# GPS AND GSM BASED ID CARD TRACKING SYSTEM

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**ABSTRACT**— *In Recent years, world struggle a lot to provide security to school students (kids, female). In order to decrease the child abuse, child missing, harassments which are happening in our recent days, so we introduce a tracking device system using student ID card. By using GSM and GPS module, the parents and school management can monitor their kids anywhere from the world using this concept. The RFID module is used to take the student attendance and also their details while they are entering and leaving from the school, immediately the message will sent to their parents and school management. In this device, we include the panic button to alert their parents. While pressing the panic button, the alert message sent to the registered mobile number. We introducing the app for live tracking. Many tracking systems are based on the Global Positioning System (GPS), Global System for Mobile communications (GSM) and smart phones, due to their wide availability and reliability. A GPS-GSM tracking system that uses the proposed scheme is implemented and tested together with two classical tracking systems under two practical test cases.*

**Keywords**—tracking systems, GPS; GSM, Economic tracking, mobile tracking application, tracking algorithm.

## I. INTRODUCTION

The tracking systems have been widely used to monitor the movement of objects moving over different environments. They are used to monitor and track cars, buses, postal parcels, people, children, animals, birds, ambulance vehicles, trucks …etc. When these moving objects are monitored and tracked, they can be better managed and secured. The widely available Global Positioning System (GPS) and Global System for Mobile communications (GSM) services have become a useful and attractive communications media for a large class of tracking systems. The majority of smart phones are equipped with GPS modules, and they can be easily loaded by mobile tracking application programs. In many cases of tracking systems, the use of smart phones as the position detection sensors is more feasible than other commercially available devices. This is due to the ease of customization and modification in mobile applications as compared with dedicated hardware commercial tracking devices. A typical classical GPS-GSM based tracking system has a central server equipped with a GSM transceiver to communicate with the moving units. The moving units are usually smart phones loaded by a tracking application program. The main task of the server is to monitor and archive the positions of the moving units. The server sends a position request SMS to the intended smart phones which respond either once or periodically by sending their GPS information via SMS messages to the server. These tracking systems are developed in the literature for applications such as moving vehicle tracking, vehicle status monitoring, car antitheft and remote vehicle engine locking, children movement monitoring and tracking , and vehicle unauthorized movement detection and maximum speed alerts. In this paper, an economic tracking scheme for GPS-GSM based tracking system of objects moving over an open area environment is proposed. The proposed scheme reduces the required number of SMS messages, and hence their total cost, for a given tracking accuracy level.

**Organization**

The rest of this paper is arranged as follows. The Related works is described in Section II. The System analysis is Section III. The details of System implementation in Section III. Section IV is Architecture. Section V is Practical testing of the implemented system. Finally, conclusions are given in Section V.

## II. RELATED WORK

A system is deployed using GPS, Web Application, Google Map and tracking device. It uses location tracking mechanism and it is updated for every 1 second to the cloud. Web application is used to monitor the exact location of the bus along with bus route and bus arrival time. Google Map will help in visualizing the location of the bus. The system was developed using GPS, GSM, RFID. The proposed approach called Bus Tracking System is evaluated using java simulation tool by considering both simulation and real time analysis. This project mainly focuses on accuracy of location and calculation of time, coordinates and simple user interface which saves time and increase the efficiency of work. The project can be done only if the bus is registered. It uses GPS, GSM and Google map. GPS along with a SIM is used for tracking the bus. The location updation from GPS is send to the Web app through the central server. The web app has a timer which will be updated and refreshed for every 40s. A system using GPS, Google Map, SMS services, web server and Database server. By this application, the students can get live location updation when internet connection either available or not available. The time could not be predicted which is the main drawback in this project. This consumes low power than GPS. In this project an RF transmitter is equipped inside the bus which transmits set of earlier decided data continuously. An RF receiver is placed at appropriate number of bus stops. When the bus is in range the information like bus identity will be sent from the RF transmitter to RF receiver. Neutral network is used for time estimation of buses. Android Application is developed which gives exact location of the bus along with bus details, driver details, contact number, routes, stops etc,. It also provides time estimation for bus arrival. An RFID system consists of tag which will send the location information to server through the reader by using radio frequency which is then processed as per the requirement of the user.

## III. SYSTEM ANALYSIS

**Existing System**

Public Transportation is the major means of transport among the people. Growing density of population increases the vehicle density leading to heavy traffic and greater percentage of pollution. Optimal solution to this problem is preferring common modes of transport. Since common people are the greater ratio in making use of public transport, the necessity to provide them with ease of access stands at higher priority. This project mainly focuses on bus transport system. A recent survey by National Sample Survey Organization says that about 62-66% of people uses bus as their mode of transport. Public transport tracking system aims at providing the instant status of the bus to the users via an automated system. This project deals with Arduino which serves as the central controller acting like brain of the system. People on a long run wait for the buses at the bus stop. Since they are unable to get the location of the bus they get to take some other modes of transport to reach their destination. To destroy the manual log entry and to automate the process this project plays a vital role. Mobiles phones are chosen as the medium to communicate with the passengers that provides an easy access to them. In this paper the project focuses on tracking the buses, sending SMS to the authorized persons, updating the passengers through notifications and improving the accessibility to the system. The highlighted features of this project increases the interest of the passengers in taking public mode of transportation.

**Proposed System**

In these system, we create a Student's ID Card with tracker. This will help us to identify the student's location and also recover students from crimes and harassment. In this device, we attached the RFID reader to take the student attendance and their details. It sends the message to registered mobile numbers like (parents, school management and nearby police station). Also, we include the Live tracking system to monitor the current location of the child. By this system, we reduces the crime issues. In classical GPS-GSM tracking systems, each moving device must update its GPS coordinates via sending SMS messages to the server continuously during the tracking period. However, the tracking cost, defined as the total cost of all used SMS messages, in this process directly proportional with the number of sent SMSs. Practically, not all of these SMS messages deliver significant information. Therefore, in the literature GPS-GSM tracking systems such as use a threshold distance value, $dTH$, such that a position update SMS is transmitted only if the moving unit has moved a distance greater than $dTH$ with respect to the last sent position. Otherwise, no position update SMS is transmitted. This results in a limited number of SMSs for a given trip path length. But, in this case, the number of needed SMSs is fixed and generally it is equal to $dp/dTH$, where $dp$ is the path length. Moreover, the tracing accuracy in this system is $dTH$. That is for any coordinates obtained by this system the actual position of the object is within an uncertainty circle of radius $dTH$. Another approach to reduce the number of SMSs is by using a fixed time interval, $T$, for the moving object to update its location information regardless the travelled distance. Again, this method results in a fixed irreducible number of SMSs being equal to $Tp/T$, where $Tp$ is the time of the trip. The tracking accuracy of this system is variable and it depends on the speed of the moving object.

In this paper, it is proposed to reduce the number of SMSs and the tracking cost by applying both time and distance quantization. In the moving unit, the values of both $dTH$ and $T$ are determined. After the first position SMS, the moving unit checks whether $dTH$ is exceeded only every $T$ seconds. That is, every $T$second a position updating SMS is sent to the server if a distance greater than $dTH$ is moved with respect to the position of the last sent SMS. The proposed scheme sacrifices some amount of tracking accuracy to gain a reduction in the number of SMSs and tracking cost. For example, let $T$=5 minutes and$dTH$=2 $km$. After 5 minutes form the first position SMS, if the object has moved a distance of say 1 $km$ then no new SMS is transmitted. Then, the system waits for the next 5 minutes to check the moved distance and to decide to send an SMS or not. Let the distance travelled within the second 5 minutes be500 $m$, then again no SMS is transmitted Therefore, it is expected that the proposed scheme will be an economic alternative to the classical GPS-GSM based tracking techniques.

## III. SYSTEM IMPLEMENTATION

**This project consist of 4 phases:**

- GPS
- GSM
- RFID
- ARDUINO

**RFID Systems**

A RFID reader and a few tags are in general of little use. The retrieval of a serial number does not provide much information to the user nor does it help to keep track of items in a production chain. The real power of RFID comes in combination with a backend that stores additional information such as descriptions for products and where and when a certain tag was scanned. RFID readers scan tags, and then forward the information to the backend.

**RFID Technology**

RFID transponders consist in general of:

- Micro chip
- Antenna
- Case

The size of the chip depends mostly on the Antenna. Its size and form is dependent on the frequency the tag is using. The size of a tag also depends on its area of use.

**Security**

The expected proliferation of RFID tags into the billions has raised many privacy and security concerns. A common concern is the loss of privacy when companies scan tags to acquire information about customers and then using data mining techniques to create individual profiles. This section describes possible scenarios where RFID tags can be exploited.

**Energy Sources**

Three types of RFID tags in relation to power or energy:

- Passive
- Semi-passive
- Active

Passive tags do not have an internal power source, and they therefore rely on the power induced by the reader. This means that the reader has to keep up its field until the transaction is completed. The second type of tags is semi-passive tags. Those tags have an internal power source that keeps the micro chip powered at all times. The third type of tags is active tags. Like semi-active tags they contain an internal power source but they use the energy supplied for both, to power the micro chip and to generate a signal on the antenna.

**RFID Location and Tracking**

This section presents two proposals that can locate tags and track the movements of them. The use of handheld readers to monitor the worker's motion and acceleration detecting tags are dismissed as not applicable or too expensive. The proposed method works as follows: The reader polls the tag a certain number of times per second and counts the number of responses. The observation is that the number of responses decreases when the distance increases. The number of readers and tags the systems accuracy can be improved. They show that their method works also in a highly dynamic environment where tags are attached to moving objects. In addition they show that their method can be used to derive the coordinates of the robot if a map of the environment is available.

**GSM**

GSM module is used for sending the coordinates to user by SMS. GSM module is used to communicate for calls and SMS. We need to insert SIM card into the GSM modem. The heart of the module is SIM 800L GSM chip for SIMCOM. In our project the GSM used at 2 process.(i.e., ID Card and School management) When the student press the panic button ,it should alert the parents by connecting the GPRS ,the message should send to registered number. The URL should processed some code for sending the message. The message should send by AT commands. When GPRS connect the set of commands should be transfer.

**GPS**

This module presenting the current location of student. There are 24 working satellite, circling the globe at a given moment. A GPS navigation (or) GPS tracker searches for transmission signal from at least 3 satellites. It is the technology where satellite send down radio signal which GPS units and receiver use to work out their current location (which is shown by latitude, longitude and elevation).

## IV. ARCHITECTURE

A GPS-GSM based tracking system that exploits the proposed tracking scheme is designed and implemented. The implemented system consists of a central server and many moving units, as shown in Fig.1

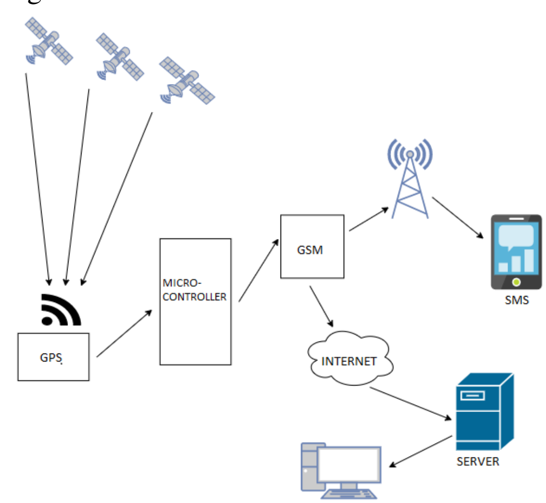


**Fig.1 Architecture**

The software of this system consists of three main parts, namely, the server, microcontroller and the smart phone application program. Firstly, the server software is a GUI built using VB.NET.

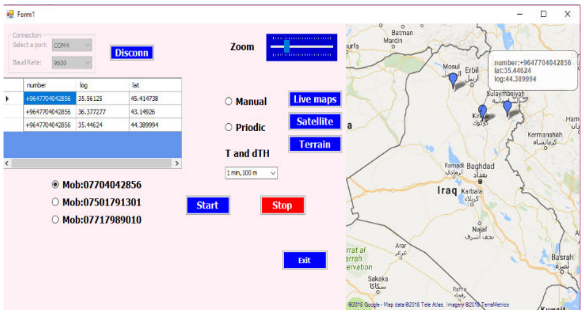


**Fig.2 Implemented server GUI**

It enables the user to determine the intended mobile unit ID, the values of the repetition time period T and the threshold distance dTH which are used to initiate a position request commands. Then in response, the position of mobile object(s) is displayed on the map and archived for possible future processing. A stop control command is available to the user at the server to end the tracking of all or some of the moving units .The microcontroller is responsible for converting the server commands to control SMSs. It encapsulates these commands in SMS messages and sends them to the intended mobile units through the GSM module according to their IDs. Then, the microcontroller waits for the response SMS messages. On the arrival of a position update SMS, the microcontroller extracts the latitude, longitude and sender unit ID and delivers them directly to the PC. The pseudo code shown in Fig. 2summarizes the microcontroller operation. On the other hand, an Android application program is developed to implement the proposed economic tracking scheme. When a position request SMS is received, the application program checks the identification number (ID) of the sender. If it is a not valid server ID, then the message is ignored. Otherwise, the program accepts the request and checks its content. The content may be either a tracking session activation or a stop commend. If it is not the latter, the mobile program extracts the embedded parameters, namely dTH and T. It also read its GPS coordinates (latitude and longitude), encapsulates them in an SMS, sends it to the server and stores the coordinates for future processing. These coordinates will be used as a reference for moved distance calculation.

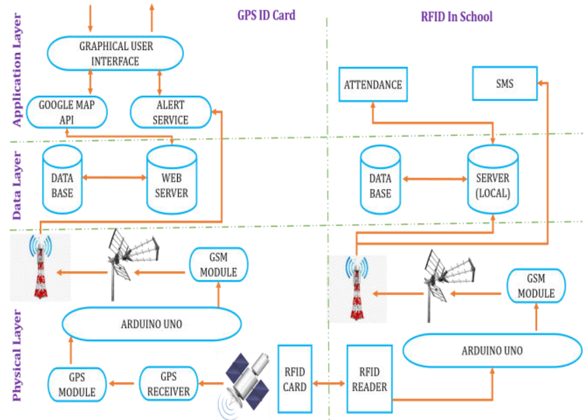


**Fig. 3. Architecture**

A GPS-GSM based tracking system that exploits the proposed tracking scheme is designed and implemented. The implemented system consists of a central server and many moving units, as shown in Fig.1 The software of this system consists of two main parts, namely, GPS ID card, and RFID in school. Firstly, the GPS ID card consist of three layer, they are application layer, data layer and physical layer. The application layer using Google map and SMS alert service to provide. The data layer using in store the data in cloud. The physical layer using in to the SMS alert in antenna and satellite connection to provide.  Second part of architecture is RFID in school, their using in attendance and alert service in application.

**<u>Mobile application algorithm</u>**

Initialization
Server_SMS = "stop"
***while*** (GPS module active) ***do***
***if (server_SMS received &&server_SMS<> "stop")***
***end***
***if (server_SMS<> "stop")***
Delay(T)
***if (d >dTH)***
***end***
***end***
***end***

## IV. PRACTICAL TESTS

### *A. Test Case 1*

In this test case, a practical application of the proposed tracking system is performed by tracking the motion of a vehicle moving from Kirkuk city to Erbil city. The total path length is about 121.4 km and it took 2 hours and 5 minutes. The SMS repetition period T is selected to be 5 minutes and the threshold distance is dTH=4 km . The constant T classical system produced 26 SMS messages, including the first position response SMS and 25 SMSs, a message every 5 minutes during the 125 minutes observation time. The total cost is then 650 IQD. The variable differential distance profile of the vehicle moved during each period of 5 minutes. This distance is calculated between every two successive latitude-longitude coordinate pair using the Have sine formula of spherical distance Next, the classical constant dTH system produced 31 SMS messages calculated from dividing the path length by dTH, plus the first position response SMS. It costs 775 IQD. On the other hand, the proposed tracking system sent 17 SMS messages with a cost of 425 IQD. Then, a percentage saving in the number of SMSs and their cost of 34.6% and 45% is achieved by the proposed tracking system with respect to the tested constant T and constant distance classical system. The tracking accuracy point of view, in the constant T system, the actual position of the vehicle at any time instant cannot be exactly determined unless a position SMS is sent from the vehicle. Whereas, in constant distance system, the this uncertainty is limited to dTH. That is the actual position of the vehicle is within a circle of radius dTH around the last sent position. In the proposed system, the radius of uncertainty is slightly greater than dTH, since the vehicle may exceed dTH but it will not send a position update SMS till the next T.

### *B. Test Case 2*

In this case, the proposed and classical tracking systems are used to track the motion of a person having a walk journey. This can be considered as a tracking of a relatively lower speed moving object with respect to test case 1. The total path length is about 2.43 km, and the walk took 43 minutes. A normal human walking speed is assumed in this test case to be 1.4 m/s (or 84 m/min). However, this speed is variable in practice. For the tested systems, the parameters T and dTH are selected to be 1 minute and 100 m, respectively. Meaning that in the proposed tracking system, the distance moved is calculated every 1 minute and if it is greater than 100 m from the last sent position SMS, then a position update SMS is sent to the server. Otherwise, no SMS is sent. The same T and dTH values are used in the constant T and constant distance classical tracking systems. This records an abrupt variation in walking speed. The total distance till 10:38 was less than 100 m (about 95 m), but during the next minute the speed was higher and the distance was 140 m, resulting in a total of about 235 m and a new SMS at 10:39. The absence of SMSs during the period 10:42 through 10:58 indicates a stop and/or a very slow walking speed. Finally, recall the assumption that a single SMS costs 25 IQD, then the total tracking cost of the proposed, constant T and constant distance systems are 425, 1100 and 625 IQD, respectively. The proposed system saves 61% and 32% of the cost spent by the classical systems. This advantage proofs the superiority of the proposed tracking system over the tested classical systems in this practical test case.

## V. CONCLUSION

An economic tracking scheme is proposed for GPS-GSM based tracking systems. In the proposed scheme, both time and distance quantization are used. The moving unit checks its moved distance with respect to the last sent position SMS at regular time instants, every T seconds. Only if the moved distance is greater than a given threshold, then a position update SMS is sent to the server. The hardware and software of a GPS-GSM based tracking system exploiting the proposed scheme are implemented. The performance of the proposed system is evaluated and compared with similar classical tracking systems under two practical test cases. The tests showed the ability of the proposed system to perform the tracking task with a lower number of SMS messages, and hence less cost, with respect to the tested classical systems. A percentage saving in tracking cost in the range of 25% through 63.9% is achieved by the proposed system. These results emphasize the economic feasibility of the proposed tracking system.

**REFERENCES**

[1] J. I. Godino-Llorente, F. Cruz-Roldan, M. Blanco-Velasco, R. Fraile, V. Osma-Ruiz, N. Saenz-Lechon, "P2P Multiuser Low-Cost Universal Solution for On-Demand GPS Positioning and Tracking in Large Environments," IEEE Transactions on Intelligent Transportation Systems , vol. 12, no. 4, p.1385-1397, December 2011.

[2] F. N. Ameen, Z. S. Mohammed, A. I.Siddiq, "GPS and GSM Based Tracking System for Objects Moving over Wide Geographical Areas," Al-Kitab Journal for Pure Science, *Accepted paper to be published in* vol. 1, issue 2, June 2018.

[3] M. S. Uddin, M. M. Ahmed, J. B. Alam, M. Islam,"Smart Anti-Theft Vehicle Tracking System for Bangladesh Based on Internet of Things," *in Proce. of 4th IEEE International Conference on Advances in Electrical Engineering (ICAEE)*, Dhaka, Bangladesh, p.624-628, 2017.

[4] T. Monawar, S.B.Mahmud, A. Hira, "Anti-Theft Vehicle Tracking and Regaining System with Automatic Police Notifying Using Haversine Formula," *in Proce. of 4th IEEE International Conference on Advances in Electrical Engineering (ICAEE)*, Dhaka, Bangladesh,p.775-779, 2017.

[5] S. Lee, G. Tewolde, J. Kwon, "Design and Implementation of Vehicle Tracking System Using GPS/GSM/GPRS Technology and Smartphone Application," *in Proce. of IEEE Conference on World Forum on Internet of Things (WF-IoT)*, Seoul, South Korea, p.353-358, 2014.

[6] H.A. A.Dafallah "Design and implementation of an accurate real time GPS tracking system,"i*n Proce. of IEEE Third International Conference on e-Technologies and Networks for Development (ICeND2014)*, Beirut, Lebanon,P.183 - 188 ,2014.

[7] M. A. Elahi, Y. A. Malkani, M. Fraz, "Designing Vehicle Tracking System - An Open Source Approach," *in Proce. of IEEE International Conference on Vehicular Electronics and Safety, Hyderabad, India*, p.135-140, 2014.

[8] M. A. Al Rashed, O. A. Oumar, D. Singh, "A Real Time GSM / GPS Based Tracking System Based on GSM Mobile Phone," *in Proce. of Second IEEE International Conference on Future Generation Communication Technologies (FGCT 2013)*, London, UK, p.65-68, 2013.

[9] A.Civilis, C. S. Jensen, J. Nenortait, S. Pakalnis, "Efficient Tracking of Moving Objects with Precision Guarantees," *in Proce. of IEEE International Conference on The First Annual International Conference on Mobile and Ubiquitous Systems*, Boston, MA, USA, p.164-173, 2004.

[10] J. O. Aasha, S. Monica, E. Brumancia, "A Tracking System With High Accuracy Using Location Prediction and Dynamic Threshold for Minimizing SMS Delivery," *in Proce. of IEEE International Conference on Computation of Power, Energy, Information and Communication (ICCPEIC)*, Chennai, India, p.1-6, 2015.

[11] M. Zahaby, P. Gaonjur, S. Farajian, "Location tracking in GPS using Kalman Filter through SMS," *in Proce. of IEEE Conference on EUROCON 2009*, St.-Petersburg, Russia, p.1707-1711, 2009.

[12] Pawale S. R., M. M. Bokare, Mohammed H. Yasen, V. M. Thakare, S.Chidrawar, "Low Cost SMS based Vehicle Tracking System using Android," International Journal of Application or Innovation in Engineering & Management (IJAIEM), vol. 5, no. 4, p.230-235, 2015.

[13] R. Ramani, S. Valarmathy, N. SuthanthiraVanitha, S. Selvaraju, M. Thiruppathi, R. Thangam, "Vehicle Tracking and Locking System Based on GSM and GPS," International Journal of Intelligent Systems and Applications, vol. 5, no. 9, p.86-93, 2013.

[14] S. Sambanthan, V. M. E. Saravanan, "RFID based pervasive tracker for physically challenged," i*n Proce. of IEEE International Conference on Innovations in Information, Embedded and Communication Systems (ICIIECS)*, Coimbatore, India, p.1-5, 2015.