Human Scream Detection and Analysis for Controlling Crime Rate

Academic Mini project report submitted in partial fulfillment of the requirements as

part of postgraduate program

DEPARTMENT OF MCA

Submitted by

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Under the esteemed guidance of

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CERTIFICATE

This is to certify that the mini project work entitled "**Human Scream Detection and Analysis for Controlling Crime Rate** "is Bonafide work submitted by M. MANIKANTA (246M1F0011). In partial of the requirement for the award of the degree **MASTER OF COMPUTER APPLICATIONS** during the academic year 2024- 2025. It is a Bonafide work carried out by the under guidance and supervision.

Internal Guide
SHEIK.LALASHA, MCA
Assistant. Professor,
Department of MCA.

Head of the Department
M. SATYANARAYANA, MCA
Head of the Department,
Department of MCA.

DECLARATION

Where by declare that is a mini project report titled **Human Scream Detection and Analysis for Controlling Crime Rate** has been done and report is submitted by me under the guidance of **MS. SHEIK.LALASHA, MCA** During the academic year 2024-2025 in partial fulfillment of requirement of the award of the degree of **MASTER OF COMPUTER APPLICATIONS**. In addition to declare that this project is the result of our own effort and has not been submitted to any other university for the award of degree.

PROJECTEE

M.MANIKANTA - 246M1F0011

ACKNOWLEDGEMENT

My mini project symbolizes practical and theoretical application so far academic education in Master's. Its completion gives us immense satisfaction. But without the co-operation of great people at different levels, this project couldn't have taken a physical form.

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PROGRAM EDUCATIONAL OBJECTIVES

PEO 1: "Achieve excellence in professional careers or higher education by acquiring comprehensive knowledge in mathematical, computing, and engineering principles."

PEO 2: "Analyze real-life problems, designing computing systems that offer technically sound, economically feasible, and socially acceptable solutions."

PEO 3: "Demonstrate professionalism, ethical conduct, strong communication, teamwork, and adaptability to current trends by engaging in lifelong learning in their professional endeavors."

PROGRAM SPECIFIC OUTCOMES

PSO 1: "Apply computing techniques integrating mathematics and industrial concepts to effectively solve real-time industrial challenges."

PSO 2: "Analyze, design, develop, test, and maintain software applications using the latest computing tools and technologies."

Signature of HOD

Department Of Computer Applications

BVC College Of Engineering (A)

Head of the Department
Master of Computer Applications
BVC COLLEGE OF ENGINEERING
PALACHARLA-533 102.

VISION

To pioneer in computer applications education, forecasting innovation and nurturing the tech Leaders of tomorrow through comprehensive learning and cutting-edge research

MISSION

DM1: Immerse students in diverse computer science fields through innovative teaching methods, emphasizing practical applications to facilitate research initiatives.

DM2: Cultivate coding expertise, programming skills, and soft skills to enhance student's employability in the IT industry.

DM3: Inspire entrepreneurial spirit and a commitment to lifelong learning.

DM4: Establish comprehensive physical and digital resources to foster the holistic development of both faculty and students

Signature of HOD

Department Of Computer Applications

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ABSTRACT

Public safety is significantly hampered by delayed police response due to a lack of accurate and timely information about crimes. In many cases the absence of police is observed at crime spots, it may be because they do not have a proper address or sometimes nobody informed them. Therefore, we have tried to address the problem with the help of our project **Human scream detection** using audio classification offers a promising solution. This work presents a novel three-phase scream detection system leveraging a K-Nearest Neighbors (KNN) classifier and a Multilayer Perceptron (MLP) model. The system first separates human distress sounds from back-ground noise using MFCC features and KNN. Subsequently, it differentiates screams from shouts within the distress category using another KNN classifier. Finally, the classified screams trigger emergency notifications sent to the police station via the Twilio library. Our proposed system offers a robust and layered approach to scream detection, potentially enhancing response times and improving public safety.

INTRODUCTION

Smartphones are no longer just communication devices their increasing processing power and advanced sensors have opened doors to new applications. One promising area is their potential role in personal safety. This study investigates the feasibility of using smartphones to detect screams and shouts, vocal cues that can signal distress. By leveraging a smartphone's built-in microphone and machine learning algorithms, the goal is to create a system that can distinguish these critical sounds from everyday background noise. This research investigates the potential applications of scream and shout detection in various fields, including home security, healthcare for the elderly, and other critical areas. To achieve this, we built a system that can distinguish these vocalizations from background noise. The dataset for this model is collected from online platforms like Kaggle, GitHub and capturing real-life screams and sounds recorded during daily activities. For accurate identification, a three-stage ap-roach is employed. First, a K-Nearest Neighbor (KNN)classifier with Mel-frequency cepstral coefficients (MFCC) as features separates screams, shouts, and speech from noise. Subsequently, the remaining speech sounds are differentiated from screams and shouts in the second phase. Finally, the third stage focuses on isolating screams from shouts within the identified non-speech category. To further enhance accuracy, the system leverages a Multilayer Perceptron model. After passing the recorded audio to Multilayer Perceptron model, If the scream is detected a Notification with your mobile number is being sent to police station using Twilio library. As the notification is reached to the police, then they can track the user location and save their lives.

SYSTEM REQUIREMENTS

REQUIREMENT SPECIFICATIONS

FUNCTIONAL REQUIREMENTS:

- **Audio Listening:** The system listens to sounds from microphones or cameras in public or monitored areas.
- **Noise Reduction:** It cleans up the audio to remove background noise and make screams easier to detect.
- **Scream Recognition:** The system uses AI to check if a sound is a human scream or not.
- **Instant Alerts:** If a scream is detected, the system quickly sends alerts to security staff, police, or emergency services.
- **Real-Time Operation:** The system works instantly, so help can be provided as soon as a scream is detected.
- **Event Logging:** Every detected scream is recorded with the time and place for future review.
- **Privacy and Security:** The system keeps all audio data safe and follows privacy laws.

NON-FUNCTIONAL REQUIREMENTS

Performance & Accuracy

- Must achieve **high detection accuracy** (above 90%) to minimize false alarms.
- Should process **audio data in real-time** for immediate response.

Scalability

- Must support **large-scale deployment** in urban areas.
- Should integrate with **existing surveillance systems**.

Security & Privacy

- Must comply with **data protection laws** to ensure user privacy.
- Should implement **encryption** for secure data transmission.

Reliability & Fault Tolerance

- Must function **effectively in noisy environments**.
- Should have **backup systems** to prevent failures.

Usability & Maintainability

- Should provide an **intuitive interface** for law enforcement.
- Must allow **easy updates** for improved accuracy.

SOFTWARE REQUIREMENTS

- Programming Language: Python (widely used for audio processing and machine learning tasks)
- Frameworks and Libraries:
    - Audio processing: librosa
    - Machine learning: scikit-learn, TensorFlow
    - Data handling: pandas, NumPy.
    - UI development: Kivy.
- Employ machine learning or deep learning models (e.g., Support Vector Machines, Multilayer Perceptions, Convolutional Neural Networks) to classify frames as "scream" or "non-scream".
- Configure automated alerts (e.g., notifications, SMS, integration with emergency systems) upon scream detection to notify authorities or trigger surveillance actions
- Use a representative, labelled dataset with sufficient positive (scream) and negative (non-scream) samples for effective model training.

HARDWARE REQUIREMENTS

1. Audio Recording:
    - Microphone.
    - Audio Recorder.
    - Connectivity**.**
2. Processing Unit:
    - Computer: A computer is essential for analysing audio signals. It should have sufficient processing power (CPU) and memory (RAM) to handle real-time analysis and potential machine learning tasks.
    - GPU (Optional but Recommended for Machine Learning): For more complex analysis involving machine learning, a GPU can significantly speed up the training and execution of models.
    - Operating System: A reliable operating system like Windows, macOS, or Linux is needed.

HOW IT WILL WORKS

Step 1: UI design

First, the UI or the user interface of the project is developed. We will develop the UI using Kivy (Python) framework, which the user will use to interact.

Step 2: Prepare a data set for Human Scream detection

The whole data set of this project is divided into two classes one is a positive class which includes around 2000 human screams to train the model and another is a negative class which includes around 3000 negative sounds which are not considered as a scream.

Step 3: Extraction of MFCCs

The next step is the extraction of MFCCs from the data set using Librosa library and save the extracted MFCCs in a CSV file on your computer.

Step 4: Training of SVM model and its saving

Next, we will train SVM (Support Vector Machine) model over those MFCCs which we had created in the previous step and when the whole training gets completed then we will save it using TensorFlow library. There is a diagram given below for detection of noise, speech, shout and scream using SVM classifier.

Step 5: Training of MPN model and its saving

Now, we will train MPN (Multilayer perceptrons model) over sounds present in the data set to get good accuracy of the model and when the whole training gets completed then again save it using TensorFlow library as we do earlier.

Step 6: Approach to generating an alert message

Now, after successfully training and saving both the models, now we will go with the testing of these two models and according to the response provided by both models we will decide the level of risk and according to the risk level, we will generate alert messages.

In this project there are two kinds of alert messages will get generate which are high-risk alert messages and medium risk alert messages based on the conditions in the surrounding.

- High-risk alert message: High-risk alert message will get generated by the system in the case when both models will detect the human scream in surroundings.
- Medium risk alert message: A medium risk alert message will automatically get generated by the system in the case when one of the two models detects the human scream in the surrounding.

Step 7: Send SMS to nearest Police Station

However, the project is currently under development so we are providing the idea only that how one can develop this feature. For the development of this feature, we can take the help of databases and can send SMS to that number at the time of any emergency detected by the project.

FEASIBILITY STUDY

ECONOMICAL FEASIBILITY:

The economic feasibility of Human Scream Detection and Analysis for Controlling Crime Rate depends on several factors, including implementation costs, technological efficiency, and potential benefits in crime prevention.

- Initial costs include hardware, software development, and training datasets.
- Operational costs involve maintenance, data storage, and emergency response integration.
- Potential savings come from reducing crime response time and enhancing public safety.

TECHNICAL FEASIBILITY:

The technical feasibility of Human Scream Detection and Analysis for Controlling Crime Rate depends on the effectiveness of audio processing, machine learning models, and real-time implementation.

- **Audio Sensors:** High-sensitivity microphones capable of capturing sounds in urban environments.
- **Machine Learning Algorithms:** Trained to distinguish human screams from other ambient sounds (e.g., car horns, sirens).
- **Integration with Emergency Services:** Automated alert systems that notify law enforcement upon verified scream detection.
- **Data Filtering:** Noise reduction, sound localization, and filtering to prevent false positives.

SOCIAL FEASIBILITY:

The social feasibility of Human Scream Detection and Analysis for Controlling Crime Rate depends on public acceptance, ethical concerns, and its impact on communities.

Public Acceptance

- People may support the system if it enhances safety and reduces crime.
- Concerns may arise regarding privacy and misuse of surveillance data.

Ethical Considerations

- Continuous audio monitoring could lead to privacy violations.
- False alarms may cause unnecessary panic or strain emergency services.

Community Impact

- Can improve security in high-risk areas.
- May require public awareness campaigns to ensure proper usage.

Legal & Regulatory Compliance

- Needs government approval for public deployment.
- Must comply with data protection laws.

SYSTEM ANALYSIS

EXISTING SYSTEM:

Human scream detection systems are sophisticated tools designed to distinguish and identify screams from other audio signals using advanced audio analysis techniques. These systems rely on analyzing key acoustic features such as pitch, intensity, and spectral characteristics, which are uniquely associated with human screams. By leveraging machine learning algorithms like support vector machines (SVM) and neural networks, these systems can effectively classify sounds. During the training phase, the algorithms are fed large datasets that include various instances of human screams recorded in different environments and under diverse conditions. This training enables the systems to detect and recognize screams in real-time, even in noisy or challenging environments, making them robust and reliable for real-world applications. The practical applications of scream detection systems are vast and varied, particularly in the domains of security, emergency response, and smart home technology. In security systems, the ability to quickly identify a scream can trigger immediate alerts, allowing security personnel or law enforcement to respond rapidly to potential emergencies such as assaults or accidents. In emergency response mechanisms, scream detection can help prioritize incidents that require urgent intervention, improving the overall efficiency of rescue operations. Smart home devices, equipped with scream detection, offer an additional layer of safety by recognizing distress signals and alerting the appropriate authorities or family members, thus enhancing user security. As technology continues to evolve, advancements in audio processing and machine learning are enhancing the accuracy, speed, and efficiency of these systems. This progress ensures that scream detection systems will remain integral to improving safety measures, emergency response times, and overall public security in critical situations.

DISADVANTAGES:

False Alarms & Accuracy Issues

- Background noise can trigger false detections, leading to unnecessary emergency responses.
- Accuracy depends on machine learning models, which may struggle in noisy environments.

Privacy Concerns

- Continuous audio surveillance raises concerns about personal privacy.
- Data security must be ensured to prevent misuse of recorded audio.

High Implementation Costs

- Requires advanced sensors, AI models, and real-time processing, making it expensive.
- Maintenance and data storage add to long-term costs.

Legal & Ethical Challenges

- May require government approvals for public deployment.
- Ethical concerns arise regarding misuse of surveillance data.

Technical Challenges

Â Human scream detection is complex because screams can sound different, and it's essential to tell apart from other sounds. To make detection systems that are reliable and effective, you need complex algorithms and a lot of training data.

PROPOSED SYSTEM:

A potential system for human scream detection combines advanced audio processing and machine learning techniques. The first step involves creating a comprehensive dataset that includes various types of screams as well as non-scream sounds, providing the foundation for training a machine learning model. Feature extraction techniques, such as Mel frequency cepstral coefficients (MFCCs), can be applied to capture the essential characteristics of audio signals. These features help the system differentiate between screams and other sounds. Following model training, real-world testing is critical to assess the system's performance in diverse environments and scenarios, ensuring that it can handle a wide range of situations. Continuous refinement, based on real-world feedback and the integration of additional data, enhances the system's accuracy and adaptability. Over time, this process improves the model's generalizability, making it more effective in varied applications. One of the system's most promising aspects is its versatility. In public safety, smart home security, and healthcare, detecting distress signals like screams is vital. For instance, in a smart home, detecting a scream can trigger emergency services, while in public surveillance, it can prompt rapid intervention. The Yin algorithm plays a complementary role by analyzing pitch variations in real-time audio, allowing the system to distinguish scream-like patterns from background noise more effectively. The integration of the Yin algorithm improves the detection system's ability to recognize screams quickly, enhancing public safety and response times. This technology holds significant potential for a variety of applications, including surveillance, smart home security, and healthcare monitoring, where timely responses are essential.

DISADVANTAGES:

Improved Crime Detection

- Uses advanced machine learning models like K-Nearest Neighbors (KNN) and Multilayer Perceptron (MLP) for accurate scream detection.
- Helps in identifying distress sounds in high-risk areas.

Faster Emergency Response

- Automatically alerts law enforcement when a scream is detected.
- Reduces response time, improving public safety.

Enhanced Accuracy

- Utilizes MFCC features to differentiate screams from background noise.
- Achieves high detection accuracy, minimizing false alarms.

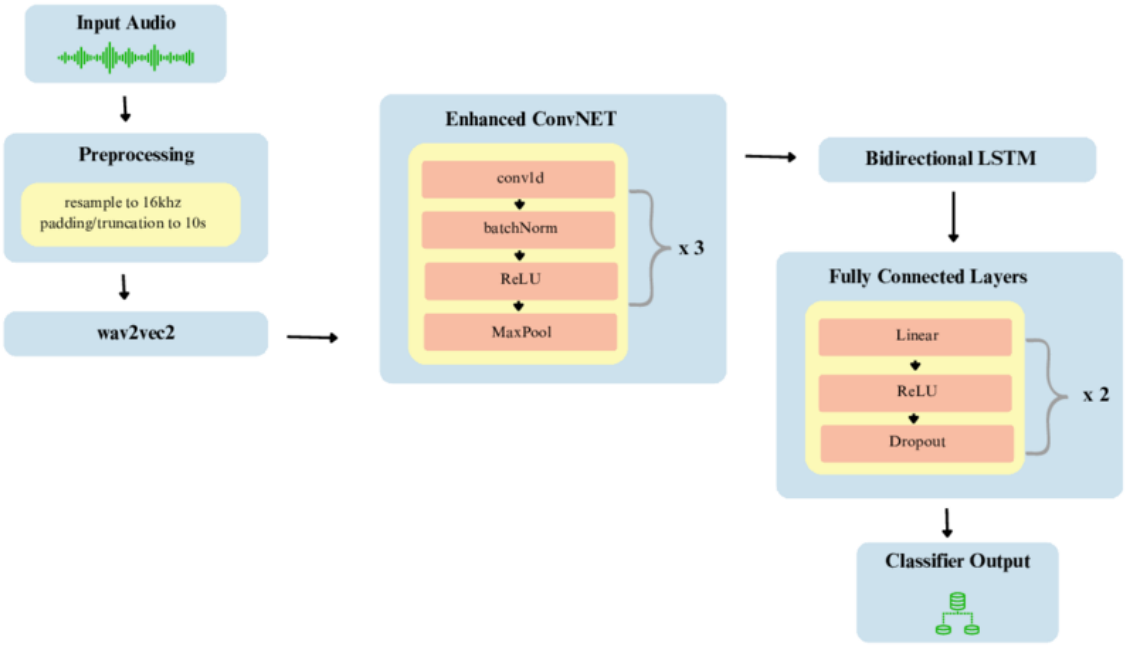
Integration with Surveillance Systems

- Can be linked to CCTV networks for automated crime detection.
- Helps in reducing emergency response time.

Scalability & Adaptability

- Can be deployed in urban areas, public spaces, and emergency centers.
- Adaptable to different environments for effective crime prevention.

SYSTEM ARCHITECTURE



A human scream detection system for crime prevention would integrate advanced audio processing, machine learning, and real-time alert mechanisms. Microphones or IoT sensors strategically placed in public or high-risk areas would capture audio, with preprocessing techniques like noise filtering and spectrogram conversion to isolate distress sounds. A deep learning model trained on scream datasets would accurately classify urgent cries, leveraging features like pitch and frequency analysis. Edge computing enables quick local processing, ensuring rapid detection without excessive latency. When a scream is identified with high confidence, the system would trigger alerts to law enforcement, integrating with CCTV for validation and dispatching emergency services as needed. Privacy and ethical considerations, including encryption and compliance with data protection laws, would be essential to balance security with individual rights. This framework could significantly enhance public safety by enabling swift responses to potential crimes or emergencies.