

UC Davis Advanced RF Technologies Lab Internship on Wearable Radar
Sensor for Long-term Cardiac Arrhythmia Monitoring

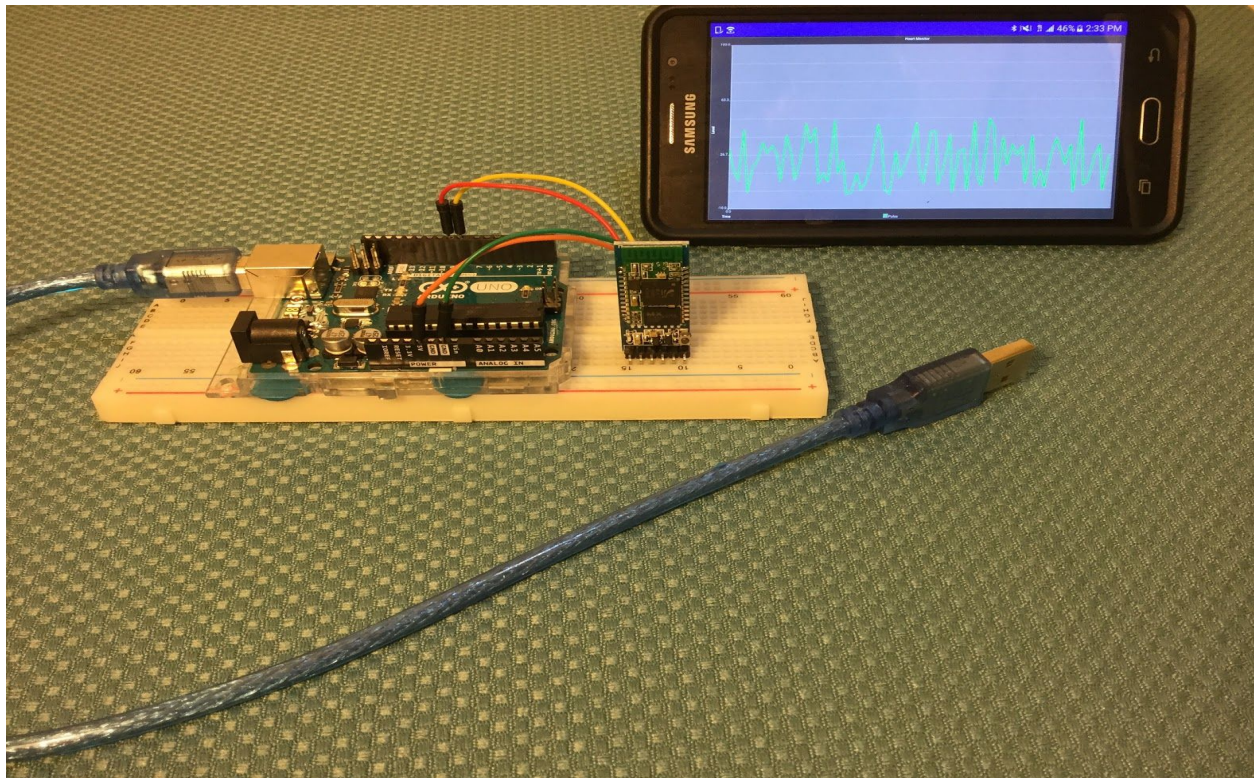
Technical Overview

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Overview

- Simple set up and data visual
- Easily adaptable with end user display, bluetooth configuration, and data transfer process
- A model of the heart sensor module
- Transfer of data from Arduino Uno Microcontroller board to mobile application via Bluetooth module
- Closely depicts the seamless data transfer and processing of what the real module will be like
- Visit research webpage for more information: <https://ucdart.github.io/research/#cardiac>

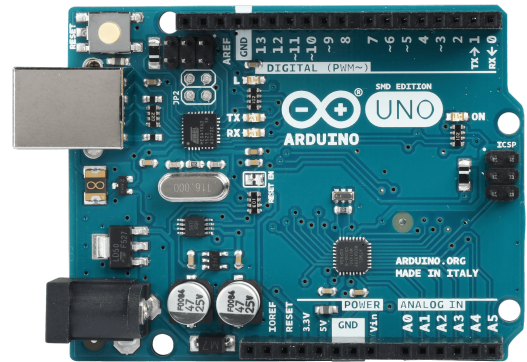


System: Arduino Uno Microcontroller, jump wires, standard issue USB 2.0 cable, Bluetooth HC-05 module, breadboard, mobile device

Technical Details

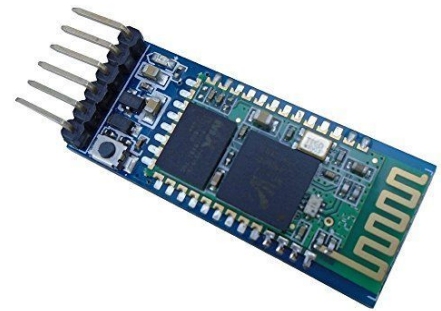
Arduino Uno Microcontroller

- Downloads and runs C programming files from the Arduino IDE (Integrated Development Environment)
- Generates randomized sequences of numeric data in a specified range
- Communicates with mobile device via Bluetooth
- Sends data at 200 Hz, the rate at which the real module will function in
- Wide versatility with sensor integration
- Utilizes built-in timer to send data rapidly with precision



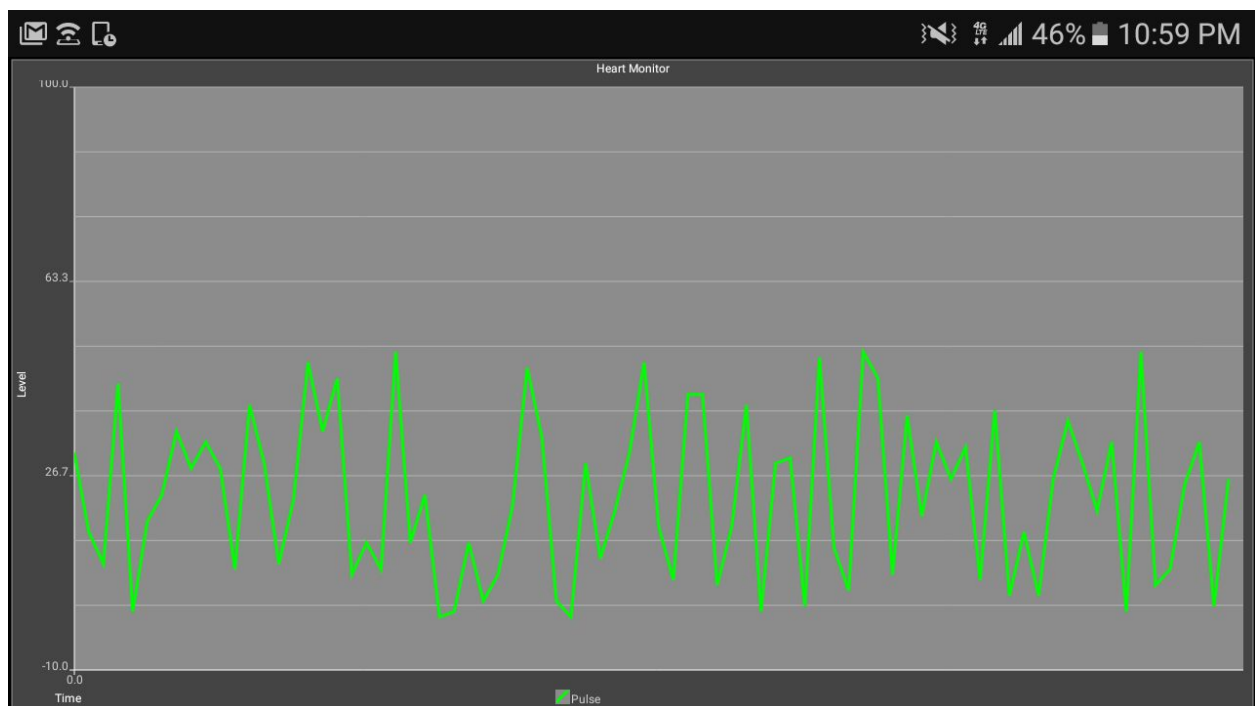
Bluetooth HC-05 Module

- Core component in the communication between Arduino and mobile device
- LED feature to signal different stages of connection
- Can send and receive data in real time
- Power range of 3.6 - 6.0 V
- Pin Connections: STATE, RXD, TXD, GND, VCC, EN



Mobile Application & Data Visualization

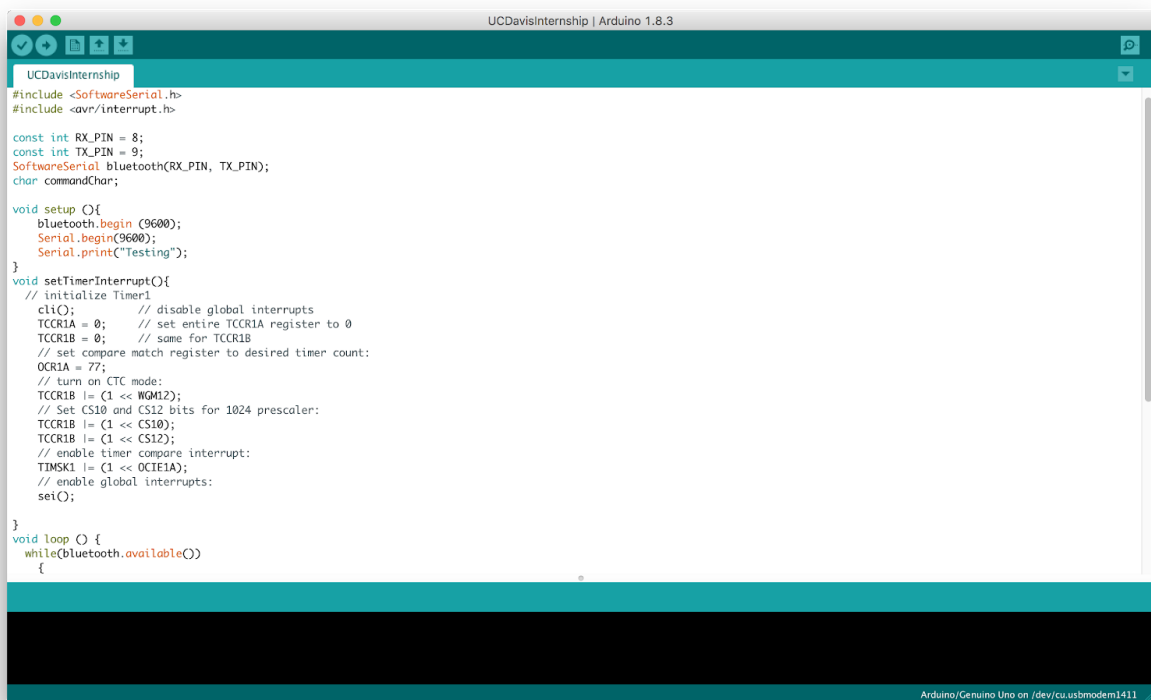
- Seamless data processing and display at 200 Hz
- Uses Bluetooth to communicate with Arduino Uno and HC-05 module
- Sends and Receives data
- Stop feature to pause graphing
- Flexible display
- User Interface is to be integrated.



- *App Screenshot*

Arduino IDE & Development

- C/ C++ Compiler
- Main default functions: setup, loop
- Flexible with vast libraries for hardware configuration such as Bluetooth modules.
- Shows output console and error logs
- Timer to send data at precise rate of 200 Hz
- Continuously listens for bluetooth connection availability and request from mobile device

A screenshot of the Arduino IDE interface. The title bar at the top reads "UCDavisInternship | Arduino 1.8.3". The main text area contains C++ code for a Bluetooth module. The code includes headers for SoftwareSerial and AVR interrupts, defines RX and TX pins, and sets up a timer interrupt to send data at 200 Hz. The loop function continuously checks for available data on the Bluetooth module. The status bar at the bottom indicates "Arduino/Genuino Uno on /dev/cu.usbmodem1411".

```
UCDavisInternship
#include <SoftwareSerial.h>
#include <avr/interrupt.h>

const int RX_PIN = 8;
const int TX_PIN = 9;
SoftwareSerial bluetooth(RX_PIN, TX_PIN);
char commandChar;

void setup () {
  bluetooth.begin(9600);
  Serial.begin(9600);
  Serial.print("Testing");
}

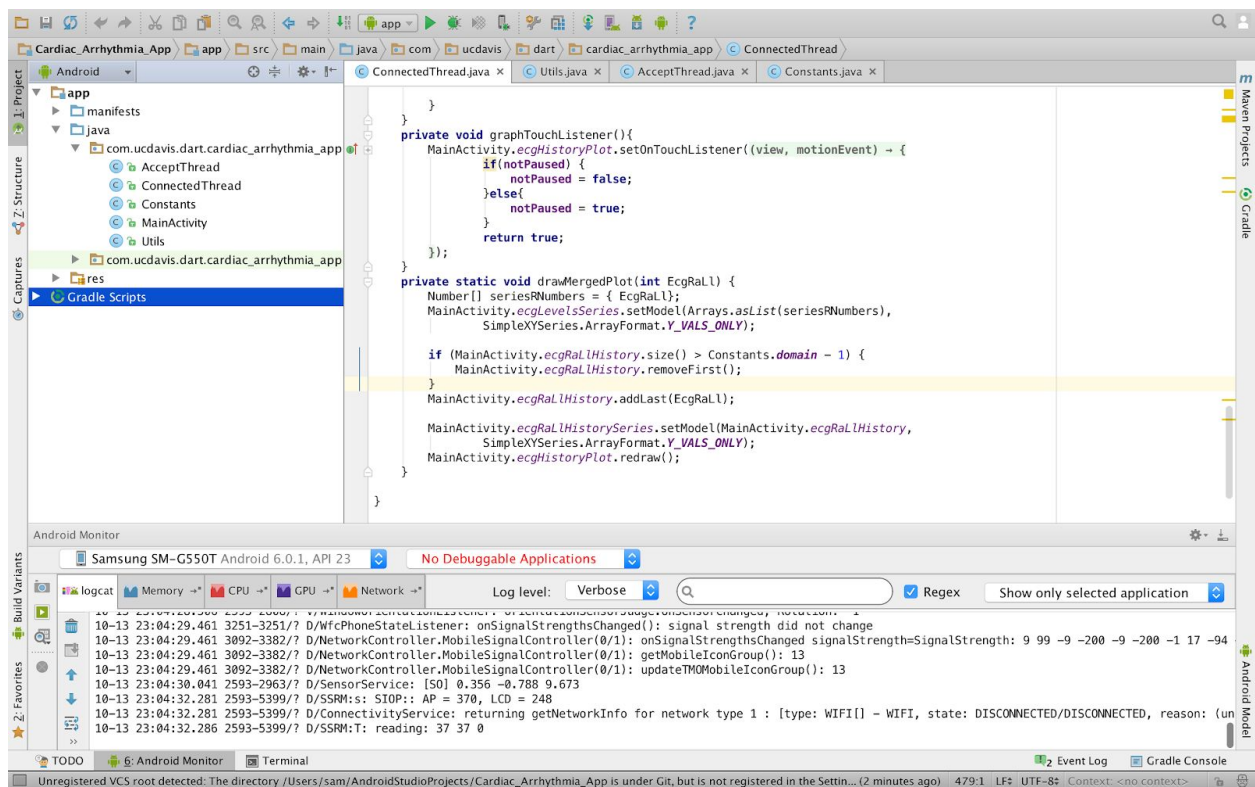
void setTimerInterrupt() {
  // initialize Timer1
  cli(); // disable global interrupts
  TCCR1A = 0; // set entire TCCR1A register to 0
  TCCR1B = 0; // same for TCCR1B
  // set compare match register to desired timer count:
  OCR1A = 77;
  // turn on CTC mode:
  TCCR1B |= (1 << WGM12);
  // Set CS10 and CS12 bits for 1024 prescaler:
  TCCR1B |= (1 << CS10);
  TCCR1B |= (1 << CS12);
  // enable timer compare interrupt:
  TIMSK1 |= (1 << OCIE1A);
  // enable global interrupts:
  sei();
}

void loop () {
  while(bluetooth.available())
  {
```

View code: <https://github.com/chung1007/2017-UCD-DART-Internship/blob/master/UCDavisInternship.ino>

Android Mobile Application Development

- Built on IntelliJ and is capable of advanced code completion, refactoring, and code analysis.
- Java programming language
- XML format for display
- Class to continuously listen for bluetooth availability from Arduino
- Instantly starts to receive stream of data after connection
- Graphs Arduino data in real time
- Logs errors and log messages in real time



View code:

https://github.com/chung1007/2017-UCD-DART-Internship/tree/master/app/src/main/java/com/ucdavis/dart/cardiac_arrhythmia_app