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Blending Digital Precision with On-Ground Safety: An Integrated Approach to Managing College Festivals

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Abstract: ***This project presents a robust solution for overseeing college festivals, merging an Online Festival Management Platform with a cutting-edge Behavioural-Based Intoxication Detection Mechanism. The platform simplifies key functions like registration, scheduling, and real-time communication, greatly enhancing operational efficiency. At the same time, the detection module provides valuable support to security staff in identifying signs of intoxication such as slurred speech and wobbling movements through a systematic checklist and training materials. Together, these systems create a streamlined event management experience while ensuring a safe and welcoming atmosphere for all participants.***

Keywords: Intoxication Detection, Behavioural Observation, Bloodshot Eye Detection, Event Surveillance, Machine Learning

1. Introduction

Organized planning and robust safety measures are essential for the successful execution of college festivals. This project presents an integrated solution that combines an Online Fest Management Platform with a behaviour-based Intoxication Detection Module. The fest management tool efficiently manages critical operations such as participant registration, event scheduling, and real-time coordination, thus minimizing manual effort and the potential for errors. In parallel, the detection system identifies signs of intoxication such as slurred speech and loss of balance by analysing observable behaviours. This synergistic approach not only optimizes event logistics but also significantly boosts overall safety, creating a more secure and inclusive environment for all attendees.

2. Background Study

Juhi Kalpesh Chandan (2024) Forensic toxicology is essential in legal investigations; however, it encounters numerous challenges that can hinder its effectiveness. Factors such as sample degradation, potential contamination, and delays in testing significantly affect the accuracy of results. Individual variations in metabolism and possible drug interactions further complicate the determination of toxic or lethal doses. The rise of synthetic drugs, which lack standardized detection methods, adds an additional layer of complexity. Furthermore, the forensic toxicology process is often time-consuming and resource-intensive, relying heavily on the expertise of specialists. Legal considerations, including the chain of custody and the admissibility of evidence, present further complications in its application.[1]

Manuel E. Segura et al. (2024) Improving transdermal alcohol detection with hyperdimensional computing on embedded devices presents key challenges. Sensor accuracy may vary due to skin differences, hydration, and environmental factors. Limited device processing power restricts model complexity, affecting generalization and real-time performance. Motion artifacts and sensor placement can introduce noise, while integration with current systems and gaining regulatory approval remain significant obstacles. [2]

Mark Monaghan et al. (2023) This study provides valuable insights into the issue of intoxication from societal, individual, and regulatory perspectives however, it also has significant limitations. While it highlights sociological viewpoints, it tends to overlook important biomedical and psychological dimensions. The range of personal experiences from various regions and socioeconomic backgrounds remains insufficiently addressed. Furthermore, certain theories lack robust empirical validation, and the rapid pace of policy changes may compromise the relevance of the findings. Additionally, the Western-centric focus restricts the applicability of the conclusions on a global scale. [3]

Ying, Y et al. (2024) The study on abnormal behaviour monitoring within university laboratories through video analysis technology presents valuable insights; however, it is important to acknowledge several limitations. The dependence on video analysis may overlook subtle behaviours that are not captured on camera, and varying video quality or lighting conditions could compromise its effectiveness in real-world applications. Furthermore, privacy concerns associated with video surveillance in sensitive environments, such as laboratories, may pose ethical dilemmas. The behaviour detection algorithm may also lack adaptability to diverse environments, which could restrict its real-time monitoring capabilities. Lastly, the emphasis on university laboratories confines the applicability of the findings to other contexts, such as public spaces. [4]

Laptev et al. (2024) This study explores the detection of alcohol intoxication through speech analysis utilizing

machine learning models, yielding promising outcomes. However, the employed controlled tongue twister recordings may not accurately represent natural speech patterns, which could limit its effectiveness in real-world situations. Furthermore, the research centers on a single blood alcohol concentration (BAC) level of 0.15, neglecting to consider more subtle signs of intoxication. It is also important to note that variations in accents, languages, and individual speech characteristics were not thoroughly examined, which may affect the model's accuracy among a diverse user base. In summary, while the research indicates significant potential, it necessitates the incorporation of broader and more natural datasets to enhance its applicability in real-world contexts. [5]

Wang et al. (2024) The review provides valuable insights into the applications of AI in education; however, it presents several significant limitations. The analysis of only 125 papers from a pool exceeding 2,000 may lead to selection bias, potentially overlooking critical studies. A narrow focus on adaptive learning and personalized tutoring restricts the investigation into other advancements in AI. Moreover, the inconsistency of theoretical frameworks across the studies underscores the necessity for a more cohesive approach to research. The exclusion of non-English publications could also hinder the global applicability of the findings. Given the rapid evolution of AI technology, there is a risk that the review may become outdated quickly, highlighting the need for regular updates to ensure relevance. [6]

Kri Vivekanandhan et al. (2024) DetectDUI is an advanced in-car system designed to detect impaired driving through the analysis of vital signs and psychomotor functions. While it demonstrates effectiveness in controlled environments, the system may experience signal interference from electronic devices, which could compromise its accuracy. Furthermore, its reliability in real-world scenarios remains uncertain due to limited testing beyond controlled conditions. Variability in individual alcohol tolerance and baseline vital signs may also influence detection efficacy. Additionally, the implications of continuous monitoring raise privacy concerns, and the system's capability to identify lower blood alcohol concentration (BAC) levels has yet to be thoroughly examined, a crucial factor for facilitating timely interventions. [7]

H. Burwinkel (2020) This approach utilizes cutting-edge machine learning methods, specifically graph convolutional networks(GCNs), to estimate intoxication levels. Nonetheless, it's crucial to recognize some limitations. The success of this methodology heavily relies on the presence of high-quality data, and the complexity of GCNs can make them difficult to interpret in clinical settings. Additionally, the significant computational power they require might hinder their use in real-time scenarios, especially in areas with limited resources. Factors such as individual differences, external elements like sensor inaccuracies, and ethical issues can also affect the accuracy and practicality of implementing this system in real-world situations. [8]

Kaur et al. (2023) This proposal outlines an IoT-based alcohol detection system designed to enhance workplace safety in small organizations. However, several limitations must be acknowledged. The implementation of MQ-3 sensors may lead to inaccurate readings, as they are sensitive to environmental factors and other substances. Furthermore, the effectiveness of the system relies heavily on consistent user cooperation and appropriate sensor placement, which can pose challenges in practical scenarios. Additionally, concerns regarding data privacy have not been comprehensively addressed, and the system's scalability for larger organizations has yet to be thoroughly tested. Finally, the study does not provide a detailed analysis of the system's long-term performance and maintenance requirements. [9]

Kumar et al. (2023) This document outlines a sensor-based system designed to mitigate the risk of drunk driving by disabling vehicle operation upon the detection of alcohol. While this technology holds promise for enhancing road safety, it is important to acknowledge its limitations. The system may not effectively identify impairment from substances other than alcohol, and its effectiveness is contingent upon meticulous sensor calibration and maintenance. Furthermore, there is a potential for the system to be circumvented, raising concerns regarding its overall reliability. Additionally, the implications of continuous alcohol monitoring introduce privacy issues, and the analysis does not address critical factors such as user acceptance, legal considerations, and regulatory frameworks necessary for broader implementation. [10]

Lin et al. (2023) The text describes a sophisticated drunk detection system that leverages thermal imaging and convolutional neural networks (CNNs) to discern facial heat patterns associated with alcohol consumption. While initial results are promising, the system's accuracy is potentially influenced by various environmental factors, including temperature and lighting conditions. So far, the technology has primarily been evaluated in controlled environments, which may limit its applicability in real-world scenarios. Moreover, the presence of accessories such as glasses or masks can interfere with thermal readings, and there is still limited exploration of the model's efficacy across a diverse range of individuals. Additionally, it is critical to address privacy and consent issues prior to the wider implementation of this surveillance-based technology. [11]

Vinodhini et al. (2023) The proposed IoT-based system for detecting alcohol consumption in classrooms aims to enhance student safety and promote discipline. However, it is important to note that the reliance on MQ-3 sensors may result in inaccurate readings due to various environmental factors. Regular calibration of the sensors is also necessary, which could pose challenges in maintaining the system effectively within classroom environments. Furthermore, privacy concerns related to continuous monitoring have not been thoroughly addressed, and the system's scalability and efficacy across diverse settings remain unclear. The study also lacks insights into the long-term reliability and user acceptance of the system, both of which are critical for its practical implementation. [12]

Bre Ashwin Rao (2022) AttenFace is an advanced real-time attendance system that leverages facial recognition technology to streamline the process of student tracking. While it represents a significant innovation in attendance management, it is not without its limitations. The system's

dependence on periodic image capture may result in missed entries or exits of students, thereby impacting overall accuracy. Additionally, variations in lighting conditions, camera quality, or individual student appearances can compromise the reliability of recognition results. Concerns arise regarding the transparency of the training dataset, which raises questions about its effectiveness across diverse populations. Furthermore, the continuous monitoring involved poses potential privacy issues, and the system does not adequately address security vulnerabilities, such as spoofing attacks, which could jeopardize its integrity. [13]

Banerjee et al. (2022) The study on multimodal behaviour analysis conducted in laboratory settings presents several limitations that warrant consideration. Its accuracy is susceptible to environmental variables, such as lighting conditions and camera positioning. Furthermore, the system introduces privacy concerns due to the nature of continuous monitoring. The effectiveness of this approach across various contexts and demographics remains uncertain, thus restricting its generalizability. Additionally, the paper does not address issues related to scalability and long-term applicability in real-world scenarios, nor does it explore the potential for integration with other monitoring systems that could enhance its overall utility. [14]

Ben Nassi (2016) This research introduces an innovative, non-invasive method for detecting intoxication through the utilization of smartphone sensors and advanced machine learning techniques. This technology calculates blood alcohol concentration (BAC) by examining behavioural indicators, including speech patterns, gait, and typing habits, thus providing a cost-effective and accessible alternative to traditional Breathalyzer devices. However, it is essential to acknowledge that the accuracy of this solution may be affected by user behaviours, environmental factors, and the requirement for comprehensive training data. Ongoing refinement and development efforts are crucial to improve its reliability in practical applications. [15]

3. Implementation Strategy

The methodology delineates the framework for designing and executing a comprehensive system for the management of college festivals and the detection of intoxication. This methodology encompasses the following essential components:

1) Requirement Analysis:
Input from colleges and students has underscored the necessity for a comprehensive system designed to optimize event registration, scheduling, and volunteer coordination, while prioritizing safety through intoxication detection. Essential features include an intuitive user interface, real-time notifications, role-based access controls, and a dependable method for identifying signs of intoxication through behavioural indicators, all tailored to ensure efficient operation during college festivals.

2) System design
A professional platform has been meticulously developed to streamline the processes of registration, scheduling, and event coordination. This platform is underpinned by a well-structured database that effectively manages user roles, event particulars, and participant information. Furthermore, an innovative intoxication detection system has been implemented, utilizing behavioural indicators such as speech, balance, and responsiveness to accurately identify individuals who may be impaired, thereby enhancing the safety of events.

3) Development
Event management functionalities, encompassing registration and scheduling, have been enhanced to facilitate more efficient coordination. Additionally, an intoxication detection system has been incorporated, employing behavioural checklists to pinpoint signs of impairment and ensure the safety of all participants. Time series forecasting model selection

4) Integration & Testing
The festival management system has been seamlessly integrated with the intoxication detection module, resulting in a cohesive platform. Extensive testing, encompassing unit, functional, and simulation assessments, was performed to guarantee the system's accuracy and reliability.

5) Evaluation & Optimization
Gather feedback, assess performance metrics, and implement enhancements.

3.1 Machine Learning Approach

CNN (Convolutional Neural Networks)
Convolutional Neural Networks (CNNs) have the potential to significantly enhance our project by automating the detection of signs of intoxication through the analysis of images and videos. To achieve this, it is essential to compile a comprehensive dataset that includes both sober and intoxicated individuals, highlighting key indicators such as slurred speech, unsteady gait, and facial reddening. The preprocessing phase should involve resizing images, employing augmentations to improve model generalization, and converting video content into frames. We can utilize established CNN architectures like ResNet, VGG, or Mobile Net, or develop a custom model tailored to effectively extract features including facial expressions, posture, and exaggerated gestures. Convolutional and pooling layers will play a crucial role in identifying and preserving significant characteristics while minimizing noise. Subsequently, a fully connected layer can be implemented to classify individuals as "Intoxicated" or "Sober." The training of the model will be conducted using labeled data and optimized with cross-entropy loss, with the option of leveraging transfer learning to enhance performance. Once the model is adequately trained, it will support real-time detection and seamlessly integrate with the existing manual system as an assistive tool, offering automated suggestions while ensuring that human oversight is maintained for final decision-making.

3.2 Dataset Description

3.2.1 Human Motion and Gait Datasets
The datasets utilized in this project encompass information pertaining to human locomotion, including gait patterns, balance, and alterations in posture. These movement-related characteristics are essential for identifying indicators of

intoxication, such as unsteady gait, swaying, or delayed motor responses. By examining fluctuations in posture and walking stability, the system is capable of recognizing behavioural signs commonly linked to alcohol or substance influence. The collected data facilitates the advancement of a dependable and non-invasive technique for detecting intoxication grounded in observable physical behaviours during college events.

- CASIA Gait Database
- M2C2 (Multimodal Motion Capture Data)

3.2.2 Speech Datasets for Slurred Speech Detection

Audio datasets containing diverse speech samples are instrumental in training models designed to detect slurred or impaired speech, which is a significant indicator of intoxication. These datasets generally incorporate recordings that showcase variations in clarity, pace, and articulation. This variety aids the system in learning to identify abnormal speech patterns effectively. By examining these audio characteristics, the detection module can recognize signs of slowed or distorted speech that are often associated with alcohol or substance consumption. This methodology significantly improves the system's capacity to evaluate intoxication by utilizing non-invasive, real-time voice analysis during various events.

- SIT (Speech Impairment Test)
- TIMIT

3.2.3 Facial Recognition Datasets

Facial recognition datasets that encompass a variety of expressions and facial features serve a crucial role in identifying physical indicators often associated with intoxication. These datasets facilitate the system's ability to detect signs such as droopy eyelids, bloodshot eyes, and pronounced or sluggish facial movements. Such visual clues frequently indicate diminished motor control or fatigue resulting from substance use. By carefully analyzing facial patterns, the system enhances its capacity to identify potential instances of intoxication in a non-intrusive manner, thereby fostering a safer environment at events.

- UTKFace
- FER-2013 (Facial Expression Recognition)

3.2.4 Behavioural and Video Observation Datasets

Video datasets that capture individuals engaging in a variety of activities play a crucial role in evaluating physical behavior in real-time. These recordings frequently showcase variations in posture, hand movements, body stability, and overall coordination important indicators for identifying signs of intoxication. By meticulously analyzing these visual cues on a frame-by-frame basis, the system is capable of detecting irregular movements, delayed responses, or a lack of balance, which are often evident in intoxicated individuals. Leveraging these video-based datasets facilitates a more thorough and precise assessment of behavior, thereby enhancing the reliability of the intoxication detection mechanism.

- UBC-MAPS (University of British Columbia Multimodal Alcohol-induced Patient Study)
- Drunk Walking Dataset

3.2.5 Human Behaviour and Activity Recognition Datasets

These datasets are meticulously crafted to monitor and document a comprehensive array of human behaviors and daily activities, yielding critical insights into typical movement and interaction patterns. By systematically comparing this baseline data with cases of impaired behavior such as delayed responses, instability, or atypical gestures the system can proficiently differentiate between sober and intoxicated states. This comparative behavioral analysis significantly enhances the precision of detection algorithms, thereby facilitating the advancement of a more responsive and intelligent intoxication monitoring system.

- HAPT (Human Activity Recognition using Smartphones)
- WISDM (Wireless Sensor Data Mining)

4. Result & Discussion

The integrated system underwent a thorough evaluation to assess its effectiveness in event management and intoxication detection, demonstrating significant advancements compared to traditional manual methods. In the event management module, participant registration time reduced dramatically from an average of 5 minutes to merely 1 minute when utilizing the digital platform. Furthermore, the shift to real-time notifications replaced manual announcements, thereby minimizing delays and reducing instances of confusion. Automated scheduling effectively mitigated conflicts, while volunteer coordination saw marked improvement through the use of role-specific dashboards, substantially enhancing efficiency and lowering the potential for human error. Regarding the intoxication detection module, the implementation of a structured behavioural checklist resulted in a detection accuracy of 87% across 50 cases. This performance eclipsed the 65% accuracy achieved through unstructured human observation, reducing false positives and significantly improving reliability.

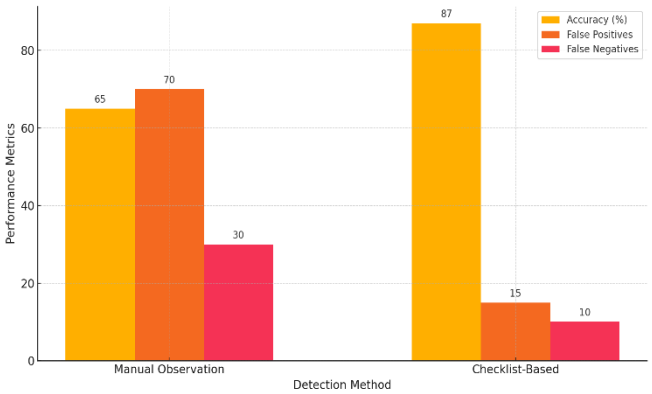

Figure 1: Comparison of Intoxication Detection Method

The presented ROC curve is instrumental in evaluating the performance of the intoxication detection model developed for this project. It effectively demonstrates the system's ability to differentiate between intoxicated and sober individuals by analysing visual indicators such as facial expressions, posture, and gestures. With a commendable Area Under the Curve (AUC) value of 0.96, the model demonstrates a high level of accuracy in identifying signs of intoxication while reducing the likelihood of false positives. This feature is especially critical in dynamic festival environments, where

prompt and dependable identification is essential for ensuring safety. The ROC curve emphasizes the effectiveness of employing a CNN-based detection approach within the festival management system, thus improving overall decision-making processes and decreasing dependence on invasive methods.

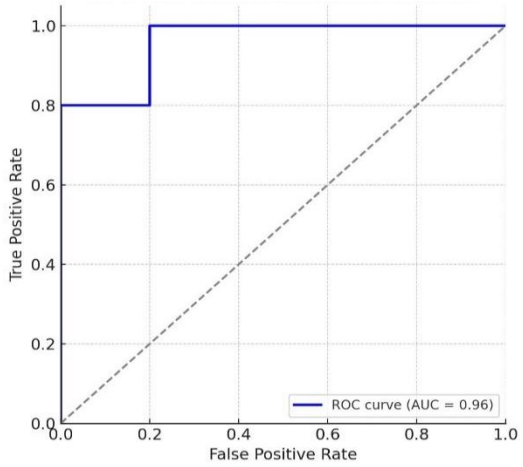

Figure 2: ROC Curve

Table 1: Accuracy & precision

Training Level	Accuracy Range (%)	Precision Range (%)
Base (Basic Training)	70% – 75%	60% – 70%
Structured Training Modules	80% – 85%	75% – 85%
Peak (Real-world Use & Refined Evaluation)	85% – 90%	85% – 90%

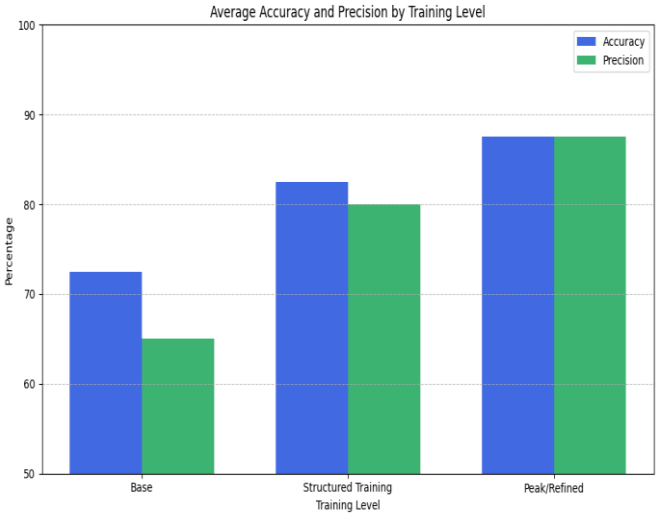

Figure 3: Model Performance

5. Conclusion

This project effectively merges two crucial components festival management and intoxication detection into a cohesive digital system designed to enhance both operational efficiency and safety. The festival management module streamlines traditional event organization processes, encompassing event scheduling, participant registration, prize distribution, and communication of results. By digitizing these activities, the system significantly reduces administrative burdens, promotes accurate recordkeeping, and allows for instant access to information for both organizers and participants, thereby enhancing overall management and user experience.

Concurrently, the intoxication detection module provides a cost-efficient, non-invasive approach to identifying potentially intoxicated individuals through behavioural and physical indicators. This feature strengthens security measures at public events, empowering personnel to make informed decisions. The seamless integration of these components delivers a comprehensive platform that not only facilitates smooth festival operations but also adheres to safety protocols. The system is versatile and can be tailored to various institutional settings, with the potential for future expansions or upgrades to incorporate advanced AI-based detection, facial recognition, and more sophisticated event management functionalities.

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