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EFFICIENT WASTE MANAGEMENT USING AUTOMATED SORTING BASED ON COLOUR AND THICKNESS

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ABSTRACT:
A crucial prerequisite for recycling forming an integral part of municipal solid waste (MSW) management is sorting of useful materials from source-separated MSW. For future development of automated sensor-based sorting in the all applications, an improvement in the separation efficiency of the equipment is desirable. In this paper, it has been developed and built a multiple sorting electromechanical system on materials and different colors as a prototype. The prototype in this study consists of hardware and software systems. In this project; Total four separation containers are used to segregate devices based on multiple properties. Initially, given material is verified using proximity sensor to classify whether metal or non-metal in order to propel its corresponding container through mechanical arrangement. Rejected waste material is processed through multiple stages like finding thickness, colour discovery stage. If measured thickness is not in limit of threshold level, then it will be processed through colour finding stage. If acquired colour is black, it will be sent to container, else will be forwarded to another container.

Keywords: Sorting Units, waste management, Proximity, Colour sensor, Arduino-Uno, Ultrasonic sensor, Servo Motor.

Introduction: Waste, depending on the type of material, consists on unwanted materials left over from manufacturing processes (industrial, commercial, mining or agricultural operations,) or from community and household activities. Everyday, tones of waste are generated; causing a major problem to various cities and their municipal authorities due to the shortage of landfill to dump such waste. Therefore, recycling is becoming an important issue with the shortage of the landfill and environmental pollutions as well as its economical impact [1]. Waste, especially household and commercial waste, is a heterogeneous mixture of different kinds of products, containing reusable or recyclable materials, and their size/condition mainly depend on how the waste is collected and transported [1-3]. Plastic bottles, for example, are the main municipal waste and they are non-biodegradable materials (are chemically stable). In fact, plastic waste can be visible for months or years and is a serious environmental problem [1, 4]. Hence, the treatment of plastic wastes becomes a serious problem and it is necessary to develop an effective recycling process. The efficiency and quality of all recycling process depends highly on the purity and accuracy of the sorted raw materials [1]. Waste separation is a critical component of any successful integrated waste management system [5] and several technologies are being developed (by size, shape, color, volume, etc.). The open literature presents several works for detecting and sorting

different materials in order to sort them out and prepare them to be recycled [1, 4, 6]. Plastic bottles, for example, can be sorted into different categories based on their chemical resin, transparency and/or color, however, the last one is much more adequate [1]. In terms of color, the plastic bottles can be sorted by manual procedures or by sensor systems. The first one presents some inconveniences relatively to the human capabilities, like: eyes capacity, fatigue, concentration and health. In these context automatic systems based on sensors appears in different countries and shows to be efficient facilities to separate the waste [3, 7, 8]. The most typical apparatus work with a high-resolution color sensor or a spectrometer to scan the near infrared spectrum. Color cameras have been used to sort materials into white, green, brown and opaque fractions or construction waste into different material classes [3, 9]. There have been studied automated sorting machines based on color using visible reflectance spectroscopy (VIS) [8] artificial intelligent systems using near infrared reflectance (NIR) measurements [1] and integrated systems [7]. Although of the higher technical capabilities of these equipments, their usage is not a guarantee of a good sorting process, purity and recovery of multiple resources. Therefore, the present study intends to improve the knowledge about automatic systems. For this purpose an automated sorting system is developed to support multiple plastic materials classification based on sensors. Waste, depending on the type of material, consists on unwanted materials left over from manufacturing processes (industrial, commercial, mining or agricultural operations,) or from community and household activities. Every day, tons of waste are generated; causing a major problem to various cities and their municipal authorities due to the shortage of landfill to dump such waste. Therefore, recycling is becoming an important issue with the shortage of the landfill and environmental pollutions as well as its economic impact.

The main task performed here is to sorting of this waste. The purpose of this project is to save the time for inspection and to reduce the efforts of the workers in material handling. An automatic sorting machine has main task of sorting components according to the size, color. A sorting machine is more practical and economical method of automation, which transfers material from one point to another. This also consists of conveyor belt, which reduces the efforts of material handling. Also both processes take place simultaneously i.e. material handling and inspection. Plastic bottles, for example, are the main municipal waste and they are non-biodegradable materials (are chemically stable). In fact, plastic waste can be visible for months or years and is a serious environmental problem. Hence, the treatment of plastic wastes becomes a serious problem and itis necessary to develop an effective recycling process. The main benefits of the device are less time required to sort the product, because the whole device is achieved via machine there is less possibility of mistake, much less man energy require. These days, in the current situation with extraordinary rivalry, creation effectiveness is for the most part viewed as the key of victory. Creation productivity incorporates the speed at which creation gear and creation line can be bringing down material and work cost of the item, improving quality and bringing down rejects, limiting personal time of creation gear and minimal effort creation hardware. Taking this matter viable the task is created which is exceptionally helpful for ventures.

LITERATURE SURVEY:

According to Kattentidt et al (2003) the performance of automated sorting equipment could be improved if quality data is obtained from the fitted sensor(s). As such some recent automated sorters have been fitted with multiple sensors. The processing speed and accuracy of data obtained from the sensor array is of importance. Having a good balance

between processing speed and efficiency of identification is also essential. For a sensor such as a camera, the acquired image is pre-processed to remove noise and distortions. The measure of light intensity of the object is utilised to gather information in pixels (picture elements). The background has to be separated from the image together with other objects in the image (image segmentation). Afterwards the image features are extracted (Acharya and Ray, 2005; Kattentidt et al 2003; Gonzalez and Woods, 1992). Following feature extraction, depending on the pre-defined classes, the images are then classified. This information is then utilised for the separation of the materials. The compilation of system and interfacing of various elements, sensors, servo motors, Hardware and software package interfacing of the system is prescribed by the "Software Interfacing ofTCS3200 color devicewith arduino " "LIM JIE SHEN [1] during this paper a color sorting automaton is researched designed and created withArduino UNO microcontroller, TCS3200 color device, SG90 tower professional servo motor and alternative physical science element. They found that color device provides totally different results once it tested outside and indoor. Dhanoj M.[4] was researched on automatonic arm primarily based color sorting robot mistreatment this TCS3200 color device. They were additionally used liquid crystal display display to display the colour detected. In image process image is captured mistreatment real time system like digital camera so objects are often sorted as per our demand like on the idea of shapes and colors[5]. Li Quaoyi [6] has used one methodology to check sensor's output. They took AN one empty tube and at rock bottom of that tube they placed device and white lightweight is placed at the highest of the tube so they visited recognize the filters are gated in turn to live the red, inexperienced and blue values and calculated alternative parameters.

PROPOSED METHOD:

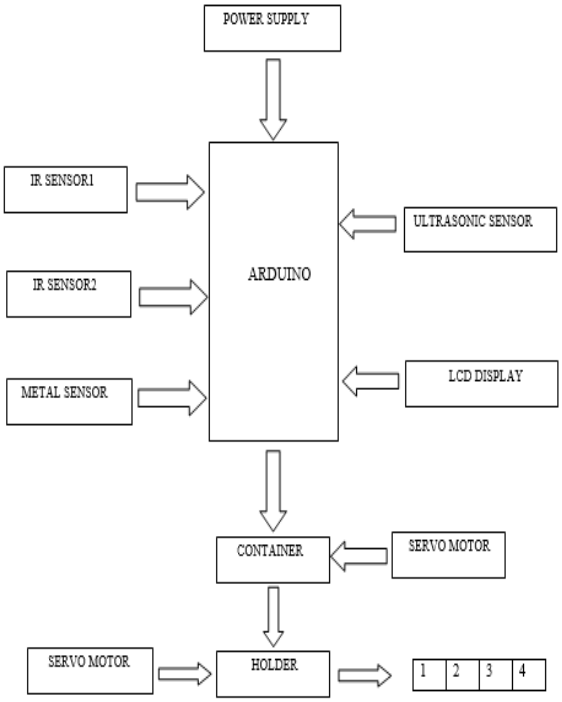
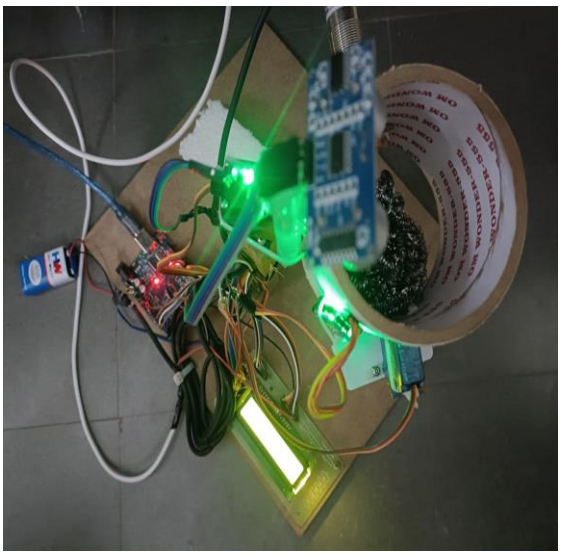


Fig1: proposed block diagram

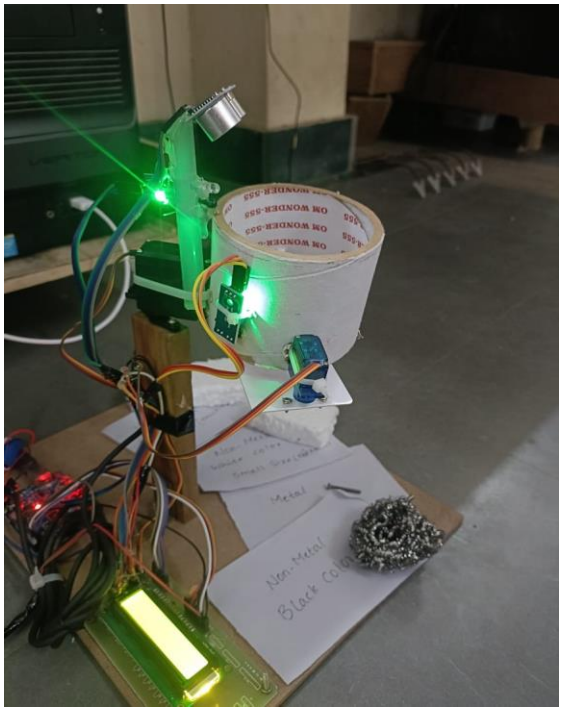
An automated sorting system based on color and thickness of waste management typically consists of several components that work together to sort different types of waste based on their color and thickness. The block diagram for this system can be explained as follows: Color Detection System: The color detection system is responsible for detecting the color of the waste materials. It uses sensors or cameras to identify the color of the waste materials as they move along the conveyor belt. Thickness Detection System: The thickness detection system is responsible for measuring the thickness of the waste materials. It uses sensors or other devices to determine the thickness of the waste materials as they move along the conveyor belt. Control Unit: The control unit is the brain of the system, which receives signals from the color and thickness detection systems and makes decisions about how to sort the waste materials. It uses a microcontroller or a programmable logic controller (PLC) to control the sorting process. Sorting Mechanism: The sorting mechanism is the final component of the

system, which physically separates the waste materials based on their color and thickness. It can be a mechanical arm or a pneumatic device that directs the waste materials into the appropriate bins. Output Bins: The output bins are where the sorted waste materials are collected. The system can have multiple output bins, each designated for a specific color and thickness combination. Overall, an automated sorting system based on color and thickness of waste management can help improve the efficiency of waste management and increase recycling rates by ensuring that waste materials are sorted accurately and efficiently. An automated sorting system for waste management based on color and thickness using IR sensors is a feasible solution for efficiently and accurately separating different types of waste materials. Here are the basic steps you can take to implement such a system. You need to determine the specific requirements of the sorting system, such as the number of sensors required, the type of sensors needed, and the processing power required to sort the waste efficiently. In this case, you will need to use IR sensors to detect the color and thickness of the waste material. IR sensors work by emitting infrared light and measuring the reflected light to determine the color and thickness of the material. Once you have chosen the sensors, you will need to set up the sorting platform. This could involve designing a conveyor belt or a chute system that directs the waste material to the sensors. You will need to calibrate the IR sensors to ensure they accurately detect the color and thickness of the waste material. This may involve adjusting the sensor settings or configuring the software to interpret the sensor data correctly. Once the sensors are calibrated, you will need to develop a sorting algorithm that uses the sensor data to sort the waste material into different categories based on color and thickness. This may involve using machine learning algorithms or other advanced techniques to improve the accuracy of the sorting process. After the sorting algorithm is implemented, you will need to test the system to ensure it accurately sorts the waste material based on color and thickness. This may involve running multiple tests with different types of waste material to ensure the system works correctly. Finally, you will need to optimize the system to improve its efficiency and accuracy. This could involve tweaking the sorting algorithm, adjusting the sensor settings, or making changes to the sorting platform to improve the flow of waste material through the system. Overall, implementing an automated sorting system based on color and thickness using IR sensors requires careful planning and execution. However, with the right sensors, platform, and algorithm, it is possible to create a highly accurate and efficient waste management system that can help reduce waste and improve recycling efforts.

RESULTS:



In the above Figure, we can observe that the setup we made to identify the type of waste that you want to sort and to determine the color and thicknesses that you want to sort choose the appropriate technology as there are various technologies for sorting. An automated sorting system requires careful planning, the selection of appropriate technology, and proper installation, testing and maintenance.



From the above Figures, we can observe that the sorting of waste materials has done according to their color thickness and metal by using IR, Ultrasonic and Proximity Sensors and sorted and sent to their compartments by using servo motor for rotation this the automated sorting system based on color and thickness of waste management.

CONCLUSION AND FUTURE SCOPE: An automated sorting system based on color and thickness using IR sensors can significantly improve waste management. The system can effectively sort different types of waste, including plastic, glass, and metal, into separate bins, which can then be easily recycled or disposed of. This not only reduces the amount of waste sent to landfills but also promotes sustainability by promoting recycling. Additionally, using IR sensors for sorting is a cost-effective solution that requires less maintenance and is less prone to errors compared to traditional sorting methods. Overall, implementing an automated sorting system based on color and thickness using IR sensors is a practical and efficient solution for waste management. In conclusion, automated sorting systems based on color and thickness are a vital component of modern waste management. They provide an effective solution to the growing problem of waste disposal, enabling materials to be recycled and reused, reducing the impact on the environment, and promoting sustainable living. As technology continues to advance, we can expect these systems to become even more efficient and effective, contributing to a cleaner, healthier planet for future generations.

There is an incredible breadth for the changes of the Garbage checking framework in future. Real time data on the fill level of the dustbin, advancement of the dustbin dependent on the real needs, cost decrease and asset improvement, compelling use of dustbins. In future WIFI, Cloud and voice-based dustbin we will develop.

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