University of Padova - Department of Information Engineering

Biomedical Wearable Technologies for Healthcare and Wellbeing

HyperMET

Academic Year 2022/23

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DIPARTIMENTO
DI INGEGNERIA
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HyperMET app goals

Fight Hypertension
promote a physical activity to combat high blood pressure

Raise awarness
educates individuals about the importance of a healthy lifestyle

Prevent Health risks
reduces risk factors associated with hypertension and increase the overall quality of life

Storage of data
follow the evolution of blood pressure data and exercise records

Hypertension

Hypertension, commonly known as high blood pressure (BP), is the major cause of premature death worldwide. Monitoring of BP at regular intervals during normal day life has emerged as a strong predictor of cardiovascular disease and mortality. **Physical inactivity** and **sedentary behaviour** are among the major modifiable risk factors associated with hypertension.

Risk factors:

- Age
- Family history
- Unhealthy lifestyle
- Chronic condition

Complications:

- Heart disease
- Stroke
- Kidney disease
- Vision problem
- Dementia

MET index

The **MET**, or metabolic equivalent of task, is a unit that estimates the amount of energy consumed by the body during physical activity, with respect to the resting metabolism.

A unit of MET can be expressed both in terms of oxygen consumption, as 3.5 mL of oxygen per kilogram per minute of activity, or in terms of calories consumed as a Kilocalorie per kilogram of body weight per hours of physical activity:

- $1\ MET = 3.5\ \frac{mL\ 0_2}{Kg\cdot min}$
- $1\ MET = 1\ \frac{Kcal}{kg\cdot h}$

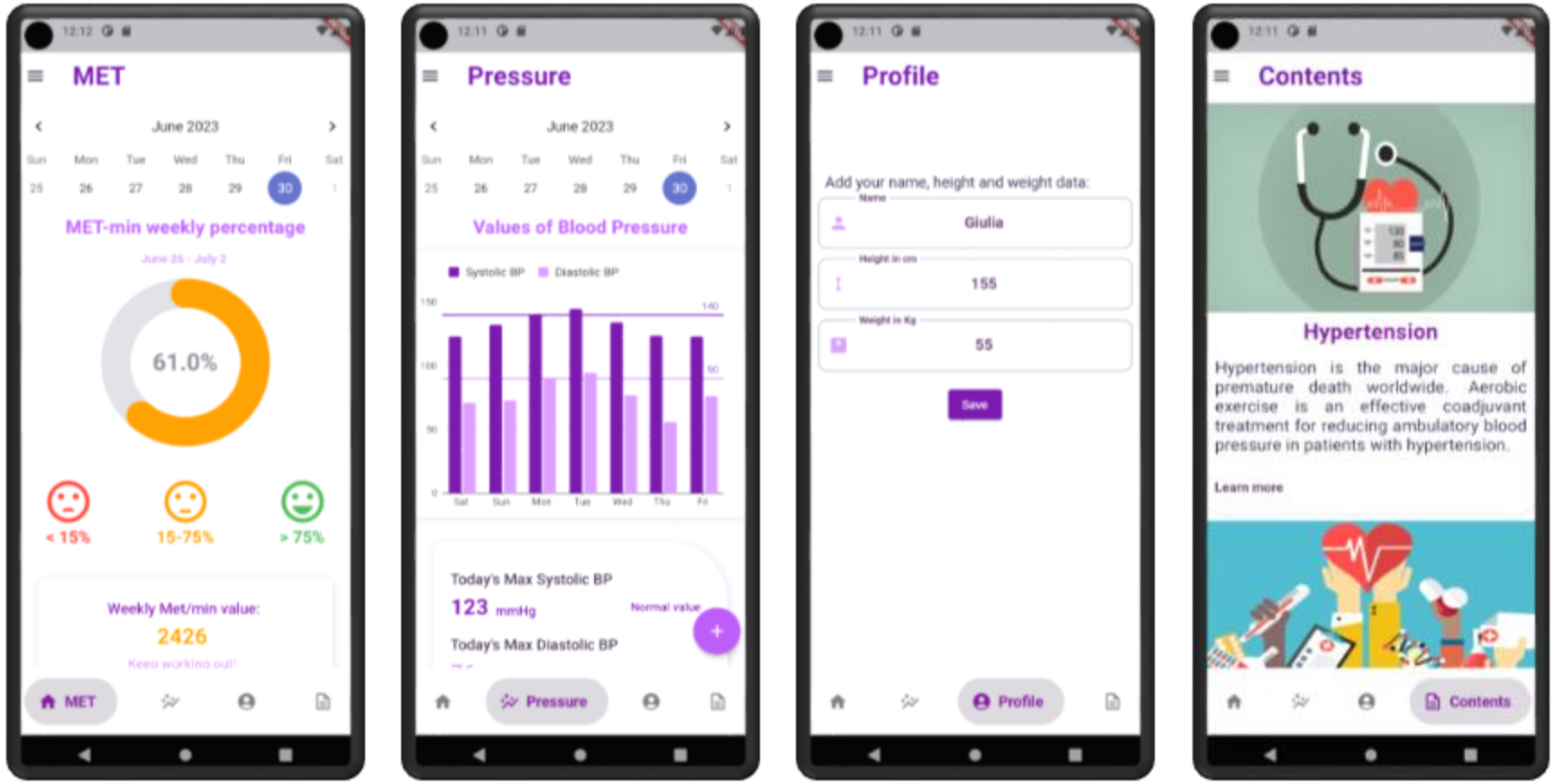
MET index

The World Health Organisation recommends that people conduct at least 600 metabolic equivalent minutes (MET/min) of physical activity. The most health gains are achieved at between 3000 and 4000 Met minutes per week.

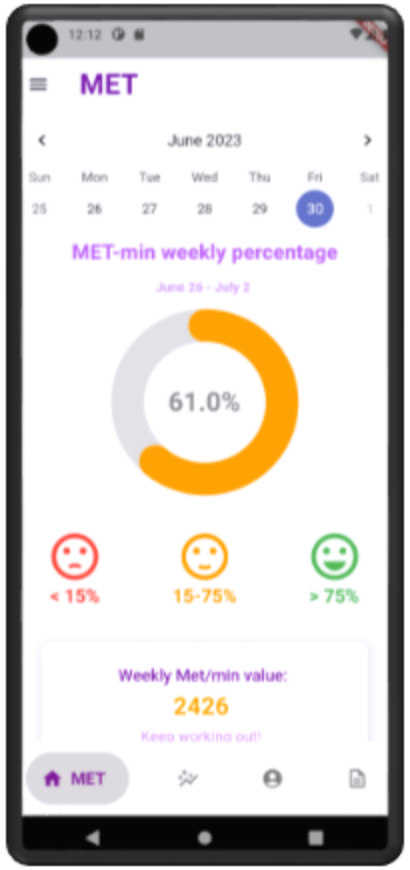
Moderate to high physical activity levels are associated with lower blood pressure. According to WHO the domains of physical activity were associated with the following range of Met-min per week:

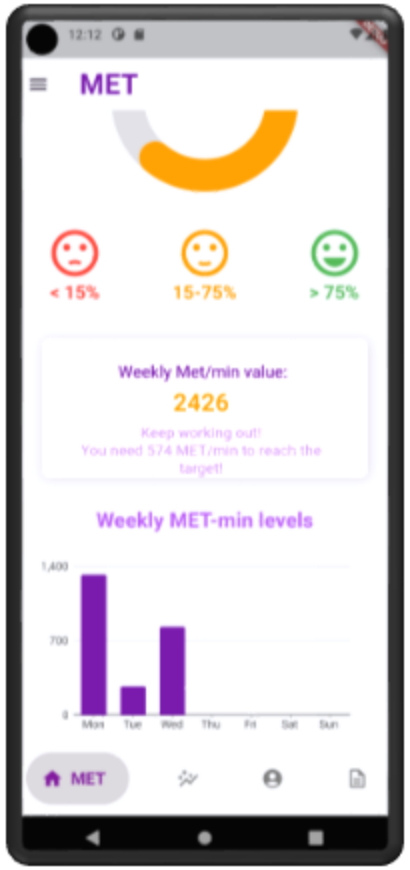
- **0-600** MET-min per week as **Insufficient** physical activity
- **601-3000** MET-min per week as **Moderate** physical activity
- **> 3000** MET-min per week as **High** physical activity

Core app functionalities



Core app functionalities



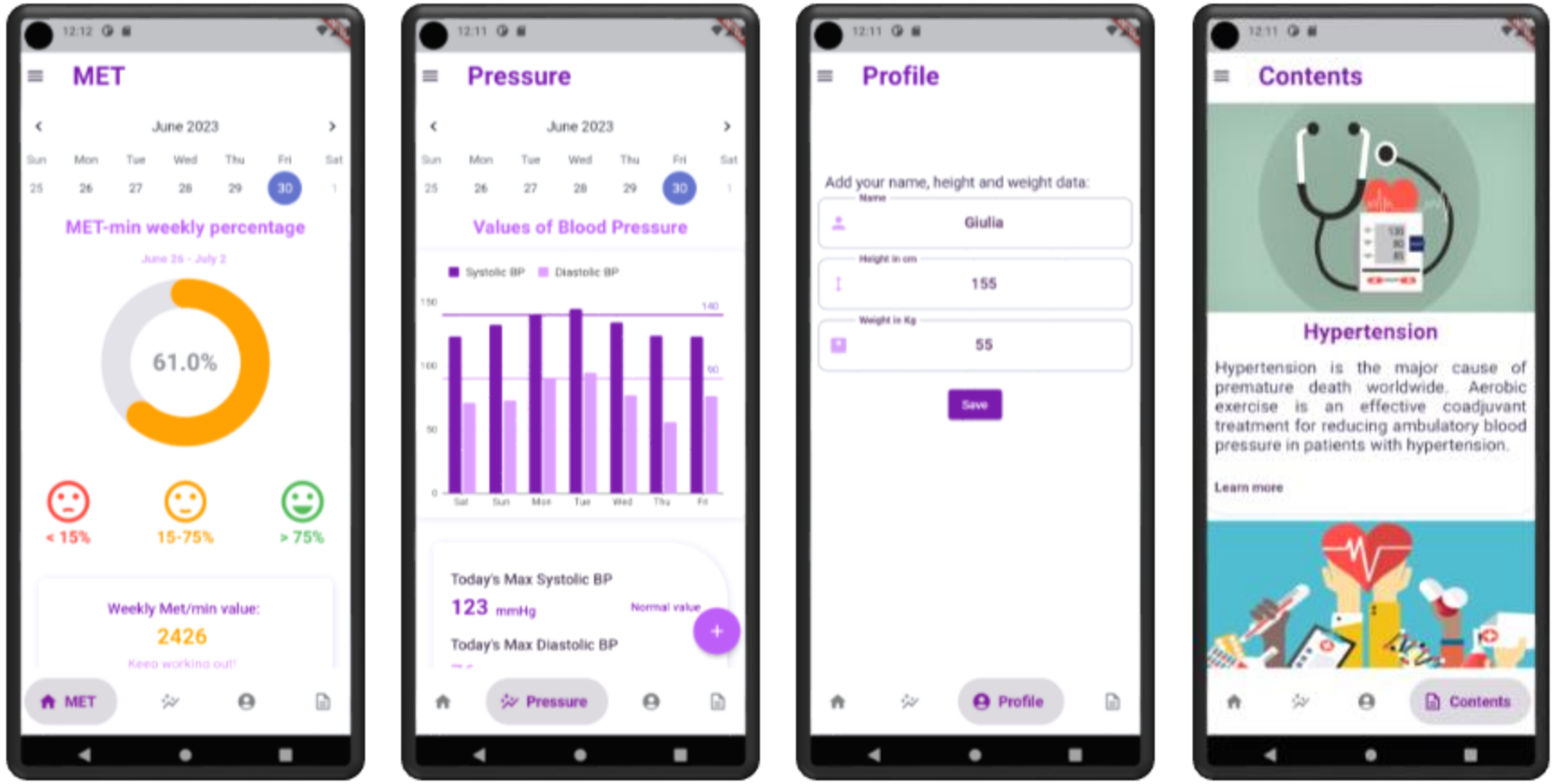


MET PAGE

The MET page shows the MET-min progress of the user for the selected week, it's composed of three main widgets:

- A **percentage indicator** with 100% being 4000 MET min per week
- A **weekly MET/min value**
- An histogram showing **daily MET levels**

Core app functionalities



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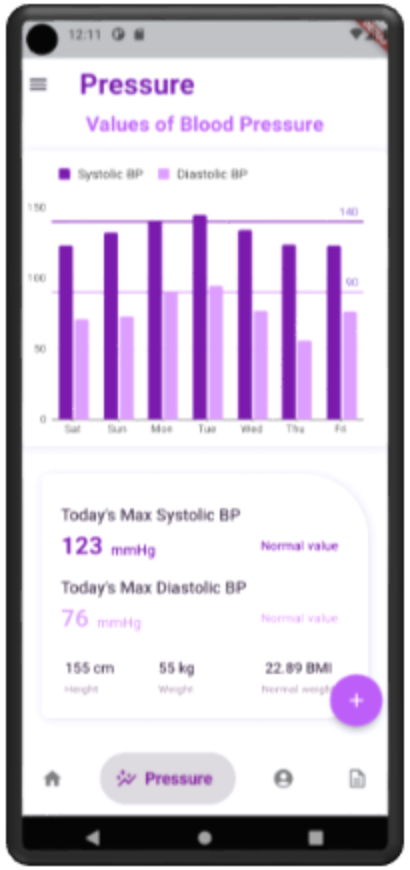
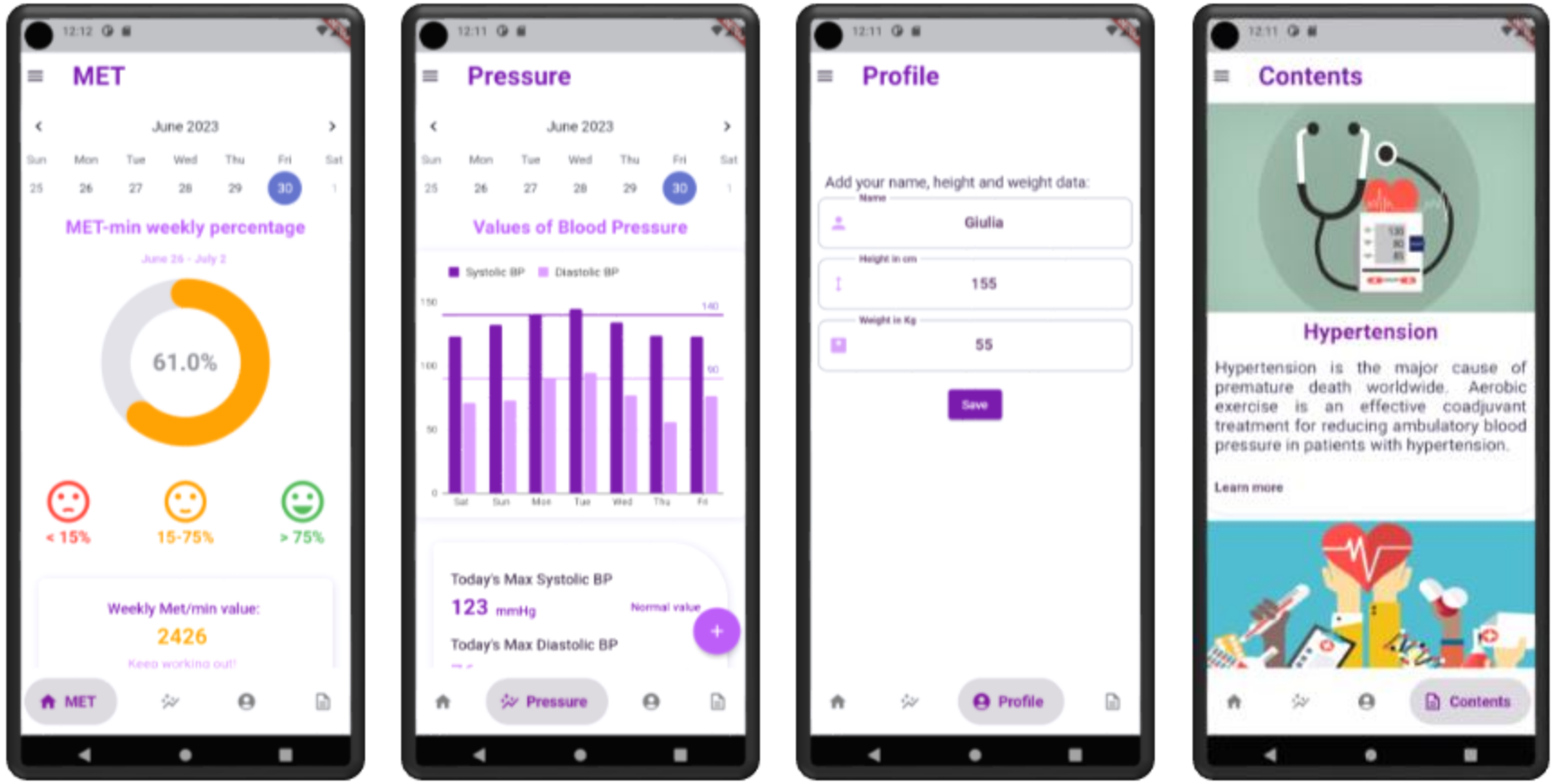


PRESSURE PAGE

The pressure page allows the user to storage and keep track of the values of systolic and diastolic pressure, it's composed of two main widgets:

- An histogram showing the **daily mean levels** of SBP and DBP
- A widget showing **daily maximum values** of SBP and DBP and **cardiometabolic indicators** such as height, weight and the BMI of the user

Core app functionalities



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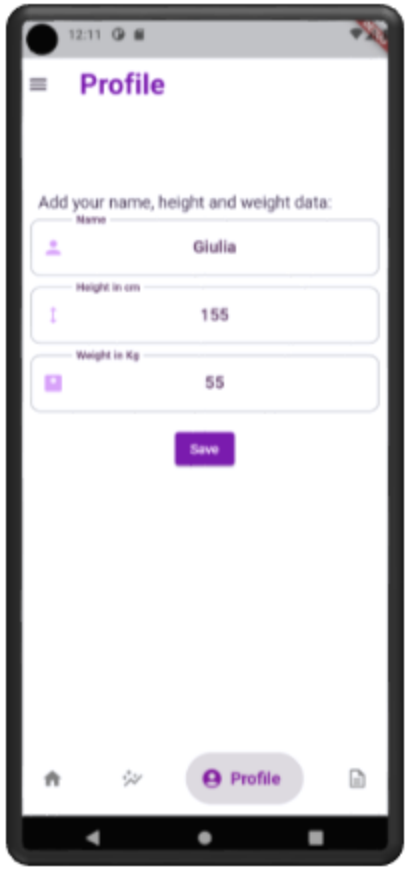
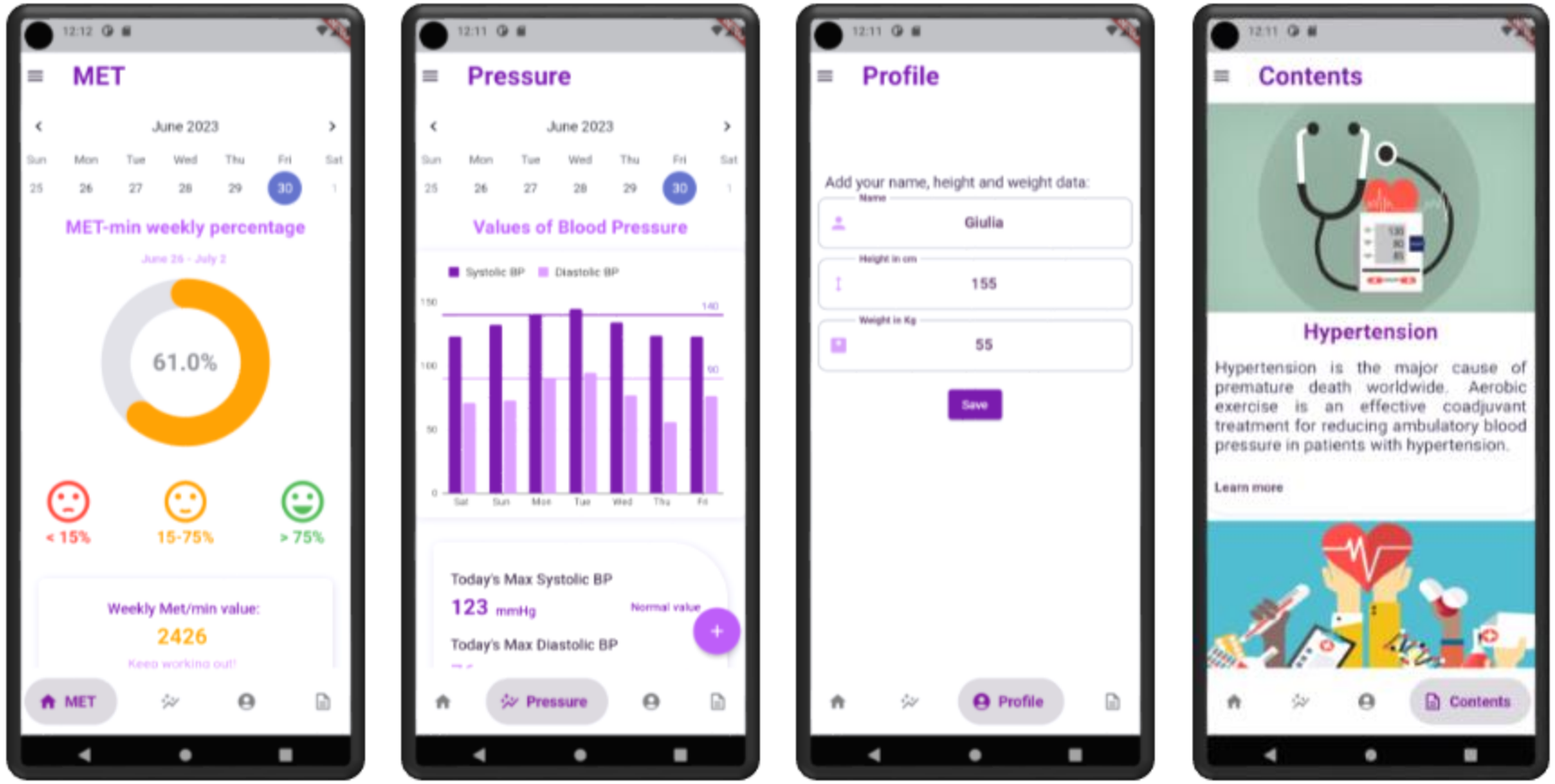


PROFILE PAGE

The profile page allows the user to insert personal information essential to calculate the MET and BMI values:

- **Name**
- **Height**
- **Weight**

Core app functionalities



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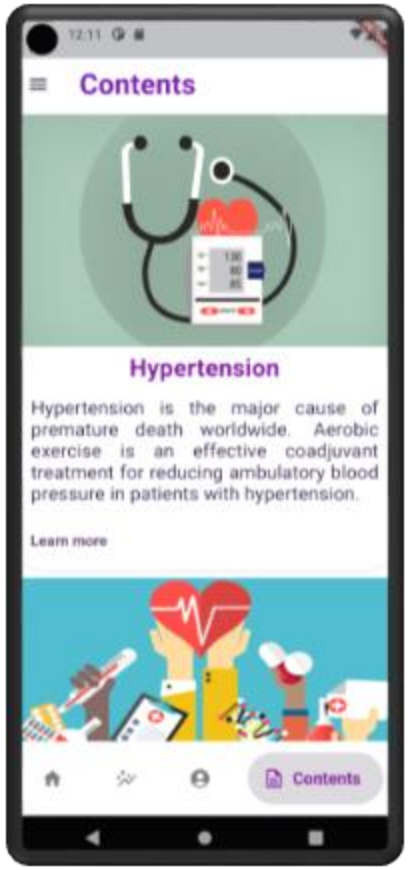


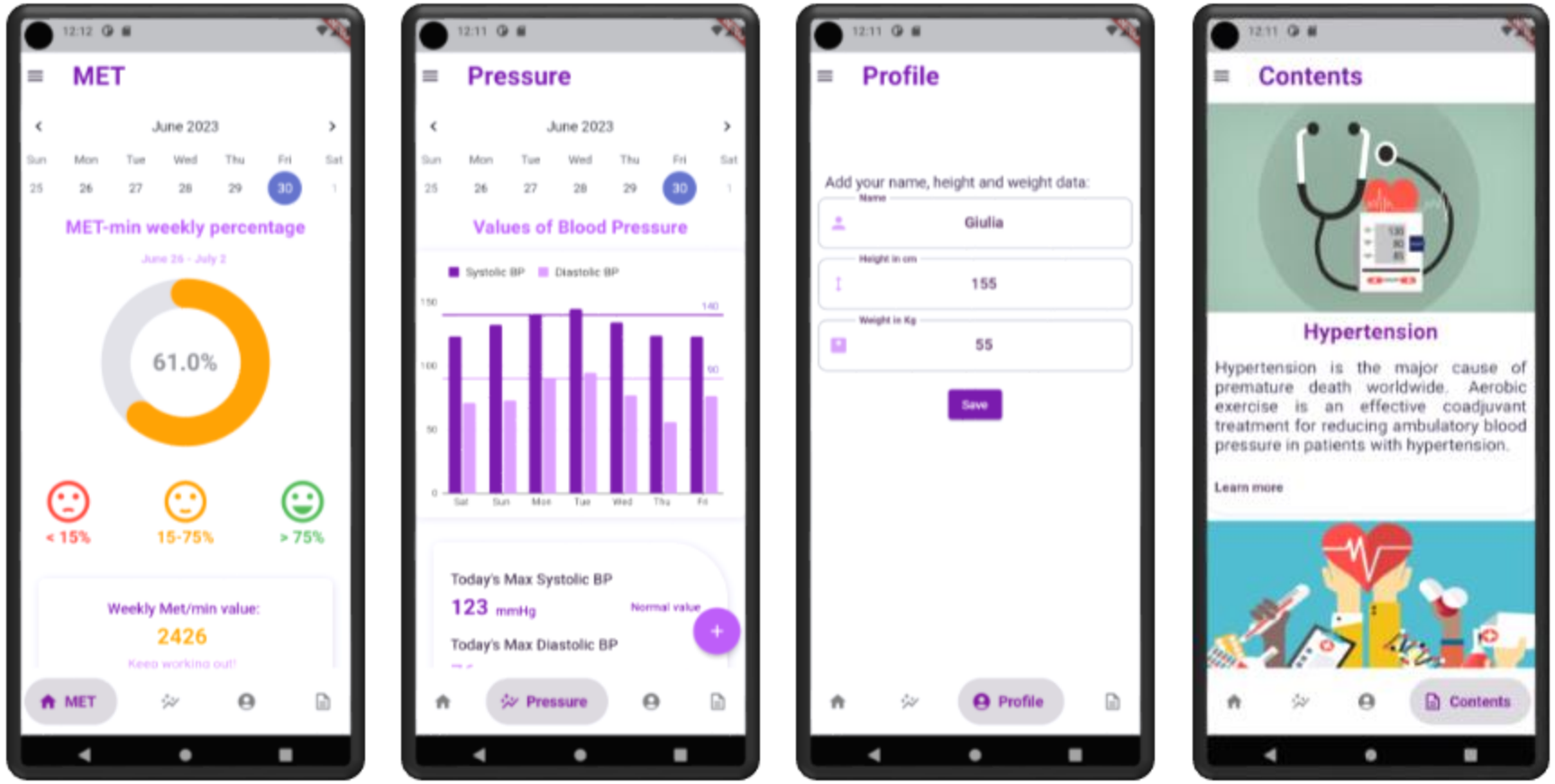
CONTENTS PAGE

The contents page provides information about the two main subject of HyperMET :

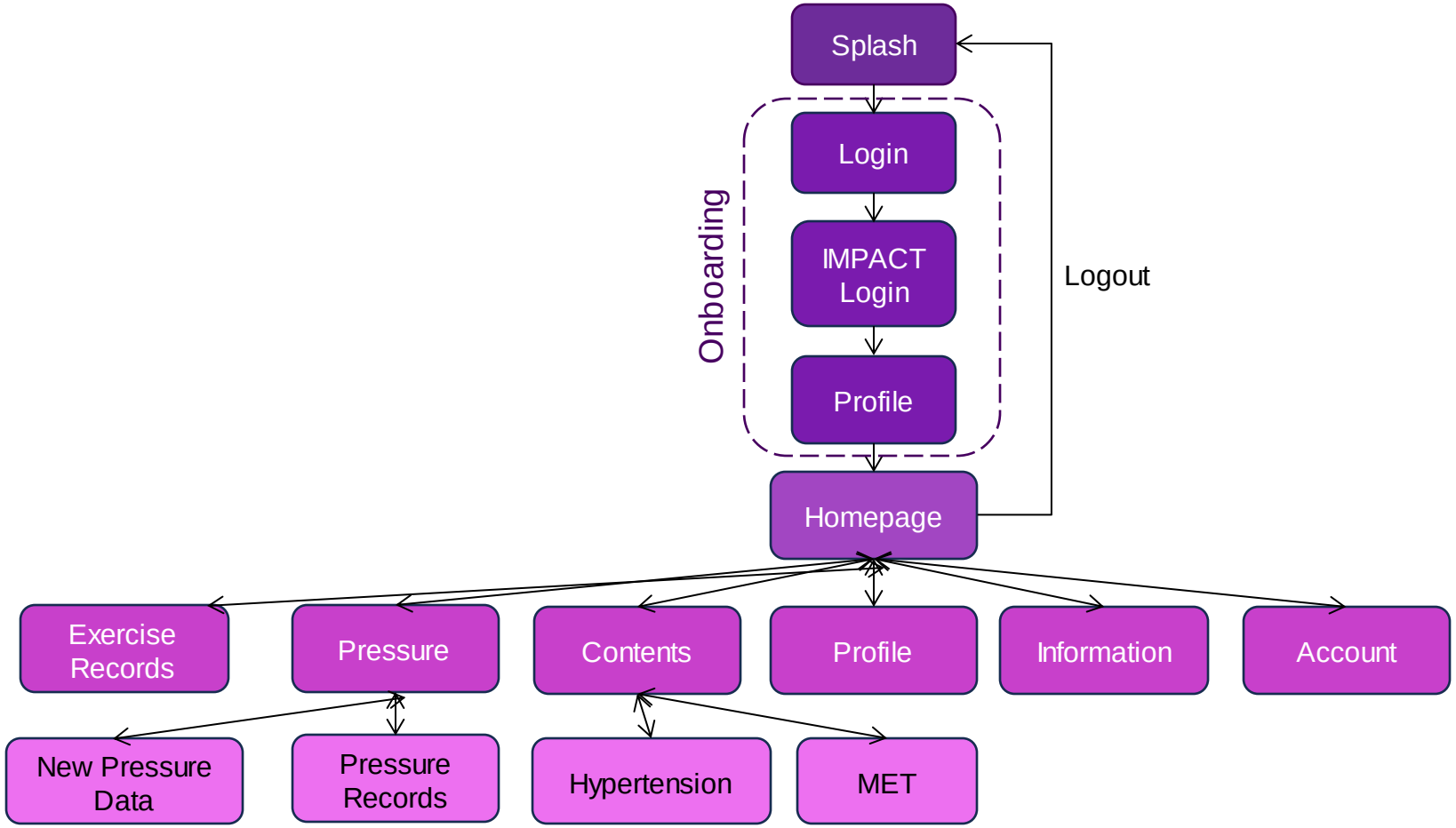
- **Hypertension**
- **MET**

In particular the information ranges from the definition of MET to how is calulated and why it is important in relation to Hypertension.

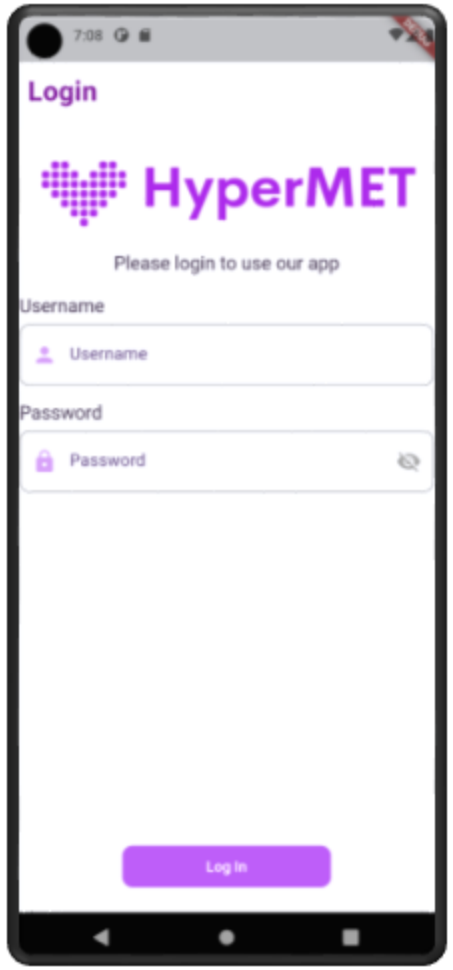
Core app functionalities

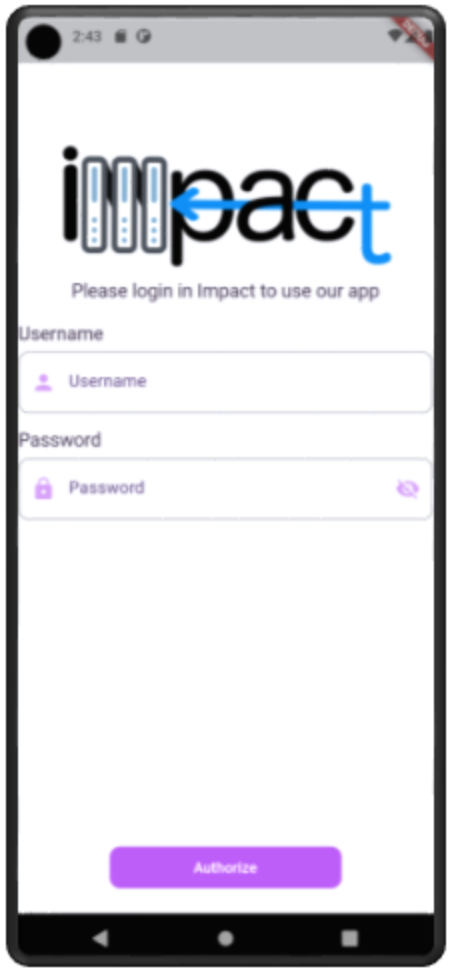


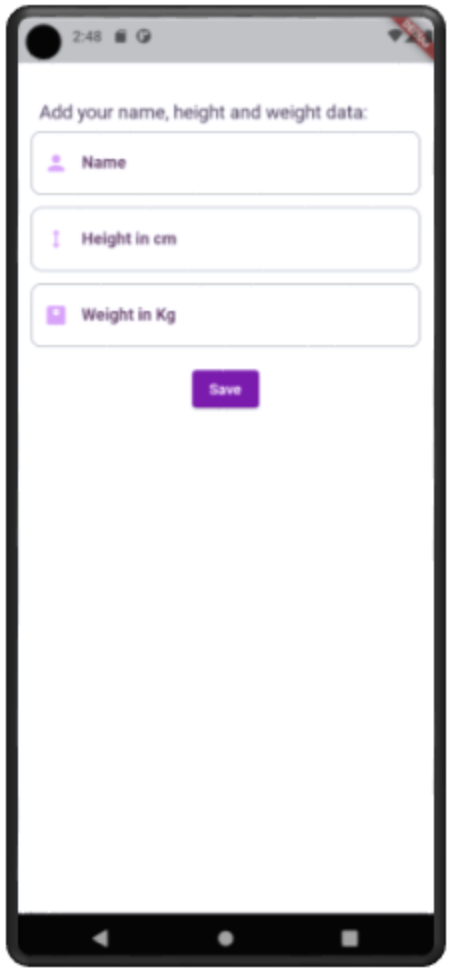
Core app functionalities: Navigation



Core app functionalities: Onboarding







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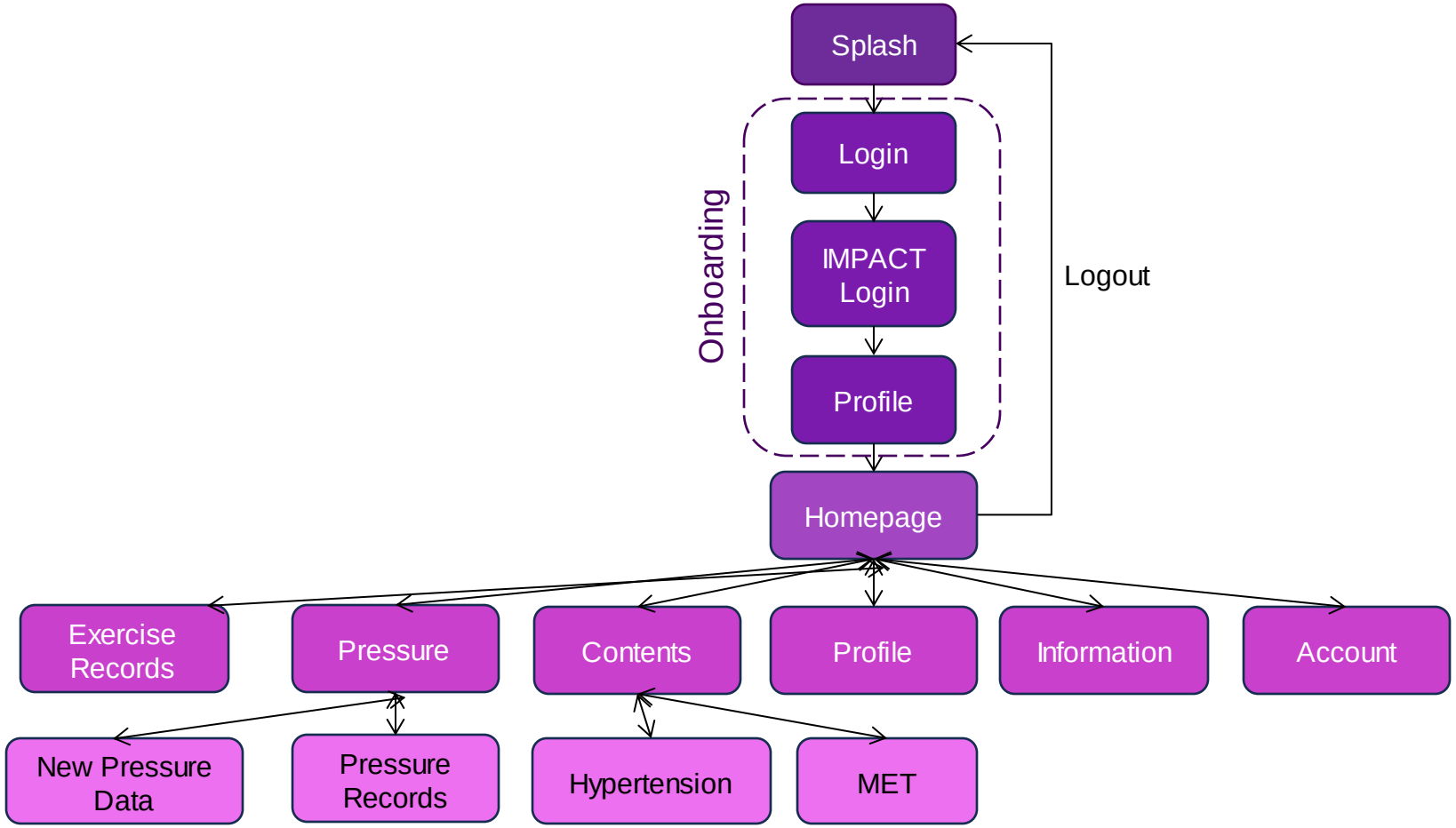
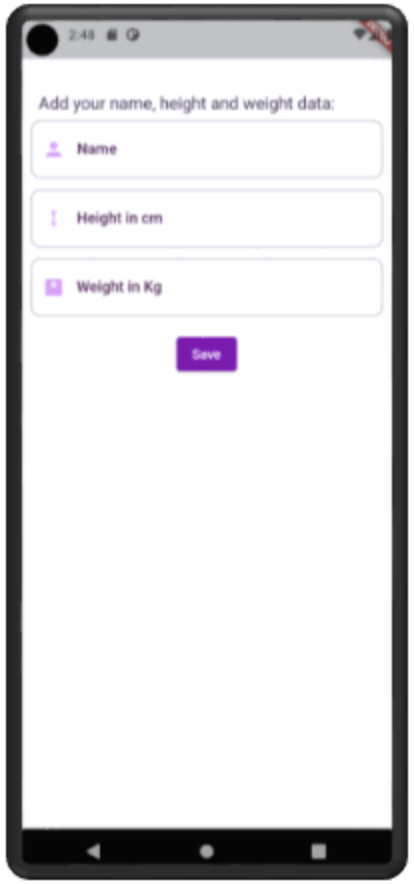
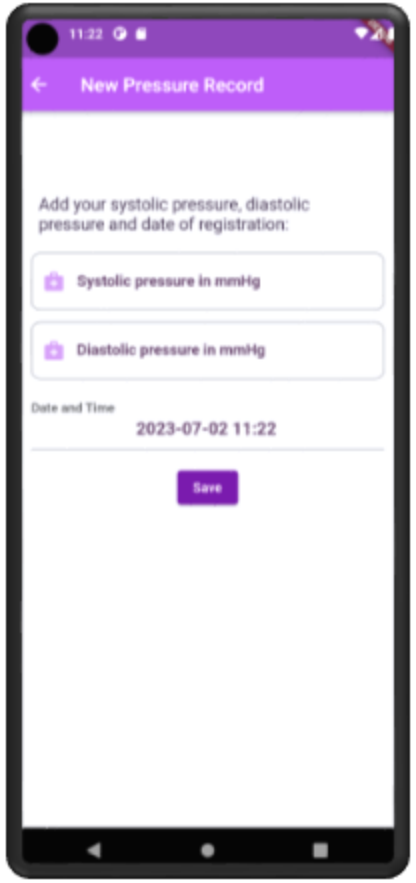


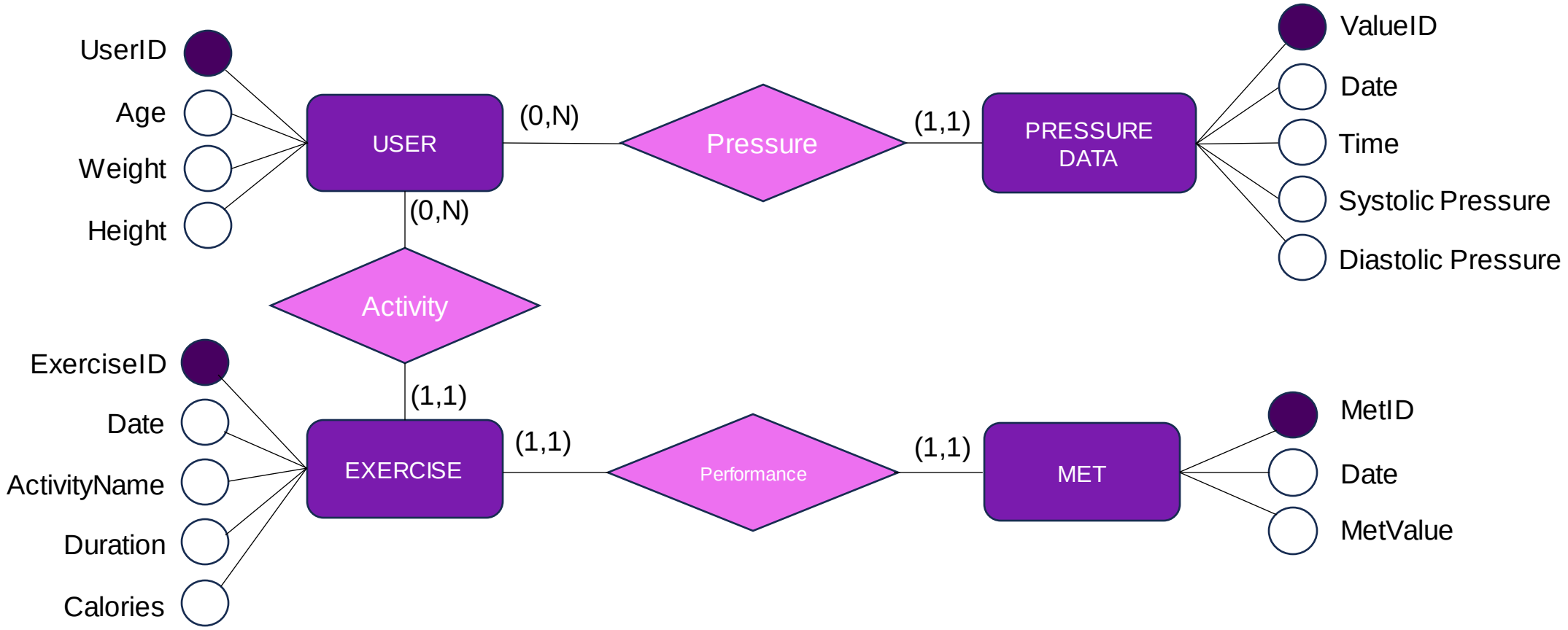
Core app functionalities: data collection



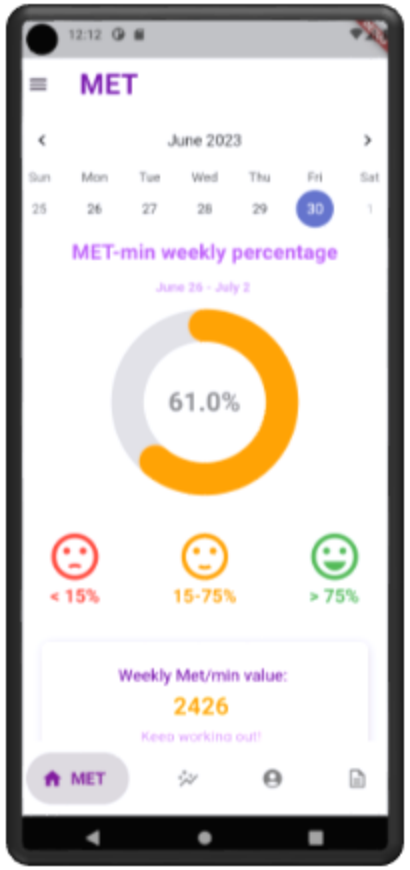


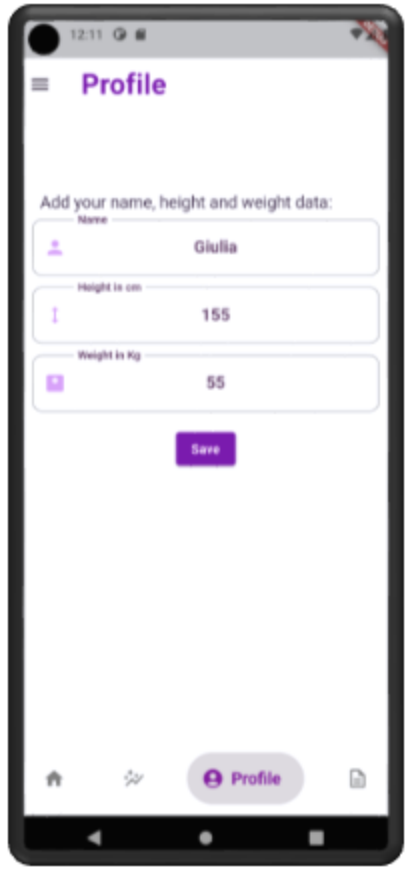
- **User-related data** are collected on the *Profile* page.
- **Physical activity data** are obtained by making queries to the impact database doing HTTP requests to IMPACT server.
- **Met values** are calculated using the user's physical activity data and weight
- **Pressure data** are collected through the *New Pressure Record* page

Core app functionalities: ER model



Core app functionalities: data representation





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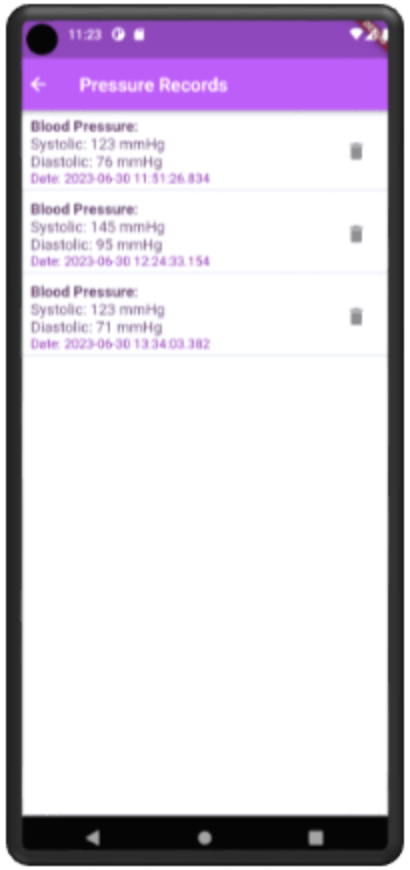


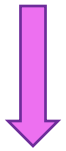
Daily activities are shown on the *Exercise Records* page

Daily recorded pressure values are shown on the *Pressure Records* page.

Closing remarks

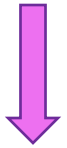
Goal: help reduce premature mortality from non-communicable diseases (e.g., hypertension), through prevention and promotion of exercise and healthy living. *(Sustainable Development Goal 3, Target 3.4)*

Raise awareness



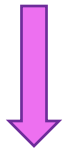
Contents page

Fight hypertension



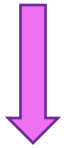
Monitoring of pressure levels

Prevent health risks



Encourage exercising

Storage data



Collection of pressure and exercise data

Original part

Association between Physical Activity and 32 Chronic Conditions among Spanish Adults

2022 Oct 20th

Associations of physical activity levels, and attitudes towards physical activity with blood pressure among adults with high blood pressure in Bangladesh

2023 Feb 3rd

Association between 24-h movement guidelines and cardiometabolic health in Chilean adults

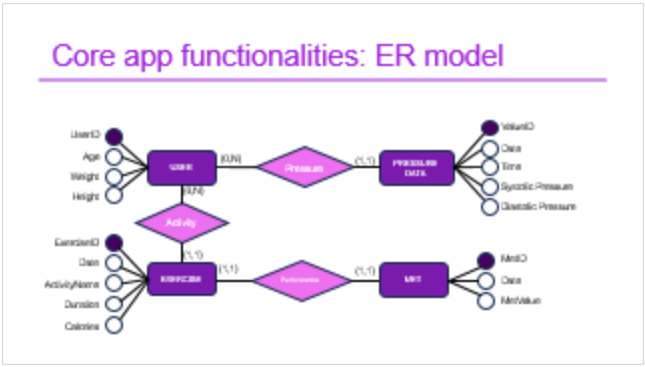
2022 Apr 6th

Exercise Reduces Ambulatory Blood Pressure in Patients With Hypertension: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

2020 Dec 15th

Future developments

- Use **steps** to improve the MET accuracy
- More **users**
- **Fitbit blood pressure** data implementation



Fitbit patents a blood pressure monitor built into a smartwatch

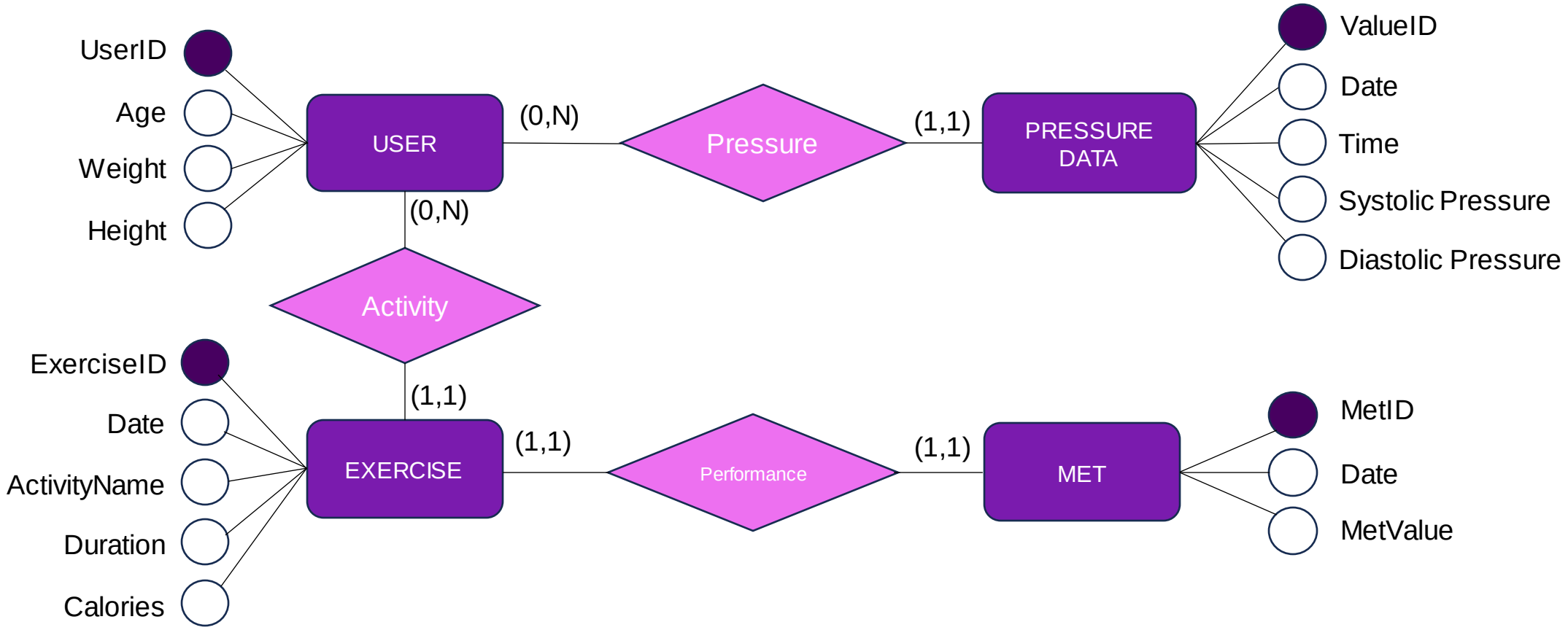
Pocketlint

BY OLIVER HASLAM

PUBLISHED FEB 10, 2023

Fitbit has filed a new patent that promises to allow people to check their blood pressure using nothing more than their smartwatch.

Core app functionalities: ER model



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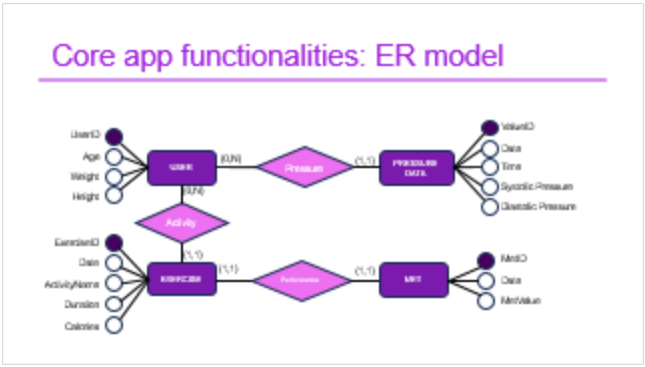

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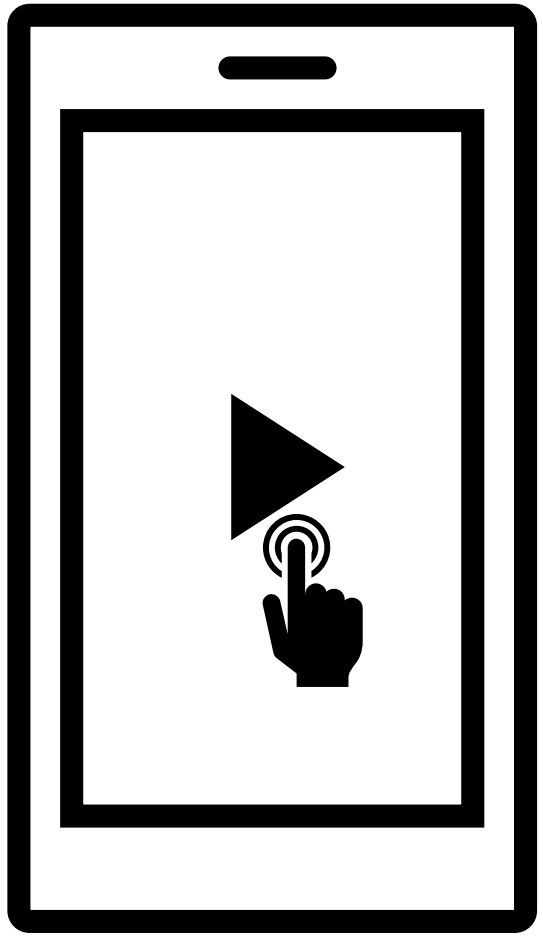
GitHub project management

Link to GitHub repository:

https://github.com/IacuSilvia/progetto

Live demo



Thank you for your attention!

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Bibliography and references

- López Sánchez, Guillermo F et al. **“Association between Physical Activity and 32 Chronic Conditions among Spanish Adults.”** *International journal of environmental research and public health* vol. 19,20 13596. 20 Oct. 2022, doi:10.3390/ijerph192013596
- Saco-Ledo, Gonzalo et al. **“Exercise Reduces Ambulatory Blood Pressure in Patients With Hypertension: A Systematic Review and Meta-Analysis of Randomized Controlled Trials.”** *Journal of the American Heart Association* vol. 9,24 (2020): e018487. doi:10.1161/JAHA.120.018487
- Riquelme, Ricardo et al. **“Association between 24-h movement guidelines and cardiometabolic health in Chilean adults.”** *Scientific reports* vol. 12,1 5805. 6 Apr. 2022, doi:10.1038/s41598-022-09729-1
- Islam, Fakir M Amirul et al. **“Associations of physical activity levels, and attitudes towards physical activity with blood pressure among adults with high blood pressure in Bangladesh.”** *PloS one* vol. 18,2 e0280879. 3 Feb. 2023, doi:10.1371/journal.pone.0280879