



PROJECT REPORT

TITLE - VirtualEye - Life Guard for
Swimming Pools to Detect Active
Drowning

TEAM ID: PNT2022TMID42289

TEAM MEMBERS

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INTRODUCTION

PROJECT OVERVIEW:

VirtualEye - Life Guard For Swimming Pools To Detect Active Drowning

Swimming is one of the best exercises that helps people to reduce stress in this urban lifestyle. Swimming pools are found larger in number in hotels, and weekend tourist spots and barely people have them in their house backyard. Beginners, especially, often feel it difficult to breathe underwater which causes breathing trouble which in turn causes a drowning accident. Worldwide, drowning produces a higher rate of mortality without causing injury to children. Children under six of their age are found to be suffering the highest drowning mortality rates worldwide. Such kinds of deaths account for the third cause of unplanned death globally, with about 1.2 million cases yearly. To overcome this conflict, a meticulous system is to be implemented along the swimming pools to save human life.

By studying body movement patterns and connecting cameras to artificial intelligence (AI) systems we can devise an underwater pool safety system that reduces the risk of drowning. Usually, such systems can be developed by installing more than 16 cameras underwater and ceiling and analyzing the video feeds to detect any anomalies. but AS a POC we make use of one camera that streams the video underwater and analyses the position of swimmers to assess the probability of drowning, if it is higher then an alert will be generated to attract lifeguards' attention.

Note: The system is not designed to replace a lifeguard or other human monitor, but to act as an additional tool. “It helps the lifeguard to detect the underwater situation where they can’t easily observe.

LITERATURE SURVEY

EXISTING SOLUTION:

Literature Survey

S no	Title	Year	Author	Method / Approach
1	Automated Vision-based Surveillance System to Detect Drowning Incidents in Swimming Pools	2020	Abdel Ilah N. Alshbatat, Shamma Alhameli, Shamsa Almazrouei, Salama Alhameli, Wadhha Almarar	The system consists of a Raspberry Pi with the Raspbian operating system, a Pixy camera, an Arduino Nano board, stepper motors, an alarm system, and motor drivers. The proposed system is based on the color-based algorithm to position and rescue swimmers who are drowning. The device then sends an alarm to the lifeguards.
2	Computer Vision Enabled Drowning Detection System	2021	U. Handalage, N. Nikapotha, C. Subasinghe, T. Prasanga, T. Thilakarthna and D. Kasthurirathna	Using convolutional neural network (CNN) models, it can detect a drowning person in three stages (drowning detection, the rescuing drone, and the hazardous activity detection). Whenever such a situation like this is detected, the inflatable tube-mounted self-driven drone will go on a rescue mission, sounding an alarm to inform the nearby lifeguards.
3	Video Based Drowning Detection System	2021	Pavithra P, Nandini S, Nanthana A, Noor Tabreen Aslam, Praveen Kumar P	The proposed system structure here comprises of a Raspberry Pi (Single Board Computer) equipped with a USB camera for taking the live feed from the pool area. The system also covers the alerting phenomenon using a buzzer so that necessary actions are taken intermittently without any delay.
4	Deep Learning Used to Recognition Swimmers Drowning	2021	Jia-Xian Jian, Chuin-Mu Wang	Using image processing technology to introduce artificial intelligence motion technology, mounting the camera on the bottom of the swimming pool, and use OpenPose to mark the image joint point features, and input the captured joint point features into the recursive neural network to determine whether the swimmer is drowning.
5	Identification of Drowning Victims in Freshwater Bodies using Drift Prediction and Image Processing based on Deep Learning	2022	Anjana Unnikrishnan, Roshni A T, Anusha P R, Anju M Vinny, Anuraj CK	Using multiple sensor data in underwater human rescue detection system to spot drifting and drowning person in a natural water ecosystem. The water flow sensor which is attached to the portable device calculates the drift distance and tracks drowning person.

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- [3] Conde, Cristina, et al. "HoGG: Gabor and HoG-based human detection for surveillance in non-controlled environments." *Neurocomputing* 100 (2013): 19-30.
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- [5] Gudyś, Adam, et al. "Tracking people in video sequences by clustering feature motion paths." *Computer Vision and Graphics*. Springer International Publishing, 2014. 236-245.
- [6] Vezzani, Roberto, Davide Baltieri, and Rita Cucchiara. "People reidentification in surveillance and forensics: A survey." *ACM Computing Surveys (CSUR)* 46.2 (2013): 29.
- [7] Bierens, Joost, and Andrea Scapigliati. "Drowning in

swimming pools." Microchemical journal 113 (2014): 53-58.

[8] Zhang, Chi, Xiaoguang Li, and Fei Lei. "A Novel Camera-Based Drowning Detection Algorithm." Advances in Image and Graphics Technologies. Springer Berlin Heidelberg, 2015. 224-233.

[9] Fei, Lei, Wang Xueli, and Chen Dongsheng. "Drowning Detection Based on Background Subtraction." Embedded Software and Systems, 2009. ICCESS'09. International Conference on. IEEE, 2009.

[10] Kharrat, Mohamed, et al. "Near drowning pattern detection using neural network and pressure information measured at swimmer's head level." Proceedings of the Seventh ACM International Conference on Underwater Networks and Systems. ACM, 2012.

PROBLEM STATEMENT DEFINITION:

The person who is swimming in a pool needs to be rescued as soon as possible if he/she is drowning so that he/she does not die and swim without the fear of drowning.

5W's

Who does the problem affect?

The problem affects a lot of people than we think it does. It affects,

- The person who drowns loses his life.
- The person's kin and kith become traumatized by the loss of their loved one.
- The fellow swimmers who used to practice along with the person who drowned get their confidence and passion towards swimming lowered.

What is the issue?

Though Swimming is a healthy exercise and popular sport there is always a risk of people drowning. More than the fear of losing a swimming competition the fear of drowning affects a lot of people making them refrain from practicing.

When does the issue occur?

The issue may occur during the following scenarios:

- When a person learns swimming.
- When a person goes unconscious in a swimming pool.
- When a person gets exhausted in a swimming pool.

Where is the issue occurring?

The issue usually occurs in a swimming pool.

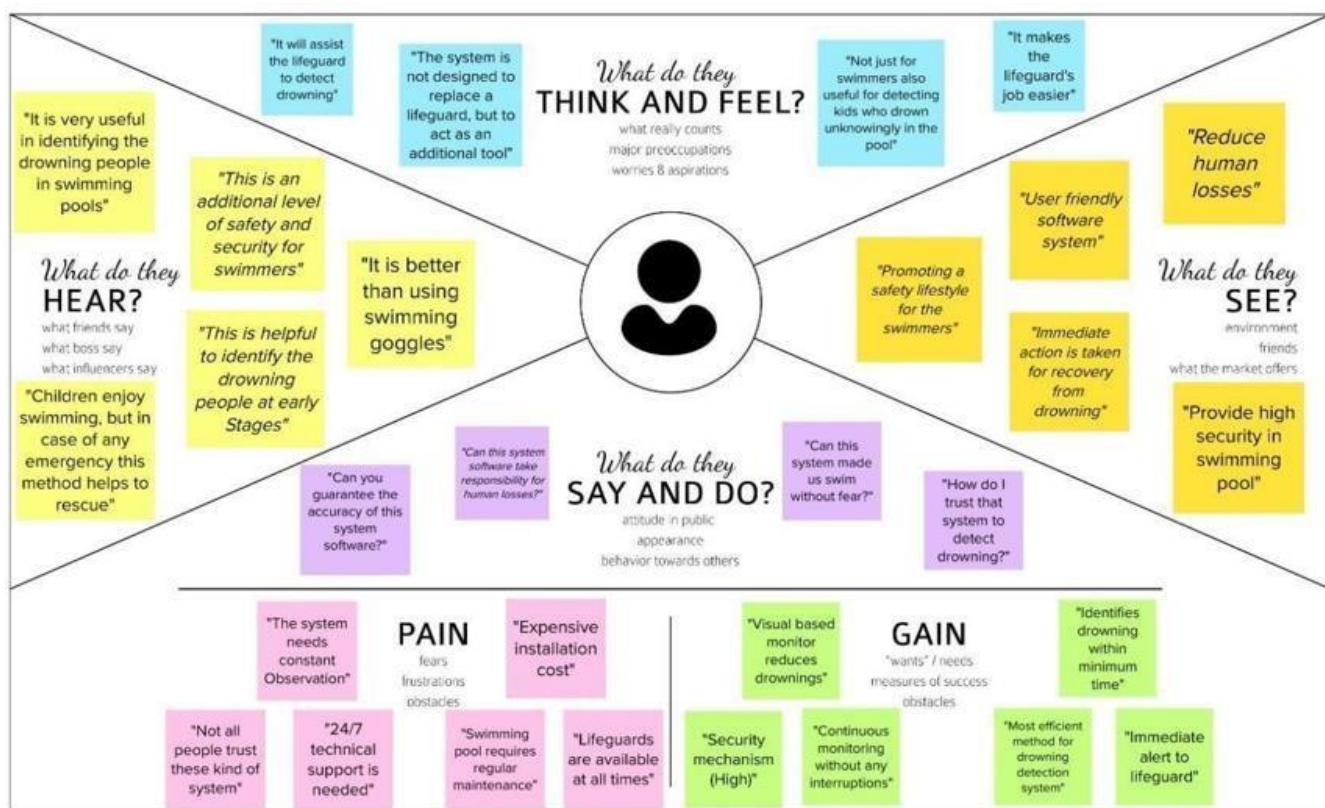
Why is it important that we fix the problem?

According to the U.S. Consumer Product Safety Commission, 390 deaths a year on average are attributed to drowning in a swimming pool. If we can fix this problem then it directly saves around 400 lives a year, this is why it is important.

IDEATION AND PROPOSED SOLUTION

EMPATHY MAP CANVAS:

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviours and attitudes. It is a useful tool to help teams better understand their users. Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.



IDEATION & BRAINSTORMING:

Brainstorming provides a free and open environment that encourages everyone within a team to participate in the creative thinking process that leads to problem solving. Prioritizing volume over value, out-of-the-box ideas are welcome and built upon, and all participants are encouraged to collaborate, helping each other develop a rich amount of creative solutions.

Use this template in your own brainstorming sessions so your team can unleash their imagination and start shaping concepts even if you're not sitting in the same room.

Step-1: Team Gathering, Collaboration and Select the Problem Statement.



VIRTUAL EYE

Brainstorm & idea prioritization

In this session we aim to achieve a good base for beginning our project. With clear understanding of the task in hand, the next step would be to collectively put in our thoughts/ imagination and end with a proper feasibility study.

Ground Rules

- Be Creative
- Rule out every possible ideas and improvements
- Make your points clear and purposeful
- Don't hesitate. (Every point is noteworthy)
- Arguments are good ALA it lands beneficial
- Have various perspectives towards the problem

1

Choose your best "How Might We" Questions

Share the top 5 brainstorm questions that you created and let the group determine where to begin by selecting one question to move forward with based on what seems to be the most promising for idea generation in the areas you are trying to impact.

⌚ 10 minutes

QUESTION 1

How might we detect and differentiate active drowning with the least possible error rate?

QUESTION 2

How might we automate the alert systems so as to provide crucial stats and info to the rescue team ?

QUESTION 3

How might we optimize the detection algorithm to yield results in the least time?

QUESTION 4

How might we bring more privacy, yet use camera for detection?

QUESTION 5

How might we optimally use minimal hardware to get the most accurate information to us around the environment?

Step-2: Brainstorm, Idea Listing and Grouping.

2

Brainstorm solo

Have each participant begin in the "solo brainstorm space" by silently brainstorming ideas and placing them into the template. This "silent-storming" avoids group-think and creates an inclusive environment for introverts and extroverts alike. Set a time limit. Encourage people to go for quantity.

⌚ 10 minutes

Aakash.S

High level testing must be carried out before real world deployment.	Proper hyperparameters must be found for the model	systematic and Efficient algorithms to be followed
Requires HD cameras for good quality frames to be processed	Underwater cameras is possible solution to detect humans under deep water	24/7 Power supply is must for the system to run
Provide critical and proper message to the rescue team	Make sure the stakeholders know, how the system works.	Make sure the stakeholders understand that there is a possibility for a false alarm as well.

Swetha.S

optimized feed transfer to achieve live relay will less BW to get the classroom video or underwater footage	able to process autonomous swimming and also alerting	setup an ACS and suggestive ways to ensure the system is working properly
ensuring safe where there is a 100% OBC	ensuring the video feed is not being instead being used only for detection which is later discarded	using alternative source of energy
ensuring an integration	being retro reflective	having considered the metrics and
possibilities of a drowning incident	detection easy	controlled and measure

Rithik.M

The AI should be trained with more samples for better results	There should be manual alert system in case of detection failure	More cameras should be used to improve accuracy.
How will be the accuracy level in the system?	Will the system detect properly if the pool is busy?	System should detect multiple drowning and should report the same
For privacy purpose the video stream should not be stored.	The system shouldnt others	cameras can be mounted on the bottom of the pool for large swimming pools.

Vijay.R

power backup should be there in case of powercut.	The network connectivity should be good for faster alert trasmission.	cameras should be maintained properly for good results
What happens if animals were encountered in the pool?	Will there be a problem to detect all so multiple problems.	Use powerful algorithm to get trained from various datasets.
AI should be trained in such a way that it should detect multiple drowning		

3

Brainstorm as a group

Have everyone move their ideas into the "group sharing space" within the template and have the team silently read through them. As a team, sort and group them by thematic topics or similarities. Discuss and answer any questions that arise. Encourage "Yes, and..." and build on the ideas of other people along the way.

15 minutes

TIP

You can use the Voting screen tool above to focus on the strongest ideas.

Privacy

ensuring the video feed is not being recorded or stored instead being used only for detection which is later discarded

For privacy purpose the video stream should not be stored.

Features

Using retro-reflective indicators given to children and novices and teaching them signals to make the drowning detection easy

Having an integration with fitness band companies to get vital have better information and predict emergencies with drowning incident

When more people are drowning there will be a problem to detect all so multiple cameras are needed to eliminate such problems.

Will the system detect people if the pool is cluttered?

User Perspective

Make sure the stakeholders know, how the system works and understand the possibility for system work.

The system should not annoy the swimmers

Make sure the stakeholders understand that there is a possibility for a false alarm as well

Cameras & Hardware

Cameras should be mounted on Underwater and bottom of floating boards for detecting drowning effectively especially on large swimming pools.

cameras should be maintained properly for good results

System should detect multiple drowning and should report the same

Network and Connectivity

The network connectivity should be good for faster alert transmission.

The network should be able to handle real time data. Live reality will less low to get the classifiable video of underwater footage

Power

24/7 Power supply and power backup must for the system to run & report rescue alerts to the rescue team.

power backup should be there in case of powercut.

using alternative source of energy such as solar to make making sure to always have backup supply

AI and ML

Proper hyperparameters must be found for the model

The AI should be trained with more samples for better results

able to process absolute drowning and also alerting the rescue team or passive possibilities as a precaution instance

AI should be trained in such a way that it should detect multiple drowning

High level testing must be carried out before real world deployment

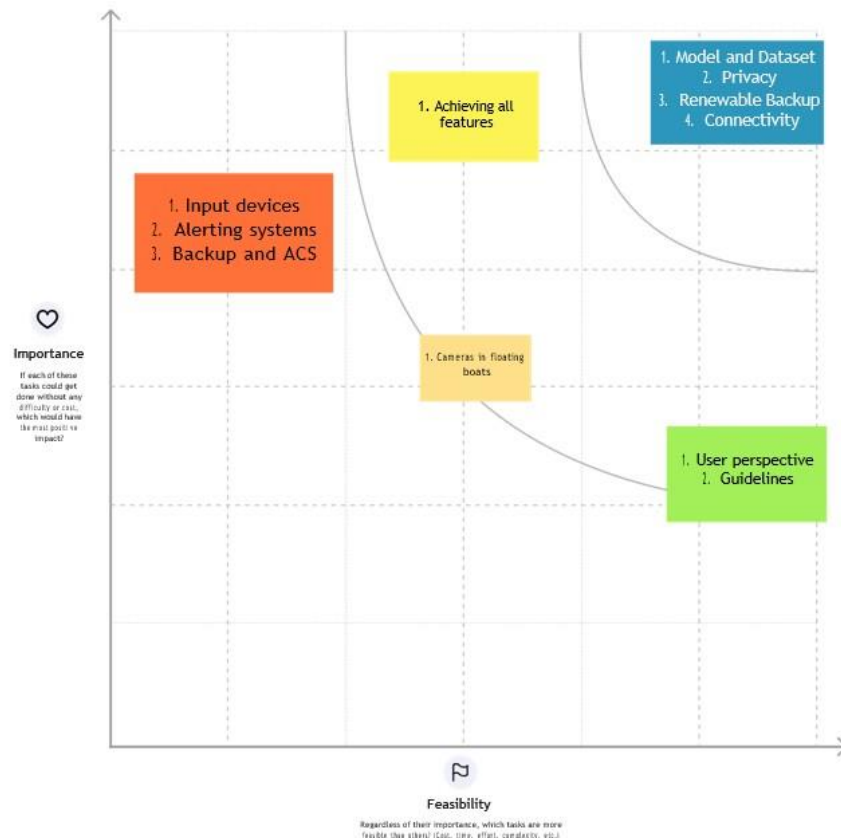
Step-3: Idea Prioritization

4

Prioritize

Your team should all be on the same page about what's important moving forward. Place your ideas on this grid to determine which ideas are important and which are feasible.

🕒 20 minutes



5

Decide your focus

Give each person two icons to vote which idea should your team focus on & assign the duties & responsibilities

🕒 5 minutes

Aakash.S
Backend and
Integration

Swetha.S
Backend and MLA

Rithik.M
Frontend and
Design

Vijay.R
and Utils

Whats Next...

1. Plan and code an efficient model and train it with the correct hyperparameters to produce a probable and accurate result.
2. Enhance the system to work in a proper environment in an integrated manner to yield a cohesive solution.
3. Create a proper frontend dash to give critical information with utmost clarity and least delay.
4. Comeup with the solution that is minimal, portable less intrusive and cost effective.



PROPOSED SOLUTION:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	Swimming pools are generally places of fun and healthy exercise, but they can be deadly as well. Even with a lifeguard observer on duty, swimmers may still have trouble in underwater or in parts of the pool beyond the lifeguard's field of view.
2.	Idea / Solution description	In this project, we use Artificial Intelligence. We install the cameras in underwater to detect the drowning people. Using deep learning, image can be recognized. If the image is detected, it triggers the alarm to alert the Life Guard who rescue the drowning peoples.
3.	Novelty / Uniqueness	The uniqueness of our system software to track the position and the location of a drowning person. We use YOLO Algorithm. Because of its high accuracy and fast detection speed. So it helps lifeguard to save people within seconds.
4.	Social Impact / Customer Satisfaction	Drowning globally has a higher death rate and is also the third leading cause of unexpected deaths worldwide, especially among children under the age of six. To overcome this conflict our drowning detection system will have an impact on society.
5.	Business Model (Revenue Model)	We can introduce the software-based approach for making a good income. It is extremely useful to lifeguards, swimmers and business operators. The number of features makes it attractive for end users to use our software system.
6.	Scalability of the Solution	Our software system can be used by the company driver who manages the pools. We use the IBM cloud server to collect and maintain the data. We will ensure the safety of the swimmers.

PROBLEM SOLUTION:

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) CS Children under six	6. CUSTOMER CONSTRAINTS ■ spending power, budget, no cash, network connection, available devices.	5. AVAILABLE SOLUTIONS ■ Fire fighters and trained swimmers	Explore AS, different
	2. JOBS-TO-BE-DONE / PROBLEMS — we make use of one camera that streams the video underwater and analyses the position of swimmers to assess the probability of drowning	9. PROBLEM ROOT CAUSE RC customers have to do it because of the change in luxurious activities have drastically increased and polls have become common everywhere.	7. BEHAVIOUR BE Install drowning detectors, or call for emergency help	
Focus on J&P, tap into BE, understand RC				Focus on J&P, tap into BE, understand RC

REQUIREMENT ANALYSIS

Functional Requirements:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Installation	Needed to be fixed under the water in the swimmingpool
FR-2	Detection	Either horrified or in unconscious
FR-3	Audio	Ask for help or stay quiet if the person is unconscious
FR-4	Support	Take swim tubes or take the help of rescuer
FR-5	Prior Alert	Send alert message to the lifeguard
FR-6	Pulse rate sensor	Detect the pulse rate of a swimmer

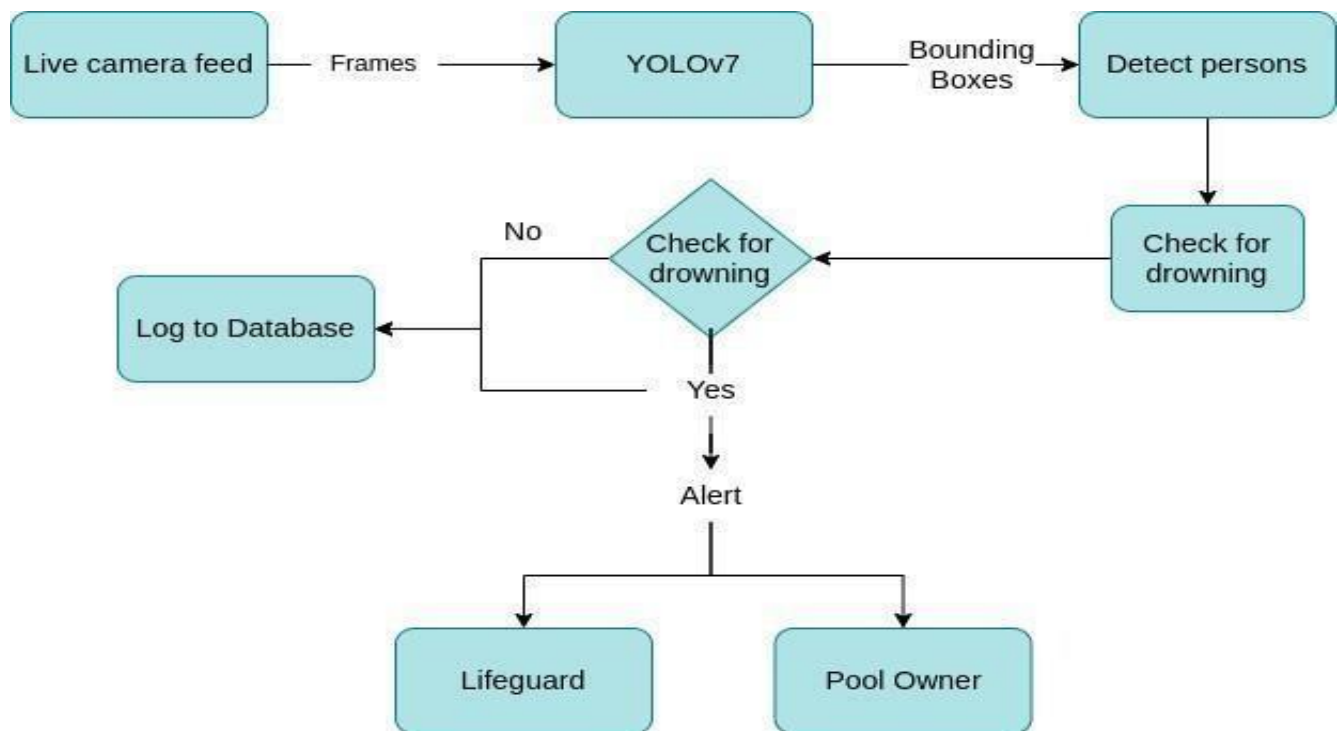
Non-functional Requirements:

Following are the non-functional requirements of the proposed solution.

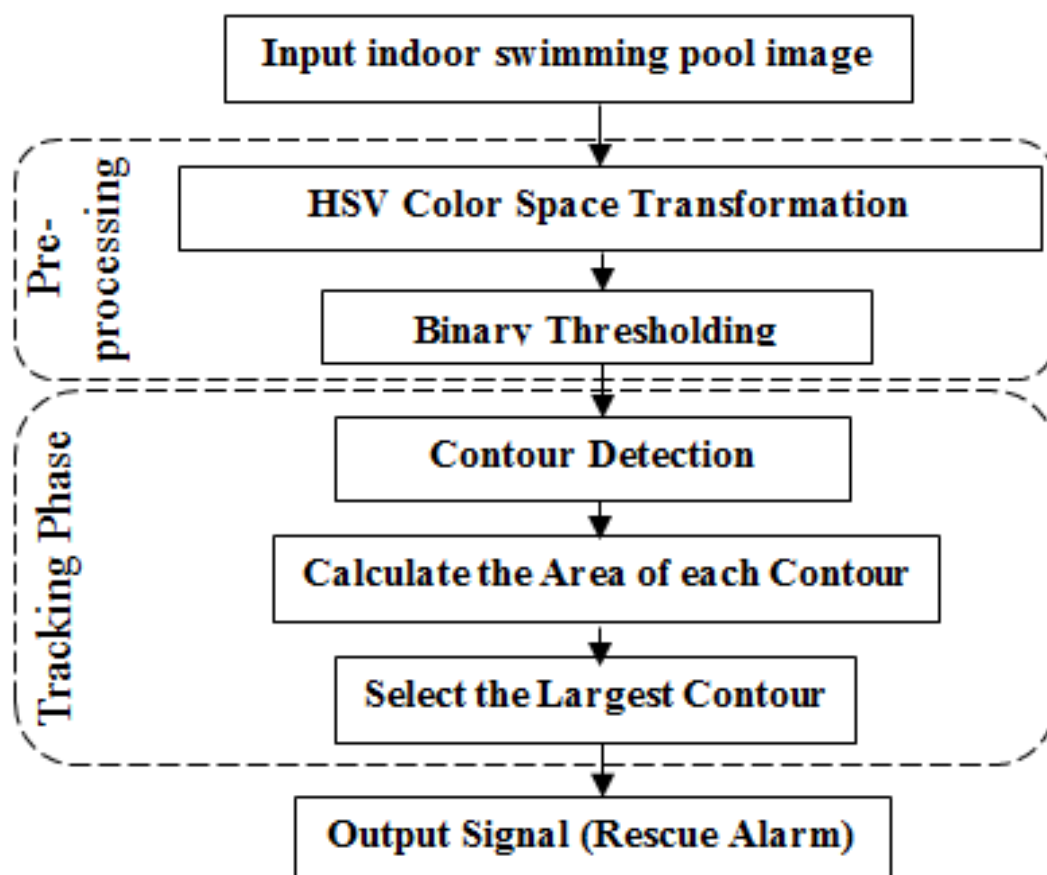
FR No.	Non-Functional Requirement	Description
NFR-1	Usability	To ensure the safety of each and every person present in the pool. A Lifeguard should be present all the time in the pool.
NFR-2	Security	Lifeguards should be aware of the alert message to save the life of the swimmer
NFR-3	Reliability	Virtual eye lifeguard triggers an immediate prior alarm if a swimmer is in peril, helping to avoid panic even in critical situations.
NFR-4	Performance	The performance of the tool works better than available tools
NFR-5	Availability	Equipment and accessories include lifesaver rings, inflatable vests, life hooks, spine boards, rescue tubes, and a first aid kit.
NFR-6	Scalability	Virtual eye lifeguard detects potential drowning and promptly notifies you. It features the latest artificial intelligence technology and adapts to the needs of the user.

PROJECT DESIGN

DATA FLOW DIAGRAMS:



FLOW CHART:



SOLUTION & TECHNICAL ARCHITECTURE:

Solution architecture is a complex process – with many sub-processes – that bridges the gap between business problems and technology solutions. Its goals are to:

Solution Architecture Diagram:

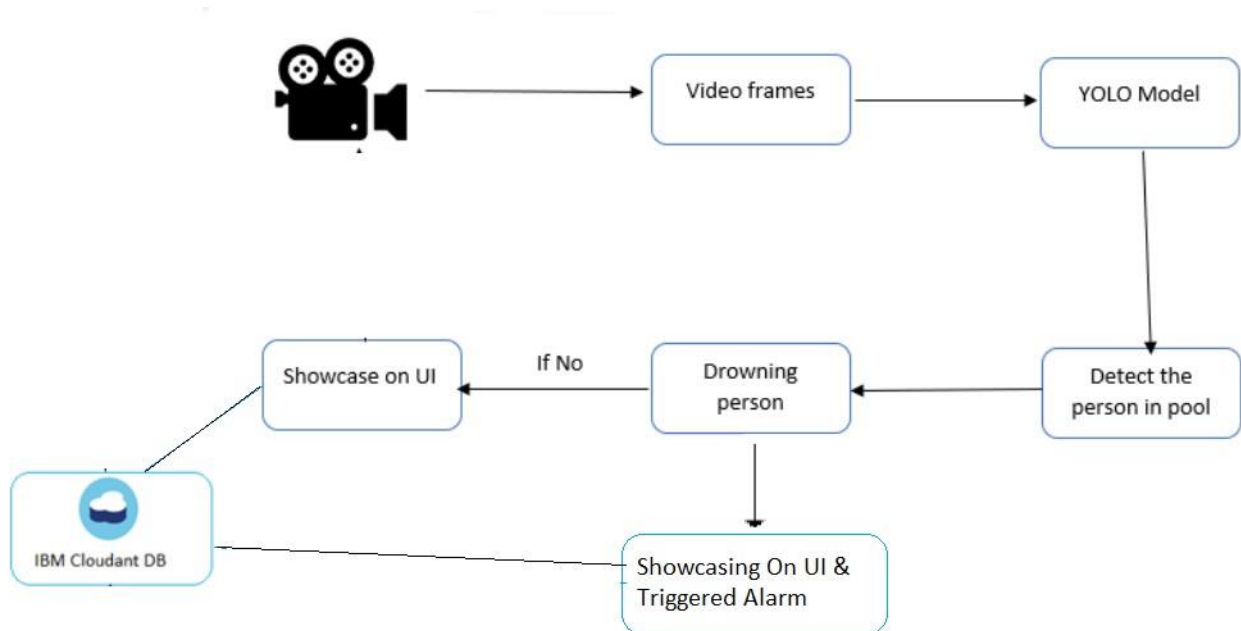


Table-1: Components & Technologies:

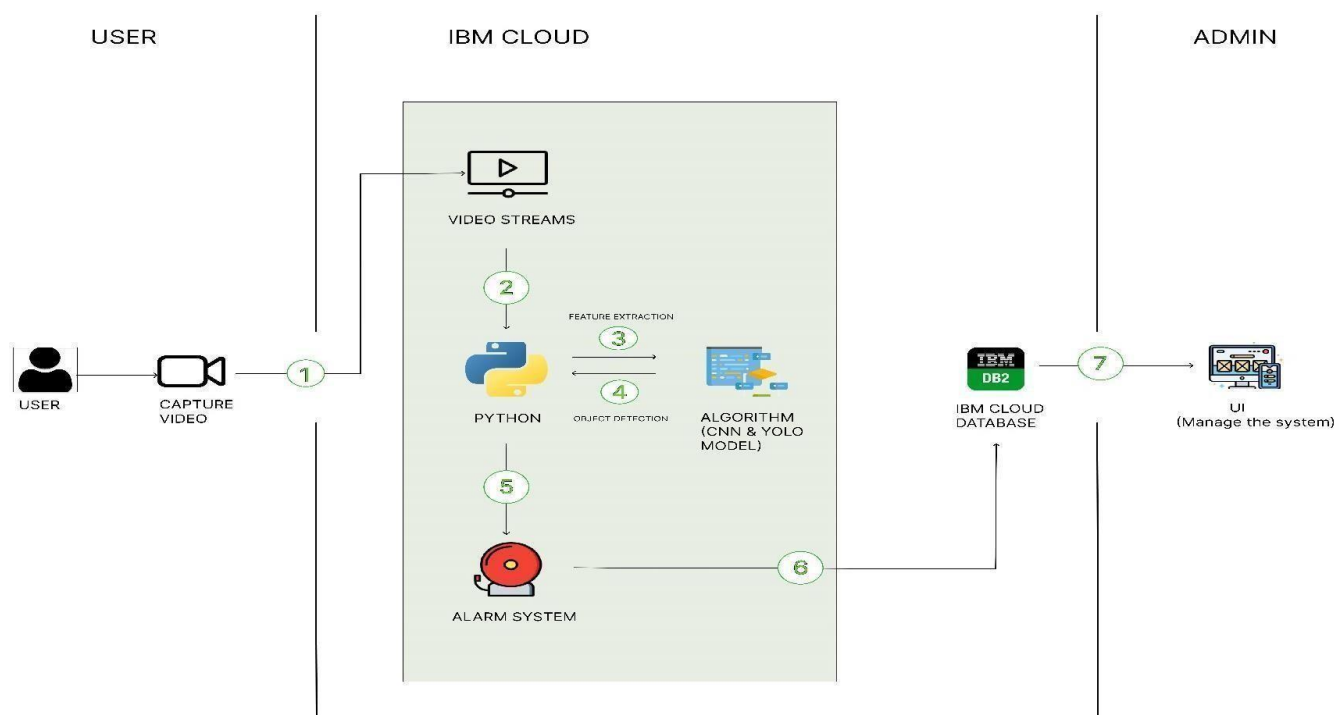
S. No	Component	Description	Technology
1.	User Interface	How user interacts with application	HTML, CSS, JavaScript / Angular Js / React Js etc.
2.	Application Logic-1	Pre-processing the model using datasets	Python
3.	Application Logic-2	Image extraction	Python
4.	Application Logic-3	Object detection	python

5.	Database	Data Type, Configurations etc.	MySQL, NoSQL, etc.
6.	Cloud Database	Database Service on Cloud	IBM DB2, IBM Cloudant etc.
7.	File Storage	File storage requirements	IBM Block Storage or Other Storage Service or Local Filesystem
8.	Deep Learning Model	Purpose of Deep Learning Model	Object Recognition Model, CNN etc. YOLOv7 model
9.	Infrastructure (Server / Cloud)	Application Deployment on Local System / CloudLocal Server Configuration: Cloud Server Configuration:	Local, Cloud Foundry etc.,

Table-2: Application Characteristics:

S. No	Characteristics	Description	Technology
1.	Open-Source Frameworks	Python (Anaconda) open-source frameworks used	python
2.	Security Implementations	Camera under pools	AI
3.	Scalable Architecture	3 – tier Architecture	Python
4.	Availability	All the time persons are under surveillance	AI
5.	Performance	Many persons in the swimming pool will be detected whether the person is drowning or not	Python

Technical Architecture Diagram:



USER STORIES:

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Pool owner)	Installation	USN-1	As a pool owner, I can install the cameras and set up the drowning detection system	I can connect the cameras to the cloud-hosted software	High	Sprint-1
	Detecting the drowning persons	USN-2	As a user, I can find the drowning persons by using the drowning detection system	I would receive an alert if a person is drowning	High	Sprint-1
	Notify the lifeguard	USN-3	As a user, I can notify the lifeguard when the system detects a drowning person	I can set up an alarm that would notify the lifeguard	High	Sprint-2
Customer (Life guard)	Rescue people	USN-4	As a user, I can rescue the drowning persons from the pool	I can save the drowning person	High	Sprint-2
Customer (Swimmers)	Safety	USN-5	As a user, I can swim without the fear of drowning	I can swim safely with the help of the system and the lifeguard	Medium	Sprint-2
Customer Care Executive	Contact	USN-6	resolve technical issues	I can contact the customer care executive to resolve any issues	Medium	Sprint-3
Administrator	Dashboard	USN-7	Management of the drowning detection system and database management.	I can access the system's logs and any other data instantly	High	Sprint-4

PROJECT
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Reports from JIRA

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Epic

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PNT2022TMI-5

+ Create issue

IN PROGRESS

+ Create issue

DONE

+ Create issue

Quickstart

User Acceptance Testing

1. Defect Analysis

This report shows the number of resolved or closed bugs at each severity level, and how they were resolved.

Resolution	Severity 1	Severity 2	Severity 3	Severity 4	Subtotal
By Design	10	4	2	3	20
Duplicate	1	0	3	0	4
External	2	3	0	1	6
Fixed	11	2	4	20	37
Not Reproduced	0	0	1	0	1
Skipped	0	0	1	1	2
Won't Fix	0	5	2	1	8
Totals	24	14	13	26	77

2. Test Case Analysis

Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2
Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	51	0	0	51
Security	2	0	0	2
Outsource Shipping	3	0	0	3

SPRINT PLANNING & ESTIMATION & DELIVERY SCHEDULING:

Project Tracker, Velocity & Burndown Chart:

Sprint	Total Story Points	Duration	Sprint StartDate	Sprint End Date (Planned)	Story Points Completed (as on Planned End Date)	Sprint Release Date(Actual)
Sprint-1	8	6 Days	24 Oct 2022	29 Oct 2022	6	29 Oct 2022
Sprint-2	14	6 Days	31 Oct 2022	05 Nov 2022	12	05 Nov 2022
Sprint-3	16	6 Days	07 Nov 2022	12 Nov 2022	11	12 Nov 2022
Sprint-4	12	6 Days	14 Nov 2022	19 Nov 2022	12	19 Nov 2022

Test Cases

			Date	18-Nov-22									
			Team ID	PNT2022TMD4289									
			Project Name	VirtualEye - LifeGuard for Swimming Pools to Detect Active Drowning									
			Maximum Marks	4 marks									
Test case ID	Feature Type	Component	Test Scenario	Pre-Requrite	Steps To Execute	Test Data	Expected Result	Actual Result	Status	Comments	TC for Automation(Y/N)	BUG ID	Executed By
Homepage_TC_001	Functional	Home Page	Verify user is able to use the navigation button in Home page		1.Navigate to virtual eye site 2.click on the navigation buttons	Virtual eye Home page	Homepage should make change when the user press any navigation button	Working as expected	Pass		Y		Aakash.S
Homepage_TC_002	UI	Home Page	Verify the UI elements in Home page, register,logout,home, predict		1. Navigate mouse to top left corner on homepage 2. click on the navigation buttons to redirect to respective page a.Home b.Register c.Predict d.logout e.login	Virtual Eye Home page	Application should show below UI elements: a.Home b.Register c.Predict d.logout e.login	Working as expected	Pass	Steps are not clear to follow	N		Rithik.M
LoginPage_TC_001	UI	Login page	Verify the UI elements in Login page		1. Navigate to login page from home page 2. check whether the elements in login page are visible		The elements in the login page must be visible	Working as expected	Pass		N		Swetha.S
LoginPage_TC_002	Functional	Login page	Verify user is able to log into application with Valid credentials		1. Navigate to virtual eye site	Username: k@gmail.com password: k	Login page should display	Working as expected	pass		Y		Vijay.R
LoginPage_TC_003	Functional	Login page	Verify user is not able to log into application with invalid credentials		1. Navigate to virtual eye site 2. Click on the login button on the navigation bar 3. Enter invalid credentials	Username: abc@gmail.com password: abc	login page should not accept invalid credentials	Working as expected	pass		Y		Shaheershah.TS
RegisterPage_TC_001	Functional	Register page	Verify user is able to see the register button on the navigation bar		1. Navigate to virtual eye site 2. Click on the register navigation item on the navigation bar	Virtual eye Home page	Register page should display	Working as expected	pass		N		Aakash.S
RegisterPage_TC_002	Functional	Register page	Verify user is able to register into application with Valid credentials		1. Navigate to virtual eye site 2. Click on the register navigation item on the navigation bar 3. enter valid credentials and submit	Username: albz@gmail.com password: abc	Application should show "Registration successful"	Working as expected	pass		Y		Rithik.M
PredictPage_TC_001	Functional	Predict Page	Verify user is able to see the Predict button on the navigation bar		1. Navigate to virtual eye site 2. Click on the predict navigation item on the navigation bar	Virtual eye Home page	Predict page should display if the user is already logged in else should redirect to login page	Working as expected	pass		N		Swetha.S
PredictPage_TC_002	Functional	Predict Page	Verify user is able to get predictions on the predict page		1. Navigate to virtual eye site 2. Click on the predict navigation item on the navigation bar 3. Upload a video file	A video file	An output video stream should be displayed on the User Interface with the detected bounding boxes and a message stating if the person is drowning or not.	Working as expected	pass		Y		Vijay.R
LogoutPage_TC_001	Functional	Logout Page	To verify whether the Log out button is working.		1. Navigate to virtual eye site 2. Click on the Log Out item on the navigation bar	Virtual eye Home page	When the User tries to log out from the page, he/she clicks the logout button. Then the page should take the user from their login to the	Working as expected	pass		N		Shaheershah.T.S
LogoutPage_TC_002	Functional	Logout Page	To verify whether the page has been successfully logged out		1. Navigate to virtual eye site 2. Click on the Log Out item on the navigation bar	Virtual eye Logout page	When the Logout button works properly, the user is redirected to the Logout page.	Working as expected	pass		Y		Aakash.S

FUTURE SCOPE

FUTURE SCOPE

Finetuning the YOLOv5 model would also result in better and more efficient prediction. Better datasets, current approaches, and technologies with great processing power, along with high quality surveillance cameras, will assist to increase the accuracy of drowning detection and can even be employed under bad conditions. After all of these requirements are met, this method can be used to detect drowning on seashores.

...

CODING & SOLUTIONING

CODING:

INTEX.html

```
<!DOCTYPE html>
```

```
<html lang="en">
```

```
<head>
```

```
  <meta charset="UTF-8">
```

```
  <meta http-equiv="X-UA-Compatible"  
content="IE=edge">
```

```
  <meta name="viewport" content="width=device-  
width, initial-scale=1.0">
```

```
  <title>VirtualEye - Home</title>
```

```
  <link rel="stylesheet"  
href="https://maxcdn.bootstrapcdn.com/bootstrap/4.0  
.0/css/bootstrap.min.css"
```

```
    integrity="sha384-  
Gn5384xqQ1aoWXA+058RXPxPg6fy4IWvTNh0E2  
63XmFcJlSAwiGgFAW/dAiS6JXm"  
crossorigin="anonymous">
```

```
  <script src="https://code.jquery.com/jquery-  
3.2.1.slim.min.js"
```

```
    integrity="sha384-  
KJ3o2DKtIkVYIK3UENzmM7KCkRr/rE9/Qpg6aAZ
```

GJwFDMVNA/GpGFF93hXpG5KkN"

crossorigin="anonymous"></script>

<script

src="https://cdnjs.cloudflare.com/ajax/libs/popper.js/1.12.9/umd/popper.min.js"

integrity="sha384-

ApNbgh9B+Y1QKtv3Rn7W3mgPxhU9K/ScQsAP7hUibX39j7fakFPskvXusvfa0b4Q"

crossorigin="anonymous"></script>

<script

src="https://maxcdn.bootstrapcdn.com/bootstrap/4.0.0/js/bootstrap.min.js"

integrity="sha384-

JZR6Spejh4U02d8jOt6vLEHfe/JQGiRRSQQxSfFWpi1MquVdAyjUar5+76PVCmYl"

crossorigin="anonymous"></script>

<script

src="https://kit.fontawesome.com/8b9cdc2059.js"

crossorigin="anonymous"></script>

<link

href="https://fonts.googleapis.com/css2?family=Akronim&family=Roboto&display=swap"

```
rel="stylesheet">
  <link rel="stylesheet" href="../static/style.css">
</head>

<body>
  <nav class="navbar navbar-expand-lg navbar-dark
bg-primary">
    <div class="container-fluid">
      <a class="navbar-brand"
href="#">VirtualEye</a>
      <button class="navbar-toggler" type="button"
data-bs-toggle="collapse" data-bs-
target="#navbarNav"
      aria-controls="navbarNav" aria-
expanded="false" aria-label="Toggle navigation">
        <span class="navbar-toggler-
icon"></span>
      </button>
      <div class="collapse navbar-collapse"
id="navbarNav">
        <ul class="navbar-nav">
          <li class="nav-item">
            <a class="nav-link active" aria-
current="page" href="#">Home</a>
```

```

        </li>
        <li class="nav-item">
            <a class="nav-link"
href="{ {url_for('login')}}">Login</a>
        </li>
        <li class="nav-item">
            <a class="nav-link"
href="{ {url_for('register')}}">Register</a>
        </li>
        <li class="nav-item">
            <a class="nav-link" href="{ {
url_for('register')}}">Predict</a>
        </li>
        <li class="nav-item">
            <a class="nav-link"
href="{ {url_for('logout')}}">Logout</a>
        </li>
    </ul>
</div>
</div>
</nav>

<section id="about">

```

```
<div class="top">
  <h3 class="title text-muted">
    ABOUT PROJECT
  </h3>
  <div class="line"></div>
</div>
```

```
<div class="body">
  <div class="left">
    <h2>Problem</h2>
    <p><i>
```

Swimming is one of the best exercises that helps people to reduce stress in this urban lifestyle.

Swimming pools are found larger in number in the hotels, weekend tourist spots and barely people

have in their house backyard. Beginners, especially often feel it difficult to breathe under water and causes breathing trouble which in turn cause a drowning accident. Worldwide, drowning produces a

higher rate of mortality without causing injury to children. Children under six of their age are found to be suffering the highest

drowning mortality rates worldwide..Such kinds of deaths account

for the third cause of unplanned death globally, with about 1.2 million cases yearly.

</i></p>

</div>

<div class="left">

<h2>Solution:</h2>

<p><i>

To overcome the conflict, a meticulous system is to be implemented along the swimming pools to save

the human life. By studying body movement patterns and connecting cameras to an artificial

intelligence (AI)system we can devise an underwater pool safety system that reduces the risk of drowning. Usually such systems can be developed by installing more than 16 cameras underwater and

ceiling and analysing the video feeds to detect any anomalies . but AS a POC we make use of one

camera that streams the video
underwater and analyses the position of swimmers to
assess the

probability of drowning ,if it is higher
than an alert will be generated to attract lifeguards
attention.

</i></p>

</div>

</div>

<div class="bottom">

<p>

Note : The system is not designed to
replace a lifeguard or other human monitor, but to act
as an

additional tool. It helps the lifeguard to
detect the underwater situation where they can't
easily

observe.

</p>

</div>

</section>

```
<section id="footer">
  <p>Copyright © 2021. All Rights Reserved</p>
</section>
</body>

</html>
```

login.html

```
<!DOCTYPE html>
<html lang="en">

<head>
  <meta charset="UTF-8">
  <meta http-equiv="X-UA-Compatible"
content="IE=edge">
  <meta name="viewport" content="width=device-
width, initial-scale=1.0">
  <title>VirtualEye - Login</title>
  <link

href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/di
st/css/bootstrap.min.css"
```

```

    rel="stylesheet"
    integrity="sha384-
Zenh87qX5JnK2Jl0vWa8Ck2rdkQ2Bzep5IDxbcnCe
uOxjzrPF/et3URy9Bv1WTRi"
    crossorigin="anonymous">
<script

src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dis
t/js/bootstrap.bundle.min.js"
    integrity="sha384-
OERcA2EqjJCMA+/3y+gxIOqMEjwtxJY7qPCqsdlt
bNJuaOe923+mo//f6V8Qbsw3"
    crossorigin="anonymous"></script>

</head>

<body>
    <nav class="navbar navbar-expand-lg navbar-dark
bg-primary">
        <div class="container-fluid">
            <a class="navbar-brand"
href="#">VirtualEye</a>
            <button class="navbar-toggler" type="button"
data-bs-toggle="collapse" data-bs-

```

```

target="#navbarNav"
    aria-controls="navbarNav" aria-
expanded="false"
    aria-label="Toggle navigation">
    <span class="navbar-toggler-
icon"></span>
    </button>
    <div class="collapse navbar-collapse"
id="navbarNav">
        <ul class="navbar-nav">
            <li class="nav-item">
                <a class="nav-link active" aria-
current="page"
href="{ {url_for('index')}}">Home</a>
            </li>
            <li class="nav-item">
                <a class="nav-link active"
href="#">Login</a>
            </li>
            <li class="nav-item">
                <a class="nav-link"
href="{ {url_for('register')}}">Register</a>

```

```

        </li>
        <!-- <li class="nav-item">
            <a class="nav-link"
href="{ {url_for('predict')}}">Predict</a>
        </li> -->
        <li class="nav-item">
            <a class="nav-link"
href="{ {url_for('logout')}}">Logout</a>
        </li>
    </ul>
</div>
</div>
</nav>
<div class="container p-4 mt-5 w-25">
    <center>
        <h1>Login</h1>
        
    </center>
    <form action="/login" method="POST">

```

```
<div class="mb-3">
  <label for="InputEmail" class="form-
label">Email address</label>
  <input name="email" type="email"
class="form-control"
  id="InputEmail" aria-
describedby="emailHelp"
  placeholder="Email">
  <div id="emailHelp" class="form-
text">We'll never share your
  email
  with anyone else.</div>
</div>
<div class="mb-3">
  <label for="InputPassword" class="form-
label">Password</label>
  <input name="password" type="password"
class="form-control"
  id="InputPassword"
placeholder="Password">
</div>
<button type="submit" class="btn btn-
primary">Submit</button>
<button type="reset" class="btn btn-
```

```
light">Reset</button>
    <p class="mt-3" style="color:red; font-size:
20px;">{ { msg } }</p>
    </form>
</div>
</body>

</html>
```

logout.html

```
<!DOCTYPE html>
<html lang="en">

<head>
    <meta charset="UTF-8">
    <meta http-equiv="X-UA-Compatible"
content="IE=edge">
    <meta name="viewport" content="width=device-
width, initial-scale=1.0">
    <title>VirtualEye - Logout</title>
    <link
```

```
href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dist/css/bootstrap.min.css"
    rel="stylesheet"
    integrity="sha384-
Zenh87qX5JnK2Jl0vWa8Ck2rdkQ2Bzep5IDxbcnCe
uOxjzrPF/et3URy9Bv1WTRi"
    crossorigin="anonymous">
<script
```

```
src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dist/js/bootstrap.bundle.min.js"
    integrity="sha384-
OERcA2EqjJCMA+/3y+gxIOqMEjwtxJY7qPCqsdlt
bNJuaOe923+mo//f6V8Qbsw3"
    crossorigin="anonymous"></script>
</head>
```

```
<body>
    <nav class="navbar navbar-expand-lg navbar-dark
bg-primary">
        <div class="container-fluid">
            <a class="navbar-brand"
href="#">VirtualEye</a>
            <button class="navbar-toggler" type="button"
```



```

        data-bs-toggle="collapse" data-bs-
target="#navbarNav"
        aria-controls="navbarNav" aria-
expanded="false"
        aria-label="Toggle navigation">
        <span class="navbar-toggler-
icon"></span>
        </button>
        <div class="collapse navbar-collapse"
id="navbarNav">
            <ul class="navbar-nav">
                <li class="nav-item">
                    <a class="nav-link" aria-
current="page"
href="{ {url_for('index')}}">Home</a>
                </li>
                <li class="nav-item">
                    <a class="nav-link"
href="{ {url_for('login')}}">Login</a>
                </li>
                <li class="nav-item">
                    <a class="nav-link"

```

```
href="{ {url_for('register')}}">Register</a>
```

```
</li>
```

```
<li class="nav-item">
```

```
<a class="nav-link"
```

```
href="{ {url_for('login')}}">Predict</a>
```

```
</li>
```

```
<li class="nav-item">
```

```
<a class="nav-link active"
```

```
href="#">Logout</a>
```

```
</li>
```

```
</ul>
```

```
</div>
```

```
</div>
```

```
</nav>
```

```
<center>
```

```
<h1 class="mt-5 text-success">Successfully  
Logged out!</h1>
```

```
<h4 class="mt-3 text-body">Login for more  
information</h4>
```

```
<a class="btn btn-primary mt-3"  
href="{ {url_for('login')}}">Login</a>
```

```
</center>
```

</body>

</html>

predict.html

<!DOCTYPE html>

<html lang="en">

<head>

 <meta charset="UTF-8">

 <meta http-equiv="X-UA-Compatible"
content="IE=edge">

 <meta name="viewport" content="width=device-
width, initial-scale=1.0">

 <title>VirtualEye - Prediction</title>

 <link

href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/di
st/css/bootstrap.min.css"

 rel="stylesheet"

 integrity="sha384-
Zenh87qX5JnK2Jl0vWa8Ck2rdkQ2Bzep5IDxbcnCe
uOxjzrPF/et3URy9Bv1WTRi"

```

        crossorigin="anonymous">
<script

src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dis
t/js/bootstrap.bundle.min.js"
        integrity="sha384-
OERcA2EqjJCMA+/3y+gxIOqMEjwtxJY7qPCqsdlt
bNJuaOe923+mo//f6V8Qbsw3"
        crossorigin="anonymous"></script>
</head>

<body>
    <nav class="navbar navbar-expand-lg navbar-dark
bg-primary">
        <div class="container-fluid">
            <a class="navbar-brand"
href="#">VirtualEye</a>
            <button class="navbar-toggler" type="button"
                data-bs-toggle="collapse" data-bs-
target="#navbarNav"
                aria-controls="navbarNav" aria-
expanded="false"
                aria-label="Toggle navigation">
                <span class="navbar-toggler-

```

```

icon"></span>
    </button>
    <div class="collapse navbar-collapse"
id="navbarNav">
        <ul class="navbar-nav">
            <li class="nav-item">
                <a class="nav-link" aria-
current="page"
href="{ {url_for('index')}}">Home</a>
            </li>
            <li class="nav-item">
                <a class="nav-link"
href="{ {url_for('login')}}">Login</a>
            </li>
            <li class="nav-item">
                <a class="nav-link"
href="{ {url_for('register')}}">Register</a>
            </li>
            <li class="nav-item active">
                <a class="nav-link"
href="#">Predict</a>

```

```

        </li>
        <li class="nav-item">
            <a class="nav-link"
href="{ {url_for('logout')}}">Logout</a>
        </li>
    </ul>
</div>
</div>
</nav>

<h1 class="text-center mt-5">Predict</h1>
<center>
    <div class="card mt-3" style="width: 50%;">
        
        <div class="card-body">
            <p class="card-text">Swimming is one of
the best exercises that
                helps people to reduce stress in this
urban lifestyle.
                Swimming pools are found larger in
number in the hotels,

```

weekend tourist spots and barely people
have in their house
backyard. Beginners, especially often
feel it difficult to
breathe under water and causes breathing
trouble which in
turn cause a drowning accident.
Worldwide, drowning produces
a higher rate of mortality without
causing injury to
children. Children under six of their age
are found to be
suffering the highest drowning mortality
rates
worldwide..Such kinds of deaths account
for the third cause
of unplanned death globally, with about
1.2 million cases
yearly.</p>

</div>

</div>

</center>

<form method="post" action="/predict"
enctype="multipart/form-data">

```

    <div class="container text-center mt-5">
        <input class="btn btn-dark" type="file"
name="file"
        autocomplete="off" required>
        <input class="btn btn-primary" type="submit"
value="Upload">
    </div>
</form>
<center>
    { % if filename % }
    <div class="container m-5">
        
    </div>
    { % endif % }
</center>
</body>

</html>

```


register.html

```
<!DOCTYPE html>
```

```
<html lang="en">
```

```
<head>
```

```
  <meta charset="UTF-8">
```

```
  <meta http-equiv="X-UA-Compatible"  
content="IE=edge">
```

```
  <meta name="viewport" content="width=device-  
width, initial-scale=1.0">
```

```
  <title>VirtualEye - Register</title>
```

```
  <link
```

```
href="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/di  
st/css/bootstrap.min.css"
```

```
  rel="stylesheet"
```

```
  integrity="sha384-  
Zenh87qX5JnK2Jl0vWa8Ck2rdkQ2Bzep5IDxbcnCe  
uOxjzrPF/et3URy9Bv1WTRi"
```

```
  crossorigin="anonymous">
```

```
  <script
```

```
src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dis
```

```
t/js/bootstrap.bundle.min.js"
  integrity="sha384-
OERcA2EqjJCMA+/3y+gxIOqMEjwtxJY7qPCqsdlt
bNJuaOe923+mo//f6V8Qbsw3"
  crossorigin="anonymous"></script>
```

```
<script>
  const passwd =
document.getElementById("InputPassword").value;
  if (passwd.length < 8 || passwd.length > 20) {
    alert("Your password must be 8-20 characters
long!");
  }
</script>
</head>
```

```
<body>
  <nav class="navbar navbar-expand-lg navbar-dark
bg-primary">
    <div class="container-fluid">
      <a class="navbar-brand"
href="#">VirtualEye</a>
      <button class="navbar-toggler" type="button"
data-bs-toggle="collapse" data-bs-
```

```

target="#navbarNav"
    aria-controls="navbarNav" aria-
expanded="false"
    aria-label="Toggle navigation">
    <span class="navbar-toggler-
icon"></span>
    </button>
    <div class="collapse navbar-collapse"
id="navbarNav">
        <ul class="navbar-nav">
            <li class="nav-item">
                <a class="nav-link" aria-
current="page"
href="{ {url_for('index')}}">Home</a>
            </li>
            <li class="nav-item">
                <a class="nav-link"
href="{ {url_for('login')}}">Login</a>
            </li>
            <li class="nav-item">
                <a class="nav-link active"
href="#">Register</a>

```

```

        </li>
        <!-- <li class="nav-item">
            <a class="nav-link"
href="{ {url_for('predict')}}">Predict</a>
        </li> -->
        <li class="nav-item">
            <a class="nav-link"
href="{ {url_for('logout')}}">Logout</a>
        </li>
    </ul>
</div>
</div>
</nav>
<div class="container p-4 w-25 mt-5">
    <center>
        <h1>Register</h1>
        
    </center>
    <form action="/register" method="post">

```

```
<div class="mb-3">
  <label for="InputEmail" class="form-
label">Email address</label>
  <input name="email" type="email"
class="form-control"
  id="InputEmail" aria-
describedby="emailHelp"
  placeholder="Email">
  <div id="emailHelp" class="form-
text">We'll never share your
    email
    with anyone else.</div>
</div>
<div class="mb-3">
  <label for="InputPassword" class="form-
label">Password</label>
  <input name="password" type="password"
class="form-control"
  id="InputPassword"
placeholder="Password">
  <div id="passwordHelpBlock"
class="form-text">
    Your password must be 8-20 characters
    long, contain letters
```

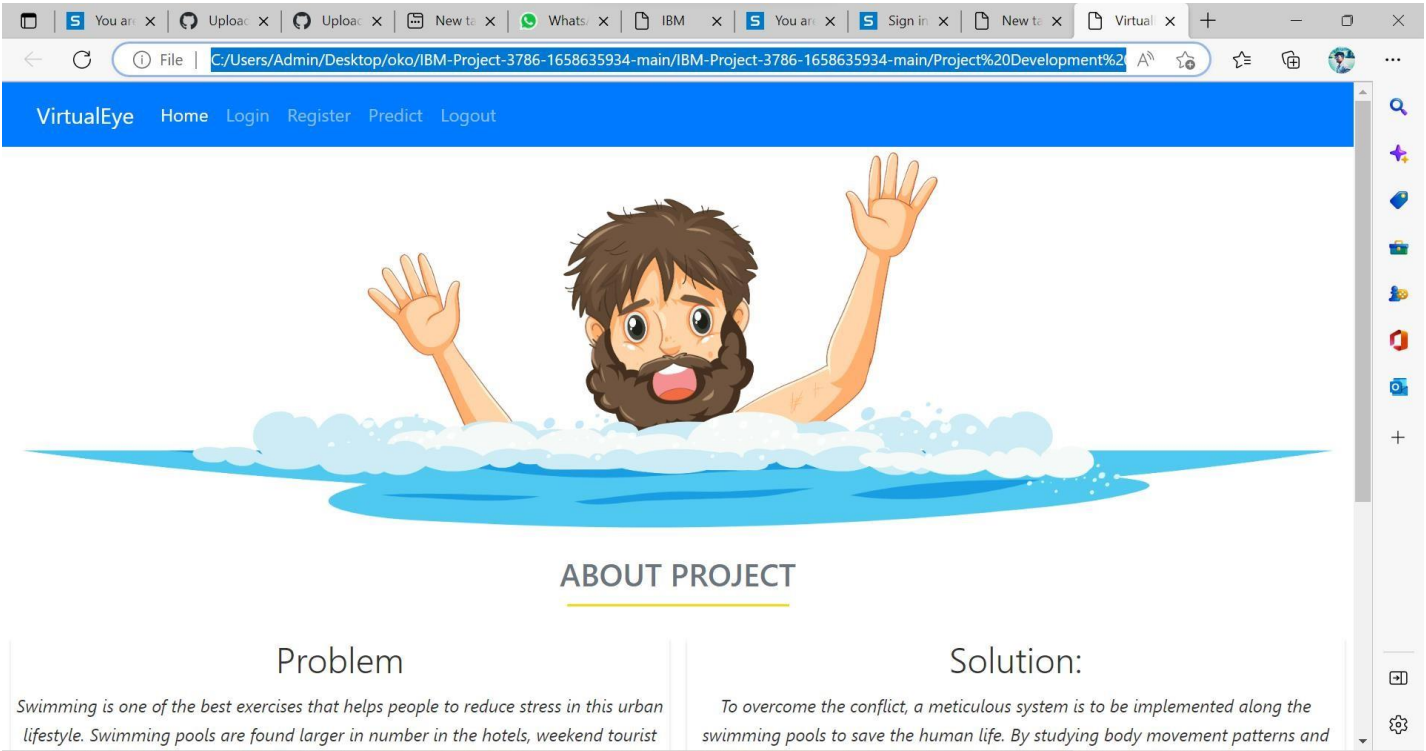
and
numbers, and must not contain spaces or
emoji.

```
</div>
</div>
<button type="submit" class="btn btn-
primary">Submit</button>
<button type="reset" class="btn btn-
light">Reset</button>
<br><br>
<div id="passwordHelpBlock" class="form-
text">
    Already a registered user?
</div>
<p class="text-primary" style="font-weight:
bold; font-size: 18px;">
    {{ msg }}</p>
<a href="{{ url_for('login') }}" class="btn btn-
success">Login</a>
</form>
</div>
</body>

</html>
```

OUTPUT:

HOME PAGE:



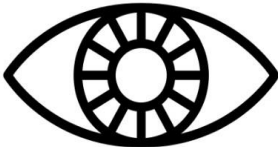
LOGIN PAGE:

File | C:/Users/Admin/Desktop/oko/IBM-Project-3786-1658635934-main/IBM-Project-3786-1658635934-main/Project%20Development...

VirtualEye

Home Login Register Predict Logout

Login



Email address

Email

We'll never share your email with anyone else.

Password

Password

Submit

Reset

File | C:/Users/Admin/Desktop/oko/IBM-Project-3786-1658635934-main/IBM-Project-3786-1658635934-main/Project%20Development...

VirtualEye

Home Login Register Predict Logout

Successfully Logged out!

Login for more information

Login

REGISTER PAGE:



PREDICT PAGE:

The image is a screenshot of a web browser window. The browser's address bar shows a local file path. The page title is "Predict". The main content area features a video player with a blue-tinted image of a child swimming. Below the video, there is a text block with the following content: "Swimming is one of the best exercises that helps people to reduce stress in this urban lifestyle. Swimming pools are found larger in number in the hotels, weekend tourist spots and barely people have in their house backyard. Beginners, especially often feel it difficult to breathe under water and causes breathing trouble which in turn cause a drowning accident. Worldwide, drowning produces a higher rate of mortality without causing injury to children. Children under six of their age are found to be suffering the highest drowning mortality rates worldwide..Such kinds of deaths account for the third cause of unplanned death globally, with about 1.2 million cases yearly." At the bottom of the page, there is a file upload section with a "Choose File" button, a "No file chosen" status, and an "Upload" button.

RESULT

PERFORMANCE METRICS

Model Performance Testing

S.No.	Parameter	Values	Screenshot																								
1.	Model Summary	-																									
2.	Accuracy	Training Accuracy - 60 Validation Accuracy - 56	<table border="1"> <thead> <tr> <th>Model</th><th>size (pixels)</th><th>mAP^{val} 0.5:0.95</th><th>mAP^{val} 0.5</th></tr> </thead> <tbody> <tr> <td>YOLOv5n</td><td>640</td><td>28.0</td><td>45.7</td></tr> <tr> <td>YOLOv5s</td><td>640</td><td>37.4</td><td>56.8</td></tr> <tr> <td>YOLOv5m</td><td>640</td><td>45.4</td><td>64.1</td></tr> <tr> <td>YOLOv5l</td><td>640</td><td>49.0</td><td>67.3</td></tr> <tr> <td>YOLOv5x</td><td>640</td><td>50.7</td><td>68.9</td></tr> </tbody> </table>	Model	size (pixels)	mAP ^{val} 0.5:0.95	mAP ^{val} 0.5	YOLOv5n	640	28.0	45.7	YOLOv5s	640	37.4	56.8	YOLOv5m	640	45.4	64.1	YOLOv5l	640	49.0	67.3	YOLOv5x	640	50.7	68.9
Model	size (pixels)	mAP ^{val} 0.5:0.95	mAP ^{val} 0.5																								
YOLOv5n	640	28.0	45.7																								
YOLOv5s	640	37.4	56.8																								
YOLOv5m	640	45.4	64.1																								
YOLOv5l	640	49.0	67.3																								
YOLOv5x	640	50.7	68.9																								
3.	Confidence Score (Only Yolo Projects)	Class Detected - Person Confidence Score - 83%																									

ADVANTAGES & DISADVANTAGES:

ADVANTAGES:

- Cost effective for larger applications.
- The system will be connected to a loud alarm system that will be set off when a active drowning has been detected. This will then alert the people and life guard in the swimming to exit and it will also alert the service provider who will then alert the emergency services.
- There are some instances that some buildings require access control systems.
- It is most helpful to the beginner in Swimming.
- It is helpful to the trainer because they will not see all students at the same time in Swimming class.

□

DISADVANTAGES:

- Cost, not as competitively priced for smaller applications.
- It is costly to maintain
- It is highly sensitive to insects and dust particles.
- This is just precaution system but the life guard must monitor the swimmers.
- Every system has error so not fully trusted only the device .

CONCLUSION

VirtualEye - Life Guard for Swimming Pools to Detect Active Drowning system

In this project an attempt has been made for making AI based VirtualEye - Life Guard for Swimming Pools to Detect Active Drowning system to identify drowning people and pass on the alert message to the life guard in the Swimming pool. By analyzing the literature review of various authors, this system is efficient to prevent from the accidents in the swimming pools . The Drowning can be monitored in various swimming places such as, schools , hotels and homes. Prevention is better than cure, as the way by using the AI based based VirtualEye - Life Guard for Swimming Pools to Detect Active Drowning system is suitable for detect the accident and save the human life

GitHub & PROJECT DEMO LINK:

GIT HUB :

<https://github.com/IBM-EPBL/IBM-Project-31979-1660207154>

Project Demo Link:

<https://youtu.be/l9WggNKiOFw>

