Garcon

Software Design

Description

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# Introduction

## Purpose of the System

The purpose of the project is making METU campus smarter than ever. Making the campus an interactive environment for both students and workers. When there is a campus wide security issue, or environment issue students can immediately inform workers of campus with this system. In addition, it enables students to get information about campus transportation and food possibilities.

## Scope

The scope of this project is providing users to talk interactively with campus workers or  
gathering information about campus. To accomplish this task an embedded system will be developed. Two potential groups of users exists:  
● Students that wants to gather information about campus or open a ticket about a  
security or environment issue.  
● Workers which is a group of campus employees that can see and close issues opened  
by students.  
Garcon makes campus an interactive and informative environment with functionalities  
like gathering transportation data and event data around campus, opening security or  
cleaning issues and ordering food.  
Therefore, the software has four main  
products:  
● Mail Service  
● Server  
● Speech to Text Service  
● Third party software called Yemeksepeti API  
By this software, users will be able to talk with this system to gather information  
instead of searching on the web or calling some people.

## Stakeholders and Their Concerns

**User:** Usersare only University students, who can access the system with their ID Cards. Their primary concern is getting campus information no matter where they are and giving feedbacks to relevant persons via opening issues to make campus a better place.

**Worker:** Workers are University employees who can access the system with their ID Cards just like Users. Their concern is solving issues opened by the Users.

**Admin:** Admins are the people who can access the system via a web interface. Their primary concern is manage the system users(students, workers).

# References

*IEEE standard for information technology--systems design--software design descriptions*. (2009). New York, NY: Institute of Electrical and Electronics Engineers.

# Glossary

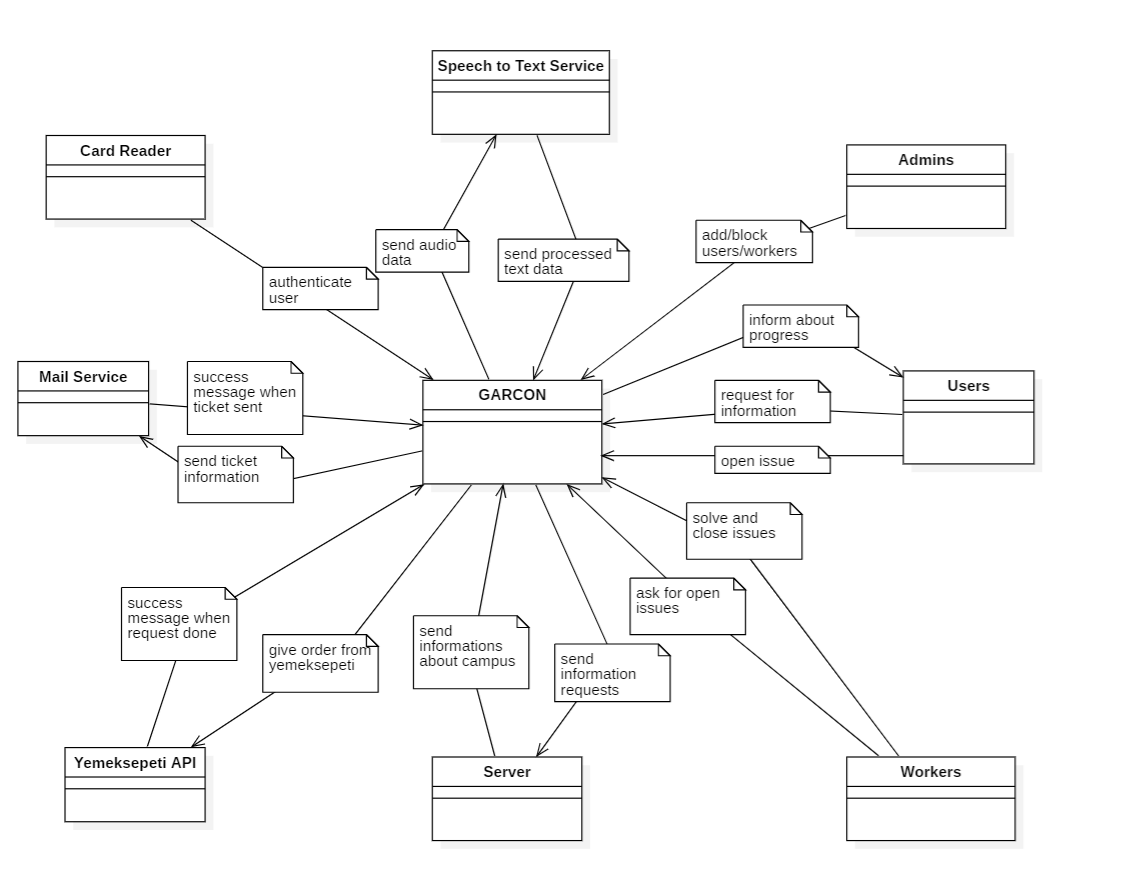
|  |  |
| --- | --- |
| **Term** | **Definition** |
| **User** | The end user(student) who is interacting with  Garcon to query for information. |
| **Worker** | Campus personnel that uses Garcon for  closing issues. |
| **Admin** | The most privileged person who registers  new users/workers to the system and deletes them.  Also responsible from maintenance. |
| **Yemeksepeti** | An online food ordering company working with  Garcon Project. |
| **Yemeksepeti API** | An external API which provides ordering food  functionality. |
| **SATA** | Serial AT Attachment |
| **CRUD** | Create, read, update, delete operations of persistent  Storage. |
| **DB** | Database |
| **API** | Application programming interface. |
| **Speech to text Service** | A service that can analyse the speech and decide whether it is about an issue or is an information request |

Table 0: Glossary

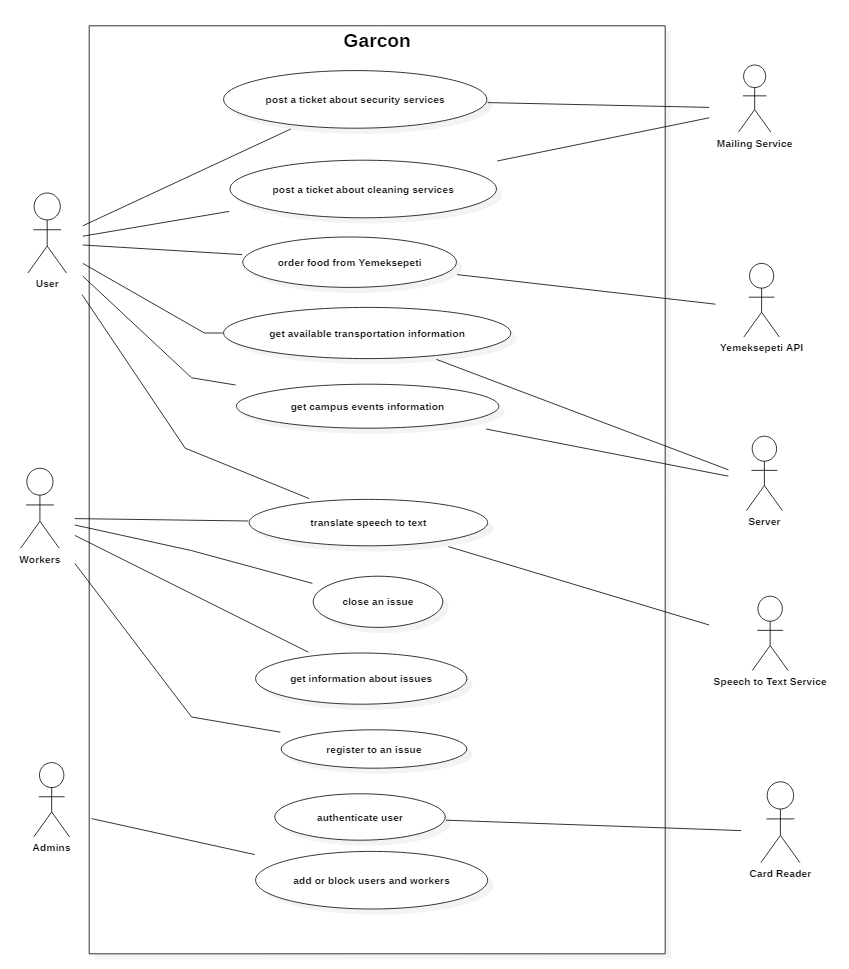
# Architectural Views

## Context View

In this viewpoint, all system use cases and descriptions explained with details. These descriptions show how system should behave in specific situations and how the functionalities implemented. Context diagram shows how users and other subsystems interacts with each other and use case diagram and functionality descriptions specified below the context diagram.



**Figure 1: Context Diagram**



**Figure 2: Use Case Diagram**

Table 1: Open security issue function

|  |  |
| --- | --- |
| **Use case name** | Issue about security service |
| **Actors** | Users, Speech to Text Service, Mailing Service, Server |
| **Description** | If a user notices a security issue he/she can notify related workers via Garcon. |
| **Data** | Audial input from user |
| **Preconditions** | User should be authenticated |
| **Stimulus** | User giving audial input about issuing a security request |
| **Basic Flow** | Step 1 – User gives audial input  Step 2 – Audial input gets processed by Speech to Text Service  Step 3 – Issue is created and server side is informed  Step 4 – Processed text of audial input is sent as an email to the related workers  Step 5 – User is informed that issue is registered |
| **Alternative Flow** | Step 3 – System detects same request already issued  Step 4 – Importance level of request is updated  Step 5 – User is informed that issue is already registered |
| **Exception Flow** | - |
| **Post conditions** | An issue instance is created on system and related workers are informed. |

Table 1: Open security issue function

|  |  |
| --- | --- |
| **Use case name** | Issue about cleaning service |
| **Actors** | Users, Speech to Text Service, Mailing Service, Server |
| **Description** | If a user notices a cleaning issue he/she can notify related workers via Garcon. |
| **Data** | Audial input from user |
| **Preconditions** | User should be authenticated |
| **Stimulus** | User giving audial input about issuing a cleaning request |
| **Basic Flow** | Step 1 – User gives audial input  Step 2 – Audial input gets processed by Speech to Text Service  Step 3 – Issue is created and server side is informed  Step 4 – Processed text of audial input is sent as an email to the related workers  Step 5 – User is informed that issue is registered |
| **Alternative Flow** | Step 3 – System detects same request already issued  Step 4 – Importance level of request is updated  Step 5 – User is informed that issue is already registered |
| **Exception Flow** | - |
| **Post conditions** | An issue instance is created on system and related workers are informed. |

Table 2: Open cleaning issue function

|  |  |
| --- | --- |
| **Use case name** | Order food from Yemeksepeti |
| **Actors** | Users, Speech to Text Service, Yemeksepeti API |
| **Description** | When user asks for ordering food, the request translated into text first, gets analyzed and then system automatically give an order from Yemeksepeti |
| **Data** | Audial input from user |
| **Preconditions** | User should be authenticated |
| **Stimulus** | User giving audial input about ordering food |
| **Basic Flow** | Step 1 – User gives audial input  Step 2 – Audial input gets processed by Speech to Text Service  Step 3 – A request is posted to Yemeksepeti Api  Step 4 – Success message shown to the user |
| **Alternative Flow** | - |
| **Exception Flow** | If any error occurs or restaurant is closed , system will show a log message. |
| **Post conditions** | User gives an order from Yemeksepeti. |

Table 3: Order food function

|  |  |
| --- | --- |
| **Use case name** | Get transportation information |
| **Actors** | Users, Speech to Text Service, Server |
| **Description** | Information service on transformation info. User can get a possible route to a direction from the device he/she is now interacting with and user can get information about transportation schedules. |
| **Data** | Audial input from user, current transportation services’ data, map data |
| **Preconditions** | Worker should be authenticated |
| **Stimulus** | User giving audial input about getting informed on transportation |
| **Basic Flow** | Step 1 – User gives audial input asking directions  Step 2 – Audial input gets processed by Speech to Text Service  Step 3 – Best possible route and its transformation information is obtained from the server  Step 4 – Information is converted to audio form by Speech to Text Service  Step 5 – User is informed |
| **Alternative Flow** | Step 1 – User gives audial input asking transportation schedules  Step 2 – Audial input gets processed by Speech to Text Service  Step 3 –Transformation information on ring, bus, subway services is obtained from the server  Step 4 – Information is converted to audio form by Speech to Text Service  Step 5 – User is informed |
| **Exception Flow** | - |
| **Post conditions** | User is informed with best routes and transportation information and information about this query is saved to database to inform further queries faster. |

Table 4: Get transportation info function

|  |  |
| --- | --- |
| **Use case name** | Get campus events informations |
| **Actors** | Users, Speech to Text Service, Server |
| **Description** | When user asks for available events in campus, server interacts the database and submits events for user’s information. |
| **Data** | Audial input from user |
| **Preconditions** | User should be authenticated |
| **Stimulus** | User giving audial input about campus event informations |
| **Basic Flow** | Step 1 – User gives audial input  Step 2 – Audial input gets processed by Speech to Text Service  Step 3 – Available events searched in server  Step 4 – Available events are converted to audio format.  Step 5– Events listed to the user. |
| **Alternative Flow** | Step 4 – If no event is available on campus, Garcon will not give any listings. |
| **Exception Flow** | If any error occurs, system will show an error message |
| **Post conditions** | System shows all events |

Table 5: Get event information function

|  |  |
| --- | --- |
| **Use case name** | Close an issue |
| **Actors** | Workers, Speech to Text Service, Mailing Service, Server |
| **Description** | Workers close issues they have handled. |
| **Data** | Audial input from worker |
| **Preconditions** | Worker should be authenticated |
| **Stimulus** | Worker giving audial input about closing an issue |
| **Basic Flow** | Step 1 – Worker gives audial input  Step 2 – Audial input gets processed by Speech to Text Service  Step 3 – Issue is closed and server side is informed  Step 4 – Worker is informed that issue is closed |
| **Alternative Flow** | - |
| **Exception Flow** | - |
| **Post conditions** | The issue is marked as solved on system. |

Table 6: Close issue function

Table 6: Close issue function

|  |  |
| --- | --- |
| **Use case name** | Register to an issue |
| **Actors** | Workers, Speech to Text Service, Server |
| **Description** | Workers register to an issue to prevent possible conflicts. |
| **Data** | Audial input from worker, current registered workers on the issue |
| **Preconditions** | Worker should be authenticated |
| **Stimulus** | Worker giving audial input about registering to an issue |
| **Basic Flow** | Step 1 – Worker gives audial input  Step 2 – Audial input gets processed by Speech to Text Service  Step 3 – Current workers on issue are displayed to worker  Step 4 – Worker is asked a confirmation after seeing current workers on issue  Step 5 – With workers confirmation he is registered to issue (Database update) |
| **Alternative Flow** | - |
| **Exception Flow** | If worker does not confirm after seeing current workers on the issue the process is aborted. |
| **Post conditions** | The worker is registered to issue. |

Table 7: Register issue function

|  |  |
| --- | --- |
| **Use case name** | Getting informations about issues |
| **Actors** | Workers, Speech to Text Service |
| **Description** | Worker scans his/her id card and Garcon gets activated. Then waits for worker to talk to decide what to do. |
| **Data** | Audial input from worker |
| **Preconditions** | Worker should be authenticated |
| **Stimulus** | Worker giving audial input about open issues |
| **Basic Flow** | Step 1 – Worker gives audial input  Step 2 – Audial input gets processed by Speech to Text Service  Step 3 – Server returns open issues from Database |
| **Alternative Flow** | - |
| **Exception Flow** | - |
| **Post conditions** | Worker can see the whole available/open issues from database. |

Table 8: Get issue information function

|  |  |
| --- | --- |
| **Use case name** | Authentication |
| **Actors** | Users, Workers, Admins, Card Reader |
| **Description** |  |
| **Data** | Chip from Id Cards |
| **Preconditions** | - |
| **Stimulus** | Id Card must be scanned |
| **Basic Flow** | Step 1 – User/Worker/Admin holds Id Card to the device  Step 2 – Device reads the Card and authenticate |
| **Alternative Flow** | - |
| **Exception Flow** | Step 1 – Card doesn’t recognized or cannot be scanned  Step 2 – System displays a visual error output |
| **Post conditions** | Authenticate successful and device gets waiting for audial input to work. |

Table 9: Authentication

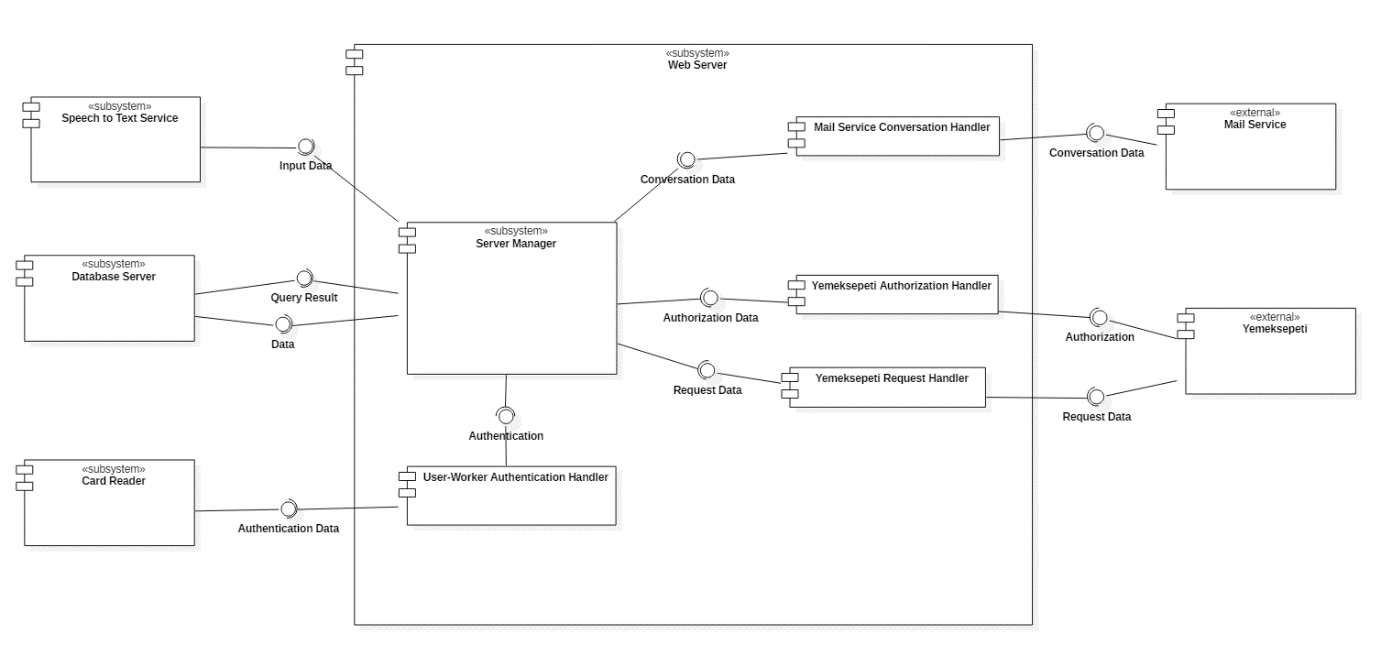
|  |  |
| --- | --- |
| **Use case name** | Adding users |
| **Actors** | Admin |
| **Description** | Admin adds new user to database |
| **Data** | - |
| **Preconditions** | Admin should be authenticated |
| **Stimulus** | Admin giving information about new user |
| **Basic Flow** | Step 1 – Admin gives information about user  Step 2 – Input gets processed by Speech to Text Service  Step 3 – User Id Card Scanned  Step 4 – New user added |
| **Alternative Flow** | - |
| **Exception Flow** | Step 1 – Admin gives information about user  Step 2 – Input cant be recognized  Step 3 – System gives a warning |
| **Post conditions** | New user added to the database. |

Table 10: Add user function

|  |  |
| --- | --- |
| **Use case name** | Blocking users |
| **Actors** | Admin |
| **Description** | Admin blocks user from database |
| **Data** | - |
| **Preconditions** | Admin should be authenticated |
| **Stimulus** | Admin gives delete command and gives information |
| **Basic Flow** | Step 1 – Admin gives information about user to be deleted  Step 2 – Input gets processed by Speech to Text Service  Step 3 – User deleted |
| **Alternative Flow** | - |
| **Exception Flow** | Step 1 – Admin gives information about user  Step 2 – Input cant be recognized  Step 3 – System gives a warning |
| **Post conditions** | User deleted from the database. |

Table 11: Block user function

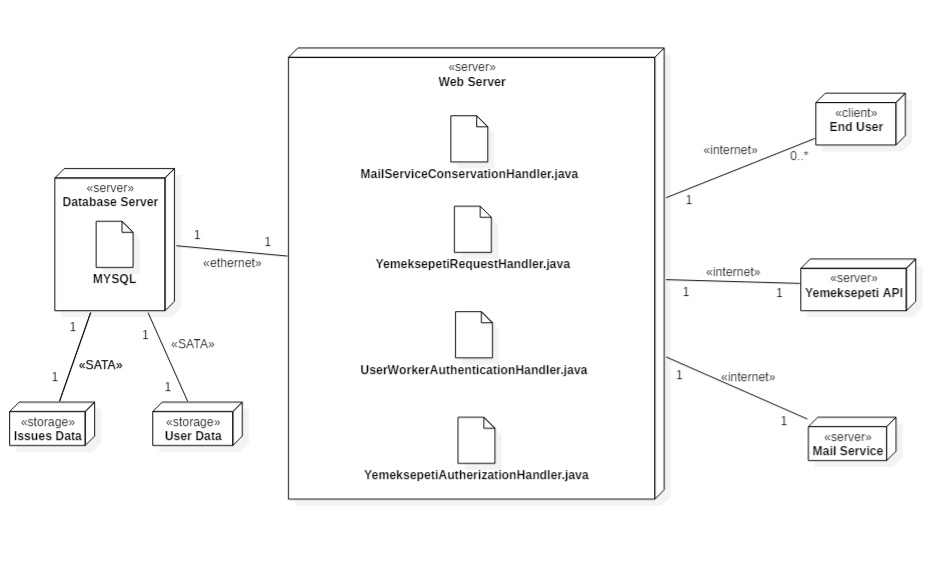
## Composition View



**Figure 5: Component Diagram**

**Design Rationale:**

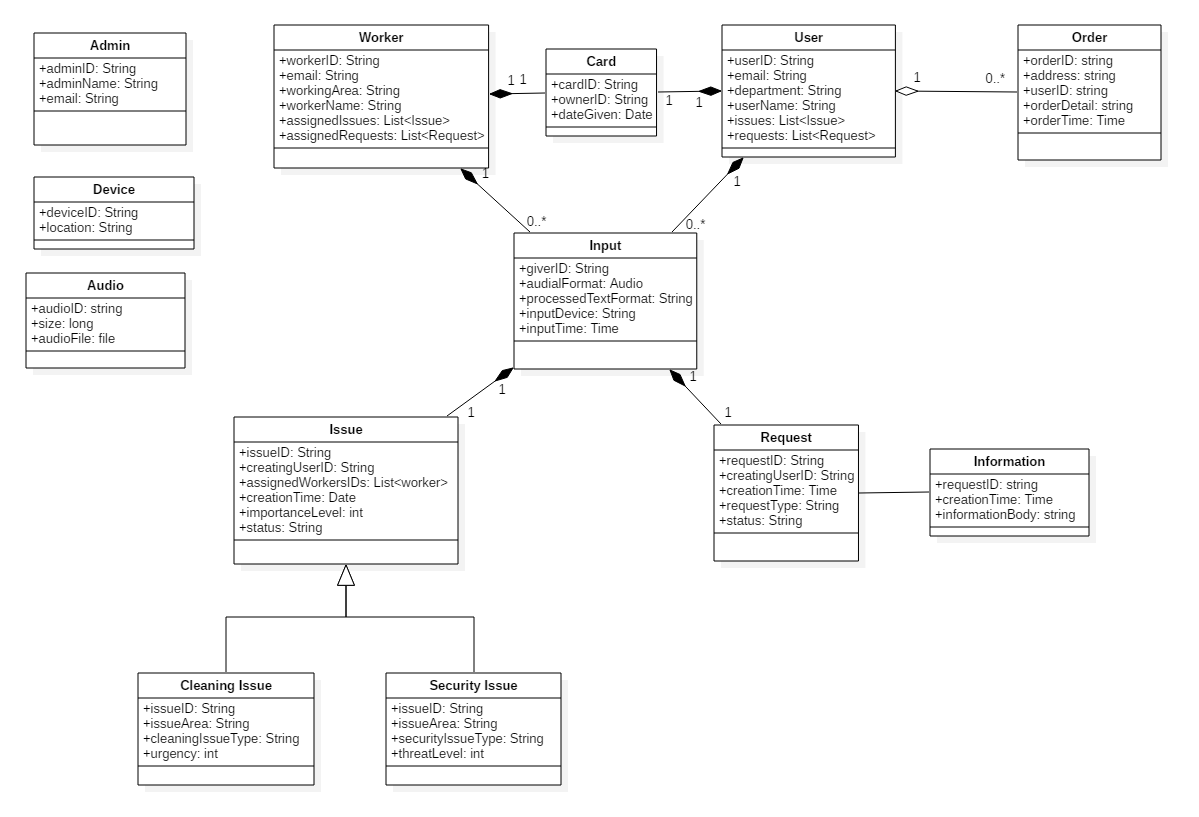
* Server Manager is the fundamental component, which manages/handles information flow and data flow in the Web Server. Moreover, it authorizes/authenticates users and workers.
* Card reader is the component for authentication of users and workers. When Card Reader reads data from ID card, it will direct Authentication Data to User-Worker Authentication handler.
* User-Worker Authentication handler component is responsible from user and worker authentication to the system. It processes raw authentication data coming from card reader.
* Speech to Text Service is the main input provider for system. It converts given audial data to processable data that will be forwarded to Server Manager.
* Database Server is the component that securely stores the related data and provides it when needed.
* Since mailing is the main conversation between workers and system itself, Mail Service is an external component, which is dedicated for managing conversation.
* Mail Service Conversation Handler is the component responsible for providing processed conversations and related data (timestamps, target workers…).
* Yemeksepeti is the external component for ordering food. Two components are responsible from the interaction between Server Manager and Yemeksepeti. Firstly, Yemeksepeti Authorization Handler manages the authorization of user to Yemeksepeti. Secondly, Yemeksepeti Request Handler processes and manages users’ orders from Yemeksepeti.

**Figure 6: Deployment Diagram**

**Design Rationale:**

* We use Java/Spring in web server side and DB is managed by MySQL.
* The end users who uses Garcon to get information or opening an issue will communicate with system with talking.
* Garcon will take audial input and translate into a text input and sends appropriate handler.
* There are two separate DB storage:
  + Issue storage is for storing all issues.
  + User storage is for storing all information about admins/workers/regular users.
* We SATA for all storage since it has much larger storage space to store whole issue/user.
* All internet-based connections will use encrypted communication protocols.

## Information View



**Figure 7: Database Class Diagram**

|  |  |
| --- | --- |
| **Operation** | **CRUD Operations** |
| addUser | Create – User  Read –  Update –  Delete – |
| deleteUser | Create –  Read –  Update –  Delete – User |
| addWorker | Create – Worker  Read –  Update –  Delete – |
| deleteWorker | Create –  Read –  Update –  Delete – Worker |
| convertAudioToText | Create – Input  Read – Audio  Update –  Delete – |
| convertTextToAudio | Create – Audio  Read – Input  Update –  Delete – |
| createIssue | Create – Issue  Read –  Update –  Delete – |
| registerToIssue | Create –  Read –  Update – Issue, Worker  Delete – |
| closeIssue | Create –  Read –  Update – Issue, Worker  Delete – |
| createRequest | Create – Request  Read –  Update –  Delete – |
| getAssignedIssues | Create –  Read – Worker  Update –  Delete – |
| getAssignedRequests | Create –  Read – Worker  Update –  Delete – |
| forwardOrder | Create –  Read – Order  Update –  Delete – |
| forwardOrderReply | Create –  Read –  Update – Order  Delete – |
| authorizeUser | Create –  Read – User  Update –  Delete – |
| authenticateUser | Create –  Read – User  Update –  Delete – |
| authenticateWorker | Create –  Read – Worker  Update –  Delete – |

Table 12: CRUD Operations

**Design Rationale:**

* MySQL is the Database Management System used in the project.
* An Issue is either a cleaning issue or a security issue.
* Request and Information classes always coexist.
* Users has Orders but orders can outlive users.
* Users, Workers are stored in Database Management System for usage of admins and Issues/Requests are stored in Database Management System for usage of workers and users.
* Every entity is stored in database in order to provide persistency of data.

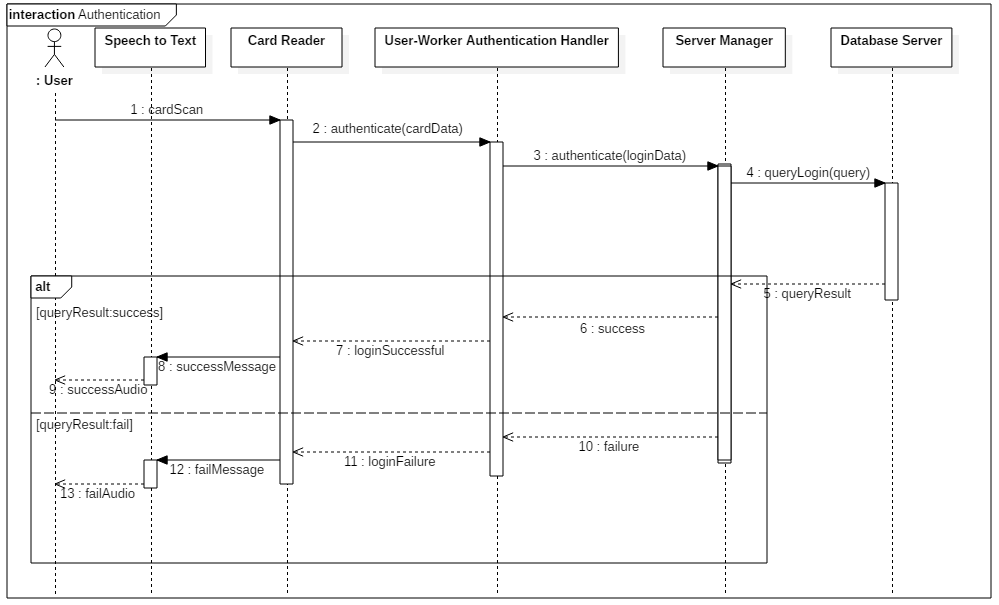
## Interface View

### Internal Interfaces

**The Interface Between the Database Server and the Server Manager:** Server manager queries the Database Server when an operation on a specific information. The query passed as string and Database Management System runs it as MySQL. If query fails, Database Server returns an error message to the Server Manager, if query is successful; Database Server returns the query result to the Server Manager.

**Design Rationale:**

* Since some students will graduate and some new students will come to the university, keeping user data is important. Therefore, an interface between Database Management System and Server Manager is required.



**Figure 8:** Sign in sequence diagram between Server Manager and Card Reader

**The Interface Between Server Manager and Card Reader:**  When a user shows his/her ID card to the Card Reader, all information on card scanned by Card Reader. Then, the information passes to the Database Management System to check whether there is a user with given information. If there is, Garcon will wait for user’s audial input for getting requests but if there is not a user with given information, Garcon will return error message.

**Design Rationale:**

* User-Worker Authentication Handler is an internal step of communication between Server Manager and Card Reader.
* System is available only to the campus student so there must be an authentication system which involves the Card Reader.
* Workers also log in with same procedure by showing their ID Cards.

**The Interface Between Server Manager and the Speech to Text Service:** In order to communicate system with audial input, there must be a speech to text converter. System takes input as audio file and passes to the speech to text service, and then this service returns a string of given input.

**Design Rationale:**

* There is a need for interfacing server manager with speech to text service since system cannot understand the user’s audial input directly and it needs to communicate with help of speech to text service. Thus, there have to be an interface between these components.

### External Interfaces

#### User Interfaces

**Student Interface:** Student interface allows students to interact with Garcon system and use all functionalities of the system. All interactions done via audial input and outputs. Only after students show their ID Cards to the card reader and card scan is successful the system will wait for the audial input from student. Then, student can perform queries, order foods or create tickets just by giving related audial inputs.

**Design Rationale:**

* The audio-based interface design provides user to access Garcon functionalities easily.
* It does not require students to use some syntax; it is in daily natural language.
* User Interface is kept simple by providing only audial interface because simplistic design on common use devices is crucial at crowded areas.

**Worker Interface:** Worker interface allows workers to query about open issues, and functionalities like closing/updating issues. This interface works with audial input like in the student interface. However, it does not have functionalities like food ordering as Student Interface has.

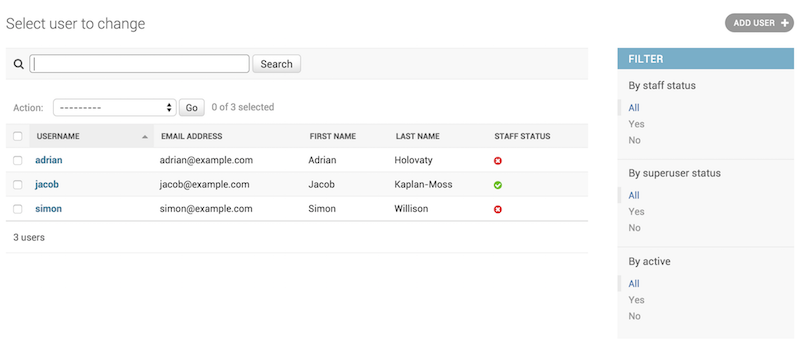
**Design Rationale:**

* The audio-based interface design provides workers to access functionalities about issues easily.
* It does not require students to use some syntax; it is in daily natural language.
* Worker interface is kept simple by providing only audial interface because some workers may not be able to perceive the complexity of using both audial and graphical interfaces.

**Admin Interface:** This interface allows admins to do operations on users and workers. They can add workers and users to the database or they can delete workers and users from database. This interface operates on a web browser, unlike user and worker interface. To login the admin system, admin should enter id and password. Then, they can do operations(generally CRUD) on users/workers.

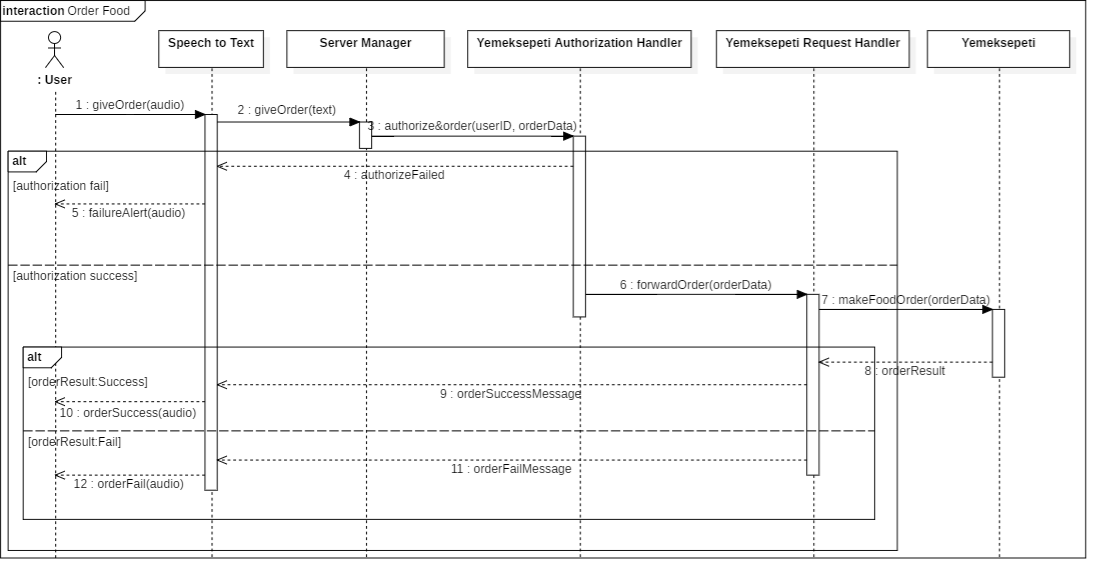
**Design Rationale:**

* Since the design of the interface is simple, probability of misusing the service is reduced.
* Single paged interface design provides functionality and information to be accessible altogether at one place.
* An admin can gain access to this interface by being registered by another admin.



**Figure 9**: Admin interface

#### System Interfaces

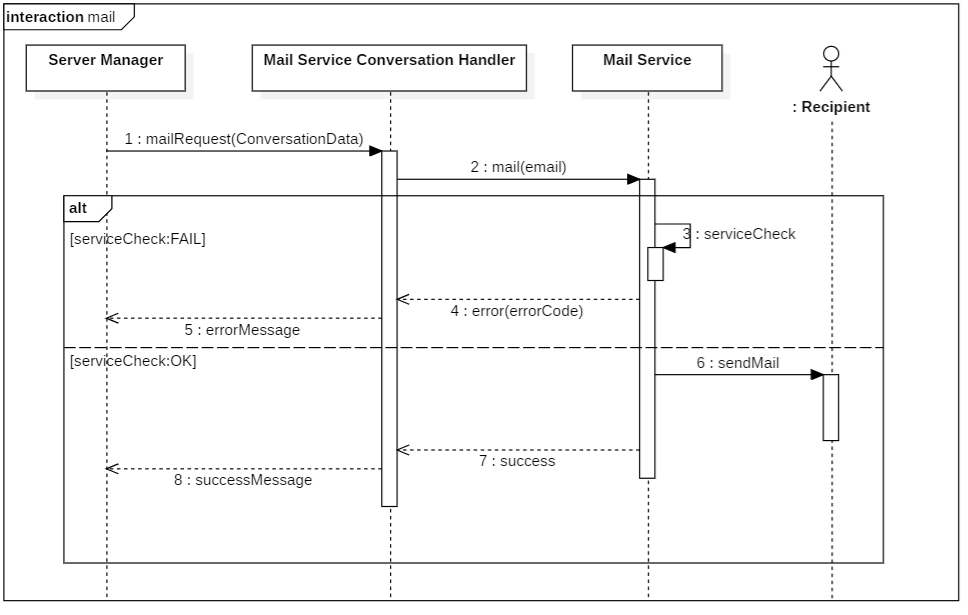
****

**Figure 10:** Sequence diagram showing ordering food from Yemeksepeti API

**The Interface between the Server Manager and Yemeksepeti API:** Server Manager will be responsible for composing food order data and getting report from the Yemeksepeti API. After getting this report, according to report type system takes action. If report is success report, system will return user a success message in audio format, if report is failure, then system will return user the reason of this failure in audio format.

**Design Rationale:**

* Yemeksepeti Authorization Handler validates user’s access and rights on Yemeksepeti.
* In case of an authorization failure Yemeksepeti Request Handler will not be used.
* If an error occurs in any part of processes, it will be reported back to the user in audio format.

****

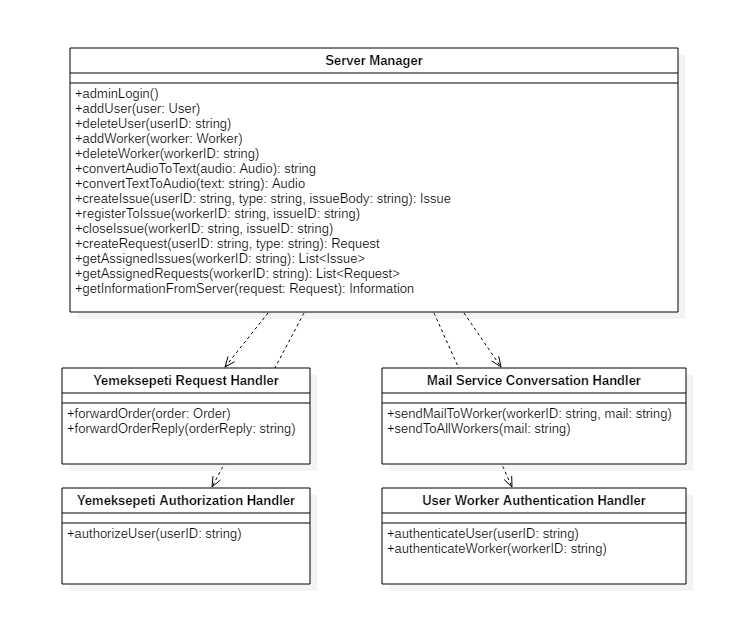
**Figure 11:** Sequence Diagram showing the interface between mail service and server manager

**The Interface between the Server Manager and Mail Service:** Server manager will be responsible for composing mail and sent this mail data to the mail service. When Mail Service Conversation Handler takes this mail data, it will generate an email, and sends it to Mail Service. Then, Mail Service performs a service check if any error occurs it returns error message to the Server Manager else Mail Service sends mails to the correspondent users(recipients). After sending the mails system returns success message.

**Design Rationale:**

* Communication between Server Manager and Mail Service is alive only when a request opened by user is about an issue.
* Mail Service Conversation Handler is responsible from the communication between Mail Service and Server Manager
* If mail does not reach to the recipient because of some unknown error, system does not do anything about it, it just continues to regular routine. A new mail will be sent after some time passes as regular routine.

### Service Interfaces

 **Figure 12: Service Interfaces Class Diagram**

|  |  |
| --- | --- |
| **Operation** | **Description** |
| adminLogin | Admin logs into the system |
| addUser | Admin registers new user to the system |
| deleteUser | Admin deletes existing user from the system |
| addWorker | Admin registers new worker to the system |
| deleteWorker | Admin deletes existing worker from the system |
| convertAudioToText | System interacts with the Speech To Text Service and get audio converted to text |
| convertTextToAudio | System interacts with the Speech To Text Service and get text converted to audio |
| createIssue | User creates a new issue which is a security or a cleaning issue |
| registerToIssue | Worker registers to an issue before handling the issue |
| closeIssue | After the worker handles the issue he/she closes the issue |
| createRequest | User creates a new request of information |
| getAssignedIssues | Shows the current assigned issues of the worker |
| getAssignedRequests | Shows the current assigned requests of the worker |
| getInformationFromServer | Gets the information requested by user from server |
| forwardOrder | Forwards user’s food order to yemeksepeti |
| forwardOrderReply | Forwards reply of yemeksepeti to user’s food order back to user |
| authorizeUser | Authorizes current user to yemeksepeti system |
| sendMailToWorker | Sends the mail to a specified worker |
| sendMailToAllWorkers | Sends the mail to all workers |
| authenticateUser | Authenticate user to the system via the card info read by card reader |
| authenticateWorker | Authenticate worker to the system via the card info read by card reader |

Table 13: Operation Descriptions

|  |  |  |  |
| --- | --- | --- | --- |
| **Operation** | **Inputs** | **Outputs** | **Exceptions** |
| adminLogin |  | If successful returns True else False | -Database Server Error |
| addUser | user | If successful returns True else False | -User already added  -Database Server Error |
| deleteUser | userID | If successful returns True else False | -User doesn’t exist  -Database Server Error |
| addWorker | worker | If successful returns True else False | -Worker already added  -Database Server Error |
| deleteWorker | workerID | If successful returns True else False | -Worker doesn’t exist  -Database Server Error |
| convertAudioToText | audio | Converted text | -Connection error |
| convertTextToAudio | text | Converted audio | -Connection error |
| createIssue | userID  type  issueBody | If successful returns True else False | -Database Server Error |
| registerToIssue | workerID  issueID | If successful returns True else False | -Worker already registered to issue  -Database Server Error |
| closeIssue | workerID  issueID | If successful returns True else False | -Issue doesn’t exist  -Database Server Error |
| createRequest | userID  type  issueBody | Returns created request | -Database Server Error |
| getAssignedIssues | workerID | List of issues | -Database Server Error |
| getAssignedRequests | workerID | List of requests | -Database Server Error |
| getInformationFromServer | request | Returns information gathered from server | -Database Server Error |
| forwardOrder | order | If successful returns True else False | -Connection error |
| forwardOrderReply | orderReply | If successful returns True else False | -Connection error |
| authorizeUser | userID | If successful returns True else False | -Connection error |
| sendMailToWorker | workerID  mail | If successful returns True else False | -Connection error |
| sendMailToAllWorkers | mail | If successful returns True else False | -Connection error |
| authenticateUser | userID | If successful returns True else False | -ID doesn’t match  -Database Server Error |
| authenticateWorker | workerID | If successful returns True else False | -ID doesn’t match  -Database Server Error |

Table 14: Operation Design

**Design Rationale:**

* Server manager is the main structure that responsible for database operations.
* Handlers are responsible for intercommunication between external/subsystems and server manager; therefore, they have operations providing functionality of that.
* All the provided methods are asynchronously working methods that are awoken by components.
* authenticateUser() and authenticateWorker() methods are using/validating the information that is read by card reader component.
* forwardOrder() method is always followed by forwardOrderReply() method.