

Requirement Analysis

Gesture-Based Cursor Control and Drawing System Using Hand Tracking

Objective:

To develop a **Software Requirements Specification (SRS)** document for the proposed project titled “**Gesture-Based Cursor Control and Drawing System Using Hand Tracking.**”

The objective of this requirement analysis is to:

- Identify and define all **functional requirements** that describe how the system should operate, such as cursor control, clicking, drawing, and gesture switching.
- Specify the **non-functional requirements** that describe the quality attributes of the system, including performance, usability, compatibility, and accuracy.
- Outline all **project development constraints**, such as tool usage, hardware limitations, and development schedule.
- Ensure that each requirement is **prioritized, quantifiable, and appropriately leveled** to guide successful implementation and evaluation of the system.

This SRS will serve as a blueprint for developers, testers, and stakeholders throughout the software development life cycle of the gesture-controlled system.

Tools/ Device: SRS Template

Procedure:

Functional Requirements

ID	Requirement Description	Priority	Precondition	Cross-reference
1.1	The system shall track the user's hand in real-time using a webcam.	High	Webcam connected	4.1, 7.2
1.2	The system shall map hand position to cursor movement on the screen.	High	Hand detected	4.2
1.3	The system shall detect a "pinch" gesture to perform a left mouse click.	High	Hand tracked	4.3
1.4	The system shall detect a different gesture (e.g., open palm) for right mouse click.	Medium	Gesture module active	4.4
1.5	The system shall allow vertical finger motion to trigger scrolling.	Medium	Two fingers extended	4.5
1.6	The system shall allow the user to enter drawing mode by using a specific gesture (e.g., index finger only).	High	Drawing gesture shown	5.1

ID	Requirement Description	Priority	Precondition	Cross-reference
1.7	The system shall render drawing trails based on fingertip position in drawing mode.	High	Drawing mode active	5.2
1.8	The system shall provide a toggle (gesture or button) to switch between navigation and drawing mode.	Medium	System initialized	5.3
1.9	The system shall give real-time visual feedback on gesture detection using overlays.	Medium	Webcam enabled	6.1
1.10	The system shall allow users to reset or recalibrate hand tracking if misalignment occurs.	Low	Calibration request made	6.2

Non-Functional Requirements

ID	Requirement Description	Priority	Quantifiable Measure
1	The system should respond to gestures with less than 0.5 seconds latency.	High	Response time $\leq 0.5s$
2	The system must work with any webcam having at least 720p resolution.	High	Compatible webcam required
3	The interface must be simple enough that a new user can operate it with 5 minutes of training.	Medium	Training time ≤ 5 mins
4	The system must operate smoothly at 30 FPS under normal lighting.	Medium	Frame rate ≥ 30 FPS
5	The software shall run on systems with minimum 4GB RAM and 2GHz processor.	Medium	Hardware spec
6	The software shall not exceed 200MB in storage.	Low	App size $\leq 200MB$
7	The software should run on Windows and Linux OS.	Medium	OS compatibility
8	The system shall maintain 90% gesture recognition accuracy.	High	Recognition accuracy $\geq 90\%$

Project Requirements (Constraints)

ID	Requirement Description	Priority	Development Phase/Week
1	Use of Python as the development language.	High	Week 1
2	Use of OpenCV and MediaPipe for image and gesture recognition.	High	Week 2–3

ID	Requirement Description	Priority	Development Phase/Week
3	All development must be tested using a standard 720p webcam.	High	Week 3–4
4	Drawing UI must be created using OpenCV canvas methods.	Medium	Week 4
5	Testing must be performed under different lighting conditions.	Medium	Week 5
6	User testing with at least 3 target users must be completed.	High	Week 6
7	Documentation must follow IEEE SRS standards.	Medium	Week 6–7
8	The system must be demonstrable on a mid-range laptop.	Medium	Week 7
9	Use GitHub for version control and collaboration.	Low	Week 1–7

Evaluation:

The functional requirements describe the key operations the system will perform, such as gesture-based cursor movement, drawing, clicking, and mode switching.

They are organized based on use cases and grouped under specific feature categories like movement, interaction, and feedback.

Each requirement is labeled with a priority level: High, Medium, or Low.

2. The non-functional requirements reflect performance, usability, compatibility, and responsiveness of the software.

Several requirements (e.g., response time under 0.5 seconds, webcam compatibility) include measurable performance indicators.

They are prioritized to reflect development and user experience focus.

3. The constraints and project requirements are clearly stated, including the use of specific tools (OpenCV, MediaPipe), hardware, and timeline limitations.