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Original Article

TRANSPECTRA: An AI-Powered Centralised Transport Management System

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Abstract *- Out there, schools and colleges still juggle bus timetables by hand. Paper logs pile up while messages bounce between staff and drivers without syncing. That gap? It sparks timing mix-ups, mismatched records, and slow responses. When more buses hit the road each day, old-school ways buckle under the load. Enter Transpectra - a single hub built to pull all transit tasks together. Instead of scattered tools, everything rides in one system. Fewer hiccups happen when updates flow in real time. Coordination sharpens because everyone sees the same schedule. Data stays put, no re-entering needed. Over time, less energy is spent on fixing avoidable errors. One way the Transpectra setup works is by linking an online admin dashboard with a phone app, creating one space where vehicle assignments, driver details, paths, journey times, and distance logs stay connected. From the desktop side, supervisors track path designs, assign assets, and watch daily activities without switching tools. Drivers get their itineraries on screen using the handheld version, marking progress as they go via straightforward menus. Access levels depend on user roles, information lives in shared folders, changes appear instantly - these pieces cut down mistakes made by hand while tightening teamwork between office workers and behind-the-wheel staff. What emerges is smoother day-to-day function, room to grow within different organisations, and a stable tech base built for handling transit tasks well.*

Keywords *- Institutional transportation, Mileage calculation, Mobile Application, Route Management, Transport Management System, Vehicle scheduling.*

1. Introduction

Moving people around matters a lot in schools and workplaces - getting it right keeps things running. Not every place uses modern tools, though; some stick to old ways like notebooks, printed sheets, or word-of-mouth updates. Mistakes pop up more often when tasks pile onto human memory instead of systems. Double entries creep in, timing slips, messages get lost - all because pieces do not talk to each other. Effort piles high while progress crawls under outdated routines.

When more buses join a network, handling schedules by hand gets messy fast. Office teams struggle to match drivers with correct runs, track distances accurately, and sometimes miss updates entirely. Though many apps show where each bus is in real time, few help log oil changes or inspection dates without typing everything twice. Errors creep into reports when details move from paper to screen slowly. Rules around maintenance or fuel use can slip through cracks if nothing flags what is overdue automatically.

What happens when paperwork slows everything down? Transpectra steps in with one connected hub combining online tools for office staff and a driver-focused app. Instead of typing up forms by hand, info flows automatically into a shared space. This shift means fewer errors show up in logs. Team updates move faster now that everyone uses the same updated records. Miscommunication drops because screens display the same real-time details. A quiet change, yet tasks once delayed now finish on time.

What stands in the way most is how scattered systems fail to log transport activity smoothly. Without one clear method, workers type in fuel numbers, distance counts, and service dates by hand - each step inviting slips. Mistakes creep in, reports lag, rules might get overlooked - all because info lives in separate corners. When machines do not pull details automatically, leaders miss live views of what is happening out on the road. A smarter setup would gather facts without typing, feed them into one space, and keep the truth intact even as things grow larger.

2. Problem Statement

Fleet tracking at schools and workplaces usually relies on old routines, mixing physical notes with basic software tools. Paper files sit beside messy spreadsheets while updates pass by word of mouth. Without one connected platform, details vanish - fuel totals go unrecorded, odometer readings blur together, services get missed. Handwritten journals fade, pages tear, mistakes stack up quietly. Admin teams grope in fragments when chasing maintenance trails or trip summaries. Clarity slips because everything lives apart.

Without built-in alerts, staying compliant gets tough. Paperwork like insurance papers, vehicle checks, or license updates usually depends on handwritten logs, which raises the chance of missing deadlines.

Forgotten renewals can lead to legal trouble and put safety at risk. Mileage and fuel amounts need manual logging too - slow work, full of slips. Wrong numbers mess up cost reports and how trips are reviewed, making fleet information less trustworthy.

Transport often runs below capacity; meanwhile, office workers face heavier loads and sluggish routines. Because updates arrive too late, problems like late departures, improper vehicle use, or clashing timetables linger without fixes. Trust in transit weakens when choices lack timely insight.

Fixing this means shifting to an organised platform that gathers trip details and handles logs automatically, instead of paper trails. Tools like Transpectra build that base - clearer oversight emerges, rules stay met, movement scales smoothly inside organisations.

2.1. Key Improvements

•Vocabulary: Transitioned from“typing errors”to“transcription inaccuracies”and from“missing data”to“fragmented ecosystem where data visibility is severely restricted”.

Because handwritten records were not kept properly, regulators took issue - this opened doors to legal trouble. Missing entries did not just confuse; they became evidence in audits. When inspections came, incomplete logs meant fines followed close behind. Officials pointed to sloppy tracking as proof that standards were ignored. Courts saw poor documentation as neglect, not oversight. Penalties arrived because paper trails failed under scrutiny.

What if fixing slow data work meant using smart tools instead of hands-on typing? That is where pulling info with AI steps in, replacing repetitive input. A fit made clear by how much time gets lost doing it the old way. Not magic, just smarter movement of bits. Done because clicking through forms no longer cuts it. Your setup needed this shift, quietly obvious once you watch the process drag.

3. Identify, Research, Methodology, and Collect Idea

Started by zeroing in on the exact issue, Transpectra took shape through focused adjustments. Its main goal? Building a unified platform that handles how vehicles get assigned, routes are mapped, distances tracked, and trips organised - especially where institutions need order.

3.1. Review of Current Systems and Comparison

Looking into how transport systems are managed today meant checking out current platforms and past studies. What stood out again and again were similar problems popping up across different setups. One big issue is that no single hub pulls everything together smoothly. Tasks often need manual handling instead of running on their own. Getting live details about what vehicles are doing right now tends to be spotty at best. When demand grows, most tools struggle to keep pace without major reworking.

Most schools still track buses using paper logs or simple GPS devices that only show location. Yet those methods miss key parts of the job, such as reporting rules or managing schedules effectively. Instead of combining everything, older ways keep tasks split and slow. Take spreadsheet use - it handles notes, but cannot track real-time movements. Basic trackers display where vehicles are, yet ignore paperwork needs completely. Transpectra steps in by doing both at once without forcing teams to juggle separate tools. This gap becomes clearer when comparing how each method deals with daily demands. One after another, traditional options fall short in linking operations with oversight. A fresh look shows why patchwork fixes struggle under pressure. What works today often breaks tomorrow when rules change or routes shift suddenly.

Feature / Aspect	Manual Excel-Based System	Standard GPS Tracking System	Transpectra
Data Entry Method	Fully manual entry	Manual entry for fuel and service logs	AI reads text from images
Fuel & Mileage Recording	Spreadsheet-based, error-prone	Often external or manual	Automatically extracted and stored
Compliance Monitoring	Manual reminders or none	Limited or absent	Automated alerts for insurance, FC, licenses

Real-Time Visibility	Not available	Location-only tracking	Operational and administrative data visibility
Architecture	Local or standalone systems	Centralised but GPS-focused	Cloud-native, multi-tier architecture
Scalability	Poor scalability	Moderate scalability	Designed for scalable institutional use
Administrative Workload	High	Moderate	Significantly reduced

Looking at current options, most zero in on either spotting vehicle locations or keeping logs by hand - so paperwork stays scattered, mistakes creep in. Built to fix that split, Transpectra pulls together smart data grabbers with one clear oversight hub, running fully online. Reading fuel and repair details with AI smarts slashes typing time and sharpens numbers, too. Instead of just pinging trucks on maps, it shapes up into an entire system for managing fleets.

3.2. Online Research and Requirement Analysis

From online research and real-world examples, a look at how schools handle transportation took shape. Through these materials, key needs in function, typical limits in systems, and fitting tech options came into view. Smooth running depends on access set by user roles, one main hub for data, while letting drivers reach tools via phone matters too.

3.3. Peer Discussions Technical Consultation

Fine-tuning the system's reach and shape leaned heavily on talks with fellow students and guiding instructors. Because of these exchanges, choices around structure, login approaches, how data was stored, and separate process blocks took clearer form - keeping things workable, ready to grow.

4. System Roles and Functional Architecture

Inside Transpectra, work splits into two main jobs: one handles setup and control, the other manages movement on the road. One screen fits each job, and both plug into the same online hub where everything meets. Data moves steadily, timing stays tight, nothing drifts out of sync. Coordination runs behind every trip.

4.1. Admin Tools Web Interface

From the top, someone has to make sure everything moves right and follows the rules. Running things through a browser means seeing what is happening everywhere without stepping outside.

A single system holds everything together - vehicle details, driver assignments, route updates. One spot where admins adjust info without switching tools. Changes happen smoothly, no extra steps needed. Updates stay current because they flow into one place. Drivers linked to routes show up clearly when checked. Info stays connected, never scattered across apps.

From behind the screen, updates flow in - each entry marking a vehicle's move or stop. A glance shows what is live, what is delayed. This view pieces together where things stand without waiting. Trip by trip, the picture clears through steady check-ins.

When dates near for insurance updates, license checks, or vehicle inspections, the tool sends out warnings on its own. Missed steps happen less because reminders pop up before things lapse. Each alert comes at a set time, tied to specific needs. Renewals stay on track without someone watching every detail. Rules around paperwork get easier when signals come automatically. Lapses drop when notifications arrive ahead of time.

With just a few clicks, transport data gets turned into clear summaries. These records help spot patterns in how vehicles are used over time. Mileage details pile up, giving insight later on. Planning repairs becomes easier when history is tracked properly. Decisions about who uses what start making more sense, too.

4.2. Driver Role Mobile App Interface

Drivers tap into the mobile app while on the job, built so it feels natural and fast. One glance updates logs without slowing down runs. Tasks slip into routines like a note passed mid-step. Focus stays where it should - on the road ahead.

Before hitting the road, drivers go through a quick online form. This list helps spot any issues with key parts like brakes or tyres. Oil levels get checked, too, just to be safe. Instead of paper, everything shows up on a screen. Each item must be reviewed one by one. The system marks progress automatically. Nothing moves forward until each step is done. Safety starts long before the engine turns on.

Photos snap odometer numbers into records without typing digits by hand. Fuel slips get saved as pictures rather than typed lines. A driver points a phone, clicks once, and data moves silently forward. No keyboard needed when glass and light do the work. Numbers leap from gauge faces straight into logs through lenses. Paper fades behind pixels stored in quiet clouds. One glance at a dashboard dials truth into systems. Receipts live now as digital ghosts in machines.

Numbers and tax details get pulled from pictures using a smart tool inside the Gemini 2.5 Flash system. This process

skips hand-typed inputs, which often carry mistakes. Instead, it reads the image directly. Mistakes drop because people are not entering values themselves. The whole thing runs without someone watching every step. Accuracy improves when the machine handles the reading part. Images become clean data fast, with less chance for slips.

Every few seconds, fresh trip info flows into the system. Vehicles report where they are without delay. This live stream heads straight to online storage. Managers see current positions as if watching in real time. Movement updates appear instantly on their screens. Trip status shifts show up moments after the change. Information travels fast; no waiting needed.

5. Architectural Design

Inside Transpectra, systems grow like roots through cloud soil - shaped not by one method but many. Availability holds steady because design flows between modes. Data slips easily from screen to screen, web into hand-sized glass, without catching on edges. Structure adapts before stress appears.

5.1. System Architecture Overview

Starting at the core, the Transpectra setup splits into four distinct layers, each managing its own role. Because tasks are separated like this, updates become simpler over time. Security strengthens when functions stay isolated across levels. As movement demands increase, expansion happens smoothly behind the scenes.

5.1.1. Client Tier

On phones and tablets, a single app runs across systems thanks to Flutter and Dart. Built on Node.js with HBS templates, the admin site lives in browsers. Drivers tap into routes and send trip changes through the handheld tool. People managing things behind desks adjust fleet settings from one online hub. Who you are decides what parts open up - no extra clutter shows. Permissions quietly block wrong turns without slowing down correct ones. Seeing only the needed tools keeps work smooth and mistakes far away.

5.1.2. Intelligence Tier

One level handles automatic data gathering and sorting. Using the Gemini 2.5 Flash API, it pulls text from driver-uploaded pictures - odometer shots, fuel slips - through OCR tech. Rather than hand-entering numbers, the setup asks the model to grab exact digits: mileage, fuel volume, price tags, tax bits. Once pulled, that info comes back neat and checked, then tucked into storage safely. Fewer typos pop up now, formats stay uniform, and less busywork piles up for both drivers and office staff.

5.1.3. Storage Tier

Authentication sits with the storage tier, while files stay put through data persistence, plus media tasks get sorted on the back end.

When someone logs in, Firebase hands out secure tokens to keep things protected. Starting at sign-in, it checks who you are before granting entry. Real-time updates flow between devices thanks to live syncing behind the scenes. Permissions depend entirely on your assigned role within the system. Only admins see admin-level info - drivers get their own separate view. Access limits come straight from custom rules baked into the setup. Push alerts arrive instantly because the backend supports a constant connection. What each person sees gets filtered long before showing up on screen.

Storing sharp pictures - like fuel receipts or odometer shots - in Cloudinary keeps them out of the main database. Because these files live separately, the system runs more smoothly. Images reach users quickly, yet never slow down daily operations.

5.1.4. Communication Tier

Sending alerts and reports happens automatically through the communication layer. Emails go out using tools like Mailjet along with Nodemailer, reaching staff who handle oversight tasks. When insurance papers, vehicle checks, or driving permits near expiration, warnings arrive by message. That way, organisations stay aligned with legal rules without falling behind. Updates roll in on schedule, removing the need for hand-driven tracking.

5.2. Operational Flow

Starting, the entire process moves step by step, so information gets recorded correctly and handled without delay.

Filling out details comes first - admins set up drivers, vehicles, and paths using the online interface. Profiles take shape piece by piece, shaped entirely within the browser tool.

Starting with photo uploads, drivers share odometer details through the app during Phase 2. Fuel logs come next, sent in right after the meter shots. This step collects real driving data straight from the device. Snapshots travel securely to the system without delays. Each entry arrives timestamped and sorted automatically. The process runs smoothly when users follow the sequence. Information flows steadily if pictures stay clear. Updates appear live once submitted by the driver.

Mileage data begins appearing once the system starts analysing the submitted pictures. Information flows through after the software identifies key details inside each file. Extraction happens slowly, then speeds up as patterns emerge across documents.

Once extraction finishes, the info lands in Firebase, tagged with timestamps. Should a certificate edge near expiration, warnings fire off via the alert module. Data sits safely until review, each entry marked by when it arrived. When deadlines draw close, the tool sends out signals without

being asked. Stored records keep their moment of arrival stamped beside them. No expiring file slips past quietly - notifications wake up at the right hour. Each piece logs into storage with clock readings attached. Near-expiry triggers ripple outward through silent pings. Timestamps anchor every detail that moves into the database. Alerts stir only when due dates begin creeping forward.

5.3. Security and Access Control

Securing entry into the system happens through Firebase Authentication. A person gets signed up using credentials tied to their specific function within the platform. Once logging in works properly, a token is handed out for continued verification.

Depending on the assigned role, different parts of the app become visible or are completely locked down. Access limits are set by built-in Firebase rules that control who can view or edit certain information. Only details connected to a user's job and linked vehicle appear when they are allowed in. Protection against outside access remains strong by design, shielding essential records from movement and regulations.

5.4. Scaling with Cloud Native Systems

When more cars, paths, or rides get added, the setup grows smoothly because it runs on cloud tools built for many tasks at once. Instead of tweaking servers by hand, Firebase handles traffic spikes while keeping data fresh across devices instantly. Photos of mileage readings and gas slips go into Cloudinary, which keeps big files off the main database. By splitting how info is saved from how it is handled, speed stays steady even when usage climbs.

6. Ethical Considerations and Data Privacy

Every file tied to transport - like scans of licenses or gas slips - is locked down tight by Transpectra. Protection is not an afterthought; it shapes how data lives in the cloud, built on standards that guard personal details without drawing attention to itself.

Inside Google Firebase, driver license information lives securely thanks to built-in management tools. Identity checks happen automatically because Firebase Authentication steps in before granting entry. Only those with admin clearance see driver files once logged in properly. Protection stays strong since data gets locked down both while sitting still and moving across networks. Personal records remain accurate and private under these layers of defence.

Pictures of fuel slips, mileage numbers, along with snapshots of vehicles taken via the phone app, go into Cloudinary for safekeeping. Secure links and permission tokens manage who sees what, so photos do not land in open view by accident. By keeping image files apart from personal details, the system limits weak spots hackers might target. Safety improves simply because fewer people have direct access to sensitive information.

Only what is needed for running and checking transport gets collected - privacy stays a priority throughout. Information never goes outside the set system functions, staying put unless part of approved operations. Used just for oversight and daily administration, every detail remains contained within clear boundaries. People can rely on how things work because openness shapes each step behind the scenes.

7. Methodology

From the start, building Transpectra moved step by step through clear phases - studying what was needed, shaping how it would work, putting it together, checking each part, then confirming everything functioned correctly. Because of this path, the system met real-world transportation demands without sacrificing stability or room to grow.

7.1. Collecting and Understanding Needs

Apart from handling basic logistics like managing vehicles and assigning drivers, the system builds routes and sets trip timetables while tracking distances covered. Administrators, plus those behind the wheel, get tailored access depending on their duties. Smooth navigation matters just as much as quick responses when using the platform. Keeping information protected sits alongside steady operation under heavy loads. Growth readiness ensures it keeps working even when transportation demands increase.

7.2. System Design

Built with separate parts that fit together like puzzle pieces, the setup made it easier to build and fix over time. Each piece had its own role - one handled requests, another managed storage, while a third took care of coordination between them. This way, changes in one area did not disrupt others, allowing updates without breaking what already worked

A digital interface sits at the front, offering staff a single view into movement systems. Control flows through one screen where updates happen live. This hub adjusts logistics tasks without switching tools. Oversight becomes simpler when every detail appears together. Operations shift smoothly because feedback arrives instantly. Management stays informed by design, never by chance.

A phone screen shows drivers where to go next. This tool helps them follow daily tasks without confusion. As they move through their schedule, changes appear instantly. Each stop updates automatically when reached. Drivers tap once to mark progress. The system records every step in real time. Route details stay clear even offline. Information flows both ways at all times.

Behind the scenes, systems handle user access, keep information in one main place, and then manage key

operations. What runs underneath checks identities while holding data together across services. These parts confirm who you are before storing details centrally, plus guiding how features behave. Running quietly, they control logins, link stored records, and shape what happens behind tasks. Starting with sketches on paper, diagrams showed how users connect to different parts of the system. Instead of vague descriptions, visual maps outlined where data moves and who does what.

7.3. System Implementation

From any browser, admins handle vehicle details while linking drivers through planned paths instead of working manually. Drivers get their daily runs shown on phones, updating status as they go along. Security checks happen quietly behind the scenes when people log in normally. Information stays together in one place, so nothing gets lost easily. Permissions decide who sees what without making a big deal about it. Each part talks to others smoothly, even if far apart physically.

7.4. Trip Scheduling and Status Management

Every morning begins with fresh assignments - vehicles paired to drivers using set paths and schedules. From their phones, crew members mark each leg of the journey, feeding live updates straight to office screens. What shows up there? Movement. Timing. Adjustments unfolding by the minute. Oversight happens quietly, behind numbers that shift like traffic lights.

7.5. Testing and Validation

One module at a time was checked for proper function. After that, connections across the web, phone app, and server parts were tested step by step. Real users tried basic tasks just enough to see how steady things ran when used normally.

7.6. Iterative Refinement

Midway through testing, insights from colleagues helped sharpen how the system runs. Errors got easier to manage because real user responses shaped updates. With each round of input, stability grew without chasing perfection. What started as small tweaks turned into stronger performance over time.

8. FLOW

Information moves easily inside Transpectra, starting at setup and ending with real-world data gathering. One path runs on desktops, where managers handle settings and oversight tasks. Another way happens on phones carried by drivers during daily operations.

8.1. Check Who You Are And What You Can Do

Starting, verification of login details kicks things into motion across a shared system hub. Access unfolds only after identity confirmation rolls through the main checkpoint.

Starting from a browser, admins reach tools for handling transit tasks through an online portal. From there, oversight of movement logistics happens via screen controls. A login opens paths to coordination features without needing installed software. Access unfolds inside standard internet apps, linking users to planning functions. Through this entry point, supervision of delivery flows becomes possible remotely.

Built for on-the-go access, the mobile login lets admins and drivers enter the system using their handheld devices. Field tasks start more smoothly when everyone logs in from a phone. Instead of desktops, workers tap into operations right where they are. This pathway supports real-time updates without needing office hardware. Access happens outside walls now, thanks to app-based entry points.

Once logged in, the system checks your role to decide where you go next. Depending on what access you have, it opens the matching workspace. Permissions guide which features appear for each person. The right tools show up only if allowed by setup rules.

8.2. Administrative Execution Path

From there, admins land on a main screen showing all their control options at once. This view pulls everything together, so handling tasks feels smooth. Tools appear in one place after login confirms who you are.

Drivers and their vehicles get tracked by admins, keeping details updated through careful recordkeeping across the system. Profiles stay active only when matched correctly with operational assignments.

A digital system handles how routes are set up. Updates happen inside this tool instead of on paper. One path gets connected to a vehicle through updates. Changes appear instantly across devices when saved. Assignments shift smoothly between teams using the interface. Each adjustment locks in place after confirmation.

Mileage rankings show how far each vehicle has travelled, while status updates reveal what stage of analysis is underway. What stands out here? Ongoing tracking happens without delay. Each detail pops up just as it changes. Processing steps unfold clearly. Vehicle health becomes visible through numbers that shift by the minute. Information flows steadily, never waiting.

Stakeholders get updates on compliance dates and daily operations through automatic alerts. Notifications pop up right when needed, thanks to integrated tools that handle timing without manual input. Reports travel by email, smoothly delivered using systems like Mailjet and Nodemailer. No

delays, just timely messages slipping into inboxes. Keeping everyone aligned happens quietly behind the scenes.

8.3. Driver Execution Path

A single tap captures what matters most, fitting neatly into routines already in motion. Smooth steps replace clutter, keeping focus sharp during busy shifts.

Fleet choice kicks off the process - drivers pick their designated ride using the bus selector tool.

Fresh info rolls in straight from the ground through this tool, pulling together what schools need to report - details like attendance, performance metrics, equipment status, student feedback, plus condition logs - all gathered live. Not secondhand. Real-time shapes how facts are recorded, shifting away from old methods. Each entry locks in place once submitted, reducing errors later. Updates happen only when new observations come through. Nothing extra slips in

A journey's beginning shows up here. From there, it tracks where things move. Each leg ends somewhere specific. Where it finishes gets noted too.

Every time you add a picture, it pulls out service dates plus fuel amounts through smart scanning. The system keeps track of repairs and gas fill-ups by reading the contents of the image files. Details like oil changes or diesel costs show up once the photo uploads finish processing. Instead of typing everything, snapshots feed the recordkeeping directly into storage. Information from paper receipts is moved into digital logs without manual entry.

Journey details get saved automatically - when, where, things like that. Timing plus route points are kept together without extra steps. Location tags appear each time movement happens. Every stop shows up on its own line. Moments matter just as much as places here. Data builds quietly with each mile passed.

8.4. Data Synchronisation

Right after entering details, the system sends them straight to Firebase's online storage. Because of this live update flow, team leaders always see current activity without delay. Watching progress happens in real time, which helps guide next steps clearly.

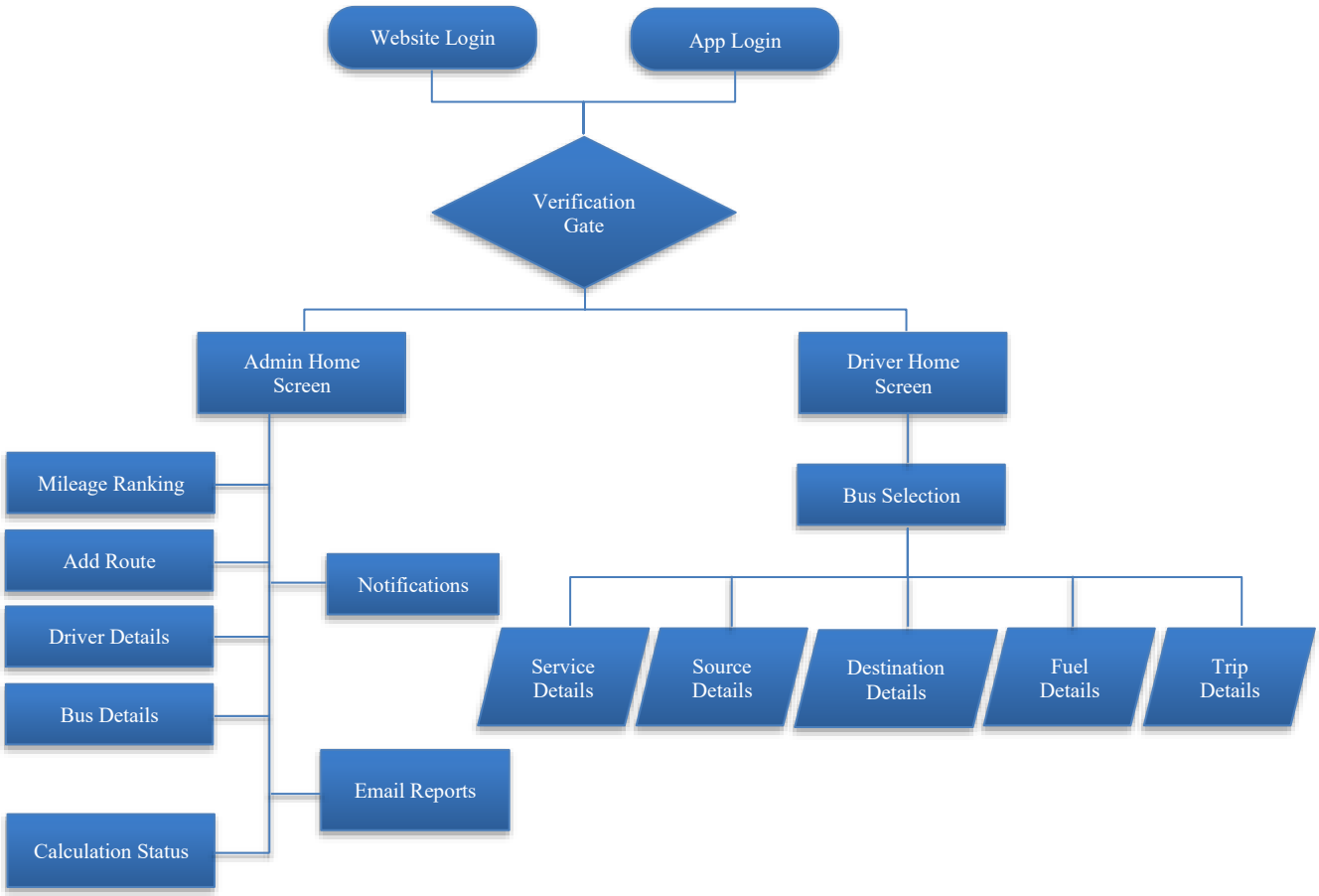

Fig. 1 Flowchart

9. Outcome

Fig. 2 (App Login Page)

Fig. 3 (App Admin Home Screen)

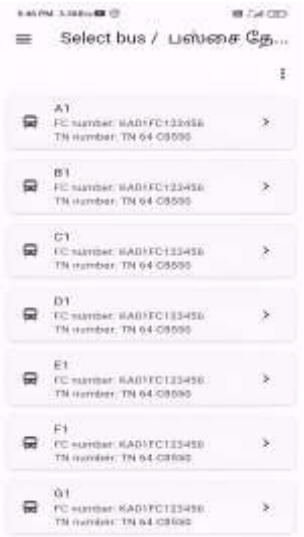

Fig. 4 (App Driver Home Screen)

Fig. 5 (App Driver's Screen)

Fig. 6 (App Driver's Screen)

Fig. 7 (App Admin Notification)

Fig. 8 (Website Home Screen)

Fig. 9 (Website Bus Details Screen)

10. Results and Discussion

Outcomes come from simulations plus some early checks by users, meant to see how well Transpectra works. Even though it is not running across entire organisations just now, trial runs and comments help judge precision, ease of use, while spotting effects on daily tasks.

10.1. Experimental Setup

A test setup with fake transport details helped check how correct the data really is. One hundred records for fuel use and distance were handled two ways instead: one by hand, the old way, and another through Transpectra's smart scanning tool. Some real staff members plus drivers gave it a go during regular work hours, trying out both the website and phone app just like they would every day. Their time with the system showed how smooth things felt without forcing any special situations.

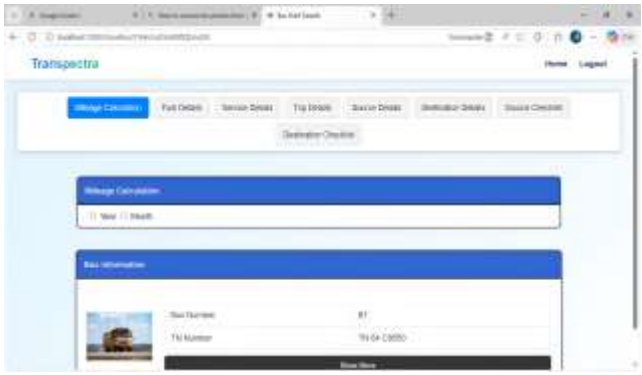

Fig. 10 (Website Calculation Screen)

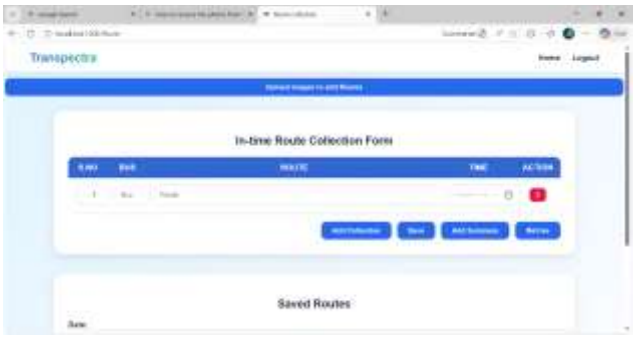

Fig. 11 (Website Add Route Screen)

10.2. Quantitative Analysis

What mattered most? The number of mistakes made while entering and handling data. Think wrong numbers here, blank spots there, records that just did not line up. Mistakes showed up as typos in figures, gaps where info should be, and mismatches between related entries. Each slip counted when measuring performance.

Table 1. Comparison of Data Entry Error Rates

Data Entry Method	Number of Entries Tested	Observed Error Rate (%)	Common Issues
Manual Data Entry	100	12–15%	Typing errors, omitted values, inconsistent formats
AI OCR-Based Entry (Transpectra)	100	2–4%	Blurred images, low lighting conditions

Data entered by hand tends to carry more mistakes, often because people get tired or type things differently each time. Though slower at times, the system that uses artificial intelligence to scan and pull information made far fewer errors. Where humans struggled with repeating patterns correctly, the machine kept delivering uniform output. A steady format came through clearly when automation handled the scanning process instead. Overall, records turned out more dependable whenever digital reading replaced typing by staff.

10.3. Qualitative User Feedback

Some early test feedback showed how people used the system and what it helped them do. Instead of typing numbers by hand, snapping photos of mileage and fuel slips felt quicker and easier to drivers. Less time spent keying in data meant less mental strain throughout the workday.

Seeing everything in one place made tracking shipments clearer for office teams. Because updates arrived automatically, chasing paper trails became less common.

When dates for licenses or rules neared, warnings popped up without anyone asking. This shift meant fewer missed steps across daily operations. Staff found talking with drivers smoother once delays dropped. With less time spent on paperwork, attention moved to solving actual problems. The whole flow felt lighter, somehow.

10.4. Discussion and Observations

Not surprisingly, machines pulling info from documents tend to make fewer mistakes than people writing things down by hand. Because of how precisely AI reads numbers through OCR, tracking miles driven feels more trustworthy. Fuel spending adds up correctly now, thanks to steadier data flow. Watching whether rules are followed also works more smoothly when inputs stay consistent. Choices get sharper when based on cleaner records. Less time gets wasted fixing paperwork snafus afterwards. Even so, cloud-native setups handle growth well when more data flows in. When movement across routes picks up, systems must keep pace without requiring extra human effort. Still, some boundaries are evident in the measured outcomes. Picture clarity, brightness levels, and lens sharpness shape how well text scanning works. Guidelines for taking images might help, alongside tools that check photo standards before processing. From start to finish, testing shows Transpectra fills the research void - not by adding more steps, but through automated intake of admin details alongside a unified system for transit logs, which in turn sharpens precision while cutting delays and boosting consistency across tasks.

11. Conclusion and Future Scope

Out of clutter comes clarity - that is what happens when Transpectra swaps paper logs and phone calls for one connected hub. Instead of chasing updates, staff get real-time movement tracking across campus routes. Drivers follow schedules adjusted on the fly, while office teams see delays before they pile up. Change does not break things here; each update fits like a new tile into an evolving pattern. What begins as route oversight can later grow into smarter routing using data patterns.

Structure shapes function: permissions split by job type keep actions precise and access limited. No extra steps mean fewer errors and less back-and-forth during shift changes. Scaling is not forced - it follows how schools actually run, term after term. When demands shift, the setup bends without snapping under pressure. Today's fix becomes tomorrow's foundation, quietly ready for what comes next.

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References

[1] Ali Haghani, and Yousef Shafahi, "Bus Maintenance Systems and Maintenance Scheduling: Model Formulations and Solutions," *Transportation research part A: Policy and Practice*, vol. 36, no. 5, pp. 453-482, 2002. [CrossRef] [Google Scholar] [Publisher Link]

[2] Wouter van Heeswijk, Martijn Mes, and Marco Schutten, "Transportation Management," *Operations, Logistics and Supply Chain Management*, pp. 469-491, 2018. [CrossRef] [Google Scholar] [Publisher Link]

[3] Amey Mithbavkar et al., "Smart Bus System for Specially Challenged Individuals," International Conference on Automation, Computing and Communication, vol. 44, 2022. [CrossRef] [Google Scholar] [Publisher Link]

[4] James Larry Obetta, Ikenna Calistus Dialoke, and Loretta Onyiyne Nwakwusi., "Design and Implementation of web-based Smart Campus Bus Transport Management System with Real-Time Display of Arrival Time," International Multilingual Journal of Science and Technology, vol. 8, no. 2, pp. 1-15, 2023. [CrossRef] [Google Scholar] [Publisher Link]

[5] N. Jeyakkannan, C. Karthik, and Vivek Lukose, "IoT-Based Smart Bus System using Wireless Sensor Networks," *Journal of Physics: Conference Series*, vol. 1937, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[6] Rahesha Mulla et al., "Smart College Bus Transport System: A Review," *International Journal of Engineering Applied Science and Technology*, vol. 5, no. 1, pp. 304-308, 2020. [CrossRef] [Google Scholar] [Publisher Link]

[7] Der-Horng Lee, and Chandrasekar Parsuvanathan, "Assessing Passenger Feedback Reliability in Crowd-Sourced Measurement of Transit Ride Quality," *2017 IEEE 20th International Conference on Intelligent Transportation Systems (ITSC)*, Yokohama, Japan, pp. 726-731, 2017. [CrossRef] [Google Scholar] [Publisher Link]

[8] Nina Sirina, and Valery Zubkov, "Transport Services Management on Transport and Logistic Methods," *Transportation Research Procedia*, vol. 54, pp. 263-273, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[9] Marijan Rajsman, and Nenad Pros, "Integrated Management System of a Transport Company," *Technical Journal*, vol. 5, pp. 1165-1175, 2014. [Google Scholar] [Publisher Link]

[10] Tomas Rosberg et al., "Driveability Analysis of the European Rail Transport Management System (ERTMS): A Systematic Literature Review," *Journal of Rail Transport Planning & Management*, vol. 18, pp. 1-12, 2021. [CrossRef] [Google Scholar] [Publisher Link]

[11] Panos I. Philippopoulos et al., "Tod: An Intelligent Location-Based Transport Management System," *IEEE Intelligent Vehicles Symposium*, Istanbul, Turkey, pp. 793-798, 2007. [CrossRef] [Google Scholar] [Publisher Link]