Project Summary Report

AI Financial Inclusion Assistant for Families with Special Needs Children

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Course: *AI for Software Engineering – Power Learn Project (Capstone)*
Prototype Version: 1.0

1. Background and Motivation

This project, *AI Financial Inclusion Assistant for Families with Special Needs Children*, was inspired by my volunteer experience with Special Olympics Kenya, where I have interacted with children with intellectual and physical disabilities and their families. Many of these households face recurring financial hardships due to therapy sessions, medication costs, and specialized education fees.

With my background in Financial Engineering and ongoing training in AI for Software Engineering, I was motivated to design a solution that merges data science, financial analysis, and artificial intelligence to promote financial inclusion for these families.

This prototype demonstrates how AI can be applied in a socially impactful way, supporting Sustainable Development Goals (SDG 1 – No Poverty**)** and SDG 10 – Reduced Inequalities by helping vulnerable households manage, predict, and plan their finances better.

2. Problem Statement

Families raising children with special needs face unpredictable and high recurring costs such as physiotherapy, occupational therapy, medications, and specialized schooling.
These costs fluctuate monthly, making it difficult to plan savings, allocate income effectively, or anticipate future needs.

The lack of accessible financial planning tools tailored to these households often leads to:

- Financial stress and debt cycles
- Inconsistent access to therapy and care
- Missed opportunities for government or NGO support

3. Objective

The main objective of this project is to develop an AI-powered financial planning assistant that:

1. Predicts the next month's household expenses based on current financial and therapy data.
2. Provides a Financial Health Score to help families understand their budgeting efficiency.
3. Offers personalized financial advice and connects users to real-world resources (e.g., NCPWD, NHIF, NGO programs).
4. Uses a simple, interactive Streamlit web interface for ease of access.

4. Project Scope

This version is a functional prototype, not yet a production-grade system.
The focus was to demonstrate an end-to-end AI workflow:

1. **Data Collection** – Simulated realistic household data for Kenyan families with special needs children.
2. **Data Preprocessing** – Normalized features such as income, rent, and therapy costs.
3. **Model Selection** – Implemented a Random Forest Regressor for expense prediction and integrated a Deep Learning model using TensorFlow for comparison.
4. **Model Training & Evaluation** – Evaluated models using R^2 and MAE to ensure reasonable prediction accuracy.
5. **Model Deployment** – Built a simple Streamlit web app for prediction, advice generation, and NLP-based financial guidance.

5. System Architecture & Workflow

1. **Input Stage:**
   The user enters details such as salary, business income, therapy expenses, and school fees into the Streamlit interface.
2. **Processing Stage:**
   - The model aggregates these features into a single vector.
   - It predicts next month's expenses using the trained Random Forest model (or optionally, a Deep Learning model if available).
   - A "realism correction" is applied to ensure the output remains financially plausible relative to total income.
3. **Output Stage:**
   - The system displays the Predicted Monthly Expenses and a Financial Health Score (0–100%).
   - Personalized recommendations are generated based on expense ratios and spending patterns.
   - A simple rule-based NLP assistant allows users to ask budgeting or support-related questions (e.g., savings, grants, or insurance).
4. **Deployment Stage:**
   - The prototype runs as a web app using Streamlit.

- Models are stored as `.joblib` (Random Forest) and `.h5` (Deep Learning) files for easy integration.

6. Key Assumptions

To make the prototype feasible, several assumptions were made:

- Household data was synthetically generated to simulate realistic Kenyan family income and expenses.
- Income and spending patterns remain relatively stable month-to-month.
- Predictions assume families provide accurate and complete expense information.
- The model is designed for educational and planning support, not certified financial advice.
- The Deep Learning model is included as a proof-of-concept to demonstrate scalability.

7. Results and Evaluation

- **Random Forest Regressor:** Provided stable, explainable predictions with good accuracy for small datasets.
- **Deep Learning Model:** Achieved comparable performance, showing potential for large-scale data integration.
- **Streamlit App:** Successfully deployed and interactive, enabling live predictions and instant financial insights.

The prototype performed well in producing realistic forecasts when given consistent income and expense inputs.

8. Recommendations and Future Improvements

1. **Real Data Integration:**
   Partner with organizations like NCPWD or Special Olympics Kenya to collect anonymized real household expense data for model retraining.
2. **AI Enhancement:**
   - Replace rule-based NLP with a fine-tuned transformer model (e.g., BERT) for more natural conversations.
   - Add reinforcement learning to personalize financial advice over time.
3. **Mobile Deployment:**
   - Convert the Streamlit prototype into a mobile-friendly web app for wider accessibility.
4. **Cloud Integration & MLOps:**
   - Deploy models on a cloud service (AWS, GCP, or Azure) with continuous learning pipelines.

5. **User Analytics:**
    - Include dashboards for users to visualize spending trends and goal tracking.

9. Social and Economic Impact

This tool demonstrates how AI can be leveraged to promote financial inclusion, especially for marginalized groups.
It bridges the gap between financial literacy, data science, and accessibility, empowering families to plan ahead and make data-driven decisions for their children's care.

If developed further, it could partner with banks, NGOs, and disability support programs to become a real national solution that fosters financial stability for special needs households.

10. Conclusion

This capstone project represents the integration of AI for social good, combining technical skills from machine learning, financial modeling, and software deployment with empathy-driven design.

While it is currently a prototype, it lays the groundwork for an AI system that could one day provide personalized financial intelligence to every family raising a child with special needs in Kenya and beyond.

11. References

- Power Learn Project (PLP) – *AI for Software Engineering Course Material*
- TensorFlow & Scikit-learn Documentation
- Streamlit Developer Guide
- National Council for Persons with Disabilities (NCPWD) – https://ncpwd.go.ke
- Special Olympics Kenya – https://specialolympicskenya.org