VirtualEye - Life Guard for Swimming Pools

To Detect Active Drowning

A PROJECT REPORT

SUBMITTED BY

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ANNA UNIVERSITY: CHENNAI- 600 025

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CHAPTER 1

1.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 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.

1.1 PROJECT OVERVIEW:

VirtualEye LifeGuard is a drowning detection system that detects every dangerous situation and accident. The VirtualEye software works in close integration with the cameras installed in the pool to continuously scan the

pool. Thanks to this combination of hardware, software and profound innovations, today VirtualEye LifeGuard represents excellence in drowning detection. When it comes to swimmers in trouble, every second counts. VirtualEye LifeGuard makes itself heard loud and clear in case of danger. The built-in notification system produces alarms within 10 seconds on smartwatches, phones, flashing lights and other configurable devices. In addition,VirtualEye's advanced technology can provide real-time location and image of the danger, making rescue operations easier. The VirtualEye LifeGuard system is able to record all the activities in the pools and to classify critical situations from normal ones in order to keep track of what happened. Thanks to its advanced image archiving system, VirtualEye LifeGuard meets the legislative requirements for the protection of personal data.

1.2 purpose:

The protection of swimmers is ensured to all facilities by a vigilance provided by personnel assigned to control the activities carried out in the pools. These controls have several critical points. The biggest problem is the difficulty in seeing the bottom of the pool. VirtualEye LifeGuard is specifically designed to provide support to lifeguards in the supervision of swimmers. It offers an additional level of safety and integrates seamlessly into rescue operations.

CHAPTER 2

2. LITERATURE SURVEY:

2.1EXISTING PROBLEM:

At present, swimming pools are built in hotels, sport clubs, schools and private residences. Although there have been various regulations put into place to reduce drowning accidents in some countries, communities still experience Many drowning incidents. Accordingly, a real-time system that will track swimmers in a pool using machine learning techniques and prevents drowning accidents is proposed. 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. To verify the performance of the proposed system, a prototype has been developed. Implemented, and tested. The results from experiments indicate that the system has a unique capability to monitor and track swimmers, thereby enabling it to mitigate and curb the number of deaths by drowning.

In this paper, an approach which addresses the problem of drowning has been presented. According to today's world scenario, saving people from drowning should need a serious attention. The objective is to address question, how an engineer system can save the life of drowning people. This paper proposes prime method to save people, who are drowning. The devised system has the ability to automatically detect drowning people by making use of two main concepts one is Sonar Sound Navigation 2 Ranging detection and the other one is Thermal detection. Both of these detection techniques are used for detection of human body underwater.

Thus, the results obtained from individual sensors of both detection techniques illustrate the effectiveness of the proposed approach in saving the life of humans from drowning underwater. Hence, the proposed approach is a viable solution to devise an innovative, portable, low cost and Customizable drowning detection system.
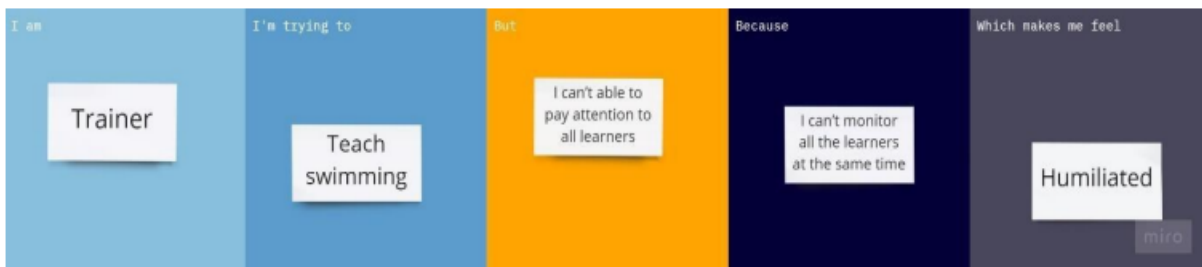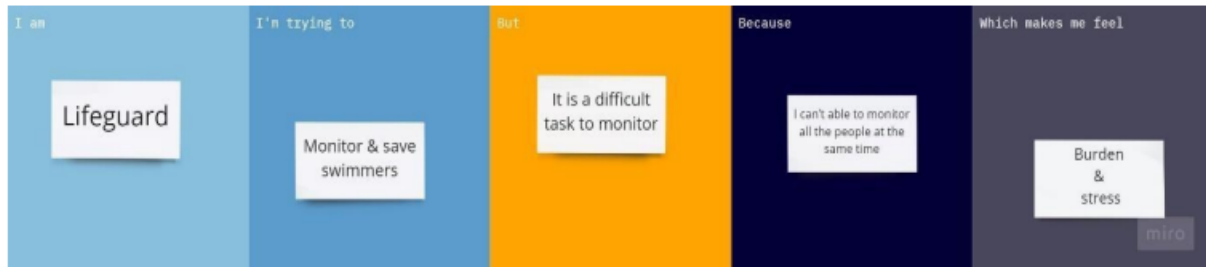
2.2 REFERENCE:

1.https://www.researchgate.net/publication/357549495_Drowning_behavior_detection_in_swimming_pool_based_on_deep_learning

2.https://onlinelibrary.wiley.com/doi/full/10.1002/acp.3756
3. https://www.ijraset.com/research-paper/drowning-detection-system-using-lrcnapproac

2.3 PROBLEM STATEMENT DEFINITION:

THARUN is the regular swimmer who needs to know about his swimming And safety measurements in the water and he has to be monitor till the Completion of swimming competition.

Problem Statement (PS)	I am (Customer)	I'm trying to	But	Because	Which makes me feel
PS-1	Swimmer (Beginner)	Learn swimming	I am afraid of drowning	Lack of Training	Fear
PS-2	Lifeguard	Monitor & save swimmers	It is a difficult task to monitor	I can't able to monitor all the people at the same time	Burden & stress
PS-3	Swimmer	Practice swimming	I am afraid of drowning	Loss of balance or consciousness sometimes	Panic
PS-4	Trainer	Teach swimming	I can't able to pay attention to all learners	I can't monitor all the learners at the same time	Humiliated

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CHAPTER 3

3.IDEATION & PROPOSED SOLUTION:

3.1 EMPATHY MAP CANVAS:

3.2 IDEATION & BRAINSTORMING:

②

Brainstorm

Write down any ideas that come to mind that address your problem statement.

⏱ 10 minutes

TIP

You can select a sticky note and hit the pencil(switch to sketch) icon to start drawing!

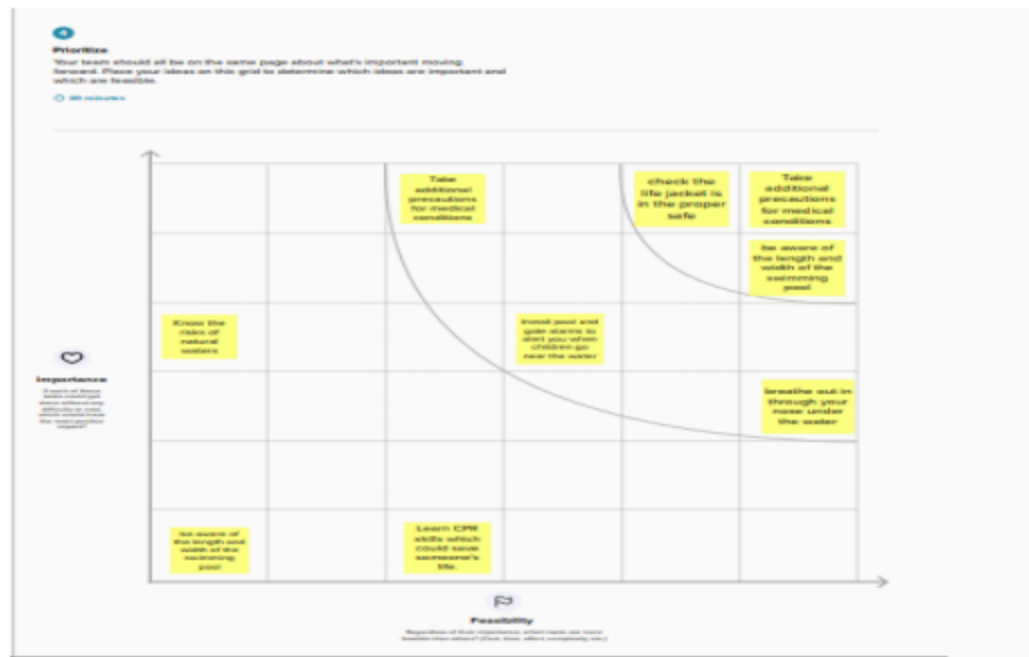Person 1　Person 2　Person 3　Person 4

③

Group ideas

Take turns sharing your ideas while clustering similar or related notes as you go. In the last 10 minutes, give each cluster a sentence-like label. If a cluster is bigger than six sticky notes, try and see if you and break it up into smaller sub-groups.

⏱ 20 minutes

Learn basic swimming and water skills

body movement should be well co ordinate

3.3 PROPOSED SOLUTION:

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	THARUN is the regular swimmer who needs to know about his swimming And safety measurements in the water and he has to be monitor till the Completion of swimming competition
2.	Idea / Solution description	SwimEye is a computer vision detection system for the prevention of drowning incidents in swimming pools. SwimEye works like an "extra lifeguard" under the water of your pool. Our object recognition software tracks the movements of all swimmers in a pool.NPO. To resolve the conflict, a system is being implemented along the swimming pools to save human lives. We are developing an underwater pool safety system that reduces the risk of drowning by studying body movement patterns and connecting cameras to artificial intelligence (AI) systems. Typically, such systems are created by installing more than 16 cameras underwater and on the ceiling and analysing the video feeds to detect any anomalies
3.	Novelty / Uniqueness	SwimEye develops, manufactures and retails rapid alerts for life-saving situations. Our flagship product is the Swim Eye drowning prevention system for public swimming pools. Swim Eye is a lifeguard support tool that works as an "extra lifeguard" in your pool.

4.	Social Impact / Customer Satisfaction	To resolve the conflict, a system is being implemented along the swimming pools to save human lives. We are developing an underwater pool safety system that reduces the risk of drowning by studying body movement patterns and connecting cameras to artificial intelligence (AI) systems. Typically, such systems are created by installing more than 16 cameras underwater and on the ceiling and analysing the video feeds to detect any anomalies. However, as a point of contact, we use a single camera that streams video underwater and analyses swimmer positions to determine the likelihood of drowning; if the probability is higher, an alert is generated to draw the attention of lifeguards.
5.	Business Model (Revenue Model)	Drowning detection system that detects every dangerous situation and accident. The software works in close integration with the cameras installed in the pool to continuously scan the pool. Thanks to this combination of hardware, software and profound innovations, the system would represent excellence in drowning detection. Features artificial intelligence technology that adapts to the needs of the user. It is the ultimate drowning detection system for those who demand the ultimate in safety. System would be able to record all the activities in the pools and to classify critical situations from normal ones to keep track of what happened.
6.	Scalability of the Solution	The proposed solution of using a single camera system can be scaled to a larger swimming pool area with addition of cameras both under and over the water surface. Along with that, we can also increase the number of alarms fitted in the place to increase the magnitude of alertness that is produced by the system. On the point of efficiency and performance, additional algorithms can be ran with existing ones so as to improve both the compute efficiency and reduce the computational overhead of the proposed solution.

3.4 PROBLEM SOLUTION FIT:

Define CS, fit into CC	1. CUSTOMER SEGMENT(S) CS	6. CUSTOMER CONSTRAINTS CC	5. AVAILABLE SOLUTIONS AS	Explore AS, differentiate
	Swimmers and Ordinary people, Organization and Trainers	It will be Affordable and Device compatibility and User-friendly device	The existing solution which gets the data and after training the model, predicts the results. Various software and device have been developed but not gives high accuracy rate	

Focus on J&P, tap into BE, understand RC	2. JOBS-TO-BE-DONE / PROBLEMS J&P	9. PROBLEM ROOT CAUSE RC	7. BEHAVIOUR BE	Focus on J&P, tap into BE, understand RC
	Lifeguards and trainers can't monitor all the swimmers /persons at a same time Detection system to detect drowning persons was not fast and accurate	The possibilities of detection of drowning were not up to the expected level and accuracy rate of the detection of existing system was low so there is a need for developing a system with high accuracy rate in detection	Get information from others Search and learn about drowning detection system Search for solution in online	

Identify strong TR & EM	3. TRIGGERS TR	10. YOUR SOLUTION SL	8.CHANNELS of BEHAVIOUR CH	Extract online & offline CH of BE
	Death rate of drowning was become high nowadays. System to detect drowning was not give high accuracy rate	Using CNN -YOLOv7 algorithm to detects the drowning people to get high and fast accuracy rate. It detects the drowning person and alerting by beep alarm and shows the exact position of a drowning person.	8.1 ONLINE Share information, social media, Blogs 8.2 OFFLINE Monitor persons, Friends and Colleague, get help from lifeguards or trainers	
	4. EMOTIONS: BEFORE / AFTER EM Before: Insecure and stressful After: Relaxed, Comfortable, feel secure			

CHAPTER 4

4.REQUIREMENT ANALYSIS:

4.1 FUNCTIONAL REQUIREMENTS:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	User Registration	Registration Via Email Registration Via phone number
FR-2	User Confirmation	Confirmation via Email Confirmation via OTP Create and store the data
FR-3	Alarm system	Monitor and detect the drowning person Alert the lifeguard by trigger the alarm
FR-4	Output	Visual representation Image detection Report generation

- The system must allow users to log into their account by entering their email and password.
- The system must allow users to log in with their Google accounts.
- The system must allow users to reset their password by clicking on "I forgot my password" and receiving a link to their verified email address.

CHAPTER 5

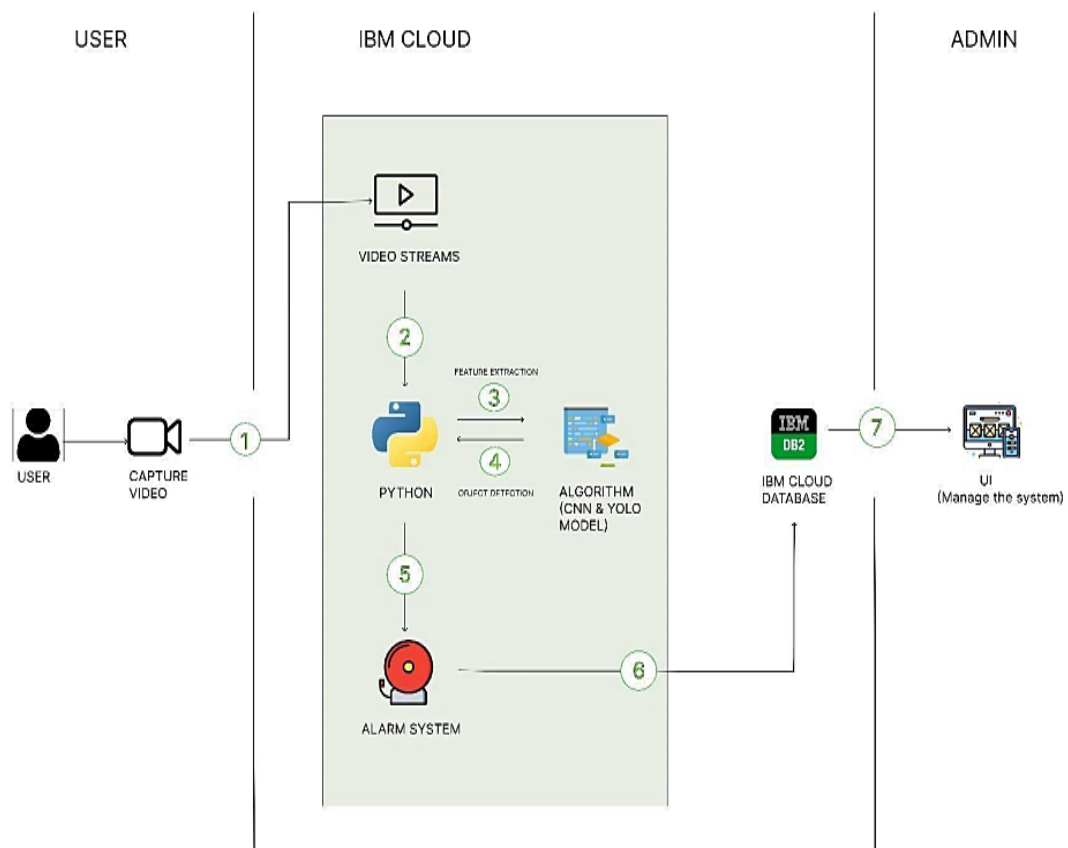## 5. PROJECT DESIGN:

5.1 DATA FLOW DIAGRAMS:
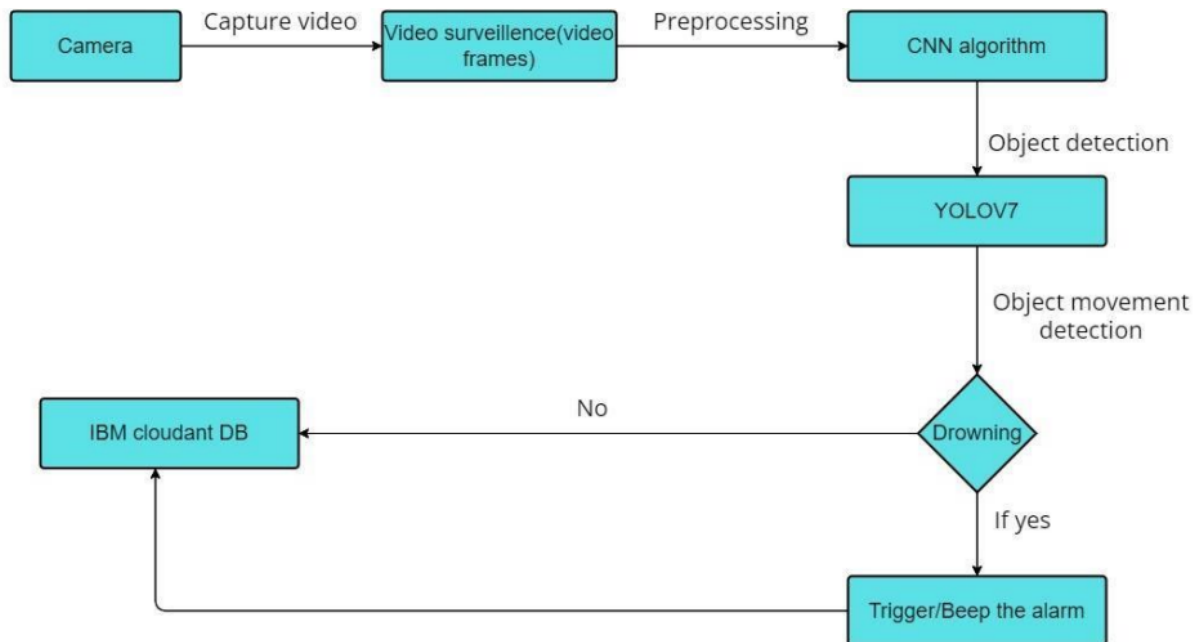
5.2 SOLUTION AND TECHNICAL ARCHITECTURE:

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 / Cloud Local 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

5.3 USER STORIES:

Use the below template to list all the user stories for the product.

User Type	Functional Requirement (Epic)	User Story Number	User Story / Task	Acceptance criteria	Priority	Release
Customer (Supervisor)	Installation	USN-1	They set the camera and install and configure the system in swimming pools	The software is installed and cameras are setup	High	Sprint-1
	Pre-processing	USN-2	Train and test the model	Train the model by using datasets	High	Sprint-1
	Detection of drowning	USN-3	The swimmers can be monitored by cameras	Camera surveillance	High	Sprint -2
		USN-4	Swimmers can be detected through their actions	Detection of drowning	High	Sprint-2
	Alarm rings	USN -5	Alarm rings When the system detects drowning person	Alert the lifeguard	High	Sprint-3
Lifeguard	Saves the person	USN-6	The Lifeguard saves the swimmer who is drowning once the alarm rings	Saves the life of people	High	Sprint-3

Administrator	Register	USN-7	Register into the application	Admin can access the account	Medium	Sprint-2
	Login	USN-8	Login and manage the application	Manage system	Medium	Sprint-2
		USN-9	Stores the database	Storage the database	Medium	Sprint-2

CHAPTER 6

6.PROJECT PLANNING & SCHEDULING:

6.1 SPRINT PLANNING & ESTIMATION:

S.NO	MILESTONE	DESCRIPTION	DURATION
1	Prerequisites	Prerequisites are all the needs at the requirement level needed for the execution of the different phases of a project.	1 WEEK
2	Create & Configure IBM cloud services	IBM Cloud provides solutions that enable higher levels of compliance, security, and management, with proven architecture patterns and methods for rapid delivery for running mission- critical workloads.	1 WEEK

3	Develop the python script	A Python script is a set of commands included in a file that is intended to be run similarly to a program. The concept is that the file will be run or performed from the command line or from within a Python interactive shell to perform a particular activity. Of course, the file includes methods and imports different modules.	3 WEEKS
4	Develop web application	A web application (or web app) is application software that runs in a web browser, unlike software programs that run locally and natively on the operating system (OS) of the device.	1 WEEK
5	Ideation phase	Ideation is the process where you generate ideas and solutions through sessions such as Sketching, Prototyping, Brainstorming, Brain writing, Worst Possible Idea, and a wealth of other ideation techniques.	1 WEEK
6	Project design phases	Project design is an early phase of a project where the project's key features, structure, criteria for success, and major deliverables are planned out. The aim is to develop one or more designs that can be used to achieve the desired project goals.	1 WEEK

7	Project planning phase	In the Planning Phase, the Project Manager works with the project team to create the technical design, task list, resource plan, communications plan, budget, and initial schedule for the project, and establishes the roles and responsibilities of the project team and its stakeholders.	1 WEEK
8	Project development phase	Project development is the process of planning and allocating resources to fully develop a project or product from concept to go-live.	4 WEEKS

6.2 SPRINT DELIVERY SCHEDULE:

the below template to create product backlog and sprint schedule

Sprint	Functional Requirement (Epic)	User Story Number	User Story / Task	Story Points	Priority	Team Members
Sprint-1	Registration	USN-1	As a lifeguard , I can register for the application by entering my email, password, and confirming my password.	2	High	Aishwarya
Sprint 1	User conformation	USN-2	As a lifeguard, I will receive the conformation mail once I have registered for the application	2	Medium	Jogi.Dileep kumar reddy
Sprint-1	Login	USN-3	As a lifeguard , I can log into the application by entering email& password	2	High	R.dinesh

Sprint-2	Cloudant DB	USN-1	Create DB	2	High	Aswini

Sprint-3	Coding (Accessing datasets)	USN-1	Coding is a set of instructions used to manipulate information so that a certain input results in a particular output.	2	High	Aishwarya
Sprint-4	Application building	USN-1	As a Lifeguard , It will show the current Information of the swimming pool	1	Medium	Jogi.Dileep kumar reddy

Project Tracker, Velocity & Burndown Chart: (4 Marks)

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	20	4 Days	24 Oct 2022	27 Oct 2022		
Sprint-2	20	5 Days	28 Oct 2022	01 Nov 2022		
Sprint-3	20	8 Days	02 Nov 2022	09 Nov 2022		
Sprint-4	20	9 Days	10 Nov 2022	18 Nov 2022		

VELOCITY:

Sprint 1 average velocity:

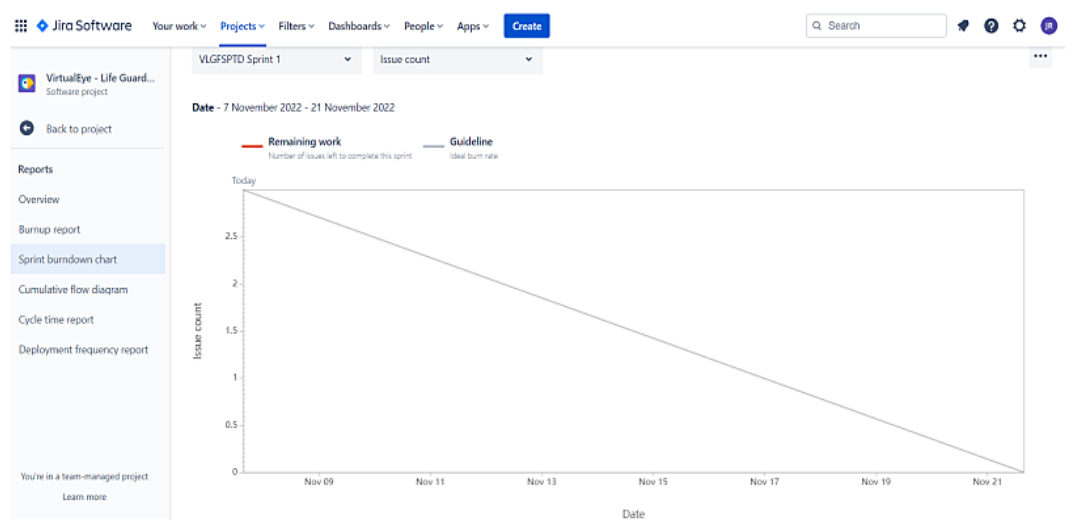Average Velocity = 20/4 =5

Sprint 2 average velocity:

Average Velocity = 20/5 =4

Sprint 3 average velocity:

Average Velocity = 20/8 =2.5
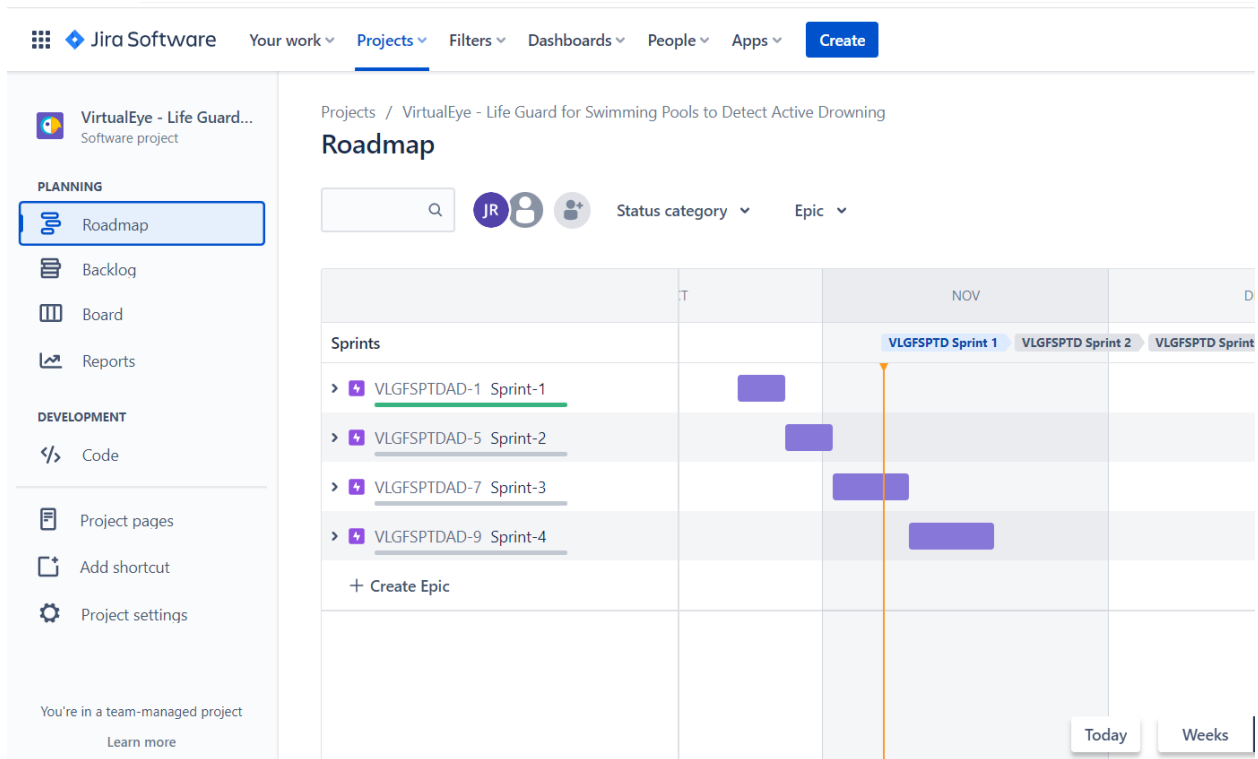
Sprint 4 average velocity:

Average Velocity = 20/9 =2.22

Burndown Chart:

6.3 REPORTS FROM JIRA:

ROAD MAP:

BOARD:

BACKLOG:

CHAPTER 7

7. CODING & SOLUTIONING:

7.1 Feature 1:

The live video stream from our underwater cameras is automatically monitored by our object recognition software. 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.

CODE:

Base.html
```html
<html lang="en">
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initialscale=1.0">
<meta http-equiv="X-UA-Compatible" content="ie=edge">
<title>High Quality Facial Recognition</title>
<link
href="https://cdn.bootcss.com/bootstrap/4.0.0/css/bootstrap.min.
css" rel="stylesheet">
```

```
<script
src="https://cdn.bootcss.com/popper.js/1.12.9/umd/popper.min.j
s"></script>
<script
src="https://cdn.bootcss.com/jquery/3.3.1/jquery.min.js"></script
>
<script
src="https://cdn.bootcss.com/bootstrap/4.0.0/js/bootstrap.min.js
"></script>
<link href="{{ url_for('static', filename='css/main.css') }}"
rel="stylesheet">
<style>
.bg-dark {
background-color: #42678c!important;
}
#result {
color: #0a1c4ed1;
}
</style>
</head>
<body style="background-color:black";>
<headerid="head" class="header">
<section id="navbar">
<h1 class="nav-heading"></i>Virtual Eye</h1>
<div class="nav--items">
<ul>
<li><a href="{{ url_for('index')}}">Home</a></li>
```

```
<li><a
href="{{ url_for('logout')}}">Logout</a></li>
<!-- <li><a href="#about">About</a></li>
<li><a href="#services">Services</a></li> -->
</ul>
</div>
</section>
</header>
<div class="container">
<div id="content" style="margin-top:2em">
<div class="container">
<div class="row">
<div class="col-sm-6 bd" >
<h2><em style="color:white;">High Quality
Facial Recognition</em></h2>
<br>
<p><h5><i style="color:white;">Emotion
Detection Through Facial Feature Recognition</i></h5></p>
<img
src="https://130e178e8f8ba617604b8aedd782b7d22cfe0d1146da69a524
36.ssl.cf1.rackcdn.com/facialrecognition-use-triggers-gdpr-fine-
showcase_image-10-a12991.jpg" style="height:240px"class="img-rounded"
alt="Gesture">
</div>
<div class="col-sm-6">
<div>
<h4 style="color:white;">Upload
```

```html
Image Here</h4>
<form action = "http://localhost:5000/"
id="upload-file" method="post" enctype="multipart/form-data">
<label for="imageUpload" class="uploadlabel">
Choose Image
</label>
<input type="file" name="image"
id="imageUpload" accept=".png, .jpg, .jpeg,.pdf">
</form>
<div class="image-section" style="display:none;">
<div class="img-preview">
<div id="imagePreview">
</div>
</div>
<div>
<button type="button" class="btn btninfo btn-lg " id="btn-
predict">Analyse</button>
</div>
</div>
<div class="loader" style="display:none;"></div>
<h3>
<span id="result"> </span>
</h3>
</div>
</div>
</div>
</body>
```

```
</div>
</div>
</div>
<footer>
<scriptsrc="{{ url_for('static', filename='js/main.js') }}"
type="text/javascript"></script>
</footer>
</html>
```

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, initialscale=1.0">
<!--Bootstrap -->
<link rel="stylesheet"
href="https://maxcdn.bootstrapcdn.com/bootstrap/4.0.0/css/boo
tstrap.min.css" integrity="sha384-
Gn5384xqQ1aoWXA+058RXPxPg6fy4IWvTNh0E263XmFcJlSAwiGg
FAW/dAiS6JXm" crossorigin="anonymous">
<script src="https://code.jquery.com/jquery-3.2.1.slim.min.js"
integrity="sha384-
KJ3o2DKtIkvYIK3UENzmM7KCkRr/rE9/Qpg6aAZGJwFDMVNA/GpG
FF93hXpG5KkN" crossorigin="anonymous"></script>
<script
src="https://cdnjs.cloudflare.com/ajax/libs/popper.js/1.12.9/umd/
```

```html
popper.min.js" integrity="sha384-
ApNbgh9B+Y1QKtv3Rn7W3mgPxhU9K/ScQsAP7hUibX39j7fakFPsk
vXusvfa0b4Q" crossorigin="anonymous"></script>
<script
src="https://maxcdn.bootstrapcdn.com/bootstrap/4.0.0/js/bootst
rap.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">
<!-- <script defersrc="../static/js/main.js"></script> -->
<title>Virtual Eye</title>
</head>
<body>
<headerid="head" class="header">
<section id="navbar">
<h1 class="nav-heading"></i>Virtual Eye</h1>
<div class="nav--items">
<ul>
<li><a
href="{{ url_for('index')}}">Home</a></li>
<li><a
href="{{ url_for('login')}}">Login</a></li>
```

```
<li><a
href="{{ url_for('register')}}">Register</a></li>
<li><a href="{{ url_for('login')}}">Demo</a></li>
</ul>
</div>
</section>
<section id="slider">
<div id="carouselExampleIndicators" class="carousel" dataride="carousel">
<ol class="carousel-indicators ">
<li data-target="#carouselExampleIndicators" data-slideto="0" class="active
"></li>
<li data-target="#carouselExampleIndicators" data-slideto="1"></li>
<li data-target="#carouselExampleIndicators" data-slideto="2"></li>
</ol>
<div class="carousel-inner">
<div class="carousel-item active">
<img class="d-block w-100" src="../static/img/1.png"
alt="First slide">
</div>
<div class="carousel-item">
<img class="d-block w-100"
src="../static/img/second.jpg" alt="Second slide">
</div>
<div class="carousel-item">
<img class="d-block w-100" src="../static/img/third.jpg"
alt="Third slide">
</div>
```

```html
</div>
<a class="carousel-control-prev"
href="#carouselExampleIndicators" role="button" dataslide="prev">
<span class="carousel-control-prev-icon" ariahidden="true"></span>
<span class="sr-only">Previous</span>
</a>
<a class="carousel-control-next"
href="#carouselExampleIndicators" role="button" dataslide="next">
<span class="carousel-control-next-icon" ariahidden="true"></span>
<span class="sr-only">Next</span>
</a>
</div>
</section>
</header>
<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>
</p>
</div>
```

```html
<div class="left">
<h2>Solution:</h2>
<p>
To overcome the conflict, a meticulous system is to be
implemented along the swimming poolsto 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
streamsthe 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.
</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. â€œIt helps
the lifeguard to detect the underwater situation where they
canâ€™t easily observe.
</b></p>
</div>
</section>
<section id="footer">
```

```html
<p>Copyright © 2022. All Rights Reserved</p>
<div class="social">
<a href="#" target="_blank"><i class="fab fa-2x fa-twittersquare"></i></a>
<a href="#" target="_blank">
<i class="fab fa-2x fa-linkedin"></i></a>
<a href="#">
<i class="#"></i>
</a>
</div>
</section>
</body>
</html>
Logout.html
<!DOCTYPE html>
<html >
<head>
<meta charset="UTF-8">
<meta name="viewport" content="width=device-width, initialscale=1">
<title>Virtual Eye</title>
<link href='https://fonts.googleapis.com/css?family=Pacifico'
rel='stylesheet' type='text/css'>
<link href='https://fonts.googleapis.com/css?family=Arimo'
rel='stylesheet' type='text/css'>
<link href='https://fonts.googleapis.com/css?family=Hind:300'
rel='stylesheet' type='text/css'>
<link
href='https://fonts.googleapis.com/css?family=Open+Sans+Conde
```

```
nsed:300' rel='stylesheet' type='text/css'>
<link
href='https://fonts.googleapis.com/css?family=Merriweather'
rel='stylesheet'>
<link href='https://fonts.googleapis.com/css?family=Josefin Sans'
rel='stylesheet'>
<link href='https://fonts.googleapis.com/css?family=Montserrat'
rel='stylesheet'>
<style>
.header {
top:0;
margin:0px;
left: 0px;
right: 0px;
position: fixed;
background-color: #28272c;
color: white;
box-shadow: 0px 8px 4px grey;
overflow: hidden;
padding-left:20px;
font-family: 'Josefin Sans';
font-size: 2vw;
width: 100%;
height:8%;
text-align: center;
}
.topnav {
```

```css
overflow: hidden;
background-color: #333;
}
.topnav-right a {
float: left;
color: #f2f2f2;
text-align: center;
padding: 14px 16px;
text-decoration: none;
font-size: 18px;
}
.topnav-right a:hover {
background-color: #ddd;
color: black;
}
.topnav-right a.active {
background-color: #565961;
color: white;
}
.topnav-right {
float: right;
padding-right:100px;
}
.login{
margin-top:-70px;
}
body {
```

```css
background-color:#ffffff;
background-repeat: no-repeat;
background-size:cover;
background-position: 0px 0px;
}
.main{
margin-top:100px;
text-align:center;
}
form { margin-left:400px;margin-right:400px;}
input[type=text],
input[type=email],input[type=number],input[type=password] {
width: 100%;
padding: 12px 20px;
display: inline-block;
margin-bottom:18px;
border: 1px solid #ccc;
box-sizing: border-box;
}
button {
background-color: #28272c;
color: white;
padding: 14px 20px;
margin-bottom:8px;
border: none;
cursor: pointer;
width: 20%;
```

```css
}
button:hover {
opacity: 0.8;
}
.cancelbtn {
width: auto;
padding: 10px 18px;
background-color: #f44336;
}
.imgcontainer {
text-align: center;
margin: 24px 0 12px 0;
}
img.avatar {
width: 30%;
border-radius: 50%;
}
.container {
padding: 16px;
}
span.psw {
float: right;
padding-top: 16px;
}
/* Change styles forspan and cancel button on extra small screens
*/
@media screen and (max-width: 300px) {
```

```
span.psw {
display: block;
float: none;
}
.cancelbtn {
width: 100%;
}
}
</style>
</head>
<body style="font-family:Montserrat;">
<div class="header">
<div style="width:50%;float:left;font-size:2vw;textalign:left;color:white;
padding-top:1%">Virtual eye</div>
<div class="topnav-right" style="padding-top:0.5%;">
<a href="{{ url_for('home')}}">Home</a>
<a href="{{ url_for('login')}}">Login</a>
<a href="{{ url_for('register')}}">Register</a>
</div>
</div>
<div class="main">
<h1>Successfully Logged Out!</h1>
<h3 style="color:#4CAF50">Login for more information<h3>
<a href="{{ url_for('login') }}"><button
type="submit">Login</button></a>
</form>
</div>
```

```
</body>
</html>
Prediction.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, initialscale=1.0">
<!--Bootstrap -->
<link rel="stylesheet"
href="https://maxcdn.bootstrapcdn.com/bootstrap/4.0.0/css/boo
tstrap.min.css" integrity="sha384-
Gn5384xqQ1aoWXA+058RXPxPg6fy4IWvTNh0E263XmFcJlSAwiGg
FAW/dAiS6JXm" crossorigin="anonymous">
<script src="https://code.jquery.com/jquery-3.2.1.slim.min.js"
integrity="sha384-
KJ3o2DKtIkvYIK3UENzmM7KCkRr/rE9/Qpg6aAZGJwFDMVNA/GpG
FF93hXpG5KkN" crossorigin="anonymous"></script>
<script
src="https://cdnjs.cloudflare.com/ajax/libs/popper.js/1.12.9/umd/
popper.min.js" integrity="sha384-
ApNbgh9B+Y1QKtv3Rn7W3mgPxhU9K/ScQsAP7hUibX39j7fakFPsk
vXusvfa0b4Q" crossorigin="anonymous"></script>
<script
src="https://maxcdn.bootstrapcdn.com/bootstrap/4.0.0/js/bootst
rap.min.js" integrity="sha384-
```

```html
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">
<script defersrc="../static/js/JScript.js"></script>
<title>Prediction</title>
</head>
<body>
<headerid="head" class="header">
<section id="navbar">
<h1 class="nav-heading"></i>Virtual Eye</h1>
<div class="nav--items">
<ul>
<li><a href="{{ url_for('index')}}">Home</a></li>
<li><a
href="{{ url_for('logout')}}">Logout</a></li>
<!-- <li><a href="#about">About</a></li>
<li><a href="#services">Services</a></li> -->
</ul>
</div>
</section>
</header>
<!-- dataset/Training/metal/metal326.jpg -->
```

```html
</br>
<section id="prediction">
<h2 class="title text-muted">Virtual Eye- Life Guard for
Swimming Pools to Detect Active Drowning</h1>
<div class="line" style="width: 900px;"></div>
</section>
</br>
<section id="about">
<div class="body">
<div class="left">
<p>
```

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 undersix 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.

```html
</p>
</div>
<div class="left">
<div class="prediction-input">
<img class="d-block w-100" src="../static/img/second.jpg"
```

```
alt="Second slide">
</br>
<form id="form" action="/result" method="post"
enctype="multipart/form-data">
<input type="submit" class="submitbtn" value="Click
Me! For a Demo">
</form>
</div>
<h5 style="text-color:Red">
<b style="text-color:Red">{{prediction}}<b>
</h5>
</div>
</div>
</section>
</br></br>
<section id="footer">
<p>Copyright Â© 2021. All Rights Reserved</p>
</section>
</body>
</html>
```

7.2 FEATURE 2:

When VirtualEye detects a swimmer in distress on the bottom of the pool, it will raise a radio alarm to pool lifeguards and an visual alarm to our Monitoring & Control Station. Lifeguards can visually assess the developing situation within seconds of the event first occurring, and initiate their rescue procedure when necessary.

CODE:

```
import cvlib as cv
from cvlib.object_detection import draw_bbox
import cv2
import time
import numpy as np
from playsound import playsound
webcam = cv2.VideoCapture('sample2.mp4')
t0 = time.time() #gives time in seconds after 1970
#variable dcount stands for how many seconds the person has been
standing still
for
centre0 = np.zeros(2)
isDrowning = False
#this loop happens approximately every 1 second, so if a person doesn't
move,
#or moves very little for 10seconds, we can say they are drowning
#loop through frames
while True:
# read frame from webcam
status, frame = webcam.read()
if not status:
print("Could not read frame")
32
exit()
# apply object detection
```

```python
bbox, label, conf = cv.detect_common_objects(frame)
#simplifying for only 1 person
#s = (len(bbox), 2)
if(len(bbox)>0):
bbox0 = bbox[0]
#centre = np.zeros(s)
centre = [0,0]
#for i in range(0, len(bbox)):
#centre[i] =[(bbox[i][0]+bbox[i][2])/2,(bbox[i][1]+bbox[i][3])/2 ]
centre =[(bbox0[0]+bbox0[2])/2,(bbox0[1]+bbox0[3])/2 ]
#make vertical and horizontal movement variables
hmov = abs(centre[0]-centre0[0])
vmov = abs(centre[1]-centre0[1])
#there is still need to tweek the threshold
#this threshold is for checking how much the centre has moved
x=time.time()
threshold = 10
if(hmov>threshold or vmov>threshold):
print(x-t0, 's')
t0 = time.time()
isDrowning = False
33
else:
print(x-t0, 's')
if((time.time() - t0) > 10):
isDrowning = True
#print('bounding box: ', bbox, 'label: ' label ,'confidence: ' conf[0], 'centre:
```

```python
', centre)
#print(bbox,label ,conf, centre)
print('bbox: ', bbox, 'centre:', centre, 'centre0:', centre0)
print('Is he drowning: ', isDrowning)
centre0 = centre
# draw bounding box over detected objects
out = draw_bbox(frame, bbox, label, conf,isDrowning)
cv2.imwrite('image.jpg',out)
if isDrowning:
playsound(r'H:\PROJECT FILES\Drowning-Detector\alarm.mp3')
#print('Seconds since last epoch: ', time.time()-t0)
# display output
cv2.imshow("Real-time object detection", out)
# press "Q" to stop
if cv2.waitKey(1) & 0xFF == ord('q'):
break
# release resources
webcam.release()
cv2.destroyAllWindows()
```
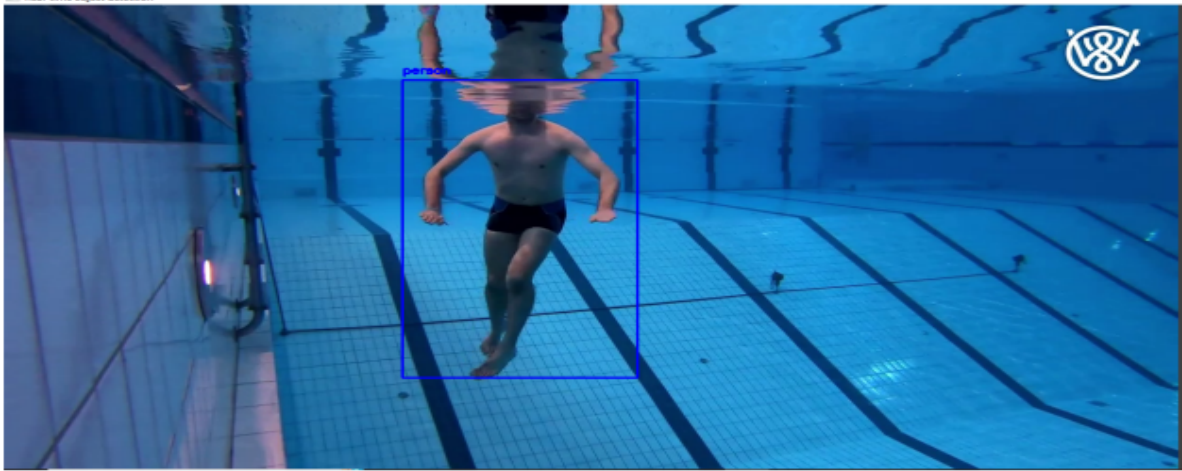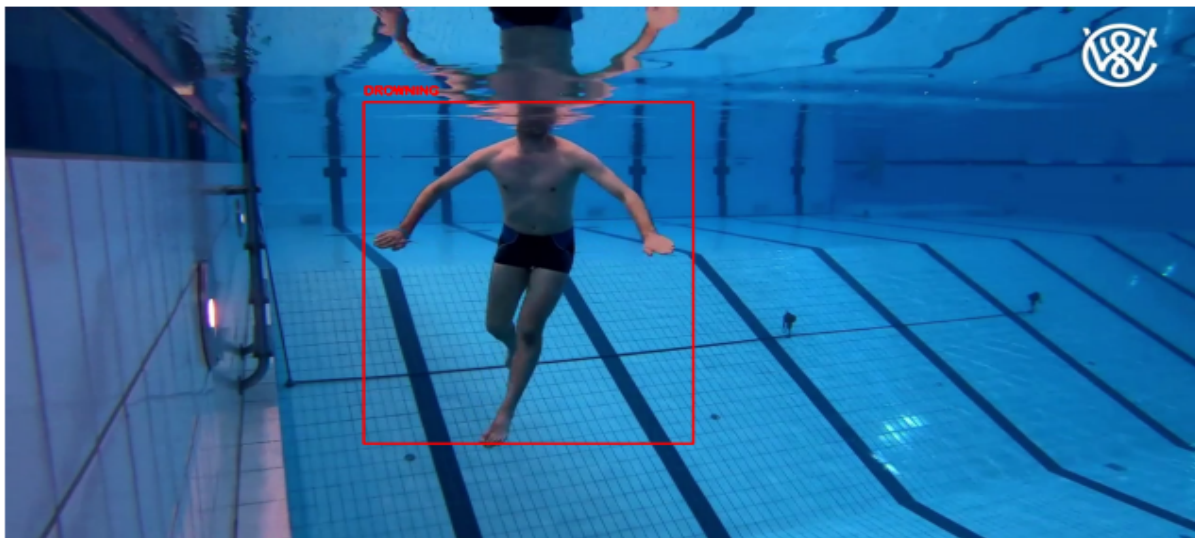
OUTPUT:

Figure 7.7 Person Detection

Figure 7.8 Drowning Detection

CHAPTER 8

8.TESTING

8.1Test Cases:

Test case ID	Feature Type	Component	Test Scenario	Pre-Requisite	Steps To Execute	Test Data	Expected Result	Actual Result	Status
LoginPage_TC_OO1	Functional	Home Page	Verify user is able to see the Login/Signup popup when user clicked on My account button		1.Enter URL and click go 2.Click on My Account dropdown button 3.Verify login/Singup popup displayed or not	login.html	Login/Signup popup should display	Working as expected	Pass
LoginPage_TC_OO2	UI	Home Page	Verify the UI elements in Login/Signup popup		1.Enter URL and click go 2.Click on My Account dropdown button 3.Verify login/Singup popup with below UI elements: a.email text box b.password text box c.Login button d.New customer? Create account link e.Last password? Recovery password link	login.html	Application should show below UI elements: a.email text box b.password text box c.Login button with orange colour d.New customer? Create account link e.Last password? Recovery password link	Working as expected	pass
LoginPage_TC_OO3	Functional	Home page	Verify user is able to log into application with Valid credentials		1.Enter URL and click go 2.Click on My Account dropdown button 3.Enter Valid username/email in Email text box 4.Enter valid password in password text box 5.Click on login button	Username: indu06 password: Testing123	User should navigate to prediction homepage	working as expected	pass
LoginPage_TC_OO4	Functional	Login page	Verify user is able to log into application with InValid credentials		1.Enter URL and click go 2.Click on My Account dropdown button 3.Enter InValid username/email in Email text box 4.Enter valid password in password text box 5.Click on login button	Username: indu password: Testing123	Application should show 'Incorrect email or password ' validation message.	working as expected	pass
LoginPage_TC_OO4	Functional	Login page	Verify user is able to log into application with InValid credentials		1.Enter URL and click go 2.Click on My Account dropdown button 3.Enter Valid username/email in Email text box 4.Enter Invalid password in password text box 5.Click on login button	Username: indu06 password: abcd	Application should show 'Incorrect email or password ' validation message.	working as expected	pass
LoginPage_TC_OO5	Functional	Login page	Verify user is able to log into application with InValid credentials		1.Enter URL and click go 2.Click on My Account dropdown button 3.Enter InValid username/email in Email text box 4.Enter Invalid password in password text box 5.Click on login button	Username: xyz password: 1234	Application should show 'Incorrect email or password ' validation message.	working as expected	pass

Predictionpage_TC_00 6	Functional	Prediction Page	Page should display whether the person is drowning or not	1, Camera should take pictures of people swimming in pools 2. It should predict the probability of drowning 3. It should show a bounding box displaying the probability Of drowning	image Of people drowning	generate a alert to lifeguard if people are drowning	Working as expected

8.2 User Acceptance Testing:

1. *Purpose of Document:*

The purpose of this document is to briefly explain the test coverage and open issues of the [ProductName] project at the time of the release to User Acceptance Testing (UAT).

2. *Defect Analysis:*

This report shows the number of resolved or closed bugs at each severity level, and howthey 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

Test Case:

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

Section	Total Cases	Not Tested	Fail	Pass
Print Engine	7	0	0	7
Client Application	1	0	0	41
Security	42	0	0	42
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

9. RESULTS:

9.1 Performance Metrics:

Once we have the working drowning detection model we can feed live video footage of the swimming pool to it so that it can keep detecting continuously for any drowning activities. If drowning is detected it will be highlighted on the system screen as well as alarms will be raised to alert security guards so that they can initiate rescue. This application will detect the drowning victim within in minute. So we can reduce the drowning accident by using our application.

```
detect.py  ×     🔊 alarm.mp3

detect.py > ...
  1   import cvlib as cv
  2   from cvlib.object_detection import draw_bbox
  3   import cv2
  4   import time
  5   import numpy as np
  6   from playsound import playsound
  7
  8   webcam = cv2.VideoCapture('sample2.mp4')

PROBLEMS   OUTPUT   DEBUG CONSOLE   TERMINAL   JUPYTER

Is he drowning:  False
7.766584873199463 s
bbox:  [[412, 118, 704, 572]] centre: [558.0, 345.0] centre0: [556.0, 344.0]
Is he drowning:  False
9.739883661270142 s
bbox:  [[404, 114, 710, 578]] centre: [557.0, 346.0] centre0: [558.0, 345.0]
Is he drowning:  False
11.645272493362427 s
bbox:  [[394, 122, 722, 580]] centre: [558.0, 351.0] centre0: [557.0, 346.0]
Is he drowning:  True
22.118805646896362 s
bbox:  [[392, 126, 732, 580]] centre: [562.0, 353.0] centre0: [558.0, 351.0]
Is he drowning:  True
31.4590523242295044 s
bbox:  [[392, 126, 732, 580]] centre: [562.0, 353.0] centre0: [562.0, 353.0]
Is he drowning:  True
40.9290081439971924 s
bbox:  [[385, 133, 739, 575]] centre: [562.0, 354.0] centre0: [562.0, 353.0]
Is he drowning:  True
50.51718282699585 s
bbox:  [[376, 133, 746, 579]] centre: [561.0, 356.0] centre0: [562.0, 354.0]
Is he drowning:  True
```

```
1
127.0.0.1 - - [14/Nov/2022 19:16:41] "POST /afterlogin HTTP/1.1" 302 -
127.0.0.1 - - [14/Nov/2022 19:16:41] "GET /prediction HTTP/1.1" 200 -
127.0.0.1 - - [14/Nov/2022 19:16:42] "GET /static/style.css HTTP/1.1" 304 -
127.0.0.1 - - [14/Nov/2022 19:16:42] "GET /static/js/JScript.js HTTP/1.1" 304 -
127.0.0.1 - - [14/Nov/2022 19:16:42] "GET /static/img/second.jpg HTTP/1.1" 304 -
5.816675424575806 s
bbox:  [[114, 112, 804, 372]] centre: [459.0, 242.0] centre0: [0. 0.]
Is he drowning:  False
4.5444793701171875 s
bbox:  [[114, 112, 804, 372]] centre: [459.0, 242.0] centre0: [459.0, 242.0]
Is he drowning:  False
8.752950429916382 s
bbox:  [[114, 112, 804, 372]] centre: [459.0, 242.0] centre0: [459.0, 242.0]
Is he drowning:  False
12.785400867462158 s
bbox:  [[120, 112, 800, 372]] centre: [460.0, 242.0] centre0: [459.0, 242.0]
Is he drowning:  True
```

CHAPTER 10

10. ADVANTAGES & DISADVANTAGES:

Advantages:

- It represents an additional level of safety and protection for swimmers.
- It ensures effective and reliable drowning detection by limiting the number of alarms generated by disturbance factors.
- Prevents drowning accidents by improving the rescue time of the lifeguards.
- The VirtualEye system operates in compliance with privacy laws.
- It increases visibility in areas of the pool that are difficult for lifeguards to see, such as the bottom and corners.
- It can be installed in any type of pool and construction variant.
- Most efficient method for drowning detection system.
- Continuous monitoring without any interruptions.

DISADVANTAGES:

- For uneducated people will suffer from this technology
- Electricity will be required
- Software and hardware requirement will need
- It is expensive technology due to costly hardware requirements.
- It does not work with few users who wear contact lenses or have long eye lashes.
- It requires some calibration time before it gives satisfactory results.

CHAPTER-11

11. CONCLUSION:

        Life safety in water has been a concern for many centuries. Latest technology advancements has enabled us to come up with effective drowning detection systems. However many of those solutions are costly and limited to few. Survey reports show us that highest numbers of deaths are reported in low and middle income countries. The survey report also mentions the children have the largest death ratio compared to adults. Also the deaths reported in these incidents are more from open water bodies than closed water bodies like swimming pools. The solution described above will be able to address these issues.

Once we have the working drowning detection model we can feed live video footage of the swimming pool to it so that it can keep detecting continuously for any drowning activities. If drowning is detected it will be highlighted on the system screen as well as alarms will be raised to alert security guards so that they can initiate rescue.

CHAPTER-12

12.FUTURE SCOPE:

Availability of better dataset, modern methodologies, and technologies with high computational power accompanied by high-quality surveillance cameras, will help to improve the accuracy of drowning detection & even can be used in adverse conditions. After the implementation of all these essentials, this system can be used on the swimming pool.

FUTURE ENHANCEMENT:

- 24/7 Technical support is needed.
- Not all people trust these kind of system.
- Swimming pool need regular maintenance.
- Require, extensive calibration and expertise.

CHAPTER 13

13.1 Source Code:

```python
from flask import Flask, request, render_template, redirect, url_for
from detect import start_test
#loading the model

from cloudant.client import Cloudant
#Authenticate using an IAM API key
client = Cloudant.iam('a1885fb9-67af-469a-83e5-
f1f78af7b19abluemix','dBqnX2HXtY8Dxm6Gd8nWvmiQ5R-
f4HaM_seOK96b30zj',
connect=True)
#Create a database using an initialized client

my_database = client.create_database('my_database')
app=Flask(__name__)
#default home page or route

@app.route('/')
def index():
return render_template('index.html')
42
@app.route('/index.html')
def home():
return render_template('index.html')
#registration page

@app.route('/register')
```

```python
def register():
    return render_template('register.html')
@app.route('/afterreg', methods=['POST'])
def afterreg():
    x = [x for x in request.form.values()]
    print(x)
    data = {
    'email': x[1], #Setting _id is optional
    'fullname': x[0],
    'password': x[2]
    }
    print(data)
    query = {'email': {'$eq': data['email']}}
    docs = my_database.get_query_result(query)
```

43

```python
    print(docs)
    print(len(docs.all()))
    if(len(docs.all())==0):
        url = my_database.create_document(data)
        #response = requests.get(url)
        return render_template('register.html', pred="Registration Successful,
please
login using your details")
    else:
        return render_template('register.html', pred="You are already a
member,please
login using your details")
```

#login page

```python
@app.route('/login')
def login():
return render_template('login.html')
@app.route('/afterlogin',methods=['POST'])
def afterlogin():
user = request.form['email']
passw = request.form['password']
print(user,passw)
44
query = {'email': {'$eq': user}}
docs = my_database.get_query_result(query)
print(docs)
print(len(docs.all()))
if(len(docs.all())==0):
return render_template('login.html', pred="The username is not found.")
else:
if((user==docs[0][0]['email'] and passw==docs[0][0]['password'])):
return redirect('/prediction')
else:
return render_template('login.html',pred="Invalid user")
#prediction page
@app.route('/prediction')
def prediction():
return render_template('prediction.html')
```

#logout page

```python
@app.route('/logout')
```

```
def logout():
return render_template('logout.html')
45
@app.route('/start', methods=['POST'])
def start():
start_test()
return redirect('/prediction')
if __name__=='__main__':
app.run(debug=True)
```

13.2 GitHub link:

https://github.com/IBM-EPBL/IBM-Project-39161-1664191241

Project Demo Link:

https://drive.google.com/drive/folders/1vj1uYgjym2_ysLXyUKXeG-kC2n4CdwuT?usp=sharing