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Design and Manufacturing of Metal & Non-metal Sorting Using Metal Detector

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Abstract: ***In recent years, sorting of scrap material using various automated techniques has gained a lot of focus. One of the multiple steps in the recycling of non-ferrous metals is the separation of shredded material into different groups. In our project, we propose the concept of "Metal & Non-metal Sorting Using Metal Detector". This system of sorting products is optimized to differentiate between metal & non-metals product, which is done with the help of a metal detector. A continuous conveyor belt carries the different products, and with the help of a control motor it separates metal from non-metal.***
In a nutshell, this system consists of a metal sensor. When the conveyor belt carries the products, it goes through a metal detector, if it's a metal product the control motor separates it with the help of a bar and the skipped product goes further to another container for non-metal. GSM technique is also introduced for mobiles messaging. The counter displays the metal count. This project is useful in automobile industries, steel plants and industry for separation of metal and non-metal element in the industry on a large basis. It can also be used for waste management so also beneficial for the environment.

I. INTRODUCTION

In recent years, sorting of scrap material using various automated techniques has gained a lot of focus. One of the multiple steps in the recycling of non-ferrous metals is the separation of shredded material into different groups. In our project, we propose the concept of "Metal & Non-metal Sorting Using Metal Detector". This system of sorting products is optimized to differentiate between metal & non-metals product, which is done with the help of a metal detector. A continuous conveyor belt carries the different products, and with the help of a control motor it separates metal from non-metal.
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Sorting is the first step of a waste management process. It should be sorted according to the type of material.so the main idea of our project is to design and implement a machine that sorts, and classifies three different types of materials which are iron, aluminium, and plastic. Then guide materials to different carts to prepare for the material recycling process.

II. LITERATURE REVIEW

Shen and Hassan [1] states that an approach for continuous recognition and the sorting of objects into their respective and desired location can be implemented as an image of colour processing that can attract an enormous attention leading to a possible widening scope of application in a different field in a modern technology. A colour-sorting robot is designed and developed using an Arduino Uno microcontroller, SG90 Tower Pro Servo Motor, TCS3200D colour sensor and several other electronic components. The system has the potential to sort the objects according to their colours into their relevant colour station in a less time. A distinct code for this system is developed.
According to Yunardi et al. [2], a 3D volume of the packed box is well quantified from the 2D images using the techniques of image processing. The 2D image consists of two images captured on the camera with a horizontal view and a vertical view. With the parameters, that is, the length, width and the height, a multiplication program is used to obtain the result of the volume. Consequently, contour based object detection can be appertained to the automatic sorting system to measure the volume of an object in a computer-based vision.

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According to Babita [3], sensors are embedded at several places that detects and senses the materials of various sizes that gets sorted at different stations based on their sizes. For sensing, the material used is an infrared sensor that is so sensitive. All the process is controlled and handled by a PLC.

Kulkarni et al. [4] has implemented the sorting of the boxes using a barcode, which is decoded by raspberry pi. This raspberry pi sends a signal to the motor driver to start and stop the motor accordingly. Proximity switches are implanted on every cylinder to sense the box position, which again sends back the signal to raspberry pi. Relay is used as an interface for the motor driver and motor. The relay used is of solid relay type. Raspberry pi uses cameras of five megapixels to capture the image, which will then be decoded.

III.METHODOLOGY

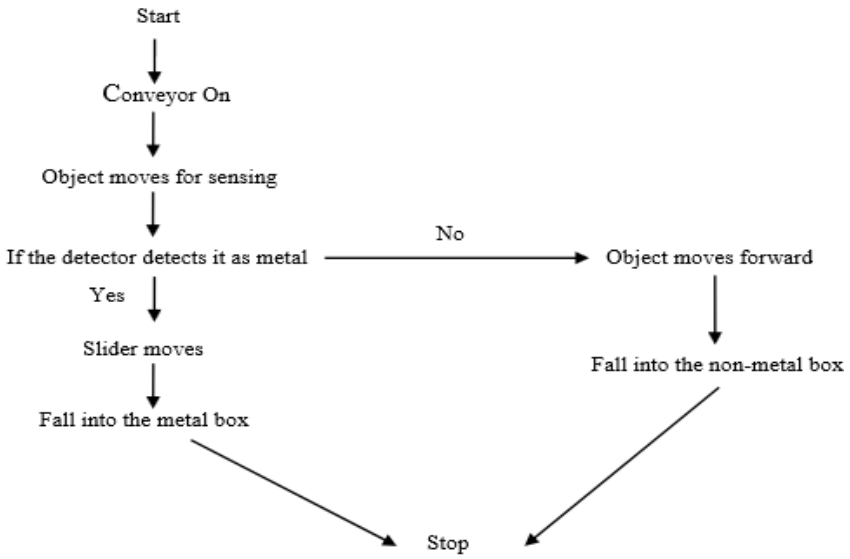


Fig.1. Methodology Flow Chart

A. Working Principle

1) The pieces are entered by hand in the hopper.

2) In the hopper, the pieces move on an inclined surface, using vibrator motor.

3) The pieces are inserted into the conveyor belt, by a first DC motor which connected to the inclined surface, In the retraction mode, the piece is allowed to enter to the conveyor, In the extension mode, pieces are blocked to entering to the conveyor belt.

4) After entering the object into the conveyor belt, the piece is checked through sensors in a sequential manner.

5) If the magnetic sensor activated, that means this piece is iron, the second DC Motor will push the piece into the iron box, otherwise, the pieces complete their path on the conveyor belt. 6) If the inductive sensor activated, that means this piece is aluminum, the third DC Motoe will push the piece into the aluminum box. Otherwise, the pieces complete their path on the conveyor.

6) If the magnetic sensor and the inductive sensor deactivate, that means this piece is plastic, then continue to plastic box at the end of the conveyor

IV. RESULT AND DISCUSSION

A. Conclusion

The proposed method is a solution to the current waste management problem which will effectively segregate metal, glass and plastic. This system can be effectively deployed in industries for material segregation, scrap shops and urban households. The waste separated material can be used to produce the desired products thus helps in saving economy and resources.

B. Application

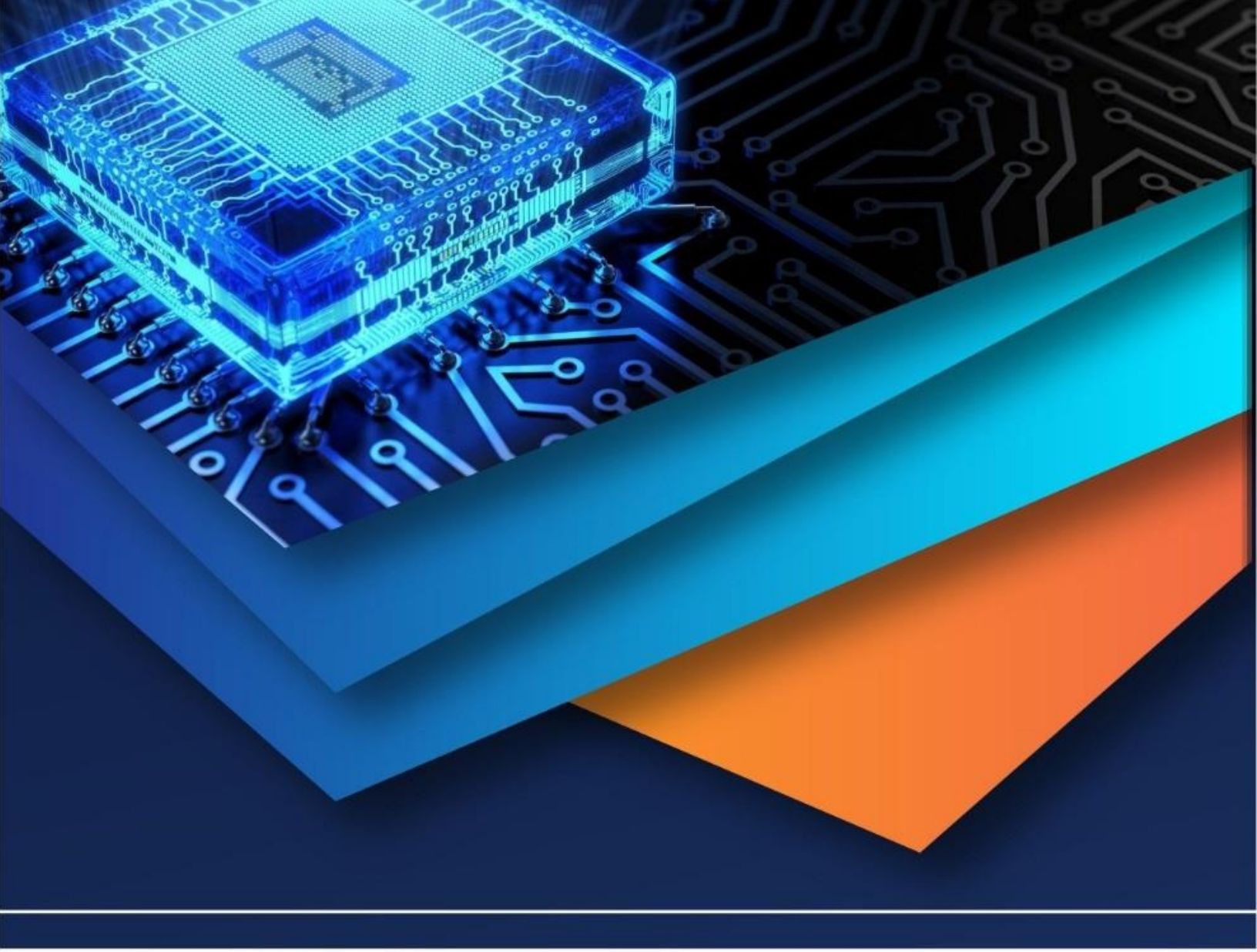
Manual sorting of any object consumes a lot of time and labour. Hence, PLC object sorting system finds wide application in the following industries.

1) *Brick Manufacturing Process:* In Brick manufacturing Process the quality of bricks considering their height as a parameter can be checked. If the height is more or less from the original size then the defective bricks can be sorted out.
2) *Luggage Sorting at Airports:* The parcels at airport which has to loaded in cargo planes can be sorted accordingly to reduced the load of the plane.
3) *Quality Checking of Solid Objects:* If the height of the solid material is taken as a criteria in quality check of that object then this system can be used effectively.
4) *In Food Processing Industries:* The food packing of the food stuffs of different sizes can be sorted in such type of industries where various quantities of packed food are running on a single line.

REFERENCES

[1] Rafeeq, M., et al. (2016). Automation of plastic, metal and glass waste materials segregation using Arduino in scrap industry. 2016 International Conference on Communication and Electronics Systems (ICCES).
[2] Sakr, G. E., et al. (2016). Comparing deep learning and support vector machines for autonomous waste sorting. 2016 IEEE International Multidisciplinary Conference on Engineering Technology (IMCET).
[3] Ali, M. H. and N. Mir-Nasiri (2017). Design of an Automated Pepper Sorting Machine. 2017 3rd International Conference on Control, Automation and Robotics (ICCAR).
[4] Zhang, W., et al. (2012). "Design and Development of a High-Speed Sorting System Based on Machine Vision Guiding." Physics Procedia 25: 1955-1965.
[5] Messal, S., et al. (2017). "Belt-Type Corona-Electrostatic Separator for the Recovery of Conductive and Nonconductive Products From Micronized Wastes." IEEE Transactions on Industry Applications 53(2): 1424-1430.
[6] Smeu, G. A. (2013). Automatic conveyor belt driving and sorting using SIEMENS step 7-200 programmable logic controller. 2013 8TH INTERNATIONAL SYMPOSIUM ON ADVANCED TOPICS IN ELECTRICAL ENGINEERING (ATEE).
[7] Kutila, M., et al. (2005). Scrap Metal Sorting with Colour Vision and Inductive Sensor Array. International Conference on Computational Intelligence for Modelling, Control and Automation and International Conference on Intelligent Agents, Web Technologies and Internet Commerce (CIMCA-IAWTIC'06).
[8] Huang, J., et al. (2010). Intelligent solid waste processing using optical sensor-based sorting technology. 2010 3rd International Congress on Image and Signal Processing.
[9] Chandramohan, A., et al. (2014). Automated Waste Segregator. 2014 Texas Instruments India Educators' Conference (TIIEC).
[10] Brunner, S. and C. Kargel (2016). Extended spectral unmixing for the classification of fluorescently labeled plastic waste. 2016 IEEE Region 10 Conference (TENCON).
[11] Lim JieShen&Irda Hassan, Design and Development of Colour Sorting Robot, Journal of Engineering Science and TechnologyEURECA2014,(2015),71-81. http://jestec.taylors.edu.my/eureca2014(1)_1_2015/eureca_14(1)_71_81.pdf
[12] Riky Tri Yunardi, Winarno and Pujiyanto, Contour-based object detection in Automatic Sorting System for a parcel boxes, International Conference on Advanced Mechatronics, Intelligent Manufacture, and Industrial Automation (ICAMIMIA), (2015) 38-41, DOI:
[13] Babita Nanda, Automatic Sorting Machine using Delta PLC, International Journal of Innovative Research in Advanced Engineering, 1(7) (2014) 235-242.
[14] Moe Win Khaing, Aye Mya Win and DawThida Aye, Automatic Sorting Machine, International Journal of Science and Engineering Applications, 7(8), (2018) 138-142. DOI:
[15] ShreeyaVasantKulkarni, Swati RajendraBhosale and PriyankaPramodBandewar, Automatic Box Sorting Machine, International Journal for Scientific Research & Development, 4(4) (2016), 57-58.

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