A monitoring system for mood disorders' patients
Project Specifications

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- The system allows the **at-home** and **in-hospital** monitoring of several biological parameters with the aim of tracking physiological changes to follow up mood disorders' patients. **Mood disorders** include *depression* and *bipolar disorder*.

- **Depression** is a psychiatric condition characterized by alterations in regulators of mood, behavior, and affection. **Bipolar disorder** is a form of depression in which periods of deep depression alternate with periods of hyperactivity and uncontrolled elation. Patients suffering from depressive and bipolar disorders are more prone to develop cardiovascular diseases (CVD), such as heart failure or stroke. Thus, depression may act as an independent CV risk factor. Together, CVDs and depressive disorders represent the most common causes of disability in high-income countries. Their main implications include considerable health expenditure and lost of productivity. Moreover, both CVD and depression profoundly affect the overall quality of life. Certain forms of depressive and bipolar disorders are difficult to diagnose and follow up.

- Continuous monitoring of patients with mood disorders can greatly facilitate follow up and improve life quality. Moreover, it can help reducing mental stress, which consequences can be particularly severe in depressed patients.

- This goal requires the regular assessment of several clinical indices, as well as the adoption of wearable technologies to track relevant behavioral and physiological markers of mood and stress. Some of these indices can be collected **either at-home or in-hospital**, while others must be collected **in hospitals**.

- The complexity of the pathology requires appropriate evaluation of **comorbidities** (e.g., CVDs) and **risk factors**.

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- The system is used by **patients** and **specialized practitioners** with different user interfaces because of their different aims.

- Moreover, the system requires a **technical administrator** for the registration of new users (patients, specialized practitioners and other technical administrators) and other maintenance tasks.

Specialized practitioners (psychiatrists, clinical psychologists, etc.) can:

- Log in

- Visualize their profile

- Visualize the list of patients along with the last visit

- Visualize the list of visits of the day

- Book a visit for a patient

- Book an exam for a patient

- Manage patients' prescriptions / therapy

- During a visit, the doctor can insert the measured parameters (hereafter named as "in hospital" parameters), add notes, and, if needed, book a follow-up visit.
  You are free to decide how to implement the booking process. However, effective and realistic designs gain more points…

- Set thresholds for all the parameters to identify *abnormalities* (even the one inserted at-home)

- Visualize diagrams and statistics regarding the temporal trend of the inserted parameters, in a selected time window, for a specific subject and, for comparison and research purposes, across the entire list of patients

- Count how many times a certain parameter was labeled as *abnormal*

Patients can:

- Log in

- Manage their profile and booked visits

- *Insert* or *upload* parameters (hereafter named as "at-home" parameters) that were measured at home. Let's assume these parameters are collected through wearables, medical devices, or mobile apps. Some of them are *manually inserted* into the system, while others (data streams and temporal trends) are *uploaded* into it through formatted files (e.g., CSV files)

- Visualize a set of statistics and diagrams regarding the temporal trend of the inserted parameters in chosen time frames

- Fill in clinical questionnaires

Technical administrators can:

- Log in

- Visualize their profile

- Add/Modify/Delete a user among the three categories. For simplicity, the password is decided by the technical administrator for all the users, but you might decide to release this constraint as well …

- Visualize a set of statistics regarding the number of users and logins per day. You might also include other system performance metrics, like access time, query execution time, user session duration and so on. In the real world, these parameters are helpful to scale the infrastructure correctly.

- Create and update risk evaluation models, based on the latest indications from the literature.

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PARAMETERS

At-home measured parameters must include:

Parameter	Insertion mode	How often?
Blood pressure (from BP monitor)	From file	Daily
Heart rate (from BP monitor)	From file	Daily
Sleep quality index and REM latency (from smartwatch)	From file	Daily
Height, weight (from smart scale), BMI	Manually	Weekly
Glycemia (from glucose meter)	Manually	Daily
Physical activity (from smartwatch)	From file or Manually	Daily
Therapy adherence (from Morisky Medication Adherence Scale) *	Manual insertion of the inputs	Weekly
Patient Health Questionnaire (PHQ-9) *	Manual insertion of the inputs	Every two weeks

* Computed as in the following slides

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Q1 – I will ask you few questions about your medication that you were using after Heart Failure

SNO	MMAS–8 Adherence Questions	Patients Response
Q1_1	Do you sometimes forget to take your prescribed medicines?	☐ Yes[0] ☐ No[1]
Q1_2	Over the past 2 weeks, were there any days when you did not take your prescribed medicines?	☐ Yes[0] ☐ No[1]
Q1_3	Have you stopped taking medications because you feel worse when you took it?	☐ Yes[0] ☐ No[1]
Q1_4	When you travel or leave home, do you sometimes forget to bring along your meds?	☐ Yes[0] ☐ No[1]
Q1_5	Did you take your prescribed medicine yesterday?	☐ Yes[0] ☐ No[1]
Q1_6	When you feel like your health is under control, do you sometime stop taking your meds?	☐ Yes[0] ☐ No[1]
Q1_7	Do you feel hassled about sticking to your prescribed treatment plan?	☐ Yes[0] ☐ No[1]
Q1_8	How often do you have difficulty remembering to take all your prescribed medicine?	☐ Never/rarely[1] ☐ Once in a while[0] ☐ Sometimes[0] ☐ Usually[0] ☐ All the time[0]
	Total Score	_____

- The total MMAS-8 score is calculated by adding all of the eight individual question scores. Patients with a score of eight are classified as adherent, otherwise non-adherent.

Over the last 2 weeks, how often have you been bothered by any of the following:	Not at all (0)	Several days (1)	More than half the days (2)	Nearly every day (3)
a. Little interest or pleasure in doing things?	☐	☐	☐	☒
b. Feeling down, depressed, or hopeless?	☐	☒	☐	☐
c. Trouble falling or staying asleep, or sleeping too much?	☐	☐	☒	☐
d. Feeling tired or having little energy?	☐	☐	☐	☒
e. Poor appetite or overeating?	☐	☒	☐	☐
f. Feeling bad about yourself—or that you are a failure or have let yourself or your family down?	☐	☐	☒	☐
g. Trouble concentrating on things, such as reading the newspaper or watching television?	☐	☐	☐	☒
h. Moving or speaking so slowly that other people could have noticed? Or the opposite—being so fidgety or restless that you have been moving around a lot more than usual?	☒	☐	☐	☐
i. Thoughts that you would be better off dead or of hurting yourself in some way?	☐	☒	☐	☐

Depression severity is evaluated through a scoring system, where specific questions are generally given greater importance than others.
A PDF with the full questionnaire and instructions can be found on WeBeep.

Example of a structured file (CSV)

HR_from_device_example.csv - Blocco note

File   Modifica   Formato   Visualizza   ?

Dates	HR
31/12/18	109
01/01/19	115
02/01/19	67
03/01/19	115
04/01/19	98
05/01/19	65
06/01/19	76
07/01/19	93
08/01/19	118
09/01/19	118
10/01/19	69
11/01/19	119
12/01/19	118
13/01/19	89
14/01/19	108
15/01/19	68
16/01/19	85
17/01/19	115
18/01/19	108
19/01/19	118
20/01/19	100
21/01/19	62

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PARAMETERS

In hospital measured parameters must include:

Parameter	Insertion mode	How often?
Heart rate (from clinical ECG)	From file	During visit
Blood pressure supine and standing (sphygmomanometer)	Manually	During visit
Cardiac Auscultation (textual report)	Manually	During visit
Blood exam results (values and comment)	Manually	During visit (not always)
Sleep Quality Assessment (PSQI)	Manual insertion of the inputs	During visit
Medical report (textual report)	Manually	During visit

IMPORTANT: Visits are planned <u>at least every 6 months</u>, but can be planned more frequently if needed.

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Material on WeBeep

Sleep Quality Assessment (PSQI)

What is PSQI, and what is it measuring?

The Pittsburgh Sleep Quality Index (PSQI) is an effective instrument used to measure the quality and patterns of sleep in adults. It differentiates "poor" from "good" sleep quality by measuring seven areas (components): subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction over the last month.

INSTRUCTIONS:

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Please answer all questions.

During the past month,

1. When have you usually gone to bed? _____
2. How long (in minutes) has it taken you to fall asleep each night? _____
3. What time have you usually gotten up in the morning? _____
4. A. How many hours of actual sleep did you get at night? _____
    B. How many hours were you in bed? _____

5. During the past month, how often have you had trouble sleeping because you	Not during the past month (0)	Less than once a week (1)	Once or twice a week (2)	Three or more times a week (3)
A. Cannot get to sleep within 30 minutes				
B. Wake up in the middle of the night or early morning				
C. Have to get up to use the bathroom				
D. Cannot breathe comfortably				
E. Cough or snore loudly				

Scoring

Component 1	#9 Score	C1 _____
Component 2	#2 Score (<15min (0), 16-30min (1), 31-60 min (2), >60min (3))	
	+ #5a Score (if sum is equal 0=0; 1-2=1; 3-4=2; 5-6=3)	C2 _____
Component 3	#4 Score (>7(0), 6-7 (1), 5-6 (2), <5 (3)	C3 _____
Component 4	(total # of hours asleep) / (total # of hours in bed) x 100	
	>85%=0, 75%-84%=!, 65%-74%=2, <65%=3	C4 _____
Component 5	# sum of scores 5b to 5j (0=0; 1-9=1; 10-18=2; 19-27=3)	C5 _____
Component 6	#6 Score	C6 _____
Component 7	#7 Score + #8 score (0=0; 1-2=1; 3-4=2; 5-6=3)	C7 _____

Add the seven component scores together _____   **Global PSQI** _____

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PERIODICAL REPORTS and FINAL PRESENTATION STRUCTURE

AIM OF THE WORK

SYSTEM DESIGN

Context analysis (max. 3 pages)

Modeling and describing the system in UML (Use case, activity, class diagrams)

Modeling Report

DATABASE DESIGN

Modeling and describing the database (via E-R Diagram)

Technical description of the tables

SYSTEM IMPLEMENTATION

Description of the queries (with some examples)

Description of the Graphical User Interface (GUI)

CONCLUSIONS

Including limitations and future work

REFERENCES

Project Report

DEADLINES for each report will be communicated soon

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1. Who's not in a team yet? If you can't find any/some teammates, please send us an email with the required information (see the previous presentation on WeBeep). We will find a team for you!

2. Start by analyzing the **context**: search for material about Depressive and Bipolar disorders on the internet and literature, together with your team members

This lesson will be dedicated to **context analysis:** knowledge of these disturbances, their symptoms, and some possible treatments is crucial to understand the different needs of each user and develop a useful and efficient application for them.

Don't hesitate to ask questions!

You might structure the results of the context analysis in a table reporting each source (article, website, book, etc.) information and a summary of the main findings you can use to develop a better/more realistic application.

Source info	Main findings
First Author, Second Author, …, Title, Journal, No., Vol., Pages, Year, DOI	• Finding 1 • Finding 2 • …
Webpage title, Authors, Website	• Finding 1 • Finding 2 • …
…	…