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**Biometric fusion system for human recognition
using face and voice**

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History of changes

Example:

Date	Author	Description	Version
14.10.2017	Kuśmierczyk Aleksander Sławińska Martyna Żaba Kornel	First version	1.0
19.10.2017	Kuśmierczyk Aleksander Sławińska Martyna Żaba Kornel	Glossary added	1.0.1

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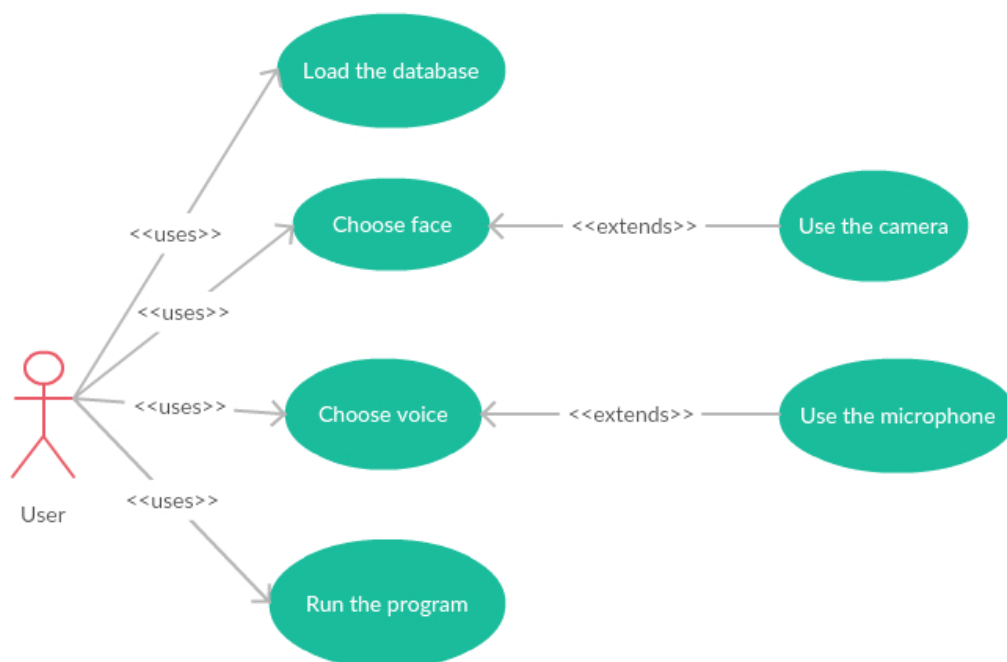
1 Specification

1.1 Executive summary

This system is designed for identification and/or verification of human. With the use of biometric algorithms based on extracting face and voice features, the program recognizes the user with the sufficient degree of compliance. The acquisition of the aforementioned data is done by the portable or built-in camera with a microphone.

1.2 Functional requirements

1. The system should display graphical user interface with options.
2. The system should allow the user to choose what to identify/verify first: face or voice.
3. The system should identify and/or verify the face:
 - 3.1. The system should use the camera for capturing the image of the face.
 - 3.2. The system should compare PV's biometric with the biometrics stored in the database.
4. The system should identify and/or verify the speech/voice:
 - 4.1. The system should use the microphone for recording the speech.
 - 4.2. The user should say the specific word in order for the system to identify his/her voice.
 - 4.3. The system should compare PV's biometric with the biometrics stored in the database.
5. After collecting PV's face and speech data, the system should compare collected results with the database and give an answer whether the PV already belongs to the database collection (verifying stage).



Actor	Name	Description	System response
User	Load the database	Load the database for machine learning purposes	The system loads the database from location pointed by the user.
	Choose face	Choose face for identification	The program starts the camera
	Choose voice	Choose voice for identification	The program starts the microphone.
	Run the program	Run the program which compares the PV's data with the database collection	The system returns the result of recognition.
	Use the camera	Use the camera for capturing the face of PV	The system captures the face of PV with camera.
	Use the microphone	Use the microphone for recording the speech of PV	The system records the voice of PV with microphone.

User stories

1. Attempt of PV verification

- 1.1 The user starts the program, chooses which biometric should be used in recognition process as first. Then the user uses the appropriate hardware to capture the required input or uses the previously prepared data for the program to use in order to recognize the PV. The user reads the results of the verification.

1.3 Non-functional requirements

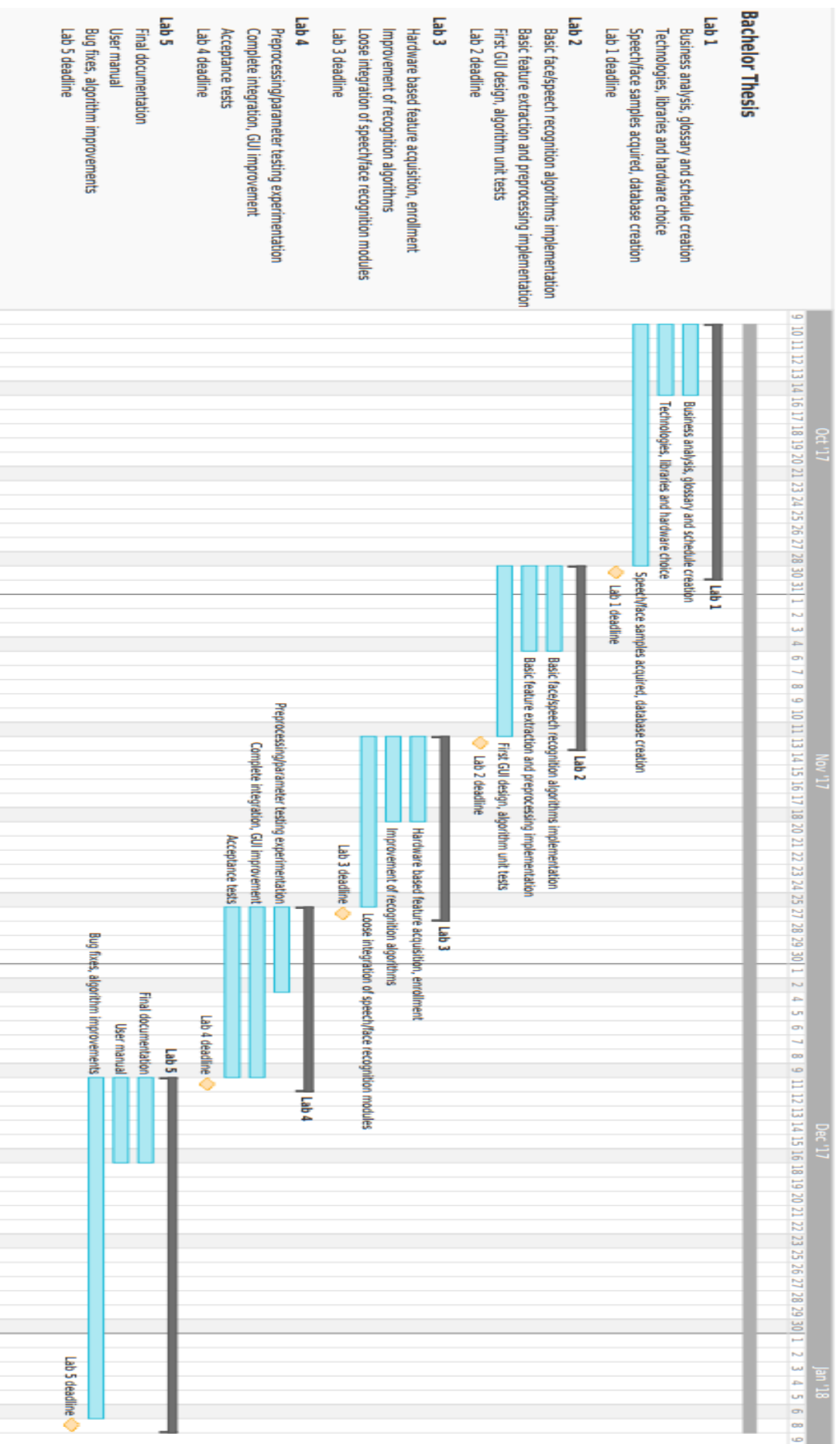
1. The system does not have any login options.
2. The system allows identifying one face/voice at the time.
3. The system should support the Windows operating system.
4. The system should work in an offline mode.
5. The system response time depends on the size of the database.
6. The system's hardware connects by USB cable: camera and microphone, or is built-in the workstation.

Below is the table that describes the URPS requirements of the program.

Requirements	Nr wymagania	Opis
<i>Usability</i>	1	The software is user friendly, as the only requirement for the use of the program is to load the database and to capture the image or to record the speech.
<i>Reliability</i>	2	The system is a desktop application, after manual start-up it is ready to work.
	3	The program handles the incorrect data types in the database, and shuts down if a hardware malfunction occurs.
<i>Performance</i>	4	The system returns the verification result with the delay basing on the database size.
	5	The program verifies the PV using two biometric features, thus achieves the sufficiently good verification correctness.
<i>Supportability</i>	6	In order to use the application, the user is required to have Windows operating system.
	7	The program requires a built-in or a USB-connected camera with a microphone.
	8	In order for the program to function correctly, it requires a database consisting of a large enough samples of face images and voice recordings.

1.4 Project schedule

DEADLINE	MILESTONE	LAB DATE
2017-10-14	Business analysis, glossary and schedule creation	LAB 1 30.10.2017: Business analysis, Glossary, Supplementary spec, Schedule
2017-10-14	Technologies, libraries and hardware choice	
2017-10-28	Speech/face samples acquired, database creation	
2017-11-04	Basic face/speech recognition algorithms implementation	LAB 2 13.11.2017: Technical project, Choice of development model
2017-11-04	Basic feature extraction and pre-processing implementation	
2017-11-11	First GUI design, algorithm unit tests	
2017-11-18	Hardware based feature acquisition, enrolment	LAB 3 27.11.2017: Source code of non-integrated modules, unit tests
2017-11-18	Improvement of recognition algorithms	
2017-11-25	Loose Integration of speech/face recognition modules.	
2017-12-02	Pre-processing/parameter testing experimentation	LAB 4 11.12.2017: Integrated modules, smoke test, acceptance tests
2017-12-09	Complete integration, GUI improvement	
2017-12-09	Acceptance tests	
2017-12-16	Final documentation	LAB 8.01.2018: Working v.1.0, user manual, code/docs, acceptance tests results, list of changes
2017-12-16	User manual	
2018-01-06	Bug fixes, algorithm improvements	
2018-01-06	Others	



1.5 Glossary

Biometric – feature owned by human, which allows verification of an individual

Enrolment – process of acquisition of data of the new PV

Face features – face biometric

Feature acquisition – process of collecting data

Feature extraction – process of extracting biometric information from data

Identification – the automatic identification of living individuals by using their physiological and behavioural characteristics

Offline mode – the mode of program, which does not require internet connection

PV – person being verified

Recognition - refers to the automated recognition of individuals based on their biological and behavioural traits

Verification - an identity authentication process used to confirm a claimed identity through uniquely identifiable biological traits

Voice features – voice biometric