

Automated Vision based Swimming Pool Surveillance System

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Abstract – nowadays swimming pools are everywhere, Like in homes, restaurant, clubs. There will be lifeguard at every pool and many swimmers in the swimming pool also, but after that also there are many number of drowning incidents. And the numbers are increasing day by day. To protect the people from drowning in swimming pool, we are using machine learning and mesh lifting system to prevent drowning incidents. The system will contain a mesh which will help the drowning person to lift up in the water, this mesh movement will be controlled by the stepper motors which are connected to the Arduino Nano board, and there will be buzzer that will alert the people near swimming pool and. The drowning person is detected machine learning, using pi camera underwater which is trained to detect these kind of situations, the pi camera is connected to the Raspberry pi, this system is used to monitor the swimming pool, track swimmers in that, if any person is in drowning condition raspberry pi will detect it and it will send command to Arduino nano board to lift the mesh up. With the help of stepper motors The mesh will lift up along with the drowning person.

Key Words: machine learning, Internet of Things (IoT), computer vision, drowning detection , alert system, image processing.

1. INTRODUCTION

Now a days, Video surveillance can be used a tool for monitoring and security. Observing public and private sites has increasingly become a very sensitive issue. Video-based surveillance systems are designed and installed in places such as railways,airports and even dangerous environments. Image processing patterns recognition and machine learning based methods are efficient ways for real time intelligent monitoring of the objects or events of interest. Applying intelligence in video surveillance systems allows real-time monitoring of places,people and their activities. The tracking approach can change with varying targets and can change with varying targets and change from a single camera to multiple camera configurations. The tracking must be robust

and overcome occlusion and noise which are common problems in monitoring.

1.1 Description

Automated vision based surveillance for a real time human behavior analysis provides an efficient way of detecting the occurrence of any abnormal events amid our surroundings. The technical challenges faced encompass the need to reliably detect and track moving targets within possibly dynamic background and inference module that interprets targets behavior patterns as events with semantic meaning.

1.2 Problem Identification

As per the WHO(World health Organization), drowning is the leading cause of unintentional deaths in the world,around 372,000 drowning deaths reported annually. Swimming pool Drowning Deaths and kids It's unbelievable statistic: According to CDC, drowning is the number one cause of unintentional deaths for children between the age 1 to 4.To overcome this problem the surveillance IoT model will helps to avoid maximum cases of death rates.

1.3 Related Work

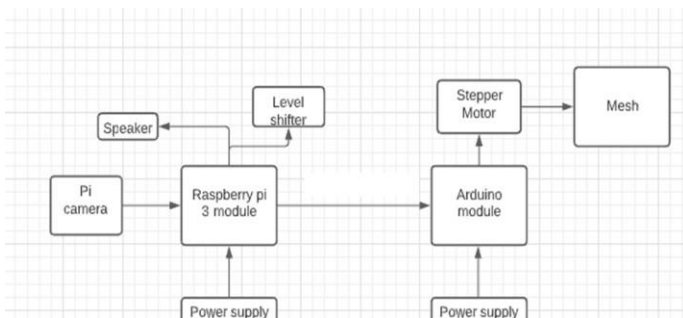
[1] This research presents an automated vision based surveillance system to detect drowning incidents in swimming pools. The Swimmers in the pool are detected and tracked by using pixy camera.[2]This study provides new information,collected in a systematic and reproducible way with maximum avoidance of bias.[3]In this research they proposed a novel camera based detection algorithm. An inter frame DE-noising scheme is employed to remove the reflections interference efficiently.[4]In this paper, provides insights into automated surveillance within dynamic conditions as demonstrated by drowning detection system for outdoor public swimming pools.[5]In this paper ,provides a method to robust human tracking and semantic event detection with the context of video surveillance capable of

automatically detect drowning incidents[6] This surveillance information is very useful for later understanding events or as an incriminatory proof, many researchers study the possibility of exploiting these huge amounts of data and analyzing them in real time with the hope and preventing some of these emergencies or facilitate a faster or more efficient response.

2. METHODOLOGY

The main contributions of this project is to develop a system for monitoring swimming pool to prevent the onset of a drowning incident. The Raspberry Pi as well as the Arduino Nano boards will be used in controlling the entire system. The individuals entering the pool territory should wear a passive yellow vest. The two pi cameras will continuously monitor the swimming pool. The analyzed data will be sent to the Raspberry Pi board where a python Script is running. The Script will calculate swimmers positions, velocities, path of movement and time under water. Based on the calculations, the occurrence of any abnormal events will be detected. If such events occur, Raspberry Pi will be send an order to stepper motor which is arranged to lift the mesh. That mesh will help in the lift the swimmer upwards out of the pool. Meanwhile, a warning signal will alert the lifeguard if any Imminent danger happens.

2.1 Modeling and Analysis



The Raspberry Pi as well as the Arduino Nano boards will be used in controlling the entire system. The individuals entering the pool territory should wear a passive yellow vest. Pi cameras will continuously monitor the swimming pool. The capture 2D images will be processed by the internal hardware attached to the cameras. The analyzed data will be sent to the Raspberry Pi board where a script is running. The script will calculate swimmers positions, velocities, path of movements, and time under water. Based on these calculations, the occurrence of any abnormal events will be detected. If such events occurs Raspberry pi will send an order to the lifting mesh. The lifting mesh will directly move to up. Meanwhile, a warning signal will

alert the life guard of an imminent danger.

Raspberry Pi 3 model B will be instructed by connecting the pi camera module and speaker.

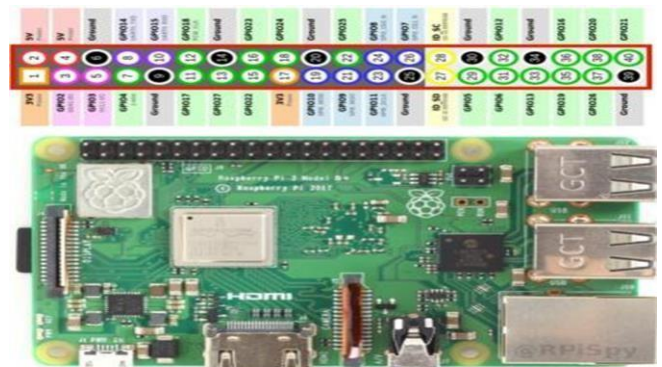


Figure 2: Raspberry pi 3

Pi camera modules are instructed to detect the yellow vest or a person who is drowning.



Figure 3: Pi camera

Buzzer is used alarm the life guards and surrounding.

Arduino Nano is used to instruct by lifting up the mesh, which are connected to stepper motor.

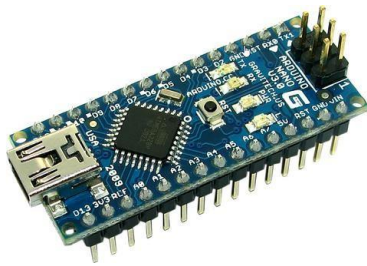


Figure 4: arduino-nano

Stepper motor is used to lift up the mesh.



Figure 5: Stepper motor

Level shifter is used as a bridge between arduino and raspberry pi.



Figure 6: level shifter

2.2 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

2.3 Disadvantages

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

3. Conclusion and Future Enhancement

This project presents an automated vision-based surveillance system to detect drowning incidents in swimming pool. The swimmers in the pool are detected and tracked using the Pi camera. As soon as the swimmer remains under a certain level for more than a determined time, Raspberry Pi will calculate that swimmer's position, path of movement and send an order to the linear stage. The linear stage will uplifts the swimmer and Meanwhile, a warning message will signal the life guard of imminent danger. With such systems, the number of drownings would be reduced. For future development, the system is currently being improved by attaching an infrared LED to the swimmer's vest.

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