"Robot arm with Material identifying And Handling"

POC for the Project

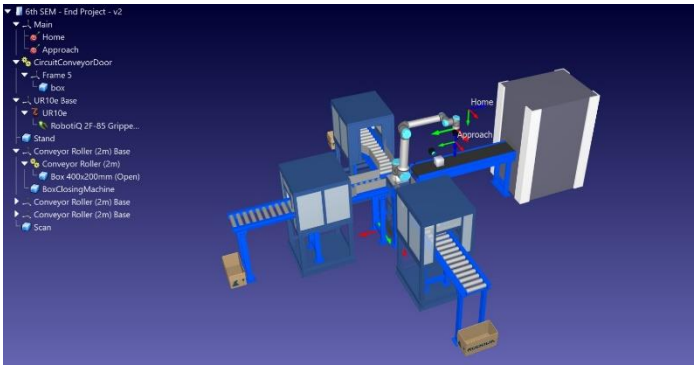
- The main objectives to achieve
    1. Robotics Arm Ex: https://youtu.be/RNpHQ1kUMDU
        - Hardware : C:\Users\Shrishaila.P\OneDrive\Desktop\GPTI\6th_SEM_Project\Software
            1. Building the body of the arm in 3D print (STL Files).
            2. Components Requirements & Purchase.
        - Software : http://ai2.appinventor.mit.edu/#6509864982282240
            1. MIT AI2 App Building and control.
            2. Robot Arm Arduino code for process.
    2. Conveyor Systems Ex: https://www.youtube.com/watch?v=o7VVmtX7SKs&t=2s
        - Selection and building of the proper conveyor for the project by considering factors such as material type to be used, transportation distance and speed, throughput, layout and features.
    3. Workstations Ex : https://youtu.be/Jw00AcxFFJY
        - Different types of material after identifying and handling will go under specific workstations for further process.

- The objective of the project is to design and build a robotic arm that can perform tasks such as pick-and-place & sorting.
- The arm should have a range of motion that allows it to access objects which are coming by the conveyor.
- Within a defined workspace it should have the ability to manipulate and handle objects with accuracy.
- The arm should be controlled by an interface that allows users to program and control the arm's movements. (By MIT AI2 App)
- The project should be completed within a specified timeframe and budget, and the final product should be reliable, easy to maintain and use, and meet expectations.

Design Thinking

1. Empathize :
    - We understand that industrial workers are often required to handle a wide range of materials in their daily tasks, which can be physically demanding and time-consuming.
    - We empathize with the need for a more efficient and ergonomic solution that can help them easily identify and handle different materials while minimizing the risk of injury and increasing productivity.
2. Define :
    - Industrial workers are frequently required to handle a variety of materials, which can be physically demanding and time-consuming.
    - Current solutions for material handling are often limited in their capabilities and can pose safety risks for workers.
    - The goal of this project is to design a robot arm with material identifying and handling capabilities that meet these needs and enhance industrial workers' working experience.

3. Ideate :
    - We aim to explore creative and innovative solutions that combine advanced sensing technologies, intuitive controls, and customizable end-effectors to create a versatile and user-friendly system. Our goal is to deliver a solution that streamlines material handling processes and boosts productivity in industrial settings.
4. Prototype :
    - V1



5. Test : Testing the end project based on some cases and conditions, before delivering it to the collage.

Project Description

- The proposed project aims to develop a robot arm material identification and handling system that can accurately identify different materials and handle them accordingly. The system will be designed to work in an industrial setting, where it can be used for a range of applications such as material sorting, picking and placing, and quality control.
- The robot arm system will be equipped with various sensors and cameras that will enable it to identify different materials based on their physical properties such as size, shape, texture, and weight. Once the materials are identified, the robot arm will pick and place them accordingly, based on pre-programmed instructions.

The project will involve the following key components:

- Hardware Development: This will involve the design and development of the robot arm system, including the sensors, gripper, and other necessary hardware components.
- Software Development: This will involve the development of the software that will control the robot arm system. The software will include algorithms for material identification, motion planning, and control.
- Integration and Testing: This will involve the integration of the hardware and software components to form a complete system. The system will be tested extensively to ensure its reliability and accuracy in material identification and handling.

Expected outcomes:

- The successful completion of this project will result in the development of a robust and reliable robot arm material identification and handling system that can be used in a range of industrial applications. The system will be able to accurately identify and handle different types of materials, improving the efficiency and accuracy of material handling processes. This will ultimately result in cost savings and increased productivity for industries that use this technology.

Project Scope

- The project scope for a Robotic Arm with Object Identifying System involves designing and building a system that can identify and pick up objects of varying sizes and shapes, and place them at designated locations. The system should use an object-identifying system, such as machine vision, to accurately identify and locate the objects.

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The scope of the project typically includes:

- Determining the specific task or process to be automated using the Robotic Arm with Object Identifying System.
- Identifying the types of objects to be picked up, their dimensions, and their placement locations.
- Designing the Robotic Arm and Object Identifying System to meet the requirements of the task or process, including accuracy, speed, and safety considerations.
- Integrating the Robotic Arm and Object Identifying System components and programming them to work together to identify and pick up objects accurately.
- Testing the system to ensure it meets the expected requirements and functions.
- Documenting the system design and providing training and support to end-users, if required.
- Overall, the project scope for a Robotic Arm with Object Identifying System involves designing, building, and implementing an automated system that can accurately identify and pick up objects of varying sizes and shapes, and place them at designated locations. The system should improve efficiency, accuracy, and safety in the specific task or process.

Test and prototype

Note :

To develop a robotic arm with material handling capabilities, you will need to follow a systematic approach that involves creating a prototype and testing it to ensure it meets the requirements. Here are the steps you can take:

- **Define the requirements:**
  Before you start designing the prototype, you need to define the requirements for the robotic arm. What materials will it be handling? What weight capacity does it need? What range of motion is required? What are the safety considerations?

- **Design the prototype:**
  Based on the requirements, you can start designing the prototype. You will need to determine the size and shape of the arm, the number of joints, and the type of actuators to be used. You will also need to design the gripper or end effector that will be used to pick up and move materials.

- **Build the prototype:**
  Once you have the design, you can start building the prototype. You will need to assemble the joints, attach the actuators, and connect the wiring. You will also need to create the gripper or end effector.

- **Test the prototype:**
  Once the prototype is built, you can begin testing it. You can test the range of motion, the weight capacity, and the accuracy of the arm. You will also need to test the gripper or end effector to ensure that it can securely hold and move materials.

- **Iterate and improve:**
  Based on the results of the testing, you may need to iterate and improve the design. You can adjust the joints, actuators, and gripper to improve the arm's performance.

- **Final testing and implementation:**
  Once the design is finalized, you can conduct final testing to ensure that the arm meets all the requirements. If the testing succeeds, you can implement the robotic arm with material handling capabilities in your intended application.

CBS – Cost Breakdown Structure

1. Robotic Arm:

Arm unit

End effector (gripper)

Control system

Installation and commissioning

2. Conveyor System:

Belt or chain conveyor

Motor and drives

Control system

Installation and commissioning

3. Material Handling:

Sensors and detection systems

Sorting and feeding systems

Packaging and labelling systems

Installation and commissioning

4. Integration:

System Integration

Testing and debugging

Training and support

Documentation

5. Other Costs:

Bus Fare

Parking

CBS – Cost Breakdown Structure	Cost Items
Robotic Arm	Arm unit End effector (gripper) Control system Installation and commissioning
Conveyor System	Belt or chain conveyor Motor and drives Control system Installation and commissioning
Material Handling	Sensors and detection systems Sorting and feeding systems Packaging and labelling systems Installation and commissioning
Integration	System Integration Testing and debugging Training and support Documentation
Other Costs	Bus Fare Parking

Note :The cost breakdown structure may vary depending on the requirements of the robotic arm and conveyor system.

Project – Risk Analysis Plan

Identify the hazards:

List out all the potential hazards that could arise from your robotic arm system, such as the risk of the arm colliding with objects, causing injury or damage to the environment.

Determine the likelihood of the hazard occurring:

Assess the probability of each hazard occurring, based on the design and operation of the system.

Evaluate the consequences:

Consider the consequences of each hazard, such as the severity of injury or damage that could result.

Determine the level of risk:

Based on the likelihood and consequences of each hazard, determine the level of risk associated with each one.

Identify risk reduction measures:

Determine what measures can be taken to reduce the risks identified in the previous steps. These may include implementing safety features such as emergency stop buttons, designing the system to operate at a safe speed or using sensors to detect potential hazards.

Implement the risk reduction measures:

Implement the measures identified in the previous step, and make sure that they are integrated into the design and operation of the system.

Monitor and review:

Regularly monitor and review the system to ensure that the risk reduction measures are effective and that any new hazards that arise are identified and addressed.

Communicate the risk analysis plan:

Share the risk analysis plan with all stakeholders, including employees and other relevant parties, to ensure that everyone is aware of the potential hazards and the measures in place to mitigate them.

Hazard	Likelihood	Consequence	Risk Level	Risk Reduction Measures
Arm colliding with objects	High	Severe injury or damage	High	Implement sensors and safety features to detect and avoid obstacles
Material mishandling	Moderate	Minor injury or damage	Moderate	Implement quality control measures and regular maintenance to ensure proper functioning
Conveyor malfunction	Low	Moderate damage	Low	Regular maintenance and inspection to prevent malfunction
Electrical hazard	Moderate	Severe injury or damage	High	Implement safety features such as grounding and insulation, provide proper training for maintenance staff
Human error	High	Minor to severe injury or damage	High	Implement proper training and standard operating procedures, provide regular safety training

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