Fall Assist

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April 27, 2012

CENTURY SOLUTIONS

Outline

- Background
- Product Design
- Testing Results
- Budget and Timeline
- Problems Encountered
- Lessons Learned
- Future Work
- Conclusion
- Questions

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Motivation

- Falls are a major concern for elderly people living on their own
- 1 in 3 adults 65 years old or older fall each year
- 30% of falls result in serious injury
- 25% of the world population will be aged 65 years or older by 2035

"Falls Among Older Adults: An Overview" Internet: http://www.cdc.gov/homeandrecreationalsafety/falls/adultfalls.html, Sept. 16, 2011 [Feb 2, 2012]

Israel Gannot, Ramat-HaSharon, Dimitry Litvak, Tel-Aviv, Yaniv Zigel. "System for Automatic Fall detection For elderly People". U.S. Patent 0224925, September 10, 2009

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Motivation

Quick detection of a fall can lower the rate of mortality and increase the chances of survival!

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Current Solutions

Pre-Impact:

- Helite created an airbag for the hips

Post-Impact:

- Life Alert ("Help! Help! I've fallen and I can't get up!")
- Lifeline with AutoAlert
- Vigi Fall

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Fall Assist

Elderly person falls

Fall detection system

Determine if assistance is needed

Mobile calling system

Emergency contact is contacted

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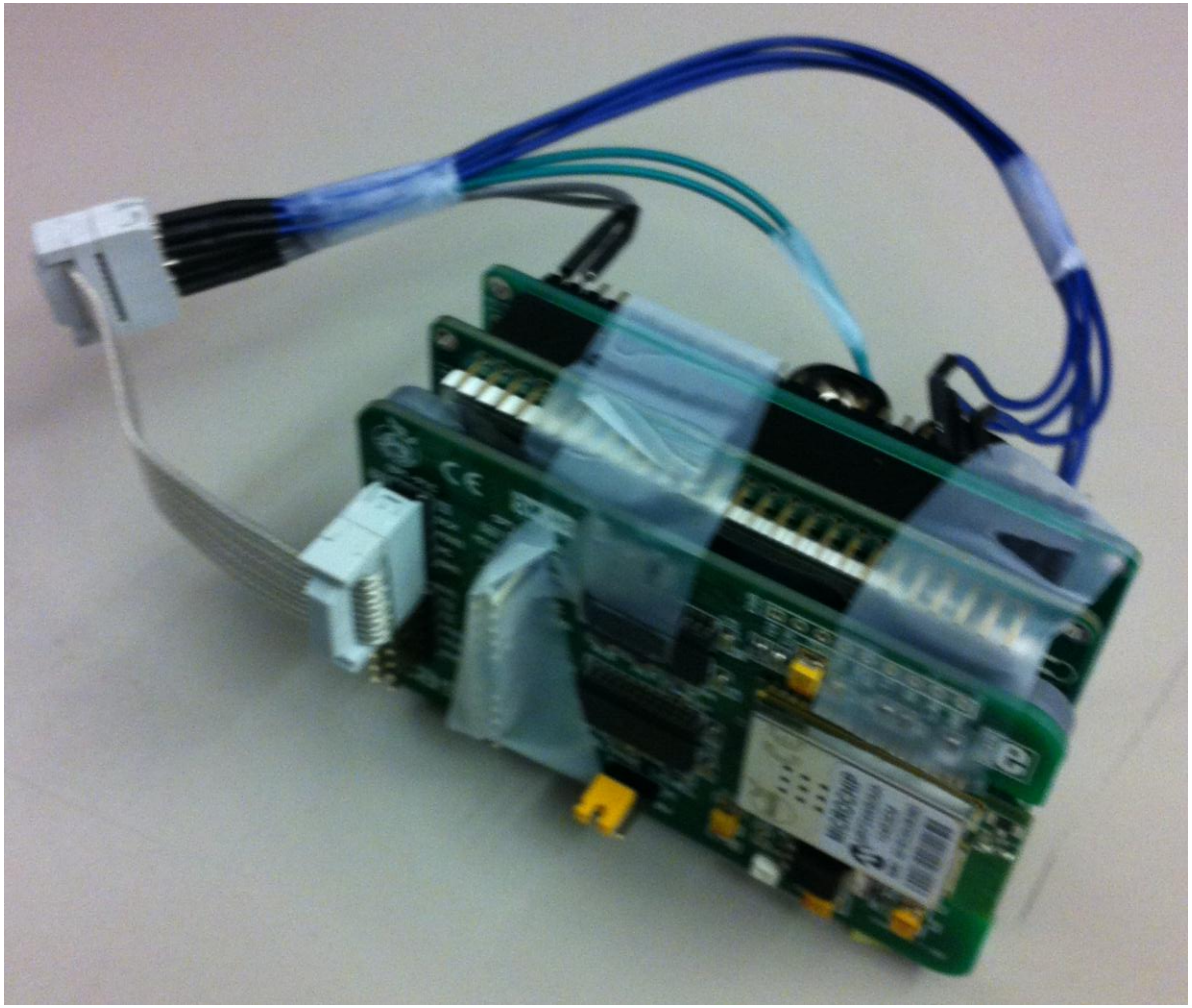
Fall Assist



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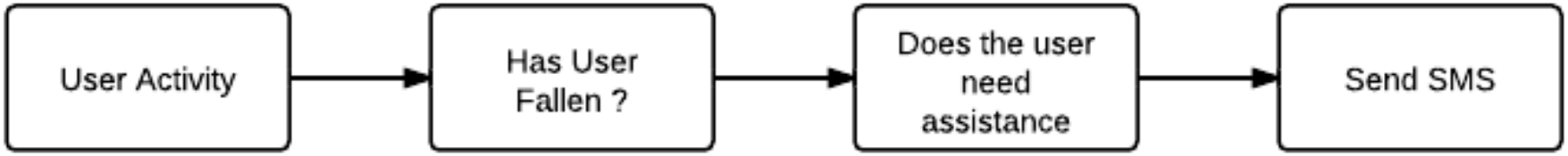
System Overview

- Fall detection system consists of an accelerometer and a microcontroller
- Wi-Fi transceiver pings web application
- Web application sends a text message to the emergency contact



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Accelerometer

- Measures acceleration in x, y, and z-axis
- Falls have a downward acceleration of 3-6g
- Other activities of daily life have a much lower acceleration
- Accuracy of 90%

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Wi-Fi Connection

- EasyWifi Board
- Widely used in home automation and consumer applications
- TCP/IP Stack
- Ping web application

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Wi-Fi Connection

- Microcontroller sends a message to the Wi-Fi board once a fall is detected
- Wi-Fi board connects to the web server that it has been configured to
- Web server contacts the user

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Web Application

- The message is composed using a web application installed on a website, Link to the web application, and is sent as an email message
- Web application consists of:
  - HTML form
  - Two PHP scripts

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Web Application

- The email address depends on the carrier of the recipient:
  - Bell: phone_number@txt.bell.ca
  - Rogers: phone_number@pcs.rogers.com
  - Fido: phone_number@fido.ca
  - Telus: phone_number@msg.telus.com

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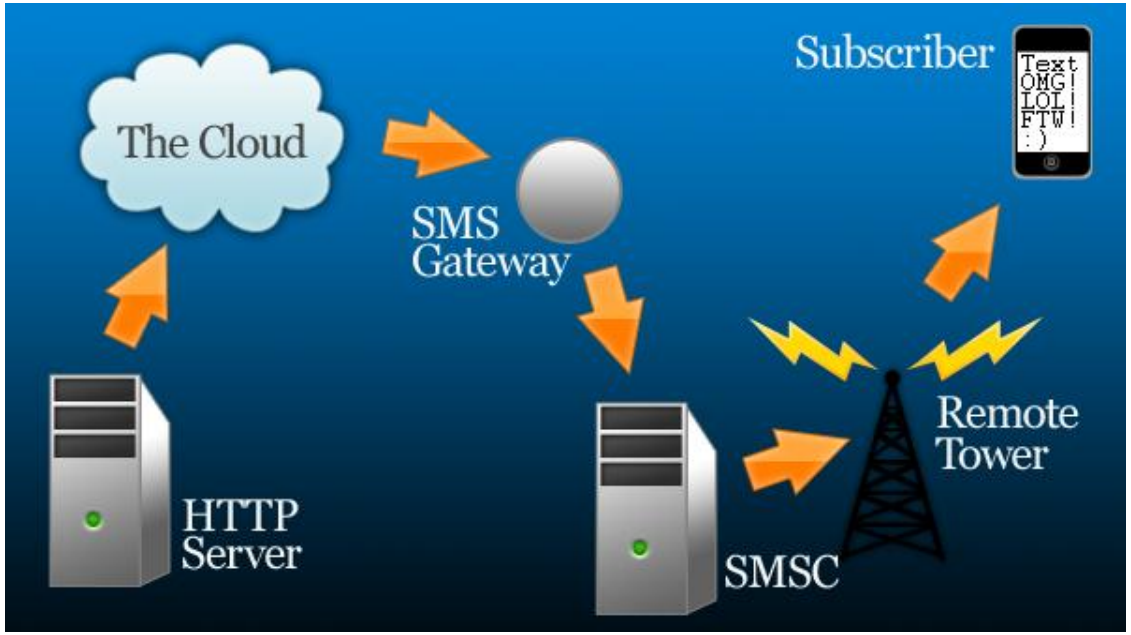
Web Application

- Received by a Short Message Service (SMS) Gateway
- SMS Gateway converts the message to an SMS message
- SMS message is transferred to a Short Message Service Center
- SMS Center transmits the message to the users' cell phones



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Battery Pack

- Battery Boost Shield
- 2 AAA Batteries
- 4V DC output
- ~300mA output

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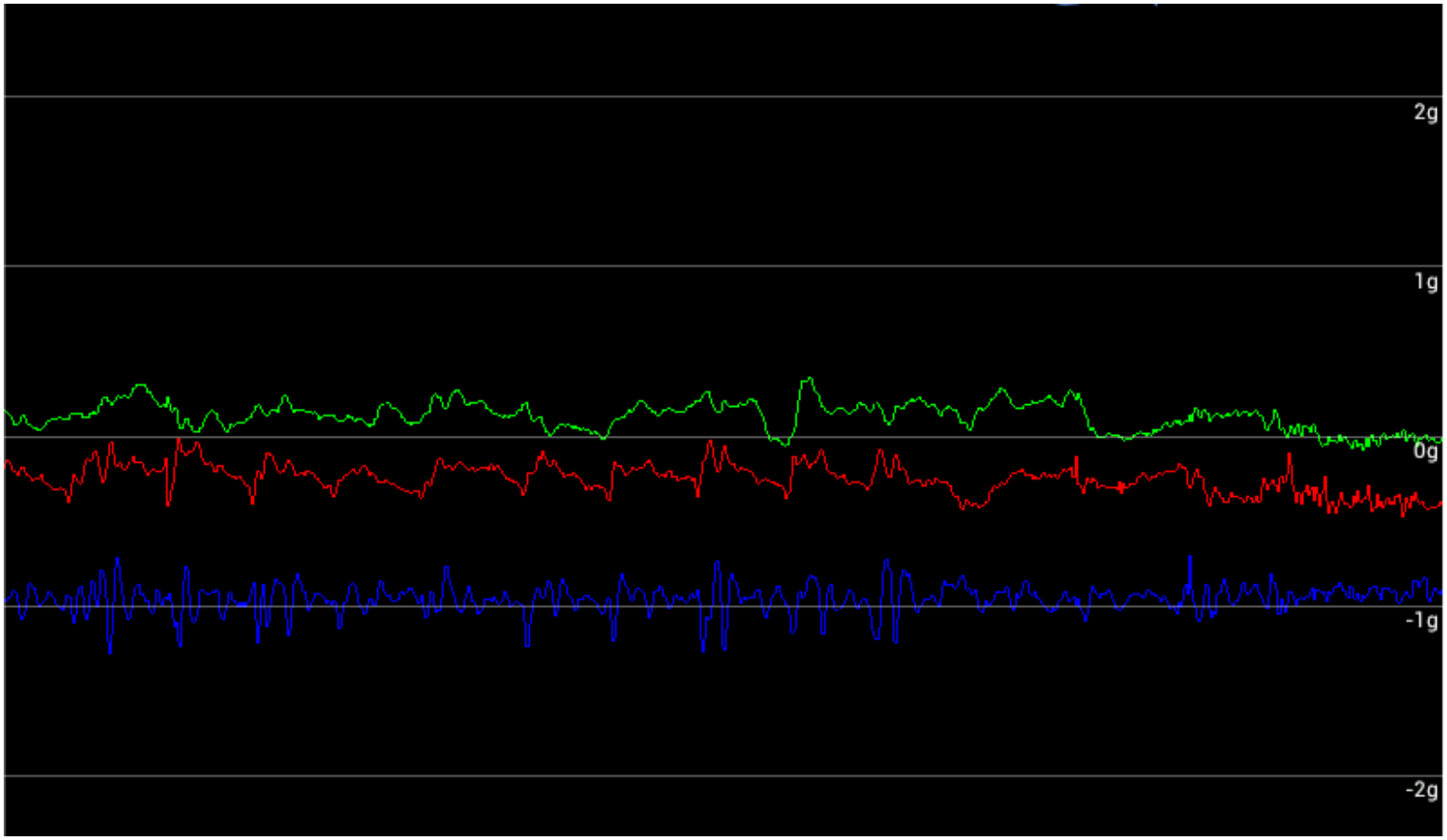
Testing

- Graph of walking



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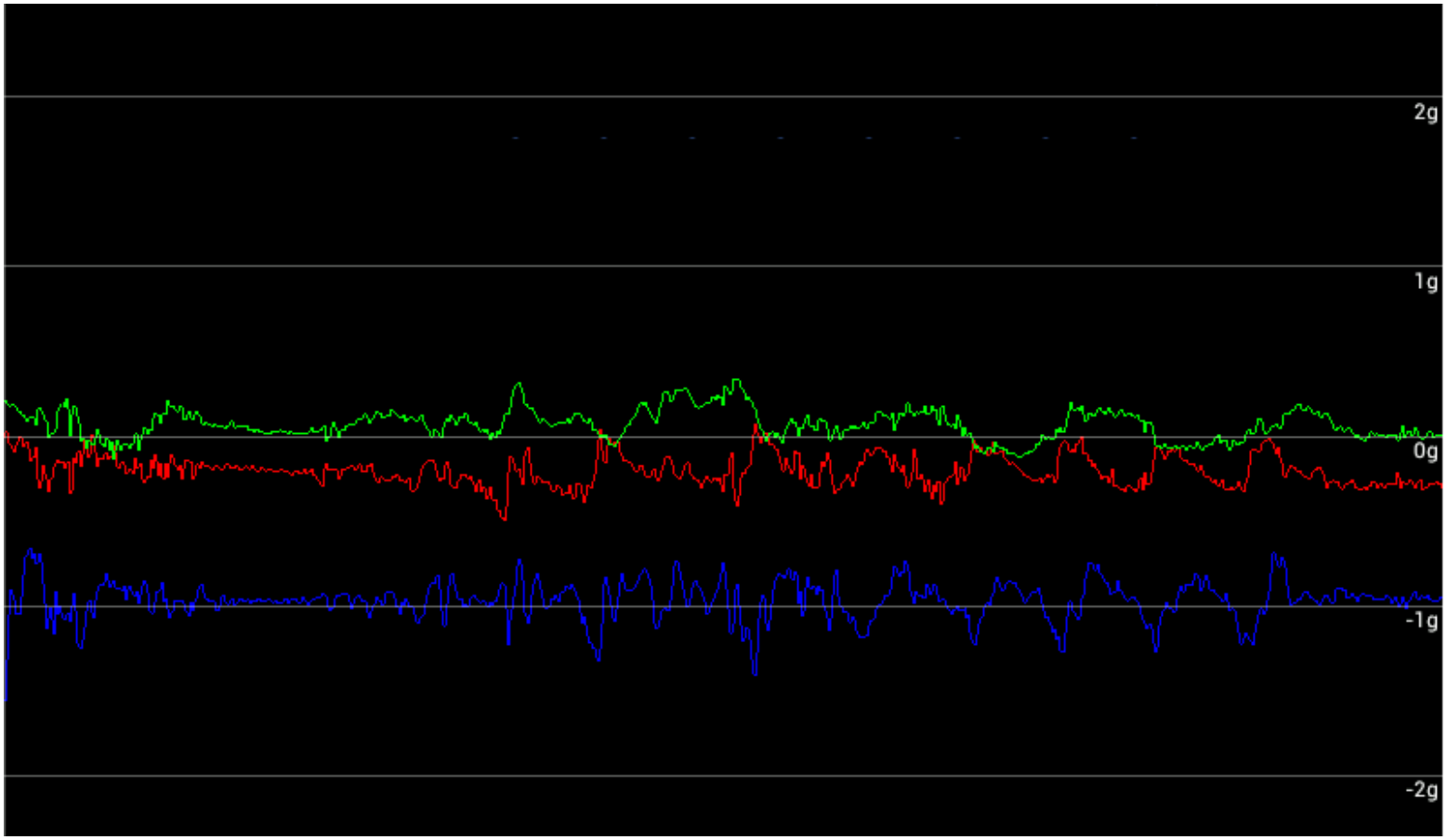
Testing

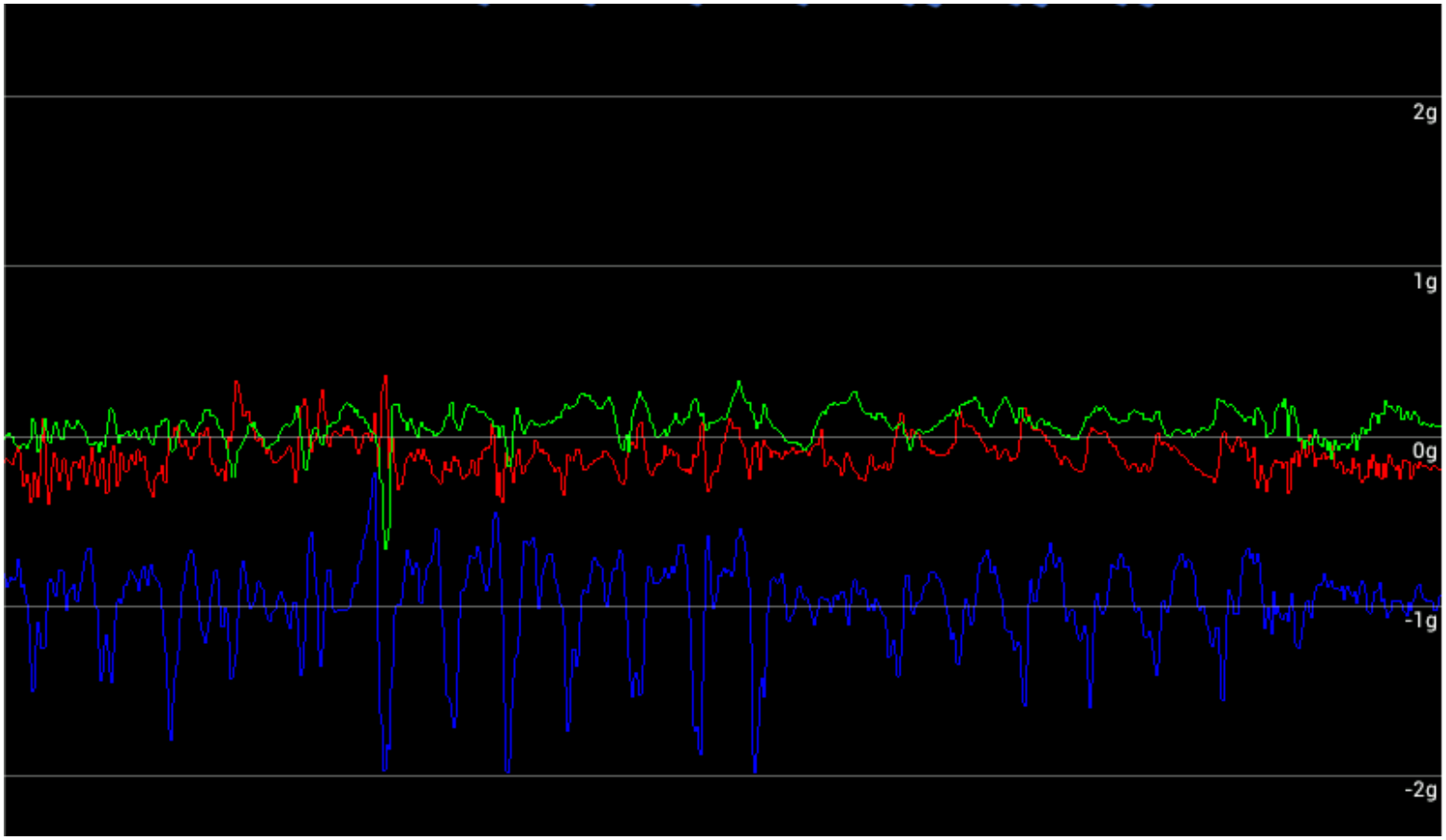
- Graph of walking upstairs



CENTURY SOLUTIONS

Testing

- Graph of walking downstairs



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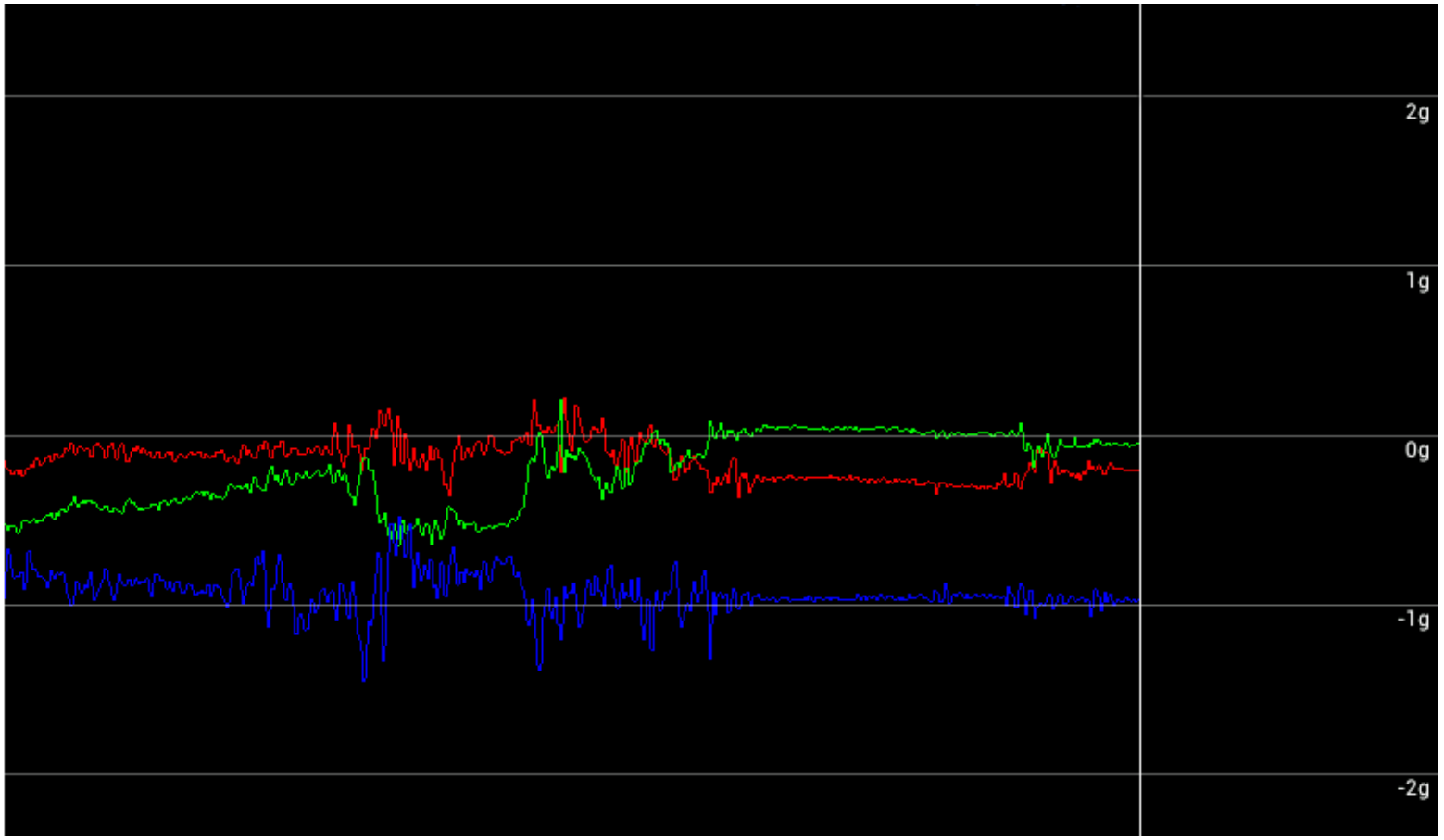
Testing

- Graph of sitting down



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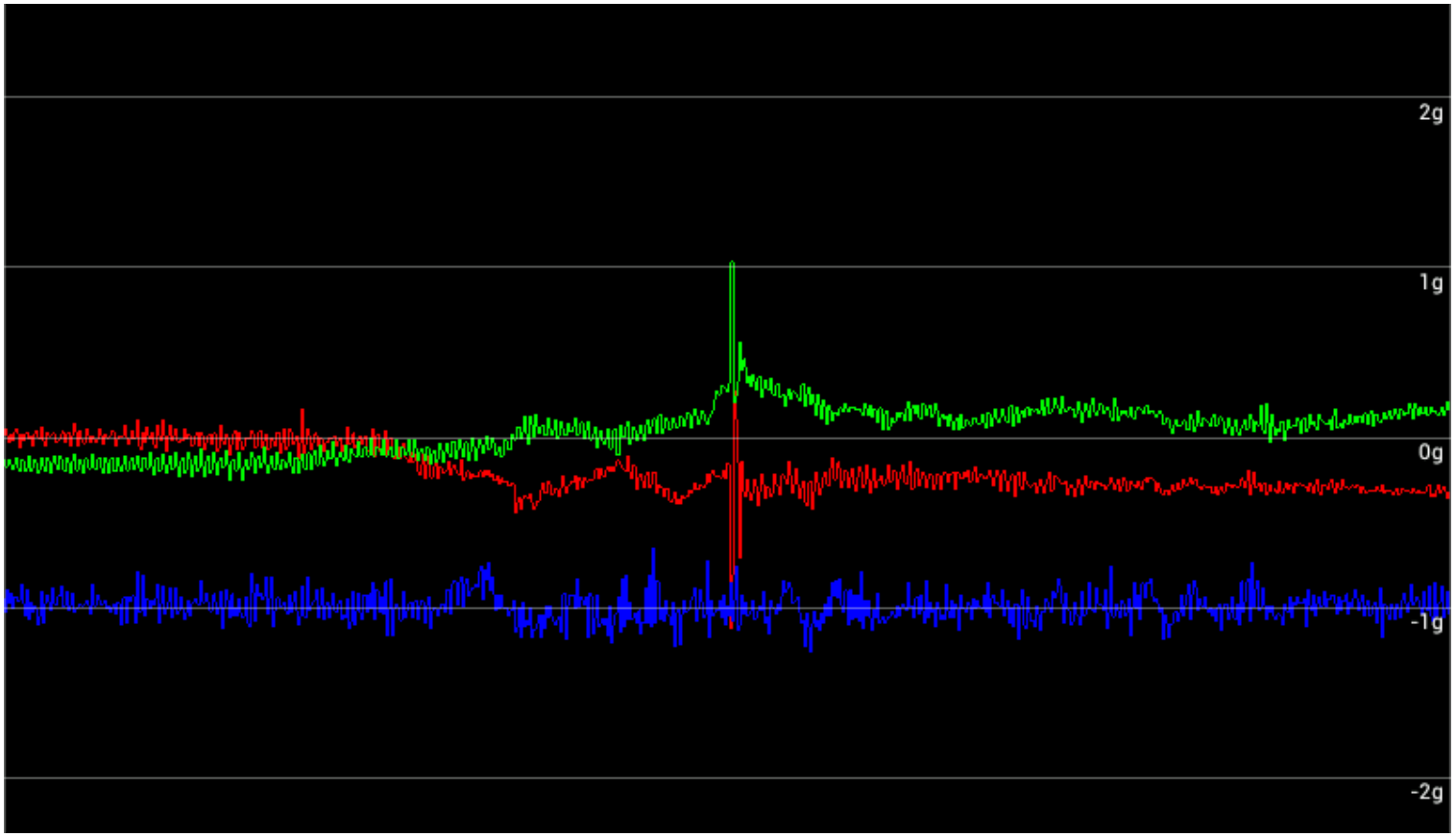
Testing

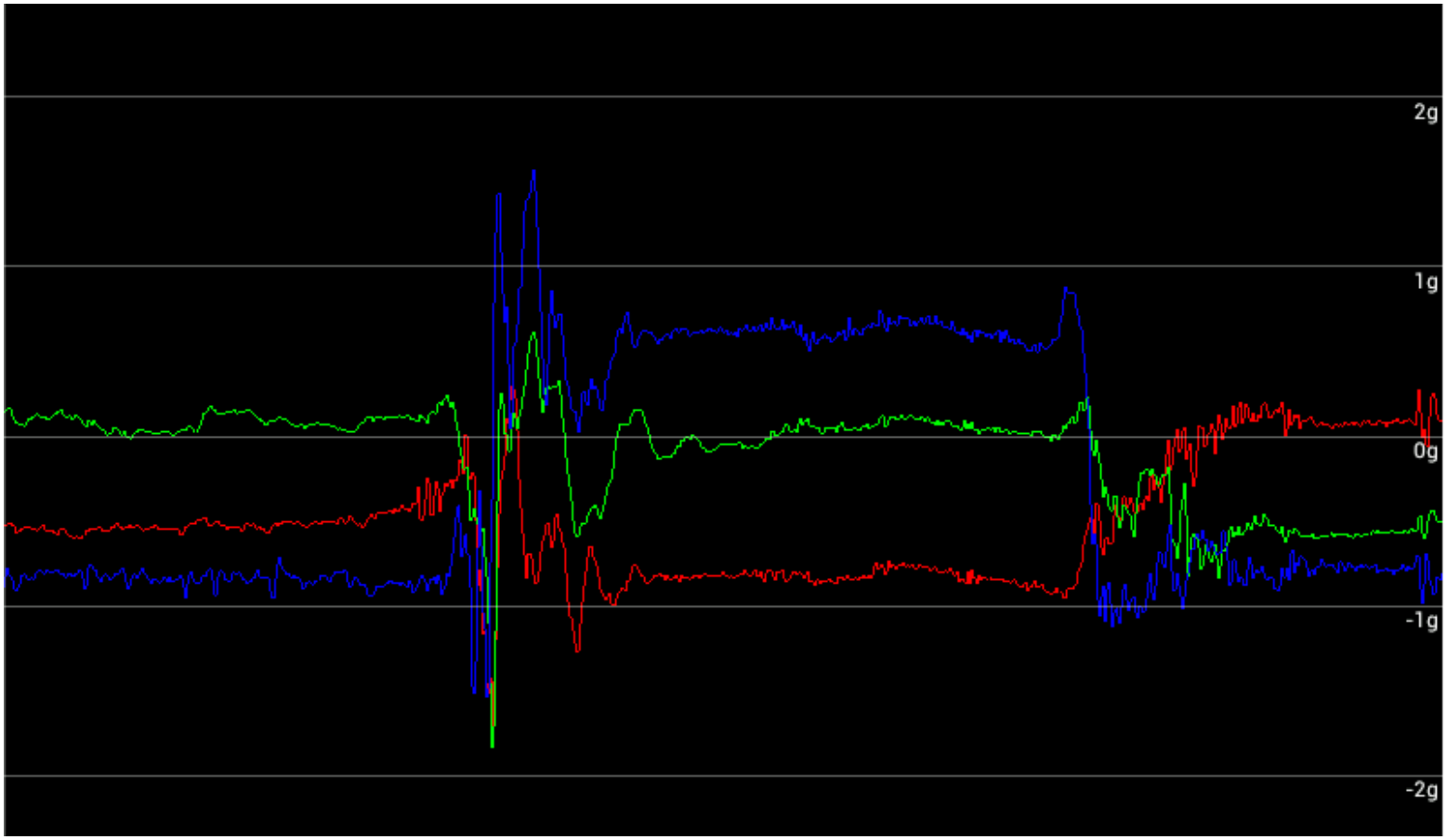
- Graph of driving downhill



CENTURY SOLUTIONS

Testing

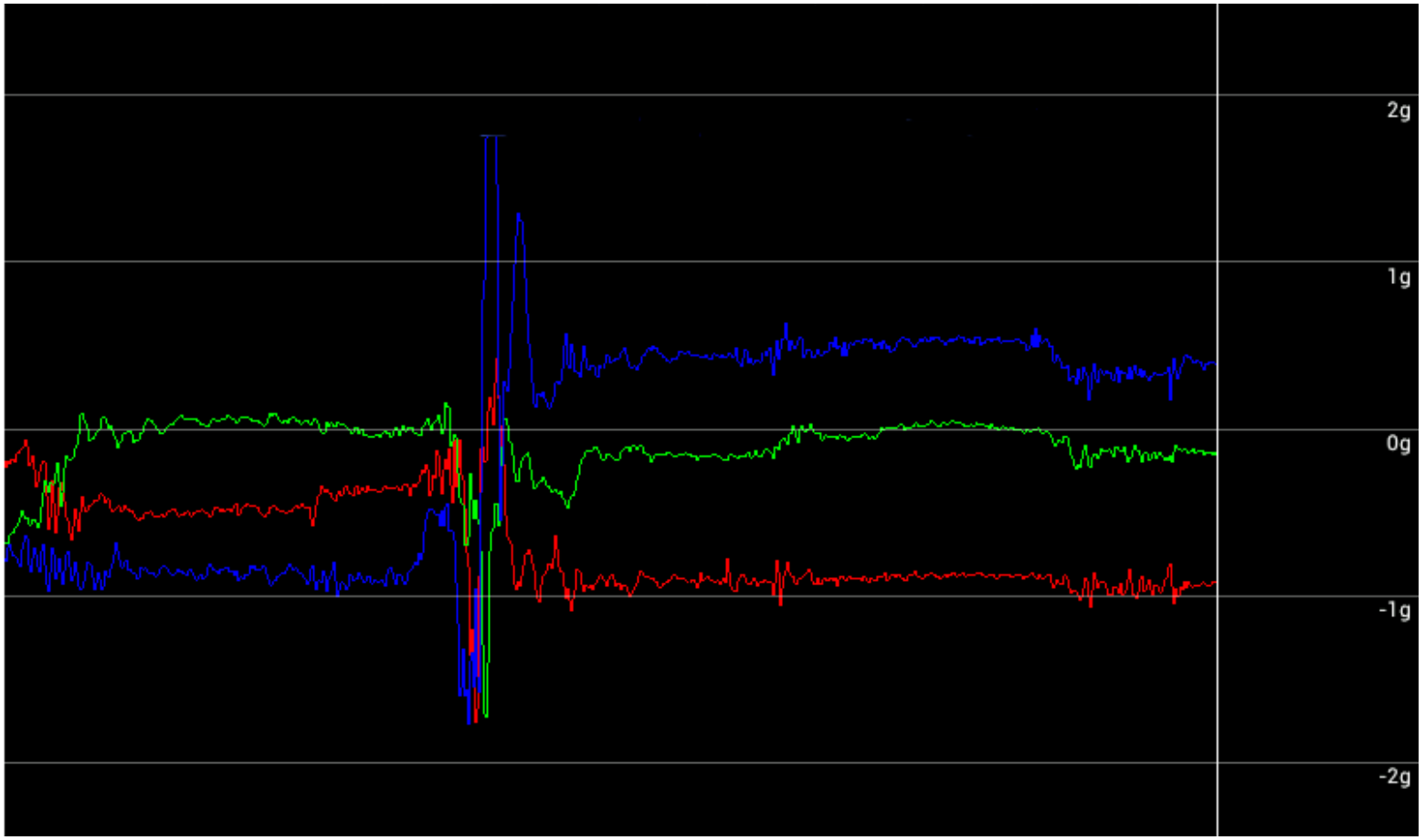
- Graph of falling



CENTURY SOLUTIONS

Testing

- Graph of falling



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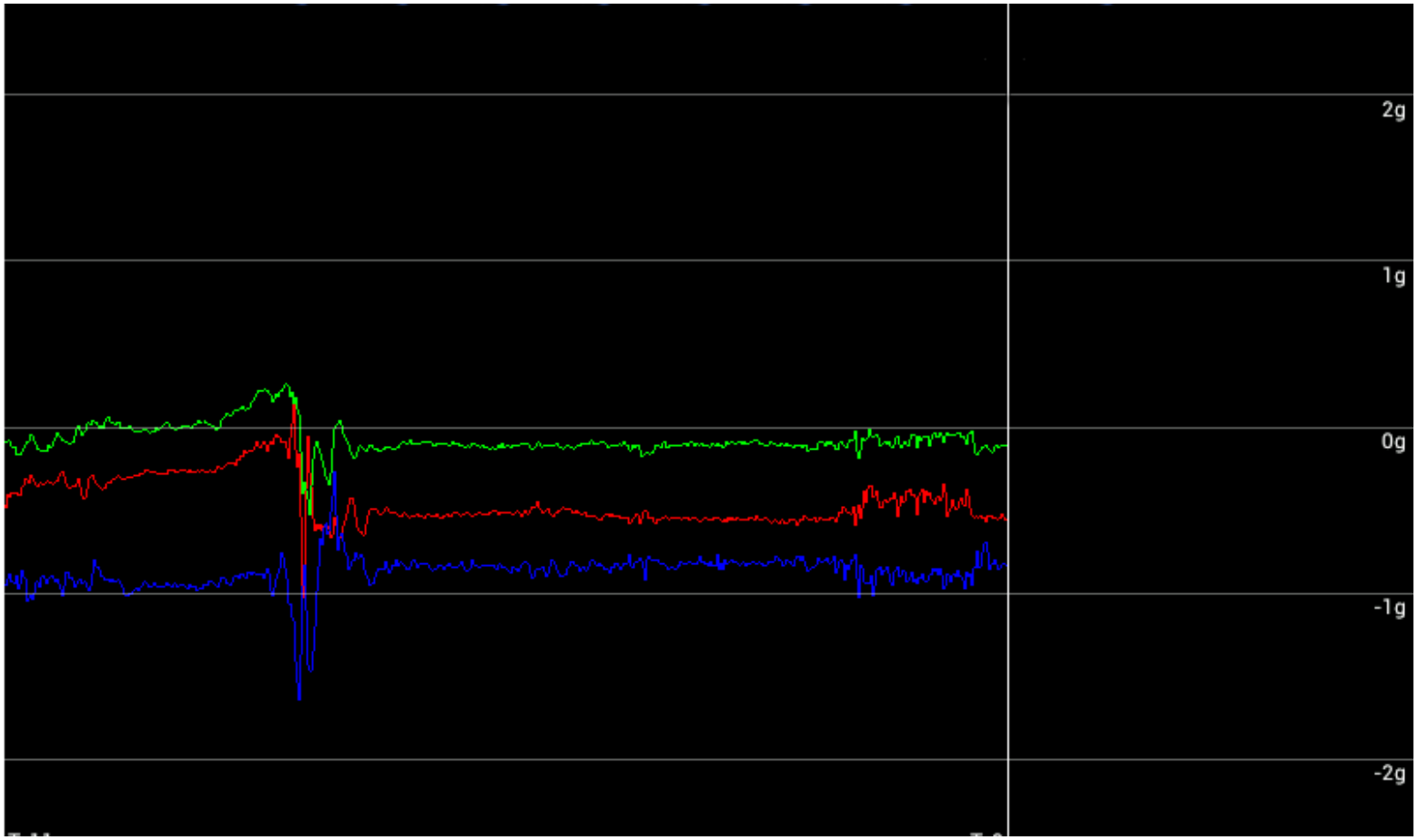
Testing

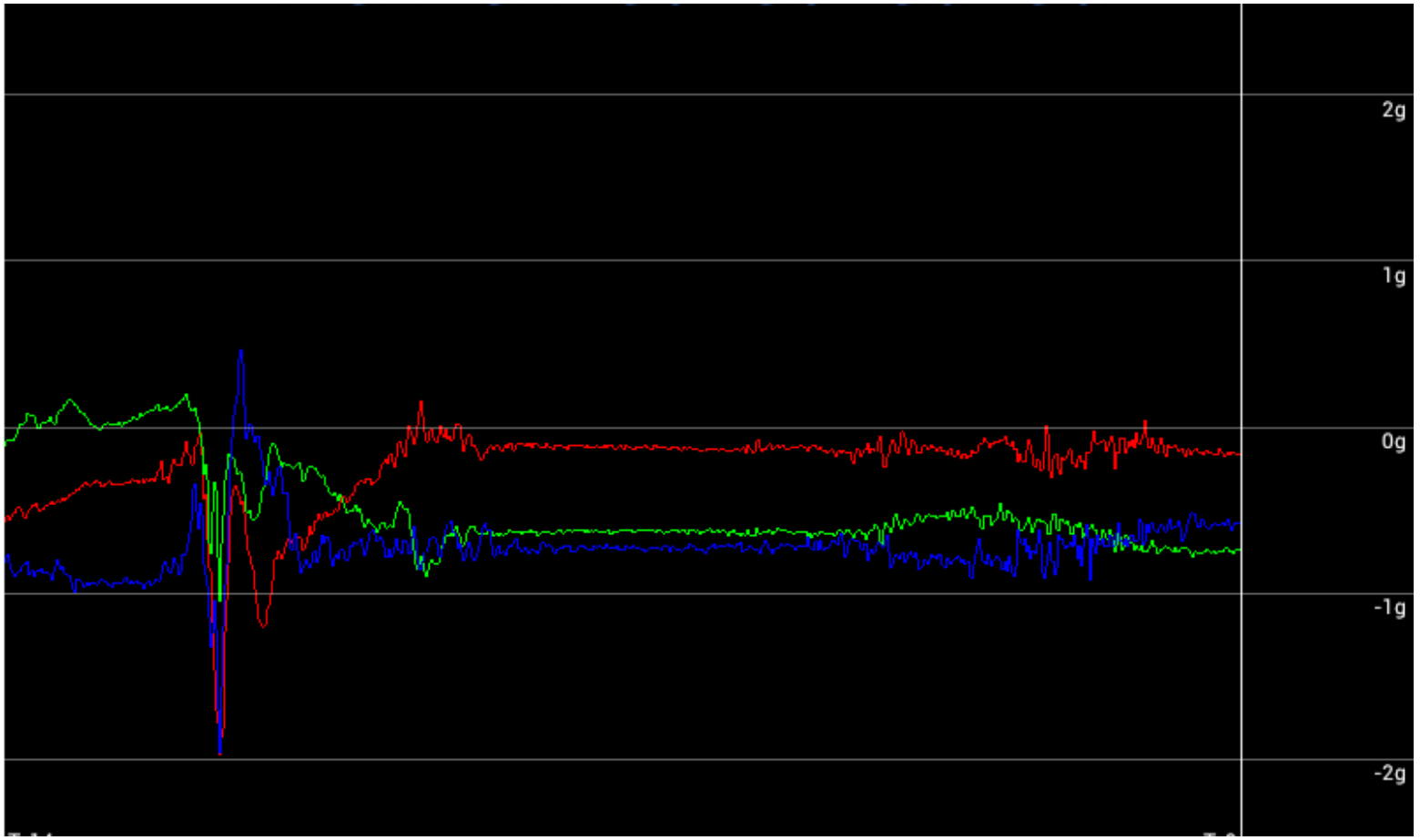
- Graph of falling onto a chair



CENTURY SOLUTIONS

Testing

- Graph of falling onto a chair



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Budget

- Original estimated cost: $688
- Received $700 from the ESSS
- Design greatly changed from original estimate
- Ordered some incompatible parts

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Budget

Equipment List	Actual Cost
2 x ADuC7026 Microcontrollers	$50
2 x ADXL345 Accelerometers	$15
2 x HC12 Microcontrollers	$30
Nerdkit	$150
LPC2148 Development Board	$200
EasyWifi Board	$120
Priority Shipping	~$150
2 AAA Batteries	$10
Wire Jumpers	$10
Total Cost	~$735

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Timeline

- Actual dates were all completed approximately a month after estimated dates

Milestone	Estimated Date	Actual Date
Finish Research	End of February	End of April
Assembly of Modules	Mid March	First week of April
Integration/Testing	End of March	End of April
Debugging	End of March	End of April

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Problems Encountered

- Audio did not work due to lack of time
- Ordered incorrect parts at the beginning
- Bluetooth design not feasible
- Underestimated shipping time
- Limited documentation
- Falling was painful!

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Lessons Learned

- Use Audrino Kits
- Spend more time designing
- Make sure components are compatible before ordering

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Future Work

- Use gyroscope with accelerometer to detect falls
- Add 3G and GPS support
- Beep for 60s before contacting help
- Create a user interface to enter emergency contact information

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Future Work

- Design a single PCB to hold all parts
- Research batteries to find a long lasting, light weight choice
- Design a waterproof belt buckle

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Conclusion

- Successfully detected a fall
- Successfully contacted help
- No broken bones!

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Demo

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Acknowledgments

- Dr. Andrew Rawicz
- Dr. Albert Leung
- Dr. Ash Parameswaran
- Dr. Steve Robinovitch
- Omar Aziz
- Parbhat Narayan
- Filip Jankovic
- Janko Kaljevic
- Humberto Evans
- Mike Robins
- Lukas-Karim Merhi
- Rick Hall
- Edwin Chand
- ESSS

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Questions?

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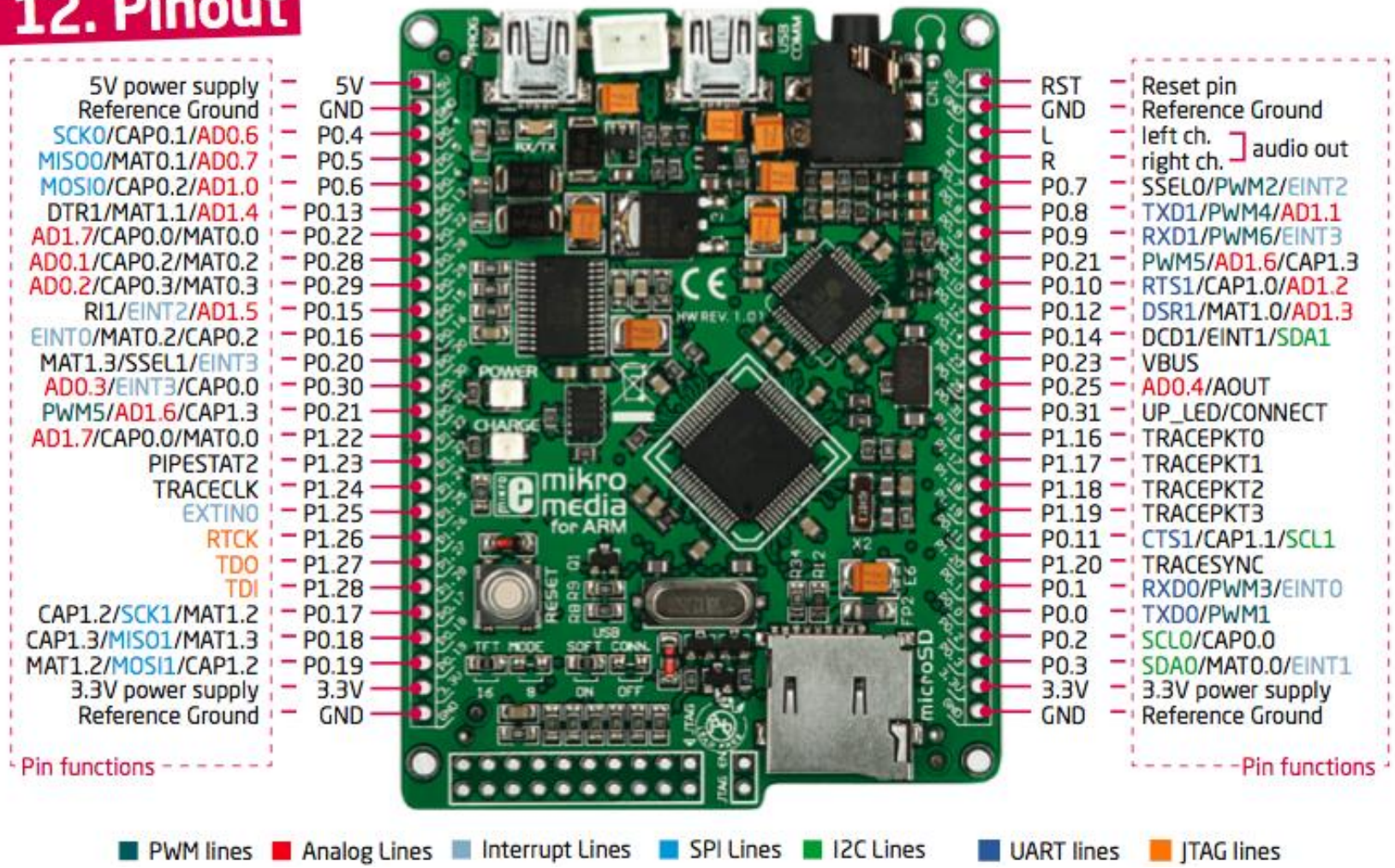
Microcontroller-Pinout

12. Pinout



User's Guide to mikromeda board for ARM. Available online: http://microcontrollershop.com/product_info.php?products_id=4400&osCsid=fqf88gg4dprbsjcs94fsknf2g5

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Budget-Estimated

Equipment List (Include brand and model # if possible)	Estimated Unit Cost
2 x (microcontroller evaluation board + USB to serial TTL cable + resistors + mosftets + switches + LEDs)	$220
1 x Accelerometer (EVAL-ADXL345NZ-ND)	$50
3 x PIR Motion sensor (EKMA1202120)	$123
3xBluetooth chips (MSP430BTS190IZQWR)	$45
2 x Analog-Digital converter (AD9637BCPZ-80)	$200
Miscellaneous (batteries + plastic pieces, etc)	$10
Shipping	$40
Total Cost	$688