instructional materials. To minimize installation problems, make sure it is compatible with the existing infrastructure. To enhance training techniques and the user experience, get operator input.
7. **Continuous improvement :** Ask operators about the operational difficulties and ease of usage. Conduct regular performance evaluations to find areas that could use improvement. Improve system performance by analyzing operational data, and increase segregation efficiency and accuracy by introducing new features like improved sensors or AI-powered monitoring systems.

III. COMPONENTS USED

- DC Motor
- Relay
- Ic
- Circuit board
- Pneumatic cylinder
- Proximity sensor
- Solenoid valve

IV.WORKING PRINCIPLE

The Material Dimension Analysis Robots use advanced sensors like cameras, laser triangulation,or ultrasonic devices to precisely measure critical material properties including length, width, thickness, and surface defects. The robot precisely places the material using its conveyor system or robotic arm. After then, sensors are used to gather accurate dimension data.

Fig 1: MATERIAL DIMENSION ANALYSING ROBOT

V. RESULT AND DISCUSSION

Modern automation tools like the Material Dimension Analyzing Robot (MDAR) greatly increase the accuracy, dependability, and speed of dimension testing in manufacturing settings. In addition to improving measurement accuracy, MDAR lowers operating expenses and human error by substituting sophisticated sensors and robotics for manual measurement techniques. It improves quality control, throughput, and product quality in high-volume manufacturing.

MDAR may save a lot of money on labor and methods by integrating automation and robots. As a result, fewer skilled manual laborers are needed to do regular inspection jobs. Because of this, MDAR is a particularly alluring choice for businesses trying to expand and boost sales.

Additionally, because MDAR can be readily linked with existing production lines, it can be used in a variety of manufacturing contexts, including automotive, electronics, aerospace, and applications.

VI. FUTURE ENHANCEMENTS

To enhance the performance of the Material Dimension Analyzing Robot (MDAR), several improvements can be considered. Integrating AI-based defect detection will help identify both dimensional errors and surface flaws. Cloud connectivity can enable real-time data access and remote monitoring. Adding 3D vision systems or LiDAR will improve accuracy, especially for complex shapes. Wireless sensors and self-calibration features can increase efficiency and reduce manual effort. Incorporating predictive maintenance through IoT will help reduce downtime, while real-time feedback can allow immediate action on dimensional faults. A touchscreen HMI can simplify user interaction, and integration with ERP systems can streamline data management. Lastly, supporting multiple material types and using adaptive learning models can make the system more versatile across industries.

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