LITERATURE SURVEY

Date	19 September 2022
Team ID	PNT2022TMID11425
Project Name	VirtualEye - LifeGuard for Swimming Pools to Detect Active Drowning
Maximum Marks	2 Marks

VIRTUALEYE - LIFE GUARD FOR SWIMMING POOLS TO DETECT ACTIVE DROWNING

ABSTRACT:

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 camera and methodological aspects such as the need or human intervention in the rescue mission. The automated visual-based monitoring system can help to reduce drownings and assure pool safety effectively. In order to quickly help life savers judge whether people are drowning in the swimming pool.The VirtualEye software works in close integration with the cameras installed in the pool to continuously to scan the swimming pool. The First, by analyzing the spatial distribution of swimming pool when swimmers are normally swimming, the data labeling and swimmer detect methods are determined. Second, a behavior recognition framework of swimmers on the basis of YOLOv4 algorithm (BR-YOLOv4) is proposed.The spatial relationship between the location information of the target and swimming/drowning area of swimming pool is analyzed to determine the swimmer's drowning or swimming behavior. It 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.The live video stream from our underwater cameras is automatically monitored by our "state-of-the-art" object recognition software. When it 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.

INTRODUCTION:

Video surveillance can be used as a tool for monitoring and security. The visual monitoring capabilities can be employed in many different locations to help people live more safely. Videobased surveillance systems are designed and installed in places such as railway stations, airports, and even dangerous environments. Image processing, pattern recognition and machine-vision based methods are efficient ways for real-time intelligent monitoring of the objects or events. The existing surveillance systems deliver valued information in monitoring of large areas. Applying intelligence in video surveillance systems allows realtime monitoring of places, people and their activities. The tracking approach can change with varying targets and can change from a single camera to multiple camera configurations. Tracking methods in video surveillance use different parameters such as objects motion, position, path of movement and velocity, biometrics such as skin color or clothes color and many more. The tracking must be robust and overcome occlusion and noise which are

common problems in monitoring.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 deeps of the swimming pools, and the life guards are not trained well enough to handle these problems. This raises the need for having a system that will automatically detect the drowning person and alarm the lifeguards of such danger. Real-time detection 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, shadows and splashes and therefore detection needs to have high accuracy.In swimming pool monitoring intelligent systems, different approaches have been proposed. Most methods perform background processing on input video frames. Some apply background subtraction and image denoising to detect the drowning person. In a Gaussian Mixture Model is used for describing the pixels and the parameters of the model are updated with the EM algorithm. Also, neural networks can be trained to classify near-drowning and normal swimming patterns. However this requires to have a large dataset of both groups of behavior. The dataset is obtained in by attaching a pressure sensor to a swimmer imitating drowning behavior and normal swimming. Pattern recognition algorithms are also very useful in swimmer detection. In a background model that has prior knowledge about swimming pools is employed. This hierarchical model operates on behavioral traits common in almost all troubled swimmers. It uses movement and intensity information from image frames. In the YCbCr color model is selected for detection of the water polo players in water where luminance is separated and the Cb and Cr components are analyzed. Moreover, underwater ultrasonic sensors can detect drowning people up to 70 meters below water in the swimming pool along with a underwater video detection unit that locates and finds the victims. This research presents a vision-based approach for detecting a drowning person and alarming the life guards of such situations. The person swimming in the pool is detected and tracked using the HSV color space properties and contour-based methods. As soon as the moving

target remains under water for more than a determined period of time, an alarm is sent to the lifeguard rescues. The HSV color space is selected over other color spaces because it is more effective in segmenting the swimmer in various light conditions from the background. The drowning detection component detects drowning victims through a custom CNN model, which detects drowning in three stages and immediately informs the user through an audio alert. The second component is the rescue drone, activated according to the drowning detection command and sent to the victim's location coordinates. This procedure uses a custom-configured x and y coordinate block system to link to ground GPS coordinates. At the same time, potentially dangerous activities, including running around the swimming pool and drinking, will be notified to authorized personnel in the premises through mobile alarms by the hazard detection component.

LITERATURE SURVEY:

1.Upulie Handalage, Nisansali Nikapotha, Chanaka Subasinghe, Tereen Prasanga "Computer Vision Enabled Drowning Detection System" - 2021

Video-based systems and wearable sensor-based systems are two types of existing drowning detection technologies. It will use of Object detection using different techniques will usage of Convolutional Neural Network (CNN) architecture in Deep Neural Networks (DNNs) has added a significant shift in learning more complicated, informative characteristics in images as compared to older techniques. Then, Drowning Detection and Tracking to avoid drowning events utilizing an alert system. Activity Detection using Computer Vision has Current work on human motion prediction has been focused on two independent but complementary sub-tasks, according to Anand Gopalkrishnan, Short-term motion prediction, which is quantitatively evaluated by measuring the mean squared error (MSE) over a short period, and long-term motion prediction, qualitatively evaluated by visual inspections of samples over a long period. Short-term

models would be valuable in motion tracking applications because these jobs are applicable in several domains of work. On the other hand, long-term models might be valuable for creating computer graphic tools due to their broad applicability. Additionally, both models could be useful in human gait analysis, kinematics research, and human-computer interaction.

ADVANTAGES:
- The monitoring system can help to reduce drowning and assure pool safety effectively.
- This system ability to save a drowning victim in under a minute has been demonstrated in prototype experiments.

DISADVANTAGES:
- Early on, failure to recognize a drowning scene could result in a longer rescue time, which is a significant issue to consider in a time-critical emergency.
- The wearable-based system is the discomfort of use, which may lead to younger children seeking to alleviate the discomfort by removing the device, which is an unsubstantiated theory.

2.Abdel Ilah N. Alshbatat, Shamma Alhameli, Shamsa Almazrouei, Salama Alhameli, Wadhha Almarar "Automated Vision-based Surveillance System to Detect Drowning Incidents in Swimming Pools " - 2020

In recent years, there has been an interest in integrating computer vision in swimming pool surveillance systems. Automating such a process will provide the communities with an efficient way of detecting drowning incidents that may occur while swimming. a hybrid system that will automatically detect a drowning person and then set off an alarm to alert the lifeguards has been developed. The system mainly consists of three modules: a vision module, an event-inference module and an event-driven module. The vision module is responsible for monitoring and detecting the position of the person who is drowning. The event-inference module is

responsible for determining a swimmer's position, velocity, and path of the movement. The event-driven module is responsible for initiating the rescue by sending an alarm alerting the lifeguard.The main contribution of this project is to develop a system for monitoring swimming pool to prevent the onset of a drowning incident.

ADVANTAGES:
- This system don't have to wait until life guard comes to rescue because it has uplifting mesh.
- This is very fast process.
- More effective and cost Efficient than previous other models.

DISADVANTAGES:
- Internet connection is necessary to use GPS or sending alert messages. Sometimes to send messages SIM balance may be required.

3.Muhammad Aftab Hayat, Goutian Yang, Atif Iqbal, Adeel Saleem, Adil hussain, Muhammad Mateen "The Swimmers Motion Detection Using Improved VIBE Algorithm " - 2019

This paper proposed a novel method for drowning person detection in the swimming pool using video images. For background extraction and to update the exact motion area from the whole video using frame by frame difference vibe algorithm is used. Static and dynamic features are detected to recognize the normal swimmer and drowning person. The present invention discloses videobased swimming pools drowning event detection method. In the detection process Time of map(Tom), the method is used to improve the traditional VIBE result. The sequence of video images of the swimming pool is collected in real-time by using a camera installed above the water surface, which mainly includes three steps of swimmers detection, swimmers tracking and drowning person behavior analysis. In the aspect of swimmer detection, an improved

VIBE swimmer detection algorithm is proposed, and the algorithm is used to determine the swimmer's position. The swimmer tracking and particle filter based on the color distribution model which is combined with the nearest neighbor data association algorithm to achieve tracking of multiple swimmers. In the analysis of drowning behavior, three characteristics of drowning behavior are proposed to determine whether the swimmer is drowning. The invention can monitor the swimming pool in real-time through the camera installed above the water surface in a real public swimming place, and automatically detect the drowning person, which has great engineering application value.

ADVANTAGES:
- The full security system promotes the development of water lifesaving services, which is also the objective requirement for the current development of swimming lifeguards.

DISADVANTAGES:
- The disadvantage of this management method is that it cannot be entered into the pool area all the time. The management of the refinement, reliability, and reaction speed is very slow because the processing capability of the information about the swimmer is very weak. It is difficult to effectively protect public safety in the venue.

4.Ajil Roy, Dr. K. Srinivasan "A novel drowning detection method for safety of swimmers " - 2018

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.

ADVANTAGES:
- This will help the lifeguard to search for his previous medical records as does the patient had any heart or lungs diseases etc. This information will provide an additional advantage while doing the rescue operation and while doing first aid.

DISADVANTAGES:
- It is also a reliable solution where the life guards have difficulty to monitor the swimmers like a highly crowded sea.

5.Nasrin Salehi and Maryam Keyvanara, Seyed Amirhassan Monadjemmi "An Automatic Video-based Drowning Detection System for Swimming Pools Using Active Contours " - 2016

Safety in swimming pools is a crucial issue. In this paper, a real time drowning detection method based on HSV color space analysis is presented which uses prior knowledge of the video sequences to set the best values for the color channels. Our method uses a HSV thresholding mechanism along with Contour detection to detect the region of interest in each frame of video sequences. The presented software can detect drowning person in indoor swimming pools and sends an alarm to the lifeguard rescues if the previously detected person is missing for a specific amount of time. The presented algorithm for this system is tested on several video sequences recorded in swimming pools in real conditions and the results are of high accuracy with a high capability of tracking individuals in real time. According to the evaluation results, the number of false alarms generated by the system is minimal and the maximum alarm delay reported

by the system is 2.6 sec which can relatively be reliable compared to the acceptable time for rescue and resuscitation.

ADVANTAGES:
- Video surveillance can be used as a tool for monitoring and security.
- Our algorithm was able to detect all the drowning conditions along with the exact position of the drowning person in the swimming pool and had an average detection delay of 1.53 seconds, which is relatively low compared to the needed rescue time for a lifeguard operation.

DISADVANTAGES:
- Each year many people including children are drowned or very close to drowning in the deeps of the swimming pools, and the life guards are not trained well enough to handle these problems.This raises the need for having a system that will automatically detect the drowning person and alarm the lifeguards of such danger.