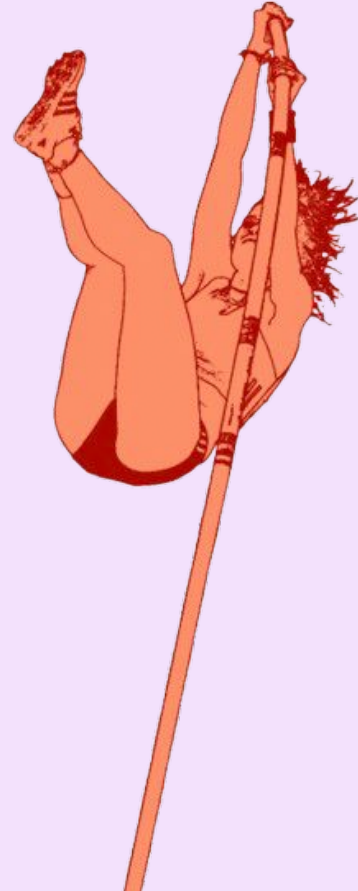


# MOBILE POLE VAULT STIFFNESS DEVICE

Technology and Health, Project course  
26th September, 2025



# Who are we?



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## Introduction

Problem  
Statement

Technical  
approach

User  
Interaction

Hypothetical  
Result

### Project idea

Measuring pole stiffness + Getting data for comparison

Mobility + Data acquisition + Data storage

### Fields

Electronics +  
informatics

### Users

Pole vaulters and  
their coaches

## Problems pole vaulters face today:

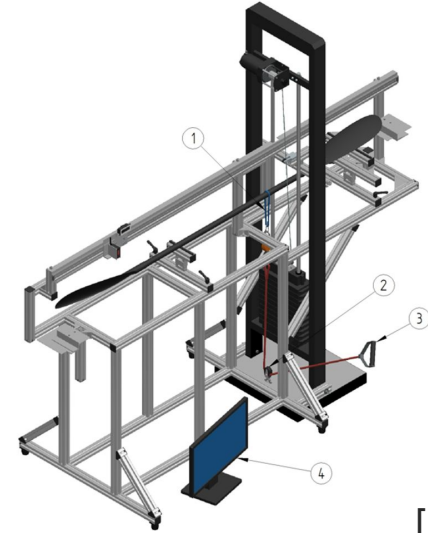
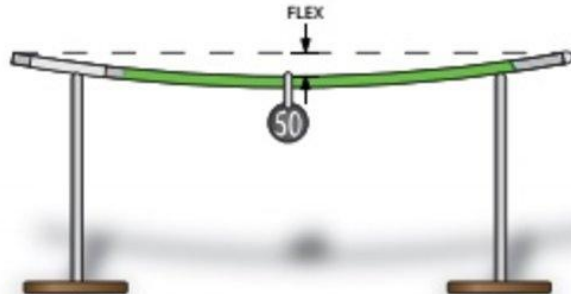
- Subjective selection → impact on performance
- Lack of safety → how to assess aging?
- No mobile and practical tool to provide accurate stiffness

London 2012 Olympics



## How can we measure pole-vault pole stiffness in real time so athletes can compare poles across brands and conditions?

- Mobility
- Data Acquisition
- Data analysis



[1], [2]

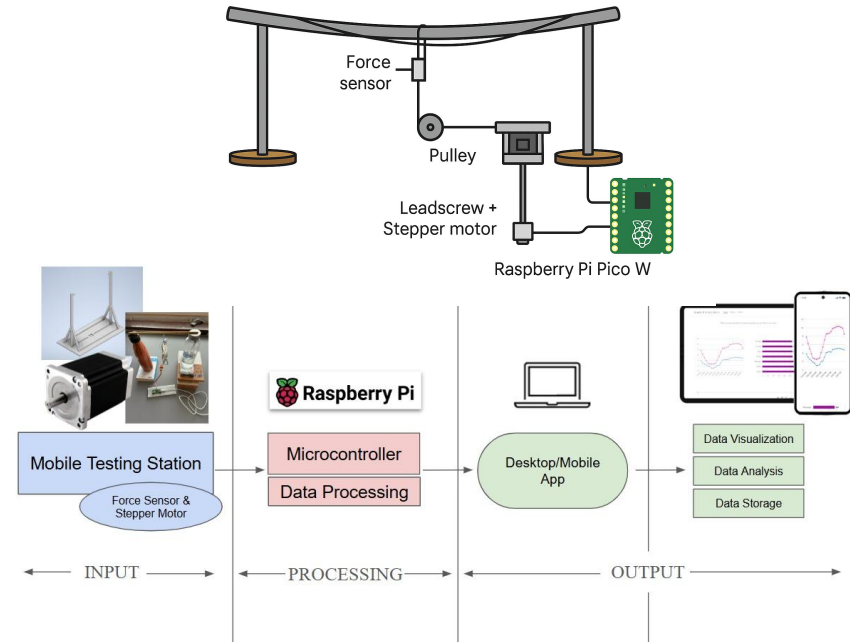
## Core system design

- a lightweight frame
- a stepper motor
- a rope
- an inline force sensor
- a leadscrew mechanism

## Electronics & Control

- Raspberry pi pico
- Python scripts

$$k = \frac{F}{\Delta x}$$



# The Prototype: Where we are now?

Introduction

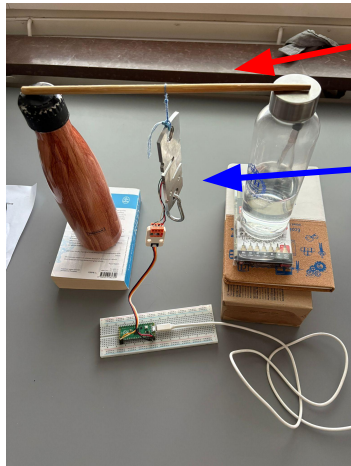
Problem Statement

**Technical Approach**

User interaction

Hypothetical Results

## System prototype

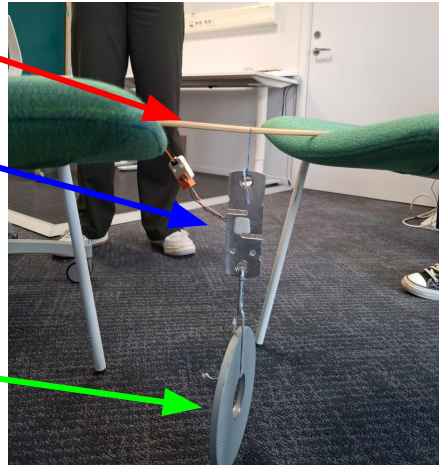


1st version of the prototype

Pole

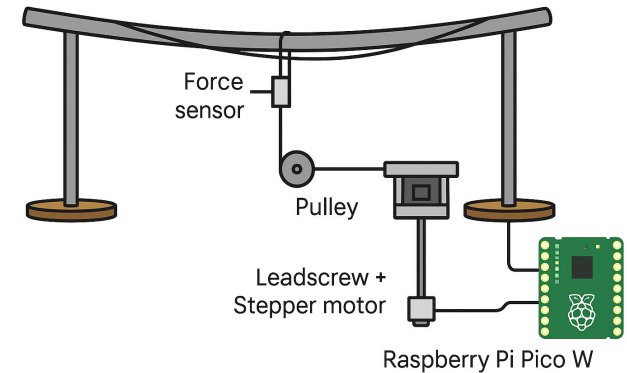
Force sensor

Weight



2nd version of the prototype

## Illustrative Example



# Streamlit interface

Introduction

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To enhance user interaction with the recorded pole data, an interface is being developed that provides the following functionalities:

Introduce Data

- Pole identifier
- Pole length
- Temperature
- Humidity

See Data Introduced

View the complete dataset of all recorded poles

Edit Data

Edit previously entered data

Delete Data

Delete data entries

Data Visualisations

Explore data visualizations based on the recorded information

## Introduce Pole Data:

Pole Identifier (id)

0

Pole Length (cm)

0,00

Displacement (cm)

0,00

Temperature (°C)

-50,00

## Database Records

Pole_Identifier	Length	Temperature	Humidity	Displacement	Weight	Force	Date
0	37	265	10.5	77	0.54	25.5	2025-08-18 09:23:
1	37	265	16	63.6	0.7	32.54	2025-09-20 09:23:
2	67	320	19	47	0.95	25.5	2025-08-18 09:23:
3	67	320	25	31	0.8	23.04	2025-09-04 09:23:
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99	37	265	13.5	94	0.35	15	2025-09-23 09:23:

## Mobile Pole Vault Stiffness Device

Choose what you want to do:

--Select an option--

--Select an option--

Introduce Data

See the Data introduced

Data

See Data

Visualisation

Illustrative examples

Choose what you want to do:

Delete Data

Select the Identifier to delete:

37

Delete Row

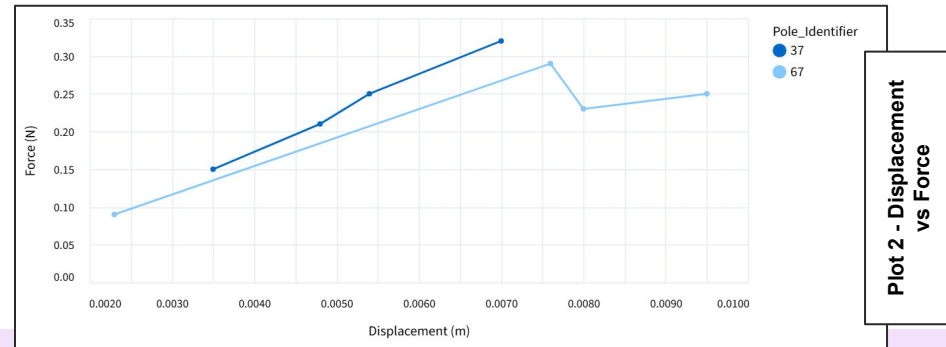
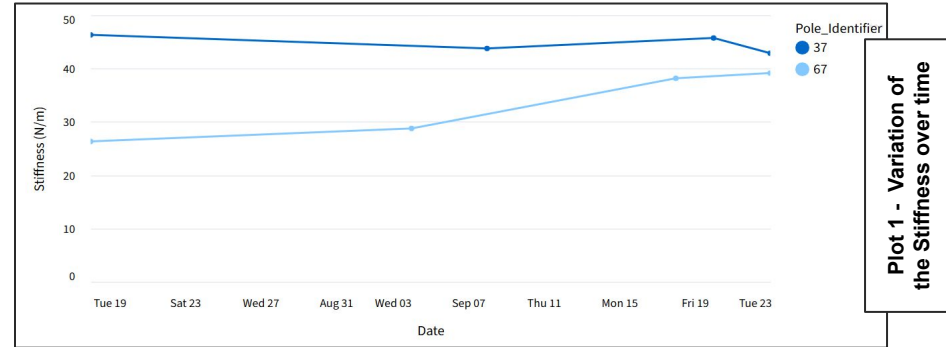


# Hypothetical Results



The hypothetical results that we expect to obtain are:

- **TIME:** The stiffness of the poles gradually decreases over time, showing how their strength decreases as they age.
- **ENVIRONMENTAL FACTORS** like temperature and humidity significantly affect stiffness, accelerating the pole's loss of rigidity.
- **QUIVER COMPARISON:** The displacement vs force graph of poles with the same flex and length measurements will be different depending on the brand.
- **There is a clear relationship between the force applied and the resulting displacement,** meaning the harder the push, the more the pole will bend or move.



**Next steps?**

# References

- [1] Rosdahl, H., Aitken, D., Osborne, M., Willén, J. & Nilsson, J., 2024. *A New Versatile Jig for the Calibration and Validation of Force Metrics with Instrumented Paddles in Sprint Kayaking*. *Sensors*, 24(4870), pp.1–23.
- [2] Bowen, G., Blume, E., Killeen, K. & Winn, B., 2017. *The Future of Pole Vaulting: Technical Report*. Georgia Gwinnett College.

# Introduction

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Problem  
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Technical  
Approach

User  
interaction

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## Project idea

Measuring pole stiffness + Getting data for comparison

Mobility + Data acquisition + Data storage

## Fields

electronics + informatics

## Users

Pole vaulters and  
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# Overview of the Technical design

Introduction

Problem Statement

**Technical Approach**

User interaction

Hypothetical Results

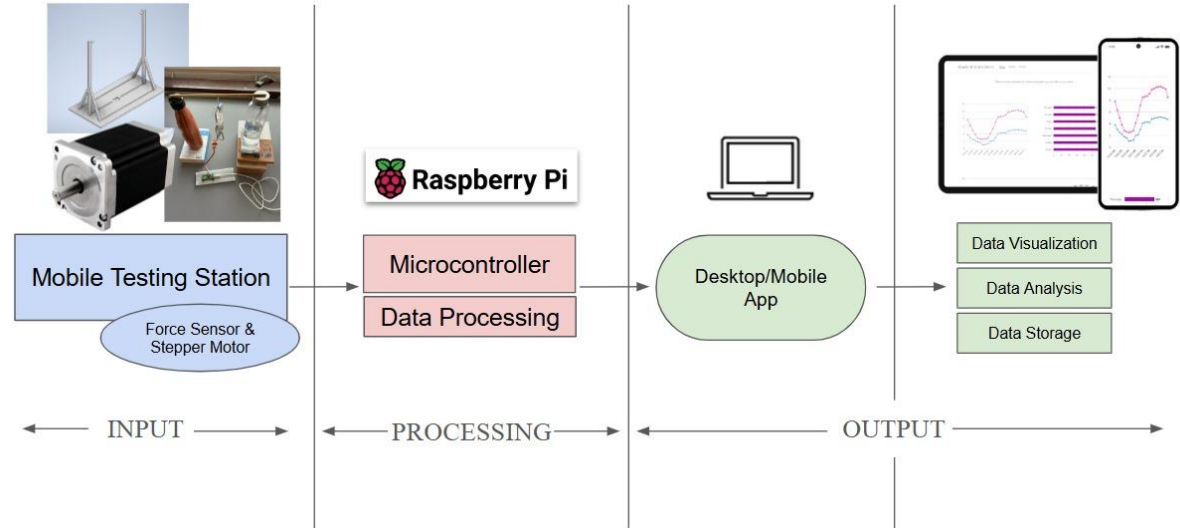
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- a rope
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- a leadscrew mechanism

## Electronics & Control

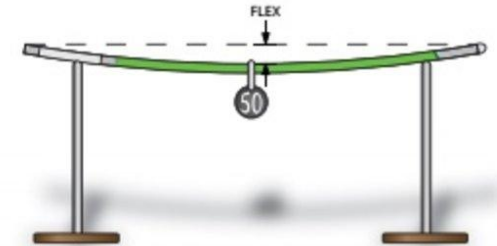
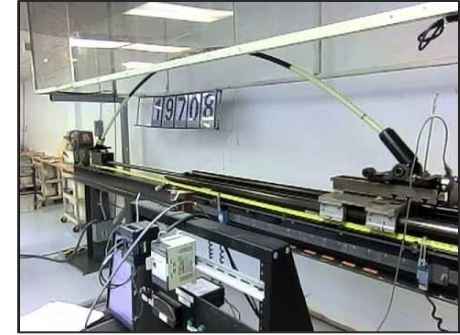
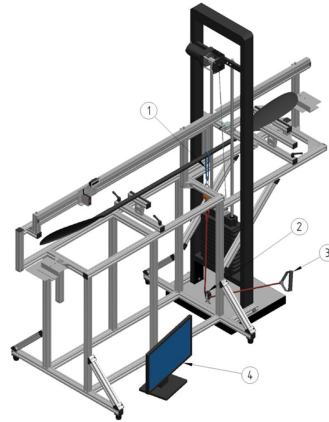
- Raspberry pi pico
- Python scripts

$$k = \frac{F}{\Delta x}$$



# How can we measure pole-vault pole stiffness in real time so athletes can compare poles across brands and conditions?

- Mobility
- Data Acquisition
- Data analysis



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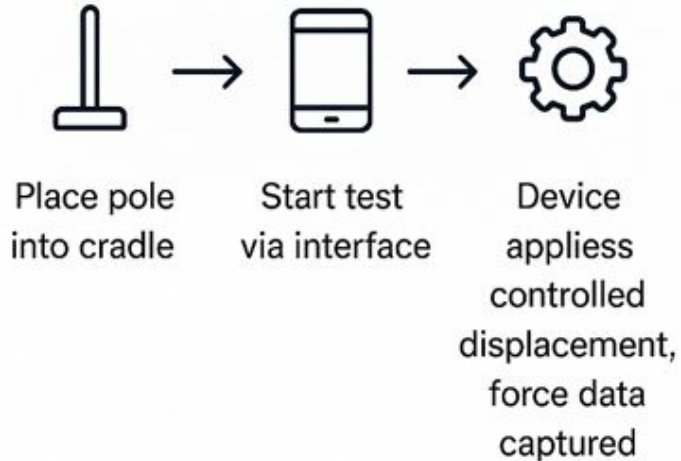
User  
interaction

Hypothetical  
Results

# User Interaction



## User Work Flow



## User Experience



Portable, easy setup in training environments



Visual outputs (charts, comparisons between poles)

# The Challenges Facing Today's Pole Vaulters

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- Subjective selection → impact on performance
- Lack of safety → how to assess aging?
- No mobile and practical tool to provide accurate stiffness

London 2012 Olympics





## System prototype

