SERVER MANUAL

LungLink Server application

Telemedicine 2025 – CEU San Pablo University

Jimena Aineto, Ana Losada, Sara Menor, Paula Reyero y Martina Zandio

1. OVERVIEW OF THE SERVER APPLICATION:

The Server is an application intended to accept, handle and store all clinical information transmitted by remote patient and doctor applications. It handles authentication, transmission of symptoms, reception of physiological such as electrocardiogram (ECG) and electromyogram (EMG) recorded via a BITalino device, retrieval of medical records and assignment of patients to doctors.

The server works as a central coordination point, maintaining continuous socket connections, ensuring all data reaches the database and supervising the state of all active users.

This document explains how to start the server, how the administrator interacts with it, and how the internal components behave during operation.

2. SERVER OBJECTIVES

- Maintain a persistent listening socket on port 9000**.**
- Accept simultaneous connections from multiple patients and doctors.
- Interpret structured commands sent by clients.
- Store symptoms, medical histories and raw signals into the SQLite database.
- Perform intelligent doctor assignment according to specialty and load.
- Ensure safe shutdown and proper closure of all active client sessions.

3. SERVER STARTUP AND INITIALIZATION

3.2. Run the Server

- Launch the server by executing the MainServer class.
- This triggers the complete initialization process: database connection, default data insertion, TCP listener setup, and displays the admin console.

3.3. Database Initialization

- The server automatically initializes the SQLite database (lunglink.db) through JDBCConnectionManager.
- If the required tables do not exist, they are created.

It ensures that the system can run in a clean environment without manual setup.

3.4. Default Doctor Creation

- During startup, the system inserts the default medical user and a default General Medicine doctor (if they do not already exist).
- This guarantees that new patients can always be assigned to a doctor immediately.

3.5. Listening for Connections

- After initialization, the server socket starts listening on port 9000.
- Whenever a client enters the correspondent server IP address on port 9000, a new connection will be established.

4. SERVER ACTIONS

4.1. View connected users

- Enter 1 in the menu.

  Display of the total number of currently connected users (clients + doctors)

4.2. Stop server

- Enter 2 in the menu.

  Enter the admin password: **admin123**.
- If there are connected clients, the server will warn you and ask for final confirmation (yes/no) before shutting down.

5. DATABASE

All information handled by the system is stored in a local SQLite database (lunglink.db), which is automatically initialized when the server starts.

CLIENT TABLE:

	client_id	name	surname	dob	mail	sex	weight	height	doctor_id	user_id
	Filtro	Filtro	Filtro	Filtro	Filtro	Filtro	Filtro	Filtro	Filtro	Filtro
1	1	Jimena	Aineto	2004-09-14	jainetosalvador...	FEMALE	175.0	65.0	4	2
2	2	Sara	Menor	2004-04-29	saramenortorrer...	FEMALE	0.0	0.0	1	3
3	3	Manuel	Blanco	1990-05-15	manuelblanco@...	MALE	0.0	0.0	3	5
4	4	Martina	Zandio	2004-10-19	mzandio@gmail....	FEMALE	180.0	60.0	4	6
5	5	Gonzalo	Aineto	1963-06-19	gag@icloud.es	MALE	0.0	0.0	2	7

The client table stores the personal data of each client, along with a unique ID for each one.

Each client is associated with a userID, having a 1-1 relationship, as one user can only be one client, and one user can only be one client.

Furthermore, the doctorID column tells us that each client has an associated doctor.

DOCTOR TABLE:

	doctor_id	name	surname	email	specialty	user_id
	Filtro	Filtro	Filtro	Filtro	Filtro	Filtro
1	1	Alfredo	Jiménez	ajimenez@lunglink.com	GENERAL_MEDICINE	1
2	2	Claudia	Collado	claudiacollado@gmail.com	NEUROPHYSIOLOGIST	8
3	3	Pepito	Perez	pepitop@gmail.com	NEUROPHYSIOLOGIST	9
4	4	Lucia	Martínez	lmartinez@hotmail.com	CARDIOLOGIST	10

Personal information of each doctor is stored in this table, with an important parameter called specialty, as this column will determine which patients the doctor gets assigned.

Each doctor is associated with a userID, having a 1-1 relationship, as one user can only be one doctor, and one user can only be one doctor.

Doctors can supervise multiple clients, and the number of clients for each doctor is determined by the load of clients in the application.

USER TABLE:

	id	username	password
	Filtro	Filtro	Filtro
1	1	AlfredoJimenez	b3666d14ca079417ba6c2a99f079b2ac
2	2	JimenaAineto	202cb962ac59075b964b07152d234b70
3	3	Sara	202cb962ac59075b964b07152d234b70
4	4	Martina	202cb962ac59075b964b07152d234b70
5	5	Manuel	202cb962ac59075b964b07152d234b70
6	6	MartinaZandio	202cb962ac59075b964b07152d234b70
7	7	GonzaloAineto	202cb962ac59075b964b07152d234b70
8	8	ClaudiaCollado	202cb962ac59075b964b07152d234b70
9	9	PepitoPerez	202cb962ac59075b964b07152d234b70
10	10	LuciaMartinez	202cb962ac59075b964b07152d234b70

This table contains authentication information for every account in the system. It stores the username and the password (encrypted) for every user. Each user has a unique ID.

This ID allows the system to recognize if the nre connection is a client or a doctor, as each unique ID can only be associated with one client or one doctor.

MEDICAL HISTORY TABLE:

	record_id	date	client_id	doctor_id	observations	symptomsList
	Filtro	Filtro	Filtro	Filtro	Filtro	Filtro
1	1	2025-11-29	2	1	*NULL*	dry cough,fever,loss of smell
2	2	2025-11-29	1	1	bronchitis	chronic cough,mucus,shortness of breath
3	3	2025-11-29	3	1	*NULL*	chest pain when breathing,dry cough
4	4	2025-11-29	1	2	signal with high noise...	*NULL*
5	5	2025-11-29	1	4	pneumonia	*NULL*
6	6	2025-11-29	4	1	*NULL*	night sweats,chest pain,dry cough
7	7	2025-11-29	5	2	*NULL*	*NULL*
8	8	2025-11-29	5	1	immediate hospitaliza...	dry throat,pain when swallowing
9	9	2025-11-29	4	4	asthma	*NULL*
10	10	2025-11-29	2	3	*NULL*	*NULL*
11	11	2025-11-29	2	1	*NULL*	bad sleep
12	12	2025-11-29	3	4	*NULL*	*NULL*
13	13	2025-11-29	3	3	need further consultin...	*NULL*

To support monitoring and clinical follow-up, the system stores symptoms, doctor observations, and signal-related information in the Medical History table.

Each entry represents a distinct clinical record that belongs to an associated client and therefore is connected to its corresponding doctor, depending on the physiological signal that needs to be studied.

SIGNAL TABLE:

	signal_id	type	signal_file	record_id
	Filtro	Filtro	Filtro	Filtro
1	1	EMG	EMG_record4.csv	4
2	2	ECG	ECG_record5.csv	5
3	3	EMG	EMG_record7.csv	7
4	4	ECG	ECG_record9.csv	9
5	5	EMG	EMG_record10.csv	10
6	6	ECG	ECG_record12.csv	12
7	7	EMG	EMG_record13.csv	13

Physiological signals (ECG or EMG) recorded from BITalino devices are stored in the signal table in a .csv format file. The type of physiological signal is also stored in the database.

Each signal has an associated recordID, being a 1-1 relationship, it means that each signal is only stored in 1 medical history, as well as a medical history can only store 1 signal at a time. The medical history is then related with the corresponding client.

6. DATABASE STRUCTURE OVERVIEW