

Remotely Controlled Car via LTE/Wi-Fi

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PROBLEM

- Professionals must enter dangerous environments just to gather information
- Existing robotic systems are expensive and complex
- Communication links are often unreliable or high-latency
- Limited real-time feedback reduces decision-making ability

OBJECTIVE

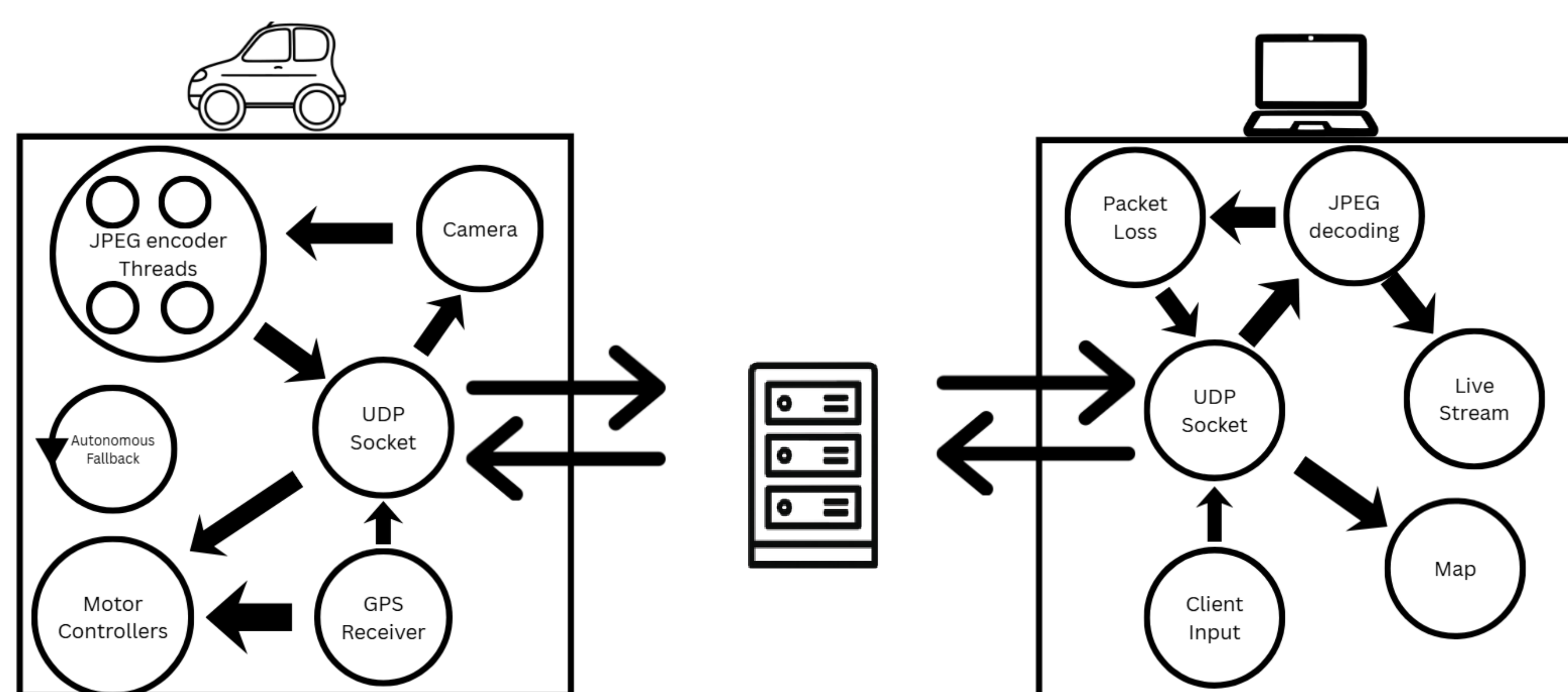
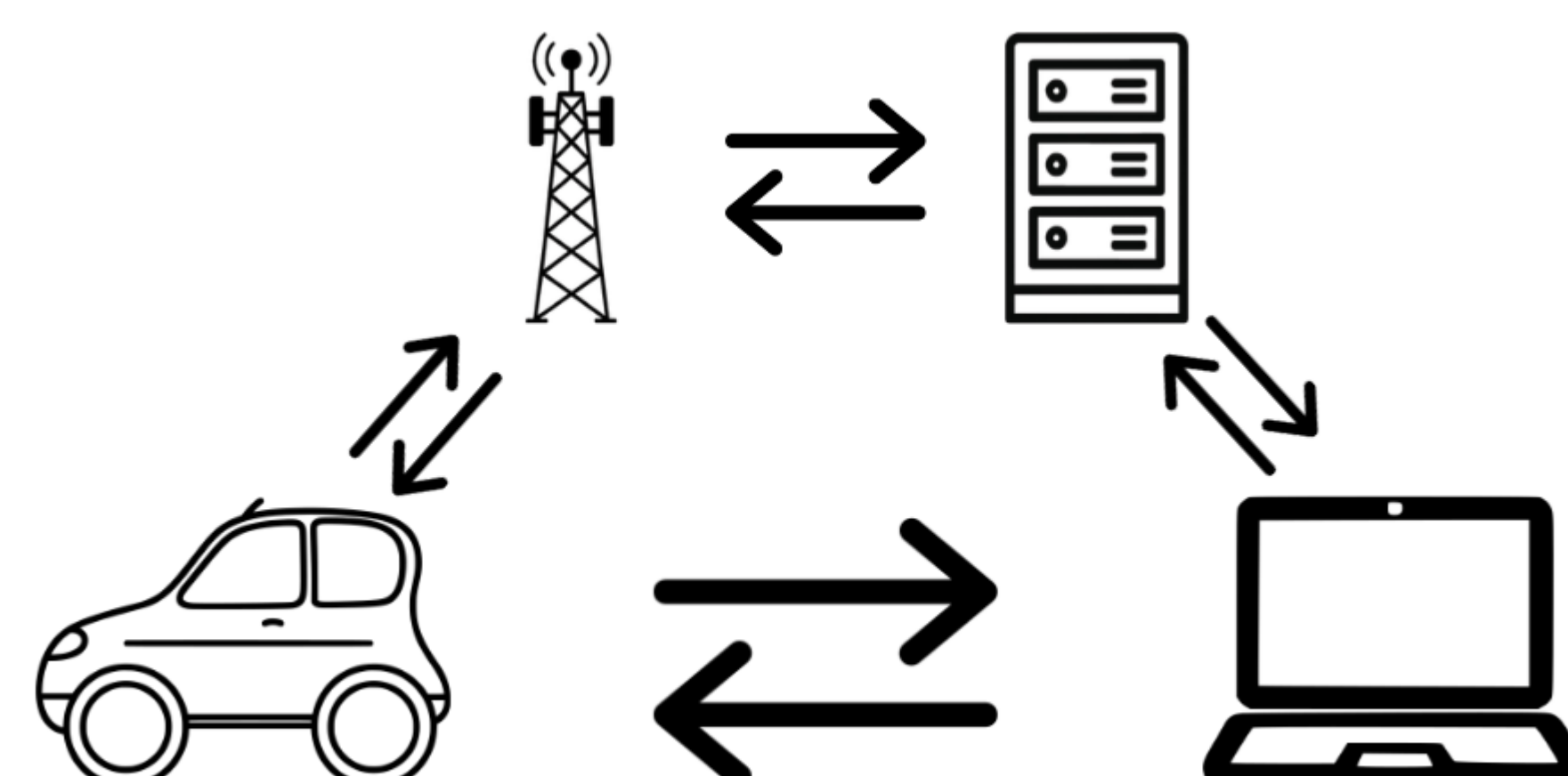
- Develop a secure, low-latency remote-controlled rover
- Enable real-time video and control over Wi-Fi and LTE
- Improve safety and situational awareness in hazardous environments

KEY IDEA

- Custom UDP-based low-latency streaming pipeline
- Automatic Wi-Fi ↔ LTE failover
- Integrated telemetry and navigation for operator awareness

APPLICATIONS

- Reconnaissance operations for fires or threat assessment
- Hazardous site inspection
- Search and rescue operations
- Security patrolling



HOW IT WORKS

- Camera captures and encodes frames
- Frames are transmitted via UDP and streamed to the client
- Client decodes and displays video with real-time telemetry
- User inputs generate control commands
- Control commands are sent back to the rover for real-time vehicle control

KEY FEATURES

- Bidirectional communication
- GPS navigation and autonomous navigation on communication loss
- Web based architecture to allow compatibility with many devices including phones, laptops, and tablets
- Adaptive communication over Wi-Fi and LTE

ARCHITECTURE

- Distributed client-server system
- UDP-based communication for low-latency streaming
- Modular design: video, networking, UI, and control subsystems
- Cross-platform system

CHALLENGES

- Maintaining low latency (<250 ms) over unreliable networks
- Handling packet loss, jitter, and reordering over UDP
- Implementing secure communication and replay protection
- Autonomous GPS navigation

RESULTS

- Real-time UDP communication with encryption between rover and client
- Functional UI with many features

FUTURE WORK

- Improve video streaming pipeline and compression
- Extend system to support more devices like drones, robotic arms, and various systems