MOSQUES AUTOMATION SYSTEM MOBILE APP REPORT

1. Introduction

1.1 Purpose

The Mosque Management System is a comprehensive Flutter-based mobile application designed to streamline the management and monitoring of mosques. It serves as a central platform for government officials, imams, and worshippers, integrating Internet of Things (IoT) capabilities with religious information management.

1.2 Scope

This system covers multiple aspects of mosque management, including:

- Real-time monitoring of mosque environments
- Prayer time management
- Lesson scheduling and management
- Worshipper information and services
- Government-level oversight of multiple mosques

1.3 Intended Audience

- Government officials responsible for mosque oversight
- Mosque administrators and imams
- IT personnel maintaining the system
- Worshippers using the application's services

2. System Architecture

2.1 Technology Stack

- Frontend: Flutter
- Backend: Firebase Realtime Database
- External APIs: Aladhan API for prayer times
- Machine Learning: TensorFlow Lite

3. Modules

3.1 Main Application (main.dart)

3.1.1 Purpose

Serves as the entry point of the application and sets up the primary navigation structure.

3.1.2 Key Features

- Firebase initialization
- Home screen with dynamic navigation options
- Custom hover effects for improved user experience

3.1.3 Code Structure

- MyApp class: Root widget of the application
- MyHomePage class: Implements the main navigation interface
- HoverCard widget: Custom widget for interactive navigation buttons

3.1.4 Dependencies

- firebase_core for Firebase initialization
- Custom LocalNotifications class for handling local notifications

3.2 Government Interface (government.dart)

3.2.1 Purpose

Provides government officials with an overview and management capabilities for all mosques in the system.

3.2.2 Key Features

- List of all managed mosques with quick access
- Navigation to detailed statistics and real-time data for each mosque
- Access to system-wide reports and analytics

3.2.3 Code Structure

- GovernmentPage class: Main widget for the government interface
- Integration with Firebase for real-time mosque data
- Navigation to AlbabtainPage and other specific mosque pages

3.2.4 Data Flow

- Fetches mosque list and summary data from Firebase
- Updates in real-time as mosque data changes

3.3 Worshippers Interface (worshippers.dart)

3.3.1 Purpose

Offers worshippers easy access to prayer times, nearby mosques, and lesson information.

3.3.2 Key Features

- Display of daily prayer times
- List of nearby mosques with distance information
- Access to lesson schedules for each mosque

3.3.3 Code Structure

- WorshippersPage class: Main widget for the worshippers interface
- fetchPrayerTimes() method: Retrieves prayer times from Aladhan API
- Integration with device location services for nearby mosque functionality

3.3.4 API Integration

- Aladhan API used for fetching accurate prayer times
- Format: http://api.aladhan.com/v1/timingsByAddress/[DATE]?address=[LOCATION]&tune=[ADJUSTMENTS]

3.4 Al Babtain Mosque Management (albabtain.dart)

3.4.1 Purpose

Provides a comprehensive management interface for the Al Babtain Mosque, serving as a template for individual mosque management.

3.4.2 Key Features

- Real-time sensor data display (temperature, motion, light, flow)
- Actuator controls for mosque equipment
- Lesson management interface
- Automated notifications for suspicious activities

3.4.3 Code Structure

- AlbabtainPage class: Main widget for mosque management
- SensorDataCard widget: Displays individual sensor readings
- ActionSwitchCard widget: Controls for actuators
- LessonsWidget widget: Manages lesson information

3.4.4 Sensor Integration

- Temperature Sensor: Monitors mosque environment
- Motion Sensor: Detects movement during prayer times
- Light Sensor: Manages lighting efficiency
- Flow Sensor: Monitors water usage

3.4.5 Actuator Control

- Fan Control: Manages mosque ventilation
- RGB LED Control: Adjusts mood lighting
- WS2812 LED Control: Manages decorative lighting

3.4.6 Machine Learning Integration

- TensorFlow Lite models for predictive analysis of sensor data
- getFutureFlow(), getFutureTemp(), getFutureLight() methods for ML predictions

3.5 Lessons Management (lessons.dart)

3.5.1 Purpose

Manages the scheduling, display, and administration of religious lessons within the mosque.

3.5.2 Key Features

- Display of current lesson schedule
- Interface for adding new lessons
- Real-time updates to lesson information

3.5.3 Code Structure

- LessonsPage class: Main widget for lesson management
- Integration with Firebase for real-time lesson data
- addLesson() method for creating new lesson entries

3.5.4 Data Model

- Lesson Title: String
- Lesson Time: String (formatted time)
- Lesson Date: Date object
- Instructor: String (optional)

4. Key Functionalities

4.1 Firebase Integration

- Real-time data storage and retrieval
- Stores sensor data, actuator states, and lesson information

4.2 Sensor Monitoring

4.2.1 Purpose

Continuously monitors and analyzes data from various sensors installed in the mosque.

4.2.2 Implementation Details

- Sensor data fetched from Firebase in real-time
- Thresholds set for each sensor type to detect anomalies
- isWithinIntervals() method checks for suspicious activities during prayer times

4.3 Actuator Control

- Allows remote control of various mosque equipment for environment management.
- fanAction(), rgbLedAction(), ws2812Action() methods control respective equipment
- State of actuators stored and updated in Firebase

4.4 Prayer Time Management

4.4.1 Purpose

Ensures accurate and up-to-date prayer times are available to all users.

4.4.2 Implementation Details

- fetchPrayerTimes() method retrieves data from Aladhan API
- Prayer times cached locally for offline access
- Automatic updates daily or upon user request

4.5 TensorFlow Lite Integration

4.5.1 Purpose

Utilizes machine learning for predictive analysis of sensor data.

4.5.2 Implementation Details

- TensorFlow Lite models loaded for flow, temperature, and light intensity prediction
- getFutureFlow(), getFutureTemp(), getFutureLight() methods process sensor data through ML models
- Predictions used for proactive environment management and anomaly detection

4.6 Local Notifications

4.6.1 Purpose

Provides timely alerts and information to users.

4.6.2 Implementation Details

- Uses LocalNotifications class for managing notifications
- Triggered for prayer times, suspicious activities, and important announcements
- Customizable notification content and timing

5. Data Models

5.1 Sensor Data

- Temperature
- Motion
- Light intensity
- Water flow

5.2 Actuator States

- Fan
- RGB LED
- WS2812

5.3 Lesson Information

- Lesson title
- Lesson time

6. API Integration

6.1 Aladhan API

- Endpoint: http://api.aladhan.com/v1/timingsByAddress/
- Used for fetching daily prayer times

7. Machine Learning Models

- Flow prediction model
- Temperature prediction model
- Light intensity prediction model

8. User Interfaces

8.1 Main Navigation

- Government
- Worshippers
- Imam

8.2 Government Dashboard

- Overview of all managed mosques with key metrics
- Quick access buttons to individual mosque management pages
- Data visualization components for system-wide statistic

8.3 Worshippers View

- Prominently displayed prayer times for the current day
- Interactive map or list of nearby mosques
- Easy access to lesson schedules and mosque event information

8.4 Mosque Management Interface

- Real-time sensor data displayed in easy-to-read cards
- Toggle switches and sliders for actuator controls
- Expandable sections for lessons management and advanced settings

9. Security Considerations

9.1 Authentication

- Implement Firebase Authentication for secure user login
- Role-based access control for different user types (government officials, imams, worshippers)

9.2 Data Encryption

- Ensure all sensitive data is encrypted both in transit and at rest
- Use secure HTTPS connections for all API communications

9.3 Input Validation

- Implement thorough input validation on all user inputs to prevent injection attacks
- Sanitize data before storing in Firebase to prevent stored XSS attacks

9.4 API Security

- Use API keys and implement rate limiting for the Aladhan API integration
- Keep API keys and sensitive configurations in secure, non-versioned files

9.5 Regular Security Audits

- Conduct periodic security audits of the codebase and infrastructure
- Keep all dependencies and Flutter SDK up to date to patch known vulnerabilities

10. Future Enhancements

10.1 Multi-language Support

- Implement localization to support multiple languages
- Allow users to switch languages within the app

10.2 Advanced Analytics Dashboard

- Develop a comprehensive analytics dashboard for government officials
- Include predictive analytics using machine learning models

10.3 Community Features

- Add a community board for mosque announcements and events
- Implement a donation tracking and management system

10.4 IoT Expansion

- Integrate with more IoT devices for enhanced mosque management
- Implement automated routines based on sensor data and prayer times

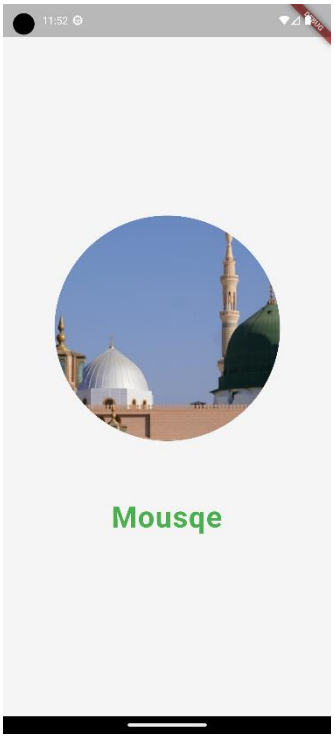
10.5 Offline Mode

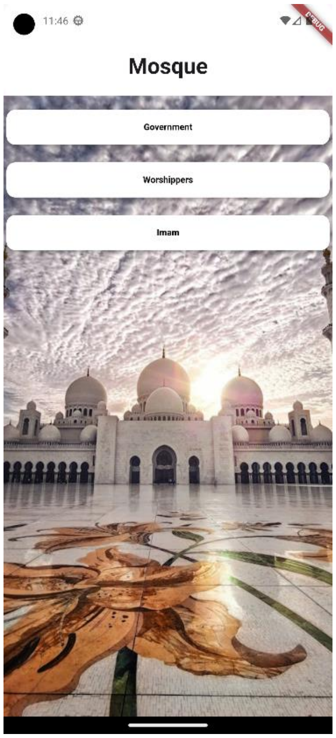
- Enhance offline capabilities

11. Troubleshooting

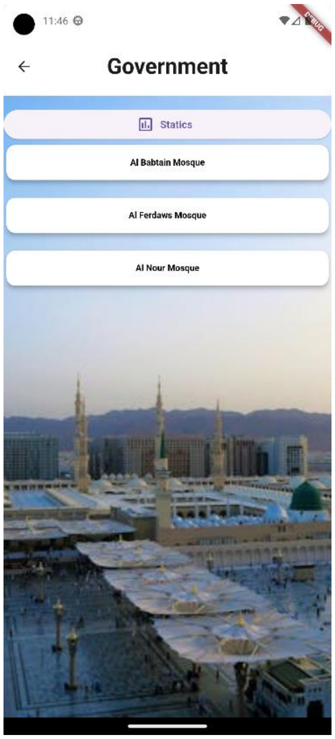
- Check Firebase connection for real-time data issues
- Verify internet connection for prayer time fetching
- Ensure TensorFlow Lite models are correctly loaded

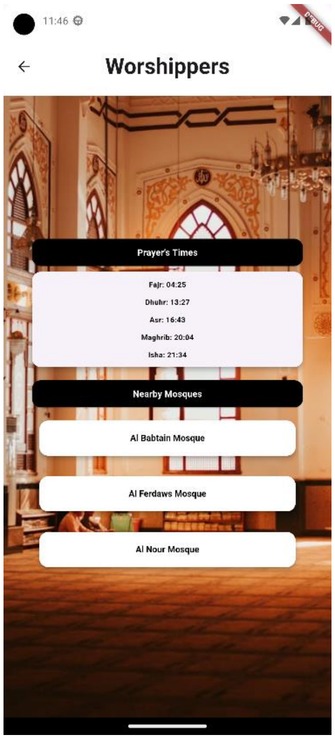
Appendix A: Images from the Mobile Application





Two images from the application the first one on the left is the intro to the application and the second one is the home page.





Fajr: 04:25

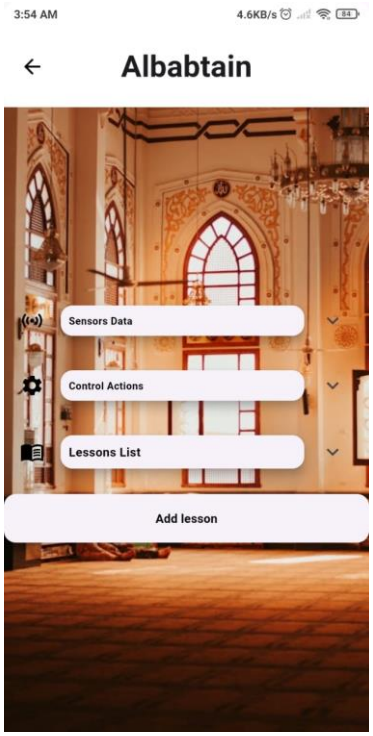
Dhuhr: 13:27

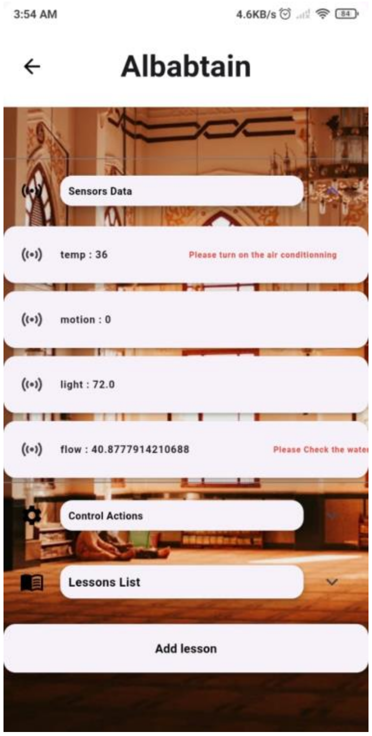
Asr: 16:43

Maghrib: 20:04

Isha: 21:34

Two images from the application the first one on the left is the government view and the second one is the worshipers view



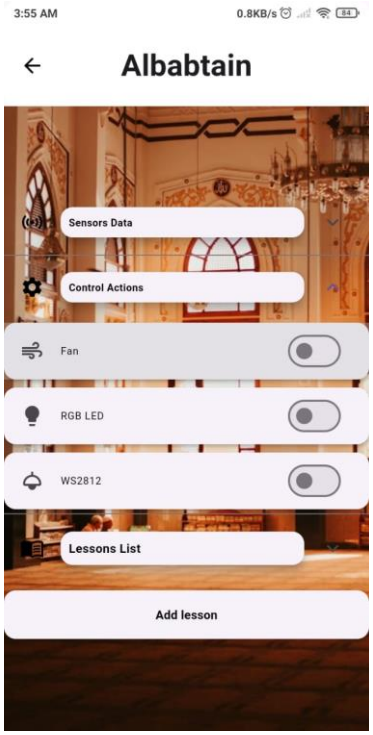


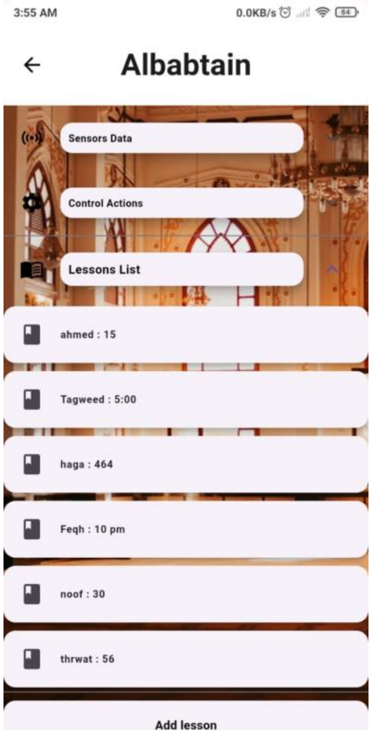
temp : 36 Please turn on the air conditionning

motion : 0

light : 72.0

flow : 40.8777914210688 Please Check the wate





ahmed : 15

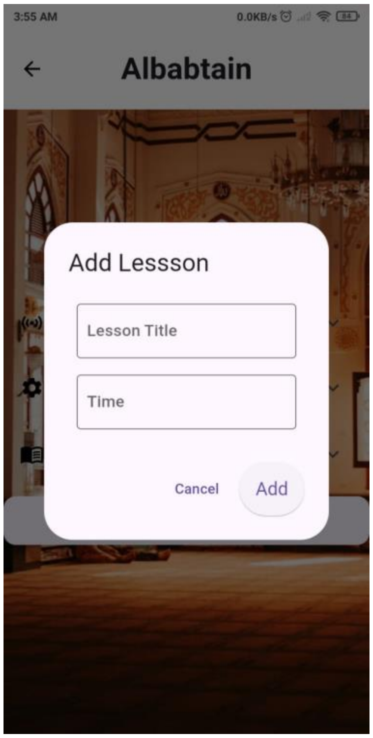
Tagweed : 5:00

haga : 464

Feqh : 10 pm

noof : 30

thrwat : 56



Five images from the Imam prospective. The imam has full control of the system