Empowering Paratransit Services in Developing Countries for Clean Energy Transition and Climate Action


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Background:

- Informal transport or paratransit continues to play a significant role in the urban transport systems of developing countries due to equity, affordability, accessibility and usefulness dimensions of mass transportation services
- The Philippines' shift to low-carbon transport policy as a response to climate change mitigation challenges is tightly coupled with the modernization of the Jeepney industry as part of its climate mitigation strategy
- Massive reforms to the public transport system were rolled out by the Department of Transportation since 2017 through the **Public Utility Vehicle Modernization Program (PUVMP)**
- The PUVMP continues to suffer from implementation bottlenecks and resistance from jeepney operators
- Newly-formed Transport Service Entities (TSEs) specifically transport cooperatives, face complex organizational, operational and financial problems

Targets:

- Develop a platform to **empower transport cooperatives** and all concerned government agencies through **technology-driven solutions** that optimize route planning, fleet management, and access to climate financing

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Key Challenges Addressed:

- Existing subsidies and fiscal support from government prioritizes vehicle ownership. Yet, the cost of modernization extends
- beyond vehicle ownership (Tacderas et al., 2021)
- Costs of modernization include capital and operational costs that burden and disrupt the long-term sustainability of the sector
- Limited options for financing the transition (Sunio & Mendejar, 2022) with the financial sector perceiving jeepneys as a risky investment
- The modernization program covers some social safeguards and non-fiscal support, but they may still be limited.
- Other material risk factors may arise from modernization, such as environmental regulation compliance, labor management costs, human capital development, and corporate structures and practices
- Consolidation and cooperative formation entail corporate structures and capacities necessary to operate manage assets, and manage competition
- The OECD reported that the informal sector, like the jeepney operators, face larger poverty and occupational risks compared to formal private enterprises. Yet their contribution to the economy is largely unrecognized, which impedes proper arguing for public and private financing

Strategic Approach:

- Support the low-carbon transition of transport cooperatives through better **Environment, Social, and Governance (ESG) risk management practices** and bridging operations with green and climate financing

Proposed Method: PARASOL

- The PARASOL platform is designed to address the specific needs of transport service entities, helping them improve **multi-level efficiencies** (city, organizational, route, driver, and vehicle) for better energy and eco-driving practices and outcomes.
- By integrating real-time data from the **SafeTravelPH app and telematics**, the platform will empower transport operators and asset managers with insights into their operations

Parasol

Open System Solution for Paratransit in Developing Countries for Energy Efficiency and Clean Energy Transition

UPPAF ParaSol SafeTravelPH

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PARASOL Solution Framework

Problem Situation

[Fossil Fuel Dependence]
- Low capital and financial capacity of small operators
- Lifetime savings invested in diesel engines and franchise
- Backyard vehicle manufacturing and assembly practices

[Poor Energy Efficiency]
- Poor vehicle maintenance of small operators
- Fragmented fleet management and operations
- Informal labor organization and poor accounting practices
- Weak social safety nets for workers

[Inclusive and Just Transition]
- Low public transport quality of service
- More power turning to personal mobility
- Lack of consensus among policy and decision-makers
- Vulnerability of informal workers to disruption and loss of livelihood

Solution Framework

[Service/Route Level]
- Achieve route rationalization and greater coordination of services

[Organization Level]
- Assist paratransit operators towards industry consolidation and protect affected households

[Vehicle Level]
- Support transition to clean energy and clean vehicles

[Driver Level]
- Achieve energy efficiency through promotion of eco-driving

[City Level]
- Improve public transport planning and collaborative governance through multi-stakeholder engagement

Competitive Advantage
- **Enhance service framework and industry using Smart Contracts**
- **Financial inclusion of industry workers and their household through social safety nets enabled by Fintech**
- **Mobilize climate financing for vehicle replacement and introduction of clean energy systems by establishing MRV system**
- **Enable access to carbon trading market through Blockchain-based energy accounting**

Fintech and Blockchain

Proposed Method: PARASOL

- **Route Network and Service Planning:** An enhanced framework for preparing the Local Public Transport Route Plan (LPTRP) of local governments, with digital tools for data generation, collection, management, analytics, evaluation, and visualization.
- **Business Intelligence and Fleet Management Systems:** A comprehensive module that allows transport service entities or TSEs (cooperatives and small business corporations) to monitor and optimize their vehicle operations and business growth
- **MRV and Benchmarking Tools:** A system that provides valuable information on climate and Environmental, Social, and Governance (ESG) risk factors, aiding in financial risk management, and providing the government and financial institutions with Monitoring, Reporting, and Verification (MRV) system for road-based public transport
- **Access to Financing and Investments:** By capturing operational data, the PARASOL platform aims to facilitate better government and private investments thru budget programming, and private and climate financing for TSEs that are transitioning to modern and energy-efficient transport solutions

PARASOL Technology-based Solution Design

Proposed Solution

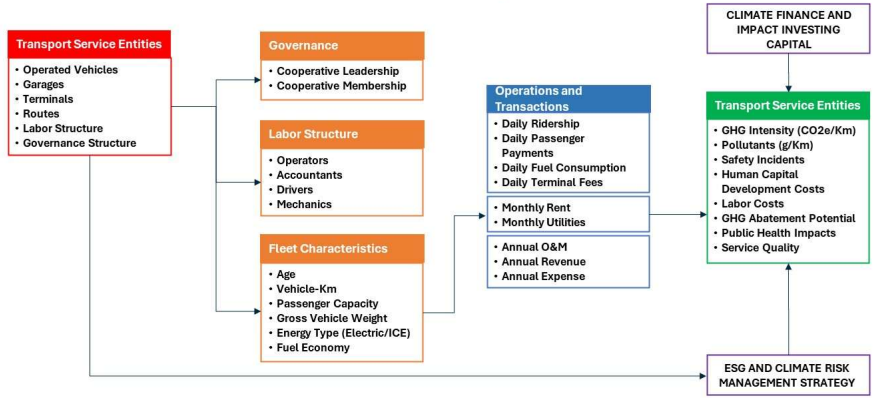
- Open platform to capture road-based public transport industry data
- Dashboard to monitor operational KPIs of transport service cooperatives
- Open and real-time system for monitoring public transport demand and supply and service quality indicators
- Monitor contractual obligations/ service level agreements (SLA) of transport service cooperatives using Smart Contracts
- Public transport energy accounting infrastructure based on Blockchain technology
- Energy demand modelling and efficiency analysis for fleet operations

HYPERLEDGER
HYPERLEDGER FABRIC
node
NGINX
docker
GTFS

Technology Development

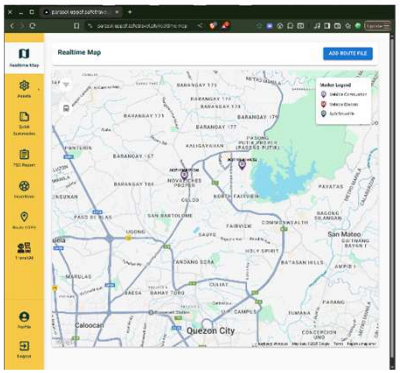
- Integrated on-board sensor technology
  - Real-time passenger counting and public transport vehicle tracking
  - Vehicle energy efficiency monitoring
  - Passenger feedback system
- Promotion and incentivization of eco-driving
- Open API for inclusive public transport planning and mobilization of climate financing
- Fintech to incentivize commuter engagement and public transport crowdsourcing
- Financial inclusion of public transport workers and users using Smart contracts
- Measurement, Reporting and Verification (MRV) for Vehicle Economy Labeling

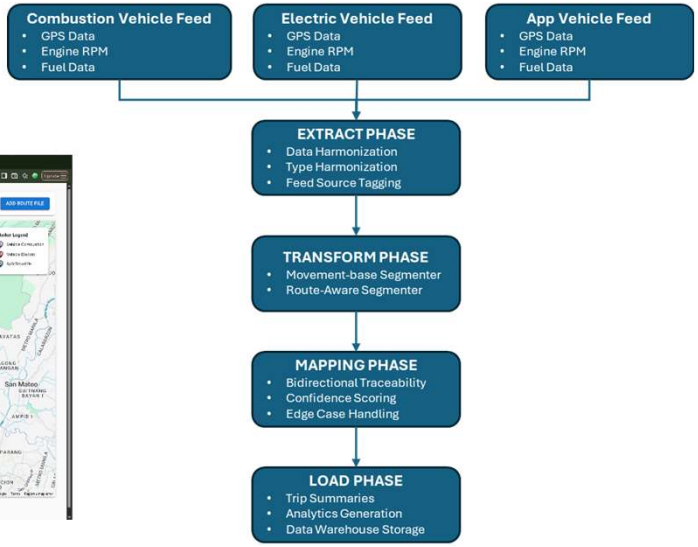
ESG and Climate Finance Ecosystem

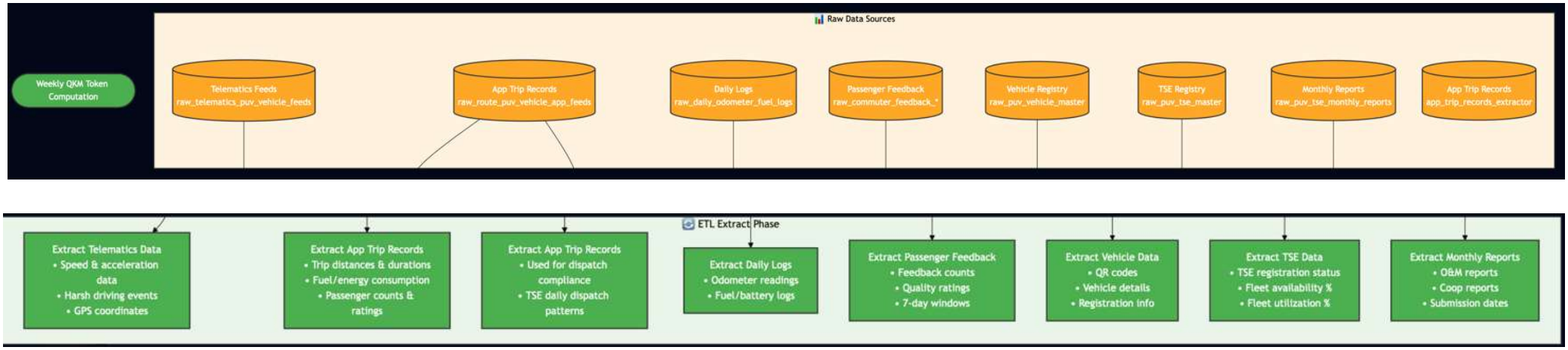


Proposed Method: PARASOL

- The **Multi-Feed Trip Segmentation Pipeline** is an ETL system designed to process telematics data from three different vehicle feeds and perform intelligent trip segmentation while maintaining complete traceability to original trip codes. This pipeline serves as the foundation for transportation analytics, compliance monitoring, and operational insights
- **A Smart Contract** for managing the Weekley **Quality-Kilometer (QKM) Token** is provisioned using a Private blockchain setup in order to track service quality metrics allowing cooperatives to access climate finance, service contracting incentives and other support mechanisms more efficiently.



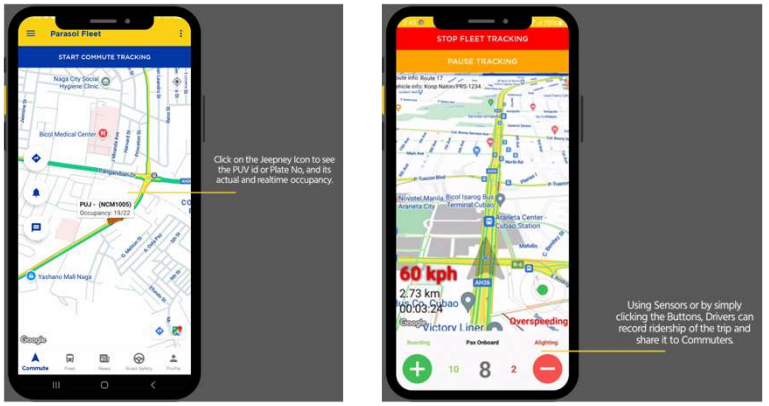




Impact: PARASOL

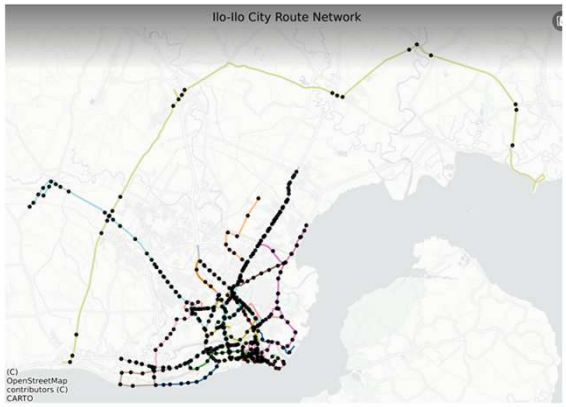
Commuters:

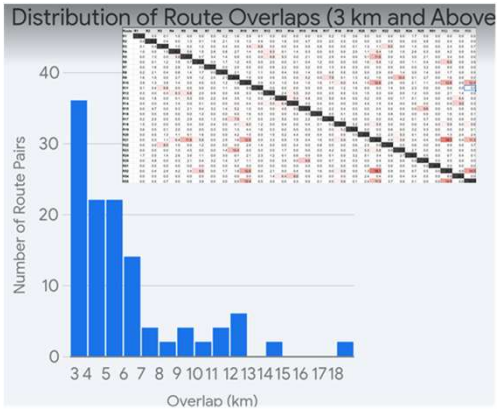
- Get real-time location and occupancy of Public Utility Vehicles (PUV)
- Know more about route alignment and stop locations
- Submit Trip Quality Rating
- Send alerts to PUV operators and regulators
- Share real-time trip info to others



Drivers:

- Monitor and share real-time location and occupancy of the PUV to other app users
- Measure and evaluate eco-driving behavior
- Get driving assistance and alerts (visual/sound/vibration) to improve behaviour and eco-driving skills





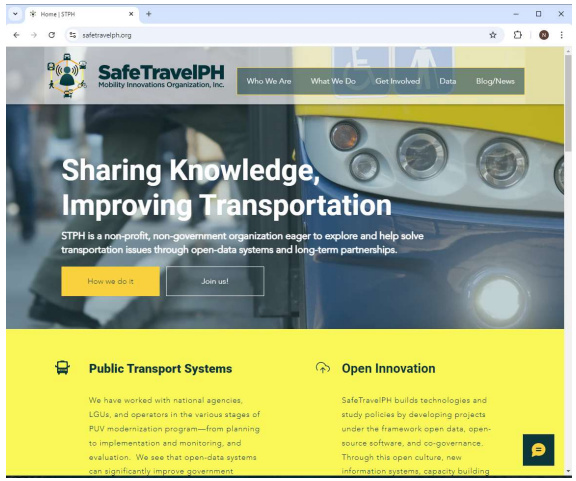
Impact: PARASOL

Identified Recurring or Unresolved Issues:

- Rigid planning formulas (for PUV fleet sizing per route)
- Not business sensitive mandated Local Public Transport Route Plan (LPTRP)
- Unexpected high costs in labor due to sudden formalization of actors
- Subsidy through Service Contracting is needed to survive (Cooperative perspective)
- Emphasis on PUV fleet replacement without service redesign and systems infrastructure (eg. PUV stops/terminals, route overlap and fleet management)
- Poor LGU capacity for route planning and monitoring
- DOTr staff turnovers (Contract-of-Service employees) and lack of capacity for program M&E

Collaborative Governance:

- SafeTravelPH Mobility Innovations, Inc. is a multidisciplinary non-government organization that operationalizes the concepts of open data and collaborative governance in promoting sustainable transport innovations (Tiglao, et al., 2020; Tiglao, et al., 2023)
- SafeTravelPH commits itself to promoting open-data systems, integrating science-based policies, and collaborating with diverse stakeholders



Impact: PARASOL

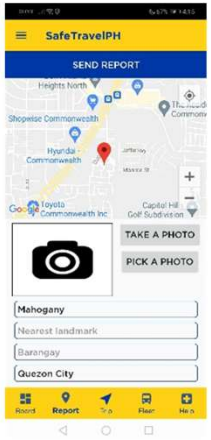
A Just Transition for Vulnerable Workers:

- As the country aims to modernize its transport sector, ensuring a just transition for workers in the jeepney sector is paramount.
- PARASOL's open platform will help support government planners in working with vulnerable transport workers by providing them with the tools and resources needed to adapt to changes in the industry while actively contributing to climate action.
- The PARASOL platform is expected to expand upon the work initiated by the SafeTravelPH Public Transport Crowdsourcing and Information Exchange Platform developed by the University of the Philippines National College of Public Administration and Governance (UP-NCPAG)

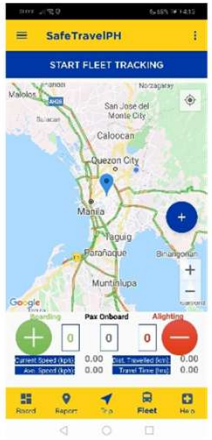
SafeTravelPH

Login page

Registration page



Reporting page



Fleet tracking

Output/Outcome: PARASOL

Collaboration:

- Research and policy discussions were conducted with national agencies – Department of Transportation (DOTr), Development Bank of the Philippines (DBP), Office of Transport Cooperatives (OTC), Department of Human Settlements and Urban Development (DHSUD), and Department of Economy, Planning, and Development (DEPDev)
- Collaborative Research Agreements (CRA)/ Field Demonstration were conducted with local government units including General Santos, Baguio, Iloilo, Bacolod, Puerto Princesa, and Naga
- Scientific articles are regularly published and project updates are provided through social media and website posts


Meeting with DBP – Head Office


Meeting with LTFRB Region VI

Meeting with DBP – Head Office


Meeting/Training with Transport Cooperative at Iloilo City

Output/Outcome: PARASOL

Collaboration:

- SafeTravelPH has been officially accredited by the House of Representatives as a Civil Society Organization (CSO) to take part in the 2026 national budget deliberations. The accreditation allows the group to bring more commuter voices and data-driven recommendations directly into the country's budget process and advocate for a fairer share of budgeting for public transport
- With the accreditation process led by the House Task Force on People's Participation (TFPP) and the Congressional Policy and Budget Research Department, SafeTravelPH pledges to support "a more inclusive and transparent budget process" and to champion greater investment in public transport systems

TSE · Oct 3 · 2 min read

SafeTravelPH Gains Accreditation as CSO, Advocating Inclusive Public Transport in Budget Deliberations

SafeTravelPH, a multidisciplinary non-government organization eager to explore and help solve transportation issues through open-data systems and long-term partnerships, has been officially **accredited by the House of Representatives** as a Civil Society Organization (CSO) to take part in the 2026 national budget deliberations. The accreditation allows the group to bring more commuter voices and data-driven recommendations directly into the country's budget process and advocate for a fairer share of budgeting for public transport.

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Conclusion: PARASOL

A Unique Solution for Developing Countries:

- PARASOL is pioneering in its approach, as it is the first system to link paratransit operations with climate financing in the Philippines
- Existing ESG-related services tend to focus on larger companies, leaving smaller Transport Service Entities (TSEs) with significant risk exposures without adequate support
- By bridging this gap, PARASOL not only addresses the specific challenges faced by TSEs but also empowers them to engage with climate financing opportunities
- The Organization for Economic Cooperation and Development (OECD) has highlighted the increased risks faced by informal transport operators, noting their significant contributions to the economy despite often being overlooked
- PARASOL aims to provide an open data system that empowers TSEs and enhances their access to financing, ultimately supporting a more resilient public transportation network

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