WEARABLE Cardiac Monitor

Members of Team 24

- Andrew O'Brien
- Peyton Sher
- Ruiyu Sun
- Scott Beard
- Sam Kimball
- Vincent Lazzaro

Client/Adviser

• Dr. Cheng Huang

http://sdmay20-24.sd.ece.iastate.edu/

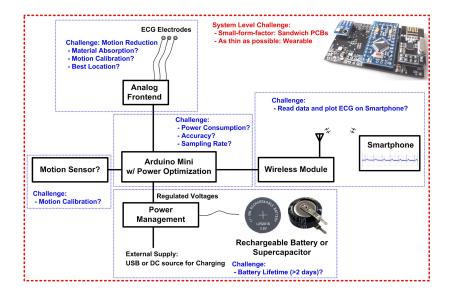
Project Vision

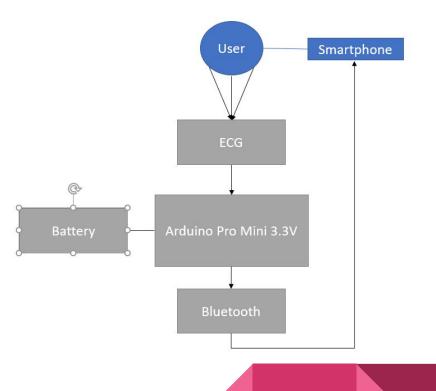
Our team spent the last two semesters building a compact, energy efficient, and user friendly heart rate monitor. This monitor was to be smaller than the typical heart rate monitor to allow the user to wear it in their normal daily lives.





Concept Sketch







Design Requirements

- Measurements
 - Continuous
 - Quality
- ECG display
 - Send data via Bluetooth
 - View on smartphone (Android)
- Runtime
 - 48+ hour battery life

- Wearability
 - Size
 - Comfort
 - Accessories
- Memory
 - Android Device
- App
 - Usability
 - User interface

Technical Requirements

- Bluetooth connectivity
- Low power usage
 - Minimum operating voltages
- Minimum Sizing
 - 50 mm x 70 mm
- Adequate sampling
- Rechargable



Operating Environment

- Connected to the body
- Handle condition involving physical activities, sweat, weather
- Average daily conditions.
- Able to wear to bed and while showering. 48 hrs continuous

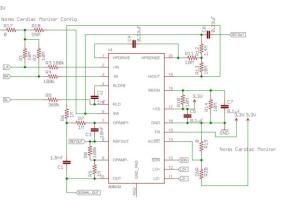


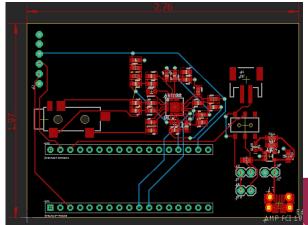
Hardware Design





- 3-lead ECG reading • TRS Auxiliary connector
- AD8232 Chip
- New gel pad increases accuracy
- 3.7 V battery
- Regulated VDD from Arduino

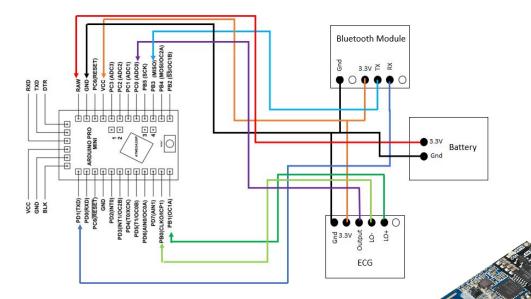




https://learn.sparkfun.com/tutorials/ad8232-heart-rate-monitor-hookup-guide/all https://cdn.sparkfun.com/datasheets/Sensors/Biometric/AD8232_Heart_Rate_Mo

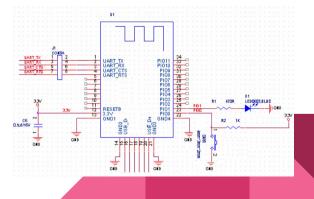
Team 24-Ruiyu

Communication Design





https://www.arduino.cc/

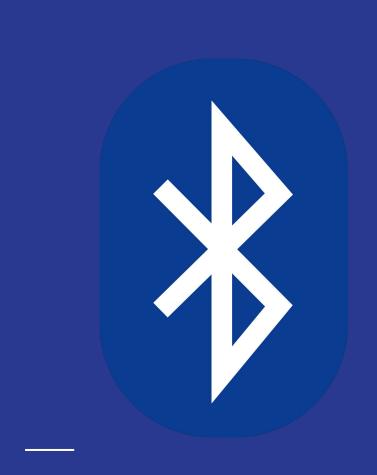


https://www.sparkfun.com/products/14839

Team 24-Vincent

Communication Design Issues

- Maintaining bluetooth connectivity
- Only send or receive data but not both causes a delay in data being sent over to the application
- Redesigned bluetooth connection to help



Software Design

- Android Application which allows for tracking and storing Cardiac Information
- Google FireBase Login
- Similar to existing applications/user familiar
- Allow user to export data
- Maintain Bluetooth connection in background

Cardiac Monitor	Cardiac Monitor
	SYNC 00:26:B4:85:B3:D7
A A	Amplify BSP15 27:4D:A3:5E:23:75
	ActivBuds A1 88:88:88:89:EB:C6
	HMSoft 00:0E:0E:0D:77:42
V V	MOKCAO SoundBoom 00:46:39:16:32:18
Welcome	
Signed Out	4
	2
Email Password SIGN IN CREATE ACCOUNT	• AMAAAAA
	-2
Screenshots from our application	-4

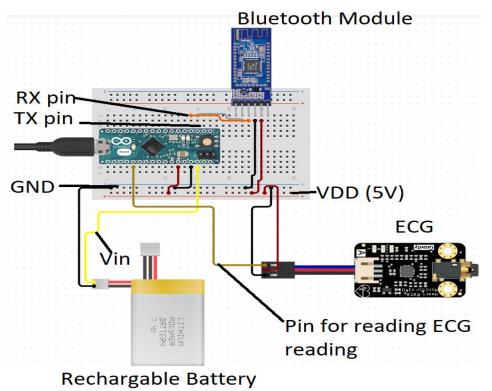
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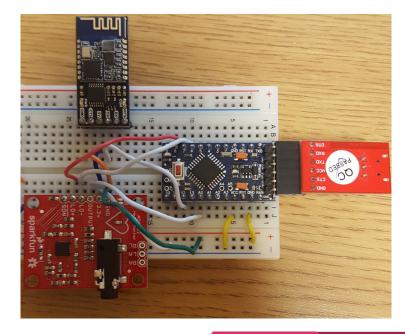


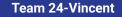
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Prototype of Final Product







Wearable Cardiac Monitor

Final Product Design



Key Components

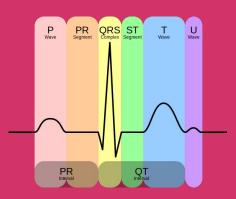
- Functionality vs. Power
- Small Form Factor (deck of cards)
- Eliminate Noise
- Style and Comfort
- Remove wires and try flexible circuit board to remove noise (unable to implement)

Model of the adjustable strapping we planned to use to hold the device

Using a Reference Heart Rate Monitor

- BioPac
 - Old fashioned heart rate monitor
 - Weren't able to run tests
- Student Health Center
 - Cosette Scallon, MD
 - Helped us understand the important parts of a heartbeat wave
 - Gave us a readout of Vincent's heartbeat

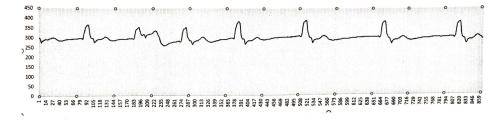




Team 24-Ruiyu

Our Results





Name: ID: Sex: BP: Weight Height DOB: Comm		11 Male	kebody Test Patient ISU 111374 le lbs inches DR/1988 (31 Years) Unconfirmed Report					Midmark Diago Rog. Physician: Technician: History: Medication: Date of Report: Reviewed By: Review Date:				Scallon, Cosette MD Brittany Turner, CMA								Duration: Beats: Normal: Premature: VECs_ PACs:			90 110 106 0 0 0		500				Number of RR Int Mean HR: Mean RR: Max RR: Max/Min: R-R SD: R-R SD: R-R CV:					terval: 109 76 789 958 644 148 % 58 7 %		PM soc soc soc				
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Engineering Standards and Design Practices

- IEEE Standards
- Circuit and Block Diagrams
- Agile practice & values
- Commenting on Code

Wearable Cardiac Monitor

How Switch Online Impacted Project

- Unable to package the final prototype its final product form
- In person team meetings couldn't happen
- Unable to do as much physical testing due to loss of lab access and equipment
- We were unable to order/install some of the features we wanted



Demo Video



Wearable Cardiac Monitor

Team 24-Andrew

Contributions

Software

- Andrew O'Brien
- Peyton Sher

Hardware

- Ruiyu Sun
- Scott Beard

Communications

- Sam Kimball
- Vincent Lazzaro

Client/Adviser

• Dr. Cheng Huang

Team 24-Andrew

Questions?