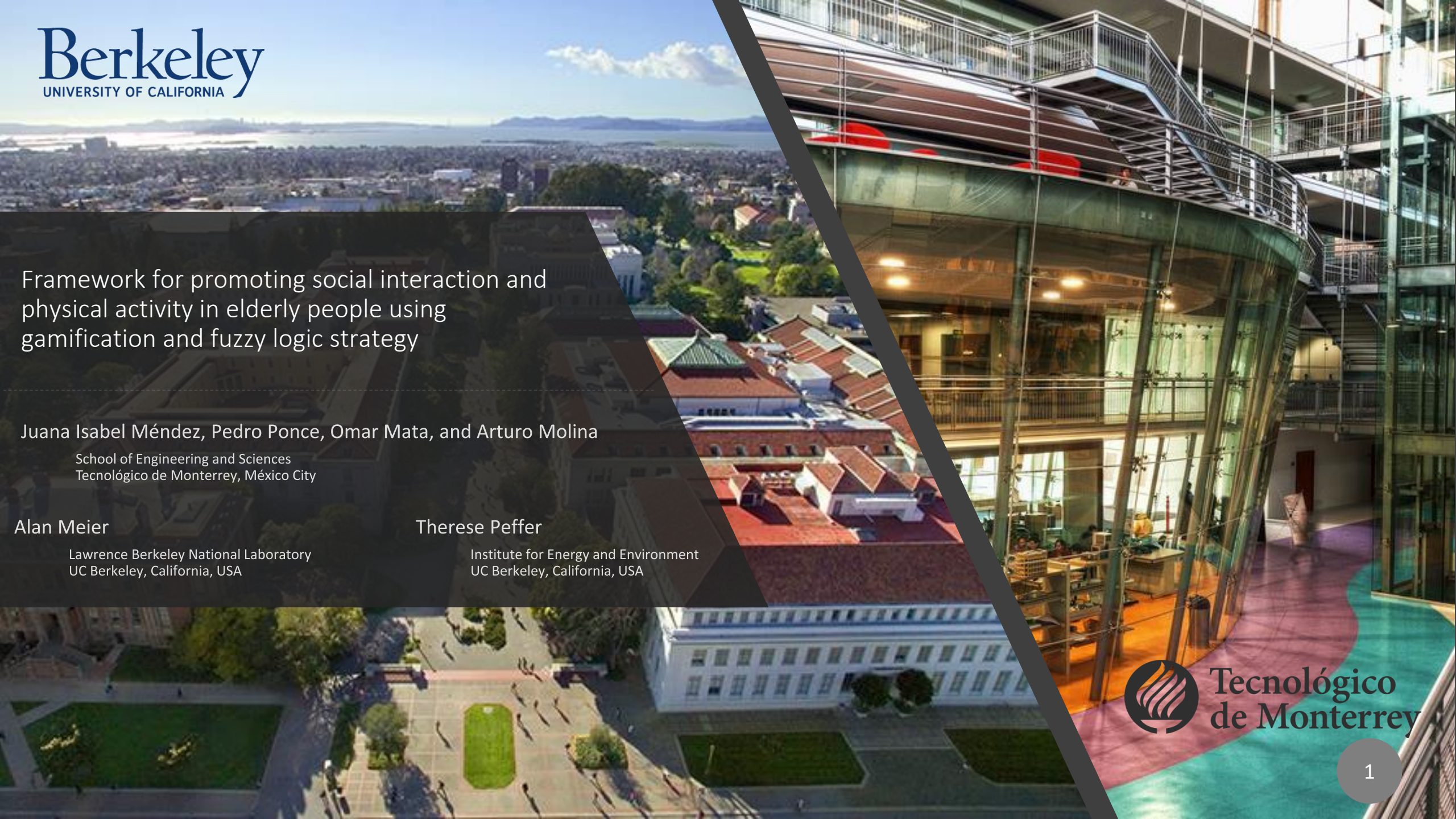

Framework for promoting social interaction and physical activity in elderly people using gamification and fuzzy logic strategy

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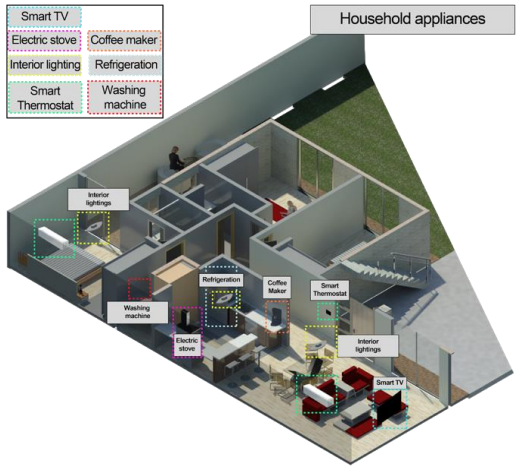
Agenda

- Introduction
- Objective
- Current solution
- Proposed solution
- Methodology
  - Proposed Framework
- Results
- Conclusion
- Further work
- References

Introduction

Population over **65 years** in the **United States** is projected to increase from **18% to 26% by 2050.**

Elderly people spend **more time** at their **home** than any other family members.



https://www.centreforbrainhealth.ca/news/2018/06/21/new-paper-offers-smart-guidelines-developing-tech-tools-older-adults

Thermostats are used in **85%** of **residential buildings** in the **United States.** Some of them use mobile phones for monitoring the house.

The **technology adoption** in **houses** and **mobile phone** are **increasing**. Thus, **new products** and applications are appearing and **making** life **enjoyable**.

e-Health applications for the elderly are related to **improving their quality of life** by promoting **routine exercises**.

Nevertheless, **elderly people failed** in adopting those **new technologies** due to **usability problems** or **lack of technological skills** causing **social isolation.**

Introduction

- The **acceptation** of a product relies on **personality traits.**
- **Gamification** within **a device** may increase **enjoyment** in elderly users and **solve usability problems**.
- **Gamification** with **fuzzy logic** has been proved to be **useful** in the **decision making process**, such as **profiling the type of user** for the personnel selection process.
- **Nevertheless**, to the best of our knowledge, applying a **gamification** strategy based **on fuzzy logic** and **the type of personality** to **develop** a **tailored product** has **not been studied previously.**

Objective

Propose a **strategy** that promotes **regular physical activities** and **social interaction** by considering the **elderly's personality traits**, the use of **gamification** techniques in mobile interfaces and the **connected thermostat**, to **teach, engage,** and **motivate** them to have a **healthier lifestyle**

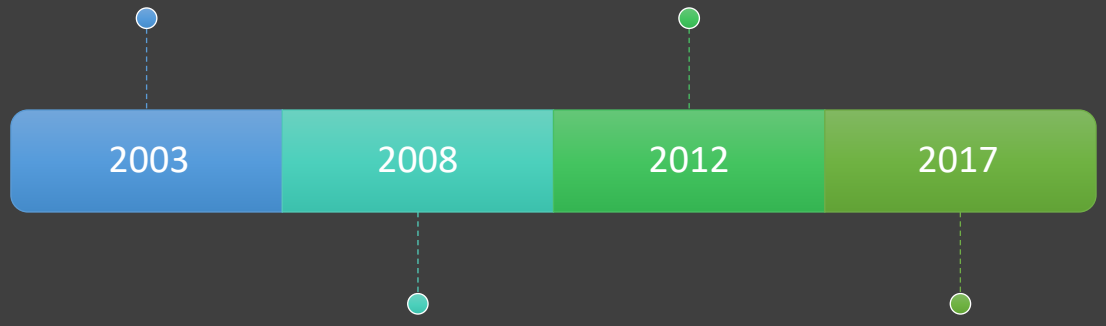
Current Solution

ENABLE project

Safety and assistive technologies for monitoring and controlling bath, temperature and gas stove.

Silver Promenade

Video game that simulated real-life activities.



UbiFit Garden

On-body sensing, activity inference and mobile to promote physical activity.

Spirit50

Online application for elderly people to promote physical activity.

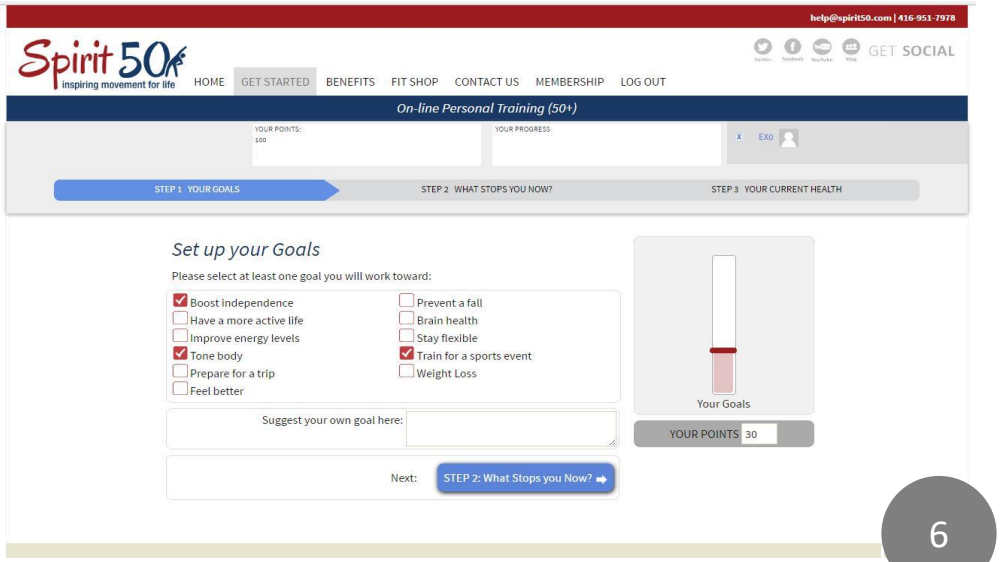
2008

https://www.consolvo.org/ubifit

2012

http://gamification-research.org/wp-content/uploads/2011/04/12-Gerling.pdf

2017



http://hcigames.com/research/gamification-of-physical-activity-www-spirit50-com/

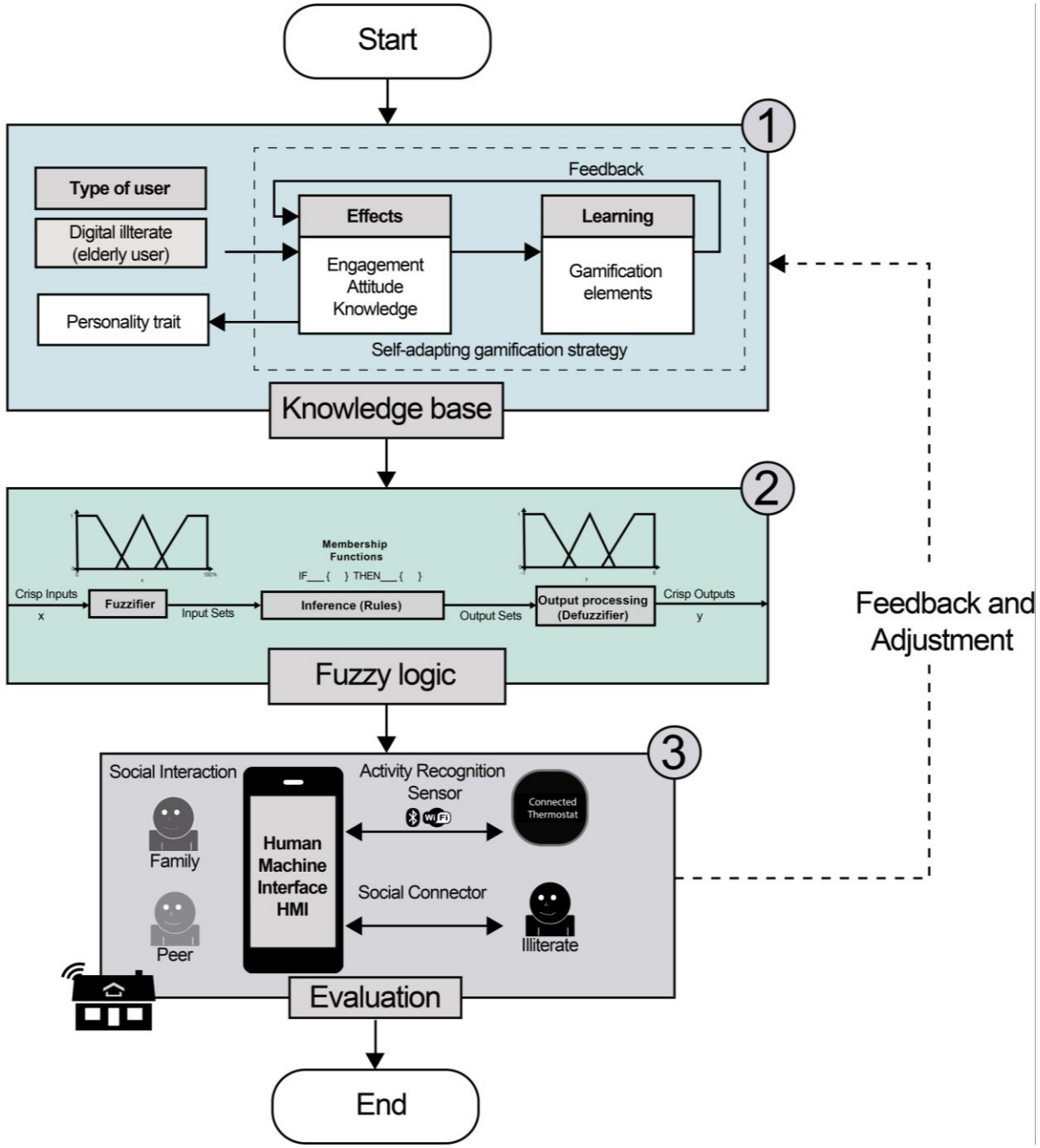
Proposed Solution

Develop a **framework** that considers **the type of personality** using a **gamification strategy** based on **fuzzy logic** to propose **a tailored Human Machine Interface.**

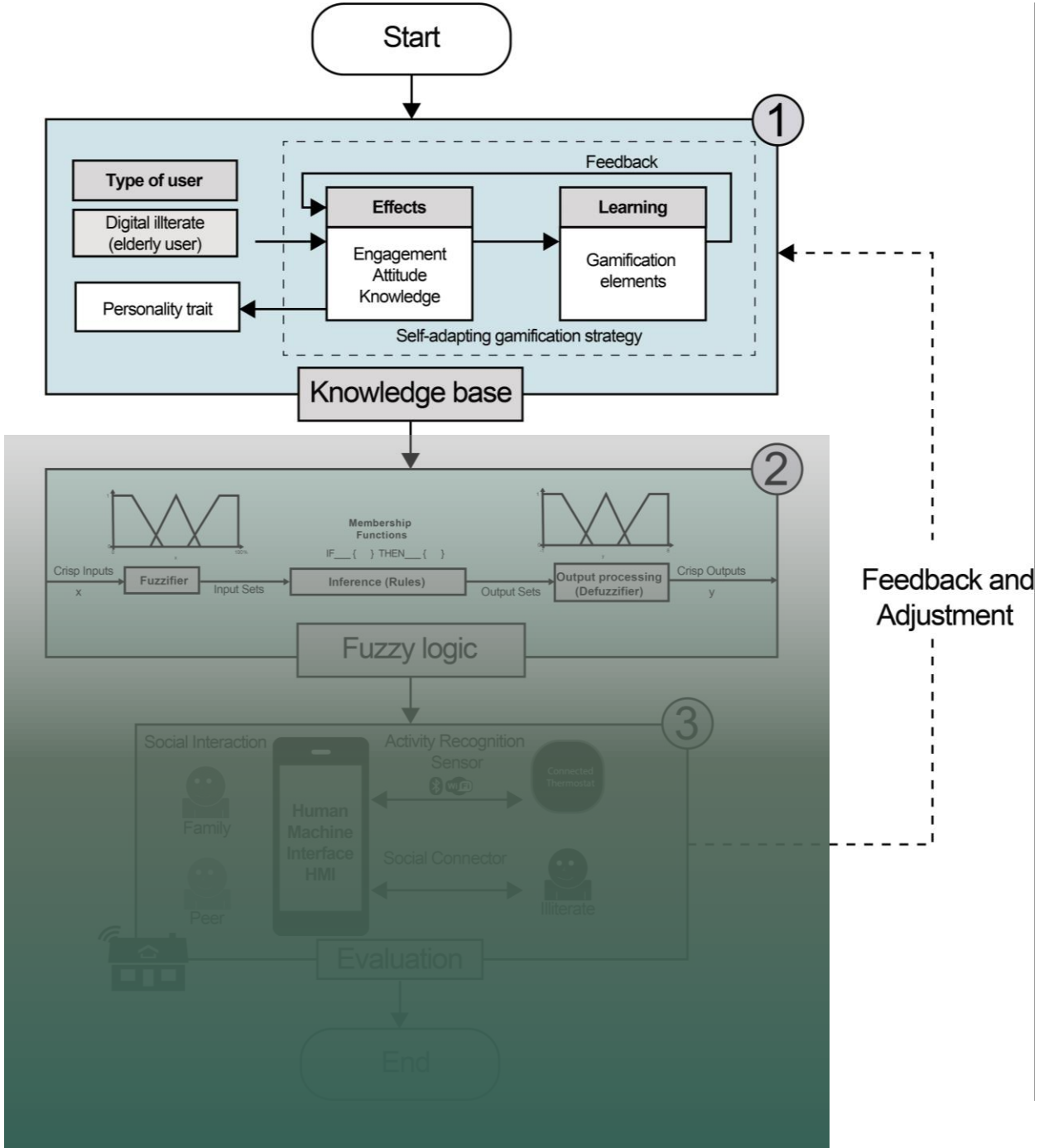
Methodology

Collection of data from books, journals and proceedings publications:

- The collected data was gathered from surveys, interviews and meta-analysis
- Gamification elements in e-Health applications for the elderly.
- Types of Gamification frameworks.
- Personalities for elderly people regarding their attitude, engagement, and knowledge about using the Internet for health purposes.
- The evaluation and metrics used in those publications to validate the HMI.

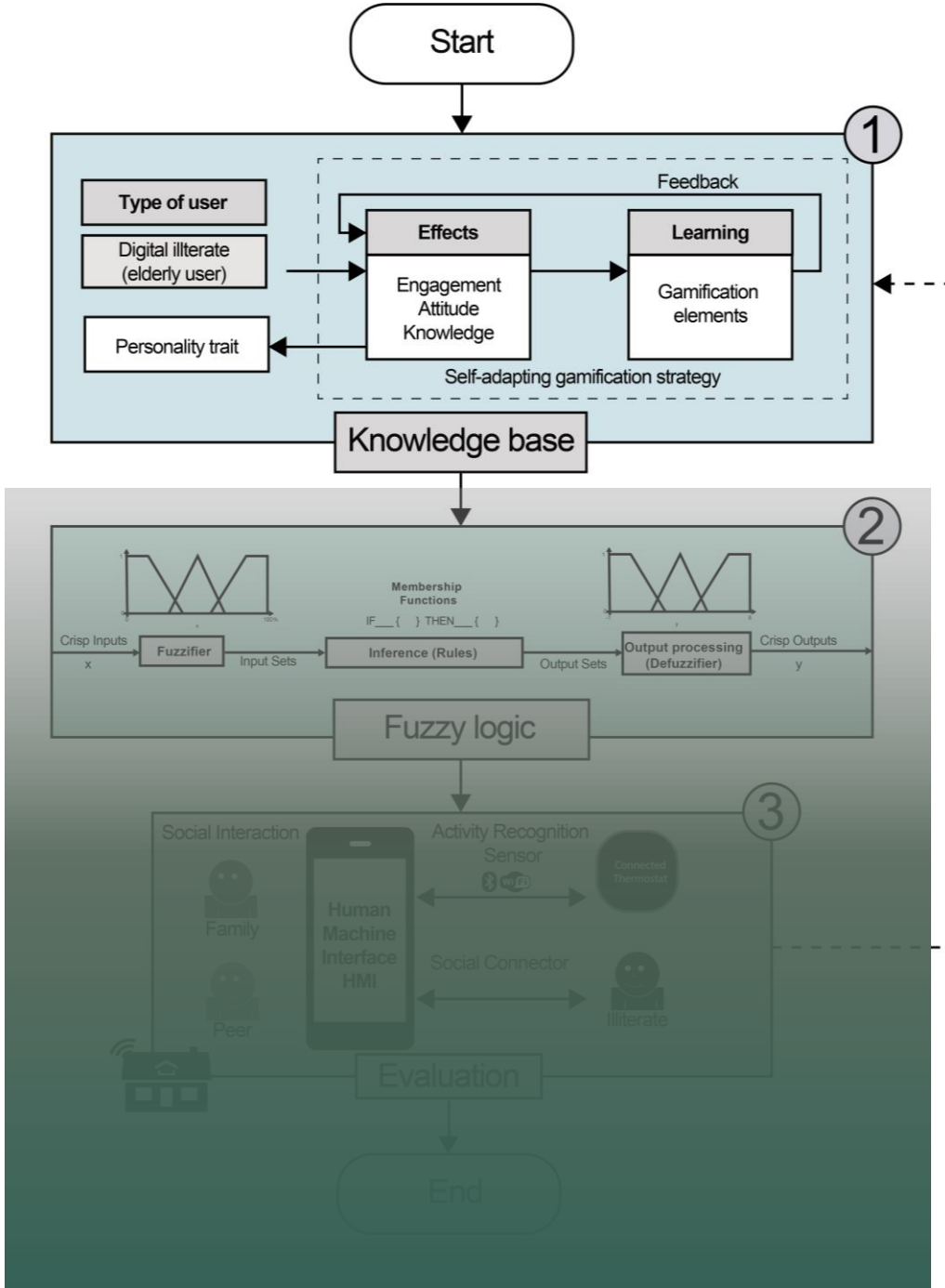

Start
1
Type of user
Digital illterate (elderly user)
Personality trait
Feedback
Effects
Engagement
Attitude
Knowledge
Learning
Gamification elements
Self-adapting gamification strategy
Knowledge base
2
Membership Functions
IF___{ } THEN___{ }
Crisp Inputs
x
Fuzzifier
Input Sets
Inference (Rules)
Output Sets
Output processing (Defuzzifier)
Crisp Outputs
y
Fuzzy logic
3
Social Interaction
Family
Peer
Human Machine Interface HMI
Activity Recognition Sensor
Connected Thermostat
Social Connector
Illiterate
Evaluation
End
Feedback and Adjustment

Framework



1

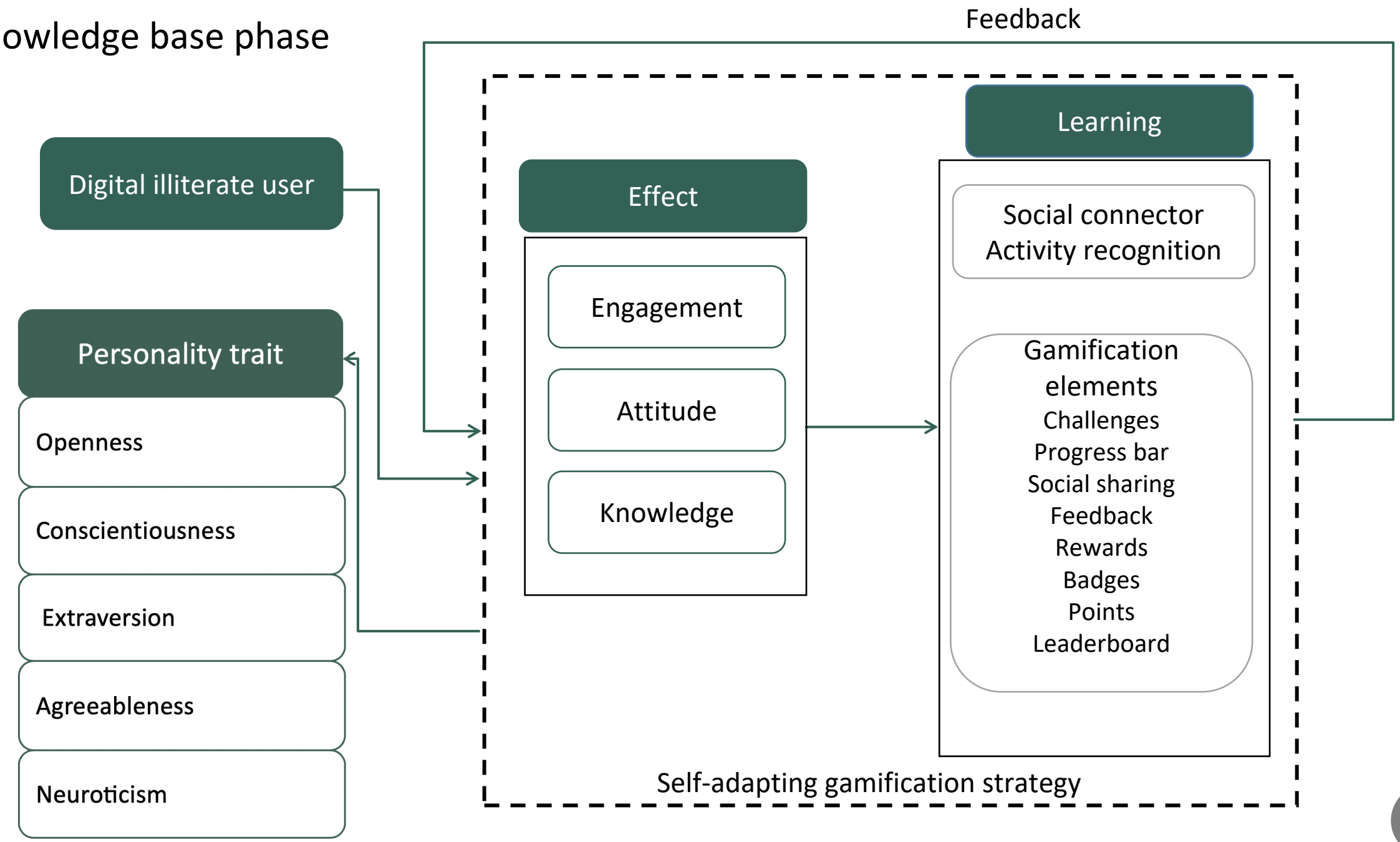
Knowledge base phase

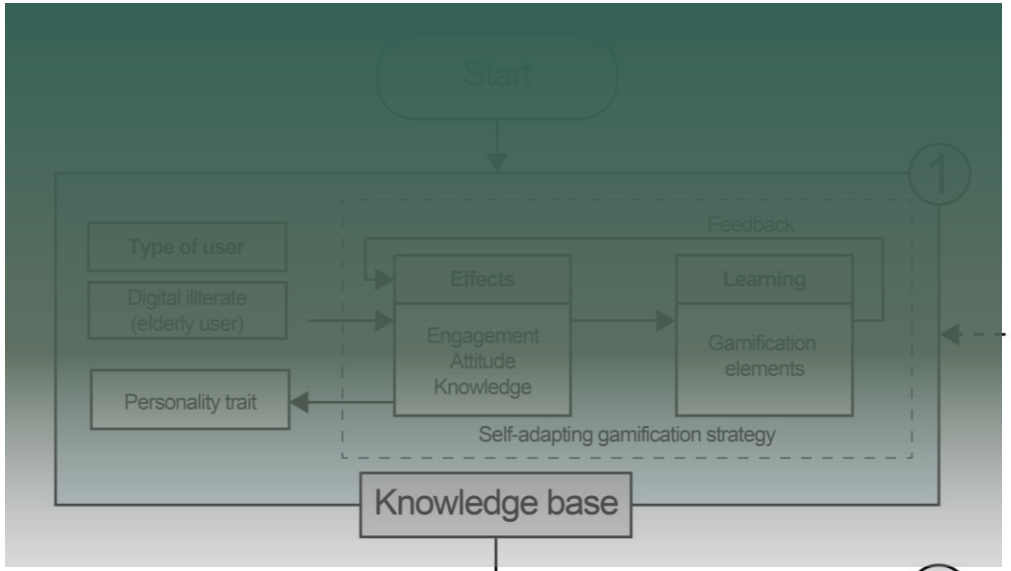


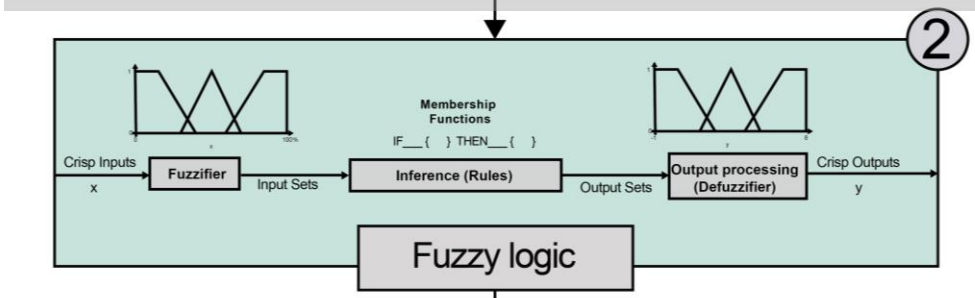
1

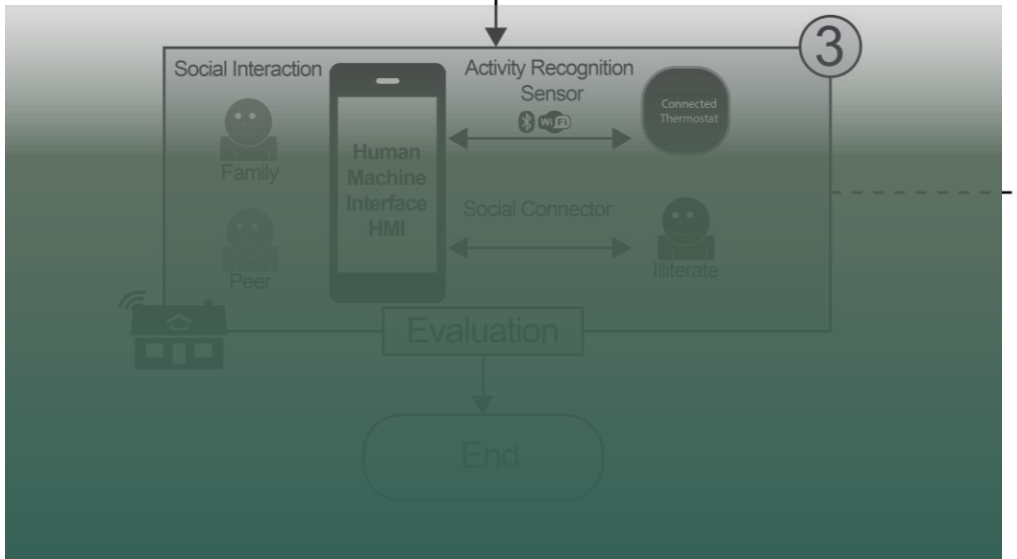
Analyzes the types of personalities, as well as the effects of the application, and the gamification elements used in e-Health applications for elderly.

Knowledge base phase





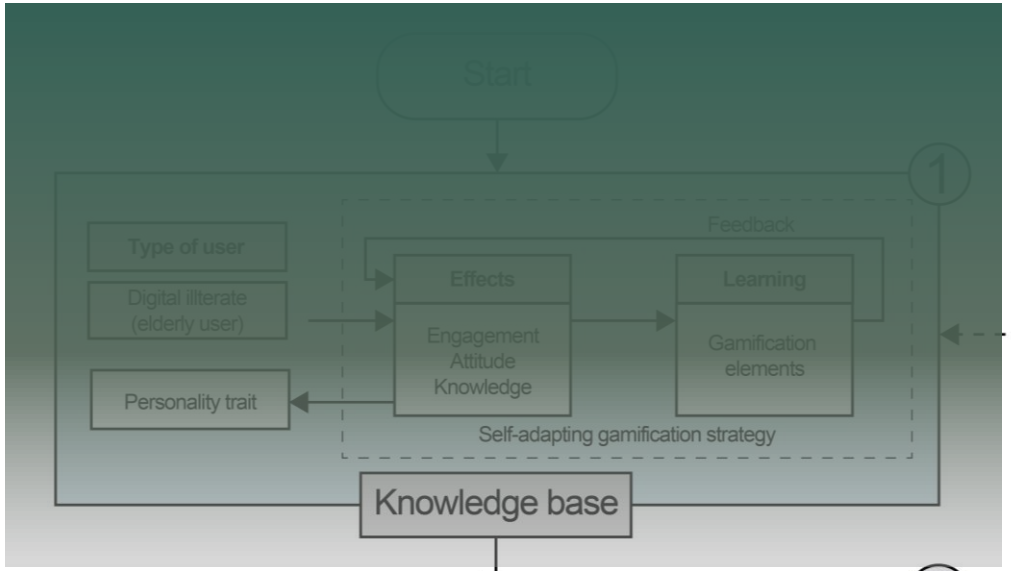


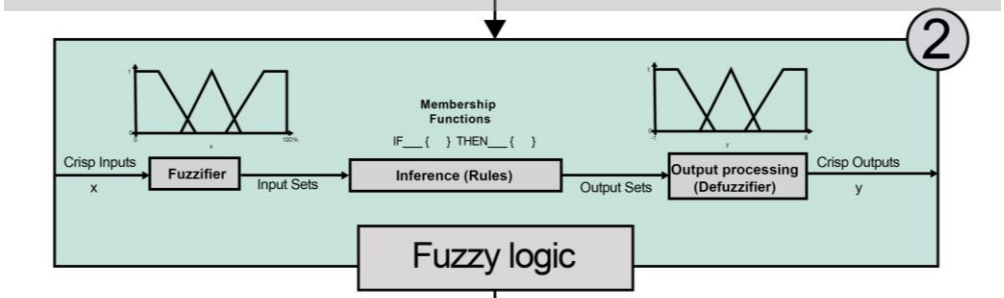


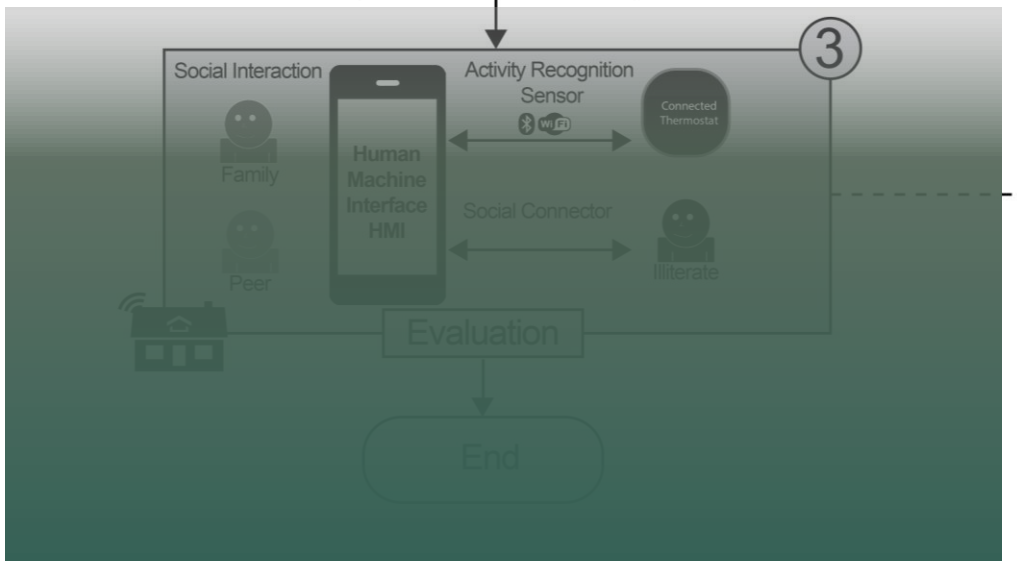
Feedback and Adjustment

2

Fuzzy logic phase







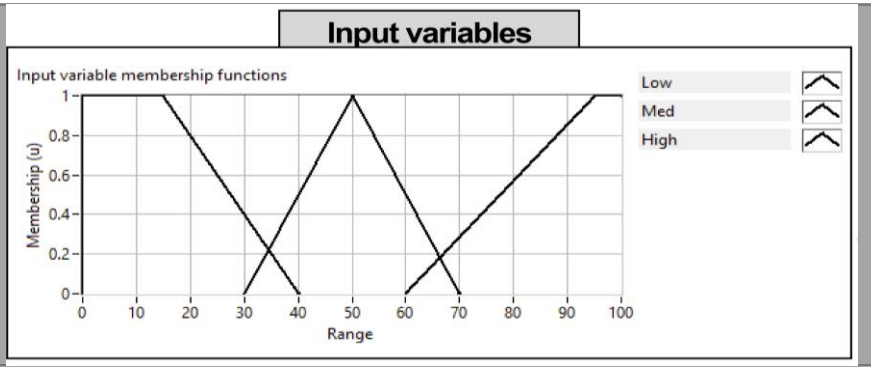
Feedback and Adjustment

2

- In 1965, L. Zadeh proposed a fuzzy set theory that models uncertainty based on linguistic variables related to human reasoning. It does not require a mathematical model of the real system to develop the set, but the experts' knowledge to propose the system.
- This step analyzes the three effects of the game to propose the gamification elements that best fit the user type. The fuzzy system helps the designer propose a tailored interface.

Knowledge

Measures the completed routine exercises and the acquired expertise they share with friends.



Input elements

Challenges

Progress bar

Badges

Points

Leaderboard

Rewards

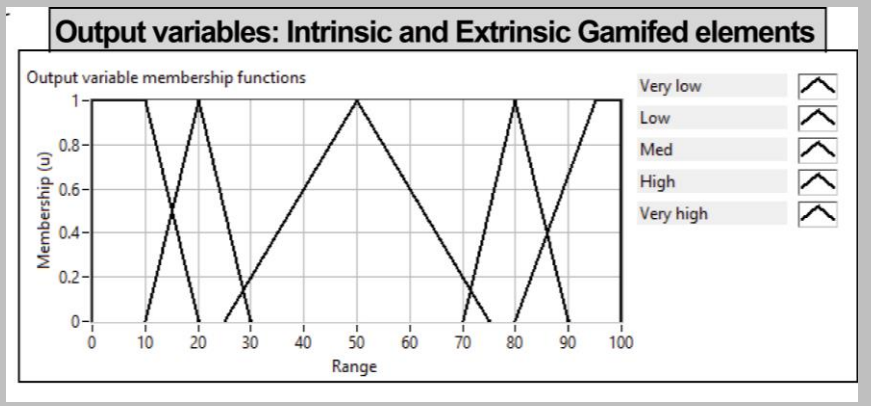
Personality trait

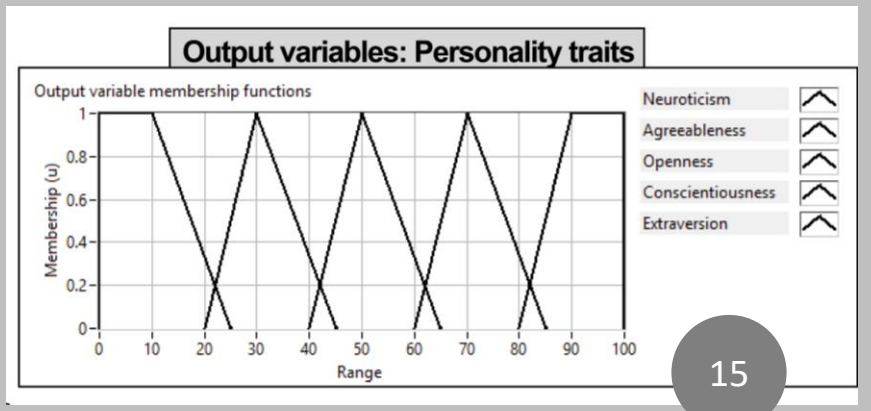
Output elements

The more completed challenges, the more knowledge the user has.

Through the number of badges, points, and rewards achieved.

Advances in the leaderboard reflect the understanding of physical activities.

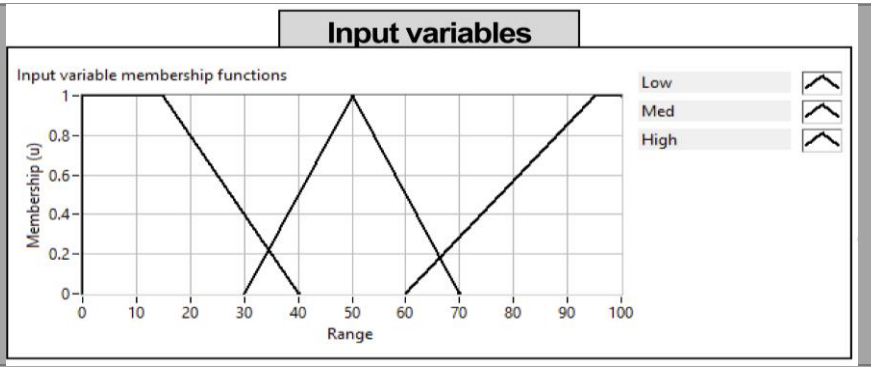




Attitude

Measures if the user is having an attitude change toward exercising

Input elements



Progress bar

Social Sharing

Feedback

Badges

Points

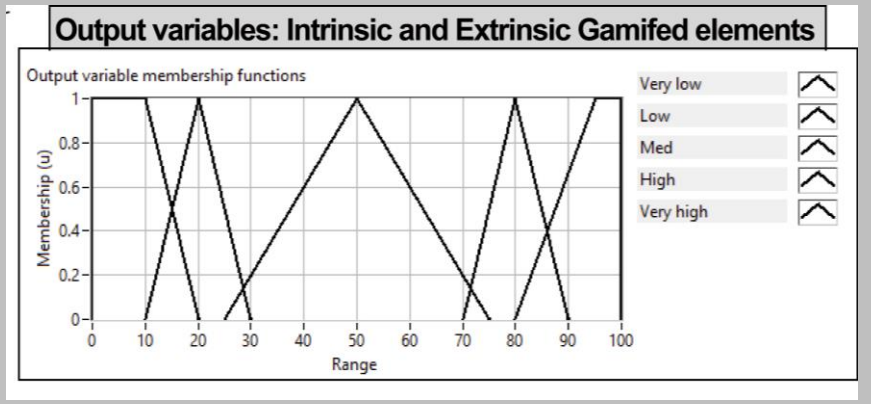
Personality trait

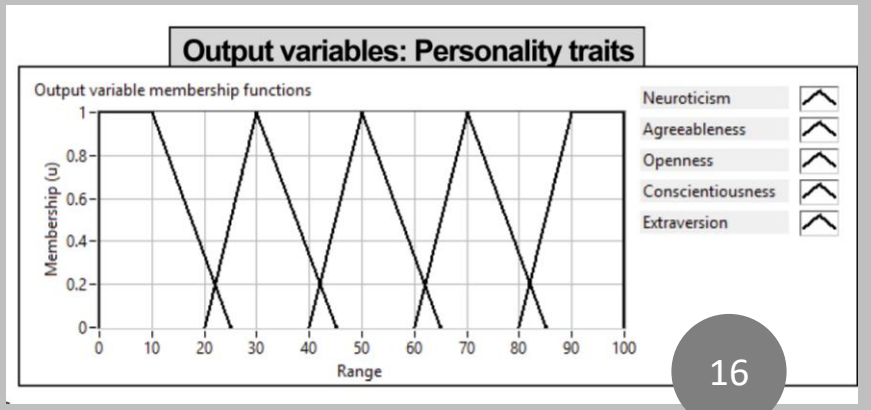
Through progress bar the elderly can track advances.

Elderly users share with peers their improvements and the benefits they are achieving.

The elderly can give their friends feedback on how they complete the exercises or activities and vice versa.

The badges and points earned reflect that the elderly users are performing the exercise.

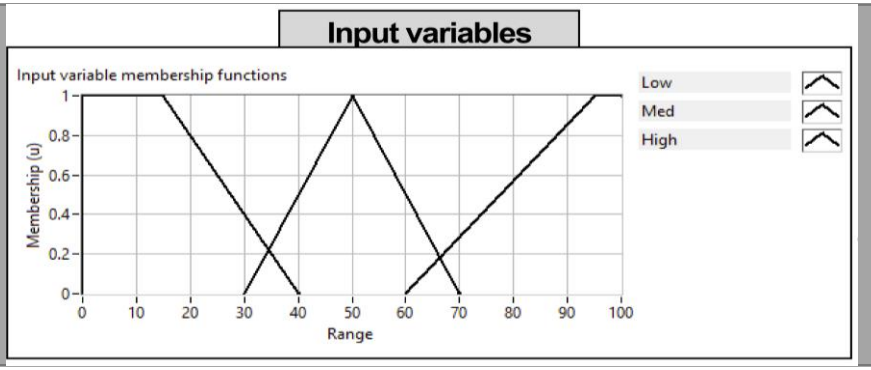




Output elements

Engagement

Monitors the time the elderly uses the application.



Input elements

Challenges

Social Sharing

Feedback

Leaderboard

Rewards

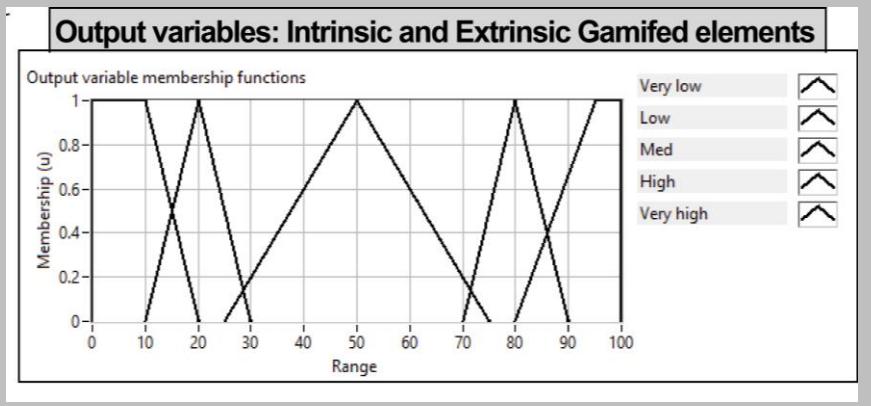
Personality trait

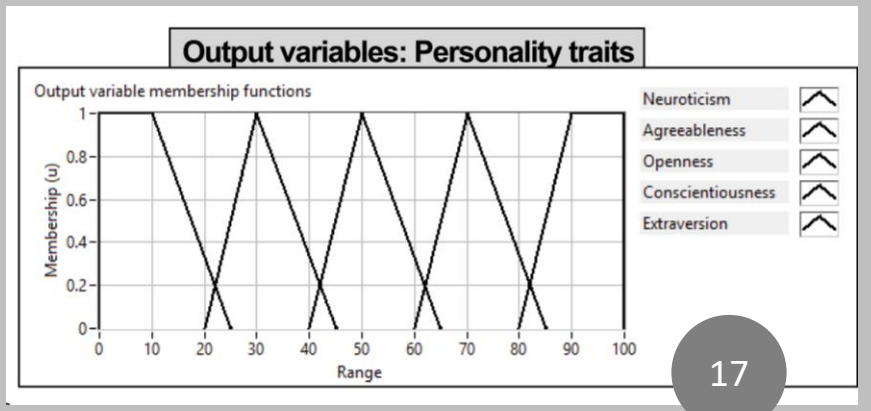
Through challenges achieved and time dedicated.

Through video calls duration or feedbacks done to elderly Friends and viceversa.

By monitoring the ascense to the top.

The more rewards is recieving the more engaged the user is





Output elements

Input elements

Output elements

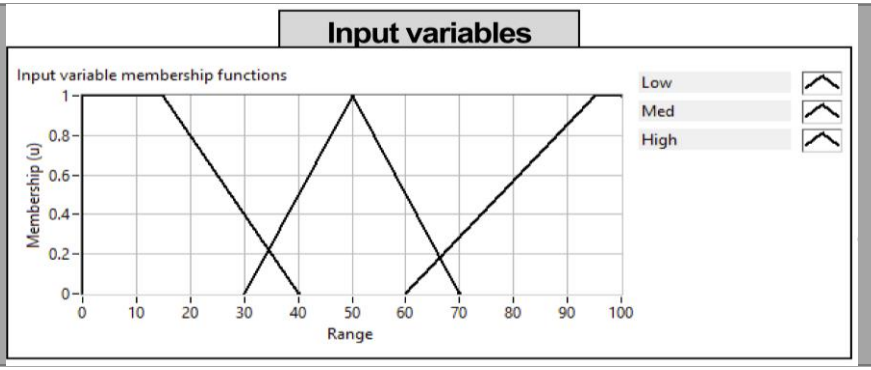
	Attitude	Knowledge	Engagement	Characteristics
Neuroticism (N)	Low	Low	Low	They are not attracted to learn and try new things.
Agreeableness (A)	Low	Low	Med	They are not attracted to technology; however, some of them are barely attracted to learn new things.
Openness (O)	Med	Med	Med	Can or cannot be attracted to use Internet
Conscientiousness (C)	Med	High	High	Attracted to learn and engage in activities, but they require to be convinced on the usefulness of the technology.
Extraversion (E)	High	High	High	They are extremely attracted to learn and try new things. They are a pro-technology user.

Attitude

Knowledge

Engagement

Input elements



Progress bar

Social Sharing

Feedback

Badges

Points

Personality trait

Challenges

Progress bar

Badges

Points

Leaderboard

Rewards

Personality trait

Challenges

Social Sharing

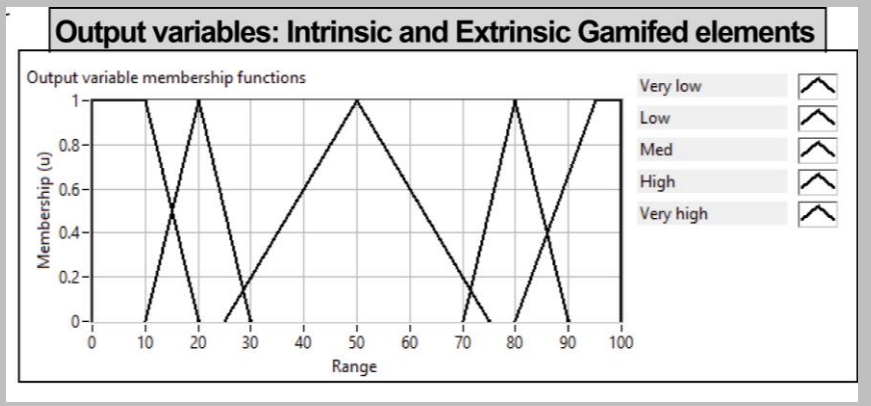
Feedback

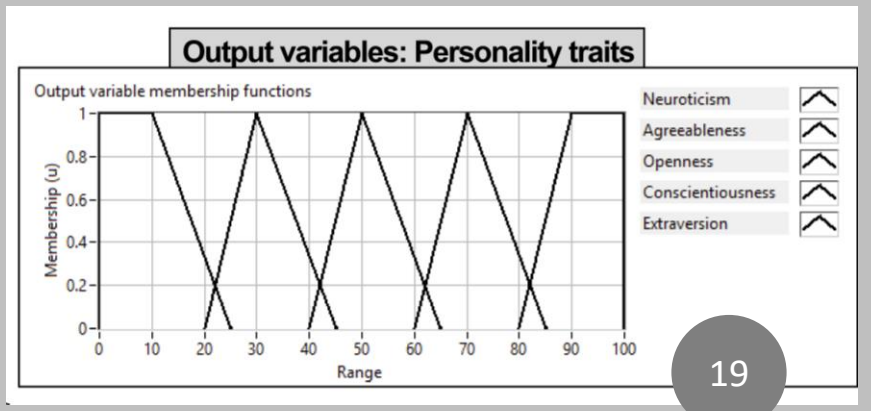
Leaderboard

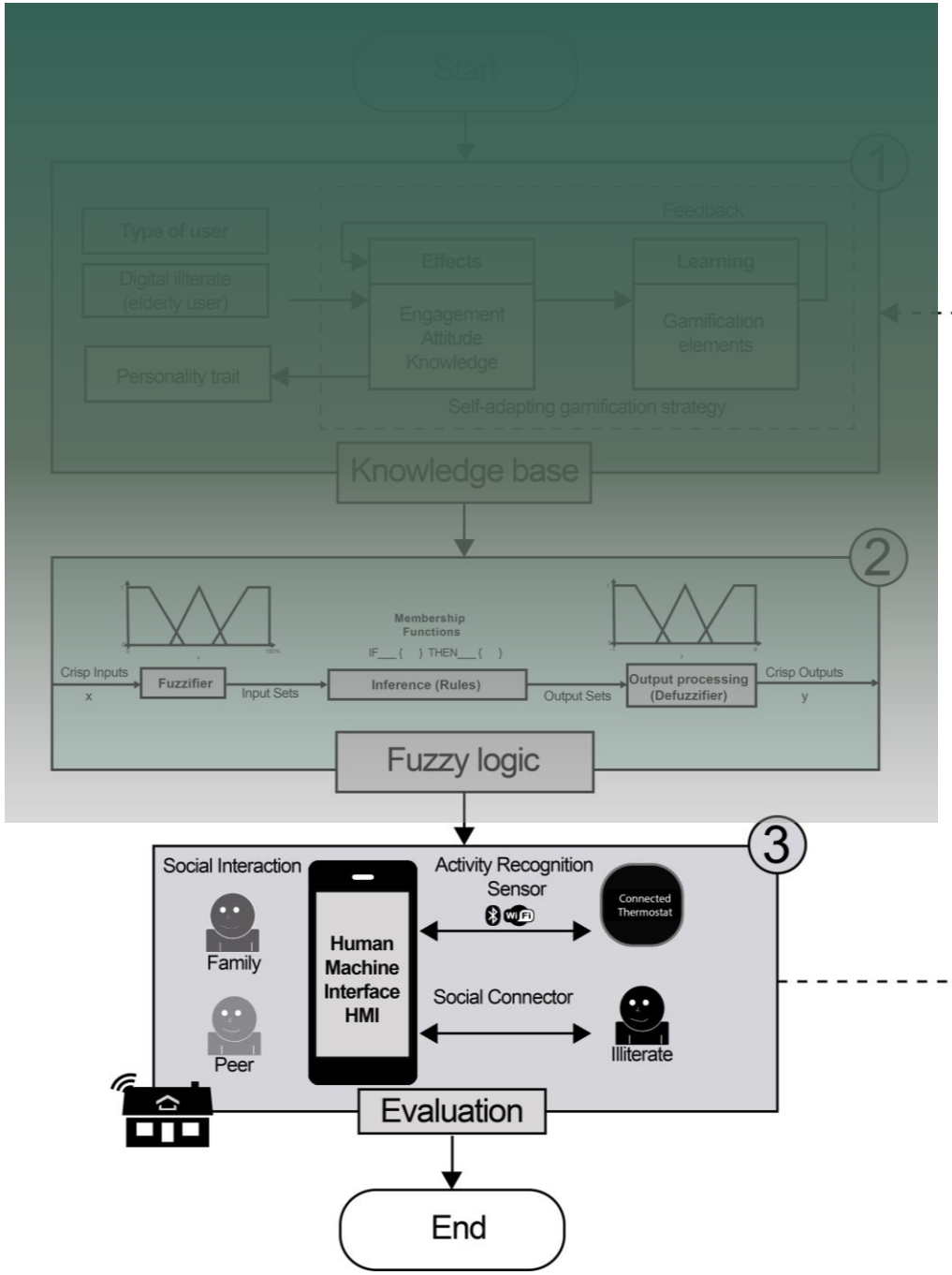
Rewards

Personality trait

Output elements





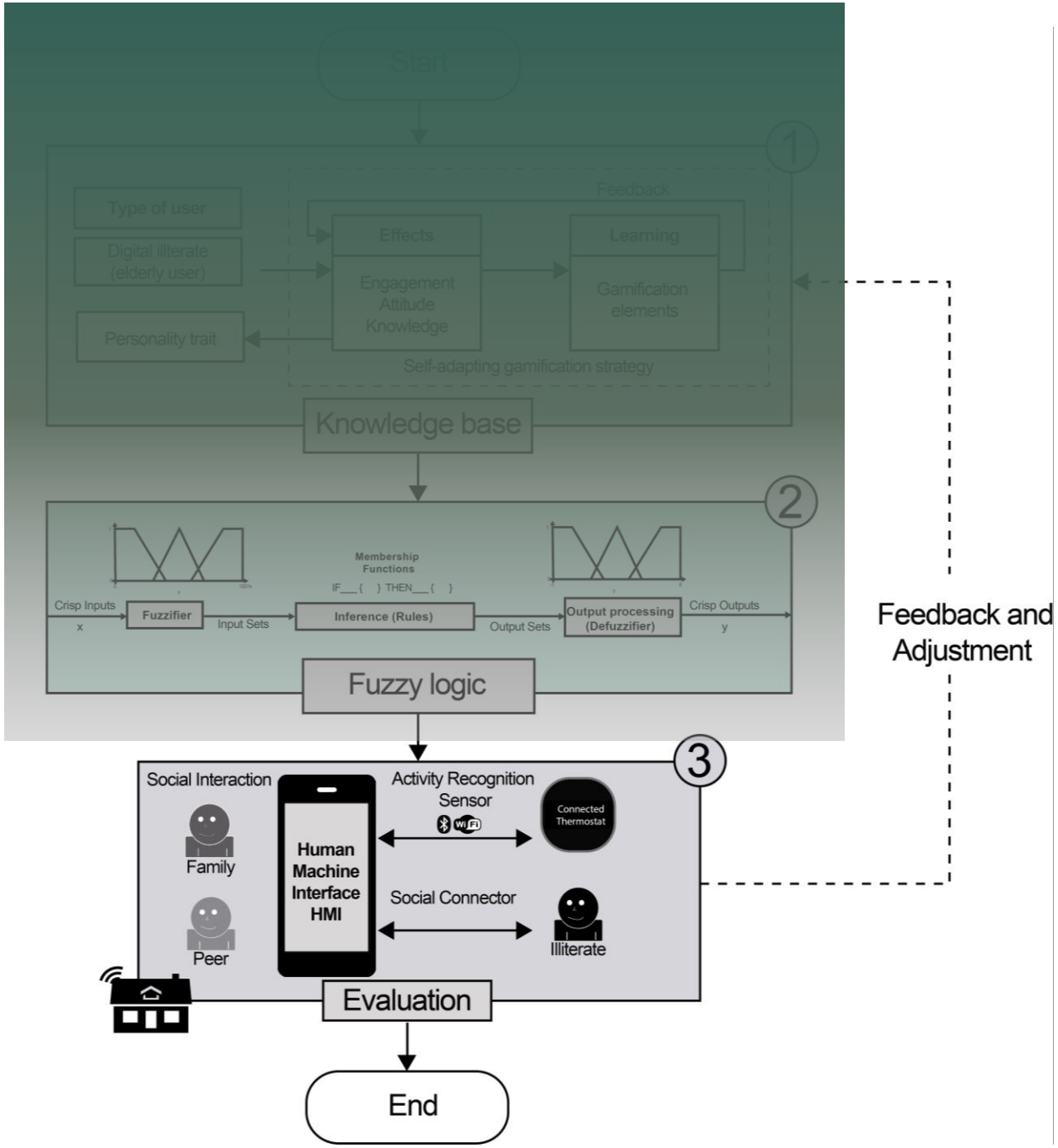


3

The HMI is proposed so the end user interacts with the application.

Through the social connector and activity recognition, user engagement, attitude and knowledge, the product and interface can be measured and evaluated.

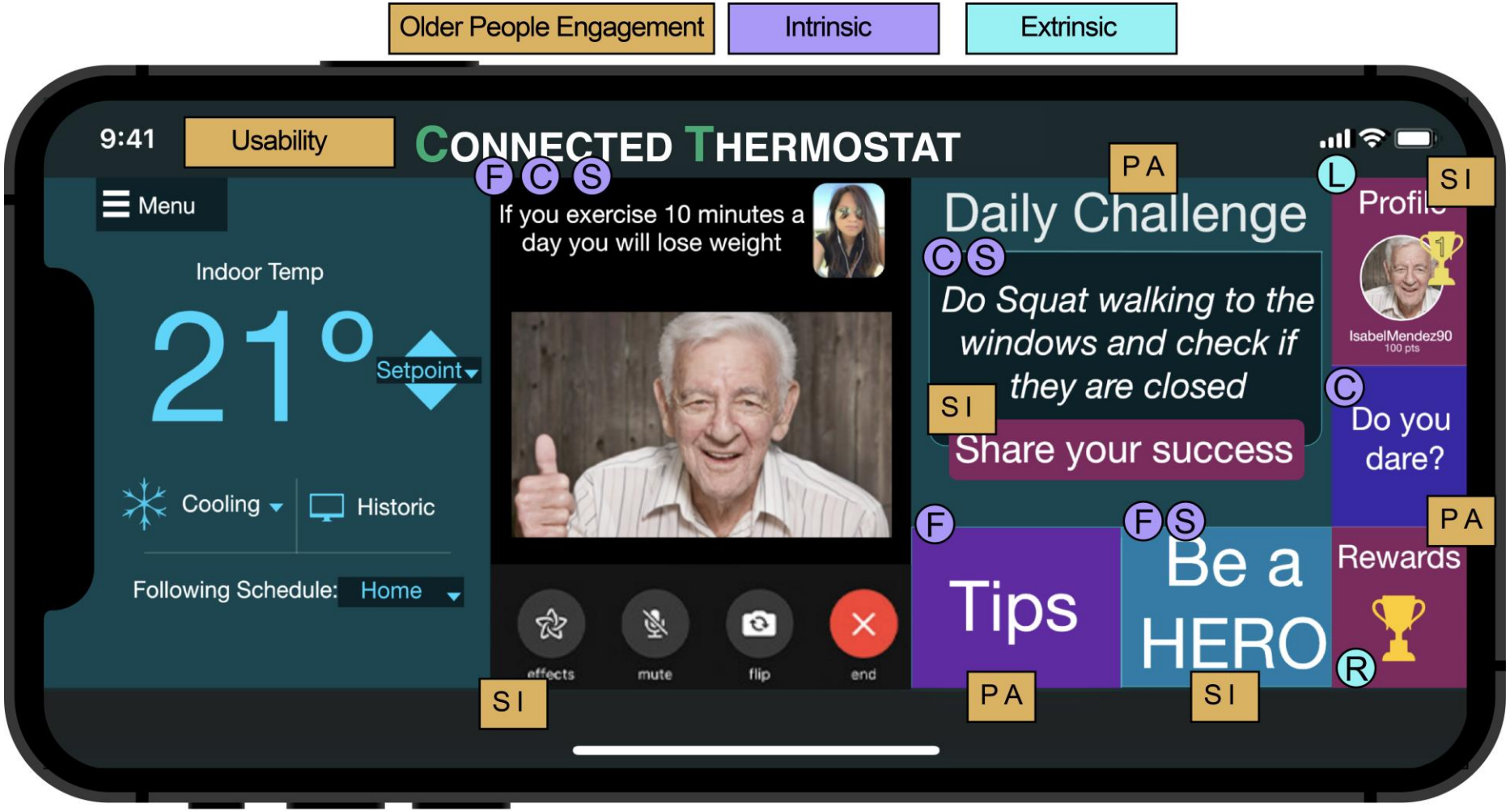
This phase provides continuous feedback to the user and the knowledge base to determine whether the user is engaged or if adjustments are required.



3

Evaluate phase

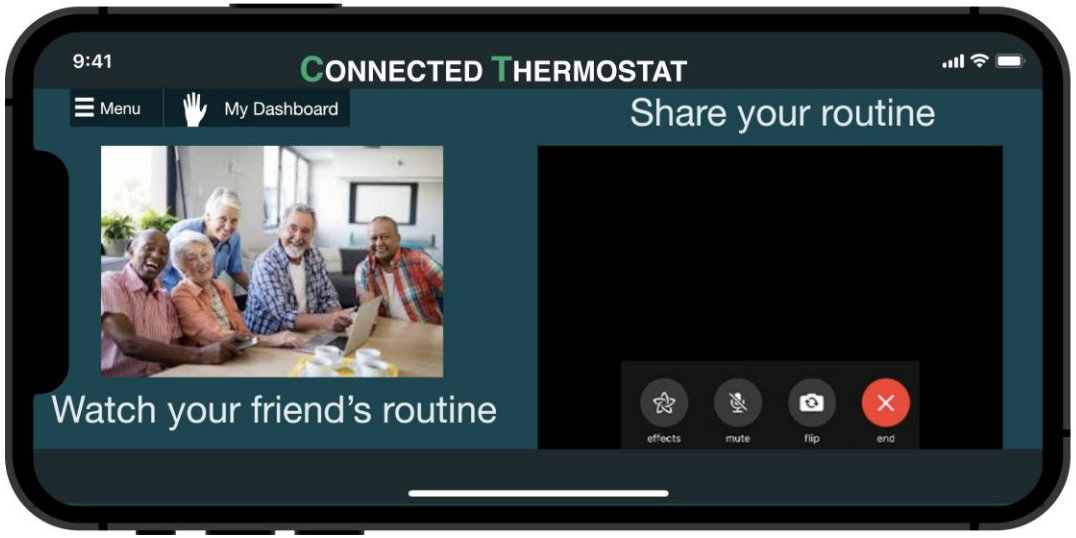
Results


Older People Engagement
Intrinsic
Extrinsic
9:41
Usability
CONNECTED THERMOSTAT
F C S
Menu
Indoor Temp
21°
Setpoint
Cooling
Historic
Following Schedule: Home
If you exercise 10 minutes a day you will lose weight
effects
mute
flip
end
S I
P A
Daily Challenge
C S
Do Squat walking to the windows and check if they are closed
S I
Share your success
L
Profile
IsabelMendez90
100 pts
S I
C
Do you dare?
P A
Rewards
R
F
Tips
P A
F S
Be a HERO
S I
Physical Activiity
Social Interaction
Usability
F Feedback
S Social Sharing
C Challenges
L Leaderboard
R Rewards

Results

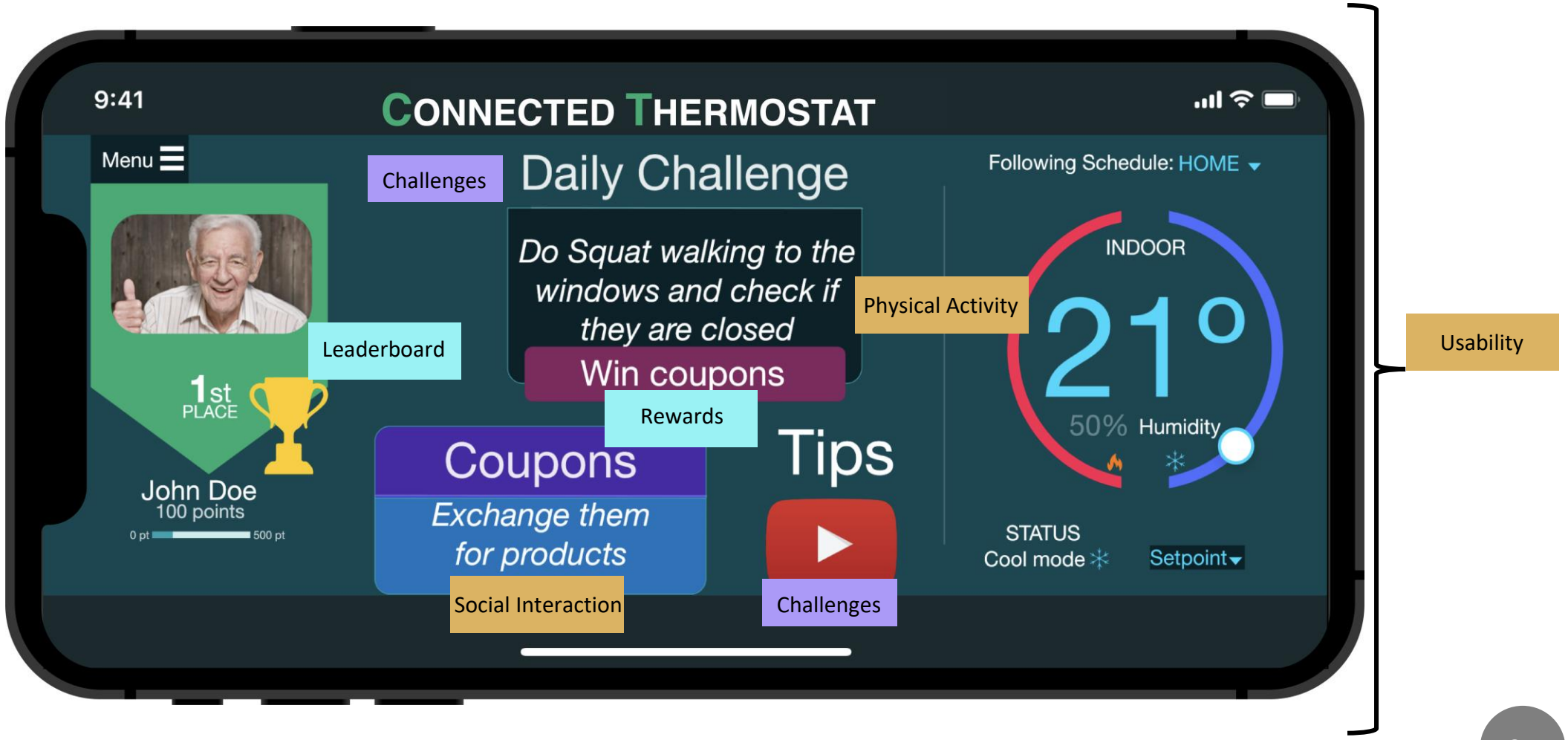

9:41
CONNECTED THERMOSTAT
My Dashboard
Add/Remove Device
Help
Settings
About
Logout
Menu
Indoor Temp
21°
Setpoint
Cooling
Historic
Following Schedule: HOME
effects
mute
flip
end
Daily C
Do Squat
windows
they a
Share yo
Tips


9:41
CONNECTED THERMOSTAT
Menu
My Dashboard
TIPS
Share your progress

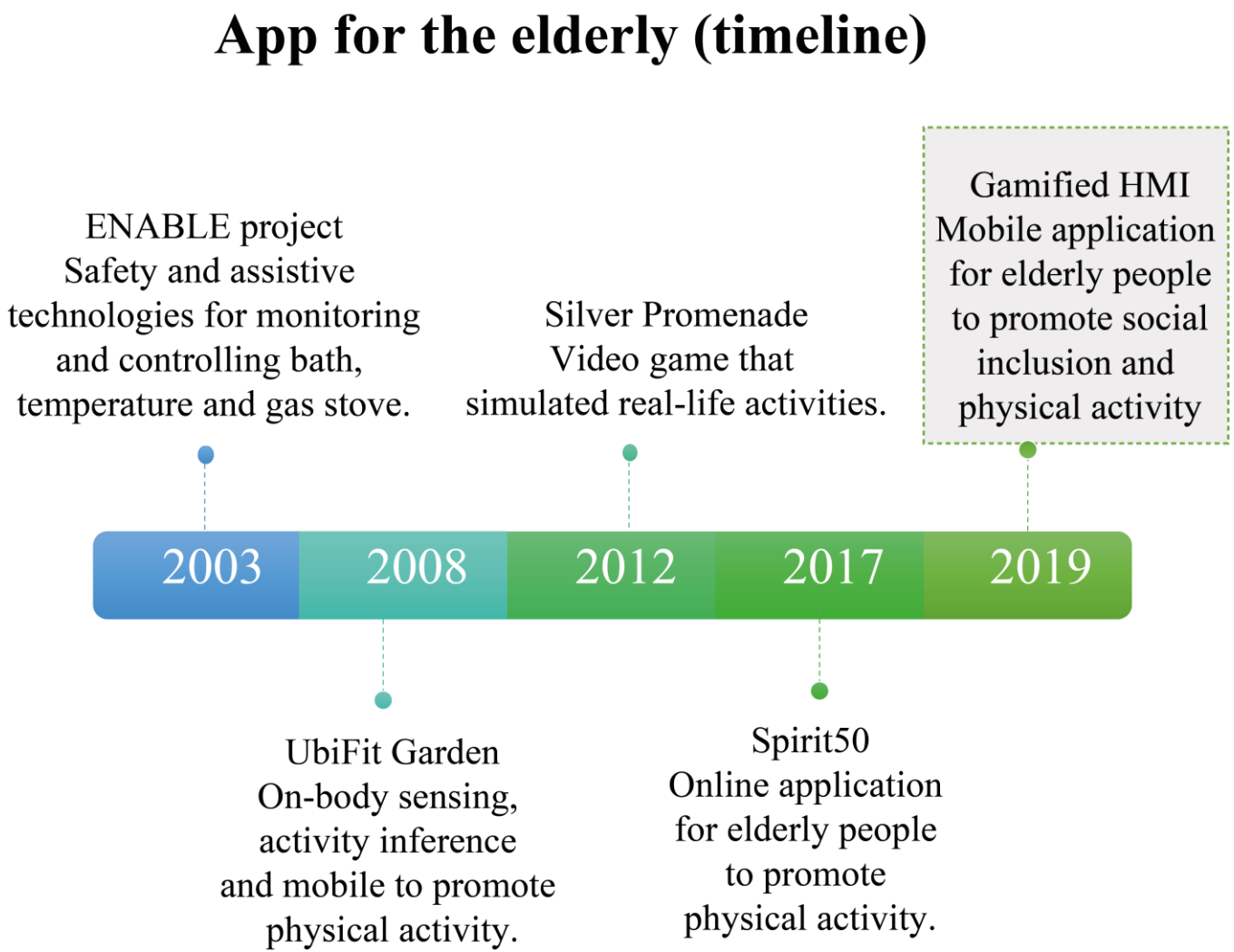

9:41
CONNECTED THERMOSTAT
Menu
My Dashboard
Share your routine
Watch your friend's routine
effects
mute
flip
end


9:41
CONNECTED THERMOSTAT
Menu
My Dashboard
REWARDS
Coupons
Exchange them for food
TICKET
TICKET
Prizes
Win points and exchange it for prizes
5
10

Results

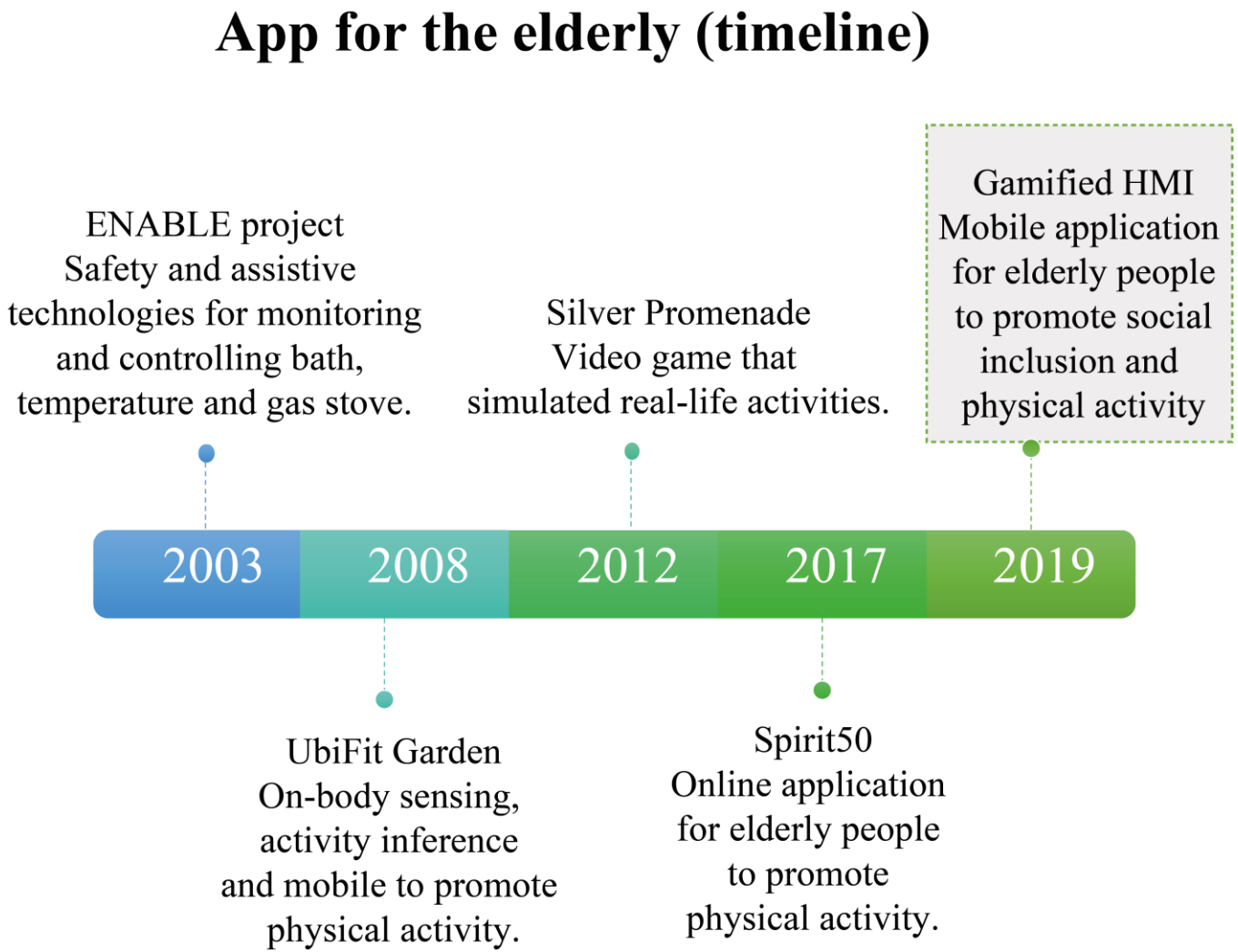

9:41
CONNECTED THERMOSTAT
Menu
Challenges
Daily Challenge
Following Schedule: HOME
Do Squat walking to the windows and check if they are closed
Win coupons
Physical Activity
INDOOR
21°
50% Humidity
Leaderboard
1st PLACE
Rewards
Coupons
Exchange them for products
Tips
John Doe
100 points
0 pt
500 pt
STATUS
Cool mode
Setpoint
Social Interaction
Challenges
Usability

Conclusion



Knowing the characteristics and personalities of elderly people could allow product designers to provide a tailored device and improve their quality life.

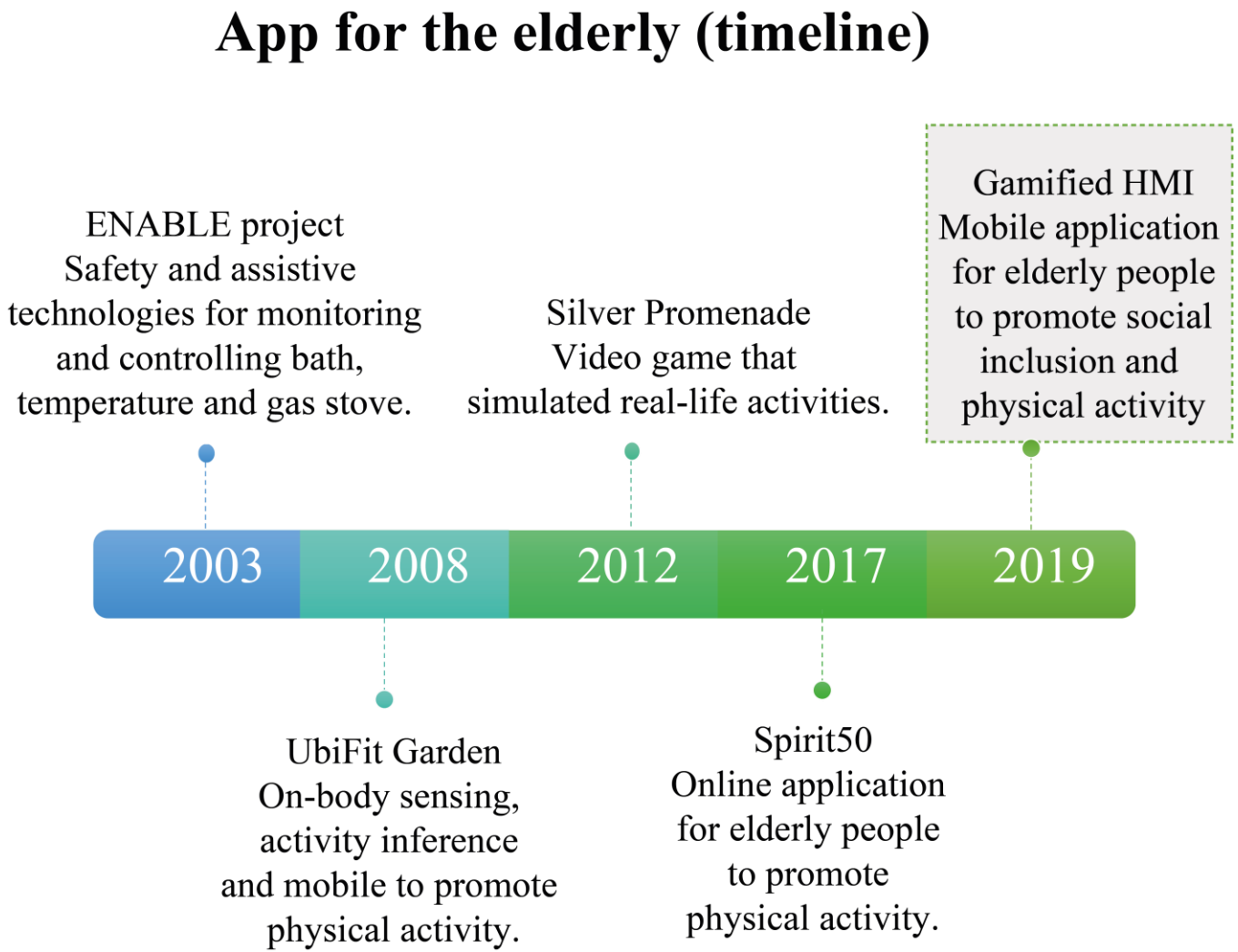
Conclusion



The HMI has the following stages:

1. Get input values.
2. Profile the end user.
3. Select gamification features

Conclusion



This proposal may facilitate the adoption of connected devices in elderly people by providing them with an interface according to their personality characteristics.

Further work

- Nov-Dec in México: Evaluate the usability of the Interface.
  - At the *National Institute of Geriatrics*
    - Survey
    - Mock-ups app
  - Next year at Berkeley: Evaluate the usability of the Interface.
- Dec: Gather databases information to know the most downloaded application
  - Characteristics of the game elements.
  - Which fitness applications are the most downloaded
    - Age, genre, location
  - Considerations in e-Health applications
- Feb ‘20: Update the framework.
  - Validate the elderly people profile
  - Get an accurate gamified HMI for elderly people.

Thank you

Contact: A01165549@itesm.mx

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