SMART POULTRY FARM IN SRI LANKA USING IOT

22_23-J 35

Individual Project Proposal Report

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B.Sc. (Hons) Degree in Information Technology specialization in Information Technology

Department of Information Technology

Sri Lanka Institute of Information Technology SriLanka

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DECLARATION, COPYRIGHT STATEMENT AND THE STATEMENT OF THE SUPERVISOR

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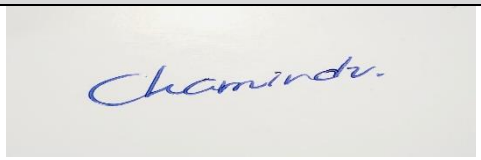
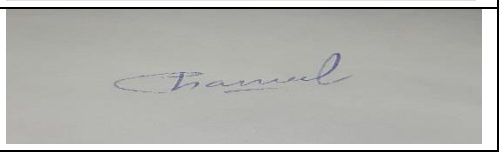
Madushan M.A.C	IT19960128	
Ananda A.M.S.C	IT19958484	
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The supervisor/s should certify the proposal report with the following declaration.

The above candidates are carrying out research for the undergraduate Dissertation under my supervision.

Signature of the supervisor: Date: 14.10.2022

ABSTRACT

In Poultry farm is a very important part of the whole farming that way you can get different products eggs, meat.

Here we are talking about solutions to several problems in egg production, a farm owner is better aware of the fact that during egg production in the poultry farm, the place where the Egg boxes inside the chicken farm should be safe otherwise it will Other animals may come and destroy it.

Even if the eggs are damaged, the farm owner has to face a huge problem in releasing them to the market.

Therefore, we have to protect the egg chamber at the right time

As we have analyzed, chicken farm owners are currently doing this method in a normal way

That is, coming from time to time to check the stalls and check if it's fine or not, some kind of poultry farms not doing it just keeping egg boxes as it's. So as we have analyzed this is a very expensive mode of operation. Then farmers not focused this as much.

The reason is that coming and checking from time to time can be seen as a waste of the employee's time,

As a solution to this, this method that I am going is to check whether there is unauthorized animal in the box and notify the farm owner or worker about it.

I hope to establish this system into poultry farms in Sri Lanka.

In my research part I focused on that future detection of unauthorized animal in the egg box and notify to the owner.

With using the image taken by the installed camera. I will Use some existing images data to image processing and machine learning algorithms and my own algorithm to detect animal in that part.

By using image processing, neural network, deep learning and classification technologies we can observe Authorized animal. And prevent when captured unauthorized animal in the box.

After done analyzing, can identify situation inside an egg box.

Keywords: deep learning, convolutional neural network, computer vision system, poultry farming

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

1.1 BACKGROUND

A poultry farm can be very useful if it can be set up to work efficiently. Many businesses have already stopped because of the current decline in production and the rising cost of animal feed. But with this method, we are trying to reduce the organizational cost to some extent and create a system to increase the convenience of employees.

So, although there is a great demand for eggs in Sri Lanka, the demand has decreased due to the increase in the price of animal feed and also unit of price may increase, we have to keep eggs safety. Another huge problem is the contribution to these products is also significantly lower, as shown in the following data [1].

Table 3. Comparison of Layer Sector for 2019 - 2021

Item	Unit	2019	2020	Change (2019-2020)	2021 est*	Expected Growth 2021
Parent Farms	Number	10	12			
Layer Parent Imports	Number	94,811	101,700	7%	103,301	2%
Layer DOC Production	Million	8.09	10.55	30%	10.93	4%
Layer DOC Issues	Million	7.98	10.44	31%		
Egg Production	Million	2,630.74	2,435.96	-7%	3,180.80	31%
Exports						
Table Eggs	Million	9.33	2.58	-72%		
Pullet DOC	Million	0.015	0.012	-20%		

Table 1.1 Total contribution of poultry farm

When we are study in relevant background fields we found out key data on the poultry farming year 2020 -2021

As we analyzed we can get idea layer faming contribution and production was goes down. Above diagram evident about that.

The main purpose of the image processing is to transform an image into digital form and perform certain operations on it in order to obtain specific models or to extract useful information from the image. Then device can understand the object and convert it in to another medium for further processing [2].

Computer vision is the ability of computers to extract information and insights from images and videos. With neural networks, computers can distinguish and recognize images similar to humans. Computer vision has several applications, such as

- Visual recognition in self-driving cars so they can recognize road signs and other road users

- Content moderation to automatically remove unsafe or inappropriate content from image and video archives
- Facial recognition to identify faces and recognize attributes like open eyes, glasses, and facial hair
- Image labeling to identify brand logos, clothing, safety gear, and other image details

Neural networks have several use cases across many industries, such as the following:

- Medical diagnosis by medical image classification
- Targeted marketing by social network filtering and behavioral data analysis
- Financial predictions by processing historical data of financial instruments
- Electrical load and energy demand forecasting
- Process and quality control
- Chemical compound identification

There in this mechanism called as neural networks,

Many of the techniques of digital image processing, or digital picture processing as it often was called, were developed in the 1960s, at Bell Laboratories, the Jet Propulsion Laboratory, Massachusetts Institute of Technology, University of Maryland, and a few other research facilities, with application to satellite imagery, wire-photo standards conversion, medical imaging, videophone, character recognition, and photograph enhancement. It has improved a lot since then.

Challenges faced in image processing are high occlusion, large changes in pose, lighting and background clutter.

In 2015 a research was carried out in Department of BCA and Software System Sri Krishna arts and science college, Coimbatore.

This was aimed to object recognized navigating system and observation System [1]. So they have used tracking techniques like region based, active contour based, etc. with their good and bad aspects , Their goal was to monitoring a scene to detect suspicious activities.

In the research paper they have given few phases that they have covered phases like,

- human identification based on gait
- automatic object detection
- monitoring a scene to detect suspicious activities

1.2 Literature Survey

1.2.1 Wild animal identify and counting

In 2017 the Department of Computer Science university of Wyoming, Harvard, Cambridge. They has been carried out to create an image recognition system in the domain of wild animal identify and counting, they did this for an analyze animal behavior and collect such data most accurately. To do this they used neural networks, deep learning, and classification [3].

They have trained deep convolutional neural network to identify count and describe the behavior of 48 species in the 3.2 million image snapshots.

They are certified the system identifying animal with > 93.8% accuracy. And their system can automate animal identification for 99.3% of the data while still performing at the same 96.6% accuracy as that of crowd sourced teams of human volunteers, saving >8.4 y (i.e., >17,000 h at 40 h/wk.) of human labeling effort on this 3.2 million-image dataset. Those efficiency gains highlight the importance of using deep neural networks to automate data extraction from camera-trap images, reducing a roadblock for this widely used technology. Our results suggest that deep learning could enable the inexpensive, unobtrusive, high-volume, and even real-time collection of a wealth of information about vast numbers of animals in the wild

1.2.2 Neural networks based computer Vision system in animal farming

Research paper that was published in 2021 at Department of agriculture and biological engineering, Mississippi State university that's was been done in the neural networks based computer Vision system in animal farming.

They have to target identification animals and their category and their used five deep learning computer vision tasks like image classification, object detection semantic/instance segmentation, pose estimation, and tracking. Cattle, sheep/goats, pigs, and poultry were the major farm animal species of concern. In this research, and they are main focused to develop systems have been increase to improve animal management, but current knowledge, practices, limitations, and solutions of the applications remain to be expanded and explored[4].

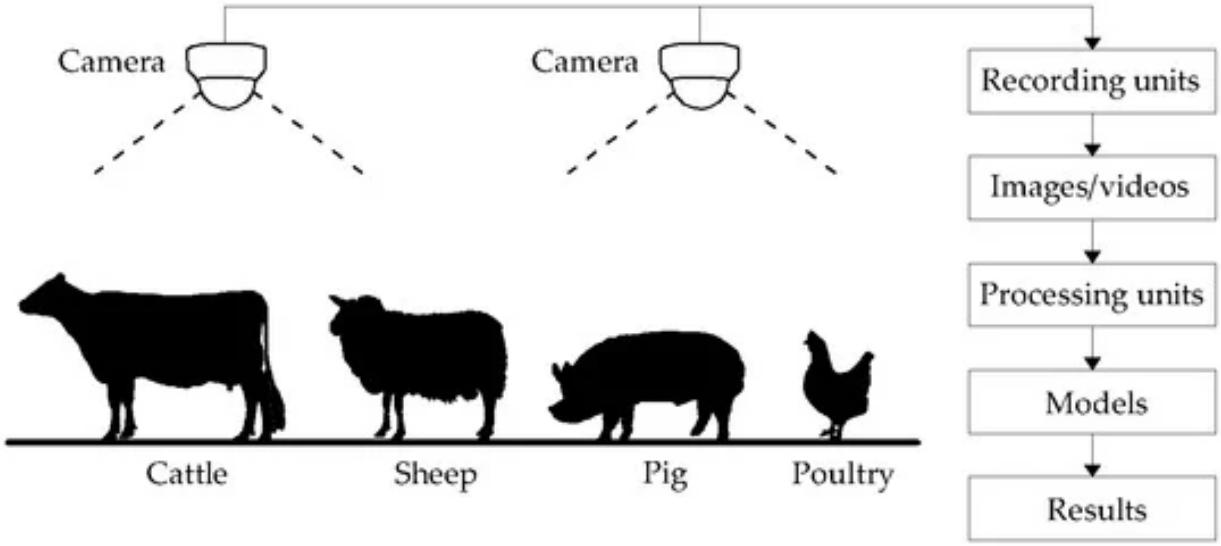

Figure 1.2.1 Diagram for image detection

1.2.3 Object recognition system to solve the problem

Research paper that was published in state university of Telecommunication, Ukraine. Their key aim was developing an object recognition system to solve the problem

In order to do that they are used object detection methods, and object describe equations to identify objects. Since the object (1), (2) is excited by a random external action, the estimate of the vector of its unknown parameters will be a random variable. This value should have the properties of unbiasedness, consistency, efficiency, and sufficiency. The purpose of object identification (1), (2) is to determine estimates of its parameters.

And also there used algorithm of the Correlation Identification Method, Passing to the solution of equations, they replace the upper limit in the integral by a finite number.

General idea was recognition process control algorithm is The considered concepts and definitions make it possible to construct an algorithm for the recognition process in the form of a rule of the sequential search for solutions, which ensures the development of an optimal plan for conducting experiments. The meaning of such an algorithm is that, based on the prehistory of experimentation, as well as on the basis of information obtained as a result of previous experiments, it determines the optimal plan for further experiments [5],

1.2.4 Object detection and tracking System for an identifying and tracking the objects,

In 2016 International Journal of Engineering Research & Technology (IJERT) was published Object detection and tracking System for an identifying and tracking the objects, there are some different ones methods of representation objects

That captured data Divide further into a frame. And, the sequel, Frames are usually closely related. Frames are played. Their used this detection objects and background subtraction and tracking methods [6].

1.2.5 Object recognition is to describe a collection of related computer vision tasks

In 2019 University of Georgia was published Object detection identification system

That was Object recognition is to describe a collection of related computer vision tasks that involve activities like identifying objects in digital photographs. Image classification involves activities such as predicting the class of one object in an image. Object localization is refers to identifying the location of one or more objects in an image and drawing an abounding box around their extent. Object detection does the work of combines these two tasks and localizes and classifies one or more objects in an image. When a user or practitioner refers to the term “object recognition“, they often mean “object detection“. It may be challenging for beginners to distinguish between different related computer visions tasks [7].

And also we are visited some of poultry farms and got much information about what kind of thing farmers are expecting ， what is the current situation and what kind of thing they are facing current situation .

In firstly I visited to see poultry farm in Matara district, it’s called Dilshan Poultry farm, in there I found out many of issues their facing so one of section I focused to safe eggs inside a poultry farm, the main issue was they have to keep eye on egg chamber, because if some animal came inside a farm we he need to come to farm and check then have to protect eggs. This is one of big issue every poultry famers have to face,

Figure1.2.2: survey for small farms

As we can see there is lot of issue when we are maintaining poultry farms, but this one is small one so they not expecting much as automated farming. According to the situation they are currently not using any automated farm system to protect them.

Another one o visited Hanwalla poultry farm, it was in Colombo district that was medium farm, like they are maintain more than 1000 hens , so when I visited to that farm I identifying the same problem , and also owner requirement also to build system to protect egg chamber,

For the keep farm safety their already using some gates and mechanical tools to that farm, so biggest challenge was safe egg chamber,

Figure: 1.2.3 Survay large farm

According to this evident we can clearly identify we should keep safe egg chamber is important,

And we are called and got phone interviews some poultry farms and they also required these kind of solution for implement poultry farms, then their works can be easy.

For this I proposed to system automatic detecting and inform system to implement poultry farm.so when we are implement this we can give successful solutions to poultry farmers

1.3 Research Gap

According to the literature survey above conducted it is evident that domain specific object identifying system for a poultry farm in a much needed implementation science only few researches has been done targeting that. Up to now in the researchers that was conducted under domain specific object detection we can see that they have follow domains.

- Traffic detection domain
- Animal categorizing domain
- Animal deceases recognition
- Object tracking and monitoring Suspicious activity
- Vehicle detection system

Today most of mobile devices also included this technology call object identification. Like a Google lenses, Live capture for I phones. But even sometimes they may fails when identifying the domain specific detection. According to the literature survey we can certified that not giving much accurate when specific domain identifying. Following given table depicts the feature of currently done researchers and proposed research.

Application Reference	Efficiency identification	Solution for low light situation	Highly response time	Technology (using CNN)	Mobile application
Research A[3]	No	No	No	Yes	No
Research B[4]	Yes	No	No	Yes	No
Research C[5]	Yes	Yes	No	No	No
Research D[6]	No	No	No	No	No
Research E[7]	Yes	No	Yes	Yes	Yes
Proposed System	Yes	Yes	Yes	Yes	Yes

Table 1.3.1: comparison between my parts of the existing projects

1.4 Research Problem

According to Sri Lanka Department of Census and statics (2015 - 2017) it has shown us to overall contribution of poultry farming

Annexure II

Key Data on the Poultry Industry (2020-2021)

Activity	2020	2021	Growth (%)
1. Procurement of Grand Parent and Parent stock			
Grand Parent Stock (Broiler)	30,792	30,052	-2.4
Parent Stock ('000)			
Broiler	1,396.70	1,511.60	8.2
Layer	101.70	91.82	-9.7
2. Production of Day - Old Chicks (Mn)			
Broiler	159.78	176.94	10.7
Layer	10.55	10.14	-3.8

Table1.4.1: data on the poultry industry

And here we are focusing on the egg farmers that statics also we can see the production outcome goes down, and following figures shows us to lot of farmers not like to do traditional poultry farming because of the current problems and limited time. But most like to go with automated farming, and their very satisfying with new functionalities.

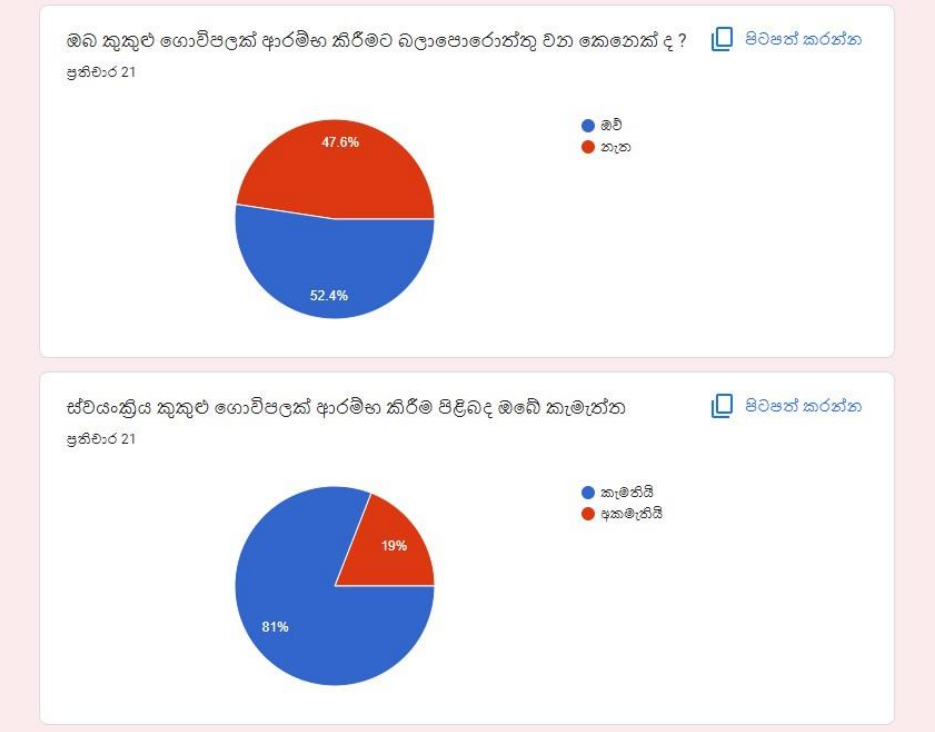

Figure 1. 4 survey response (Google analysis form)

And there is what kind of issues may face during poultry farming and what about current status we are analyzed from the Google form survey.

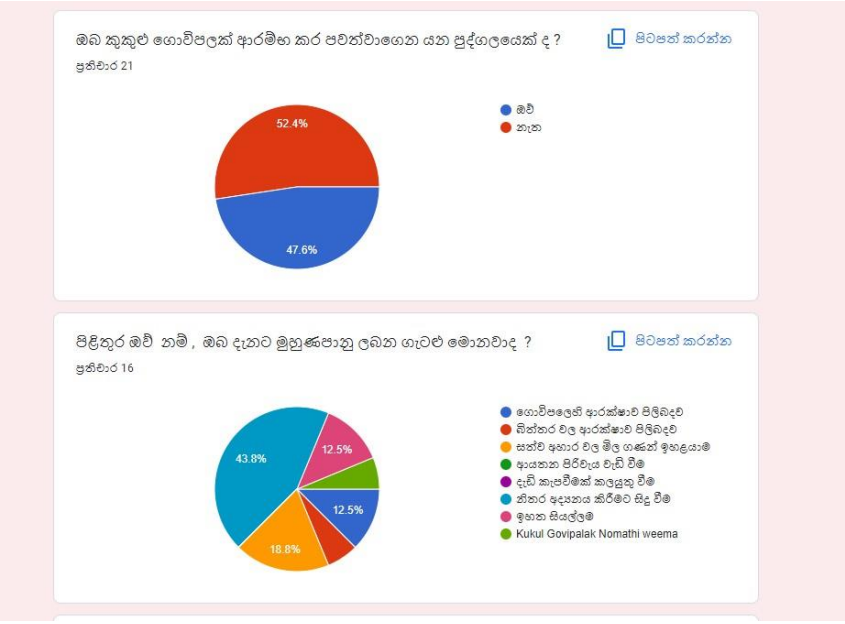

Figure 1. 5 survey response (Google analysis form)

So when we do this implementation these are correct and system issues like this should be done with more accurate output.

- How to identify unauthorized animals most accurately
- How to classify captured images
- How to track objects within low light situation
- How to identify unauthorized animal within minimum amount of time
- How to notify owner through mobile application
- How to do overall process within minimum time

2. OBJECTIVE

2.1 Main objective

In our research primary objective is to giving an automatic solution for the common issues face by farmers who use poultry farms to improve the quality of product and service using Iot based technology.

The part from the proposed system is ability to secure product outcomes 24 hrs. And speedup production time and system can able to without human interaction through mobile application and also giving business predictions to make dictions, Elderly people also can use this system because many automatic processes are performed in this system.

Also, as we have studied, the young people do not resort to these kinds of production activities due to the lack of technical facilities available to them. But our mobile application can consider this as a remote control if the system and continue the production.

2.2 Specific objectives

- Collection of image data set to compare for authorized animal detection

  There is a chamber inside a poultry farm, as we are analyzed we have to keep safe that chamber. Because some kind of animal can enter to the chamber and then eggs may can damaged. Or else they can destroyed it. So we have to identify actually who is inside a box accurately.

- If an unauthorized animal is identified, notify the owner of poultry farm

  After identifying an animal and identifying those animals as Authorized animals, we will deal with it in some way

  The establishment must notify the owner or employee. Therefore, if an animal is Unauthorized Have to notify through mobile phone application, the owner or employee of the establishment should be notified in a short period of time.

- Train the model captured image data collection will be used.
- Images will be collected that are related to unauthorized animal to poultry farming.

- When detect unauthorized object , notify owner through mobile application

3 .METHODOLOGY

After having some session with our supervisor and co supervisor, we are finalized the unauthorized animal detection system requirements were identified for the component. Background and literature survey was done in domain specific object recognition area to find out about certain similar implementations that has been done by the scholar's world wide as it is evident in the literature survey that has not been done a specific poultry farming object detection system in the poultry farming to protect egg chamber.

Following requirements were identifying for the projects

- Identify authorized animals and objects most accurately
- Classified captured images
- Recognition images within low light situations
- Identify unauthorized objects within minimum time period
- Notify owner through mobile application
- Have to do overall process within minimum time period

Our overall research is including several platforms, in this part basically user can see the mobile application. But components of the applications handled by the system, specially the using algorithms neural networks. Basically it's detecting objects and informing when unauthorized objects tracked, also that informing when client running the application in their mobile.

3.1 System Architecture

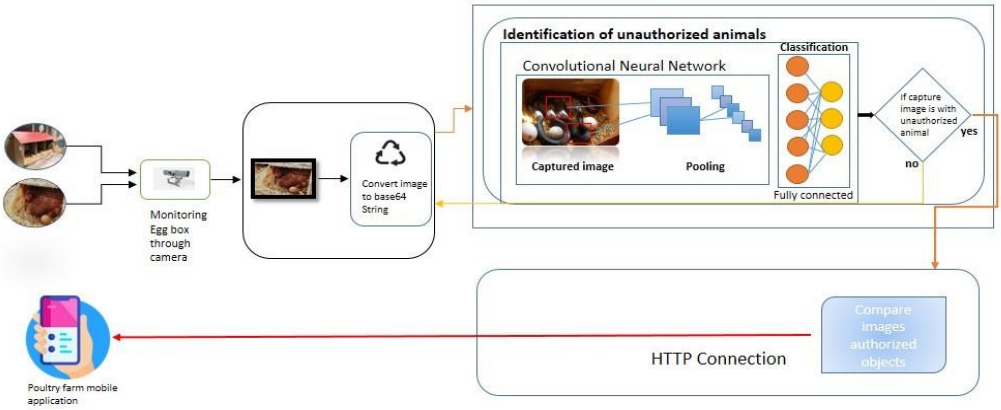

Figure 3.1.1**:** *High level system architecture*

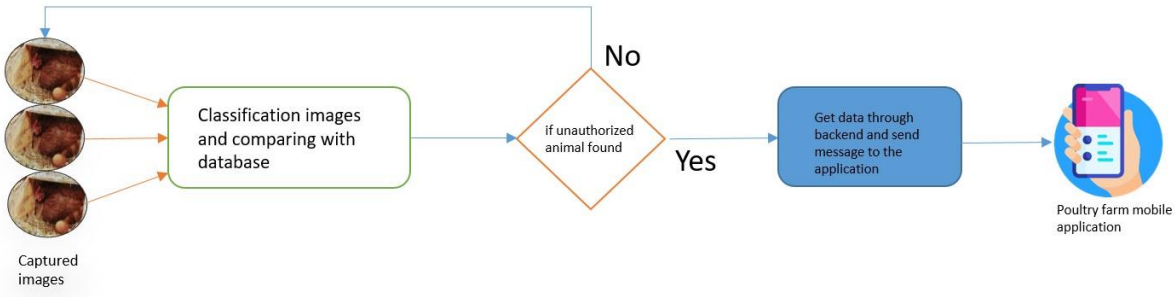

Figure 3.1.2: High level system architecture for the individual component

Yolo framework in one of the most popular framework to object detection and identification. Since their community saying Yolo it's a supremely fast and accurate framework, and their using various algorithm and predict bounding boxes implementation of Faster –RCNN in python

The biggest advantage of using YOLO its superb speed, its incredible fast and can process 45 frames per second .Yolo also understand generalized object representation.

3.2 Research Area

According to this feature, need to follow some machine learning techniques, image processing frameworks and techniques, like object detection identification neural networks , and when we are implementing we have to use several algorithms some of are my own algorithms and some are existing algorithms in the system.

3.3 Requirement Gathering and Analyzing

Requirement gathering is a most important part for the research as well as my part. In specially, I must be very careful about the information I collect, because in doing this kind of research, the opinions and needs of the organization owner / service owner are very important. It should also match to the research Area. And should be given right things to that area.

- Read research papers and reports according to my part
- Studying similar projects and survey farms and focus existing systems
- Go and meet poultry farm owner and gathering requirements

3.4 Design

After completion of requirement gathering, we will focus to design phase, so in the design phase we can specify hardware and software also the system requirements and help to design overall system architecture in the design phase. There is a collection of specific needs and set of specific requirements in system design architecture. We can design a perfect system in design phase through these needs and requirements. So then

design phase is most important part in the waterfall model to design a good output also good System.

3.5 Tools and Technologies

I will plan to implement this part using image processing, using python and open CV and YOLO Framework.im going to use mainly Yolo framework because it's very powerful and speedup, then I hope to develop backend using node.js to implementing with the mobile application integrated with databases and integrated ML Algorithm with the backend.

And also to as technologies for a build mobile application we are going to use flutter framework, so then we can design our app attractively.

As well as we going to use visual studio code, pycharm, android studio as an ide's I hope to develop mobile application for my research. Visual studio code is the best text editor to develop all mobile applications. We use flutter, node and python as the development languages .The summarize list of our tools and technologies shown as follow,

Tools

Visual Studio code

Jupiter notebook

MongoDB

Firebase

Pycharm

Android Studio

Technologies

Python

Node js

Flutter

Tensor Flow

Open CV

Keras

YOLO

3.6 Implementation

Implementation is the process converting the design into a working System. So we are Separate it to small sub parts and build and develop Separately like an object capturing part , Machine learning part , detection part , Checking part etc. . After done each level, its transfer to the testing section to process of testing to verify and validate is the system is working perfectly. And the whole part is going covered by using those processes.

I used normal camera to capture image from the poultry egg chamber and suppose to use opencv, Yolo technology. Then the YOLO algorithm can use to image classification and identification.

And I suppose to use flutter framework for the build mobile application part. And tools and plugins and also libraries, and also while implementation we are going to plan use mongoDB or firebase for the application, Algorithms are created in python language using Jupiter notebook.

3.7 Testing

Testing is a very important part when overall system implementation is working correctly, there is some kind of testing types we have to do , testing Is basically starting from the begin point. Life cycle method will proceed until the finish of life cycle and will be proceed until the finish each of part. When we are doing testing there is software testing and device testing, as a functional testing will go with each component tested. Nonfunctional will be done verify the framework while doing functional testing.

3.8 Gantt Chart

Table 3.8.1: Gannt Chart

4. DESCRIPTION OF PERSONAL AND FACILITIES

Member	Component	Task
Madushan M.A.C	unauthorized Animal detecting and inform system	1.implemet device to capture egg chamber 2.Track the object is authorized or not 3.Train the model 4.Implement the mobile application for my part 5.Implement mobile application function to notify egg chamber status

Table 4: description of personal and facilities

5. BUDGET

Resources	**Price**
Travelling cost	8000
Education survey cost	3000
Internet	2500
Stationery	2000
Documentation and print cost	2000
mechanical implemantationpart	15000
Sensors implementation	20000
TOTAL	**52500**

Table 5.1: Estimated budget for the system

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