Defect Detection and Packing System: A REVIEW

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ABSTRACT:

With recent advances in industrial technologies, automation has become an indispensable part in the manufacturing world. Industrial environments are adopting more and more aspects of automation to increase product quality, accuracy, and reduce product costs. Conveyor systems are used wildly in manufacturing industries. This automated conveyor system works by detecting the defective items of the production in the conveyor using ESP-32 CAM Module and deep learning. The microcontroller analyses the picture taken by camera and then directs the servo motor to separate directions depending on the condition of the product. The position of the conveyor is detected by a IR Sensor, This project thus automates the material separation process in the conveyor to improve efficiency and increase productivity.

Keywords: - Conveyor Systems, ESP-32 Camera Module, Infrared Proximity Sensor, Defect Detection.

I. INTRODUCTION

Every Company needs Maintains Its Product quality as it is the most important thing for their brand value in the market if any defective or damaged product is bought by consumers brand image among public goes and it effects any company very high and sales go down and company loses its profits and it's not good for companies future.

To Stop all this from happening every company make sure that product sent out of production line is not defective and so they adapt for system after producing the product products will be sent For Defect Detection After passing that test they will sent to packing if product is damaged it will be taken out of production line, For detecting the Defect In Product the process varies depending on the product as each item/product is different from one another.

As Defect Detection is part of Quality Control and Assurance to customer, This system is widely used in field of industrial automation so that process is fast and can be productive at the same time this helps in mass production industries where it is hard to employee Humans for Defect Identification Of high amount of products at a time and also it delays the packing process and turnover falls down, By using System Automation Into the production line this can make work faster and company's output increases, Industrial Automation is good for any company because it increases productivity and no need for regular maintenance and it is one time investment to produce any product and can be easily variable to change product design by flexible manufacturing system as many industries use Defect Detection there are few ways to detect defect item based of product and precision of detecting it they are, By Using Laser

Scanning System In this method product is scanned by a laser Scanner From every angle and compares with the data that is already programmed into system if there is any defect in product the system detects it by comparing the data and takes it out of production line above mentioned technique is mainly used in detecting the defects in products which are huge in size and also having different depths and heights at each side more of an irregular shaped , this types needed to compared from original dimensions of data that is of product and another process is using Deep Learning in our project we are going to use this method in our model integrated into ESP-32 Module and there as camera mounted to it for this process module is pretrained with images so that it can detect the defect product from good product in this we first input the model with multiple images of Defective products and when camera capture the image of each product in line it matches with the records after product image is processed if Defective/Good this system works as efficient as we give the multiple input data of images for detecting more efficiently

In Production line Camera captures each product in line and analyzed it with Deep Learning Program many companies use this method to detect Defects In Color of the product and detecting basic defects in product like cracks etc.. as this is low cost consumes less power same any other production line after identifying the Defective Piece product will be taken out before it is sent for packing the products.

II. LITARATURE REVIEW

Here are few review papers which we have reviewed and gives the importance and need of this project.

Sr.no	Author(s)	Type/Title of study
1)	H. Schweitzer, W.B. James, and W. Feng	"Very fast template matching."
2)	H. Zhang, S. Shen, and I.A. McAllister	"Camera blemish defects detection."
3)	M.S. Kim	"Lens shading correction device and method in image sensor."
4)	D.Y. Kim, Y.H. Noh	"Method and apparatus for compensating image sensor lens shading."
5)	CW. Huang,	"System and method for detecting defects in camera modules."

1. Conventional methods for detecting defects are, using template matching [1], using edge filter [2] with the option of applying lens shading algorithm [3], [4] prior or not, and dividing the lens shading algorithm applied image into subimages then comparing the average value of each subimage with average values of nearby subimages [5].

2. [2]proposed a defect detection method by creating horizontal edge image and vertical edge image with one dimension edge filters and combining them to create an edge map.
3. [5] proposed a defect detection method by first setting the test regions as subimages created by dividing the images.
4. Gabor filter [6] is applied to the filtered image to detect edges in various orientations.
5. Detected PP defects and defect candidates from the second stage are then fed to convolutional neural network [7] for classification and verification.

III. HARDWARE COMPONENT

a) ESP-32 CAM Module:-

The ESP32-CAM is a small size, low power consumption camera module based on ESP32. It comes with an OV2640 camera and provides on board TF card slot. The ESP32-CAM can be widely used in intelligent IOT applications such as wireless video monitoring, Wi-Fi image upload, QR identification, and so on. It Has Bluetooth Connectivity Also which make this b module more specs small size & low power consumption

Bluetooth: - Bluetooth-4.2

Wi-Fi: - 802.11

Support interfaces: UART, SPI, I2C, and PWM

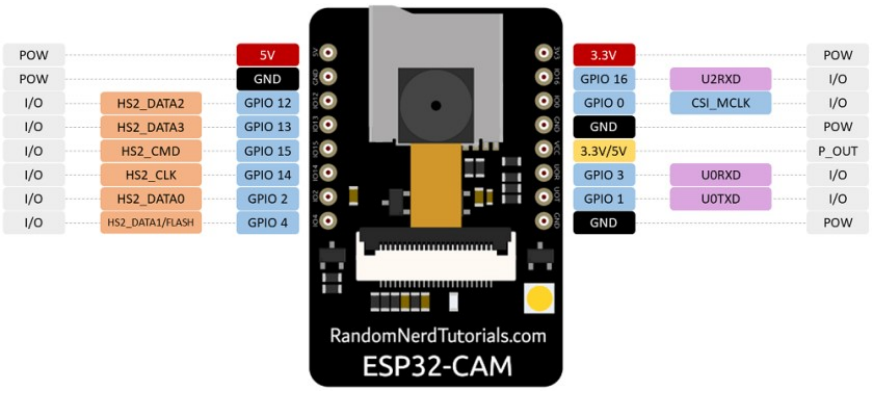

Fig-1: ESP-32 CAM Module Pinout

b) TCRT5000:-

The TCRT5000 is an IR sensor unit. It has both a Photodiode and a Phototransistor coupled in its package. ... This sensor can be used to detect the presence of object or any other reflective surface in front it, also with some level of programming it can also calculate the distance of the object in front it. It runs on 3.3v input voltage

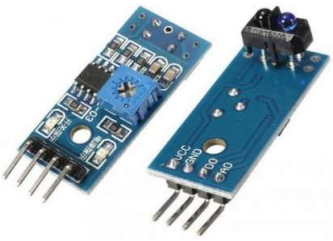

Fig-2: TCRT5000 IR Sensor

c) Servo Motor :-

Micro **Servo Motor SG90** is a tiny and lightweight server **motor** with high output power. **Servo** can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. You can use any **servo** code, hardware or library to control these **servos**

Fig-3: Servo Motor SG90

d) DC Motor :-

A direct current (DC) motor is a type of electric machine that converts electrical energy into mechanical energy. DC motors take electrical power through direct current, and convert this energy into mechanical rotation. The output torque and speed depends upon both the electrical input and the design of the motor

Fig-4: Servo Motor SG90

e) L293D Motor Driver :-

L293D IC is a typical Motor Driver IC which allows the DC motor to drive on any direction. This IC consists of 16-pins which are used to control a set of two DC motors instantaneously in any direction. It means, by using a L293D IC we can control two DC motors. As well, this IC can drive small and quiet big motors.

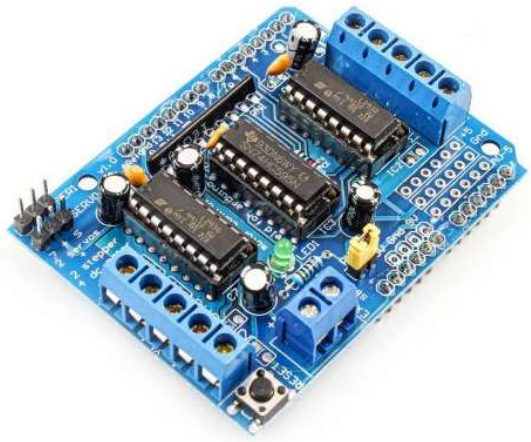

Fig-5: Servo Motor SG90

IV.PROPOSED METHODOLOGY & DESIGN

1) WORKING :-

In Our Project we are going to show how an defect detection system works as product is made and comes out of production after all processing its turn to process through "Defect Detection System" This is the process we are going to show in our model where product will be passing by conveyor belt and undergoes the Defect Detection System Where an camera captures a picture of product and then analyse it Through Deep Learning we have trained the model with images of "Plate" As an example and our model detects whether the plate under line is "Broken/Good" when system detects that product is broken then it activates servo motor which is fixed by line to take out the Defective/Broken Product from line and then it is sent for packing the product

Here the image is captured and processed by one Module "ESP-32 CAM" it has processor which runs the program for analysing the image which is trained using EDGE IMUPLSE, Conveyor Belt system is made from DC Motor Rotating the belt to move the product, after Passing the Defect Test then all the products are sent for packing this is done using Robotic Arm placing the Product On Cart in order and packed and further shipped.

Before capturing the image the product needs to placed exactly below camera for capturing the image this done by using the IR Sensor Placed by the side of conveyor belt which it triggers the DC Motor To Stop and Hence Conveyor Belt stops at a certain time that Product is under the Camera Module, This Triggering process is also programmed within the ESP-32 module that is used for Processing the defective once.

2) FLOW CHART :-

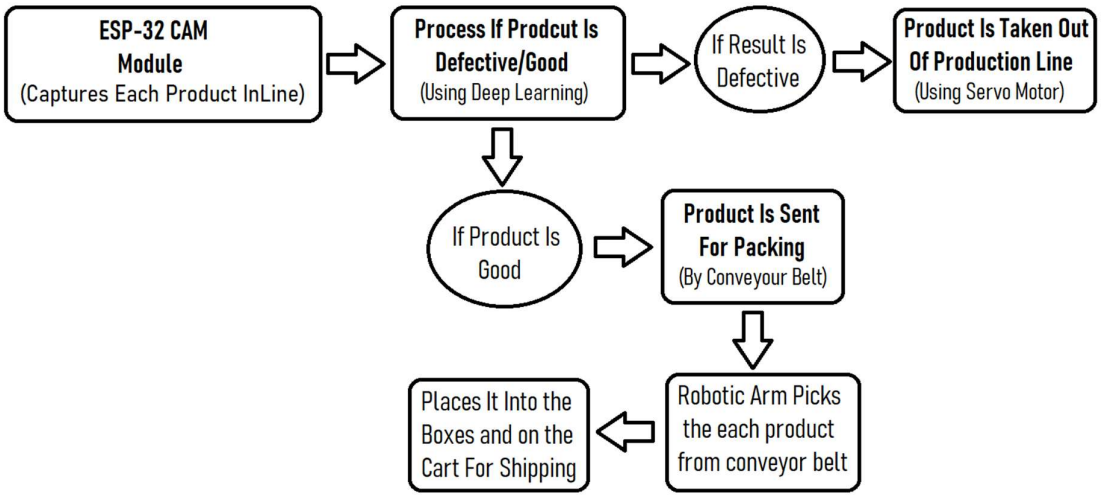

Fig: - 2.1 Flow chart

3) CIRCUIT DIAGRAM :-

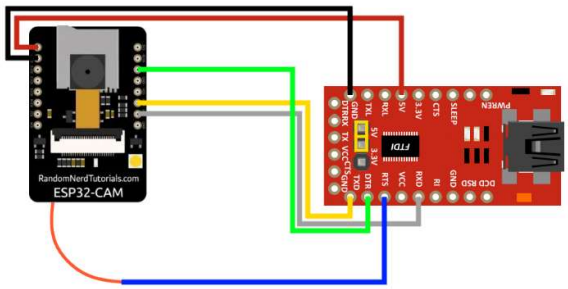

Fig:- 3.1 ESP-32 FTDI Programming

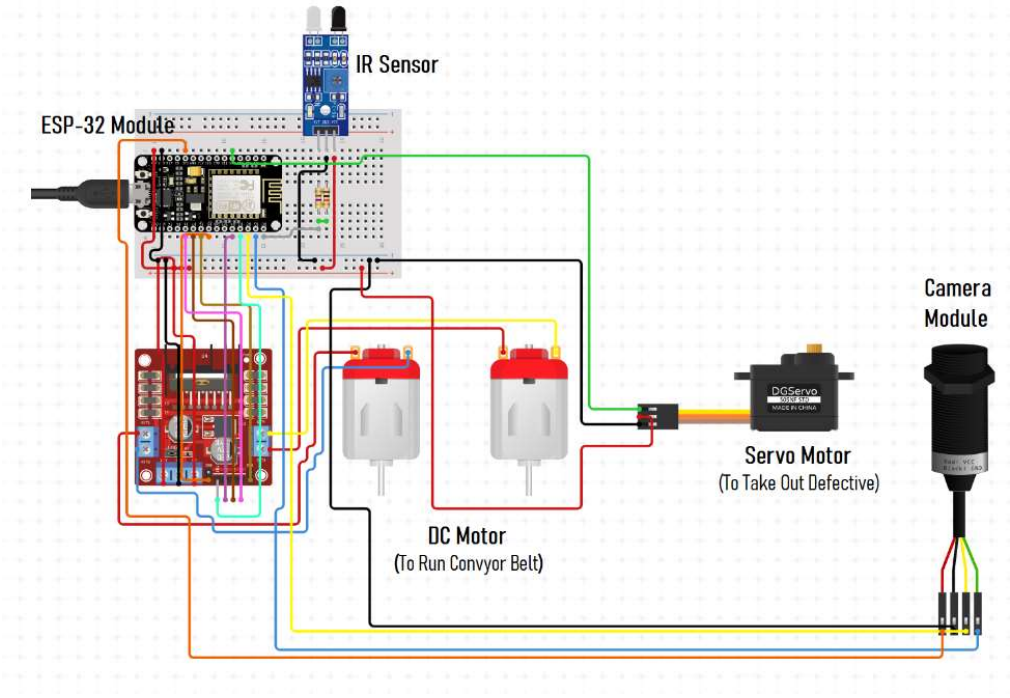

Fig-3: Schematic Diagram

V. CONCLUSION

Final output project is to improve the Quality Control In Industries using ML to make model of Defect Detection & Packing System By using Deep Learning and integrating it into the ESP-32 Module and create working model of Production Line running and taking out the Defective products & packing the good once so that Quality of product out of Factory is compromising companies image.

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