American International University Bangladesh (AIUB)

Department of Computer Science

Faculty of Science & Technology (FST)

Smart Home Automation

A Software Engineering Project Submitted by

Semester: Spring_23-24		**Section:H**	**Group Number:08**	
SN	Student Name	Student ID	Contribution (CO3+CO4)	Individual Marks
1	Umme Jannatul Fariha	21-45718-3		
2	Asir Foysal Al Mukit	21-45696-3		
3	Afsana Jahan Onu	21-45708-3		
4	Upanta Chowdhury	22-46736-1		
5	Emon Das	22-46599-1		

The project will be Evaluated for the following Course Outcomes

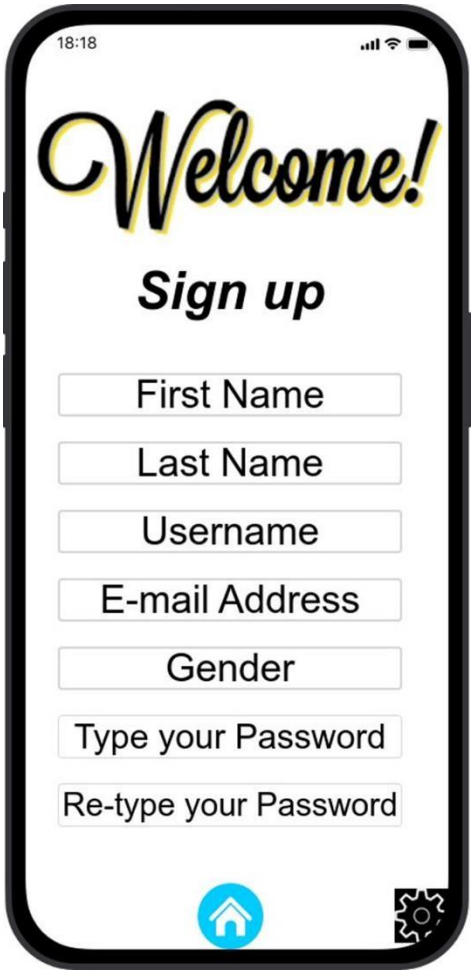
CO3: *Select* appropriate software engineering models, project management roles and their associated skills for the complex software engineering project and evaluate the sustainability of developed software, taking into consideration the societal and environmental aspects	Total Marks	
Appropriate Process Model Selection and Argumentation with Evidence	[5 Marks]	
Evidence of Argumentation regarding process model selection	[5Marks]	
Evaluate the sustainability of the developed software in terms of both society and the environment (Impact identification)	[5Marks]	
Submission, Defense, Completeness, Spelling, grammar and Organization of the Project report	[5Marks]	
CO4: *Develop* project management plan to manage software engineering projects following the principles of engineering management and economic decision process	Total Marks	
Develop the project plan, its components of the proposed software products	[5Marks]	
Identify all the activities/tasks related to project management and categorize them within the WBS structure. Perform detailed effort estimation correspond with the WBS and schedule the activities with resources	[5Marks]	
Identify all the potential risks in the specific project and prioritizing/categorizing those to overcome the risk factors.	[5Marks]	

Description of Student's Contribution in the Project work

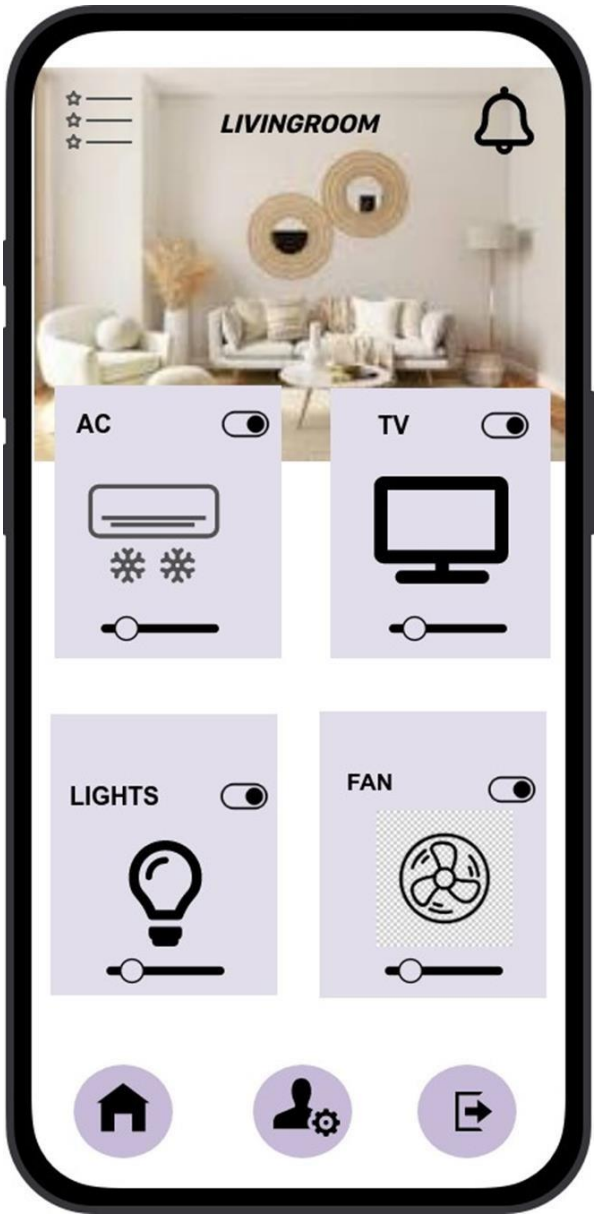
Student Name: Umme Jannatul Fariha Student ID: 21-45718-3 Contribution in Percentage (%): 20 Contribution in the Project: • Contribution Description: UI Design, Testing, Activity scheduling, Cocomo _____Fariha_____ Signature of the Student
Student Name: Asir Foysal Al Mukit Student ID: 21-45696-3 Contribution in Percentage (%): 20 Contribution in the Project: • Contribution Description: UI Design, Testing, Activity scheduling, Risk Management _____Asir_____ Signature of the Student
Student Name: Afsana Jahan Onu Student ID: 21-45708-3 Contribution in Percentage (%): 20 Contribution in the Project: • Contribution Description: UI Design, Testing, Activity scheduling, Estimation _____Onu_____ Signature of the Student
Student Name: Upanta Chowdhury Student ID: 22-46736-1 Contribution in Percentage (%): 20 Contribution in the Project: • Contribution Description: UI Design, Testing, Activity scheduling, Resource Allocation _____Upanta_____ Signature of the Student
Student Name: Emon Das Student ID: 22-46599-1 Contribution in Percentage (%): 20 Contribution in the Project: • Contribution Description: UI Design, Testing, Activity scheduling, Estimation _____Emon_____ Signature of the Student

UI DESIGN:

SMART HOME
EXPLORE THE HOME EASILY
USERNAME
PASSWORD
LOGIN
DON't HAVE AN ACCOUNT? CREATE ONE

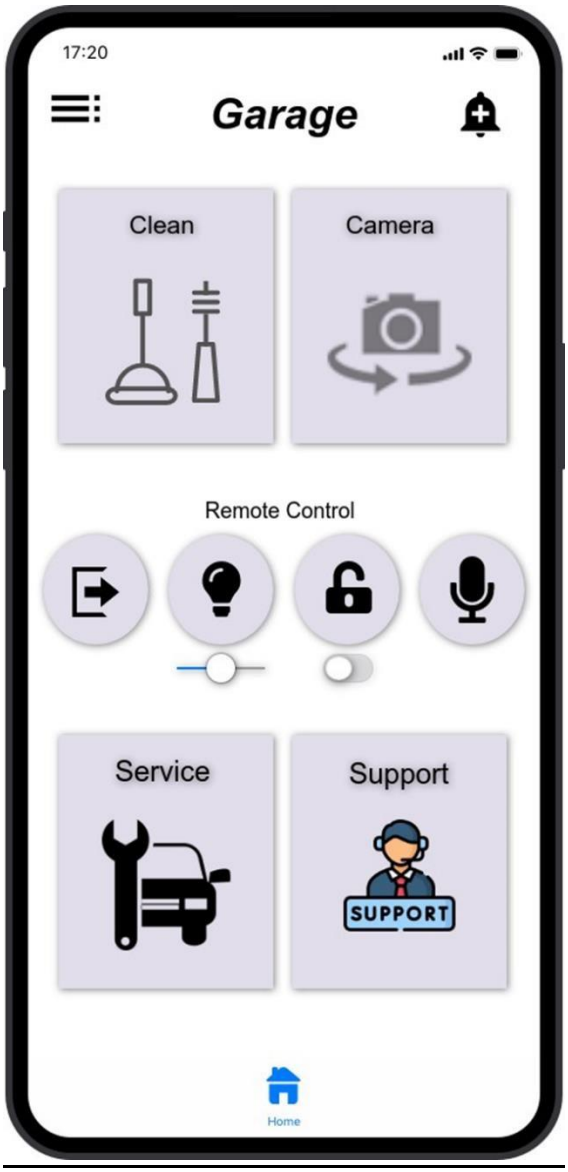

18:18
Welcome!
Sign up
First Name
Last Name
Username
E-mail Address
Gender
Type your Password
Re-type your Password

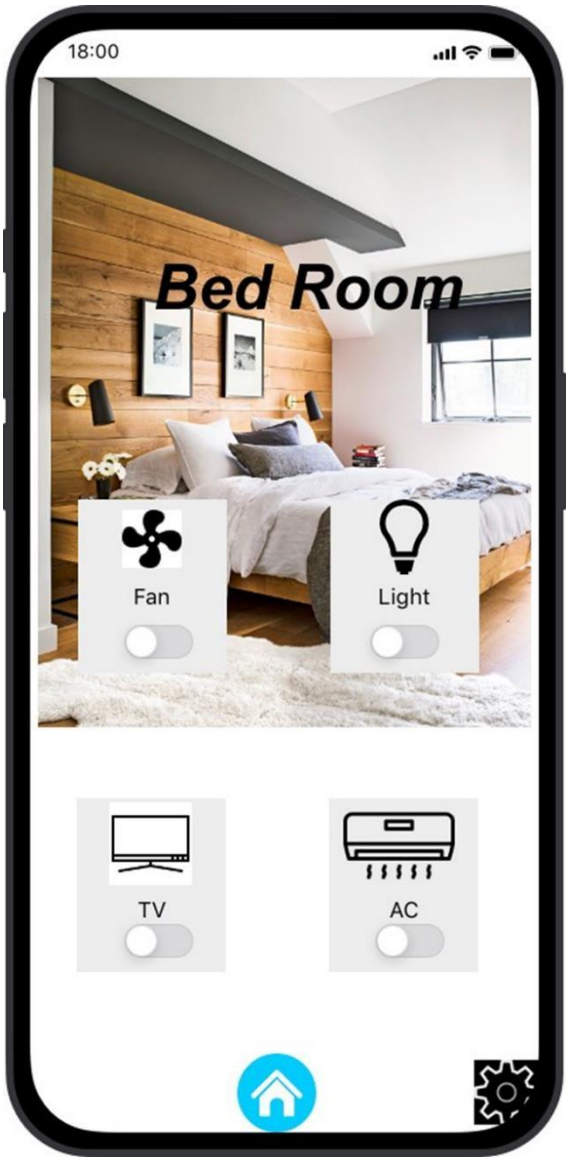
WELCOME,HOME
LIVING ROOM
BEDROOM
DINING ROOM
KITCHEN
GARAGE
BATHROOM

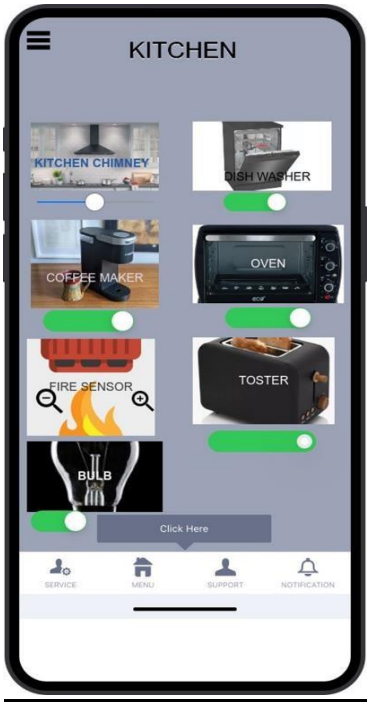

LIVINGROOM
AC
TV
LIGHTS
FAN

17:31
Dining room
Camera
Table lamp
Controls
AC
Coffee Maker

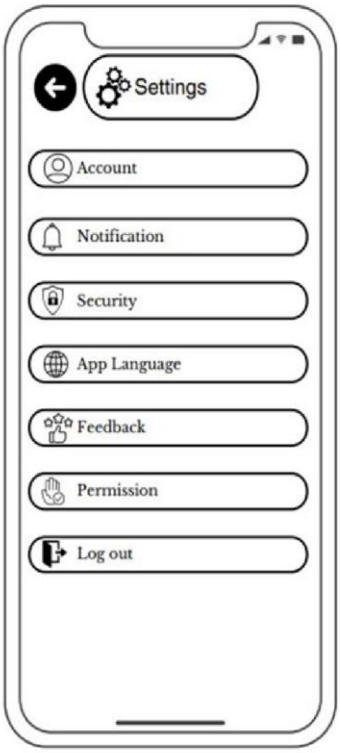
17:20
Bathroom
Fan Conditioner
Light
Mode
flush
Home


17:20
Garage
Clean
Camera
Remote Control
Service
Support
SUPPORT
Home


18:00
Bed Room
Fan
Light
TV
AC


KITCHEN
KITCHEN CHIMNEY
DISH WASHER
COFFEE MAKER
OVEN
FIRE SENSOR
TOSTER
BULB
Click Here
SERVICE
MENU
SUPPORT
NOTIFICATION

NOTIFICATIONS
1.System was disarmed by Asir Mukit at 03.22,tue 11/12.


Settings
Account
Notification
Security
App Language
Feedback
Permission
Log out

Testing:

Project Name: SMART HOME AUTOMATION SYSTEM	Test Designed by: Upanta Chowdhury
Test Case ID: FR_1 Test Priority (Low, Medium, High): Medium	Test Designed date: 28/03/2024 Test Executed by: Test Execution date:
Module Name: Registration Session Test Title: verify Registration with Name, username, Email address,	Gender, password ,Confirm Password.
Description: Test website Registration page	
Precondition (If any): User must have valid Emaill Address and fill up all the criteria of Username and Password .	

Test Steps	Test Data	Expected Actual	Result	Status (Pass/Fail)
1.Go to the website 2.Click Signup 3.Enter Name 4.Enter Username 5.Enter Email address 6.Select Gender 7.Enter Password 8.Enter Confirm Password. 9.Click submit Post User is validated with database successfully logged in the database.	Name: Wilson Gomez Username: Wilson_01 Email Address:wilson48@gmail.com Gender:Male Password: qwer1234 Confirm Password: qwer1234	User should successfully register into the application		

Project Name: SMART HOME AUTOMATION SYSTEM	Test Designed by: Afsana Jahan Onu
Test Case ID: FR_2 Test Priority (Low, Medium, High): Medium	Test Designed date: Test Executed by:
Module Name: AC control Test Title: Air Conditioner (AC) Control Functionality Test	Test Execution date:

Description: This test verifies the functionality of controlling the air conditioner (AC) in the Smart Home Automation System.

Precondition (If any): The Smart Home Automation System is installed and operational.

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
1. Turn on the AC using the designated control. 2. Set the desired temperature. 3. Verify if the AC is turned on and the temperature is set correctly. 4. Turn off the AC using the designated control. 5. Verify if the AC is turned off.	AC control actions Desired temperature setting	1.The AC should turn on successfully. 2.The desired temperature should be set. 3.The AC should start cooling to the desired temperature. 4.The AC should turn off successfully. 5.The AC should stop cooling.		

Post Condition: The AC control functions properly, and the AC state corresponds to the actions performed.

Project Name: SMART HOME AUTOMATION SYSTEM	Test Designed by: Afsana Jahan Onu
Test Case ID: FR_3 Test Priority (Low, Medium, High): Medium	Test Designed date: Test Executed by:
Module Name: TV control Test Title: Television (TV) Control Functionality Test	Test Execution date:

Description: This test verifies the functionality of controlling the television (TV) in the Smart Home Automation System.

Precondition (If any): The Smart Home Automation System is installed and operational.

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
1. Turn on the TV using the designated control. 2. Change the channel. 3. Adjust the volume. 4. Turn off the TV using the designated control.	• TV control actions • Channel number • Volume level	1.The TV should turn on successfully. 2.The channel should change according to the input. 3.The volume should adjust to the specified level. 4.The TV should turn off successfully.		

Post Condition: The TV control functions properly, and the TV state corresponds to the actions performed

Project Name: SMART HOME AUTOMATION SYSTEM	Test Designed by: Afsana Jahan Onu
Test Case ID: FR_4 Test Priority (Low, Medium, High): Medium	Test Designed date: Test Executed by:
Module Name: Camera Control Test Title: Camera Control Functionality Test	Test Execution date:

Description: This test verifies the functionality of controlling the camera in the Smart Home Automation System.

Precondition (If any): The Smart Home Automation System is installed and operational.

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
1. Access the camera control interface. 2. Pan the camera left and right. 3. Tilt the camera up and down. 4. Zoom in and out using the camera controls.	Camera control actions	1.The camera control interface should be accessible. 2.The camera should pan left and right smoothly. 3.The camera should tilt up and down smoothly. 4.The camera should zoom in and out smoothly.		

Post Condition: The camera control functions properly, and the camera movements correspond to the actions performed.

Project Name: SMART HOME AUTOMATION SYSTEM	Test Designed by: Afsana Jahan Onu
Test Case ID: FR_5 Test Priority (Low, Medium, High): Medium	Test Designed date:04/04/2024 Test Executed by:
Module Name: Garage Service And Support Test Title: Garage Door Control Functionality Test	Test Execution date:

Description: This test verifies the functionality of controlling the garage door in the Smart Home Automation System.

Precondition (If any): The Smart Home Automation System is installed and operational.

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
1. Open the garage door using the designated control. 2. Verify if the garage door is opened completely. 3. Close the garage door using the designated control. 4. Verify if the garage door is closed completely.	Garage door control actions	1.The garage door should open successfully . 2.The garage door should be fully open. 3.The garage door should close successfully 4.The garage door should be fully closed.		

Post Condition: The garage door control functions properly, and the garage door state corresponds to the actions performed.

Project Name: SMART HOME AUTOMATION SYSTEM Test Case ID: FR_6 Test Priority (Low, Medium, High): Medium Module Name: Login Session	Test Designed by: Emon Das Test Designed date: 28/03/2024 Test Executed by: Test Execution date:

Test Title: verify login with valid username password

Description: Test website login page

Precondition (If any): User must have valid username and password

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
1.Go to the website 2.Enter username 3.Enter password 4.Click submit	Username: Wilson_01 Password: qwer1234	User should login into the application		

post condition: User is validated with database and successfully login to account. The account session details are logged in the database.

Project Name: SMART HOME AUTOMATION SYSTEM Test Case ID: FR_7 Test Priority (Low, Medium, High): High Module Name: Test Security and Safety	Test Designed by: ASIR FOYSAL Test Designed date: 28/03/2024 Test Executed by: Test Execution date:

Test Title: Verify Security Door Lock.

Description: Test Security System

Precondition (If any): User must have a valid account and is authenticated within the smart home automation system and the system installed .

Test Steps	Test Data	Expected Result	Actual Result	Status (Pass/Fail)
1. Login to the system. 2. Go to the Security Section. 3. Check the password for the Doorlock ,if Credentials match ,the door will unlock.	Doorlock Pin:- 3949596	User should successfully open the door with right pin		

Post condition: Door lock is working properly.

Project Name: SMART HOME AUTOMATION SYSTEM	Test Designed by: Fariha
Test Case ID: FR_8	Test Designed date: 03./04/2024
Test Priority (Low, Medium, High): Medium	Test Executed by:
Module Name: Logout Session	Test Execution date:
Test Title: verify logout button	
Description: Test website logout button	
Precondition (If any): Ensure that the user is logged in and has an active session.	

Test Steps	Test Data	Expected Actual	Results (Pass/Fail) Results	Status
1. Go to the website 2. Identify the logout option 3. Click logout 4. Now,it will take you to the login page	Test logout confirmation prompts with different confirmation responses (e.g., "Yes," "No").	User should Logout from the application		

Post Condition: User is successfully logged out from the application.

Project Name: SMART HOME AUTOMATION SYSTEM	Test Designed by: Fariha
Test Case ID: FR_9	Test Designed date: 03./04/2024
Test Priority (Low, Medium, High): Medium	Test Executed by:
Module Name: Notification Session	Test Execution date:

Test Title: verify notification button

Description: To verify that the notification button functions correctly and provides users with timely and relevant notifications.

Precondition (If any): Ensure that the user is logged in and has an active session.

Test Steps	Test Data	Expected Result	Actual Results	Status (Pass/Fail)
1. Go to the website 2. Verify that the notification button is visible . 3. Click on the notification button and confirm that the notification panel opens. 4. Verify the display of notification details (e.g., message, timestamp). 5. Click on a notification and verify that it opens the corresponding content or action. 6. Test marking notifications as read and unread.	Click on the notification button. Expected Result: Click on a notification within the notification panel. Mark a notification as read or unread.	The notification panel should open smoothly. The corresponding content or action associated with the clicked notification should open. The notification should be visually updated to reflect its read/ unread status .		

Post Condition: User is successfully access all the notifications.

Project Name: SMART HOME AUTOMATION SYSTEM	Test Designed by: Fariha
Test Case ID: FR_10	Test Designed date: 03./04/2024
Test Priority (Low, Medium, High): Medium	Test Executed by:
	Test Execution date:

Test Title: verify dishwasher button

Description: To verify that the dishwasher button functions correctly and initiates the dishwasher cycle as intended.

Precondition (If any): Ensure that the user is logged in and has access to kitchen.

Test Steps	Test Data	Expected Actual	Results	Status (Pass/Fail)
1.Go to kitchen homepage. 2.Press the dishwasher button. 3.Toggle the dishwasher button.	Press the dishwasher button. Toggle the dishwasher button.	The dishwasher button should initiate the dishwasher cycle upon pressing.	Results	

Post Condition: User can successfully access dishwasher Button anytime.

Project Name: SMART HOME AUTOMATION SYSTEM	Test Designed by: Fariha
Test Case ID: FR_11	Test Designed date: 03./04/2024
Test Priority (Low, Medium, High): Medium	Test Executed by:
Module Name: coffee maker Session	Test Execution date:
Test Title: verify coffee maker button	

Description: To verify that the coffee maker functions correctly.

Precondition (If any): Ensure that the user is logged in and has access to kitchen.

Test Steps	Test Data	Expected Result	Actual Results	Status (Pass/Fail)
1.Go to kitchen homepage. 2.Press the coffee maker button. 3.Press the oven button. 4.Select the mode you want to use.	Press the coffee maker button. Press the oven button. Select any mode or set timer.	The coffee maker button should initiate the coffee making and stopped automatically after making the coffee. The oven button should initiate process upon pressing	Results	

Post Condition: User can successfully access coffee maker Button anytime.

Project Name: SMART HOME AUTOMATION SYSTEM	Test Designed by: Fariha
Test Case ID: FR_12 Test Priority (Low, Medium, High): Medium	Test Designed date: Test Executed by:
Module Name: oven Session Test Title: verify oven button	Test Execution date:

Description: To verify that the oven button functions correctly.
Precondition (If any): Ensure that the user is logged in and has access to kitchen

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
1.Go to kitchen homepage. 2. Press the oven button. 3. Select the mode you want to use.	Press the oven button. Select any mode or set timer.	The oven button should initiate process upon pressing.		

Post Condition: User can successfully access oven Button anytime.

Project Name: SMART HOME AUTOMATION SYSTEM	Test Designed by: Fariha
Test Case ID: FR_13 Test Priority (Low, Medium, High): Medium	Test Designed date: Test Executed by:
Module Name: toaster Session Test Title: verify toaster button	Test Execution date:

Description: To verify that the toaster functions correctly.
Precondition (If any): Ensure that the user is logged in and has access to kitchen.

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
1. Go to kitchen homepage. 2. Press the toaster button	Press the toaster button.	The toaster button should initiate the making and stopped automatically after making the toast.		

Post Condition: User can successfully access toaster Button anytime.

Project Name: SMART HOME AUTOMATION SYSTEM	Test Designed by: Fariha
Test Case ID: FR_14 Test Priority (Low, Medium, High): Medium	Test Designed date: Test Executed by:
Module Name: Exhaust fan Session Test Title: verify exhaust fan functionality	Test Execution date:

Description: Test exhaust fan functionality and its work.
Precondition (If any): User must have logged into the session

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
1.Go to the bathroom page. 2. Turn on the exhaust fan. 3. Turn off the exhaust fan.	Turn on the exhaust fan. Turn off the exhaust fan.	The fan is turn on,off successfully	As expected	Passed

Post Condition: The exhaust fan control is working successfully.

Project Name: SMART HOME AUTOMATION SYSTEM	Test Designed by: Afsana Jahan Onu
Test Case ID: FR_15 Test Priority (Low, Medium, High): Medium	Test Designed date: Test Executed by:
Module Name: Test setting button Test Title: Setting Button Functionality Test	Test Execution date:

Description: This test aims to verify the functionality of the setting button in the Smart Home Automation System.
Precondition (If any): The Smart Home Automation System is installed and operational.

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
1.Click on the setting button. 2.Verify that the settings menu opens. 3.Navigate through the settings options (if any). 4.Make changes (if applicable) and save settings.	User interaction with the setting button and navigation through the settings menu	1.The setting options menu should be displayed. 2.The setting options should include options for configuring the system. 3.The selected setting option should be editable. 4.The changes made should be saved successfully	As expected	Passed

Post Condition: The setting changes are saved and reflected in the Smart Home Automation System.

Project Name: SMART HOME AUTOMATION SYSTEM	Test Designed by: Afsana Jahan Onu
Test Case ID: FR_16 Test Priority (Low, Medium, High): Medium	Test Designed date: Test Executed by:
Module Name: Light on, off Test Title: Light Control Functionality Test	Test Execution date:

Description: This test verifies the functionality of turning the light on and off in the Smart Home Automation System.

Precondition (If any): The Smart Home Automation System is installed and operational.

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
1. Turn on the light using the designated control. 2. Verify if the light is turned on. 3. Turn off the light using the designated control. 4. Verify if the light is turned off.	Light control actions	1.The light should turn on successfully. 2.The light should be illuminated. 3.The light should turn off successfully 4.The light should not be illuminated		

Post Condition: The light control functions properly, and the light state corresponds to the actions performed.

Project Name: SMART HOME AUTOMATION SYSTEM	Test Designed by: Afsana Jahan Onu
Test Case ID: FR_17 Test Priority (Low, Medium, High): Medium	Test Designed by: Test designed date: 02/04/2024 Test Executed by:
Module Name: Fan on, off Test Title: Fan Control Functionality Test	Test Execution date:

Description: This test verifies the functionality of turning the fan on and off in the Smart Home Automation System.

Precondition (If any): The Smart Home Automation System is installed and operational.

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
1. Turn on the fan using the designated control. 2. Verify if the fan is turned on. 3. Turn off the fan using the designated control. 4. Verify if the fan is turned off.	Fan control actions	1. The fan should turn on successfully. 2. The fan should start spinning. 3. The fan should turn off successfully. 4. The fan should stop spinning.		

Post Condition: The fan control functions properly, and the fan state corresponds to the actions performed.

Project Name: SMART HOME AUTOMATION SYSTEM	Test Designed by: Afsana Jahan Onu
Test Case ID: FR_18 Test Priority (Low, Medium, High): Medium	Test Designed date:04.04.2024 Test Executed by:
Module Name: flush on Test Title: flush Functionality Test	Test Execution date:

Description: This test verifies the functionality of turning the flush on in the Smart Home Automation System.

Precondition (If any): The Smart Home Automation System is installed and operational.

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
1. Turn on the flush using the designated control. 2. Verify if the flush is turned on.	Flush control actions	5. The flush should turn on successfully. 6. And it should automatically turn off after its work.		

Post Condition: The flush control functions properly, and corresponds to the actions performed.

Project Name: SMART HOME AUTOMATION SYSTEM	Test Designed by: upanta
Test Case ID: FR_19 Test Priority (Low, Medium, High): Medium	Test Designed date:04.04.2024 Test Executed by:
Module Name: voiceover session Test Title: voice Functionality Test	Test Execution date:

Description: This test verifies the functionality of voice in the Smart Home Automation System.

Precondition (If any): The Smart Home Automation System is installed and it gives permission to use the microphone.

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
3. Turn on the voice option using the designated control. 4. Verify if the voice is turned on.	Give any voice commands.	7. The voice should turn on successfully. 8. And it should automatically do the thing that the user asked for.		

Post Condition: The voice functions properly, and corresponds to the actions performed.

Project Name: SMART HOME AUTOMATION SYSTEM	Test Designed by: emon
Test Case ID: FR_20 Test Priority (Low, Medium, High): Medium	Test Designed date:04.04.2024 Test Executed by:
Module Name: water mode/speed session Test Title: water mode/speed Functionality Test	Test Execution date:

Description: This test verifies the functionality of water mode in the Smart Home Automation System.

Precondition (If any): The Smart Home Automation System is installed and operational.

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
1.Click on the mode option using the designated control. 2.Select the mode/speed of the water.	Water mode control actions	1.The water mode/speed should turn on successfully.		

Post Condition: The water mode/speed control functions properly, and corresponds to the actions performed.

Project Name: SMART HOME AUTOMATION SYSTEM	Test Designed by: Asir
Test Case ID: FR_21 Test Priority (Low, Medium, High): Medium	Test designed date: 02/04/2024 Test Executed by:
Module Name: Table lamp on, off Test Title: Table lamp Control Functionality Test	Test Execution date:

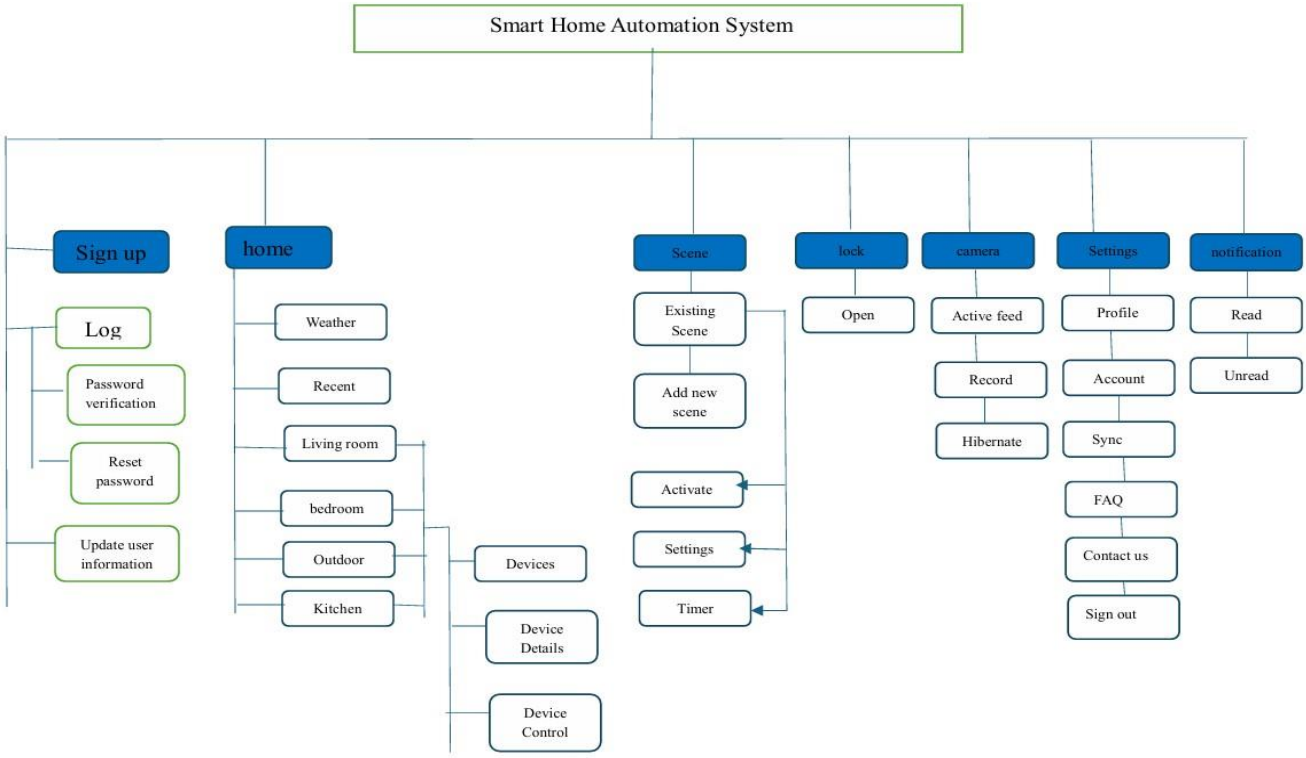
Description: This test verifies the functionality of turning the table lamp on and off in the Smart Home Automation System.

Precondition (If any): The Smart Home Automation System is installed and operational.

Test Steps	Test Data	Expected Results	Actual Results	Status (Pass/Fail)
5. Turn on the table lamp using the designated control. 6. Verify if the table lamp is turned on. 7. Turn off the table lamp using the designated control. 8. Verify if the table lamp is turned off.	table lamp control actions	5. The table lamp should turn on successfully. 6. The table lamp should start spinning. 7. The table lamp should turn off successfully. 8. The table lamp should stop spinning.		

Post Condition: The table lamp control functions properly, and the fan state corresponds to the actions performed.

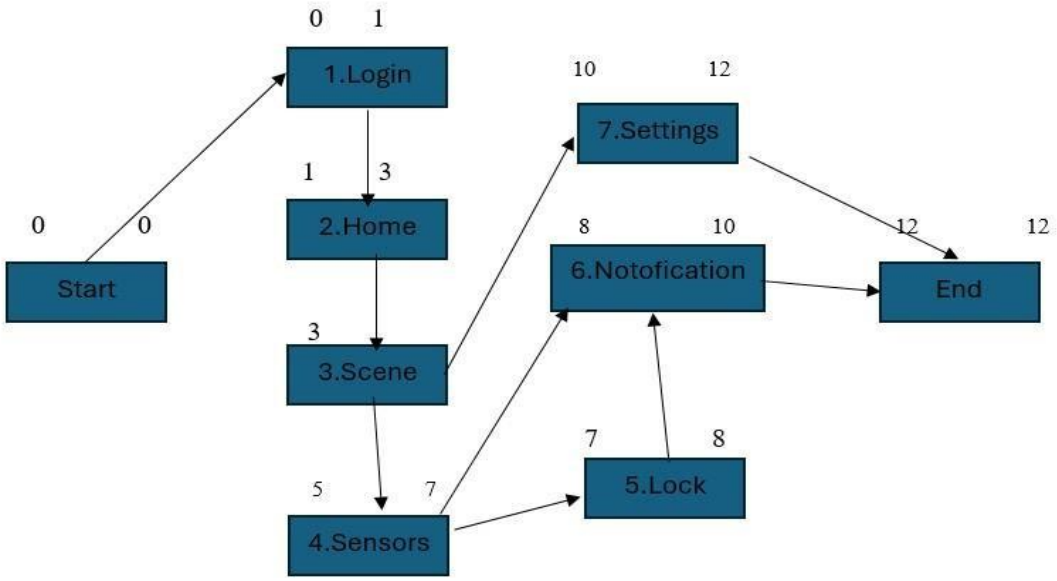
Work Breakdown Structure (WBS)



Activity Scheduling and Resource Allocation:

Activity #	Description	Predecessors	Duration (Weeks)
1	Login	-	1
2	Home	1	2
3	Scene	2	2
4	Sensors	3	2
5	Lock	4	1
6	Notification	4,5	2
7	Settings	3	2

Network Diagram



Timeline Chart–1

Weeks / Task per person	0	1	2	3	4	5	6	7	8	9	10	11
1												
2												
3												
4												
5												
6												
7												

Timeline Chart–2

Week 0	Day 1	Day 2	Day 3	Day 4	Day 5
Login					
Password Verification					
Reset Password					
Update User Information					

Week 1	Day 1	Day 2	Day 3	Day 4	Day 5
Weather					
Recent					
Devices					
Device Details					

Week 2	Day 1	Day 2	Day 3	Day 4	Day 5
Device Details					
Device Control					
Room Linking					

Week 3	Day 1	Day 2	Day 3	Day 4	Day 5
Add New Scene					
Existing scene					
Timer					

Week 4	Day 1	Day 2	Day 3	Day 4	Day 5
Activate Scene					
Scene Settings					

Week 5	Day 1	Day 2	Day 3	Day 4	Day 5
Fire Alarm					
Door					
Window					

Week 6	Day 1	Day 2	Day 3	Day 4	Day 5
Window					
Ac					
Dish washer					

Week 7	Day 1	Day 2	Day 3	Day 4	Day 5
Lock Mechanism					
Sensor Calibration					

Week 8	Day 1	Day 2	Day 3	Day 4	Day 5
Notification Read					

Week 9	Day 1	Day 2	Day 3	Day 4	Day 5
Notification Unread					

Week 10	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
PROFILE					
ACCOUNT					
SYNC					

Week 11	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
CONACT US					
SIGN OUT					
CONACT US					

Earned Value Analysis (EVA)

Table: Smart Home Automation System Execution Report After 4 Weeks

Description	Duration (Weeks)	Cost	Work Completed	Money Spent
Sign Up	2	Tk 8000	100%	Tk 9500
Login	1	Tk 7000	85%	Tk 8500
Update user info	2	Tk 6000	25%	Tk 7000
Sensor	2	Tk 12000	75%	Tk 15000
Controls	3	Tk 5000	85%	Tk 8000
Security	3	Tk 9000	95%	Tk 12000
Notification	3	Tk 6000	100%	Tk 7800
Feedback	1	Tk 3000	100%	Tk 5200

Table: Estimation for Smart Home Automation System

Project	BCWS	BCWP	ACWP	SV	CV	CPI	SPI
Sign Up	Tk8000	Tk 6000	Tk 4000	Tk 0	Tk (7000)	0.12	0.85
Login	Tk 7000	Tk 4000	Tk 2000	Tk (600)	Tk (5000)	0.175	0.45
Update user info	Tk 6000	Tk 5000	Tk 1000	Tk (300)	Tk (4000)	0.78	1.25
Sensor	Tk 12000	Tk 8000	Tk 5000	Tk (200)	Tk (3000)	0.56	0.62
Controls	Tk 5000	Tk 3000	Tk 2000	Tk (50)	Tk (4000)	0.43	0.89
Security	Tk 9000	Tk 7000	Tk 1000	Tk (100)	Tk (5000)	0.58	0.74
Notification	0.00	0.00	0.00	0.00	0.00	0	0
Feedback	0.00	0.00	0.00	0.00	0.00	0	0
Total	Tk 47000	Tk 33000	Tk 15000	Tk (1250)	Tk (28000)	2.645	4.8

Table: Progress Data Of Project Execution

Tasks	Planned Effort	Actual Effort
1	15	17
2	15	15
3	21	14
4	8	13
5	8	25
6	11	24
7	12	28
8	16	28
9	13	13
10	15	14
11	26	8
12	25	8
Total	185	207

Total Task= 12; Effort Estimation=440 person0-day

BAC=440 person-day
BCWP=148
BCWS=185
ACWP=142
SPI=BCWP÷BCWS= 0.8
SV= BCWP-BCWS=-37
CPI= BCWP÷ACWP= 1.04
CV= BCWP-ACWP= 6
% schedule for completion= BCWS÷BAC= 42.04% [% of work schedule to be done at this time]
%complete=BCWP÷BAC= 33.63% [% of work complete this time]

COCOMO (Construction Cost Model)

It's a semi detached project.
P=1.12
T=0.35
Coefficient=3
SLOC:20000
PM=Effort=Coefficient*(SLOC/1000)^P

$$=3*\left(\frac{20000}{1000}\right)^{1.12}$$

=85.955

DM=Development time=2.50*(PM)^T

=2.50*$(85.955)^{0.35}$

=11.883 week days

Required number of people=ST=PM/DM

=85.955/11.883

=7.233

Risk Management:

Risks	Category	Probability	Impact	Risk Reduction Techniques
Size estimate may be low	PS	70%	2	Simulation, prototyping, tuning
Larger number of user than planned	PS	20%	3	Scalability planning, Load testing, Performance tuning
Less reuse than planned	PS	60%	2	Code modularization, Component reuse, Design patterns
Delivery deadline will be tightened	BU	40%	2	Incremental Development, Resource Optimization
Technology will not meet expectations	TE	20%	1	Proof of Concept, Prototyping, Technology Evaluation
Lack of training on tools	DE	80%	3	Training, Knowledge Transfer, Documentation
Staff inexperienced	ST	30%	2	Training, Knowledge Transfer, Mentorship
Staff turnover will be high	ST	60%	2	Friendly environment, Knowledge Transfer, Mentorship, Team Building, Flexibility
System Overload	PS	40%	3	Load Testing, Performance Tuning, Capacity Planning
User Resistance	BU	50%	3	User Involvement, Change Management, Communication
Performance Issues	TE	30%	2	Performance Tuning, Model Evaluation
Security Vulnerabilities	TE	20%	2	Security Audits, Penetration Testing, Encryption
Funding Shortfall	CU	30%	1	Cost Estimation, Budget Management, Funding Diversification
Integration Challenges	TE	30%	2	Integration Testing, Interoperability Testing, API Design
Real Time Performance Problems	TE	50%	2	Performance Tuning, Load Testing, Caching
Sensor Failure	TE	4s0%	2	Failover Mechanism, Regular Maintenance