

e-ISSN: 2319-8753 | p-ISSN: 2320-6710

DIA

International Journal of Innovative Research in SCIENCE | ENGINEERING | TECHNOLOGY

# INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

808

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 6, June 2021

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

### Impact Factor: 7.512

9940 572 462

6381 907 438

 $\odot$ 

🖂 ijirset@gmail.com





| e-ISSN: 2319-8753, p-ISSN: 2320-6710| <u>www.ijirset.com</u> | Impact Factor: 7.512|

Volume 10, Issue 6, June 2021

DOI:10.15680/IJIRSET.2021.1006011

## Anti-Drowning System Using Machine Learning and Head Band

Neeta Chavan<sup>1</sup>, Kshitija Kadam<sup>2</sup>, Shreya Swanne<sup>3</sup>, Shraddha Shinde<sup>4</sup>, Kabir Lulla<sup>5</sup>

Assistant Professor, Department of Electronics & Telecommunication Engineering, Vivekanand Education Society's

Institute of Technology, Mumbai, Maharashtra, India<sup>1</sup>

Students, Department of Electronics & Telecommunication Engineering, Vivekanand Education Society's Institute of

Technology, Mumbai, Maharashtra, India<sup>2,3,4,5</sup>

**ABSTRACT**: The ultimate aim of this surveillance system is to automatically understand and handle incidents that occur at a location. Drowning is the third leading cause of accidental accident death worldwide, accounting for 7% of all injury-related deaths, according to the WHO. Every year, an estimated 320,000 people die from drowning around the world. The main goal of this system is to create a swimming pool that meets safety standards that can predict how people will move near or inside the pool if there is no lifeguard present. This system uses a drowning alarm system to avoid accidental drowning. This system can be used in hotels, homes, and waterparks, among other places.

KEYWORDS: Drowning, OpenCV, Haar cascade classifier, Headband, Rescue.

#### I. INTRODUCTION

Drowning is the condition of having respiratory failure as a result of submersion or immersion in water. Typically, drowning happens unexpectedly and without anyone's knowledge. It causes respiratory problems as well as instant death. Drowning is the third leading cause of accidental death and injury worldwide, according to the World Health Organization. Annual drowning deaths are estimated to be about 360,000 worldwide. Children, men, and individuals are the ones that are most affected by drowning. Drowning is regarded as a major public health problem, with an estimated 567,090 people dying from it in 2015. Aside from the death rate associated with drowning, this impact causes a variety of injuries. In 2015, about 9% of people were injured by drowning. An estimate of ten people dying from accidental drowning. Two of these are young people, aged 14 or younger. Between 2005 and 2014, there were 3,536 fatal accidental drownings linked to non-boating in the United States. In addition, last year, 332 people die from drowning in incidents that are only loosely linked to boating. Unintentional drowning claims the lives of about ten people every day. Of these, two are youngsters' elderly round 14 or younger. Drowning is believed to be the cause of 3,650 deaths per year. In addition, 332 people perish per year as a result of drowning in incidents that are only tangentially related to boating. As a result, several inventions have been made over the years to avoid drowning and to save drowning victims. By detecting the pulse, recent patterns make prevention easy. The proposed device is extremely useful in saving the life of someone who is drowning in water. The system detects the objects (faces) of the people in the swimming pool and determines its count using Haar Cascade Classifier algorithm. And also, we have used two sensors i.e., Gyroscope and Ultrasonic sensors to determine position and distance respectively of the swimming individual.

Paper is organized as follows: Section II describes the device that detects heartbeats and pressure from their respective sensors and raises an alarm, sending an email notification to the concerned authority, rapid object detection, AdaBoost learning algorithm and haar like features. Our proposed system is described in section III. The techniques used in our implemented model to save a drowning person are explained in section IV. Section V presents the experimental results showing results of images tested. Finally, Section VI presents conclusion.



| e-ISSN: 2319-8753, p-ISSN: 2320-6710| <u>www.ijirset.com</u> | Impact Factor: 7.512|

Volume 10, Issue 6, June 2021

#### DOI:10.15680/IJIRSET.2021.1006011

#### II. RELATED WORK

In paper [1], the system proposed uses two sensors which are the heartbeat sensor and the ultrasonic sensor. These sensors detect the heartbeat and the water level. If both the outputs of the sensors are high, timer is started and if the output are constantly high then the alarm is triggered else the timer is reset. The authors Venkatesh.P, Aishwarya.A, Asha.A, suggested in paper [2] the use of Node cell and Magnetic wave switch. The Node cell is built across the swimming pool and the wave detector continuously monitors the wave. This system uplifts the child to the surface of the platform whenever the child is drowning and thus prevents suffocation due to drowning. Along with this, the system provides live video streaming to the authorities. The method proposed in paper [3] is Image Segmentation. The current video frame is given as the input to the system. The swimmers are detected from the videos by clearing the background images. The prediction of the person whether he/she is drowning or not is made by Speed, Posture, Splash index, Activity Index, Submersion Index, and then alert is given. This system also has Live streaming for the authorities. The approach suggested in paper [4] is that different Object Detection Algorithms such as face detection, skin detection, colour detection, shape detection, target detection is simulated and implemented using MATLAB 2017b to detect various types of objects for video surveillance applications with improved accuracy. The technique used in paper [5] is based on the heart rate pressure concept. The device consists of two basic modules: the wristband part, which looks like a watch and contains heart rate pressure sensors and a microcontroller on the transmitter side, and another microcontroller, a buzzer, and an LCD monitor on the receiver end, which would be with the lifeguard. Individuals entering the pool area will be required to wear a wristband that would be on at all times. The heart rate pressure will be set at specific high and low levels, which would be used as thresholds to signify when real danger exists. Once in the water, the heart rate pressure of the person is continuously assessed and tracked by the heart rate sensor connected to the microcontroller. An alerting signal is sent to the receiver when the current value exceeds the threshold limits. An RF module is used for signal transmission and reception over a wireless network. When the microcontroller receives a valid signal, it switches on the buzzer. The system's goal is to prevent drowning deaths by alerting lifeguards to an impending danger and providing assistance to victims before they drown. In paper [6,] a face detection system is defined that is capable of processing images quickly while achieving high detection rates. There are three main parts. The first is the implementation of a new image representation known as the "Integral Image" which allows the features used by our detector to be computed quickly. The second is a simple and powerful classifier that selects a limited number of important visual features from a wide collection of possible features using the AdaBoost learning algorithm. The third section is a method for combining classifiers in a "cascade" which enables the image's background regions to be easily discarded while more computation is spent on promising face-like regions. A new collection of rotated haar-like features was introduced by Rainer Lienhart and JochenMaydt [7]. These novel features greatly enhance the basic features and are also calculated efficiently. Their sample face detector now has a 10% lower false alarm rate at a given hit rate because of these new rotated features. They also introduced a novel post optimization technique for a given boosted cascade, which improved the false alarm rate by 12.5% on average.

#### III. PROPOSED SYSTEM

The proposed system entails developing a drowning warning system to prevent beginners and children from drowning. There are two parts to the system: detection and prevention.

#### 3.1 Detection

The surveillance camera is set to the angle from where the whole swimming pool is captured. The camera will continuously monitor the swimming pool to detect whether the person is drowning or not with a delay of 1 second. Haar cascade classifier in OpenCV is used for detection of the people. Then the input will be given to a classifier which will have positive and negative images where a positive image is one in which presence of a person is detected and a negative image is one in which presence of person is not detected in a swimming pool. In the Logic unit, if the count of



| e-ISSN: 2319-8753, p-ISSN: 2320-6710| <u>www.ijirset.com</u> | Impact Factor: 7.512|

Volume 10, Issue 6, June 2021

DOI:10.15680/IJIRSET.2021.1006011

people in present is less than the count of people earlier, then an alarm will be raised. Simultaneously, for detection gyroscope and ultrasonic sensors are used. They are connected to the hand of the individual and after every 500 microseconds the output of these sensors would be sent to the Arduino NANO.

#### 3.2 Prevention

In the prevention part, the input to the Arduino NANO is coming from the gyroscope and ultrasonic sensors. The gyroscope sensor continuously monitors the position of the individual and checks for the threshold value given to it. Also, the ultrasonic sensor used calculates the distance between an individual's body and underwater surface and checks for the threshold value given to it. If output of one of the sensors is true then output of the logic unit is high which an indication of drowning is and the output of the machine learning is also checked. If either of the machine learning or sensor output is true then the alarm will be raised and the person's location indication will be given through the LED which would be constantly "ON" on the band and then the person will be rescued by the lifeguard.



Fig. 1 Proposed Block Diagram

#### **IV. IMPLEMENTATION**

For visual surveillance, we will be using a web camera which will be placed outside the swimming pool at an appropriate angle so that the entire view of the pool is covered. We continuously monitor the video captured through the camera and it is then fed to the Haar Cascade Classifier. The haar cascade classifier is an object detection algorithm where a lot of positive and negative images are used to train the classifier. Positive images are those in which the faces are present and negative images are those in which the faces are not present. We have created the dataset which consists of the images. There are a total of 60 images in the dataset. The output of the surveillance camera is fed to the classifier which takes the real-time image and converts the image from RGB to grey which is pre-processing and the object is detected also the green rectangle is formed around the face. So, the count of the object i.e., face is given to the Arduino UNO (Logic Unit). If the count of the faces in the present image is less than the previous one, then it will raise an alarm, which is the prevention part. In the headband part which consists of two sensors: 1. Gyroscope sensor 2. Ultrasonic sensor. Gyroscope sensor detects the position of the swimmer and ultrasonic sensor detects the distance between the swimmer body and underwater surface. The readings of the gyroscope and ultrasonic sensors would be sent to the Arduino NANO. Then the Arduino NANO checks whether the reading is in accordance with the set threshold value in the controller with a delay of 500 microseconds. The logic unit is basically an OR Gate.

| e-ISSN: 2319-8753, p-ISSN: 2320-6710| <u>www.ijirset.com</u> | Impact Factor: 7.512|



Volume 10, Issue 6, June 2021

DOI:10.15680/IJIRSET.2021.1006011



Fig. 2 System Flowchart

For the output of logic unit to be high, either of the 3 conditions needs to be satisfied:

- Gyroscope reading should be equal to or more than 45 degrees.
- Ultrasonic sensor reading is less than 30cm.
- ML output showing less count of people in the present image compared to previous one. If the system does not satisfy all of these conditions correctly then the buzzer is not raised. But if either of the above conditions are satisfied then the system will raise an alarm and also indicate the location of the drowning individual by constantly flashing LED. Through this, understanding the emergency situation, the lifeguard would be able to come early in time and save the drowning individual.



| e-ISSN: 2319-8753, p-ISSN: 2320-6710| <u>www.ijirset.com</u> | Impact Factor: 7.512|

||Volume 10, Issue 6, June 2021||

DOI:10.15680/IJIRSET.2021.1006011

V. EXPERIMENTAL RESULTS

#### A. Machine Learning Results:

The outputs for the machine learning section are given below.



Fig. 3If no person is in the frame (i.e., Count=0), then buzzer is not raised.



Fig. 4If two persons are in the frame (i.e., Count=2), then buzzer is not raised.



Fig. 5When one person goes out of the frame (i.e., Count becomes 1), then buzzer is raised.





Volume 10, Issue 6, June 2021

DOI:10.15680/IJIRSET.2021.1006011



Fig. 6When one person goes out of the frame (i.e., Count becomes 1), then buzzer is raised.

#### **B. Headband Results:**

The outputs for the Headband section are given below.



Fig. 7When swimmer is in normal position, then no buzzer is raised & LED is OFF.



Fig. 8When Gyroscope position is vertical, then buzzer is raised & LED is ON.

| e-ISSN: 2319-8753, p-ISSN: 2320-6710| <u>www.ijirset.com</u> | Impact Factor: 7.512|



Volume 10, Issue 6, June 2021

DOI:10.15680/IJIRSET.2021.1006011



Fig. 9When Distance is less than 30 cm, then buzzer is raised & LED is ON.



Fig. 10Whenboth the conditions are True, then buzzer is raised and LED is ON.

#### VI. CONCLUSION

Swimmers, accident victims, teenagers, and recreational seekers are all at risk of drowning. Drowning injuries are becoming more common, and parents are fearful of allowing their children to be alone near water. The suggested approach is simple and quick to implement. There's no need to be concerned. The drowning rescue system was created to prevent drowning deaths by monitoring a swimmer's or non-swimmer's location in the water and, if they are in danger, sending signals to a receiver or lifeguard through a wearable device connected to the victim's head, allowing the rescuer to provide immediate assistance. In future, we can be used airbag floater for automatic drowning prevention. Anti-loss alarms can also be added to device to track them. The proposed system can be extended by connecting two parts of the system i.e., Machine Learning part and Head-Band part through IOT. GPS can be used and its readings can be stored. Also, it will enable the lifeguard to know what the approximate location of the victim is.

#### REFERENCES

- [1] Ajil Roy, Dr. K. Srinivasan, A novel drowning detection method for safety of swimmers, Tiruchirappalli, India, IEEE,2018.
- [2] Venkatesh.P, Aishwarya.A, Asha.A, ANTI-CHILD DROWNING SYSTEM. Volume:02/Issue:03 Hosur, India,2020.
- [3] How-Lung Eng, Kar-Ann Toh, Alvin H.Kam, Junxian Wang and Wei-Yun Yau, An automatic drowning surveillance system for challenging outdoor pool environments. Heng Mui Keng Terrace, Singapore, IEEE,2003.



| e-ISSN: 2319-8753, p-ISSN: 2320-6710| <u>www.ijirset.com</u> | Impact Factor: 7.512|

#### Volume 10, Issue 6, June 2021

#### DOI:10.15680/IJIRSET.2021.1006011

- [4] ApoorvaRaghunandan, Mohana, PakalaRaghav and H. V. Ravish Aradhya, Object Detection Algorithms for Video Surveillance Applications. IEEE, India,2018.
- [5] Samuel Ndueso John, Ukpabio Imelda Godswill, OmoruyiOsemwegie, Godfrey Onyiagha, Etinosa Noma-Osaghae, and Kennedy Okojie, DESIGN OF A DROWNING RESCUE ALERT SYSTEM, Ogun State Nigeria, IAEME, IJMET, Volume 10,2019.
- [6] Paul Viola and Michael J. Jones, Robust Real-Time Face Detection, International Journal of Computer Vision 57(2), 137–154, 2004.
- [7] Rainer Lienhart and JochenMaydt, An Extended Set of Haar-like Features for Rapid Object Detection, Volume 1, IEEE, 2002.
- [8] Johan Carlén& Jonas Larsson, Wristband Design for Pool Safety System Redesign of a Multifunctional Wearables for Drowning Detection, Luleå University of Technology, Sweden, 2017.
- [9] Qi-Chao Mao; Hong-Mei Sun; Yan-Bo Liu; Rui-Sheng Jia, Mini-YOLOv3: Real-Time Object Detector for Embedded Applications, IEEE,2018.
- [10] TejaswiniChaudhari, Yash Kava, GaurangPandit, Pratik Gupta, Prof. Mohan Kumar, Anti Drowning system using remote alert. IOSR Journal of Engineering (IOSRJEN), ISSN (e): 2250- 3021, ISSN (p): 2278-8719, Volume 1, 2018.
- [11] A. Vidyavani, K. Dheeraj, M. Rama Mohan Reddy, KH. Naveen Kumar, Object Detection Method Based on YOLOv3 using Deep Learning Networks. International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-9 Issue-1, 2019.
- [12] Mingliang Zhong, FeiMeng, A YOLOv3-based non-helmet-use detection for seafarer safety aboard merchant ships, Shanghai, China, ICAITA, 2019.





Impact Factor: 7.512





## INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

🚺 9940 572 462 应 6381 907 438 🖂 ijirset@gmail.com



www.ijirset.com