Internex – Project summary

# Project Description

This project showcases a surveillance system where multiple clients stream their camera feeds to a central server over WiFi, with all feeds displayed in a grid layout. It uses the TCP protocol over WiFi for reliable, ordered transmission of video. To ensure smooth and stable playback, each client stream is managed by a custom dynamic buffer that adjusts its size based on the incoming frame rate. This adaptive buffering prevents stuttering and slow-motion playback by only displaying frames once a sufficient buffer threshold is reached.

# **Concepts Used**

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| **Socket Programming** | TCP sockets are used for real-time data transmission between client devices and the central server. |
| **Dynamic Buffering** | The server intelligently adapts each client’s buffer size based on the actual frame rate received, ensuring smooth playback regardless of network variability or client performance.  By using per-client buffers and only displaying frames when enough are queued, the system avoids stuttering and "slow motion" effects, providing a consistently fluid video experience. |
| **Image Processing** | OpenCV is used for encoding, decoding, resizing, annotating, and displaying video frames. |
| **Client-Server Architecture** | A centralized server receives camera feeds from distributed clients and renders them in a synchronized grid layout. |
| **Application layer** | custom protocol is implemented where each image frame is preceded by a 2-byte header indicating the frame size. |
| **Transport layer** | The project uses TCP for reliable and ordered delivery of video frames, ensuring no frames are dropped or out-of-sequence. |
| **IP Addresing** | The server displays the IP address of each connected client on its video tile to 0identify sources. Connection logs and slot allocation are based on client IP addresses. |

# **Sensors Used**

Each client device uses a built-in camera sensor for video capture and a WiFi module to transmit the captured frames to the server over a local network. Thus, the system relies on:

* Camera sensor (e.g., laptop webcam or phone camera)
* WiFi module (used as a network sensor for communication)