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INTRODUCTION

REVIEW OF LITERATURE

NEED/IMPORTANCE OF THE STUDY

STATEMENT OF THE PROBLEM

OBJECTIVES

HYPOTHESES

RESEARCH METHODOLOGY

RESULTS & DISCUSSION

FINDINGS

RECOMMENDATIONS/SUGGESTIONS

CONCLUSIONS

SCOPE FOR FURTHER RESEARCH

ACKNOWLEDGMENTS

REFERENCES

APPENDIX/ANNEXURE

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- The location of endnotes within the text should be indicated by superscript numbers.

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BOOKS

- Bowersox, Donald J., Closs, David J., (1996), "Logistical Management." Tata McGraw, Hill, New Delhi.
- Hunker, H.L. and A.J. Wright (1963), "Factors of Industrial Location in Ohio" Ohio State University, Nigeria.

CONTRIBUTIONS TO BOOKS

- Sharma T., Kwatra, G. (2008) Effectiveness of Social Advertising: A Study of Selected Campaigns, Corporate Social Responsibility, Edited by David Crowther & Nicholas Capaldi, Ashgate Research Companion to Corporate Social Responsibility, Chapter 15, pp 287-303.

JOURNAL AND OTHER ARTICLES

- Schemenner, R.W., Huber, J.C. and Cook, R.L. (1987), "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, Vol. 21, No. 1, pp. 83-104.

CONFERENCE PAPERS

- Garg, Sambhav (2011): "Business Ethics" Paper presented at the Annual International Conference for the All India Management Association, New Delhi, India, 19–22 June.

UNPUBLISHED DISSERTATIONS AND THESES

- Kumar S. (2011): "Customer Value: A Comparative Study of Rural and Urban Customers," Thesis, Kurukshetra University, Kurukshetra.

ONLINE RESOURCES

- Always indicate the date that the source was accessed, as online resources are frequently updated or removed.

WEBSITES

- Garg, Bhavet (2011): Towards a New Natural Gas Policy, Political Weekly, Viewed on January 01, 2012 http://epw.in/user/viewabstract.jsp

DESIGN AND IMPLEMENTATION OF A REAL-TIME VEHICLE TRACKING SYSTEM

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ABSTRACT

Security in general is a major concern in our society today and over time, the security of vehicles has become a priority. Various inventions and technologies have been brought about to put minds at rest, but the complete eradication of theft of cars is much of a tedious task. A solution to knowing the location of vehicles either when they are stolen or for any other reasons. To know this location, it involves the installation of a vehicle tracker in a hidden position in the vehicle so that it is not easily seen while providing essential clues as to the location of the vehicle and also a remote tracking server that receives the location information of the car in longitude and latitude and converts it to a physical address and sends it to the authorized user.

KEYWORDS
Tracker, vehicle, longitude, latitude.

INTRODUCTION

Security in general is a major concern in our society today. Every day, people purchase vehicles for different purposes, but for which ever reason, a lot of money is spent in the transaction which demands that adequate provision should be provided for its security and safety (Bajaja et al. 2012). Auto theft is a serious crime which is getting rampant day after day. It is then necessary for car users everywhere to have a way to track down their cars in case it is ever stolen. Real Time Vehicle Tracking System is one of the measures of securing vehicles. The word tracking means to find or follow something, therefore, Real time vehicle tracking is a method used to track and monitor any remote vehicle equipped with a hardware unit that receives and transfers signals through global positioning system (GPS) satellite. It makes use of GPS to provide actual geographic real time position of each vehicle.

A vehicle tracker is therefore a major and essential device that should be in every vehicle because it gives the owner the ability to know the exact location of such cars at any point in time anywhere in the world with geography information systems (GIS) (Ambade et al. 2011).

It is very useful for both individuals and companies. It can help a company in the sense that the company workers cannot take the company car(s) to unassigned locations. It can also help an individual who is probably on a business trip to know whether his car is still where he left it or not.

Today, the vehicle tracking system is playing a major role in most sectors as vehicles have become a major means of transportation.

PROBLEM STATEMENT

An increase in car theft in the society which in most cases searching for such cars may not have positive effect is becoming a major concern. Systems like the security lock and alarm system has been implemented in cars to prevent theft, but if a burglar can break open the lock, it therefore becomes easy for the burglar to steal the car. This brought the need for the introduction of this real time tracking system.

OBJECTIVES OF THE STUDY

The main objectives of this system are:

Developing Automatic Vehicle Location system using GPS for positioning information and global systems of telecommunication (GSM) for information transmission.

LITERATURE REVIEW

Over time, the security of vehicles has become a priority. Various inventions and technologies have been brought about to put minds at rest, but the complete eradication of theft of cars is much of a tedious task. Technologies like the car alarm system have been put in place but it is limited to an audible distance and it doesn't give the location of the car if it is successfully stolen. A solution to knowing the location of vehicles when they are stolen is the Real Time Vehicle Tracking System that involves the installation of a vehicle tracker in a hidden position in the vehicle so that it is not easily located while providing essential clues as to the location of the vehicle.

GPS

The **Global Positioning System** (**GPS**) is the only fully-functional satellite navigation system. More than two dozen GPS satellites orbit the Earth, transmitting radio signals which allow GPS receivers to determine their location, speed and direction. GPS has become indispensable for navigation around the world and an important tool for map-making and synchronization of telecommunications networks. (Khindker, 2009)

It provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.

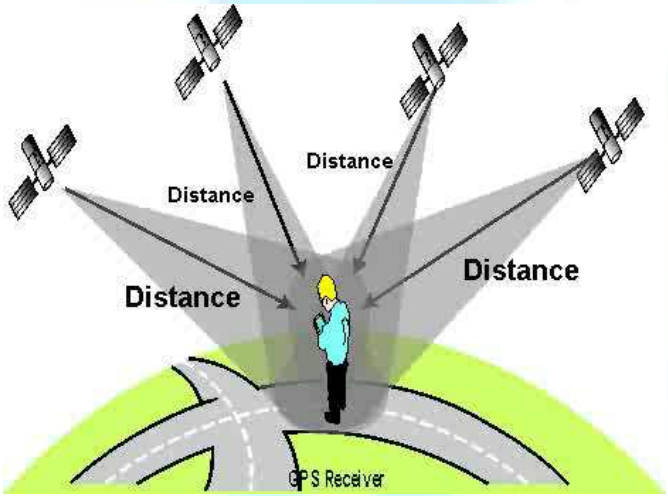
Global Positioning System satellites transmit signals to equipment on the ground. GPS receivers passively receive satellite signals; they do not transmit. GPS receivers require an unobstructed view of the sky, so they are used only in outdoors and they often do not perform well within forested areas or near tall buildings. GPS operations depend on a very accurate time reference, which is provided by atomic clocks at the U.S. Naval Observatory. Each GPS satellite has atomic clocks on board (Introduction to GSM, 2013).

Each GPS satellite transmits data that indicates its location and the current time. All GPS satellites synchronize operations so that these repeating signals are transmitted at the same instant. The signals, moving at the speed of light arrive at a GPS receiver at slightly different times because some satellites are farther away than others. The distance to the GPS satellites can be determined by estimating the amount of time it takes for their signals to reach the receiver.

HOW GPS DETERMINES POSITION

A GPS receiver knows the location of the satellites because that information is included in satellite transmissions. By estimating how far away a satellite is, the receiver also knows that it is located somewhere on the surface of an imaginary sphere centred at the satellite. It then determines the sizes of several spheres, one for each satellite. The receiver is located where these spheres intersect; this can be seen as depicted in fig. 1.

FIGURE 1. - HOW GPS RECEIVER DETERMINES ITS LOCATION



Source: (Introduction to GSM, 2013)

HOW ACCURATE IS THE GPS?

The accuracy of a position determined with GPS depends on the type of receiver. Most hand-held GPS units have about 10-20 meter accuracy. Other types of receivers use a method called Differential GPS (DGPS) to obtain much higher accuracy. DGPS requires an additional receiver fixed at a known location nearby. Observations made by the stationary receiver are used to correct positions recorded by the roaming units, producing an accuracy greater than 1 meter (Khondker, 2009).

TYPES OF VEHICLE TRACKING SYSTEM

Research according to Parade et al. (2011) indicates that Vehicle tracking system can be typically classified into passive tracking and active systems. Each of these utilizes the GPS technology and the satellite to get the vehicle's location but the mode by which the user gets the location information is what differs. For the purpose of this article, the active system will be used.

PASSIVE SYSTEMS

Passive tracking systems store information such as GPS location, vehicle speed, and can trigger events such as start/stop or ignition on/off. It is usually used by people who need to track mileage or monitor location stops. When a vehicle returns to a predetermined location, the tracking device's information is wirelessly sent to a host computer or it is removed from its location and plugged into a computer to view the information.

ACTIVE SYSTEMS

Active tracking systems generally collect the same information, but are more sophisticated than passive systems because they are enabled to work with cellular or satellite networks. Using these wireless networks, they are able to transmit data to a computer or data centre for further evaluation. They can also allow you to locate a vehicle live on a map and to do this you might be required to install a software onto your computer or create an account with a tracking company, when this is done you will be able to monitor a vehicle's direction and speed in real time.

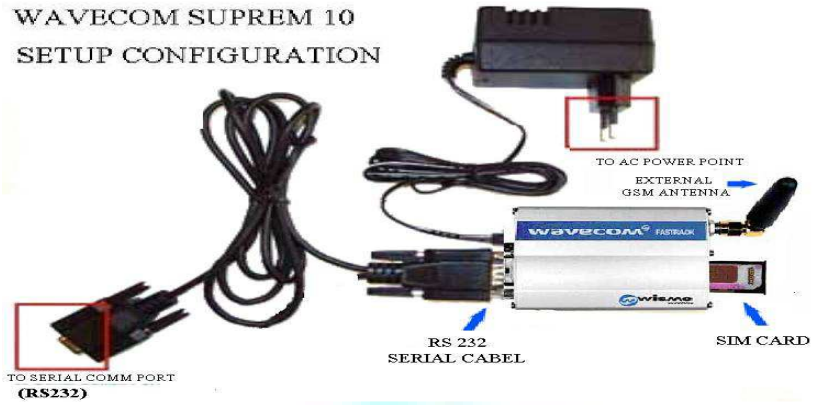
The advantage of using this type of system is that it allows you to redirect vehicles and warn drivers about their speed as they progress along their journey. Additionally, these systems are commonly web-based so tracking data can be accessed from any capable device with an internet connection.

GSM/GPRS MODEM

A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives data through a fixed telephone line while a wireless modem sends and receives data through radio waves (How passive and active works, 2013).

Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate as seen in fig 2.

FIGURE 2: A GSM/GPRS MODEM



Source: (How active and passive works, 2013)

DESIGN AND IMPLEMENTATION OF VEHICLE TRACKING SYSTEM

This article was aimed at developing an Automatic Vehicle Location system using GPS for positioning information and GSM/GPRS for information transmission with the following features:

- Acquisition of vehicle's location information (latitude longitude) after specified time interval.
- Transmission of vehicle's location and other information (including ignition status, door open/close status) to the monitoring station/Tracking server after specified interval of time.
- A Web based software to display all transmitted information to end user along with displaying location of vehicle on a map.

The objective of the paper was to build an additional feature to the present security system that will warn the owner of the vehicle by sending SMS when there has been an intrusion into the vehicle.

The system was designed to have two major units

- In-Vehicle unit
- Tracking Server/Monitoring Station.

The In-Vehicle unit is the major part of the system and it is installed into the vehicle. It is responsible for capturing the current location of vehicle, proximity sensors for parking assistance, vibration Sensors and ultrasonic Sensors for measuring the distance. It is also responsible for transmitting this information to the Tracking Server located anywhere in the world.

COST EFFECTIVE GPS – GPRS BASED OBJECT TRACKING SYSTEM

This article proposes and implements a low cost object tracking system using GPS and GPRS. The objective of this research is to reduce the cost of the tracking system using the latest technologies and also making it available to the common people.

The system allows a user to view the present and the past positions recorded of a target object on Google Map through the internet. The system reads the current position of the object using GPS, the data is sent via GPRS service from the GSM network towards a web server using the POST method of the HTTP protocol. The object's position data is then stored in the database for live and past tracking (Ambade et al. 2011).

The system has two parts:

- The tracking device and
- The database server.

The device is attached with the moving object and it gets the position from GPS satellite in real-time.

DATA TRANSMISSION METHOD

The tracking device communicates with the server and the data is sent via GPRS service from the GSM network. The reason for this choice is because using GPRS is cheaper than using SMS.

It then sends the position information with the International Mobile Equipment Identity (IMEI) number as its own identity to the server. The data is checked for validity and the valid data is saved into the database. When a user wants to track the device, he logs into the service provider's website and gets the live position of the device on Google Map. A custom report is also generated which includes a detailed description of the vehicles status. Users can also see the previous positions of the device as seen in the fig. 3.

FIGURE 3: A DIAGRAMMATIC REPRESENTATION OF HOW THE SYSTEM WORKS

Source: (Jennifer, 2013)

REAL TIME VEHICLE LOCKING AND TRACKING SYSTEM USING GSM AND GPS TECHNOLOGY-AN ANTI-THEFT SYSTEM

This project deals with the design & development of a theft control system for an automobile, which is being used to prevent/control the theft of a vehicle. The developed system makes use of an embedded system based on Global System for Mobile communication (GSM) technology. The designed & developed system is installed in the vehicle. An interfacing mobile is also connected to the microcontroller, which is in turn, connected to the brain box of the vehicle (Parade et al. 2011).

An AVR Microcontroller is interfaced to a GSM module, GPS Receiver and also to the vehicle locking system. The Microcontroller will keep listening for new SMS arrival. If a SMS arrives, it will check for authentication and after authentication is verified, it will read the GPS location and will send it to the user's cell phone in the form of SMS, also same information will be sent to a host pc. The PC will have a Visual Basic (VB) based application running on it. This will extract the SMS information from GSM modem or cell phone, and it will plot the latitudes and longitudes on the Google maps. For plotting on the Google maps pc must have an Internet connection. The vehicle can also be locked/ unlocked by sending a message to the system.

MICROCONTROLLER

The microcontroller is the central controller for the whole unit. In this article, the Arduino AT328 microcontroller is used for interfacing to the various hardware peripherals. The microcontroller will continuously monitor a moving vehicle and report the location status on demand. The AT328 is interfaced serially to a GSM Modem and GPS Receiver [6]. The microcontroller can be seen in fig 4.

Features of ArduinoATmega328 Microcontroller

- High Performance, Low Power AVR 8-bit Microcontroller
- Advanced RISC Architecture
- 131 Powerful Instructions – Most Single Clock Cycle Execution
- 32 X 8 General Purpose Working Registers
- Fully Static Operation
- Up to 20 MIPS Throughput at 20 MHz
- On-chip 2-cycle Multiplier
- High Endurance Non-volatile Memory Segments
- Write/Erase Cycles: 10,000 Flash/100,000 EEPROM
- Data retention: 20 years at 85°C/100 years at 25°C
- Optional Boot Code Section with Independent Lock Bits

FIGURE 4: BLOCK DIAGRAM OF MICROCONTROLLER.

Source: (History of vehicle tracking, 2013)

TABLE 1: SUMMARY OF THE FEATURES OF ARDUINO BOARD

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 Ma
DC Current for 3.3V Pin	50 Ma
Flash Memory	32 KB (ATmega328) of which 0.5 KB used by bootloader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz

OPERATIONAL PROCEDURES

The Arduino Uno has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over universal serial bus (USB) and appears as a virtual com port to software on the computer. The '16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, an inf file is required. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from

the Arduino board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-serial chip and USB connection to the computer (but not for serial communication on pins 0 and 1).

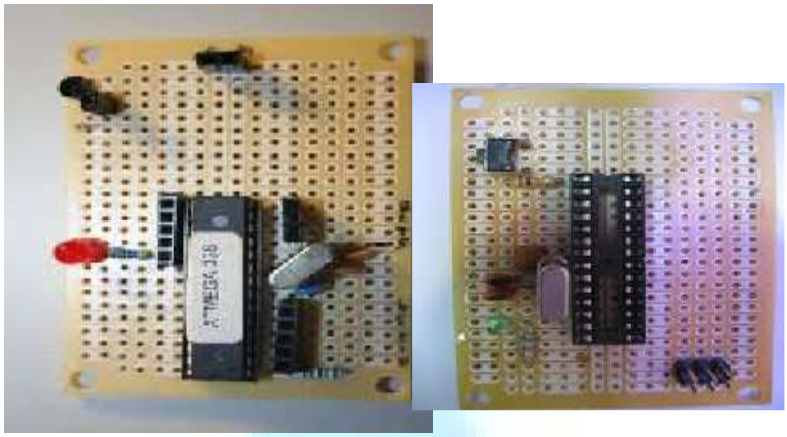
The Software Serial library allows for serial communication on any of the Uno's digital pins.

The ATmega328 also supports I2C (TWI) and SPI communication. The Arduino software includes a Wire library to simplify use of the I2C bus.

16MHZ CRYSTAL RESONATOR

The crystal resonator is connected to Pins 9 and 10 of the Microcontroller. It is responsible for clocking the microcontroller at 16Mhz. The resonator is seen in fig. 5.

FIG 5– 16MHZ CRYSTAL RESONATOR INTERFACED TO A MICROCONTROLLER BOARD



Source: (History of vehicle tracking, 2013)

POWER SUPPLY

The power source of the tracker will be a 9v battery or 12v from the vehicle battery which will be eventually regulated to 5v which is the voltage rate of the circuit.

TRACKING SERVER TOOLS

AT COMMANDS

AT commands are instructions used to control a GSM modem. In this project, AT commands are used to control the GSM modem connected to PC serving as the tracking server and also the GSM/GPRS module in the tracker. Attention (AT) and every command line starts with AT or at that is why modem commands are called AT commands. The starting AT is the prefix that informs the modem about the start of a command /line. It is not part of the AT command name. For example, D is the actual AT command name in ATD, and +CMGS is the actual AT command name in AT+CMGS.

REVERSE GEOCODING

Geocoding refers to translating a human-readable address into a location on a map. The process of doing the converse, translating a location on the map into a human-readable address, is known as reverse geocoding.

For example, the following query contains the latitude/longitude value for a location in Abuja:

http://maps.googleapis.com/maps/api/geocode/json?latlng= 09.045020, 007.405295&sensor=true

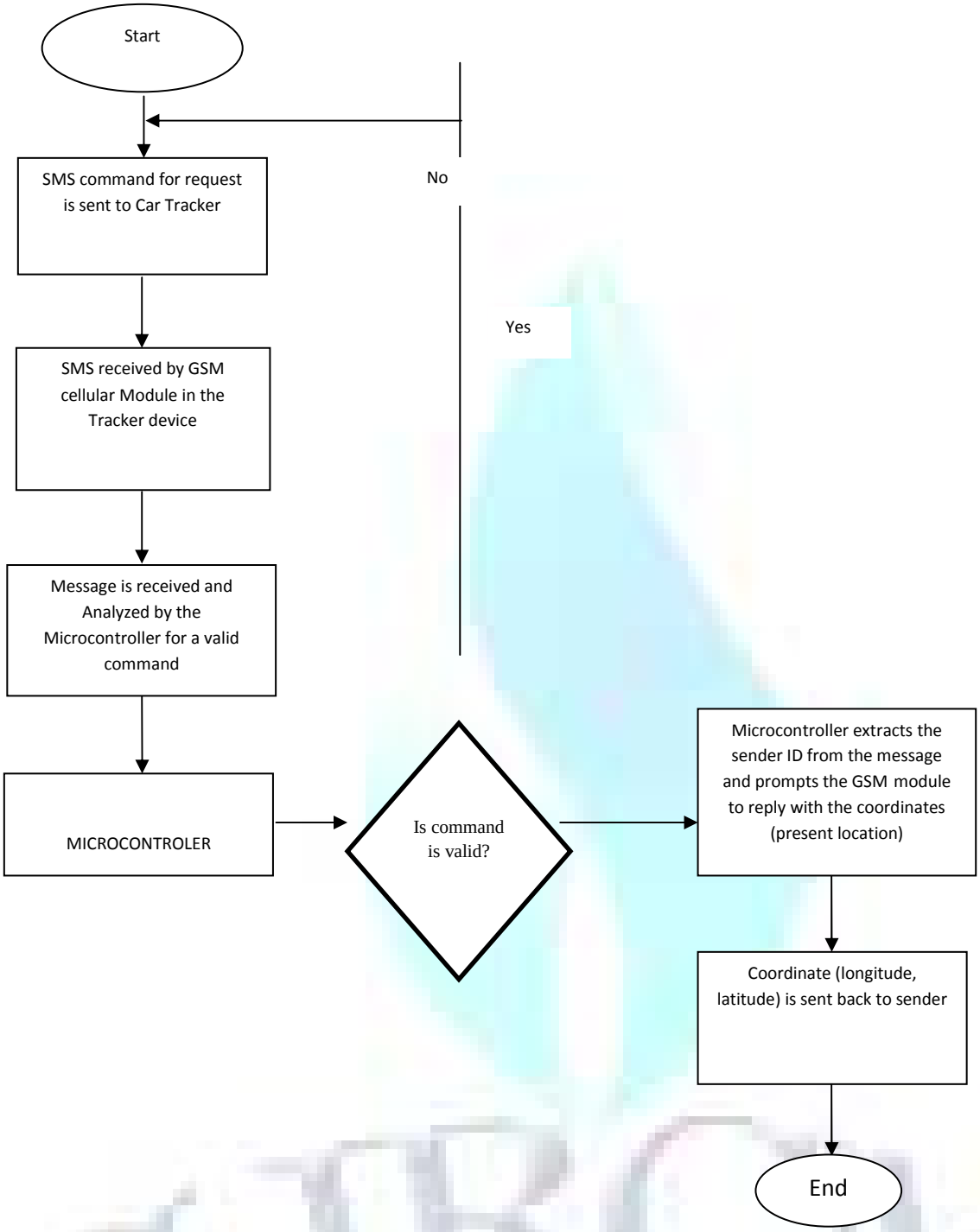
Results of the possible addresses:

- Nnamdi Azikiwe Expy, Abuja, Nigeria
- Citec Estate, Abuja, Nigeria
- Abuja Capital Territory, Nigeria
- Nigeria

The resulting addresses are not just postal addresses, but any way to geographically name a location. For example, when geocoding a point in a city, the geocoded point may be denoted as a street address, as the city, as its state or as a country. The reverse geocoder returns any of these types as valid results. The reverse geocoder matches political entities (countries, provinces, cities and neighbourhoods), street addresses, and postal codes.

Generally, addresses are returned from most specific street address to least specific address. The more exact address is the most prominent result. Reverse geocoding is usually an estimate. The geocoder attempts to find the closest addressable location within a certain tolerance; if no match is found, the geocoder returns zero results.

FLOW CHART OF THE REAL-TIME VEHICLE TRACKING SYSTEM

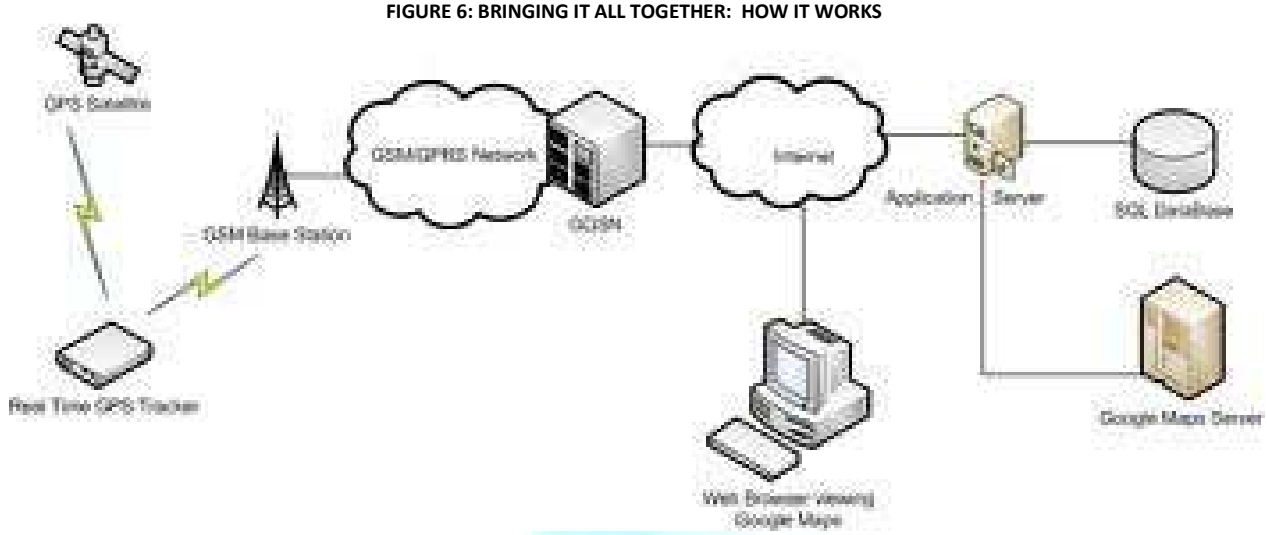


Source: Research article, 2013

OPERATIONAL METHODS

An SMS command is sent to the tracker; the microcontroller receives this message from the serial line via the Tx pin of the Cellular Module. Meanwhile, at all times, the GPS module is continuously picking up locations (longitude and latitude) from the satellites. The microcontroller parses the stream of NMEA data returning from the GPS module and extract out the Longitude and Latitude and send an SMS to the sender's phone number as seen in fig. 6.

FIGURE 6: BRINGING IT ALL TOGETHER: HOW IT WORKS



Source: (Introduction to GSM/GPRS Wireless modem, 2013)

SUMMARY AND CONCLUSION

The main objective of the article is to know the precise location of the vehicle at a particular time with the help of the main parts of the tracking device, which includes the in-vehicle unit, and a PC based application. This objective was achieved by the successful review and analysis of different related works and by meticulously scrutinizing different method of design of a car tracking device together with its properties.

The paper is written in such a way that it allows us to understand the different components used in making a car tracking device and also the principles behind them such as longitude, latitude, GPS, GSM communication amongst others.

In conclusion, we can gather that it is very necessary to give our car adequate protection because it is quite valuable and for this to be guaranteed, we encourage owners/users to invest on real time car tracking system.

RECOMMENDATION

This research has not reach it peak point, better technology could still be applied by writing codes that is capable of either switching off the ignition or activate an alarm system.

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