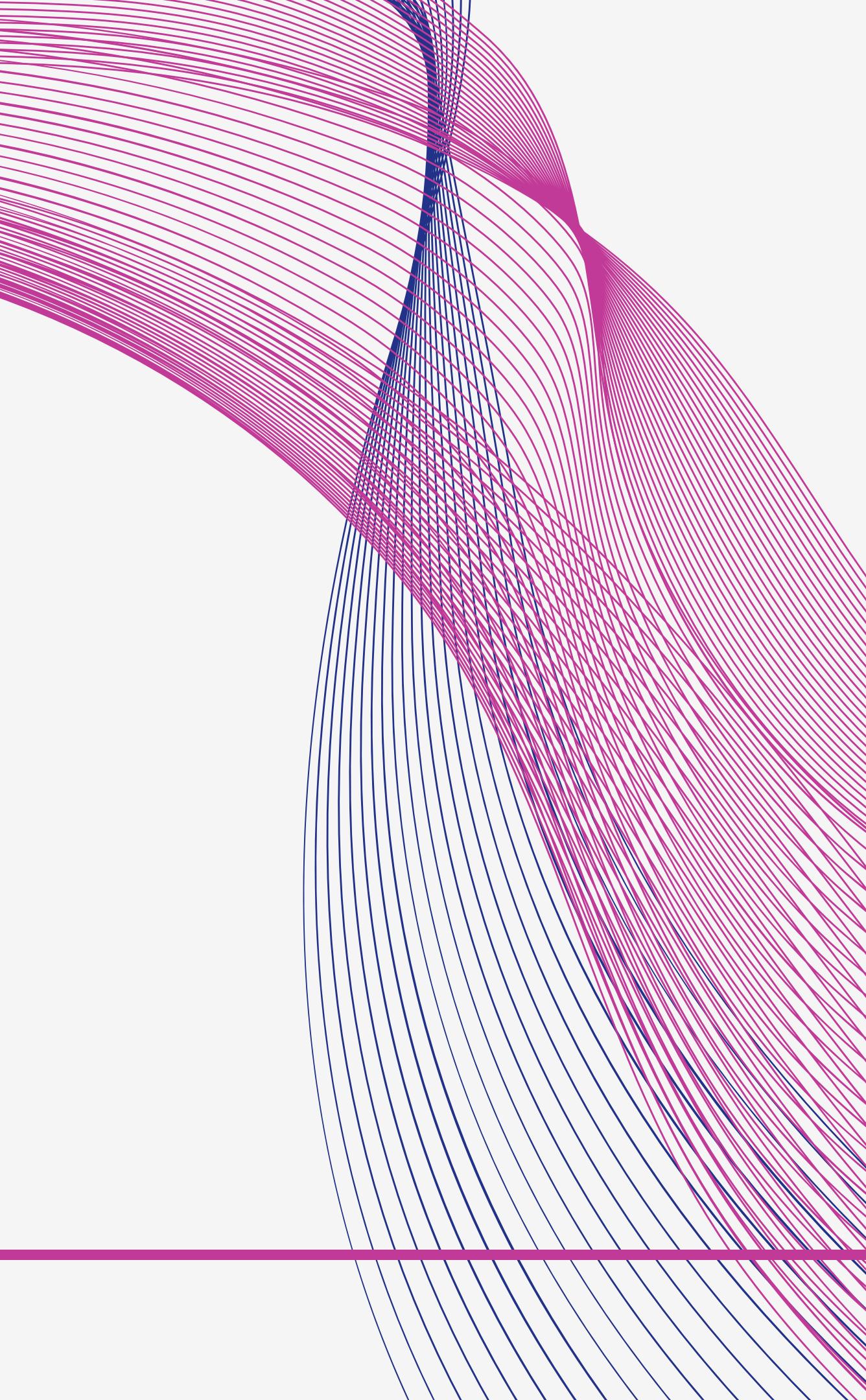


VIDEO TRANSMISSION



PROBLEM DEFINITION

To develop a secure wireless transmission system to convert analog video signals from a thermal camera, encrypt the data, and transmit it wirelessly over a long range using an optical sensor. The system must ensure real-time and reliable signal transmission for effective monitoring and surveillance, while ensuring the confidentiality and integrity of the video data through strong encryption measures.



Currently, surveillance operations heavily rely on wired transmission methods to transmit video signals from cameras to monitoring stations.

LIMITATIONS:

- Limited Flexibility
- Higher Installation Costs
- Maintenance Challenges
- Vulnerability to Physical Damage
- Limited Range
- Signal Interference

Considering these disadvantages, the development of a secure and efficient wireless transmission system can address these challenges and provide a more flexible, scalable, and reliable solution for surveillance applications.



OUR CONDITIONS

- high data rate
- low power consumption
- handling interference
- security
- long distance transmission

IMPLEMENTATION

Encryption for Video Transmission:

Enable end-to-end encryption for video transmission between the CCTV camera and the receiver.



Secure the Thermal Camera Device:

Ensure that the thermal CCTV camera device itself is secured with a strong password or access control measures

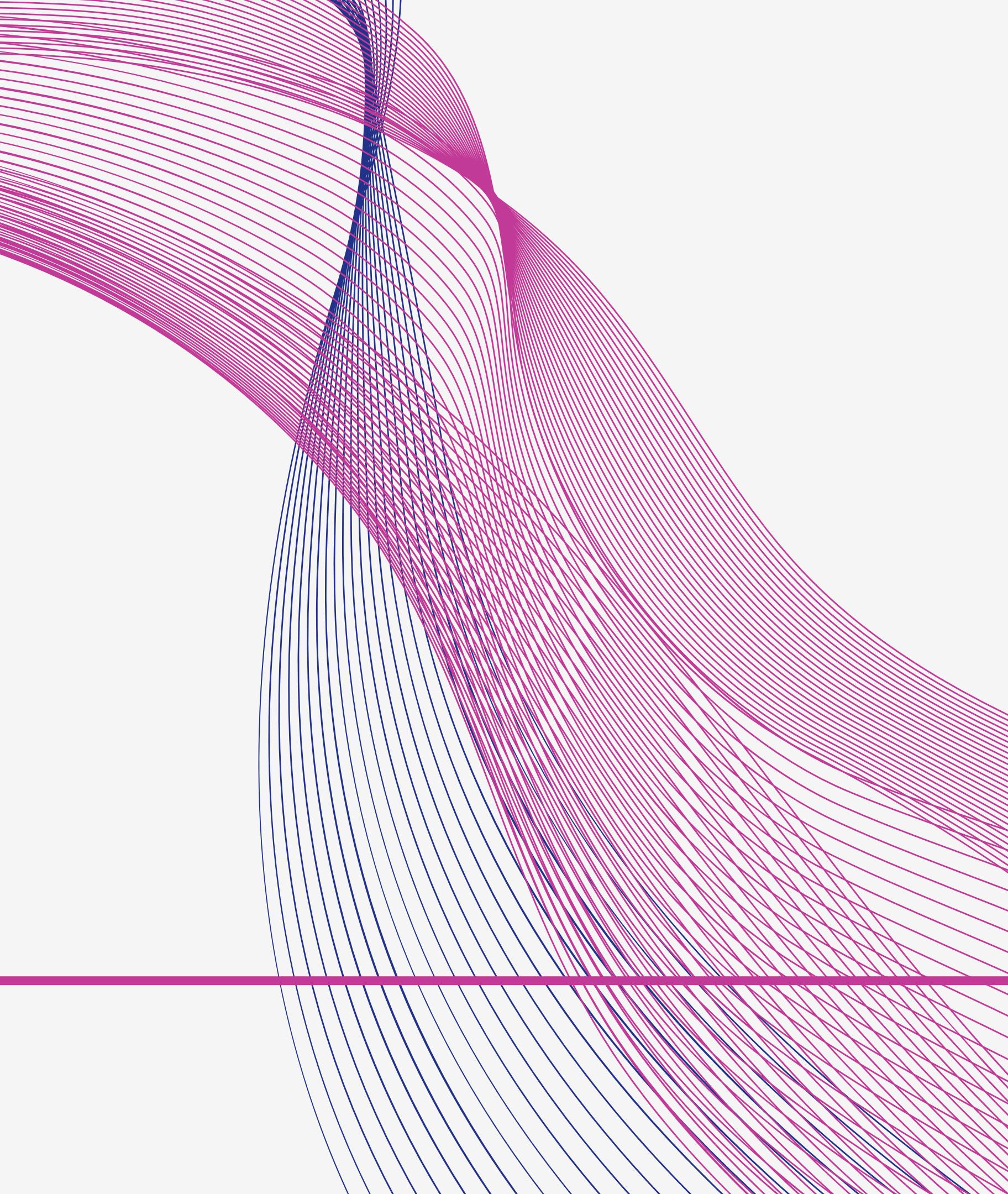
Secure Wireless Network:

Ensure that the wireless network used for video transmission is secure



Physical Security:

Ensure that the physical location of the CCTV camera and the receiver is secure and accessible only to authorized personnel.



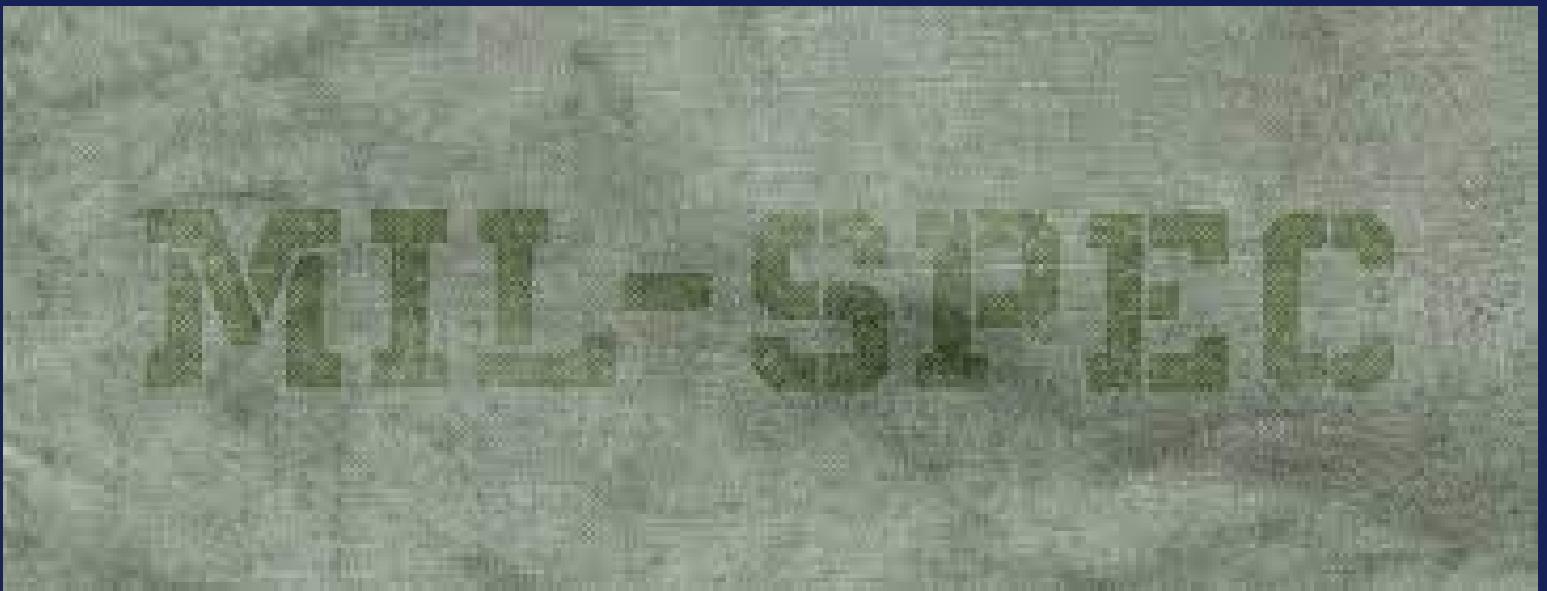
HARDWARE REQUIRED

1. Thermal Camera (video Source)
 2. BNC Cable
 3. AV-to-HDMI Converter with BNC Inputs
 4. Transmitter
 5. Antenna
 6. Receiver
 7. Display Device
 8. Power Supply
-

MILITARY STANDARD

To create a protocol for Military use, the components used should be MIL GRADE MIL-STD stands for "Military Standard." MIL-STDs are used to establish common requirements and procedures for military contracts and acquisitions. They provide detailed specifications and guidelines that manufacturers, contractors, and suppliers must follow when developing, manufacturing, and testing equipment and systems for military use.

- MIL-STD-810: Environmental Engineering Considerations and Laboratory Tests
- MIL-STD-461: Electromagnetic Interference (EMI) and Electromagnetic Compatibility (EMC)
- MIL-STD-1275: Requirements for a Vehicle Electrical Power System
- MIL-STD-704: Aircraft Electric Power Characteristics
- MIL-STD-882: System Safety Program Requirement



THERMAL CAMERA

A thermal camera is a specialized device that detects and captures images based on the heat emitted by objects or living beings, enabling visibility in low-light conditions and finding temperature differences in various applications, such as security, industrial inspections, and medical diagnostics.

Properties

1. Night Vision
2. Unaffected by Lighting Conditions
3. Detection of Intruders
4. Accurate Temperature Measurement
5. Wide Area Coverage



BNC CONNECTOR

A BNC (Bayonet Neill-Concelman) connector is a type of coaxial connector commonly used in video and audio applications. It features a bayonet-style coupling mechanism, which allows for quick and secure connections without the need for twisting or screwing.



Properties

1. Analog Video Transmission
2. Quick and Easy Installation
3. Robust and Secure Connection
4. High-Frequency Performance
5. Compatibility with Legacy Systems
6. Reliability in Long Cable Runs
7. Durable and Rugged Design
8. Cost-Effective Solution

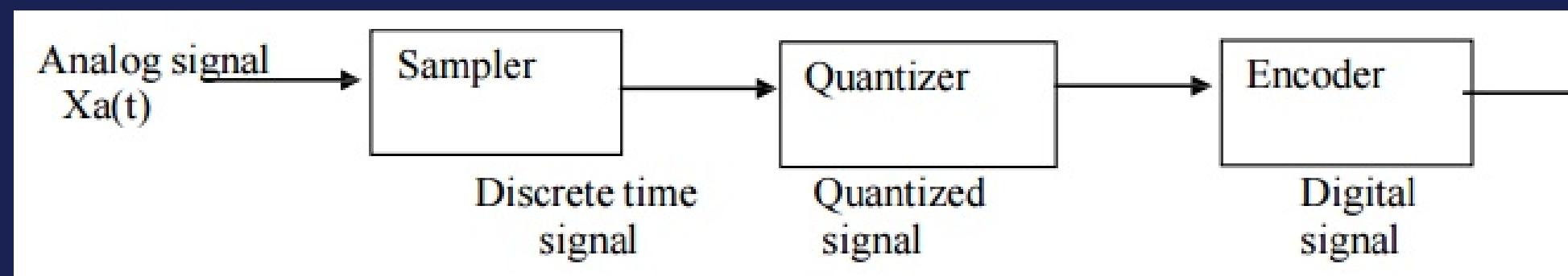
Limitations

1. Bulkiness
2. Signal Interference
3. Limited Versatility
4. Unidirectional
5. Connectivity Challenges
6. Migration to Digital System
7. Security Concerns

Analog to Digital Converter

An analog-to-digital converter (ADC) is an electronic device or integrated circuit that converts analog signals into digital format. In the context of electronics and computing, analog signals are continuous and vary in amplitude, while digital signals are discrete and represented by binary numbers (0s and 1s).

The primary function of an ADC is to sample an analog input signal at specific intervals, measure its voltage or amplitude, and then quantize it into digital values.



TRANSMITTER

A transmitter is an electronic device or system that is responsible for sending or transmitting signals, data, or information over a communication channel or medium to a receiver.

Microwave transmitters operate at high frequencies (above 1 GHz) and are commonly used for long-range point-to-point video communication between fixed locations or relay stations, providing high data rates and low latency.

BANDWIDTH

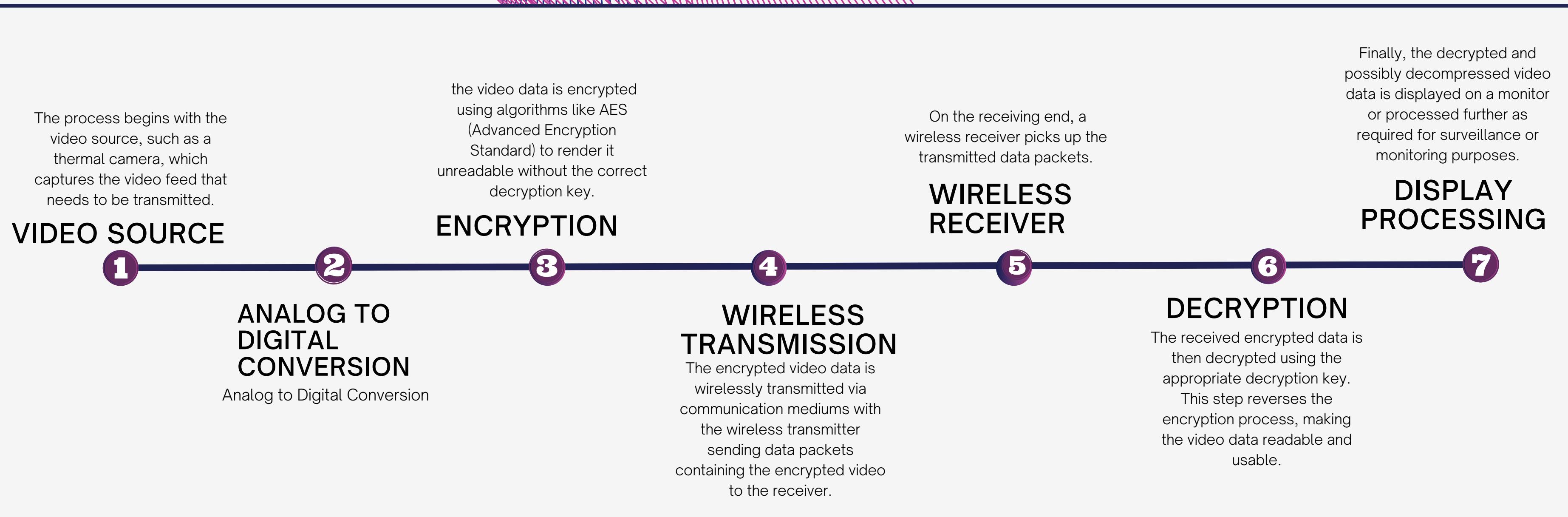
Bandwidth is the total range of frequency required to pass a specific signal that has been modulated to carry data without distortion or loss of data. The ideal bandwidth allows the signal to pass under conditions of maximum AM or FM adjustment.

The bandwidth required for thermal camera video transmission can vary widely. As an example, let's estimate the bandwidth for a thermal camera with the following specifications:

- Resolution: 640x480 pixels
- Frame Rate: 30 fps
- Color Depth: 8-bit
- Compression: H.264

Bandwidth required \approx 73.73 Mbps

WIRELESS VIDEO TRANSMISSION PROCESS



HOW TO SECURE DATA DURING TRANSMISSION?

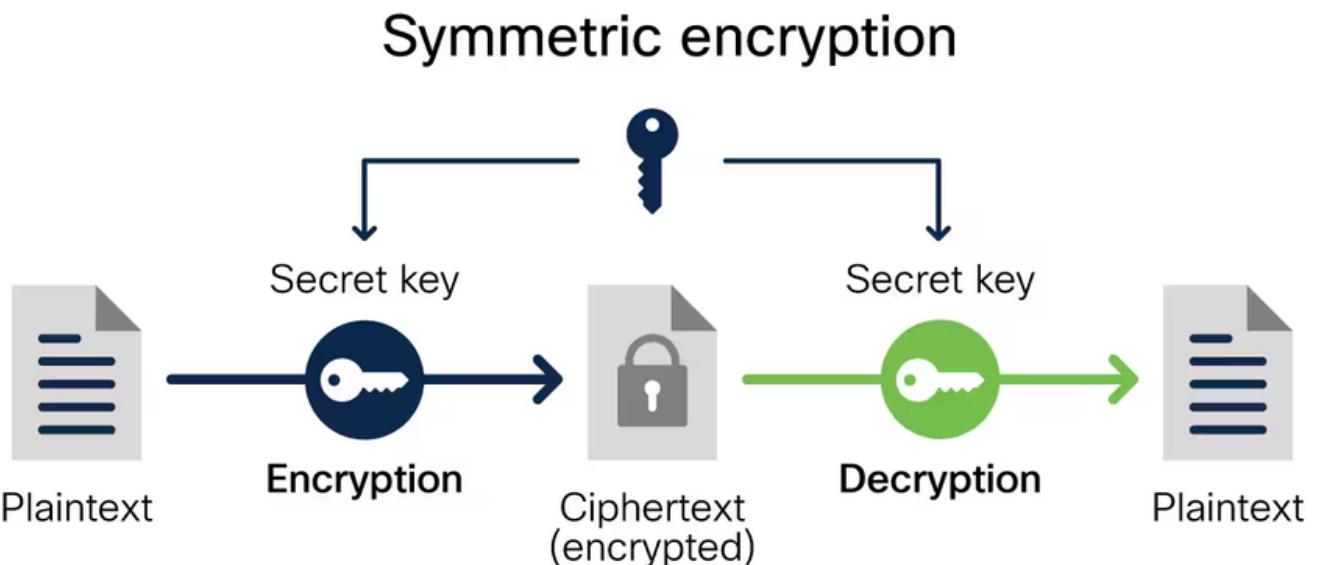
ENCRYPTION/DECRYPTION

Encryption is the process of converting data into a coded form that can only be read or understood by authorized parties with the appropriate decryption key, while decryption is the reverse process of converting the encrypted data back into its original, readable form.



How it works?

The cryptography process involves both encryption and decryption to secure data and communications. Here's a simplified overview of the process



Plaintext

The original data or message that needs to be protected is called plaintext.

Encryption Algorithm

An encryption algorithm, such as AES, DES, or RSA, is applied to the plaintext. This algorithm uses a cryptographic key to perform mathematical operations that scramble the plaintext into ciphertext.

Encryption Key:

The encryption key is a parameter used by the encryption algorithm. It determines how the plaintext is transformed into ciphertext. The strength of the encryption largely depends on the complexity and length of the encryption key.

Encrypted Ciphertext

The encrypted ciphertext is received by the authorized party who possesses the correct decryption key.

Decryption Algorithm

A decryption algorithm, which is the reverse of the encryption algorithm, is applied to the ciphertext. This algorithm uses the decryption key to perform mathematical operations that reverse the encryption process and retrieve the original plaintext.

VARIOUS ENCRYPTION PROTOCOLS

AES (Advanced Encryption Standard):
AES is a widely used symmetric encryption algorithm that ensures data confidentiality. It is commonly used in various applications, such as securing data at rest on storage devices and encrypting sensitive data during transmission.

ECC (Elliptic Curve Cryptography):
ECC is another asymmetric encryption algorithm that provides strong security with smaller key sizes compared to RSA. It is widely used for digital signal encryption in resource-constrained environments. ECC leverages the mathematics of elliptic curves for secure key exchange and digital signatures.

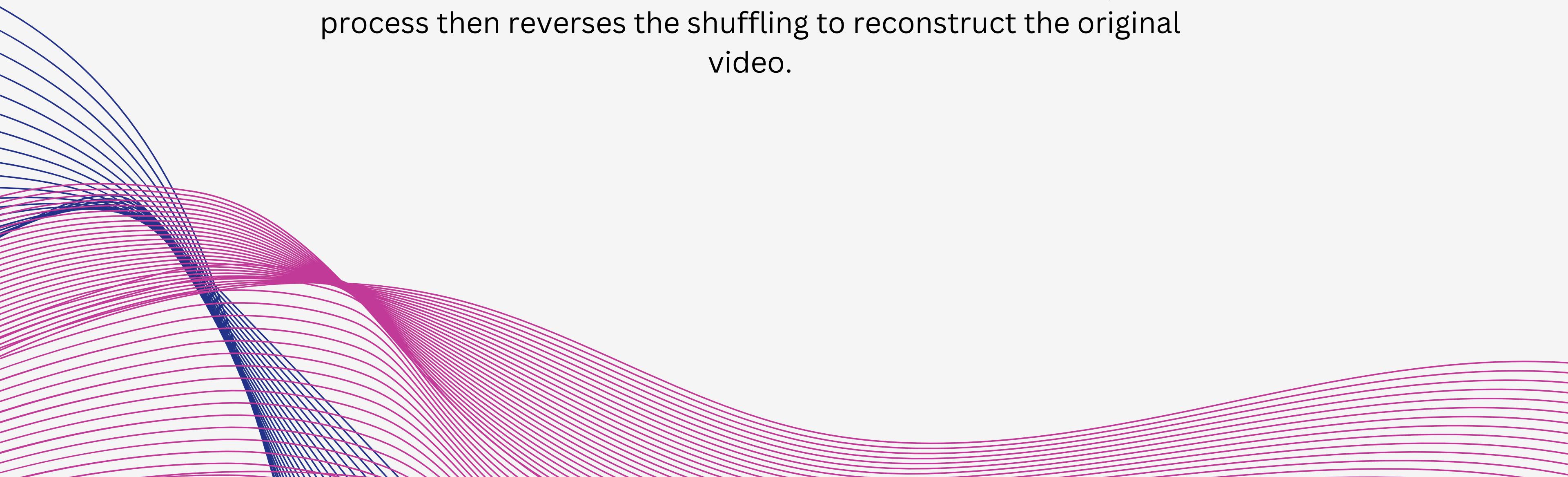
Triple DES (Data Encryption Standard):
Triple DES is a symmetric encryption algorithm that applies the DES encryption algorithm three times to increase security. It is commonly used in legacy systems and applications.

RSA (Rivest–Shamir–Adleman):
RSA is a widely used asymmetric encryption algorithm used for secure key exchange and digital signatures. It allows secure communication without the need for sharing a secret key and is commonly used in secure online transactions and certificate-based authentication.

Diffie-Hellman Key Exchange:
Diffie-Hellman is a key exchange protocol that allows two parties to establish a shared secret key over an insecure communication channel. It is often used as a component in encryption protocols to securely negotiate session keys between communicating parties.

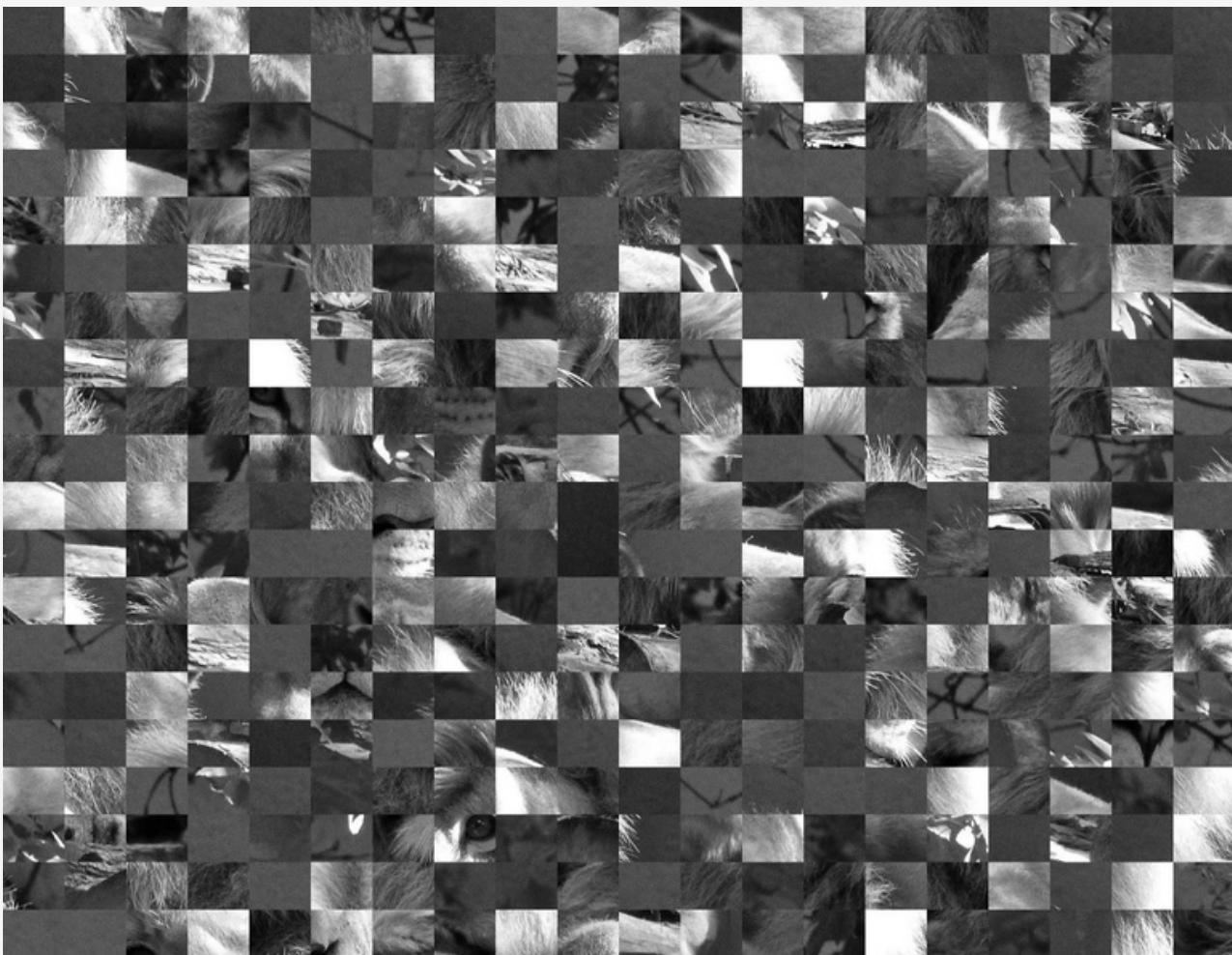
HOW ARE WE ENCRYPTING

The encryption technique we're using here involves breaking down the video frames into a grid of puzzle pieces, shuffling those pieces randomly, and then saving the order of shuffling as a permutation. This process creates an "encrypted" version of the video that appears as shuffled puzzle pieces. The decryption process then reverses the shuffling to reconstruct the original video.



ENCRYPTION

The "encrypt_video" function takes an input video file, divides it into puzzle pieces, shuffles them randomly, and saves the shuffled pieces to a new video file called "encrypted_video.mp4." It also stores the permutation used for shuffling in a pickle file named "encrypted_video_permutation.pkl" for future decryption.



DECRYPTION

The "decrypt_video" function reads the "encrypted_video.mp4" file and loads the permutation from the pickle file. It then rearranges the puzzle pieces in the video frames based on the permutation and creates a new video file called "decrypted_video.mp4." The decrypted video should be similar to the original video.



APPLYING THIS TO A VIDEO NOW

CONCLUSION

In conclusion, The project aims to design a secure wireless transmission system for long-distance video transmission from a thermal camera. It converts analog video to digital, encrypts the data, and transmits it securely through a wireless network, ensuring confidentiality. At the receiver's end, the data is decrypted and displayed for real-time monitoring and surveillance applications.

- Wired to Wireless
- Hardwares involved in Wireless Transmission
- Military Grade
- Wireless Transmission Process
- Encryption Process
- Various encryption Protocols
- How are we encrypting

The background features a dark blue gradient with a subtle radial effect. Overlaid on this are several sets of thin, light red lines forming complex geometric patterns. These include concentric circles, wavy lines, and a series of nested, chevron-like shapes that create a sense of depth and motion.

THANKYOU