JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Development of an iot integrated automatic chromatic classification and sorting machine for industrial automation

[1]Mr. Madane Vijay Jagannath, [2]Mr. Gade Dnyaneshwar Ambadas, [3]Ms. Jadhav Sulabha Sunil, [4]Ms. Jadhav Gayatri Purushottam

[1]Assistant Professor of karmayogi Institute of Technology, DBATU university, Department of Electronic & Telecommunication Engineering, Shelve, Pandharpur, vijaymadane@gmail.com

[2]Student of karmayogi Institute of Technology, DBATU university, Department of Electronic & Telecommunication Engineering, Shelve, Pandharpur, gadednyaneshwar9356@gmail.com

[3]Student of Karmayogi Institute of Technology, DBATU university, Department of Electronic & Telecommunication Engineering, Shelve, Pandharpur, sulabhajadhav1750@gmail.com

[4]Student of Karmayogi Institute of Technology, DBATU university, Department of Electronic & Telecommunication Engineering, Shelve, Pandharpur, jadhavgayatri493@gmail.com

---

Abstract: This project focuses on designing and developing an automated system that integrates Internet of Things (IoT) technology for the chromatic classification and sorting of objects in industrial settings. Utilizing color sensors and microcontroller-based control, the system detects and categorizes items based on their color attributes. With the implementation of IoT connectivity, the machine allows for real-time monitoring, remote management, and data collection to enhance operational efficiency and maintenance. The automation of the sorting process reduces human error, labor costs, and processing time, making it suitable for various industries including manufacturing and agriculture. The system architecture supports scalability and adaptability for different sorting requirements, contributing toward the advancement of smart industrial automation.

1.INTRODUCTION

In this era 4.0 With the growing demand for automation in industries, the need for accurate and efficient sorting systems has become crucial. Sorting objects based on color plays a vital role in sectors such as manufacturing, agriculture, and recycling. Manual sorting is often slow, error-prone, and labor-intensive, making automation a practical solution. This paper presents the design and development of an automatic color classification and sorting machine integrated with Internet of Things (IoT) technology. The system uses color sensors and microcontrollers to detect and categorize items automatically. By incorporating IoT, the machine supports real-time monitoring and remote management, enhancing operational efficiency and data accessibility. This approach not only reduces human intervention and error but also improves processing speed and adaptability to different industrial needs. The proposed system aims to contribute to smarter industrial automation by combining color detection with connected technologies, enabling scalable and flexible sorting operations.

2. MATERIAL:

Esp 32, Color sensor (TCS3200), I2C, Servo motor, Dc Power Supply, Connector, Connecting wire, Copper clad, Male-Female connector.

3. BLOCK DIAGRAM:

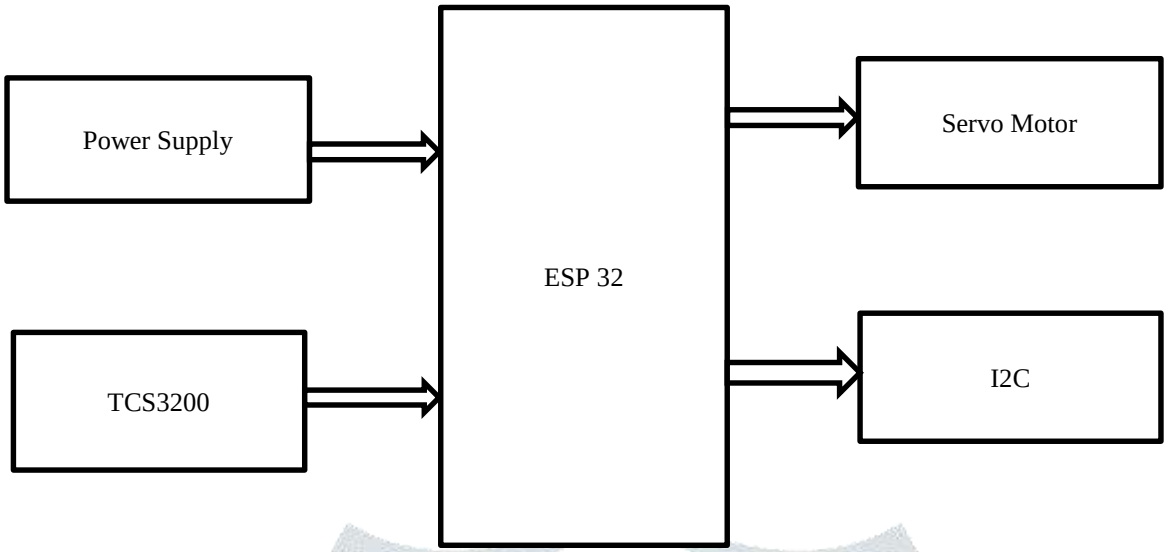

Fig 1: Block Diagram

ESP 32:
Function: Dual-core 32-bit processor it integrates WI-FI and Bluetooth connectivity.
Description: ESP32 is versatile microcontroller. The chip includes multiple GPIO pins, ADC, DAC, PWM, and support for communication interfaces like SPI, I2C, and UART. It also features low power consumption modes and built-in security functions. This combination allows the ESP32 to handle wireless communication and control tasks efficiently in embedded systems.

TCS 3200:
Function: Detects and measures colour properties of objects.
Description: A colour sensor module with an array of photodiodes and filters. It outputs frequency signals proportional to detected colour intensity, which are read by a microcontroller.

Power Supply:
Function: Provides the required electrical energy to all system components.
Description: Converts AC mains or battery energy to stable DC voltage appropriate for devices like the ESP32, TCS3200, and servo motor.

Servo Motor:
Function: Performs mechanical movement based on control signals.
Description: Converts electronic signals into precise angular or linear movement. Often used for positioning in sorting systems or automation.

I2C:
Function: Enables communication between a microcontroller and multiple peripheral devices using only two shared lines (SDA for data, SCL for clock).
Description: I2C (Inter-Integrated Circuit) is a serial communication protocol that allows multiple digital devices to exchange data efficiently. It supports connecting sensors, displays, and other modules with simple wiring, using a unique address for each device on the bus.

4. CIRCUIT DIAGRAM**:**

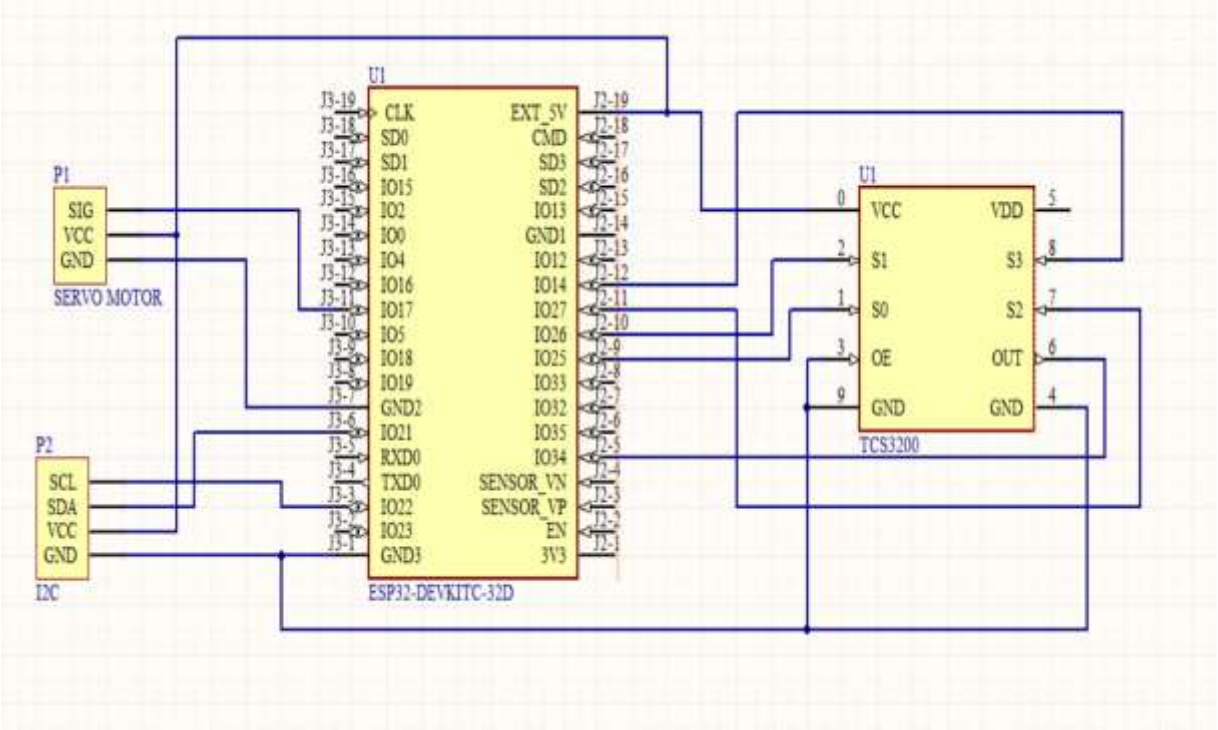

Fig 2: Circuit Diagram

1. ESP32-DEVKITC-32D:

The ESP32 module handles central control, interfacing with a servo motor and the TCS3200 color sensor. Standard pins (IOxx) on the ESP32 are used for digital input/output operations. Dedicated pins are allocated for VCC, GND, and communication lines relevant to sensor and peripheral connections.

2. TCS3200 Color Sensor Interface:

The TCS3200 sensor receives power via VCC and GND pins. Its control pins (S1, S2, S3, S4) are directly connected to ESP32 digital pins to select photodiode filter and frequency scaling. The sensor's output (OUT) is fed to the ESP32 for color signal processing. The Enable (OE) is controlled through the ESP32 to toggle output activation.

3. Servo Motor:

The servo motor is powered by VCC and GND. The control signal (SIG) comes from an ESP32 digital pin, which enables precise angle control for sorting mechanisms based on detected color.

4. I2C Communication Port:

An I2C connector is provided for connecting external devices or sensors via the SCL (clock), SDA (data), VCC, and GND lines. These lines are mapped to specific ESP32 pins to support expansion and integration with additional modules.

5. SOFTWARE DESIGN:

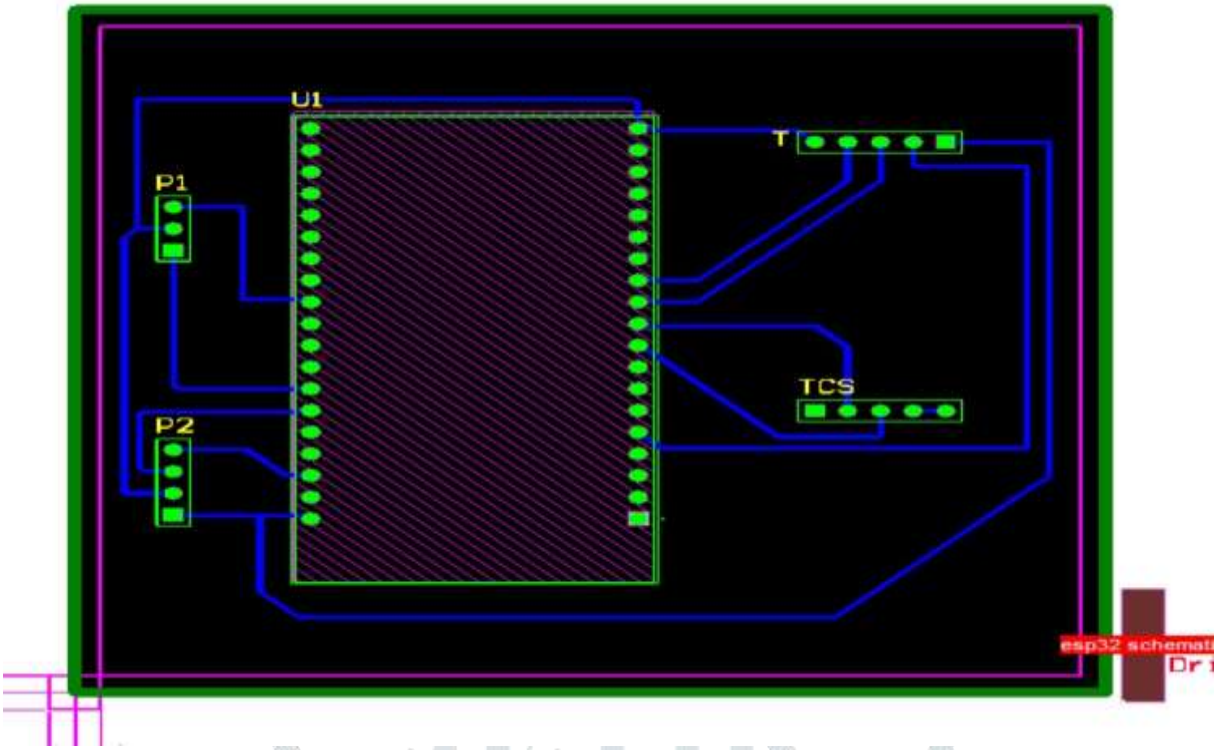

Fig 3: Simulation

P1: Servo Motor
Acts as an actuator to perform controlled movements based on commands from the microcontroller. Commonly used for rotating or positioning mechanisms in automation tasks.

P2: I2C LCD
Functions as a display unit that shows output data such as sensor readings or status messages, communicating with the controller using the I2C protocol for efficient two-wire data transfer.

TCS, T: Colour Sensor (TCS3200)
Detects the color of objects by measuring reflected light intensity across different wavelengths. Interfaces with the controller to provide frequency-based color signals for processing.

U1: ESP32
Serves as the central processing and control unit, managing communication between sensors, actuators, and display. It executes program logic and interfaces with external components for system operation.

6. RESULT:

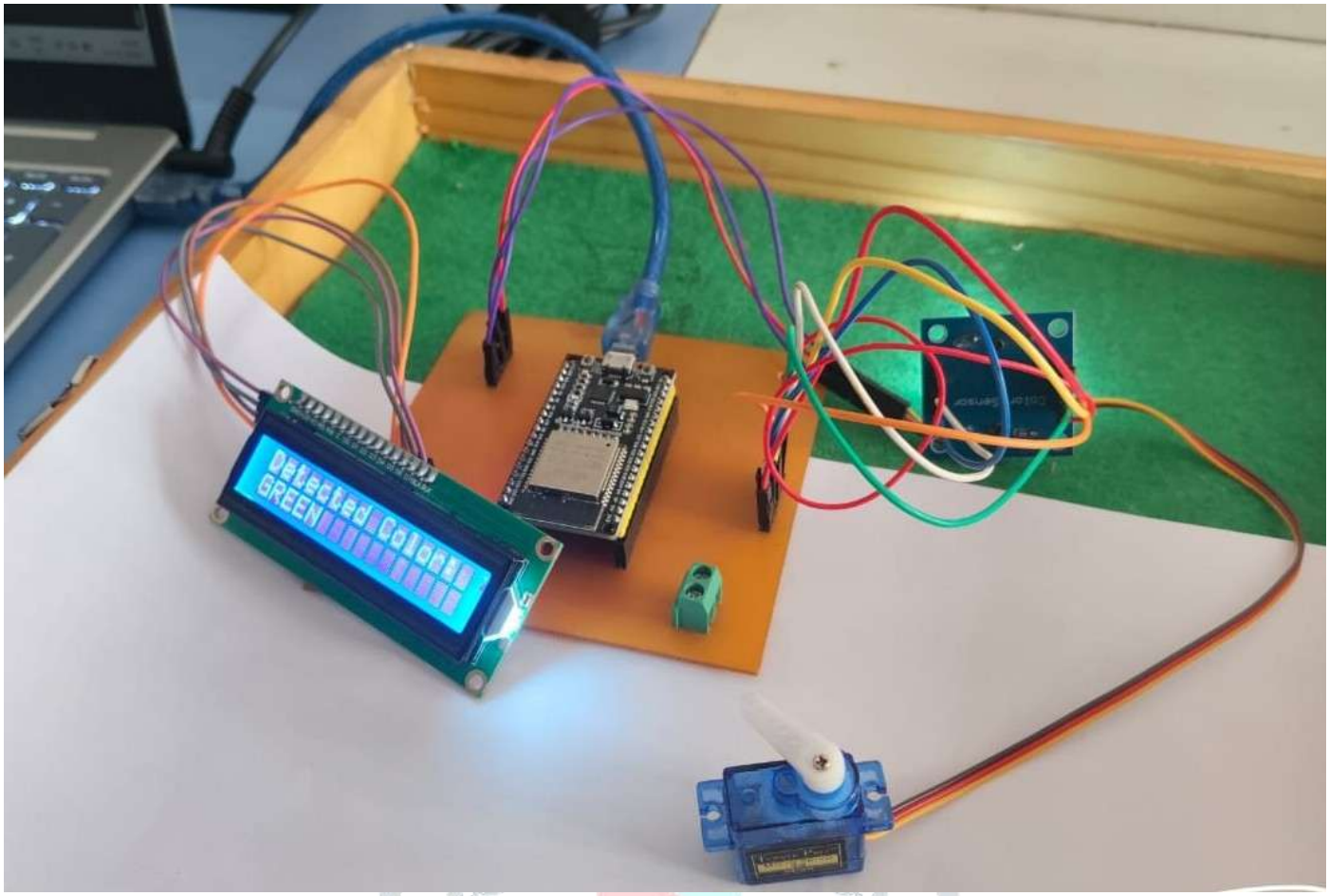

Fig 4: Result

- The system displays "GREEN DETECTED" on the LCD screen, indicating successful identification of a green object.

➢ Components:

- Microcontroller board, likely ESP32, for control and processing.
- LCD display module for output feedback.
- Color sensor module used to detect object color.
- Servo motor for actuation, possibly sorting.
- Jumper wires for electrical connections.
- Prototype testing board for assembly.
- Laptop for programming and monitoring.
- Wooden tray for setup support.

7. CONCLUSION:

An IoT-integrated automatic chromatic classification and sorting machine significantly enhances efficiency, accuracy, and scalability in industrial automation settings by utilizing sensors, microcontrollers, and IoT connectivity for real-time sorting and remote monitoring. This system successfully addresses challenges associated with manual sorting, such as labor intensity, errors, and slow production rates, by leveraging color sensors (e.g. TCS3200), conveyor belts, sorting mechanisms, and cloud-based data management. Such solutions are adaptable for various industries including agriculture, manufacturing, logistics, and recycling—supporting high precision and operational flexibility.

The integration of IoT enables continuous monitoring, data-driven optimization, and remote control, contributing to improved productivity, reduced labor costs, and minimized human error. This automated approach forms an important technological advancement, paving the way toward more connected and intelligent industrial processes. In summary, IoT-based chromatic classification and sorting machines offer a robust, scalable, and reliable solution to modern industrial sorting needs, marking a significant step towards Industry 4.0 automation.

8. FUTURE DIRECTIONS:

The future of IoT-integrated automatic chromatic classification and sorting machines lies in enhanced AI integration, improved accuracy with advanced sensors, and real-time monitoring through Industry 4.0 connectivity. These machines will expand across various industries, driving sustainability and efficiency, with modular designs enabling wider adoption and cost-effectiveness. This technology will play a vital role in the future of smart industrial automation.

9. REFERENCES:

1. Microcontroller Based Product Sorting by Using Colour Sensor (Molane et al., 2020)
2. A Developed Sensor for Colour Identification, Sorting and Counting Automation Control System (Yue ET Al., 2021)
3. Applied Colour Sensor-Based Solution for Sorting in Food Industry Processing (Ala-ya, Thoth & Géczy, 2019)
4. Design and Implementation of a Candy Colour Sorter Device using Micro-controller-Based Colour Sensor TCS3200 (Mechanics Education, UMY, 2023)