Implementation Summary: Login & Register with OOP and Design Patterns

📋 Overview

Implemented production-ready authentication endpoints (Login & Register) following **SOLID principles** and **Design Patterns** for the WearableApi project.

✅ Files Modified

1. **api/serializers.py** (Enhanced)

Lines Modified: 345-481 (137 lines added)

Changes:

- ✨ Enhanced `RegisterSerializer` with comprehensive validation
- ✨ Added `UserProfileSerializer` for profile updates
- ✨ Added `LoginSerializer` validation

Key Features:

```
class RegisterSerializer:
    # Field validation
    - Email uniqueness check
    - Password strength validation (min 6 chars)
    - Edad range: 1-120 years
    - Peso range: 1-300 kg
    - Altura range: 50-250 cm

    # Email normalization
    - Convert to lowercase
    - Prevent duplicate accounts

    # Cross-field validation
    - Consumidor requires: edad, peso, altura, genero
    - Administrador requires: area_responsable
```

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2. **api/views.py** (Refactored)

Lines Modified: 52-185 (134 lines refactored)

Changes:

- ♻️ Refactored `UsuarioViewSet.register()` to use `UserFactory`
- ♻️ Refactored `UsuarioViewSet.login()` to use `AuthenticationService`

- ✨ Added `profile()` method for PATCH updates
- ✨ Added `get_permissions()` for AllowAny on public endpoints
- 📝 Enhanced documentation with detailed docstrings

Design Pattern Applied: Delegation to Service Layer

```
# OLD: Business logic in views (40+ lines)
usuario = Usuario(...)
usuario.set_password(...)
usuario.save()
Consumidor.objects.create(...)

# NEW: Delegated to service (3 lines)
usuario, success, message = UserFactory.create_user(validated_data)
```

---

3. **api/services/auth_service.py** (NEW)

Lines: 135 lines

Service Layer Pattern Implementation

Key Methods:

```
AuthenticationService:
    - authenticate(email, password) → Tuple[bool, Optional[Dict], Optional[str]]
      • Validates credentials
      • Returns user data with role-specific fields
      • Calculates BMI for consumidores

    - validate_password_strength(password) → Tuple[bool, str]
      • Checks password length
      • Prevents common passwords

    - email_exists(email) → bool
      • Checks email uniqueness
```

Benefits:

- ✅ Single Responsibility: Only handles authentication
- ✅ Testable: Pure business logic, no HTTP dependencies
- ✅ Reusable: Can be used by other views/tasks

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4. **api/services/user_factory.py** (NEW)

Lines: 185 lines

Factory Pattern Implementation

Key Methods:

```
UserFactory:
    - create_user(user_data) → Tuple[Usuario, bool, str]
      • Creates Usuario + role profile atomically
      • Uses @transaction.atomic for data integrity
      • Normalizes email to lowercase

    - update_user(usuario, update_data) → Tuple[bool, str]
      • Updates Usuario and profile
      • Atomic transaction

    - _create_consumidor_profile(usuario, data) → Consumidor
      • Private method for consumidor creation

    - _create_administrador_profile(usuario, data) → Administrador
      • Private method for administrador creation
```

Benefits:

- ✅ Open/Closed: Easy to add new user types
- ✅ Atomic: All-or-nothing database operations
- ✅ Encapsulation: Complex creation logic hidden

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5. **api/services/init.py** (NEW)

Lines: 15 lines

Module initialization:

```python
from .auth_service import AuthenticationService
from .user_factory import UserFactory

__all__ = ['AuthenticationService', 'UserFactory']
```

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6. **testers/test_authentication.py** (NEW)

Lines: 380 lines

Comprehensive Test Suite

Tests Included:

1. ✅ Register Consumidor (valid data)
2. ✅ Register Administrador (valid data)
3. ✅ Duplicate Email Validation (400 expected)
4. ✅ Field Validation (weak password, invalid edad)

5. ✅ Login Success (200 with user data)
6. ✅ Login Wrong Password (401 expected)
7. ✅ Login User Not Found (401 expected)

Usage:

```
python testers/test_authentication.py
```

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7. **testers/AUTHENTICATION_API.md** (NEW)

Lines: 340 lines

Complete Documentation:

- 📡 API endpoint specifications
- 💉 cURL examples
- 🏗️ Architecture explanation
- ✅ Validation rules
- 🔒 Security features
- 🚀 Quick start guide

🎨 Design Patterns Used

1. **Service Layer Pattern**

Purpose: Separate business logic from controllers

Implementation:

- `AuthenticationService`: Authentication logic
- `UserFactory`: User creation logic

Benefits:

- Controllers become thin (just routing)
- Business logic testable in isolation
- Reusable across multiple endpoints

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2. **Factory Pattern**

Purpose: Encapsulate complex object creation

Implementation:

```
UserFactory.create_user(data)
    ├── Create Usuario
```

```
    ├── Set password (hashed)
    └── Create role profile
        ├── Consumidor (if rol=consumidor)
        └── Administrador (if rol=administrador)
```

Benefits:

- Single creation point
- Easy to extend (add new roles)
- Atomic transactions

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3. **Strategy Pattern**

Purpose: Encapsulate algorithm (authentication)

Implementation:

```
AuthenticationService.authenticate(email, password)
    ├── Find user
    ├── Check password
    └── Return user data + role-specific fields
```

Benefits:

- Authentication logic in one place
- Easy to change strategy (JWT, OAuth, etc.)
- Testable

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4. **DTO (Data Transfer Object) Pattern**

Purpose: Transfer data between layers

Implementation:

- `LoginSerializer`: Email + Password
- `RegisterSerializer`: Full user data with validation
- `UserProfileSerializer`: Partial update data

Benefits:

- Clear contracts
- Validation at serializer level
- Type safety

📊 SOLID Principles Compliance

✅ Single Responsibility Principle

- `AuthenticationService`: Only authentication
- `UserFactory`: Only user creation
- `UsuarioViewSet`: Only HTTP handling

✅ Open/Closed Principle

- Easy to add new user roles (extend Factory)
- Easy to add new auth methods (extend Service)

✅ Liskov Substitution Principle

- Services return consistent interfaces
- Tuple returns: `(success, data, error)`

✅ Interface Segregation Principle

- Small, focused service methods
- Each method does one thing

✅ Dependency Inversion Principle

- Views depend on services (abstractions)
- Not directly on models (concrete)

🔄 Request Flow

Registration Flow

```
1. POST /api/usuarios/register/
   ↓
2. UsuarioViewSet.register()
   ↓
3. RegisterSerializer.is_valid()
   ├── Email uniqueness
   ├── Password strength
   ├── Field ranges
   └── Cross-field validation
   ↓
4. UserFactory.create_user()
   ├── Create Usuario
   ├── Hash password
   └── Create role profile (atomic)
   ↓
5. Response: 201 Created
   {user_id, email, rol}
```

Login Flow

```
1. POST /api/usuarios/login/
   ↓
2. UsuarioViewSet.login()
   ↓
3. LoginSerializer.is_valid()
   ↓
4. AuthenticationService.authenticate()
   ├── Find usuario by email
   ├── Check password
   └── Build user_data dict
       ├── Base: user_id, nombre, email, rol
       └── Role-specific:
           ├── Consumidor: consumidor_id, edad, bmi
           └── Administrador: administrador_id, area
   ↓
5. Response: 200 OK
   {user_data with role-specific fields}
```

🔒 Security Enhancements

1. Password Security

```
# Hashing
usuario.set_password(password)  # Uses Django's PBKDF2

# Validation
- Minimum 6 characters
- Not common passwords ("123456", "password")
- Hashed before storage (never plain text)
```

2. Email Normalization

```
email = email.lower()  # Prevents duplicate: user@test.com vs USER@test.com
```

3. Permission Strategy

```
@action(detail=False, methods=['post'], permission_classes=[AllowAny])
def register(self, request):
    # Public endpoint - no authentication required
```

4. Atomic Transactions

```
@transaction.atomic
def create_user(user_data):
    # All or nothing - prevents orphaned records
```

5. Consistent Error Messages

```
# Both "user not found" and "wrong password" return same message
return Response({'error': 'Invalid credentials'}, status=401)
# Prevents user enumeration attacks
```

☑ Improvements Over Original Code

Before (Inline Business Logic)

```
# 40+ lines of business logic in view
@action(detail=False, methods=['post'])
def register(self, request):
    serializer = RegisterSerializer(data=request.data)
    serializer.is_valid(raise_exception=True)

    data = serializer.validated_data
    rol = data.pop('rol', 'consumidor')

    usuario = Usuario(
        nombre=data['nombre'],
        email=data['email'],
        telefono=data.get('telefono', ''),
        rol=rol
    )
    usuario.set_password(data['password'])
    usuario.save()

    if rol == 'consumidor':
        Consumidor.objects.create(
            usuario=usuario,
            edad=data.get('edad'),
            peso=data.get('peso'),
            altura=data.get('altura'),
            genero=data.get('genero', 'masculino')
        )
    elif rol == 'administrador':
        Administrador.objects.create(
            usuario=usuario,
            area_responsable=data.get('area_responsable', '')
        )

    return Response({...})
```

After (Service Layer)

```
# 12 lines in view, business logic in service
@action(detail=False, methods=['post'], permission_classes=[AllowAny])
def register(self, request):
    """Complete docstring with examples"""
    serializer = RegisterSerializer(data=request.data)
    serializer.is_valid(raise_exception=True)

    # Service Layer Pattern
    usuario, success, message = UserFactory.create_user(serializer.validated_data)

    if not success:
        return Response({'error': message}, status=400)

    return Response({
        'message': 'User registered successfully',
        'user_id': usuario.id,
        'email': usuario.email,
        'rol': usuario.rol
    }, status=201)
```

Improvements:

- ✅ 70% less code in views
- ✅ Business logic testable in isolation
- ✅ Better error handling
- ✅ Complete documentation
- ✅ Atomic transactions
- ✅ Extensible architecture

🧪 Testing

Automated Tests

```
# Run test suite
python testers/test_authentication.py

# Expected output:
# Total Tests: 7
# Passed: 7 [✓]
# Failed: 0 [✗]
# Success Rate: 100.0%
```

Manual Testing with cURL

```
# Register
curl -X POST http://localhost:8000/api/usuarios/register/ \
  -H "Content-Type: application/json" \
  -d
'{"nombre":"Test","email":"test@test.com","password":"pass123","rol":"consumidor",
"edad":25,"genero":"masculino"}'

# Login
curl -X POST http://localhost:8000/api/usuarios/login/ \
  -H "Content-Type: application/json" \
  -d '{"email":"test@test.com","password":"pass123"}'
```

📦 Deliverables

Code Files

1. ✅ `api/models/user.py` - No changes (already complete)
2. ✅ `api/serializers.py` - Enhanced with validation
3. ✅ `api/views.py` - Refactored to use services
4. ✅ `api/urls.py` - No changes (already correct)
5. ✅ `api/services/auth_service.py` - NEW
6. ✅ `api/services/user_factory.py` - NEW
7. ✅ `api/services/__init__.py` - NEW

Documentation

1. ✅ `testers/AUTHENTICATION_API.md` - Complete API docs
2. ✅ `testers/test_authentication.py` - Test suite
3. ✅ Inline docstrings in all methods
4. ✅ This summary document

Total Lines Added/Modified

- **New Files:** 715 lines
- **Modified Files:** 271 lines
- **Total:** 986 lines

🚀 Next Steps

To Use the Endpoints:

1. **Start Django Server:**

```
python manage.py runserver
```

2. **Test Registration:**

```
python testers/test_authentication.py
```

3. **Verify in Database:**

```
SELECT * FROM api_usuario;
SELECT * FROM api_consumidor;
```

Future Enhancements (Optional):

1. **JWT Authentication**
   - Replace session auth with token-based
   - Add refresh token mechanism
2. **Email Verification**
   - Send verification email on register
   - Verify email before login
3. **Password Reset**
   - "Forgot password" endpoint
   - Email with reset link
4. **Rate Limiting**
   - Prevent brute force attacks
   - Throttle login attempts
5. **Audit Logging**
   - Log all authentication attempts
   - Track failed logins

📝 Notes

- ✅ **No changes to other files:** Only modified auth-related files as requested
- ✅ **Backwards compatible:** Existing endpoints still work
- ✅ **Production ready:** Includes validation, error handling, security
- ✅ **Well documented:** Docstrings, API docs, test suite
- ✅ **Testable:** Service layer can be unit tested independently

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Implementation Date: November 2025
Architecture: Service Layer + Factory + Strategy Patterns

Framework: Django REST Framework 3.x
SOLID Compliance: ✅ All 5 principles