VIRTUAL REALITY USING DIGITAL IMAGE PROCESSING

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ABSTRACT

The main objective of this paper is to develop a low cost data glove using Arduino UNO (ATMEGA328 micro controller) and Processing IDE. The glove is designed for use in Virtual Reality systems and is integrated into a suite of applications and we can simply wave our hand in front of the computer and move the pointer to the desired location and perform some task

Keyword: - *Arduino UNO , Processing IDE, Data Glove, and Virtual Reality etc….*

1. INTRODUCTION

Virtual Reality is something that allows everyone to experience the impossible. The term used to describe a three-dimensional, computer generated environment. This will be explored and interacted a person. Virtual reality will be a computer-induced environment that can be interacted with as if that environment was authentic. Communication systems means the VR systems which includes sensations and transmission of vibration to the user by a game controller and also by other devices is known as kinaesthetic communication systems. This tactile is generally used in video game Military training medical applications. This VR system also refers to Virtual presence of users with artifact in remote communication environment.

1.1 Existing System

Previously we can able to track a particular object when something that points the object, which depends on the RGB colour combination. Later it is developed as a stylus to work with the smart board and scribble pad. As the any colour combination which include red, green or blue or some other colour which has the more intensity is used for the object to be tracked. Once the program is done with the image processing the specified colour is tracked. And this kind of mechanism is mostly seen in major supermarkets to identify and bill the fruits.

1.2 Proposed System

In addition with the tracking of the object, we can even able to control our system with by our hand using this glove without any contact with the system this will happen we simply wave our hand in front of our system or laptops.

1.3 System Specifications

The system specification shows the description of the function and the performance of the system and the user. The scope of this project is to control our system without any stylus or touch pads, by simply waving our hand in front of the screen.

1.4 System Description

The system has two parts namely hardware and the software. The hardware here used is ATMEGA328 micro controller which is a 28 pin IC and the Hall Effect sensor. The software part used is Arduino IDE and Processing IDE.

1.4.1 Hardware used

The following hardware part is used in this project is explained as follows

1.4.1 Arduino UNO

Arduino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller. Variety of microprocessors and controllers is used by arduino board designs. A set of digital and analog input/output (I/O) pins is equipped in the board and it may be interfaced to various expansion boards (*shields*) and other circuits. In some models the board feature serial communications interfaces, including Universal Serial Bus (USB) on some models, that can be used for loading programs from personal computers. A dialect features from the programming languages C and C++ are used for microcontroller.

1.4.2 Hall Sensor

Hall Sensor is also called as Hall Effect Sensor as it is a transducer that varies its output voltage in response to the magnetic field. Hall Effect Sensor is used for proximity switching, positioning, speed detection, and current sensing applications. In a hall-effect sensor a thin strip of metal has a current applied along it, in the presence of a magnetic field the electrons are deflected towards one edge of the metal strip, producing a voltage gradient across the short-side of the strip (perpendicular to the feed current). Inductive sensors are just a coil of wire, in the presence of a changing magnetic field a current will be induced in the coil, producing a voltage at its output. Hall Effect sensors have the advantage that they can detect static (non-changing) magnetic fields.

2. Software Used

The following software part is used in this project is explained as follows.

2.1 Arduino IDE

Fig -1: Arduino IDE

The Arduino Software (IDE) or Arduino Integrated Development Environment - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload the program and communicate with them. The Arduino IDE is a cross platform Java application that serves as a code editor and compiler and is also capable of transferring firmware serially to the board.

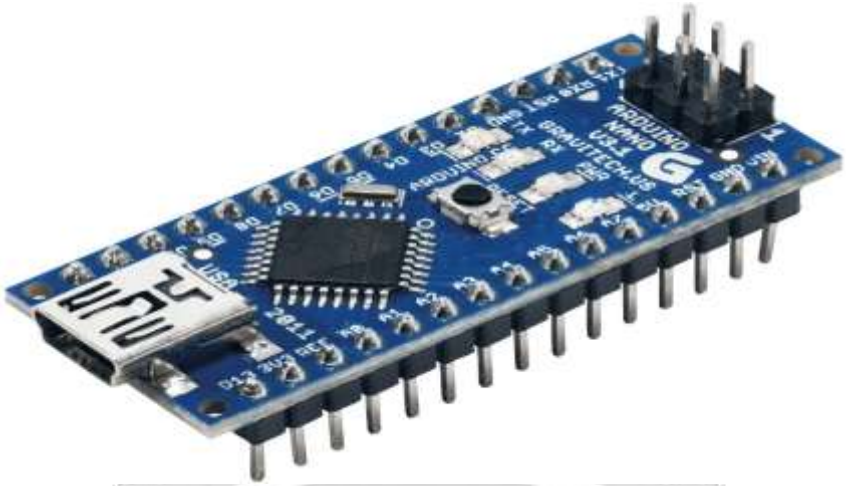

Fig -2: Arduino Nano

2.2 Processing IDE

It is an integrated environment and open source language of computer programming developed for electronics arts, new media arts, and visual design communities for the purpose of teaching the fundamental programming language in a visual context and to serve as a foundation for electronics sketchbooks. Processing has spawned another project, Wiring, which uses the Processing IDE with a collection of libraries written in the C++ language as a way to teach artists how to program microcontrollers. There are now two separate hardware projects, Wiring and Arduino, using the Wiring environment and language.

Fig -3: Processing IDE

3. Working Principle

To make this happen we have to leverage the power of Arduino and Processing combined. Most of would be familiar with Arduino, but Processing might be new for you. Processing is an application just like Arduino and it is also Open source and free to download. Using Processing you can create simple system applications, Android applications and much more. It also has the ability to do Image Processing and Voice recognition. It is just like Arduino and is much easy to learn, but do not worry if you are completely new to processing because I have written this tutorial fairly simple so that anyone with interest can make this working in no time.Here we are using processing to create a simple System application which provides us an UI and track the position of our hand using Image processing. Now, we have to make left click and right click using our fingers. To make that happen I have

used two hall sensors (one on my index finger and the other on middle finger) which will be read by the Arduino Nano. The Arduino also transmits the click status to the Computer wirelessly via Bluetooth.

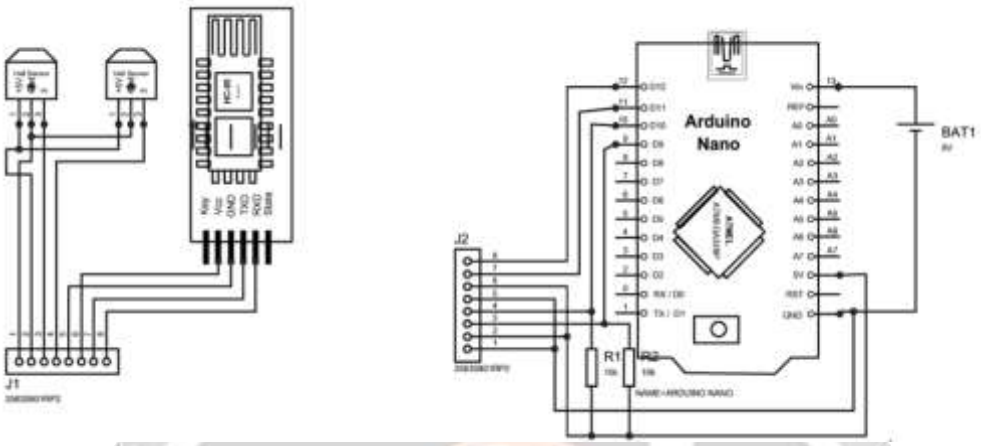

Fig -4: Arduino Block Diagram

3.1 . PROGRAM FOR ARDUINO

The purpose of this Arduino code is it to read the status of the hall sensor and broadcast them using the Bluetooth module. It should also receive data from Bluetooth and toggle the on-board LED based on the incoming value.

```
If (Phs1!=HallState_1 || Phs2!=HallState_2) //Check if new keys are pressed
 {
If (HallState_1==LOW && HallState_2==LOW)
Aisha. Write (1);
If (HallState_1==HIGH && HallState_2==LOW)
Aisha. Write (2);
If (HallState_1==LOW && HallState_2==HIGH)
Aisha. Write (3);
If (HallState_1==HIGH && HallState_2==HIGH)
Aisha. Write (4);
 }
```

As shown in the above lines based on the status of the hall sensor the Bluetooth will write a particular value. For example if hall sensor 1 is high and hall sensor 2 is low, then we will broadcast the vale “2” via the Bluetooth module. Make sure to write the values to the BT module and not print them. Because it will be easy to read the only on Processing side only if they are written. Also the value will only send if it is not as same as the previous value.

```
If (Bluetooth Data=='y')
```

```
Digital Write (led pin, HIGH);
If (Bluetooth Data=='n')
Digital Write (led pin, LOW);
```

These lines are used to toggle the on board LED which is connected to the Pin 13, based on the value received by the BT module. For example if the module receives a 'y' then the LED is turned on and if it receives an 'n' then it is turned off.

3.2 PROGRAM FOR PROCESSING:

The purpose of the Processing program is to create a system application which can act as an UI (User interface) and also perform image processing to track a particular object. In this case we track the blue object that we stuck to our gloves above. The program basically has four screens.

1. Calibration Screen
2. Main Screen
3. Paint Screen
4. LED toggle Screen

We can navigate from one screen to another by simply waving our hands and dragging screens on air. We can also make clicks on desired places to toggle LED or even draw something on screen.

You can copy paste the complete Processing program (given at the end) and modify it based on your creativity, and follow the following steps to launch the application.

1. Install JAVA in your computer if you have not installed it before
2. Install You Cam perfect on your computer
3. Power up your Arduino and pair your Computer with the Bluetooth Module
4. Launch the application file

If everything goes fine you should be able to notice the LED on your Bluetooth module getting stable and your webcam light going ON. If you have any problems reach me through the comment section and I will help you out.

Watch the video at the end to know how to calibrate your application and use it.

If you want to modify the code and build more features into this then you can use the following insights of the program

Processing has the ability to read Serial data, in this program the serial data is comes from the Bluetooth COM port. You have to select which COM port your Bluetooth is connect to by using this line below

```
Port = new Serial (this, Serial .list ()[1],9600);
```

Here we have selected my 1st COM port which is COM5 in my case (see image below) and I have mentioned that by Bluetooth module runs on 9600 baud rate. As said earlier processing also has the ability to do image processing, the images are sent inside the sketch using a webcam. In each image we track for a particular object.

4. CONCLUSIONS

Virtual reality is the advanced aid which makes a person's presence move around in it and interact with virtual features or items. This technology have led to massive up gradation of the society. From virtually at a distant place. A person using virtual reality equipment is able to "look around" the artificial world, and with high quality VR

education to national security, virtual reality has made an effective advancement. From their earliest age, the next generation will be surrounded by virtual reality in all aspects of their life. In school, virtual environments will be learning grounds for biology, space, history, civics and more.

5. REFERENCES

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