SoftWatch: The Next Generation of Smartwatch

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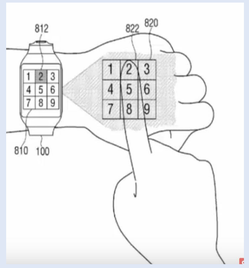
Introduction

The use of smartwatches have evolved advantages over other devices. They have become much more convenient and more compact than a regular smartphone.

However, controlling the smartwatch is the biggest limitation because the screen is just too small.

What if we could do away with said limitation? We present our SoftWatch, a smartwatch that will break the limitation of the screen. No more need for touchscreens as you would be able to control your smartwatch just by touching your skin.



https://www.youtube.com/watch?v=6wnPhQktCYg

Design

Block Diagram

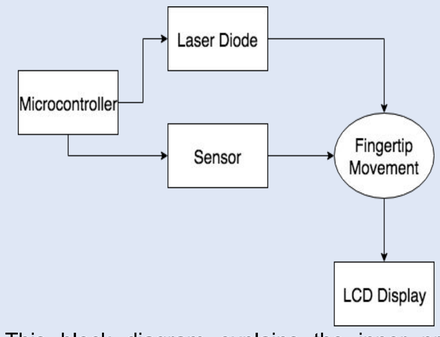


Figure 1. This block diagram explains the inner process of the hardware physical components: I2C microcontroller, laser diode, time flight sensor, the fingertip movement, and the LCD display.

- The I2C microcontroller is used to control the time flight sensor and the laser diode.
- The Laser Diode is used for projection and will project a keyboard letter on the skin.
- The fingertip movement is from the user which the sensor will pick up.
- The time flight sensor will collect the data and convert this to be shown on the LCD Display.

Current Progress

Sensors

a.

Figure 2.(a) Adafruit GEMMA v2 - Miniature wearable electronic platform (b) VL53L0X Time-of-Flight Sensor

b.

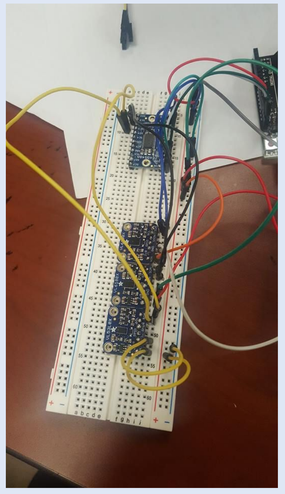


Figure 2. (b) Current prototype depicting an array of 3 time of flight sensors(a mix of one **VL53L0X** and two **VL6180** sensors)

These sensors are used to detect the movements and the locations of fingers in front of them and then map their positions onto a 2D plane.

Sensor Circuit Layout

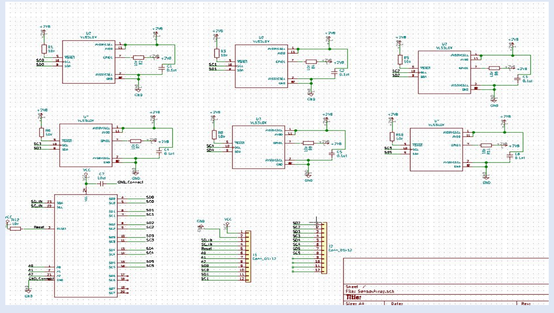


Figure 3. PCB Schematic of the custom PCB board that combines 6 VL53L0x proximity sensors with a single TCA9545A I2C multiplexor. The sensors are aligned next to each other to cover the full range of finger inputs when a arm it touched.

More Progress

Code for VL53L0X(VL6180X) and I2C

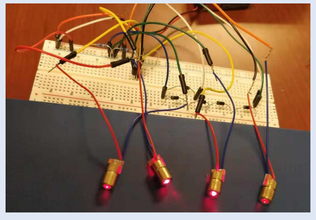
```
void loop()
{
  /* Get a new sensor event */
  sensors_event_t event;
  tcaselect(1);
  /* Display the results (magnetic vector values are in micro-Tesla (uT)) */
  float lux1 = vl1.readLux(VL6180X_ALS_GAIN_5);
  uint8_t range1 =  vl1.readRange();
  uint8_t status1 = vl1.readRangeStatus();
  if (status1 == VL6180X_ERROR_NONE) {
       if (range1 < 100){
         int diff1 = (millis() - lastTimeofLeft);
         if (left && diff1 < 250 && diff1 > 140){
           left = false;
         }else{
           right = true;
         }
         lastTimeofRight = millis();

       }
  }
  tcaselect(2);
  float lux2 = vl2.readLux(VL6180X_ALS_GAIN_5);
  uint8_t range2 = vl2.readRange();
  uint8_t status2 = vl2.readRangeStatus();
  if (status2 == VL6180X_ERROR_NONE) {
       if (range2 < 100){
         int diff2 = (millis() - lastTimeofRight);
         if (right && diff2 < 200 && diff2 > 120){
           right = false;
         }else{
           left = true;
         }
         lastTimeofLeft = millis();
       }
  }
  if(range1 > 0 && range2 > 0 && (range1 < 200 || range2 < 200)){
    Serial.println(determinSide(range1, range2));
  }
  delay(500);
}
```

Figure 4. VL53I0X(VL6180) time-of-flight sensor is an important component to detect the movement of fingers. The picture is the **Loop()** function where **Microcontroller** keeps checking the data over I2C communication from the the time-of-flight sensor array and analyze the x, y positions of the finger.

Laser Diode Projection

Figure 5. 5mW 650nm Laser Diodes are used for projection of keyboard letters. To drive the laser diode, we used a circuit that include components such as 9v battery, zener diode, pnp bjt transistor, and 120 ohms, 1k ohms resistors.



Acknowledgment

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