IoT-Based Automated Weight Scale and Conveyor System for Poha Handling

Introduction

This document outlines an IoT-based automated system to enhance hygiene and efficiency in poha handling at your factory. Currently, the process involves manual collection of poha from the ground, which is unhygienic and labor-intensive. The proposed system utilizes a smart weight-scale bucket system integrated with IoT for automating the transfer of poha to containers and packaging systems.

Objectives

- **Improve Hygiene**: Prevent poha from touching the ground during the collection and transfer process.
- **Enhance Efficiency**: Automate the transfer of poha from buckets to containers without manual intervention.
- **Real-Time Monitoring**: Allow tracking of weight and system status through IoT platforms.
- **Optimize Labor Usage**: Reduce the dependency on labor for repetitive tasks, such as collecting and transferring poha.

System Overview

Components Required

Sensors and Modules

- **Load Cell (X kg capacity)**: Measures the weight of poha in the bucket.
- **HX711 Amplifier**: Interfaces the load cell with the microcontroller.
- **NodeMCU ESP8266**: Processes data from the load cell and controls the motor system, while also enabling IoT connectivity.

Actuators

- **High-Torque DC Motor**: Moves the bucket to unload poha into the container.
- **Motor Driver (L298N/TB6600)**: Controls the motor operation.

Mechanical Components

- **Buckets (2 units)**: Each with a volume capable of holding 10-20 kg of poha.

- **Containers (2 units)**: Large storage containers to collect poha from buckets.
- **Conveyor Belt**: Automates the movement of buckets between the poha collection point and the container.
- **Metal Frame**: Provides structural support for the system.

Additional Components

- **Limit Switches**: Detect the position of the bucket for precise stopping.
- **Power Supply**:
  - 5V for NodeMCU.
  - 12-24V for the motor system.
- **Cloud Platform**: Blynk or Arduino Cloud for monitoring and control.

Workflow of the System

1. **Poha Collection**: Poha is collected directly into the bucket placed on a load cell. This prevents the grains from touching the ground, maintaining hygiene.
2. **Weight Monitoring**: The load cell measures the weight of poha in real time. When the bucket weight reaches a pre-set threshold (e.g., 10-20 kg), the system triggers the motor.
3. **Bucket Transfer**: The high-torque motor moves the filled bucket along a conveyor belt to the container for unloading.
4. **Unloading and Reset**: Once the poha is transferred into the container, the empty bucket is returned to the collection point, while a second bucket is used for continuous collection.
5. **IoT Integration**: The NodeMCU sends real-time weight data and system status to a cloud platform. Alerts can be triggered for maintenance or manual intervention if needed.

System Flow Diagram

Flowchart

1. **Start**: System is initialized, and NodeMCU monitors the load cell.
2. **Poha Collection**: Poha is directly collected into Bucket 1, which is placed on the load cell.
3. **Weight Detection**: Load cell continuously measures the weight of Bucket 1.
   - If weight $<$ threshold (10-20 kg): Continue collecting.
   - If weight $\geq$ threshold: Trigger motor system.
4. **Bucket Transfer**: Motor moves Bucket 1 to the container.
   - Simultaneously, Bucket 2 starts collecting poha.
5. **Unloading**: Bucket 1 unloads poha into the container.
6. **Return**: The empty Bucket 1 returns to the collection point.
7. **Data Monitoring**: Real-time weight and system status are sent to the cloud platform.
8. **End**: System waits for the next cycle or user input.

Limitations

- **Volume Constraints**: Poha is lightweight and requires large bucket volumes for efficient handling. Adjustments may be needed to optimize bucket size and conveyor belt length.
- **Cost of Customization**: The conveyor belt and metal frame may require precise customization, increasing initial costs.
- **Load Cell Accuracy**: High sensitivity is required to detect small weight variations, which may be affected by environmental factors like vibrations or uneven bucket placement.
- **Maintenance**: Regular cleaning and maintenance are essential to prevent grains from jamming mechanical parts.
- **Power Backup**: The system relies on continuous power; any interruption could disrupt the workflow.