

# AUTOMATIC HATCHING MACHINE WITH CAPABILITY EMBRIO QUALITY DETECTION OF EGGS USING REGIONPROPS AND BINARY SEGMENTATION METHOD

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## ABSTRACT

Abstract— This study is making a system that combines two system from egg hatching machine and egg embryo quality detector into one tool. So it can facilitate the breeder in sorting the damaged egg or infertile during the hatching process. The eggs used in this research are kampung chicken eggs. The method used in egg identification process is using binary segmentation and regionprops method. Combining those two methods can maximize the detection of egg embryo with the number of eggs more than one to detect, so it can increase the efficient of hatching egg. The identification based on the value of pixel from the embryo image. Each egg will give a certain pixel value, and this becomes a benchmark in determining the quality of the egg. In the egg hatch machine there is a temperature control system using PID method and ON-OFF control system for humidity control. The final result from this research is making a tool of combination from two systems, which is egg hatcher machine and also egg embryo quality detection.

## Keywords

*Image Processing, Binary Segmentation, Regionprops, PID Controller, Pixel, Threshold.*

## 1. INTRODUCTION

The population of chicken farmer in Indonesia from year to year become increase. The use of technology in chicken farming is now used by some people. Automatic egg hatchery machine is one of them. However, in the implementation, not all eggs can success to hatch in one period. This is caused by eggs that have no embryo. It will be more efficient and more profitable if the egg hatch machine can automatically detect the quality of the egg embryo directly. So that the hatching can run optimally which is not accompanied by loss of time.

Research for the egg embryo detector has been done by Khabibulloh et al (Khabibulloh et al., 2012). This study identifies the egg embryo using the thresholding method. Identification is made by using an analysis of the number of pixels. The level of accuracy of egg embryo detection that made by the researchers is 98%.

Research for the manufacture of automatic egg hatching machine has been done by Rivaldy Siregar (Siregar, 2016). This study controlling the temperature of the egg hatch machine room using the PID control system with the REX C-100 controller. And also control the humidity of the room using On-Off control system.

This final project will focus more on making fertility identification tool of egg during hatching process. And also make machine tool of hatching machine which its the controller use is REX C100 module and also On-Off control system with Arduino microcontroller. By using egg fertility detection system, the machine will be more efficient. In addition, because the detection is done without having to remove the egg from the machine but has been connected directly with the system so that the eggs are not disturbed during the process of detection of egg embryo.

## 2. FORMULATION OF THE PROBLEM

The problem to be solved in this final project is

- Determine the egg characteristic parameters with various embryonic conditions using the method of Regionpros and Binary segmentation.
- Design and realize temperature and humidity control systems in egg hatching machines using PID method.
- Design and build an egg embryo detector using digital image processing with 9 chicken eggs.

## 3. OBJECTIVES OF THE RESEARCH

The purpose of this final project is:

- Create a temperature and humidity PID control system on egg hatch machine.

- Creating an egg embryo quality detector of 9 egg using digital image processing with Regionprops and Binary segmentation method.
- Determine the parameters of digital image processing to identify the quality of the egg embryo.

#### 4. METHOD

##### 4.1 Digital Image Processing Using Binary Segmentation and regionprops Method

The camera and egg setting location is to help the webcam capturing an image when the eggs irradiated by the laser. Due to the single-use lighting, this one-way direction is required for the egg object to be caught right in the middle and no errors in shooting.

The thresholding segmentation method used to separate the image object from the background image. This thresholding operation works by segmenting the image into two parts the background and the object. In this research the object is the egg embryo. Its set to white while the other image objects are black. This is to distinguish between egg embryos and the other. The result of the thresholding process is a binary image that has only two grey degrees, that is of black and white that shows in value of "1" and "0".

Figure 1 is the diagram block of digital image processing of egg embryo detector. The egg embryo quality detection system begins by lighting the eggs using a 2538 led smd module. After irradiation, it will begin to show the contents of the egg in the form of an embryo. Then do the image by the webcam taken by manual click through the computer that has been installed MATLAB software. After obtaining images of the nine eggs, it will be regionprops, which in this regionprops will divide the image into nine frames. If the condition is not met a number of nine frames eating will be done image retrieval and done once again regionprops. If the condition is fulfilled in the form of nine pieces of egg frame, followed by image conversion from RGB format (Red Green Blue) to Grayscale. It aims to facilitate thresholding. After the image conversion, continued with thresholding on every 9 frames of the egg image with the threshold value of the value to be analyzed. The output of this stage is the determination of the condition of each egg embryo image by comparing it to the pixel value. If the pixel value of the image is between zero to six hundred, then the condition of the egg in a fertile state (there is an embryo). If the pixel value of the image is between six hundred to ten thousand, then the condition of the egg in a state of damaged. And if the pixel value of the image is above ten thousand, then the egg is not fertilized (no embryo).

After the identification process, the diaggap process has been completed. Subsequent filtering of eggs that have been identified damaged or non-fertile.

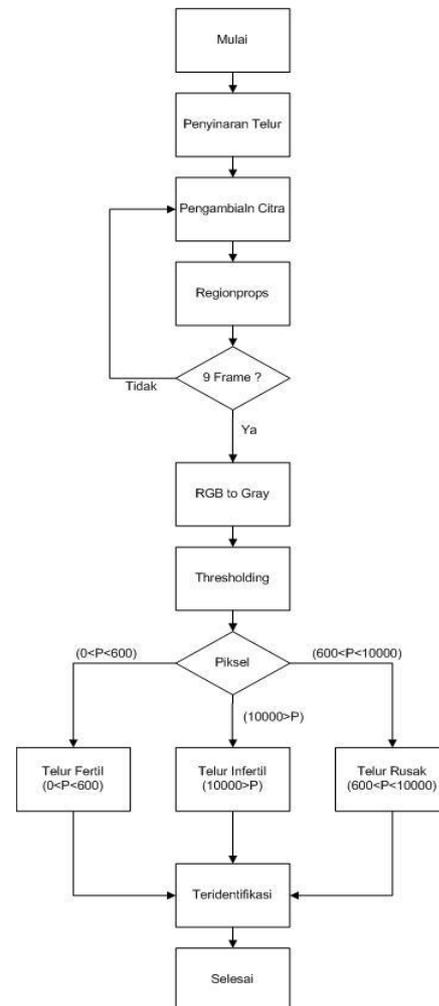


Fig 1: Diagram Block Of Egg Detector with Image Processing

##### 4.2 Temperature PID Control System

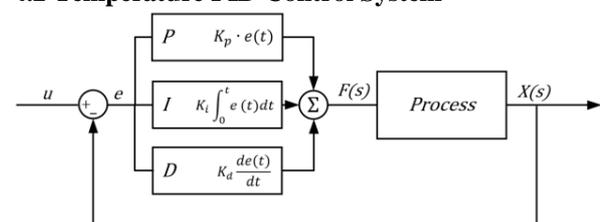


Fig 2: Diagram Block of PID Controller

Figure 2 above is a diagram block of PID Controller. PID control system (Proportional Integral Derivative) is a digital control system that has high precision on an instrumentation system with the characteristics of feedback from the system. PID control system has been widely used in the

industrial world. This PID controller will give a signal to the actuator that is caused by the amount of error value from the feedback.

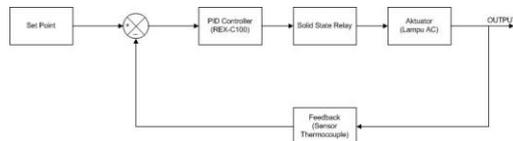


Fig 3: Diagram Block of Rex C-100

Figure 3 above is a diagram block of REX C-100. The beginning process of it start from giving the set point value. After that the controller will be processed by comparing the read values of the K type thermocouple sensor. After comparison, an error value will be generated. The error value will be processed by the PID controller and generate a signal to the actuator, which will be determined how long the actuator should work. And the process continues continuously or what is called a closed control system.

## 5. SYSTEM DEVELOPMENT

### 5.1 Tools And Equipment

The main equipment used in this final project is as follows:

- a. Led Module SMD 3535  
Led Module SMD 3535 will be used to irradiate eggs in the process of egg embryo detection. Led has a power of 95LM / LED with a power of 1.5 watts. There are 9 led that will be attached to the embryo detection kit
- b. Webcam Logitech C310  
Webcam Logitech c310 will be used to take pictures of the egg embryo
- c. Arduino Uno  
Arduino Uno is used as humidity control and humidity room temperature display.
- d. Ultrasonic Mist  
Ultrasonic is used as an actuator for moisture control to improve the humidity of the room
- e. PID Controller REX C-100  
Rex C100 is a PID control Temperature used to increase the room temperature
- f. K-Type Thermocouple  
The K type thermocouple is used as a feedback / temperature sensor used by the rex C-100 PID controller
- g. DHT22  
The DHT 22 sensor is used as a feedback / humidity sensor used by the Humidity On-Off control system
- h. Egg Tr The egg rack module is used to rotate egg rotation by 45 degrees. This egg rack player uses an AC moto rack Turner

### 5.2 Mechanical Design

In the mechanical design, the tool is made 55 x 45 x 50 cm. The mechanical design of this tool is divided into 2 parts namely egg hatcher and track turner that is designed using Solidwork software. The material of making electronic panel box made of iron plate and in it there is acrylic attached to the box panel as a place of electronic devices that is Arduino mega, and other modules supporting electronic. The reason for choosing acrylic material because of light material and avoid short circuit.

### 5.3 Electronic Design

In electronic design it's divided into 2 main parts and 2 supporting parts. The main circuit in this research is the temperature control circuit, and the humidity control circuit. While the support circuit there is a LCD and DHT22 sensor circuit.

### 5.4 Controller Design

In the design of temperature control, the dht22 sensor is used to extract the temperature change graph data generated by the REX-C100 module and the data will be connected to Matlab. So that temperature signal readings can be made in graphical form. To connect DHT22 sensor with Matlab, assisted with arduino mega controller which pin used is analog and digital input / output pin. The program is connected to matlab to display the temperature change graph.

Connection between arduino and matlab is assisted with simulink facility found in matlab.

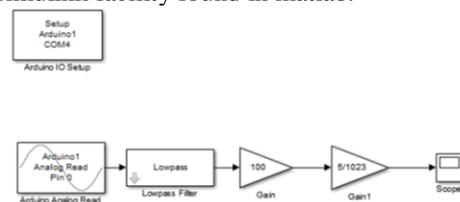


Fig 6: Simulink Diagram of temperature Interface with MATLAB

Figure 6 above is a block diagram of Simulink matlab which Arduino IO setup is enabled to connect arduino with matlab. Then the read analog block is enabled to read analog pins of arduino mega. Block lowpass filter is used to filter read analog readings to avoid noise. The Gain 100 block is used to change the value value from 0.01V to 1 degree celcius. The gain block 5/1023 is used to convert the read analog read value from 0-1023 bit to 0-5 volt voltage. The scope block is used to display the temperature change graph that occurs in the egg hatcher room.

### 5.5 Program Design

The design of the program in this case using 2 software namely Arduino Ide and Matlab. Arduino Idea is used for humidity control and temperature display programs. While matlab used as digital image processing as well as screen HMI / SCADA by using MATLAB GUI. Programming Flow begins by turning on the control of temperature and humidity. After the egg has been heated up to 4 days, just done detection of egg embryo quality. Detection of egg embryo quality begins with irradiation of eggs. Then start shooting. Shooting is the first step to start image processing. Furthermore setting the scale or size of the image, this is done to facilitate the image processing. Next is the process of mapping each egg into 9 images on each egg. Then the process of image constraint from RGB to Grayscale. This is done to facilitate image processing by thresholding method. After that the process of degrees degrees into a binary color between "0" for black and "1" for white. After the object is inseparable from its background, it is followed by the pixel count of the object. After that can be determined the condition of each egg.

## 6. EXPERIMENTAL RESULTS

### 6.1 Mechanical Preparation of Eggs Hatching Machine



Fig 7: Mechanic Realization

Figure 7 above is the progress of machine tool Hatcher egg made of aluminum frame and coated by plywood. There are 2 bulb lamps of 20W which serves to heat the room. Until now the progress of mechanical manufacture has reached 70%. In the egg hatch machine there are 2 first room heating room and the second is the electrical room. The turning system is 45 degrees.

### 6.2 Mechanical Preparation of Eggs Embryo Detector



Fig 8: Mechanical Progress of Led Module

Figure 8 above is the mechanical preparation of egg embryo detector. To do the detection we use a led module smd which is enough to irradiate the egg so it can take the picture of the embryo. The base used comes from black foam which has a function to hold the egg from falling and close the gap of light that will come out so that the light is focused on the egg alone.

### 6.3 Electronic Preparation of Temperature PID Controller



Fig 9: PID Controller Rex c-100 Testing

Figure 9 above is the trial of PID REX C-100 Controller.. When the module is set to 38 degrees Celsius then the output will give a signal to the ssr relay so that the light will illuminate the room up to the desired temperature.

### 6.4 Program Preparation of Egg Embryo Quality Detector

In the egg embryo quality detection system, MATLAB software is used. There are 2 kinds of methods used are method of Thresholding and Method of Regionprops.

#### 6.4.1 Thresholding an egg embryo

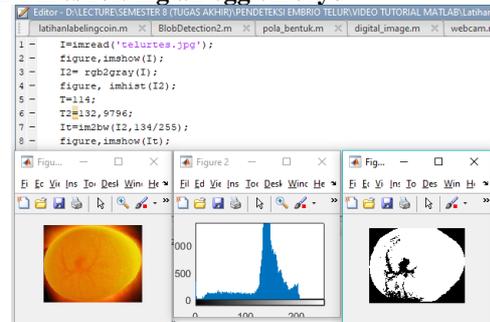


Fig 10: Program progress of Embryo Detector Using Threshold

Program progress made to detect the quality of egg embryo has reached 60%. Still needed refinement of the program by way of tereus to experiment until the threshold value obtained stable

### 6.6.2 Regionprops Method

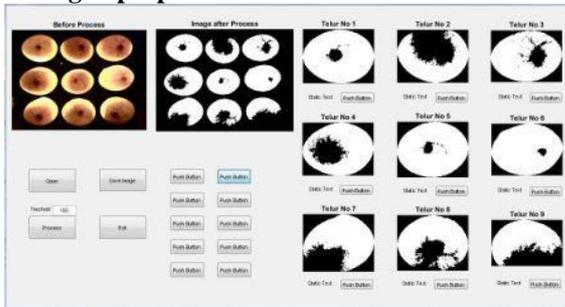


Fig 11: Regionprops Method of Object Labeling

The method of regionprops is used to divide 1 image with 9 eggs into 9 part drawings. So it can facilitate MATLAB software to detect every egg of all the eggs that are photographed. Until now the progress of the regionprops program has reached 50%.

### 7. CONCLUSIONS AND SUGGESTIONS

Based on the test results of testing each tool and program, we can concluded that:

Module Rex C100 PID Controller Has been successfully has been tried as expected. The output of the C100 rex module is a DC voltage signal that will be tranfered to the solid state relay. On solidstate relay they convert from DC voltage into AC voltage. The output of the solidsate relay gives a voltage signal to the lamp so that the lamp can heat the room up to a specified temperature

The aluminum frame and plywood layers are enough to build an egg hatch machine. The results is the egg hatch machine has a lighter weight than the egg hatch machine in general.

Ultrasonic Mist can provide moisture with the help of fan to distribute the moisture. So that's two tools used to keep the humidity in room that controlled by Arduino Uno with On-Off control system.

Thresholding method is good enough to detect the quality of egg embryo. A good average thresholding value is around 132 -134. This is done by trial several times.

The method of Regionprops is good enough to break up 1 picture into 9 pieces by dividing it by the width and circumference of every 9 eggs obtained from the webcam.

### 8. THANKS EXPRESSION

Thank goodness and Alhamdulillah always the writer pray to the presence of Allah SWT. who have the privilege and gift of all the great pleasures, both favors faith, health and strength in the preparation of this paper. Salawat and sallam are always poured to Sayyidina Muhammad SAW. For that the writer would like to say to:

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