Turn Any Computer Screen into a Gesture-Assisted Touch Screen Using a Leap Motion Controller

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Background

Current Desktop Environment

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Enhance Human-Computer Interaction (HCI)

How?

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LEAP MOTION
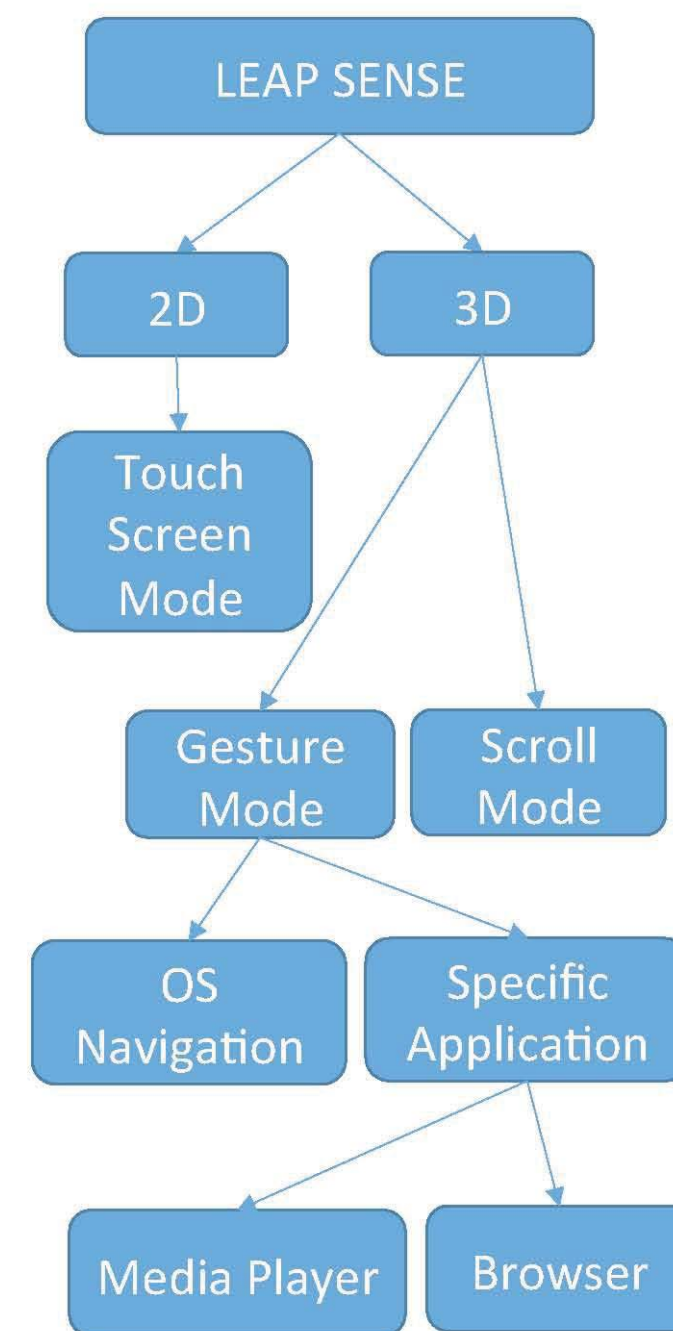
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Touch Screen

+

Interactive Gestures

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LEAP SENSE

Objectives

- Enhance Human-Computer Interaction (HCI)
- Introduce new and innovative way to interact with computers
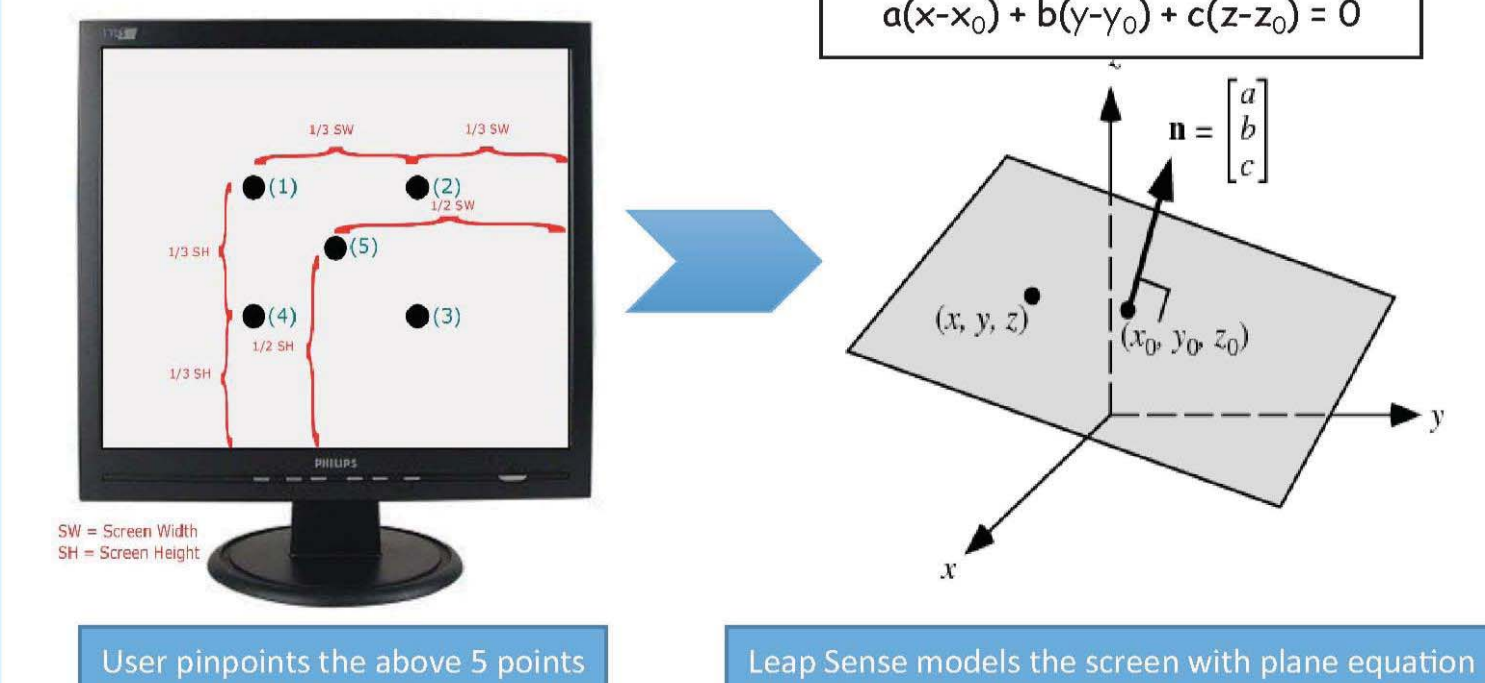- Enable touch screen setup anywhere and anytime
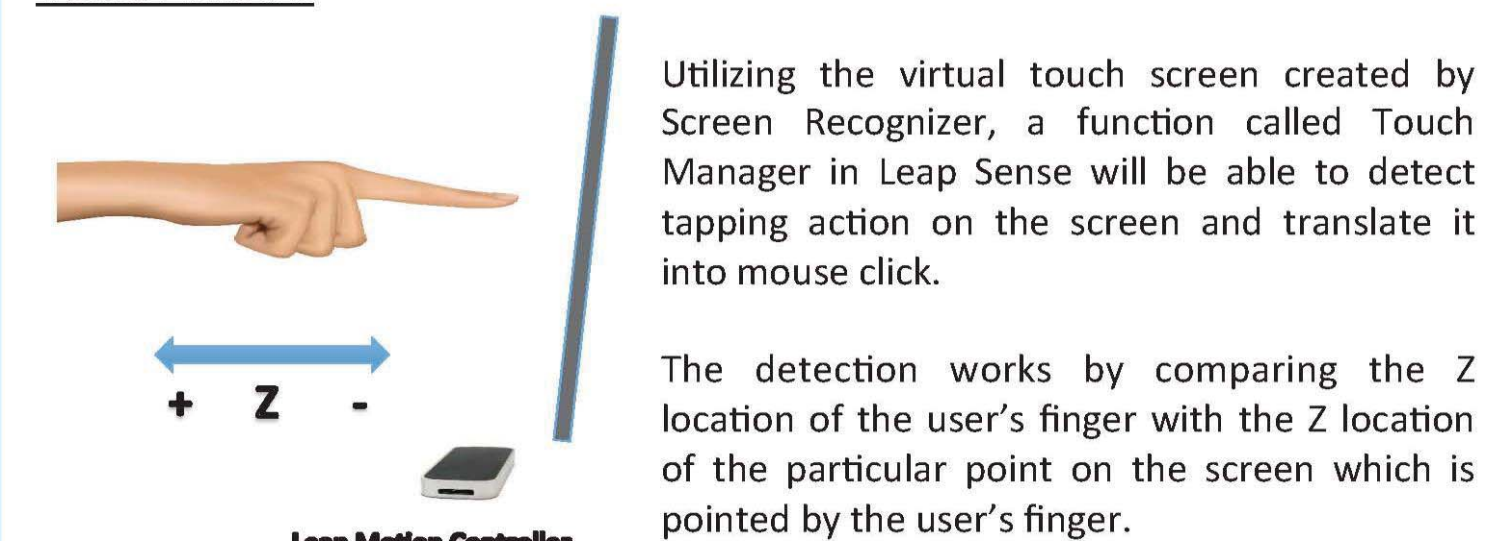
Design

LEAP SENSE
- 2D
  - Touch Screen Mode
- 3D
  - Gesture Mode
  - Scroll Mode
  - OS Navigation
  - Specific Application
    - Media Player
    - Browser

Implementation in 2D Space
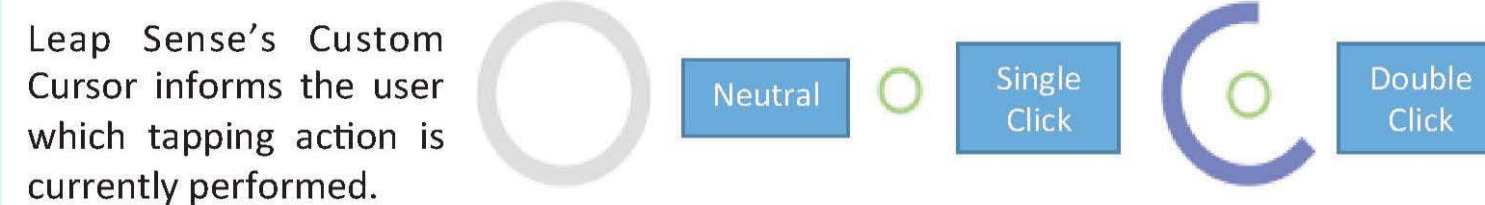
Screen Recognizer

By pinpointing 5 determined points on the screen, Screen Recognizer function in Leap Sense will be able to recognize the screen width, screen height, and also its coordinate in Leap Motion Controller coordinate system. With all of these information, Leap Sense will be able to model the screen with plane equation and build a virtual touch screen!

$$a(x-x_0) + b(y-y_0) + c(z-z_0) = 0$$

$$n = \begin{bmatrix} a \\ b \\ c \end{bmatrix}$$

SW = Screen Width
SH = Screen Height

| User pinpoints the above 5 points | Leap Sense models the screen with plane equation |

Touch Mode

Utilizing the virtual touch screen created by Screen Recognizer, a function called Touch Manager in Leap Sense will be able to detect tapping action on the screen and translate it into mouse click.

+ Z -

Leap Motion Controller

The detection works by comparing the Z location of the user's finger with the Z location of the particular point on the screen which is pointed by the user's finger.

Depending on the duration of the tap, Touch Manager could translate the tapping action into single left mouse click or double left mouse click.

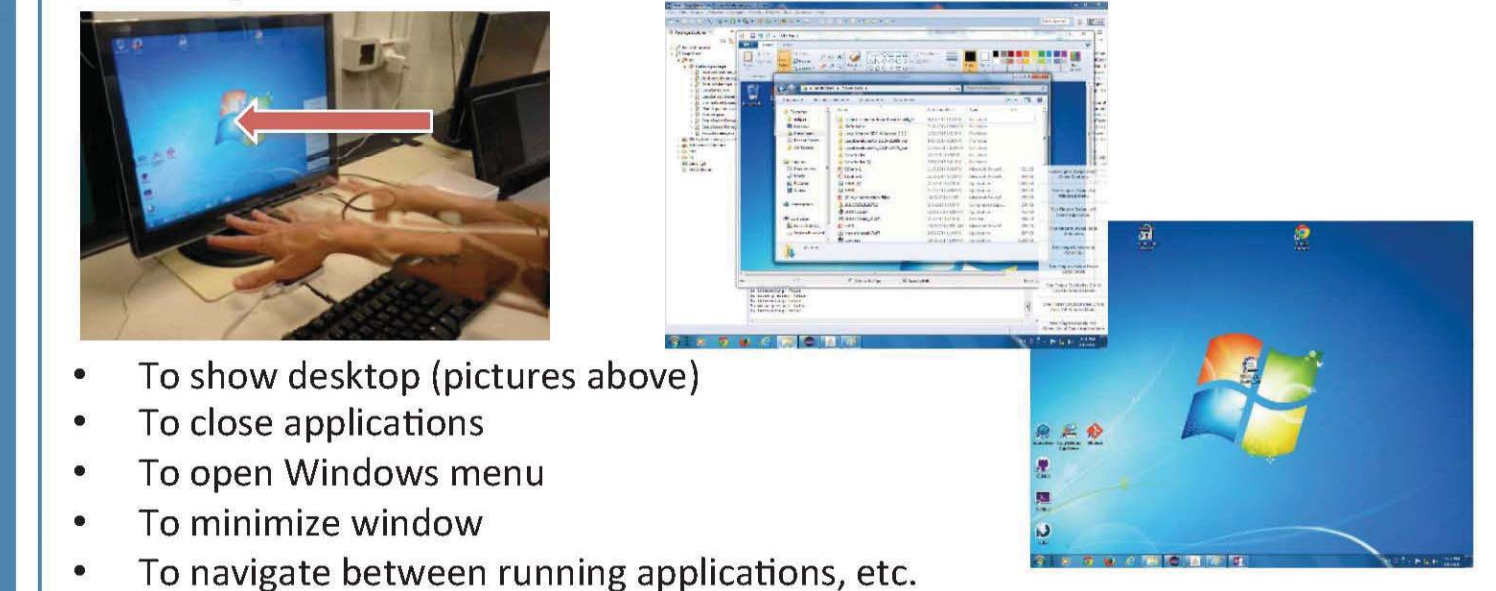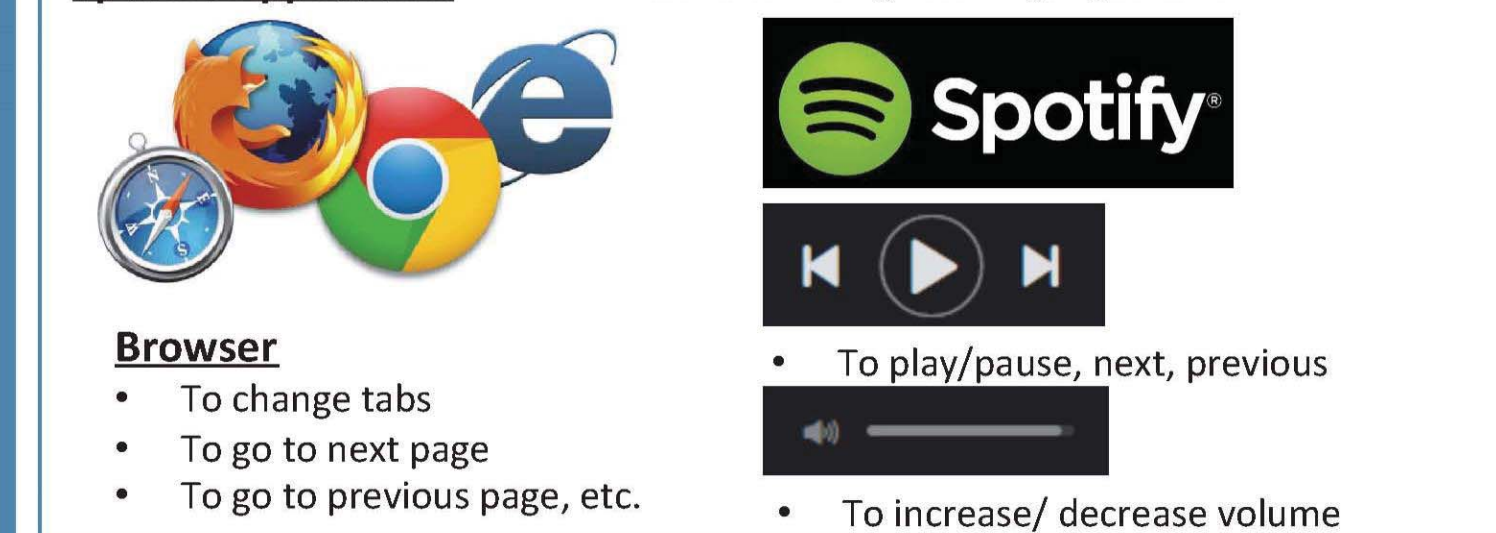Leap Sense's Custom Cursor informs the user which tapping action is currently performed.

| Neutral | Single Click | Double Click |

Implementation in 3D Space

Gesture Mode

Identified by this cursor's shape:

OS Navigation → Controlled using five-finger gestures

- To show desktop (pictures above)
- To close applications
- To open Windows menu
- To minimize window
- To navigate between running applications, etc.

Specific Application → Controlled using one-finger gestures

Spotify

Browser
- To change tabs
- To go to next page
- To go to previous page, etc.

- To play/pause, next, previous
- To increase/ decrease volume

Scroll Mode

Allow user to scroll up and down mimicking the usage of mouse wheel. Scroll Mode is identified with the following cursor's shape:

| Neutral | Scroll Up | Scroll Down |

Conclusion

This project takes the challenge of combining both touch screen and motion detection technology to enhance human computer interaction by creating Leap Sense, an application that has the ability to turn any computer screen into gesture-assisted touch screen.