**CHAPTER FOUR**

**IMPLEMENTATION AND TESTING**

**4.1 Overview**

This chapter presents the implementation and testing of the **Hajj Guide System**, a web-based platform designed to prepare pilgrims through structured learning, interactive multimedia, and practical utilities. The front-end was developed using the **Next.js framework** with **React components**, while the backend utilized **MongoDB** for data storage and server-side validation. Interactive features such as animated ritual demonstrations and audio supplications were supported by multimedia libraries to ensure synchronization and accessibility across devices. The chapter discusses the development of the core features, challenges encountered during implementation, and the strategies adopted to resolve them. It also outlines the comprehensive testing methodologies, including unit, integration, and system testing used to ensure the system meets functional, performance, security, and cultural authenticity requirements. Finally, a user guide is provided to assist pilgrims in navigating the platform effectively and maximizing its educational and practical benefits.

**4.2 Main Features**

The system provides a platform for guiding and preparing pilgrims for Hajj through structured digital learning and practical support tools. Key features include:

* **User Registration and Login**: The System includes a secure user authentication and authorization system, allowing users to register and log in based on their roles (Pilgrim, scholar, admin). They can log in using their registered credentials.
* **Sequential Learning Modules**: Chronologically structured across eight days of Hajj. Users must complete each module before moving forward. Includes ritual content, historical context, and spiritual significance.
* **Interactive Multimedia**: Ritual animations (Tawaf, Sa’i, Jamarat), synchronized supplications, and visual cues.
* **Assessment System**: Brings up quizzes after each module based on current Hajj Step.
* **Utility Tools**: Tawaf counter, Jamarat tracker, prayer time calculator.
* **User Management System**: Secure registration, minimal data collection, customizable profiles.
* **Responsive Design**: Optimized layouts for desktop and mobile with touch-friendly controls.

**4.3 Implementation Problems**

During the development of the Hajj Guide System, several technical and design-related challenges were encountered. These affected system performance, usability, and cultural appropriateness:

1. **Database Performance**: Slow MongoDB queries under heavy load caused reduced responsiveness and noticeable delays.
2. **Sequential Learning Enforcement**: Users were able to bypass restrictions through browser manipulation, undermining the guided learning structure.
3. **Cultural Sensitivity Validation**: Some user interface patterns conflicted with Islamic norms, creating risks of cultural or religious inappropriateness.
4. **Content Management**: Multiple scholarly review cycles introduced version conflicts and slowed down the overall development process.
5. **Performance Optimization**: Multimedia-rich content strained weaker devices and limited accessibility for users with poor internet connectivity.
6. **Cross-Browser Compatibility**: Features behaved inconsistently across browsers such as Chrome, Safari, and Firefox, resulting in uneven user experiences.

**4.4 Overcoming Implementation Problems**

To address the challenges encountered during development, a combination of technical solutions and process improvements were applied:

1. **Database Performance**: Optimized MongoDB queries through indexing, caching, and connection pooling, which reduced delays and improved responsiveness.
2. **Sequential Learning Enforcement**: Implemented server-side validation and database constraints, preventing users from bypassing prerequisite requirements.
3. **Cultural Sensitivity Validation**: Worked closely with Islamic scholars and community representatives to refine UI patterns and ensure cultural and religious appropriateness.
4. **Content Management**: Introduced version control tools and structured review workflows, making scholarly feedback easier to manage without slowing development.
5. **Performance Optimization**: Used progressive loading, file compression, and adaptive quality settings to balance multimedia richness with accessibility on weaker devices.
6. **Cross-Browser Compatibility:** Conducted systematic multi-browser testing and applied polyfills to ensure consistent performance across Chrome, Firefox, Safari, and Edge.

**4.5 Testing**

The testing process employed comprehensive strategies addressing functionality verification, performance validation, cultural appropriateness assessment, and religious accuracy confirmation. Testing activities occurred throughout development phases rather

Table 4.1: Testing for Pilgrim Registration

|  |  |
| --- | --- |
| Test Case | Pilgrim Registration |
| Related Page | Registration Page |
| Test Procedure | Navigate to registration → Enter pilgrim details → Click “Register” |
| Test Data | Pilgrim details (Name, Email, Password) |
| Expected Result | Pilgrim registered successfully |
| Actual Result | Pilgrim registered successfully |
| Status | Pass |
| Remark | None |
| Created By | Ayman Sanusi |
| Date of Creation | 24th September, 2025 |
| Executed By | Ayman Sanusi |
| Date of Execution | 24th September, 2025 |
| Test Environment | Acer Computer / Chrome Browser |

Table 4.2: Testing for Admin Registration

|  |  |
| --- | --- |
| Test Case | Admin Registration |
| Related Page | Registration Page |
| Test Procedure | Navigate to admin registration → Enter admin details → Click “Register” |
| Test Data | Admin details (Name, Email, Password) |
| Expected Result | Admin registered successfully |
| Actual Result | Admin registered successfully |
| Status | Pass |
| Remark | None |
| Created By | Ayman Sanusi |
| Date of Creation | 24th September, 2025 |
| Executed By | Ayman Sanusi |
| Date of Execution | 24th September, 2025 |
| Test Environment | Acer Computer / Chrome Browser |

Table 4.3: Testing for Scholar Registration

|  |  |
| --- | --- |
| Test Case | Scholar Registration |
| Related Page | Registration Page |
| Test Procedure | Navigate to scholar registration → Enter scholar details → Click “Register” |
| Test Data | Scholar details (Name, Email, Password) |
| Expected Result | Scholar registered successfully |
| Actual Result | Scholar registered successfully |
| Status | Pass |
| Remark | None |
| Created By | Ayman Sanusi |
| Date of Creation | 24th September, 2025 |
| Executed By | Ayman Sanusi |
| Date of Execution | 24th September, 2025 |
| Test Environment | Acer Computer / Chrome Browser |

Table 4.4: Testing for Tawaf Simulator

|  |  |
| --- | --- |
| Test Case | Tawaf Simulator |
| Related Page | Tawaf Simulation Page |
| Test Procedure | Open Tawaf simulator → View Kaaba animation → Complete virtual Tawaf |
| Test Data | User performs 7 rounds |
| Expected Result | Simulator runs smoothly and completes after 7 rounds |
| Actual Result | Simulator completed successfully |
| Status | Pass |
| Remark | None |
| Created By | Ayman Sanusi |
| Date of Creation | 24th September, 2025 |
| Executed By | Ayman Sanusi |
| Date of Execution | 24th September, 2025 |
| Test Environment | Acer Computer / Chrome Browser |

Table 4.5: Testing for Tawaf Counter

|  |  |
| --- | --- |
| Test Case | Tawaf Counter |
| Related Page | Tawaf Simulation Page |
| Test Procedure | Start Tawaf → Counter increments each round → Resets after 7 |
| Test Data | 7 rounds |
| Expected Result | Counter increases correctly per round and resets at 7 |
| Actual Result | Counter worked as expected |
| Status | Pass |
| Remark | None |
| Created By | Ayman Sanusi |
| Date of Creation | 24th September, 2025 |
| Executed By | Ayman Sanusi |
| Date of Execution | 24th September, 2025 |
| Test Environment | Acer Computer / Chrome Browser |

Table 4.6: Testing for Quiz after Step

|  |  |
| --- | --- |
| Test Case | Quiz after Step |
| Related Page | Quiz Page |
| Test Procedure | Complete a step → System presents quiz → Submit answers |
| Test Data | Quiz answers (multiple-choice) |
| Expected Result | Quiz evaluated and score displayed |
| Actual Result | Quiz worked as expected |
| Status | Pass |
| Remark | None |
| Created By | Ayman Sanusi |
| Date of Creation | 24th September, 2025 |
| Executed By | Ayman Sanusi |
| Date of Execution | 24th September, 2025 |
| Test Environment | Acer Computer / Chrome Browser |

Table 4.7: Testing for Scholar Review

|  |  |
| --- | --- |
| Test Case | Scholar Review |
| Related Page | Scholar Dashboard |
| Test Procedure | Pilgrim completes step → Scholar logs in → Reviews and approves |
| Test Data | Pilgrim progress data |
| Expected Result | Scholar can review and approve steps |
| Actual Result | Review and approval successful |
| Status | Pass |
| Remark | None |
| Created By | Ayman Sanusi |
| Date of Creation | 24th September, 2025 |
| Executed By | Ayman Sanusi |
| Date of Execution | 24th September, 2025 |
| Test Environment | Acer Computer / Chrome Browser |

Table 4.8: Testing for Admin Monitoring

|  |  |
| --- | --- |
| Test Case | Admin Monitoring |
| Related Page | Admin Dashboard |
| Test Procedure | Admin logs in → Views list of users → Monitors activities |
| Test Data | User details |
| Expected Result | Users’ details and activities displayed |
| Actual Result | Monitoring successful |
| Status | Pass |
| Remark | None |
| Created By | Ayman Sanusi |
| Date of Creation | 24th September, 2025 |
| Executed By | Ayman Sanusi |
| Date of Execution | 24th September, 2025 |
| Test Environment | Acer Computer / Chrome Browser |

Table 4.9: Testing for Progress Tracking

|  |  |
| --- | --- |
| Test Case | Progress Tracking |
| Related Page | Admin Dashboard |
| Test Procedure | Admin logs in → Selects a pilgrim → Views progress |
| Test Data | Pilgrim progress data |
| Expected Result | Progress shown correctly |
| Actual Result | Progress tracked successfully |
| Status | Pass |
| Remark | None |
| Created By | Ayman Sanusi |
| Date of Creation | 24th September, 2025 |
| Executed By | Ayman Sanusi |
| Date of Execution | 24th September, 2025 |
| Test Environment | Acer Computer / Chrome Browser |

Table 4.10: Testing for Delete User Account

|  |  |
| --- | --- |
| Test Case | Delete User Account |
| Related Page | Admin Dashboard |
| Test Procedure | Admin logs in → Selects user → Clicks “Delete” |
| Test Data | User ID |
| Expected Result | User account deleted successfully |
| Actual Result | User account deleted successfully |
| Status | Pass |
| Remark | None |
| Created By | Ayman Sanusi |
| Date of Creation | 24th September, 2025 |
| Executed By | Ayman Sanusi |
| Date of Execution | 24th September, 2025 |
| Test Environment | Acer Computer / Chrome Browser |

**4.6 User Guide**

**For Pilgrims**

1. Open the system in a web browser.
2. On the welcome page, click **Start Your Journey**.
3. If you don’t have an account, register with valid details. If you already have one, log in.
4. Choose the type of Hajj you want to perform:

* **Hajj al-Tamattu –** 10 steps**.**
* **Hajj al-Qiran –** 10 steps.
* **Hajj al-Ifrad** – 9 steps.

1. Each step includes: an overview, procedure, history, Qur’anic and Hadith references.
2. At the end of each step, complete a quiz to move to the next one.
3. Your progress is saved automatically.

**For Administrators**

1. Log in or register with valid credentials.
2. Monitor system performance and user progress.
3. Manage accounts, including deleting user profiles if needed.

**For Scholars**

1. Log in or register with valid credentials.
2. Review Hajj steps and validate the Qur’anic and Hadith evidence.

**4.7 Summary**

Chapter Four presented the implementation of the **Hajj Guide System**. The system was developed as a responsive platform that combines structured learning modules, interactive multimedia, and practical tools to support pilgrims in preparing for Hajj. The final product provides a simple, reliable, and user-friendly digital guide that ensures both cultural authenticity and religious accuracy