

Tourists Localization System in Iraqi marshlands Zone

Zahraa Abbas Al-zubaydi, Salih Mahdi Al-Qaraawi

Abstract— Localization systems have become a common technology in various fields and a tool to assist with the recreation resource management. Such technologies allow real-time tracking and monitoring of tourists and modeling their movement on Google Map. Furthermore, they provide security and safety for tourists and countries by accurately transmitting series of their movements to a datacenter. This paper introduces a system that can track the tourists in Iraqi marshlands using Global Position System (GPS) and Radio Frequency Identification (RFID) where the movement of tourism in the marshes is monitored by tracking the tourist boats, which are the only means of transport. The proposed system includes two main parts; datacenter and boats of tourists. The datacenter collects data related to the boat location for tourists as well as tourists' identification data through RFID tags (cards) attached to tourists. The second part of the system is related to the boat where the location of the boat of tourists and their identifications are sent through Arduino, (GPS) shield, RFID reader and Global System Mobile (GSM) shields fixed on the boats. All the locations of boats and RFID tags information are stored in a database at the server of datacenter for more reporting and actions. Different software have been used, such as PHP, MYSQL server and Arduino IDE.

Index Terms— GPS Arduino shield, GSM Arduino shield, RFID, Tourist Tracking, Marshlands Transportation..

I. INTRODUCTION

It is substantial for the tourism services industry to develop a system that determines the accurate location of the tourists and identifies the tourists by attached tags for safety and security purposes. Diverse technologies can be utilized to fulfill this purpose. The RFID (Radio Frequency Identification) technology is recognized for real-time identification and tracking. Because of its precise and express identification, RFID is used extensively to asset tracking [1]. The GPS is the most common technology that used to obtain the position information in outdoor environments. Constantly GPS is assisting for tracking of vehicles over a broad geographical area. With simultaneously information received from four satellites and typical conditions and least of Ionosphere, users can calculate an object's position included latitude, longitude, and altitude. This powerful combination of data and advanced technologies allows tracking objects accurately [2]. Moreover, wireless communication systems have been used

to transmit and receive information between the stations. The most prevalent used communication system is GSM. This is due to inexpensive cost and accessibility around the covered area and its reliability [3].

In terms of data centers, several software and algorithms have been used to reach the object tracking systems. Moreover, the data center includes some intellectual property have to be preserved in a secure environment to emphasize confidentiality and availability [4]. The database is used to store the data and assist managers to produce different reports related to events. It is essentially to note that all the applications are built as a webpage based to be universal and can be accessed from different places [5].

In the proposed system, the boats of tourists are monitored and tracked by the data center. The investigated system consists of two main parts, which are data center and boats of tourists. The task of data center is explained previously, while the boat of tourists includes the hardware equipment which uses the microcontroller of Arduino added to GPS, RFID reader and GSM shields. The GPS shield is used to get the present position of boat, while the RFID reader identify tourists by the cards attached to tourists and finally the GSM shield is utilized to transmit the GPS and RFID readings periodically to the data center for processing and decision. Many software environments have been used and web based data base built.

II. RELATED WORKS

Researches in the field of localization and tracking of individuals and objects such as vehicles are a very effective area. Generally these researches not only interested in the field of tracking and monitoring but also concern with safety, security, control and management issues. Many monitoring systems have been designed; each varies with some of its properties, merits and abuses. Some of those systems will be reviewed:

In [6] cargo based GPS presented for petroleum transportation tankers. The system collect different types of information related to cargo and sent them to a data base by GSM technology. Moreover, the system supported with a security technique for overall operation.

In [7] authors presented a methodology to analyze the spatial behavior of tourists based on tracking data. This method was applied during a field study in the city of Go'rlitz at the east border of Germany. Global Positioning System (GPS) was used to know the places (which sights, shops, restaurants, events, etc.) and times (at which daytime, in which season, etc.) tourists visit.

In [8] vehicle terminal system was proposed to realize continuous monitoring and tracking the location of cargos or goods loaded on board for digital logistics. The embedded design of the terminal system was combined both the RFID

Manuscript received March, 2018.

Zahraa.A.Hassan, Computer Engineering Department, University of Technology., Baghdad, Iraq

Salih.M.Al Qaraawi, Computer Engineering Department, University of Technology., Baghdad, Iraq

with GPS technologies. The ultra-low power 16-bit RISC microcontroller is used as the central control unit considering both small size and high efficiency. The vehicle terminal system can give the automatic identification of cargos load, the real-time vehicle location, the data and voice communication, and continuous monitoring. The results specify that the combination of RFID and GPS can provide the reliability of the system, which further improve the accuracy and efficiency of digital logistics management. In [9] authors used GSM & GPS based system for Vehicle Tracking and Employee Security System. It consists of car unit, emergency button and company unit. Car unit is placed inside the car. When the car picks up the employee; he/she needs to swap the RF card. The micro controller matches the RF card number. with its database records and sends map. The system's efficiency is depending on the sufficiency of the used communication network. In [10] a hybrid RFID-GPS tool used, allowing for the real-time location of humans. This tool tracks the location of humans using GPS within 100 meters range and RFID within 2 meters range. The tool that ensures security and monitors the location along with watch over a suspicious person or prisoners with human tracking of cared ones in case of emergency.

III. THE PROPOSED SYSTEM

The architecture of the proposed system design is shown in Figure (1). The embedded system fixed in each boat consists of Arduino uno as a microcontroller, GPS Arduino shield to get latitude and longitude (GPS signals) for tracking purposes, RFID reader to identify the tourists by their attached tags and GSM Arduino shield to send location of a boat and RFID tags related information to data center. The database, which is web based one, is built to store the information of boats' trips and tags readings. It is important to note that the data center contains the database, administration computer and server.

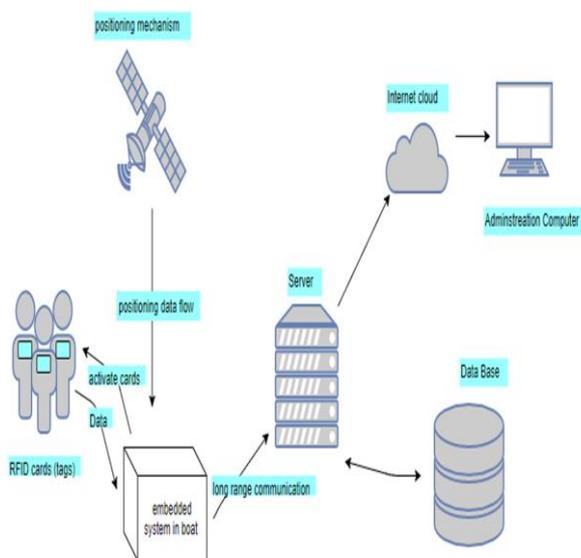


Fig. 1, “Default Boat Localization System Block Diagram”

The specifications of the component used in proposed system can be summarized as follows:

A. Arduino UNO Board:

In this paper, Arduino uno is used as a microcontroller for its high flexibility with additional shields, such as GSM, RFID and GPS. See Figure (2). These specifications making it easy to connect with other electronic devices and using GSM as internet provider and RFID as identification tool.



Fig. 2, “Arduino Uno Board” [11]

B. Arduino GPS Shield:

Another component is used in this work is Arduino GPS Shield which utilized as a navigation system, see Figure (3). It provides the location and more data in various conditions for different applications, like vehicles.



Fig. 3, “Arduino GPS Shield” [12]

C. Arduino GSM Shield:

Arduino GSM shield shown in Figure (4), allows an Arduino board to connect to the internet, send and receive SMS, and make voice calls using the GSM library.



Fig. 4, “Arduino GSM Shield” [13]

D. RC522 RFID module:

RFID module shown in Figure (5), consists of card reader and cards (tags). The microcontroller and card reader uses SPI for communication (chip supports I2C and UART protocols). The card reader and the tags communicate using a 13.56MHz electromagnetic field. (ISO 14443A standart tags).



Fig. 5, “RC522 RFID module” [14]

IV. THE PROPOSED SYSTEM IMPLEMENTATION

The proposed system consists of two parts; Boat of tourist embedded (hardware) and data center (software). The hardware part consist of Arduino, GPS, RFID reader and GSM Arduino shields, all exist in the boat as embedded system (unit). The job of this part is collecting the GPS signals and RFID tags’ data then sending them to the data center using GSM network at a scheduled time (periodically). Concerning the data center, software environments are utilized to build a database for data storing and tracking the boat. For more explanation, this part can be illustrated as follows:

A. Boat (Hardware) Part:

The utilized hardware components (Arduino Uno, RC522 RFID module, GPS Arduino shield and GSM Arduino shield) are explaining in Figure (6). GPS shield is connected to the Arduino and GSM shield using pins of 0 and 1 and RFID module through pins 9 and 10. The space collected GPS signals and RFID data are sent to the data center by GSM network to be saved in the database.

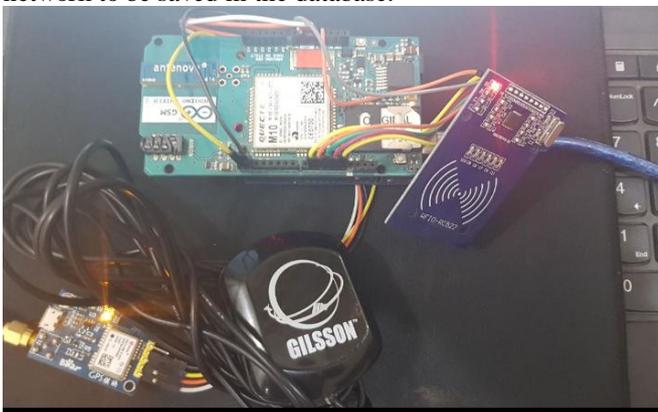


Fig. 6, “The Component of System Hardware”

Hardware working steps can be summarized as shown in the flowchart of Figure (7), where RFID reader should read N number of tags in a specified interval due to its ability to read just one tag at a time.

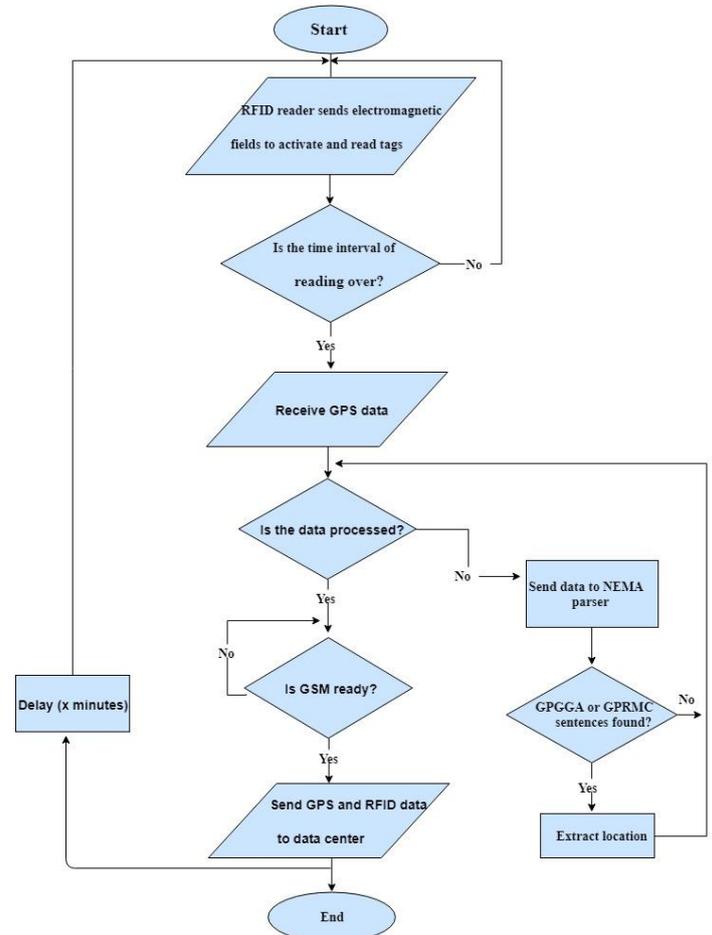


Fig. 7, “RFID and GPS Parsing Flowchart”

B. Software part (Data base building):

This part consists of a data base building steps to complete supporting the hardware so that a complete system will be achieved. An entity relationship diagram (ERD) illustrates the relationships of entity sets saved in a database, which represents the logical structure of databases as shown in Figure (8).

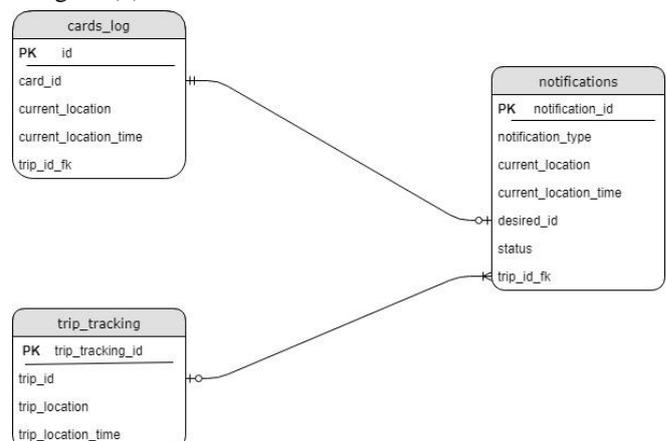


Fig. 8, “ERD of the proposed data base”

The first table (Cards_Log) represents the data comes from RFID reader fixed in the tourists’ boat which read the ID information from cards (tags) attached to the tourists. The second table (Trip_Tracking) shows the current location of the tourists’ boat obtained from GPS device while the last table (Notifications) specifies various types of notification messages related to the following cases:

1. Notification Type1: explains the case of boat ideal
2. Notification Type2: explains the case of tourists missing
3. Notification Type3: explains the case when the tourists' boat exceeds the allowed borders with the neighboring countries.

The next section shows the results that have been taken as a real case study.

V. RESULTS

The proposed system is tested in Al-Jadrya area in Baghdad which has been taken as a prototype and we receive the following data are obtained:

The table, shown in Figure (9), represents the saving step of the current location of boat received from the hardware part and stored in the datacenter of the boat is called "Trip_Tracking". Moreover, in this table the data of numerous boats can be stored that includes four columns: trip_tracking_id, trip_id, trip_location and trip_location_time.

trip_tracking_id	trip_id	trip_location	trip_location_time
43	19	33.31189664150427@44.4957001508742	2018-02-14 15:32:51
44	19	33.31189664150427@44.4957001508742	2018-02-14 15:33:01
45	19	33.31189664150427@44.4957001508742	2018-02-14 15:33:13
46	19	33.31189664150427@44.4957001508742	2018-02-14 15:35:20
47	19	33.31189664150427@44.4957001508742	2018-02-14 15:37:37
48	19	33.31189664150427@44.4957001508742	2018-02-14 15:38:31
49	19	33.31189664150427@44.4957001508742	2018-02-14 15:38:53
50	19	33.31189664150427@44.4957001508742	2018-02-14 15:41:37
51	19	33.31189664150427@44.4957001508742	2018-02-14 15:42:55
52	19	33.31189664150427@44.4957001508742	2018-02-15 01:44:54
53	19	33.31189664150427@44.4957001508742	2018-02-15 01:46:13
54	19	33.31189664150427@44.4957001508742	2018-02-15 12:39:34
55	19	33.31189664150427@44.4957001508742	2018-02-15 12:39:49
56	19	33.31189664150427@44.4957001508742	2018-02-15 12:40:17
57	19	33.31189664150427@44.4957001508742	2018-02-15 12:40:46
58	19	33.31189664150427@44.4957001508742	2018-02-15 12:41:31
59	19	33.31189664150427@44.4957001508742	2018-02-15 12:41:36
60	19	33.31189664150427@44.4957001508742	2018-02-15 12:42:16
61	19	33.31189664150427@44.4957001508742	2018-02-15 12:42:20
62	19	33.31189664150427@44.4957001508742	2018-02-15 12:42:55
63	19	33.31189664150427@44.4957001508742	2018-02-15 12:43:27

Fig. 9, "Trip_Tracking Table Representation"

The table, shown in Figure (10), represents the storing (saving) the cards number received from the RFID reader at the boat. This table is called "Cards_Log" and includes five columns that are: id, card_id, current_location, current_location_time and trip_id_fk.

id	card_id	current_location	current_location_time	trip_id_fk
76	BB 6F 6A 29	33.31189664150427@44.4957001508742	2018-02-15 14:28:50	19
77	1A FF A4 F9	33.31189664150427@44.4957001508742	2018-02-15 14:44:07	19
78	BB 6F 6A 29	33.31189664150427@44.4957001508742	2018-02-15 14:44:07	19
79	1A FF A4 F9	33.31189664150427@44.4957001508742	2018-02-15 14:44:14	19
80	1A FF A4 F9	33.31189664150427@44.4957001508742	2018-02-15 14:46:48	19
81	1A FF A4 F9	33.31189664150427@44.4957001508742	2018-02-15 14:48:49	19
82	1A FF A4 F9	33.31189664150427@44.4957001508742	2018-02-15 14:49:03	19
83	BB 6F 6A 29	33.31189664150427@44.4957001508742	2018-02-15 14:49:03	19
84	1A FF A4 F9	33.31189664150427@44.4957001508742	2018-02-16 05:27:03	19
85	BB 6F 6A 29	33.31189664150427@44.4957001508742	2018-02-16 05:27:03	19
86	1A FF A4 F9	33.31189664150427@44.4957001508742	2018-02-16 05:27:10	19
87	1A FF A4 F9	33.31189664150427@44.4957001508742	2018-02-16 05:27:30	19
88	1A FF A4 F9	33.31189664150427@44.4957001508742	2018-02-16 05:27:55	19
89	1A FF A4 F9	33.31189664150427@44.4957001508742	2018-02-16 08:25:19	19
90	BB 6F 6A 29	33.31189664150427@44.4957001508742	2018-02-16 08:25:19	19

Fig. 10, "Cards_Log Table Representation"

The table, shown in Figure (11), represents the notifications that display various types of error messages that demonstrated above. This table is called "Notifications" and includes seven columns that are: notification_id, notification_type, current_location, current_location_time, desired_id, status and trip_id.

notification_id	notification_type	current_location	current_location_time	desired_id	status	trip_id
302	1	33.31189664150427@44.4957001508742	2018-02-16 05:27:50	1	1	19
303	2	33.31189664150427@44.4957001508742	2018-02-16 05:27:59	0	1	19
304	1	33.31189664150427@44.4957001508742	2018-02-16 05:27:59	1	1	19
305	2	33.31189664150427@44.4957001508742	2018-02-16 08:25:20	0	1	19
306	2	33.311897@44.495700	2018-02-16 08:27:19	0	1	19
307	2	33.31189664150427@44.4957001508742	2018-02-16 09:15:32	0	1	19
308	2	33.31189664150427@44.4957001508742	2018-02-16 08:49:44	0	1	19
309	1	33.31189664150427@44.4957001508742	2018-02-25 08:49:44	1	1	19
310	3	33.264610@44.359327	2018-02-25 09:23:09	1	1	19
311	1	33.264583@44.359325	2018-02-25 09:55:57	1	1	19
312	2	33.264606@44.359336	2018-02-25 09:55:57	0	1	19
313	1	33.264606@44.359336	2018-02-25 09:55:57	1	1	19
314	2	33.264652@44.359302	2018-02-25 09:55:57	0	1	19

Fig. 11, "Notifications Table Representation"

VI. CONCLUSION

A tracking system for tourists in the Marshlands using GPS and RFID devices was presented. The proposed system includes two parts; boat of tourists and data center. The boat contains the hardware unit that collects the GPS signals and RFID readings to be sent to the webpage of the datacenter in which they saved in database later. The datacenter saved the database for other processing purposes. Different software environments have been utilized, such as PHP, and SQL server. The proposed system was tested as a prototype in real-time experiment in Al-Jadrya area.

REFERENCES

- [1] Y. Zhang, P. Kitsos, "Security In RFID and Sensor Networks", CRC Press, Taylor and Francis Group, 2009.
- [2] Fleischer et.al., "Design & Development of GPS/GSM Based Vehicle Tracking and Alert System for Commercial Inter-City Buses", IEEE 4th International Conference on Adaptive Science & Technology (ICAST) 2012.
- [3] N. Chadil, A. Russameesawang and P. Keeratiwintakorn, "Real-Time Tracking Management System Using GPS, GPRS and Google Earth", Proceedings of ECTI-CON 2008.
- [4] S.Sujatha, M.Sakthi, N.Shrijith, J.Stalin, "Design of Intelligent Traffic Control System", International Journal of Advanced Research in Electrical, Electronics and Instrumentation Engineering Volume 5, special issue 1, march 2016.
- [5] Asmaa S. Abdul Munem and Dr. Muayad S. Croock, "Smart Traffic Light Control System for Emergency Ambulance", International Journal of Advanced Research in Computer Engineering & Technology (IJARCET), vol. 5, no. 8, pp. 2247 – 2255, 2016.
- [6] S. Al-Qaraawi, M. Al-Sabbagh, "Simulation and Implementation of a Secured Monitoring System for Petroleum Transportation System", IJCCCE, vol.16, No.1, 2016.
- [7] M. Modsching, R. Kramer, K. Ten Hagen and U. Gretzel, "Using Location-Based Tracking Data To Analyze The Movements Of City Tourists", Information Technology & Tourism, Vol. 10 pp. 31–42
- [8] A. Rajasekhar reddy, P.Anwar basha, "The Terminal System Design based on hybrid RFID-GPS in Vehicular communications", International Journal of Modern Engineering Research (IJMER), Vol.2, Issue.4, pp-2316-2319, July-Aug. 2012
- [9] S.S.Pethakar, N. Srivastava and S.D.Suryawanshi "GPS and GSM based Vehicle Tracing and Employee Security System" International Journal of Computer Applications, Volume 62– No.6, January 2013
- [10] Divya Kamath M et.al."Hybrid Tool To Track The Location Of Cared", National Conference on Emerging Trends and Advances in Information Technology Department of CS & E, AIT, Chikmagalur, January 29th & 30th , 2016
- [11] Arduino Hardware and Software, www.arduino.cc.com
- [12] Guochang Xu. and Yan Xu "GPS Theory, Algorithms and Applications" Springer 2016
- [13] http:// www.tinyosshop.com/datasheet/ GSM/GPRS shield datasheet, 4:16 PM 2/27/2018.
- [14] Product datasheet MFRC522, Rev.3.2-22 May 2007.