LITERATURE SURVEY

- **AUTOMATED DROWNING DETECTION AND SECURITY IN SWIMMING POOL :**

  The automated drowning detection system works on the principle of differential pressure. The system contains two fundamental modules to begin with, the wristband consists of pressure sensors on the transmitter side. Second, the receiver module at the swimming pool site. The children entering the pool territory should wear the wristband. The Pressure underwater is different and greater than the pressure at the air - water interface. The pressure at a particular depth is measured and set as the threshold. Once the child gets into the pool, the pressure is continuously measured and monitored by the microcontroller. When the current value surpasses the threshold limit an alerting signal is sent to the receiver. The wireless transmission and reception of signals is done through an RF module. On receiving the valid signal microcontroller sets the buzzer ON, turns ON the motor driver which in turn lifts the acrylic plate of the multi-floored swimming pool. The kid is brought to the air-water interface, i.e. the top level of the swimming pool by the acrylic plate.

- **POSEIDON- VIDEO BASED DROWNING DETECTION SYSTEM IN THE SWIMMING POOL:**

  Swimming pool drowning monitoring systems based on video technology are mostly reported in the literature. There are three kinds of drowning monitoring systems according to the different positions of the camera. One is that the camera is mounted on the underwater swimming pool wall, then monitors underwater swimmer status. A

limitation of this equipment is that if too many swimmers, the occlusion problem arises. The other is that the camera is mounted upon the water, and monitors the Swimmer posture change. The reflection and refraction of light in air-water interference will affect the image quality, and drowning man feature this method detected is not easy to distinguish swimmers and divers obviously. The third is a combination of the two, underwater camera and aerial camera matched, monitoring the swimmer's posture. This system needs constant observation which is the main disadvantage.

- **DROWNING DETECTION SYSTEM USING CNN:**

An alternative for real time downing detection solution for real time developed by using deep learning technology. The method uses convolution neural network object detectors to generate confidence maps of object location in the pool and non maximum suppression to extract head pixel coordinate. Humans detect by various algorithms and detect behaviour of objects that are already set by us.If the swimmer or object gets into difficulty then the system detects it by motion and gets alert and saves the swimmer’s life.

- **A SMART MULTI -SENSOR DEVICE TO DETECT DISTRESS IN SWIMMERS:**

A robust and waterproof sensor-based device to detect distress in swimmers at varying depths and different types of water environments. The proposed device comprises four main components, including heart rate, blood oxygen level, movement, and depth sensors. Although these sensors were designed to work together to boost the system’s capability as an anti-drowning device, each could operate independently. The sensors were able to determine the heart rate to an

accuracy of 1 beat per minute (BPM), 1% SpO2, the acceleration with adjustable sensitivities of ±2 g, ±4 g, ±8 g, and ±16 g, and the depth up to 12.8 m. The data obtained from the sensors were sent to a microcontroller that compared the input data to adjustable threshold values to detect dangerous situations. Being in hazardous situations for more than a specific time activated the alarming system. Based on the comparison made in the program and measuring the time of submersion, a message indicating drowning or safety was sent to a lifeguard to continuously monitor the swimmer' condition via Wi-Fi to an IP address reachable by a mobile phone or laptop.

- **DROWNING DETECTION USING AI:**

Cameras are placed around the pool, at different points underwater and four in the ceiling, and are connected to a computer and AI server that uses a human pose estimation algorithm and deep learning. The cameras are used firstly to record the coordinates of knees, arms, shoulders and elbows in every swimming position. The pictures are then labelled and fed into the computer to teach it about body parts and movement, a process called annotation. Once the computer has amassed enough data, it can monitor movements in the pool. When the pre-set threshold of a drowning probability is reached – for example, when the computer assesses that the probability of drowning is higher than an adjustable threshold, say 60 percent – an audio alarm is triggered to attract the lifeguard's attention.

- **AUTOMATED VIDEO BASED DROWNING DETECTION USING ACTIVE CONTOURS:**

  Real time video analysis of the cameras installed around the swimming pool in a way in which the entire swimming pool can be covered. Each camera is mounted on pool walls oriented downwards with a sharp angle, so that it can minimise the effect of the lighting system which causes occlusions and foreshadowing. In this work, an ODROID-XU as a distributed system is installed in the swimming pool to collect all the video signals collected from cameras and process them using computer vision methods. The used hardware includes the distributing system known as ODROID-XU. The system is used to firstly detect the background of the pool and then decide to send an alarm to rescue team if a previously detected person is

  missing in video frames for a specific and defined period of time. In the next sections of this paper, we try to explain the concepts we used to detect and track individuals in swimming pools.