An Embedded System Development for Field Workers Safety Detection

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Embedded System Final Project

Proposal

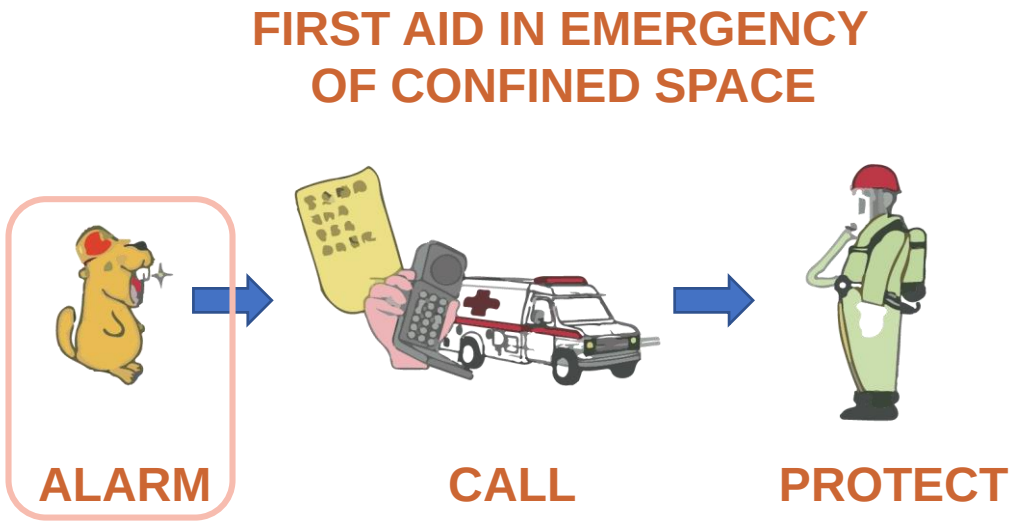
Group 7

Outline

1. Motivation
2. System Block Diagram
3. Fall Detection
4. Introduction to AHRS
5. Expected Result

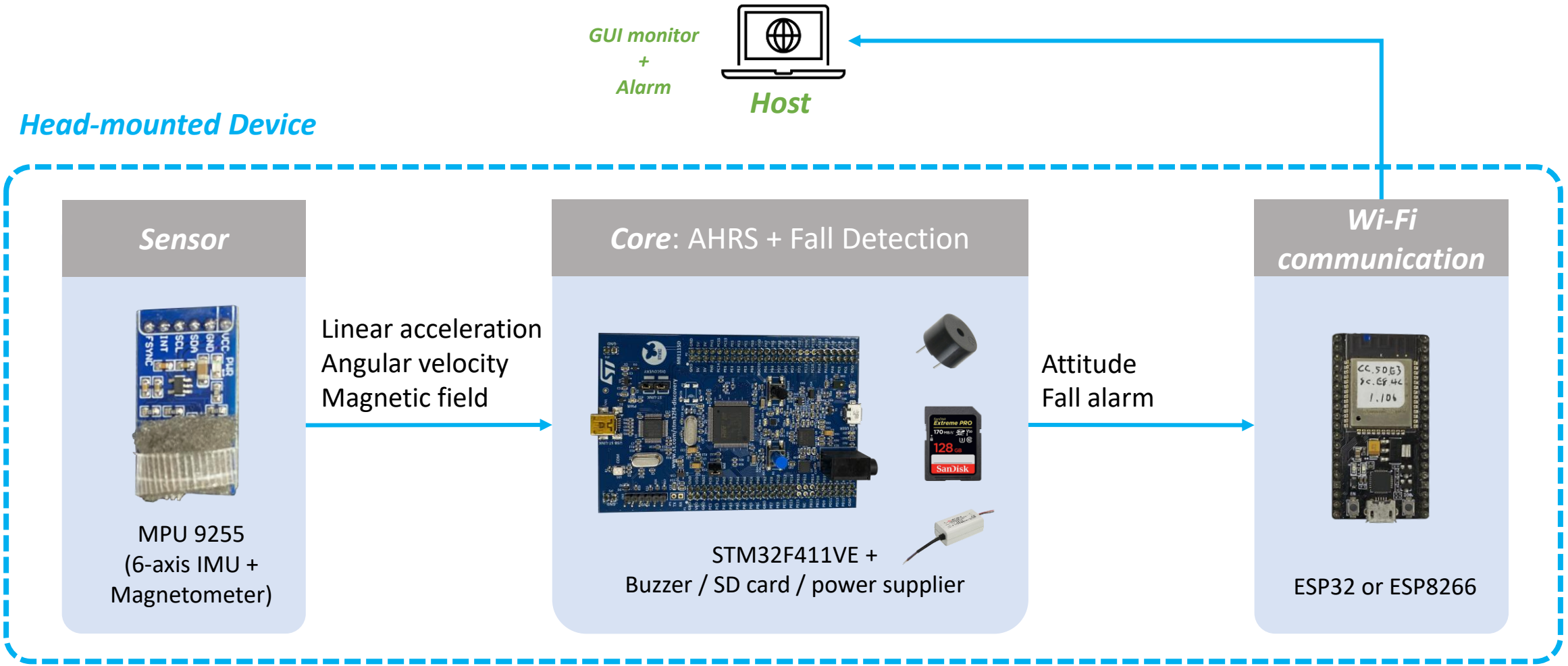
Motivation

- Workplace accidents are sometimes due to insufficient manpower allocation and confined space. For these conditions, it may cause more damage if the worker cannot seek rescue in time.
- Wearable devices like wristbands, watches and necklaces are not allowed in workplace.
- Hence, we're trying to propose a fall detection system, which should achieve these design features:
  - Low cost
  - Lightweight
  - Low power consumption
  - Real-time monitoring
  - Automatic alarm systems



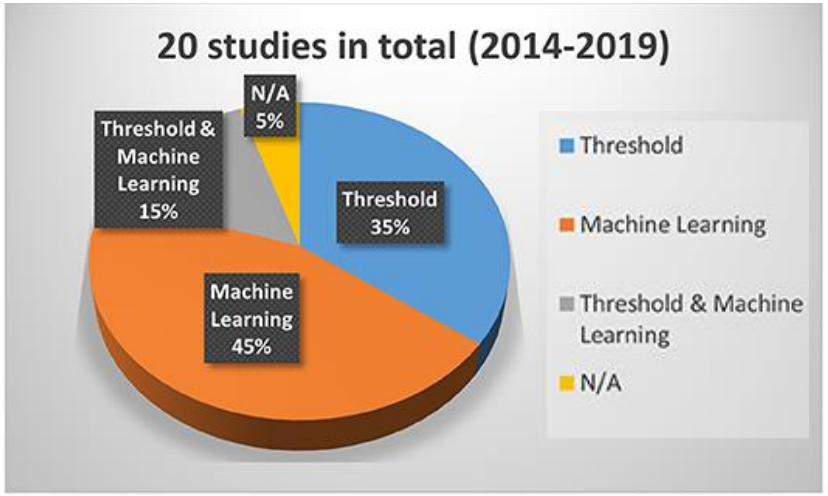
Picture source: 勞動部職業安全衛生署

System Block Diagram

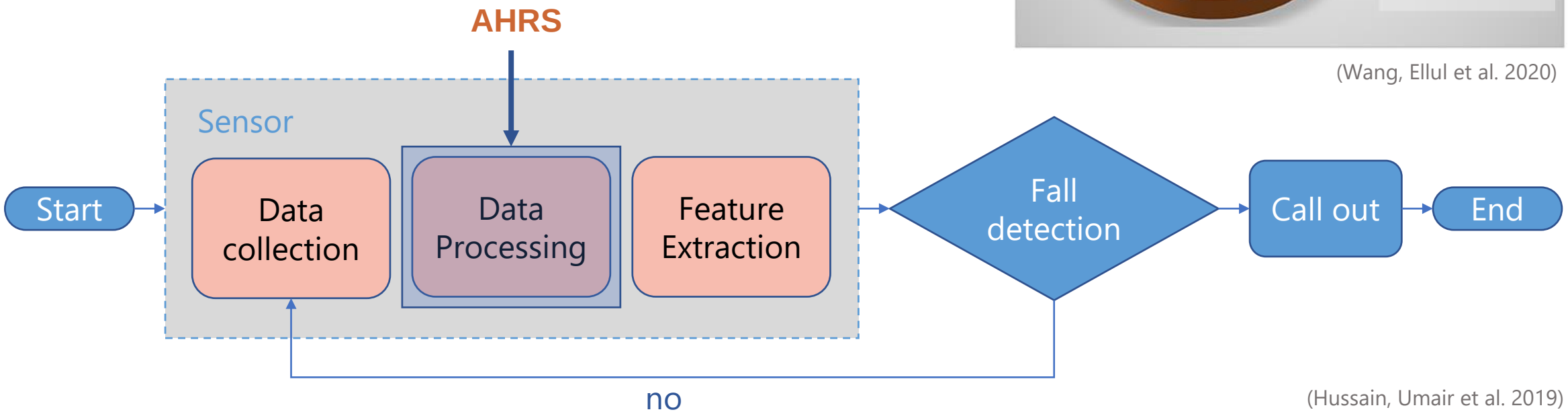


Fall Detection

- Critical Point
  - Tell the difference between falling and other actions.
- Method
  - Analytical
    - Thresh-Holding technique
  - Machine Learning



(Wang, Ellul et al. 2020)



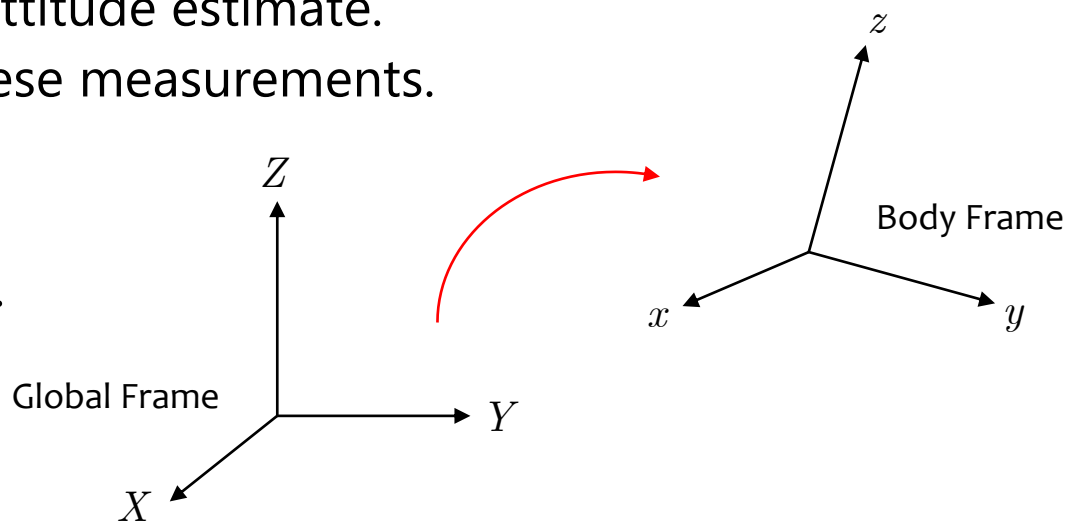
(Hussain, Umair et al. 2019)

Brief Introduction of AHRS

- Attitude/Orientation
  - The orientation of a body in the three-dimensional space.
  - It usually is represented by related rotation of the body frame with respect to the global frame.

- AHRS = Attitude and Heading Reference System
  - A System that determines the attitude/orientation of a body.
  - It used multiple sensors (accelerometer, gyroscope, magnetometer) and fuses the measurements each other to acquire a reliable attitude estimate.
  - The inertia measurement unit (IMU) provides these measurements.

- In this project, the AHRS will be implemented in the STM32F411VE for attitude determination.



Expected Results

References

- [1] F. Hussain *et al.*, "An efficient machine learning-based elderly fall detection algorithm," *arXiv preprint arXiv:1911.11976,* 2019.
- [2] A. Ramachandran and A. Karuppiah, "A survey on recent advances in wearable fall detection systems," *BioMed research international,* vol. 2020, 2020.
- [3] X. Wang, J. Ellul, and G. Azzopardi, "Elderly fall detection systems: A literature survey," *Frontiers in Robotics and AI,* vol. 7, p. 71, 2020.