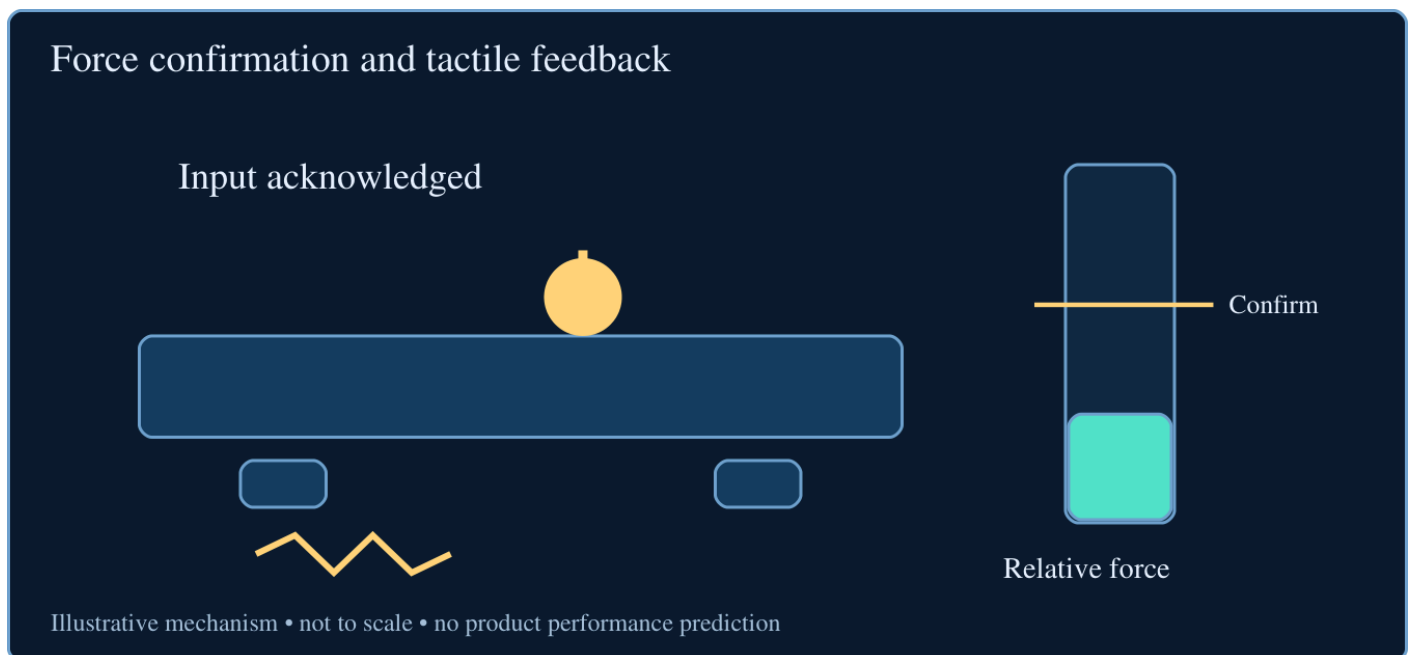


Force sensing, haptics and touchless extensions

Chapter 11 | Reading 1 of 3



Force is an additional measurement

A product can measure applied force using changes in resistance, capacitance, strain or a mechanical sensor arrangement. Some designs infer location from distributed force; others combine force measurement with a separate position sensor.

For a simple static panel on supports, total applied normal force is approximately the sum of support reactions after tare. A force centroid can be inferred from force moments under ideal conditions. Preload, mounting friction, multiple contacts and acceleration complicate that model.

Our animation is a one-contact teaching model. It illustrates a confirmation threshold, not a universal force-to-coordinate algorithm or a qualified safety function.

Force sensing, haptics and touchless extensions

Chapter 11 | Reading 2 of 3

Haptics is an output

A vibration actuator or piezoelectric element can provide tactile feedback after a recognized input. Feedback timing and strength influence whether the interface feels responsive. The haptic pulse confirms what the software decided; it does not prove that the intended command was selected.

Ultraleap also demonstrates mid-air tactile sensation using focused ultrasound. This is a different feedback mechanism, typically paired with a separate way to locate the user's hand. Touchless selection changes interaction geometry and accidental-activation risks.

For gloves or vehicle vibration, test whether the user can perceive and distinguish the intended feedback. An actuator that is obvious on a desk may be hard to recognize in service.

Force sensing, haptics and touchless extensions

Chapter 11 | Reading 3 of 3

Deliberate actuation without new confusion

Separate highlight, selection and execution in the user-interface definition. An illustrative sequence is: locate a contact, highlight a target, cross a defined force or confirmation condition, execute, then acknowledge. Specify cancellation and release behavior.

Do not add a hard press merely because a sensor supports it. It may increase fatigue or make operation in motion harder. Compare it against a second confirmation step or a tactile physical control for the same task.

Validate end-to-end behavior during repeated presses, long holds, interrupted power and missed feedback. Include users with different hand strength and reach.

Apply the idea

A haptic click is felt but the commanded system does not change state. Has the command succeeded?

Discussion: Not necessarily. The pulse may acknowledge only input recognition. The interface must distinguish touch acceptance, command transmission and confirmed system state.

References:

S15 Ultraleap - [Focused-ultrasound haptics](#)