Transforming Projector Screens into Interactive Smart-Boards Using Microsoft's Xbox Kinect.

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Abstract

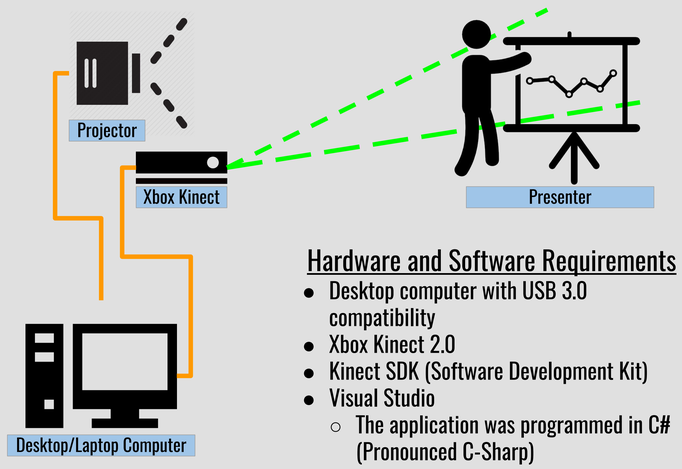
Smartboards add numerous benefits to the classroom environment that significantly facilitate learning and teaching; however, smart-boards are with many shortcomings. Some of these shortcomings include cost, requirement of electronic pens and limited instructor participation. The current project used an Xbox Kinect, which is a highly advanced motion sensing camera, to detect human body movements and execute certain tasks on a regular classroom projector screen. By leveraging such technology we can transform projector screens into interactive smart-boards, that are controlled just by the human body.

Regular Smart-board	Kinect Smart-board
Cost: Approximately $2500	Cost: $99
Extra Software Required for Full Capabilities	No Additional Software Required
Electronic Pen Required	No Electronic Pen; Everything Gesture Based
Low Instructor Participation	High Instructor Participation

Objective

The current project "hacked" into an Xbox Kinect to enable a user to control a PowerPoint presentation using body gestures. This is possible as the Kinect detects gestures, and was programmed to execute certain tasks based on those gestures. Some compatibilities include moving through slides, controlling the on-screen mouse, and writing on the presentation.

System Setup



Hardware and Software Requirements

- Desktop computer with USB 3.0 compatibility
- Xbox Kinect 2.0
- Kinect SDK (Software Development Kit)
- Visual Studio
  - The application was programmed in C# (Pronounced C-Sharp)

Gestures

Some gestures that were programmed to control the application.

- Change Slides
  - Right hand moves forward
  - Left hand moves back

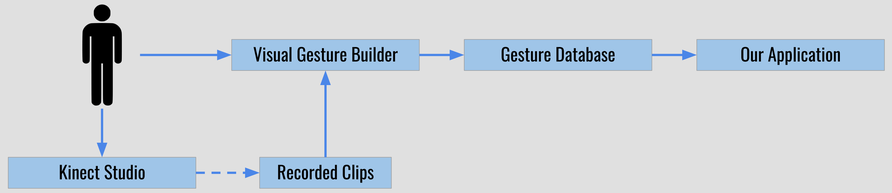
- Summons mouse-cursor
  - Each time this gesture is performed, the user toggles between controlling the mouse and not.

- Controls mouse-cursor
  - Once the mouse-cursor is summoned (above gesture), the user controls it with his/her right hand

- Toggle between pen modes
  - The following modes are available...
    - Cursor
    - Pen
    - Lazer

Visual Gesture Builder

- Microsoft's Xbox Kinect SDK (Software Development Kit) includes a 'Visual Gesture Builder' application.
- We were able to record any gesture as required and use those recordings in our C# program.
- The Gesture Builder used a machine learning model to predict if a gesture is performed or not; therefore, the more data of gesture recordings we had, the smoother the application ran.



Challenges and Future Work

- Limited development documentation for Kinect 2.0
- Add additional features such as changing color, pen size and dominant hand writing
- "Flipped Issue": The Kinect cannot distinguish when the user is facing forward or backwards.
  - This makes writing on the board complicated
- Enable touch sensor capabilities
  - To do this, we need to somehow make the Kinect detect the dimensions of the projector screen
- Expand to other desktop applications, such as Microsoft word, Excel and even general maneuvering on a computer screen.

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