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SMS based IoT Key Finder using GPS and GSM Integration

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***Abstract*: In this age of connected devices, IoT has become a game-changer with applications in various fields. In this paper, we will introduce an innovative solution that solves the common problem of finding lost or misplaced things, with a particular emphasis on keys. The proposed system combines GPS and GSM technologies to track and retrieve lost keys in real-time. The compact GPS module provides precise location information, so that no matter where the device is located, it can be tracked. The integrated GSM technology makes it easy for the device to communicate with your smartphone. When you lose your keys, you can send SMS to your IoT Key Finder and it will send your current GPS coordinates via GSM to your smartphone.**

***Keywords*: IoT key finder, GPS and GSM integration, location tracking, SMS based.**

1. Introduction

Innovative solutions to everyday problems have been made possible by the Internet of Things' (IoT) explosive expansion. One such difficulty is the recurring issue of losing keys, which causes stress and trouble in our hectic schedules. In response, we provide our suggested solution, which offers a sophisticated Internet of Things (IoT) key finder that smoothly combines GSM and GPS technology. An effective and dependable method of tracking and recovering misplaced keys is what this integration attempts to offer.

IoT Key Finder solves a daily problem faced by people all over the world. Misplaced keys can be a source of annoyance and delays in our everyday routines. Conventional approaches for key tracking, such memory recall or manual searches, frequently don't work. Our solution takes advantage of the Internet of Things to enhance key tracking and retrieval, realizing this goal.

With the integration of GPS and GSM technologies, the IoT Key Finder provides a reliable way to locate and recover misplaced keys. This system stands out in part because it uses Short Message Service (SMS) to tell consumers where their keys are in real time. This novel method guarantees usability and accessibility even in situations where a specific mobile application might not be available.

2. Literature Review

A. Introduction to IoT in Key Finder Systems

An introduction to Internet of Things (IoT) in key finder systems gives a basic grasp of how IoT has transformed the idea of tracking and finding personal goods. IoT offers a seamless integration of wireless technology, sensors, and connections in the context of key finder systems, improving the effectiveness and capabilities of conventional key finding solutions. Key finders give consumers an advanced and linked method of monitoring their important possessions by utilizing Internet of Things concepts to become smarter, more responsive, and able to communicate in real-time. The context for investigating the particular use of IoT in the context of an SMS-based key finder system with GPS and GSM integration is established by this introduction.

B. Key Finder Technologies

1) RFID (Radio-Frequency Identification)

- RFID technology utilizes radio waves to identify and track objects equipped with RFID tags.
- In key finder systems, an RFID tag is attached to the key, and a reader device emits radio waves to locate the tagged item.

2) Bluetooth-based Key Finders

- Bluetooth-enabled key finders use the Bluetooth Low Energy (BLE) protocol for communication.
- Users connect their smartphones to a small Bluetooth tag attached to the key. The smartphone app then helps locate the key within the Bluetooth range.

3) GPS (Global Positioning System)

- GPS technology relies on satellite signals to determine the real-time geographical location of an object.
- GPS-based key finders provide accurate location information, often accessible through a mobile app or web interface.

4) Wi-Fi Tracking Devices

- Some key finders leverage Wi-Fi networks to determine the location of the tagged item.
- These devices can triangulate the position based on nearby Wi-Fi signals and provide location data.

C. Limitations of Current Solutions that SMS-based IoT Key Finder Aims to Address

1) Dependency on Bluetooth Range

While many key finders on the market now rely on Bluetooth connectivity, their actual range is only a few tens of meters. By

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using GSM for communication, the SMS-based IoT Key Finder seeks to offer a wider and more adaptable range, enabling users to find their keys even when they are outside of Bluetooth range.

2) Smartphone Dependency

Many times, Bluetooth-based key finders need a smartphone that is coupled with a tracking app. By using SMS connectivity, the SMS-based IoT Key Finder seeks to eliminate reliance on smartphones and makes it available to users without smartphones or in scenarios where smartphones are not easily accessible.

3) Privacy and Security Issues

Certain key finders could cause users to worry about their privacy, particularly if they use cloud-based services or ongoing tracking. By using SMS communication for location updates, the SMS-based IoT Key Finder seeks to solve privacy issues by perhaps reducing data exposure and offering a more secure communication channel.

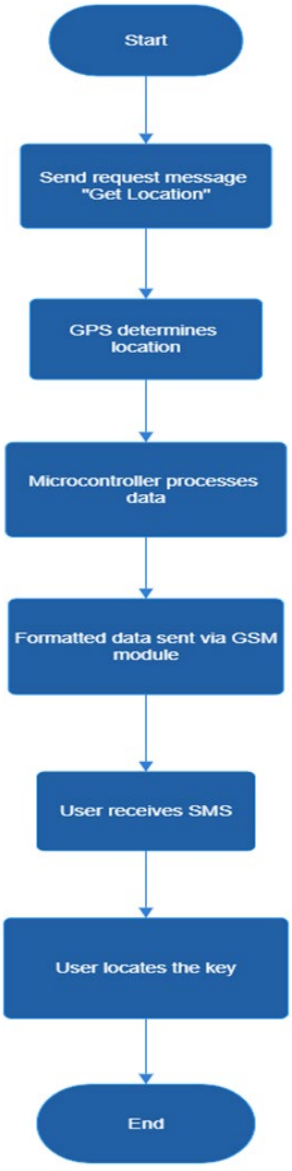

Fig. 1. Flow diagram

3. Materials and Methods

The hardware and software required for an IoT Key Finder using GPS and GSM Integration are listed below:

A. Hardware

- u-blox NEO-6M GPS Module
- ESP8266MOD
- SIM900A
- SIM Card
- Female to Female cables

B. Software

- Arduino IDE
- SMS (Short Message Service)

The user is instructed to initiate a request message to the phone number associated with the u-blox NEO-6M GPS (Global Positioning System) module. Subsequently, the GPS module determines the location upon receiving the request message. To triangulate the key's position, the GPS module necessitates signals from a minimum of three GPS satellites, analysing their time delay.

The ESP8266MOD microcontroller, serving as the central processing unit of this project, orchestrates the interactions among the GPS module, GSM module, and other components. It undertakes the processing of data obtained from the GPS module, formats the information, and dispatches it through the GSM module in the form of Short Message Service (SMS) messages.

The GPS information extracted is structured in the format:

*$GPGGA,181908.00,3404.7041778,N,07044.3966270, W,4,13,1.00,495.144,M,29.200,M,0.10,0000*40*

Where,

- GP represent that it is a GPS position (GL would denote GLONASS).
- 181908.00 is the time stamp: UTC time in hours, minutes and seconds.
- 3404.7041778 is the latitude in the DDMM.MMMMM format. Decimal places are variable.
- N denotes north latitude.
- 07044.3966270 is the longitude in the DDDMM.MMMMM format. Decimal places are variable.
- W denotes west longitude.
- 4 denotes the Quality Indicator:
- 1 = Uncorrected coordinate
- 2 = Differentially correct coordinate (e.g., WAAS, DGPS)
- 4 = RTK Fix coordinate (centimetre precision)
- 5 = RTK Float (decimetre precision.
- 13 denotes number of satellites used in the coordinate.
- 1.0 denotes the HDOP (horizontal dilution of precision).

- 495.144 denotes altitude of the antenna.
- M denotes units of altitude (e.g. Meters or Feet)
- 29.200 denotes the geoidal separation (subtract this from the altitude of the antenna to arrive at the Height Above Ellipsoid (HAE).
- M denotes the units used by the geoidal separation.
- 1.0 denotes the age of the correction (if any).
- 0000 denotes the correction station ID (if any).
- *40 denotes the checksum

To enhance user comprehension, only crucial data, specifically latitude and longitude, are included in the formatted information. The SIM900A GSM (Global System for Mobile Communications) module facilitates communication between the key finder device and the user's mobile phone via SMS. Consequently, the user receives an SMS containing latitude and longitude data along with a Google Map link to the respective location. Clicking on the Google Map link directs the user to the exact location of the key on the map. The SMS, containing this information, is transmitted to the user every 5 seconds, enabling real-time tracking of the key.

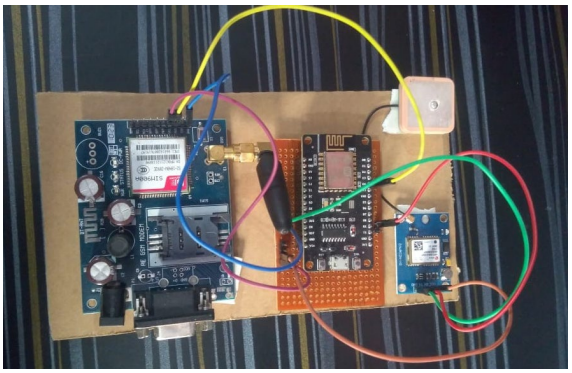

Fig. 2. Circuit and hardware model

4. Results and Discussions

The user can locate the keys by using the latitude and longitude information found in the reply SMS that they got. To find the key, the user only needs to click on the link to the Google Map. The user will continue to receive SMSs unless they request to cease doing so. To achieve this, they can send a "STOP" message.

While it overcomes some of the drawbacks of conventional key finders, an SMS-based IoT key finder with GPS and GSM integration has drawbacks of its own. Due of the dependence on SMS connection, one significant drawback is the possible lag in location updates. Delays in SMS messages might reduce the accuracy of real-time tracking. Environmental variables like dense foliage or steep buildings can also impair the accuracy of GPS data, resulting in less accurate position information. Additionally, the reliance on cellular networks limits the system's efficacy in isolated or poorly connected areas by raising worries about coverage in those areas. Optimizing the performance of an SMS-based IoT Key Finder with GPS and GSM integration requires balancing the trade-offs between real-time tracking, precision, and network coverage.

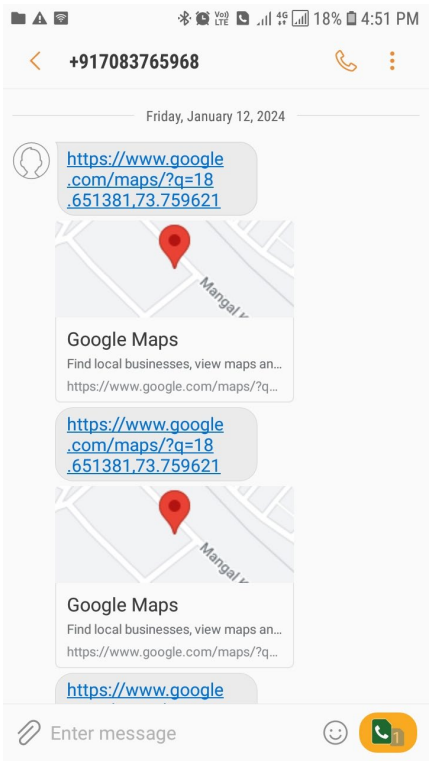

Fig. 3. SMS screenshot

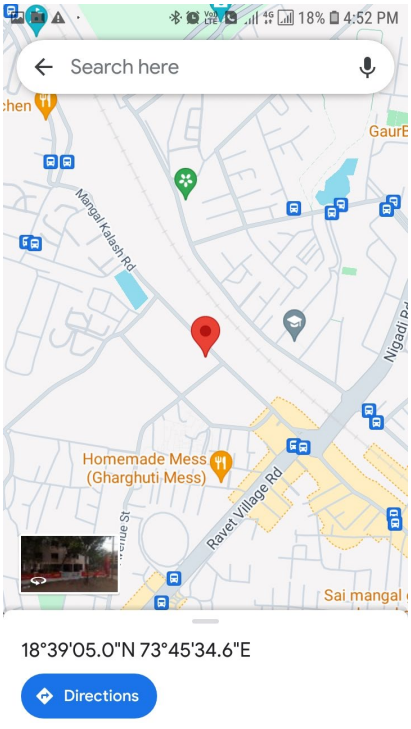

Fig. 4. Google map screenshot

5. Future Scope

The future of the SMS based IoT Key Finder with GPS & GSM integration has huge potential for further development and wide application. As technology advances, there is a chance to integrate machine learning algorithms to improve predictive tracking capabilities. The system will be able to learn user behavioral patterns and anticipate key misplacement.

Improvements in energy efficient hardware and low power communication protocols could extend battery life and reduce frequent maintenance. Integrating more advanced geofencing capabilities and seamless integration into smart home ecosystems could expand the scope of the IoT Key Finder. Exploring collaboration with emergency services/law enforcement agencies could improve the device's security functionalities and make it a valuable personal safety tool.

As IoT ecosystems continue to grow, the SMS based key finder will become an essential part of the connected living ecosystem, providing users with a dependable, easy to use, intelligent solution for finding their belongings in different environments.

6. Conclusion

To sum up, the SMS based IoT Key Finder, which integrates GPS and GSM technology, is a major step forward in overcoming the shortcomings of the current key finders. By combining GSM communication and GPS real-time tracking, the system provides users with a wider and more versatile range, breaking away from the limitations of Bluetooth-based solutions. The removal of smartphone dependency improves accessibility, allowing users to find their keys even when they are not connected to a paired device. The key finder is designed to optimize power consumption and extend battery life, providing continuous and reliable tracking capabilities. Integrating SMS communication not only improves privacy and security, but also makes the setup process easier and more user-friendly. Balancing functionality with affordability, this solution offers an affordable and effective approach to key finding that meets the diverse needs of different users in different situations. The SMS- based IoT Key Finder stands out as a reliable and robust solution in the world of IoT key tracking systems.

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