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Hand Data Glove Using K-NN Classifier and PIC Microcontroller

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ABSTRACT: In the recent years significant research has been carried out in virtual reality and on data gloves. Data glove based interfaces are designed and researched for replacing static and fixed keyboard and mouse to have more intuitive way of communication as human being does by making gestures while communication, and also plays a vital role in sign language processing research But to realize this notion , the gesture must be recognized first and thus data glove is used. It provides data based on the angular measure of the bones in hand.
A real-time Human-Computer Interaction (HCI) based on the hand data glove and K-NN classifier for gesture recognition is proposed. The gestures classified are categorized as clicking, rotating, dragging, pointing and ideal position. The results show that glove used for interaction is better than normal static mouse as the interaction process is more accurate and natural in dynamic environment with no distance limitations.

KEY WORDS: Classification, K-NN classifier, gesture recognition,zig bee module,pic microcontroller

I.INTRODUCTION

The new age PC innovation is flourishing and encompassing people and PCs communicating as normally as a human with other human. The Ubiquitous frameworks are more typical and controlling them is an assignment. The innovation in UIs (UI) has changed to signal interface, catching the movement of our hands and controlling the gadgets is more characteristic and reasonable. Hand gesture may incorporate multi-touch screen interface, MS Surface processing, or camera based signal recognition, including new cooperations in shopping applications and even in gaming enterprises. Motion acknowledgment is more typical to Virtual Augmented Reality (VAR) as the primary info gadget and turn out to be more mainstream with films like Minority Report.

Human-Machine Interaction time-to-time continues moving towards more intuitive and natural UIs. Individuals have a decent grip and controlling capacity with their hands and in this way interfaces like console and mouse are more famous.

Right now in the majority of the, HCI interfaces hand is utilized including static signal acknowledgment and dynamic motion acknowledgment. The motion in view of information glove is been utilized as a part of gesture based communication handling and preparing, yet now it is additionally utilized as a part of mechanical technology to control the robot arms wearing the glove.

In this venture, we predominantly focus on the constant information and yield of the information from the information glove and effectively and precisely getting a handle on the activities. Hand Data Glove is electronic gadgets equipped with a sensor that detects the movements of hand and fingers separately and pass those developments to PC in analog or digital signal continuously.

II. SIGNIFICANCE OF THE SYSTEM

Existing system we have is the popular joystick stick controlled wheel chair with a hand-glove control system for easier maneuvering by bending the fingers. Intended users control the system by wearing an instrumented glove fitted with flex or bend sensors for controlling the movement and direction of the wheelchair.

DISADVANTAGES:

It has a high bit error rate.
Untill this transmission is slow and not effective
Previous system only to make Slide changes.

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PROPOSED SYSTEM:

In past few years many research have been carried out in virtual reality and on data glove. Data glove based interface are designed and researched for replacing static and fixed keyboard and mouse to have more natural way of communication as human being does by making gestures while communication. But have this, the gesture must be recognized first and thus data glove is used. It provides data based on the angular measure of the bones in hand.

A real-time Human-Computer Interaction (HCI) based on the hand data glove and K-NN classifier for gesture recognition is proposed. The gestures classified are categorized as clicking, rotating, dragging, pointing and ideal position. The results show that glove used for interaction is better than normal static mouse as the interaction process is more accurate and natural in dynamic environment with no distance limitations.

ADVANTAGES:

It is low cost.

High reliability and performance in ZigBee protocol

III. LITERATURE SURVEY

Title: Vision-based Multimodal Human-Computer Interaction using Hand and Head Gestures
Authors: 1.Anupam Agrawal, 2. Rohit Raj, 3. Shubha Porwal
Gestures are used in day to day life like nodding and waving without us being aware of them. It has become an important part in the communication among the humans. In the recent years new methods of Human Computer Interaction (HCI) are being developed. Some of them are based on interaction with machines through hand, head, facial expressions, voice, touch and many are still the current topic of research. However relying on just one of them reduces the accuracy of the whole HCI and is also limiting the options available to users. The objective of this paper is thus to use two of the important modes of interaction – hand and head to control any application running on computer using Computer Vision algorithms. From input video stream, hand is segmented and the corresponding gesture is being recognized based on the shape and pattern of movement of hand. For head gesture recognition, head is first detected and then optical flow method is used to get the movement of head which is then recognized by finite state automata. Using the user interface of the software, an operator can control any interactive application (say VLC player, Image browser etc) using hand and head gestures which in turn are automatically mapped to the mouse and keyboard events through Windows API. The proposed multimodal approach is particularly useful to communicate with computers and other electronic appliances from a distance where mouse and keyboard are not convenient to work with.

Title: Real-time Finger Tracking for Interaction
Author: 1 M. AbouZliekha, 2. Noor Shaker

In this work, we describe an approach for human finger motion and gesture detection using two cameras. The target of pointing on a flat monitor or screen is identified using image processing and line intersection. This is accomplished by processing above and side images of the hand. The system is able to track the finger movement without building the 3D model of the hand. Coordinates and movement of the finger in a live video feed can be taken to become the coordinates and movement of the mouse pointer for human-computer interaction purpose.

Head motion controlled power wheel chair
Authors:1. D. J. Kupetz, 2. S. A. Wentzell, 3. B. F. BuSha
Quadriplegics rely on power wheelchairs for mobility, but the hands-free controller systems currently available are obtrusive and expensive. The objective of this project was to design a power wheelchair with a novel control system for quadriplegics with head and neck mobility.

The control system translates the position of the user's head into speed and directional control of the wheelchair. Head movement was measured
using camera-based motion-tracking of an infrared LED array on the back of the user's head. The control system included a standby mode that was activated by pressing the head back against the headrest, which activated the braking system while deactivating the drive train, allowing for manual control of the wheelchair via a rear support system.

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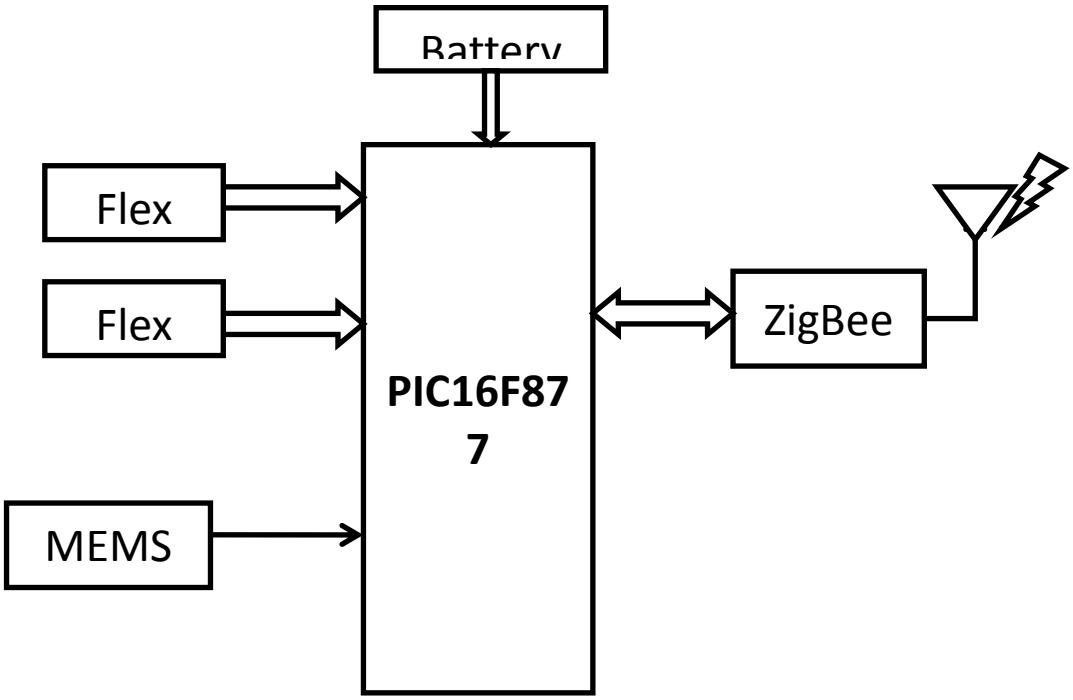
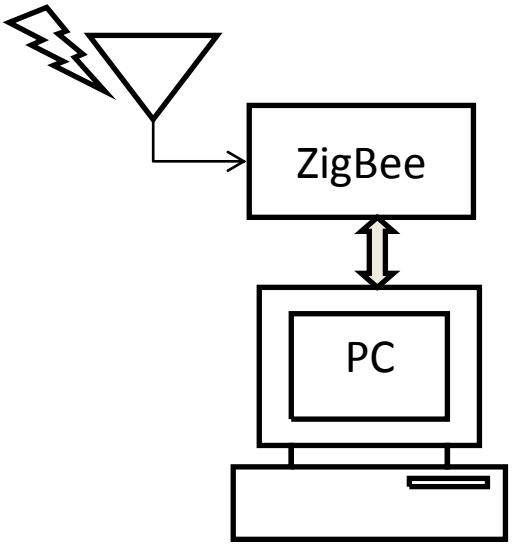
IV. METHODOLOGY

BLOCK DIAGRAM:

TRANSMITTER BLOCK DIAGRAM



2 RECEIVER BLOCK DIAGRAM



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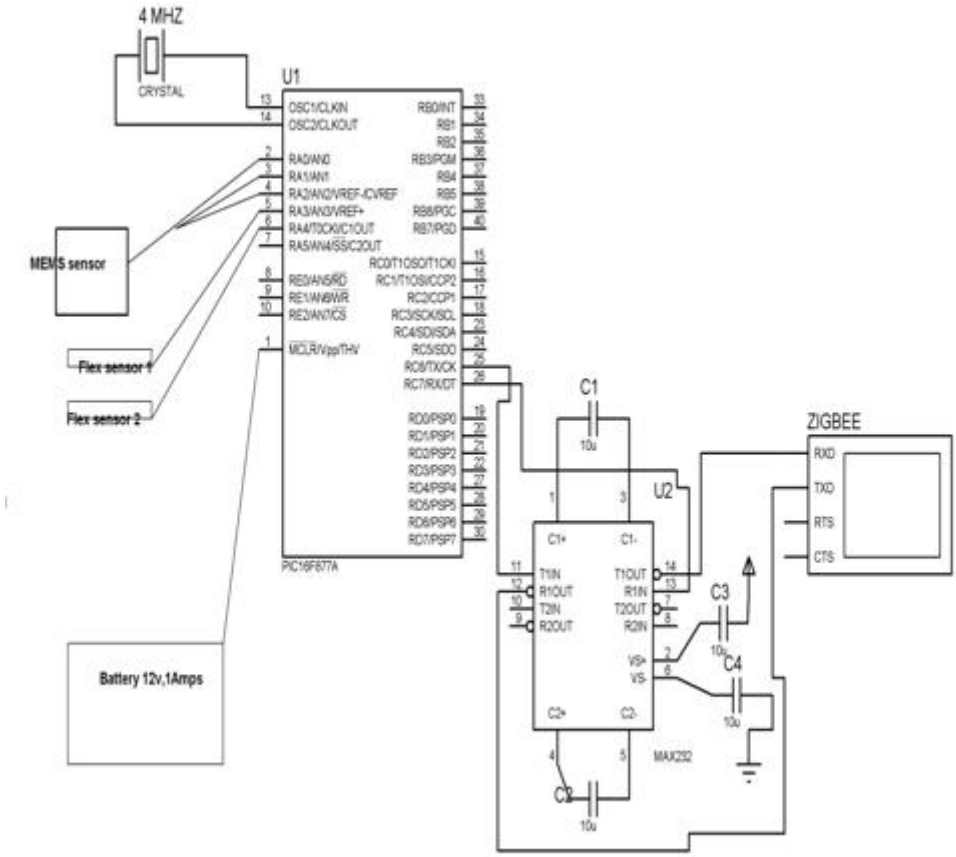

HARDWARE REQUIREMENTS

FLEX SENSOR:

A simple flex sensor 2.2" in length. As the sensor is flexed, the resistance across the sensor increases. The resistance of the flex sensor changes when the metal pads are on the outside of the bend (text on inside of bend). Connector is
0.1" spaced and bread board friendly. Note: Please refrain from flexing or straining this sensor at the base. The usable range of the sensor can be flexed without a problem, but care should be taken to minimize flexing outside of the usable range. For best results, securely mount the base and bottom portion and only allow the actual flex sensor to flex.

MEMS ACCELEROMETER ADXL335:

MEMS stands for Micro Electro Mechanical System. Here we are using MEMS accelerometer to measure the tilt or alignment of the motor also level of vibration.. Accelerometers can be used for measuring both dynamic and static measurements of acceleration. The Free scale MMA6200Q and MMA7260Q series accelerometers are good solutions for XY and XYZ tilt sensing.

PIC CONTROLLER 16F877A:

The PIC16F877A is one of the latest products from *Microchip*.

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It features all the components which modern microcontrollers normally have. For its low price, wide range of application, high quality and easy availability, it is an ideal solution in applications such as: the control of different processes in industry, machine control devices, measurement of different values. It is a High-Performance RISC CPU. Only 35 single-word instructions to learn. All single-cycle instructions except for program branches, which are two-cycle of operating speed: DC – 20 MHz clock input DC – 200 ns instruction cycle

ADC: The ADC0808/ADC0809 data acquisition component is a monolithic CMOS device with an 8-bit analog-to-digital converter, 8-channel multiplexer and microprocessor compatible control logic. The 8-bit A/D converter uses successive approximation as the conversion technique.

UART: A universal asynchronous receiver/transmitter is a type of "asynchronous receiver/transmitter", a piece of computer hardware that translates data between parallel and serial forms. UARTs are commonly used in conjunction with other communication standards such as EIA RS-232.

ZIGBEE:

ZigBee is a **mesh network**specification for low-power wireless local area networks **(WLANs)** that cover a large area. It was designed to provide high data **throughput** in applications where the **duty cycle** is low and low power consumption is an important consideration.

ZigBee and IEEE 802.15.4 are standards-based protocols that provide the network infrastructure required for wireless sensor network applications. 802.15.4 defines the physical and MAC layers, and ZigBee defines the network and application layers.

4.7 MAX 232:

MAX232 acts as a buffer driver for the processor. It accepts the standard digital logic values of 0 and 5 volts and converts them to the RS232 standard of +10 and -10 volts. It also helps protect the processor from possible damage from static that may come from people handling the serial port connectors. The MAX232 requires 5 external 1uF capacitors. These are used by the internal charge pump to create +10 volts and -10 volts.

SOFTWARE ANALYSIS

MPLAB IDE is a software program that runs on a PC to develop applications for Microchip microcontrollers. It is called an Integrated Development Environment, or IDE, because it provides a single integrated "environment" to develop code for embedded microcontrollers. Experienced embedded systems designers may want to skip ahead to **Section 1.7 "Components of MPLAB IDE"**. It is also recommended that **"MPLAB IDE On-line Help"**and**"MPLAB IDE Updates and Version Numbering"** be reviewed. The rest of this chapter briefly explains embedded systems development and how MPLAB IDE is used.

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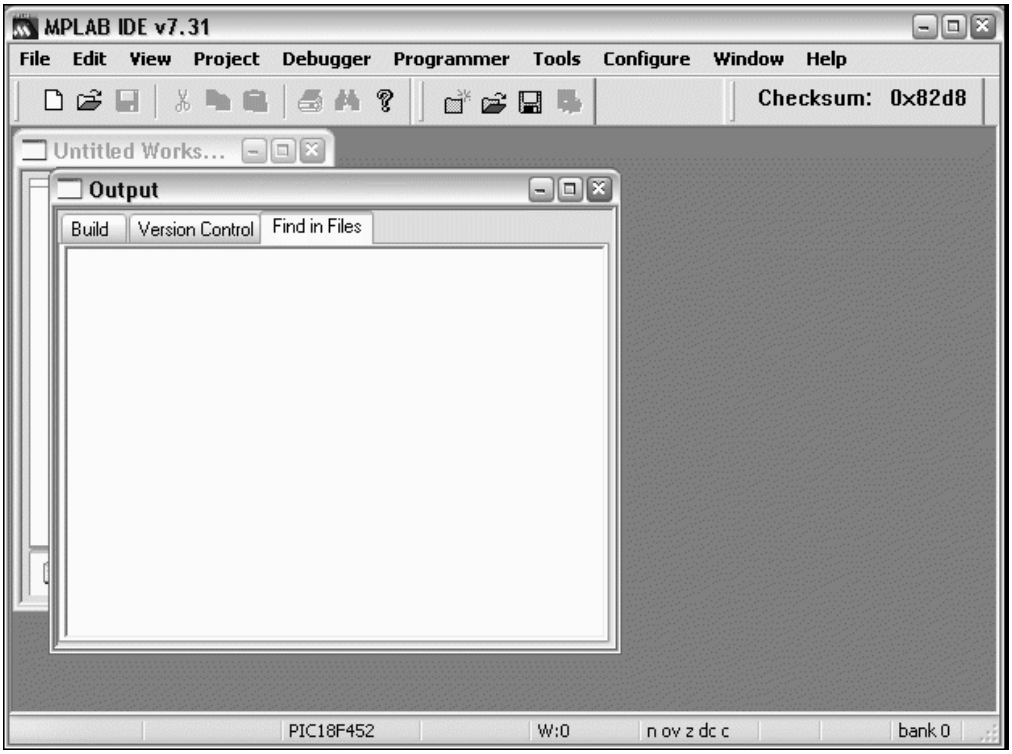

PROGRAM

```
#define MX_PIC
//Defines for microcontroller
#define P16F877A
#define MX_EE
#define MX_EE_TYPE2
#define MX_EE_SIZE 256
#define MX_SPI
#define MX_SPI_C
#define MX_SPI_SDI 4
#define MX_SPI_SDO 5
#define MX_SPI_SCK 3
#define MX_UART
#define MX_UART_C
#define MX_UART_TX 6
#define MX_UART_RX 7
#define MX_I2C
#define MX_MI2C
```

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```
#define MX_I2C_C
#define MX_I2C_SDA 4
#define MX_I2C_SCL 3
#define MX_PWM
#define MX_PWM_CNT 2
#define MX_PWM_TRIS1 trisc
#define MX_PWM_1 2
#define MX_PWM_TRIS2 trisc
#define MX_PWM_2 1
/**** Macro Substitutions ****
3 = Which ADC Channel
40 = Acquisition time
3 = Conversion Speed
0 = VRef+ Option
500 = VRef Voltage x 0.01V
*******************************/
//Macro implementations
void main()
{
//Initialisation
adcon1 = 0x07;
#if (RS232_3801918_UART == 0)
set_bit(RS232_3801918_RX_TRIS, RS232_3801918_SW_RX);          // Receive pin is a input
clear_bit(RS232_3801918_TX_TRIS, RS232_3801918_SW_TX);
// Transmit pin is a output
set_bit(RS232_3801918_TX_PORT, RS232_3801918_SW_TX);          // Transmit pin is default high
#endif
#if (RS232_3801918_UART == 1)
txsta = RS232_3801918_TXSTA_VAL;
// 8-bit, async, low speed, off
spbrg = RS232_3801918_SPBRG_VAL;
// set the baud rate
rcsta = 0;
// 8-bit, disabled
if(RS232_3801918_DATASIZE == 1)
{
```

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```
st_bit(txsta, TX9);
// 9-bit TX
st_bit(rcsta, RX9);
// 9-bit RX
}
st_bit(rcsta, SPEN);
// turn on serial interface
#endif
#if (RS232_3801918_UART == 2)
txsta2 = RS232_3801918_TXSTA_VAL;
// 8-bit, async, low speed, off
spbrg2 = RS232_3801918_SPBRG_VAL;
// set the baud rate
rcsta2 = 0;
// 8-bit, disabled
if(RS232_3801918_DATASIZE == 1)
{
st_bit(txsta2, TX9);
// 9-bit TX
st_bit(rcsta2, RX9);
// 9-bit RX
}
st_bit(rcsta2, SPEN);
// turn on serial interface
#endif
#ifdef RS232_3801918_HARDWARE
set_bit( RS232_3801918_CTS_TRIS, RS232_3801918_CTS_PIN);
//CTS is an input
clear_bit( RS232_3801918_RTS_TRIS, RS232_3801918_RTS_PIN);
//RTS is an output
set_bit( RS232_3801918_RTS_PORT, RS232_3801918_RTS_PIN);
//not ready to accept data
#endif
//Interrupt initialisation code
option_reg = 0xC0;
//Loop
```

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```
//Loop: While 1
while (1)
{
//Call Component Macro
//Call Component Macro: adc=ADC(0)::ReadAsInt
FCV_ADC = FCD_ADC0_ReadAsInt();
//Call Component Macro
//Call Component Macro: adc1=ADC(1)::ReadAsInt
FCV_ADC1 = FCD_ADC1_ReadAsInt();
//Call Component Macro
//Call Component Macro: l=ADC(2)::ReadAsInt
FCV_L = FCD_ADC2_ReadAsInt();
//Decision
//Decision: l>258?
if (FCV_L>258)
{
//Call Component Macro
//Call Component Macro: RS232(0)::SendRS232Char('5')
FCD_RS2320_SendRS232Char('5');}
//Call Component Macro
//Call Component Macro: r=ADC(3)::ReadAsInt
FCV_R = FCD_ADC3_ReadAsInt();
//Decision
//Decision: r>=225?
if (FCV_R>=225)
{
//Call Component Macro
//Call Component Macro: RS232(0)::SendRS232Char('6')
FCD_RS2320_SendRS232Char('6');
}
//Decision
//Decision: adc>=419&&adc<=452?
if (FCV_ADC>=419&&FCV_ADC<=452)
{
//Call Component Macro
//Call Component Macro: RS232(0)::SendRS232Char('3')
```

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```
FCD_RS2320_SendRS232Char('3');
}
else
{
//Decision
//Decision: adc>=583&&adc<=625?
if (FCV_ADC>=583&&FCV_ADC<=625)
{
//Call Component Macro
//Call Component Macro: RS232(0)::SendRS232Char('4')
FCD_RS2320_SendRS232Char('4');
}
else
{
//Call Component Macro
//Call Component Macro: adc1=ADC (1)::ReadAsInt
FCV_ADC1 = FCD_ADC1_ReadAsInt();
//Decision
//Decision: adc1>=614&&adc1<=655?
if (FCV_ADC1>=614&&FCV_ADC1<=655)
{
//Call Component Macro
//Call Component Macro: RS232(0)::SendRS232Char('2')
FCD_RS2320_SendRS232Char('2');
}
else
{
//Decision
//Decision: adc1>=430&&adc1<=471?
if (FCV_ADC1>=430&&FCV_ADC1<=471)
{
//Call Component Macro
//Call Component Macro: RS232(0)::SendRS232Char('1')
FCD_RS2320_SendRS232Char('1');
}}}}
//Delay
```

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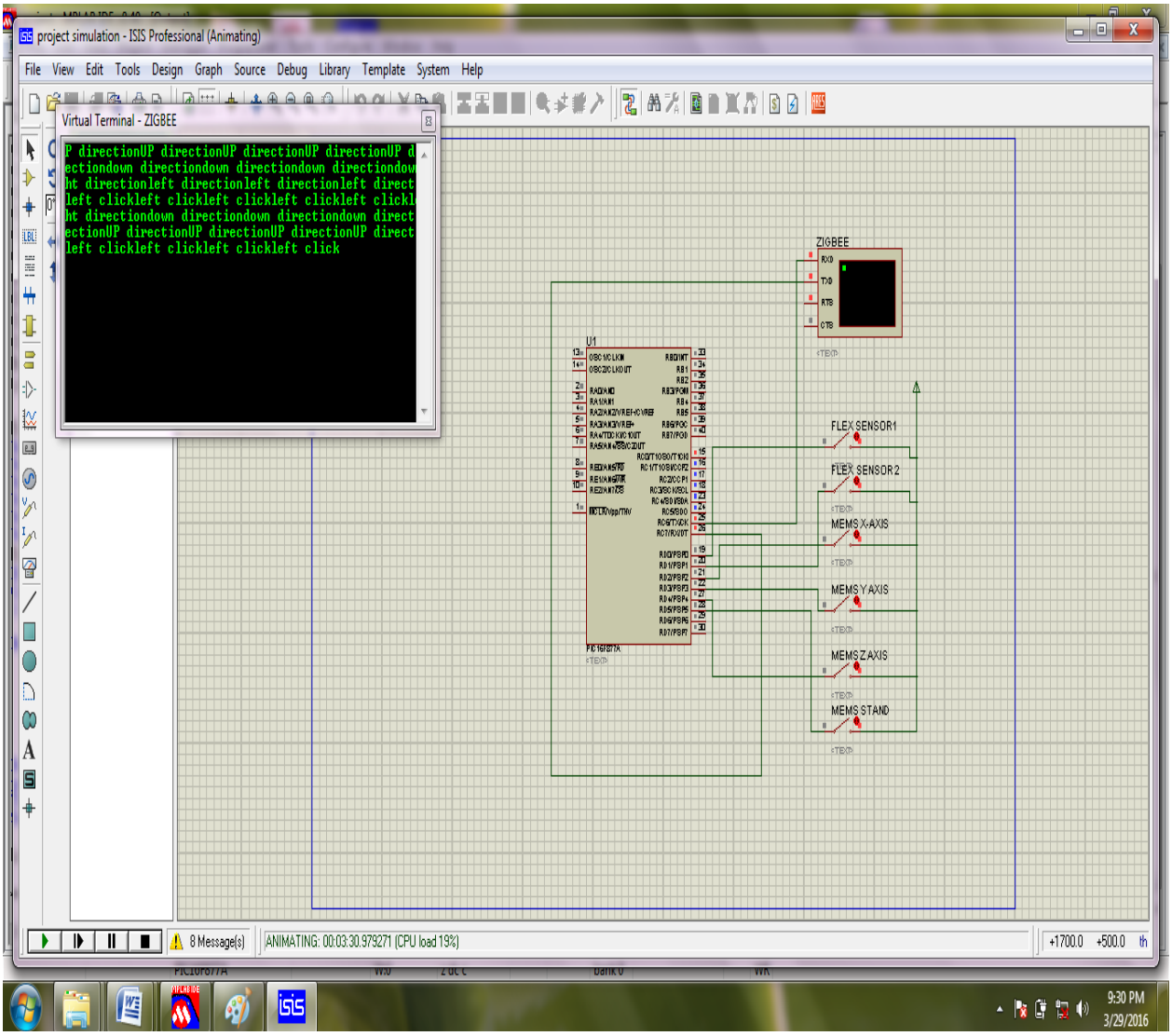
```
//Delay: 200 ms
delay_ms(200);
}
mainendloop: gotomainendloop;
}
```

V. EXPERIMENTAL RESULTS



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VI.CONCLUSION AND FUTURE WORK

This paper intends to investigate how a Hand Data Glove functions and how it is utilized as an interface amongst humans and machines. It is discovered that the static console and mouse are having numerous constraints with them, while for the situation with data glove can be utilized for a similar reason with no confinements. The level of flexibility (DoF) of data glove is more than mouse resulting in better contributions to the universe of virtualization. K-NN here is utilized to prepare the information and perceive the motions and take the proper activities. The results are observed to be great and efficient with real time. This examination demonstrates that such gadgets are a decent innovation for cooperating and controlling the gadgets, programming or equipment.

Inthe future, the data glove can be utilized to type the characters and work every one of the uses of PC making it console and mouse free and numerous high dimensional applications can keep running on the framework or in the virtual condition. Additionally there can be a blend of at least two motions to shape another mind boggling signal for an unpredictable errand to perform utilizing HMD.

REFERENCES

1.D.J.Kupetz, S.A.Wentzell,B.F.Busha,"Head motion controlled power wheel chair" The College of New Jersey 2000 Pennington Road Ewing, NJ 08628,2013 IEEE

2.Piyush Kumar,JyotiVerma and Shitala Prasad-"Hand Data Glove: A wearable real time device for human computer interaction", International journal of advanced science and Technology,vol.43,June,2012.

3.Kenji Oka and Yoichi sato university of Tokyo,Hideki Koike University of Electro-communication,Tokyo,"Real time fingertip tracking and gesture recognition"2012 IEEE

4.Anupam Agrawal, Rohit Raj and Shubha Porwal, Indian Institute of Information Technology,Allahabad (IIITA) India-"Vision-based Multimodal Human-Computer

Interaction using Hand and Head Gestures", Proceedings of 2013 IEEE Conference on Information and Communication Technologies (ICT 2013).

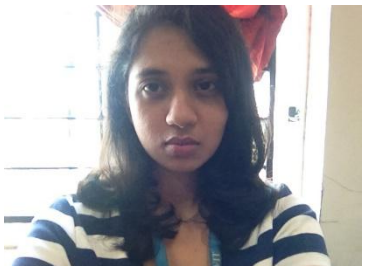
5.T. Shiratori and J. K. Hodgins, "Accelerometer-based user interfaces for the control of a physically simulated character",ACM Transactions on Graphics, vol. 27, no. 5, (2008), pp. 1–9.

6.Macro Altini, Julien Penders,RuudVullers and Oliver Amft-" Estimating Energy Expenditure Using Body-Worn Accelerometers: a comparison of Methods,Sensors Number and Positioning" IEEE Journal of Biomedical and Health Informatics.

7.S. P. Priyal, P. K. Bora, "A study on static hand gesture recognition using moments", In Proceedings of International Conference on Signal Processing and Communications (SPCOM), (2010), pp. 1-5.

8.T. Takahashi and F. Kishino, "hand Gesture Coding based on Experiments using a Hand Gesture Interface Device",SIGCHI Bull, vol. 23, no. 2, (1991), pp. 67-74.

AUTHOR'S BIOGRAPHY



SaveriBalaji is currently pursuing her Bachelor of technology in Electronics and Communication Engineering from Vellore Institute of Technology, Chennai (2014-2018). Her areas of interest include Human computer interaction, wireless and mobile and Green computing, IOT, Machine Learning, Deep learning and optics. She has worked as a research Intern in Hewlett Packard in the embedded and HCI platform. She published the paper titled "self sustained RF energy harvesting antenna for GSM band applications" in IJARSET volume 5,Issue 4 March 2018