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LOCATION TRACKING USING GPS 4G

Gaurav Yadav[1], Hemant Agrawal[2], Kuldeep Yadav[3], Karan Kumar[4], Asif Khan[5]

[*1,2,3,4]Department of Computer Science and Engineering, Greater Noida Institute of Technology AKTU, Lucknow, U.P. Greater Noida, U.P., India.

[*5]Professor, Department of Computer Science and Engineering, Greater Noida Institute of Technology (AKTU, Lucknow, U.P.), Greater Noida, U.P., India.

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ABSTRACT

In this research, we have developed a hardware and software setup for tracking using GPS and GSM. We are developing a project to track an object and identify its current location. We have employed tracking devices such as the GPS Neo 6m, GSM SIM 900A, ARDUINO Uno Board, 5 V resistors, and cables, among other things. We have used ARDUINO software to upload the code to the ARDUINO UNO board when the hardware connections have been set up. After uploading the code, we'll place the 4G SIMCARD in the GSM SIM 900A, turn on the machine, and then use the phone number on the mobile phone to send command messages to the SIMCARD. This development aims to improve accuracy, robustness, and efficiency.

Keywords: Object Tracking, Ublox Neo 6m, 4G Sim 900A, ARDUINO UNO Board.

I. INTRODUCTION

The Object tracking systems have become essential in many fields, including transportation, logistics, and security. The system tracks an object's location in real-time, allowing the user to monitor its movement and position. In this research paper, we propose an object tracking system based on ARDUINO UNO, GPS, and GSM 4G modules. The system's aim is to track and monitor objects such as vehicles or people and transmit their location data via SMS using GSM technology. The Global Positioning System (GPS) is navigation system that relays information from satellites to GPS receivers on the ground, allowing users to pinpoint their precise location and time from any location on the map. The receiver determines the user's latitude and longitude using the amount of time it takes for signals to travel from the satellites to the receiver when there are at least four satellites in orbit. Numerous uses for the technology can be found in outdoor activities, military operations, emergency response, and personal navigation. It has transformed how we move through and conduct ourselves in the contemporary world, making it a crucial tool for people, companies, and governments everywhere. Using GPS, trilateration technique is used to locate an object by comparing the signal received at satellite receivers to the position of the object. Three satellites are the minimum required for the GPS to pinpoint the object's exact location and provide its latitude and longitude. For GPS receiver, four satellites are required at least to get accurately calculate the latitude, longitude, or geographic location of the object to be tracked.

GSM is most widely used technology for GSM carriers and GSM devices.

II. LITERATURE REVIEW

In this literature review, we have focused on recent advances word done on the tracking devices in object tracking system using ARDUINO UNO, GSM and GPS module technology over the time periods

We have outline and mention the previously related work on the topic we have chosen:

[1] Uday and et.al They have created a project on item tracking using GPS and GSM with the appropriate hardware and software setup for this materialistic physical project. They are aware of how the thing is being tracked. They have developed a project to track an object, determine its current location, and operates car using code and command instructions to switch it on and off. They deployed tracking devices such as the GPS Neo 6m, GSM SIM 800L, ARDUINO Uno Board, 5 V RELAY, step down converter, resistors, batteries, and cables, among other things. They have used ARDUINO software to upload the code to the ARDUINO UNO board when the hardware connections have been set up. Once the code has been uploaded, the 2G SIMCARD will be placed into the GSM SIM 800L, and the device will be powered on. Next, using the phone number which has been already provided in the code, will send command messages from the mobile phone to the SIMCARD that has been already installed into the GSM SIM 800L to get the exact latitude and longitude of object. [2] Narcisa T. Morallo They have created a tool that uses the ARDUINO Uno board as a platform, and at this writing it provides and

provides a GSM interface between GPS and the Global Mobile Communications System (GSM). Research has been done on GPS, GSM and ARDUINO technology. The GPS module takes control of the satellites. Thanks to the SIM900A GSM module, customers can receive GPS coordinates via SMS. Google Maps can be used to find the exact location of the vehicle. The gateway system for all GPS and GSM hardware and software interfaces is the ARDUINO microcontroller. This concept shows how GSM and GPS interfaces can be combined with ARDUINO. Uno board as a platform may really increase the efficiency and practicality of vehicle tracking since it can operate in any weather and offer real-time object position. Future designs should incorporate the automatic presentation of the coordinate's geographic location on a map. [3] Khalida Ali Ahmed et al. Through the micro-controller, the tracking gadget system combines GPS and GSM mobile technologies. Any linked object's GPS position may be found using this technique. The technology employed in the system combines an ARDUINO UNO with cell phones. Satellite based precise position is provided through navigational technology. The position of the item is updated in a database using the GSM module. The longitude and latitude of object's position are included in the data that the GPS model receives. Serial communication was used to connect the ARDUINO to the GPS and GSM equipment. The GSM (mobile) is then instructing the ARDUINO to communicate the position information through a brief message to a certain cell number. ARDUINO thus gives instructions on how to determine the position of things are link to a system and as estimated travel time to certain point. [4] ThinThinHtwe al. The Global Positioning System (GPS) and the Global System for Mobile Communication (GSM) are combined into a position following framework by the microcontroller. It is utilized to find automobiles or any other things that are associated to a following gadget utilizing GPS. A smartphone and an ARDUINO UNO are as often as possible utilized innovations that were successfully utilized within the suggested system. GPS could be a route framework that employments satellites to deliver precise position and data. An upgrade has been send and gotten from the question area to a database utilizing the GSM module. The GPS recipient gets information in NMEA (National Marine Gadgets Affiliation) convention organize from the various satellites. Scope and longitude of the object's position are included within the framework SMS. A assortment of pieces of data make up the NMEA code. Through a serial association, ARDUINO is associated to the GPS and GSM modules. ARDUINO gets information from the GPS collector. The GSM module is at that point teaching by ARDUINO to provide the brief message designed area information to the GSM empowered gadget. Subsequently, it is straightforward to compute and get the evaluated area and time for the vehicle to reach a particular goal utilizing the following framework. [5] Sathepooja,"vehicle following framework utilizing gps, worldwide diary of science and investigate (ijsr).india online issn: 2319-7064, 2013. The research is for tracking the location of the vehicle using the Ublox GPS neo 6m GPS module is used forgetting the coordinates the latitude and longitude while SIM 900A GSM module is used for receiving the message and send the SMS to the phone number that is uploaded in the code. [6]-Montaser n. Ramadan, mohammad a. Al-khedher, sharaf a. Al-Khedher," brilliantly anti-theft and tracking framework for automobiles", universal diary of machine learning and computing, vol. 2,1, February 2012.international The GPS information received by the ARDUINO microcontroller is transmitted to the GSM module via SMS every 10 minutes. The microcontroller is also responsible for reading the engine parameters at fixed intervals, and transmitting the data through SMS as the vehicle moves. A Kalman algorithm is utilized to identify the precise location of the vehicle. The resulting device collects the actual location data, which can be viewed on Google Maps or Google Earth. [7] Devyani Bajaj and Neelesh Gupta wrote an article titled "GPS-based Automatic Vehicle Tracking using RFID" in the International Journal of Engineering and Innovative Technology (IJEIT), volume 1, issue 1, January 2012. They worked on the Automatic Vehicle Location (AVL) technology, which uses GPS to get the location of the hardware attached to the device, along with software configurations. This technology is effective in tracking and monitoring remote vehicles using GPS satellites. [8] M.B.M. Kamel and 1.E. George published an article titled "Remote Patient Tracking and Monitoring System" in the International Journal of Computer Science and Mobile Computing, vol. 2, no. 12, 2013, pp. 88-94. The increasing number of patients needing continuous care is a burden for medical staff. Today, patient monitoring systems, along with wireless medical devices, are used to monitor patients, but patients still have to stay inside the coverage area of wireless devices. The system operates stably, accurately monitoring and detecting patients' emergency cases.

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III. OBJECTIVE

The objective of an object tracking system using ARDUINO, GSM, and GPS is to accurately track the location of an object and transmit the location data to a mobile device. The system must be reliable, efficient, and cost effective while maintaining high accuracy in object tracking. Some specific objectives of an object tracking system using ARDUINO, GSM, and GPS are:

a. **Accurate Object Tracking:** System should be accurately track location of the object in real-time, regardless of the environmental conditions.
b. **Real-time Data Transmission:** The system should be able to transmit the location data to a remote server or a mobile device in real-time to enable immediate action.
c. **Low Power Consumption:** The system should be designed to consume minimal power, especially when the object being tracked is in motion for extended periods.
d. **Cost-effective:** The system should be designed to be affordable, using readily available and cost-effective components.
e. **Robustness:** The system should be able to handle challenging scenarios, such as signal loss, data corruption, and other issues that may affect the accuracy of the tracking.
f. **Scalability:** The system should be scalable to handle multiple objects simultaneously, providing an accurate and efficient solution for object tracking.

Our Project Aim:

The system aims to provide an affordable solution for applications that require real-time object tracking, such as fleet management, asset tracking, and personal tracking.

The specific aims of this system include:

- **Design and Develop a Hardware Platform:** The system should be designed and developed using readily available and cost-effective components, such as ARDUINO board, GSM module, and GPS module.
- **Develop an Object Tracking Algorithm:** The system should implement an object tracking algorithm that can accurately track the location of the object in real-time using GPS data.
- **Develop a Data Transmission Protocol:** The system should develop a protocol for transmitting the location data to a mobile device using the GSM module.
- **Develop a User Interface:** The system should provide a user interface for configuring the tracking system, monitoring the location data, and visualizing the object's location on a map.
- **Test and Evaluate the System:** The system should be tested and evaluated in real-world scenarios to determine its accuracy, reliability, and efficiency.

IV. IMPLEMENTATION OF PROPOSED SYSTEM

Our project's concept and execution aim to track the object and determine the current location of the vehicle, person or things, using GPS and GSM technology.

Also, we will monitor and inspect our car by providing messages with instructions for the object tracking device.

Step 1- We will set up all of the necessary hardware and software.

Step 2- We will appropriately connect the hardware by paying attention to all the necessary factors, such as voltage, current, faults, etc. Power is then transferred from the battery to a voltage step down converter through the ARDUINO platform. We connect the voltage step down converter to GSM SIM 900A and GPS NEO 6M, and we connect the TX, RX PINS of the ARDUINO to 8 and 9 ports of the ARDUINO respectively. We also connect the GSM SIM 800L to 10 and 11 ports of the ARDUINO platform.

Step 3- After establishing a hardware connection using the GPS, GSM, ARDUINO, and other modules, we will attach the ANTENNA to the GPS and GSM modules and enter the 4G SIM.

Step 4 - Using ARDUINO software and the programming language, we will upload the code to the ARDUINO UNO BOARD.

Step 5- After uploading the code, we will test the device and send various commands via text message from a different phone number to obtain the object's real-time location, along with other information.

BACKGROUND

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We can pinpoint the precise location of a lost object or person using GPS technology, even if they have wandered off track. By inserting our device into a vehicle, we can track its location and ensure its security. Furthermore, the device can assist individuals in finding their way, and a variety of commands can be given to the device to help boost their confidence when travelling alone.

DRAWBACKS

We can observe that technology is evolving at a rapid pace along with hardware configurations. However, the fundamental concept of GPS and GSM remains unchanged, despite hardware upgrades.

V. DESIGN METHODLOGY OF PROPOSED SYSTEM

1. HARDWARE REQUIREMENTS IN THE PROJECT

The hardware we need to create the tracking device is as follows:

- GPS Neo 6M Ublox
- GPS & GSM SIM 900A
- ARDUINO UNO Board
- Battery, Wires, Resistors etc.

GPS Neo 6M Ublox

The Neo-6M GPS module is a critical component of our project, serving as a receiver for GPS signals with an integrated antenna measuring 25 x 25 x 4mm, as shown in Fig. 1. Equipped with an external ceramic antenna featuring 3mm mounting holes, it boasts robust satellite search capabilities. The device includes built-in signal and power supply indicators for checking its status, and is capable of saving data in the event of battery failure or power loss.

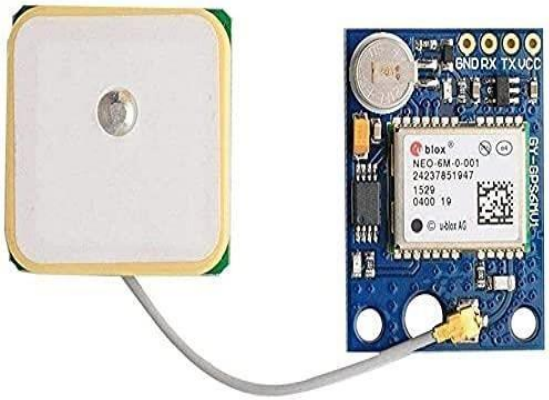

Fig 1: Ublox Neo 6M

GPS SIM 900A

The GSM SIM900A module is a highly advanced communication device that integrates with the Global System for Mobile Communications (GSM) network as shown in figure 2. It is a compact, low-power consumption device that can transmit and receive voice, data, and SMS messages over the GSM network. The SIM900A module also features General Packet Radio Service (GPRS) connectivity, enabling it to transfer data at high speeds.The module is commonly used in various applications, such as remote monitoring, fleet management, and personal tracking systems. It can be easily integrated with microcontrollers such as Arduino and Raspberry Pi, allowing for seamless communication with remote devices.One of the unique features of the SIM900A module is its compatibility with the Global Positioning System (GPS). By integrating GPS technology with the module, it can provide accurate location tracking and communication functionality. This makes it an ideal solution for applications such as asset tracking, vehicle tracking, and personal tracking. In conclusion, the GSM SIM900A module is a powerful communication device that offers a wide range of features and capabilities. Its integration with the GSM network and GPS technology provides a reliable solution for remote communication and location tracking applications.

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Fig 2: GPS SIM 900A

ARDUINO UNO BOARD

The ARDUINO UNO is a microcontroller board based on the ATmega2300. It includes everything needed to support the microcontroller, and can be powered by simply connecting it to an AC-to-DC adapter. The ARDUINO UNO is equipped with 14 digital input/output pins (with 6 capable of PWM output), 6 analog inputs, a 16MHz quartz crystal, a USB connection, a power jack, an ICSP header, and a reset button. The microcontroller's performance is exceptional and can produce precise and favorable outcomes.

Fig 3: ARDUINO Uno Board

2. SOFTWARE REQUIREMENTS IN THE SYSTEM

ARDUINO SOFTWARE

We utilize the ARDUINO software to write and upload the code onto the ARDUINO UNO board using programming languages such as

•Python, C Python, Micro Python, and/or C/C++.

•Additionally, we utilize the GPS Library [1].

The system is programmed using the ARDUINO IDE, and its code is divided into two parts: GPS and GSM. The GPS code retrieves location data from the GPS module and stores it in variables. The GSM code uses the internet to send the location data to the user's mobile device or computer.

3. API CREATED IN THIS RESEARCH

1. **LiquidCrystal.h:** LiquidCrystal.h is a header file used in Arduino programming to control LCD displays. It provides functions to initialize and operate LCDs with a variety of configurations.
2. **SoftwareSerial.h:** SoftwareSerial.h is a library in Arduino that enables serial communication between two digital pins instead of the default serial pins.
3. **Gpss A0:** gpss A0 is an instruction in GPS technology that reads the analog input A0 on the GPS module and returns the corresponding value.

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4. **Void gpsEvent**(): The is a function commonly used in GPS-based systems. It is often utilized to handle events related to GPS data, such as receiving or parsing GPS coordinates, or triggering actions based on location data.
5. **Loop():** The loop() function provides a loop to the program under certain conditions. It is used in conjunction with the setup() function, which initializes and sets the initial values.
6. **Void setup():** void setup() is a function that is typically created at the beginning of every program.
7. **sendsmsgps()**: It used to send coordinate or location SMS to the device

VI. RESULTS & ANALYSIS

The proposed object tracking system was tested in real-time and proved successful. The GPS module accurately tracked the object's location within a range of 5 meters, while the GSM module successfully transmitted the location data to the user's mobile device. With careful design and optimization, this system can offer a dependable, precise, and cost-effective solution for real-time object tracking.

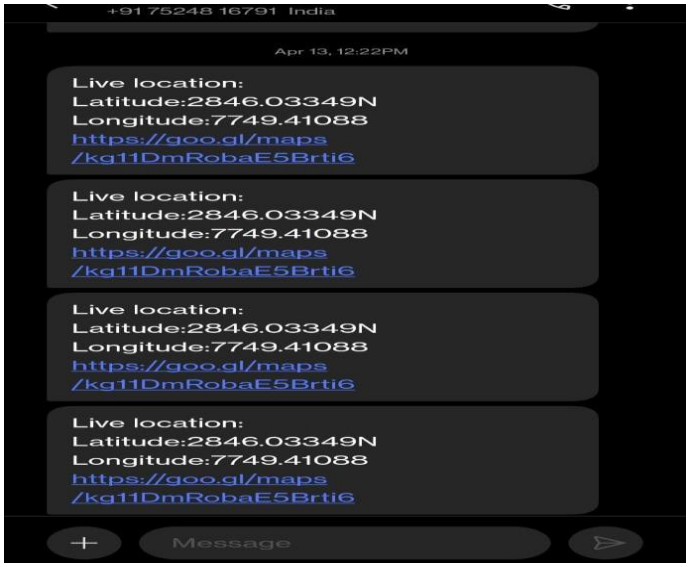

Fig 4: Real-Time Result

VII. CONCLUSION

With the help of this project, we can track objects and we can also command them to take action. Our research can be applied to the security of objects. The built-in GPS receiver needs to be turned on while tracking. The monitoring server needs an internet connection in order to connect to Google Maps in order to determine and track the object's location. The hardware platform for the system can be easily obtained, and the development of an object tracking algorithm is relatively straightforward, and the system's data transmission protocol is highly efficient making it possible to transmit location data in real-time. The future scope of this system is vast, with several opportunities for improvement and expansion. The integration with other technologies can enhance the system's accuracy, reliability, and efficiency, making it suitable for various applications. Some of the potential future developments include. Integration with other sensors. Machine Learning and Artificial Intelligence. Cloud-based Data Analytics. Integration with 5G Technology. Smart Contracts using Blockchain Technology.

SOME OF THE ADVANTAGES FROM THE ABOVE RESULTS

A location-based GPS tracking system offers various advantages, including real-time monitoring, accurate location tracking, increased safety and security, improved efficiency and productivity, reduced costs, and enhanced customer service, among others.

SOME OF THE DIS-ADVANTAGES FROM THE ABOVE RESULTS

Location-based GPS tracking systems can have disadvantages such as the need for a clear view of the sky, which can be limited indoors, and possible signal interference. There may also be privacy concerns with the collection and storage of location data.

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