GPS TRACKING SYSTEM – TEAM BITDEXTROUS

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TABLE OF CONTENTS

1. Abstract:

This paper talks about implementing GPS technology to a university's transport system. It covers defining the problem that exists and how it can be solved using the proposed technology. Furthermore, various business and technical approaches are described with the changes that will affect the business process. We also touch on the additional technologies that could be used to augment this solution. Finally, we seek recommendations for this solution and decide on further course of action and a high-level implementation plan.

2. Brief company background:

Bit-dextrous provides an extensive collection of intelligent transport solutions for public transport, university, it parks and hospitals. Each product has excellent integration transport capabilities within the ecosystem, so administrators can effectively manage their systems from a unified location in real-time.

3. Discussion of business problem(s):

- **Shuttle system in place, but not known to many:**

The university operates a transit system for faculty, staff and students to get around campus. The system has been in place for the last 8 years but is known to only about 30% of the people. This has resulted in under-utilization of the transit resources and we believe a supporting it system will increase ridership to 80%.

- **No real-time tracking of arrival and departures of shuttles:**

The arrival and departure schedule of the transit system is currently only available on the shuttle stops and the university website. One can refer to this and plan to board the shuttle, but

since the real-time location of the shuttle isn't available, people are skeptical of its arrival. Thus, a supporting IT system which shows real-time location of the shuttle along with arrival and departure times in terms of the current time, will be very helpful.

● **No transit data available to make predictions**

Any process (simple or complex) that takes place, generates enormous amounts of data. In this case, data such as no. Of passengers, distance covered by shuttle, average travel time, etc. among many others is generated.

This data houses hidden insights that could be extremely valuable in predicting. Future patterns and being prepared for adverse conditions. Currently, there is no system in place to capture this data. Thus, a supporting it system will help collect transit data for analytics.

4. High level solution (business solution):

Global positioning system is a technique for working out precisely where something is. A GPS, for instance, might be set in a vehicle, on a phone, or on any important gadgets, which can either be a fixed or moving unit. GPS helps track the exact real-time movement of vehicles, person depending on where it is installed.

The advantages of GPS tracking will ease the communication between students and drivers and will help students to access bus schedules that are up-to-date.

Few important features that would add business value are listed below:

- **Financial stability:** if universities upgrade transport systems with GPS tracking, it will help them track drivers for over speeding which increase the safety of the students using transit system. Moreover, GPS tracking devices will be beneficial for businesses as they help with

route/fleet optimization.so, using GPS tracking would help save insurance cost, fuel cost and will help in optimization of route/fleet.

- **Improved service**: improved services to student would help develop business a more students would be using the transport system. GPS tracking can help in sending alerts, exact location of the bus and estimation time for the arrival of the bus at the stop, this would help students plan and make their life easy.

  By upgrading the university transport system with GPS tracking, students won't have to compromise pick up /drop off times anymore.

- **Advanced technology**: GPS can enhance the operational proficiency of your business by empowering you access to on time data about potential breakdowns, inevitable coordination issues, and decrease repair time and expenses.

  Once the transit system is upgraded with GPS, its users will straight away can make an exact expectation when and where the bus is located and how long will it take to arrive at the stop.

- **Streamlined communication:** enables drivers to track the transport system using mobile application for any conditions like mishaps and construction going around in the route, so that they can take the other route. Mobile application will also help to the students to know if the bus is running behind the schedule, so that they can plan accordingly. this type of updates will help the students which will increase consumer loyalty and will be efficient for the managers.

  - **Increase passengers:** with GPS, students can get the near real-time schedule with constant updates. With this type of improvement in the transit system, students are likely to depend on the transit system. That implies that students might prefer using transport system for their regular travel or even if they want to go to other place on campus.

- **Cost and time efficiency:** overseeing fuel costs, mileage, upkeep and diminishing idle time have both short and long-term benefits. Using GPS tracking can increase the annual savings tremendously. With GPS, it is likely for more students use the university transport system to ride. At the point when more students use the transport, fuel savings increase since fuel spend is less. These savings can result in enormous profit annually.
- **Optimize resources: GPS** tracking enables you to monitor all the vehicles and get all the details of fuel utilization, driver conduct and all the other required information to manage effectively. With the information acquired, the administrators can strategize accordingly to save money and increase profits.
- **Low maintenance –** These days, GPS tracking systems are furnished with cutting edge features, for example, vehicle diagnostics, fuel level indicator, engine temperature pointer. We can also monitor other important viewpoints, for example, engine oil and the general working of vehicle. Thus, we don't have to spend money on not so required mechanic inspections. As well, the GPS will help us know when the inspection is required for the vehicle to ensure the safety of both drivers and students using the transport system.
- **Ease of use** – the important details of the buses like vehicle status, driver's conduct, any delay can be gathered effortlessly with the assistance of a GPS tracking system. Students and supervisors will have the power to get to the information of the vehicle from anyplace on mobiles, tablets and pcs. GPS can send SMS or email alarms when your vehicle leaves your business zone. Moreover, GPS can send convenient warnings if there should be any occurrence of mishaps or accidents so that necessary teams can be involved at the location.
- **Improve safety** – Enhance the security of your field staff and passengers by checking progressively. If there should be an occurrence of untoward incidents, we can give

assistance and support to drivers. GPS can likewise enable you to execute two-route communication between drivers and managers as well as communicate all the real-time information effectively.

A GPS tracking can be viewed as a solitary arrangement that has been identified to contribute to increase organizations' benefits and additionally increase annual savings significantly. All the universities should be enhancing their transport system with GPS tracking system which will improve their business by increase in number of passengers, reduce costs, customer satisfaction and will improve their reputation for providing reliable service. They also help to get the complete information of the vehicles, drivers to keep the track. It also helps improve security and safety of both students and drivers which is the utmost important goal.

5. Benefits of solving the problem

- *Reduces operating expenses* by allowing you to choose the best and shortest routes which in turn will reduce the fuel consumption.
- Insurance companies now provide discounts on vehicles that are installed with GPS tracking systems, therefore this helps an organization eliminate *high insurance costs.*
- It gives the customers an opportunity to *track real time information* about the vehicles and other minute details.
- It allows the management to *track drivers* effectively. For example, if they see a driver over speeding they can take corrective actions immediately.
- The management can identify routes with the help of GPS tracking system that *saves both time and money* by reducing unproductive work and eliminating unnecessary fuel expenses.

- GPS tracking systems will be equipped with advanced features such as vehicle diagnostics, engine temperature indicators and fuel level indicators that will help the management monitor important aspects that contributes to the overall health of the vehicle. This saves the organization's money by avoiding the routine inspection/monthly service of vehicles.
- The management can get access to the data from anywhere on mobile, laptops and tablets; therefore, making the GPS tracking system even more hassle free.
- GPS tracking system can even notify the management by sending notification sin the form of emails or text message when the vehicle goes out of business zone or in case of accidents.
- Safety is improvised by delivering direct assistance and support to the drivers by executing two-way communication between the management and drivers.
- A GPS tracking system even reduces the amount of parking space required in an organization. If the employees/ students can track the shuttle/vehicle in real time, they do not need their vehicles to get around the campus.

6. Business / Technical approach:

Business approach:

One of the advantages of GPS tracking is the potential savings it would offer through improved fuel efficiency, reduced vehicle maintenance, less labor cost, and reasonable insurance cost. Although the initial investment is high, the breakeven point is reduced hence making it a profitable and attractive business to invest.

Easy-to-use technology: The GPS enabled device is user friendly and simple to browse. If you encounter a problem, there's a 24 * 7 technical support team ready to assist you

Technical approach:

A GPS tracking system utilizes the global navigation satellite system (gnss) network. This network includes a range of satellites that will utilize microwave signals that are transmitted to GPS devices to give information on the current location, vehicle speed and time. Therefore, a GPS tracking system can provide us with real-time as well as historic navigation data.

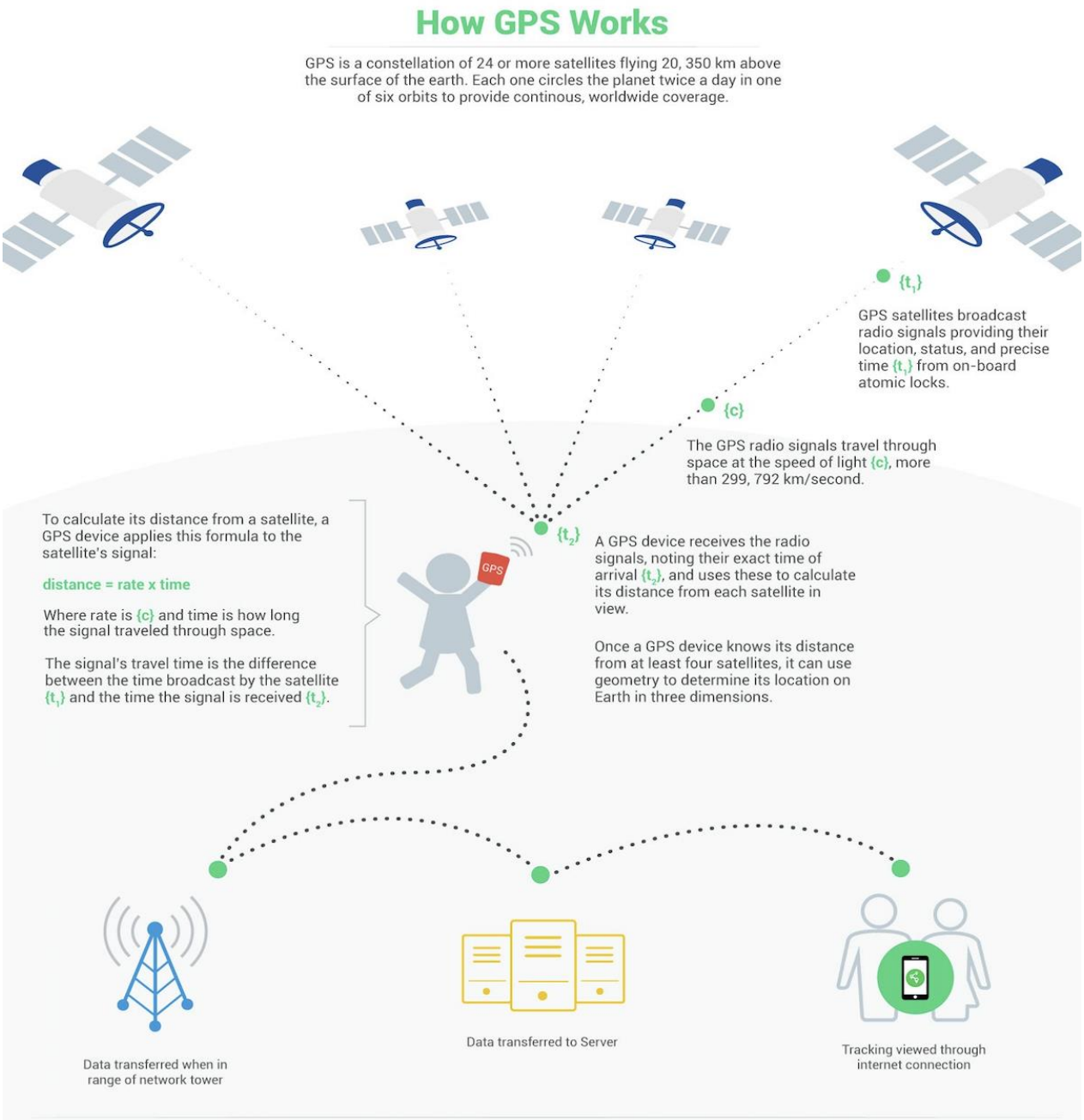
GPS imparts special satellite signals, which are processed by a receiver. These GPS receivers track the exact location and can also compute velocity and time. The positions can even be calculated in three-dimensional views with the help of four GPS satellite signals. The space segment of the global positioning system consists of 27 earth-orbiting GPS satellites. There are 24 operational and 3 extra (in case one fails) satellites that move around the earth each 12 hour and send radio signals from space that are received by the GPS receiver.

The control of the positioning system consists of different tracking stations that are located across the globe. These monitoring stations help in tracking signals from the GPS satellites that are continuously orbiting the earth. Space vehicles transmit microwave carrier signals. The users of global positioning systems have GPS receivers that convert these satellite signals so that one can estimate the actual position, velocity and time.

The GPS tracking system can be divided into two parts, active GPS tracking system and passive GPS tracking system. A passive GPS tracking system will keep an eye on the location and will accumulate its data on journey of the vehicle. The data accumulated here is usually stored in internal memory or on a memory card, which can be later downloaded to a computer/laptop for data for analysis. An active GPS tracking system is also known as a real-time system because this method sends the information automatically on the GPS system to a central tracking portal or system in real-time.it is particularly useful from a security

perspective as it allows the management to pinpoint the exact location of a vehicle at any given time.

A snapshot of how the idea can be implemented is given bellow:



7. Business process changes (changes after implementing the proposed technology):

The app will have different layers of user authentication:

- Customer/commuter
- Employee/driver
- Administrator

Students/commuter:

The commuters need to install the bitdextrous app. This app will be available for people using apple and android smartphones. The app will provide a live tracking facility to all the students/customers. They can find the nearest bus stop which will provide them route details with bus stops and landmarks on the route. The commuters can get a time estimation based on the route and the bus stop selected. The commuters also get an update if the bus has been delayed or cancelled. The app will be enabled to the user based on the student id(university) / user authentication (user registration i.e. Email id and mobile number). the user can download / connect the app using the university Wi-Fi or mobile internet service provider like at&t, tmobile, verizon etc.

Employee/driver:

Drivers will be provided with a tablet/iPad which will help them in getting rid of the paper-based sheets and, they don't need to provide updates using a walkie talkie. Every driver can see the buses zipping through the university and can even get an update if the bus has broken down. The user interface for the drivers will be different which will provide them the facility to check the shift start/end time. The driver can provide any notes for the next driver or the administrator using the messaging facility available in the app. In case of emergency the drivers have the right to use the calling facility available on the tablet.

Administrator:

The administrator will keep track of the buses and assist the drivers in case of any accident or delay on the route. The administrator will also be maintaining the system so that it is up to date functional. It will also act as a super user to control the system and the app. It will have the facility to broadcast messages to all the drivers.

8. Technology or business practices used to augment the solution (supporting services/technology):

Technology

Implementing a commercial fleet tracking software will improve efficiency and safety. It is an off the shelf technology that can augment our solution. Integrating the software into our administration area of our solution will help us track the vehicles. The drivers will be aware that their driving is being monitored as a result it will encourage safety. Collecting data on the routes can help maximize efficiency. We can determine peak times and add additional resources to accommodate the additional surge in customers. Routes can also be optimized base on models and algorithms once the data is mined.

Communications with the customer through social media is another technology we can leverage for our platform. It will keep the customer updated with any potential problems such as delays. Also, it will create good marketing to promote the solution. Social media can provide direct access to customer's feedback. If there are issues we can reach out and try and resolve the issues before it escalates.

Autonomous vehicle technology is in early stages of development. Once the technology matures we can use it to enhance our solution. There will be inherent risks and other issues

will be arising from this technology but overall it will be a benefit. The human factor will not be present, so it will greatly improve safety because drivers will not get distracted. The system will have an optimum up time because driver availability will not be a factor.

Image courtesy: web references at the end

Process

Having an ERP system in place allows us to automate and organize the processes we need to run our solution. Improving processes will always be an ongoing task. In our case, we are using technology to try and improve processes currently in place. The ERP software can be adapted to meet our needs.

An accounting system will handle all the financial needs. External vendors will need a process to bill and receive money for their services or products. Payroll is also a part of the financial system. The financial system will be transparent and easily auditable.

An operations system will handle the everyday tasks. Everything required to run the business' day to day operations is the responsibility of this process and its systems. It will contain a management process that handles employee scheduling. Also manages the fleet of buses and the maintenance for them as well as the facilities.

A route system will handle the routes for the fleet of buses. Its primary responsibility is route optimization. Optimizing routes will make the service more efficient. Efficiency will in turn save the company money over time.

9. Conclusions and overall recommendations (future recommendations, enhancements):

As a society, we are transcending into a much more technology-oriented global community. Almost everyone today carries a smartphone, a tablet and/or a computer that has an internet service, giving them the required tools to access a variety of data, including real-time information being transmitted from a university bus.

When an educational institute provides a facility to install a GPS vehicle tracking system on a college shuttle, they have an option to share the real-time location of the data with anyone. Hence a GPS based solution is both a rider friendly and an economically viable for a hassle-free transport around an educational institute.

Future recommendations:

- Since the tracking system runs on a mobile device further developments on the performance of the app can be gauged by monthly surveys, just to get an idea of what the users are expecting from the app.

- Every campus has several events happening on timely basis. Syncing the app with the current events on campus will help students attend them.
- Having detailed and timely administrative ports analyzing the route travel times and riders can further help build a better route plan for the shuttles
- Push notifications can be sent to the rider's phone providing them an estimated time of arrival. However, riders can set up the notifications in advance on how far before the eta do they want to be notified.
- The technology on the driver's end can have a head count of number of riders awaiting at each stop on the way. This allows the administrators to alter and create cost and fuel-efficient routes, based on the requirements.

10. High-level implementation plan:

- **Getting approvals:** Since we will be implementing it support systems, we would require state approvals for data collection. This data will be available for further review to the state and will be sole property of the university and bit-dextrous.

  Also, an agreement between bit-dextrous and the university for accessing the university's network and shuttle stop locations. This will include any and every change which takes place outside of the system. For instance, unscheduled vehicle maintenance, route change due to construction work, etc. However, passenger safety will always remain with the university.
- **Training plans:**

  After implementing it systems, the drivers will have to be trained to use it. Moreover, this system will also aid in managing the entire transit system w.r.t. Routes, driver shifts, start-end times, etc. Which will require a training session for the admin people and non-driver staff.

We will also be holding training sessions for situations where the it system might fail and what drivers, admin need to do to continue operating the transit system without a supporting it system.

Some ideas on how the project could tie together:

Once the decision has been made by an organization to use GPS tracking system, a game plan should be put in place for the deployment. To make sure the system is successful, the management should meet with everybody involved in the project to clearly identify and define the expectations from the GPS system. Discussing about what the system would do, what the involved people need to do, and the basic understanding of the functionality increases the efficiency of the system. Below are few steps that would help this system to be successful in any organization:

- **Select a GPS tracking point person**

  The organization needs to make sure that there is one person managing the GPS tracking system and knows the software in and out to utilize the data in the best possible way.

- **Introduce GPS tracking to employees**

  It is highly recommended that the organization hold information sessions for employees before the GPS tracking system is implemented so that the employees take full advantage of the system. Explain why the organization will be using this system and how will it benefit them. Be clear and transparent about the features and explain the system in way that employees are encouraged to use it.

11. Summary of project:

This proposed project intends to resolve the problem with long waiting times students are facing for buses at the university. In this project, we have done an elaborate and extensive research on the advantages of the using GPS tracking system in the university transport system. For students time is money, so implementing GPS tracking systems bus services would like to save more of.

By implementing a GPS system for fleet tracking of university transport system, bus services can improve dispatch and route times, improve customer service, and increase fleet security for both drivers and passengers. Few of the many reasons explained above are the major advantages of implementing and using a GPS vehicle tracking device for fleet management.in general, customers do prefer fast service and quick delivery. With GPS vehicle tracking, businesses can stay ahead of incoming customer demands.

We have discussed the in depth technical approach of how GPS tracking can be installed in the university transport system. We can also build the mobile application to track the exact real-time location of the buses which will help students to plan things ahead of time. This paper also talks about the how GPS tracking can improve the business value of the businesses.

GPS tracking helps the university to manage services that are related to shuttles and passengers efficiently and effectively. It also comes with great customer support and customer satisfaction.

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