

Literature survey

Virtual Eye - Life Guard for Swimming Pools to Detect Active Drowning

1.Ajil Roy, K. Srinivasan,et al,”A novel drowning detection method for safety of Swimmers”,2019.

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

2. Lixing He, Haozheng Hou,et al,”An Underwater Sonar-Based Drowning Detection System”,2022.

Drowning is a major cause of unintentional deaths in swimming pools. Most swimming pools hire lifeguards for continuous surveil-lance, which is labor-intensive and hence unfeasible for small private pools. The existing unmanned surveillance solutions like camera array requires non-trivial installations, only work in certain conditions (e.g., with adequate ambient lighting), or raise privacy concerns. This demo presents SwimSonar, the first practical drowning detection system based on underwater sonar. SwimSonar employs an active

ultrasonic sonar and features a novel sonar scanning strategy that balances the time and accuracy. Lastly, SwimSonar leverages a deep neural network for accurate drowning detection. Our experiments in real swimming pools show that the system achieves 88 % classification accuracy with a scan time of 1.5 seconds.

3.Saifeldin Hasan, John Joy,et al,”A Water Behavior Dataset for an Image-Based Drowning Solution”,2021.

Drowning is responsible for an estimated of 320,000 deaths annually worldwide, roughly 25% of those deaths are in swimming pools. This is probably due to the fact that a drowning person, to the untrained eye, will appear to be normally playing or floating in the water. While drowning, a person is unable to call for help, as the nervous system focuses on gathering oxygen for the lungs. To assist the lifeguards with their rescue mission, we propose a water behavior dataset curated to support the design of image-based methods for drowning detection. The dataset includes three major water activity behaviors (swim, drown, idle) that have been captured by overhead and underwater cameras. Moreover, we develop and test two methods to detect and recognize the drowning behavior using the proposed dataset. Both methods use deep learning and aim to support a fast and smart pool rescue system by watching for the early signs of drowning rather than looking for a drowned person. The results show a high performance of the presented methods validating our dataset, which is the first public water behavior dataset and the main contribution of the work.

4. Tereen prasanga,dharshana,et al,”Computer Vision Enabled Drowning Detection System”,2021.

Safety is paramount in all swimming pools. The current systems expected to address the problem of ensuring safety at swimming pools have significant problems due to their technical aspects, such as underwater cameras and

methodological aspects such as the need for human intervention in the rescue mission. The use of an automated visual-based monitoring system can help to reduce drownings and assure pool safety effectively. This study introduces a revolutionary technology that identifies drowning victims in a minimum amount of time and dispatches an automated drone to save them. Using convolutional neural network (CNN) models, it can detect a drowning person in three stages. Whenever such a situation like this is detected, the inflatable tube-mounted self-driven drone will go on a rescue mission, sounding an alarm to inform the nearby lifeguards. The system also keeps an eye out for potentially dangerous actions that could result in drowning. This system's ability to save a drowning victim in under a minute has been demonstrated in prototype experiments' performance evaluations.

5. Eslam M. Mohamed,Ahmed M. Mohamed,et al,” A Survey of Drowning Detection Techniques”,2021.

Drowning is one cause of unintentional injury death worldwide, which made it a public health problem. It gained the interest of many engineers to create drowning detection systems by applying different technologies. This paper reviews different methods used for drowning detection in swimming pools, that applied the concepts of image processing, accelerometer, pulse and pressure sensing and LASER-LDR techniques. The reviews discussed the process, reliability and goals of each system. By surveying this we represented a comparison between the provided systems. A further discussion of the future challenges facing these systems is also mentioned with ideas to overcome them.

6. Wenmiao Lu,Yap-Peng Tan,et al,”A vision-based approach to early detection of drowning incidents in swimming pools”,2020.

We present in this paper a vision-based approach to detection of drowning incidents in swimming pools at the earliest possible stage. The proposed approach consists of two main parts: a vision component which can reliably detect and track swimmers in spite of large scene variations of monitored pool areas, and an event-inference module which parses observation sequences of swimmer features for possible drowning behavioral signs. The vision component employs a model-based approach to represent and differentiate the background pool areas and foreground swimmers. The event-inference module is constructed based on a finite state machine, which integrates several reasoning rules formulated from universal motion characteristics of drowning swimmers. Possible drowning incidents are quickly detected using a sequential change detection algorithm. We have applied the proposed approach to a number of video clips of simulated drowning and obtained promising results as reported in this paper.

7. [A T Roshni](#),PR Anusha,et al,"Identification of Drowning Victims in Freshwater Bodies using Drift Prediction and Image Processing based on Deep Learning",2021.

Year after year drowning deaths are increasing tremendously, making it the 3rd leading cause of unintentional injury deaths worldwide. Drift prediction methodology is typically not used in river ecosystems and conventional methods for human rescue do not account for feasible and faster human detection. Utilization of multiple sensor data in underwater human rescue applications can capacitate faster human detection. This paper discusses the design, implementation, and testing of such an underwater human detection system, which spots the victim drifting or drowning in freshwater ecosystems. The water flow sensor attached to this portable device can calculate drift distance to track down the victim. The ultrasonic sensor activates the underwater camera upon detecting an object, to facilitate real-time human localization. We performed real-time object detection on a custom dataset by

applying DarkNet-53 pre-trained weights on YOLOv3 architecture and a mean Average Precision (mAP) of 98.0% was achieved. The system attained a detection depth of 5m. Combined action of drift distance calculator and YOLOv3 real-time detection model can speed up underwater human extrication.

8. Pavithra P ,Nandini S, Nanthana A,et al,"Video Based Drowning detection System",2021.

At present, there are swimming pools in every part of the world. Most of the swimming pool accidents or incidents occur due to improper security. Therefore, Accidental deaths in swimming pools are actually increasing. So, Video based drowning detection system is designed in this article. The proposed system structure comprises raspberry pi (Single Board Computer) equipped with a USB camera for taking the live feed from the pool area. The system also covers the alerting phenomena using a buzzer so that necessary actions are taken intermittently without any delay. The working structure starts from the raspberry pi with image processing for video feed intake, deep learning for activity recognition and finally GPIO system for alerting and short message service.

9. Abdel Ilah N. Alshbatat, Shamma Alhameli,et al,"Automated Vision-based Surveillance System to Detect Drowning Incidents in Swimming Pools",2020.

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.

10. Aboli Kulkarni; Kshitij Lakhani,et al, "A sensor based low cost drowning detection system for human life safety",2020.

In this paper, we present an approach which addresses the problem of drowning. Drowning is one of the leading causes of accidental deaths which needs to be given attention. The objective is to address the question-how can we engineer a system that saves the life of a drowning person? The devised system has the capability to automatically detect drowning by making use of three sensors, namely, a non-invasive oxygen saturation level sensor, respiration monitoring sensor and water sensor that are used for detecting parameters like blood oxygen saturation levels, respiratory movements and submersion of a person's body underwater respectively and a controller for monitoring, processing and controlling purposes. If any two of the above mentioned parameters detect drowning, the system detects it as a case of drowning. Results obtained by performing tests on individual sensors and entire system illustrate the effectiveness of the approach. Thus the approach is a viable solution to devise an innovative, portable, low cost and wearable system.