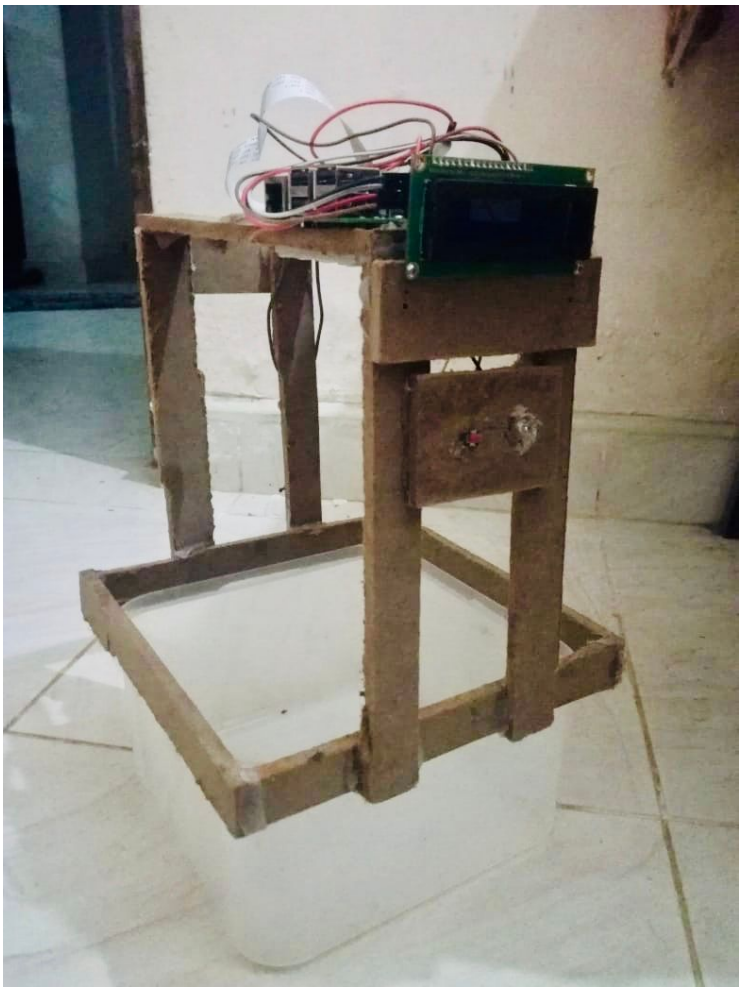
Intelligent Fish Counting System



Automation Challenge 2
August 2018 - December 2018
<u>Group Members</u>

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1.Introduction

In a fish breeding farm counting fish is one of the main activities and it is done manually.Since they need to count around 20,000 fish a day, It is a very hard and time taking task. Therefore automating this task is really helpful in that industry. They can count fish very accurately and efficiently with an automated fish counting system which can be operated easily. Then the regular work in the farm will be less time consuming and can win customer's trust by sending the required number of fishes accurately.

So that We focused on building an automated fish counting system which is capable of capturing an image of the artificial tank from the above once a new batch of fish arrived in the tank and counting the number of fish in it. As batches of fish arrived the count of the particular batch is updated and the total count so far is incremented. And both of these counts are displayed to the user.

2.Field Visit and Survey

Date of survey was 20th September 2018 and the location of survey was Horana fish breeding farm. Farm is supposed to export 45000 fish in a week and all these fish was counted and sorted (gender) manually using man power without a proper procedure. Fish is breeded on 5 x 5 ft tanks (Figure 2.1). They export around 15 types of fish which have different kind of needs and specifications. Figure 2.2 and Figure 2.3 show two species of fish.The process is very long and tedious often with human errors.Main areas in this process that needs automation is Fish Counting Process, Fish Gender Sorting Process and Fish Monitoring Process. All these three areas are done using manual labour. Also these three covers the most importants aspects of the process.As fish are very sensitive to changes specials are to be used in the process. And fish have different behaviours which should be accounted for. Also the as the breeded in darker places lighting conditions are very poor and the surrounding is wet damp lights used. But their lighting is very poor and unreliable.

Figure 2.1

Figure 2.2

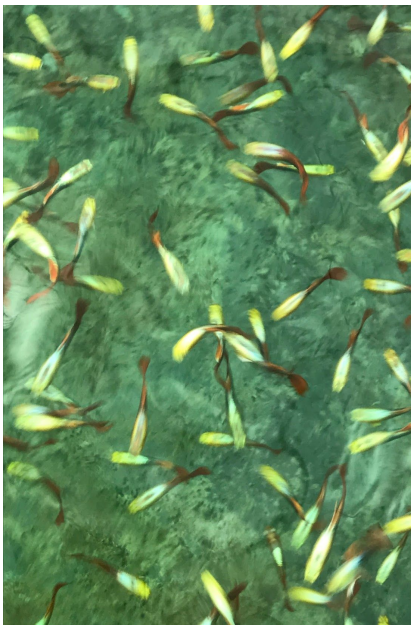


Figure 2.3

3.Project Description

With the inspiration of the manual fish counting process of the fish breeding farm, We decided to design a tank with white walls into which the batch of fish are added as Figure 3.1. An image of the the batch of fish is taken from the above with a camera placed above the tank as shown in below pictures. That image will be sent to the Raspberry pi which is attached to the system(Figure 3.2) and the number of fish in the image is counted using an object detection algorithm which is trained using thousands of different fish images. The count is displayed with the display to the user.(Figure 3.1)

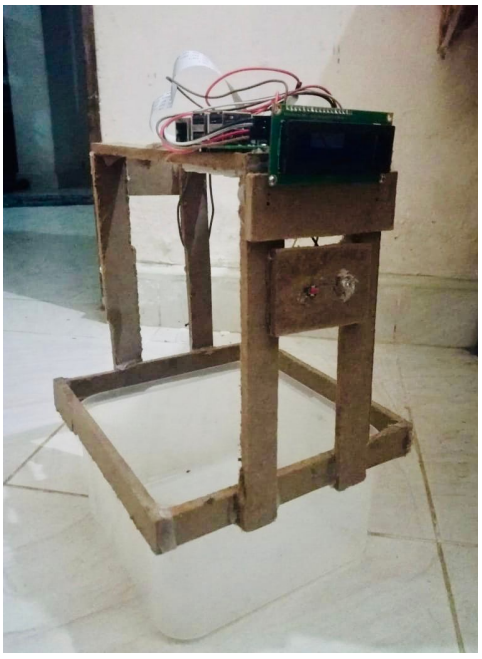


Figure 3.1

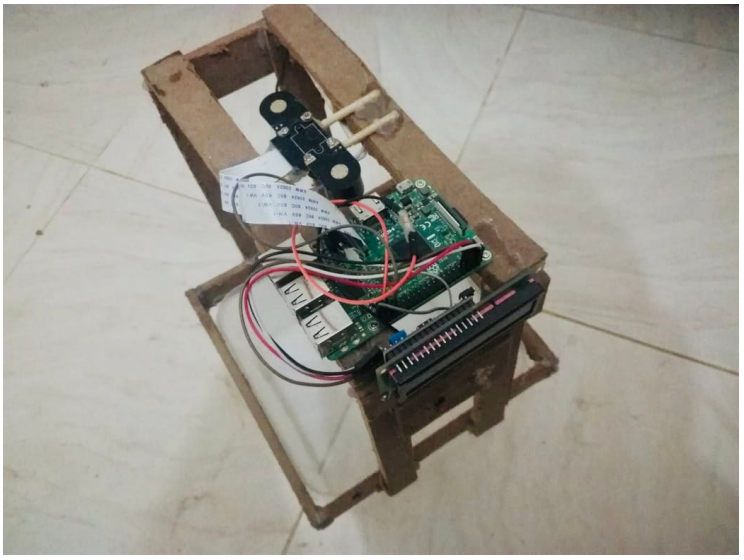


Figure 3.2

4.Project Design

4.1. Project Requirements

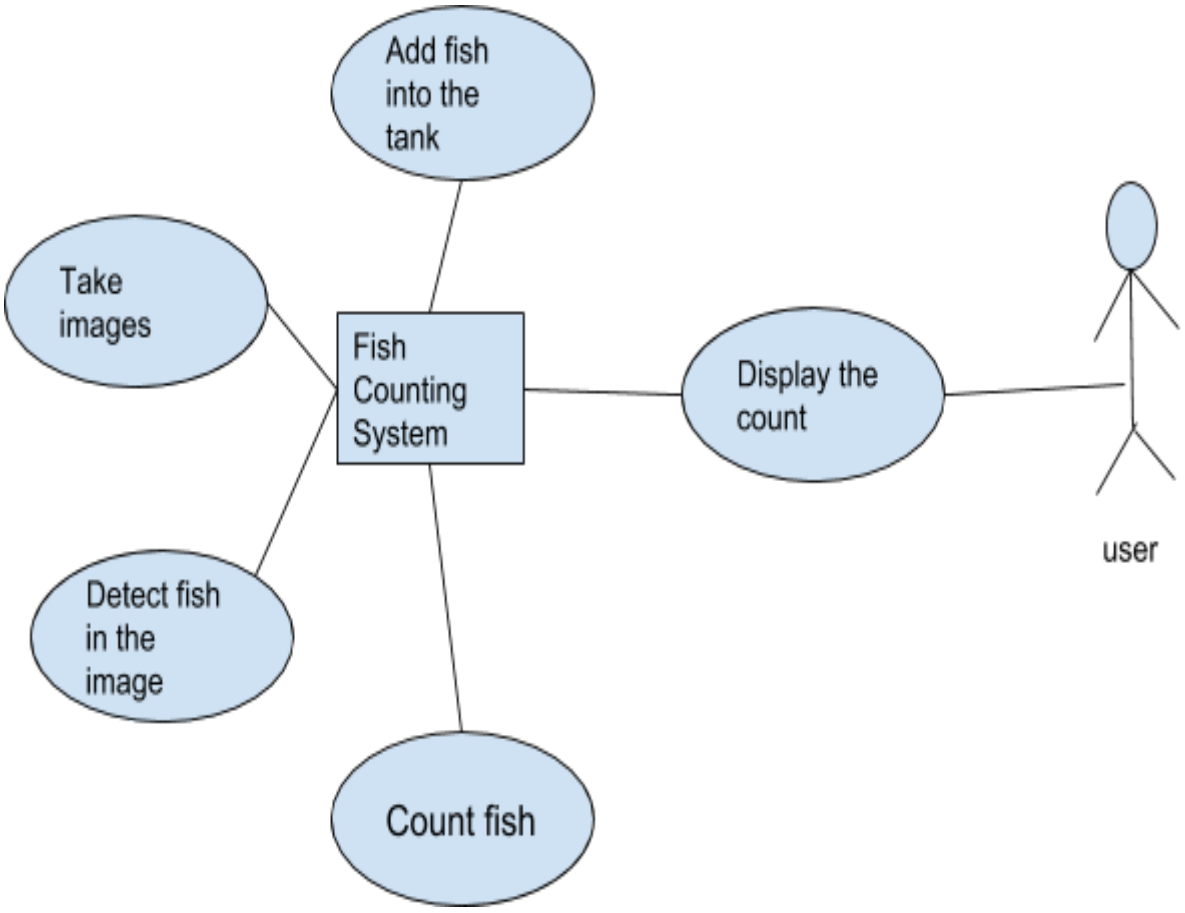
4.1.1 Functional Requirements

- Ability to take images of tank with fishes
- Ability to detect all the fishes in the image
- Ability count the number of fishes in each image.
- Ability to add and remove fish from the tank automatically
- Ability to display the fish count to the user

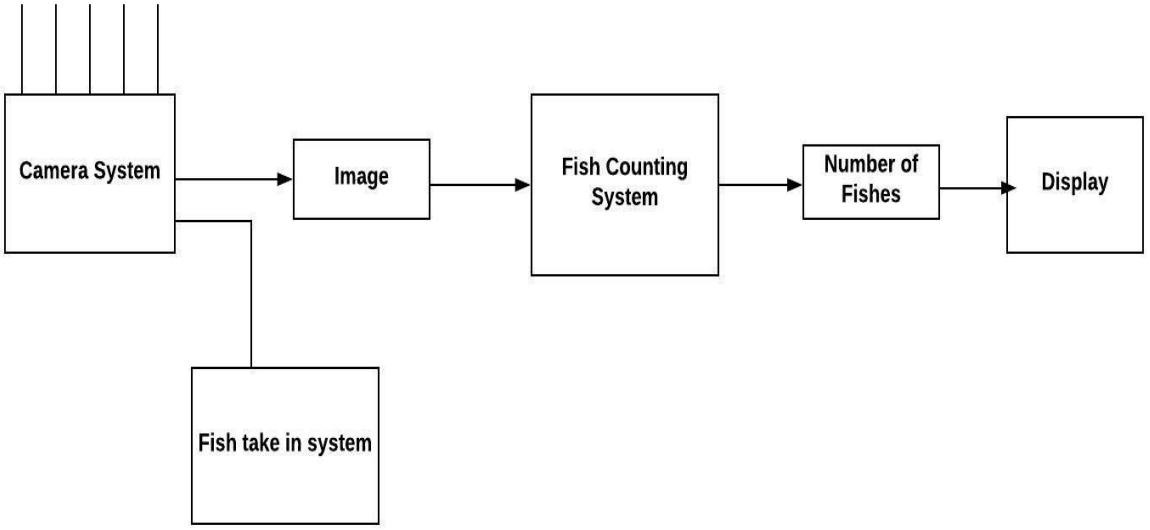
4.1.2. Non- Functional Requirements

- The method that is used should not be harmful for fish
- Image that taken should be high quality
- System should affordable for the wet environment

4.2.Use Case Diagram



4.3.Block Diagram and Module Description



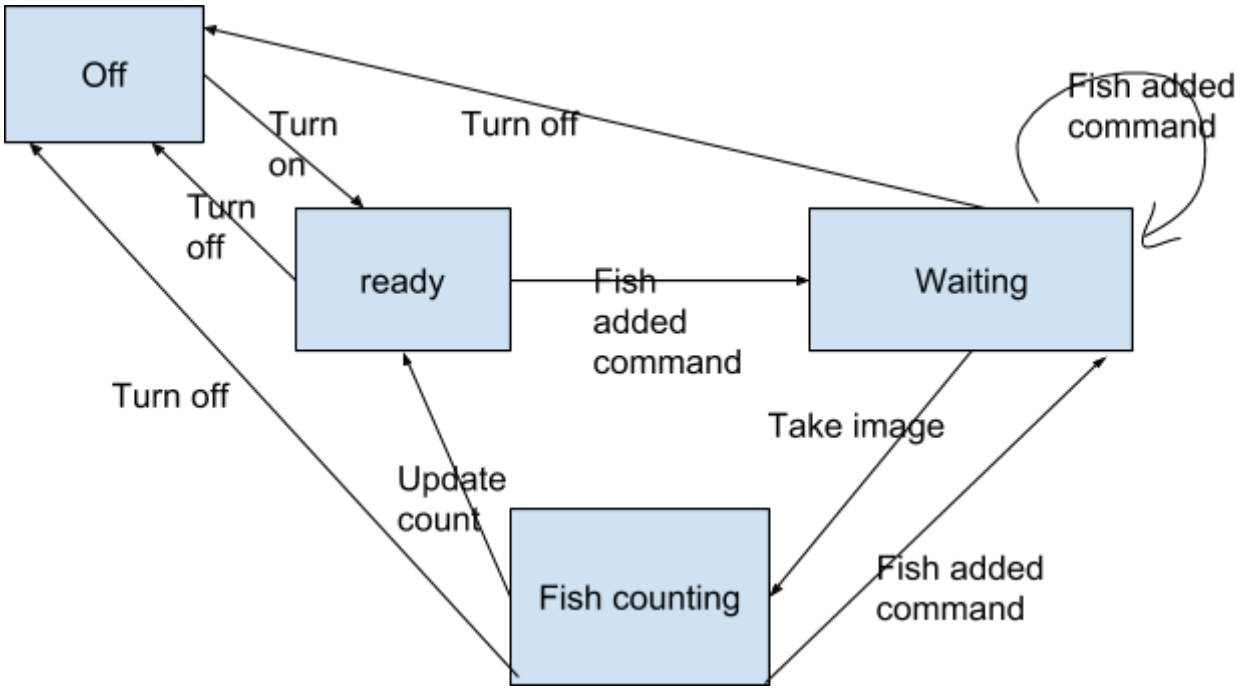
- **Fish Take in System**
  It is a small tank to where batch of fish to be counted is placed. We used a white colour small for easiness of image processing and fish detection.

- **Camera System**
  This module is used to take the image of batch of fish that should be counted and placed inside the tank. It consists of one camera

- **Fish Counting System**
  This module is used to detect all the fish in the camera image and count them. It consists of a Raspberry Pi which is programmed with a trained object detection algorithm.

- **Display**
  This module is used to display the fish count of the batch and the total count to human user.

4.4. State Chart



4.5 Hardware and Software used

Hardware

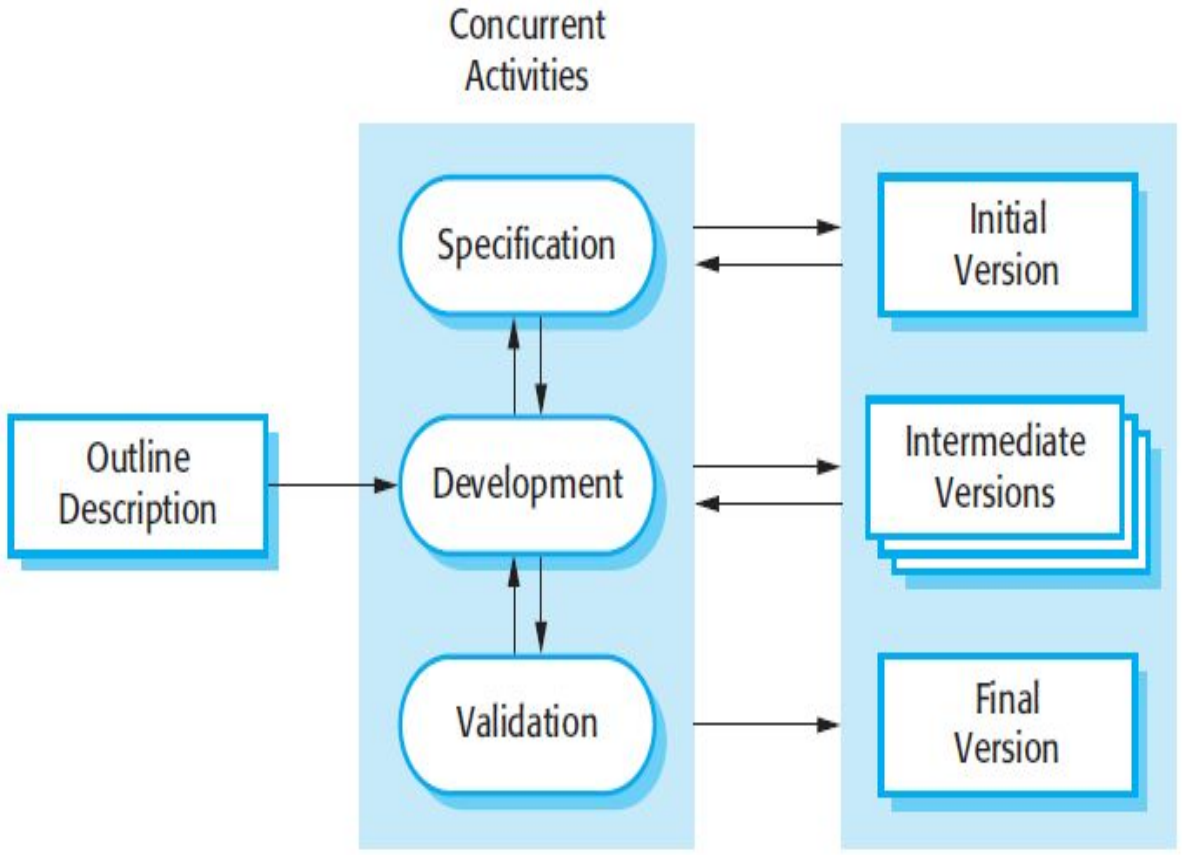
1.Raspberry Pi - For computaion and image processing
2.Camera - For taking images for image processing
3.Display - To give a count for the user
4.Button - "Start" button for start calculating
5.Bucket - As a controlled environment for image capturing of fish

Software

1.Python
2.Tensorflow - for training and implementing the object detection model
3.Labelimg - for labeling images for training
4.Protos - for creating xml files from images
5.Mobilenet Model – model used for training
6.Tensorflow Object Detection API

5.Process

Incremental development process model was used in order to be able to accommodate requirement changes with minimum effort. Because of the requirement changes of the customer and requirement changes due to resources and time insufficiency our decision about process model was reasonable. In this way we conducted system specification , development and validation concurrently.



6.Project Risks and Risk Management

Risk	Probability	Seriousness	Risk Management Strategy
Reusable software components cannot be reused as planned.	moderate	serious	Replace those components with components implemented by ourselves.
Group members are ill or in other problems and members become unavailable	high	catastrophic	Reorganize the team so that there is more overlap of work and members understand each others' work.
Software tools cannot work together	moderate	tolerable	
XML files of images for training become incompatible with the software.	high	serious	Prepare few XML files first and check the compatibility.
Changes to requirements require major design rework.	moderate	serious	Use incremental development and get feedback from the customer regularly.
Time to develop the system is underestimated.	high	Serios	Increase the working hours of the members and use high level libraries more.
Images used to train the algorithm is different from the actual camera images.	high	Serious	Train the algorithm with camera images as well.

7.Conclusion

This project reached the state-of-the-art Intelligent Fish Counting System which is enable to count around 1-5 fish more or less accurately. Accuracy was limited due to the quality difference between images used to train the algorithm(taken by mobile phone camera) and the actual system camera images.

8.Schedule and Tasks by Members

Task	Effort(days)	Duration (days)	Dependency
1.Surveying about the industry and system requirements	63	21	
2.Designing the system	42	14	1
3.Implementing the fish detection code	84	28	2
4.Preparing the training set	14	14	2
5. Preparing the fish take in system	14	14	2
6.Training the algorithm and programming the Raspberry Pi and assembling hardware	3	3	3,4,5,7
7.Building the display	21	21	2

3rd of september to 28th November

Starting date of the week	10/9	17/9	24/9	1/10	8/10	15/10	22/10	29/10	5/11	12/11	19/11	26/11
Chiranthana												
Melonie												
Uditha												

References

- Rapid object detection with boosted cascade of simple features/ P. Viola ; M. Jones//ieeexplore.ieee.org/abstract/document/990517