EYE CONTROLLED ROBOT

Prachurjya Sharma[1], Sachin Vinayak[2], Soumabrata Mukherjee[3], Hemant Sakhrani[4]

[1] Student, Electronics And Communication, SRM Institute of Science and Technology, Tamil Nadu, India
[2] Student, Electronics And Communication, SRM Institute of Science and Technology, Tamil Nadu, India
[3] Student, Electronics And Communication, SRM Institute of Science and Technology, Tamil Nadu, India
[4] Student, Electronics And Communication, SRM Institute of Science and Technology, Tamil Nadu, India

ABSTRACT

The main objective of this paper is to develop a low cost eye tracking system using Arduino UNO (ATMEGA328 micro controller) and an Android Smartphone. The system is designed for use with a wheel chair enabling a patient to move using only the movement of their eye.

Keyword: - *Arduino UNO , Android Studio IDE, Eye tracking, and OpenCV 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

Previous eyetracking system use bulky computers and laptops that need to be mounted to the wheel chair for tacking and movement of the patient.

1.2 Proposed System

In our new system we have improved upon the designed by utilizing a smartphone. Smartphones are popular devices in todays world and most of very cheap but with highly capable processing capabilities for handling image processing

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 two motors for movement. The software part used is Arduino IDE and Android Studio 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 HC05 Bluetooth module

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. Serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR ‘Bluecore’ 04-External single chip Bluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature).

2. Software Used

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

2.1 Arduino IDE

AN OPEN PROJECT WRITTEN, DEBUGGED, AND SUPPORTED BY ARDUINO.CC AND THE ARDUINO COMMUNITY WORLDWIDE

LEARN MORE ABOUT THE CONTRIBUTORS OF ARDUINO.CC on arduino.cc/credits

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 Android Studio IDE

Android Studio is the official integrated development environment (IDE) for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development.[8] It is available for download on Windows, macOS and Linux based operating systems. It is a replacement for the Eclipse Android Development Tools (ADT) as primary IDE for native Android application development.

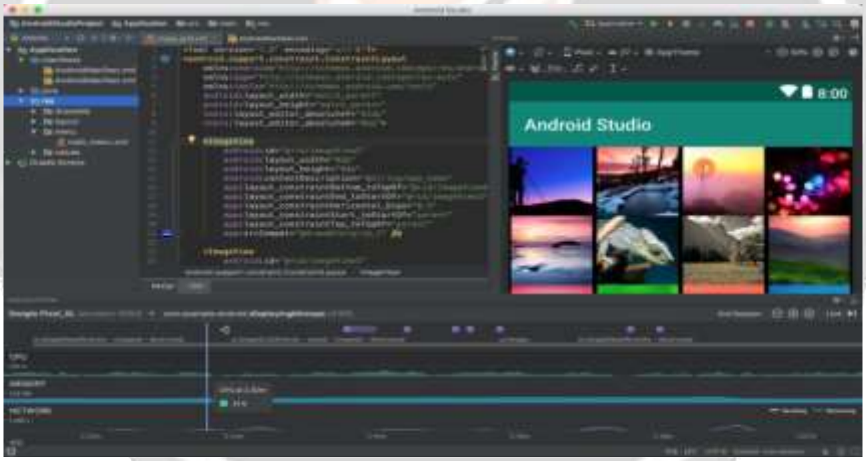


Fig -3: Android Studio IDE

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.

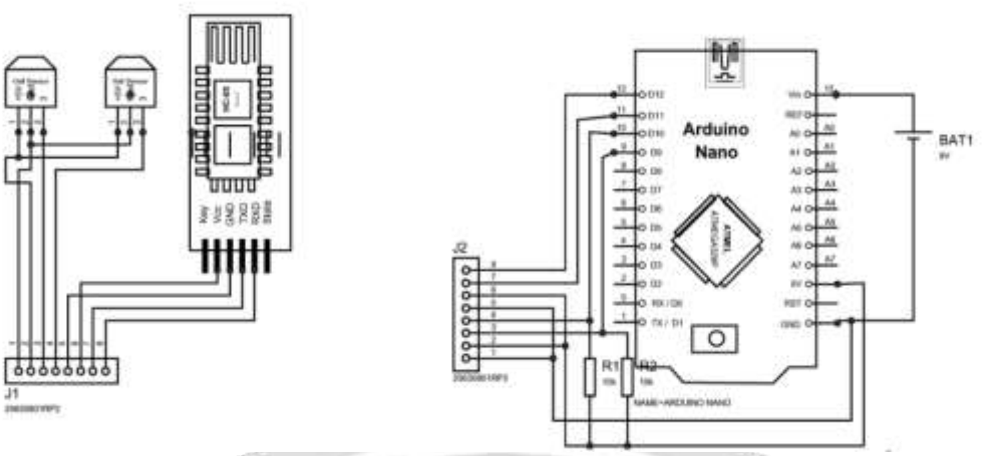


Fig -4: Arduino Block Diagram

3.1. PROGRAM FOR ARDUINO

The following Arduino program is used to receive the direction in which the wheelchair needs to move and rotate the motors correspondingly.

```
 #include <SoftwareSerial.h> //For Bluetooth Comm


SoftwareSerial BlueT(2, 3); // RX | TX
char BTData='0';
char SerialData='0';


const int timedelay = 500;


//L293D
//Motor A
const int motorAPin1  = 5;  // Pin 14 of L293
const int motorAPin2  = 6;  // Pin 10 of L293
//Motor B
const int motorBPin1  = 10; // Pin  7 of L293
const int motorBPin2  = 9;  // Pin  2 of L293
```

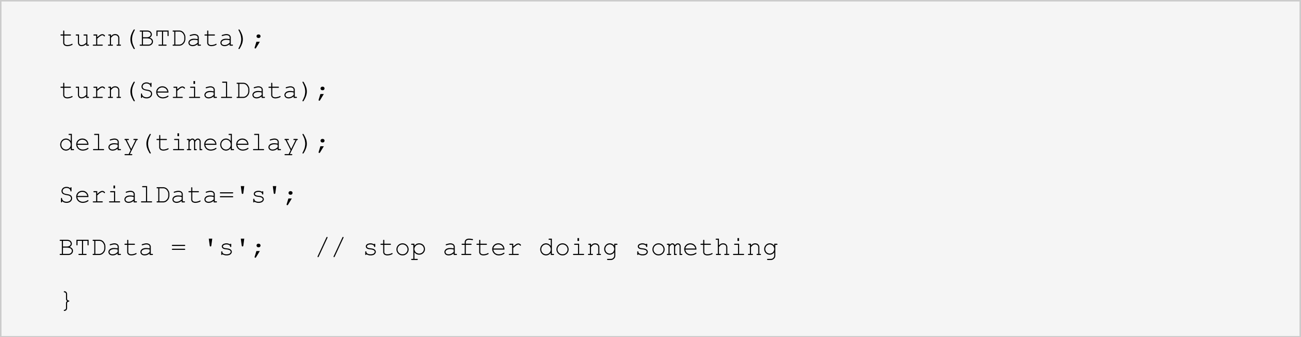
In the setup() function we setup the baud rate of the serial ports for USB communication and Bluetooth communication. Then we set the pins connecting to the motor driver L293D as “output”.

```
void setup() {
```

```
Serial.write("Begin\n");
 //Init' Serial Ports
 Serial.begin(9600);
 BlueT.begin(9600);


 //Set pins as outputs
 pinMode(motorAPin1, OUTPUT);
 pinMode(motorAPin2, OUTPUT);
 pinMode(motorBPin1, OUTPUT);
 pinMode(motorBPin2, OUTPUT);
 }
```

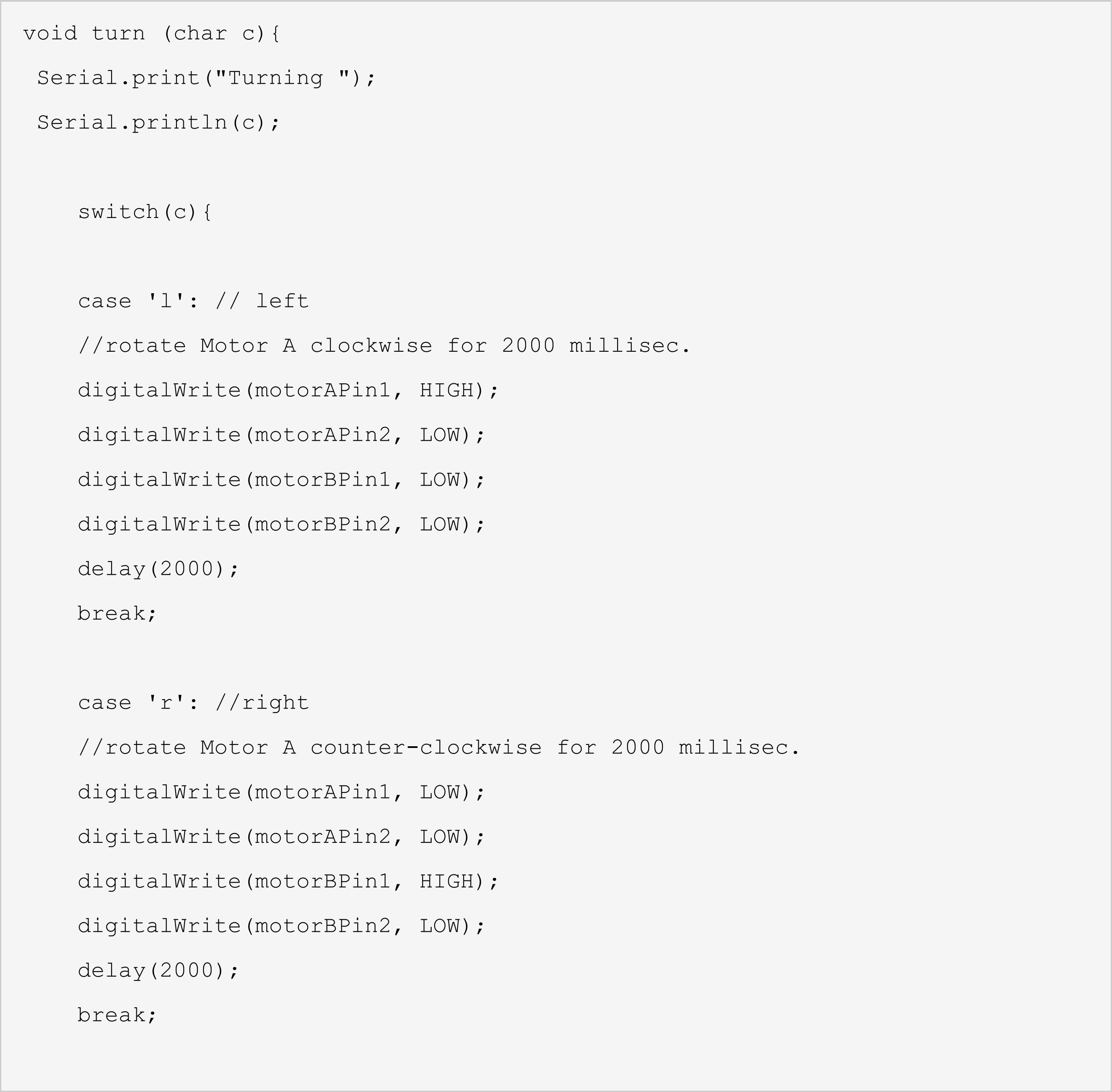
In the loop() function has 3 main parts , first to read the received data from the Bluetooth transceiver module, next to receive data from the USB serial which may be used for testing, and finally to move the wheelchair in the direction corresponding to the received data.

```
void loop() {
  // put your main code here, to run repeatedly:
  //Serial.print("loop\n");


  // Recieve the bluetooth data
  while(BlueT.available()){
    BTData=(byte)BlueT.read();
    Serial.print("Debug: BT recieved "+ BTData);
    }
  Serial.print("\n"); // newline


  // Use serial monitor to turn(For testing)
  while (Serial.available()) {
    SerialData = Serial.read();
    Serial.print("Debug: Serial recieved ");
    Serial.println(SerialData);
  }
  Serial.println("turning");
```

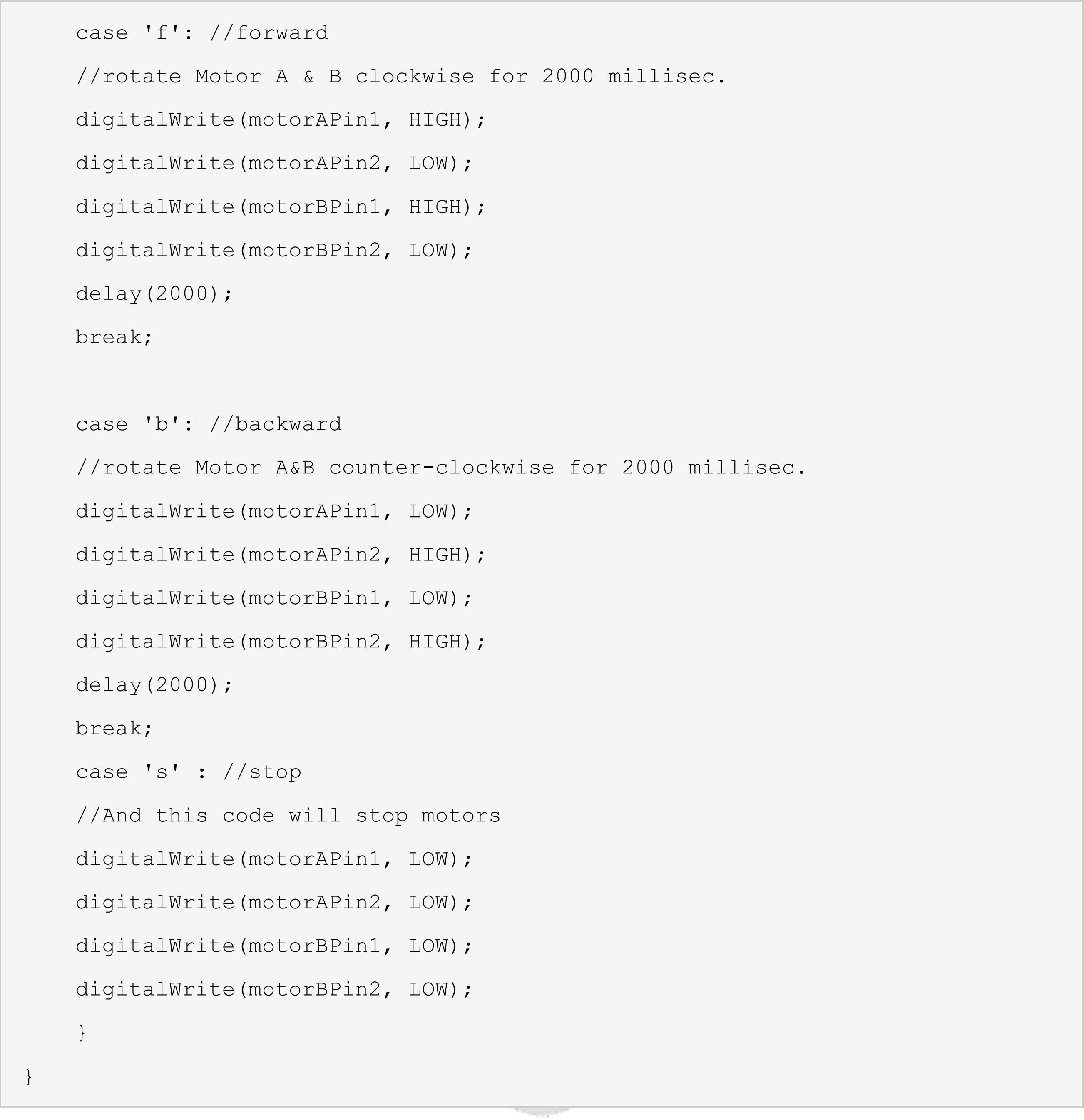


```
  turn(BTData);
  turn(SerialData);
  delay(timedelay);
  SerialData='s';
  BTData = 's';   // stop after doing something
  }
```

In the turn() function we map the direction received by the Bluetooth transceiver to the rotation of the motors(either clockwise or counter clockwise) .



```
void turn (char c){
 Serial.print("Turning ");
 Serial.println(c);

    switch(c){

    case 'l': // left
    //rotate Motor A clockwise for 2000 millisec.
    digitalWrite(motorAPin1, HIGH);
    digitalWrite(motorAPin2, LOW);
    digitalWrite(motorBPin1, LOW);
    digitalWrite(motorBPin2, LOW);
    delay(2000);
    break;

    case 'r': //right
    //rotate Motor A counter-clockwise for 2000 millisec.
    digitalWrite(motorAPin1, LOW);
    digitalWrite(motorAPin2, LOW);
    digitalWrite(motorBPin1, HIGH);
    digitalWrite(motorBPin2, LOW);
    delay(2000);
    break;
```



```
    case 'f': //forward
    //rotate Motor A & B clockwise for 2000 millisec.
    digitalWrite(motorAPin1, HIGH);
    digitalWrite(motorAPin2, LOW);
    digitalWrite(motorBPin1, HIGH);
    digitalWrite(motorBPin2, LOW);
    delay(2000);
    break;

    case 'b': //backward
    //rotate Motor A&B counter-clockwise for 2000 millisec.
    digitalWrite(motorAPin1, LOW);
    digitalWrite(motorAPin2, HIGH);
    digitalWrite(motorBPin1, LOW);
    digitalWrite(motorBPin2, HIGH);
    delay(2000);
    break;
    case 's' : //stop
    //And this code will stop motors
    digitalWrite(motorAPin1, LOW);
    digitalWrite(motorAPin2, LOW);
    digitalWrite(motorBPin1, LOW);
    digitalWrite(motorBPin2, LOW);
    }
}
```

3.2 PROGRAM FOR PROCESSING:

The purpose of Android™ application is to create a UI (User interface) for selecting and viewing and perform image processing to track a particular object. In this case we track the person’s eye movements. There are two main screens in the program-

1. Selecting the Bluetooth device
2. For tracking the eye

You can find the application source code at “https://github.com/SachinVin”, you can then setup your android studio and compile and build the project for yourself.

If everything goes well, you should be able to notice the LED on your Bluetooth module getting stable.

The app uses OpenCV for image processing and uses its Hough circle algorithm to find circles.

5. REFERENCES

[1]. Aroca, Rafael V.; Gomes, Rafael B.; Dantas, Rummennigue R.; Calbo, Adonai G.; Gonçalves, Luiz M.G. 2013. "A Wearable Mobile Sensor platform to Assist Fruit Grading."’ Sensors 13, no.5: 61096140.

[2]. Faludi, Robert (January 4, 2011), Building Wireless Sensor Networks: with ZigBee, XBee, Arduino, and Processing (1st ed.), O'Reilly Media, p. 320, ISBN 978-0-596-80774-0.

[3]. Deliang Zhu, Zhiquan Feng, Bo Yang, Yan Jiang, Tiantian Yang. The Design and Implementation of 3D Hand-based Human Computer Interaction. 20IO International Conference on Computer Application and System Modeling (ICCASM 2010).

[4]. Vantomme, Jan (September 20, 2012), Processing 2, Creative Programming Cookbook (1st ed.), Packt Publishing, p. 291, ISBN 9781849517942.

[5] Pearson, Matt (June 1, 2011), Generative Art, A practical guide using Processing (1st ed.), Manning, p. 240, ISBN 9781935182627.