Misr International University
جامعة مصر الدولية

iFISH FARM

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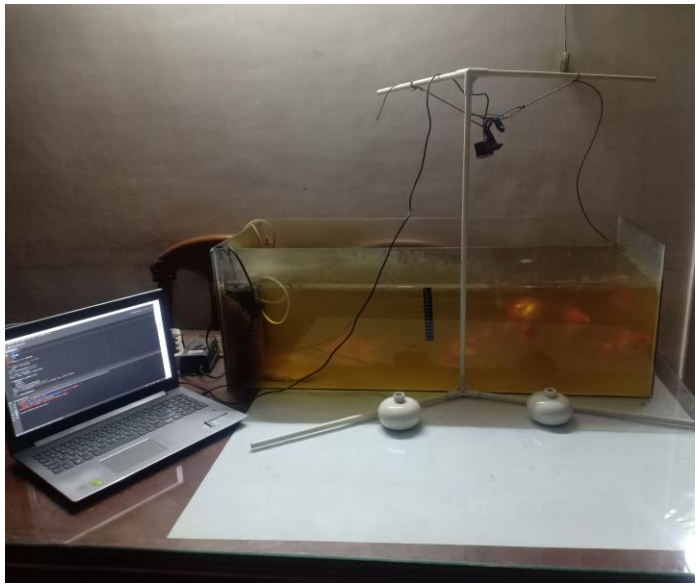
Introduction

- **Different tasks in fish farms:**
  - Tracking Fish.
  - Water quality monitoring. (Ammonia level detection)
  - Anomalies insides pond (Size, Speed, ..etc)

- We built our own fish tank to observe fish during the 24/7.

- UN Sustainable Development Goals



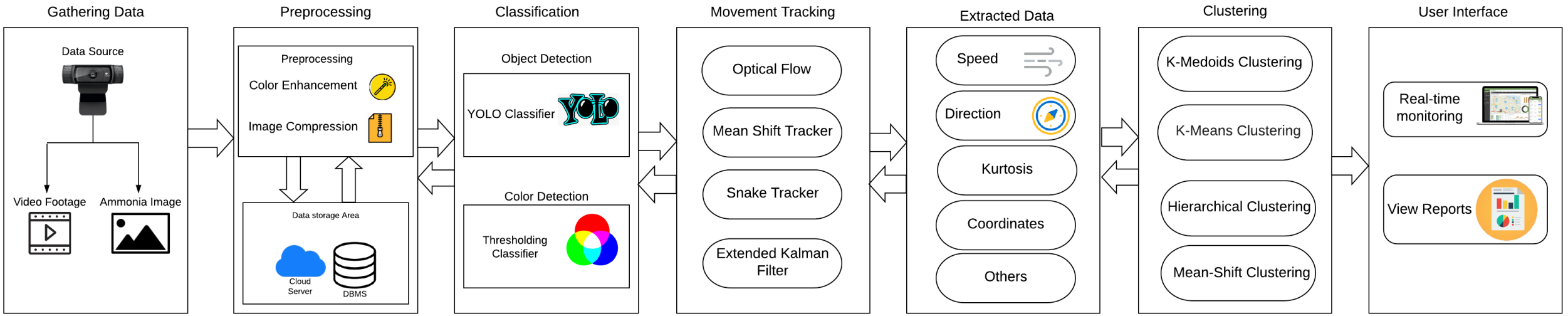
- Our Fish Tank

http://documents.worldbank.org/curated/en/458631468152376668/pdf/831770WP0P11260ES003000Fish0to02030.pdf

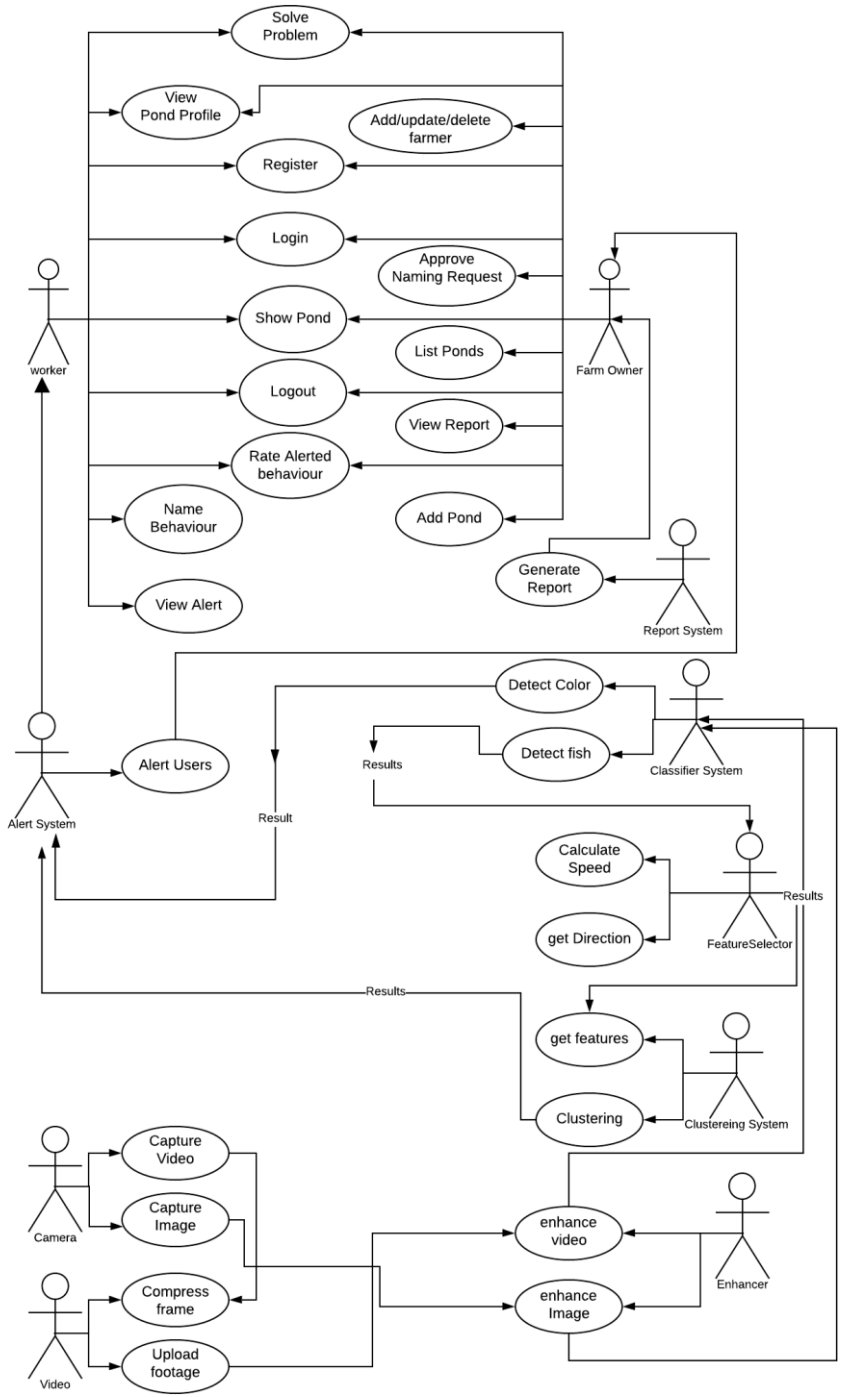
Problem Definition

Enhancing the classification accuracy of fish behavior under difficult water conditions by improving the water visual through image processing techniques, and providing real-time feedback on water quality through web and mobile applications.

Block Diagram



Use Case Diagram



Main Functional Requirement

Function ID: FR6

Title	Clustering
Description	This function takes 2D array of features that contains the selected features needed so we can apply clustering algorithms to split data to different clusters according to fish behaviors.
Action	It takes an 2d array of features to cluster behaviors. The array of features should not be null. If null, the function will break and return nothing. Else, it will apply k-medoids to cluster the data.
Input	2D array of features.
Output	String with the Nearest Cluster.
Precondition	Features should be extracted and put into 2D array .
Post-condition	Alert for abnormal behavior.
Dependencies	FR17
Priority	10/10

Non-Functional Requirements 1/2

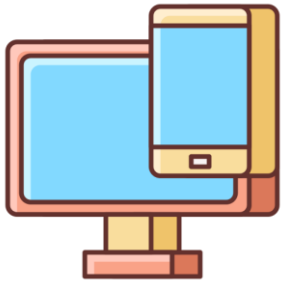
Reliability

- Speed: Providing real-time notifications on any abnormal behavior in the pond.
- Accuracy: Should be nearly 90% in clustering the type of each anomaly in the fish pond.
- For speed, we compress each video frame to enhance the speed (FR20). For Accuracy, we apply different clustering algorithms to ensure system accuracy (FR6).

Usability

- The system will be easy to use and learned as fish farmers are usually unfamiliar with modern technologies.
- Nielsen's heuristics will be applied to ensure a simple and easy interface. A usability study is to be conducted with the client to get feedback and improve the usability.

Non-Functional Requirements 2/2



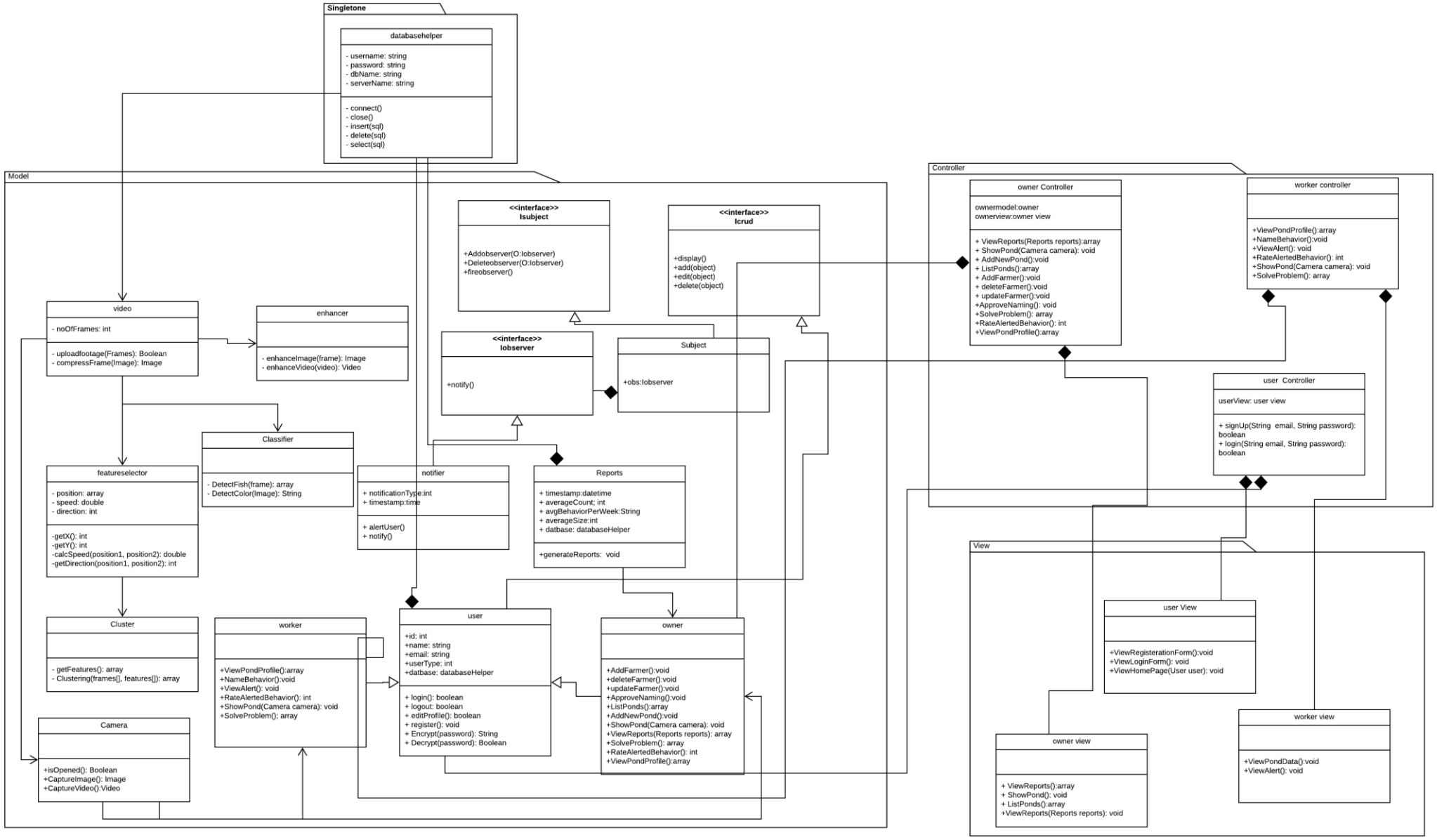
Portability

- This feature is applied by implementing a responsive website that allows users to access the system on any web browser from any device.

Maintainability

- (MVC) design pattern along other design patterns are applied to make sure the system is flexible to improvements.
- (EAV) is implemented which allows the developers to easily apply new requirements.
- The system can be improved by letting the user label a new abnormal behavior which can improve the accuracy of the system.

Class Diagram



Methodology

- Get data from YOLO and Optical flow
- Calculated extra features from collected data
- Form feature array and normalize it
- Use K-medoids to cluster it and detect the pond behavior

	x	Y	Z	speed	Direction	x	Y	Z	speed	Direction	x	Y	Z	speed	Direction	x	Y	Z	speed	Direction
Frame 1																				
Frame 2																				
Frame 3																				
Frame 4																				

Color Enhancement Experiment

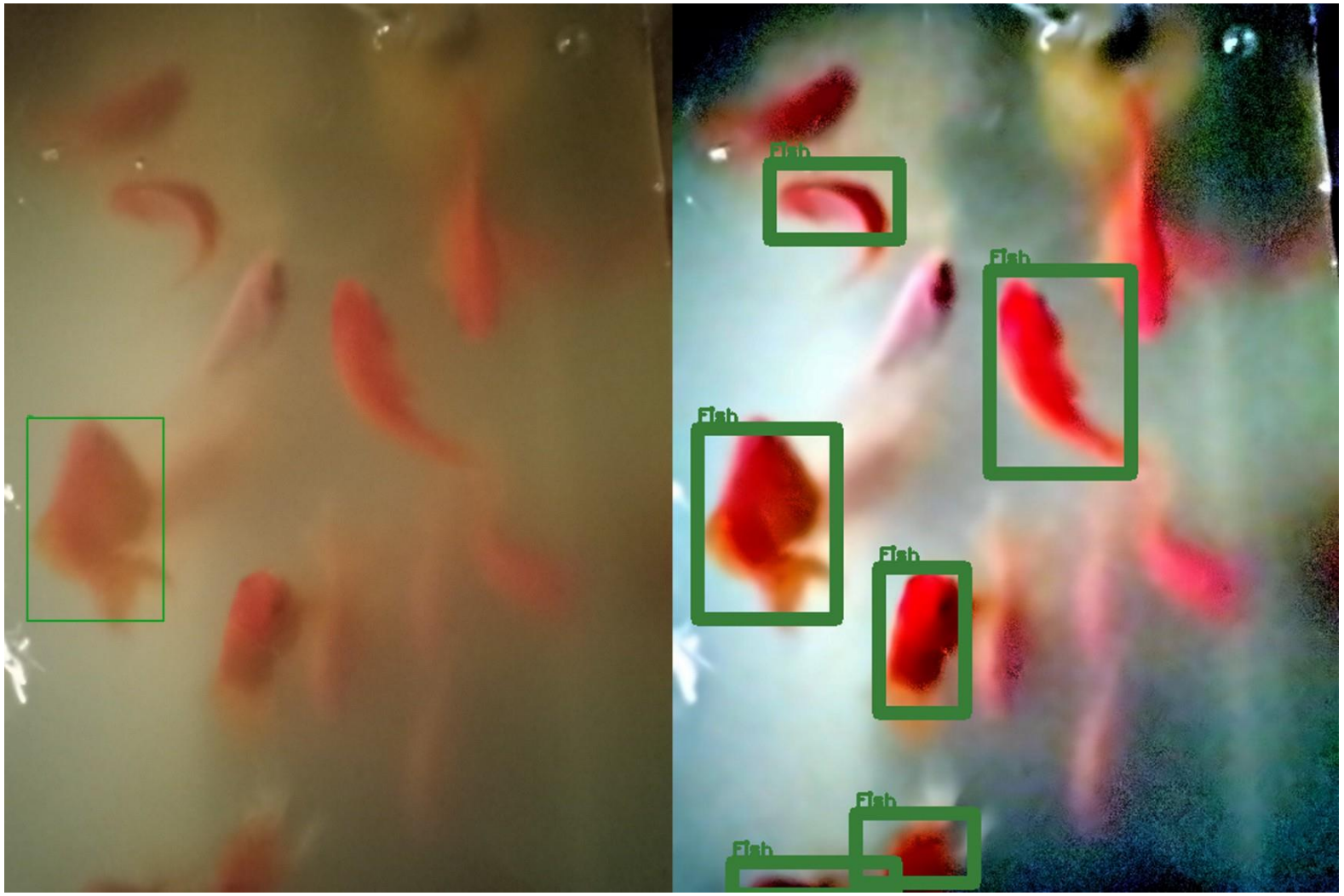
- **Objective:**

  Enhancing images in unclear water to increase the accuracy of fish detection.

- **Setup:**

  It was done in our fish tank where the water was unclear.

Color Enhancement Results



- Before Enhancement

- After Enhancement

Fish Tracking Experiment

- **Objective:**

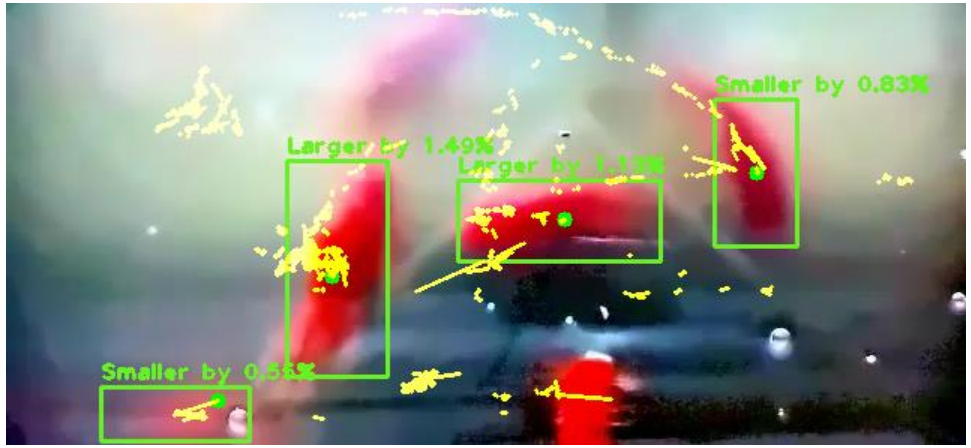
  Measuring the accuracy of tracking fish using optical flow with and without the combination with YOLO.

- **Setup:**

  We apply the tracking of fish trajectories on each video frame from the video footage we took from above the tank.

Fish Tracking Results

Results when using Optical Flow only



Results when using Optical Flow with YOLO

Paper Acceptance

We've submitted our paper to *The 11th International Conference on Ambient Systems, Networks and Technologies. April 6 - 9, 2020, Warsaw, Poland*
Our Paper was accepted and will be published by Elsevier Science.

ANT-2020 notification for paper 112

ANT-2020 <ant2020@easychair.org> 12:27 PM (29 minutes ago)
to me

Dear Omar Anas,

We are glad to inform you that your paper:

Paper ID: 112
Paper Title: MSR-YOLO: Method to Enhance Fish Detection and Tracking in Fish Farms
Authors: Omar Anas

has been accepted as a Full Paper at the 11th International Conference on Ambient Systems, Networks and Technologies (ANT-2020)

You should refer to the comments of the reviewers attached to this email to assist you in preparing the camera-ready for publication.

Please refer to (http://cs-conferences.acadiau.ca/ant-20/#cameraReadySubmissions) for preparing and submitting the Camera-ready copy of your paper (maximum 8 pages) for inclusion in the proceeding.

If you need assistance in the preparation of camera-ready copy, send an email to: cr.submit@gmail.com

If you need assistance in the registering your paper, send an email to: infor.regs@gmail.com

General information on conference venue, accommodation, conference program, registration, visa, etc. can be found at the conference web site at: http://cs-conferences.acadiau.ca/ant-20/

Please note that April 7, 2020 is the first day of the technical sessions; however, April 6, 2020 evening the registration at the front desk starts on.

Thank you and congratulations on the acceptance of your paper. We look forward to seeing you on April 6, 2020 in Warsaw, Poland.

Sincerely,
ANT 2020 Organizing Committee

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Paper Reviews

- We got the acceptance from all the 3 reviewers.
- Overall, the 3 reviewers said that the paper is well structured.

---------- REVIEW 2 ----------
SUBMISSION: 112
TITLE: MSR-YOLO: Method to Enhance Fish Detection and Tracking in Fish Farms
AUTHORS: Hussam Eldin Mohamed, Ali Fadl, Omar Anas, Youssef Wageeh, Noha Elmasry, Ayman Nabil and Ayman Atia

---------- Overall evaluation ----------
SCORE: 2 (accept)
----- TEXT:
The paper discusses the use of a new algorithm for image processing to detect and track fishes in fish swarms in unclear water environments. The authors make a good point in explaining and motivating the problem addressed. The introduction is nicely written.

The paper is well written and structured and methodologically sound. The related work section is good and the research contribution clearly motivated.

The actual work and contribution are clearly described, the algorithm is evaluated appropriately with an experimental setup.

- Review 2 comment

Demo

- Ammonia Paper Demo

- Optical Flow without YOLO

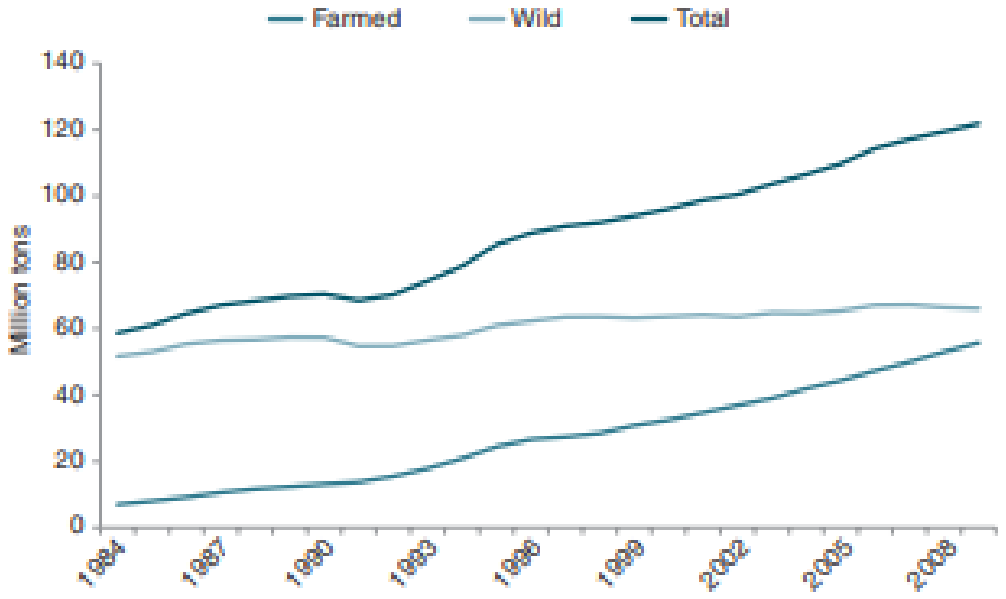
- Optical Flow with YOLO

Any Questions?

Thank You.

Appendix

FIGURE 1.2: Evolution of World Food Fish Production, 1984–2009



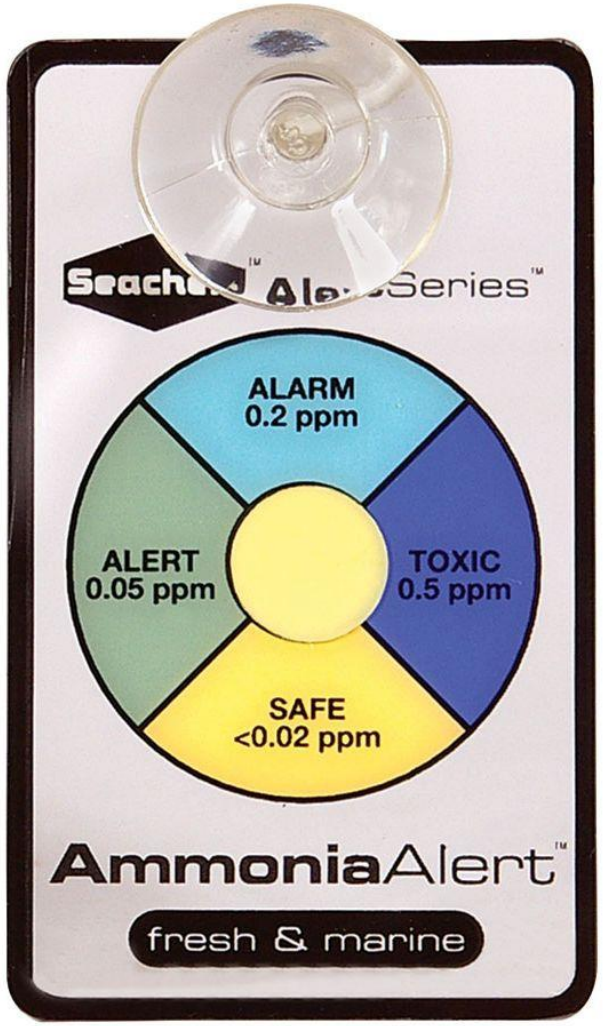
Source: FishStat.

TABLE E.1: Summary Results under Baseline Scenario (000 tons)

	TOTAL FISH SUPPLY		FOOD FISH CONSUMPTION	
	DATA 2008	PROJECTION 2030	DATA 2006	PROJECTION 2030
Capture	89,443	93,229	64,533	58,159
Aquaculture	52,843	93,612	47,164	93,612
Global total	142,285	186,842	111,697	151,771
Total broken down by region as follows				
ECA	14,564	15,796	16,290	16,735
NAM	6,064	6,472	8,151	10,674
LAC	17,427	21,829	5,246	5,200
EAP	3,724	3,956	3,866	2,943
CHN	49,224	68,950	35,291	57,361
JAP	4,912	4,702	7,485	7,447
SEA	20,009	29,092	14,623	19,327
SAR	6,815	9,975	4,940	9,331
IND	7,589	12,731	5,887	10,054
MNA	3,518	4,680	3,604	4,730
AFR	5,654	5,936	5,947	7,759
ROW	2,786	2,724	367	208

Source: IMPACT model projections.
Note: ECA = Europe and Central Asia; NAM = North America; LAC = Latin America and Caribbean; CHN = China; JAP = Japan; EAP = other East Asia and the Pacific; SEA = Southeast Asia; IND = India; SAR = other South Asia; MNA = Middle East and North Africa; AFR = Sub-Saharan Africa; ROW = rest of the world.

Appendix



- Ammonia Paper