SOFTWARE REQUIREMENTS SPECIFICATION

GARCON

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Change History

Version	Date
1.0	11.03.2019
1.1	19.03.2019

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1. Introduction

This is a Software Requirement Specification (SRS) document for “Garcon Project” which is introduced by Microsoft.

1.1. Purpose of the System

“Garcon Project” is a smart campus project launched by Microsoft whose objective is presenting a better, safer and smarter campus environment for students and staff. In order to increase collaboration, creativity and efficient use of resources along with space utilization, this project uses IOT and AI technologies to process data comes from sensors and cameras. This background is used by assistants called “Garcons” which are distributed along smart campus, provides the user-end service and communication.

1.2. Scope

This smart campus project’s aim is providing a jointly operated environment for both using resources efficiently and reaching information about campus easily. In order to achieve such an environment for campus community, project shall have lots of coordinated hardware and software components that described below explicitly.

● Project shall have lots of “Garcon” assistants that are scattered along campus. These Garcons provide connection between users and system. These assistants are like an interface of software.

● Since Garcon system should be maintained and improved,this system shall have IT staff and Admins.Objectives of these groups are explained in the related subsystems.

● Garcons shall use voice queries. Therefore, these assistants shall have a microphone to take voice queries and a software system that uses natural language processing and computational linguistics to understand the query.

● Garcons shall transmit the processed query to the main server. Therefore, these assistants shall have a trustworthy connection with the server.

● All the given queries shall be responded from this server. Therefore, the server has to obtain information from campus every moment with the aid of connected devices to the server and this information has to be processed with the aid of AI algorithm.

● Since past queries should be kept in order to be used by machine learning algorithms , this system shall have a database connected to the main server. In order to maintain system efficiency, system admins and IT staff shall reach this database.

1.3. System Overview

This section has information about the system overview.The factors affect and components constitute the system are explained in depth.

1.3.1. System Perspective

Garcon system is a smart campus service which provides two main features - campus information and ticket service- to the end users. Campus information system's aim is to provide users various information about food and transportation services in the campus. Ticket creation procedure uses Service Systems of the campus (health,security and cleaning services) to let the user create tickets to get said services. It is connected to a web server to get real-time info about food & transportation informations. The web server retrieve and send information to hardware devices and information systems connected to. Thus, Garcon uses all the benefits of IoT to manipulate hardware or get sensor information from a network with the extra calculation side of AI technologies. It also retrieves and sends some data to a database center to measure system variables and use in make AI calculations. Thus, even though Garcon is not part of a larger system, it provides different interfaces for different users. End users have access points through which they can get information or create tickets by voice commands. Admins and IT staff have their own interfaces to maintain and improve system quality by viewing system logs or user reviews.

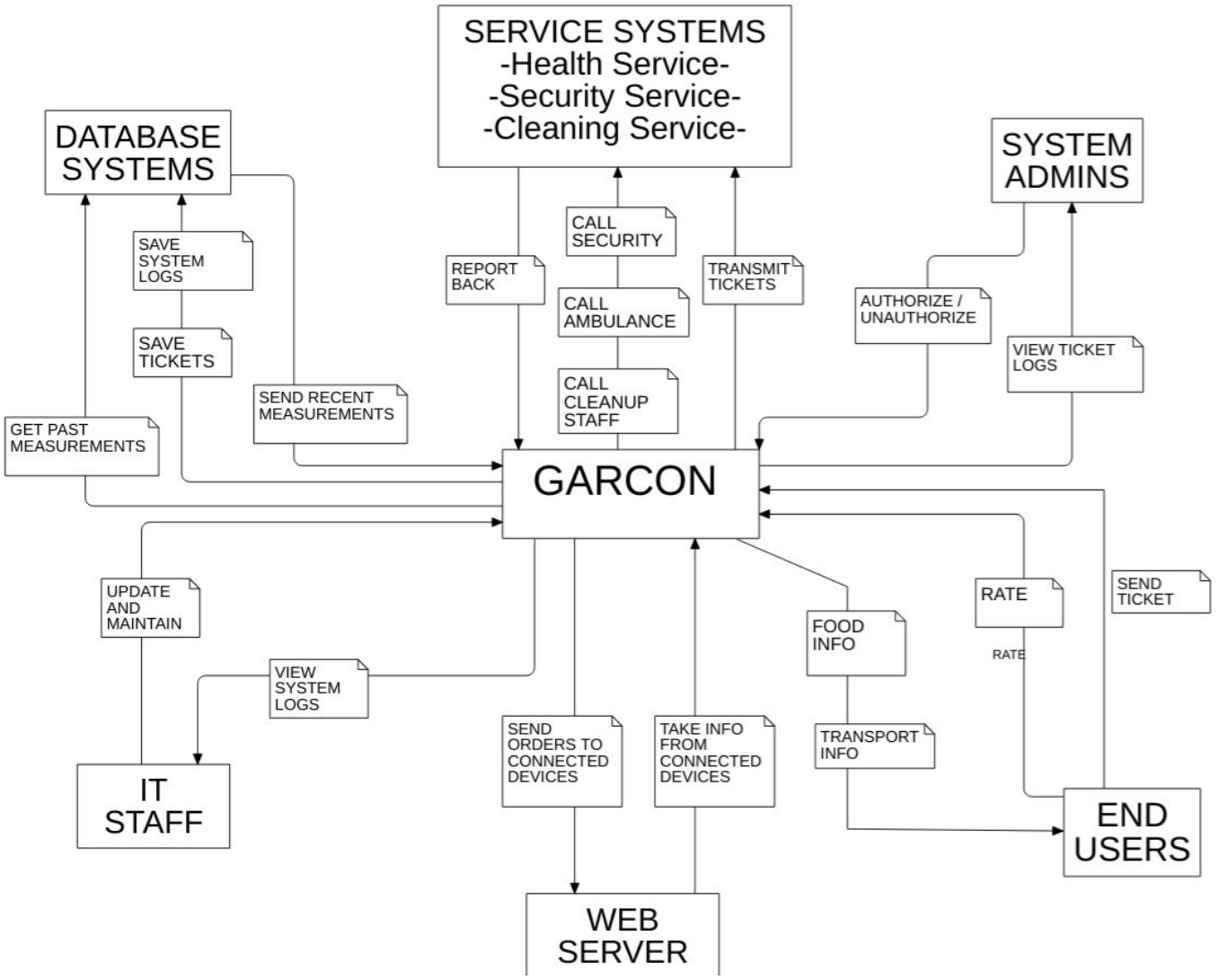

Figure 1:Context Diagram

1.3.2. System Functions

Functionalities (use cases) of Garcon is summarized as what they do in the table below. More advanced and detailed version can be found in Functions section (3.2) with corresponding complete description tables.

Call Ambulance	Lets user to create a ticket in order to call an ambulance
Call Security	Lets user to create a ticket in order to call security units.
Transmit Tickets	Garcon transmits ticket from access point to health services
Call Cleanup	Lets user to create a ticket about cleaning issues and get directs cleaner staff to access point.
Authorize	Lets admin to authorize or deauthorize members, access points or even IT staff.
View ticket logs	Authorized personnel can see tickets and their logs accordingly.
Send Ticket	Allows user to send tickets to the system with varying subjects.
Rate	Lets user to review the experience.
Report back	Garcon informs the user about the processes.
Food information	Lets user to get information about food in the campus.
Transportation information	Lets user to get information about transportation in and outside of the campus.
Get info from connected devices	Allows web server to get information from connected devices like sensors and cameras with the help of IOT technology.
Send order to connected devices	Allows web server to send orders to connected devices like traffic lights or sensors to manipulate them thanks to IOT.
View system logs	Authorized personnel can see system logs accordingly.
Update and Maintain	IT staff has access to update to system in order to Garcon to meet future needs.
Save tickets	Garcon sends tickets to database in order to save them.
Save system logs	Garcon sends system logs to database in order to save them.
Get past measurements	Garcon gets past measurements of sensors readings from database in order to use in AI calculations.

Table 1:System Functions

1.3.3. User Characteristics

Target users of Garcon assistant can be categorized into 3 parts as end-users , IT staff and system admins.

In Garcon smart campus project, end-users will be campus community in short.Guests of campus are end-users as well. This group is most populous one among 3 groups. They are not required to have a technical background.The single precondition to create a conversation between end-users and Garcon assistant is speaking and understanding a language which Garcon recognizes as well.

Other groups are related to technical sides of Garcon system.

The second group is administrators.This group has permissions to access system itself which normal users can't do.They are able to see system logs that are created by ticket system.
This logs are saved in the database system. Also they have authority to cut off a session of an end-user which uses system in a harmful way. Since administrator person has an access to database system and Garcons ,he/she should have a strong technical knowledge in his/her area.

The last group that are expected to use this smart campus system is IT staff group.These staffs are expected to fix/maintain/upgrade the system.In order to do this, this group members should have a permission to investigate system logs.These logs are stored in the database system as well.Since database system, web server system and other technical sides of this project need strong background, IT person should have strong knowledge about his/her professional field.

1.3.4. Limitations

Regulatory policies: Since conversation logs are kept in the database system and they might contain personal information, any unauthorized person should not access these logs.

Hardware limitations: End-users do not need a device. However, a network connection should be established between connected devices such as Garcon assistants,sensors and web server system.

Interfaces to other applications: Since Garcon smart campus project has all necessary systems to operate, it doesn't have an interface to other applications.

Parallel operations: Since all Garcon assistants are available to be used at every moment , systems are capable of serving to all Garcon assistants at the same time.

Control functions: IT staff and admins are authorized to control database system and web server systems.However,end-users and any other people cannot access the systems of Garcon .

High-order language requirements: Project should use web based systems so appropriate languages such as JavaScript and HTML can be used.In the database side , SQL should be used. Also, for other purposes, languages that are not machine dependant such as Java can be used since lots of hardware devices exist in project.

Signal handshake protocols: Since web server system uses web , HTTPS will be required.Also TCP/IP services can be used for database connection.

Quality requirements: Safety and reliability are really crucial.For that purposes , staff should take backups of logs and should control security of system regularly.

Criticality of the application: Since ticket system can be used for medical purposes such as calling ambulance , at least that property should work when system failures occurred.From this point, system can be seen as critical.

Safety and security considerations: System admins and IT staff should keep system protected from malicious users/unauthorized people.

Physical/mental considerations: Any person that can speak are able to create conversation between Garcon. Garcons should be distributed in an organized way that walking disabled people can reach to these assistants.

1.4. Definitions

IT Staff	Person whose job is related to “information technology”.
Database	Organized collection of data.
HTTPS	“HyperText Transfer Protocol Secure is a protocol for secure communication over network which is widely used on web.
HTML	“Hypertext Markup Language” is the standard markup language for creating web pages and web applications.
SQL	"Structured Query Language" is a domain-specific language used in programming and designed for managing data held in a relational database management system.
Admin	Person who has “administration”.

Table 2:Definitions

2. References

This document is written with respect to the specifications of the document below:

29148-2011 - ISO/IEC/IEEE International Standard - Systems and software engineering --Life cycle processes --Requirements engineering.

Other sources:

"Microsoft shows off Garcon smart campus concierge", March 2019 , URL: https://www.iothub.com.au/news/microsoft-shows-off-garcon-smart-campus-concierge-514870.

Sommerville, I. (2016). Software engineering. Boston: Pearson Education Limited.

3. Specific Requirements

3.1. External İnterfaces

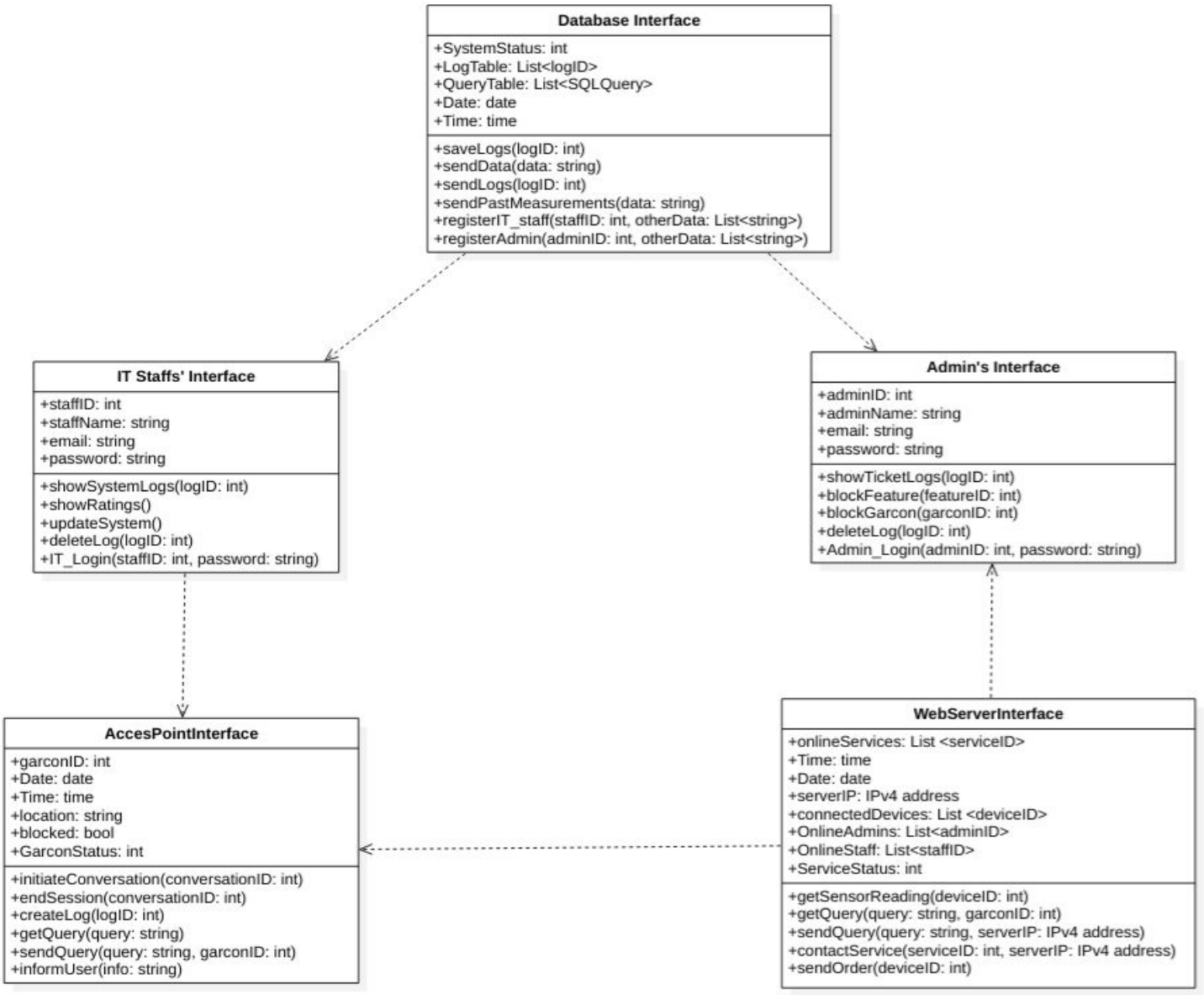

Figure 2:External Interfaces

Access Point Interface:

req01: Garcon access points shall provide a voice chat system between user and the software.

req02: If the system can not recognize voice query, it shall ask user to try again.

req03: The system shall warn the user if it detects an abuse.

req04: The system shall translate incoming informations to voice messages and transmit them to the user.

req05: The system shall inform user about crashes or updates if necessary.

req06: The system shall inform user if it can not reach main server. Possibly advise user to use nearby access points.

Database Interface

req07: The system shall hold and serve ID of personnel when necessary.
req08: This interface shall serve an authentication system to disallow unauthorized people to reach or manipulate data.
req09: The interface shall hold the data of past sensor readings and serve them when the query is sent.
req10: The system will provide a management page for authorized personnel to enable them edit or copy the data.
req11: The system shall hold system and ticket logs. It also shall have an interface segment in order to show them to authorized staff.
req12: The interface shall get recent AI data from Garcon in order to use in the future AI calculations.

Admins' Interface

req13: The interface shall hold related information about admins.
req14: The system shall provide a login subsystem for authentication.
req15: The interface shall provide admins full access and control of the system.
req16: The interface shall allow admins to view system logs.
req17: The system shall provide ticket logs to admin.
req18: The system shall allow admins to ban features or garcons in case of abuse by the users.
req19: The system shall allow admin to view tickets in order to provide security of the system.
req20: The system shall provide the live information of status of all garcons.
req21: The system security will not allow other people to sign in as admin and manipulate the system.
req22: The system shall notify the admin about crashes and bugs on the garcon.

IT Staffs' Interface

req23: The interface shall hold related information about admins.
req24: The system shall provide a login subsystem to IT staff for authentication.
req25: The interface shall allow staff to view system logs so that they can maintain and improve the system.
req26: The system shall provide user rating information to IT staff. IT staff will have ways to improve the system based on ratings, using this interface.

Web Server Interface

req27: The system shall provide a way of communication between Garcon and web server.
req28: The system shall allow sensor devices to send data to web server, in order to do that the interface shall use IOT technologies.
req29: The system shall also let web server to send orders to these devices in order to manipulate them.
req30: The interface shall include ways of communication with out of campus services in order to provide information to users or send tickets to them.
req31: The web server interface shall hold all live information of the system, directly communicate with the garcon and devices to keep them updated.

3.2. Functions

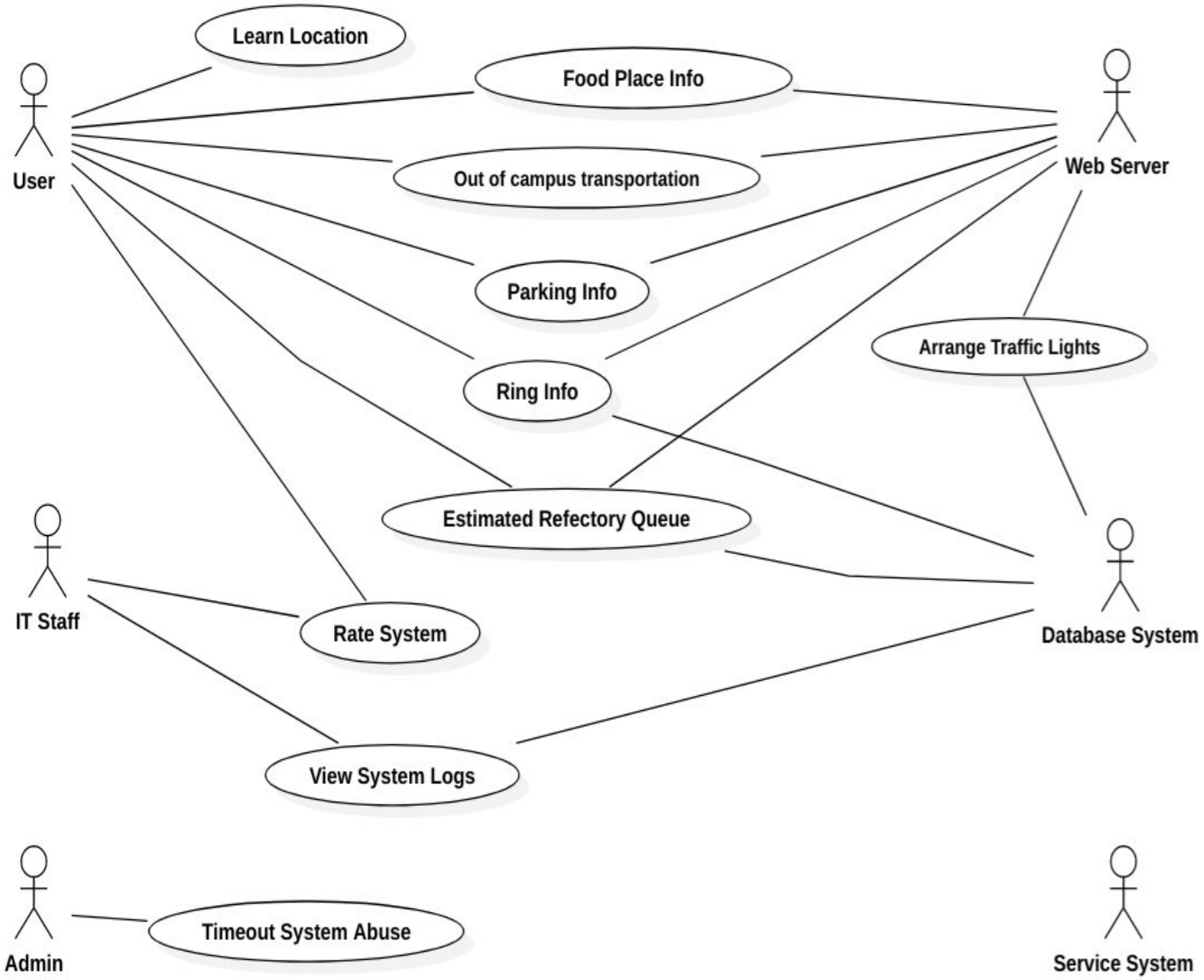

Figure 3:Use Case Model For Information System

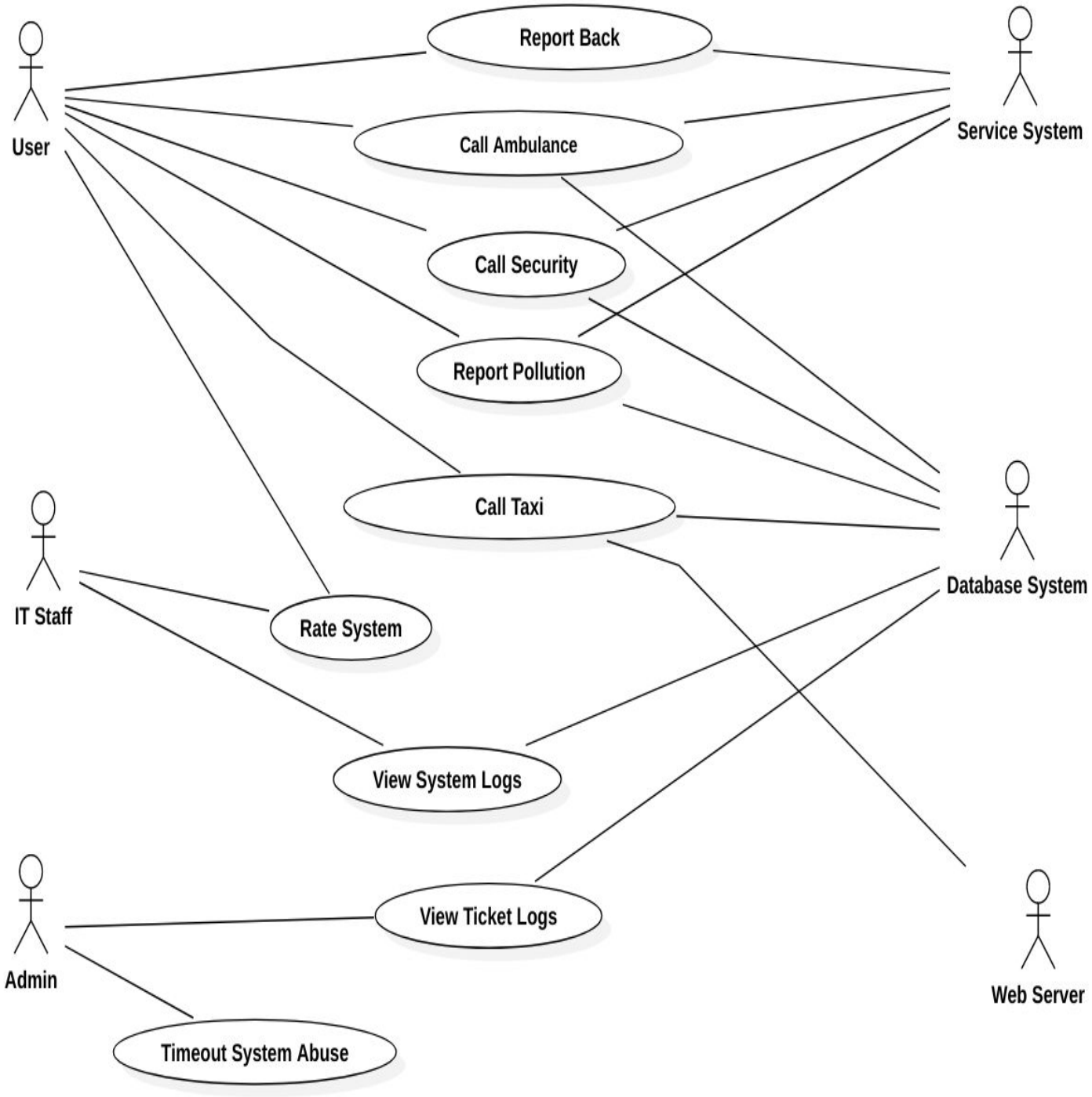

Figure 4:Use Case Model For Ticket System

Use Case Descriptions For Information System are given below.

Use case name	Ring information
Actors	User , Web Server , Database System
Description	Garcon system gives in campus ring system information to end-users.
Data	Current ring locations and their departure times, availability of seats, past data of ring times.
Preconditions	When end-user wants to learn where is the ring and when end-user doesn't know rings' departure times.
Stimulus	Given voice query that contain request ring information.
Basic Flow	Step 0 – System arranges ring times with the help of readings from seat sensors and artificial intelligence calculations which use past data collected from database. Information is now available to use. Step 1 – User sends a voice query about rings. Step 2 – Garcon sends processed query to the system. Step 3 – Web server system takes the current ring location together with the seat availability and sends to Garcon assistant. Step 4- Garcon informs the user about rings.
Alternative Flow	Step 3-When there is no ring , Garcon informs user about this situation.
Exception Flow	When Web Server can't reach current location of rings.
Postconditions	Garcon sends current data of seat availability thanks to IOT to the database in order to use in future AI calculations. Garcon is ready to process new sound queries.

Table 3: Use Case Description for Ring Information

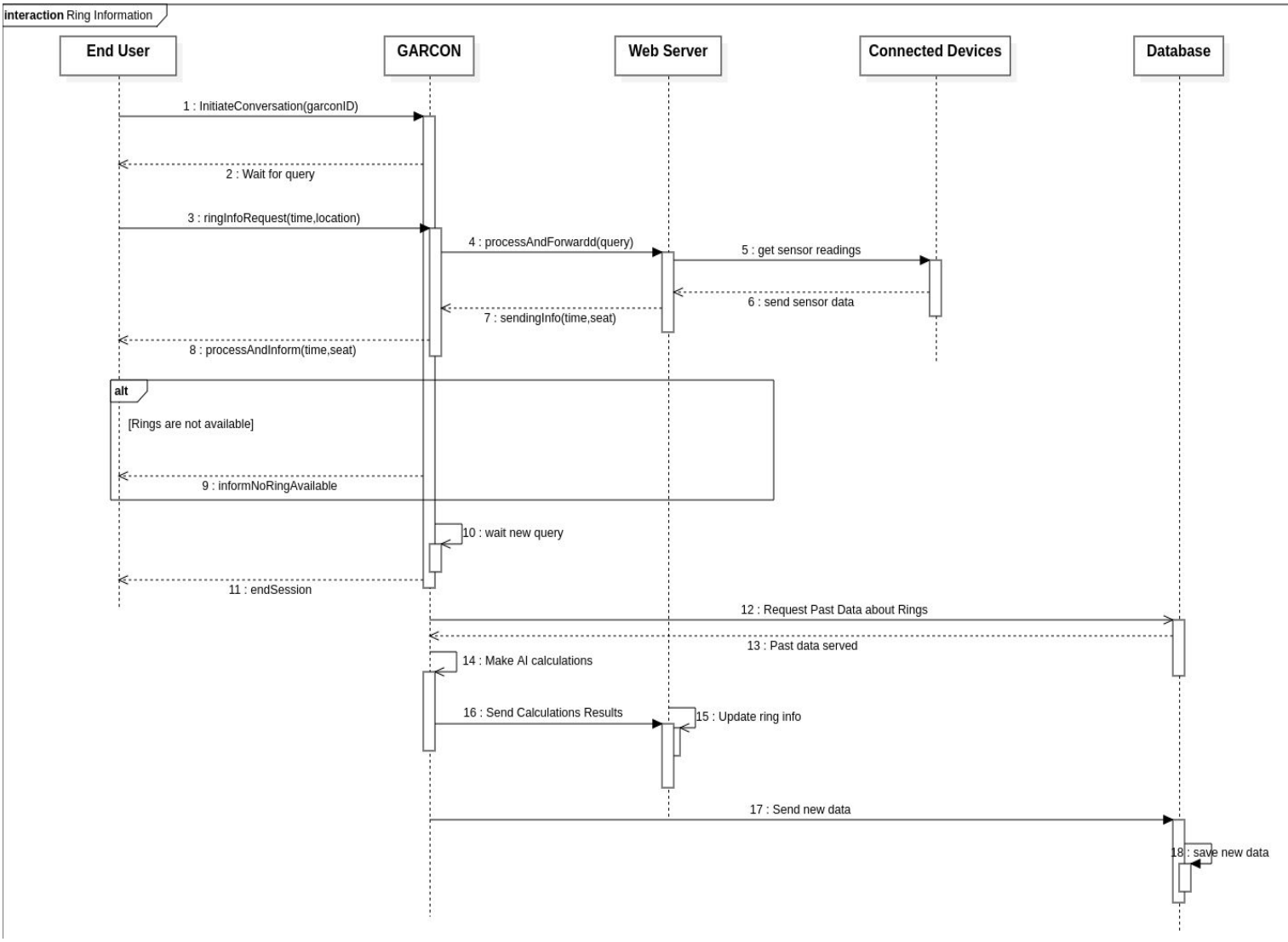

Figure 5: Sequence Diagram for Ring Information

Use case name	Arrange Traffic Lights
Actors	User , Web Server, Database System
Description	Garcon system manages traffic lights considering car crowd on the roads.
Data	Car density on the roads.
Preconditions	-
Stimulus	Necessity to efficient management of traffic in the campus.
Basic Flow	Step 1 – Connected devices sends information about the car density on the roads in the campus. Step 2 – Garcon system takes these data and processes with specialized AI algorithms. Step 3 – Processed data saved in the database system to use it later for artificial learning purposes. Step 4 – Web server system sends commands to traffic lights corresponding to their car density.
Alternative Flow	-
Exception Flow	The Web Server can't reach connected devices.
Postconditions	-

Table 4: Use Case Description for Arrange Traffic Lights

Use-case descriptions for ticket system are given below.

Use case name	Call Ambulance
Actors	End User, Service System, Database System
Description	User creates a ticket to call ambulance.
Data	Number of ambulances needed Reason for the call
Preconditions	Health problem occurs and ambulance is needed. User needs to find an access point to call ambulance.
Stimulus	Garcon gets a ticket to forward health service system.

Basic Flow	Step 1 – Health problem occurs and ambulance become necessary. Step 2 – A user creates a call ambulance ticket. Step 3 – System gets the ticket and communicates with health service systems to send ambulance
Alternative Flow	-
Exception Flow	If system can't contact with health service systems, it can't request ambulance.
Postconditions	User is informed about process with a report back. Ambulance arrives to the needed point. A system log will be created and sent to database.

Table 5: Use Case Description for Call Ambulance

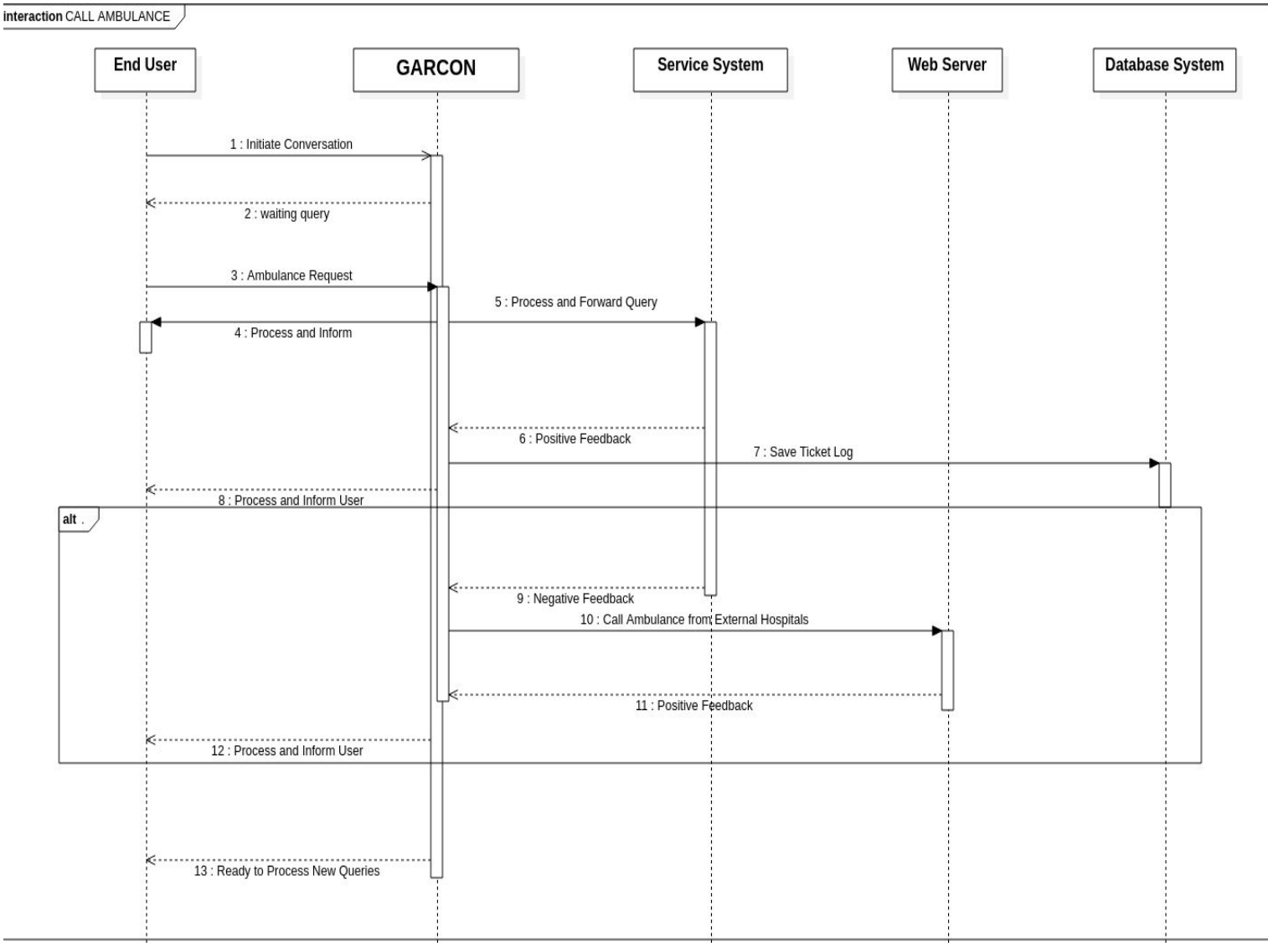

Figure 6: Sequence Diagram for Call Ambulance

Use case name	Call Security
Actors	End User, Service System, Database System
Description	A user recognizes a security issue and creates a ticket to get security units.
Data	Reason for the call Level of danger Location
Preconditions	Security problem occurs and units are needed. User needs to find an access point to call security.
Stimulus	Garcon gets a security ticket to forward security service system.
Basic Flow	Step 1 – Security problem occurs and units are needed. Step 2 – A user creates a call security ticket specifying danger level. Step 3 – System gets the ticket and communicates with security systems to send units. Step 4 – Service responds to system and sends the units.
Alternative Flow	-
Exception Flow	If system can't contact with health service systems, security units can't be requested.
Postconditions	User will be reported back to get informed about the process. Security units will arrive at the time that user is informed about. A system log will be created and sent to database.

Table 6: Use Case Description for Call Security

3.3. Usability Requirements

req32: The system shall be easy to use and work with only voice commands.
req33: The user shall be able to access system from any garcon access point.
req34: The user shall get both services (information and ticket) as long as there is no abuse case.
req35: At the end of every session, the user shall be able to rate the system behaviour and overall experience.
req36: Users shall be able to create a conversation with access point by givin a simple voice query.
req37: Every ticket process shall have a report back future to help the user understand process.
req38: The system shall have an FAQ section to help users about how to fully use Garcon.
req39: The system shall have accessible stations to help people with special needs better.

3.4. Performance Requirements

req40: The system shall be able to handle the situation that every garcon access point is being used and all personnel is online.
req41: The system shall fetch the information that user requested in at most 10 seconds.
req42: Backend of the system shall have at least 16 Gbps bandwidth and symmetric 1 Gbps upload/download speed.
req43: The system shall let the sensor devices send recent data every single minute.
req44: Database of the system shall be synchronized with three separate databases and these three databases shall work concurrently. They shall be designed as at least one of them work at any time instant (including maintenance times).
req45: The system overall speed shall not see a decrease over 15% while creating log files.
req46: Access points shall use UDP (User Datagram Protocol) to send some packets in order to speed up the data communication process.

3.5. Logical database Requirements

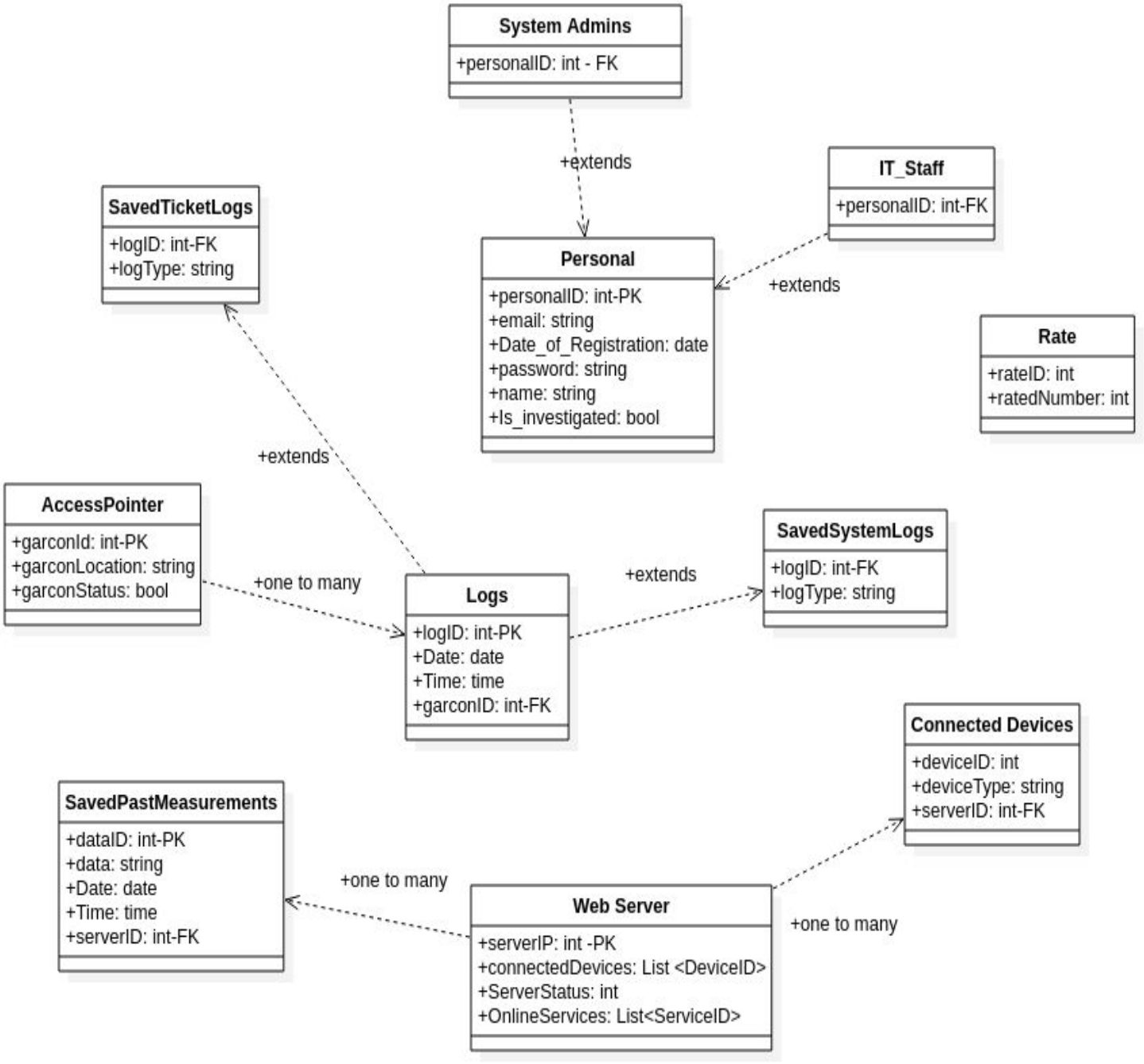

Figure 7: Key Data Objects and Attributes

req47: Only system admins shall have an access to system admins table.
req48: Only system admins shall be able to add new entry to system admins table.
req49: Only consensus of admins shall remove an entry from admin table.
req50: Saved System Logs table and Saved Ticket Logs table are weak entities of Logs table.
req51: Only system admins shall be able to see Saved Ticket logs table and search in it.
req52:Entries of Saved Ticket Logs table shall be updated when new ticket is created.
req53:Access Pointer table shall be updated when new Garcon access point is established.
req54:Only system admins shall be able to change garconStatus entry in the AccessPointer table.
req55: System's IT staff shall have an access to Rate table.
req56:Entries of Rate table shall be updated when an end-user gives rate.
req57: Only system's IT staff shall have an access to Saved System Logs table and search in it.
req58:Entries of Saved System Logs table shall be updated when new system log is created.
req59:When a new device is connected to the system,Connected Devices table shall be updated.
req60:Saved Past Measurements table shall be updated by web server system for each given measurement.
req61:Admin passwords and IT Staff passwords shall be encrypted when login.
req62:Completeness of database system shall be done by IT staff.
req63: Database backup shall be done by IT Staff.
req64:Web server table is in 1 to many relationship with Saved Past Measurements table and connected devices table.
req65:Web server table shall keep Online services and connected devices.
req66:Web server table shall be updated when services' status is changed.

3.6. Design constraints

req67: The system shall be designed in accordance with all constraints determined by laws.
req68: All data shall be stored for legal purposes.
req69: The system shall be working in accordance with campus rules.
req70: The system shall work well with external components, it shall not harm any outer world system or service.

3.7. Software system attributes

3.7.1. Reliability

req71: Average occurrence of failure must be once in a month.
req72: Probability of data corruption of the system shall not exceed 0.02. This shall be acquired by three concurrent databases and 6 daily backups.
req73: System shall be testable for reliability issues. Autonomous tests should be done twice a day.
req74: System shall have an emergency hardware to call needed ambulance or security in these situations.

3.7.2. Availability

req75: Maximum maintenance time interval shall be restricted by 4 hours.
req76: System shall be available all the time except maintenance interval.
req77: Total unavailable time of the system in a year shall not exceed 24 hours. Maintenance hours are excluded.
req78: IT staff shall be responsible to rapidly solve crashes & failures, they shall also plan and execute maintenance process.
req79: All systems shall be restarted in at most 10 minutes after failure.

3.7.3. Security & Privacy

req80: Database Management Interface shall be durable to any database injection and man-in-the-middle attacks.
req81: Passwords of authorized members should be encrypted using SHA512.
req82: Web Server shall pass the Vulnerability Scanning and it shall be protected against DOS attacks.
req83: Access points and the system in general shall be protected against all type of abuses.
req84: Non-authorized members shall not access the information they are prohibited from.
req85: Implementation details of the system shall be preserved and all use shall be prohibited by certificates.
req86: Personal data of the members in database shall be encrypted and protected.

3.8. Supporting information