

InfluenzaNet 2.0: Requirements Document (version 1.5)

Based on Master's Thesis: "Design and Implementation of a Scalable Distributed Data Collection Architecture for a European Wide Flu Monitoring System" by Maša Reko

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More information: <https://influenzanet.github.io/>

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1. Introduction

This document contains the system requirements for the Master thesis titled "*Design and Implementation of a Scalable Distributed Data Collection Architecture for a European Wide Flu Monitoring System*" and serves as basis for the Influenzanet 2.0 development.

1.1 General Description

This section will give a non-technical overview of the InfluenzaNet project, which could acquaint new readers with the purpose of the project and what it is supposed to do.

The main idea behind this project is that anyone can help in researching and predicting the spread of contagious diseases. This led to the creation of InfluenzaNet - a European participatory network of web platforms, that uses the survey data submitted by the users in order to monitor Influenza-Like Illnesses (ILI).

Its main goals are:

- To make scientific information accessible to both broad public and researchers
- To promote participation in an interactive enterprise in which the participant could experience the sensation of being a genuine scientist
- To establish a standardized syndromic surveillance system across European countries from both a technological and epidemiological point of view

With that said, InfluenzaNet is currently active in 11 countries across Europe, with each country having a separate national platform known under different name.

In addition to the Web platforms, there is also a mobile application called GrippeNET. Being compatible with InfluenzaNet, it is used to monitor, analyze and map the spread of ILI. It extends the functionalities of the Web portal by also including the collection of smartphone sensor data and phone usage data. This data is combined with survey data and analyzed using advanced methods in order to give more precise results.

The main motivation behind building a system like InfluenzaNet is that it complements traditional health surveillance systems, with proven performance consistent with findings from traditional methods. It offers near real-time data availability, so it detects substantial changes in population health at a very early stage. As mentioned above, it is a uniform framework that allows for direct comparison of ILI rates between countries. And finally, unlike the traditional systems, it is highly scalable with very limited costs.

This particular thesis focuses on redesigning the InfluenzaNet backend architecture, which will be used by both Web and mobile applications.

1.2 Scope of the Product

This thesis focuses on modifying and/or redesigning the current backend architecture of InfluenzaNet. It will provide a complete design and the rationale behind it, and, after a thorough research on current state-of-the art technologies, also a proposal on how the new architecture can be implemented. Then, a demo application with limited functionalities will be implemented in order to validate the proposed architecture.

The solution should be available in six months.

1.3 Business Case for the Product

In order to see why a backend redesign is necessary, we provide a brief description of the current backend solution and the issues it faces.

The current backend architecture relies on two servers:

- Server 1 (main server, InfluenzaNet Web platform server), responsible for manipulating identification data, data from the intake questionnaire and weekly symptom questionnaire
- Server 2 (mobile application server), responsible for manipulating smartphone sensor data, smartphone usage data and links to selected questionnaires data stored on Server 1

Server 1 is in charge of all identifying data (e-mails, IP addresses). Thus, authentication and sign up for the mobile application can only be done through Server 1. Additionally, data needs to be constantly synchronized between the two servers, so that the users can use both Web and mobile application at their convenience.

Unfortunately, this backend design and its implementation face many problems that need to be addressed. Some of them are:

- The existing system has issues with adapting to different platforms, devices and OS versions.
- The mobile application is dependent on the existing InfluenzaNet platform, with many compatibility issues.
- Mobile application does not communicate with the server over HTTPS protocol.
- Privacy and ethics constraints.
- Other stability, efficiency and user experience issues.

Having said that, this thesis aims at providing a restructured and more efficient backend architecture, which will be easy to extend with new modules and easy to setup for multiple, different platforms and devices. The solution shall be easily deployable and as flexible as possible, so that different country requirements can be covered in an efficient way.

The aim is to not only make the system more suitable for further development and maintenance, but also to make it run faster and more reliable, in order to lead to bigger user satisfaction.

1.4 Overview Sections

Section 1 introduces the project, its scope and business motivation.

Section 2 lists constraints of the project, dependencies of other projects and assumptions made about the project.

Section 3 describes the types of users that are expected to benefit from the system.

Section 4 explains in detail the data, functional and non-functional requirements of the project.

Section 5 includes glossary of definitions, acronyms, and abbreviations used in this document that might be unfamiliar to some readers.

2. Assumptions and Constraints

Data collection and storage needs to be in accordance with the **General Data Protection Regulation** (GDPR), specifically with regards to:

- **Consent:** The privacy policy needs to be clearly communicated to the user and no data can be collected from the user before he gives his full consent.
- **Encryption:** Identification data and its link to submitted questionnaires / sensor data must be securely encrypted, as the data collected belongs to a special category of *personal data* (also known as *sensitive personal data*) that is subject to a higher level of protection.
 - Personal data is all information which is related to an identified or identifiable natural person.
 - Sensitive personal data is all information related to genetic, biometric and health data of a person.

The sensitive data must be secured even in case of data stealing. One way to handle that risk is separating the identification data and the collected data in the way explained above by encrypting the link that connects them.

- **Right of Access:** The right of access includes information about the processing purposes, the receiver, the planned duration of storage, information about the rights of those impacted such as correction, erasure or restrictions to processing and the right to object to this processing.
- **Right to be Forgotten:** Personal data must be erased immediately if the data is no longer needed for their original processing purpose, the impacted person has withdrawn his consent, or erasure is required to fulfil a statutory obligation under the EU law. However, due to the nature of research, in this case the data shall be removed when the “contract of use” with the user has ended. This means that the collected data can be kept for research purposes, if it is ensured that the link between the collected data and identification data is broken.

According to recital 46 in this Directive, technical and organizational measures (TOM) must be considered already at the time of planning a system to protect data safety (“*Privacy by Design*”). Behind this is the thought that data protection in data processing procedures is best adhered to when it is already integrated in the technology when created. This includes:

- The type, scope, circumstances and purpose of the processing must be considered.

- Identification data (e-mail, password) shall be kept separately from the data collected from the users (survey, sensor, phone usage data). This does not mean that it must be physically separated (stored on different machines). Separate database tables are enough, if the link between them is encrypted.
- User authentication and technical implementation of the right to be forgotten must be considered.
- ISO standards may be used while designing/building the system.
- It must be ensured that the state-of-the-art, as well as reasonable implementation costs are included when selecting technologies for the system.

3. Users of The System

This section of the document describes the types of users that are expected to benefit from the system, as well as their technical knowledge level and personal needs/desires. Note that this is just an initial list of roles, and that new ones can be added at any time.

3.1 Volunteer Participant

Name: Volunteer Participant	
Description: Uses Web or Mobile application to submit survey, sensor and phone usage data in order to contribute to ILI research.	Technical Knowledge Level: Low to Medium
Tasks: <ul style="list-style-type: none"> • Fill in surveys • Provide sensor and phone usage data 	Goals: <ul style="list-style-type: none"> • Contribute to ILI research • Get valuable ILI-related information
Needs / Desires: <ul style="list-style-type: none"> • Easy to use system that allows for quick and efficient survey filling out • Non-invasive method for sensor and phone usage data collection that doesn't affect the phone's performance in a significant way (e.g. battery life) • Possibility to get informed on significant ILI-related news 	

3.2 Researcher

Name: Researcher	
Description: Does research on ILI based on the data collected from volunteer participants.	Technical Knowledge Level: Low to Medium
Tasks: <ul style="list-style-type: none"> • Create surveys for a specific purpose • Perform calculations and statistical analysis on the collected data 	Goals: <ul style="list-style-type: none"> • Obtain scientifically significant results
Needs / Desires: <ul style="list-style-type: none"> • Possibility to create new surveys and modify old ones • An engine that runs a specified survey dynamically • Support for easy translation of surveys to different languages • A way to determine a version of each survey and go through history of survey modifications • Possibility to download raw data collected from volunteer participants 	

- Data collected is aggregated and stored in appropriate form that allows for meaningful scientific research without disrupting the privacy policy
- Ability to visualize results and perform statistical analysis without any additional tools

3.3 System Administrator

Name: System Administrator	
Description: Ensures high performance and usability of the system.	Technical Knowledge Level: Medium to High
Tasks: <ul style="list-style-type: none"> • Manage content • Send messages to users (newsletters, notifications, etc.) • Monitor system performance, network communication, etc. • Document system changes, installation and configuration procedures • Inform users of problems, changes and updates • Backup data • Implement security measures 	Goals: <ul style="list-style-type: none"> • Make sure that the system runs smoothly and without problems • Make users interested in the topic by providing interesting content
Needs / Desires: <ul style="list-style-type: none"> • A way to contact users by sending messages (notifications, newsletters, etc.) • Easy-to-use interface for providing news & content • A way to monitor system performance 	

3.4 Developer

Name: Developer	
Description: Builds, maintains and extends the system when necessary.	Technical Knowledge Level: High
Tasks: <ul style="list-style-type: none"> • Implements the system based on the provided requirements and architecture document • Performs testing of the system • Configures the servers and installs the system • Maintains the system and fixes any bugs that might occur • Makes sure that the system runs correctly, in accordance to its quality requirements • Develops new features when needed and integrates them with the system 	Goals: <ul style="list-style-type: none"> • Build the system that complies with its requirements and design • Ensure that the system operates correctly and efficiently • Fulfill the need for new features whenever necessary
Needs / Desires: <ul style="list-style-type: none"> • Well-documented and detailed requirements and design 	

- System that is easy to maintain and test
- System that is easy to extend with new features

4. Specific Requirements

This section of the document lists specific requirements for InfluenzaNet’s backend. Requirements are divided into the following sections:

1. Data requirements
2. Functional requirements.
3. Non-functional requirements.

4.1 Data Requirements

This section explains the data requirements in detail.

4.1.1 Data Model

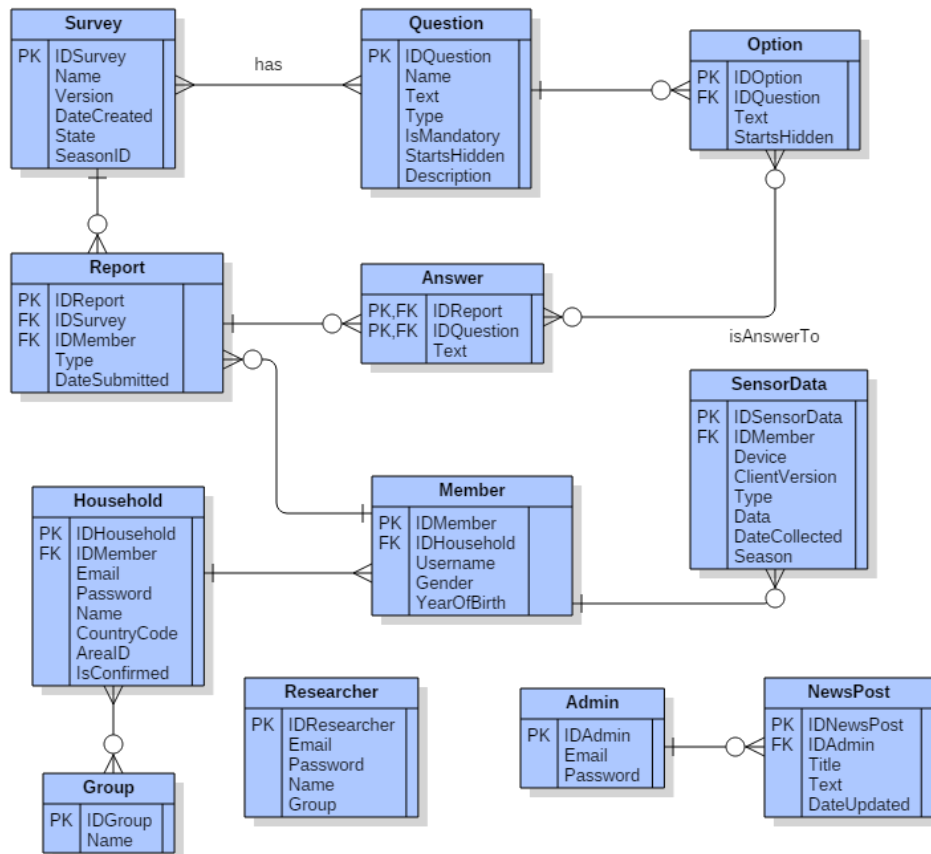


Figure 1. Data Model

A survey consists of multiple questions. Questions can either be open-ended or have multiple options to choose from. The main account of a volunteer participant is called a “Household”. It is created when a new participant registers for the platform, with one member (the creator of the

account, now the account holder) automatically added to it. New members (children, spouse, etc.) can be added to the household at any time. Additionally, households can be organized into groups. A group can contain multiple households, and a household can belong to multiple groups. A report is one submission of a survey by one member and for a particular survey. It contains answers to the survey questions. Sensor data is one set of phone usage and sensor data collected from a particular member.

The entities are explained in detail in Section 4.1.2 using a data dictionary.

4.1.2 Data Dictionary

Name	SURVEY			
Description	A survey that can be filled in by members of the households. Can have multiple questions.			
Attributes				
Name	Type	Description	Mandatory	Notes
IDSurvey	Integer	Survey identifier. Generated automatically by the system.	YES	Primary Key
Name	Text	The name of the survey.	YES	/
Version	Text	Version of the survey. Whenever a survey is modified, a new survey is added to the database with a new version number.	YES	/
DateCreated	DateTime	Timestamp when the survey was created.	YES	/
State	Text	State of the survey.	YES	Has three possible values (published, draft, archived)
SeasonID	Text	Season identifier. Researchers can specify dates for each season and for each country. These dates are saved in a lookup table, where the key is SeasonID and the value are the dates.	YES	Has the following format: $S + year + country$

Name		QUESTION		
Description		A question that can be a part of multiple surveys. Is either open-ended or has multiple options to choose from.		
Attributes				
Name	Type	Description	Mandatory	Notes
IDQuestion	Integer	Question identifier. Generated automatically by the system.	YES	Primary Key
Name	Text	The name of the question.	YES	/
Text	Text	The text of the question.	YES	/
Type	Text	The type of the question.	YES	Has five possible values (single, multiple, open, date, matrix).
IsMandatory	Boolean	Indicator whether the question must be answered.	YES	Default value: False.

StartsHidden	Boolean	Indicator whether the question is hidden at the beginning of the survey or not. If yes, it can be uncovered depending on the options chosen in the previous questions.	YES	Default value: False.
Description	Text	An optional description of the question.	NO	/

Name	OPTION			
Description	An option that can be chosen to answer a particular question.			
Attributes				
Name	Type	Description	Mandatory	Notes
IDOption	Integer	Option identifier. Generated automatically by the system.	YES	Primary Key
IDQuestion	Integer	Identifier of a question that the option belongs to.	YES	Foreign Key
Text	Text	The text of the option.	YES	/
StartsHidden	Boolean	Indicator whether the option is hidden at the beginning of the survey or not. If yes, it can be uncovered depending on the options chosen in the previous questions.	YES	Default value: False.

Name	GROUP			
Description	A group of households. Can contain multiple households.			
Attributes				
Name	Type	Description	Mandatory	Notes
IDGroup	Integer	Group identifier. Generated automatically by the system.	YES	Primary Key
Name	Text	The name of the group.	YES	/

Name	HOUSEHOLD			
Description	A main account for using the system for volunteer participants. Can have multiple members. All members use the same authentication data connected to the household in order to log in.			
Attributes				
Name	Type	Description	Mandatory	Notes
IDHousehold	Integer	Household identifier. Generated automatically by the system.	YES	Primary Key
IDMember	Integer	Identifier of the account holder.	YES	Foreign Key
Email	Text	E-mail connected to a particular household. Used by all members of the household when logging in to the system.	YES	/
Password	Text	Password that all members of the household use to login to the system. Chosen by the user that registers to the system.	YES	Must be encrypted.
Name	Text	The name of the household.	YES	/

CountryCode	Integer	The country code of the household. There is also a lookup table with key-value pairs, where key is country code and value is country name.	YES	/
AreaID	Integer	The area ID of the household (e.g. postal code).	YES	/
IsConfirmed	Boolean	Indicator whether the account is confirmed.	YES	Default value: false.

Name	MEMBER			
Description	A participant that can fill in surveys. Belongs to a particular household.			
Attributes				
Name	Type	Description	Mandatory	Notes
IDMember	Integer	Member identifier. Generated automatically by the system.	YES	Primary Key
IDHousehold	Integer	Identifier of a household that the member belongs to.	YES	Foreign Key
Username	Text	The username chosen by the account holder.	YES	/
Gender	Char	The gender of the member.	NO	Has two possible values (M - male, F - female).
YearOfBirth	Integer	The year of birth of the member.	NO	/

Name	REPORT			
Description	One submission of a survey by one member and for a particular survey. Contains answers to the survey questions.			
Attributes				
Name	Type	Description	Mandatory	Notes
IDReport	Integer	Report identifier. Generated automatically by the system.	YES	Primary Key
IDSurvey	Integer	Identifier of a survey filled in by a member.	YES	Foreign Key
IDMember	Integer	Identifier of a member that filled in a survey.	YES	Foreign Key, Must be encrypted
Type	Text	The type of the report.	YES	Has two possible values (completed, partial).
DateSubmitted	DateTime	Timestamp when the report was submitted.	YES	/

Name	ANSWER			
Description	Answer to a question belonging to particular survey that is a part of a specific report.			
Attributes				
Name	Type	Description	Mandatory	Notes

IDReport	Integer	Identifier of a report that the answer is part of.	YES	Primary Key, Foreign Key
IDQuestion	Integer	Identifier of a question that the answer answers.	YES	Primary Key, Foreign Key
Text	Text	The answer to the question if the question was open-ended.	NO	/

Name	SENSOR DATA			
Description	One set of phone usage and sensor data collected from a particular member.			
Attributes				
Name	Type	Description	Mandatory	Notes
IDSensorData	Integer	Sensor data identifier. Generated automatically by the system.	YES	Primary Key
IDMember	Integer	Identifier of a member from whom the data was collected.	YES	Foreign Key, Must be encrypted
ClientVersion	Text	Version of the mobile application that the member has installed on his/her phone.	YES	/
Device	Text	Device model that the member used for collecting sensor data.	YES	/
Type	Text	The type of the sensor data.	YES	Has six possible values (bluetooth, stepCount, activity, location, userApps, setting).
Data	Text	The data collected from the member's phone.	YES	/
DateCollected	DateTime	Timestamp when the data was collected.	YES	/
SeasonID	Text	Season identifier. Researchers can specify dates for each season and for each country. These dates are saved in a lookup table, where the key is SeasonID and the value are the dates.	YES	Has the following format: <i>S + year + country</i>

Name	RESEARCHER			
Description	A main account for using the system as a researcher. Can only be created by an administrator of the system.			
Attributes				
Name	Type	Description	Mandatory	Notes
IDResearcher	Integer	Researcher identifier. Generated automatically by the system.	YES	Primary Key
Email	Text	The e-mail of a researcher. Used as a username when logging in to the system.	YES	/
Password	Text	The password of a researcher. Used when logging in to the system.	YES	Must be hashed.
Name	Text	The name of the researcher.	YES	/

Group	Text	The group that the researcher works for (e.g. organization).	NO	/
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Name	ADMIN			
Description	A main account for using the system as an administrator. Can only be created and deleted manually in the database.			
Attributes				
Name	Type	Description	Mandatory	Notes
IDAdmin	Integer	Administrator identifier. Generated automatically by the system.	YES	Primary Key
Email	Text	The e-mail of the administrator. Used as a username when logging in to the system.	YES	/
Password	Text	The password of the administrator. Used when logging in to the system.	YES	Must be hashed.

Name	NEWS POST			
Description	A news or blog post written/provided by the administrator or fetched from the Web.			
Attributes				
Name	Type	Description	Mandatory	Notes
IDNewsPost	Integer	News post identifier. Generated automatically by the system.	YES	Primary Key
IDAdmin	Integer	Identifier of the administrator who wrote/provided the news post.	YES	Foreign Key
Title	Text	The title of the news post.	YES	/
Text	Text	The text of the news post.	YES	/
DateUpdated	DateTime	Timestamp when the news post was created / last updated.	YES	/

4.2 Functional Requirements

4.2.1 Registration

Registration is allowed only to the volunteer participants. During registration, it is necessary to provide a valid e-mail and password. Upon registration, a new household account is created, with one member automatically added to it (the creator of the account, now the account holder).

Researcher accounts are created exclusively by the administrator of the system upon request.

Pre-conditions	Action steps	Post-conditions
1. The participant does not have an account.	<ol style="list-style-type: none"> 1. Registration action is initiated either through Web or Mobile application. 2. The Web/Mobile application requests from the participant to enter his/her data. 3. The participant enters his/her required data. 4. The Web/Mobile application transfers the data to InfluenzaNet server. 5. The system validates the entered data, creates a new household with one member and saves it to the database. <p>Optional steps:</p> <ol style="list-style-type: none"> 6. An e-mail is sent to the participant to ask for account confirmation. 7. The participant confirms the account by clicking on a link provided in the e-mail. 8. The account is flagged as confirmed. <p>Exceptions:</p> <ol style="list-style-type: none"> 5a. If the system detects invalid entered data, an error message will be sent to the Web/Mobile application and then displayed to the participant. 	1. Participant account is successfully created.

4.2.2 Log In

For a successful login, it is necessary to provide an e-mail and a corresponding password.

There is also a possibility to log in using a Facebook or Google account.

Pre-conditions	Action steps	Post-conditions
1. An account exists and is confirmed by its owner.	<ol style="list-style-type: none"> 1. The Web/Mobile application requests from the user to enter his/her e-mail and password. 2. The user enters his/her e-mail and password. 3. The Web/Mobile application transfers the data to InfluenzaNet server. 4. The system validates the entered e-mail and password and sends success message to the Web/Mobile application. <p>Exceptions:</p> <ol style="list-style-type: none"> 4a. If the system detects invalid e-mail/password combination, an error message will be sent to the Web/Mobile application and then displayed to the user. 	1. The user is logged into the application.

4.2.3 Unregistered Survey Submission

System administrators and researchers are allowed to send a temporary link to a survey. The link is valid for two weeks and during that time the receiver can fill in and submit a survey without needing to register and log in to the system.

After opening the provided link, the rest of the flow is identical to the one in Sections 4.2.6.4 and 4.2.6.5.

4.2.4 Account Management

4.2.4.1 Account Modification

Every user shall be able to access and modify his own profile.

Pre-conditions	Action steps	Post-conditions
1. The user is logged in to the system.	<ol style="list-style-type: none"> 1. The user initiates the account modification action either through Web or Mobile application. 2. The Web/Mobile application requests from the user to enter his/her data that he/she wants to change. 3. The user enters his/her new data. 4. The Web/Mobile application transfers the data to InfluenzaNet server. 5. The system validates the entered data and saves it in the database. <p>Exceptions:</p> <ol style="list-style-type: none"> 2a. Some data cannot be changed using the Mobile application (e.g. e-mail). 5a. If the system detects invalid entered data, an error message will be sent to the Web/Mobile application and then displayed to the user. 5b. Some data needs additional validation apart from syntax validation (e.g. e-mail → in case of e-mail change, a notification is sent to the old e-mail). 	1. Account data has been successfully changed.

4.2.4.2 Account Deactivation

The participant shall be able to deactivate his/her account at any time, when all identification data belonging to that participant shall be deleted from the server (both household and member data, as well as all other members of the household). Data collected from the participant will therefore be anonymized (the link between that particular participant and collected data is deleted), so it shall be allowed to remain on the server.

The account deactivation procedure shall be applied to all participants that haven't logged in to the Web/Mobile application after 2 years.

Researcher accounts are deactivated by the system administrator upon request.

Pre-conditions	Action steps	Post-conditions
1. The participant is logged in to the system.	<ol style="list-style-type: none"> 1. The participant initiates the account deactivation action either through Web or Mobile application. 2. The Web/Mobile application sends account deactivation request to InfluenzaNet server. 3. The application sends an e-mail to the participant informing him about the request and the procedure (and the way to cancel it). 4. After some delay, if not cancelled, the system deletes all identification data of the participant from the database (household 	<ol style="list-style-type: none"> 1. Participant account is successfully deactivated. 2. Operations have been logged.

	<p>and member data belonging to that participant, as well as all other members of the household).</p> <p>Additional Feature: If the participant hasn't used the Web/Mobile application for 2 years, an e-mail is sent to the participant warning him about the procedure. The participant then has some configurable days to log in to the Web/Mobile application in order to stop his account from deactivating.</p>	
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4.2.5 Household Management

4.2.5.1 Adding Members

New members (spouse, children, etc.) can be added to the household at any time. The account holder needs to provide a username for the new member. Once added, new members are allowed to fill in an intake questionnaire and submit reports.

Additionally, the account holder needs to acknowledge that a new household member allows him to manage his account.

Pre-conditions	Action steps	Post-conditions
1. The account holder is logged in to the system.	<ol style="list-style-type: none"> 1. The account holder initiates adding a new household member action either through Web or Mobile application. 2. The Web/Mobile application requests from the user to enter new member's data. 3. The account holder enters the required data. 4. The Web/Mobile application transfers the data to InfluenzaNet server. 5. The system validates the entered data, creates a new member of the household and saves him/her in the database. <p>Exceptions: 5a. If the system detects invalid entered data, an error message will be sent to the Web/Mobile application and then displayed to the user.</p>	1. New household member is successfully added.

4.2.5.2 Removing Members

Household members can be removed at any time by the account holder. Upon request, a member is deleted, but his/her submitted data remains in the database.

Pre-conditions	Action steps	Post-conditions
1. The account holder is logged in to the system.	<ol style="list-style-type: none"> 1. The account holder initiates the household member removal action either through Web or Mobile application. 2. The Web/Mobile application sends member removal request to InfluenzaNet server. 3. The system deletes member data belonging to a specified member from the database. 	1. Household member is successfully removed.

4.2.5.3 Household Separation

Household members can decide to exit the household in order to create their own. In that case, a new household is created, with this member as the account holder.

Pre-conditions	Action steps	Post-conditions
1. The member is logged in to the system.	<ol style="list-style-type: none"> 1. The member initiates the household separation action either through Web or Mobile application. 2. The Web/Mobile application requests from the member to enter new household data. 3. The member enters the required data. 4. The Web/Mobile application transfers the data to InfluenzaNet server. 5. The system validates the entered data, creates a new household with current member as the account holder, and removes the member from his previous household. 	1. New household is successfully created.

4.2.5.4 Household Connection

Multiple households can be connected by placing them in the same group. These groups are similar to standard social network “friend” groups, where multiple accounts are grouped based on something they have in common.

4.2.6 Survey Management

4.2.6.1 Survey Editor

Researchers shall be able to define new surveys and modify existing ones.

Pre-conditions	Action steps	Post-conditions
1. The researcher is logged in to the system.	<ol style="list-style-type: none"> 1. The researcher initiates the create survey action through the Web application. 2. The Web application requests from the researcher to enter the survey data (questions, options, rules, etc.). 3. The user enters survey data or imports it from a JSON definition. 4. The Web application transfers the data to InfluenzaNet server. 5. The system validates the entered data and saves it in the database. <p>Variation Points:</p> <ol style="list-style-type: none"> 1a. The researcher initiates the modify survey action through the Web application. The Web application then allows the researcher to modify survey data. <p>Exceptions:</p> <ol style="list-style-type: none"> 5a. If the system detects invalid entered data, an error message will be sent to the Web application and then displayed to the researcher. 	1. The survey is successfully created / modified.

4.2.6.2 Survey History

Researchers shall be able to determine a version of each survey and go through entire history of survey modifications. He/she shall be able to download a chosen survey in JSON format.

Pre-conditions	Action steps	Post-conditions
1. The researcher is logged in to the system.	1. The researcher initiates the survey history action through the Web application. 2. The Web application sends survey history request to InfluenzaNet server along with any search parameters specified by the researcher. 3. The system sends a list of surveys and their versions / modifications to the Web application where it is displayed to the researcher. 4. The researcher chooses a survey version to download. 5. The system sends the chosen survey in JSON format to the Web application. 6. The Web application allows the researcher to save the file.	1. The survey is successfully downloaded.

4.2.6.3 Survey Translation

The system shall provide support for easy translation of surveys (either through dictionaries, existing translation APIs, etc.).

Pre-conditions	Action steps	Post-conditions
1. The user is logged in to the system.	1. The user initiates the survey translation action either through Web or Mobile application. 2. The Web/Mobile application sends survey translation request to InfluenzaNet server, along with a language chosen by the user. 3. The system translates the survey and sends it to the Web/Mobile application where it is displayed to the user.	1. The survey is successfully translated and displayed to the researcher.

4.2.6.4 Survey Engine

The system shall be able to parse the survey into a form suitable for dynamic execution of said survey (e.g. state machine), as well as run it.

Pre-conditions	Action steps	Post-conditions
1. The survey is defined and stored in the database.	1. The user initiates the survey action either through Web or Mobile application. 2. The Web/Mobile application sends survey execution request to InfluenzaNet server. 3. The system parses the survey based on survey rules and user's account data and saves it into a form suitable for dynamic execution of said survey. 4. The system sends initial questions to the Web/Mobile application where they are displayed to the user. 5. As the user answers the questions, new questions are loaded based on his/her answers.	1. The survey is successfully executed.

4.2.6.5 Report Storage

In the case of the Web application, survey data submitted by the user shall be stored on the server immediately after submission.

In the case of the Mobile application, the submitted survey data shall be stored on the device until Internet connection is available.

If the survey is not completed in due time, incomplete survey data shall be transmitted and stored on the server (and marked as incomplete).

Pre-conditions	Action steps	Post-conditions
1. The user is logged in to the system.	1. The user submits the survey answers either through Web or Mobile application. 2. The Web/Mobile application transfers the data to InfluenzaNet server. 3. The system validates the entered data and stores it in the database. Exceptions: 2a. In the case of the Mobile application, if the device is not connected to the Internet, survey data is stored on the device until the connection becomes available. 3a. If the system detects invalid entered data, an error message will be sent to the Web/Mobile application and then displayed to the user.	1. Survey data is successfully stored on the server. 2. Server responds to the client given the workflow rules: next survey or thanks page.

4.2.7 Sensor Storage

Sensor and phone usage data from user's mobile device shall be processed and aggregated on the device itself, due to the sensitive nature of collected results (e.g. location).

The collected data shall then be transferred to the server and stored there in its aggregated form.

Pre-conditions	Action steps	Post-conditions
1. The participant is logged in to the system.	1. The Web/Mobile application transfers the phone usage & sensor data to InfluenzaNet server on a set timer. 2. The system validates the received data and stores it in the database. Exceptions: 2a. If the system detects invalid data, an error message will be sent to the Web/Mobile application.	1. Phone usage & sensor data is successfully stored on the server.

4.2.8 Data Analysis

4.2.8.1 Raw Data Download

Every user (participant or researcher) shall be able to download anonymized and processed survey / sensor data stored on the server.

Pre-conditions	Action steps	Post-conditions
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	<ol style="list-style-type: none"> 1. The user initiates the raw data download action through the Web application. 2. The Web application sends raw data download request to InfluenzaNet server. 3. The system sends anonymized and processed data in JSON format to the Web application. 4. The Web application allows the user to save the file. 	<ol style="list-style-type: none"> 1. The raw data is successfully saved on the user's device.
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4.2.8.2 Statistical Analysis

Researchers shall be able to perform statistical analysis on the collected data. An R language tool shall be available to the researchers for performing common statistical analysis tasks.

4.2.8.2 Data Visualization

Researchers shall be able to visualize results in the form of different diagrams / graphs / charts. A researcher is allowed to choose the way in which the data is visualized. This is done with the help of an R language tool mentioned in 4.2.7.2.

4.2.9 Messages

A system administrator shall be able to send out messages to a specified set of accounts.

Messages can be newsletters, notifications, requests, reminders, etc.

Pre-conditions	Action steps	Post-conditions
	<ol style="list-style-type: none"> 1. The system administrator chooses a set of accounts to send a message to, by applying specific filters to household accounts. 2. The message is sent out to all accounts specified by the administrator. 	<ol style="list-style-type: none"> 1. The message is successfully sent.

4.2.10 News

The system shall be able to provide ILI-related news on request for both Web and Mobile application.

The news are fetched from the Web based on specific key words. Additionally, system administrators shall be allowed to write their own news and blog posts.

Pre-conditions	Action steps	Post-conditions
	<ol style="list-style-type: none"> 1. The user initiates the news action either through Web or Mobile application. 2. The Web/Mobile application sends news request to InfluenzaNet server. 3. The system searches the Web and the news database for ILI-related news and sends the result to the Web/Mobile application. 4. The Web/Mobile application displays the news to the user. 	<ol style="list-style-type: none"> 1. The news are successfully fetched from the database and Web and displayed to the user.

4.3 Non-functional Requirements

For the project to be successful, the system needs to be in top form – efficiently collecting the data, accurately parsing and visualizing the results, successfully functioning in the manner by which it is expected to function in order to ensure that the users will continue using the system.

The table below (*Table 1*) represents a quality grid where different quality attributes are ranked for importance. Those marked as “critical” and “important” are further refined in the following chapters.

	Critical	Important	As usual	Unimportant	Ignore
Operation					
Security		X			
Correctness			X		
Reliability/Availability		X			
Usability					X
Efficiency	X				
Revision					
Maintainability	X				
Testability			X		
Flexibility	X				
Transition					
Portability			X		
Interoperability		X			
Reusability			X		

Table 1. *Quality Grid*

4.3.1 Reliability

QRR1: Failure frequency of the system shall be less than 2 per day.

QRR2: The system shall be available 99% of the time during one day.

4.3.2 Maintainability

As multiple research papers claim that maintainability is the main challenge for sustaining the system in the long run, the following requirements are of high priority.

QRM1: Installation of a new version shall leave all database contents unchanged.

QRM2: Development must use regression testing allowing full re-testing every 24 hours.

QRM3: The cyclomatic complexity of code may not exceed 10.

QRM4: Product shall log all actions and provide remote diagnostic functions.

4.3.3 Flexibility

Flexibility in system configuration potentially allows for a wide variety of applications in public health preparedness and control.

QRF1: The system shall be able to cope with the regulations of different countries regarding the data collection method.

QRF2: It shall be possible to extend the system with new functionalities with minimum changes to the original code.

4.3.4 Efficiency

The total number of users varied both between years and between countries. The following requirements are based on the average case.

QRE1: The system shall be able to store 50 000 users (5000 – 10 000 per national platform).

QRE2: The system shall be able to store 100 000 reports.

QRE3: The system shall be able to store user accounts for minimum of 2 years.

QRE4: Expected number of simultaneous users is less than 1000 (up to 300 connections to the database). In this case the system shall be able to handle requests without any issues.

QRE5: An extremely stressful situation for the system is when the number of simultaneous users is greater than 1500. In this case the system shall be able to handle more that 80% of requests with a slight delay.

QRE6: The exact amount of sensor data that the system shall be able to store is still unknown. It is expected that the sensor data will represent much heavier load than survey data, as it is collected at a much bigger frequency (daily, or even hourly - comparing to weekly for surveys).
Note: one of the future revisions of this document should address these numbers as well.

QRE7: Survey and sensor data upload shall take less than 1.5s for 90% of the cases.

QRE8: Survey and sensor data download shall take less than 2s for 90% of the cases.

QRE9: Survey and sensor data collected from the user shall be available do download in less than 2h.

4.3.5 Interoperability

QRI1: The system shall provide a well-documented API to be used by the Web and Mobile applications.

4.3.6 Security

QRS1: Product shall include firewalls for malicious access detection.

QRS2: Every transmission of data between the Web/Mobile application and the InfluenzaNet server shall be done through the HTTPS protocol.

QRS3: Possible presence of malicious access shall be constantly monitored and failed access attempts shall be recorded as fraudulent.

QRS4: Data transmission and storage shall be securely encrypted

QRS5: Data loading, account creation and deletion requests should be logged.

5. Glossary

Term	Meaning
ILI	Influenza-Like Illness
OS	Operating System
System	InfluenzaNet Backend Application
GDPR	General Data Protection Regulation
TOM	Technical and Organizational Measures