

Intelligent PLC-SCADA Based Metal Sorting and Counting System using VFD Controlled Conveyor

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Abstract - This paper describes the design and development of a real-time intelligent metal sorting and counting system using Delta DVP-SS2 PLC, SCADA, HMI, pneumatic actuators, and VFD-controlled conveyor belt. This system is designed to detect and sort and count the number of metal items through automation processes with maximum accuracy. For detection of metal objects, a photoelectric sensor is used along with the use of an inductive metal detector sensor. A Variable Frequency Drive (VFD) is used to control the speed of the conveyor.

Delta PLC will take care of the automation process by performing real-time processing of signals from sensors, along with controlling the motor for the conveyor belt, solenoid valves, and pneumatic actuators. Through HMI and SCADA interfaces, operators can monitor and manage overall system functionality, including detection of faults, conveyor speed, and counting of objects. Communication between PLC, HMI, SCADA, and field devices is also ensured.

Through this technology, productivity and efficiency levels are significantly improved, along with increased accuracy, operational safety, and reliability of the process while minimizing human efforts. Further improvements can also be made using IoT technology, AI, etc., in smart manufacturing applications.

Index Terms—PLC, SCADA, HMI, VFD, Industrial Automation, Metal Sorting, Conveyor System, Pneumatic Actuator, Delta DVP-SS2 PLC, Material Counting

I. INTRODUCTION

Industrial automation is now considered one of the most important inventions in the process and manufacturing industries that can contribute toward enhancing efficiency, effectiveness, reliability, and safety. Traditional methods of sorting material depend on manual work, which increases processing time, labor cost, risk of error, and decreases efficiency of processes. To address the above challenges, industries are turning toward PLC-based automation systems combined with HMI and SCADA technologies.

Sorting and counting of materials are some of the applications of material sorting and counting systems. Material sorting and counting are critical for industries to sort and identify metallic objects, which are important for achieving quality during industrial processes. Traditional sorting systems do not perform consistently due to lack of real-time monitoring features.

In this paper, the design and development of a real-time intelligent metal sorting and counting system based on the Delta DVP14SS2 PLC, WPLSoft programming software, and DIAView SCADA software is presented. The developed system combines industrial communication protocols, inductive metal detectors, photoelectric sensors, pneumatic actuators, solenoid valves, and VFD conveyor drive to perform the functions of automatic material sorting.

Delta DVP14SS2 PLC serves as a control unit in the proposed sorting system because of its high processing power, reliable operation, small size, and robustness. Ladder logic programming is done by the help of the WPLSoft software to manage conveyor movements, interface with sensors, count objects, and sort metals using pneumatics. The conveyor belt is driven by the Variable Frequency Drive (VFD) for smooth motor operation, energy saving, and efficiency.

The functionality of DIAView SCADA software is applied in supervisory control of the proposed system. The SCADA interface allows operators to view in real-time status of the conveyor belt, object counts, sensor readings, actuator status, faults, and other information about the sorting process. Industrial communication protocols have been employed between PLC, SCADA system, and various field equipment.

The system designed utilizes the induction principle for detecting and counting metallic objects, and segregating them using the help of pneumatic actuation controlled by the pro-

programmable logic controller.

The inclusion of programmable logic controller, SCADA, human-machine interface, variable frequency drive, and communication technology improves the efficiency and accuracy of the system, ensuring safety and reliability with minimum human interaction and cost-effectiveness.

The system designed is scalable to accommodate future developments required for industrial automation systems. Also, further advancements could include Internet-of-things enabled monitoring systems for the same along with machine learning algorithms and cloud computing.

II. LITERATURE SURVEY

Automation systems that use Programmable Logic Controllers (PLC), Human Machine Interface (HMI), and Supervisory Control and Data Acquisition (SCADA) are gaining importance in modern industries. Several researchers have designed an automated sorting system so as to improve efficiency, enhance accuracy, and reduce manual labor.

S. Wardhana *et al.* [1] designed the concept for the development of the automated sorting system with Programmable Logic Controllers (PLC). Their research focused on the automation of the conveyor and object detection through sensors. The concept proved to be successful in making the process automatic.

A. Kumar and R. Singh [2] They developed a fully automated sorting system that employs PLC technology. In their system, sensor systems were used to automatically sort objects on conveyors. This technique greatly increased efficiency in industry, reducing manual work.

M. H. Pratama [3] Developed a speed control system using programmable logic controllers (PLCs) for sorting operations on conveyors with the help of counters and timers. The research was mostly concentrated on dynamic control of the speed of conveyors in order to enhance synchronization and accuracy of sorting.

R. Patel and S. Shah [4] designed a box sorter system based on PLC through using various types of sensors available in the industries. It shows the use of automation in sorting objects through conveyor belts. The proposed system decreased the sorting time and increased system efficiency.

N. Almtireen *et al.* [5] proposed an intelligent conveyor system controlled by a PLC and using AI techniques in the vision area for automatic material classification purposes. This system was able to classify plastic, paper, and metallic materials thanks to computer vision and machine learning approaches that achieved good accuracy rates in classification. However, it was complex and costly to implement.

R. Bhat *et al.* [6] The authors designed an omni-wheel conveyor sorter controlled by a PLC that could be used for industrial sorting operations. Their design had the advantage of achieving higher rates of operation along with more flexible control of the conveyor's motion.

K. P. Kshirsagar *et al.* [7] Installed a machine that sorts automatically based on PLC and HMI techniques. Their machine had the ability to give real-time status reports and control via HMI interfaces. Use of PLC and HMI enhanced efficiency, visualization, and fault detection abilities of their process.

K. Sasidhar and V. Ramesh [8] developed an automatic sorting system of objects based on PLC technology, incorporating the use of industry-grade sensors and conveyors. They were involved in the automation of material handling processes, proving their effectiveness through efficient PLC programming and sensor interface methodologies.

The Delta DVP-SS2 PLC user manual [9], Information about PLC architecture, ladder logic programming, communication protocols, SCADA software, and techniques in automation can be found in DIAView SCADA Software Manual [10] and WPLSoft Programming Manual [?]. These industrial products have gained popularity in contemporary automation systems because of their high performance and robustness.

Books by Bolton [?], Webb and Reis [?], and Petruzella [?] explain the principles, programming methods, and industrial applications of PLC systems. Boyer [?] discussed SCADA systems and supervisory control architectures used in modern industrial automation and monitoring applications.

Based on the literature review, it can be seen that the most common trend found in many of the existing systems is mainly focusing on conveyor automation, sensing, and sorting along with PLC controlled systems. But, it is quite rare that any work had been done to integrate Delta DVP14SS2 PLC, WPLSoft Programming, DIAView SCADA System, Variable Frequency Driven Conveyor, metal counting system, and pneumatic sorting system together into one real-time intelligent industrial automation system. Therefore, the current proposed system aims at building an efficient and economical system.

III. PROBLEM DEFINITION

In modern-day industries, sorting and counting of objects are important aspects when it comes to improving quality of products, increasing productivity, and automation of processes. Conventional systems used for sorting usually depend on manual detection and identification and counting of metallic and non-metallic objects. Such systems have proven to be inefficient, prone to mistakes due to human error, and are generally slow and imprecise.

It is difficult for manual sorting methods to achieve a consistent workflow, real-time tracking, and reliable process control. Also, in the absence of an automated monitoring system, the process will be complicated, and productivity will fall. The old-fashioned way rarely manages to bring all elements under one umbrella.

Industries require an intelligent system of automation which is able to do real-time object detection, identify metal, sort automatically, and do counting. Other requirements include controlled speed operation of the conveyor belt, reliable industrial equipment communication, and supervision of the process by a central supervisor unit. Even though there have been quite a number of sorting systems utilizing the PLCs, there is minimal research on the incorporation of the Delta DVP14SS2 PLC with WPLSoft programming, DIAView SCADA, variable frequency drives, communication protocols, pneumatic actuator systems, and metal counting devices in one integrated system.

Therefore, there is a need to develop a real-time PLC-

SCADA based intelligent metal sorting and counting system that can:

- Automatic detection and identification of metallic components
- Precise sorting and counting of materials
- Effective management of conveyor speed via VFD
- Real-time monitoring by means of SCADA and HMI
- Less human involvement and cost savings
- Increased efficiency in industries.

IV. OBJECTIVES

The main objectives of the proposed project are as follows:

- For the creation and development of an intelligent metal sorter and counter that operates in real-time.
- Use the Delta DVP14SS2 PLC as the main controller for automatic sorting processes.
- Create ladder logic programs using WPLSoft to control sensors, conveyors, counters, timing relays, and pneumatics.
- Utilize DIAView SCADA and Human-Machine Interface (HMI) systems for real-time monitoring and control.
- Sort metals through inductive metal detector sensors.
- Develop an automatic counting system to track the quantity of sorted metallic parts.
- Control the speed of the conveyor belt through an efficient method called Variable Frequency Drive (VFD).
- Use automated pneumatic actuator for quick and accurate sorting of materials.
- Maintain good communication among PLC, SCADA, HMI, sensors, and other field devices through existing industrial standards.
- Eliminate human involvement and minimize mistakes made during the sorting process.
- Improve industrial efficiency, accuracy of the sorting process, its reliability, and safety.
- Design an automation structure that is able to integrate new technologies including IoT and Industry 4.0 in the future.

V. SCADA SYSTEM

Introduction to Supervisory Control and Data Acquisition (SCADA) is an industrial control system that offers real-time monitoring and supervision for controlling and collecting data from industrial processes. The proposed system will use DIAView SCADA software to control the intelligent metal sorter and counter.

The SCADA system offers a GUI through which the operator can monitor conveyor operations, the state of the sensors, object detection, pneumatic actuator performance, motor status, and faults. The use of this system promotes a high level of centralized supervision of the whole manufacturing process, improving its performance and reliability.

The connection between the PLC and SCADA systems in the manufacturing plant takes place through

industrial communication protocols, thus promoting the reliable exchange of information between the equipment and the monitoring system. Through the communication protocol, the PLC system transmits data regarding sensors, actuators, and the status of the conveyor.

The major functions of SCADA system is proposed project include:

- Real-time monitoring of the performance of the conveyor belt
- Monitoring the status of the metal detector sensor
- Counting value display for metal objects
- Pneumatic actuator performance visualization
- Controlling conveyor start and stop processes
- Fault monitoring and alarm control
- Industrial process control and human-machine interface
- Effective industrial process control and enhanced safety

The combination of DIAView SCADA software and Delta PLC makes automation easy by cutting down on supervisory intervention, thereby giving rise to a useful means of industrial process monitoring and control.

VI. HUMAN MACHINE INTERFACE (HMI)

A Human Machine Interface (HMI) is an essential element within industrial automation systems through which operators interact with machines. The use of HMI in the current project will help monitor and control the intelligent sorting and counting of metals.

The Human Machine Interface provides a means for monitoring the conveyor belts, the status of sensors, the number of metallic objects, and the status of actuators using a graphical user interface. The Human Machine Interface can also be used for performing operations such as operating or stopping the conveyor belt system and managing sorting processes easily.

HMI interfaces with Delta DVP14SS2 PLC to collect the process data by means of industrial communication protocols. This helps in improving the flexibility in managing the industrial process.

These are the main functions that would be served by the HMI system in the suggested design:

- Real time status monitoring of conveyor system

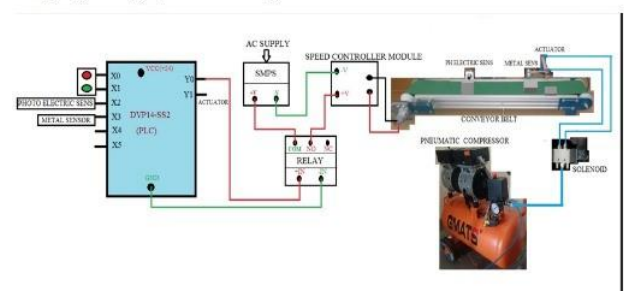


Fig. 1. Hardware Implementation of the Proposed Intelligent Metal Sorting and Counting System

- Status display of metal detecting sensors
- Status display of metal objects counted
- Operation monitoring of pneumatic actuators
- Operation control of Start/Stop functions of conveyor
- Status display of faults and alarms
- Real time human interaction and process supervision
- Increased safety and ease of use

The use of the HMI increases the efficiency and functionality of the industrial automation system since it offers a more effective interface for real-time monitoring and control.

VII. HARDWARE IMPLEMENTATION

The hardware implementation of the intelligent sorting and counting system of metals entails the use of the Delta DVP14SS2 PLC, the photoelectric sensor, inductive metal detector sensor, relay module, conveyor mechanism, pneumatic actuator, solenoid valve, speed control module, and pneumatic compressor. The PLC operates as the primary controller while processing the data obtained from the sensors to conduct the counting and sorting activities. The conveyor carries the metallic objects through the area where the detection and sorting of the metals takes place.

VIII. METHODOLOGY

This system will be employed to carry out automatic metal detection, counting, and sorting using Delta DVP14SS2 PLC, SCADA, HMI, industrial sensors, pneumatic actuators, and VFD operated conveyor belt. The process employed by this system consists of sensing, automated decision making, conveyor operation, and supervisory control for effective industrial automation.

Firstly, the conveyor will be powered with an AC motor through the use of Variable Frequency Drive (VFD). This will be carried out to ensure that the conveyor can operate at an optimal speed. The conveyor keeps on moving the objects towards the section of the system where the sensing and sorting are performed.

A photoelectric sensor will be installed near the conveyor to detect any object on it. Upon detecting an object, the sensor transmits a signal to Delta DVP14SS2 PLC. The PLC receives the input signal and triggers the metal detection process.

For identifying the metal or non-metal nature of the sensed object, an inductive metal detector sensor is utilized. In case the sensing object happens to be metal, the sensor will generate signals to indicate the same to the PLC. The PLC program will increase the counter value for objects and activate the pneumatic separation system.

For separating the objects, a pneumatic separation system utilizing pneumatic cylinders is employed. On detection of the metal objects, the PLC controls the solenoid valve that actuates the pneumatic cylinder, and pushes the metallic object to another collection box. Non-metallic objects move along on the belt conveyor uninterrupted.

The system operation is programmed based on Ladder Logic Programming utilizing WPLSoft programming software. PLC

is responsible for carrying out the real-time operation of various components like sensors, timers, counters, belt conveyor, solenoids, and pneumatic actuators. Communication protocol is developed for ensuring reliable industrial communication. DIAView SCADA and HMI software help monitor and control the sorting process in real time. Some of the parameters include conveyor status, sensors' status, number of metals, actuators' functioning, and faults that may occur during the sorting process. The operator is also capable of starting and stopping the sorting process using both the HMI and SCADA software.

This entire method will help improve industrial production, sorting process accuracy, reliability, and safety of the sorting process, as well as reduce manual labor and cost. The implemented system can be expanded for the future as per IoT and Industry 4.0.

A. Finite State Machine (FSM) Operation

The intelligent sorting and counting machine is designed with Finite State Machine (FSM), which involves a system of Delta DVP14SS2 PLC. Finite State Machine allows process control through process automation and real-time monitoring. Finite State Machine involves several states, and each of the states executes particular actions in the sorting process. The transitions between states depend on the input sensors and control signals among others.

- **S0 – Idle State:** The system is initially set to the idle state during power initialization. This state ensures that the conveyor motor is off, the pneumatic actuator is in the home state, and the object counter is reset. The PLC constantly awaits the START signal from the HMI or SCADA.
- **S1 – Conveyor Running State:** Once the START signal is received by the PLC, the conveyor motor is turned on using the VFD and starts moving objects towards the sensing area. This state ensures that information regarding conveyor status and sensor conditions is provided in real-time using HMI and SCADA interfaces.
- **S2 – Metal Detection State:** In this process, the photoelectric sensor recognizes the presence of the object and transmits a signal to the PLC, which triggers the operation of the metal detector inductor sensor to decide whether

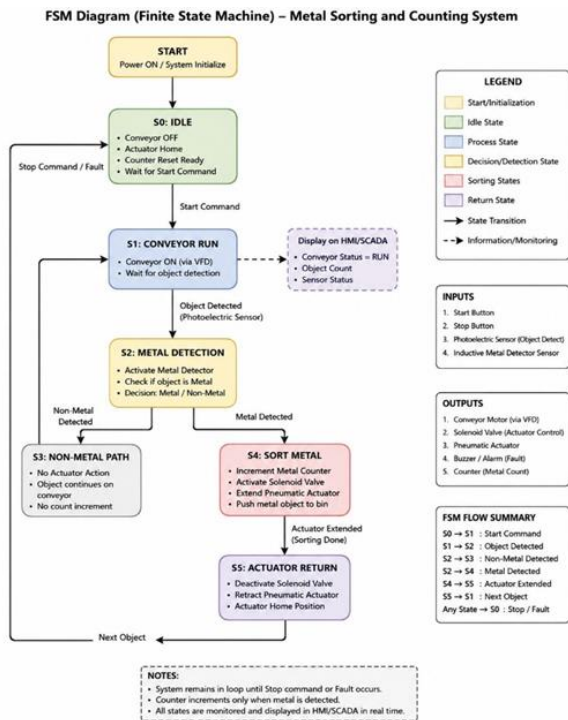


Fig. 2. Finite State Machine (FSM) Diagram of the Proposed Metal Sorting and Counting System

the object is made up of metals or not. Decision-making processes are carried out by the PLC after analyzing the input from the sensors.

- **S3 – Non-Metal State:** In case of detecting a non-metallic object, the pneumatic actuator stays idle, and the object moves forward on the conveyor system without any hindrance. In this case, there is no increase in the counter value.
- **S4 – State of Metal Sorting:** If the object is recognized to be metallic in nature, the PLC increases the count for the metallic objects and activates the solenoid valve. The pneumatic actuator moves and pushes the metallic object into the corresponding container. This state handles the sorting action.
- **S5 – State of Actuator Return:** Once the sorting process is done, the PLC turns off the solenoid valve and allows the pneumatic actuator to return to its original position. When the actuator is back to its home position, then the machine goes into the conveyor run state.

The FSM continues cycling until either a STOP signal or an error is encountered. With the FSM control methodology, higher reliability of operation, easier process handling, and effective coordination between the motion, sensing, counting, and actuation processes can be attained.

Combining the FSM logic in PLC programming, Human Machine Interface display, and SCADA systems ensures that

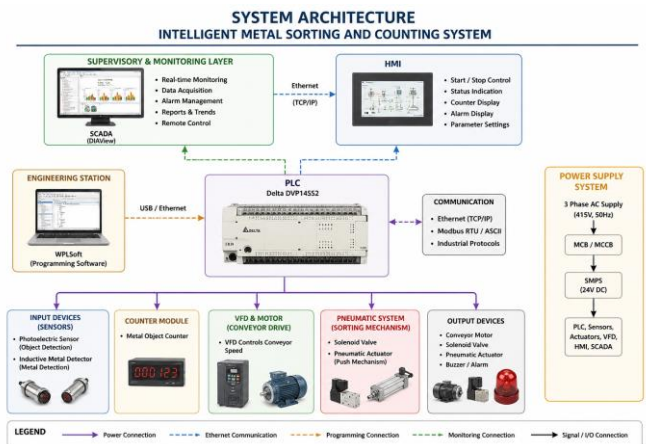


Fig. 3. System Architecture of the Proposal Intelligent Metal Sorting and Counting System

system performance and reliability, automation efficiency, and process management are improved significantly.

B. System Architecture

The suggested intelligent metals sorting and counting system uses a hierarchical industrial automation design based on four layers, including supervisory, control, communications, and field devices. The system comprises several components, including Delta DVP14SS2 PLC, DIAView SCADA, HMI, various industrial sensors, actuators, communication technologies, and a VFD-driven conveyor system for efficient industrial automation.

The supervisory level utilizes DIAView SCADA and HMI systems to control and monitor all processes that occur during the sorting process in real-time. Through the SCADA system, the process information is acquired from the PLC, and the conveyor status, sensor states, number of objects, actuator activity, and alarm information are shown. Additionally, through the HMI, operators interact with the system by means of START/STOP operations, status information, counters, etc.

The control layer is made up of the Delta DVP14SS2 PLC. The Delta DVP14SS2 acts as the system's processor and decision-maker. The programming language for the PLC is WPLSoft through ladder logic programming. The PLC gets inputs from the industrial sensors, processes the logic conditions, controls the operation of the conveyor through the variable frequency drive, activates the pneumatic sorters and manages the metal counting operations.

Communication is established between the control unit (Delta DVP14SS2 PLC) and the supervisory control unit (SCADA system), as well as Human Machine Interface (HMI). Industrial communication protocols like Modbus RTU/ASCII and Ethernet TCP/IP facilitate communication to achieve efficient supervisory control of the industrial automation system. Field devices consist of sensors that receive inputs and output devices. There is a photoelectric sensor which detects any object on the conveyor belt, and an inductive metal detector sensor which detects any metallic objects. The conveyor belt is powered by an AC motor through the variable frequency drive.

Pneumatic separation includes a solenoid valve and pneumatic actuator. Upon detection of any metallic part, the PLC triggers the solenoid valve; subsequently, the pneumatic actuator extends and ejects the metallic item into a new container. There is an addition of a counter that keeps track of the number of metals detected in the process.

Power supply ensures the PLC, sensors, VFD, HMI, SCADA, and other pneumatic components are provided with power by using industrial SMPS and protection mechanisms like MCBs and MCCBs.

The whole system design ensures efficient industrial automation and monitoring, sorting, and counting accuracy, increased process efficiency, and minimization of human efforts. The designed modular structure also ensures ease of integration with IoT, Industry 4.0, and other cloud monitoring technologies.

IX. SOFTWARE AND HARDWARE USED

A. Software Used

• WPLSoft

- Programming software for Delta DVP14SS2 PLC
- Manages the logic controlling conveyor operation and sorting
- Handles timer and counter functionalities
- Facilitates sensor and pneumatics interfacing

• DIAView SCADA

- Software for industrial process monitoring
- Allows supervision and data acquisition
- Monitors status of conveyor system, alarm conditions, and

– DOPSoft HMI Software

- * Used for designing HMI screens
- * Provides START/STOP control operations
- * Displays real-time process parameters

- * Enables operator interaction with the system

– PLC Simulator

- * For testing ladder logic program
- * Used to debug PLC operation
- * Simulation of industrial environment

– Draw.io / AutoCAD

- * For designing system architecture
- * For FSM diagrams
- * Helps in industrial documentation and visualization

B. Hardware Used

– Delta DVP14SS2 PLC

- * Serves as the main control center
- * Performs calculations from sensor inputs
- * Operates ladder logic
- * Manages conveyor and sorting operations

– Photoelectric Sensor

- * Determines whether there is an object on the conveyor belt
- * Generates a signal to be read by the PLC

– Inductive Metal Detector Sensor

- * Identifies metallic objects
- * Distinguishes between metallic and non-metallic items

– Variable Frequency Drive (VFD)

– AC Conveyor Motor

- * Drives the conveyor belt
- * Transports objects through the sorting section

– Pneumatic Actuator (Cylinder)

- * Pushes metallic objects into collection bin
- * Performs automatic sorting operation

– Solenoid Valve

- * Controls airflow to pneumatic actuator
- * Activated by PLC output signals

– Relay Module

- * Interfaces PLC with industrial loads
- * Controls switching operations

– HMI Panel

- * Provides real-time monitoring
- * Allows operator control and interaction
- * Displays conveyor and sensor status

– SCADA System

- * Supervises industrial process operation
- * Displays alarms and process parameters
- * Enables centralized monitoring

– Counting Module

- * Shows number of metal objects
- * Checks sorting process effectiveness

– SMPS Power Supply (24V DC)

- * Delivers controlled voltage of DC type
- * Used to power PLC, sensors, etc.

– MCB / MCCB

X. EXPECTED RESULTS AND PROPOSED OUTCOMES

It can be noted that by employing the intelligent metal sorting and counting system based on the Delta DVP14SS2 PLC, SCADA, HMI, VFD controlled conveyor systems, industrial sensors, and pneumatic actuators, the proposed system will successfully automate the industrial process. The expected results and proposed outcomes from the development of this project include the following:

- Successful development and implementation of an automated real-time metal sorting and counting system designed for industrial use.
- Accurate detection and proper classification of metallic and non-metallic objects through inductive metal detectors.
- Smooth operation of conveyors along with their variable speeds achieved through the application of VFD technology.
- Reliability and accurate real-time industrial control and automation through the employment of the Delta DVP14SS2 PLC programmed through the WPLSoft software.
- Automatic metal counting along with enhanced counting efficiency and process synchronization.
- Fast and precise operation of pneumatic actuators and solenoid valves.
- Successful real-time monitoring and supervisory control through DIAView SCADA software and HMI interfaces.
- Continuous monitoring and display of all the necessary statuses such as conveyor, sensor, actuator conditions, alarm, and object count achieved using the SCADA/HMI systems.
- Decrease in manual operations, errors, and labor costs.
- Industrial productivity improvement through the developed solution.
- Increased industrial process efficiency and sorting accuracy.
- Greater operational safety and reliability obtained through the development of an industrial automation control system.
- Effective communication between PLC, SCADA, HMI, and the rest of field equipment established through industrial communication protocols.
- A scalable industrial automation platform capable of future integration into Internet-of-Things technologies, Industry 4.0 solutions, and cloud-based monitoring.
- An effective, cost-efficient, and energy-saving automation system design.

The system will be designed in such a way that it can offer a reliable and intelligent automation system for industry with improved sorting and counting capabilities.

XI. FUTURE SCOPE

Further improvements can be made to this intelligent metal sorting and counting system by incorporating sophisticated industrial automation and smart manufacturing principles. Following developments will form the future scope of this project:

- Incorporation of IoT technologies to enable remote monitoring and controlling of the system from any internet-enabled platform.
- Utilization of AI and computer vision technologies for advanced object recognition, classification, and identification based on shape, color, size, and other factors.

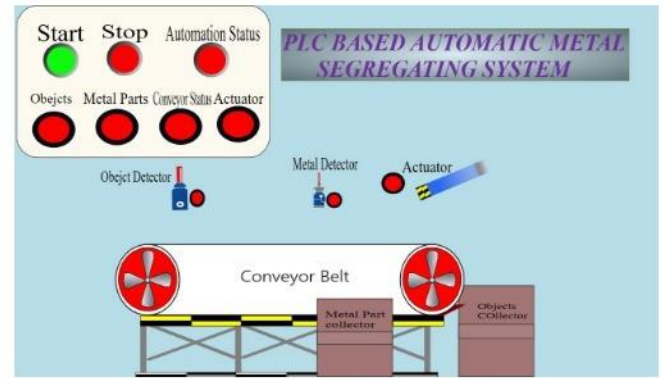


Fig. 4. Expected Results and Proposed Outcomes of the Intelligent Metal Sorting and Counting System

- Utilization of wireless industrial communications systems for better flexibility and less cabling requirements.
- Incorporating cloud-based data logging and analytics technologies for better industrial process monitoring and analysis.
- Enhancing the system functionality to sort multiple types of objects like plastics, glass, paper, etc.
- Implementing intelligent decision-making and process optimization techniques using machine learning algorithms.
- Developing mobile applications for the purpose of remote SCADA and HMIs.
- Implementing robotics for pick and place operations, thereby enabling full automation of industrial processes.
- Implementing conveyor belt speed optimization techniques for maximum throughput and productivity.
- Installing industrial safety systems to incorporate fault diagnosis and emergency shutdowns in the system.
- Expanding the scale of operation to accommodate high-speed production lines.
- Incorporating Industry 4.0 principles into this system for efficient automation of manufacturing processes.

The proposed system can be easily extended to support advanced industrial automation in the future with additional functionalities such as IoT-based remote sensing, cloud-based

process monitoring, AI-driven sorting algorithms, and smart industrial systems.

XII. CONCLUSION

In this study, the concept and development of an intelligent system for automated metal sorting and counting using Delta DVP14SS2 PLC, WPLSoft programming software, DIAView SCADA, HMI, industrial communication protocols, pneumatic actuators, and conveyor system controlled by VFD was investigated. As a result, the designed system automatically performs metal detection,

counting, sorting and other tasks related to the metal processing process.

The use of photoelectric and inductive metal detectors allowed precise detection and classification of metallic objects. The Delta PLC performed real-time control over conveyor movement, metallic object counting, and pneumatic valves operation via ladder logic programming. In addition, the implementation of Variable Frequency Drive (VFD) technology made it possible to control the speed and efficiency of conveyor movement.

DIAView SCADA and Human Machine Interface (HMI) systems were used to provide the necessary functionality for monitoring, supervising, alarm and human machine interaction. Synchronization of processes within the entire system took place via communication between PLC, SCADA, HMI, and various field devices.

Thus, the designed industrial automation system increased productivity, sorting precision, industrial safety, reliability, and minimized both labor costs and manual errors during the sorting process. Due to its modular and scalable nature, the proposed system may be used in other fields such as manufacturing, packaging, recycling, etc. It should be noted that the proposed industrial automation system may be further extended and developed for creating advanced smart industrial automation solutions by implementing Industry 4.0 technologies.

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