System Architecture - Kilometros de Vida

Overview

Kilometros de Vida is a full-stack MERN application connecting food donors with volunteer drivers to reduce food waste and alleviate hunger.

Technology Stack

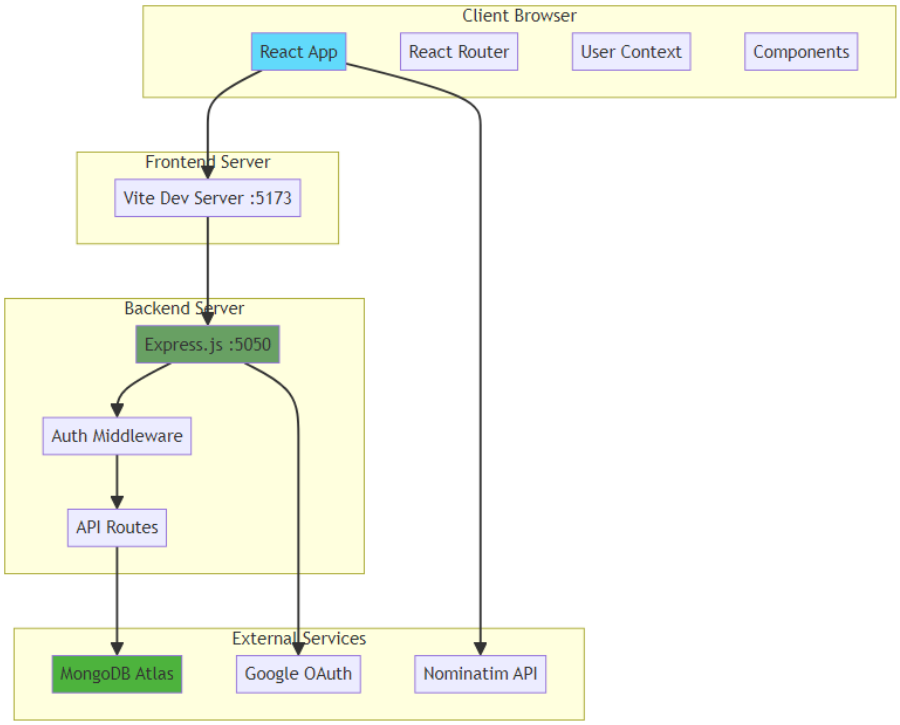
Frontend

- **React 19** with Vite for fast development
- **React Router** for client-side routing
- **Tailwind CSS 4** for styling
- **Framer Motion** for animations
- **Axios** for HTTP requests
- **React Leaflet** for map visualization

Backend

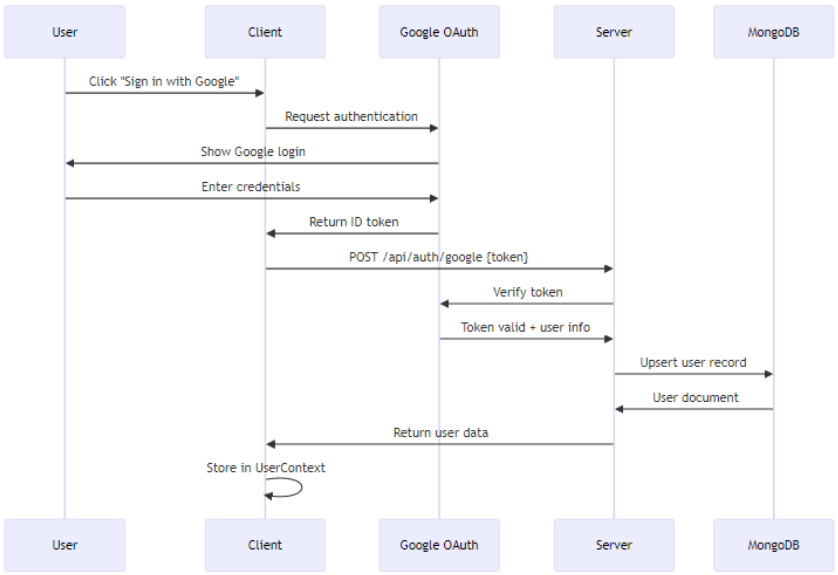
- **Node.js** with Express.js
- **MongoDB Atlas** for database
- **Google OAuth 2.0** for authentication
- **Nominatim API** (OpenStreetMap) for geocoding

System Architecture Diagram

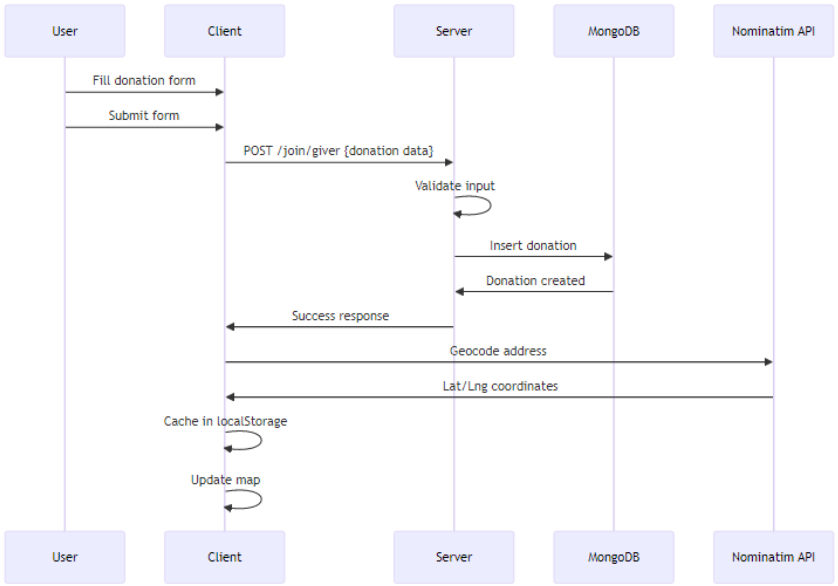


Data Flow

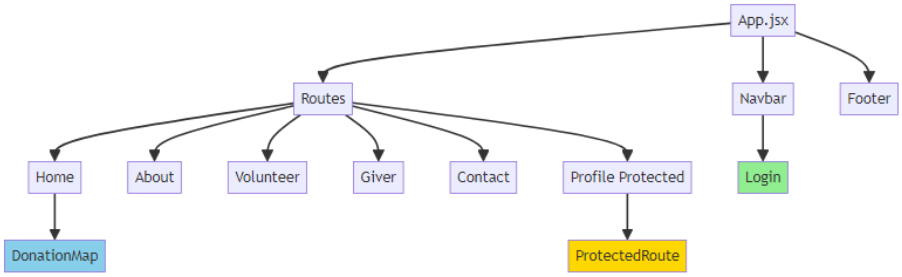
Authentication Flow



Donation Creation Flow



Component Hierarchy



API Endpoints

Authentication

Method	Endpoint	Description	Auth Required
POST	`/api/auth/google`	Verify Google token and create/update user	No

Donations (Givers)

Method	Endpoint	Description	Auth Required
POST	`/join/giver`	Create new donation	No*
GET	`/api/data`	Get all donations (public)	No
GET	`/api/my-donations`	Get user's donations	Yes
PUT	`/api/donations/:id`	Update donation	Yes
DELETE	`/api/donations/:id`	Delete donation	Yes

*Links to user if logged in

Volunteers (Drivers)

Method	Endpoint	Description	Auth Required
POST	`/join/driver`	Register as volunteer	No*
GET	`/api/my-volunteer-shifts`	Get user's shifts	Yes

Database Schema

Collections

users

```
{
  _id: ObjectId,
  email: String (unique),
  name: String,
  picture: String (URL),
  lastLogin: Date
}
```

givers (donations)

```
{
  _id: ObjectId,
  userId: String (optional, links to user),
  orgName: String,
  contactPerson: String,
  donorEmail: String,
  donorPhone: String,
  foodType: String,
  pickupTime: String,
  address: String,
  createdAt: Date
}
```

drivers (volunteers)

```
{
  _id: ObjectId,
  userId: String (optional),
  volunteerName: String,
  volunteerEmail: String,
  volunteerPhone: String,
  availability: String,
  createdAt: Date
}
```

Security Measures

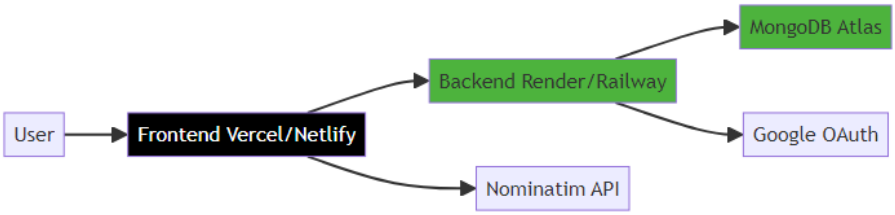
Implemented

1. **Google OAuth 2.0**: Secure authentication without password storage
2. **Environment Variables**: Sensitive data in `.env` files
3. **Protected Routes**: `ProtectedRoute` component prevents unauthorized access
4. **Input Validation**: Server-side validation for all form submissions
5. **CORS**: Configured to allow frontend-backend communication

Recommended for Production

1. JWT tokens for session management
2. Rate limiting on API endpoints
3. HTTPS enforcement
4. Input sanitization against XSS/injection
5. CSRF protection
6. Database query parameterization

Deployment Architecture



Performance Optimizations

1. **Geocoding Cache**: Addresses cached in localStorage to minimize API calls
2. **React.memo**: DonationMap component memoized to prevent unnecessary re-renders
3. **Lazy Loading**: Could implement code splitting for routes
4. **CDN**: Static assets served via Vite's optimized build

Scalability Considerations

1. **Database Indexing**: Add indexes on `email` fields for faster queries
2. **Caching Layer**: Redis for session storage and frequent queries
3. **Load Balancing**: Multiple backend instances behind load balancer
4. **CDN**: Cloudflare or similar for static asset delivery
5. **Background Jobs**: Queue system for geocoding and notifications