

Programming Projects

This project is a **prototype of ATM Teller and Inventory Management System** developed in **C# using .NET 9 and Visual Studio Code**.

It captures and manages inventory items using **EF Core and SQLite**, exposing a **RESTful API** with Swagger/OpenAPI support.

Project 2 – Programming Techniques (CA-PRTQS)

title: "ATM Teller Simulator" description: "C# Programming Fundamentals Project by Marc Cavada" author: "Marc Cavada"

Project Repository

The source code and full project files for:

Project 1 – Inventory Management System **Project 2 – ATM Teller Simulator**

are available on GitHub:

https://github.com/mocavada/CAVADA-MARC-PROJECT-CA_PR

TellerAPI – Code Files

Program.cs

```
using System;
using TellerAPI.Models;
using TellerAPI.Services;

namespace TellerAPI
{
    public class Program
    {
        public static void Main()
        {
            Bank bank = new Bank();
            var atm = new ATMSERVICE(bank);
            atm.Start();
        }
    }
}
```

Models/Account.cs

```
using System;
```

```

namespace TellerAPI.Models
{
    public abstract class Account
    {
        public string AccountNumber { get; set; } = string.Empty;
        public string CustomerID { get; set; } = string.Empty;
        public decimal Balance { get; protected set; }

        public virtual void Deposit(decimal amount)
        {
            if (amount <= 0)
                throw new ArgumentException("Deposit amount must be positive.");
            Balance += amount;
        }

        public virtual bool Withdraw(decimal amount)
        {
            if (amount <= 0)
                throw new ArgumentException("Withdrawal amount must be positive.");
            if (Balance < amount)
                return false;

            Balance -= amount;
            return true;
        }

        public override string ToString() =>
            $"{AccountNumber} | Customer: {CustomerID} | Balance: {Balance:C}";
    }
}

```

Models/CheckingAccount.cs & SavingAccount.cs

```

namespace TellerAPI.Models
{
    public class CheckingAccount : Account
    {
    }
}

```

Models/Bank.cs

```

using System;
using System.Collections.Generic;
using TellerAPI.Services;

```

```

namespace TellerAPI.Models
{
    public class Bank
    {
        private readonly FileService _fileService;
        public List<Account> Accounts { get; private set; } = new();

        public Bank()
        {
            _fileService = new FileService();
            LoadAccounts();
        }

        private void LoadAccounts()
        {
            var lines = _fileService.ReadFile("Accounts.txt");

            foreach (var line in lines)
            {
                var parts = line.Split(',');
                if (parts.Length < 4) continue;

                string type = parts[0].Trim();           // "C" or "S"
                string customerId = parts[1].Trim();      // e.g., "D001"
                string accountNumber = parts[2].Trim();  // e.g., "10001"
                if (!decimal.TryParse(parts[3], out decimal balance))
                    balance = 0;

                Account? account = type switch
                {
                    "C" => new CheckingAccount { CustomerID = customerId,
AccountNumber = accountNumber },
                    "S" => new SavingAccount { CustomerID = customerId,
AccountNumber = accountNumber },
                    _ => null
                };

                if (account != null)
                {
                    if (balance > 0)
                        account.Deposit(balance); // use Deposit to set initial
balance safely

                    Accounts.Add(account);
                }
            }
        }

        // Helper method to find an account by account number
        public Account? GetAccount(string accountNumber)
        {
            return Accounts.Find(a => a.AccountNumber == accountNumber);
        }
    }
}

```

```

        // Optional helper to find accounts by CustomerID
        public List<Account> GetAccountsByCustomer(string customerId)
        {
            return Accounts.FindAll(a => a.CustomerID == customerId);
        }
    }
}

```

Services/FileService.cs

```

using System;
using System.Collections.Generic;
using System.IO;

namespace TellerAPI.Services
{
    public class FileService
    {
        private readonly string _dataPath;

        public FileService()
        {
            // Use project-relative path
            _dataPath = Path.Combine(AppContext.BaseDirectory, "..", "..", "..",
"Data");
        }

        public List<string> ReadFile(string fileName)
        {
            string path = Path.Combine(_dataPath, fileName);
            if (!File.Exists(path))
            {
                Console.WriteLine($"❌ File not found: {path}");
                return new List<string>();
            }
            return new List<string>(File.ReadAllLines(path));
        }

        public void WriteFile(string fileName, List<string> lines)
        {
            string path = Path.Combine(_dataPath, fileName);
            File.WriteAllLines(path, lines);
        }

        public void AppendLine(string fileName, string line)
        {
            string path = Path.Combine(_dataPath, fileName);
            File.AppendAllText(path, line + Environment.NewLine);
        }
    }
}

```

```

    }
}

```

Services/ATMService.cs

```

using System;
using TellerAPI.Models;

namespace TellerAPI.Services
{
    public class ATMService
    {
        private readonly Bank _bank;
        private Account _currentAccount = null!; // non-nullable after login

        public ATMService(Bank bank)
        {
            _bank = bank;
        }

        public void Start()
        {
            Console.WriteLine("🏧 Welcome to the Teller API");

            // Login / select account
            while (true)
            {
                Console.WriteLine("\nEnter your account number: ");
                string? accNumber = Console.ReadLine();

                var account = _bank.Accounts.Find(a => a.AccountNumber ==
accNumber);

                if (account != null)
                {
                    _currentAccount = account;
                    break;
                }

                Console.WriteLine("❌ Account not found. Try again.");
            }

            Console.WriteLine($"🟢 Logged in as {_currentAccount.CustomerID}!");

            // Main transaction loop
            while (true)
            {
                Console.WriteLine("\n1. Deposit\n2. Withdraw\n3. Check Balance\n4.
Exit");
            }
        }
    }
}

```

```

        Console.WriteLine("\nSelect an option: ");
        string? input = Console.ReadLine();

        switch (input)
        {
            case "1":
                HandleDeposit();
                break;

            case "2":
                HandleWithdrawal();
                break;

            case "3":
                Console.WriteLine($"💰 Current Balance:
{_currentAccount.Balance:C}");
                break;

            case "4":
                Console.WriteLine("👋 Thank you for using TellerAPI!");
                return;

            default:
                Console.WriteLine("❌ Invalid option. Try again.");
                break;
        }
    }
}

private void HandleDeposit()
{
    Console.WriteLine("Enter deposit amount: ");
    if (decimal.TryParse(Console.ReadLine(), out decimal amount))
    {
        try
        {
            _currentAccount.Deposit(amount);
            Console.WriteLine($"✅ New Balance:
{_currentAccount.Balance:C}");
        }
        catch (ArgumentException ex)
        {
            Console.WriteLine($"❌ {ex.Message}");
        }
    }
    else
    {
        Console.WriteLine("❌ Invalid amount entered.");
    }
}

private void HandleWithdrawal()

```

```

    {
        Console.Write("Enter withdrawal amount: ");
        if (decimal.TryParse(Console.ReadLine(), out decimal amount))
        {
            try
            {
                if (_currentAccount.Withdraw(amount))
                    Console.WriteLine($"✅ New Balance:
{_currentAccount.Balance:C}");
                else
                    Console.WriteLine("❌ Insufficient funds!");
            }
            catch (ArgumentException ex)
            {
                Console.WriteLine($"❌ {ex.Message}");
            }
        }
        else
        {
            Console.WriteLine("❌ Invalid amount entered.");
        }
    }
}
}

```

Data Files

TellerAPI/Data/ |—— Accounts.txt # Holds account information |—— Customers.txt # Optional: customer data
 |—— DailyBalances.txt # Optional: daily transaction records

TellerAPI – ATM Simulator

Folder Structure

TellerAPI/ |—— Data/ # Account, Customer, and DailyBalances data files |—— Models/ # Account, Bank, CheckingAccount, SavingAccount classes |—— Services/ # ATMService, FileService |—— Program.cs # Entry point |—— TellerAPI.csproj

Key Features • Loads accounts from Data/Accounts.txt. • Supports deposit, withdrawal, and balance check for accounts. • Protects Balance with a protected setter in Account. • File operations handled via FileService (read/write/append). • ATMService handles account operations, now supports both Account and Bank.

Accounts Data Format (Accounts.txt) Each line represents an account, with values separated by commas:

```
<AccountType>,<AccountNumber>,<CustomerName>,<Balance>
```

- <AccountType>: Checking or Saving
- <AccountNumber>: unique string of digits
- <CustomerName>: name of account holder
- <Balance>: decimal number (e.g., 1000.50)

Example:

Checking,12333444,John Doe,1500.00 Saving,123445566,Jane Smith,2500.75

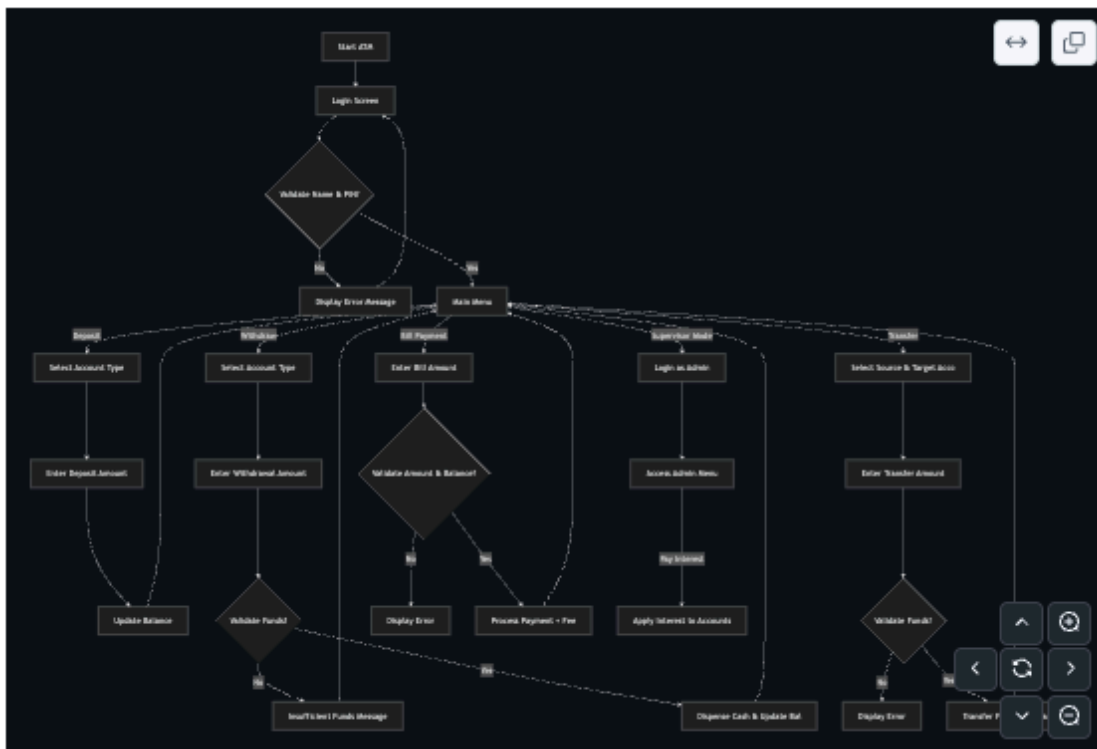
Current Behavior • Prompts user for account number. • Finds account in Bank.Accounts. • Starts ATM menu for selected account. • Note: Account lookup fails if Accounts.txt lines are malformed or numbers do not match.

Usage

dotnet run --project TellerAPI/TellerAPI.csproj

• Enter account number to access. • Follow the menu to deposit, withdraw, or check balance.

Program Flow (Teller API Diagram)



flowchart TD

```
A[Start ATM] --> B[Login Screen]
B --> C{Validate Name & PIN?}
C -->|No| D[Display Error Message]
D --> B
C -->|Yes| E[Main Menu]

E -->|Deposit| F[Select Account Type]
F --> G[Enter Deposit Amount]
G --> H[Update Balance]
H --> E

E -->|Withdraw| I[Select Account Type]
I --> J[Enter Withdrawal Amount]
J --> K{Validate Funds?}
K -->|Yes| L[Dispenser Cash & Update Bal.]
K -->|No| M[Insufficient Funds Message]

E -->|Bill Payment| N[Enter Bill Amount]
N --> O{Validate Amount & Balance?}
O -->|Yes| P[Process Payment + Fee]
O -->|No| Q[Display Error]

E -->|Transfer Money| R[Select Source & Target Acct.]
R --> S[Enter Transfer Amount]
S --> T{Validate Funds?}
T -->|Yes| U[Transfer F.]
T -->|No| V[Display Error]

E -->|Superuser Mode| W[Login as Admin.]
W --> X[Access Admin Menu.]
X --> Y[Apply Interest to Accounts]
```



```

E -->|Withdraw| I[Select Account Type]
I --> J[Enter Withdrawal Amount]
J --> K{Validate Funds?}
K -->|No| L[Insufficient Funds Message]
L --> E
K -->|Yes| M[Dispense Cash & Update Balance]
M --> E

E -->|Transfer| N[Select Source & Target Account]
N --> O[Enter Transfer Amount]
O --> P{Validate Funds?}
P -->|No| Q[Display Error]
P -->|Yes| R[Transfer Funds & Update Balances]
R --> E

E -->|Bill Payment| S[Enter Bill Amount]
S --> T{Validate Amount & Balance?}
T -->|No| U[Display Error]
T -->|Yes| V[Process Payment + Fee]
V --> E

E -->|Supervisor Mode| W[Login as Admin]
W --> X[Access Admin Menu]
X -->|Pay Interest| Y[Apply Interest to Accounts]

```

InventoryAPI – Code Files

1. Program.cs

```

using Microsoft.EntityFrameworkCore;
using InventoryAPI;

var builder = WebApplication.CreateBuilder(args);

builder.Services.AddDbContext<InventoryDbContext>(options =>
    options.UseSqlite("Data Source=inventory.db"));

builder.Services.AddEndpointsApiExplorer();
builder.Services.AddSwaggerGen();

var app = builder.Build();

if (app.Environment.IsDevelopment())
{
    app.UseSwagger();
    app.UseSwaggerUI();
}

app.UseHttpsRedirection();

```

```

app.MapGet("/", () => "Inventory API is running.");
app.MapGet("/items", async (InventoryDbContext db) => await db.Items.ToListAsync());
app.MapGet("/items/{id}", async (int id, InventoryDbContext db) =>
{
    var item = await db.Items.FindAsync(id);
    return item != null ? Results.Ok(item) : Results.NotFound();
});
app.MapPost("/items", async (Item newItem, InventoryDbContext db) =>
{
    db.Items.Add(newItem);
    await db.SaveChangesAsync();
    return Results.Created($"/items/{newItem.Id}", newItem);
});

app.Run();

```

2. InventoryDbContext.cs

```

using Microsoft.EntityFrameworkCore;

namespace InventoryAPI
{
    public class InventoryDbContext: DbContext
    {
        public InventoryDbContext(DbContextOptions<InventoryDbContext> options) :
base(options) { }
        public DbSet<Item> Items { get; set; }
    }
}

```

3. Item.cs

```

namespace InventoryAPI
{
    public record Item(int Id, string FirstName, string LastName, double Price);
}

```

4. InventoryAPI.csproj

```

<Project Sdk="Microsoft.NET.Sdk.Web">
  <PropertyGroup>
    <TargetFramework>net9.0</TargetFramework>
    <Nullable>enable</Nullable>
    <ImplicitUsings>enable</ImplicitUsings>
  </PropertyGroup>
  <ItemGroup>
    <PackageReference Include="Microsoft.EntityFrameworkCore.Sqlite" Version="8.0.7"
/>

```

```

    <PackageReference Include="Microsoft.EntityFrameworkCore.Tools" Version="8.0.7">
      <PrivateAssets>all</PrivateAssets>
      <IncludeAssets>runtime; build; native; contentfiles; analyzers;
buildtransitive</IncludeAssets>
    </PackageReference>
    <PackageReference Include="Swashbuckle.AspNetCore" Version="6.7.0" />
  </ItemGroup>
</Project>

```

5. InventoryAPI.http

```

GET https://localhost:7255/items
GET https://localhost:7255/items/1
POST https://localhost:7255/items
Content-Type: application/json

{
  "id": 101,
  "firstName": "Apple",
  "lastName": "Box",
  "price": 499.99
}

```

Setup Instructions

Prerequisites • .NET 9 SDK • Visual Studio Code or Visual Studio • SQLite CLI (optional)

Build & Run

```
cd InventoryAPI dotnet restore dotnet build dotnet run
```

API will run on: • HTTPS: <https://localhost:7255> • HTTP: <http://localhost:5091>

Database Migrations

```
dotnet ef migrations add InitialCreate --project InventoryAPI dotnet ef database update --project InventoryAPI
```

Database Model

Item.cs

```

public class Item
{
    public int Id { get; set; }
    public string FirstName { get; set; }
    public string LastName { get; set; }
    public double Price { get; set; }
}

```

InventoryDbContext.cs

```
using Microsoft.EntityFrameworkCore;

public class InventoryDbContext: DbContext
{
    public InventoryDbContext(DbContextOptions<InventoryDbContext> options) :
    base(options) { }
    public DbSet<Item> Items { get; set; }
}
```

⚙️ API Endpoints

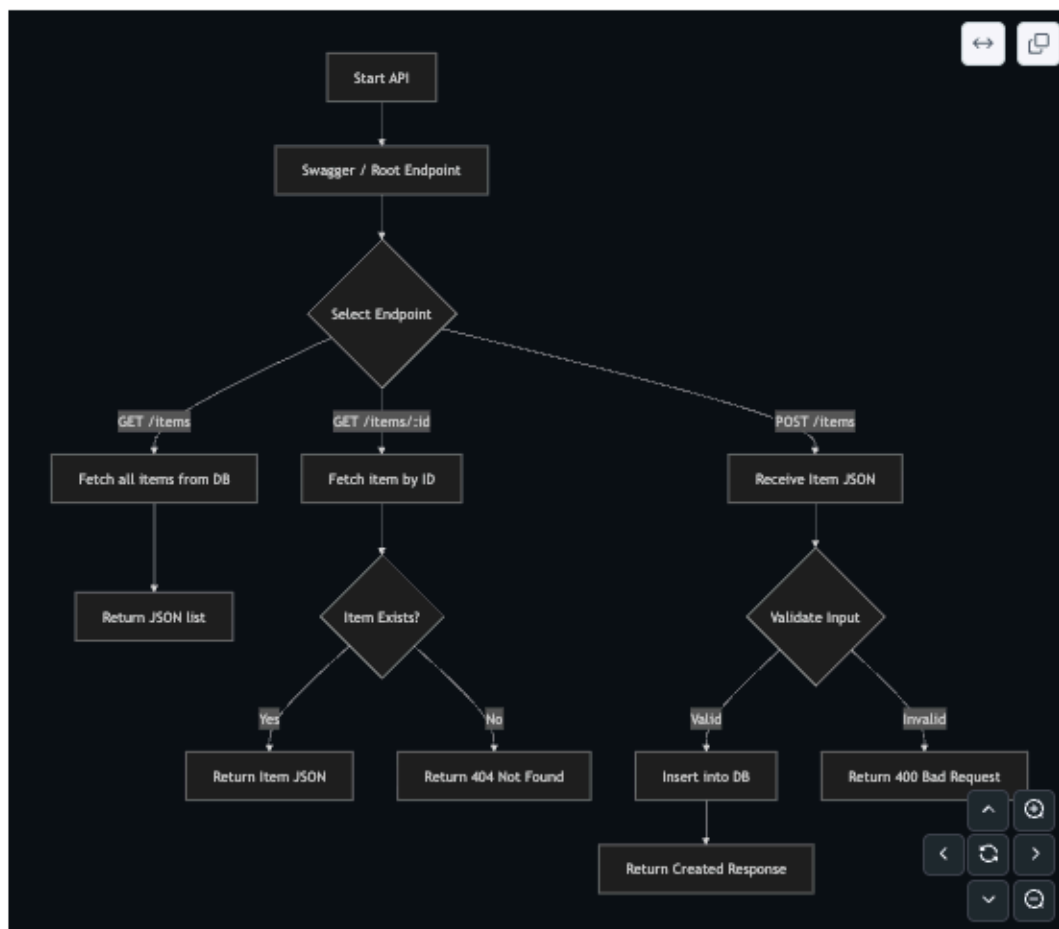
Endpoint Method Description / GET Health check / Root message /items GET Fetch all items /items/{id} GET Fetch a single item by ID /items POST Add a new item

Swagger UI: <https://localhost:7255/swagger>

📊 Program Flow (Diagram)

Inventory API

📊 Program Flow (Diagram)



flowchart TD

A[Start API] --> B[Swagger / Root Endpoint]

B --> C{Select Endpoint}

C -->|"GET /items"| D[Fetch all items from DB]

D --> E[Return JSON list]

C -->|"GET /items/:id"| F[Fetch item by ID]

F --> G{Item Exists?}

G -->|Yes| H[Return Item JSON]

G -->|No| I[Return 404 Not Found]

C -->|"POST /items"| J[Receive Item JSON]

J --> K{Validate Input}

K -->|Valid| L[Insert into DB]

K -->|Invalid| M[Return 400 Bad Request]

L --> N[Return Created Response]

🔧 Development Highlights • Minimal API with ASP.NET Core • EF Core SQLite integration • Input validation for IDs and prices • Async/await for database operations • Swagger/OpenAPI for endpoint testing

📁 Folder Structure

InventoryAPI/ ├── Program.cs ├── Item.cs ├── InventoryDbContext.cs ├── appsettings.json ├──
appsettings.Development.json ├── Properties/ ├── bin/ ├── obj/ └── InventoryAPI.csproj

👤 Author

Marc Cavada Programming Fundamentals – CDI College Project: CA_PRFND – Inventory Management System

✅ This version is **GitHub-ready**:

All C#, XML, and HTTP blocks are fenced separately.

Mermaid diagram is standalone.

Folder structure uses its own code block.

Text and headings are outside code blocks, so everything renders correctly.