Advancing Cookstove Projects with Data Acquisition and Analytics

Transformative Project Scaling and Management with Blockchain, IoT, and AI Technologies

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Addressing Unacceptable Conditions in 2020

The Clean Cookstove Sector is plagued by promises not kept and results not delivered.

Thousands if not millions of delivered stoves go untracked and remain unconfirmed as to their ongoing usage and impacts.

These stoves range from short-lived, inexpensive clay charcoal burners to sophisticated units that may have embedded and/or attached electronics.

Additionally, millions of give-away LPG stoves go unused or under-used due to fuel costs and supply.

Improving Best Practices with Modern Technologies

Numerous funders of cookstove projects are using Results Based Financing (RBF) to promote record keeping through the first (or several) verifications.

One NGO, Juntos Energy Solutions, utilizes field assistants who visit all cookstove locations every 28 days to collect usage data that is digitally transcribed and immutably recorded using a blockchain-enabled verification system.

Next-level project management and verification goals can be met by developing an app ecosystem utilizing IoT, AI, Blockchain technologies to process data from cookstove sensors and other electronic devices, such as those utilized by shipping/placement sources, field assistants, etc.

Types of Useful Data

Static (Collected Once, Typically)	Dynamic (Periodic)
Geographic Placement of Cookstoves (GPS coordinates of households)	**Fuel Consumption** (Primarily for projects that include wood pellet disbursements)
Demographic Makeup of Household (Voluntary disclosures only. Ages and count of residents may be correlated to expected fuel consumption and per-meal duration of stove operation.)	**Stove Operation** (Sensor-provided temperature and/or fan/blower readings at timestamped intervals)
	Charcoal Yield (Weight of charcoal collected per household each collection cycle – e.g., 28-day accumulation)
	Charcoal Displacement or Sequestration (Weight per cycle)

Methods of Data Collection
(Focusing on Periodic, Dynamic Data)

- **Manual**. Typically involves in-field manual recording (handwritten chit) by field assistants (charcoal collectors) with subsequent manual data entry to a spreadsheet or app by project implementation partners or staff.

- **Semi Automated**. Typically involves periodic batch offloading of datasets from installed sensors to portable, handheld collection devices.

- **Fully Automated**. This data collection method does not require human interaction.

Benefits of Fully Automated Data Collection

- **Accuracy**. Eliminates human error in data transcribing and data entry.

- **Speed**. Enables immediate analysis and early identification of issues.

- **Timeliness**. Always-current view of cookstoves in use.

- **Security**. Sensor controller board (Arduino) data encryption with digital signing occurs prior to transmission to cloud-based, blockchain-enabled data collection app.

- **Reliability**. Date/timestamp + Device ID + Digital signature.

- **Immutability**. Direct to blockchain.

Advancement with Modern Technologies

- Internet of Things (IoT)

- Blockchain

- Artificial Intelligence (AI)

IoT – Internet of Things

IoT refers to an extension of the Internet and other network connections to various sensors and devices — or "things" — that can gather and transmit data from their environments for remote processing as well as receive remote directives and data.

Over 26 billion IoT devices were active in 2019, and that number is expected to triple by 2025.

Blockchain   [Non-financial use]

Blockchain technology in its simplest implementation is a decentralized, distributed ledger that records the provenance of a digital asset.

Sometimes referred to as Distributed Ledger Technology (DLT), blockchain makes the history of any digital asset unalterable and transparent through the use of decentralization and cryptographic hashing.

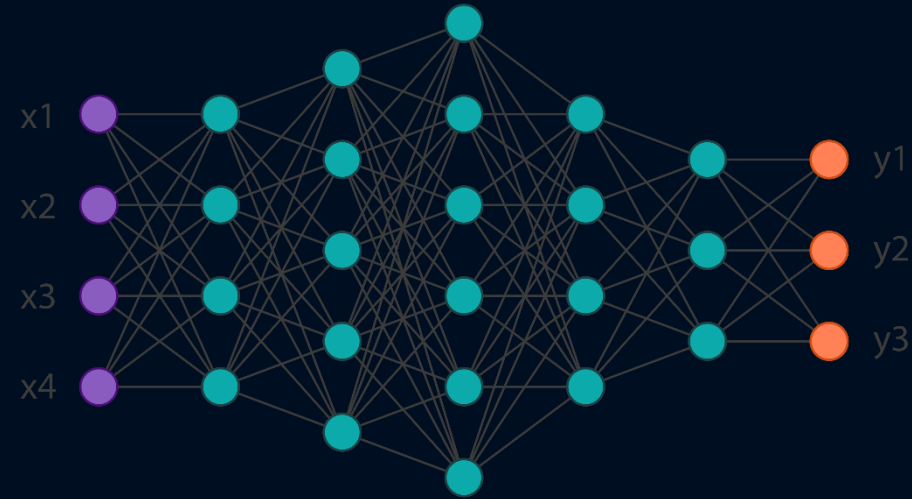**MultiChain**
Private Blockchain Platform

ethereum

AI – Artificial Intelligence

Computational processes that parse data contextually to reveal or provide useful information, analyses, or event triggers.

Artificial neural networks (ANNs) are machine learning algorithms that aim to imitate the way our brains make decisions.

Arduino Nano 33 IoT
(US$21)

Microcontroller with secure WiFi and Bluetooth module.

Integrates ECDH (Elliptic Curve Diffie Hellman) security protocol, an ultra-secure method to provide key agreement for encryption/decryption, along with ECDSA (Elliptic Curve Digital Signature Algorithm) sign-verify authentication for Internet of Things (IoT) applications.

Fully Automated, Secure Data Acquisition with Intelligent Analytics Enables:

- Reduction or elimination of human error and subjective interpretations in field operations assessments and measurements, especially those involving manual recording and transcribing activities.

- Increased uniformity of application in methods for field operations assessments and measurements.

Fully Automated, Secure Data Acquisition with Intelligent Analytics Enables:

- Early detection of faulty or failing components, as well as anomalous cookstove use, including training shortcomings, unexpected use, and even fraudulent use to secure unwarranted project benefits.

- Means to gauge data integrity. Data integrity is important because it refers to reliability and trustworthiness throughout its lifecycle. This is essential for properly assessing, quantifying, and validating carbon offsets, for example.

Without automation and intelligent analytics, these critical project management and verification aspects quickly become unmanageable as a cookstove project grows (scales).

Juntos NFP (sponsor) and Bitmaxim Laboratories (developer) have launched the blockchain-enabled initial app (CharTrac) of the previously-mentioned app ecosystem. With proper funding, this development work can continue with IoT integration of cookstove sensors and AI-driven data analytics to help guide effective and efficient cookstove project management.

For additional information about CharTrac and the proposed
app ecosystem, please visit

https://CharTrac.com/introduction

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