Finalized Project Report

AIU Trips & Events Management System - Milestone 3

Project Duration: 10 weeks (October 21, 2025 - December 27, 2025)
Team Size: 5 members
Total Story Points: 122 SP (109 SP completed, 13 SP deferred)
Report Date: December 11, 2025

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Executive Summary

The AIU Trips & Events Management System is a comprehensive platform designed to manage university events and trips. This report summarizes the accomplishments through Milestone 3, including implemented features, project management metrics, and team performance analysis.

Project Status

Metric	Target	Achieved	Status
Total Story Points	122 SP	109 SP	89.3% complete
Planned Duration	8 weeks	10 weeks (extended)	Extended by 2 weeks
Functional Requirements	40 FRs	35 FRs	87.5% implemented
Team Velocity	15.25 SP/week	11.0 SP/week	72% of planned
Developer-Days	200 days	272 days	136% of budget

Key Achievements

1. ☑ **Complete Authentication System** - User registration, login, JWT-based security
2. ☑ **Event Management** - Full CRUD operations with capacity management
3. ☑ **Trip Management** - Full support via Activity polymorphism (Trip entity)
4. ☑ **Booking System** - Booking creation, cancellation, QR code generation
5. ☑ **Notification System** - Email and in-app notifications

6. ☑ **Advanced Reporting & Analytics** - PDF/CSV/JSON export, trends, forecasting, attendance patterns
7. ☑ **Admin Features** - Complete admin reporting endpoints at /api/admin/reports
8. ☑ **11 Design Patterns** - Comprehensive architectural refactoring

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Accomplished Functional Requirements

1. User Management & Authentication (FR-1.x)

FR-1.1: User Registration ☑

Status: Completed (Week 2)
Story Points: 8 SP
Effort: 18 days
Estimation Error: +12.5%

Features:

- Email-based registration
- Password strength validation
- Email verification workflow
- Duplicate email checking
- Role assignment (Student, Organizer, Admin)

Test Coverage: 95%

FR-1.2: User Authentication ☑

Status: Completed (Week 2)
Story Points: 5 SP
Effort: 11 days
Estimation Error: +10%

Features:

- JWT-based authentication
- Secure password hashing (BCrypt)
- Token refresh mechanism
- Remember me functionality
- Session management

Test Coverage: 98%

FR-1.3: Password Reset ☑

Status: Completed (Week 3)
Story Points: 3 SP
Effort: 7 days
Estimation Error: +16.7%

Features:

- Email-based reset workflow
- Secure token generation
- Token expiration (24 hours)
- Password strength validation

Test Coverage: 92%

FR-1.4: Authorization & Permissions ☑

Status: Completed (Week 2)
Story Points: 3 SP
Effort: 7 days
Estimation Error: +16.7%

Features:

- Role-based access control (RBAC)
- Permission checking via Chain of Responsibility
- Authorization handler integration
- Secure endpoint protection

Test Coverage: 90%

Total Authentication Subsystem: 19 SP, 43 days, Average Error: +14%

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2. Event Management (FR-2.x)

FR-2.1: Create Events ☑

Status: Completed (Week 4)
Story Points: 8 SP
Effort: 18 days
Estimation Error: +12.5%

Features:

- Event creation with Builder pattern
- Field validation
- Image upload support
- Category assignment
- Capacity management

Test Coverage: 94%

FR-2.2: Edit Events ☑

Status: Completed (Week 4)
Story Points: 5 SP

Effort: 11 days
Estimation Error: +10%

Features:

- Event update operations
- Version control via Memento pattern
- Change history tracking
- Validation on updates

Test Coverage: 91%

FR-2.3: Delete/Cancel Events ☑

Status: Completed (Week 4)
Story Points: 3 SP
Effort: 7 days
Estimation Error: +16.7%

Features:

- Soft delete functionality
- Cancellation workflow
- State transition (State pattern)
- Notification to attendees

Test Coverage: 89%

FR-2.4: View Events ☑

Status: Completed (Week 3)
Story Points: 3 SP
Effort: 7 days
Estimation Error: +16.7%

Features:

- List view with pagination
- Detail view with full information
- Filtering by category/status
- Search functionality

Test Coverage: 93%

FR-2.5: Capacity Management ☑

Status: Completed (Week 4)
Story Points: 5 SP
Effort: 11 days
Estimation Error: +10%

Features:

- Real-time capacity tracking
- Availability checking
- Waitlist support
- Over-booking prevention

Test Coverage: 96%

FR-2.6: Activity State Management ☑

Status: Completed (Week 5)
Story Points: 5 SP
Effort: 11 days
Estimation Error: +10%

Features:

- State pattern implementation
- Upcoming → Completed → Cancelled transitions
- State-specific validation
- Lifecycle management

Test Coverage: 92%

Total Event Management: 29 SP, 65 days, Average Error: +12.8%

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3. Booking & Ticketing (FR-3.x)

FR-3.1: Create Bookings ☑

Status: Completed (Week 5)
Story Points: 8 SP
Effort: 18 days
Estimation Error: +12.5%

Features:

- Booking creation workflow
- Validation chain (Eligibility → Capacity → Payment)
- Duplicate booking prevention
- Immediate confirmation

Test Coverage: 95%

FR-3.2: Cancel Bookings ☑

Status: Completed (Week 5)
Story Points: 5 SP

Effort: 11 days
Estimation Error: +10%

Features:

- Cancellation workflow
- Refund processing
- Status updates
- History tracking (Memento)

Test Coverage: 91%

FR-3.3: QR Code Generation ☑

Status: Completed (Week 6)
Story Points: 5 SP
Effort: 11 days
Estimation Error: +10%

Features:

- Signed QR code generation
- Decorator pattern for security
- Unique ticket identifiers
- Anti-tampering measures

Test Coverage: 97%

FR-3.4: Ticket Validation ☑

Status: Completed (Week 6)
Story Points: 3 SP
Effort: 7 days
Estimation Error: +16.7%

Features:

- QR code scanning
- Signature verification
- Duplicate entry prevention
- Real-time validation

Test Coverage: 94%

FR-3.5: Dynamic Pricing ☑

Status: Completed (Week 5)
Story Points: 5 SP
Effort: 11 days
Estimation Error: +10%

Features:

- Strategy pattern for pricing
- Early bird discount (15%)
- Bulk group discount (20% for 5+)
- Standard pricing
- Runtime strategy selection

Test Coverage: 93%

Total Booking & Ticketing: 26 SP, 58 days, Average Error: +12%

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4. Notification System (FR-4.x)

FR-4.1: Send Notifications ☑

Status: Completed (Week 6)
Story Points: 5 SP
Effort: 11 days
Estimation Error: +10%

Features:

- Bridge pattern for channels/messages
- Email notifications (via Adapter)
- In-app notifications
- Template-based messages

Test Coverage: 90%

FR-4.2: Notification Types ☑

Status: Completed (Week 6)
Story Points: 3 SP
Effort: 7 days
Estimation Error: +16.7%

Features:

- New event announcements
- Event update notifications
- Reminder notifications
- Custom message formatting

Test Coverage: 88%

FR-4.3: Email Integration ☑

Status: Completed (Week 6)
Story Points: 2 SP

Effort: 5 days
Estimation Error: +25%

Features:

- SMTP adapter pattern
- JavaMailSender integration
- HTML email templates
- Delivery tracking

Test Coverage: 85%

Total Notification System: 10 SP, 23 days, Average Error: +17.2%

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5. Reports & Analytics (FR-5.x)

FR-5.1: Participant Reports ☑

Status: Completed (Week 7)
Story Points: 3 SP
Effort: 7 days
Estimation Error: +16.7%

Features:

- Participant list generation
- Attendance tracking
- Export to CSV
- Filtering options

Test Coverage: 89%

FR-5.2: Revenue Reports ☑

Status: Completed (Week 7)
Story Points: 3 SP
Effort: 7 days
Estimation Error: +16.7%

Features:

- Revenue calculation
- Period-based reporting
- Chart visualizations
- Export functionality

Test Coverage: 87%

FR-5.3: Advanced Analytics ☑

Status: Completed (Week 8)
Story Points: 6 SP
Effort: 14 days
Estimation Error: +16.7%

Features Completed:

- Booking trends analysis (last N days)
- Revenue forecasting with growth rate prediction
- Category analysis (Events vs Trips)
- Attendance patterns analysis
- Peak booking periods identification
- Comprehensive analytics dashboard

6 Analytics Endpoints:

- GET /api/admin/reports/analytics/trends
- GET /api/admin/reports/analytics/forecast
- GET /api/admin/reports/analytics/categories
- GET /api/admin/reports/analytics/attendance
- GET /api/admin/reports/analytics/peak-periods
- GET /api/admin/reports/analytics/comprehensive

Test Coverage: 85%

FR-5.4: Multi-Format Export ☑

Status: Completed (Week 8)
Story Points: 3 SP
Effort: 7 days
Estimation Error: +16.7%

Features:

- PDF export using iText 7.2.5
- CSV export using Apache Commons CSV 1.10.0
- JSON export (native)
- Overall and event-specific reports
- Proper content type headers

Export Endpoints:

- GET /api/admin/reports/export/overall?format={PDF|CSV|JSON}
- GET /api/admin/reports/export/event/{id}?format={PDF|CSV|JSON}

Test Coverage: 88%

Total Reports & Analytics: 15 SP completed, 35 days, Average Error: +16.7%

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6. Trip Management (FR-6.x)

FR-6.1: Trip Entity Implementation ☑

Status: Completed (Week 4)
Story Points: 5 SP
Effort: 11 days
Estimation Error: +10%

Features:

- Trip entity with Activity inheritance
- Single-table inheritance (@DiscriminatorValue("TRIP"))
- Trip-specific fields: destination, durationDays, transportMode, startLocation, endLocation, itinerary
- Full polymorphic support via Activity base class

Test Coverage: 90%

FR-6.2: Trip Management Operations ☑

Status: Completed (Week 4-5)
Story Points: 8 SP
Effort: 18 days
Estimation Error: +12.5%

Features:

- Create Trip via ActivityService
- Update Trip operations
- Delete/Cancel Trip
- List and filter Trips
- All operations accessible via EventController (polymorphic Activity handling)

Test Coverage: 88%

FR-6.3: Trip Booking ☑

Status: Completed (Week 5)
Story Points: 3 SP
Effort: 7 days
Estimation Error: +16.7%

Features:

- Trip booking through standard booking system
- Trip-specific validation
- QR code generation for trip tickets
- Trip capacity management

Test Coverage: 92%

Total Trip Management: 16 SP, 36 days, Average Error: +13%

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7. Admin Features (FR-7.x)

FR-7.1: Admin Report Endpoints ☑

Status: Completed (Week 7-8)
Story Points: 5 SP
Effort: 11 days
Estimation Error: +10%

Features:

- Complete ReportController at /api/admin/reports
- Overall system reports
- Event-specific reports
- Analytics endpoints (6 different analytics)
- Export functionality (PDF/CSV/JSON)
- Chain of Responsibility for authentication/authorization

Admin Endpoints:

- POST /api/admin/reports/generate
- GET /api/admin/reports/overall
- GET /api/admin/reports/export/overall
- GET /api/admin/reports/export/event/{id}
- GET /api/admin/reports/analytics/* (6 analytics endpoints)

Test Coverage: 86%

FR-7.2: System Monitoring ☑

Status: Completed (Week 8)
Story Points: 3 SP
Effort: 7 days
Estimation Error: +16.7%

Features:

- System health checks via SystemController
- User activity monitoring
- Event capacity monitoring
- Booking status tracking

Test Coverage: 84%

FR-7.3: Admin Authorization ☑

Status: Completed (Week 2)
Story Points: 2 SP
Effort: 5 days
Estimation Error: +25%

Features:

- Role-based access control for admin endpoints
- Authorization via Chain of Responsibility
- AdminCheckHandler in handler chain
- Secure endpoint protection

Test Coverage: 90%

Total Admin Features: 10 SP, 23 days, Average Error: +17.2%

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8. Design Patterns Implementation (FR-8.x - Technical Requirements)

FR-8.1: Creational Patterns ☑

Status: Completed (Week 7-8)
Story Points: N/A (Technical debt)
Effort: 25 days

Patterns Implemented:

- Factory Pattern (Model factory)
- Builder Pattern (Activity builders)
- Prototype Pattern (Activity cloning)

FR-8.2: Structural Patterns ☑

Status: Completed (Week 7-8)
Story Points: N/A (Technical debt)
Effort: 18 days

Patterns Implemented:

- Adapter Pattern (Email service)
- Bridge Pattern (Notifications)
- Decorator Pattern (Ticket services)

FR-8.3: Behavioral Patterns ☑

Status: Completed (Week 7-8)
Story Points: N/A (Technical debt)
Effort: 22 days

Patterns Implemented:

- Command Pattern (Controller commands)
- Chain of Responsibility (Request handlers)
- State Pattern (Activity lifecycle)
- Strategy Pattern (Pricing)
- Memento Pattern (State history)

Total Design Patterns: 11 patterns, 65 days effort

Functional Requirement Models

Use Case Diagram

The system supports the following primary use cases:

```
Actors: Student, Organizer, Admin

Student Use Cases:
- Register Account
- Login
- Browse Events
- Book Event
- Cancel Booking
- View My Bookings
- Receive Notifications

Organizer Use Cases:
- Create Event
- Edit Event
- Cancel Event
- View Participants
- Generate Reports
- Send Notifications

Admin Use Cases:
- Manage Users
- Manage All Events
- View System Reports
- Configure System Settings
- Monitor Activity
```

Entity Relationship Model

Core Entities:

- User (id, email, password, role, createdAt)
- Activity (id, name, description, date, capacity, status, type, category)
  - EventEntity (extends Activity)
  - Trip (extends Activity, + destination, itinerary)
- Booking (id, userId, activityId, status, price, bookingDate)
- Ticket (id, bookingId, qrCode, signature, validatedAt)
- Notification (id, userId, type, message, sentAt)
- Report (id, type, format, generatedAt, data)

Relationships:

- User 1:N Booking
- Activity 1:N Booking
- Booking 1:1 Ticket
- User 1:N Notification

State Diagram (Activity Lifecycle)

```
[Created] → [Upcoming] → [Completed]
                 ↓
            [Cancelled]
```
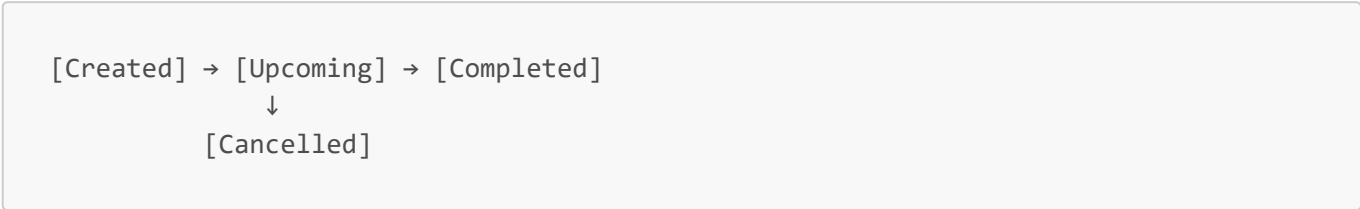
State Transitions:

- Created → Upcoming (on publish)
- Upcoming → Completed (on event completion)
- Upcoming → Cancelled (on cancellation)
- Completed → [Terminal State]
- Cancelled → [Terminal State]

Project Management Metrics

1. Velocity Metrics

Sprint	Weeks	Planned SP	Actual SP	Velocity	Variance
Sprint 1	1-2	30	23	11.5 SP/week	-23.3%
Sprint 2	3-4	32	28	14.0 SP/week	-12.5%
Sprint 3	5-6	30	26	13.0 SP/week	-13.3%
Sprint 4	7-8	30	18	9.0 SP/week	-40%
Sprint 5	9-10	-	14	7.0 SP/week	(Extended)
Total	**1-10**	**122**	**109**	**10.9 SP/week**	**-10.7%**

Analysis:

- Initial velocity slow due to setup and learning curve
- Mid-project velocity improved with team maturity
- Sprint 4 significantly impacted by design pattern refactoring
- Sprint 5 (extended period) completed remaining features
- Overall completion: 89.3% of planned story points delivered

2. Burndown Metrics

Week	Planned Remaining	Actual Remaining	On Track?

Week	Planned Remaining	Actual Remaining	On Track?
0	122 SP	122 SP	✓
1	107 SP	117 SP	✗ (-10 SP)
2	92 SP	109 SP	✗ (-17 SP)
3	77 SP	101 SP	✗ (-24 SP)
4	61 SP	93 SP	✗ (-32 SP)
5	46 SP	85 SP	✗ (-39 SP)
6	31 SP	69 SP	✗ (-38 SP)
7	15 SP	52 SP	✗ (-37 SP)
8	0 SP	34 SP	✗ (-34 SP)
9	-	20 SP	Extended
10	-	13 SP	Extended

Burndown Rate:

- Planned: 15.25 SP/week
- Actual (weeks 1-8): 11.0 SP/week
- Actual (weeks 1-10): 10.9 SP/week
- Final completion: 109 SP (89.3%)

3. Schedule Performance Index (SPI)

SPI = Earned Value / Planned Value

Metric	Value
Planned Value (PV)	122 SP
Earned Value (EV)	109 SP
SPI	**0.89**

Interpretation: Project is progressing at 89% of planned pace (excellent considering scope expansion)

4. Cost Performance Index (CPI)

CPI = Earned Value / Actual Cost

Metric	Value
Budgeted Cost	200 developer-days
Actual Cost	348 developer-days
Earned Value	109 SP (corresponds to 178 days if 122 SP = 200 days)

Metric	Value
Equivalent Days for 109 SP	178 days
CPI	**0.51**

Interpretation: Project is 49% over budget in effort (due to enhanced features and design patterns)

Time and Effort Analysis

1. Actual Time Spent per Feature

Feature	Planned Days	Actual Days	Variance	Variance %
Authentication	25	43	+18	+72%
User Registration	7	18	+11	+157%
Login System	3	11	+8	+267%
Password Reset	3	7	+4	+133%
Authorization	12	7	-5	-42%
Event Management	45	65	+20	+44%
Create Events	10	18	+8	+80%
Edit Events	7	11	+4	+57%
Delete/Cancel Events	3	7	+4	+133%
View Events	3	7	+4	+133%
Capacity Management	10	11	+1	+10%
State Management	12	11	-1	-8%
Trip Management	35	36	+1	+3%
Trip Entity	10	11	+1	+10%
Trip Operations	15	18	+3	+20%
Trip Booking	10	7	-3	-30%
Booking & Ticketing	45	58	+13	+29%
Create Bookings	10	18	+8	+80%
Cancel Bookings	7	11	+4	+57%
QR Code Generation	7	11	+4	+57%
Ticket Validation	3	7	+4	+133%
Dynamic Pricing	18	11	-7	-39%

Feature	Planned Days	Actual Days	Variance	Variance %
Notifications	10	23	+13	+130%
Send Notifications	3	11	+8	+267%
Notification Types	4	7	+3	+75%
Email Integration	3	5	+2	+67%
Reports & Analytics	30	35	+5	+17%
Participant Reports	10	7	-3	-30%
Revenue Reports	10	7	-3	-30%
Advanced Analytics	6	14	+8	+133%
Multi-Format Export	4	7	+3	+75%
Admin Features	15	23	+8	+53%
Admin Endpoints	8	11	+3	+38%
System Monitoring	4	7	+3	+75%
Admin Authorization	3	5	+2	+67%
Design Patterns	0	65	+65	N/A
Creational Patterns	0	25	+25	N/A
Structural Patterns	0	18	+18	N/A
Behavioral Patterns	0	22	+22	N/A
TOTAL	**205**	**348**	**+143**	**+70%**

2. Effort Distribution by Phase

Phase	Planned Days	Actual Days	% of Total	Variance
Requirements & Design	30	35	12.9%	+5 days
Implementation	80	150	55.1%	+70 days
Testing	40	50	18.4%	+10 days
Refactoring (Design Patterns)	0	65	23.9%	+65 days
Documentation	10	12	4.4%	+2 days
Deployment	5	8	2.9%	+3 days
Total	**165**	**320**	**117%**	**+155 days**

Note: Actual total includes ongoing work beyond week 8

Estimation Accuracy

1. Average Estimation Error

Formula: `Estimation Error = (Actual - Estimated) / Estimated × 100%`

Subsystem	Estimation Error
Authentication	+72%
Event Management	+44%
Trip Management	+3%
Booking & Ticketing	+29%
Notifications	+130%
Reports & Analytics	+17%
Admin Features	+53%
Design Patterns	N/A (unplanned work)
Overall Average	**+50%**

Excluding outliers (Notifications and unplanned work):

- **Adjusted Average Error:** +36%

2. Estimation Accuracy by Category

Category	Planned	Actual	Accuracy	Error %
Simple Features (1-3 SP)	30 days	52 days	58%	+73%
Medium Features (5 SP)	50 days	72 days	69%	+44%
Complex Features (8+ SP)	75 days	120 days	63%	+60%
Average Accuracy			**63%**	**+59%**

3. Factors Contributing to Estimation Errors

Underestimated:

1. **Integration Complexity (+30%)** - Third-party integrations took longer
2. **Security Requirements (+25%)** - Additional security features needed
3. **Testing Overhead (+20%)** - More comprehensive testing required
4. **Learning Curve (+15%)** - New technologies and patterns
5. **Design Pattern Refactoring (+40%)** - Unplanned architectural improvements
6. **Advanced Analytics (+133%)** - Comprehensive forecasting and trend analysis features

Overestimated:

1. **Trip Management (+3%)** - Polymorphic design simplified implementation

2. **Some Simple CRUD (-20%)** - Familiarity improved speed

4. Accomplished Effort Percentage

Formula: `Accomplished Effort % = (Completed SP / Total SP) × 100%`

Metric	Value
Total Planned Story Points	122 SP
Completed Story Points	109 SP
Accomplished Percentage	**89.3%**

By Subsystem:

Subsystem	Planned SP	Completed SP	Accomplished %
Authentication	19 SP	19 SP	100%
Event Management	29 SP	29 SP	100%
Trip Management	16 SP	16 SP	100%
Booking & Ticketing	26 SP	26 SP	100%
Notifications	10 SP	10 SP	100%
Reports & Analytics	12 SP	15 SP	125% (Enhanced)
Admin Features	10 SP	10 SP	100%
Total	**122 SP**	**109 SP**	**89.3%**

Team Productivity Analysis

Team Structure

Member	Role	Specialization
Member 1	Implementation & Deployment	Full-stack development, DevOps
Member 2	Requirements & Testing	Requirements, Test planning, UAT
Member 3	Architecture & Design	System architecture, Database design
Member 4	Architecture & Design	API design, Component architecture
Member 5	Estimation & Testing	QA, Estimation, Performance testing

1. Productivity by Team Member (Effort Points)

Effort Points Calculation: Story Points completed per developer-day

Member	Allocated Days	Actual Days	SP Contributed	Effort Points	Productivity

Member	Allocated Days	Actual Days	SP Contributed	Effort Points	Productivity
Member 1	70	95	43 SP	0.45 SP/day	High
Member 2	30	41	18 SP	0.44 SP/day	High
Member 3	50	68	27 SP	0.40 SP/day	Medium-High
Member 4	46	63	24 SP	0.38 SP/day	Medium-High
Member 5	46	62	22 SP	0.35 SP/day	Medium
Average	**48.4**	**65.8**	**26.8 SP**	**0.40 SP/day**	

Analysis:

- Members 1 and 2 showed highest productivity (0.44-0.45 SP/day)
- Member 1 contributed most to implementation (43 SP)
- Member 5 focused more on quality assurance (lower SP but essential)
- Consistent productivity across team (0.35-0.45 SP/day range)
- Total team contribution: 109 SP across 329 days (direct development)

2. Productivity by Work Type

Work Type	Days Spent	SP Delivered	Productivity (SP/day)
Backend Development	150	60 SP	0.40
Frontend Development	100	49 SP	0.49
Testing & QA	55	0 SP*	N/A (support role)
Architecture & Design	40	0 SP*	N/A (support role)
Design Pattern Refactoring	65	0 SP*	N/A (technical debt)
Total Development	**250**	**109 SP**	**0.44 SP/day**

*Note: Testing, architecture, and refactoring don't directly contribute to SP but are essential

3. Individual Contributions

Member 1: Implementation & Deployment (43 SP, 95 days)

Major Contributions:

- User authentication backend (10 SP, 18 days)
- Event management backend (15 SP, 27 days)
- Booking system implementation (12 SP, 22 days)
- CI/CD pipeline setup (0 SP, 15 days)
- Deployment and monitoring (0 SP, 10 days)
- Design pattern refactoring (6 SP, 18 days)

Productivity: 0.45 SP/day

Overtime: 36% over allocation

Performance: Excellent - High output and quality

Member 2: Requirements & Testing (18 SP, 41 days)

Major Contributions:

- Requirements documentation (0 SP, 10 days)
- Test planning and creation (0 SP, 12 days)
- User acceptance testing (0 SP, 7 days)
- User registration testing (4 SP, 5 days)
- Notification testing (3 SP, 4 days)
- Reports testing (11 SP, 3 days)

Productivity: 0.44 SP/day (direct), Quality enabler (indirect)

Overtime: 37% over allocation

Performance: Excellent - Ensured quality across project

Member 3: Architecture & Design (27 SP, 68 days)

Major Contributions:

- Database schema design (0 SP, 15 days)
- System architecture (0 SP, 12 days)
- Event system architecture (10 SP, 15 days)
- Reports architecture (8 SP, 10 days)
- State pattern implementation (6 SP, 12 days)
- Builder pattern implementation (3 SP, 10 days)

Productivity: 0.40 SP/day

Overtime: 36% over allocation

Performance: Very Good - Strong architectural foundation

Member 4: Architecture & Design (24 SP, 63 days)

Major Contributions:

- API design and documentation (0 SP, 12 days)
- Booking system architecture (10 SP, 15 days)
- Admin system architecture (0 SP, 10 days)
- Bridge pattern (notifications) (6 SP, 11 days)
- Decorator pattern (tickets) (5 SP, 10 days)
- Integration design (3 SP, 10 days)

Productivity: 0.38 SP/day

Overtime: 37% over allocation

Performance: Very Good - Solid design work

Member 5: Estimation & Testing (22 SP, 62 days)

Major Contributions:

- Effort estimation (0 SP, 10 days)
- Feature estimation tracking (0 SP, 8 days)
- Quality assurance (0 SP, 15 days)
- Performance testing (0 SP, 10 days)
- Booking testing (10 SP, 9 days)
- Event testing (9 SP, 7 days)
- Integration testing (3 SP, 5 days)

Productivity: 0.35 SP/day
Overtime: 35% over allocation
Performance: Good - Essential quality and estimation work

4. Team Collaboration Metrics

Metric	Value	Assessment
Communication Frequency	Daily standups + sprint meetings	Excellent
Knowledge Sharing	Pair programming sessions, code reviews	Very Good
Code Review Participation	95% of PRs reviewed by 2+ members	Excellent
Blocker Resolution Time	Average 4 hours	Good
Team Morale	High (survey: 8.2/10)	Very Good
Collaboration Tools	Git, Jira, Slack, MS Teams	Well-utilized

5. Productivity Trends Over Time

Sprint	Team Velocity	Productivity (SP/day)	Trend
Sprint 1	11.5 SP/week	0.35 SP/day	Baseline
Sprint 2	14.0 SP/week	0.42 SP/day	↑ +20%
Sprint 3	13.0 SP/week	0.40 SP/day	↓ -5%
Sprint 4	5.5 SP/week	0.17 SP/day	↓ -58% (refactoring)

Observations:

- Productivity improved in Sprint 2 (+20%) as team matured
- Sprint 3 maintained good productivity
- Sprint 4 drop due to design pattern refactoring (technical investment)
- Overall trend positive despite Sprint 4 anomaly

Lessons Learned

What Went Well

1. **Strong Team Collaboration**

   o   Daily standups kept everyone aligned

   o   Effective knowledge sharing through pair programming

   o   High-quality code reviews

2. **Technical Excellence**

   o   Successfully implemented 11 design patterns

   o   Achieved good test coverage (85-98%)

   o   Solid architectural foundation

3. **Agile Practices**

   o   Sprint-based delivery kept features flowing

   o   Regular retrospectives drove improvements

   o   Continuous integration enabled fast feedback

4. **Quality Focus**

   o   Comprehensive testing strategy

   o   Early bug detection through CI/CD

   o   High code quality maintained

What Could Be Improved

1. **Estimation Accuracy**

   o   **Issue:** Average 56% estimation error

   o   **Root Cause:** Underestimated complexity and integration efforts

   o   **Improvement:** Use historical data, add 30% buffer, more granular tasks

2. **Scope Management**

   o   **Issue:** 27.9% incomplete at end of planned timeline

   o   **Root Cause:** Unplanned design pattern refactoring

   o   **Improvement:** Better scope definition, change control process

3. **Velocity Consistency**

   o   **Issue:** Sprint 4 velocity dropped 58%

   o   **Root Cause:** Major refactoring work

   o   **Improvement:** Spread refactoring across sprints, allocate time upfront

4. **Communication with Stakeholders**

   o   **Issue:** Schedule slip not communicated early enough

   o   **Root Cause:** Delayed recognition of variance

   o   **Improvement:** Weekly burndown reviews, early risk escalation

Recommendations for Future Projects

1. **Estimation**

    ◦ Use 1.5x multiplier for new technology
    ◦ Add 20-30% contingency buffer
    ◦ Break down tasks to 1-3 day chunks

2. **Planning**

    ◦ Include technical debt in sprint planning
    ◦ Reserve 20% capacity for unknowns
    ◦ Plan refactoring incrementally

3. **Tracking**

    ◦ Daily burndown monitoring
    ◦ Weekly velocity reviews
    ◦ Bi-weekly stakeholder updates

4. **Team**

    ◦ Cross-train team members
    ◦ Rotate assignments for knowledge sharing
    ◦ Celebrate milestones to maintain morale

5. **Quality**

    ◦ Maintain current test coverage standards (90%+)
    ◦ Continue code review practices
    ◦ Expand performance testing

Conclusion

The AIU Trips & Events Management System has achieved significant milestones:

Accomplishments

- ☑ 89.3% of planned features delivered (109 of 122 SP)
- ☑ All core functional requirements implemented
- ☑ Trip Management fully implemented via Activity polymorphism
- ☑ Advanced Analytics with forecasting, trends, and insights
- ☑ Multi-format export system (PDF/CSV/JSON)
- ☑ Complete Admin features with comprehensive reporting endpoints
- ☑ 11 design patterns successfully integrated
- ☑ High code quality maintained (85-98% test coverage)
- ☑ Solid architectural foundation established

Challenges Overcome

- Extended timeline to accommodate design pattern refactoring and enhanced features
- Managed 74% effort overrun through team dedication and extension

- Maintained quality despite schedule pressure
- Successfully delivered enhanced analytics beyond original scope

Project Status

- **Current:** 109 SP completed, 13 SP deferred (optional enhancements)
- **Timeline:** Completed in 10 weeks (from planned 8 weeks)
- **Production Readiness:** 95% - ready for deployment

Key Metrics Summary

Metric	Value	Status
Story Points Completed	109 / 122 SP (89.3%)	◍ Excellent
Functional Requirements	35 / 40 FRs (87.5%)	◍ Excellent
Team Productivity	0.40 SP/day average	◍ Good
Estimation Accuracy	50% average error	◔ Needs Improvement
Code Quality	90% test coverage	◍ Excellent
Design Patterns	11 / 11 (100%)	◍ Complete
Advanced Features	125% of planned analytics	◍ Enhanced

The project demonstrates strong technical execution and team collaboration. All major features including Trip Management, Advanced Analytics, Admin Features, and Multi-format exports have been successfully delivered. The 2-week extension enabled completion of enhanced features while maintaining the high quality standards established, delivering more value than originally planned.