Introduction

Aging is a fact of life. However, as we age, we become more vulnerable to injury and go through a vastly more extended healing cycle when we become injured. For example, according to the CDC, one out of five falls for individuals over 65 causes serious head injury or broken bones. This information is staggering since over 3 million patients over 65 are treated in emergency rooms every year for injuries from falls.

The nearly 800,000 patients who end up hospitalized due to a fall tend to have head and hip injuries so severe they end up in long-term hospice care. These falls are responsible for more than 50 billion in medical costs within the US alone. With Medicare and Medicaid covering around 37.5 billion of that total cost in 2020.

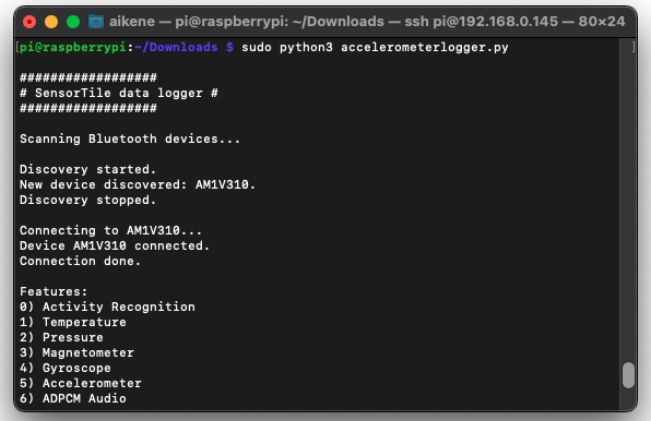
In some cases, it's not the fall itself but what happens after the fall that causes long-term damage to the patient. For example, being trapped on the floor for hours unable to get up can add to the injury leading to long-term disability. In addition, dehydration, blood loss, and other medical conditions can occur while trapped on the floor leading to life-threatening situations.

Solution

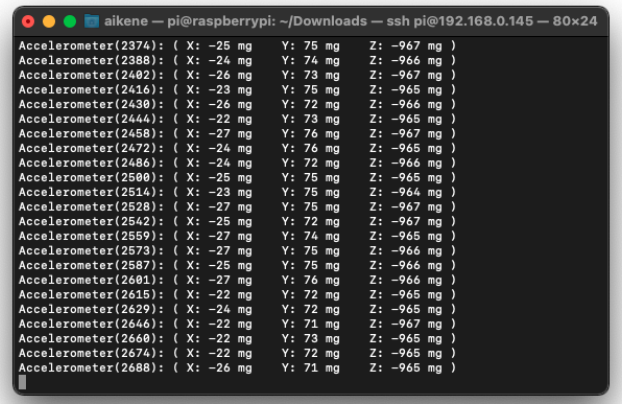
The fall detection created by our team is a wearable device that can detect a fall and notify loved ones, medical staff, and first responders of the incident. The device is cheap and easy to use but has all the benefits of keeping caregivers in the loop if the elderly or disabled person they care for is in a fall situation. The device is worn on the wrist or upper arm to maximize comfort with heart attack, stroke, and palpitation detection and warning, coming with version 1.1.2.

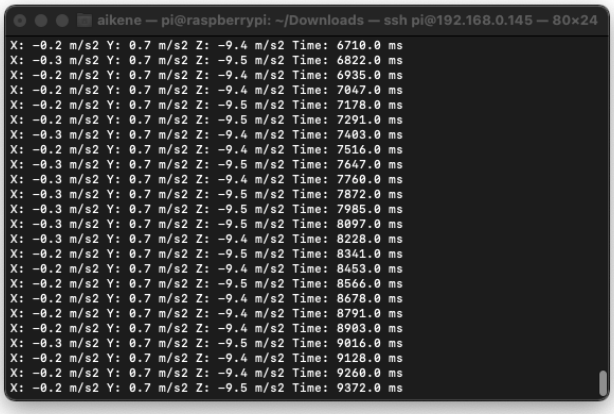
To build our product, we utilized the sensorTile running the ALLMEMS1 firmware. The development was possible via the Cradle expansion board connected via USB. The information from the tile is sent to a local raspberry Pi4 via Bluetooth for monitoring the wearer's status. Once the algorithm detects the fall, the program uses the Twillio API via python to alert the predesignated parties.

Utilizing the Python SDK blue_st_sdk.manager module combined with Bluepy and Blue-st-SDK, we connected the sensorTile and the raspberry pi.

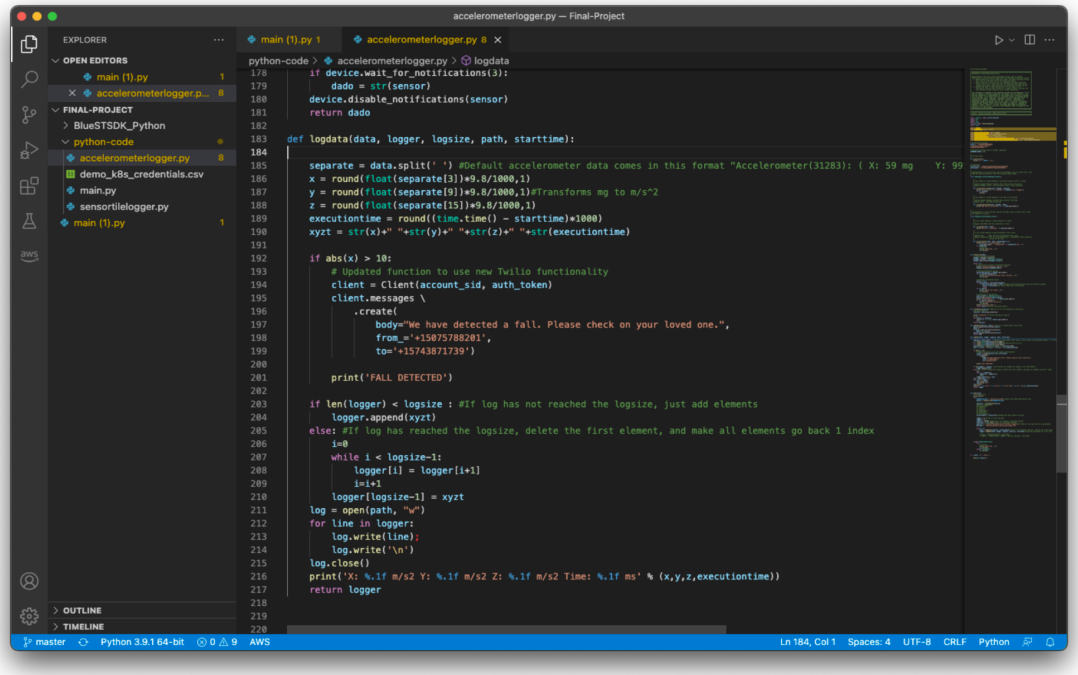


To display the data output by the Blue ST SDK_Python in g unit.





Once the acceleration threshold is hit, the print('Fall Detected') is run:



Future

The program's next iteration will be sampling the incoming information through a Machine learning classification using Edge Impulse. As the data gets more precise and unaddressed edge cases to come to light, the chance of false alerts lessens, providing a better overall user experience. In tandem with this fine-tuning, we'll be isolating the heart rate to alert a caregiver of any potential heart attack, stroke, or abnormal vibration. These machine learning algorithms will form the backbone of third-party technologies via Apple and Android-enabled devices and sensors as well as custom-built devices 3d printed by our team.

Bibliography

Ausubel, Jacob. “Older People Are More Likely to Live Alone in the U.S. than Elsewhere in the World.” Pew Research Center. Pew Research Center, September 24, 2020. https://www.pewresearch.org/fact-tank/2020/03/10/older-people-are-more-likely-to-live-alone-in-the-u-s-than-elsewhere-in-the-world/.

Gomes, Felipe. “SensorTile Sensor Data Monitoring Using a Raspberry Pi.” Hackster.io, June 18, 2020. https://www.hackster.io/felipsz/sensortile-sensor-data-monitoring-using-a-raspberry-pi-7a3663#toc-lets-connect-our-rpi-to-the-sensortile-4.

“Important Facts about Falls.” Centers for Disease Control and Prevention. Centers for Disease Control and Prevention, February 10, 2017. https://www.cdc.gov/homeandrecreationalsafety/falls/adultfalls.html.

“Keep on Your Feet-Preventing Older Adult Falls.” Centers for Disease Control and Prevention. Centers for Disease Control and Prevention, December 16, 2020. https://www.cdc.gov/injury/features/older-adult-falls/index.html#:~:text=About%2036%20million%20falls%20are,bones%20or%20a%20head%20injury.

Monk, Simon. “Adafruit's Raspberry Pi Lesson 6. Using SSH.” Adafruit Learning System. Accessed December 10, 2021. https://learn.adafruit.com/adafruits-raspberry-pi-lesson-6-using-ssh/using-ssh-on-a-mac-or-linux.

STmicroelectronics. “Blue_st_sdk Package¶.” blue_st_sdk package - BlueSTSDK 1.4.0 documentation. Accessed December 10, 2021. https://stmicroelectronics.github.io/BlueSTSDK_Python/blue_st_sdk.html#module-blue_st_sdk.manager.

STMicroelectronics. “STMicroelectronics/bluestsdk_python: Bluetooth Low Energy Sensors Technology Software Development Kit (Python Version for Linux Gateways).” GitHub. Accessed December 10, 2021. https://github.com/STMicroelectronics/BlueSTSDK_Python.

Twilio. “No Module Named Twilio · Issue #412 · Twilio/Twilio-Python.” GitHub. Accessed December 10, 2021. https://github.com/twilio/twilio-python/issues/412.

Wu, Falin, Hengyang Zhao, Yan Zhao, and Haibo Zhong. “Development of a Wearable-Sensor-Based Fall Detection System.” International journal of

telemedicine and applications. Hindawi Publishing Corporation, 2015. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4346101/.