# Revision History

<table>
<thead>
<tr>
<th>Number</th>
<th>Date</th>
<th>Reason</th>
<th>Version</th>
<th>Author</th>
</tr>
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<tr>
<td>1</td>
<td>2013.2</td>
<td>First manual for HandGKET</td>
<td>0.9</td>
<td>Myoung-Kyu Sohn</td>
</tr>
<tr>
<td>2</td>
<td>2013.3</td>
<td>Working on OpenNI2 &amp; NiTE2</td>
<td>0.9.1</td>
<td>Myoung-Kyu Sohn</td>
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<td>3</td>
<td>2013.4</td>
<td>Support dual monitor in mouse control</td>
<td>0.9.2</td>
<td>Myoung-Kyu Sohn</td>
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<tr>
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1. SUMMARY

1.1. SUMMARY

This toolkit facilitates integration of hand gesture control with games and PC applications. This middleware recognizes user's hand gestures and generates keyboard or mouse events to control applications in your computer. This toolkit operates on 3D cameras which support the OpenNI framework. This tool is free to use and distribute for noncommercial purposes (for commercial uses, please contact us: smkzzang@gmail.com). This work was built under inspiration of FAAST.

1.2. DEMO

- Need for Speed - Hot pursuit game
- **PC & XBMC Control**
2. QUICK START

Quick Start
If you already have set your environment for using OpenNI & NiTE, follow the instructions.

1. Run HandGKET.exe
2. Make your application be the topmost position
3. Do hand gesture
   - Wave or push your hand (Information window shows 🖐️ ⇒ 🖐️)
   - Wait until system ready (Information window shows 🖐️ ⇒ 🖐️)
   - Make a gesture (Information window shows 🖐️ ⇒ 🖐️)

Defined gesture & Gesture Basics
HandGKET has six basic gestures for one-hand mode. Every gesture must turn back to the starting position of the gesture.

Gesture to Key mapping
The gesture_event.txt file defines a mapping from gesture to key event. For example, the following script shows syntax of the file for controlling XBMC. Right hand gesture(HAND_RIGHT) and the corresponding key event, key(VK_RIGHT) are registered in the third line of the script. The threshold value means the size of the gesture in centimeter. The corresponding key event will be generated if the size of the gesture is greater than the threshold.
<table>
<thead>
<tr>
<th>#</th>
<th>GESTURE</th>
<th>TRHESHOLD</th>
<th>EVENT_TYPE</th>
<th>KEY_TO_GENERATE</th>
<th>KEY_TO_RELEASE</th>
<th>PARAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HAND_LEFT</td>
<td>5</td>
<td>KEY_CLICK</td>
<td>VK_LEFT</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>HAND_LEFT</td>
<td>25</td>
<td>KEY_CLICK</td>
<td>M</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>HAND_RIGHT</td>
<td>5</td>
<td>KEY_CLICK</td>
<td>VK_RIGHT</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>HAND_RIGHT</td>
<td>25</td>
<td>KEY_CLICK</td>
<td>VK_BACK,X</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>HAND_UP</td>
<td>5</td>
<td>KEY_CLICK</td>
<td>VK_UP</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>HAND_DOWN</td>
<td>5</td>
<td>KEY_CLICK</td>
<td>VK_DOWN</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>HAND_PUSH</td>
<td>10</td>
<td>KEY_CLICK</td>
<td>VK_RETURN</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

※XBMC : XBMC is an award-winning free and open source (GPL) software media player and entertainment hub for digital media (http://xbmc.org)
3. INSTALLATION

3.1. SYSTEM REQUIREMENTS

Hardware
- Operating system : Windows 7
- Depth Camera : MS Kinect, ASUS Xtion pro

Software
- OpenNI 2.1 & NiTE 2.0 (32bit or 64bit)
- Sensor driver

3.2. INSTALLATION

To use HandGKET, you will need to download and install the following software:

1. OpenNI 2.1 for Windows
2. PrimeSense NiTE 2.0 for Windows
3. MS Kinect for Windows SDK v1.7 or MS Kinect for Windows Runtime v1.7

Make sure that examples of NiTE run well after the installation.

3.3. SETTINGS

To use two-hand mode, uncomment each line of the following file to enable two hands detection (delete the first character, ";" in each line)

C:\Program Files (x86)\PrimeSense\NiTE2\Redist\NiTE2\HandAlgorithms.ini
(default installation directory, it can be different according to your system or installation)
4. USAGE

4.1. OPERATION MODE

HandGKET supports three operation modes as follows:

<table>
<thead>
<tr>
<th></th>
<th>Gesture mode</th>
<th>One-hand</th>
<th>Two-hand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keyboard</td>
<td>O</td>
<td>O</td>
<td></td>
</tr>
<tr>
<td>Mouse</td>
<td>O</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

One-hand mode has six basic gestures and two-hand mode has ten basic gestures separately. The gestures in each gesture mode are shown in section 4.2.

In one-hand mode, you can choose keyboard or mouse mode in the configuration script before starting HandGKET. You can also change the event mode during run-time by using \texttt{TOGGLE\_MODE} keyword. Following script is an example for changing mode – The toolkit starts with \texttt{KEYBOARD\_MODE} and the mode toggles by \texttt{TWO\_HANDS\_UP} gesture during execution.

```plaintext
# GESTURE TRHESHOLD EVENT_TYPE KEY_TO_GENERATE KEY_TO_RELEASE PARAM
FEEDBACK_SOUND BEEP
FEEDBACK_WINDOW WINDOW4
ONE_HAND_MODE KEYBOARD_MODE

# two-hand gestures (for keyboard)
TWO_HANDS_UP 10 KEY_TOGGLE TOGGLE_MODE 0 0
```

4.2. GESTURES
Gesture Basics
Every gesture must turn back to the starting position of the gesture in one-hand mode. But gesture doesn’t need to be back directly in two-hand mode.

![Example of hand gesture in one-hand mode]

Gestures for one-hand mode
HandGKET support six gestures basically, but you can extend the number of gesture by setting different threshold for the same gesture.

![Basic gestures]

In the following example, there are two HAND_RIGHT gestures registered with different threshold. If the size of HAND_RIGHT gesture you perform is between 5cm and 25cm, VK_RIGHT key event will occur. But if the size of HAND_RIGHT gesture you perform is greater than 25cm, VK_BACK and X key event will occur.
Gestures for two-hand mode

Two-hand mode supports following gestures.

- TWO_HANDS_PUSH
- TWO_HANDS_BACK
- TWO_HANDS_UP
- TWO_HANDS_DOWN
- TWO_HANDS_OPEN
- TWO_HANDS_CLOSE
- LEFT_HAND_PUSH
- RIGHT_HAND_PUSH
- TURN_LEFT
- TURN_RIGHT

4.3. HOW TO USE

One-hand mode (keyboard mode)
Make sure HandGKET.exe is running and your application that you want to control is topmost position. Then, follow the steps below.

1. Wave or push your hand (Information window $\rightarrow$)
2. Wait until system ready (Information window shows $\rightarrow$)
3. Make a gesture (Information window shows $\rightarrow$)

**One-hand mode (mouse mode)**

Make sure HandGKET.exe is running and your application that you want to control is topmost position. Then, follow the steps below.

1. Wave or push your hand (Information window shows $\rightarrow$)
   Move your hand to move the mouse position
2. Wait until system ready to mouse click (Information window shows $\rightarrow$)
3. Make a gesture (Information window shows $\rightarrow$)

Gestures for clicking mouse button are the same as gestures used in keyboard. But you should wait threshold time (threshold in HAND_HOLD gesture) to start a gesture.

< Default mapping from gesture to mouse event >
Two-hand mode (keyboard mode)

Make sure HandGKET.exe is running and your application that you want to control is topmost position. Then, follow the steps below

1. Wave or push your hands (Information window shows 👋 → 👋)
2. Wait until system ready (Information window shows 👋 → 👋)
3. Make a gesture (Information window shows 👋 → 👋)

In the step 2, you need to perform an initialization pose to get a reference position of the two hands. After setting the reference position, key event is occurred when position of the hand from the reference position is greater than the threshold. The following picture shows a depth image when the initialization pose has done.
4.4. INFORMATION WINDOW

<table>
<thead>
<tr>
<th>Mode</th>
<th>State</th>
<th>Waiting for system ready (Mouse move)</th>
<th>Waiting for gesture</th>
<th>Gesture is ongoing</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-hand</td>
<td>No hand</td>
<td>[hand]</td>
<td>[hand]</td>
<td>[hand]</td>
</tr>
<tr>
<td>(Keyboard mode)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>One-hand</td>
<td>Waiting</td>
<td>[hand]</td>
<td>[hand]</td>
<td>[hand]</td>
</tr>
<tr>
<td>(Mouse mode)</td>
<td>for gesture</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Two-hand</td>
<td>Waiting</td>
<td>[hand]</td>
<td>[hand]</td>
<td>[hand]</td>
</tr>
<tr>
<td></td>
<td>Gesture is</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>ongoing</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.5. CONFIGURATION FILE

The gesture_event.txt file defines a mapping from gesture to key event.

ENVIRONMENT SETTING (Optional)

- **FEEDBACK_SOUND**  BEEP
  System makes a beep sound when gesture state has changed
- **FEEDBACK_WINDOW**  WINDOWS5
  It shows the information window at the bottom-right of the screen
  (WINDOW1: top-left, WINDOW2: top-right, WINDOW3: bottom-left, WINDOW4: bottom-right, WINDOW5: center. WINDOW5 is default)
- **ONE_HAND_MODE**  KEYBOARD_MODE
  It sets the starting event mode for one-hand gesture mode
  (KEYBOARD_MODE: keyboard event mode, MOUSE_MODE: mouse event mode)

SYNTAX

GESTURE  TRHESHOLD  EVENT_TYPE  KEY_TO_GENERATE  KEY_TO_RELEASE  PARAM
• **GESTURE**: the name of hand gesture
• **THRESHOLD**: the minimum threshold for activation (real distance in centimeter)
• **EVENT_TYPE**: the type of event (KEY_CLICK, KEY_TOGGLE etc.)
• **KEY_TO_GENERATE**: the specific key to be generated
• **KEY_TO_RELEASE**: the specific key to be released (experimental)
• **PARAM**: this varies by KEY

**GESTURE**
- Two hand gestures
  • TWO_HANDS_PUSH
  • TWO_HANDS_BACK
  • TWO_HANDS_UP
  • TWO_HANDS_DOWN
  • TWO_HANDS_OPEN
  • TWO_HANDS_CLOSE
  • LEFT_HAND_PUSH
  • RIGHT_HAND_PUSH
  • TURN_LEFT
  • TURN_RIGHT

- One hand gestures for keyboard mode
  • HAND_PUSH
  • HAND_BACK
  • HAND_LEFT
  • HAND_RIGHT
  • HAND_UP
  • HAND_DOWN

- One hand gestures for mouse mode
  • HAND_MOVE
    It is used for system. Don't change the parameters of this line
  • HAND_HOLD
    It is used for system. Don't change the parameters of this line except THRESHOLD. The threshold in millisecond means the waiting time to start gesture for mouse button.
• ONE_HAND_PUSH
• ONE_HAND_BACK
• ONE_HAND_LEFT
• ONE_HAND_RIGHT
• ONE_HAND_UP
• ONE_HAND_DOWN

EVENT_TYPE
- keyboard event type
  • KEY_CLICK
    A key is pressed and released when a gesture is performed
  • KEY_TOGGLE
    A key is pressed when a gesture is performed first and the key is release when the gesture is performed again
  • KEY_MULTI_CLICK
    A key is clicked continuously while a gesture is on state, which means that your hand is away from the reference position. (PARAM : delay time(ms) of each click) (only supported in two-hand mode)
  • KEY_HOLD
    A key is pressed when a gesture is on state. The key is released when the gesture is finished, which means that all your hands returned back at the reference position. (only supported in two-hand mode)
- mouse event type
  • MOUSE_CLICK
    A mouse click event is generated when a gesture is performed
  • MOUSE_DOUBLE_CLICK
    A mouse double click event is generated when a gesture is performed
  • MOUSE_TOGGLE
    A mouse button is pressed when a gesture is performed and the mouse button is release when the gesture is performed again.
  • MOUSE_MOVE
    A mouse point is moving according to your hand movement (used for system)
**KEY_TO_GENERATE, KEY_TO_RELEASE**

- **keyboard keys**
  - VK_UP, VK_DOWN, VK_LEFT, VK_RIGHT, VK_CONTROL, VK_LCONTROL, VK_RCONTROL,
  - VK_RETURN, VK_ESCAPE, VK_SPACE, VK_SHIFT, VK_LSHIFT, VK_RSHIFT, VK_BACK
  - VK_TAB, VK_END, VK_HOME, VK_INSERT, VK_DELETE, VK_ADD, VK_SUBTRACK
  - VK_F1 ~ VKF12
  - a ~ z, A ~ Z, 0 ~ 1, etc.

- **mouse keys**
  - M_MOVE, M_NOMOVE (used for system)
  - M_LBUTTON, M_RBUTTON, M_MBUTTON

- **system keys**
  - CHANGE_MODE
    This change event mode. If you are in keyboard mode, it will change the mode to mouse mode and if you are in mouse mode, it will change the mode to keyboard mode.

**Syntax example**

- **TWO_HANDS_PUSH 20 KEY_HOLD VK_LSHIFT 0 0**
  : When user pushes two hands toward (20cm from the initial pose), the shift key is pressed and hold. The key is released when the gesture is finished.

- **ONE_HAND_UP 5 KEYCLICK VK_LWIN, VK_UP 0 0**
  : When user makes an up-gesture, the window key and up key are clicked in mouse mode(press and release).

- **HAND_RIGHT 25 KEYCLICK VK_BACK, X 0 0**
  : When user makes a right-gesture, the backspace key and ‘x’ key are clicked in keyboard mode(press and release).
5. KNOWN ISSUES

- Keyboard event could not be generated on some game using DirectX.