# Prevention Of Drowning Incidents In Swimming Pool On Automated Vision Based Surveillance System

**Avinash Singh[1], Ankit Tripathi[2], Rajan Vishwakarma[3], Shaikh Sharique Ahmad[4]**

[123] *Student Department of Information Technology, TCOE College, Maharashtra, India*

[4] *Asst. Prof. Department of Information Technology, TCOE College, Maharashtra, India*

## ABSTRACT

Swimming pools are everywhere, like in homes, restaurants, clubs. There will be a lifeguard at each pool and many swimmers at the swimming pool, but even then there are many drownings. The numbers are increasing daily. To protect people from drowning in the pool, we use machine learning and a net lifting system to prevent drowning incidents. The system will include a net to help the drowning person rise in the water, this movement of the net will be controlled by servo motors that are connected to the Arduino Uno board, and there will be a buzzer and LED indication to alert people near the pool and. Drowning is detected by machine learning using a camera that is trained to detect such situations, the camera is connected to a computer or laptop, this system is used to monitor the pool, watch the swimmers in it, if there is a person in it, the drowning state system detects it and sends a command to the Arduino Uno board to she raised the net. With the help of servomotors, the mesh rises together with the sinking one.

## 1. INTRODUCTION

Nowadays, video surveillance can be used as a monitoring and security tool. Surveillance of public and private places is increasingly becoming a very sensitive matter. Video surveillance systems are designed and installed in places like railways, airports and even hazardous environments. Image processing pattern recognition and machine learning-based methods are effective ways to intelligently monitor objects or events in real time. The use of intelligence in video surveillance systems enables real-time monitoring of places, people and their activities. The surveillance approach can change with different goals and can change with different goals and change from a single camera to a multi-camera configuration. Tracking must be robust to automatically detect drownings. This tracking information is very useful for understanding events later or as incriminating evidence, many researchers are studying the possibility of using these huge amounts of data and analyzing them in real time with the hope of preventing some of these extraordinary events or facilitating faster or more efficient .

The main contribution of this project is to develop a pool monitoring system so that swimmers can swim freely without fear of drowning. Have an automated model that will work by itself, without the presence of a lifeguard.

### 1.1 Problem Statement

According to the WHO (World Health Organization), drowning is the leading cause of unintentional death in the world, with approximately 372,000 drowning deaths reported annually. Swimming Pool Drowning Deaths and Children It's an unbelievable statistic: According to the CDC, drowning is the leading cause of unintentional death for children ages 1 to 4. To overcome this problem, an IoT monitoring model will help to avoid the maximum number of cases.

## 2. LITERATURE SURVEY

The system consists of a PC/laptop running Windows and Anaconda, an Arduino Uno board, servo motors, an alarm system and motor controllers. The proposed system is based on the circular Hough transform algorithm for locating and rescuing drowning swimmers. The results of the experiments indicate that the system has a unique ability to track and monitor swimmers, allowing it to mitigate and reduce the number of drowning deaths.

Lei Fei[1], Wang Xueli[2], Off-time Swimming Pool Surveillance Using Thermal Imaging System, proposed a background subtraction method for drowning detection and swimmer identification using visual tracking in their research. This method cannot accurately reflect the real background, which limits the model-accurate shape detection of moving objects.

Ajil Roy[1], Dr. K. Srinivasan[2], A live Visual Surveillance System for Early Drowning Detection at Pool proposed drowning detection using RFID-based swimming goggles, but this model also fails to overcome accuracy limitations because the water sensor is not placed too close to the mouth and nose.

Hanbing Liu et al[1], A framework for Vision-based Swimmer Tracking it consists of a framework that uses specialized cameras and DSP engines to generate alerts based on the analysis of the swimmer's movement, but this system lacks an autonomous rescue mechanism.

Journal by Mr. Lin[1], Wang LY[2], A Vision-Based Approach to Early Detection of Drowning Incidents in Swimming Pools, in some countries such as South Africa, Guyana, Morocco, Houtamalla and India, the death rate is heart-rending, and one regrets few countries such as Austria, Portugal, Austria, The Netherlands, Denmark, Korea, etc. have somehow managed to significantly reduce the number of deaths.

## 3. METHODOLOGY

The primary contributions of this project are to create a monitoring system for swimming pools to stop the beginning of a drowning episode. The complete system will be controlled by the Raspberry Pi and Arduino Nano boards. Anyone accessing the pool area should be wearing passive yellow vests. The two Pi cameras will keep an ongoing eye on the pool. The Raspberry Pi board, which is executing a Python script, will receive the data after it has been analysed. The script will compute the locations, velocities, paths of movement, and time spent submerged for each swimmer. The computations will enable the detection of any abnormal events. If such occurrences take place, Raspberry Pi will send a command to a stepper motor that is set up to lift the mesh. The swimmer can be lifted out of the pool by using that mesh. Whenever any impending danger occurs, a warning signal will alert the lifeguard.

### 3.1 Requirement Analysis

#### 3.1.1 Hardware Requirement

a. Motion Detection Sensor
b. Camera
c. PC/Laptop
d. Arduino/uno
e. Servo Motor
f. Light/Buzzer

#### 3.1.2 Software Requirement

a. Python 3.9(Coding Lnguage)
b. Visual Studio Code

c. Arduino Software

## 4. RESULT AND DISCUSSION

The project is to be developed in python, which should run on Windows OS, which will be implemented in Arduino to perform the expected actions as needed. The mesh should look correct just like the lift but on the flat side.

### 4.1 Proposed System

The proposed automated and intelligent pool safety monitoring system based on Internet of Things and transfer learning is shown in Figure 3. The system uses a single image taken in two steps: (1) a motion sensor detects any number of people entering the pool and sends a signal to the camera and (2) a camera that is installed above the pool as shown captures one image.Then the PC/laptop connects to the camera and takes one picture.

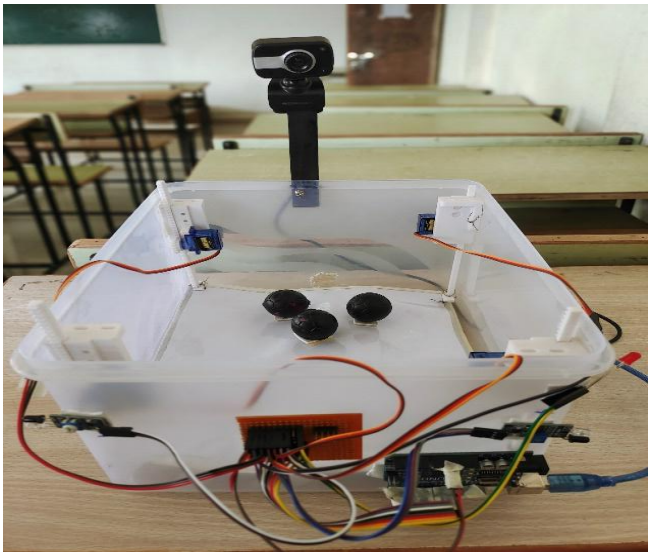
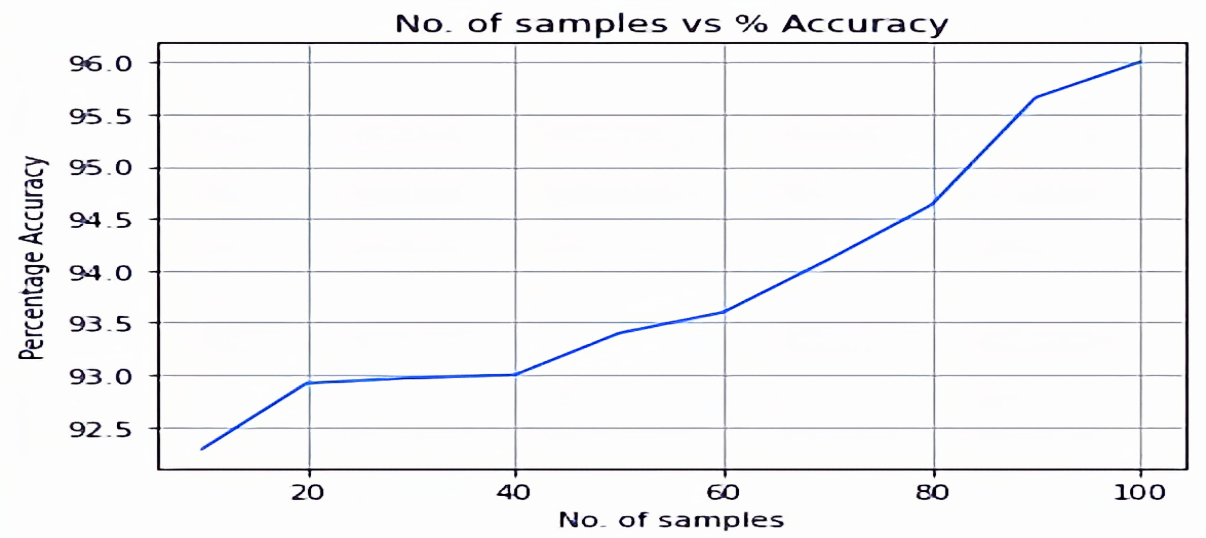


**Fig 4.1:** Proposed System

The prototype was built and tested several times to verify its durability and responsiveness. The prototype worked exactly as described in the UML diagrams. A prototype of the proposed product is built in a controlled environment, tested for safety and security in different lighting conditions. In order to reach the surface in time, the actual system must include powerful elevator motors with tuned speeds. The system works well using the Hough Circle Detection method with 98% accuracy, which is improved by taking the value of consecutive frames to avoid false starts.




No.of samples are the number of images captured from live camera video , Initially the no.of balls in 1 image is 3 balls.So , if the count of balls is 3 for every increasing image samples then the accuracy will be greater i.e,close to 98%.

### 4.2.1 Command for activation

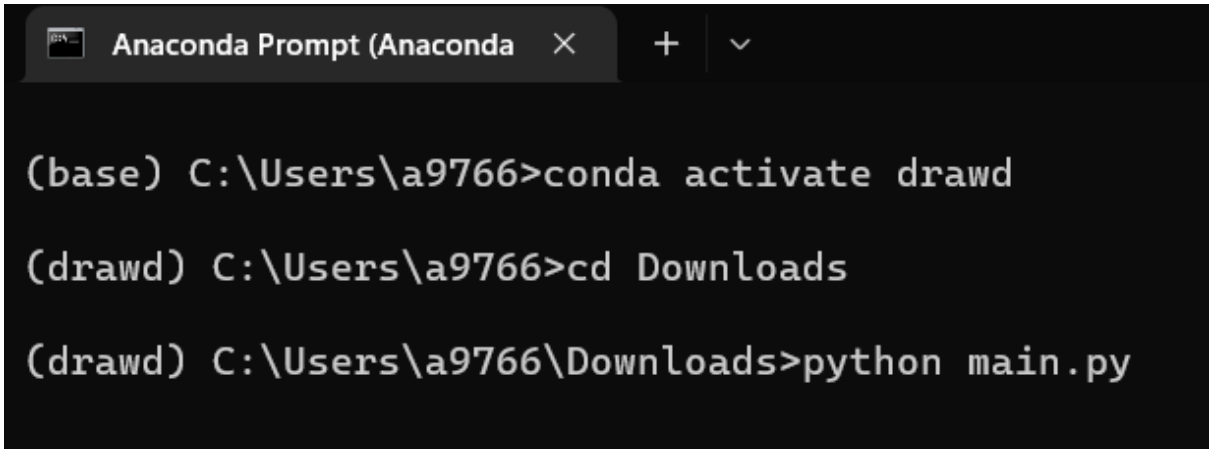



**Fig 4.2:** Anaconda prompt

To run the project,we need to open the terminal and activate the project name.After activating project name ,we need to give access to the path of python library in which the algorithm is stored. After providing the path , we need to run the main.py file from which the camera will start working and the process will go on.

### 4.2.2 Detecting the number of swimmers inside the pool

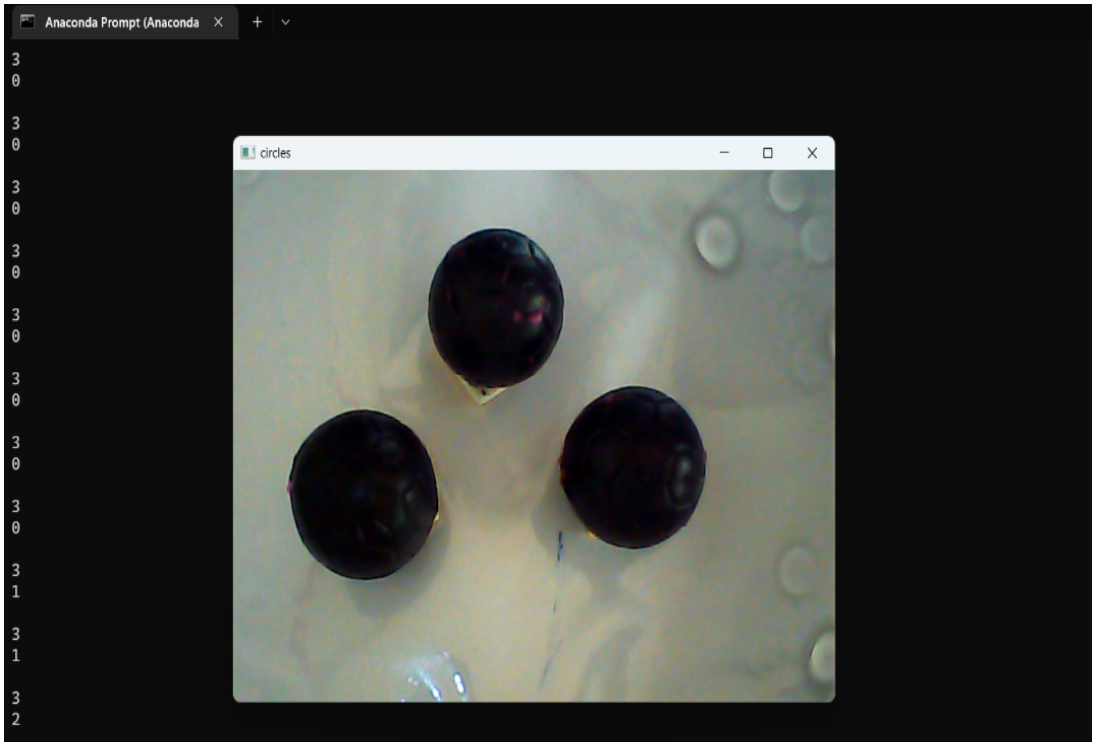



**Fig 4.3:** Camera Detection

The model will start working with the use of live camera as it detects the number of swimmer in the swimming pool with the help of hough transform algorithm and it will continue to do so until one of the swimmer is missing for a while

### 4.2.3 Notification to guard


**Fig 4.4:**Telegram Alert

Within 10 seconds an alert notification will be send to the guard or the owner of the swimming pool so that they can be known about the incident within seconds and they can manually bring the mesh down.

## 5. CONCLUSION

This project presents an automated vision-based monitoring system for pool drowning detection. Swimmers in the pool are detected and monitored by a camera. The linear step raises the swimmer and meanwhile a warning message signals the impending danger to the lifeguard. libraries will be added to explore and investigate the effectiveness of the proposed system, as well as additional functionality to send live images of the drowning as a notification directly to the pool owner, as currently only text messages are forwarded to the owner.

## 6. FUTURE SCOPE

More classes and libraries will be added to explore and to investigate the efficiency of the proposed system.Additional function of sending the live images of drowning just as a notification directly to the owner of the pool as currently only text messages is forwarded to the owner.


## ACKNOWLEDGEMENT

We would like to take this opportunity to express our gratitude towards all the people who have helped us in various ways, for successful completion of our project. We would like to extend our appreciation to the participants who took part in this study and generously shared their time and insights. Their contributions have greatly improved the quality of this manuscript.


## REFERENCES


[1] Abdel Ilah N. Alshbatat[1], ,Shamma Alhamel[2] , Shamsa Almazrouei[3] ,Salama Alhameli [4], Wadhha Almarar[5] "Automated Vision-based Surveillance System to Detect Drowning Incidents in Swimming Pools " University of Birmingham-July 26,**2020**.

[2] W. Lu, Y. Tan, Y. Peng, "A Vision-Based Approach to EarlyDetection of Drowning Incidents inSwimming Pools," IEEETransactions on Circuits and Systems for Video Technology **2004**.

[3] S. Nagalikitha, A. Kiranmai, "Automatic Waist Airbag Drowning Prevention System Based on Motion Information Measured by Memos Accelerometer and Pressure," International Journal of Emerging Trends in Engineering Research (IJETER) **2015.**

[4] Z. Chi, X. Li, and F. Lei, "A Novel Camera-Based Drowning Detection Algorithm," Advances inImage and Graphics Technologies, Springer Berlin Heidelberg **2015.**

[5] N. Salehi, M. Keyvanara, S. Monadjemmi, “An Automatic Video-based Drowning Detection System for Swimming Pools Using Active Contours,” I.J. Image, Graphics and Signal Processing **2016.**

[6] A. Kam, W. Lu, W. Yau, “A video-based Drowning Detection System,” Proceedings of EuropeanConference on Computer Vision LNCS, vol. 2353, pp. **2002.**

[7]F. Lei, W. Xueli, and C. Dongsheng, “ Drowning Detection Based on Background Subtraction,”Embedded Software and Systems, **2009.**