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Infant Drowning Prevention and Alert System using Video Vision Transformer

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ABSTRACT: Drowning deaths represent the third leading cause of accidental deaths worldwide. Drowning accidents in indoor swimming pools are growing in recent years, especially for children. This is because traditional techniques for the supervision and care of people, especially children, in large pools are inefficient or, in some cases, non-existent. Nowadays, this problem has become a topic of interest for several researchers who seek to propose different methods of drowning detection. This project seeks to propose the process to be followed to develop a drowning detection system in swimming pools using Video Vision Transformer. This project proposes a novel embedding scheme and a number of Transformer variants to model video clips. This model extracts spatio-temporal tokens from the input video, which are then encoded by a series of transformer layers. The output tokens of the pre-trained ViViT contain spatio-temporal information of drowning scenes. Then transform a query scene and candidate scenes into output token features using the pre-trained ViViT and calculate the similarity between the tokens with cosine similarity.This project proposes a novel embedding scheme and a number of Transformer variants to model video clips. This model extracts spatio-temporal tokens from the input video, which are then encoded by a series of transformer layers. The output tokens of the pre-trained ViViT contain spatio-temporal information of drowning scenes. Then transform a query scene and candidate scenes into output token features using the pre-trained ViViT and calculate the similarity between the tokens with cosine similarity. The proposed network is designed to be lightweight based on the Temporal Transformer and Feature Pyramid Networks to detect drowning infants underwater instead of large networks.

KEYWORDS: Deep Learning,Video Vision Transformer,Surveillance Web,DrownNet model,Implement object recognition.

I.INTRODUCTION

The system analysis phase involves assessing the requirements and objectives of the Infant Drowning Prevention and Alert System using Video Vision Transformer. It encompasses gathering and analysing user needs, defining system functionalities, and evaluating technical feasibility. This process enables the identification of potential risks, constraints, and opportunities to ensure the successful development and implementation of the drowning prevention system. Additionally, system analysis helps in establishing clear project scope, defining system boundaries, and laying the groundwork for subsequent stages of system design and development.The Infant Drowning Prevention and Alert System offer a comprehensive solution to enhance pool safety, mitigating the risks associated with infant drowning incidents.Drowning is defined by the World Health Organization Opens a new window(WHO) and other medical groups as respiratory impairment (i.e. being unable to breathe) as a result of being underwater. Though the term "drowning" has traditionally only been used to refer to fatal events in the water, WHO's definition includes both fatal drowning and nonfatal drowning. An average of 3,957 Indian infants die from drowning each year, with children ages 1 to 4 at the highest risk. In fact, drowning is one of the leading causes of unintentional deaths among children ages 1 to 14, second only to car crashes. Children under 15 also experienced a high rate of fatal drownings and nonfatal drowning injuries, with an average of 371 fatalities per year between 2018 and 2023 and 8,300 injuries that needed hospitalization between 2020 and 2023.drowning in children can be very devastating and have profound effects on the family.

II.RELATED WORKS

Visual monitoring is a fundamental practice in the traditional system. Lifeguards and caregivers visually scan the pool area, looking for any signs of distress or unusual behaviour. This continuous observation allows for the early detection of potential drowning incidents, enabling swift intervention. The effectiveness of visual monitoring depends on the attentiveness and diligence of those responsible for surveillance.In the traditional system, lifeguards play a pivotal role in ensuring pool safety. Their primary responsibility is to visually monitor pool areas, identify potential drowning risks, and respond promptly to emergencies. Continuous supervision is crucial to maintaining a safe environment for all

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individuals, including infants. Lifeguards are trained to recognize distress signals and employ life-saving techniques when necessary.

III.PROPOSED SYSTEM

The proposed system aims to leverage advanced technologies, including Video Vision Transformer and deep learning, to create a proactive and effective Infant Drowning Prevention and Alert System. It prioritizes real-time monitoring, rapid alerting, and caregiver intervention to enhance overall safety around water bodies. The core component, the Swimming Pool Surveillance Web App, serves as the central platform. Developed with Python, Flask, MySQL, and Bootstrap, it ensures comprehensive functionality for both administrators and caregivers. The User Authentication Module guarantees secure access, while the Dashboard Module offers real-time insights into multiple pools, incorporating live video feeds and alert statuses.

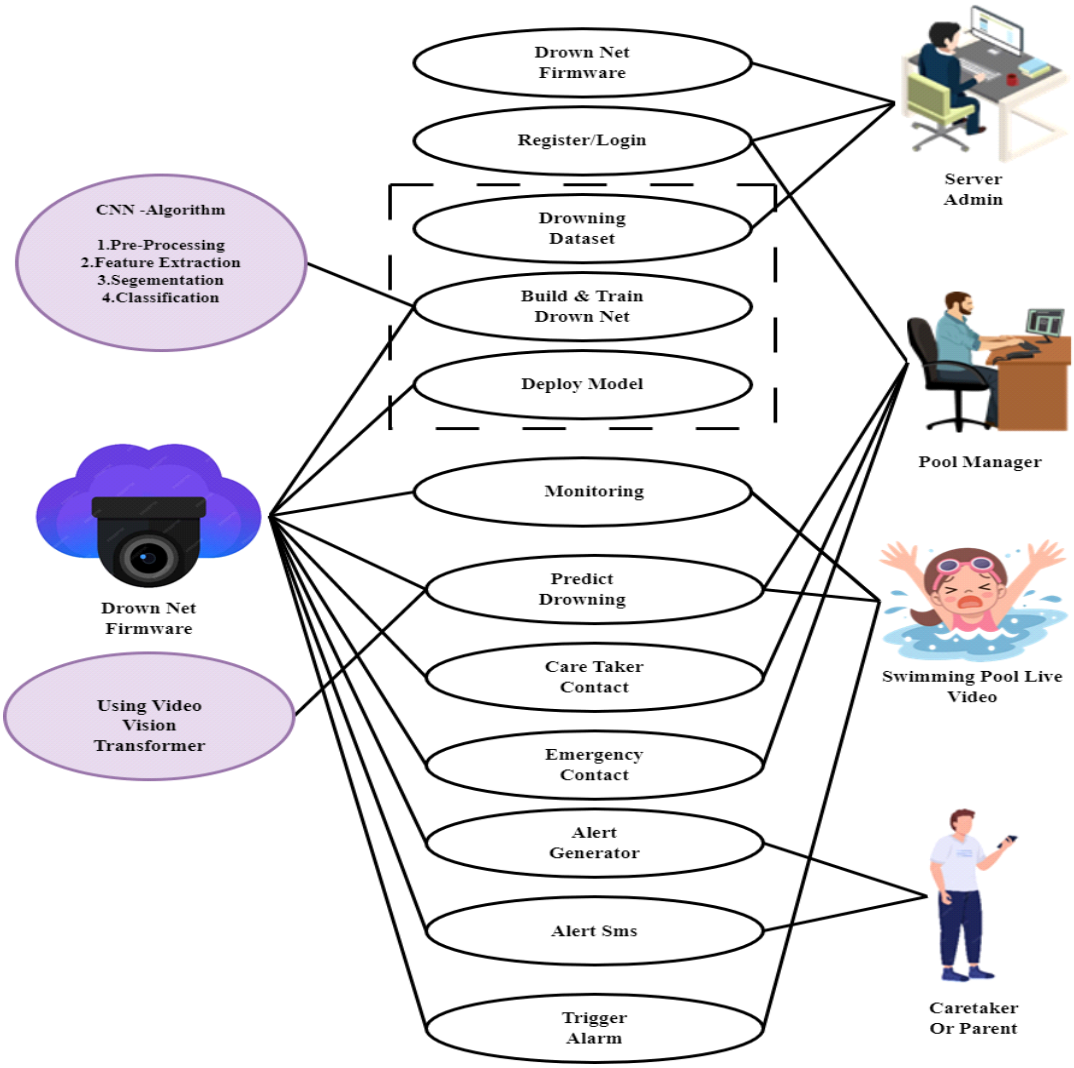

Figure- 1 System Architecture

Object Detection, Feature Extraction, and Classification are carried out using Convolutional Neural Networks (CNNs), culminating in the deployment of the trained DrownNet model within the Swimming Pool Surveillance System Web App. Infant Drowning Detection relies on real-time pool camera video footage. The prediction process integrates the Video Vision Transformer and the DrownNet Model, both specialized in recognizing potential drowning risks. The Alert Generation system ensures a swift response by analysing infant behaviours, comparing features extracted by VVT

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and the DrownNet Model, and triggering alerts when potentially dangerous situations are detected. Notifications are delivered through multiple channels, including SMS, email, in-app alerts, and audible alarms, enhancing the overall responsiveness of the system. The User Interface encompasses Web Admin, Pool Manager, Pool Camera, and DrownNet Model interfaces, providing a comprehensive and user-friendly experience.

IV. RESULT & DISCUSSION

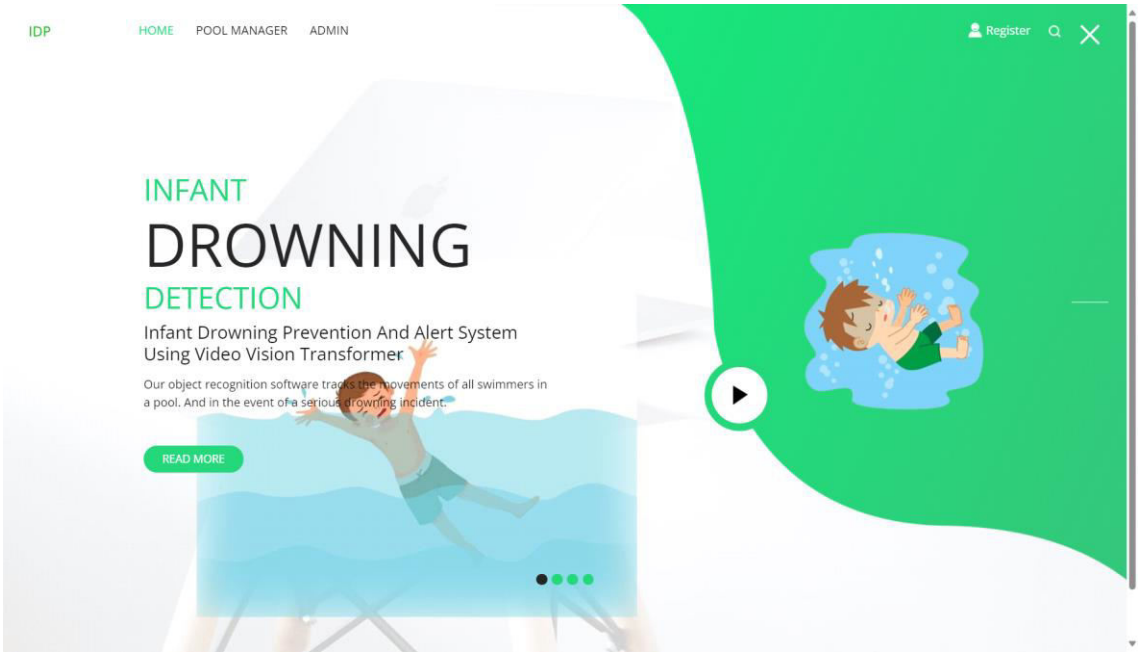

Figure- 2 Infront Drowning Detection

Figure- 3 Infront Drowning Prevntion

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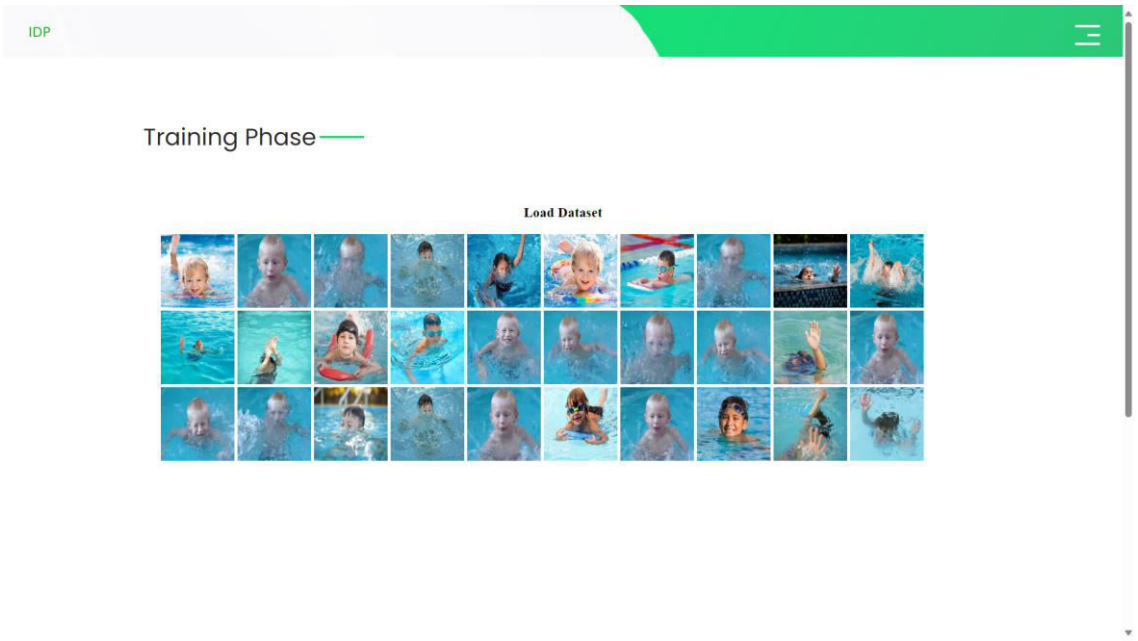

Figure-4 Trainning Phase

V. CONCLUSION

In conclusion, this project stands at the forefront of technological innovation in ensuring the safety of infants around water bodies. By harnessing the capabilities of the Video Vision Transformer (VVT) and the trained DrownNet Model, the system demonstrates remarkable accuracy in the real-time detection of potential drowning risks. Its proactive alerting mechanism serves as a crucial lifeline, delivering immediate notifications to caregivers and facilitating prompt intervention in critical situations. The user interfaces, including the Web Admin, Pool Manager, Pool Camera, and DrownNet Model interfaces, collectively contribute to a comprehensive and user-friendly system. Caregivers receive real-time alerts through multiple channels, ensuring they stay informed and can respond swiftly to any potential threats. The system's adaptability to diverse environments, coupled with the Historical Data and Reporting Module, fosters a culture of continuous improvement.The insights gained from historical data allow for refinements in the model and system configuration, ensuring ongoing efficacy and responsiveness to emerging challenges. In essence, the Infant Drowning Prevention and Alert System not only represents a technological milestone but also a compassionate and practical approach to safeguarding the well-being of infants. Its multifaceted design, proactive features, and commitment to ongoing enhancement position it as a valuable tool in creating safer aquatic environments and preventing tragic incidents of infant drowning.

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