

# Design and Development of Automatic Rotten Egg Separator-Image Processing Algorithm

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**Abstract** — Now-a-days the qualities of the eggs are the major issue in health care. So, we proposed a system where the quality of the eggs and their conditions could be identified. This system involves the development of a low cost machine vision system using webcams and image processing algorithms the defected eggs. The decision was based on the features extracted by the image processing algorithms. The shape features were used for detecting and it will be floated over the water, in case of rotten egg due to low density. If it captures the image it is noted that it has defective eggs, it would be separated. The inspection speed of 20 eggs per min was achieved by the algorithms and the prototype has been developed.

**Keywords** — Image Processing Algorithm, Surface detection, Buoyancy, Solenoid Actuator.

## I. INTRODUCTION

In this work the mechanical setup and electrical setup plays an important role in the separation of eggs. The eggs which are continuously loaded in the conveyer carries the eggs and it is made to dip into the water. The rotten egg starts to float in the water whereas the remaining good eggs sink into the water (Buoyancy). Webcam is used to capture the egg surface and send the image to the system by graphical user interface. It turns ON the motor. In the motor shaft a turner is coupled in which it creates waves in the surface of the water. Due to these waves the rotten eggs are moved to the side of the tank. At this time the cylinder gets actuated and removes the rotten eggs from the tank. These rotten eggs are collected separately. Good eggs are unloaded from the box manually. In future this loading and unloading can be automated.

[1] proposed some technique used in processing egg by the concept of the image processing. There are two types of the machines available in the market such as egg yolk separator as well as egg breaking machines. But in both the cases the rotten egg would adversely affects the production rate.

[2] explains about the surface detection of the various objects. The surface detection is performed on a greyscale image containing only the detected objects. A combination of thresholding and

mathematical morphology are used to extract object features.

[3] presents the measurements of trash contents and grades in cotton using digital processing and analysis. A measuring system has been constructed and transmitted, reflected and compound light measurement mode has been tested, discussed and the optimum mode identified. A formula has been derived and used to translate the trash content by area into the trash content by mass. Matlab and its image processing toolbox have been used in images processing and analysis.

## A. Existing System

The method used by the distributors to grade the eggs is through traditional quality inspection and handpicking which is time-consuming, laborious and less efficient as shown in Fig.1. Manual grading is based on traditional quality inspection performed by human operators, which is tedious, time-consuming, slow and non-consistent. Traditional method is done by manual sensory observations. Commercially human senses are employed to sort or grade.

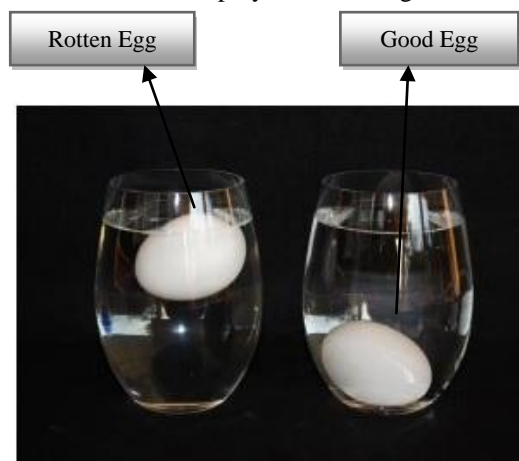


Fig.1 Existing Method

## B. Proposed System

Eggs are dipped into water. Camera senses the presence of rotten egg and make a logical decisions based on algorithms developed. Efficiency and accuracy is maximum as compared to existing model. Block diagram of proposed system is shown in Fig. 2.

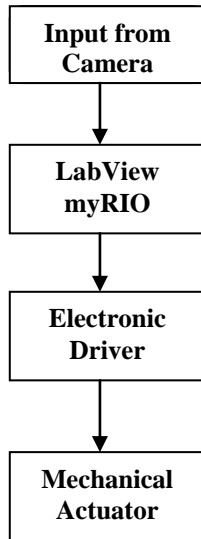


Fig.2 Block Diagram of Proposed Method

**II. DESIGN OF PROPOSED SYSTEM**

The design setup consists of Proximity Sensor, Arduino Controller, VGA Camera, DCV, Relay, myRIO and Motor. Table 1 describes about the technical specification of the proposed system.

**Table 1 Specification of the Proposed System**

S.No	Components	Specification	Quantity
1	Proximity Sensor	12 V, NPN type	3
2	Controller-Arduino UNO	16 MHz	1
3	Camera VGA	16 Mp Resolution	1
4	Directional Control Valve	12 V, Solenoid Operated	2
5	Single Point Relay	12 V	2
6	Pneumatic Cylinder	1 to 8 bar	2
7	Motor	12 V	1
8	myRIO	-	1

**A. Design Calculation**

Chain drive motor calculation,  
 Diameter of sprocket (D) = 10 cm  
 Velocity (v) = 5 cm/sec  
 Maximum load on chain (W) = 2 kg  
 Length of chain (L) = 80 cm  
 Torque (T) =  $\frac{1}{2}(D \times W)$   
 =  $2 \times 5$   
 = 10 kg-cm  
 Circumference of sprocket (A) =  $2 \times \pi \times r$   
 = 21.98 cm

$$\begin{aligned} \text{Rpm required (rpm)} &= (5/21.98) \times 60 \\ &= 25 \text{ rpm} \\ \text{Torque, (T)} &= T \times \text{FOS} \\ &= 10 \times 2 \\ &= 20 \text{ kg-cm} \end{aligned}$$

**B. Assembly Model**

The CAD model of the proposed system is shown in Fig. 3.

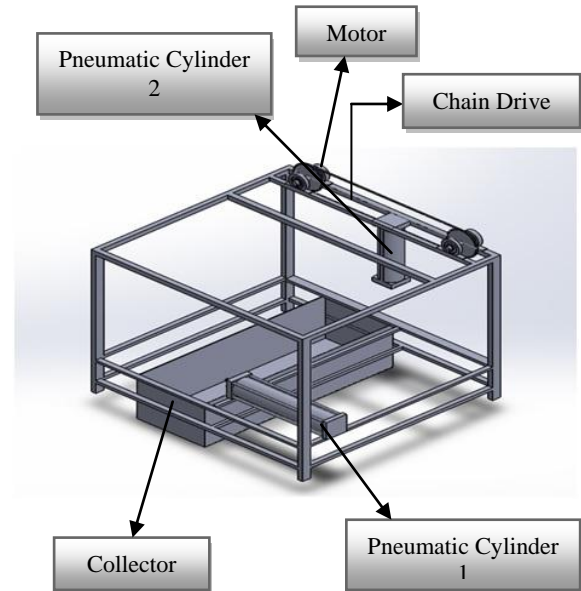


Fig.3 Assembly Model

Mechanical setup consists of pneumatic cylinders, chain drive, motor, tank and base frame. Motor is used to run the chain drive. Pneumatic cylinders are used to process the eggs in water.

**C. Electrical System**

The circuit design using Proteus software is shown in Fig.4.

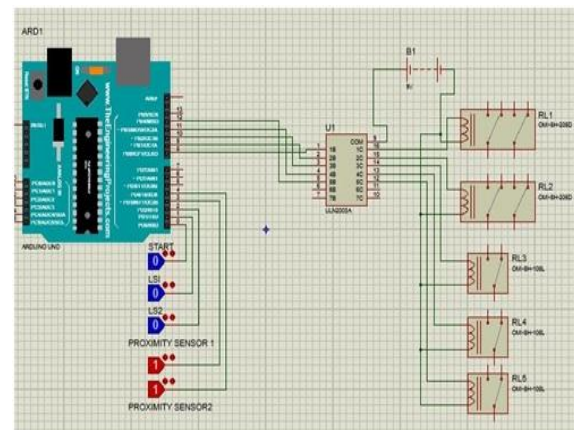


Fig.4 Circuit Design

Electronic circuit consists of proximity sensors, switching IC (ULN2003), relays, start switch, limit switches and Arduino controller. Proximity sensors,

limit switches and start switch are the inputs to controller. Switching IC controls relay position which controls output devices.

**D. Image Processing - LabVIEW**

The Fig.5 shows the front panel display of the LabVIEW 2017 software. It indicates the availability of the eggs, Color Sensitivity, error in and error out clusters.

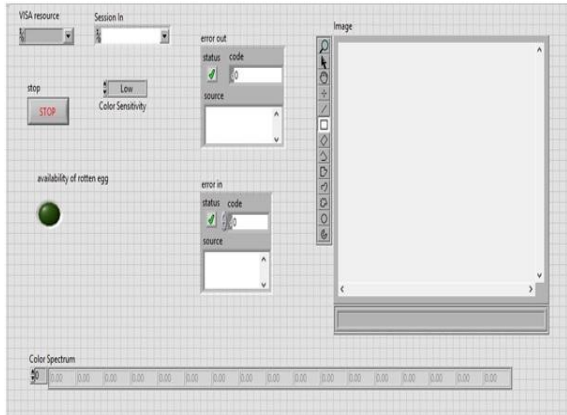


Fig.5 Front Panel

GUI (Graphical User Interface) can be created by using the LabVIEW software and image can be acquired by following the various set of the image acquisition algorithms. Fig. 6 shows the graphical coding for the image acquisition process.

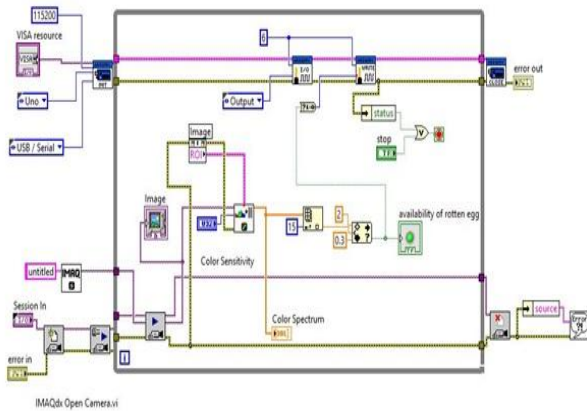


Fig.6 Block Diagram

**III.PRINCIPLE OF OPERATION**

The entire system consists of two major parts; one is the mechanical setup involving the chain drive and pneumatic cylinders, while the other part is the electrical circuit involving relays, micro controller and voltage regulator. The two parts, work with synergy, to perform the manual serving process automatically.

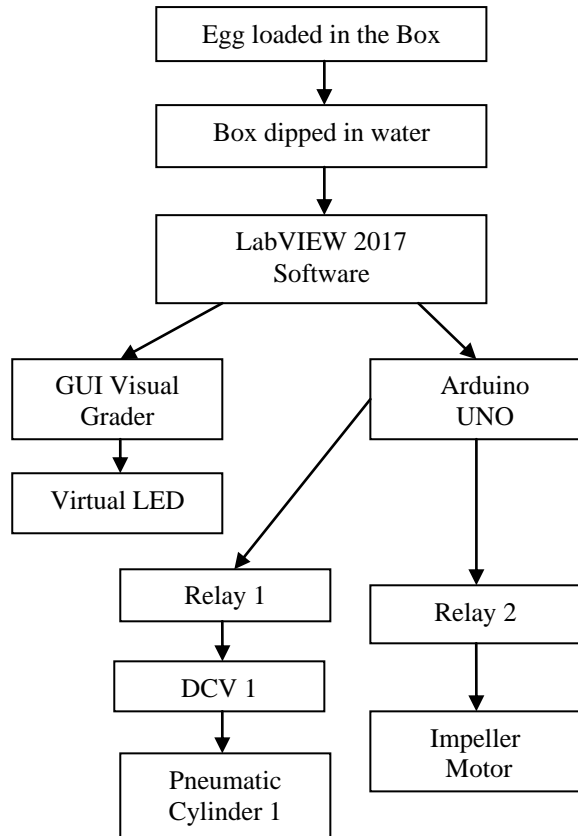


Fig.7 Block Diagram of Operation

The box attached with cylinder1 is loaded with eggs and the cylinder1 is linked with chain. Chain drive motor is switched ON. When the cylinder1 comes over the tank limit switch senses the position and stops the motor. Cylinder1 is actuated to dip the eggs into water and if any rotten egg(s) is (are) present in the box it will start to float over the water surface. A camera captures the image of the rotten egg and compares the threshold value of image with the predefined values as by the algorithms. Algorithm senses the color in the captured image by using color spectrum analysis in LabVIEW software. LabVIEW consists of vision development module and it consists of color learn block, it splits the image into value. By using the value of image, grades of the tomatoes are processed.

Software consists of two blocks, graphical user interface shows the presence of rotten egg by glowing a virtual led on the screen and another block it sends the data to the Arduino board through serial communication using USB interface and the output produced at the software sends the data to Arduino pin 6. When a rotten egg is detected, impeller motor is switched ON which creates waves on water surface to separate the rotten egg then cylinder2 is actuated to remove the rotten egg from the tank. The box is taken out from the tank then chain drive motor is switched ON but it rotates in reverse direction to bring the cylinder1 to initial position.

```

#include<LabVIEWInterface.h>
//inputs
int start=0;
int ls1=1;
int ls2=2;
int prx1=3;
int prx2=4;
int pulse=6;
//outputs
int r1=8;//motor fwd
int r2=9;//motor rev
int r3=10;//cyl1
int r4=11;//cyl2
int r5=12;
void setup()
{
  // put your setup code here, to run once:
  //pinmodeconfiguration
  pinMode(ls1,INPUT);
  pinMode(ls2,INPUT);
  pinMode(prx1,INPUT);
  pinMode(prx2,INPUT);
  pinMode(pulse,INPUT);
  pinMode(r1,OUTPUT);
  pinMode(r2,OUTPUT);
  pinMode(r3,OUTPUT);
  pinMode(r4,OUTPUT);
  pinMode(r5,OUTPUT);
}
void loop()
{
  // put your main code here, to run repeatedly.
  if(digitalRead(start)==HIGH)
  {
    digitalWrite(r1,HIGH);
    delay(1000);
    if(digitalRead(ls2)==HIGH)
    {
      digitalWrite(r1,LOW);
      delay(1000);
      digitalWrite(r3,HIGH);
      delay(10000);
      if(digitalRead(pulse)==HIGH)
      {
        digitalWrite(r5,HIGH);
        delay(10000);
        digitalWrite(r5,LOW);
        delay(1000);
        digitalWrite(r4,HIGH);
        if(digitalRead(prx2)==HIGH)
        {
          digitalWrite(r4,LOW);
          delay(1000);
        }
      }
      digitalWrite(r3,LOW);
      delay(1000);
      if(digitalRead(prx1)==HIGH)
      {
        digitalWrite(r2,HIGH);
        delay(1000);
        if(digitalRead(ls1)==HIGH)
        { digitalWrite(r2,LOW);
        }
      }
    }
  }
}

```

Fig.8 Interfacing Coding

In order to interface the myRIO kit with the arduino, the interfacing code shown in the Fig.8.

#### IV. CONCLUSION AND FUTURE SCOPE

##### A. Conclusion

In this work, the hardware of rotten egg separator has been designed and successfully implemented. The designed system to find the rotten eggs more efficient and it reduces the labour cost. And also cost of camera used is too low. The designed system requires minimum maintenance with a practically good level of improvement of system efficiency and has more economic feasibility. The designed system capable of processing 10 eggs per minute.

##### B. Future Scope

Now eggs are loaded manually in the box for checking process. In future, egg loaded trays continuously conveyor. These trays are clamped and processed for removal of rotten eggs. So manual loading and unloading of eggs will be automated. It also increases the number of eggs being processed and reduces the time consumption.

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