Project Interview:

Rolling Reality: Leveraging Rolling Shutter Effects in Photography for

Privacy-Protected Human-Computer Interfaces

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**Project Proposal:** <https://mediasite-cecs.umd.umich.edu/Mediasite/Play/0c5469b3fc4e43f98f48284f2ee8972b1d>

**Interview:** *Tuesday, September 10th, 2024 @ 2pm - 2:30pm @ ZOOM*

# Interview Questions

### **Technical Implementation**

1. **Technology Stack:**
   * What technologies and tools will be essential for building this human-computer interface? Beyond rolling shutter cameras and LED gloves, will any specialized hardware be needed?
   * Which programming languages, libraries, or frameworks (e.g., Python, TensorFlow, OpenCV) do you plan to use?
2. **Machine Learning Integration:**
   * Will machine learning be used for gesture recognition and prediction? If so, which models (e.g., neural networks, reinforcement learning) do you plan to implement?
   * How will you collect and preprocess training data to optimize gesture recognition accuracy?
3. **Algorithm Design:**
   * What algorithms will be used for trajectory generation and prediction? Will these be custom-developed or based on existing models?
   * How will you manage the computational demands of real-time gesture detection while maintaining energy efficiency in IoT and wearable devices?
4. **Hardware Requirements:**
   * What additional hardware components, beyond the cameras and gloves, will be critical to the system's performance? Will specific sensors, processors, or communication modules be needed?
   * How will you manage the power consumption of the LED gloves to ensure consistent performance over extended use?
5. **Data Processing:**
   * Will data processing be handled on-device (edge computing) or offloaded to the cloud? What are the trade-offs between latency, privacy, and energy consumption?
   * How will the system handle real-time data processing without sacrificing performance? Are there specific optimization techniques you will implement?

### **Project Development and Challenges**

1. **Prototyping and Testing:**
   * What is your approach to building initial prototypes? What key milestones do you envision, such as proof of concept or meeting accuracy benchmarks?
   * How will you test the system in real-world scenarios? Will user studies be part of the validation process, and how will you define success?
2. **Algorithmic Challenges:**
   * How will you address distortions caused by rolling shutter cameras in gesture recognition algorithms?
   * What filtering or signal processing techniques will you use to capture LED glove signals accurately, minimizing interference from ambient light or noise?
3. **ML Model Development:**
   * How will you train machine learning models to adapt to different users' hand gestures? Will you need a large, diverse dataset, and how will you manage potential biases?
   * Will reinforcement learning or self-learning algorithms be used to improve the system over time through user interactions?
4. **System Integration:**
   * How will the rolling shutter cameras and LED gloves communicate with each other and other IoT devices? Will specific communication protocols (e.g., Bluetooth, Wi-Fi) be used?
   * How will you synchronize the gloves and cameras to ensure accurate gesture recognition, especially in dynamic environments?
5. **Deployment and Scalability:**
   * What challenges do you anticipate in scaling this technology for different applications, such as AR/VR environments or digital health?
   * How will the system’s design accommodate future upgrades, such as adding new gestures or features?

### **Specific Project Considerations**

1. **Generative AI in HCI:**
   * Can this project be developed using DALL-E for image generation and ChatGPT for writing machine instructions without traditional programming languages (e.g., C#) or UX design tools (e.g., Adobe XD)?
2. **Assistive Technology:**
   * How could this technology help people with Parkinson's disease who struggle with precision in touch interactions? How would the system predict and adjust for unintentional movements?
3. **Glove Design:**
   * What considerations will guide the design of the gloves for this project? Will they be wireless or wired, and how will you ensure they are both comfortable and functional?
4. **Internet Connectivity:**
   * Should this system require an internet connection to use APIs like ChatGPT, or would a pre-trained model be installed locally to function offline?

### **Educational and Background Questions**

1. **Educational Preparation:**
   * As a professor, what courses would you recommend we take to build a solid foundation for this project? If formal classes aren't possible, what topics should we self-study?
2. **Project Motivation:**
   * What aspects of your academic and professional background led you to propose this project? How did your experiences shape your interest in this area?
3. **Influences and Inspirations:**
   * What existing projects or research inspired this proposal? Are there specific innovations or breakthroughs that guided your approach?

### **Long-Term Vision and Impact**

1. **Project Outcomes:**
   * If the project succeeds, what would the hardware requirements look like for large-scale deployment in consumer or healthcare products?
   * What software requirements would you anticipate? Would specialized development be necessary, or could existing platforms and tools be leveraged?
2. **Challenges and Difficulties:**
   * As a software engineering major without an introduction to AI, how challenging will this project be? What areas might be particularly difficult?
3. **Return on Investment:**
   * What is the expected return on time and effort if this project succeeds? What impact do you foresee on HCI, healthcare, or other fields?
4. **Dealing with Rolling Shutter Effects:**
   * How will you address the distortions caused by rolling shutter cameras when capturing fast-moving objects? What methods will be used to minimize or eliminate these effects?