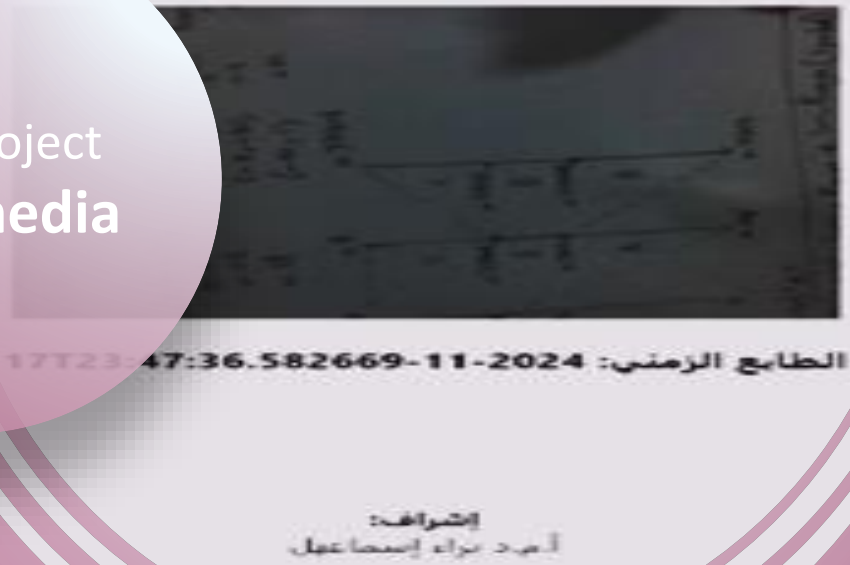
MINI Project

**Multimedia**




# EFFICIENT COMPRESSED SENSING-BASED SECURITY APPROACH FOR VIDEO SURVEILLANCE APPLICATION IN WIRELESS MULTIMEDIA SENSOR NETWORKS

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This research presents an integrated system combining Compressed Sensing techniques with advanced encryption methods to secure video frame transmission over Wireless Multimedia Sensor Networks. The proposed methodology starts by reducing the data size by approximately 83.5%,

effectively decreasing the required bandwidth and enhancing transmission efficiency. Following compression, an additional security layer is applied using strong encryption to ensure data confidentiality and protect against potential attacks.

# Abstract


- The system is implemented using Python's Django framework to build a secure API that features an extra security layer through ApiKeyMiddleware for request verification. Compressed and encrypted frames are securely stored on the server, with access granted only through authorized API keys. This comprehensive approach meets modern surveillance needs, providing effective data protection over wireless networks.

# Research Problem

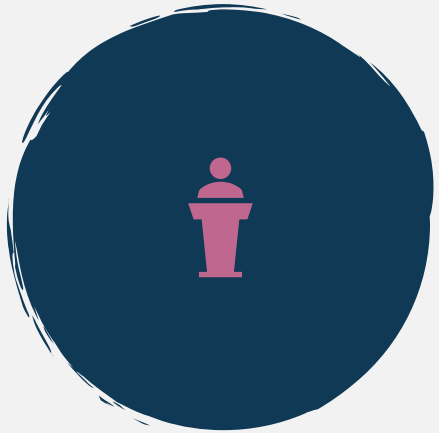
The main challenge addressed in this project is the efficient transmission and storage of large video data in wireless sensor networks, which often encounter limitations in bandwidth and power. Additionally, there is a growing need for robust security measures to protect sensitive information from unauthorized access and attacks. This project aims to tackle these issues by developing a system that compresses video frames and secures them through encryption before transmission, thereby reducing data size and enhancing security during transmission.

# Programming Language

The Programming Language used in this project.

Flutter

Flutter is an open source framework for building beautiful, natively compiled, multi-platform applications from a single codebase.



API

Django is a high-level Python web framework that enables developers to quickly build secure and scalable web applications.

Python

is a versatile, high-level programming language known for its readability and ease of use.

# SEARCH OBJECTIVE

THE SIGNIFICANCE OF THIS RESEARCH LIES IN ITS POTENTIAL TO ENHANCE THE EFFICIENCY AND SECURITY OF VIDEO SURVEILLANCE SYSTEMS. AS URBAN AREAS CONTINUE TO EXPAND, THE DEMAND FOR EFFECTIVE MONITORING SOLUTIONS IS ON THE RISE. THIS PROJECT CONTRIBUTES NOT ONLY TO THE ACADEMIC FIELD OF MULTIMEDIA SENSOR NETWORKS BUT ALSO OFFERS PRACTICAL SOLUTIONS FOR REAL-WORLD APPLICATIONS IN SECURITY AND MONITORING, MAKING IT VALUABLE FOR IMPROVING OVERALL SURVEILLANCE PERFORMANCE AND INCREASING THE LEVEL OF PROTECTION.

# Methodology

## Data Acquisition

Capturing video frames using a camera integrated with the WMSN.

## Data Compression

Implementing JPEG compression to reduce the size of video frames.

## Data Encryption

Utilizing the AES encryption algorithm to secure the compressed frame data.

## Data Transmission

Sending the encrypted data to a server for storage and further processing.

## Data Retrieval

Providing an API for retrieving video frame data as needed.

- 1. Frame Capture:

  The system uses the laptop’s camera to capture video frames at regular intervals.

- 2. Compression:

  After capturing the video frames, each frame undergoes compression to reduce its size, optimizing it for storage and transmission

- 3. Encryption:

  Once compressed, the frames are encrypted using the AES encryption algorithm.

- 4. File Size Comparison:

  A key part of the implementation is comparing the file sizes before and after compression to demonstrate the effectiveness of the compression algorithm

# Implementation

## Design & Implementation Process Breakdown

# Results

## Frame 1

Original size: 93,359 bytes

Compressed size: 13,641 bytes

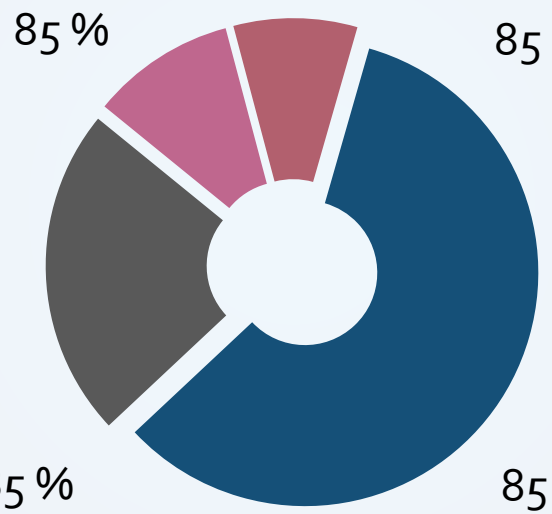
Size reduction: ~85.5%

## Frame 2

Original size: 93,940 bytes

Compressed size: 13,676 bytes

Size reduction: ~85.4%




## Frame 3

Original size: 93,518 bytes

Compressed size: 13,701 bytes

Size reduction: ~85.4%

## Frame 4

Original size: 95,340 bytes

Compressed size: 13,754 bytes

Size reduction: ~85.3%

# CONCLUSIONS

THIS PROJECT SUCCESSFULLY ADDRESSES THE CRITICAL ISSUES OF VIDEO DATA TRANSMISSION, STORAGE, AND SECURITY IN WIRELESS MULTIMEDIA SENSOR NETWORKS (WMSNS). BY INTEGRATING COMPRESSED SENSING TECHNIQUES WITH AES ENCRYPTION, THE SYSTEM ACHIEVES SIGNIFICANT BANDWIDTH REDUCTION WHILE ENSURING THE CONFIDENTIALITY AND INTEGRITY OF VIDEO DATA. THE USE OF PYTHON'S DJANGO FRAMEWORK FURTHER ENHANCES THE PROJECT'S CAPABILITIES BY PROVIDING A ROBUST PLATFORM FOR WEB API DEVELOPMENT, VIDEO FRAME MANAGEMENT, AND SECURE COMMUNICATION

# FUTURE WORK

**OPTIMIZATION OF VIDEO COMPRESSION:**

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**1.ENHANCEMENT OF ENCRYPTION METHODS:**

**2.INTEGRATION OF MACHINE LEARNING FOR REAL-TIME ANALYSIS:**

**3.ENERGY-EFFICIENT ALGORITHMS FOR SENSOR NETWORKS:**

**4.DISTRIBUTED PROCESSING AND EDGE COMPUTING:**

**5.CLOUD-BASED SCALABILITY AND STORAGE SOLUTIONS:**

**6.INCORPORATION OF REAL-TIME DATA ANALYTICS:**

**7.SUPPORT FOR 5G AND IOT NETWORKS:**

# THANK YOU