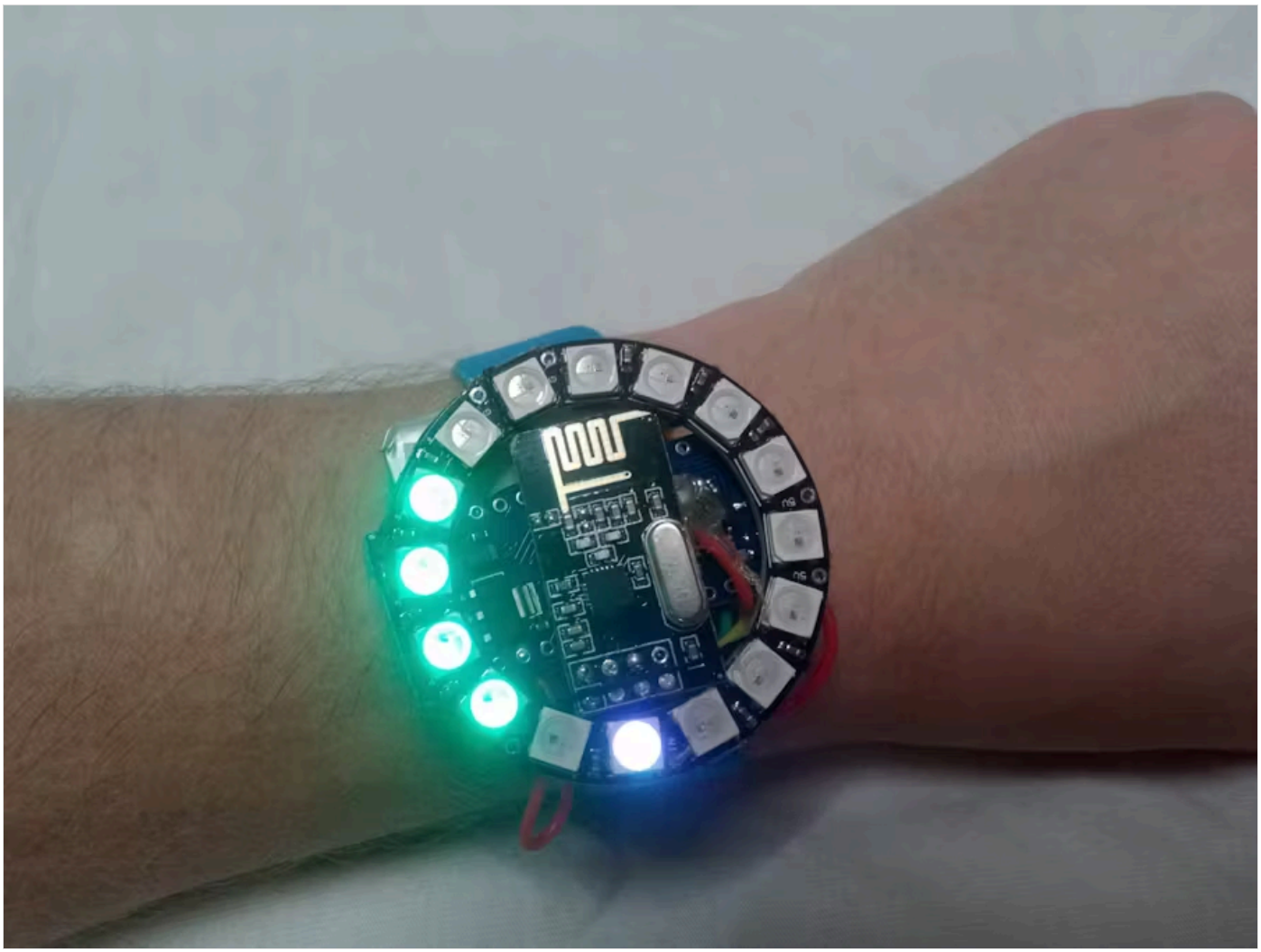
Dmytro Dziuba (/the_3d6)
Published July 18, 2019

Heart Rate Monitor (Wearable and Wireless Using ECG)

A rather convenient device to monitor heart rate while running.

Intermediate(/projects?difficulty=intermediate) Full instructions provided 6 hours 60,552



Things used in this project

Hardware components

	uECG device For actually measuring BPM. It can send data via nRF24-compatible protocol	× 1	(/products/buy/1029562?s=BAhJIhMxNjM4NDMsUHJvamVjdAY6BkVG%0A)
	Arduino Nano R3 (/arduino/products/arduino-nano-r3?ref=project-e96dce)	× 1	(/products/buy/191723?s=BAhJIhMxNjM4NDMsUHJvamVjdAY6BkVG%0A)
	nRF24 Module (Generic) Any module would work here. Required to receive BPM data from uECG	× 1	
	Adafruit NeoPixel Ring: WS2812 5050 RGB LED (/adafruit/products/neopixel-ring-ws2812-5050-rgb-led?ref=project-e96dce)	× 1	(/products/buy/173443?s=BAhJIhMxNjM4NDMsUHJvamVjdAY6BkVG%0A)
	LiPo battery Any battery with 200+ mAh capacity	× 1	

Hand tools and fabrication machines

	Soldering iron (generic)

Story

This is a second iteration of my heart monitoring project, previous one (https://www.hackster.io/aka3d6/heart-beat-indicator-using-ecg-87b938) was showing heart beats on a chest, and was connected to uECG (https://www.tindie.com/products/18040/) via wire. That looks cool, but isn't practical at all - you can't see well how many LEDs exactly are currently on, it's out of your normal view field, and wire connecting it to uECG device creates a lot of problems for the sensor itself, so it basically doesn't work when you run.

This version solves all these problems: it is wrist-worn, so you can see it while keeping eyes on the road, and it's wireless, so no distortion of readings, it really works for running and allows you to keep track on heart load.

Read more

Schematics

Untitled file

File missing, please reupload.

nrf24_led_ring_o2Gij5oigT.fzz

(https://hacksterio.s3.amazonaws.com/uploads/attachments/944163/nrf24_led_ring_o2Gij5oigT.fzz)

Code

bpm_watch.ino Arduino

(/code_files/270101/download)

```
106       int max_bright = 160; //value of maximum brightness, max 255. But you don't always want it a
107       float dd = 25; //change in BPM between color tones (blue->green->yellow->pink->red)
108       float t1 = 90, t2, t3, t4; //t1 - "base" BPM, lower than t1 would be blue
109       t2 = t1 + dd;
110       t3 = t2 + dd;
111       t4 = t3 + dd;
112       //code for changing color depending in which t1...t4 range we are now
113       if(bpm < t1){ r = 0; g = 0; b = max_bright; }
114       else if(bpm < t2) { r = 0; g = max_bright * (bpm-t1)/dd; b = max_bright - g; }
115       else if(bpm < t3) { r = max_bright * (bpm-t2)/dd; g = max_bright - r; b = r/4; }
116       else if(bpm < t4) { r = max_bright; g = 0; b = max_bright/2 - max_bright * (bpm-t3)/(2*dd);
117       else {r = max_bright; g = 0; b = 0; }
118       int on_pixels = (bpm-80)/8; //since it's intended for running, I'm not
119       //showing anything less than 80 BPM, this way it's more sensitive in
120       //high load area
121       for(int i=0;i<NUMPIXELS;i++)
122       {
123         //pixels are set from last to first for no particular reason, would
124         //work just as fine if set from first to last
125         if(i < on_pixels) pixels.setPixelColor(NUMPIXELS-i-1, pixels.Color(r,g,b));
126         else pixels.setPixelColor(NUMPIXELS-i-1, pixels.Color(0,0,0)); //turn off all other LEDs
127       }
128       pixels.show();
129     }
130   }
```

Credits

Dmytro Dziuba (/the_3d6)

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(/the_3d6) I'm an electronics engineer with background in AI and physics

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Thanks to **Ultimate Robotics (https://ultimaterobotics.com.ua/)**.

Comments

Write | Preview | B | I | <> | ☰ | ❝

Share your thoughts! What do you like about this project? How could it be improved? Be respectful and constructive – most Hackster members create and share personal projects in their free time.

Post

(/lemontree) **lemontree (/lemontree)**
5 years ago

可以重新上传下你的原理图吗

Thank • Reply

(/the_3d6) **Dmytro Dziuba (/the_3d6)**
5 years ago

It should work now 😃

Thank • Reply to conversation • 1 thank

(/Master2903) **Master2903 (/Master2903)**
5 years ago

Can you tell how to make wireless heart rate monitor?

Thank • Reply

(/the_3d6) **Dmytro Dziuba (/the_3d6)**
5 years ago

Please ask more specific question 😃 All this post is about making one

Thank • Reply to conversation

(/shreyashsonavane18) **shreyashsonavane18 (/shreyashsonavane18)**
4 years ago

sir, I'm shreyash sonavane from India ,Telangana state .I've seen your project of heart rate monitor (wearable and wireless using ECG) .But I have a doubt in it ,if I want to attach a heart beat sensor with a display how should I do it .can you please make one and instruct me too!!

Thank • Reply to conversation

(/fishmangr) **fishmangr (/fishmangr)**
5 years ago

Great project Dmitry thanks for sharing ! I would like to try it my self, but not sure if my beginners skills it will be enough to build that watch. What you think I should try it?

Thank • Reply • 1 thank

(/the_3d6) **Dmytro Dziuba (/the_3d6)**
5 years ago

You might have problems putting it all together as a wearable, that requires some trial and error (and if you have little experience, maybe you'll need quite a few tries). But no doubt you can assemble it, after all it's only 12 wires, even if you'll need 30 minutes for each, you still can complete it in 6 hours 😃 And code (a) definitely works, I wrote and tested it, and (b) I'll be checking comments and will help if something goes wrong.
Also you can use this setup to get BPM on PC via serial monitor.
Just keep in mind: if you will order uECG device now, you'll get it either in late September or early October, first batch will be sent in production in about 2 weeks and this process takes some time.

Thank • Reply to conversation

(/fishmangr) **fishmangr (/fishmangr)**
5 years ago

Wow, that is long wait for me...i need to deliver a project until end of august... I dont need to do something so fancy like yours cause is my first quarter on servo-robots and arduinos. But i thought to do your project because my professor have serious heart issues..... I guess i will try something that i get all the parts more easily.. thank you so much for you time.

Thank • Reply to conversation • 1 thank

(/the_3d6) **Dmytro Dziuba (/the_3d6)**
5 years ago

Yes, unfortunately for this timeline it's not an option. But you can keep it in mind for later 😃

Thank • Reply to conversation

(/1234Siddhu-) **1234Siddhu- (/1234Siddhu-)**
5 years ago

Hey there! Can we connect the whole system to a Wifi Wireless Transceiver Module ?
If so , how do we do that?
Should we make any changes to the code?

Thank • Reply

(/the_3d6) **Dmytro Dziuba (/the_3d6)**
5 years ago

Hi! It uses custom radio protocol and I can confirm that it works with nRF24, nRF51822, nRF52832/52840 chips, but don't think you can receive it with WiFi module.
You still can connect nRF24 to ESP8266 (or to ESP32), get packets from nRF and re-send them over WiFI

Thank • Reply to conversation

(/ashwinjishnu) **ashwinjishnu (/ashwinjishnu)**
5 years ago

Hi,can you tell me how to configure it. i mean are there any packages we need to download?

can you also please explain the working of the code.

thank you:)

Thank • Reply

(/the_3d6) **Dmytro Dziuba (/the_3d6)**
5 years ago

You need RF24 library, but that's it.
As for the code - I've tried to comment it. Basically it does one thing: in an endless cycle it checks if there are new packets received by nrf24 module (after configuring it to listen for only uECG data), and if there are any - uses byte that contains BPM calculated on uECG side, and transforms it into pixels number/color.

Thank • Reply to conversation

(/gkminna) **gkminna (/gkminna)**
5 years ago

hi! this look super cool! I'm kind of new to all of this so I was wondering, do you have a circuit diagram of this that I can look at?

Thank • Reply

(/the_3d6) **Dmytro Dziuba (/the_3d6)**
5 years ago

Device circuit is described in text (breadboard diagram and list of connections are pretty much the same as circuit diagram). If you are interested in uECG, its schematics is available on hackaday page here: https://hackaday.io/project/164486-uecg-a-very-small-wearable-ecg (https://hackaday.io/project/164486-uecg-a-very-small-wearable-ecg)

Thank • Reply to conversation

S (/Sofyanjm) **Sofyanjm (/Sofyanjm)**
5 years ago

You mentioned that you are using uECG, but the uECG is not shown in the schematics. Can now explain that ?

Thank • Reply

(/the_3d6) **Dmytro Dziuba (/the_3d6)**
5 years ago

uECG sends data wirelessly, so it's not shown - but without it nothing would work 😃

Thank • Reply to conversation

S (/SaiOfAllTrades) **SaiOfAllTrades (/SaiOfAllTrades)**
4 years ago

I hope you will notice my question as soon as possible but where does the uecg connected? Is it attached on your body?

Thank • Reply

(/the_3d6) **Dmytro Dziuba (/the_3d6)**
4 years ago

Sorry, I'm not getting any comment notifications here, so it's not fast ((

uECG sends data via radio, it stays on my chest. nRF24 module receives these data

Thank • Reply to conversation

(/shreyashsonavane18) **shreyashsonavane18 (/shreyashsonavane18)**
4 years ago

sir, I'm shreyash sonavane from India ,Telangana state .I've seen your project of heart rate monitor (wearable and wireless using ECG) .But I have a doubt in it ,if I want to attach a heart beat sensor with a display how should I do it .can you please make one and instruct me too!!

Thank • Reply

(/the_3d6) **Dmytro Dziuba (/the_3d6)**
4 years ago

Right now we are fully focused on making an EMG device - but once it is ready, I will make an example with streaming to OLED attached to Arduino

Thank • Reply to conversation

(/the_3d6) **Dmytro Dziuba (/the_3d6)**
3 years ago

> ...and here is the project where I'm showing ECG data on OLED 😃
> https://www.hackster.io/the_3d6/getting-realtime-ecg-on-oled-screen-c20edd
> (https://www.hackster.io/the_3d6/getting-realtime-ecg-on-oled-screen-c20edd)

Thank • Reply to conversation


(/Cha_L) **Cha_L (/Cha_L)**
4 years ago

Hello ! Thanks for sharing your project it's amazing. I found all the component but I can't seem to find the nRF24 module anywhere, at least the good one. Do you mind sending me a link or ideas where I could get it ?
Thank you,
Charlotte

Thank • Reply


(/zlapim) **zlapim (/zlapim)**
3 years ago

For the uECG, do we need to add the USB receiver base with it? In the uECG link, it gives the option of adding the USB receiver base with it.
https://www.tindie.com/products/ultimaterobotics/uecg-smallest-open-low-power-ecg/
(https://www.tindie.com/products/ultimaterobotics/uecg-smallest-open-low-power-ecg/)

Thank • Reply


(/james-adams2) **James Adams (/james-adams2)**
3 years ago

Are you using female or male wires?

Thank • Reply

> 
> (/the_3d6) **Dmytro Dziuba (/the_3d6)**
> 3 years ago
>
> On the bracelet I've just soldered wires. And uECG which measures ECG data is placed on gel electrodes via its standard 3mm button connectors
>
> Thank • Reply to conversation • 1 thank


(/Marius_Kotz) **Marius Kotz (/Marius_Kotz)**
3 years ago

Hello, when I try to enter the code into an Arduino, he says In function 'void setup()':
sketch_dec30a:54:35: error: expected ';' before ':' token
rf.setCRCLength(RF24_CRC_DISABLED): How do I fix this problem?

Thank • Reply

(/the_3d6) **Dmytro Dziuba (/the_3d6)**
3 years ago

You have ":" at the end of your line instead of ";", not sure why.

Also, please use uECG library from Arduino Library manager instead of this code - it is outdated and if you are using any uECG device bought in 2021, it most probably won't work

Thank • Reply to conversation • 1 thank

(/Marius_Kotz) **Marius Kotz (/Marius_Kotz)**
3 years ago

Hello, so after I install uecg library into Arduino what do I type in the code editor?

Thank • Reply to conversation

(/the_3d6) **Dmytro Dziuba (/the_3d6)**
3 years ago

You can start with included examples - one of them prints BPM and some other data into serial. You can use that value and combine it with code from here

Thank • Reply to conversation

(/Marius_Kotz) **Marius Kotz (/Marius_Kotz)**
3 years ago

Ok. Problem is I'm only a beginner and I am not sure how to do this.

Thank • Reply to conversation

M (/mar43) **mar43 (/mar43)**
2 years ago

Hello , I want to collaborate with you ,so it’s fine to contact me ? as soon as possible .

My email : 48mrym@gmail.com (mailto:48mrym@gmail.com)

Best regards.

Thank • Reply

(/macysharp) **macysharp (/macysharp)**
2 years ago

Hi, i am looking at using this project as a part of a project of mine. I want to add a screen to show the heart rate, would you be able to suggest how i can include this in the code to show the heart rate on the screen?

Thank • Reply

(/the_3d6) **Dmytro Dziuba (/the_3d6)**
2 years ago

Sorry, missed your comment 😦 As of now you can use uECG library from Arduino library manager with the same hardware setup, it has 2 included examples, one of which shows data on OLED screen

Thank • Reply to conversation

Y (/yashrajsharma3363) **Yashraj Sharma (/yashrajsharma3363)**
2 years ago

Is the schematics file missing here? It says 'file missing'. Can someone please confirm and provide the file? Thanks

Thank • Reply

(/the_3d6) **Dmytro Dziuba (/the_3d6)**
2 years ago

It's present in the main text as an image (in the form of connection diagram in chapter 2). But please note that it's only the part for displaying the data - actual ECG measurements are performed by uECG device and are sent wirelessly to nRF24 module.
Also that code is quite old - since then, I wrote a dedicated library (uECG library in Arduino library manager), with it code becomes much simpler. If you'll decide to make that project, you can ask questions in our Discord channel https://discord.gg/dEmCPBzv9G (https://discord.gg/dEmCPBzv9G)

Thank • Reply to conversation

(/cadenechase) **Caden Chase (/cadenechase)**
5 months ago

What are the actual steps for connecting the uECG device to the nRF24 chip? The code in the current library does not include this project, should I continue using the sample code given?

Thank • Reply

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Polar Heart Rate Monitor and Blink(1) with Octoblu (/team-octoblu8/polar-heart-rate-monitor-and-blink-1-with-octoblu-32d382)

Cody Matthieu (/fashion-mermaid)

836

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