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An Interactive GPS And RFID Based Receptacle Security System

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Abstract*: Global Positioning System (GPS), Global System Mobile Communication (GSM) and Radio Frequency Identification (RFID) are some successful technologies implemented for luggage tracking, locking and unlocking systems. This paper examines the use of location tracking and safety systems for suitcases that communicate with GPS, GSM and RFID. When the owner wants to open the suitcase, he can use the RFID tag to lock and unlocking. If the suitcase is lost and anyone attempts to open the lock, an alert message will be sent to the mobile phone of the owner. If the user cannot open the lock, use GPS modem to send a message to the user's mobile suitcase / bag location. The suitcase's zip is made of steel so that it cannot be broken or cut with a knife.

***Keywords*: GPS, GSM, RFID, luggage, location tracking, mobile phone.**

I. INTRODUCTION

The major issues in today's society are increasing robbery, criminal activity, and theft. This raises the question of the security framework. In essence, nearly available security systems are personal surveillance by security officers [1]. Because of unprofessional guards, the main drawbacks of these systems are several security officers serving the increasing problems and low efficiency. Several research groups have therefore studied implemented and implemented automatic systems and modern technologies to protect assets against theft. GPD, GSM, and an RFID are some of the promising technologies that have been extensively applied into the location tracking and security system respectively [5]. A suitcase having Safety system helps to open and close the suitcase/bag with the help of central locking system. Moreover, this system was unable to provide ultimate luggage security in the event of any theft.

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So, a more advanced system are implemented which works on Embedded GSM, GPS and RFID - based systems. This designed and developed system can be installed in the suitcase / bag. GSM is the most widely used mobile accessory in the world. This device uses a mega microcontroller from Arduino that interfaces with other data input devices such as GSM, GPS, RFID reader, etc. The GPS and GSM Based systems which are integrated with Arduino Systems are the most important systems. It is required due to the many applications of both GSM and GPS systems and the large usage of them by millions of people throughout the world [10]. The RFID reader integrated in the suitcase / bag. The Suitcase / bag is developed using a servo motor connected to the Arduino mega 2560 to lock and unlock the system. The suitcase will lock automatically when the theft is in place. If an unauthorized person wishes to open the lock, then without an RFID tag he or she is unable to open [6]. It may be possible for the person to break or cut the zip/lock of the luggage, GSM module will send the alert message to owner's mobile. If the user fails to open the lock, then the position of the suitcase/bag will send the information to the user with the help of GPS [7]. The zip of the suitcase is prepared with steel so that it cannot be broken or cut with a knife. This gives the introduction part and the second section gives an overview of the previously designed systems. The third section provides an overview of the application development specifications. The section four deals with the future conclusion and scope.

II. INTERNET OF THINGS

A dynamic overall association with self - structuring limits that are subject to standard and interoperable symmetrical traditions in which physical and virtual things have characters, physical properties and virtual personalities and use sharp interfaces and are reliably planned to sort out information. The Internet of Things is shown by the ITU and IERC as a dynamic overall organize establishment with self-structure limits deplanement on standard besides, interoperable correspondence traditions where physical and virtual "Equivalent words/Hyponyms (Ordered by Estimated Frequency) of thing " have characters, physical character and virtual personalities, use canny interfaces and are reliably planned into the information orchestrate.

Over the span of the latest twelvemonth, IoT has moved from being a Synonyms/Hyponyms (Ordered by Estimated Frequency) of thing cut - edge vision - with occasionally a dimension of progression - to a growing basic supply world. Telecom official consider that Machine-to-Machine (M2M) and the Inter-net of Things are transforming into an inside business focus, uncovering basic development in the amount of related inquiries in their framework. Gadget makes e.g. concerning wearable comfort anticipate a full new business partition towards a broader allotment of the IoT. These geographic campaign results are as of now sustaining into headway, and a movement of sections is open, which could accommodatingly be mishandled and overhauled by the market. Though greater players in a few applications program zones still don't see the voltage, numerous them spring watchful situation or even enliven the walk by bringing forth new terminal Fig for the IoT and including additional portions to it. Likewise end client in the private and business space have nowadays acquired an important capacity in overseeing canny devices and masterminded applications. As the Internet of Things keeps on development, advance potential is assessed by a mix with related advancement strategies and thoughts for instance, Cloud figuring, Hereafter Internet, Big Data, Robotics and Semantic loan. The 1 feeling of believe is clearly not new everything considered yet rather, as these thoughts cover in a couple of segments (concentrated and advantage models, virtualization, interoperability, computerization), veritable trailblazer see progressively the piece of correspondingly instead of guarding space.

Characteristics of IoT:

- Interconnectivity: concerning the IoT, anything can be interconnected with the overall information and correspondence hypothetical record.
- Things-related administrations: The IoT is fit for giving thing-related advantages inside the farthest point of issue, for instance, security protection and semantic consistency between physical Synonyms/Hyponyms (Ordered by Estimated Frequency) of thing and their related virtual issue. With the true objective to give thing-related foundation s inside the jussive state of mind of things, both the ahead movement in physical world and information world will assortment.
- The device in the IoT is heterogeneous as subject to differing gear point and association. They can associate with other contraption or organization arrange through different association.
- Dynamic changes: The country of wind change powerfully e.g. resting what's more, awakening related and also disconnected and moreover the Set of contraptions including zone and speed. In addition, the proportion of contraptions can change logically.

III. EASE OF USE

A. Arduino Mega:

The Arduino Mega 2560 is also a microcontroller board based on ATmega2560. It consists of 54 Digital input / output pins, 15 of which can be used as PWM outputs, 16 analog inputs, 4 UART serial hardware ports, 16 MHz crystal oscillator, USB connection, ICSP header and button to reset. Connect to a computer with a USB cable or power it with an AC to - DC converter or battery to start the microcontroller. For complex circuits and more memory space, Arduino Mega is introduced especially. We can power the board in three different ways. Either we can use a USB cable to power the board or transfer code to the board or by producing power using Vin of the board or through Power jack or batter.

B. RFID Technology:

An RFID tag is used to identify the Information and antenna broadcasting the data to the reader through wireless communication. Basically, the chip contains a serialized identifier that uniquely identifies the object; today many bar codes are used [4].

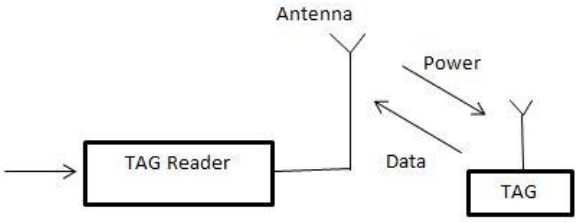

Fig 1: RFID system architecture

There are three types of RFID tags: active, passive and semi-passive.

There is no internal source of power in passive tags. They derive power from the electromagnetic field produced by the RFID reader and then the microchip will send back information on the same frequency. When we use passive tags the reading range is limited [6].

Active tags have their own transmitters and a small battery power source. Until they detect the presence of the RF field which is being sent by the reader, they remain in a low-power 'idle' state. When the tag leaves the reader's field, it shuts down the power once again to its idle state to retain its battery. Therefore, active tags can be detected at a greater range when compared to passive tags. Semi- passive tags also have their own power source, which can only power the microchip, but they don't have a transmitter. The transceiver will transmit their data so that they rely on altering the RF field [2]. Users will be provided with the registered cards or tags to access the system. When placing the card / tag on the RFID sensor (about 6 cm), this card / tag's serial number is detected and thus compared to a serial number. or bar code which is recorded in the software or memory card database; if the serial number is registered, the user lock will be released by the system [5]. There will be a green LED and the text message will appear to the user (user recognition and user reception), in addition to driving a servo motor to unlock a safety device. If not, the system will not be released the user access and a red LED warning will appear to advise the user to contact the operation manager [8].

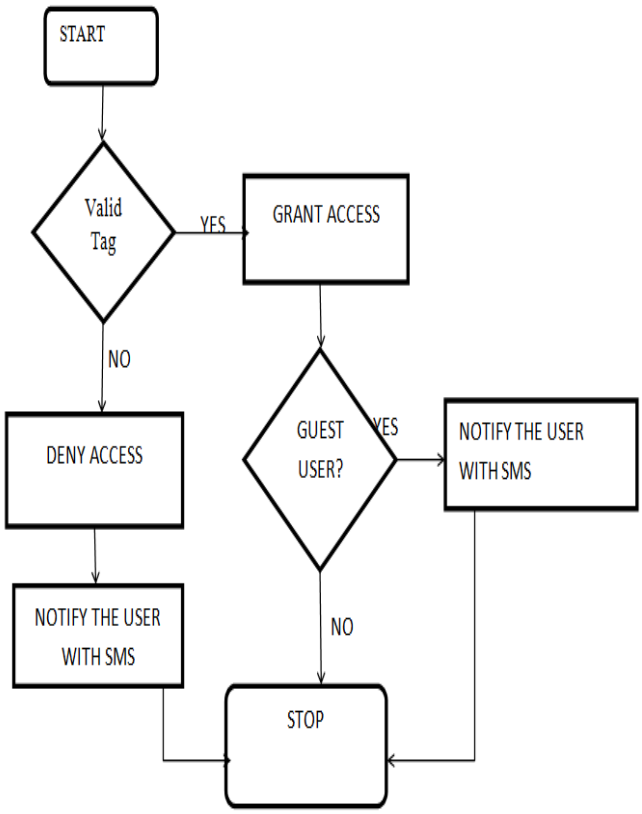

Fig 2: Flowchart of RFID module locking and Unlocking system

The system applied the RFID module consists of reader and tags. The reader is installed at the locking system of the baggage. The tags are attached on ID cards and any of their properties which include barcodes. Arduino mega 2560 microcontroller is used to connect to different peripherals of hardware [9].

From Fig 2, When the user starts to open the bag lock by placing the RFID tag close to the reader scanning the serial number or bar code on the tag. If the used tag is a valid tag, then the system will grant access to the user to open the lock. On the other hand, if the tag is not valid, then the system will deny or cancel the access and will notify the user with a text message and the stops. Now, if the access is granted and some guest user needs to access the lock of a suitcase, then the user will be notified with a text message and stops. Finally, when some unknown person wants to access the lock the system stops, and execution and the GPS and GSM modules will track and locate the position of the suitcase the sends a text message to the registered mobile [3].

C. GPS Module:

The Global Positioning System (GPS) is a satellite navigation system consisting of a network of 24 orbiting satellites. The system provides extremely important information to military, civil and commercial users worldwide, which is open to anyone with a GPS receiver [12]. GPS works anywhere in the world under any weather conditions. Normally no subscription charges the destination of the system, time and other. The GPS receiver is used to detect the location of the luggage and provide the owner with information via GSM technology. [3].

D. GSM Module:

GSM is one of the world's most successful technologies. The title GSM is first extracted from the Group Special Mobile (GSM), which was created by the European Conference on Postal and Telecommunications Administration (CEPT) in 1982 to create a pan - European cellular system. Many existing cellular systems that are incompatible could be replaced. The "GSM" was renamed the Global Mobile Communications System in 1991, when GSM service has been started. Frequency Division Multiplexing (FDM) and Time Division Multiplexing (TDM) are used in the GSM module [3]. Three modules specify the GSM network:

i. Mobile Station
ii. Station base
iii. Network Subsystem

Mobile station includes mobile devices and a Subscriber Identity Module. A mobile phone is used as In the mobile station, the most common mobile setup. By placing the SIM card in the SIM, the inserting the SIM card into the sim slot, the user will receive calls and text messages at that phone [10]. The base station subsystem includes the base transceiver station and the base station controller. Station and controller of the base station [9].

From the Fig 3, the modem shall regularly provide the data in the form of geographical coordinates showing the position of the bag. The modem provides the output specification, but sends the required data to the mobile at the end of the suitcase / bag position. When the mobile at the other end. When an unauthorized person tries to open the lock GSM and GPS will ON and the GSM module will for the request such as location or change the mobile number of any other unauthorized activity [8]. Now, if any of these requests are invalid then again, the GSM will wait for the request.

If the request is valid then the GPS will ON and will track the location of the suitcase and sends the request. Once the request is received the tracked data will be sent to the GSM module and the data will be sent to the registered mobile owner. The data that is been received by the GSM module will be saved on the SD card or the memory card and will store the data until it is erased by some external activities [11] [12].

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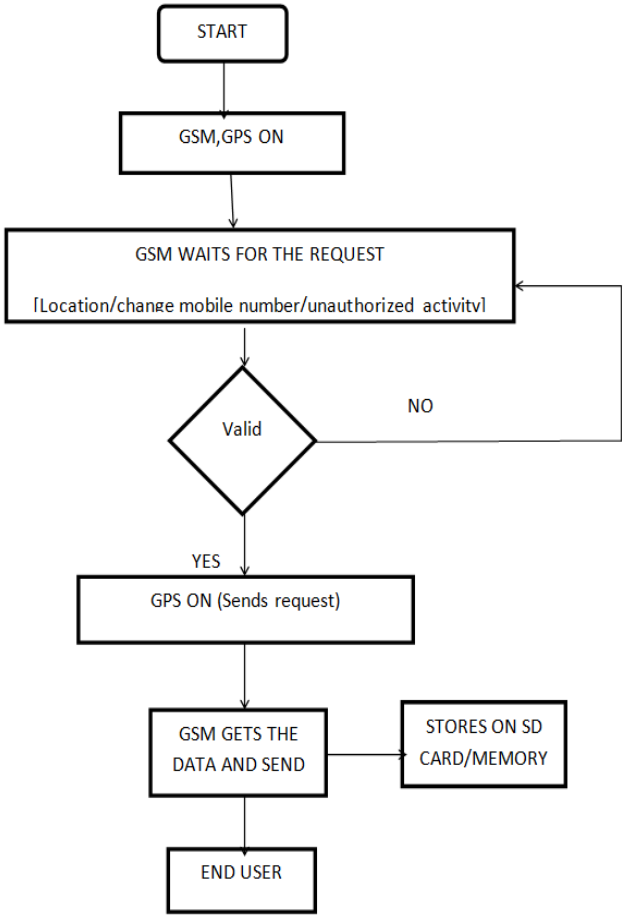

Fig 3: Flowchart of GPS and GSM module Of the system.

E. Servo motor:

A servomotor is a rotating actuator or linear actuator enabling effective control of angular or linear position, speed and acceleration. It consists of an appropriate motor coupled with a sensor for feedback on the position. It also requires a relatively sophisticated controller, although it requires a dedicated module specifically designed for servomotor use. Servomotors were not a specific motor class, although the term servo motor is often used to refer to an appropriate motor for use in a closed loop system. In applications such as robotics, CNC machinery or automated production, they are used [9]. A servomotor is a closed servo loop mechanism that controls its movement as well as final position using position feedback. The input to the control of the output shaft is a signal representing the commanded position. The engine is combined with some type of converter for positioning, speed feedback. Only the position is measured in the simplest case. The output's measured position is compared with the command position, the controller's external input. If the output position varies from that needed, an error signal is generated which further causes the motor to rotate in other direction, as required to bring the output shaft to the appropriate position. As the positions reach, the error signal decreases to zero and the motor stops.

IV. METHODOLOGY

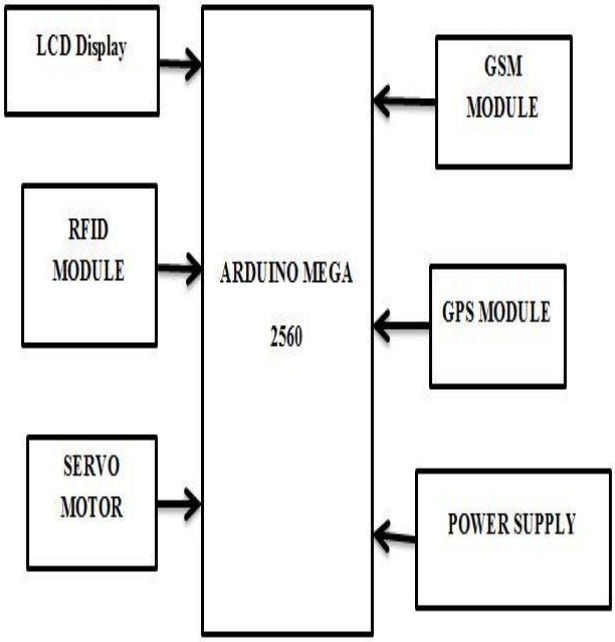

Fig 4: Block diagram of complete system

In this paper, it is proposed to develop a system for tracking and positioning any suitcase / bag using Global Positioning System and Global System for mobile communication. In this device, Arduino mega 2560 microcontroller is used to attach with various hardware peripherals. To do that, an Arduino mega microcontroller is combined together serially into a GSM Modem and GPS Receiver [2]. A GSM modem is used to send from a distant location, latitude and longitude the suitcase / bag position. This modem will provide the data regularly in the form of geographical coordinates indicating the suitcase / bag position. The modem provides as output many parameters, but only the required data from where the suitcase / bag position is required will be sent to the mobile at the other end. When the request is made the user is sent to the modem number, the system automatically sends a return response to the mobile, indicating the latitude and longitude of the suitcase/bag in terms of latitude and longitude [4]. Since the project includes the positioning and navigation system, the microcontroller, GPS receiver, GSM modem can be used to locate the luggage bag around the globe. Arduino mega 2560 is a micro controller. The code is written in Arduino mega 2560's internal memory, which is read only by using the instruction set, processes the instructions and acts as an interface between GSM and GPS with the help of Arduino mega 2560 [8]. GPS can only broadcast the data and the data can be transmitted and received by GSM. The system used the RFID module in practice consists of readers and tags. The reader is installed in the baggage lock system. The tags and any of their own properties are attached to the ID cards which include barcodes. In this device, Arduino mega 2560 microcontroller is used to attach with various hardware peripherals.

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For doing so an Arduino mega microcontroller is interfaced with the RFID module in order to perform the locking and unlocking mechanism [12]. A servo motor is connected to the Arduino mega 2560 to help the RFID reader to lock and unlock the baggage. Servos are controlled through the control wire by sending a variable width or pulse width (PWM) electrical pulse. For a total of 180 ° movement, a servo motor can normally turn 90 ° in either direction. The servo moves up when waving the RFID key in front of the coil. The servo motor will turn 90° in either direction according to which the lock mechanism takes place [10]. In order to switch on the Arduino mega 2560 microcontroller, we required power supply. Here, we use 5 volts battery which can charge and discharged. We can also place a thin sheet of solar panel which can charge the power bank and help the device to store the energy. The thin layer of solar panel is fixed to the suitcase/bag which can be folded once the charging is full. This helps the device to power up.

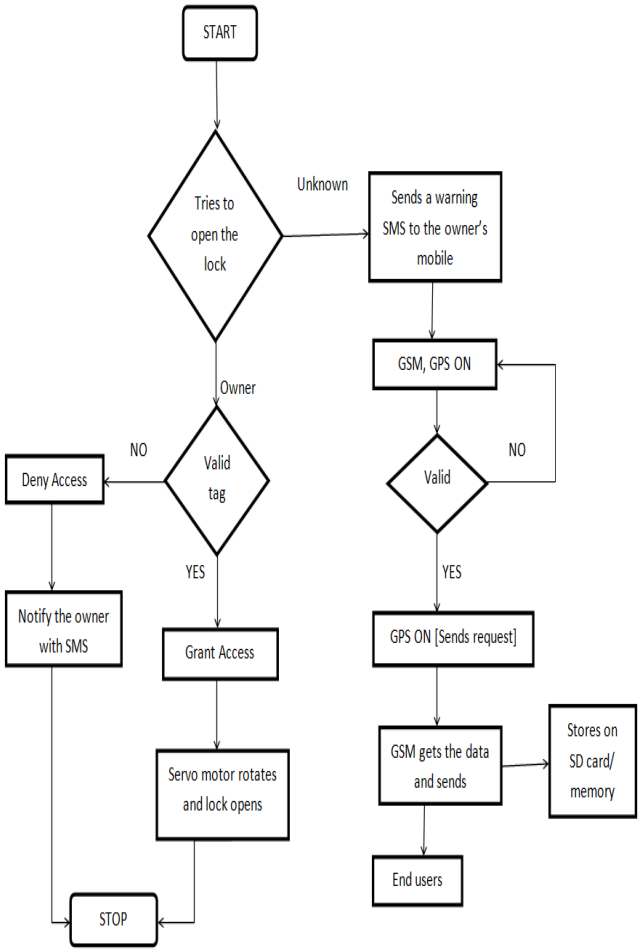

Fig 5: Flow chart diagram of complete system

From Fig 5, we can clearly see how the system works. When the person tries to open the lock of the bag, if it is some unknown person then they will try to open the lock by some other means such as hammer, blade, hack-saw etc. A warning message will then be sent to the registered mobile number by the GSM module. Then the GPS module will ON and checks whether the selection option is correct or not. If is not valid, then again it will check the possibility of the selecting the options [2]. When the suitcase owner tries to open the lock of the suitcase by placing the RFID tag near the reader which scan the serial number or the bar code present on the tag. If it is a valid one, then the GPS module will send a request to find the location and then the GSM module will collect the data from the GPS module and transfers it to the registered mobile number [5]. The collected data will be stored in the SD card or the memory of the GMS module. If the used tag is a valid tag, then the system will grant access to the user to open the lock. On the other hand, if the tag is not valid, then the system will deny or cancel the access and will notify the user with a text message and the stops. Now, if the access is granted and some guest user needs to access the lock of a suitcase, then the user will be notified with a text message and stops [11]. Finally, when some unknown person wants to access the lock the system stops, and execution and the GPS and GSM modules will track and locate the position of the suitcase the sends a text message to the registered mobile.

V. TESTING RESULTS

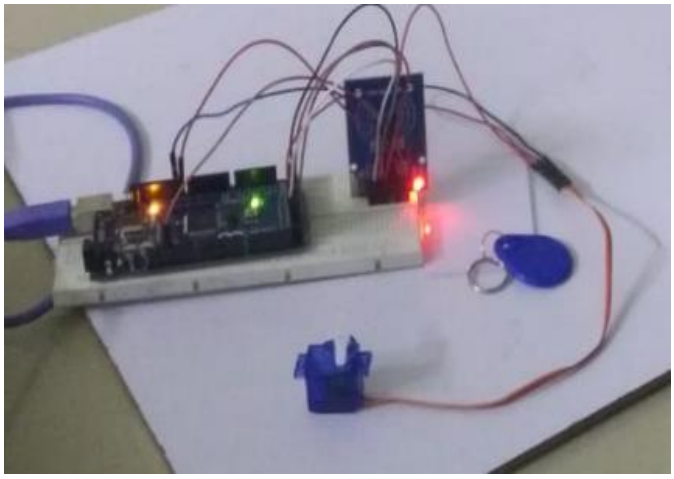

Fig 6: Interfacing of the RFID module

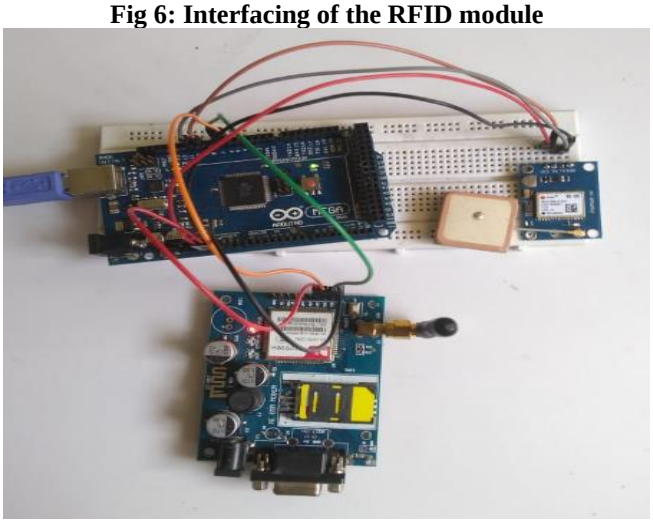

Fig 7: Interfacing of the GPPS and GSM module.

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-------------
Lat/Long(10^-5 deg): 16450572, 80617801 Fix age: 38ms.
Lat/Long(float): 16.45057, 80.61780 Fix age: 56ms.
Date(ddmmyy): 120319 Time(hhmmsscc): 3191300 Fix age: 129ms.
Date: 3/12/2019  Time: 11:19:13.0 UTC +08:00 Malaysia  Fix age: 194ms.
Alt(cm): 999999999 Course(10^-2 deg): 0 Speed(10^-2 knots): 36
Alt(float): 1000000.00 Course(float): 0.00
Speed(knots): 0.36 (mph): 0.41 (mps): 0.19 (kmph): 0.67
Stats: characters: 9611 sentences: 41 failed checksum: 10
-------------
```

Fig 8a: Data received from the GPS.

```
Acquired Data
-------------
Lat/Long(10^-5 deg): 16450628, 80617796 Fix age: 37ms.
Lat/Long(float): 16.45063, 80.61779 Fix age: 56ms.
Date(ddmmyy): 120319 Time(hhmmsscc): 3192300 Fix age: 128ms.
Date: 3/12/2019  Time: 11:19:23.0 UTC +08:00 Malaysia  Fix age: 192ms.
Alt(cm): 999999999 Course(10^-2 deg): 0 Speed(10^-2 knots): 22
Alt(float): 1000000.00 Course(float): 0.00
Speed(knots): 0.22 (mph): 0.25 (mps): 0.11 (kmph): 0.41
Stats: characters: 10945 sentences: 51 failed checksum: 10
-------------

Acquired Data
-------------
Lat/Long(10^-5 deg): 16450630, 80617796 Fix age: 38ms.
Lat/Long(float): 16.45063, 80.61779 Fix age: 57ms.
Date(ddmmyy): 120319 Time(hhmmsscc): 3192400 Fix age: 129ms.
Date: 3/12/2019  Time: 11:19:24.0 UTC +08:00 Malaysia  Fix age: 194ms.
Alt(cm): 999999999 Course(10^-2 deg): 0 Speed(10^-2 knots): 11
Alt(float): 1000000.00 Course(float): 0.00
Speed(knots): 0.11 (mph): 0.13 (mps): 0.06 (kmph): 0.20
Stats: characters: 11078 sentences: 52 failed checksum: 10
-------------
```

Fig 8b: Data received from the GPS.

```
GSM SIM900A BEGIN
Enter character for control option:
h : to disconnect a call
i : to receive a call
s : to send message
c : to make a call
e : to redial

Calling
Hangup Call
Calling
Hangup Call
Calling
```

Fig 9: working progress of the GSM module.

In the Fig 10, you will send a short message to the registered mobile number. If the bag is lost, the GPS module will check the location of the bag. In terms of geographical coordinates, the location of the bag is sent.

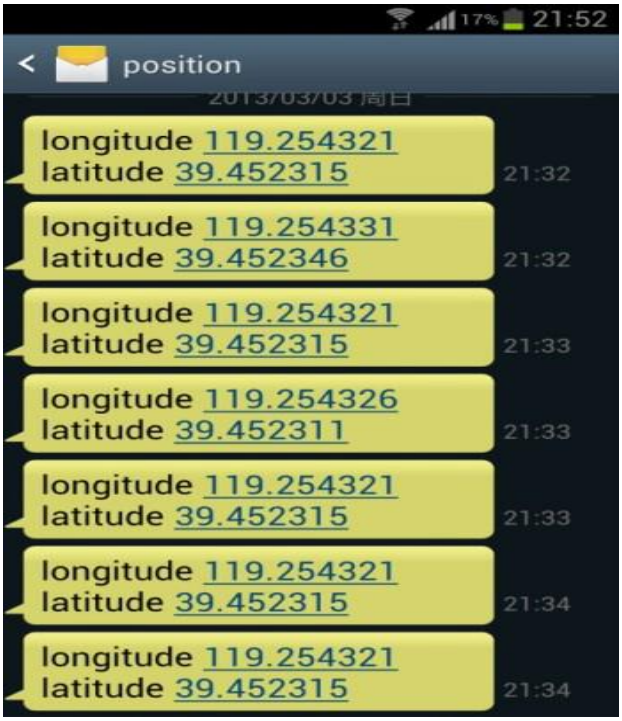

Fig 10: Short message displaying screen

VI. CONCLUSION AND FUTUE SCOPE

In this paper, a receptacle tracking and locking system based on interactive RFID and GPS was proposed. An anti-theft security system can be installed in the baggage easily.

Using this security system, access to the suitcase lock is too difficult for an unknown person. The experiment is designed to create a low - cost and excellent baggage control system that uses the power supply of the baggage control system. It can be added very low, not only this but also some additional features such as sensors for drug detection, sensors for bomb detection, etc. The future scope is for the system to be more stable and also for more scope to include the anti - hacking system.

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