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Gesture Based Television Control Using Leap Motion Sensor in Lower end Television

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Abstract : This project aims gesture based control on lower end television for visually challenged person. Normally analysis of Gesture Controlled User Interface (GCUI), and identifies trends in technology, application and usability. Our research concludes that GCUI now provides realistic opportunities for specific application areas, and especially for users who are not comfortable with more commonly used input devices. We consider the next direction of GCUI using gestures seems suitable for ambient devices. This paper also provides a research background for gesture controlled lower end television which can be controlled by remote and gesture given by the user. Scope of the research work describes television control by gesture through remote. Gesture will be sensed by the Leap motion sensor module which is connected with the remote. Through remote we can control the television.

1. INTRODUCTION

Television (TV) is commonly used all around the world. Till now, the TV display screen has been innovated for several generations while the TV controller is not nearly unchanged for a long while. Recently, with the enhancement of TV programs, more and more frequent controlling operations like channel switching and program searching are required, which makes the traditional button hand-held TV controller remote uncomfortable for using. For example, to change the channel the user has to make his/her head to down to first see and then press the small buttons. Next, he/she requires to looking up at the TV screen to see whether the changed one is what the user actually want to change. Otherwise, he has to do this process again to switch the channel. In case of visually challenged person, it is really hard to understand the buttons given in the remote.

1.1. Wearable Controlling Device

Wearable devices are very popular now days, as well as increasing the convenience of using several controlling devices. A wearable smart watch is the device where the smart television can control with user customized gesture. That controls a web browser on a smart TV running in the Tizen Operating System. A mobile computing device, such as a smart phone, is used to translate the smart watch commands into a format that the TV can understand, as well as perform any other processing tasks. But drawback with the smart watch is, it can be used by one user at a time to control the browser of the television. Otherwise, the mobile has to be held in the user's hand instead of the smart watch for making gestures.

1.2. Speech Recognition Module

TV controller can be operated by the user's voice command and then response accordingly. Anyway, there are still drawbacks in voice control too. Initially, the speech recognition algorithm is not efficient enough due to large number of vocabularies and different dialects. Secondly, the interference coming from the

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environment and the voice coming from the TV's speaker itself will affect voice recognition and make the system very inefficient which is not easy to eliminate. Additional with this, the module which has to be recognize, should always kept on in order to find when and what kind of voice command is activated, which makes too much computational cost and power consumption. In the normal television, remotes are the only devices which can control them. It will be difficult to the visually challenged people.

1.3. Hand Gesture Module

Gestures can be given by bodily motion or state, But commonly given by the face or hand. But Current research focuses in the field of dealing with emotion recognition from face. Hand gesture recognition is used widely for giving the gestures since the face gesture recognition is still in improvising level. There are so many approaches have been made using cameras and algorithms to understand sign given by the user. Gesture recognition is a way for computers to initialize to understand human body language, thus creating a greater bridge between machines and humans than text user interfaces or GUIs (graphical user interfaces), which limits the majority of input to keyboard and mouse.

1.4. Present Scenario and Drawback of Existing System

While using wearable controlling device, it requires the user to hold or wear a device which may be difficult to found sometimes in a big room. When it comes to real time, synchronization between the voice reorganization module and words that spoken by the user should be there. Otherwise module will not work properly. For Real time sync - by the time the software processes the initial set of words, the user would have spoken too much. So that software needs to grasp all the statements in real time and process close to the same speed[1].

Error detection and correction - similar to automatic spelling correction, there must be error correction in voice too. This is more important here than text because the user will not be "displayed" with the data "typed" for the user to correct it and the user also won't keep repeating. Adaptability to different voices - the software must understand the voice of all users. In the gesture based television control also have the drawback in power consumption for camera module. When the television is being in on state, then the camera module will be in on state along with the television. So it will consume more power.

2. LITERATURE REVIEW

This paper proposes an automatic user state recognition scheme to recognize the TV user's state and activate the camera-based gesture recognition module only when the user is trying to control the TV. Specifically, the user's behavior active or not is detected by low cost sensors, the user's gaze watching TV or not is tracked by the face-based view detection, and the user's state is then decided according to a finite-state machine composed of four states: Absent, Other Action, Controlling, and Watching. The prototypes based on an ultrasonic distance sensor array, a red-green-blue (RGB) camera, and a depth camera are implemented and tested. The results show that the proposed scheme can effectively reduce the power consumption or computational cost of the original hand gesture based control schemes. [2]

Current research will be dealing with leap motion sensor which will give the accurate output than the camera module. So that the Camera module will be replaced by the leap motion sensor.

3. DESCRIPTION

3.1. Hardware Description

3.1.1. Introduction to leap motion sensor

Figure 1 represents the interfacing of leap motion sensor with PC. The Leap Motion controller [3] is a compact and affordable commercialized sensor for hand and finger movements in 3D space of approximately 8 cubic feet above the device. Position and speed of palm will be reported by the sensor and the sensor’s coordinate system will be react based on fingers. Data are sent to a computer via a USB connection. The frame rate of data transmission is set at 15 frames per second in this study. The controller comes with APIs supported by the maker. Via the API, the hand and finger data can be sent to user designed programs to use the sensor as an alternative computer-human interface. Many apps have been made using the controller.

Figure 1: Interfacing of leap motion sensor with PC

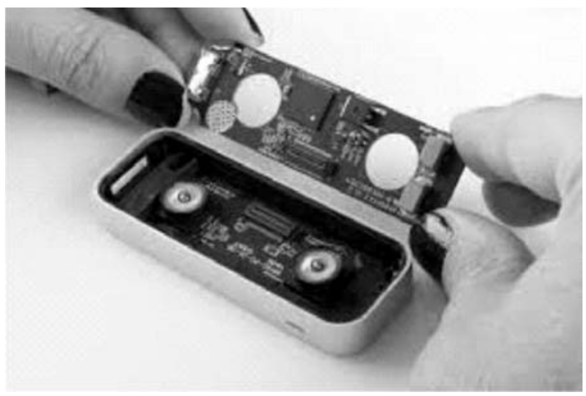

Figure 2: Leap motion sensor

As shown in figure 2, leap motion sensor will have two camera and three IR sensors inside. That will be transmitting the information about the gestures given by the human. From the different gesture, we will get different controlling options.

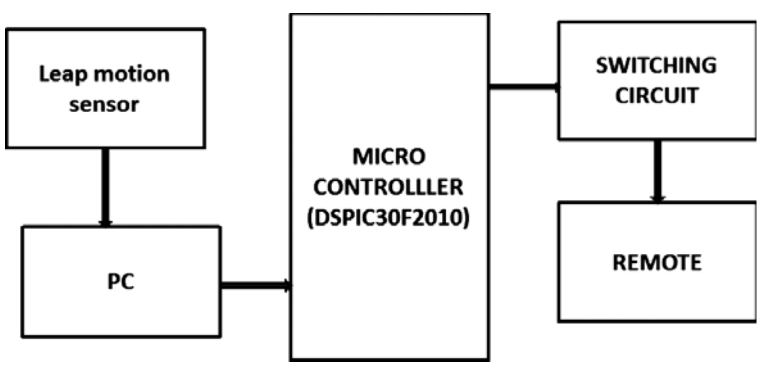

Figure 3: Block diagram

Figure 3 gives the overall block diagram.

3.1.2. Introduction to Micro controller

The DSPIC30F2010 microcontrollers are based on a 28 bit high performance has used over here. Features of the micro controller are given below.

- Modified Harvard architecture

- C compiler optimized instruction set architecture
- 84 base instructions with flexible addressing modes
- 24-bit wide instructions, 16-bit wide data path
- 12 Kbytes on-chip Flash program space
- 512 bytes on-chip data RAM
- 1 Kbyte non-volatile data EEPROM
- 16 x 16-bit working register array
- Up to 30 MIPs operation: - DC to 40 MHz external clock input - 4 MHz-10 MHz oscillator input with PLL active (4x, 8x, 16x)
- 27 interrupt sources
- Three external interrupt sources
- 8 user selectable priority levels for each interrupt
- 4 processor exceptions and software traps

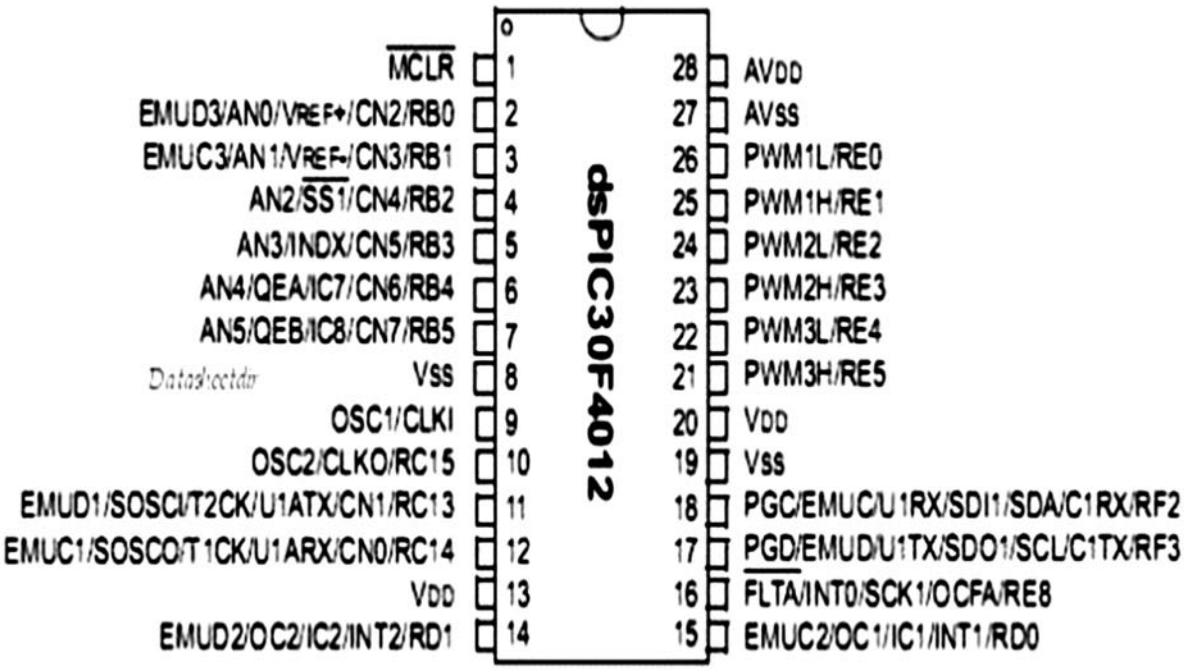

Figure 4: Pin diagram of micro controller

Figure 4 shows the pin description of the micro controller.

3.2. Software description

Introduction to C sharp

C-sharp is the language which is used to develop the software for processing gestures from the leap motion sensor[4]. C# (pronounced as see sharp) is a multi-paradigm programming language encircling strong typing, imperative, declarative, functional, generic, object oriented (class-based),and component oriented programming disciplines. It was developed by Microsoft within its .NET initiative and later approved as a standard by Ecma (ECMA-334) and C# is one of the programming languages designed for the Common Language Infrastructure.

4. IMPLEMENTATION

In this research, leap motion sensors are used for getting the gestures. Different gesture can be used for getting different operational controls. Since the leap motion sensors are recent developing technology it will give the different observation for gesture based controlling devices. Figure 5 depicts the overall flow of the mechanism.

Initially, leap motion sensors will be placed at the place where the user can produce the gesture input to it. After getting gestures from the leap motion sensor, that will be given to the PC. In PC, using leap motion SDK gesture inputs will be processed.

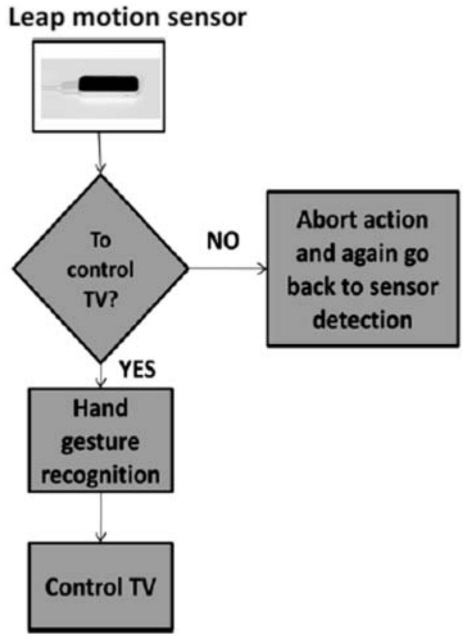

Figure 5: Flow chart

Secondly, output according to the processed gesture will be given to the micro controller. Micro controller will operate the switching device. Here, FET has used. Since FET device has the good power efficient characteristics, which is very suitable for the process.

At finally, switching devices will be connected with the remote. Remotes are working under the protocol called RC3 or RC5. In the remote segment there will be IR sensor transmitter and IR receiver will be fitted in the controller part which is placed along with the television.

Following are the controlling option that can be given by this module.

- TV-ON
- TV-OFF
- VOLUME-UP
- VOLUME-DOWN
- CHANNEL-UP
- CHANNEL-DOWN

5. ALGORITHM

Processing of gesture can be done in many ways. There are enormous techniques and different procedures. Since leap motion sensor has used here for getting gestures, new algorithm has been created. Here number of fingers and direction of movement of the fingers are used to give the different gestures. So that we can implement number of control options that can be done by gesture. In this algorithm, number of fingers only will be concerned. The detail of gestures belongs to each and every control options which can be done by gestures are given below.

1. No finger- off TV
2. Five finger- on TV
3. Forward motion – channel up
4. Backward motion- channel down

5. Left side motion-volume up
6. Right side motion- volume down

6. HARDWARE SETUP

This project employs leap motion sensor to initiate the process. Since the leap sensor is built up with two cameras and three IR sensors it can sense the gesture up to 1m. Figure 6 shows the leap motion sensor construction.

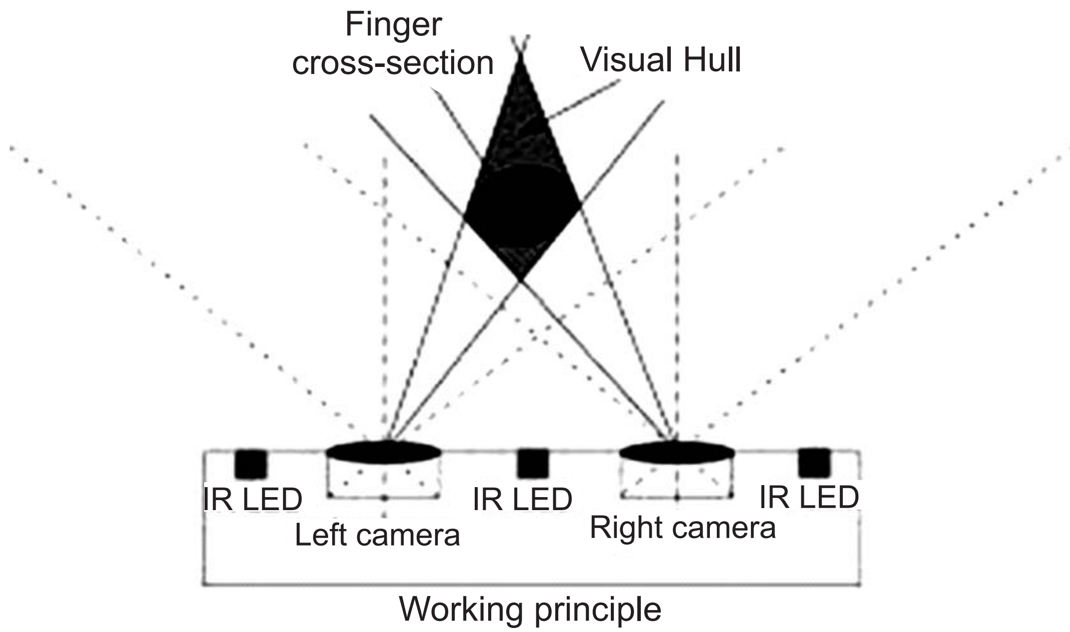

Figure 6: Construction of leap motion sensor

Gestures will be processed with the help of PC. In the PC leap software controller has been installed. C# language is used to develop the program to recognize the gesture.

Processed gesture output from the PC has given to the micro controller part. Here digital signal controller dsPIC30F2010 has equipped. Remote will be connected with that. Microcontroller will send the corresponding signal according to the gesture given by the user.

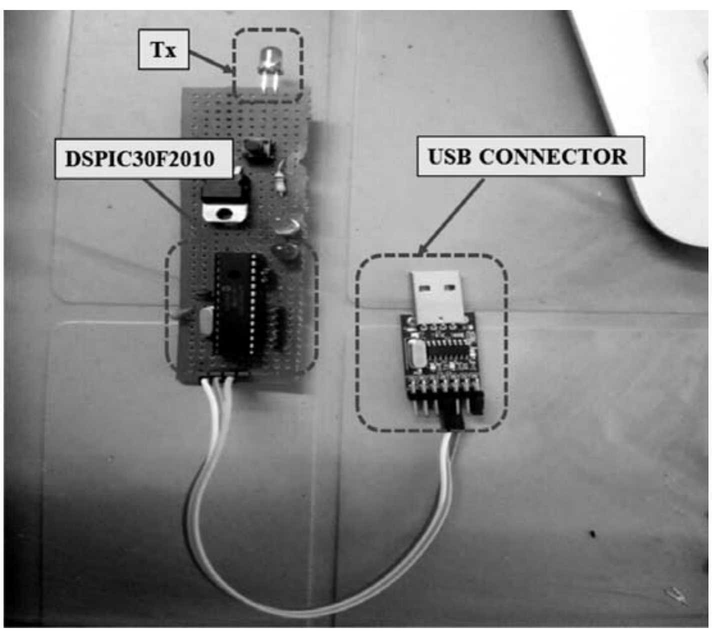

Figure 7: Micro controller part

Figure 7 depicts the hardware part of the remote.

In figure 8, gesture which is belong to channel up has given and according device output has shown in the window.

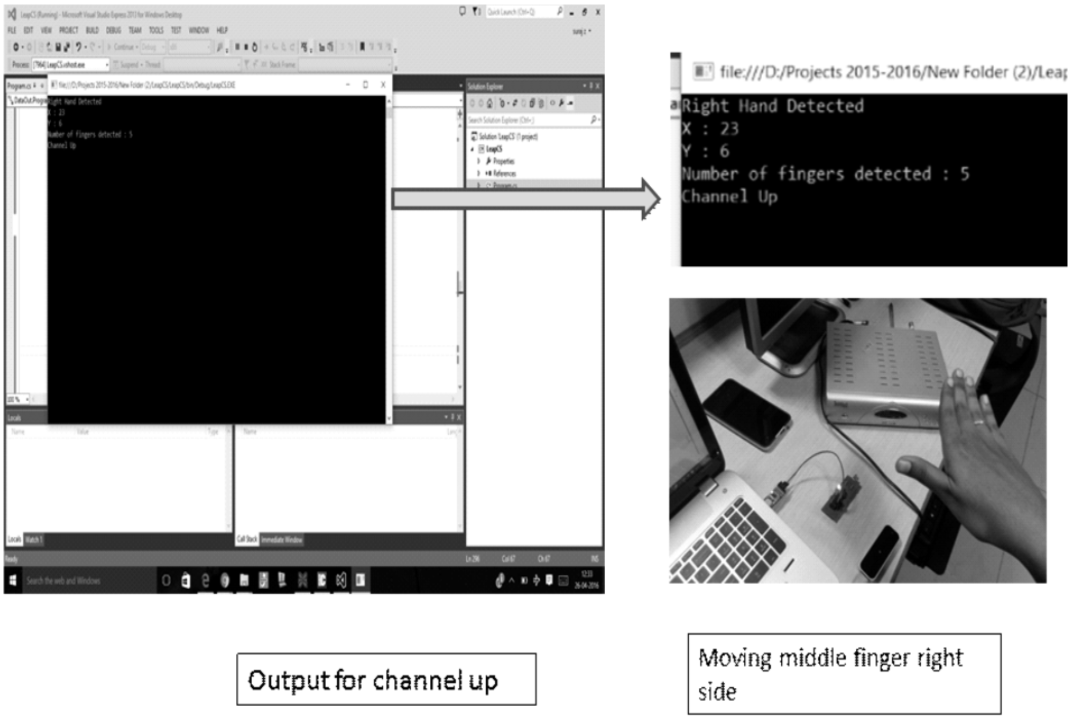

Figure 8: Display showing results according to gesture

7. RESULT AND DISCUSSION

In this section with figure 9, results of the module are described. Same method can be used for set top boxes. Because now days, total control of the television can be given by the remote which belongs to set top box. So it can be done for that also. Leap motion technology is the recent one which is booming up in the gesture technology world. From that we can get accurate result with low cost controlling module.

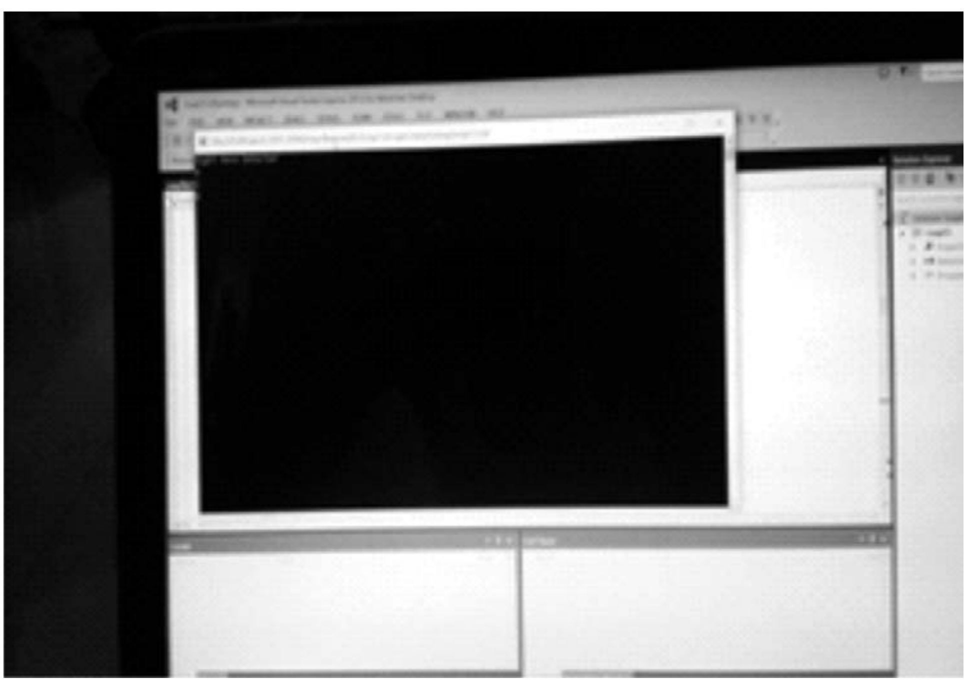

Figure 9: Output

8. CONCLUSION

This paper concludes that gesture can be implemented for lower end televisions which can be operated by leap motion sensor. Power consumption and cost of the television which are operated by gestures can also be reduced. Lower end televisions can also be operated by gesture without changing any hardware part build inside the television. By controlling the remote through sensor module we can make it possible with lower cost along with low power consumption.

9. REFERENCES

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