IBM – NALAIYA THIRAN PROJECT

VIRTUALEYE-LIFE GUARD FOR SWIMMING POOLS TO DETECT ACTIVE DROWNING

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TABLE OF CONTENT

1.INTRODUCTION

1.1 PROJECT OVERVIEW

Effective drowning detection methods are essential for the safety of swimmers. VirtualEye is a Computer Vision System for the detection of drowning accidents in swimming pools. It works like an "extra lifeguard" under the water of tour pool. Our object recognition software tracks the movements of all swimmers in your pool and in the event of a serious drowning incident. VirtualEye will improve the reaction-time of lifeguards as they initiate a rescue.

1.2 PURPOSE

Safety in water has been a concern for many centuries for the survival of human lives. The latest technology advancements have enabled to come up with effective drowning detection methods . A recent report for World Health Organization(WHO) gives us some insight into the drowning incidents globally. The number of reported drowning deaths globally is 37200. The highest numbers of deaths are in low and middle income countries. The survey also points that children have the largest death ratio compared to adults. Majority of the drowning Deaths are reported from open water bodies like lakes and sea and not in pools. In the report WHO has recommended various drowning prevention techniques like constructing fences across the lakes, to prevent accidental fall to teaching school age children swimming as a part of their curriculum in schools.

2. LITERATURE SURVEY

2.1 EXISTING PROBLEM:

The existing surveillance systems deliver valued information in monitoring of large areas. Applying intelligence in surveillance sustems allows real time monitoring of places, people and their activites. The tracking approach can change with varying targets and can change from a single camera to multiple camera configurations. Tracking methods in surveillance use different parameters such us objects motion position path of movement and velocity biometics such us skin color or clothes color and many more.

One important environment that the need for monitoring systems is crucially sensed is the swimming pool. Each year many people including children are drowned or very close to drowning in the deep of the swimming pools, and the life guards are not trained well enough to handle these problems. Real-time dection of a drowning person in swimming pools is a challenging task that requires an accurate system. The challenge is due to the presence of water ripples, shaows and splashes and therefore detection needs to have high accurancy.

2.2 REFERENCES:

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2.3 PROBLEM STATEMENT DEFINITION

Several death happens in several nations due to drowning swimming pools especially with kids. Due to lack of monitoring and not intimated by drowning many lives are lost.so we have come with solution which detects drowning and rings an alarm and the trainer gets intimated and saves the person who is drowning.

3.IDEATION & PROPOSED SOLUTION

3.1 EMPATHY MAP CANVAS:

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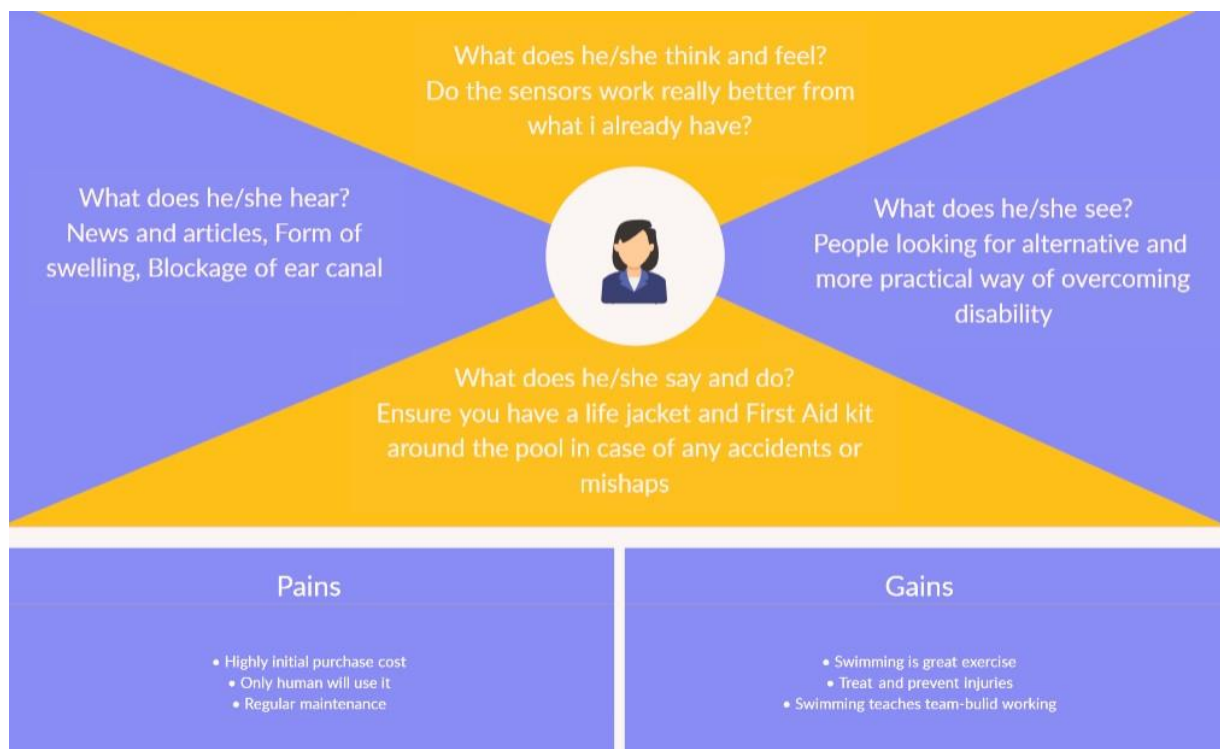
3.2 IDEATION & BRAINSTROMING:

A group problem-solving technique that involves the spontaneous contribution of ideas from all members of the group. The mulling over of ideas by one or more individuals in an attempt to devise or find a solution to a problem.

3.3 PROPOSED SOLUTION

Project team shall fill in the following information in the proposed solution template.

S.No.	Parameter	Description
1.	Problem Statement (Problem to be solved)	In the Swimming pool which is crowded with people, it will be difficult for the lifeguard to surveillance the whole pool by him/herself. Identifying the drowned person in the crowd will be difficult from above.
2.	Idea / Solution description	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.
3.	Novelty / Uniqueness	This device is used to solve the burden of the lifeguard with the help of advanced technology.
4.	Social Impact / Customer Satisfaction	The device will be socialized in no time because of the help of this device
5.	Business Model (Revenue Model)	It is medium cost. It cannot be provided to everyone.

3.4 PROBLEM SOLUTION FIT

1. CUSTOMER SEGMENT(S) `CS`

Who is your customer?
i.e. working parents of 0-5 y.o. kids

Designed for whom has to guarantee every day the safety in public and intensive-use pools, VirtualEye -LifeGuard detects potential drownings and promptly notifies you.

6. CUSTOMER CONSTRAINTS `CC`

What constraints prevent your customers from taking action or limit their choices of solutions? i.e. spending power, budget, no cash, network connection, available devices.

Teach basic swimming and water safety skills to school-age children aged 6 years and older.

Training bystanders in safe rescue and resuscitation.

Use life guard while swimming

5. AVAILABLE SOLUTIONS `AS`

Which solutions are available to the customers when they face the problem or need to get the job done? What have they tried in the past? What pros & cons do these solutions have? i.e. pen and paper is an alternative to digital notetaking

There are many actions to prevent drowning.Installing barriers (e.g. covering wells, using doorway barriers and playpens,fencing swimming pools etc.) to control access to water hazards, or removing water hazards entirely greatly reduces water hazard exposure and risk.

Define CS, fit into CC | *Explore AS, differentiate*

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2. JOBS-TO-BE-DONE / PROBLEMS `J&P`

Which jobs-to-be-done (or problems) do you address for your customers? There could be more than one; explore different sides.

Beginners, especially, often feel it difficult to breath 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.

9. PROBLEM ROOT CAUSE `RC`

What is the real reason that this problem exists?
What is the back story behind the need to do this job?
i.e. customers have to do it because of the change in regulations.

The most common cause of drowning not knowing how to swim. Many adults and children will attempt to get into the water without proper swim training.

Drowning is the 3rd reason for the highest unintentional deaths, and that's why it is necessary to create trustable security mechanisms.

7. BEHAVIOUR `BE`

What does your customer do to address the problem and get the job done? i.e. directly related: find the right solar panel installer, calculate usage and benefits; indirectly associated: customers spend free time on volunteering work (i.e. Greenpeace)

In order to quickly help lifesavers judge whether people are drowning in the swimming pool,

Focus on J&P, tap into BE, understand RC | *Focus on*

---

3. TRIGGERS

What triggers customers to act? i.e. seeing their neighbour installing solar panels, reading about a more efficient solution in the news.

Drowning Awareness through the Advertisements and other social medias like Instagram , Facebook, Linkedin & News etc

4. EMOTIONS: BEFORE / AFTER `EM`

How do customers feel when they face a problem or a job and afterwards? i.e. lost, insecure > confident, in control - use it in your communication strategy & design

1. (i) struggle to keep the airway clear of the water,(ii) initial submersion and breath holding (iii) aspiration of water,(iv) unconsciousness,(v) cardio-respiratory arrest and (vi) death – inability to revive.
2. In order to quickly help lifesavers judge whether people are drowning in the swimming pool

10. YOUR SOLUTION

If you are working on an existing business, write down your current solution first, fill in the canvas, and check how much it fits reality.
If you are working on a new business proposition, then keep it blank until you fill in the canvas and come up with a solution that fits within customer limitations, solves a problem and matches customer behaviour.

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.

8. CHANNELS of BEHAVIOUR

8.1 ONLINE
What kind of actions do customers take online? Extract online channels from #7

Search engines are considered to be the best marketing channel for acquiring new leads for drowning detection system. Social media continues to grow every year as a powerhouse marketing channel.

8.2 OFFLINE
What kind of actions do customers take offline? Extract offline channels from and use them for customer development.

Local media advertising- Advertising on both television and radio is still very effective in creating brand awareness about drowning in the swimming pool

Identify strong TR & EM | *Extract online & offline CH of BE*

⭐ **AMALTAMA**

4.REQUIREMENT ANALYSIS

4.1 FUNCTIONAL REQUIREMENT:

Following are the functional requirements of the proposed solution.

FR No.	Functional Requirement (Epic)	Sub Requirement (Story / Sub-Task)
FR-1	Installation	Needed to be fixed under the water without Creating any disturbance to the people in the swimming pool.
FR-2	User registration	Register via Email/Phone number and get verified for further use
FR-3	Deduction	Either not moving or in unconscious state
FR-4	Support	Take swim tubes or take the help of rescuer.
FR-5	Alert	Set alarm and send message through the application to life guard.
FR-6	Output	Vision based monitor Image, position and movement detection Drowning is detected Resue drowning people by Life Guard

4.2 NON-FUNCTIONAL REQUIREMENTS:

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

FR No.	Non-Functional Requirement	Description
NFR-1	**Usability**	To ensure the safety of each and every person present in the pool. A Lifeguard should be present all the time in the pool.
NFR-2	**Security**	Lifeguards should be aware of the alert message to save the life of the swimmer.
NFR-3	**Reliability**	Virtual eye lifeguard triggers an immediate prior alarm if a swimmer is in peril, helping to avoid panic even in critical situations.

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.

Live camera feed — Frames → YOLOv7 — Bounding Boxes → Detect persons

Detect persons → Check for drowning

Check for drowning — No → Log to Database

Check for drowning — Yes → Alert

Alert → Lifeguard

Alert → Pool Owner
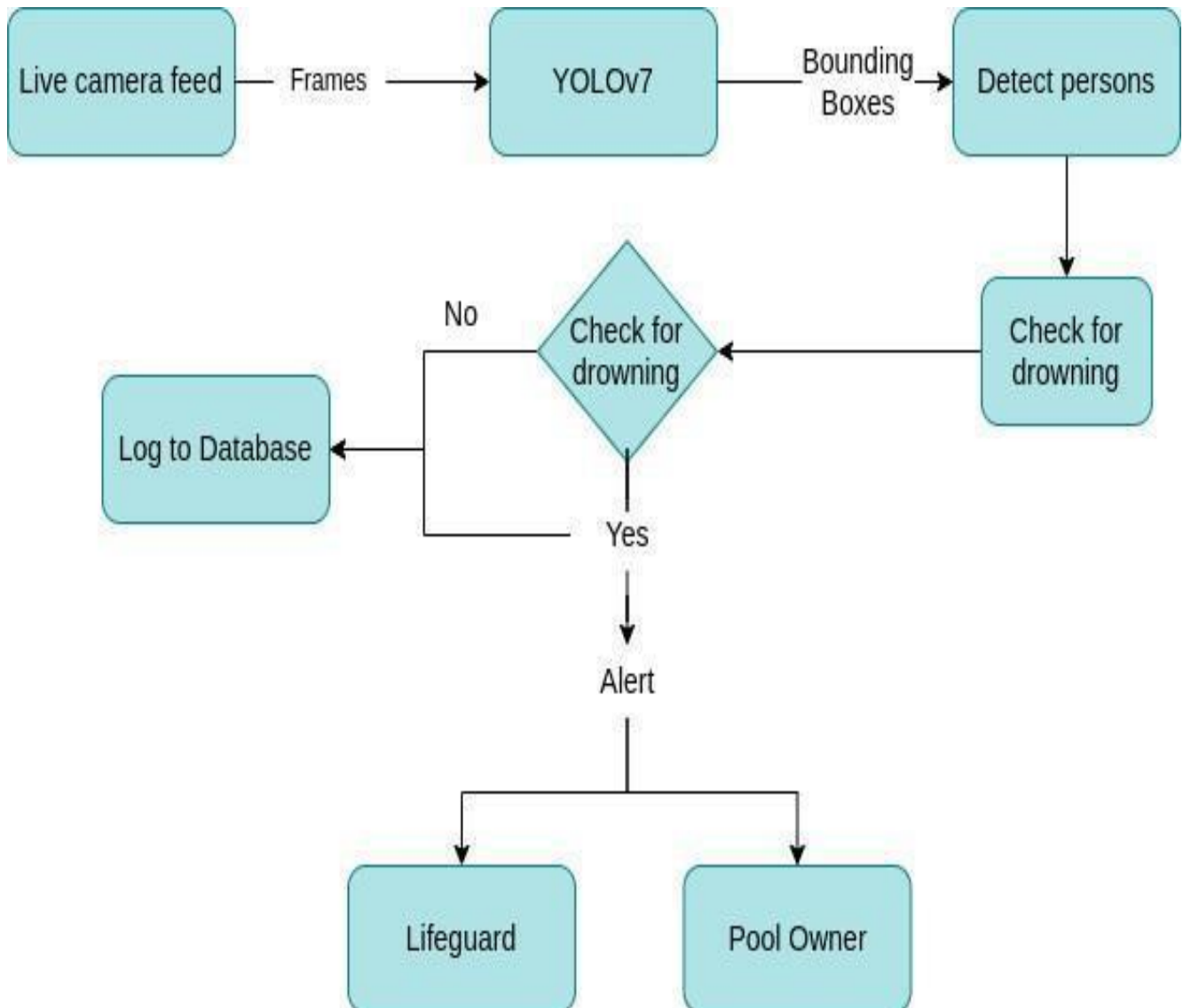
5.2 SOLUTION & TECHNICAL ARCHITECTURE:
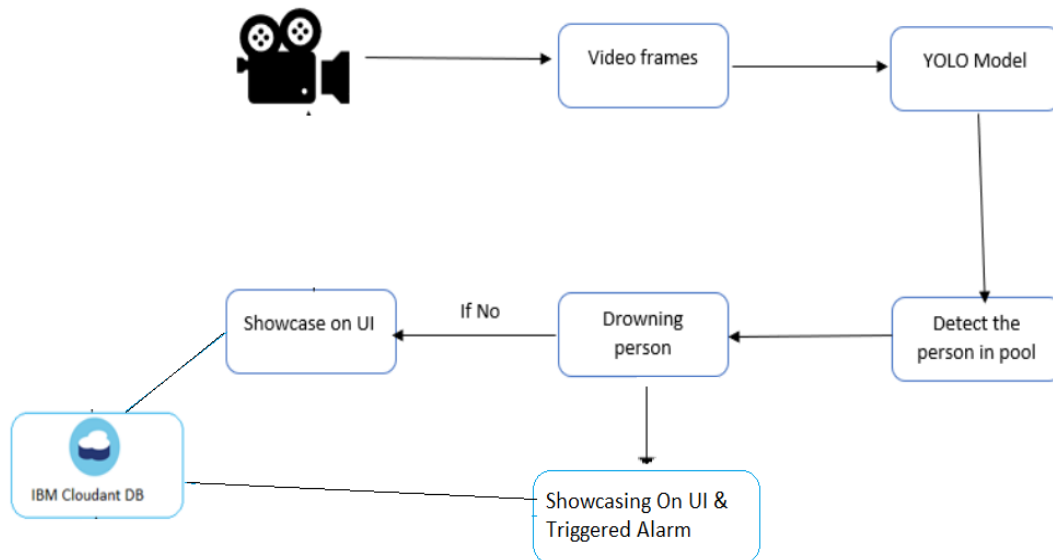
5.3 USER STORIES :

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

6. PROJECT PLANNING & SCHEDULE

6.1 SPRINT PLANNING & ESTIMATION:

Use 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	VIR-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Veshnu Bhalajee V
Sprint-1	Registration	VIR-2	As a user, I will receive confirmation email once I have registered for the application	1	High	Sribharathi S
Sprint-1	Registration	VIR-3	As a user, I can register for the application through Facebook	2	Low	Naresh Kumar S
Sprint-1	Registration	VIR-4	As a user, I can register for the application through Gmail	2	Medium	Shaakar S
Sprint-1	Registration	VIR-5	As a user, I can log into the application by entering email & password	1	High	Veshnu Bhalajee

Use 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	VIR-1	As a user, I can register for the application by entering my email, password, and confirming my password.	2	High	Veshnu Bhalajee V
Sprint-1	Registration	VIR-2	As a user, I will receive confirmation email once I have registered for the application	1	High	Sribharathi S
Sprint-1	Registration	VIR-3	As a user, I can register for the application through Facebook	2	Low	Naresh Kumar S
Sprint-1	Registration	VIR-4	As a user, I can register for the application through Gmail	2	Medium	Shaakar S
Sprint-1	Registration	VIR-5	As a user, I can log into the application by entering email & password	1	High	Veshnu Bhalajee

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	6	7 Days	24 Oct 2022	31 Oct 2022	5	29 Oct 2022
Sprint-2	20	7 Days	31 Oct 2022	07 Nov 2022	18	07 Nov 2022
Sprint-3	17	7 Days	07 Nov 2022	14 Nov 2022	15	14 Nov 2022
Sprint-4	14	7 Days	14 Nov 2022	21 Nov 2022	14	21 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)

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

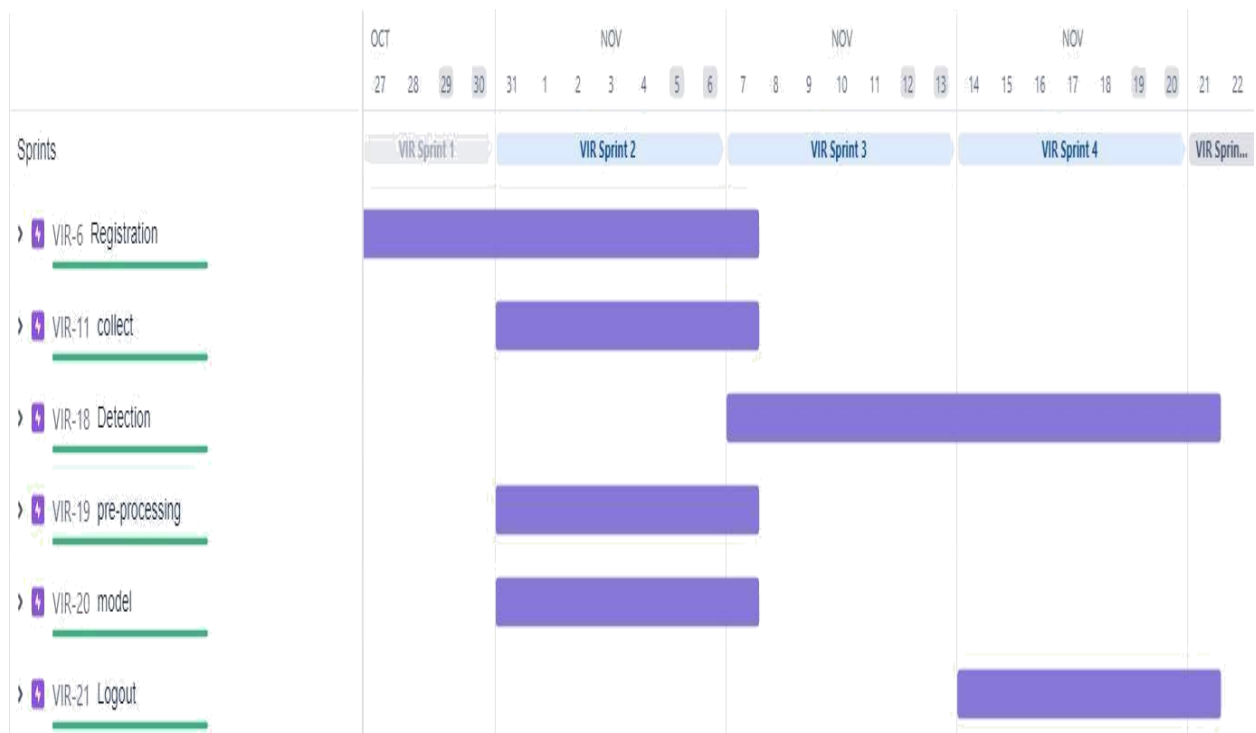For Sprint-1 AV = sprint duration/velocity = 6/7 = 0.8

For Sprint-2 AV = sprint duration/velocity = 20/7 = 2.8

For Sprint-3 AV = sprint duration/velocity = 17/7 = 2.4

For Sprint-4 AV = sprint duration/velocity = 14/7 = 2

6.3 REPORTS FROM JIRA:

7. CODING AND SOLUTIONING

7.1 FEATURE 1

```html
HOME.HTML
<!DOCTYPE html>
<html>
<head>
        <meta charset="utf-8">
        <meta name="viewport" content="width=device-width, initial-scale=1">
        <title>sample html page</title>
</head>
<body>
         <div id="container">
  <div id="topbar"> Virtual Eye
        <ul>
                        <li><a href="Home.html">Home</a></li>
                        <li><a href="Register.html">Register</a></li>
                        <li><a href="Login.html">Login</a></li>
                        <li><a href="#">Demo</a></li>
                </ul></div>
   <div id="header">
                <img src="https://thumbs.dreamstime.com/b/young-boy-drowning-pool-danger-
32796259.jpg"/>
        </div>
        <div id="content">
                <h4 class="heading">ABOUT PROJECT</h4>


        <div id="bottom1">
                                <h2>Problem:</h2>
                        <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 hotels, and weekend tourist
spots and barely people have them in their house backyard. 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 id="bottom2">
                                <h2> Solution:</h2>
                                <p>By studying body movement patterns and connecting cameras to
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 , 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.
</p>
        </div>
  </div>
  <style >
        #topbar
{
        background-color: black;
        width: 100%;
        height: 70px;
```

```css
color: white;
}
#topbar ul
{ float: right;
margin-top: 8px;}
#topbar ul li
{display: inline;
margin-right: 20px;}
#topbar ul li a
{ color:white;
text-decoration: none;
font-size: 18px;}
#header img
{ height: 300px;
width: 100%;}
body
{background-color: white;}
#container
{
        height: 700px;
        width: 100%;
        margin: 0px auto;
}
#content
{float:left;
width: 100%;
height: 50px;
text-align: center;
text-decoration: underline;
text-decoration-color:
 #ffff00;}
#bottom1
{margin-top: 15px;
width: 50%;
float: left;}
#bottom1
{
        color: black;
}
#bottom2
{margin-top: 15px;
width: 50%;
float: right;
}
#bottom2 h2
{
        color: black;
        margin-left: 20px;
}
#bottom1 p
{
        margin-left: 8px;
        margin-right: 9px;
}
#bottom2 p
```

```
{
        margin-left: 8px;
        margin-right: 8px;
}
    </style>
    </body>
</html>
```


REGISTER.HTML

```html
<!DOCTYPE html>
<html>
<head>
        <meta charset="utf-8">
        <meta name="viewport" content="width=device-width, initial-scale=1">
        <title>Login Page</title>
</head>
<body>
        <div id="topbar">Virtual Eye
                <ul>
                        <li><a href="Home.html">Home</a></li>
                        <li><a href="Login.html">Login</a></li>
                        <li><a href="Register.html">Register</a></li>
                </ul>
        </div>
<div class="login-box">
                        <div class="image">
                                <h2>REGISTER</h2>
 <form>
        <div class="user-box">
                <input type="text" name="" required="">
                <label>Enter Email</label>
```

```html
            </div>
            <div class="user-box">
                    <input type="text" name="" required="">
                    <label>Enter name</label>
            </div>
            <div class="user-box">
                    <input type="password" name="" required="">
                    <label>Enter password</label>
            </div>
            <div class="button-form">
                    <a id="Register" href="Login.html">Submit</a>
                    <div id="Login"> Already have a account ?
                            <a href="Login.html">Login</a>
                    </div>
            </div>
        </div>
</div>
</form>
<style >
        #topbar
{
   background-color: black;
   width: 100%;
   height: 50px;
   text-decoration-color: white;
color: white;
}
#topbar ul
{ float: right;
margin-top: 8px;}
#topbar ul li
{display: inline;
margin-right: 20px;}
#topbar ul li a
{ color:white;
text-decoration: none;
font-size: 18px;}
.{
   box-sizing: border-box;
}
body{
   background: floralwhite;
}
.login-box{
   margin-top:72px;
   position: absolute;
   color: black;
   top: 50%;
   left: 50%;
   height: 550px;
   width: 500px;
   padding: 40px;
   transform: translate(-50%, -50%);
   background: #CCCCFF;
   box-shadow: 0 15px 25px rgba(143, 124, 236, 0.7);
   border-radius: 10px;
```

```css
    }
    .login-box img
    {
        margin-top: 10px;
        width: 150px;
        height: 150px;
margin-left: 175px;
border-radius: 100px;
margin-bottom: 25px;
    }
    .login-box h2{
        margin: 0 0 30px;
        padding: 0;
        color: black;
        text-align: center;
    }
    .login-box .user-box input{
        position: relative;
        width: 100%;
        padding: 10px 0;
        font-size: 16px;
        color: black;
        margin-bottom: 30px;
        border: none;
        border-bottom: 1px solid #fff;
        outline: none;
        outline-color: #0000ff;
        background: transparent;
    }
    .login-box .user-box label{
        position: relative;
        left: 0;
        top: -60px;
        padding: 10px;
        font-size: 16px;
        color: black;
        pointer-events: none;
        transition: .5s;
    }
    .login-box .user-box input:focus~label,
    .login-box .user-box input:valid~label {
        top: -85px;
        left: 0;
        color: #BE7CEC;
        font-size: 12px;
    }
    #Register{
        padding: 10px 20px;
        color: #CBBDDB;
        font-size: 16px;
        text-decoration: none;
        text-transform: uppercase;
        overflow: hidden;
        transition: .5s;
        letter-spacing: 5px;
```

```
    border: 1px solid #BF7CEC;
    border-radius: 15px;
    margin: auto;
}
#Register:hover{
    background: #BF7CEC;
    color: #fff;
    border-radius: 5px;
    box-shadow: 0 0 5px #BF7CEC 0 0 50px #BF7CEC, 0 0 100px #BF7CEC ;
}
.button-form{
    display: flex;
    flex-direction: row;
    margin-top: 20px;
}
#Login{
    font-size: 14px;
    text-decoration: none;
    color: black;
    margin: auto;
    width: 60%;
    text-align: center;
}

#Login a{
    margin: auto;
    color: black;
    text-decoration: none;
}
</style>
</body>
</html>
```

7.2 FEATURE 2

LOGIN.HTML

```html
<!DOCTYPE html>
<html>
<head>
        <meta charset="utf-8">
        <meta name="viewport" content="width=device-width, initial-scale=1">
        <title>Login Page</title>
</head>
<body>
         <div id="topbar">Vritual Eye
                <ul>
                        <li><a href="Home.html">Home</a></li>
                        <li><a href="Login.html">Login</a></li>
                        <li><a href="Register.html">Register</a></li>
                </ul>
          </div>
<div class="login-box">
<h2>LOGIN</h2>
 <form>
        <div class="user-box">
                <input type="text" name="" required="">
                <label>Enter Register Email Id</label>
        </div>
        <div class="user-box">
                <input type="password" name="" required="">
                <label>Enter password</label>
        </div>
        <div class="button-form">
                <a id="Login" href="prediction.html">Submit</a>
                </div>
        </div>
</div>
</form>
<style >
#topbar
{
   background-color: black;
   width: 100%;
   height: 50px;
   text-decoration-color: white;
   text-size: 20px;
color: white;
}
#topbar ul
{ float: right;
margin-top: 8px;}
```

```css
#topbar ul li
{display: inline;
margin-right: 20px;}
#topbar ul li a
{ color:white;
text-decoration: none;
font-size: 18px;}
.{
    box-sizing: border-box;
}
body{
    background: floralwhite;
}
.login-box{
    position: absolute;
    color: black;
    top: 50%;
    left: 50%;
    height: 300px;
    width: 500px;
    padding: 40px;
    transform: translate(-50%, -50%);
    background: #CCCCFF;
    box-shadow: 0 15px 25px rgba(143, 124, 236, 0.7);
    border-radius: 10px;
}
.login-box img
{
    width: 200px;
    height: 200px;
margin-left: 150px;
border-radius: 100px;
margin-bottom: 25px;
}
.login-box h2{
    margin: 0 0 30px;
    padding: 0;
    color: black;
    text-align: center;
}
.login-box .user-box input{
    position: relative;
    width: 100%;
    padding: 10px 0;
    font-size: 16px;
    color: black;
    margin-bottom: 30px;
    border: none;
    border-bottom: 1px solid #fff;
    outline: none;
```
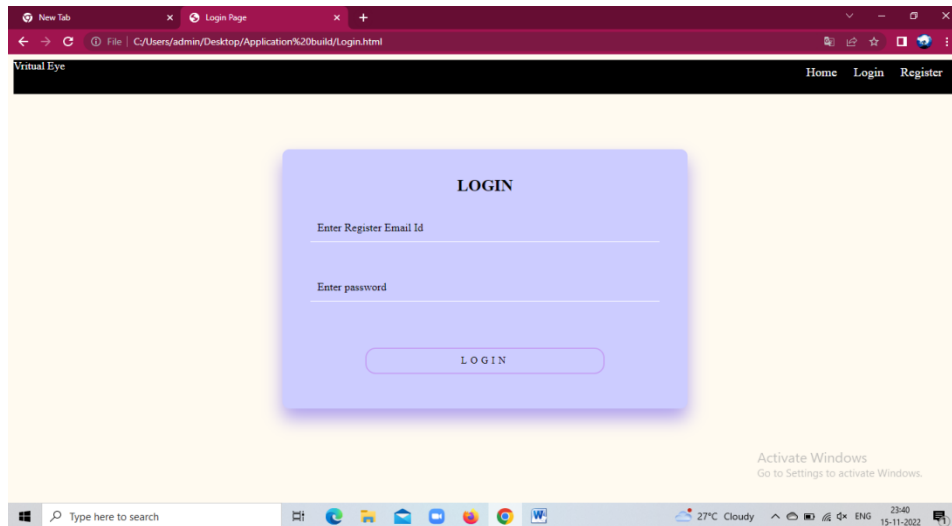
```css
    outline-color: #0000ff;
    background: transparent;
}
.login-box .user-box label{
    position: relative;
    left: 0;
    top: -60px;
    padding: 10px;
    font-size: 16px;
    color: black;
    pointer-events: none;
    transition: .5s;
}
.login-box .user-box input:focus~label,
.login-box .user-box input:valid~label {
    top: -85px;
    left: 0;
    color: #BE7CEC;
    font-size: 12px;
}
#Login{
    padding: 10px 20px;
    color: #CBBDDB;
    font-size: 16px;
    text-decoration: none;
    text-transform: uppercase;
    overflow: hidden;
    transition: .5s;
    letter-spacing: 5px;
    border: 1px solid #BF7CEC;
    border-radius: 15px;
    margin: auto;
}
#Login:hover{
    background: #BF7CEC;
    color: #fff;
    border-radius: 5px;
    box-shadow: 0 0 5px #BF7CEC 0 0 50px #BF7CEC, 0 0 100px #BF7CEC ;
}
.button-form{
    display: flex;
    flex-direction: row;
    margin-top: 20px;
}
#Login{
    font-size: 14px;
    text-decoration: none;
    color: black;
    margin: auto;
    width: 60%;
```

```
   text-align: center;
}
#Login a{
   margin: auto;
   color: black;
   text-decoration: none;
}
</style>
</body>
</html>
```


PREDICTION.HTML

```
<!DOCTYPE html>
<html>
<head>
      <meta charset="utf-8">
      <meta name="viewport" content="width=device-width, initial-scale=1">
      <title>prediction</title>
</head>
      <body>
            <style >
      #topbar
{
      background-color: black;
      width: 100%;
      height: 60px;
color: white;
}
#topbar ul
{ float: right;
margin-top: 8px;}
#topbar ul li
```
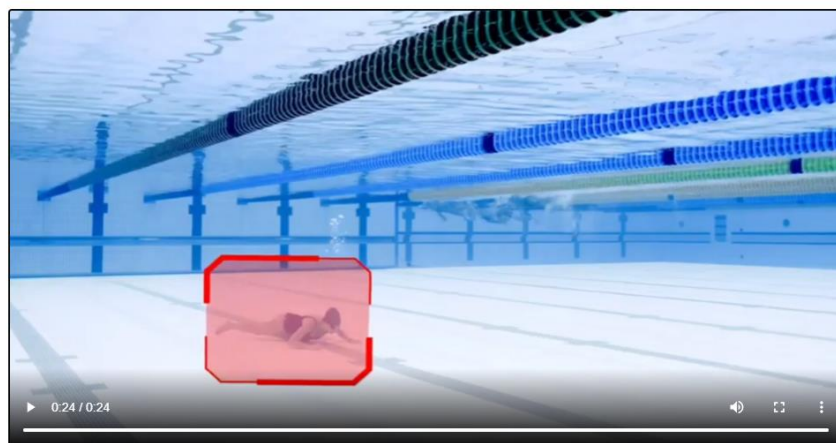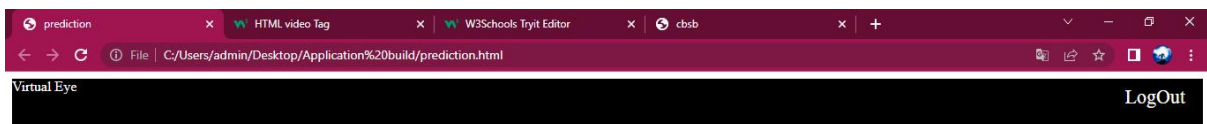
```
{display: inline;
margin-right: 20px;}
#topbar ul li a
{ color:white;
text-decoration: none;
font-size: 22px;}
#video
{
        margin-top: 50px;
}
        </style>
</body>
<body>
    <div id="container">
  <div id="topbar"> Virtual Eye
        <ul>
                        <li><a href="Sign Out.html">LogOut</a></li>
                </ul></div>
                <body>
                        <div id="video">
                                <center>
                <video width="70%" height="50%" controls>
 <source src="LIVEVIDEO.mp4" type="video/mp4">
 Your browser does not support HTML video.
</video></center>
                </body>
</body>
</html>
```

8. TESTING

8.1 .TEST CASES
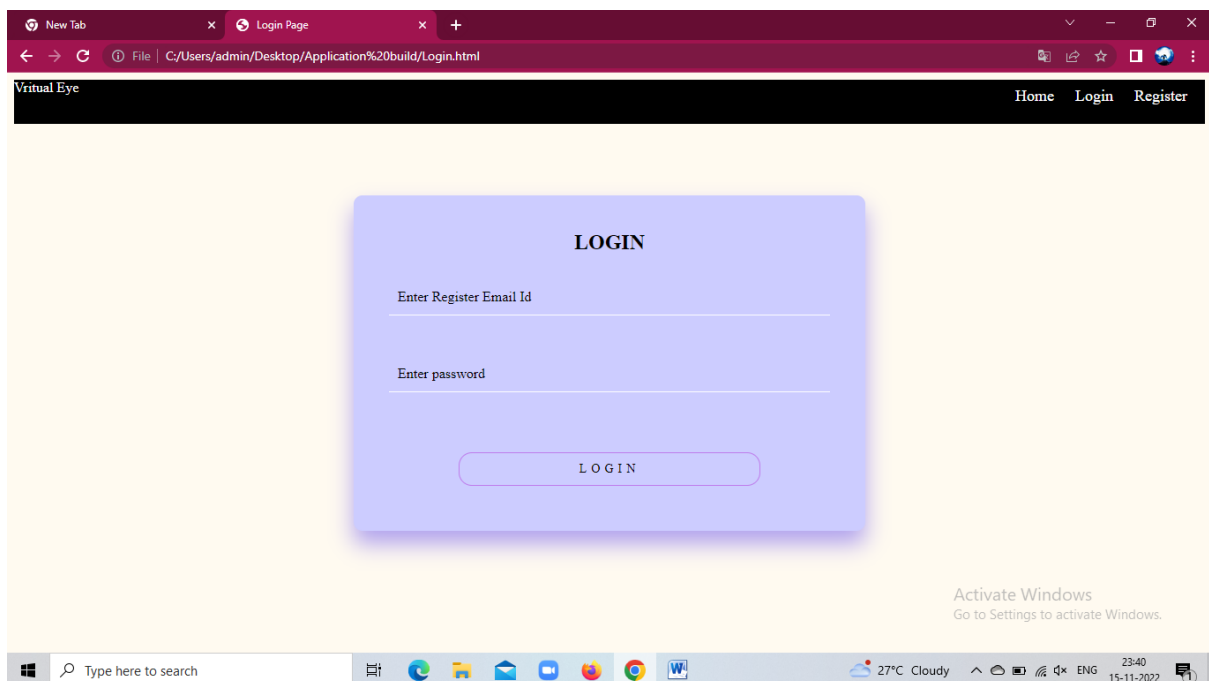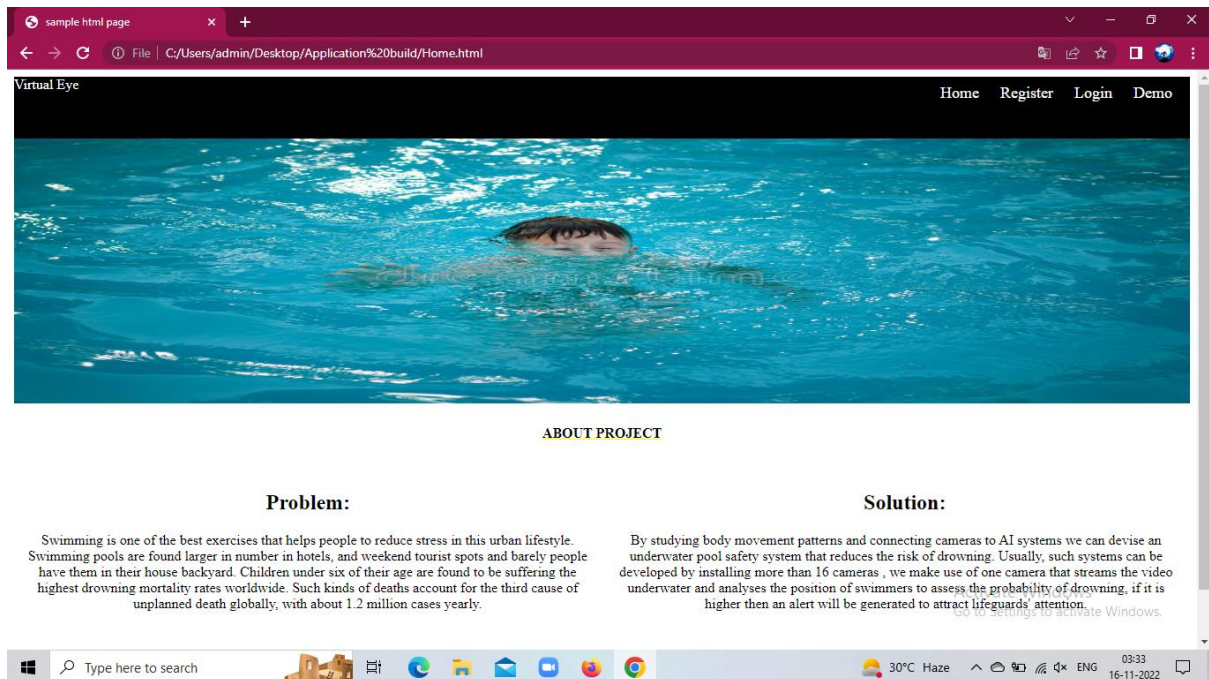
9.RESULTS

9.1 PERFORMANCE METRICS:

Background Model...
Specifically, let B denote the background model consisting of a mixture of Gaussian components $\{B_i\}_{i=1}^k$, each characterized by its mean vector μ_{B_i} and covariance matrix Σ_{B_i}, in some proportions $\alpha_1,...,\alpha_k$, where $\sum_{i=1}^k \alpha_i = 1$ and $\alp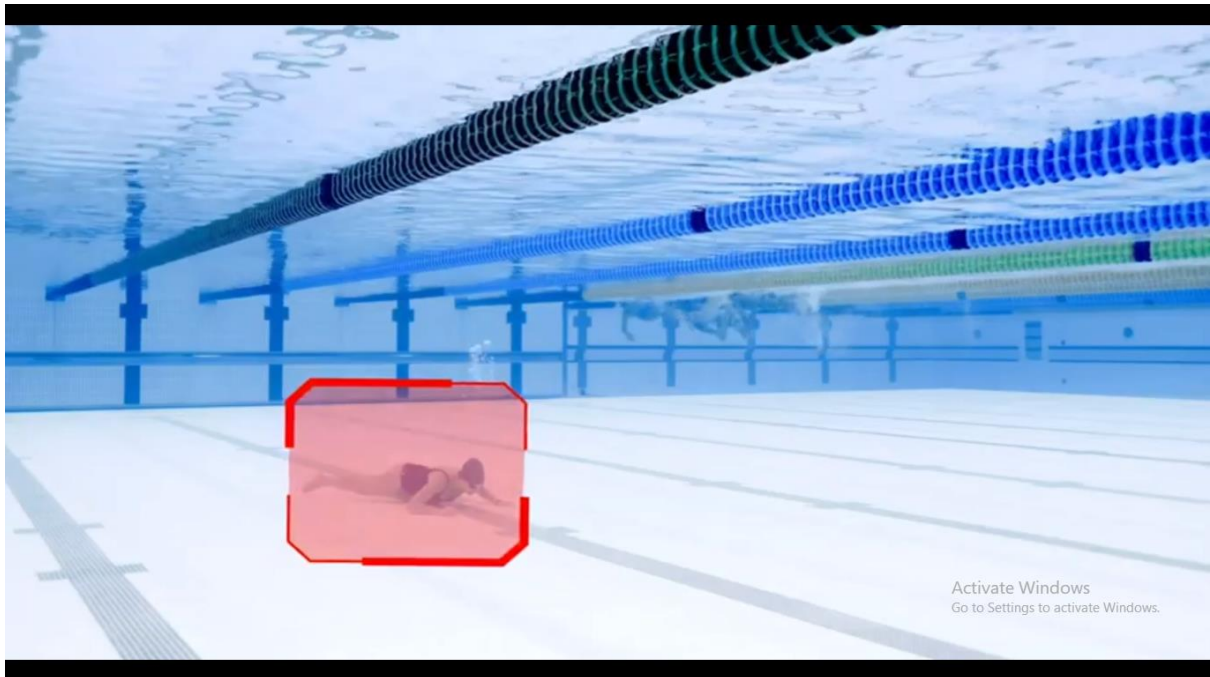ha_i > 0$. The probability that a pixel j with HSV color value X_j belongs to the background model B can be computed as $p(X_j|B) = \sum_{i=1}^k \alpha_i \exp{-\frac{1}{2}(X_j - \mu_{B_i})^T \Sigma^{-1}_{B_i}(X_j - \mu_{B_i})} / (2\pi)^{3/2} |\Sigma_{B_i}|^{1/2}$ (1) If $p(X_j|B)$ is less than a preset threshold, the pixel is considered not belonging to the background scene.

$$p(X_j|B) = \sum_{i=1}^k \frac{\alpha_i \exp\left\{-\frac{1}{2}(X_j - \mu_{B_i})^T \Sigma^{-1}_{B_i}(X_j - \mu_{B_i})\right\}}{(2\pi)^{3/2} \left|\Sigma_{B_i}\right|^{1/2}}$$

All such pixels sharing some spatial proximity are grouped together using a standard connected component algorithm. The presence of a new swimmer is assumed if a sizable connected region of these non-background pixels has been detected.

Swimmer Model…

Once a sufficient number of pixels corresponding to a swimmer have been accumulated, a color appearance model for the swimmer can be constructed. Similar to the background modeling, a Gaussian mixture model is used to model the color distribution of the swimmer pixels.

$$p(X_j|S) = \sum_{i=1}^k \frac{\gamma_i \exp\left\{-\frac{1}{2}(X_j - \mu_{S_i})^T \Sigma^{-1}_{S_i}(X_j - \mu_{S_i})\right\}}{(2\pi)^{3/2} \left|\Sigma_{S_i}\right|^{1/2}}$$

10.ADVANTAGES & DISADVANTAGES

ADVANTAGES:

1. It increases computing and resource efficiency.
2. It helps to assess human conditions and behaviours.
3. It helps to learn from experts delivering skills.
4. It makes technology more intuitive.
5. It helps to communicate with machines in order to automate manual tasks.
6. It increases user experience and performance in playing games.

DISADVANTAGES:

The ability to create a machine that can simulate human intelligence is no small feat. It requires plenty of time and resources and can cost a huge deal of money. AI also needs to operate on the latest hardware and software to stay updated and meet the latest requirements, thus making it quite costly.

A big disadvantage of AI is that it cannot learn to think outside the box. AI is capable of learning over time with pre-fed data and past experiences, but cannot be creative in its approach.

11. CONCLUSION

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. 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. The swimming goggles with drowning detection unit can be economically viable solution. The range of the alarms transmission can be improved by using underwater acoustics. Any age groups will be comfortable wearing the goggles, without hampering the recreational joy while swimming. The goggles can be useful even in sea. The alarm receivers can be placed at different locations in the water bodies which is having high chance of drowning. Another major advantage of this approach unlike other approach is the ease of use in all atmospheric conditions, like rain or wind to day or night. This solution is also a reliable solution where the life guards have difficulty to monitor the swimmers like a highly crowded sea.

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 also can be used on sea beaches for drowning detection.

Similarly, but broadening the scope, it would be interesting to investigate whether the features generalize to other appliances, i.e., whether the features are indicative not only for pools. If so, the features could be used for transfer learning, meaning that the already trained CNN is reused by fixing the weights in the feature layers and only retraining the classification layers on the new task. Moreover, the transfer learning setting could be applied to similar datasets from other countries. A generalization across appliances or countries would have even more negative implications for privacy.

13.APPENDIX

SOURCE CODE:

HOME.HTML

```html
<!DOCTYPE html>
<html>
<head>
        <meta charset="utf-8">
        <meta name="viewport" content="width=device-width, initial-scale=1">
        <title>sample html page</title>
</head>
<body>
         <div id="container">
   <div id="topbar"> Virtual Eye
        <ul>
                        <li><a href="Home.html">Home</a></li>
                        <li><a href="Register.html">Register</a></li>
                        <li><a href="Login.html">Login</a></li>
                        <li><a href="#">Demo</a></li>
                </ul></div>
    <div id="header">
                <img src="https://thumbs.dreamstime.com/b/young-boy-drowning-pool-danger-
32796259.jpg"/>
        </div>
        <div id="content">
                <h4 class="heading">ABOUT PROJECT</h4>


        <div id="bottom1">
                                <h2>Problem:</h2>
                <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 hotels, and weekend tourist
spots and barely people have them in their house backyard. 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 id="bottom2">
                        <h2> Solution:</h2>
                        <p>By studying body movement patterns and connecting cameras to
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 , 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.
</p>
        </div>
  </div>
  <style >
        #topbar
{
        background-color: black;
        width: 100%;
        height: 70px;
color: white;
```

```css
}
#topbar ul
{ float: right;
margin-top: 8px;}
#topbar ul li
{display: inline;
margin-right: 20px;}
#topbar ul li a
{ color:white;
text-decoration: none;
font-size: 18px;}
#header img
{ height: 300px;
width: 100%;}
body
{background-color: white;}
#container
{
        height: 700px;
        width: 100%;
        margin: 0px auto;
}
#content
{float:left;
width: 100%;
height: 50px;
text-align: center;
text-decoration: underline;
text-decoration-color:
 #ffff00;}
#bottom1
{margin-top: 15px;
width: 50%;
float: left;}
#bottom1
{
        color: black;
}
#bottom2
{margin-top: 15px;
width: 50%;
float: right;
}
#bottom2 h2
{
        color: black;
        margin-left: 20px;
}
#bottom1 p
{
        margin-left: 8px;
        margin-right: 9px;
}
#bottom2 p
{
```

```
        margin-left: 8px;
        margin-right: 8px;
}
  </style>
  </body>
</html>
```

REGISTER.HTML

```
<!DOCTYPE html>
<html>
<head>
        <meta charset="utf-8">
        <meta name="viewport" content="width=device-width, initial-scale=1">
        <title>Login Page</title>
</head>
<body>
        <div id="topbar">Virtual Eye
                <ul>
                        <li><a href="Home.html">Home</a></li>
                        <li><a href="Login.html">Login</a></li>
                        <li><a href="Register.html">Register</a></li>
                </ul>
        </div>
<div class="login-box">
                        <div class="image">
                                <h2>REGISTER</h2>
 <form>
        <div class="user-box">
                <input type="text" name="" required="">
                <label>Enter Email</label>
        </div>
        <div class="user-box">
                <input type="text" name="" required="">
                <label>Enter name</label>
        </div>
        <div class="user-box">
                <input type="password" name="" required="">
                <label>Enter password</label>
        </div>
        <div class="button-form">
                <a id="Register" href="Login.html">Submit</a>
                <div id="Login"> Already have a account ?
                        <a href="Login.html">Login</a>
                </div>
        </div>
</div>
</div>
</form>
<style >
        #topbar
{
  background-color: black;
  width: 100%;
  height: 50px;
  text-decoration-color: white;
```

40

```css
    color: white;
}
#topbar ul
{ float: right;
margin-top: 8px;}
#topbar ul li
{display: inline;
margin-right: 20px;}
#topbar ul li a
{ color:white;
text-decoration: none;
font-size: 18px;}
.{
    box-sizing: border-box;
}
body{
    background: floralwhite;
}
.login-box{
    margin-top:72px;
    position: absolute;
    color: black;
    top: 50%;
    left: 50%;
    height: 550px;
    width: 500px;
    padding: 40px;
    transform: translate(-50%, -50%);
    background: #CCCCFF;
    box-shadow: 0 15px 25px rgba(143, 124, 236, 0.7);
    border-radius: 10px;
}
.login-box img
{
    margin-top: 10px;
    width: 150px;
    height: 150px;
margin-left: 175px;
border-radius: 100px;
margin-bottom: 25px;
}
.login-box h2{
    margin: 0 0 30px;
    padding: 0;
    color: black;
    text-align: center;
}
.login-box .user-box input{
    position: relative;
    width: 100%;
    padding: 10px 0;
    font-size: 16px;
    color: black;
    margin-bottom: 30px;
    border: none;
```

```css
    border-bottom: 1px solid #fff;
    outline: none;
    outline-color: #0000ff;
    background: transparent;
}
.login-box .user-box label{
    position: relative;
    left: 0;
    top: -60px;
    padding: 10px;
    font-size: 16px;
    color: black;
    pointer-events: none;
    transition: .5s;
}
.login-box .user-box input:focus~label,
.login-box .user-box input:valid~label {
    top: -85px;
    left: 0;
    color: #BE7CEC;
    font-size: 12px;
}
#Register{
    padding: 10px 20px;
    color: #CBBDDB;
    font-size: 16px;
    text-decoration: none;
    text-transform: uppercase;
    overflow: hidden;
    transition: .5s;
    letter-spacing: 5px;
    border: 1px solid #BF7CEC;
    border-radius: 15px;
    margin: auto;
}
#Register:hover{
    background: #BF7CEC;
    color: #fff;
    border-radius: 5px;
    box-shadow: 0 0 5px #BF7CEC 0 0 50px #BF7CEC, 0 0 100px #BF7CEC ;
}
.button-form{
    display: flex;
    flex-direction: row;
    margin-top: 20px;
 }
#Login{
    font-size: 14px;
    text-decoration: none;
    color: black;
    margin: auto;
    width: 60%;
    text-align: center;
}
```

```
#Login a{
   margin: auto;
   color: black;
   text-decoration: none;
}
</style>
</body>
</html>
```

LOGIN.HTML

```
<!DOCTYPE html>
<html>
<head>
        <meta charset="utf-8">
        <meta name="viewport" content="width=device-width, initial-scale=1">
        <title>Login Page</title>
</head>
<body>
         <div id="topbar">Vritual Eye
                <ul>
                        <li><a href="Home.html">Home</a></li>
                        <li><a href="Login.html">Login</a></li>
                        <li><a href="Register.html">Register</a></li>
                </ul>
         </div>
<div class="login-box">
<h2>LOGIN</h2>
 <form>
        <div class="user-box">
                <input type="text" name="" required="">
                <label>Enter Register Email Id</label>
        </div>
        <div class="user-box">
                <input type="password" name="" required="">
                <label>Enter password</label>
        </div>
        <div class="button-form">
                <a id="Login" href="prediction.html">Submit</a>
                </div>
        </div>
</div>
</form>
<style >
#topbar
{
   background-color: black;
   width: 100%;
   height: 50px;
   text-decoration-color: white;
   text-size: 20px;
```

```css
    color: white;
}
#topbar ul
{ float: right;
margin-top: 8px;}
#topbar ul li
{display: inline;
margin-right: 20px;}
#topbar ul li a
{ color:white;
text-decoration: none;
font-size: 18px;}
.{
    box-sizing: border-box;
}
body{
    background: floralwhite;
}
.login-box{
    position: absolute;
    color: black;
    top: 50%;
    left: 50%;
    height: 300px;
    width: 500px;
    padding: 40px;
    transform: translate(-50%, -50%);
    background: #CCCCFF;
    box-shadow: 0 15px 25px rgba(143, 124, 236, 0.7);
    border-radius: 10px;
}
.login-box img
{
    width: 200px;
    height: 200px;
margin-left: 150px;
border-radius: 100px;
margin-bottom: 25px;
}
.login-box h2{
    margin: 0 0 30px;
    padding: 0;
    color: black;
    text-align: center;
}
.login-box .user-box input{
    position: relative;
    width: 100%;
    padding: 10px 0;
    font-size: 16px;
```

```css
    color: black;
    margin-bottom: 30px;
    border: none;
    border-bottom: 1px solid #fff;
    outline: none;
    outline-color: #0000ff;
    background: transparent;
}
.login-box .user-box label{
    position: relative;
    left: 0;
    top: -60px;
    padding: 10px;
    font-size: 16px;
    color: black;
    pointer-events: none;
    transition: .5s;
}
.login-box .user-box input:focus~label,
.login-box .user-box input:valid~label {
    top: -85px;
    left: 0;
    color: #BE7CEC;
    font-size: 12px;
}
#Login{
    padding: 10px 20px;
    color: #CBBDDB;
    font-size: 16px;
    text-decoration: none;
    text-transform: uppercase;
    overflow: hidden;
    transition: .5s;
    letter-spacing: 5px;
    border: 1px solid #BF7CEC;
    border-radius: 15px;
    margin: auto;
}
#Login:hover{
    background: #BF7CEC;
    color: #fff;
    border-radius: 5px;
    box-shadow: 0 0 5px #BF7CEC 0 0 50px #BF7CEC, 0 0 100px #BF7CEC ;
}
.button-form{
    display: flex;
    flex-direction: row;
    margin-top: 20px;
 }
#Login{
```

```
    font-size: 14px;
    text-decoration: none;
    color: black;
    margin: auto;
    width: 60%;
    text-align: center;
}
#Login a{
    margin: auto;
    color: black;
    text-decoration: none;
}
</style>
</body>
</html>
```

PREDICTION.HTML

```
<!DOCTYPE html>
<html>
<head>
        <meta charset="utf-8">
        <meta name="viewport" content="width=device-width, initial-scale=1">
        <title>prediction</title>
</head>
        <body>
                <style >
        #topbar
{
        background-color: black;
        width: 100%;
        height: 60px;
color: white;
}
#topbar ul
{ float: right;
margin-top: 8px;}
#topbar ul li
{display: inline;
margin-right: 20px;}
#topbar ul li a
{ color:white;
text-decoration: none;
font-size: 22px;}
#video
{
        margin-top: 50px;
}
        </style>
</body>
<body>
```

```html
    <div id="container">
  <div id="topbar"> Virtual Eye
       <ul>
                        <li><a href="Sign Out.html">LogOut</a></li>
                </ul></div>
                <body>
                        <div id="video">
                                <center>
                <video width="70%" height="50%" controls>
  <source src="LIVEVIDEO.mp4" type="video/mp4">
  Your browser does not support HTML video.
</video></center>
                </body>
</body>
</html>
```

LOGOUT.HTML

```html
<!DOCTYPE html>
<html>
<head>
        <meta charset="utf-8">
        <meta name="viewport" content="width=device-width, initial-scale=1">
        <title>LogOut</title>
</head>
<body>
        <style >

        #topbar
{
        background-color: black;
        width: 100%;
        height: 60px;

color: white;
}
#topbar ul
{ float: right;
margin-top: 8px;}
#topbar ul li
{display: inline;
margin-right: 20px;}
#topbar ul li a
{ color:white;

text-decoration: none;
font-size: 22px;}
#content h1
{
        text-align: center;
}
```

47

```css
#content h3
{
        text-align: center;
        color: green;
        text-decoration-line:underline ;
}

#Login:hover{
   background: #BF7CEC;
   color: #fff;
   border-radius: 20px;
   box-shadow: 0 0 5px #BF7CEC 0 0 50px #BF7CEC, 0 0 100px #BF7CEC ;
}

.button-form{
   display: flex;
   flex-direction: row;
   margin-top: 20px;

 }


#Login{
   font-size:20px;
   text-decoration: none;
   color: black;
   margin: auto;
   width: 10%;
   text-align: center;
}

#Login a{
   margin: auto;
   color: black;
   text-decoration: none;

}
</style>

</body>
<body>
```

```html
<div id="container">
   <div id="topbar"> Virtual Eye
        <ul>
                    <li><a href="Home.html">Home</a></li>
                    <li><a href="Register.html">Register</a></li>
                    <li><a href="Login.html">Login</a></li>
```

```
            </ul></div>
            <div id="content">
                    <h1>Successfully Logged Out</h1>
                     <h3>Login for more information</h3>
                                   </div>
</div>
<div class="button-form">
            <a id="Login" href="Login.html">Login</a>


            </div>
</body>
</html>
```

GITHUB & PROJECT DEMO LINK

GITHUB LINK: https://github.com/IBM-EPBL/IBM-Project-34344-1660234466

DEMO LINK: https://youtu.be/rrFlTM8l4h4