Proposal for RapidRide Ticketing System

A Modern, Secure, and Accessible Transit Ticketing Solution

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Contents

1 Executive Summary

RapidRide is a lightweight, secure, and extensible fare system for public transit. Designed for mid-sized municipalities such as Rapid City, South Dakota, it offers a cost-effective, open, and auditable alternative to commercial transit fare platforms.

Using digitally signed QR code tickets and a flexible mobile-friendly interface, RapidRide empowers riders and administrators with secure, modern infrastructure—without the costs or complexity of proprietary systems.

2 Project Scope

- Deploy a mobile- and kiosk-friendly digital fare platform
- Enable digital ticket purchase via Stripe integration
- Support secure QR-code-based validation
- Provide tools for fare enforcement, reporting, and expansion
- Ensure accessibility for all riders, including offline and low-tech options

3 System Overview

3.1 Frontend

The RapidRide client is a cross-platform application written in Qt/QML using PySide6, providing:

- A secure user wallet for ticket storage
- Stripe checkout integration for ticket purchasing
- QR code generation and display for scanned validation
- Offline ticket caching for intermittent connectivity

3.2 Backend

The backend is built in Python using FastAPI, supporting:

- Ticket generation using ED25519 digital signatures
- Ticket validation against cryptographic and database records
- User login, wallet synchronization, and Stripe session handling

4 Deployment Plan

1. **Phase 1: MVP (Proof of Concept)** 2–4 weeks
   - Core ticket generation, QR validation, and Stripe checkout
   - Basic enforcement scanner page
   - Pilot on a small number of devices or routes
2. **Phase 2: Fleet Rollout and Admin Features** 4–6 weeks
   - Wallet management dashboard (optional)
   - Driver/passenger usage analytics
   - Training and support for operators

5 Cost Estimate

Software Development

- Initial system deployment: $3,500-$8,500
- Optional expansion (reporting, dashboards): $1,200–$5,000

Hardware Requirements

One MiniPC running Debian Stable is recommended for backend infrastructure. Hardware costs for such a PC range from $200-$500. The frontend client can run on existing Android tablets, iPhones, or Linux laptops with cameras for validation.

6 Ongoing Support and Additional Development

After deployment of the core RapidRide system, ongoing support and additional development are available at the following rates:

Ongoing Support

- **Standard Support (Monthly)** $400/month
  - Covers small bug fixes, basic questions, user support, and monthly maintenance updates
  - Includes up to 4 hours/month of development time
- **On-Demand Support (Hourly)** $40/hour
  - For updates, troubleshooting, or deployment help beyond the base agreement

Additional Development

New features, expansions, or tooling requests are billed at:

- **$40/hour for planned development**
- Flat-rate feature pricing available upon request

All code remains GPL-licensed and open to the City of Rapid City, with no proprietary restrictions.

7 Future Add-Ons and Expansion Opportunities

The RapidRide system is designed to be modular and extensible. The following features can be added after the initial deployment as the needs of the transit system evolve. Each item includes a preliminary cost estimate based on hourly development and integration effort.

1. Admin Dashboard and Reporting

A secure, web-based interface for transit administrators to monitor system usage, download records, and manage operational data.

- **Estimated Cost:** $1,200–$2,500
- **Includes:**
  - Ticket sales and usage analytics
  - Rider activity summaries and filtering by route
  - CSV export and dashboard visualizations
- **Benefits:**
  - Improves data transparency and decision-making
  - Reduces staff time spent on manual record queries

2. Offline Ticket Validation Mode

Support for ticket validation on devices that operate without consistent internet access, such as rural-route buses or mobile fare inspectors.

- **Estimated Cost:** $800–$1,500
- **Includes:**
  - Local cache of ticket ID and status
  - Secure fallback validation logic

  - Sync mechanism for online catch-up

- **Benefits:**
  - Ensures continuity of fare enforcement in remote or offline areas
  - Enables validation on the move without real-time network dependency

3. Kiosk Mode for Public Purchase Stations

A locked-down, touchscreen-compatible interface for riders to purchase tickets at transit centers or high-traffic stops.

- **Estimated Cost:** $1,000–$1,800
- **Includes:**
  - Touch-optimized UI layout
  - Persistent login for kiosk identity
  - Stripe-hosted checkout flow integration
- **Requirements:**
  - Commercial tablet or touch screen
  - Optional: printer integration or SMS ticket delivery
- **Benefits:**
  - Expands ticket access to unbanked and non-smartphone users
  - Reduces lines at customer service counters

4. Physical QR/NFC Card Support (Tap or Scan)

This upgrade allows riders to use physical fare cards embedded with a QR code or contactless NFC chip. Cards can be distributed to riders without smartphones, used for pass programs, or issued for rapid boarding on high-volume routes.

- **Estimated Cost:** $1,800–$3,500
- **Includes:**
  - Backend logic to register and validate card IDs
  - Card issuing interface (admin or API)
  - QR-encoded card UID integration
  - Optional: MIFARE DESFire NFC support
- **Requirements:**

  - Physical card printing (typically $1–2 per card in bulk)
  - USB or serial NFC readers (if tap-to-ride is enabled)
  - Fare inspector or vehicle-mounted reader device
- **Benefits:**
  - Enables support for riders without mobile phones
  - Faster boarding on fixed-route buses
  - Durable, reusable fare media for passholders or youth programs

5. Multi-Language Support

Adds language toggle functionality to the user interface, enabling the display of all content in English, Lakota, Spanish, or other languages as needed.

- **Estimated Cost:** $600–$1,200
- **Includes:**
  - UI translation tables
  - Dynamic language toggle
  - Lakota and Spanish translation integration (where available)
- **Benefits:**
  - Increases accessibility for non-English speakers
  - Improves compliance with local and federal equity standards

6. Inspector/Admin Tablet Mode

Adds an inspection tool for fare enforcement personnel, with access to ticket validation tools, limited analytics, and offline fallback capability.

- **Estimated Cost:** $800–$1,500
- **Includes:**
  - Device-friendly layout for tablets
  - PIN-protected admin login mode
  - Real-time and offline ticket validation tools
- **Benefits:**
  - Streamlines fare enforcement on board buses
  - Reduces dependence on paper records or verbal verification

7. Ticket Sharing or Gifting

Enables riders to transfer tickets to another user or device, either permanently (gift) or for limited use (sharing window).

- **Estimated Cost:** $700–$1,200
- **Includes:**
  - Ticket ownership transfer logic
  - QR-scan or link-based acceptance flow
  - Audit trail and one-time-use token control
- **Benefits:**
  - Enables gifting to friends or dependents
  - Useful for youth programs, visitor passes, and parental sharing

8. Custom Branding and Theming

Applies visual design changes to match Rapid Transit or city branding standards.

- **Estimated Cost:** $400–$900
- **Includes:**
  - Custom color schemes and typefaces
  - Logo and graphic integration
  - Branded ticket UI and welcome screens
- **Benefits:**
  - Aligns visual identity with public-facing communications
  - Creates a more professional and polished rider experience

All estimates are preliminary and based on a standard development rate of $40/hour. Bundled packages, pilot programs, or grant-funded collaborations may reduce the overall cost.

8 License and Code Ownership

The RapidRide ticketing system is developed and maintained by the author and is provided under the terms of the **GNU General Public License v3 (GPL-3.0)**.

This ensures:

- The source code remains free and open to the public

- Modifications and derivative works must also be licensed under GPL
- The City of Rapid City is granted full rights to use, deploy, and modify the system
- The developer retains ownership of the original codebase and its licensing terms

This licensing model ensures long-term transparency, prevents vendor lock-in, and aligns with the values of public digital infrastructure.

For reference, the full license text is available at: `https://www.gnu.org/licenses/gpl-3.0.html`

9 Conclusion

RapidRide provides a high-trust, low-friction fare system without vendor lock-in or heavy infrastructure costs. With a pilot-ready QR-based deployment and a path for secure digital operations, it is a strong foundation for the modernization of Rapid City public transit.

A Appendix: References

- ED25519 Cryptographic Signatures: `https://ed25519.cr.yp.to/`
- Qt + PySide6 Documentation: `https://doc.qt.io/qtforpython/`
- Stripe Payments: `https://stripe.com/docs`
- FastAPI Web Framework: `https://fastapi.tiangolo.com`