

HOME APPLIANCE CONTROL SYSTEM

OOAD PROJECT – PHASE I

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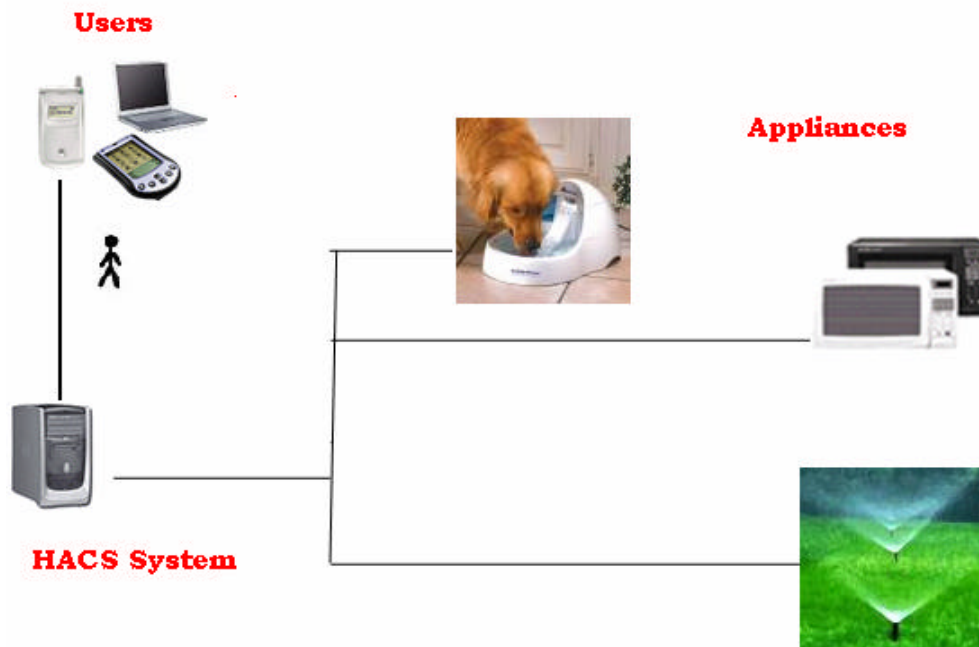
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HOME APPLIANCE CONTROL SYSTEM

1. Introduction

A home appliance control system (HACS) is a system which provides various services to remote systems such as a mobile phone, desktop and palm-top, to control, monitor and coordinate home appliances such as microwave oven, entertainment system, security system, air conditioning system, Sprinklers, Pet Feeder etc. The HACS system is illustrated below. This document furnishes the Use Case diagrams, Class diagrams, Sequence diagrams and Collaboration diagrams for the Home Appliance Control System using UML.



2. Project Overview

The Home appliance control system is controlled either by a cell phone or a by palm top or by a PC. It controls various appliance such as a microwave, sprinklers etc. The HACS system receives signals from the user either through wireless application protocol (WAP) or through Internet. The system in turn gives command to respective appliances.

The system administrator of the HACS system has the ability to add or delete a new appliance and its operations. Also the system administrator can add or delete user. The user can give commands to existing device, get the status of a device and set the operation of a specific appliance. For example if the user wants to operate Microwave then he can give commands like Cook, Warm or Defrost.

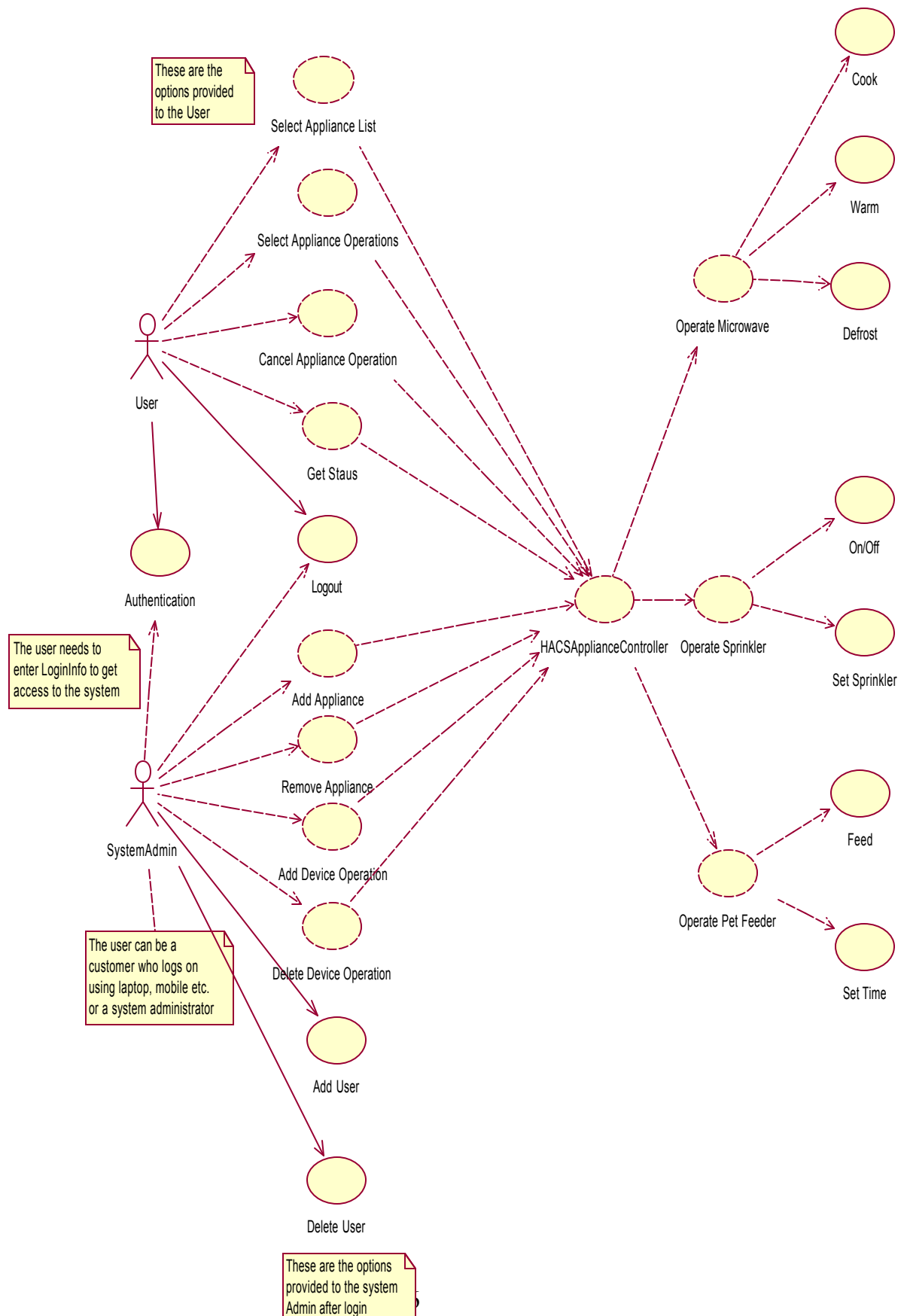
If the user wants to change his previously specified operation for a particular appliance he simply proceeds with his request. The HACS system in turn stops the current ongoing operation and processes the new request.

The HACS system is highly adaptable to changes in environment. For example user can request through system administrator to add a new device to the existing system. He can operate the system using various remote devices, for example when he is out of the house, he can use a cell phone, when at home he can use a simple remote or there will be one remote system near each family member.

3. Use Case Diagram

Use case diagrams are central to modeling the behavior of the system. It shows a set of use cases and actors and their relationships. The following figure shows the use case diagram of the HACS system from the end user point of view.

HOME APPLIANCE CONTROL SYSTEM



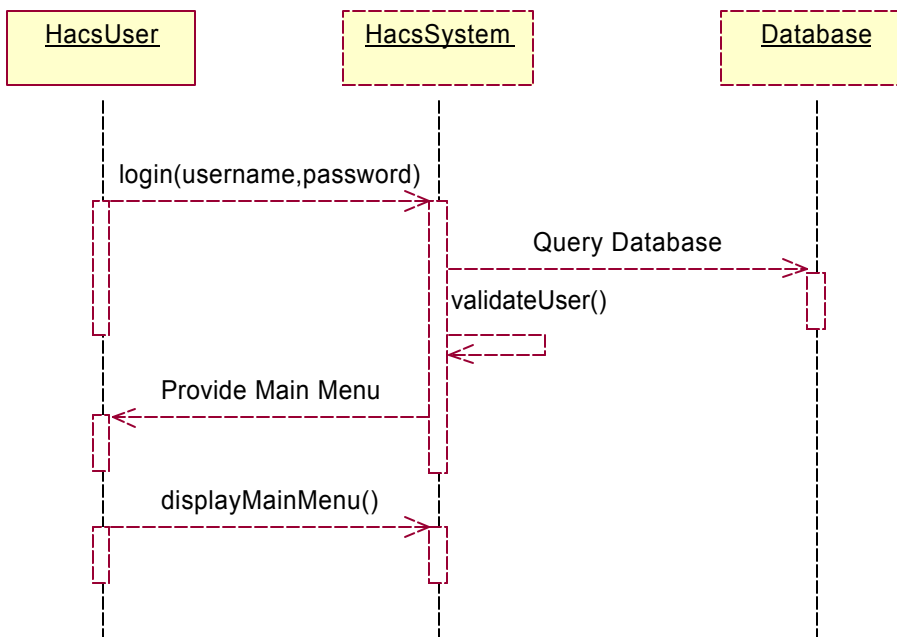
3.1 Use Case Description

3.1.1 Use Case Name -Authentication

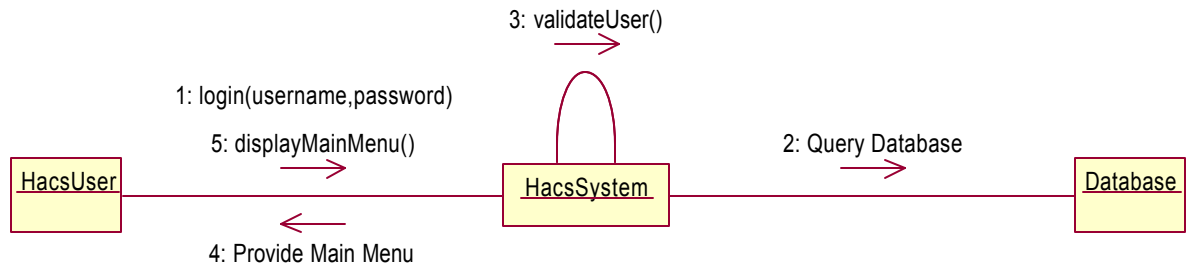
Flow of events:

- **Precondition:** User needs a valid user name and password to logon to the HACS system.
- **Main Flow:** This use case takes in the user name and password and checks for its validity.
 - After validation, the HACS Appliance Controller establishes a session between the remote user and the system.
- **Exceptional flow:** If the validation fails it sends a message and asks the user to re-enter the user name and password.
- **Post condition:** A session is established for the authenticated user

3.1.1.1 Sequence Diagram – Authentication



3.1.1.2 Collaboration Diagram - Authentication

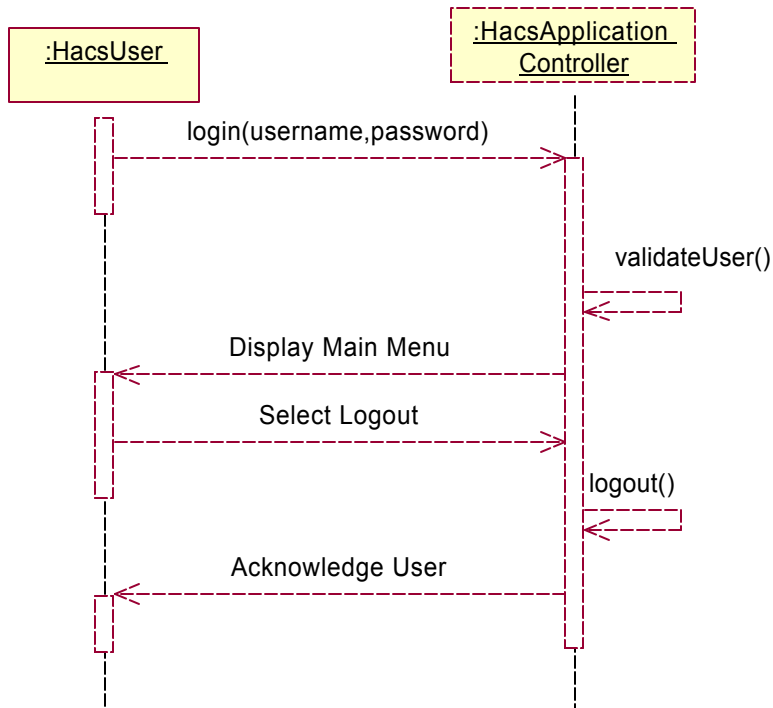


3.1.2 Use Case Name -Logout

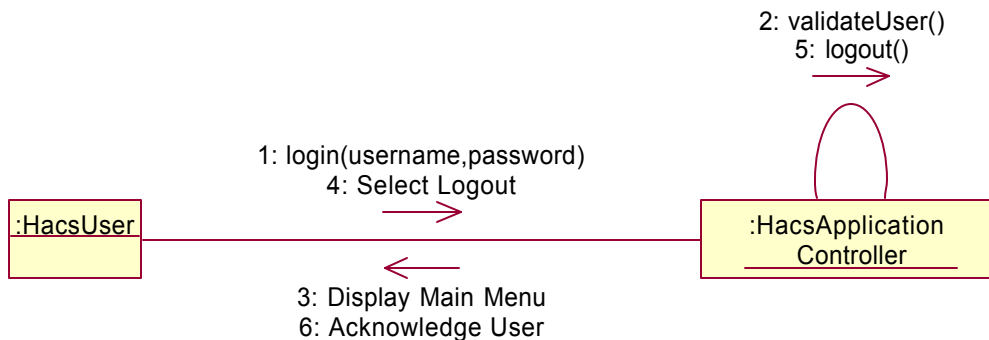
Flow of Events:

- **Pre condition:** Valid session already established.
- **Main Flow:** This use case terminates the session on users request.
- **Exceptional Flow:** due to some technical problems like power cut, the session ends abruptly.
- **Post Condition:** Session terminated.

3.1.2.1 Sequence Diagram – Logout



3.1.2.2 Collaboration Diagram – Logout

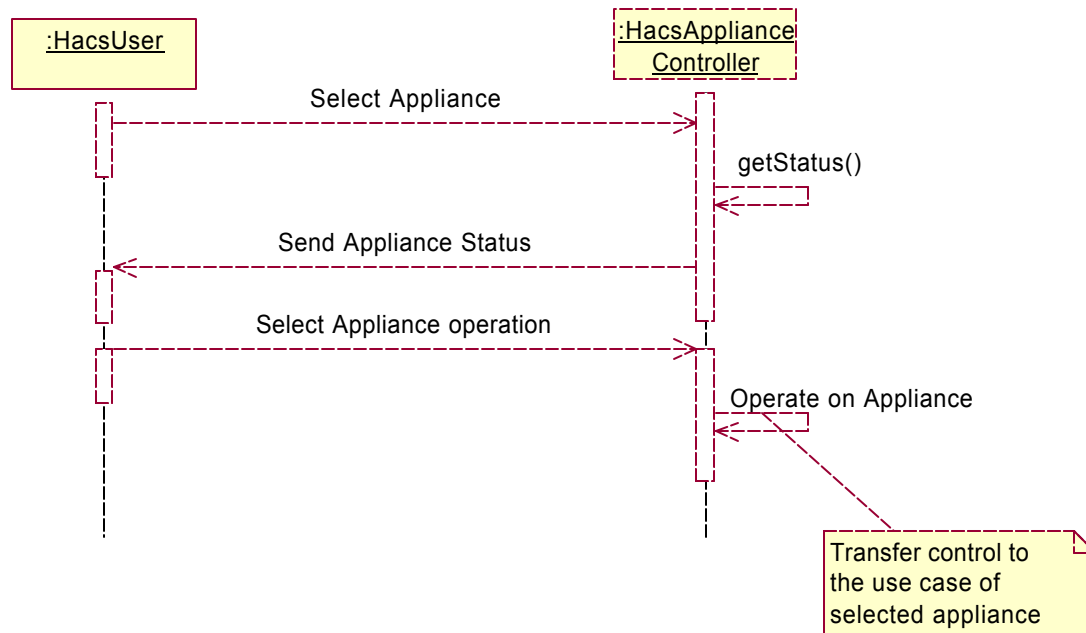


3.1.3 Use Case Name –HacsApplianceController

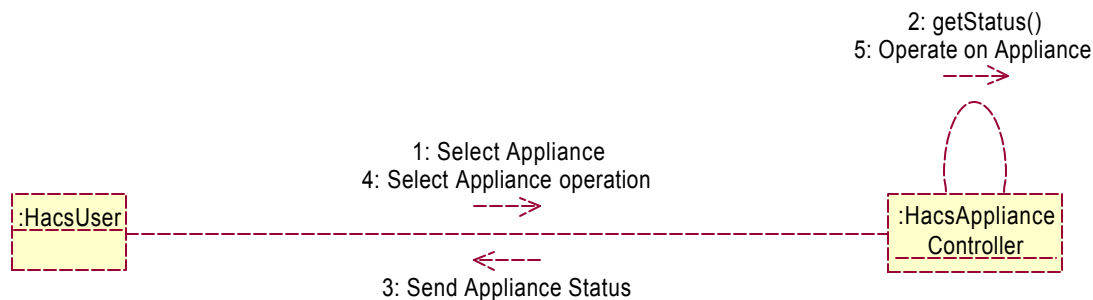
Flow of Events:

- **Pre condition:** Valid session already established. The controller is capable of communicating with the remote user and the appliances.
- **Main Flow:** This use case begins when the user accesses the HACS appliance controller via a remote device such as cellular phone or palm top.
 - The system provides the appliance menu to the user
 - The user selects the appliance.
 - The system displays the current status of the selected appliance along with its operation menu
 - System acts upon the selected appliance according to the user's selected operation
 - Transfers control to the specific use case according to the user's input.
- **Exceptional Flow:** Due to some technical problems like power cut, the session ends abruptly.
- **Post Condition:** Control is transferred to the specific use case according to the user input.

3.1.3.1 Sequence Diagram – HacsApplianceController



3.1.3.2 Collaboration Diagram – HacsApplianceController



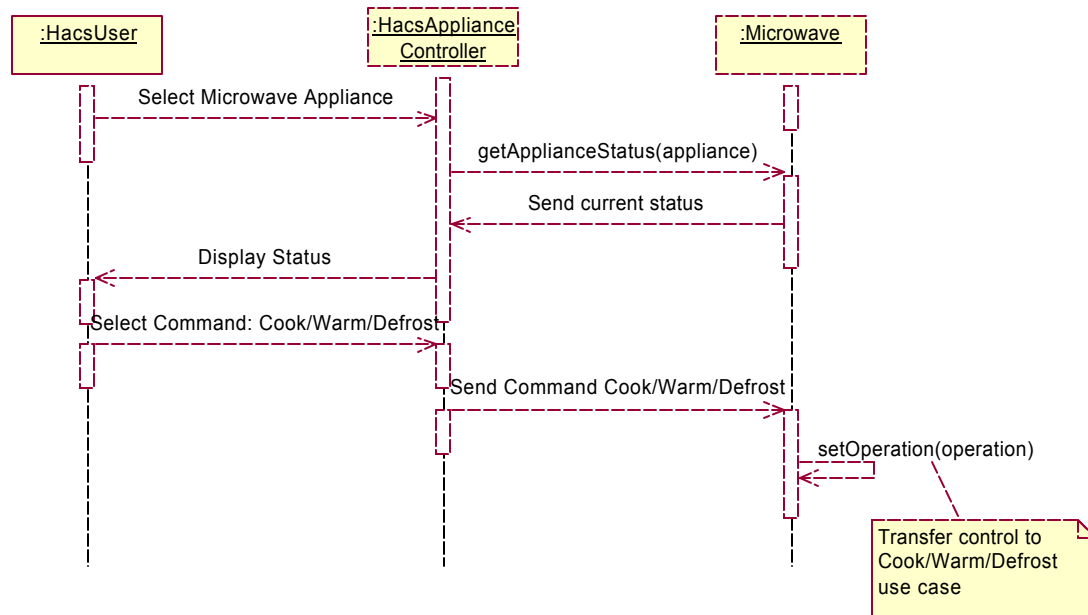
3.1.4 Use Case Name – Operate Microwave

Flow of Events:

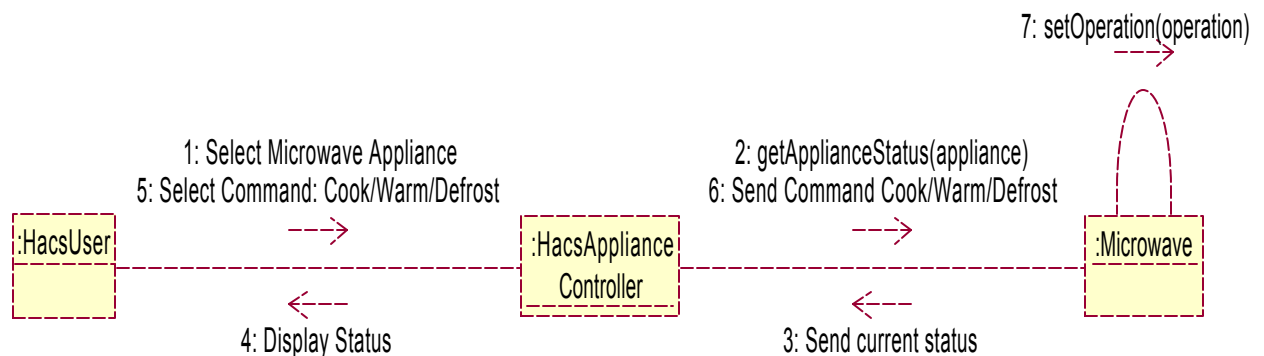
- **Pre Condition:** Valid session established between the remote device and the HACS Appliance controller. The user has selected this appliance from the appliance menu
- **Main Flow:** This use case begins when user chooses the appliance microwave oven.
 - It operates on the commands Cook/ Warm/Defrost food as directed by the HACS Appliance controller
 - If command is cook the control is transferred to Cook use case.

- If command is warm the control is transferred to Warm use case
- If command is Defrost the control is transferred to Defrost use case
- **Exceptional Flow:** Due to some technical problems like power cut, the session ends abruptly.
- **Post Condition:** Based on the user preference, the food is processed or the microwave is switched off.

3.1.4.1 Sequence Diagram – Operate Microwave



3.1.4.2 Collaboration Diagram - Operate Microwave

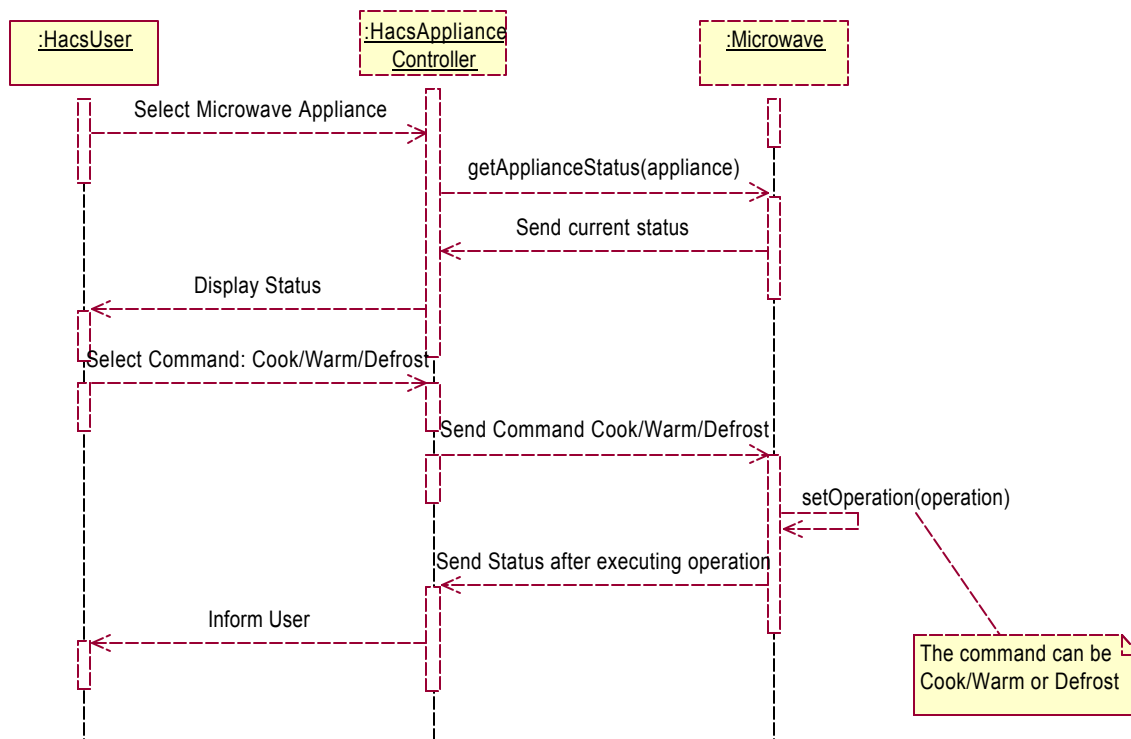


3.1.5 Use Case Name – Cook/Warm/Defrost

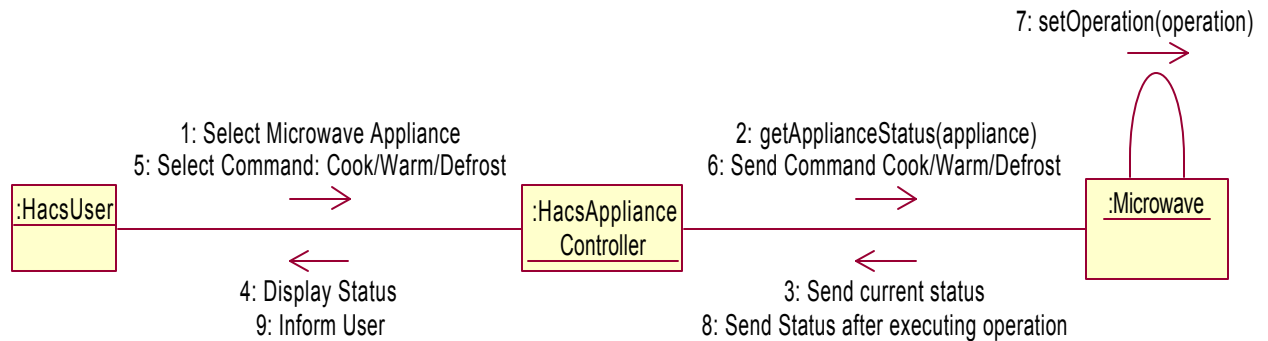
Flow of Events:

- **Preconditions:** Valid session is established between the remote device and the HACS Appliance controller. The user has selected the appliance Microwave from the menu.
- **Main Flow:** This use case begins when the Cook/Warm/Defrost command is selected by the use case Microwave.
 - It operates for the time and duration directed by the HACS controller.
 - On receiving the command the microwave starts processing the selected operation
 - On completing cooking/warming/defrosting the microwave sends the status to the controller
- **Exceptional flow:** Due to some technical problems like power cut, the session ends abruptly.
- **Post Conditions:** The Microwave finishes operation and sends the status to the HACS Appliance controller.

3.1.5.1 Sequence Diagram - Cook/Warm/Defrost



3.1.5.2 Collaboration Diagram - Cook/Warm/Defrost



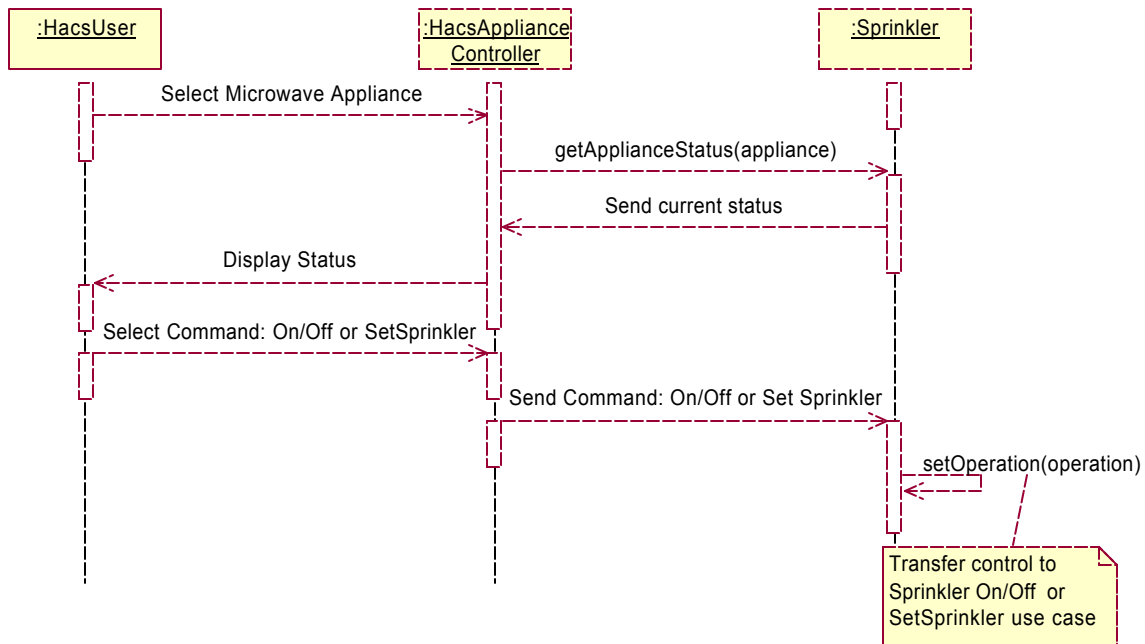
3.1.6 Use Case Name – Operate Sprinkler

Flow of Events:

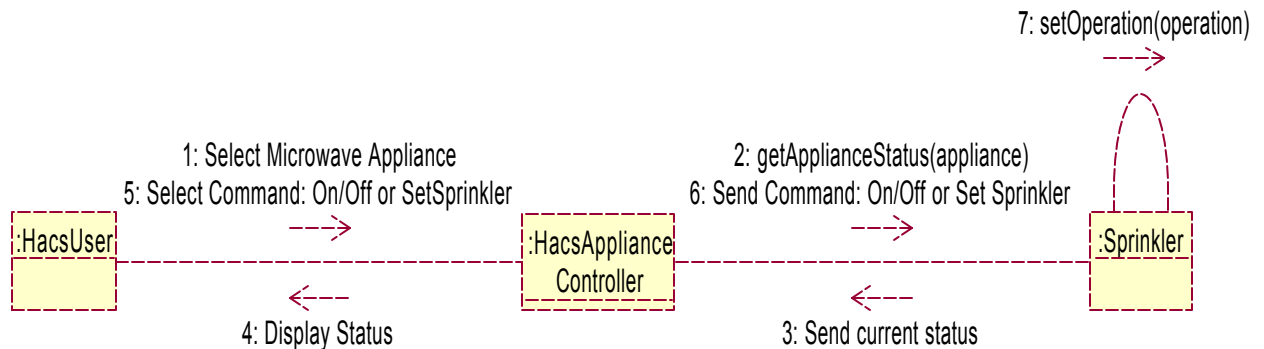
- **Preconditions:** Valid session is established between the user and the HACS Appliance controller. The user has selected the appliance Sprinkler.
- **Main Flow:** This use case begins when the user selects the appliance Sprinkler from the appliance menu.
 - It operates on the various operations as directed by the HACS controller.
 - It sends the control to the On/Off sprinkler use case if this operation is selected by the user from operation menu of Sprinkler.
 - It sends the control to the Set sprinkler use case if it is selected by the user from menu.
- **Exceptional flow:** Due to some technical problems like power cut, the session ends abruptly.

Post Condition: Set the sprinkler parameters or switch on/off the sprinkler as directed by the HACS Appliance controller

3.1.6.1 Sequence Diagram - Operate Sprinkler



3.1.6.2 Collaboration Diagram - Operate Sprinkler



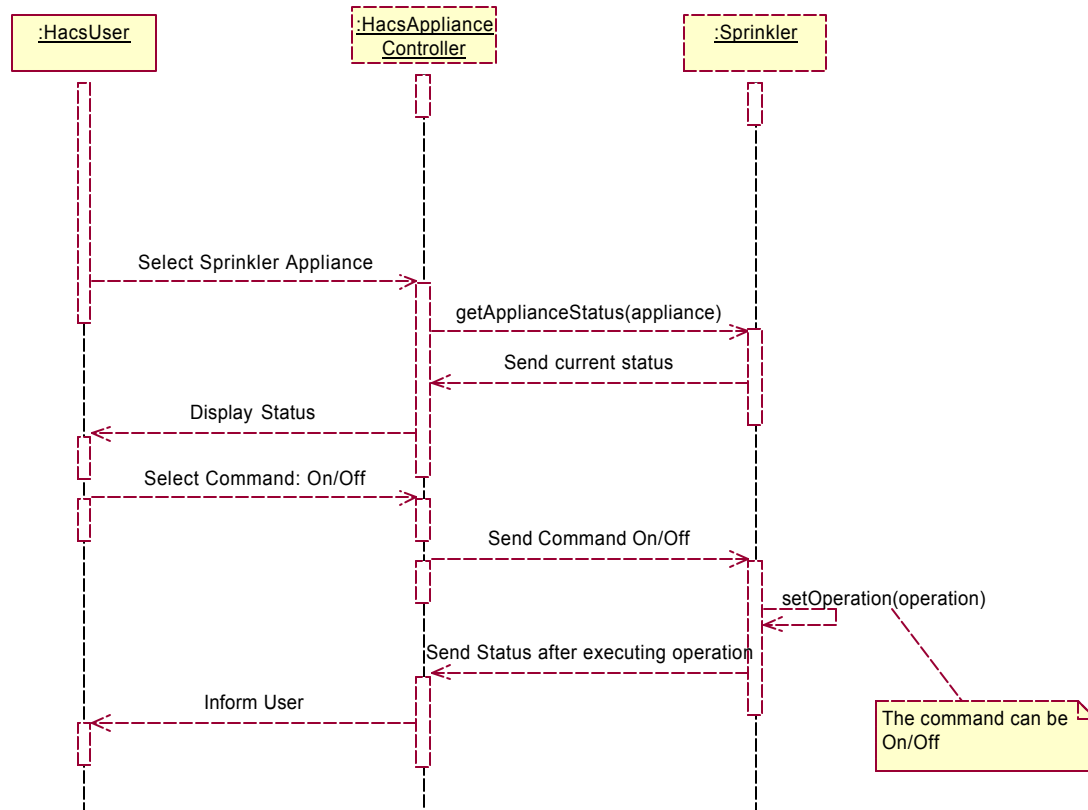
3.1.7 Use Case Name – On/Off Sprinkler

Flow of Events:

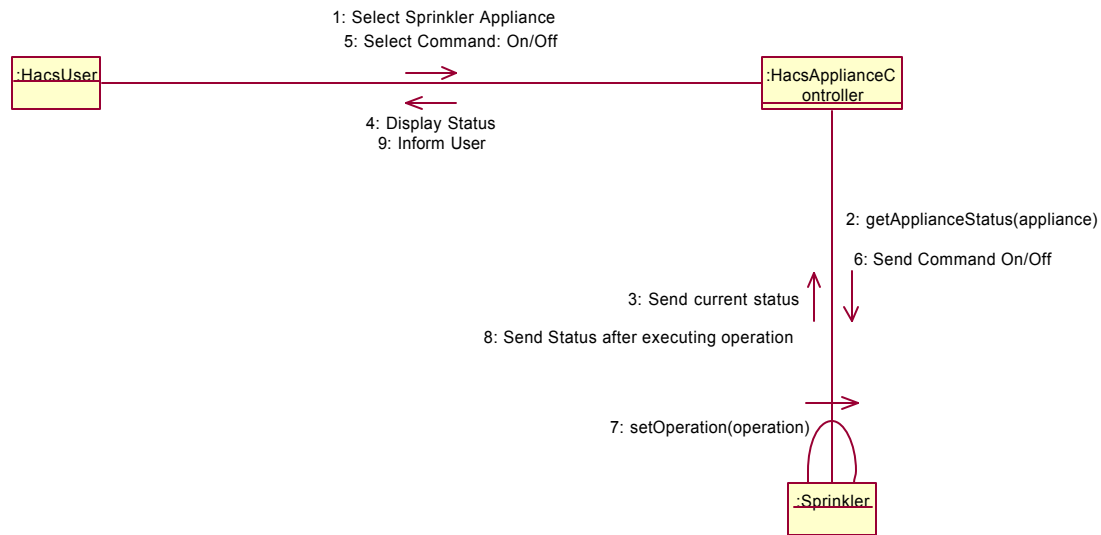
- **Preconditions:** There is a valid session established between the remote device and the Appliance controller. The user has selected the option start/stop sprinkler.
- **Main Flow:** This use case begins when the On/Off command is selected by the use case Operate sprinkler.
 - It stops the sprinkler when the controller gives the Off sprinkler command.
 - It starts the sprinkler when the controller gives the On sprinkler command.
 - On receiving the command the water sprinkler acknowledges the user and starts processing the opted task.

- On completing the task it saves the current status and sends it to the controller
- **Exceptional flow:** Due to some technical problems like power cut, the session ends abruptly.
- **Post Conditions :** The water sprinkler finishes operation and sends the status to the Appliance controller.

3.1.7.1 Sequence Diagram – On/Off Sprinkler



3.1.7.2 Collaboration Diagram – On/Off Sprinkler

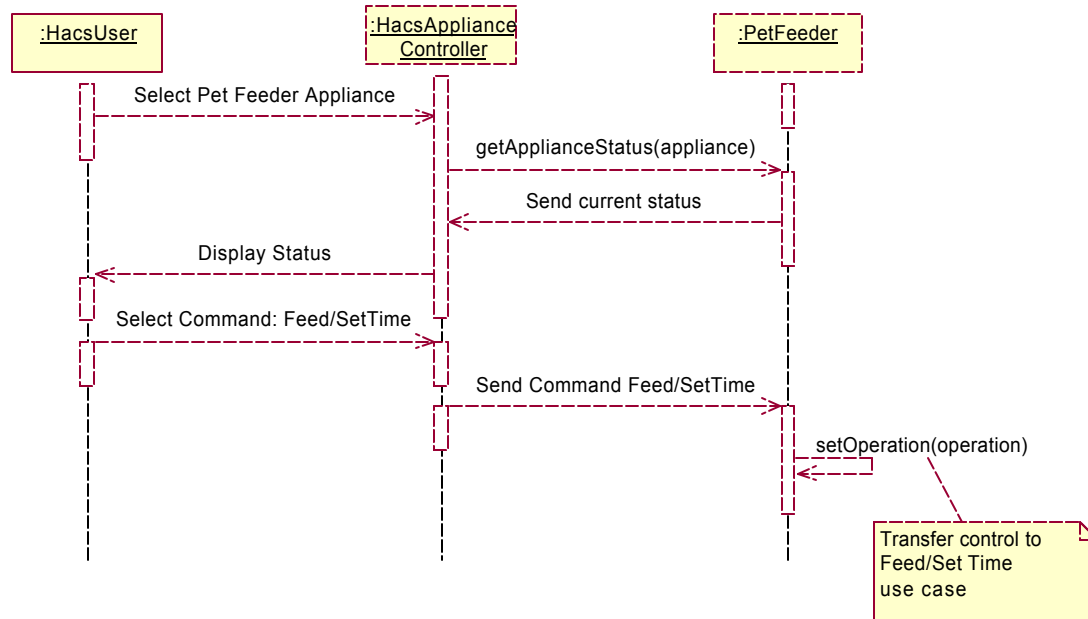


3.1.8 Use Case Name – Operate Pet Feeder

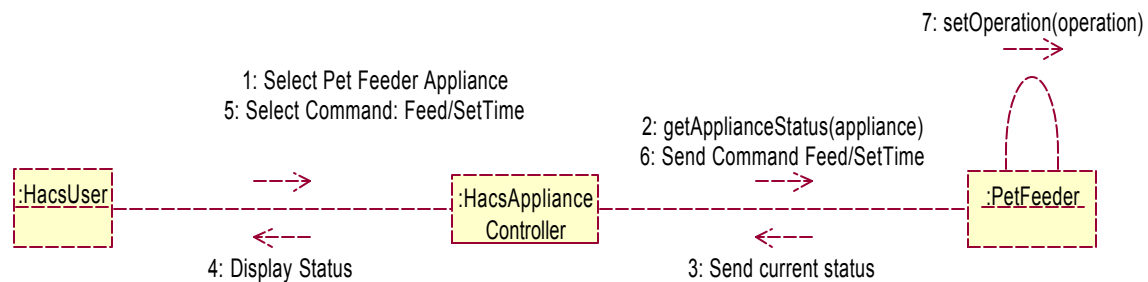
Flow of Events:

- **Preconditions:** Valid session is established between the user and the HACS Appliance controller. The user has selected the appliance Pet Feeder.
- **Main Flow:** This use case begins when the user selects the appliance Pet Feeder from the appliance menu.
 - It operates on the various operations as directed by the HACS Appliance controller.
 - It sends the control to the Feed/SetTime use case if this operation is selected by the user from operation menu of Pet Feeder.
- **Exceptional flow:** Due to some technical problems like power cut, the session ends abruptly.
- **Post Condition:** Based on the user preference, the time is set as specified by the user and the pets are fed periodically according to time set. Acknowledgement is sent to the Appliance controller once the command is executed.

3.1.8.1 Sequence Diagram – Operate Pet Feeder



3.1.8.2 Collaboration Diagram - Operate Pet Feeder



3.1.9 Use Case Name – Set Time of Pet Feeder

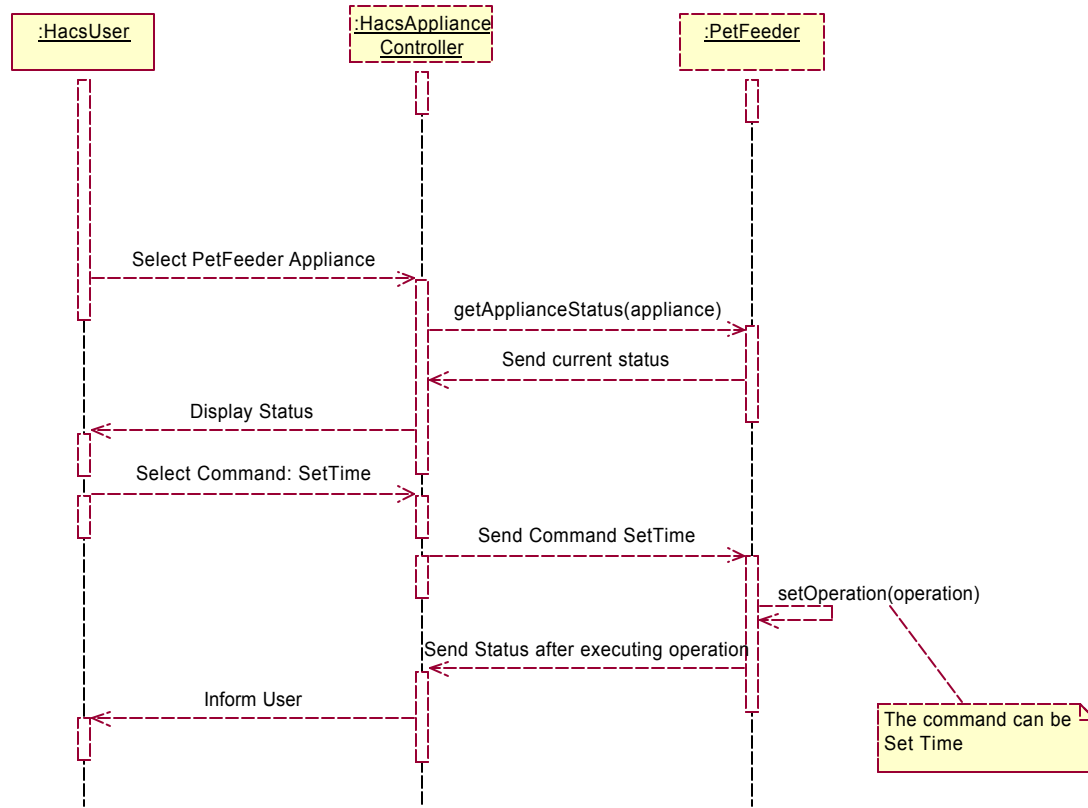
Flow of Events:

- **Pre condition:** There is a valid session established between the remote device and the Appliance controller. The user has selected the pet feeder.
- **Main Flow:** This use case begins when the pet feeder gets set time command.
 - According to the user preference, the following action is taken
Set Time - sets the time on the Pet Feeder; so as to .

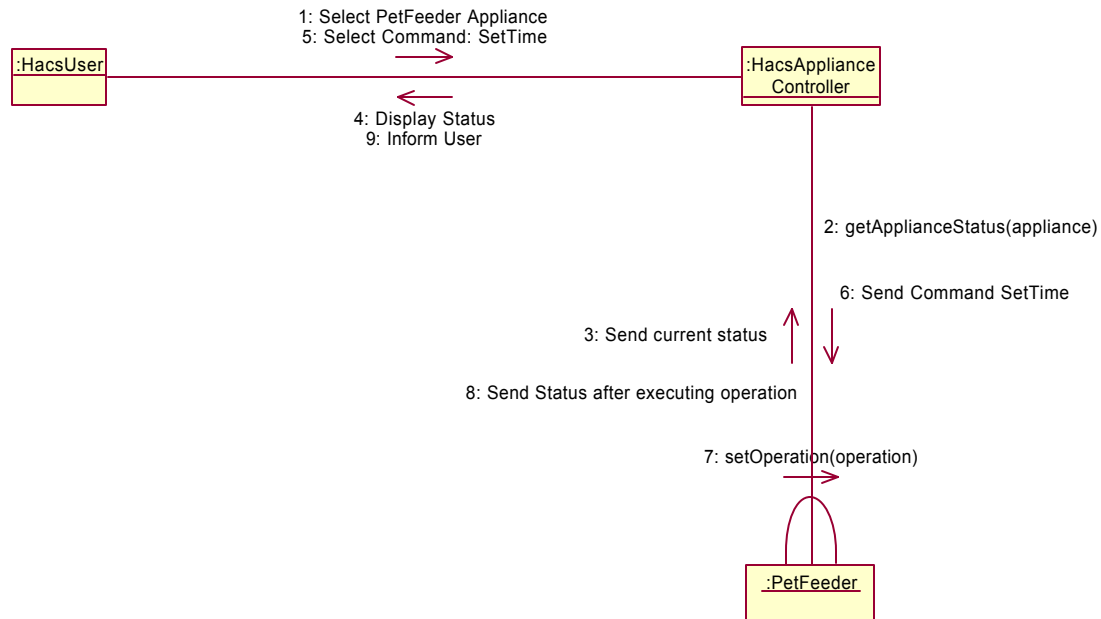
- **Exceptional Flow:** Due to some technical problems like power cut, the session ends abruptly.

Post Condition: Based on the user preference, the time is set as specified by the user and the pets are fed periodically according to time set. Acknowledgement is sent to the Appliance controller once the command is executed.

3.1.9.1 Sequence Diagram – Set Time Pet Feeder



3.1.9.2 Collaboration Diagram – Set Time Pet Feeder

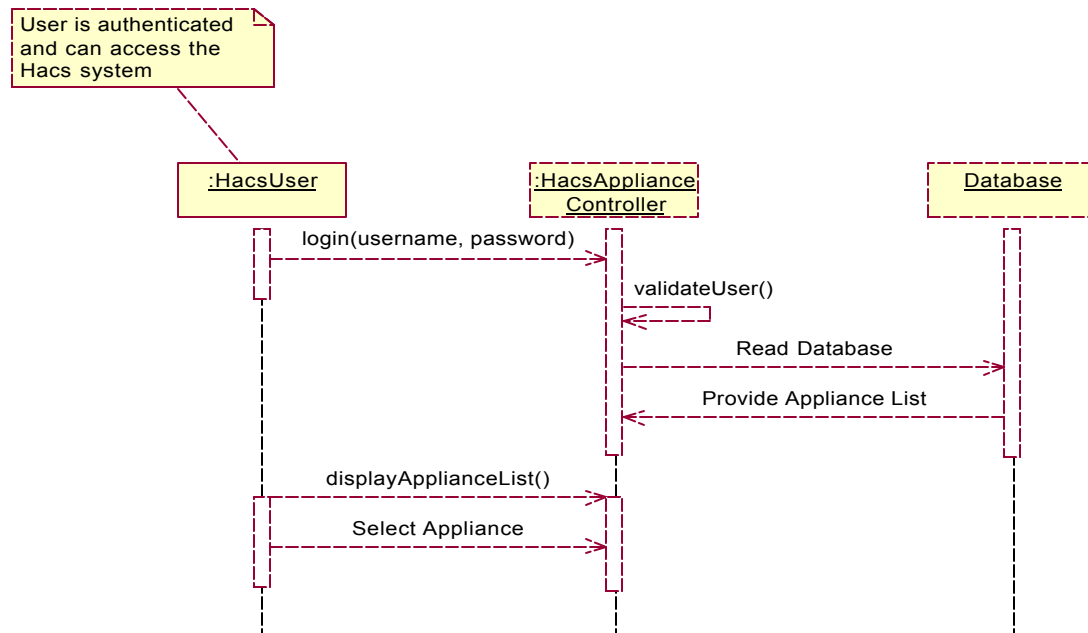


3.1.10 Use Case Name – Select Appliance List

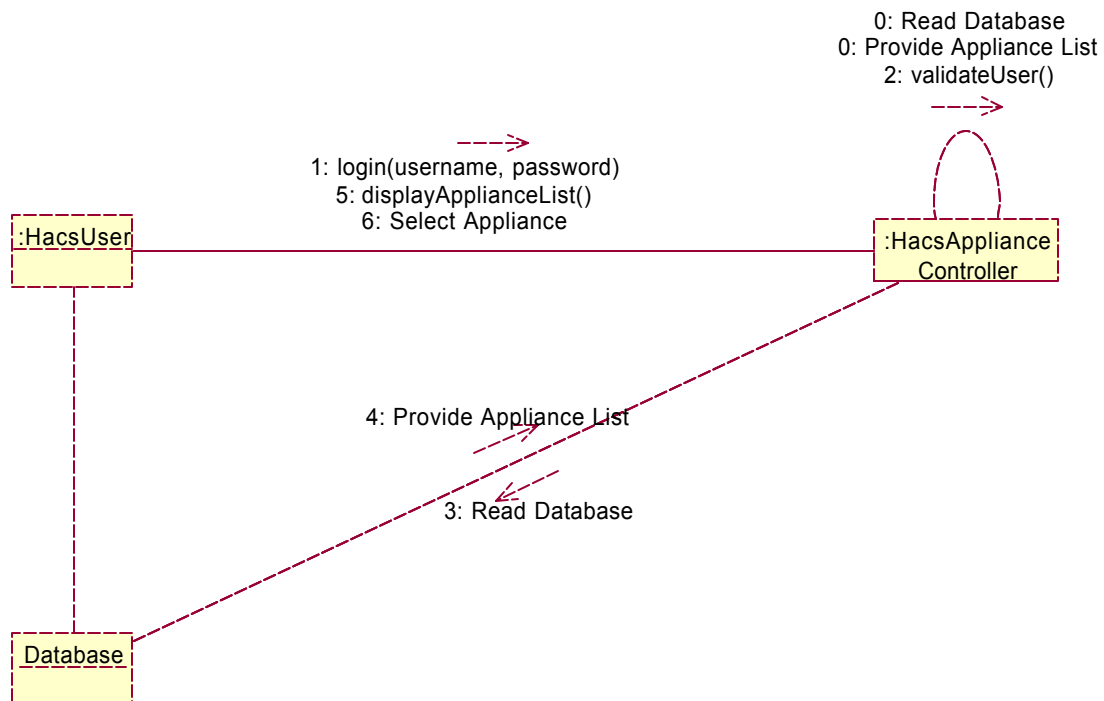
Flow of Events:

- **Pre condition:** Valid session already established. The controller is capable of communicating with the remote user and the appliances.
- **Main Flow:** This use case begins when the user accesses the HACS appliance controller via a remote device such as cellular phone or palm top.
 - The system provides the appliance menu to the user
 - Appliance List is retrieved from the database.
 - The system displays the Appliance List
 - The user selects the appliance
- **Exceptional Flow:** Due to some technical problems like power cut, the session ends abruptly.
- **Post Condition:** Control is transferred to the specific use case according to the user input.

3.1.10.1 Sequence Diagram – Select Appliance List



3.1.10.2 Collaboration Diagram – Select Appliance List

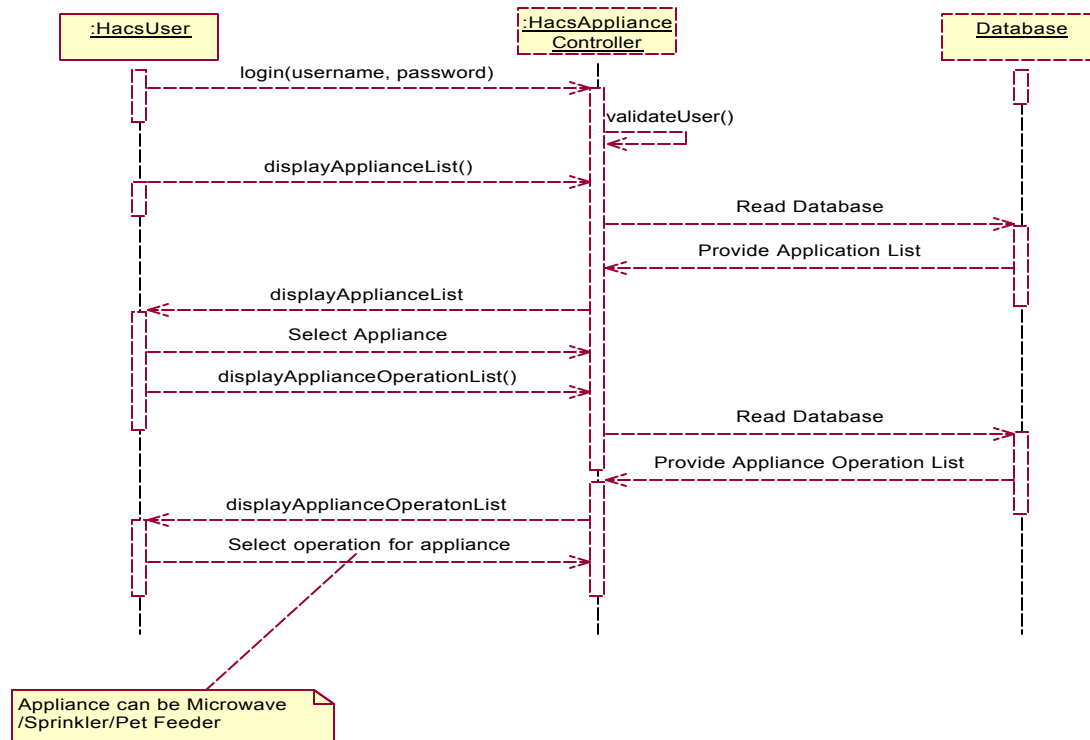


3.1.11 Use Case Name – Select/Cancel Appliance Operations

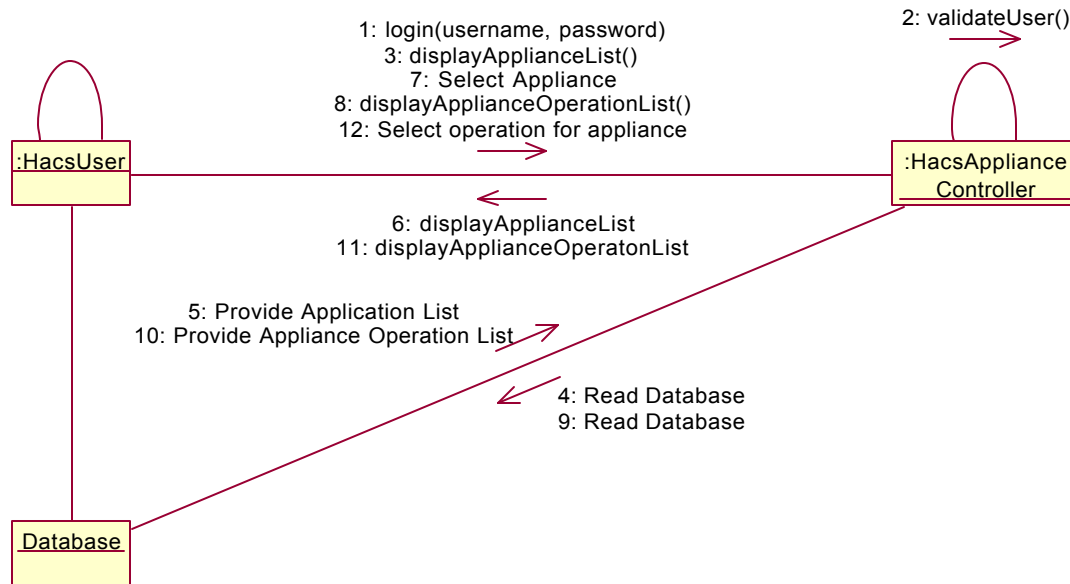
Flow of Events:

- **Pre condition:** Valid session already established. The controller is capable of communicating with the remote user and the appliances.
- **Main Flow:** This use case begins when the user accesses the HACS appliance controller via a remote device such as cellular phone or palm top.
 - The system provides the appliance Operations menu to the user
 - Appliance Operations List is retrieved from the database.
 - The system displays the Appliance Operations List
 - The user selects the appliance Operation or Cancel the current Operation.
- **Exceptional Flow:** Due to some technical problems like power cut, the session ends abruptly.
- **Post Condition:** Control is transferred to the specific use case according to the user input.

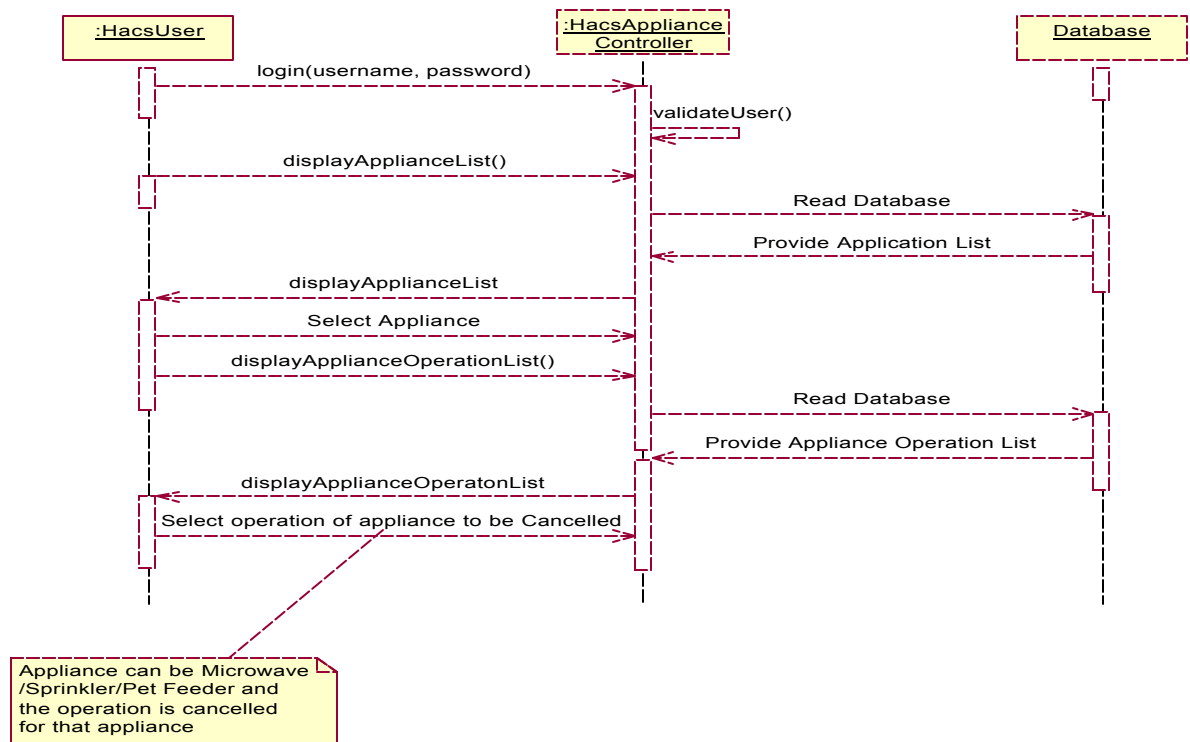
3.1.11.1 Sequence Diagram – Select Appliance Operation



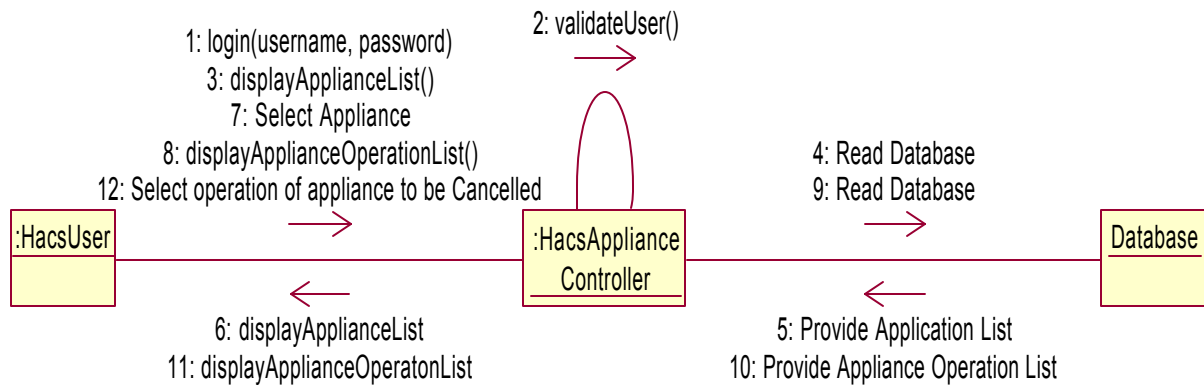
3.1.11.2 Collaboration Diagram – Select Appliance Operation



3.1.11.3 Sequence Diagram – Cancel Appliance Operation



3.1.11.4 Collaboration Diagram – Cancel Appliance Operation

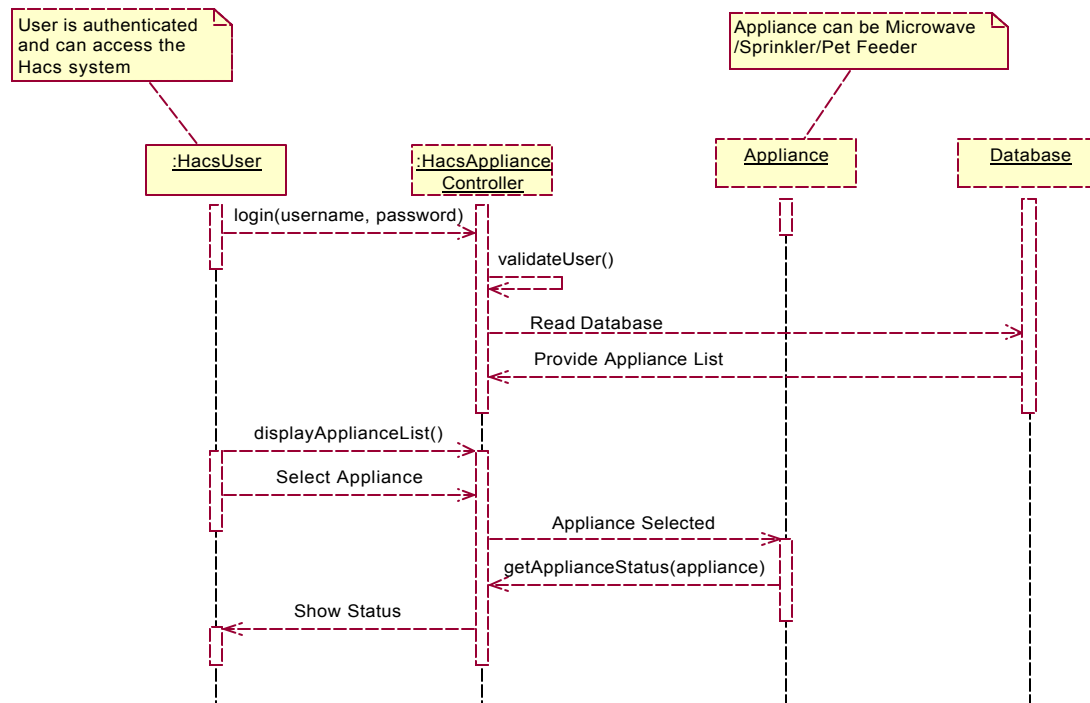


3.1.12 Use Case Name – Get Status

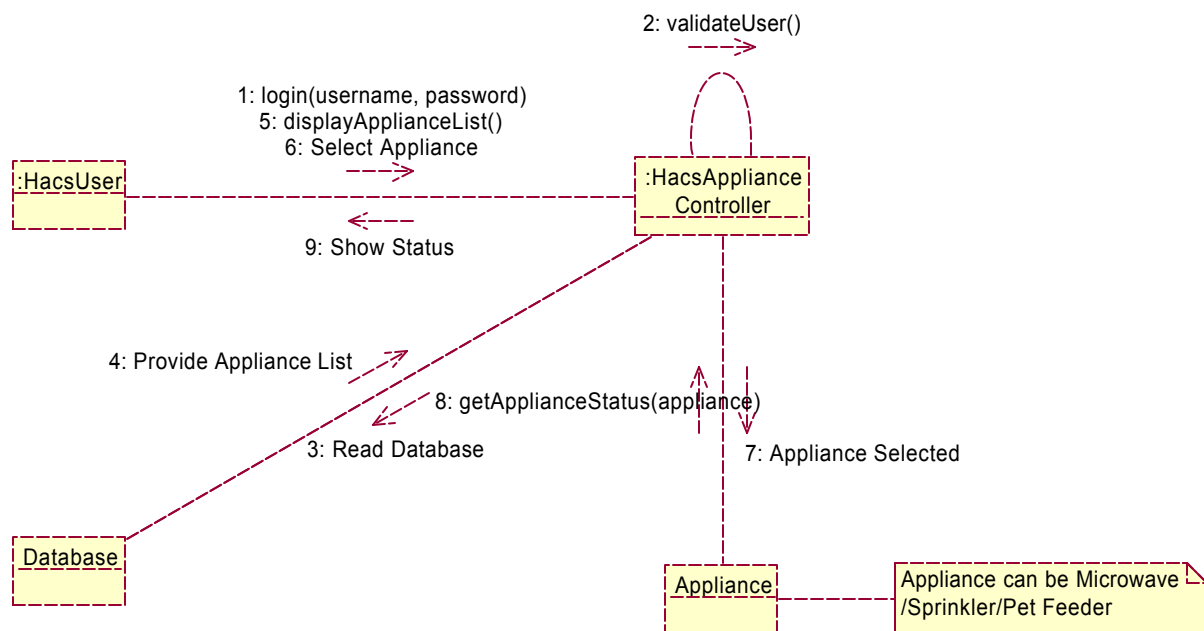
Flow of Events:

- **Pre condition:** Valid session already established. The controller is capable of communicating with the remote user and the appliances.
- **Main Flow:** This use case begins when the user accesses the HACS appliance controller via a remote device such as cellular phone or palm top.
 - The system provides the status of the appliance to the user
- **Exceptional Flow:** Due to some technical problems like power cut, the session ends abruptly.
- **Post Condition:** Status of the selected appliance can also be got

3.1.12.1 Sequence Diagram – Get Status



3.1.12.2 Collaboration Diagram – Get Status

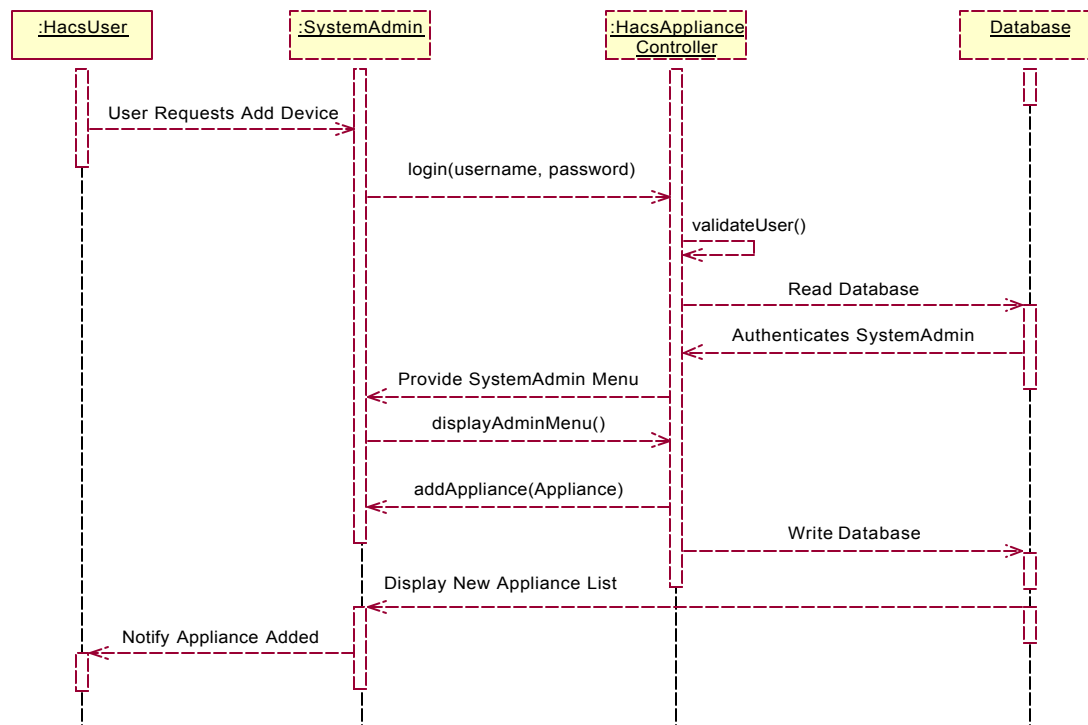


3.1.13 Use Case Name – Add Appliance

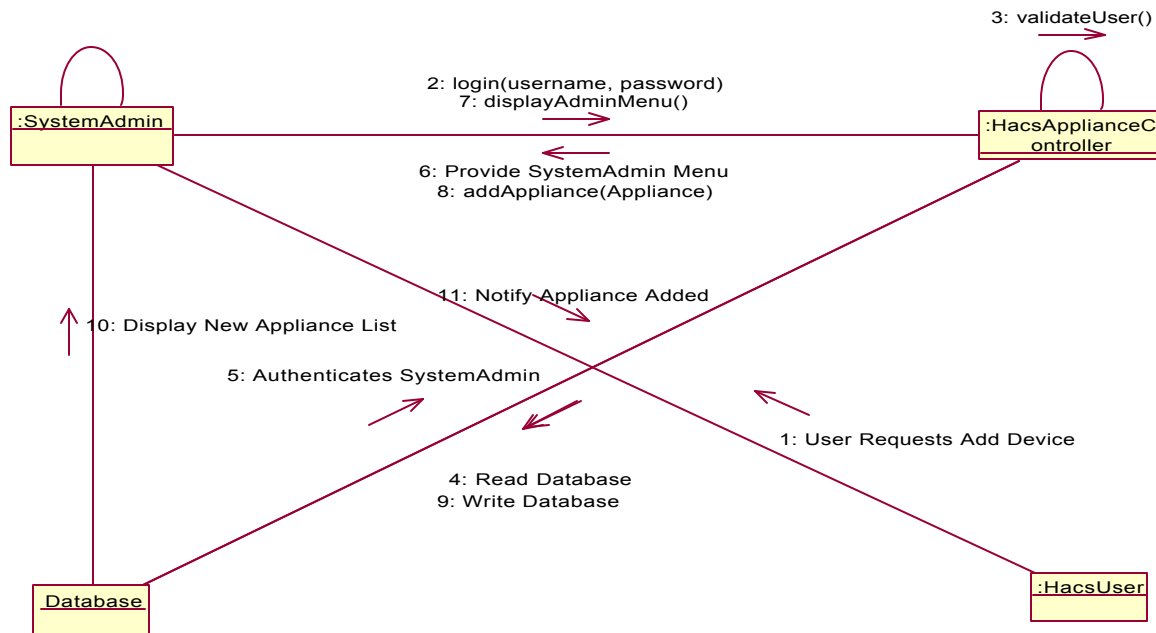
Flow of Events:

- **Pre condition:** Valid session already established. The controller is capable of communicating with the remote user and the appliances.
- **Main Flow:** This use case begins when the system admin accesses the HACS appliance controller via a remote device such as cellular phone or palm top.
 - The system provides the appliance Operations menu to the system admin
 - Appliance Operations List is retrieved from the database.
 - The system admin adds a new Appliance to the database.
- **Exceptional Flow:** Due to some technical problems like power cut, the session ends abruptly.
- **Post Condition:** Database is updated and the updated Appliance list is displayed.

3.1.13.1 Sequence Diagram – Add Appliance



3.1.13.2 Collaboration Diagram – Add Appliance

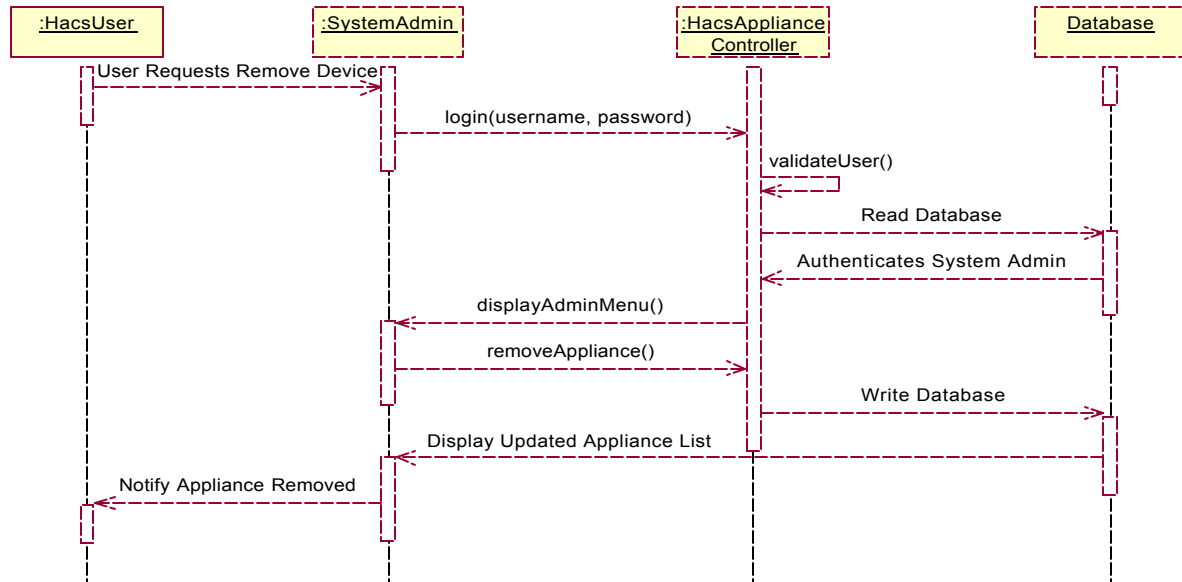


3.1.14 Use Case Name –Remove Appliance

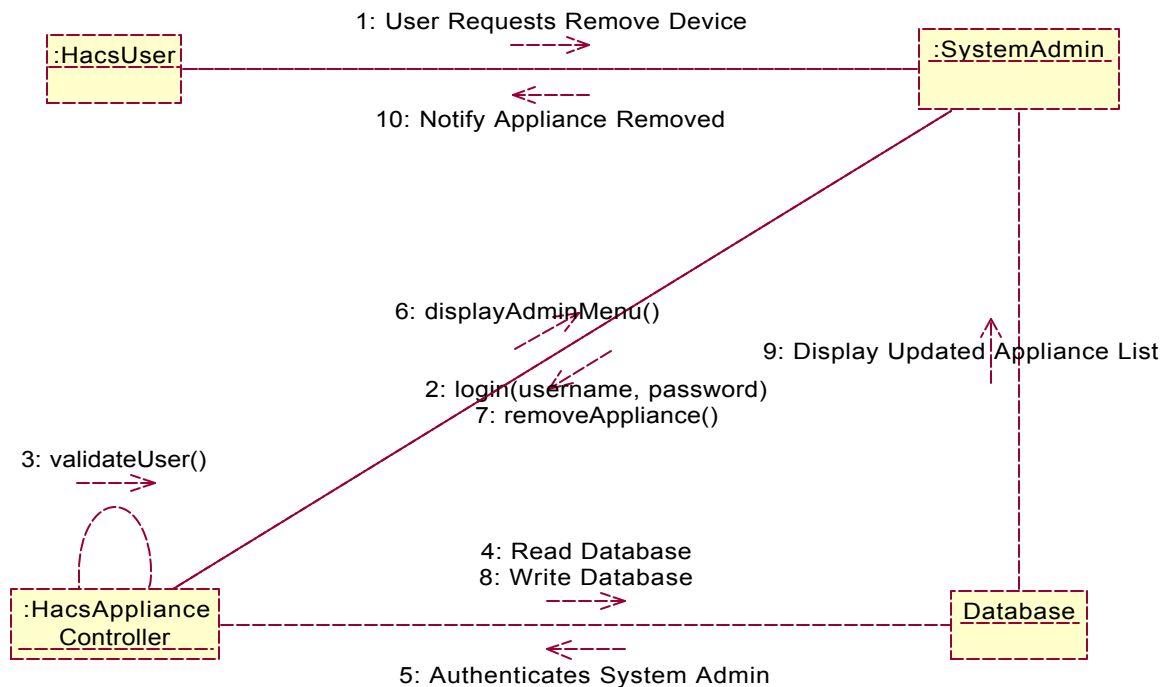
Flow of Events:

- **Pre condition:** Valid session already established. The controller is capable of communicating with the remote user and the appliances.
- **Main Flow:** This use case begins when the system admin accesses the HACS appliance controller via a remote device such as cellular phone or palm top.
 - The system provides the appliance Operations menu to the system admin
 - Appliance Operations List is retrieved from the database.
 - The system admin removes an Appliance from the database.
- **Exceptional Flow:** Due to some technical problems like power cut, the session ends abruptly.
- **Post Condition:** Database is updated and the updated Appliance list is displayed.

3.1.14.1 Sequence Diagram – Remove Appliance



3.1.14.2 Collaboration Diagram – Remove Appliance

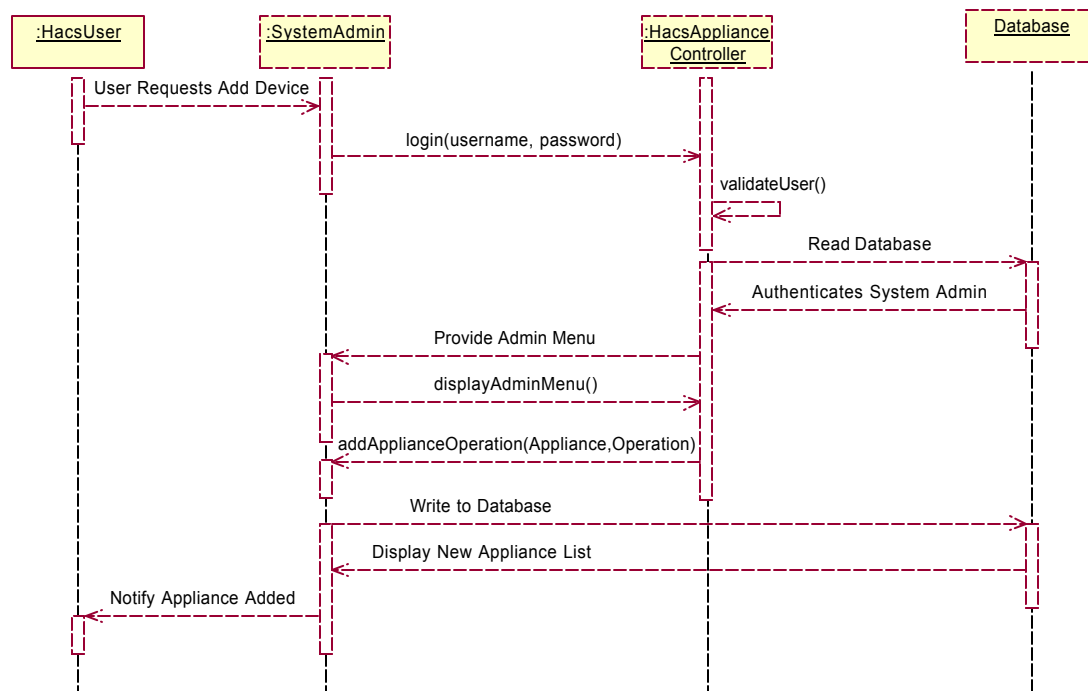


3.1.15 Use Case Name –Add Appliance Operation

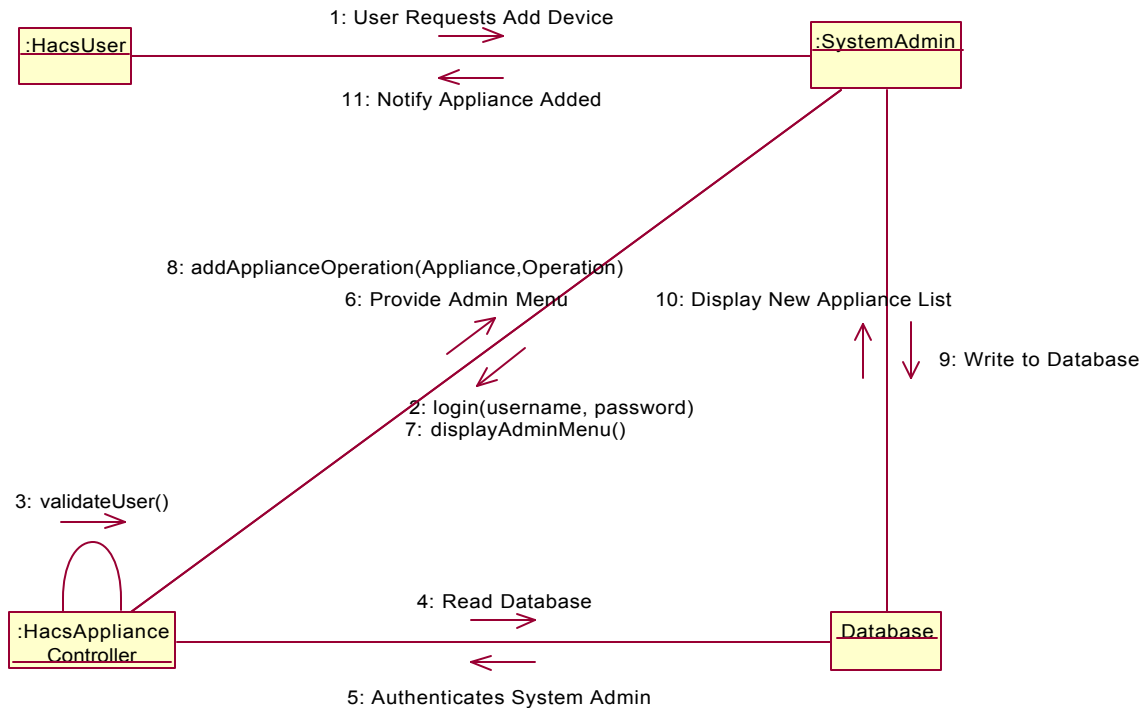
Flow of Events:

- **Pre condition:** Valid session already established. The controller is capable of communicating with the system admin and the appliances.
- **Main Flow:** This use case begins when the system admin accesses the HACS appliance controller via a remote device such as cellular phone or palm top.
 - The system provides the appliance Operations menu to the user
 - Appliance Operations List is retrieved from the database.
 - The system admin adds a new operation to the Appliance from the List
- **Exceptional Flow:** Due to some technical problems like power cut, the session ends abruptly.
- **Post Condition:** Database is updated and the appliance is ready to use the new operation

3.1.15.1 Sequence Diagram – Add Appliance Operation



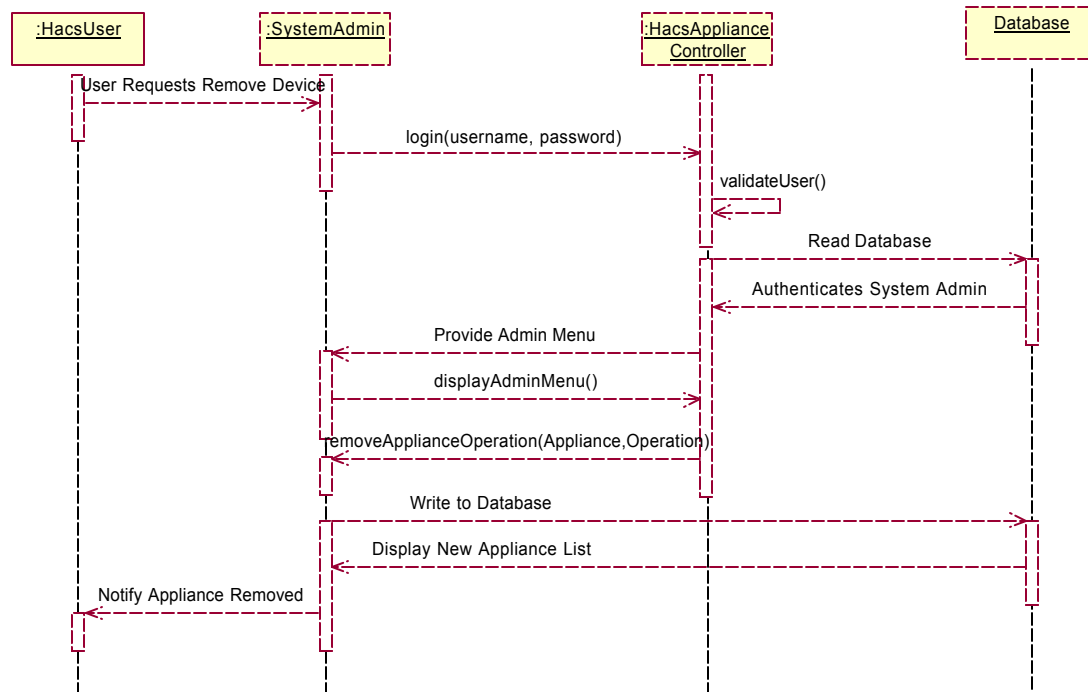
3.1.15.2 Collaboration Diagram – Add Appliance Operation



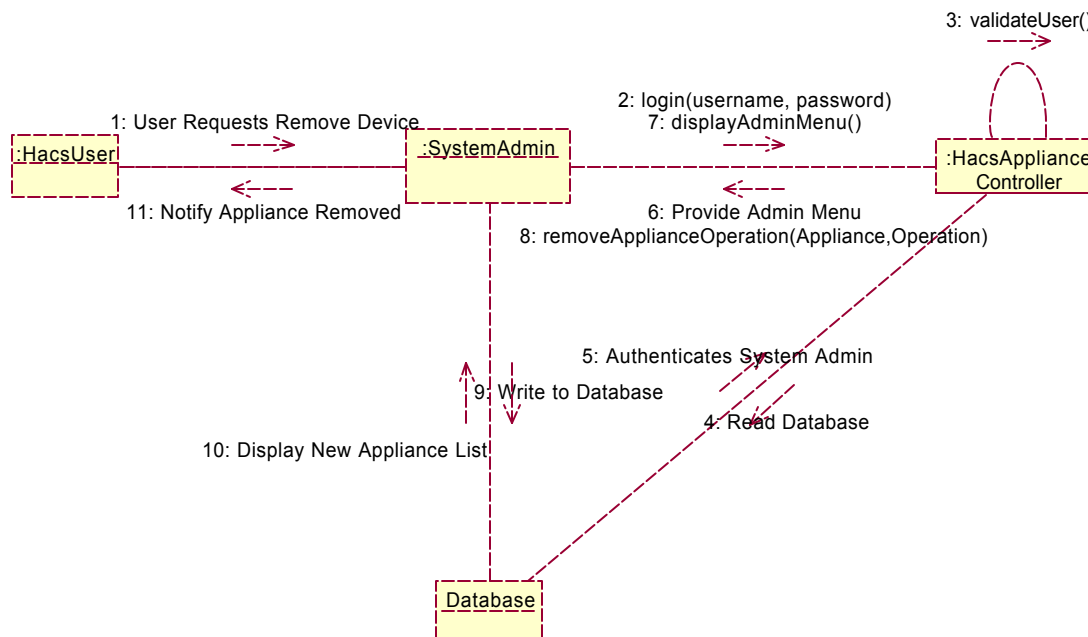
3.1.16 Use Case Name –Remove Appliance Operation

- **Pre condition:** Valid session already established. The controller is capable of communicating with the system admin and the appliances.
- **Main Flow:** This use case begins when the system admin accesses the HACS appliance controller via a remote device such as cellular phone or palm top.
 - The system provides the appliance Operations menu to the user
 - Appliance Operations List is retrieved from the database.
 - The system admin removes an operation for the Appliance from the List
- **Exceptional Flow:** Due to some technical problems like power cut, the session ends abruptly.
- **Post Condition:** Database is updated and the appliance has the new set of operations

3.1.16.1 Sequence Diagram – Remove Appliance Operation



3.1.16.2 Collaboration Diagram – Remove Appliance Operation

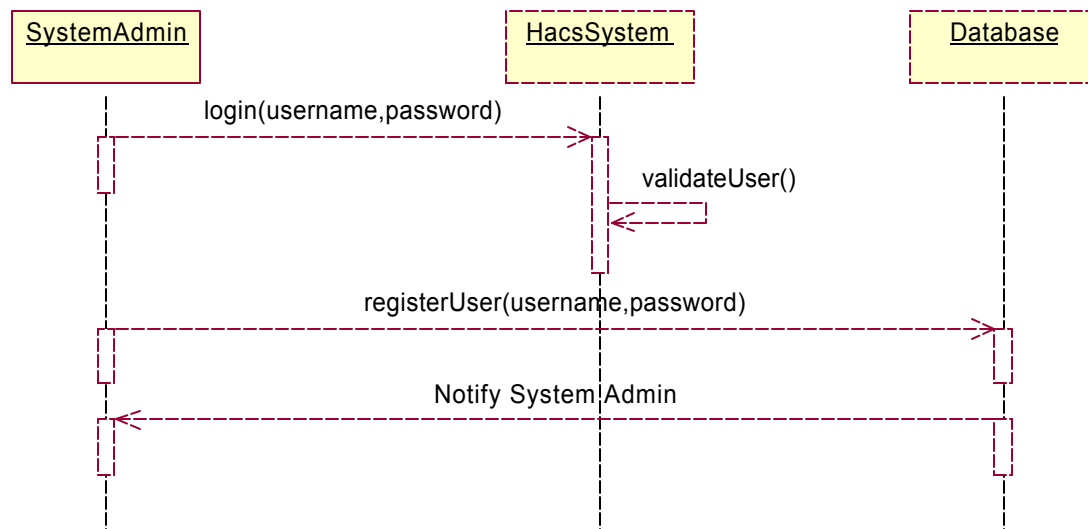


3.1.17 Use Case Name –Add User

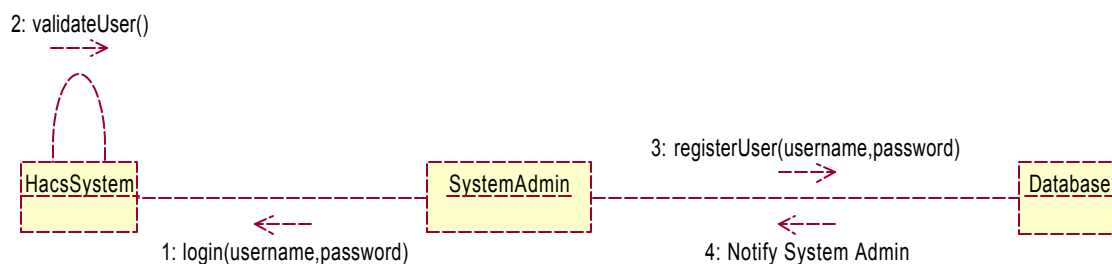
Flow of Events:

- **Pre condition:** Valid session already established. The controller is capable of communicating with the system admin and the HACS system.
- **Main Flow:** This use case begins when the system admin accesses the HACS appliance controller via a remote device such as cellular phone or palm top.
 - The system admin adds a new user who can access the HACS system
- **Exceptional Flow:** Due to some technical problems like power cut, the session ends abruptly.
- **Post Condition:** The new user has privileges to access all the appliances and controls them according to his/her preference.

3.1.17.1 Sequence Diagram – Add User



3.1.17.2 Collaboration Diagram – Add User

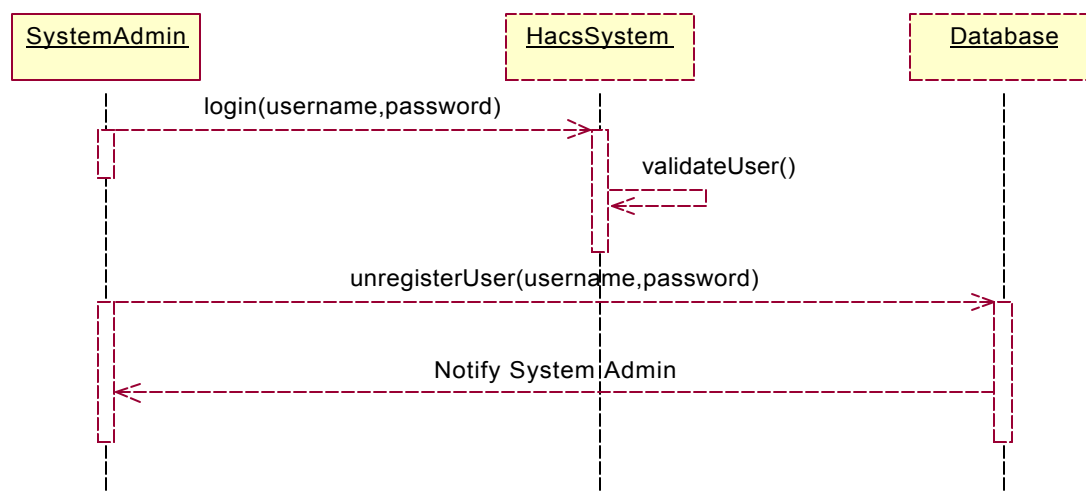


3.1.18 Use Case Name –Delete User

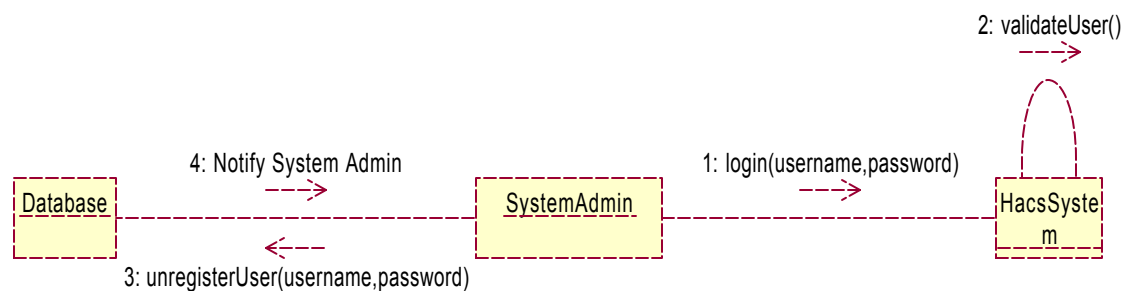
Flow of Events:

- **Pre condition:** Valid session already established. The controller is capable of communicating with the system admin and the HACS system.
- **Main Flow:** This use case begins when the system admin accesses the HACS appliance controller via a remote device such as cellular phone or palm top.
 - The system admin deletes an existing user who can access the HACS system
- **Exceptional Flow:** Due to some technical problems like power cut, the session ends abruptly.
- **Post Condition:** Only the existing users have privileges to access all the appliances and control them according to their preferences.

3.1.18.1 Sequence Diagram – Delete User



3.1.18.2 Collaboration Diagram – DeleteUser



4. System Analysis using CRC cards

4.1 HACS User CRC Card

HACSUSER	
RESPONSIBILITIES	COLLABORATORS
-User enters valid username, password to logon to system. -User is given appliance menu to select appliance. -Sends Command to HacsAppliance system. - Show the status of the appliance chosen by the user. -End the session when user wants to exit the system.	Service Provider

4.2 Hacs Appliance Controller CRC Card

HacsApplianceController	
RESPONSIBILITIES	COLLABORATORS
- Authenticate the HacsUser and SystemAdmin - Establish session on authenticating the user and displays appliance menu to HacsUser. - Get the status of the appliance chosen by the user - Display the appliance status to the user along with appliance operations. - For Microwave set these operations: Cook, Warm, Defrost - For Sprinkler set these operations: On/Off, set time. - For Pet Feeder set these operations: feed, set time.	HACSApplianceController

- | | |
|---|--|
| <ul style="list-style-type: none"> -Return the Status of the appliance after it finishes appliance operation. - Terminate the session after completing the requested appliance operations and logoff. | |
|---|--|

4.3 System Admin CRC Card

SYSTEMADMIN	
RESPONSIBILTIES	COLLABORATORS
- SystemAdmin enters valid username, password to logon to HacsAppliance System. - SystemAdmin can add user, delete user. -SystemAdmin can add appliance, remove appliance, cancel appliance on user's request. - This user can also add, delete operations to new and existing appliance to users request. -Logoff from the system after saving changes made to the appliances to database.	HACSApplianceController

4.4 Microwave CRC Card

MICROWAVE	
RESPONSIBILTIES	COLLABORATORS
- When the HACUser selects this appliance it sends its current status back to the HacsAppliancecontroller. - It receives command from the Hacontroller and acts accordingly. - It sets the option to either cook/warm/defrost food to user's preference.	HACSApplianceController

-Return the Status of the microwave after it finishes the operation.	
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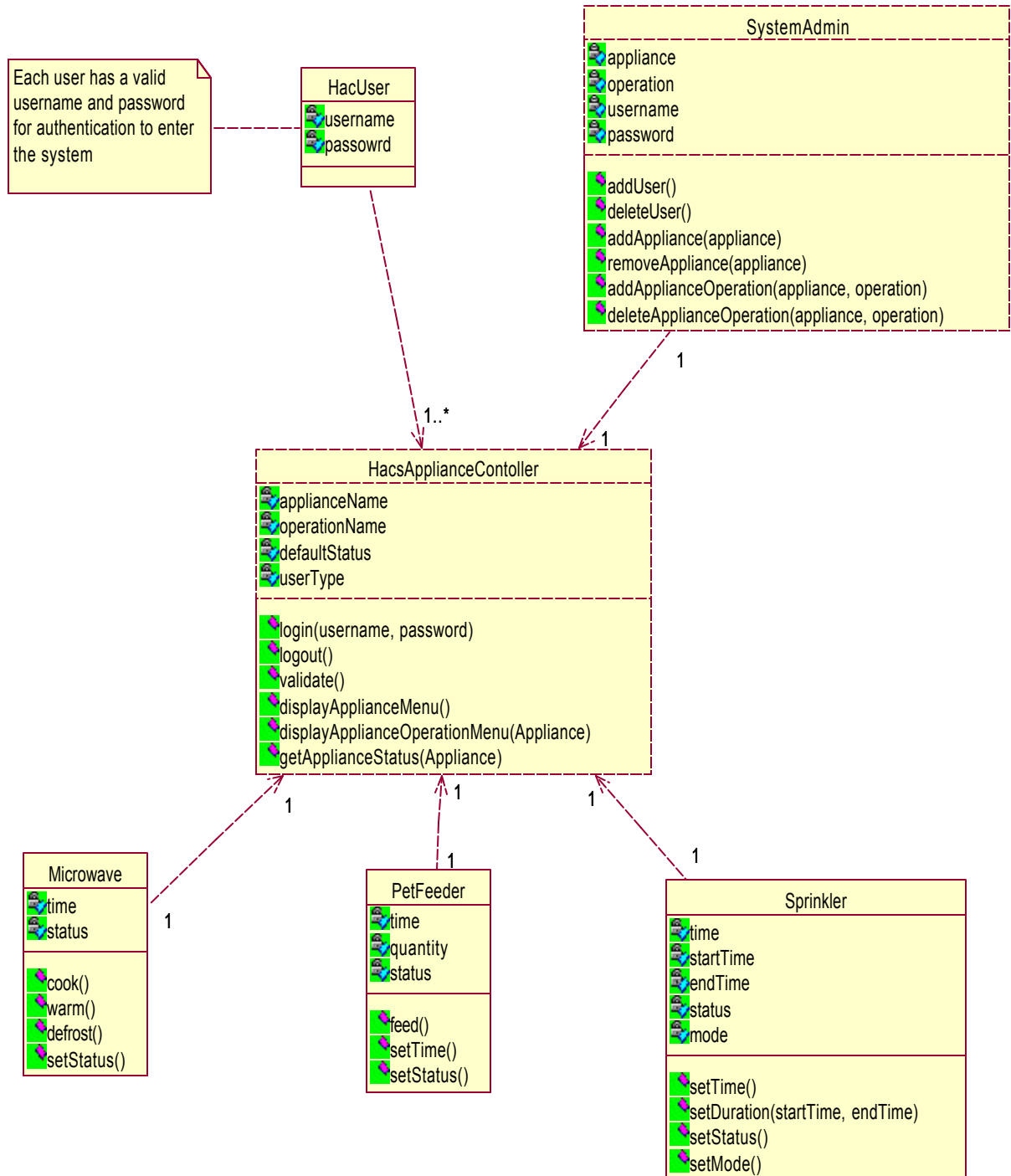
4.5 Sprinkler CRC Card

SPRINKLER	
RESPONSIBILITIES	COLLABORATORS
- When the HACUser selects this appliance it sends its current status back to the HacsAppliancecontroller. - It receives command from the Hacontroller and acts accordingly. - It sets the option to either On/Off, Set sprinkler to user's preference. -Return the Status of the sprinkler after it is done with the operation.	HACSApplianceController

4.6 Pet Feeder CRC Card

PET FEEDER	
RESPONSIBILITIES	COLLABORATORS
- When the HACUser selects this appliance it sends its current status back to the HacsAppliancecontroller. - It receives command from the Hacontroller and acts accordingly. - It sets the option to either feed, set Time to user's preference. -Return the Status of the pet feeder after it is done with the operation.	HACSApplianceController

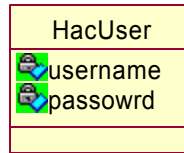
5 .CLASS DIAGRAM



5.1 Class Diagram Description

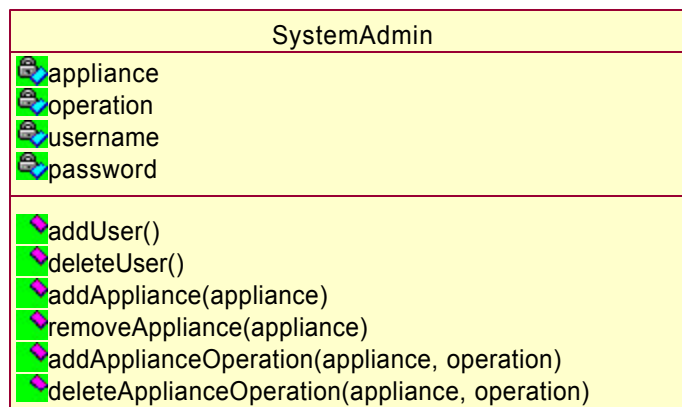
5.1.1 HACS User

Each User has a username and password to login to the HACS system. One or more user can login to the system at a time. User is authenticated and enters the HACS system.



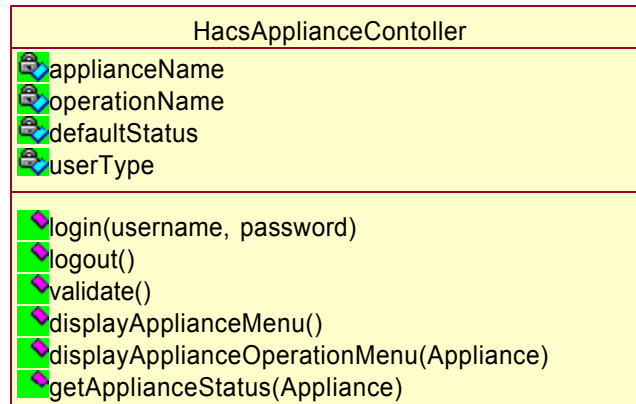
5.1.2 System Admin

- HACS has a system admin who is authenticated and enters the system
- He can add/delete user by invoking addUser() /deleteUser() methods
- He can also add/remove appliance using addAppliance()/removeAppliance()
- Appliance Operations can modified by invoking the respective methods



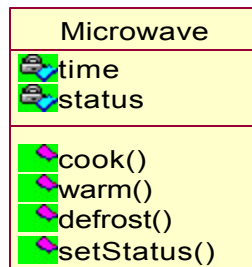
5.1 3 HACS Appliance Controller

- Login() logs the user
- Validate() validates if the user is authentic.
- logout(), logs off the user and ends the session.
- getApplianceStatus() gives the status of the selected appliance.
- displayApplianceMenu() and diaplayApplianceOperationMenu() displays the menu of the appliance and their corresponding operations.



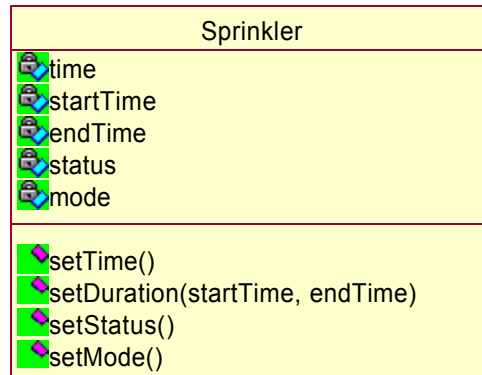
5.1 4 Microwave

- setStatus() sets the current status of the appliance.
- cook() takes time as a parameter and performs cook food operation.
- warm() takes time as a parameter and performs warm food operation.
- defrost() takes time as a parameter and performs defrost food operation.
- The time attribute sets the time or the duration for which operation has to perform.



5.1 5 Sprinkler

- setStatus() sets the status of the appliance.
- SetTime() takes time as a parameter, to set the time.
- SetDuration() takes start time and end time to set the duration for operation to perform.
- The start time and end time has to be set by the HACS user.



5.1 6 Pet Feeder

- setStatus() sets the status of the appliance.
- setTime() takes time as a parameter, to set the time for the pets to be fed.
- feed() takes quantity attribute as a parameter and supplies food for the pets with the specified quantity.

