VirtualEye - Life Guard For Swimming Pools To Detect Active Drowning

NALAIYA THIRAN - PROJECT REPORT

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BONAFIDE CERTIFICATE

Certified that this project report

"VirtualEye - Life Guard For Swimming Pools To Detect Active Drowning PNT2022TMID00795"

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CHAPTER 1

INTRODUCTION

INTRODUCTION

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 houses and backyards. 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 analyzes the position of swimmers to assess the probability of drowning, if it is higher, then an alert will be generated to attract lifeguards' attention.

1.1 Project Overview

Although there have been few studies of applied visual search that have examined this domain, lifeguard surveillance is a challenging task that is essential for swimmer safety. In the present study, dynamic, naturalistic stimuli—video clips of cooperative swimmers—were used to compare the search abilities of lifeguards and non-lifeguards with varying set sizes and types of drowning. Lifeguards were more precise and reacted more quickly to targets who were drowning. Additionally, different responses were observed for different types of drowning targets, demonstrating that passive drowning may be less obvious but is nonetheless highly instructive once identified. Passive drowning was detected less frequently but more quickly than active drowning. At an intermediate set-size level, set-size effects showed a decline in reaction times, pointing to a potential change in visual search strategies as the array size grows.

1.2 Purpose

Because drowning is the third most common cause of unintentional death, reliable security measures must be developed. Through the use of human action detection, the project's goal is to develop a system that can recognize drowning incidents in swimming pools automatically. The system will receive a video that has been captured using live security cameras and will process and categorize it using a drowning detection model. In order for the lifeguards to begin their rescue efforts, the system will break this video up into image frames and apply a model to it. If any early drowning behaviors, such as hand waving, water splashing, or diving, are identified, the system will sound an alarm. The system uses the state-of-the-art YOLOv5 object detection model to detect persons in each frame and check if they are drowning.

CHAPTER 2

LITERATURE SURVEY

2.1 Existing problem

A victim of drowning cannot yell for help because the water is blocking their mouth, so the process is silent. Gravity will cause the drowning victim's body to fall to the pool floor as soon as they have consumed enough water, gained enough weight, and reached the bottom. After a while, the stomach and lungs will produce bacteria, and the corpse will begin to float on water. Depending on the state of the water, this floating could take several hours or several days. The chances of survival without severe brain or organ damage are higher if the drowning victim is removed from the water within five or six minutes. Existing drowning detection methods include wearable sensor-based systems and vision-based systems. The second division of vision-based technologies is between those that employ underwater cameras and those that employ above-water cameras. The disadvantage of underwater cameras is that they don't capture the initial battle above the water. A crucial concern to take into account in a time-critical emergency is the possibility of a longer rescue time if a drowning incident is not recognized as soon as possible. The biggest drawback of a wearable-based system is its pain, which may cause younger children to attempt to remove the gadget in order to feel better. However, this idea is unproven.

2.2 References

Title: Automated Drowning Detection And Security in Swimming Pool.

Authors: Kanchana A, Kavya G.R, Kavitha C, Soumyashree V, Salila Hedge (Department of Electronics and Communication).

Year: 2019

Description: Swimming pool surveillance systems play an essential role in safeguarding the premises. In this project, a differential pressure approach is used for the detection of drowning incidents in swimming pools at the earliest possible stage. The automated drowning detection system works on the principle of differential pressure. The system contains two fundamental modules: begin with the wristband consisting of pressure sensors on the transmitter side. Second, the receiver module at the swimming pool territory should wear the wristband. The pressure underwater is different and greater than the pressure at the air-water interface. The pressure at a particular depth is measured and set as the threshold.

Pros:

- The children's life is saved during drowning incidents in this swimming pool by lifting the acrylic plate.
- The demo system uses a pressure sensor, which has the advantages of being convenient, economical, and having a straightforward algorithm.

Cons:

- The reflection and refraction of light in air-water interference will affect the image quality and the drowning man feature in this method does not easily distinguish swimmers and divers obviously.

Title: A Novel Drowning Detection Method for Safety of swimmers.

Authors: Ajil Roy, Dr.K.Srinivasan (Department of Instrumentation and Control Engineering).

Year: 2018

Description: Effective drowning detection methods are essential for the safety of swimmers. In this paper, a novel type of drowning detection method addressing many limitations of prevailing drowning detectors is proposed. The proposed method ensures the detection of drowning and reporting at the earlier stages. The proposed drowning detection method is also a generic solution that suits different water bodies from pools to oceans, and an economically viable method useful for both low and middle-income countries. The prototype of the drowning detection method is developed and demonstrated and the model of the system is simulated in the Proteus design suite. The results of the simulation and hardware experimentation are also reported.

Pros:

- The alarm receivers can be placed at different locations in the water bodies which are having a high chance of drowning.
- Another major advantage of this approach, unlike other approaches, is the ease of use in all atmospheric conditions, like rain or wind day or night.

Cons:

- The average time a child of age between 5-10 years can hold their breath for 10 seconds underwater.
- This feature should be valid only if the GPS connectivity was alive for a minimum of 10 minutes before the drowning, as a very old GPS value will give a wrong location itself.

Title: Drowning Detection System Using LRCNApproach.

Authors: Shardul Sanjay Chavan, Sanket Tukaram Dhake, Shubham Virendra Jadhav, Prof. Johnson Mathew (Department of Computer Engineering).

Year: 2022

Description: This project provides insights into a real-time video surveillance system capable of automatically detecting drowning incidents in a swimming pool. Drowning is the third reason for the highest number of unintentional deaths, and that's why it is necessary to create trustable security mechanisms. Currently, most of the swimming pool security mechanisms include CCTV surveillance and lifeguards to help in drowning situations. But this method is not enough for huge swimming pools like in amusement parks. Some security systems are using AI for drowning detection using cameras situated underwater at a fixed location and also by using floating boards having a camera mounted on the bottom side so that an underwater view can be captured. But the main problem in this system arises when the pool is crowded and visions of the cameras are blocked by people.

Pros:

- The alarm receivers can be placed at different locations in the water bodies which are having a high chance of drowning. Another major advantage of this approach, unlike other approaches, is the ease of use in all atmospheric conditions, like rain or wind day or night.

Cons:

- The average time a child of age between 5-10 years can hold their breath for 10 seconds underwater.
- This feature should be valid only if the GPS connectivity was alive for a minimum of 10 minutes before the drowning, as a very old GPS value will give a wrong location itself.

Title: Automated and Intelligent System for Monitoring Swimming PoolSafety Based on the IoT and Transfer Learning.

Author: AzizAlotaibi (College of Computer and Information Technology).

Year: 2020

Description: Recently, integrating the Internet of Things (IoT) and computer vision has been utilized in swimming pool automated surveillance systems. Several studies have been proposed to overcome off-time surveillance drowning incidents based on using a sequence of videos to track human motion and position. This paper proposes an efficient and reliable detection system that utilizes a single image to detect and classify drowning objects, to prevent drowning incidents. The performance of the specialized model is evaluated by using a prototype experiment that achieves higher accuracy, sensitivity, and precision, as compared to other deep learning algorithms. The collected data from different physical devices were processed by using ML techniques, to generate an action value.

Pros:

- This system utilizes the IoT and transfers learning to provide an intelligent and automated solution for off-time monitoring swimming pool safety.
- A specialized transfer-learning-based model utilizing a model pre-trained on “ImageNet”, which can extract the most useful and complex features of the captured image to differentiate between humans, animals, and other objects.

Cons:

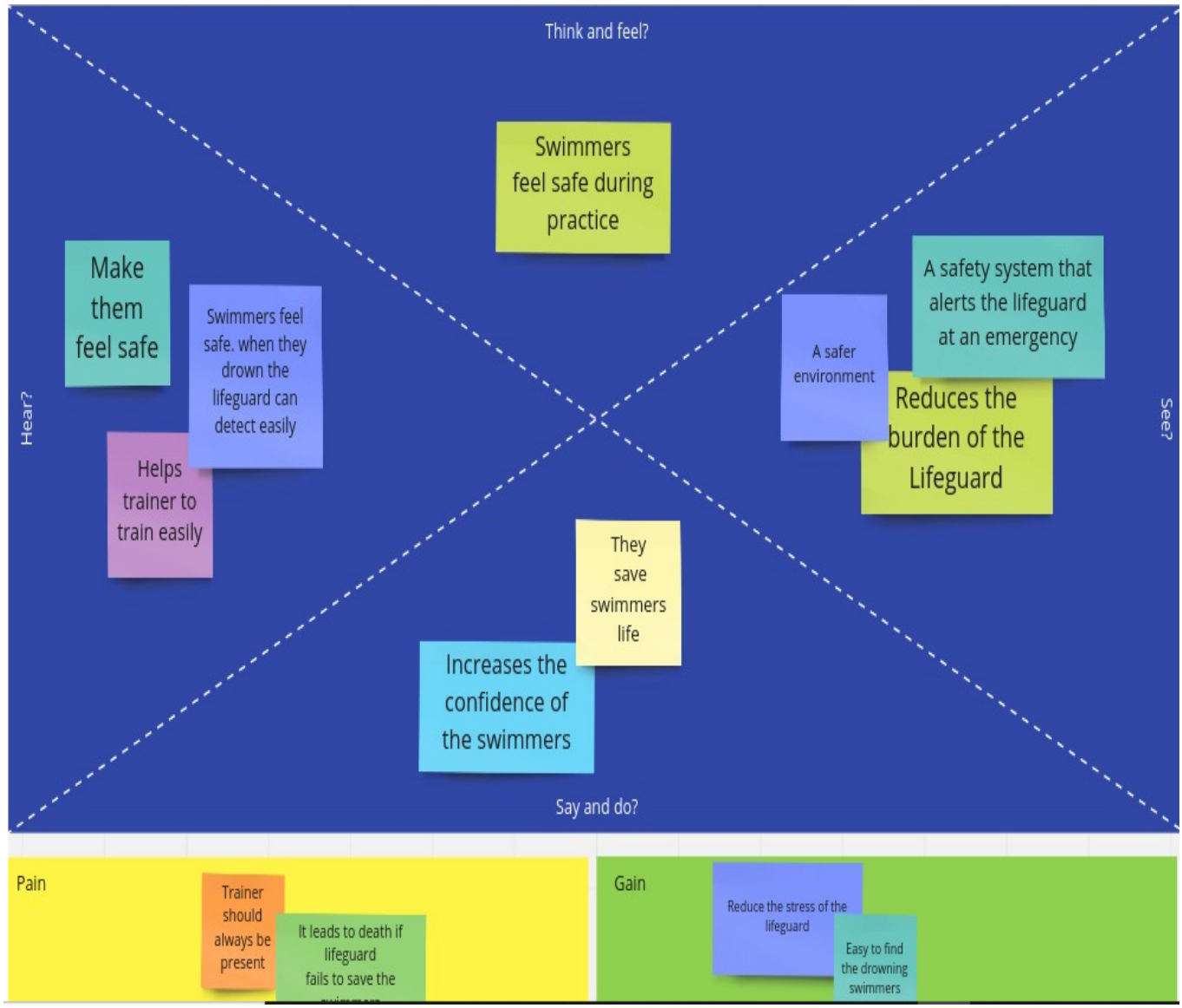
- A generative adversarial network should be applied to generate synthesis data, in order to increase the size of the training dataset.
- More classes should be added to explore and investigate the efficiency.

1.3 Problem Statement Definition

Safety is the top priority in all swimming areas. Due to their technical characteristics, such as underwater cameras, and methodological aspects, like the requirement for human engagement in the rescue mission, the present solutions supposed to handle the issue of maintaining safety at swimming pools have serious issues. The effective reduction of drowning and assurance of pool safety can be achieved through the implementation of an automated visual-based monitoring system. This study proposes a ground-breaking system that triggers an alarm to help to drown victims after quickly identifying them. It can identify a drowning person in three phases using the state-of-the-art object detection model called YOLOv5. Then the detections are processed in real-time to check for drowning swimmers and trigger an alarm.

CHAPTER 3
IDEATION & PROPOSED SOLUTION

3.1 Empathy Map Canvas



3.2 Ideation & Brainstorming

3.3 Proposed Solution

S. No.	Parameter	Description
1.	Problem Statement	If someone is drowning while swimming in a pool, immediate assistance is required so that the individual can continue swimming without the risk of dying.
2.	Idea / Solution description	We came up with a solution that detects drowning people with help of deep learning and computer vision techniques
3.	Novelty / Uniqueness	The proposed system uses a state-of-the-art object detection model to detect a drowning person in real-time with the highest degree of accuracy.
4.	Social Impact / Customer Satisfaction	This ensures the safety of all swimmers and promotes a safe environment for swimming in swimming pools.
5.	Business Model (Revenue Model)	Subscription model - The subscription business model is a business model in which a customer must pay a recurring price at regular intervals for access to a product or service.
6.	Scalability of the Solution	Since this is a cost-effective model, it can be implemented in all swimming pools.

3.4 Problem Solution Fit:

The Problem-Solution Fit simply means that you have found a problem with your customer and that the solution you have realized for it actually solves the customer's problem. It helps entrepreneurs, marketers and corporate innovators identify behavioral patterns and recognize what would work and why.

Purpose:

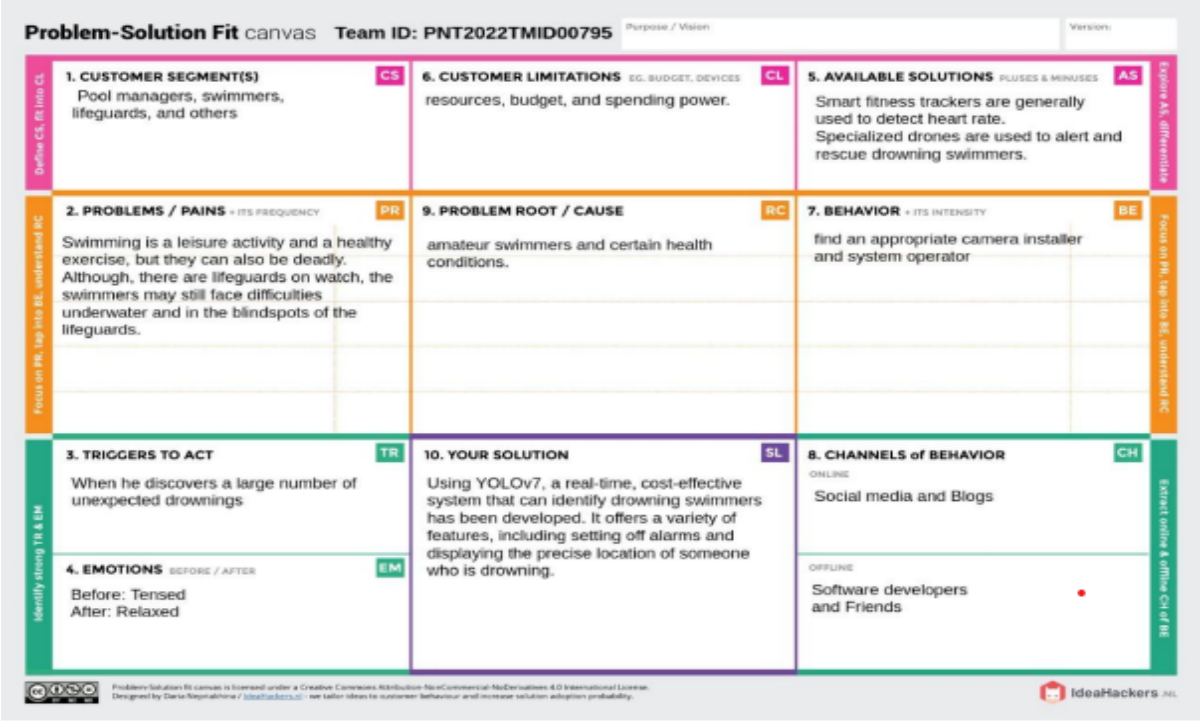
❑ Solve complex problems in a way that fits the state of your customers.

❑ Succeed faster and increase your solution adoption by tapping into existing mediums and channels of behavior.

❑ Sharpen your communication and marketing strategy with the right triggers and messaging.

❑ Increase touch-points with your company by finding the right problem-behavior fit and building trust by solving frequent annoyances, or urgent or costly problems.

❑ Understand the existing situation in order to improve it for your target group**.**



CHAPTER 4

REQUIREMENT ANALYSIS

4.1. Functional requirements

Following are the functional requirements of the proposed solution

Fr No	Functional Requirements	Sub Requirement
1	User Registration	Registration through Form Registration through Gmail Registration through LinkedIn
2	User Confirmation	Confirmation via Email Confirmation via OTP
3	User Profile	User information Bank details
4	Database	Car database Customer database
5	Features and Technology	Accuracy, the efficiency of drowning detection system, etc.
6	Feedback	Feedback through Form Feedback through Gmail Feedback through LinkedIn

4.2 Non-Functional requirements

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

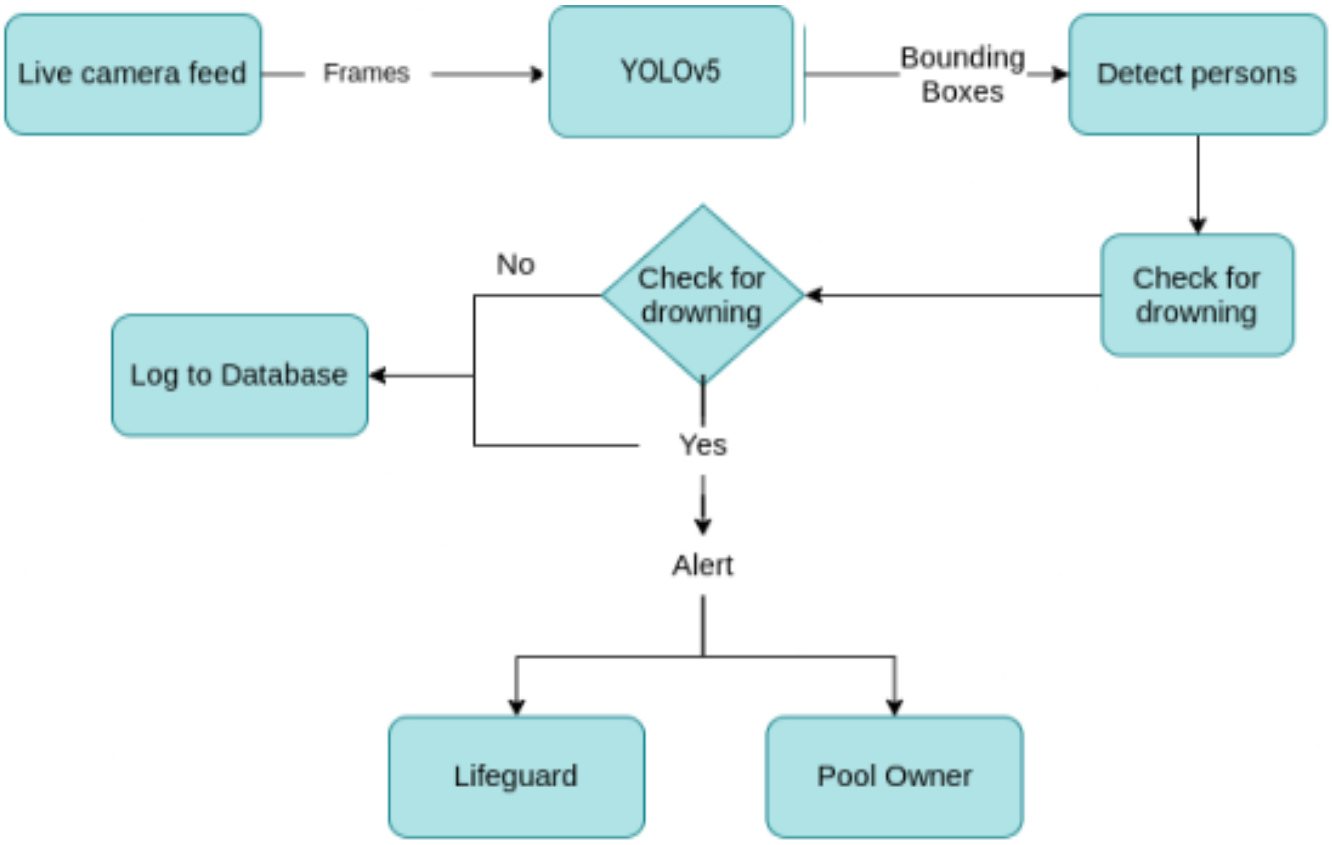
FR No.	Non-Functional Requirement	Description
NFR 1	Usability	Great UI (user interface), Quick adaptation of user.
NFR 2	Security	Aware of fraud and scams, Protect your password and account personal details.
NFR 3	Reliability	Rate of occurrence of failure is less. Failure free.
NFR 4	Performance	Perform value and correct prediction value, The landing page must support several users and must provide 5 second or less response time.
NFR 5	Availability	Uninterrupted services must be available at all times except at the time of server updation.
NFR 6	Scalability	that can handle any amount of data and perform many computations in a cost-effective and timesaving way to instantly serve millions of users residing at global locations.

CHAPTER 5

PROJECT DESIGN

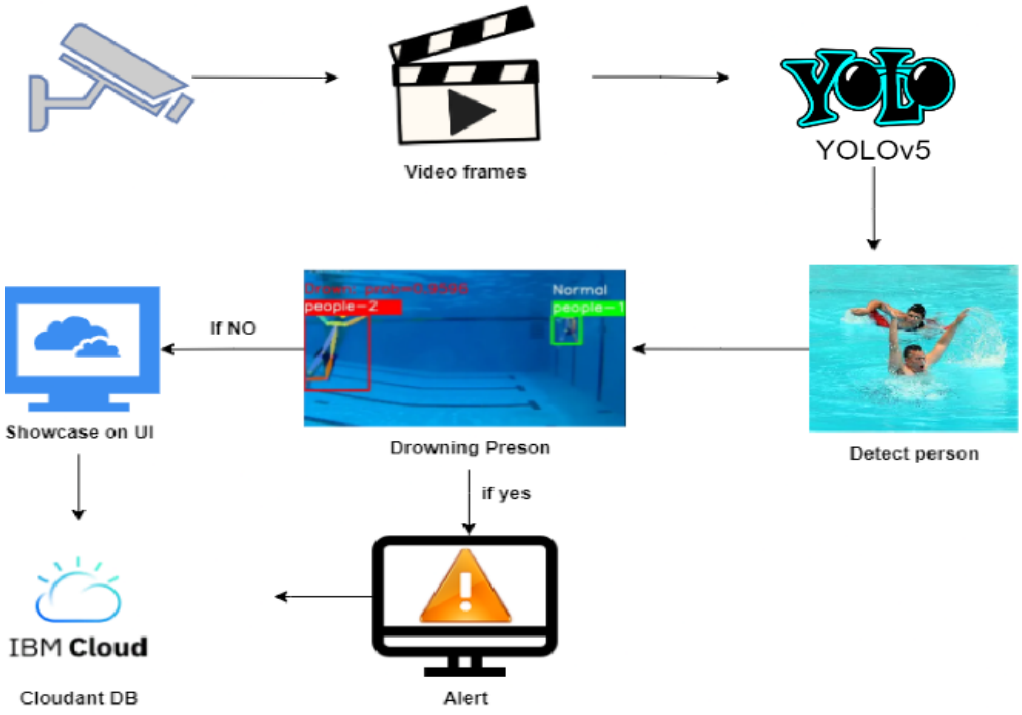
5.1 Data Flow Diagrams

A Data Flow Diagram (DFD) is a traditional visual representation of the information flows within a system. A neat and clear DFD can depict the right amount of the system requirement graphically. It shows how data enters and leaves the system, what changes the information, and where data is stored.

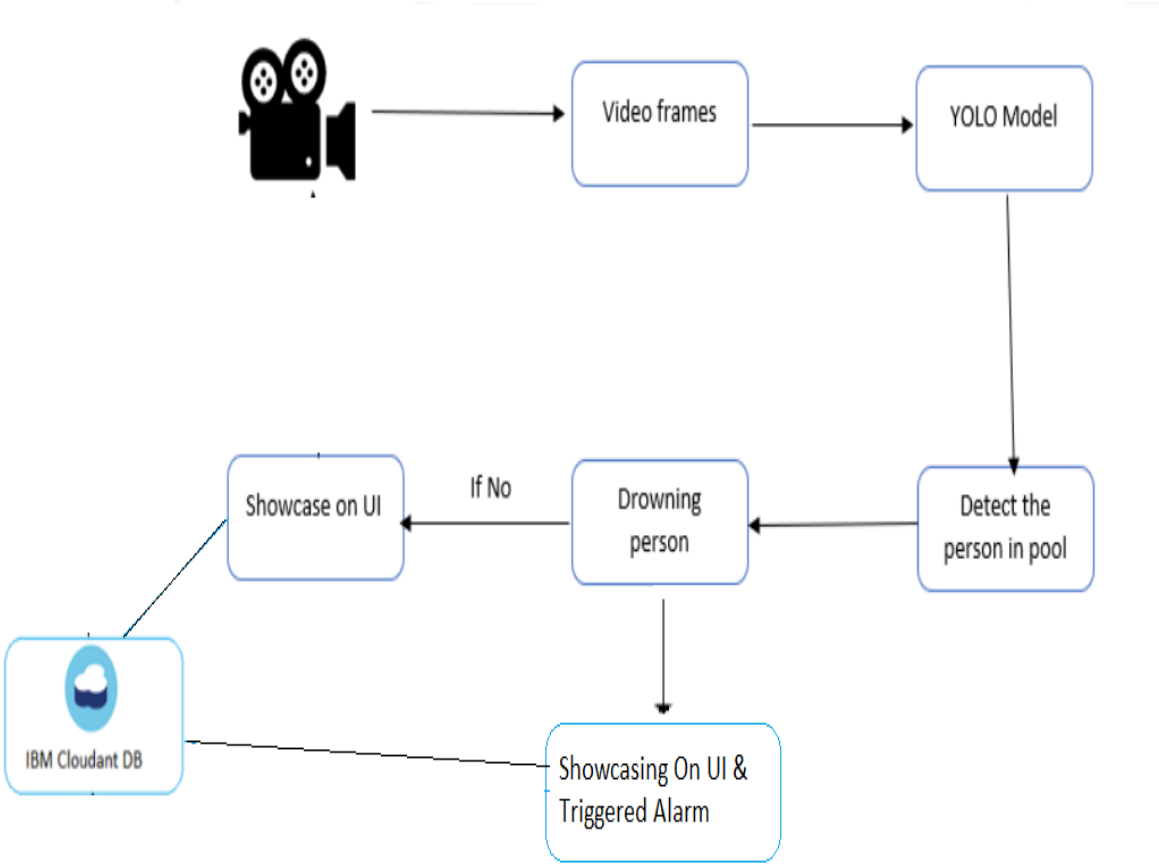


5.2 Solution & Technical Architecture

5.2.1 Solution Architecture:



5.2.2 Technical Architecture:



5.3 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 (Lifeguard)	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
Adminitsrator	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

CHAPTER 6
PROJECT PLANNING AND SCHEDULING

6.1 Sprint Planning & Estimation

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Collect Testset	USN-1	Collect Testset	2	Medium	Kevin
Sprint-1	Preprocess test set	USN-2	extract features from the Testset by preprocessing	2	High	Logesh
Sprint-1	fine-tune the model	USN-3	fine-tune the model	4	High	Koushik
Sprint-2	Detection	USN-4	Load the fine-tuned model.	4	High	Kevan
Sprint-2	Detection	USN-5	Identify the person by collecting real-time data through a webcam.	6	High	Kevin
Sprint-2	Detection	USN-6	Classifies it using a trained model to predict the output	8	High	Koushik
Sprint-3	Registration	USN-7	As a user, I can register for the application by entering my email, and password, and confirming my password.	2	High	Kevan
Sprint-3	Registration	USN-8	As a user, I will receive a confirmation email once I have registered for the application	1	High	Koushik
Sprint-3	Login	USN-9	As a user, I can log into the application by entering email & password	1	High	Kevan

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-4	Detection	USN-10	If a person is drowning, the system will ring an alarm to give signal	8	High	Logesh
Sprint-4	Detection	USN-11	As a User, I can detect the drowning person.	7	Medium	Kevan
Sprint-4	Logout	USN-12	As a User, I can log out of the application.	2	Low	Kevin

6.2 Sprint Delivery Schedule

Sprint	Total Story Points	Duration	Sprint Start Date	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	18	6 Days	31 Oct 2022	05 Nov 2022	14	05 Nov 2022
Sprint-3	4	6 Days	07 Nov 2022	12 Nov 2022	3	12 Nov 2022
Sprint-4	17	6 Days	14 Nov 2022	19 Nov 2022	15	19 Nov 2022

Velocity:

Imagine we have a 10-day sprint duration, and the velocity of the team is 20 (points per sprint). Let's calculate the team's average velocity (AV) per iteration unit (story points per day)

$$AV = \frac{sprint\ duration}{velocity} = \frac{20}{10} = 2$$

For Sprint-1 the Average Velocity (AV) is: AV = Sprint Duration/velocity = 8 / 6 = 1.33

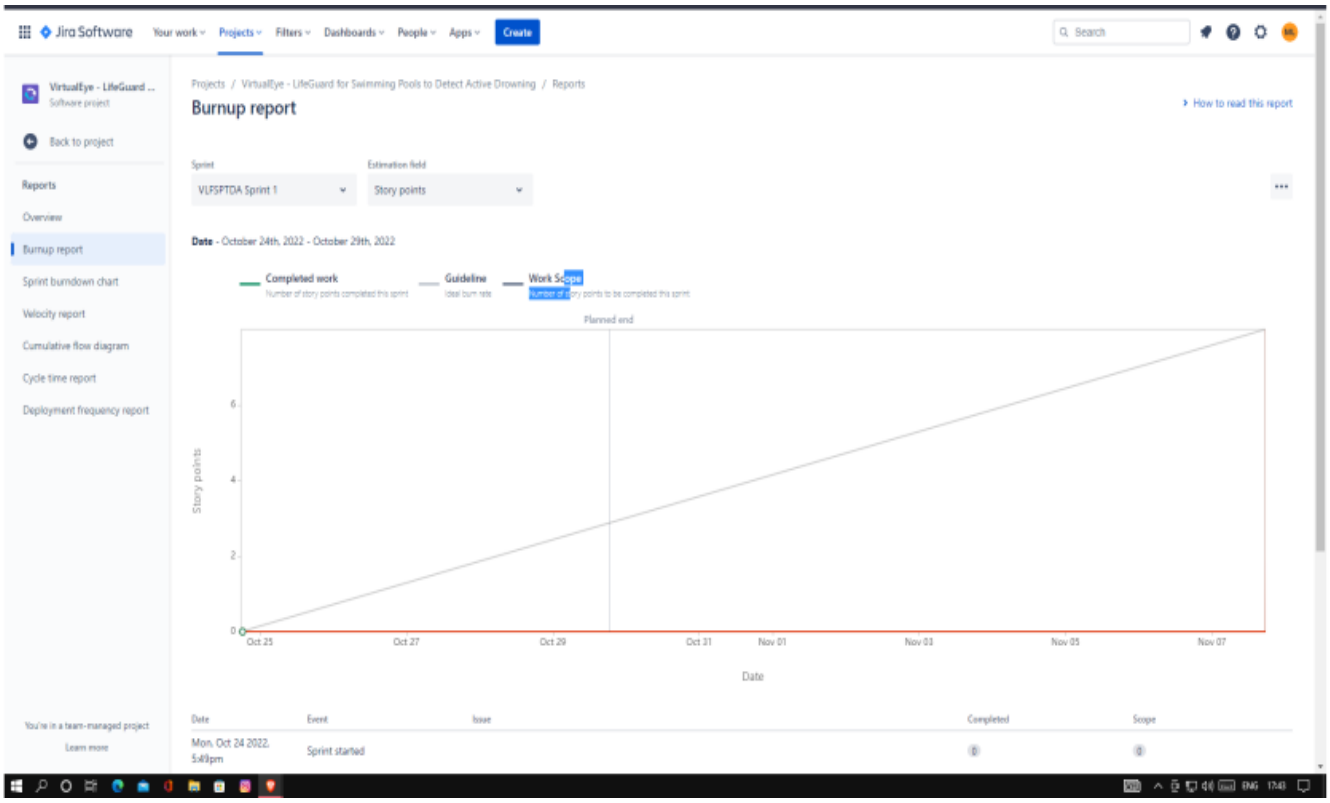
For Sprint-2 the Average Velocity (AV) is: AV = Sprint Duration/velocity = 18 / 6 = 3

For Sprint-3 the Average Velocity (AV) is: AV = Sprint Duration/velocity = 4 / 6 = 0.66

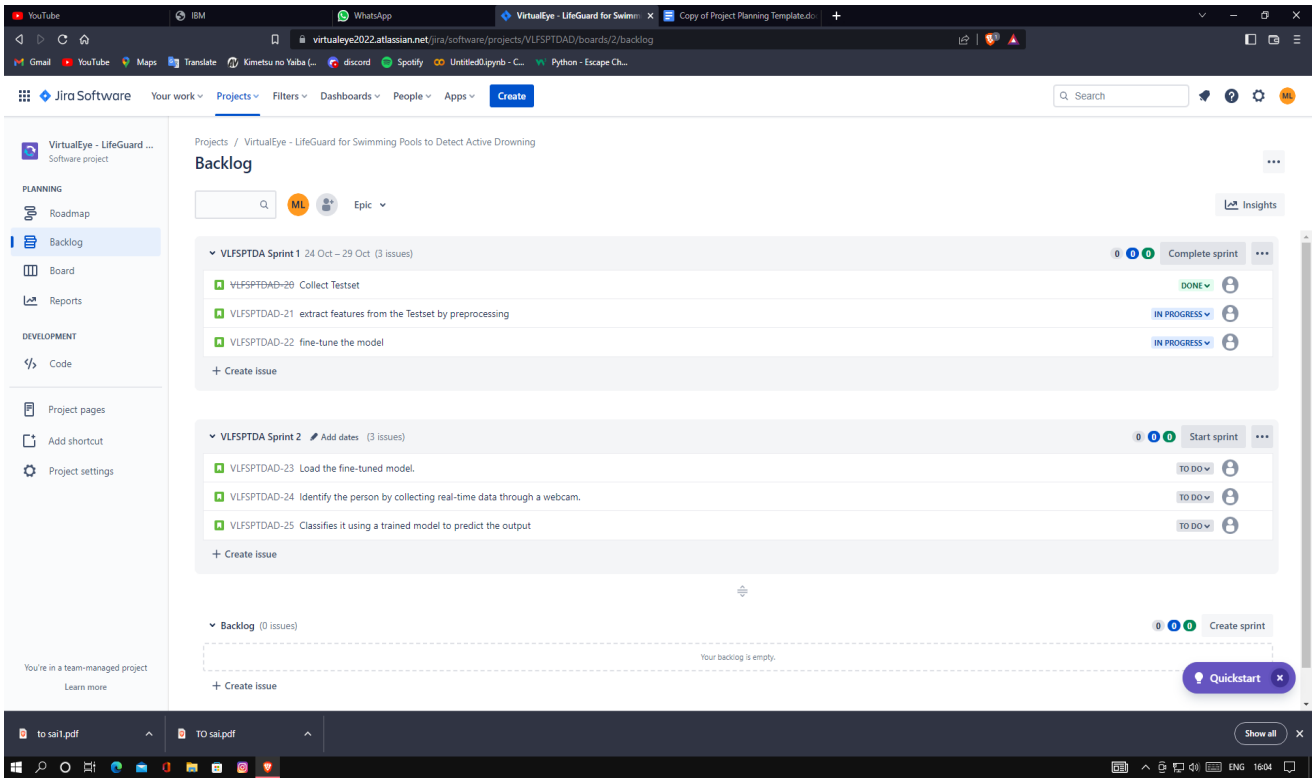
For Sprint-4 the Average Velocity (AV) is: AV = Sprint Duration/velocity = 17 / 15 = 1.13

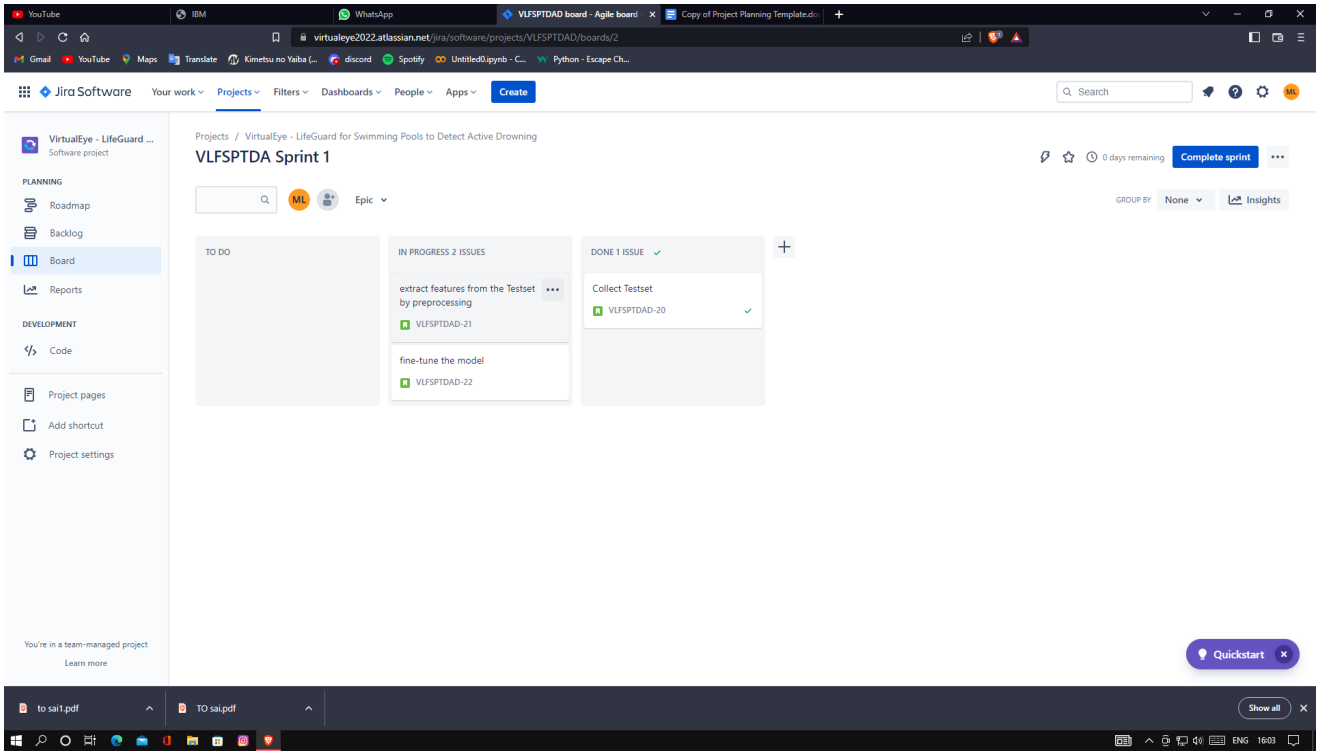
Burndown Chart:

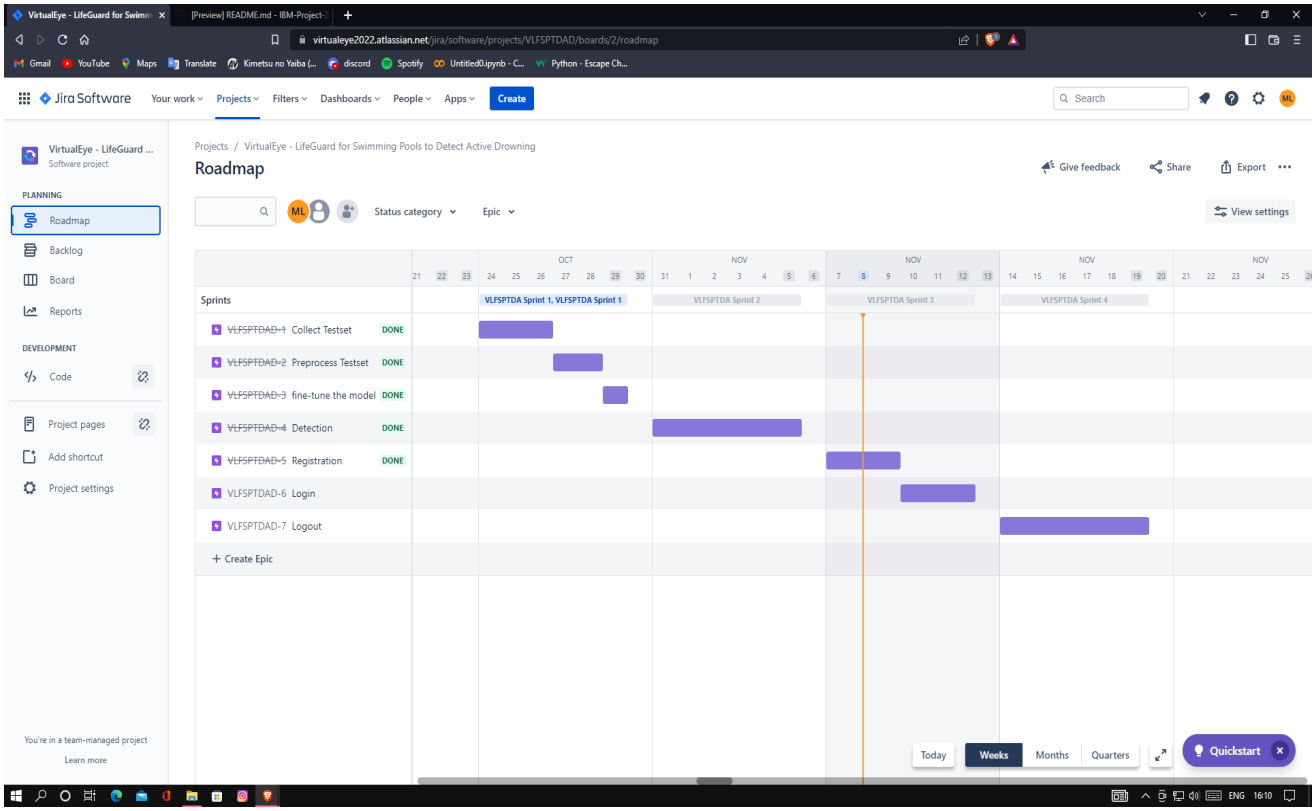
A burndown chart is a graphical representation of work left to do versus time. It is often used in agile software development methodologies such as Scrum. However, burn-down charts can be applied to any project containing measurable progress over time.



6.3 Reports from JIRA






VirtualEye - LifeGuard for Swimm
[Preview] README.md - IBM-Project-2
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Jira Software
Your work
Projects
Filters
Dashboards
People
Apps
Create
Search
VirtualEye - LifeGuard ...
Software project
PLANNING
Roadmap
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Reports
DEVELOPMENT
Code
Project pages
Add shortcut
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You're in a team-managed project
Learn more
Projects / VirtualEye - LifeGuard for Swimming Pools to Detect Active Drowning
Roadmap
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Status category
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View settings
OCT
NOV
NOV
NOV
NOV
Sprints
VLFSPTDA Sprint 1, VLFSPTDA Sprint 1
VLFSPTDA Sprint 2
VLFSPTDA Sprint 3
VLFSPTDA Sprint 4
VLFSPTDAD-1 Collect Testset DONE
VLFSPTDAD-2 Preprocess Testset DONE
VLFSPTDAD-3 fine-tune the model DONE
VLFSPTDAD-4 Detection DONE
VLFSPTDAD-5 Registration DONE
VLFSPTDAD-6 Login
VLFSPTDAD-7 Logout
+ Create Epic
Today
Weeks
Months
Quarters
Quickstart
ENG
16:10

CHAPTER 7
CODING & SOLUTIONING

7.1 Feature 1

The person detection feature is implemented using YOLOv5 pre-trained model.

```
import cv2
import torch
from tqdm.auto import tqdm

device = torch.device("cuda" if torch.cuda.is_available() else
"cpu")
model = (
                torch.hub.load("ultralytics/yolov5",     "yolov5s",
pretrained=True).eval().to(device)
)


def             detect(source_path,             num_track_seconds=5,
save_path="static/output.mp4"):

    cap = cv2.VideoCapture(source_path)
    FPS = cap.get(cv2.CAP_PROP_FPS)
    total_frames = cap.get(cv2.CAP_PROP_FRAME_COUNT)
    print("FPS: ", FPS)
    print("Total Frames: ", total_frames)

    imageWidth = int(cap.get(cv2.CAP_PROP_FRAME_WIDTH))
    imageHeight = int(cap.get(cv2.CAP_PROP_FRAME_HEIGHT))

    writer = cv2.VideoWriter(
        save_path,
        cv2.VideoWriter_fourcc("m", "p", "4", "v"),
        FPS,
        (imageWidth, imageHeight),
    )
```

```
    prev_center = None
    not_moving_frame_count = 0

    for frame_num in tqdm(range(int(total_frames))):
        success, frame = cap.read()
        if success:
            with torch.inference_mode():
                results = model(frame)

            xyxys = results.xyxy[0].cpu().numpy()
            for xyxy in xyxys:
                    center = ((xyxy[0] + xyxy[2]) // 2, (xyxy[1] +
xyxy[3]) // 2)
                # check if the detected object is a person
                if xyxy[-1] == 0 and prev_center is not None:
                    # check for no movement
                    if (
                        abs(prev_center[0] - center[0]) < 20
                        and abs(prev_center[1] - center[1]) < 20
                    ):
                        not_moving_frame_count += 1

                prev_center = center

                    bbox, conf, class_id = xyxy[:4].astype(int),
xyxy[4] * 100, xyxy[5]

                if not_moving_frame_count >= (num_track_seconds *
FPS):
                    color = (0, 0, 255)
                    frame = cv2.putText(
                        frame,
                        "Drowning: Yes",
                        (80, 50),
                        cv2.FONT_HERSHEY_DUPLEX,
```

```
                        1,
                        color,
                        2,
                        cv2.LINE_AA,
                    )

                else:
                    color = (0, 255, 0)
                    frame = cv2.putText(
                        frame,
                        "Drowning: No",
                        (80, 50),
                        cv2.FONT_HERSHEY_DUPLEX,
                        1,
                        color,
                        2,
                        cv2.LINE_AA,
                    )
                       out_frame = cv2.rectangle(frame, bbox[:2],
bbox[2:], color, 2)
                out_frame = cv2.putText(
                    out_frame,
                    f"conf: {conf:.2f}",
                    bbox[:2],
                    cv2.FONT_HERSHEY_DUPLEX,
                    0.6,
                    color,
                    2,
                    cv2.LINE_AA,
                )
                center_pt = list(map(int, center))
                   out_frame = cv2.circle(out_frame, center_pt, 3,
color, -1)

                ret, buffer = cv2.imencode(".jpg", out_frame)
```

```
                out_frame_bytes = buffer.tobytes()

                yield (
                    b"--frame\r\n"
                            b"Content-Type: image/jpeg\r\n\r\n" +
out_frame_bytes + b"\r\n"
                )

            writer.write(out_frame)


    # release resources
    cap.release()
    cv2.destroyAllWindows()


if __name__ == "__main__":
    detect("swim.mp4")
    detect("standby.mp4")
```

7.2 Feature 2

```
import os

from cloudant.client import Cloudant
from flask import Flask, flash, redirect, render_template,
request, url_for, Response
from werkzeug.utils import secure_filename

from detect import detect

UPLOAD_FOLDER = "static/uploads/"
RESULTS_FOLDER = "static/results/"

app = Flask(__name__)
app.secret_key = "secret-key"
app.config["UPLOAD_FOLDER"] = UPLOAD_FOLDER

API_KEY = "api key"
USERNAME = "username"

databaseName = "virtual_eye"

client = Cloudant.iam(USERNAME, API_KEY, connect=True)


@app.route("/")
def index():
    return render_template("index.html", static_folder="static")


@app.route("/register", methods=["GET", "POST"])
def register():
    if request.method == "POST":
        # Get the form data
```

```
        try:
            email = request.form["email"]
            password = request.form["password"]
            # Create a database using an initialized client
            my_database = client.create_database(databaseName)
            # Check that the database doesn't already exist
            if my_database.exists():
                print(f"'{databaseName}' successfully created.")
            # Create a JSON document
            json_document = {
                "_id": email,
                "email": email,
                "password": password,
            }
            if email in my_database:
                            return  render_template("register.html",
msg="Email already exists")
            else:
                # Create a document using the Database API
                                                    new_document    =
my_database.create_document(json_document)

                return render_template(
                            "register.html", msg="Account created
successfully!"
                )
        except Exception as e:
            return render_template(
                        "register.html", msg="Something went wrong!
Please try again"
            )
    if request.method == "GET":
        return render_template("register.html")
```

```
@app.route("/login", methods=["GET", "POST"])
def login():
    if request.method == "POST":
        email = request.form["email"]
        password = request.form["password"]
        my_database = client[databaseName]
        # Check that the database exists
                            if    email    in    my_database    and
my_database[email]["password"] == password:
            return redirect(url_for("predict"))
        else:
                return render_template("login.html", msg="Invalid
credentials!")
    if request.method == "GET":
        return render_template("login.html")


@app.route("/predict", methods=["GET", "POST"])
def predict():
    if request.method == "POST":
        if "file" not in request.files:
            flash("No file part")
            return redirect(request.url)
        file = request.files["file"]
        if file.filename == "":
            flash("No video selected for uploading")
            return redirect(request.url)
        else:
            filename = secure_filename(file.filename)
               file.save(os.path.join(app.config["UPLOAD_FOLDER"],
filename))
            return render_template(
                "predict.html",
                msg="Video uploaded successfully",
                filename=filename,
```

```
            )

    if request.method == "GET":
        return render_template("predict.html")


@app.route("/response/<string:filename>",methods=["GET",
"POST"])
def response(filename):
    print(filename)
    return Response(
        detect(
            os.path.join(app.config["UPLOAD_FOLDER"], filename),
        ),
        mimetype="multipart/x-mixed-replace; boundary=frame",
    )


@app.route("/logout", methods=["GET"])
def logout():
    return render_template("logout.html")


if __name__ == "__main__":
    app.run(debug=True)
```

CHAPTER 8

TESTING

8.1 Test Cases

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	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		Kevan
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		Kevin
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		Logesh
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		Koushik
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		Kevin
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		Kevan
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: abc@gmail.com password: abc	Application should show 'Registration successful'	Working as expected	pass		Y		Logesh
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		Kevan
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		Koushik
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		kevin
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		logesh

8.2 User Acceptance Testing

8.2.1 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

8.2.2. Test Case Analysis

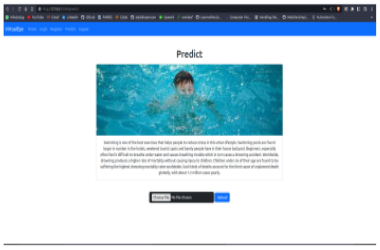
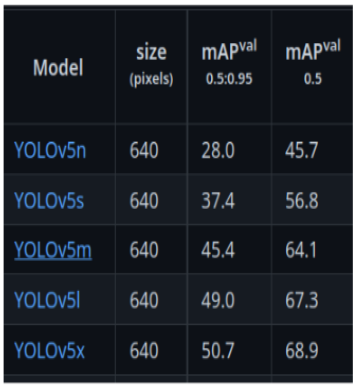
This report shows the number of test cases that have been passed, failed and untested.

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
Exception Reporting	9	0	0	9
Final Report Output	4	0	0	4
Version Control	2	0	0	2

CHAPTER 9
RESULTS

9.1 PERFORMANCE METRICS

Model Performance Testing

S.No.	Parameter	Values	Screenshot
1.	Model Summary	-	
2.	Accuracy	Training Accuracy - 60 Validation Accuracy - 56	
3.	Confidence Score (Only Yolo Projects)	Class Detected - Person Confidence Score - 83%	

CHAPTER 10
ADVANTAGES AND DISADVANTAGES

10.1 ADVANTAGES

- The system will monitor everyone in the pool and if it notices someone isn't moving for a certain period of time, it will trigger alarms and send alerts to the lifeguards monitoring device.
- To continuously monitor the pool, our software closely integrates with the cameras already in place.
- The built-in notification system produces alarms within 10 seconds on the lifeguard's monitoring device.
- The proposed system can work in real-time on edge devices, making rescue operations effortless.

10.2 DISADVANTAGES

- Underwater live cameras are exorbitant.
- Swimming pools may have potential blind spots due to their size and shape.
- Risk that such systems can create a false sense of security for lifeguards.
- Concerns over inconsistent levels of reliability of systems and situations where glare, and high occupancy activity rates can cause false alarms.

CHAPTER 11
CONCLUSION

11. CONCLUSION

The results will determine the class names for a batch of frames from the videos provided as input. The action in the swimming pool will be detected as the projected class name with the highest probability. As the confidence variable, the predicted class name with the highest likelihood might be displayed. After the project is completed successfully, the video monitoring and drowning detection system can be used. If someone is discovered drowning, an alert will sound. Drowning prevention procedures can be implemented as a result of the system's early warnings.

CHAPTER 12

FUTURE SCOPE

12. FUTURE SCOPE

Fine tuning the YOLOv5 model would also result in better and more efficient predictions. 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.

CHAPTER 13

APPENDIX

13.1 SOURCE CODE

index.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+058RXPxPg6fy4IWvTNh0E263XmFcJlSAwiGgFAW/dAiS
6JXm" crossorigin="anonymous">
   <script src="https://code.jquery.com/jquery-3.2.1.slim.min.js"

integrity="sha384-KJ3o2DKtIkvYIK3UENzmM7KCkRr/rE9/Qpg6aAZGJwFDMVNA/GpGFF93hXpG
5KkN"
       crossorigin="anonymous"></script>
   <script
src="https://cdnjs.cloudflare.com/ajax/libs/popper.js/1.12.9/umd/popper.min.js
"

integrity="sha384-ApNbgh9B+Y1QKtv3Rn7W3mgPxhU9K/ScQsAP7hUibX39j7fakFPskvXusvfa
0b4Q"
       crossorigin="anonymous"></script>
   <script
src="https://maxcdn.bootstrapcdn.com/bootstrap/4.0.0/js/bootstrap.min.js"

integrity="sha384-JZR6Spejh4U02d8jOt6vLEHfe/JQGiRRSQQxSfFWpi1MquVdAyjUar5+76PV
CmYl"
       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=s
wap" 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>
    <img class="d-block w-100" src="../static/drown1.jpg" alt="Drowning Image"
>
```

```
   <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><b>
                    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.
                </b></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/dist/css/bootstrap.min.css"
```

```
        rel="stylesheet"

integrity="sha384-Zenh87qX5JnK2Jl0vWa8Ck2rdkQ2Bzep5IDxbcnCeuOxjzrPF/et3URy9Bv1
WTRi"
        crossorigin="anonymous">
    <script

src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dist/js/bootstrap.bundle.min
.js"

integrity="sha384-OERcA2EqjJCMA+/3y+gxIOqMEjwtxJY7qPCqsdltbNJuaOe923+mo//f6V8Q
bsw3"
        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>
        <img src=" static/logo.png" alt="VirtualEye" width="300px"
            height="200px" />
    </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>
```

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/dist/css/bootstrap.min.css"
        rel="stylesheet"

integrity="sha384-Zenh87qX5JnK2Jl0vWa8Ck2rdkQ2Bzep5IDxbcnCeuOxjzrPF/et3URy9Bv1
WTRi"
        crossorigin="anonymous">
    <script

src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dist/js/bootstrap.bundle.min
.js"

integrity="sha384-OERcA2EqjJCMA+/3y+gxIOqMEjwtxJY7qPCqsdltbNJuaOe923+mo//f6V8Q
bsw3"
        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>
            <img src=" static/logo.png" alt="VirtualEye" width="300px"
                height="200px" />
        </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>
```

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/dist/css/bootstrap.min.css"
      rel="stylesheet"

integrity="sha384-Zenh87qX5JnK2Jl0vWa8Ck2rdkQ2Bzep5IDxbcnCeuOxjzrPF/et3URy9Bv1
WTRi"
      crossorigin="anonymous">
   <script

src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dist/js/bootstrap.bundle.min
.js"

integrity="sha384-OERcA2EqjJCMA+/3y+gxIOqMEjwtxJY7qPCqsdltbNJuaOe923+mo//f6V8Q
bsw3"
      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%;">
            <img src="static/drown.jpg" class="card-img-top"
                alt="drowning child">
            <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">
            <img src="{{ url_for('response', filename=filename) }}" width="50%"
                height="400px" />
        </div>
        {% endif %}
    </center>
</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-Zenh87qX5JnK2Jl0vWa8Ck2rdkQ2Bzep5IDxbcnCeuOxjzrPF/et3URy9Bv1
WTRi"
        crossorigin="anonymous">
    <script

src="https://cdn.jsdelivr.net/npm/bootstrap@5.2.2/dist/js/bootstrap.bundle.min
.js"

integrity="sha384-OERcA2EqjJCMA+/3y+gxIOqMEjwtxJY7qPCqsdltbNJuaOe923+mo//f6V8Q
bsw3"
        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>
```

13.2 GitHub & Project Demo Link

GitHub link: https://github.com/IBM-EPBL/IBM-Project-3786-1658635934

Project demo link: https://youtu.be/uiwF3lQH4OE