# IOT: Smart Item Sorting Model

Anushika Singh[1], Gargee Mishra[2], Jay Patel[3], Suraj Rasal[4]
[1,2,3]*Student, Bharati Vidyapeeth(Deemed To Be)University, College of Engineering,Pune,India*
[4]*Prof., Bharati Vidyapeeth(Deemed To Be)University, College of Engineering,Pune,India*

***Abstract*- There is wide variety of products in our daily life and manufacturing of this products are done in many small scale and large scale industries. And nowadays the main difficultly is of sorting the items after the production. As sorting is one of the most important tasks in production line. Due to high turnover arranging of items in industry become a dull process and difficult to achieve consistency in object sorting. Earlier industries used RGB based model to sort the items which leads to many erroneous outcomes due to its certain limitations. As a result, an automated system for sorting is greatly needed to replace the manual sorting system. This type of sorting system will help to sort objects in the industries according to their color, weight, size, shape etc. In this paper we have proposed object sorting which uses raspberry pi 2 (Raspbian operating system) with its inbuilt camera feature used to capture images, conveyer belt and servo motors. We use face detection and open CV (open source computer vision) to implement color detection algorithm.**

***Index Terms*- IOT, Item Sorting, Image Processing**

## I.INTRODUCTION

1.1) What is an IOT?

The Internet of Things is simply "A network of Internet connected objects able to collect and exchange data." It is commonly abbreviated as IoT. The word "Internet of Things" has two main parts; Internet being the backbone of connectivity, and Things meaning objects / devices. In a simple way to put it, You have "things" that sense and collect data and send it to the internet. This data can be accessible by other "things" too. The “Internet of Things” has the power to change to the world. There are lots of areas for Internet of Things to be utilized. With the use of smart sensor technology, any electronics devices or appliances can be designed to connect to internet. Internet of Things applications can be found in every industry with a diversity of application for smart homes, smart buildings, travel and transportation, health and personal care, retail, agriculture, construction etc. The industrial Internet of Things revolves around automation and logistics. Increasingly we will see Internet of Things creating smarter solutions, programmatically adjusting to the human behavior[1]. The driving forces are efficiency and convenience.

1.2) Why these boards?

This proposed System has an automatic object sorting and implementing pick and place technique. The proposed System make use of advanced raspberry Pi 3 processor, conveyer belt, stepper motor.

Raspberry Pi 3 is the latest version of Raspberry Pi Computer. It is simply a credit-card sized electronic board. The quad-core Raspberry Pi 3 is both faster and more capable than its predecessor. The new board is capable of playing 1080p MP4 video at 60 frames per second (with a bitrate of about 5400Kbps), boosting the Pi's media center credentials. The Raspberry Pi processor checks the captured images from the predefined database of the objects.

Alike Raspberry Pi, Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online.

Similar to Raspberry Pi and Arduino, Beaglebone boards are used by artists, designers to realize their projects. Beaglebone is a low power open-source single computer produced by Texas Instruments. Beaglebone Black is nothing more than a small, standalone Linux computer, but the hardware is designed for use as an embedded system—a computer installed inside of a larger electronics project [2].

1.3) Why we choose Raspberry PI?

Beneath of all the advantages and disadvantages of Arduino and Beaglebone we are using Raspberry Pi 3 because it is a general purpose mini computer, usually with a Linux operating system, and the ability to run multiple programs. It is best in use when you need a full-fledged computer: driving a more complicated robot, performing multiple tasks, doing intense calculations. Raspberry Pi can be easily connected to the internet using Ethernet Port and USB Wi-Fi Dongles while Arduino and Beaglebone requires external hardware to connect with internet [3].

## II. EXISTING ITEM SORTING

A common requirement in the field of color sensing is that of color identification or sorting of objects with the help of colors. The existing RGB color model is based on the fact that different colors can be created with the help of primary colors of red, green and blue. These colors are termed as primary additives.

### A. WORKING OF THE EXISTING RGB BASED ITEMSORTING SYSTEM

Working of our system is very simple. Initially when product is on the conveyor belt, sensor will detect the presence of the particular product & give signal to the color sorting controller. Then color sorting controller will send this signal to the computer by serial interfacing. Image processing software of the system will send the signal to the camera for capturing the image. Once image is captured, the software will process on the captured image and will generate signals according to requirement and which in turn the signals will be send back to color sorting controller. Accordingly, the color sorting controller with the help of motor driving circuit will control the conveyer belt and robotic arm [4]. Robotic arm will pick & place the given component according to the color. If color is not matched with a given requirement, the product will be rejected. This cycle will be repeated number of times as per requirement.

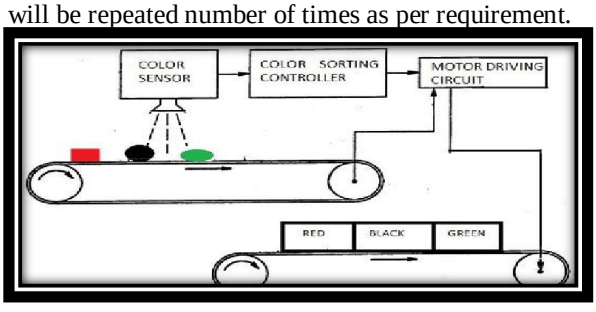


Figure 3.1.: Existing RGB based item sorting

### RGB MODEL COLOR COMPONENTS

RGB color model uses red, green and blue light to generate a broad array of objects. The secondary color components (cyan, magenta and yellow) are generated by the addition of two major color components excluding the third one as shown in figure.

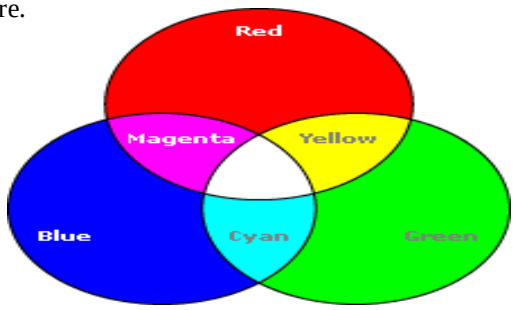


Figure 3.2.: RGB Color Model

With the help of some programming languages like Python, this can be done in a very naive way. It sorts the first component, then the second component and then finally the third one [5]. If two colors have the same red component then the next component (green) will be used to determine which one is bigger [6].

### DRAWBACKS OF THE EXISTING RGB MODEL

1. The most insignificant way through which we can sort colors is by directly sorting their RGB values. This is because sorting based on RGB color model is very inefficient and RGB color density varies with different colors.
2. It is a three-channel model in which combination of red, green and blue provides a specific shade. These values changes with respect to illumination which in turn results in erroneous operation.
3. This model also gets affected due to sensor sensitivity and environmental conditions.
4. Sorting based on RGB color model is application/color specific, provides less flexibility and is comparatively slow.

## III. PROPOSED RESEARCH METHODOLOGY

The Proposed Model working can be well explain by the fig 4.1. The idea behind the proposed methodology is to remove all the drawbacks or some of the drawbacks of existing model. The procedure of the working of the proposed model is as follows:

- Initially when product is on the conveyor belt, it slowly moves on the conveyer belt with the help of stepper motor.
- Later, comes the servo motor which gives the object a perfect angle in which the photograph by the camera can be taken perfectly.
- Image processing software of the system will send the signal to the camera for capturing the image.
- Once image is captured, the raspberry pie will send the image to be compared with the object images saved in the database according to the parameters and characteristics.
- Moving arm will pick & place the given component according to the color, size and shape.
- If the size, shape, color and other characteristics match with the saved images then the moving arm places the object in the suitable container [7].
- But if the image does not match the saved images in the database then the object is completely rejected by the system.

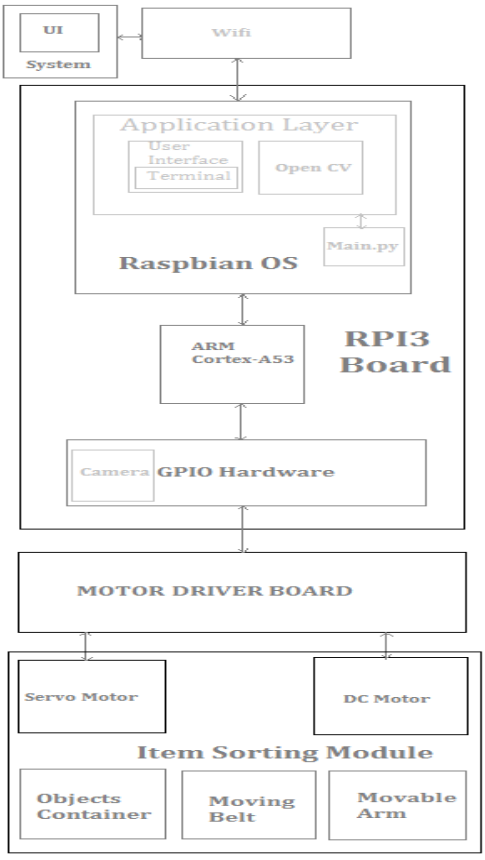


Figure 4.1.: Proposed Research Project Smart Item Working Diagram

Further are some images for the top view and the side view of the working model. These are given in fig 4.2 and fig 4.3 respectively.

Therefore, the images are given below-

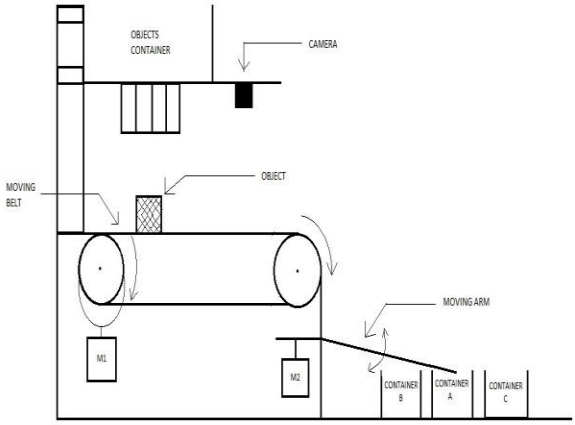


Figure 4.2.: Proposed Research Project Smart Item Sorting Model Side View

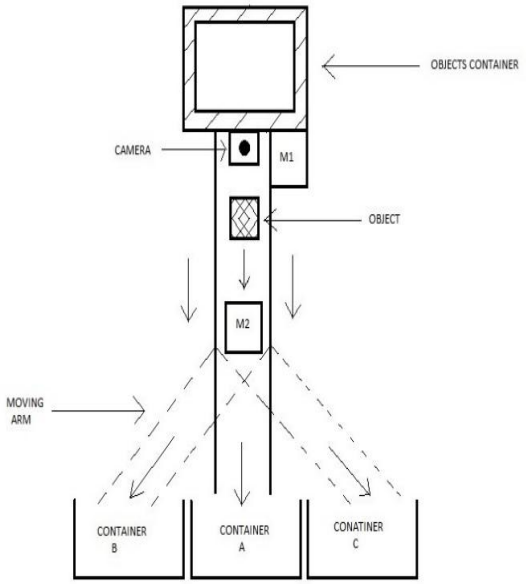


Figure 4.3.: Proposed Research Project Smart Item Sorting Model Top View

The side view and the top view of the proposed research model for Smart Item Sorting portrays the entire components that have been used and also how the model works in brief.

These images contain the following hardware components:

1)RaspberryPI-3 with a Camera: Helps in taking the picture of the object that is compared to the images stored in database.

2)Moving ARM/Cortex: This arm helps in distributing the objects in the containers matching the characteristics respectively.
3)Conveyer Belt: The moving belt on which the object will move while picture is being clicked and reaches the arm which will sort it to the containers.
4)Servo Motor/ Stepper Motor: Giving motion to the Conveyer belt to move properly.
5)Objects and Its Containers.
These images of the side view and top view of the model also explains the moving of the conveyer belt, working of the motors and how the arm works to sort the objects according to the matching characteristics in their respective containers.

## IV. COMPLIANCE WITH ETHICAL STANDARDS

Funding: This study has no funding.
Ethical Approval: This study was approved by the university human research ethics committee and all procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed Consent: Informed consent was obtained from all individual participants included in the study. Conflicts of Interest: The authors report no conflicts of interest.

## V. CONCLUSION

- Almost all the drawbacks of the existing system/model have been overcome such as efficiency, accuracy, time consumed, costs, Flexibility, Compatibility, and Precision.
- Existing system can only limit the sorting to some colors, size and the color combinations related to HCV and RBG model which has been overcome in this proposed system.
- Existing RGB model was unable to give a good threshold value which the proposed model has been successful in increasing the threshold value.

There are many benefits of the proposed research work which has overcome the drawbacks of the previous models such as High precision: the margin of error can be reduced to great extent, Good quality level, Low failure rate with long life, Reliable operation, performance and maintenance, High accuracy, High extent of intellect, Fully automatic venture, Speed of operation is high, Highly productive, Less human Interference.

## REFERENCES

[1] S. U. Rasal, R. Agarwal, V. S Rasal, and S. T. Shelar, "IOT appliance access structure using ABE based OTP technique," The IIOAB Journal, vol. 7, pp. 180-186, Sept. 2016.
[2] Rasal, S.U., Gupta, K., Rasal, V. and Shelar, S., 2017. Auto motive refuge concept using Embedded and computing approches. International Journal of Advanced Research in Computer Science, 8(5).
[3] Horak, K. and Zalud, L., 2016. Image processing on raspberry pi for mobile robotics. International Journal of Signal Processing Systems, 4(2), pp.1-5.
[4] SURAJ U. RASAL, VARSHA S. RASAL, SHRADDHA T. SHELAR. (1). ENHANCING SECURITY LEVELS AT ISP SERVER USING MULTIPLE SECURITY TECHNIQUES WITH PROPOSED CRYPO APPLICATION. INTERNATIONAL JOURNAL OF ENGINEERING AND TECHNOLOGY INNOVATION. 9 (1), P49-60.
[5] ATA, A.A., RAFEEK, A. AND YUSOF, H., 2005. SENSORY-BASED COLOUR SORTING AUTOMATED ROBOTIC CELL. JOURNAL OF INTELLIGENT AND ROBOTIC SYSTEMS, 43(1), PP.99-110.
[6] GIGLIOTTI JR, M.F.X., BENZ, M.G. AND MILLER, R.S., GENERAL ELECTRIC CO, 2000. APPARATUS FOR COLOR-BASED SORTING OF TITANIUM FRAGMENTS. U.S. PATENT 6,043,445.
[7] WALSH, C.P., HOFFMAN, P.L., DRUMMOND, W.S. AND SQUYRES, H.P., SIMCO/RAMIC CORP, 1995. PLASTIC CONTAINER SORTING SYSTEM AND METHOD. U.S. PATENT 5,443,164.