Research Article

BOX SORTING MONITORING SYSTEM BY USING ARDUINO

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Abstract: The creation of an electrical system for sorting boxes by size marks an important progress in mechanical automation. In order to enhance the sorting mechanism, this framework utilizes modern sensors, controllers, and actuators. This enhances overall efficiency while adding points to lessen manual work and mistakes. It addresses the essential requirement for sophisticated supply chain management and collaboration among various departments. Transport frameworks, box detection sensors, and a measurement estimation system that utilizes laser or infrared sensors for accurate degree measurement are instances of cutting-edge technologies incorporated into the system. The key components of the proposed framework include a transport system that facilitates effective box movement, an estimation framework that guarantees accurate measurement assessment, and box detection sensors that recognize the presence of boxes. The main control unit, which could be a PLC, utilizes sensor data to execute smart sorting decisions. The sorting mechanism effectively organizes boxes into specific chutes or transportation paths according to their dimensions utilizing pneumatic barrels, solenoids, or servo motors. By utilizing the Human Machine Interface (HMI), operators can effortlessly monitor and manage the sorting process, while a robust communication system facilitates smooth data exchange among system components. Because security is the top priority, crisis management tools, security sensors, and an extensive input system are essential to avert accidents and ensure the precision of the sorting process. Comprehensive testing verifies the framework's viability in diverse conditions while considering factors like transport speed, box size compatibility, and sorting precision. The system's thoughtful design facilitates maintenance and adaptability, allowing for straightforward adjustments to address the changing requirements of sectors dependent on effective box sorting. Ultimately, this activity guarantees enhanced precision and proficiency in supply chain management methods

Keywords: Arduino, Automation, Servomotor, Electric System

INTRODUCTION

The current manual sorting of boxes based on size is inefficient, error-prone, and costly. Variability in box sizes, high labor costs, errors, limited scalability, space utilization issues, and worker safety concerns pose challenges. In an increasingly competitive environment, there is a need for an efficient "Electrical System for Size-Based Box Sorting" to enhance productivity and accuracy in logistics and distribution processes.

Automation is the use of control systems for handling different processes and machineries to replace human efforts. Using automation also prevents danger which might occur when humans are made to work in hazardous environments. Thus, use of automation is effective in manufacturing industry.Sorting based on size is done in many industries to ensure the quality of the object is consistent and up to the mark. Automated sorting also reduces the labour cost and the production time. The error cased due to human negligence is avoided by the use of automated system by colour based sorting using a colour sensor. The aim of implementing an "Electrical System for Size-Based Box Sorting" is to enhance sorting efficiency, reduce labor costs, improve scalability, optimize space usage, ensure worker safety, and meet competitive demands in logistics and distribution operations

LITERATURE REVIEW

1. M. Ahamed and H. Gu, "Package sorting control system based on barcode detection," 2022 7th International Conference on Automation, Control and Robotics Engineering (CACRE), Xi'an, China, 2022, pp. 148-152,.

This paper presents an innovative approach to package sorting, focusing on barcode detection as a key element of the control system. In contrast to conventional methods based on PLC or color sensors, the authors employ an Arduino microcontroller and introduce a unique conveyor design to enhance sorting speed and accuracy. The design emphasizes low friction, fast sorting, and high precision.

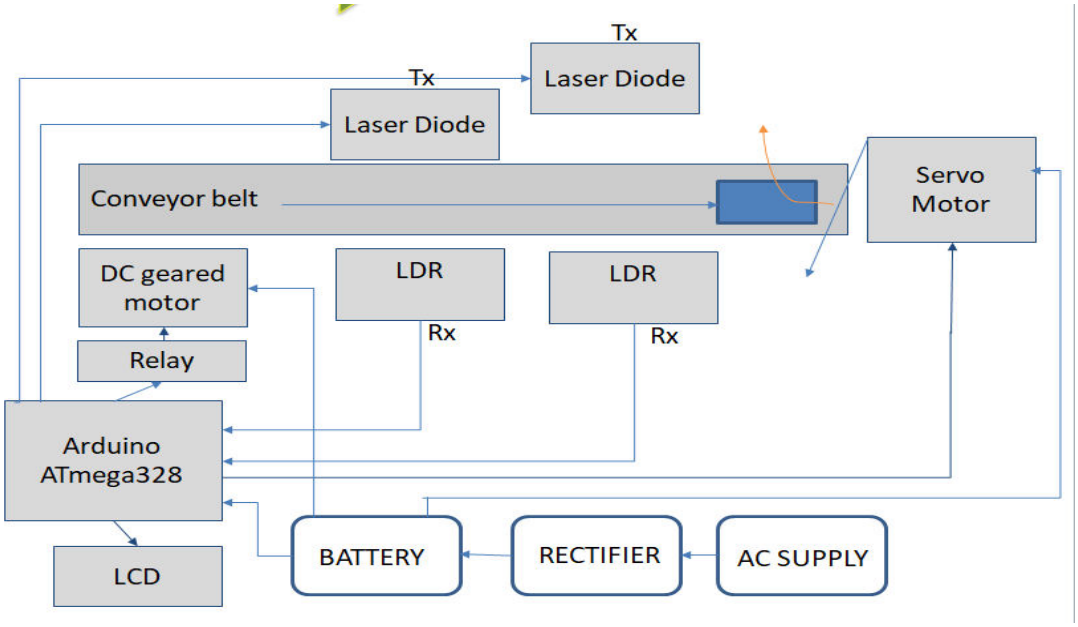
2. F. H. Altaf Hussain, V. K. Shukla and A. Tripathi, "Sorting of Objects from Conveyer Belt

through Colour Detection and Audrino UNO," 2021 International Conference on Communication information and Computing Technology (ICCICT), Mumbai, India, 2021, pp. 1-5, doi: 10.1109/ICCICT50803.2021.9510037.
Addressing the challenges of manual sorting in industrial packaging, this paper proposes an automatic sorting machine using the TCS3200 color sensor and Arduino UNO. The system leverages color detection to distinguish between different colored objects on a conveyor belt, ensuring accurate and efficient categorization. By incorporating a servo motor, the objects are directed to specific directions

3. A. Haque, T. A. Abdulhussein, M. Ahmad, M. Waheed Falah and A. A. Abd El-Latif, "A Strong Hybrid S-Box Scheme Based on Chaos, 2D Cellular Automata and Algebraic Structure",in IEEE Access, vol. 10, pp. 116167-116181, 2022, doi: 10.1109/ACCESS.2022.3218062. Focusing on the realm of symmetric-key cryptosystems, this paper introduces a novel method for creating substitution-boxes (S-boxes) with enhanced cryptographic properties. The proposed hybrid S-box scheme incorporates principles from chaos theory, two-dimensional cellular automata, and algebraic group structure. The resulting 8x8 S-box exhibits excellent security performance features, including high nonlinearity, the absence of fixed points, and strong resistance against various cryptanalytic attacks.

4. Kumar, R., & Gupta, A. (Year). Advances in Automated Material Handling Systems for Warehouse Logistics. International Journal of Advanced Manufacturing Technology, 72(5-8), 123-145.
Investigate other studies on automated material handling systems, exploring how robotic systems, conveyor technologies, and IoT integration contribute to improved efficiency and optimization in warehouse logistics. Look for research that addresses specific challenges in warehouse automation and proposes innovative solutions.

BLOCK DIAGRAM



ELECTRONICS HARDWARE USE

Arduino UNO ATmega328, Relay, Laser and LDR reader module, DC geared motor, 12V power supply, Servo Motor and Conveyor belt system

Software Used : Arduino IDE compiler

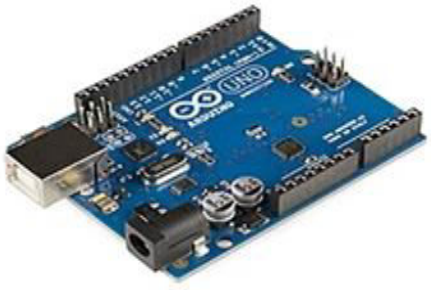
A. ARDUINO UNO

Arduino Uno circuit board with Arduino IDE is capable of reading analog or digital input signals from different sensors, activating the motor, turning LED on/off and do many other such activities. All functionalities are performed by sending a set of instructions to the ATtmega328 main microcontroller, on the board via Arduino IDE. The Arduino board also includes Power USB, Power (Barrel Jack), voltage regulator, crystal oscillator, voltage pins (3.3v,5v,gnd,vin), A0 to A5 analog pins, icsp pin, power led indicator, tx and rx leds, 14 digital input/output pins, Aref, and Arduino reset

The Arduino Uno is a microcontroller board, based on the ATmega328.The Uno board functioning is different from all other boards in that it does not use the FTDI USB to serial

driver chip. Instead, the Atmega328 is programmed as a USB to serial converter. The ATmega328 is a low power CMOS 8 bit microcontroller based on the AVR enhanced RISC architecture structure

The Arduino project started in 2003 as a program for students at the Interaction Design Institute Ivrea in Ivrea, Italy,[2] aiming to provide a low-cost and easy way for novices and professionals to create devices that interact with their environment using sensors and actuators. Common examples of such devices intended for beginner hobbyists include simple robots, thermostats and motion detectors.



The Arduino project was started at the Interaction Design Institute Ivrea (IDII) in Ivrea, Italy. At that time, the students used a BASIC Stamp microcontroller at a cost of $50, a considerable expense for many students. In 2003 Hernando Barragán created the development platform Wiring as a Master's thesis project at IDII, under the supervision of Massimo Banzi and Casey Reas. Casey Reas is known for co-creating, with Ben Fry, the Processing development platform. The project goal was to create simple, low cost tools for creating digital projects by non-engineers. The Wiring platform consisted of a printed circuit board (PCB) with an ATmega168 microcontroller, an IDE based on Processing and library functions to easily program the microcontroller.[4] In 2003, Massimo Banzi, with David Mellis, another IDII student, and David Cuartielles, added support for the cheaper ATmega8 microcontroller to Wiring. But instead of continuing the work on Wiring, they forked the project and renamed it Arduino.

The initial Arduino core team consisted of Massimo Banzi, David Cuartielles, Tom Igoe, Gianluca Martino, and David Mellis, but Barragán was not invited to participate.

Following the completion of the Wiring platform, lighter and less expensive versions were distributed in the open-source community.It was estimated in mid-2011 that over 300,000 official Arduinos had been commercially produced, and in 2013 that 700,000 official boards

were in users' hands.

In October 2016, Federico Musto, Arduino's former CEO, secured a 50% ownership of the company. In April 2017, Wired reported that Musto had "fabricated his academic record.... On his company's website, personal LinkedIn accounts, and even on Italian business documents, Musto was until recently listed as holding a PhD from the Massachusetts Institute of Technology. In some cases, his biography also claimed an MBA from New York University." Wired reported that neither University had any record of Musto's attendance, and Musto later admitted in an interview with Wired that he had never earned those degrees.

Around that same time, Massimo Banzi announced that the Arduino Foundation would be "a new beginning for Arduino." But a year later, the Foundation still hasn't been established, and the state of the project remains unclear.

The controversy surrounding Musto continued when, in July 2017, he reportedly pulled many Open source licenses, schematics, and code from the Arduino website, prompting scrutiny and outcry.

In October 2017, Arduino announced its partnership with ARM Holdings (ARM). The announcement said, in part, "ARM recognized independence as a core value of Arduino ... without any lock-in with the ARM architecture." Arduino intends to continue to work with all technology vendors and architectures

B.Relay

A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal. The first relays were used in long distance telegraph circuits as amplifiers: they repeated the signal coming in from one circuit and re-transmitted it on another circuit. Relays were used extensively in telephone exchanges and early computers to perform logical operations..

CONCLUSION

This paper seeks to reduce manual work and mistakes while enhancing overall productivity. It tackles the essential requirement for enhanced supply chain management and logistics across various industries. Contemporary technologies are incorporated into the system, including conveyor belts, box detection sensors, and a size measurement system that employs laser or infrared sensors for accurate dimension measurement.

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