Automatic Sorting Machine

Acy M. Kottalil  
Professor  
Department of Electrical & Electronics Engineering  
Mar Athanasius College of Engineering, Kothamangalam

Bijn B. Krishnan  
UG Student  
Department of Electrical & Electronics Engineering  
Mar Athanasius College of Engineering, Kothamangalam

Ashik Anto  
UG Student  
Department of Electrical & Electronics Engineering  
Mar Athanasius College of Engineering, Kothamangalam

Boney Alex  
UG Student  
Department of Electrical & Electronics Engineering  
Mar Athanasius College of Engineering, Kothamangalam

Abstract

The Automatic Sorting Machine is used to sort different types of products or commodities based on the barcode provided on them. This gives a provision to reduce the manual effort and hence human error by replacing the conventional methods of sorting in areas involving hectic sorting. The system comes into play in airports and other industrial distribution centres where the products or commodities have to be sorted into batches in order to take them to their respective destination. The products are put on a conveyer system where they are scanned for the particular barcode provided on them. Depending on the barcode, they are placed on the respective carriers automatically where these carriers dispatch them to the corresponding destinations.

**Keywords:** Automation, Microcontroller, Sorting, Barcode, Python, Image processing

I. INTRODUCTION

In the present world, there are plenty of scientific innovations and sophisticated technologies that has simplified human life and raised the standard of living. Scientists are busy with the research and development works. Day-by-day scientists come up with better ideas that make the life of common man more automated. As an attempt to develop an automated set-up in whatever area possible which would further simplify human life and make it easier, we ended up with the very relevant area of concern - sorting.

A. Relevance:

The sorting of different kinds over wide area has proven to be an important part in every sector. So as to accomplish the work of sorting, manual efforts were put in. Earlier, the manual involvement has been commonly imparted for the sorting process from small-scale industries to comparatively high-level large-scale industries. But, due to increase in competition in the global market, the so-called big companies and industries started seeking for better technologies that would reduce human effort and hence the consequent errors which in turn would help them increase their productivity and meet the increasing demand. This further would help them take a huge profit in return and thus the growth of that firm gets kick-started. As a result, the advent of automation in sorting sector has become a boon for such industrial sector. In large-scale industries and multi-national companies, the manual sorting is very less or nearly nil. This has further improved the product quality and reliability as a whole.

In various other places where sorting comes into play predominantly are airports, seaports, small-scale industries, super markets, etc. But due to the restricted reach of automation in sorting in these sectors, the thought about automated sorting in such fields ought to be considered with much importance. Thus, to extend the advantages of automated sorting in large-scale sectors to the above mentioned sector, a notion of automation has been thought to implement in small-scale sectors.

With this in mind, we set out for a search throughout to gather more ideas and simpler technologies to implement to realise our notion. Thereafter, we thought of selecting a barcode sorted technology since most of the products are with a barcode on them. This would further simplify our job, hence, giving clarity on how the products need to be sorted. The gadgets required for the implementation of this system were also easily available and without much complicated circuitry, the system could be set up. After a detailed enquiry about the scope and implementation of our system, we were able to collect two papers based on sorting but using different criteria for sorting. One was "Automatic sorting machine using delta PLC" and the other "Automatic letter sorting system for Indian postal address recognition system based on PIN codes".

B. Project Objective:

The system that we have come up with aims to reduce the human effort and hence, the consequent errors. Moreover, the system helps tackle the tedious sorting process by mere barcode scanning done on the selected products. It, furthermore, promotes speed and reliability of sorting.
II. LITERATURE SURVEY

In many industries sorting the materials of different sizes is difficult. For this purpose we need more human efficiency to sort the materials. For this purpose we are using the automated process which is used to sort the materials which are of different sizes. After completion of manufacturing the product they automatically move on the conveyor belts. Here we are using sensors at different places which detect and sense the materials of different sizes. They get sorted at different places based upon their sizes and they are placed in their respected containers or boxes. For sensing the material we are using infrared sensors which are so sensitive. In the first reference paper, "Automatic sorting machine using delta PLC"[1], by Babita Nanda, all these process is controlled and handled by PLC. Automating every sector of industry is an important step towards increasing efficiency and reducing human related errors, here we try to automate the sorting process by using PLC. In many industries job pieces of various sizes are moved on same conveyor belt these need to separate at various locations in the manufacturing line. For this purpose we are using the automated process which is used to sort the materials which are of different sizes. After completion of manufacturing the products automatically move on the conveyor belts. Sensors at different places sense and detect the job pieces of different sizes. They get sorted at different places based upon their sizes. For sensing the material infrared sensors are used. The entire process is controlled by the program dumped in PLC.

In the second reference paper, "Automatic letter sorting system for Indian postal address recognition system based on PIN codes"[2], the barcode on the letter was used to sort them according to the pin-codes. Both these reference papers was used to decide and design the "Automatic Sorting Machine".

III. BLOCK DIAGRAM

The block diagram description of the proposed system shows the major components used in the system and give an insight into the construction and working of the model.

A. Block Diagram:

![Block Diagram](image)

Fig. 1: Block Diagram Representation

B. Construction:

The Automatic Sorting Machine is device which is used to reduce human effort by replacing manual sorting of things by introducing automation. The system consists of three conveyors among which one is the main conveyor and the other two are the secondary conveyors. An IR sensor[3] is also integrated on the main conveyor. DC motors[3] of 60 rpm are used for the control of the three conveyors. Another important component of the system is a servo motor which is used to operate the carrier which is used to carry and drop the products from the main conveyor to the secondary conveyors. The most important component of the system is a webcam which is integrated to a Laptop and is used to scan and decode the barcode on each product. This is how the system is constructed.

C. Working:

The working of the sorting machine is described below. The products are placed on the main conveyor which moves it forward. Once the product cut the IR sensor, the micro controller will stop the main conveyor. Once this is done, a signal is send to the computer which on receiving the same will activate the webcam which will provide a live feedback of the product under the cam. Python software is used to use this feedback from the webcam is processed and the barcode is identified which is then decoded and the barcode data is printed. The decoded data is compared with the set of pre-set values. After the comparison the type of product and the place where it is to be dropped is decided. A signal corresponding to the type of product is send to the microcontroller from the laptop. Now the microcontroller will start the main conveyor which will result in dropping of the
product in to the carrier. The carrier will then drop the product to the appropriate secondary conveyor. After dropping the product the carrier is brought back into the default position, ready to accept the next product by proper operation of the servomotor.

IV. FLOWCHART AND SIMULATION

A. Flowchart:

The flowchart shown above show the flow of control of the program [5] which is used for the implementation of the project. It also gives an insight into the processes involved and thus the working of the system.
B. Simulation:

The simulation the project was done using the circuit diagram in Proteus software. The communication between the microcontroller and the laptop was mocked with the help of virtual terminal which acts similar to serial communication between the two.

In the simulation the barcode was entered in the virtual terminal which was processed and the type of product was sent to the microcontroller via the virtual terminal. Once the microcontroller received this data it send the appropriate signals to the motors which dropped the product into the carrier and then into the respective secondary conveyor by proper control of the servo motor.

Fig. 3: Simulation Circuit

V. Hardware Implementation

The hardware setup was constructed and assembled. The structure of the conveyors were made using iron bars which were welded together to form the shape required [4]. The return pulleys were made using PVC pipe and end caps whereas the conveyor belts were made with sheets of rubber.

Fig. 4: Hardware Implementation

The DC motors were fixed on the conveyor structures with the help of nut and bolt arrangement.
VI. CONCLUSION

The prototype that was designed and built was meant to sort only two types of products. The same can be used to sort any number of products by making small changes in the carrier arrangement. Replacing the single servomotor carrier with a conveyor belt with a number of carriers will help in increasing the versatility of the machine.

The Automatic Sorting machine makes sorting process easy, more precise and reliable. In various other places where sorting comes into play predominantly are airports, seaports, small-scale industries, super markets, etc. All these use conventional method of sorting which is manual, tiring, time consuming and often with mistakes. But due to the restricted reach of automation in sorting in these sectors, the thought about automated sorting in such fields ought to be considered with much importance. Thus, to extend the advantages of automated sorting in large-scale sectors to the above mentioned sector, a notion of automation has been thought to implement in small-scale sectors.

REFERENCES

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