Project Report

Title:

Screen control using hand movements via Kinect

Group Name and members:

TEAM FRIDAY

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Background

It is well known that nowadays the technology industry has become one of the booming industries. No one is a stranger to technology now and with so many gadgets and electronic devices around us, we still lack technological advancement in remote-controlled devices. For instance, we rely on remote to control the television or sometimes mouse to operate laptops or PCs. However, this still has a scope of better user experience which can be done by Hand gesture recognition in which the actions on the device are merely done with some hand gestures from a distance and not done by any external device. Good user experience has always been one of the major goals of every tech company, as their major market relies upon the hand of people least exposed to complex technologies. For instance, there are a lot of devices used on a daily basis such as television, mobile phones, projectors which although have started giving good user experiences these days but it still has scope of improvement, that is in case of television, we still require an external device to operate it, completely dependent on that for a comfortable experience. Also, in the case of projectors, we still need to use the device used for projection on the screen or we need a projector remote and, in some cases, a wireless mouse is required. The projector remote has also some limitations in terms of its functionalities such as it can only control the slide change, play/pause the video or can

highlight anything by the laser beam being emitted from the remote. Other functionalities like scroll, zoom-in, zoom-out and volume are still difficult to control. Therefore, a better solution is required where a user can be in more control and not rely on anything else but themselves to scroll or operate other video-control related features which can be way more comfortable than anything else. Hence, in this project, we are trying to resolve the above-mentioned problem by using hand gesture recognition so that the user can have a seamless experience while changing the channels on television or surfing the internet or browsing the web.

To resolve the aforementioned issues, we will be using Microsoft Kinect Device version1 which is a motion sensor input device and one of the major advantages of using this device is that it doesn't require wearing any external sensor gloves in order to interact with any connected device. The device consists of three cameras in which one is InfraredProjector, Infrared camera, RGB camera. It can be used to recognize the hand skeleton which can further help to recognize some of the hand gestures mapped with different functionalities, for instance, by just moving the hand, the volume of the device it is connected can be increased or decreased.

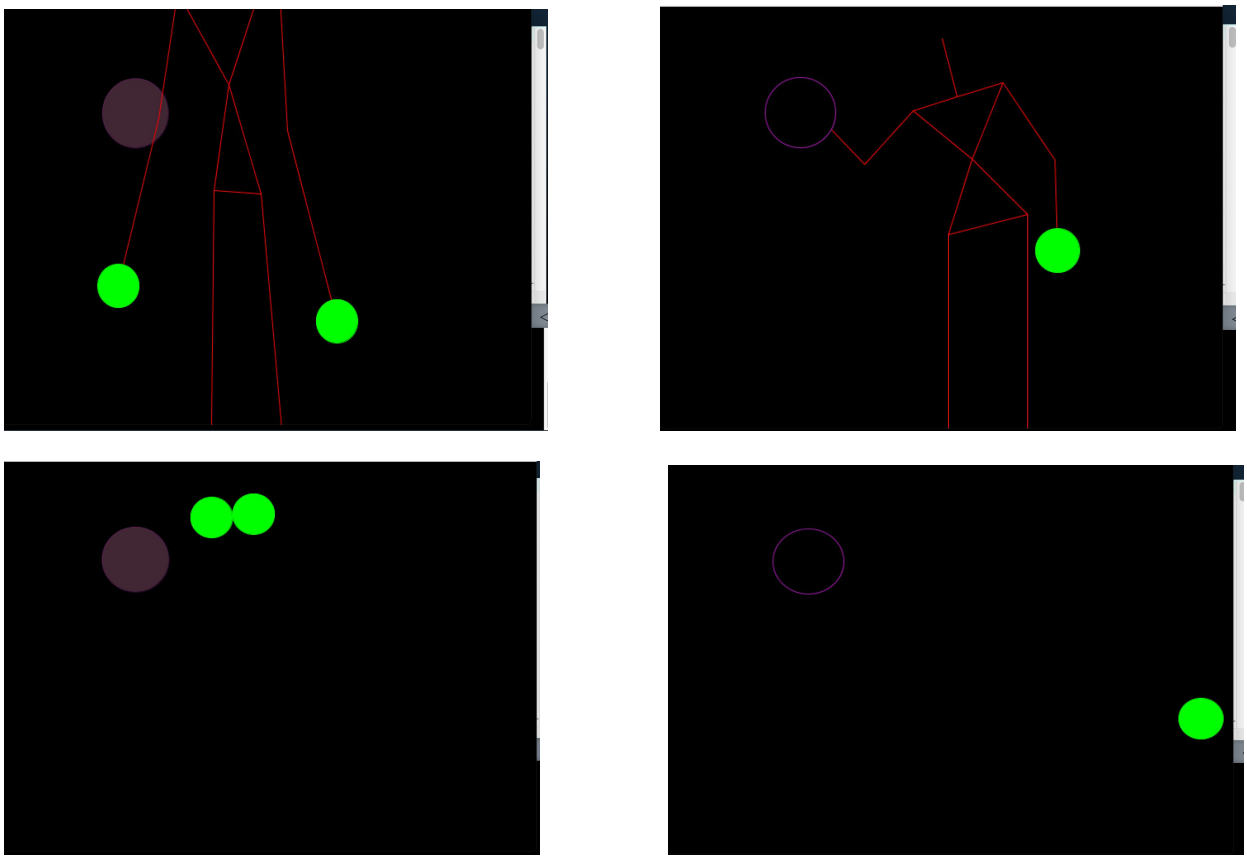
Design Criteria:

One of the major goals of our project was to enhance the user experience by giving them the power to control any digital screen by just their hands and not any external device. In order to develop this project, we first divided it into two criterias. One was the primary features which included the basic features that our product must possess and other one was secondary criteria which included additional features that could potentially be added in the project in order to improve it. The details of these criterias are given below:

Primary criteria :

1. The product must be easy to use.

2. The application must be able to recognise only the hands of the user instead of its skeleton.



(i) (ii)

Figure 1. *The above images shows the process of how hands are getting recognized by the Kinect:*

(i) - The images shows hands with and without the skeleton

(ii)- The images shows how the hand is able to interact with the button

3. It should be able to execute different commands on the basis of which hand we are using whether it is right or left.

4. To begin with, the application must have a video player module, music player module and an image gallery module.

5. Hands movements should be able to control the following for each interface:

i). Video player module - play, pause, fast forward, slow

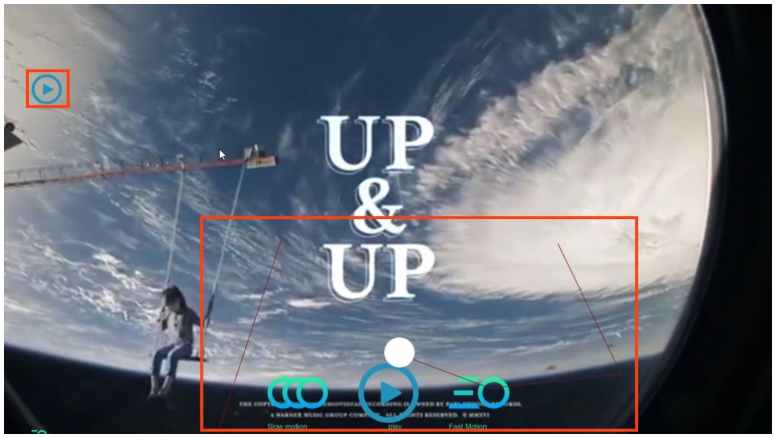


Figure 2: *This is a screenshot of the video player module in which the highlighted area shows the play button recognising the hand(white circle). The top left highlighted area proves that the video is playing .*

ii). Music player module - volume control, speed control

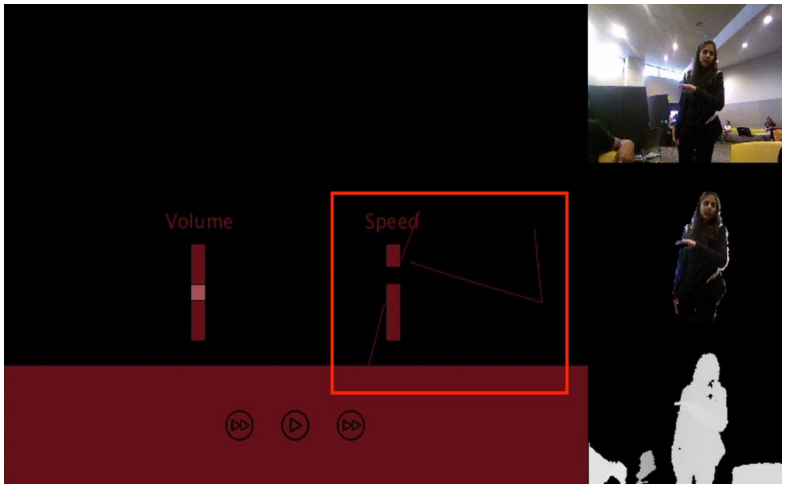


Figure 3: *This is a screenshot of music player module and the highlighted area demonstrates how the slider for music speed will work after hand recognition.*

iii). Image gallery - select and change the images

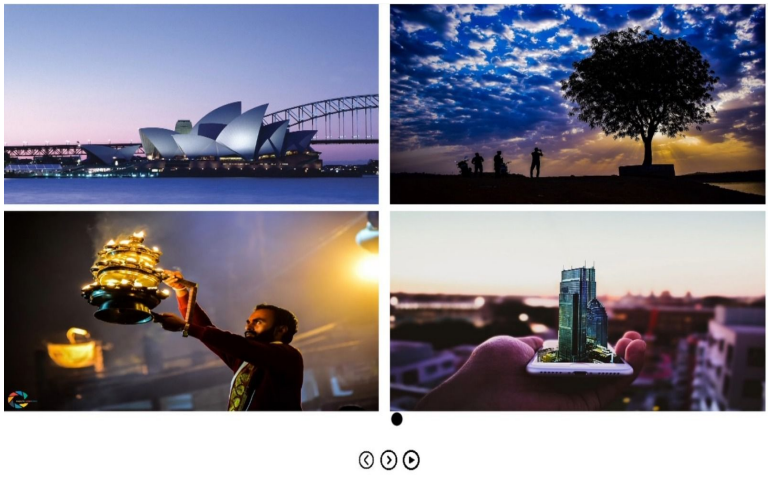


Figure 4: *Image gallery module*

Secondary criteria :

Some of the additional features that could be added to enhance the outcome of the application:

1. All the modules are to be integrated in one interface.

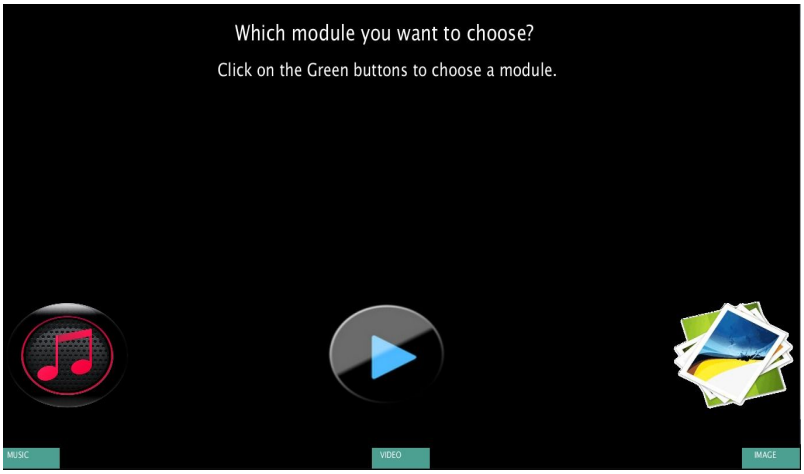


Figure 5: *The image shows a rough version of the project's common interface*

2. More hand gestures should be added in order to control other features of the modules such as

i). In the video player module, the ability to reverse the video and change the video could be added.

ii). In the music player module, album selection feature should be added and shuffle between

tracks.

iii). In the Image gallery, zoom in, zoom out and slideshow feature should be added.

3. Try to create a search bar to index between various components.

Final Project Video:

The below link demonstrates our final project video with the basic features
https://vimeo.com/368984740

Critical Reflection

Considering the present prototype that we have created, we would like to research more so in terms of creating various applets for opening various windows for individual applications. We would also try to focus on finding a better way to represent the human skeleton over the whole application. We could possibly hide all the feature when the user is dormant and activate them when motion is detected for a set amount of time. This would help to increase the efficiency of the product to run smoother without having to constantly provide a skeleton over the applications which might prove to be distracting for the users and hinder the original experience.

Using the knowledge that we got throughout the course, we would like to experiment with other latest technologies like leap motion, Raspberry pi or Arduino boards to increase the engagement between the user and the product device. Making the level of interaction more natural and streamlined is our priority. We would want to explore into the depths of processing by utilizing its vast range of libraries to make multiple individual output components to integrate with our gesture recognition software. In addition to this, we also have been wanting to look into various input pointers like buttons, sliders, and toggles.

On the interface part, we would like to make a more design-oriented interface next time, as we were looking into a more at the gesture integrated part interface this time to make our product

more individual and standalone instead of being just an extension to an existing interface. We want to focus on making more components that can be both minimalist and efficient for easy usability standards. We intend on extending our output modules range to take a larger blanket of applications. We also intend to create a library to open this source code publicly for anyone interested in experimenting with it.

Finally, on the ease of usage aspect, we have decided to not show the entire skeleton of the person and only use their hand data that would not be recorded but only for real-time scanning, But we intend to include a timer to avoid false-positive inputs. A delay might also be added to increase the time between various clicks so that the buttons don't jitter between pause and play cycles for instance. Also making the efficiency better to make sure most of the processing power is used for the output component and only a little computation power is needed for the gesture recognition part to ensure lag-free no latency runtime environments.

Using all this critical information that can be used to further improve the gesture recognition system will help our team to further implement these on various output modules which could then be used to be scaled up to multiple platforms like Android and iOS too. We, Team Friday, are proud of the product that we have created and would use this reflection to only improve the functionality and efficiency of our product. We will only add to what we have created and not backtrack any of our existing functionalities.

Our Experience:

Our experience while working on this project has been both great and challenging. Firstly, to form a group with people having different educational backgrounds and work experience was interesting. It helped us learn so much about each other's work ethic. Secondly, to work with technology like Kinect that none of us had any past experience with nor any prior knowledge about was particularly challenging but it was only in the beginning because with time it eventually proved out to be a great learning experience for all of us.

To begin with, we all found ourselves in a state of confusion when we first had to divide the tasks for the project and research about Kinect. All of us had a different vision for the project but eventually, after a lot of group meetings and discussions, we understood how important it is to agree on something common. This taught all of us how crucial it to openly discuss our ideas with each other, be a good listener and respect each other's points of view. Only after realizing this, we improved our team working ability and started having productive group meetings. We divided our tasks and trusted that everyone will do their part and helped each other whenever needed. It increased our individual achievements compared to working alone. One major thing about working in group projects is that we learn from our own project experiences as well as the experiences of others. We reviewed the lessons learned at each step and made decisions on how to use the knowledge gained. Sharing lessons learned among project team members prevented us from repeating the same mistakes. We got to know how Kinect works with processing and how we can use it to build our project by going through various tutorials and already existing projects. Working with the oldest version of Kinect taught us how to critically review a technology and how sometimes it is best to be patient, as we noticed that the version of Kinect we were working on was vulnerable to losing the skeleton if we move too much on the side and is also more prone to interferences, we managed to implement the screen control functions that we planned to do. Planning is another important aspect that we learned about. Planning is the most vital part of reducing risk and failure rates. Planning is needed to identify desired goals, avoid missed deadlines, and ultimately deliver the agreed product. We did have to plan way ahead of time about how we are going to divide the tasks and integrate it later, but due to miscommunication in how everyone is doing their individual tasks, it becomes difficult to integrate at the end of the project. We didn't do micromanagement in terms of coding, we should have defined some basic guidelines for that as well.