GRANT FUNDING PROPOSAL FOR THE COMMERCIALIZATION

of SEDI-E SMART DIGITAL WEIGHING SCALE

SEDI-ESmartScale

SEPTEMBER 11, 2025

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1. Executive Summary

The SEDI-E Smart Digital Weighing Scale (SEDI-ESmartScale) is a next-generation, IoT-enabled weighing and pricing solution designed to enhance operational efficiency, transparency, and data-driven decision-making for small and medium enterprises (SMEs), market vendors, agricultural producers, and logistics operators. It integrates precision load cell sensing, microcontroller-based control, secure cloud connectivity, and offline operational capabilities into a portable and scalable device built for environments with unreliable power and internet access.

At its core, the SEDI-ESmartScale solves key limitations of conventional weighing devices: lack of traceability, manual price calculations, limited data analytics, and security vulnerabilities. The innovation's Unified Tare/Zero feature ensures accurate operation while protecting users from overload misuse, while its password-controlled access secures pricing updates and administrative actions. The device supports remo te monitoring and control through a cloud dashboard, as well as offline failover mode, making it robust for both urban and rural deployment.

The SEDI-ESmartScale's design emphasizes affordability, modularity, and scalability. Built using open-architecture microcontrollers (Arduino UNO + ESP8266), it offers opportunities for easy upgrades and future product diversification. A built-in rechargeable lithium-ion battery system ensures uninterrupted service during power outages, while HTTP-based data synchronization allows seamless integration with enterprise systems and inventory management platforms.

This project's commercialization potential is significant - the solution targets a growing SME and informal retail market segment that lacks affordable digital transformation tools, presenting opportunities for scaling hardware sales, analytics services, and subscription-based data platforms. By aligning with NASENI's vision of fostering indigenous innovation and technology commercialization, the SEDI-ESmartScale stands to boost productivity, increase trust in market transactions, and strengthen Nigeria's capacity for localized manufacturing of smart IoT devices.

Grant Objectives

The primary objective of this grant application is to secure funding and technical support

to transition the Smart Digital Weighing Scale from prototype development to pilot manufacturing, regulatory certification, and market deployment. This project aims to address the critical need for affordable, accurate, and connected weighing solutions that empower small businesses, agricultural traders, and logistics operators in Nigeria and other developing economies.

Specifically, the grant seeks to:

a. Refine and validate the design of the SmartScale to meet commercial Class III metrology standards and international compliance requirements.

b. Develop a scalable manufacturing plan with locally sourced components to reduce production costs and enhance self-reliance.

c. Obtain regulatory certifications to ensure market readiness and export potential.

d. Pilot test the product with key stakeholders (market vendors, agro-processors, logistics companies) to collect user feedback and refine usability.

e. Build a commercialization and distribution framework to enable nationwide deployment, job creation, and technology transfer.

f. Establish a pathway for future product scaling (integration with fintech platforms, analytics dashboards, and IoT solutions) to expand market opportunities.

2. Innovativeness and Novelty

The SEDI-E Smart Digital Weighing Scale (SEDI-ESmartScale) introduces a comprehensive leap in digital weighing technology by integrating advanced sensing, embedded intelligence, IoT connectivity, and security features into a compact, cost-effective device tailored for both urban and rural market conditions. Unlike conventional weighing systems that operate as standalone tools with limited data integration, the SEDI-ESmartScale delivers end-to-end functionality—from weight sensing and automated price calculation to real-time database synchronization and offline operation. Key innovations include:

i. Unified Tare/Zero Logic System
   - A single, intelligent button determines whether to zero the scale or apply a tare adjustment based on real-time load status, significantly reducing user error and preventing misuse of tare values.
   - This innovation enforces safe operation by triggering alerts when cumulative tare values approach maximum capacity.

ii. Integrated IoT and Local Failover Design
   - The SEDI-ESmartScale employs an HTTP POST protocol to upload timestamped transaction data to a cloud-hosted PHP/MySQL database,

enabling real-time analytics and administrative control.

- During connectivity loss, the system automatically switches to offline mode, maintaining operational continuity and later synchronizing stored data seamlessly when connectivity is restored.

iii. Secure Access Control and User Management

- Pricing updates and sensitive operations require password authentication, a feature uncommon in low-cost weighing scales.
- Administrators can modify passwords and unit prices both locally and remotely through a web dashboard, introducing enterprise-level data security to retail weighing.

iv. Memory Recall and Transaction Traceability

- The scale's embedded memory enables retrieval of the last three transactions, supporting transparent audits and empowering vendors to demonstrate pricing accuracy to customers.

v. Dual-Power Resilience and Mobility

- With three 3.7V lithium-ion batteries and a custom charging circuit, the SEDI-ESmartScale ensures uninterrupted operation in power-unstable regions, making it highly suitable for mobile commerce, rural markets, and field-based logistics operations.

vi. Modular, Scalable Architecture

- Designed with open-source hardware (Arduino UNO and ESP8266 WiFi module), the SEDI-ESmartScale is low-cost to manufacture and easy to scale, modify, or integrate with additional technologies such as AI-based inventory forecasting or blockchain-based transaction verification.

Novelty Statement: The SEDI-ESmartScale distinguishes itself from generic digital scales by offering a full-stack ecosystem that combines precision weight sensing, embedded computation, secure authentication, IoT integration, and local resilience in a single product. Its Unified Tare/Zero button and seamless online-offline synchronization are industry-first features that simplify user interaction while delivering enterprise-grade transparency and control. This positions the SEDI-ESmartScale as a patentable innovation and a catalyst for Nigeria's indigenous smart hardware industry.

3. Commercial Viability

The SEDI-E Smart Digital Weighing Scale (SEDI-ESmartScale) is strategically designed to address the growing demand for affordable, connected retail technologies in Nigeria's informal and SME-driven economy. With over 39 million micro, small, and medium enterprises (MSMEs) in Nigeria [PwC MSME Survey 2024; SMEDAN and NBS National MSME Survey], and increasing

adoption of digital tools and IoT solutions in agriculture, retail, and logistics [PwC MSME Survey 2024; ResearchGate: Adoption Trends of Cloud-Based Precision Agriculture in Nigeria and Kenya], the SEDI-ESmartScale represents a high-impact commercialization opportunity.

3.1. Target Markets

- **Retail SMEs and Market Vendors:** Nigeria's retail sector is predominantly informal, with an estimated $200+ billion annual market size, and vendors increasingly seek affordable solutions to improve pricing accuracy and customer trust. The retail industry is a critical driver of Nigeria's economy, valued at approximately $125 billion annually as of recent reports [BusinessDay, Global Retail Index], with food and grocery retail alone estimated at $45.7 billion in 2020 [Guardian Nigeria]. However, this sector remains fragmented and largely cash-driven, with vendors facing challenges in ensuring accurate weighing, transparent pricing, and data-driven inventory management.

- **Agricultural Processing and Produce Trading:** Smallholder farmers and agricultural traders require portable, battery-backed weighing systems with traceable pricing, especially in grid-unstable regions.
- **Logistics and Distribution Hubs:** Logistics firms managing bulk goods need reliable digital transaction records to improve supply chain transparency.
- **Mobile and Rural Commerce:** The scale's offline capabilities and battery power make it suitable for rural markets, where mobile devices are often the only point of connectivity.

3.2. Competitive Advantages

- **Affordability:** Built with open-source microcontrollers, the SEDI-ESmartScale reduces production costs compared to imported alternatives.
- **IoT Connectivity and Dashboard Analytics:** Offers advanced data management capabilities not typically found in budget scales.
- **Security and Transparency:** Password-protected pricing and audit features differentiate it in informal market spaces where pricing trust is a challenge.
- **Localization:** Designed and manufactured locally, reducing import reliance and allowing customization for local market needs.

3.3. Revenue Model

- **Hardware Sales:** Direct sales to SMEs, retailers, farmers, and cooperatives at

an affordable price point.

- **Data Analytics Subscription (Optional):** Enterprises and cooperatives can subscribe to the SEDI-ESmartScale Dashboard for inventory tracking, analytics, and reporting features.
- After-Sales Services and Training: Software updates and vendor training create a recurring revenue stream.
- **Partnership Channels:** Collaboration with cooperatives, agricultural extension programs, and retail associations to distribute and install our units widely, ensuring large-scale adoption

3.4. Market Potential and Scaling Strategy

- Nigeria's push for digitalization and financial inclusion positions the SEDI-ESmartScale to capture a large underserved market.
- By leveraging NASENI's support for local manufacturing and R&D commercialization, the SEDI-ESmartScale can transition from pilot-scale production (hundreds of units) to industrial-scale manufacturing (thousands of units annually).
- Initial deployments will focus on Nigeria's urban markets, agricultural hubs, and logistics centers, with expansion into West African regional markets over the next 3 - 5 years.

Commercialization Vision: The SEDI-ESmartScale will evolve from a hardware innovation into a data-enabled commerce platform, transforming informal retail and agricultural trade by providing real-time pricing accuracy, traceability, and analytics at scale. This positions it as a flagship Nigerian-manufactured IoT solution with strong regional export potential.

4. Preliminary Results and Feasibility

The SEDI-E Smart Digital Weighing Scale (SEDI-ESmartScale) has successfully moved beyond the concept stage into a fully functional prototype, demonstrating its technical feasibility and readiness for commercialization. Initial development, bench testing, and real-world trials have validated its accuracy, connectivity, resilience, and usability, laying a strong foundation for scaling production.

4.1. Prototype Development

- A microcontroller-based prototype was built using Arduino UNO for core computation, ESP8266 WiFi module for connectivity, and HX711 for

high-precision weight sensing.

- A triple 7-segment display system was implemented for weight, unit price, and computed transaction amount, providing dual-view capability for vendor and customer transparency.
- The device's 5×4 keypad interface was successfully programmed to handle core operations including:
  a) Unified Tare/Zero
  b) Password authentication
  c) Unit conversion (kg/lb)
  d) Transaction uploads
  e) Offline access
  f) Memory recall for recent transactions

4.2. Technical Validation

- Measurement Accuracy: Achieved Class III commercial accuracy with a resolution of 30 g and a maximum capacity of 200 kg, meeting retail and agricultural standards.
- Connectivity and Data Synchronization: Demonstrated reliable HTTP POST communication with a PHP/MySQL cloud dashboard, supporting 5-second refresh rates.
- Web Host Failover: Validated offline failover logic, ensuring uninterrupted operation during network downtime.
- Battery Backup Performance: Tested a 3×3.7V lithium-ion battery module with seamless auto-switching between mains and battery supply, sustaining continuous operations for several hours in grid-unstable conditions.

4.3. Software Features Testing

- Unified Tare/Zero Algorithm: Performed accurately under multiple load scenarios, effectively preventing overload errors and simplifying usability.
- Secure Access Control: Password-protected settings were successfully validated, preventing unauthorized changes to unit pricing and configurations.
- Memory Recall Function: Enabled retrieval of three previous transactions, supporting transparency for audits.
- Dashboard Admin Controls: Verified ability to update passwords and prices remotely via the web platform.

4.4. Field Feasibility Trials

- Initial pilot testing in market and retail settings confirmed.
- Ease of adoption by vendors with minimal training.
- High customer trust due to visible dual-display setup.
- Stable connectivity and reliable performance even in low-connectivity areas.

- Strong portability and resilience, meeting rural deployment needs.

5. Alignment with NASENI Objectives

The SEDI-E Smart Digital Weighing Scale (SEDI-ESmartScale) aligns strongly with the National Agency for Science and Engineering Infrastructure (NASENI) mandate to promote indigenous innovation, technology transfer, and commercialization of locally developed solutions. This project is a prime example of homegrown R&D transitioning into a market-ready product, directly supporting NASENI's core strategic objectives.

5.1. Key Areas of Alignment:

i. Indigenous Technology Development:
   - The SEDI-ESmartScale is fully designed and prototyped in Nigeria, leveraging locally available components, open-source platforms, and in-house engineering expertise to create a scalable solution tailored for Nigerian market conditions.
   - By reducing reliance on imported weighing systems, the project enhances Nigeria's technology sovereignty and capacity for localized manufacturing.

ii. Commercialization of R&D Outputs:
   - This project demonstrates the end-to-end commercialization pathway, from concept development and prototype testing to market readiness.
   - NASENI's support will enable pilot manufacturing, market rollout, and scaling, turning an indigenous innovation into a revenue-generating, job-creating product line.

iii. SME and Informal Sector Empowerment:
   - The SEDI-ESmartScale empowers millions of small and medium enterprises (SMEs), agricultural producers, and informal market vendors with access to affordable digital technology.
   - Its transparency features (dual-display, audit-ready records) build trust in market transactions, boosting financial inclusion and consumer confidence.

iv. Capacity Building and Skills Development:
   - This project builds local expertise in embedded systems, IoT, and precision measurement technologies, creating opportunities for hands-on training, STEM education integration, and workforce upskilling in hardware development and electronics assembly.

v. Support for National Digitalization and Industry 4.0/5.0 Goals:
   - The SEDI-ESmartScale contributes to Nigeria's digital economy drive by enabling real-time data analytics, IoT integration, and e-commerce compatibility, helping local businesses transition into technology-enabled operations.

- This project serves as a stepping stone for developing future smart devices and IoT ecosystems under NASENI's research commercialization initiatives.

vi. Sustainability and Rural Development Impact:

- Designed with battery backup, offline functionality, and rugged hardware, the SEDI-ESmartScale is suitable for rural and grid-unstable communities, bridging the technology access gap and promoting inclusive economic growth.

6. Technology Readiness Level (TRL)

The SEDI-E Smart Digital Weighing Scale (SEDI-ESmartScale) is currently at Technology Readiness Level (TRL) 6, demonstrating a system/subsystem model or prototype tested in a relevant environment. This rating reflects the project's progress from early research to a validated, field-tested solution with a clear pathway to full-scale production.

6.1. Evidence of TRL 6 Status:

- System-Level Prototype Built and Validated: Fully assembled prototype integrates precision load cell sensing (HX711), Arduino-based control logic, IoT connectivity (ESP8266 WiFi), and multi-display interfaces.
- Successfully tested core functionalities: Unified Tare/Zero, secure password control, offline failover, cloud synchronization, and memory recall features.
- Functional Testing in Relevant Environments: Field trials in retail and agricultural markets demonstrated device stability, connectivity resilience, and ease of use, validating its suitability for real-world deployment.
- Hardware and Software Integration Achieved: Embedded firmware, database synchronization, and dashboard functionalities are fully operational and tested for reliability, paving the way for pilot manufacturing.
- Manufacturability Assessment Conducted: Open-source hardware design enables low-cost local production. Modular architecture allows scaling, servicing, and future upgrades, reducing time-to-market.

6.2. Planned Advancement to TRL 8–9:

- Pilot Manufacturing (TRL 7–8): Produce an initial batch (50 - 200 units) for pilot deployment across retail markets, agricultural cooperatives, and logistics hubs.
- Certification and Regulatory Compliance: Engage relevant Nigerian standards authorities to certify measurement accuracy and safety.

- Mass Production and Commercial Rollout (TRL 9): Scale up manufacturing and distribute through national and regional vendor networks, targeting SMEs, cooperatives, and large-scale distributors.

7. Scale-Up and Sustainability Plan

The SEDI-E Smart Digital Weighing Scale (SEDI-ESmartScale) has been engineered with scalability, cost-effectiveness, and sustainability as core design principles. This section outlines the pathway to scale production, expand market reach, and ensure long-term financial and operational sustainability.

7.1. Scale-Up Strategy

i. Pilot Deployment and Validation (Short-Term: 0 - 9 Months)
   - Manufacture and deploy 50–200 units to strategic locations: urban markets, agricultural hubs, logistics centers, and mobile vendors.
   - Collect user feedback to fine-tune hardware, firmware, and user experience.
   - Establish calibration and servicing protocols in collaboration with local regulatory agencies.

ii. Local Manufacturing and Assembly (Mid-Term: 9–12 Months)
   - Partner with local electronics assembly facilities to reduce production costs and strengthen Nigeria's indigenous manufacturing ecosystem.
   - Develop a supply chain network for sensors, microcontrollers, and enclosures, emphasizing local sourcing wherever feasible.
   - Implement semi-automated assembly lines to support mass production of 5,000+ units annually.

iii. Market Expansion and Distribution (Mid- to Long-Term: 12+ Months)
   - Establish distribution partnerships with retail cooperatives, agro-allied firms, fintech platforms, and equipment resellers.
   - Explore regional export opportunities in West Africa, focusing on rural commerce and agriculture-driven economies.
   - Deploy targeted marketing campaigns emphasizing affordability, transparency, and IoT analytics features.

7.2. Business and Revenue Model for Sustainability

The SEDI-ESmartScale's business model is designed to ensure long-term profitability and impact:

- Hardware Sales: Direct sales of SEDI-ESmartScale units at competitive price points for MSMEs and large enterprises.
- Data and Analytics Subscription: Optional cloud dashboard subscription for enterprises, cooperatives, and distributors to access inventory tracking, data analytics, and automated reporting.
- Calibration and After-Sales Services: Annual calibration packages and firmware updates to ensure compliance and extend product life.
- Customization Services: Industry-specific firmware and dashboard customization for logistics firms, e-commerce operators, and agro-allied companies.

7.3. Sustainability Drivers

i. Economic Sustainability:
- Locally sourced components and open-source design reduce costs and foreign dependency, ensuring sustainable manufacturing.
- Scalable production volume drives down per-unit costs, making the solution accessible to SMEs and informal vendors.

1. Environmental Sustainability:
   - SEDI-ESmartScale's battery backup system is rechargeable and energy-efficient, supporting reduced power wastage and extending device life.
   - Modular architecture encourages repairability and reduces e-waste.
2. Social Sustainability:
   - Provides affordable digital tools for underserved communities, empowering SMEs and smallholder farmers.
   - Creates opportunities for local employment in hardware assembly, technical support, and device calibration services.
3. Technology Sustainability:
   - Built on open-source platforms (Arduino, ESP8266), enabling continuous innovation and adaptability to future needs such as AI-powered demand forecasting or blockchain-based audit trails.

7.4. Partnerships for Scale and Impact

To ensure sustainability, strategic partnerships will be formed with:

- NASENI and Local Manufacturing Hubs for R&D commercialization and assembly capacity.
- Agricultural Extension Services and Cooperatives for rural deployment.
- Retail Associations and Trade Unions for vendor adoption and market penetration.

- Fintech and IoT Startups for integration with digital payments and analytics solutions.

8. Implementation Plan and Budget

The implementation strategy for the SEDI-E Smart Digital Weighing Scale (SEDI-ESmartScale) is designed to ensure a smooth transition from prototype to large-scale commercialization within 12 months. The plan focuses on iterative development, pilot deployment, capacity building, and full market rollout, supported by a clear budget structure.

8.1. Implementation Roadmap

Phase	Timeline	Key Activities	Deliverables
Phase 1: Final Design Optimization	Months 1–3	- Refine hardware design for manufacturability - Firmware optimization and system integration - Design for certification (measurement and safety standards)	Finalized SEDI-ESmartScale design documents, optimized firmware, certification-ready prototype
Phase 2: Pilot Manufacturing and Field Testing	Months 3–5	- Manufacture 50–200 pilot units - Deploy to select urban, rural, and agricultural markets - Collect performance data and customer feedback	Field-tested units, user feedback report, revised production specifications
Phase 3: Certification and Compliance	Months 4–5	- Obtain regulatory approvals (Weights and Measures, SON standards) - Conduct environmental and electrical safety testing	National certification for market release
Phase 4: Assembly Line Setup and Workforce Training	Months 5–7	- Establish local assembly/production line - Train local workforce for assembly, calibration, and servicing	Fully operational assembly line, trained technicians
Phase 5: Market Launch and Distribution	Months 6 - 9	- Official product launch - Secure distribution with cooperatives, agricultural	SEDI-ESmartScale commercial launch, sales and service

Phase	Timeline	Key Activities	Deliverables
Partnerships		unions, and retail associations - Start subscription-based analytics platform	network established
Phase 6: Scale-Up and Regional Expansion	Months 9 - 12	- Scale production to 5,000+ units annually- Expand into West African regional markets- Integrate advanced features (mobile payments, blockchain audits)	Large-scale deployment, expanded product ecosystem

8.2. Budget Estimate (12-Month Project Cycle)

Category	Description	Estimated Cost (₦)
R&D and Prototyping	Hardware iteration, firmware development, testing tools	30,000,000
Pilot Manufacturing	Production of 200 units (components, assembly, enclosures)	30,000,000
Certification and Standards Compliance	Regulatory certification, safety testing, calibration approvals	5,000,000
Assembly Line Setup	Equipment, jigs, production tools, and calibration stations	20,000,000
Training and Workforce Development	Hiring and training assembly technicians and support teams	10,000,000
Marketing and Distribution	Branding, packaging, marketing campaigns, partnerships	10,000,000
Cloud Infrastructure and Dashboard Development	Server hosting, analytics platform, security upgrades	5,000,000
Operational Costs (12 months)	Logistics, consumables, maintenance, project management	40,000,000
Contingency (10%)	Buffer for unexpected costs	15,000,000
TOTAL		**165,000,000**

8.3. Key Milestones

- Month 3: Finalized and optimized SEDI-ESmartScale design, certification-ready prototype.
- Month 3: Pilot batch (200 units) deployed in select markets.
- Month 4: Certification and regulatory approvals secured.

- Month 6: Local assembly line operational, team trained.
- Month 9: Commercial launch, partnerships established nationwide.
- Month 12: Regional market expansion and advanced feature integration.

9. Team and Organizational Capability

The SEDI-E Smart Digital Weighing Scale (SEDI-ESmartScale) project is driven by a multidisciplinary team of engineers, researchers, and product developers at the Scientific Equipment Development Institute (SEDI-E), Enugu, a subsidiary of the National Agency for Science and Engineering Infrastructure (NASENI). With extensive experience in embedded systems, precision instrumentation, IoT integration, and product commercialization, SEDI-E is uniquely positioned to deliver this innovation from prototype to industrial-scale production.

9.1. Lead Institution: Scientific Equipment Development Institute (SEDI), Enugu

SEDI-Enugu is a NASENI research institute focused on R&D in scientific instruments, industrial automation, and locally manufactured technologies.

i. Core Expertise:
- Embedded electronics, microcontroller systems, and IoT applications.
- Precision measurement systems (scales, metering devices, calibration tools).
- Design and fabrication of mechanical/electronic equipment for industrial and scientific use.

ii. Facilities:
- Electronics design and prototyping labs.
- Mechanical fabrication workshop and CNC machining.
- Software development and IoT systems integration units.

iii. Track Record:
- Over a decade of indigenous innovation in automation, weighing, and measurement solutions.
- Experience commercializing scientific equipment for government agencies, educational institutions, and private-sector clients.

9.2. Key Project Team Members

Name / Role	Expertise and Contribution
Project Lead / Principal Investigator	Embedded systems engineer with 15+ years of experience in industrial automation, IoT systems, and PCB design. Oversees technical development and commercialization strategy.
Electronics and Firmware Engineer	Specialist in microcontroller programming, sensor integration (HX711), IoT connectivity (ESP8266), and real-time systems optimization.
Mechanical and Industrial Designer	Designs enclosures and ergonomics for SEDI-ESmartScale, ensuring manufacturability, durability, and compliance with safety standards.
Software and Dashboard Developer	Develops the PHP/MySQL cloud platform, data analytics dashboard, and secure web-based control systems.
Quality Assurance and Standards Officer	Ensures compliance with Standards Organisation of Nigeria (SON) and Weights and Measures Department regulations.
Manufacturing and Assembly Manager	Leads supply chain coordination, production scaling, and workforce training for mass manufacturing.
Business Development and Commercialization Lead	Drives market analysis, partnership development, and sales strategy for SMEs, cooperatives, and large enterprises.

Project Team List

1. Engr. Dr. Lois O. Nwobodo
Ag. Managing Director / CE
Project Director/Overall Leader

2. Engr. Dr. Henry N. Uzo
Project Lead / Principal Investigator
Digital and Computer Electronics

3. Engr. Dr. Uzoamaka H. Nonyelu
Computer and Control Engineer specialist

4. Dr. Onyedika E. Okoye
Atmospheric Physicist

5. Engr. Bernard O. Omame
System design and Fabrication Supervisor

6. Engr. Augustine C. Nnadi
Power Sysytem Engineer

7. Engr. Blessing Okeakpu
Communication Engineer

8. Engr. Kingsley C. Mbanu
CNC Machine Tools Specialist

9. Engr. John E. Ugwu
Fabrication Engineer

10. CONCLUSION

The SEDI-ESmartScale project stands as a bold testament to Nigeria's capacity for indigenous innovation, industrial advancement, and technological leadership. With a validated TRL 6 prototype, a robust commercialization roadmap, and a multidisciplinary team anchored at SEDI-Enugu, this initiative is not merely a product—it is a catalyst for national transformation.

Through NASENI's strategic support, the SmartScale will evolve into a mass-produced, revenue-generating IoT solution that addresses real market needs, enhances transparency in commerce, and strengthens Nigeria's industrial base. Its modular architecture, scalable business model, and local manufacturing potential ensure long-term sustainability, job creation, and regional competitiveness.

This proposal outlines a clear, actionable 12-month plan to transition from prototype to full commercialization, backed by technical rigor, operational readiness, and institutional credibility. With NASENI's investment, the SEDI-ESmartScale will become a flagship product—one that not only exemplifies homegrown technological excellence but also positions Nigeria as a regional powerhouse in smart hardware manufacturing.

By funding this project, NASENI will be empowering a new era of Nigerian innovation—one that is locally built, globally relevant, and economically transformative.

11. Appendices and Supporting Documents

See Supporting Documents

12. Appendices and Supporting Documents

This section provides additional technical and organizational documentation that reinforces the feasibility, innovativeness, and commercialization readiness of the SEDI-E Smart Digital Weighing Scale (SEDI-ESmartScale). These supporting materials ensure transparency, demonstrate design maturity, and provide evidence of alignment with industry standards and NASENI's commercialization goals.

11.1. Technical Specifications (Summary Table)

Feature	Specification
Maximum Capacity	200 kg
Resolution	30 g (Class III Commercial Accuracy)
Microcontroller	Arduino UNO (ATmega328P)
Connectivity	ESP8266 WiFi Module (802.11 b/g/n)
Communication Protocol	HTTP POST / UART Serial
Load Cell Interface	HX711 ADC (24-bit precision)
Display	Triple 7-segment LED displays for weight, unit price, and total amount
Keypad	5×4 Matrix Keypad (ON/OFF, Unified Tare/Zero, Upload, Recall, etc.)
Power Supply	220V AC with auto-switching battery backup (3×3.7V Li-ion)
Offline Mode	Supported; automatic failover during network loss
Security Features	Password-protected pricing and offline access; dashboard-based password management
Environmental Range	0°C to 45°C; 20% – 85% RH, non-condensing
Enclosure	Rugged, portable design suitable for market and rural deployment

11.2. Block Diagram of System Architecture

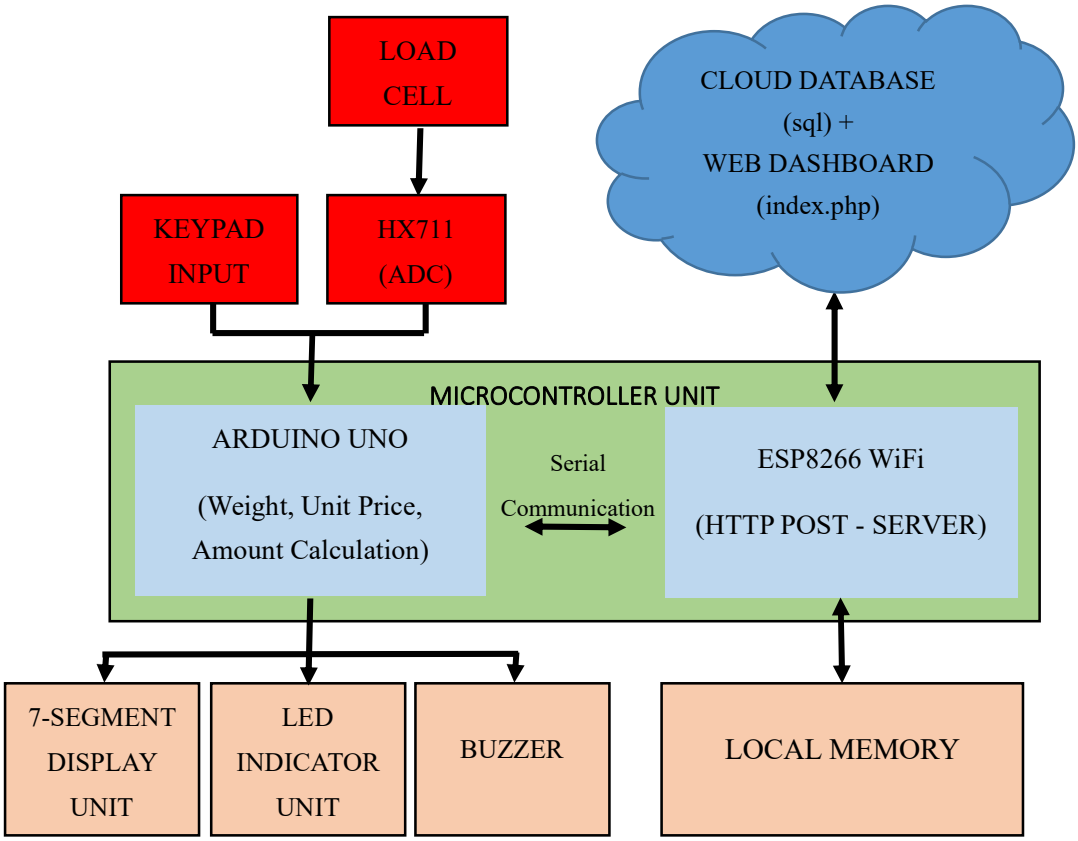

Figure 1: The block diagram of SEDI-ESmartScale