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Raspberry Pi-Based Vehicle Tracking Security System

Abhishek Jadhav, Ajay Babar, Manoj Raut, Mayur Shinde, Dr.P.G. Vispute

BE Students, Dept. of E&TC, Amruta Vaishnavi Education & Welfare Trust's Shatabdi Institute of Engineering & Research Center, Nashik, India

Assistant Professor, Dept. of E& TC, Amruta Vaishnavi Education & Welfare Trust's Shatabdi Institute of Engineering & Research Center, Nashik, India

ABSTRACT: The emerging technological innovations, users are looking for automotive system than the manually operated system. As the number of vehicle users increased, the number of accidents and thefts are increasing. Due to a convergence of multiple technologies usage of Internet evolved in the field of networking, which helps objects to be sensed and controlled remotely. Pi based Embedded System for Vehicle Monitoring, tracking and controlling over internet uses mobile or computer device to monitor, track, and control the vehicle. It can provide tele-monitoring system for intercity transportation vehicles. This system is integrated with GPS and GSM to provide features like Location information and Real time tracking using SMS. The vehicular module is used to track, observer, and investigation and finds the accident place and intimate to the monitoring station. The proposed design provides information regarding vehicle Identity, speed, and position on real time basis. This information is together by the RASPBERRY PI by using different section and dispatch it to the observing station where it stores the information in database and display it on graphical user interface (GUI) that is user friendly. This system implemented for real time ambulance tracking system. If Ambulance get damaged at anywhere on its route, then our system will send message to its nearby hospitals.

KEYWORDS: Raspberry pi kit, GSM (Global System for Mobile communication), GPS (Global Positioning System), Memory card, SIM, Embedded system.

I. INTRODUCTION

The Raspberry Pi based vehicle tracking system is a cutting-edge solution that combines advanced hardware and software technologies to provide real-time tracking and monitoring of vehicles. It utilizes a compact and powerful single-board computer, the Raspberry Pi, as the central control unit, along with a GPS module, a GSM module, and a camera module to capture images of intruders or suspicious activities. The system is designed to be installed in vehicles, allowing owners and fleet managers to track their movement and location, as well as detect any unauthorized access or theft attempts. The GPS module provides accurate and reliable location data, which is transmitted to a remote server using the GSM module, enabling real-time monitoring of the vehicle's movement and status. In addition to location tracking, the system also has a camera module that can capture images of intruders or suspicious activities. When triggered by an SMS command sent to the GSM module, the camera module takes photos of the vehicle's surroundings and sends them to a remote location for further analysis and action. The system can be easily controlled and configured using SMS commands, allowing vehicle owners or fleet managers to remotely access and manage the system from anywhere in the world. This includes features such as setting up geofencing alerts, defining safe zones and no-go areas, and triggering the camera module to capture photos of intruders or suspicious activities. One of the most useful features of the system is the ability to capture photos on demand. When the vehicle owner sends an SMS command to trigger the camera, the Pi camera takes a photo of the vehicle's surroundings and sends it to the owner along with a Google Maps link that shows the current location of the vehicle. This feature is particularly useful in case of theft or damage to the vehicle, as it allows the owner to assess the situation and take appropriate action quickly and easily. The Raspberry Pi based vehicle tracking system offers a cost-effective and reliable solution for tracking the location of vehicles and monitoring suspicious activities. It is ideal for fleet managers who need to manage and monitor their vehicle fleets, as well as vehicle owners who want to ensure the security of their vehicles. Additionally, the system can be customized and integrated with other technologies.

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II. RELATED WORK

This is the user interface for the system. The user can use a mobile phone to send SMS commands to the vehicle. The smartphone is connected to the cellular network, which is used to send and receive SMS messages. The user can use a mobile app or a web interface to send commands to the vehicle to get the location core ordinates or to initiate image capture using the Pi camera. This component allows the Raspberry Pi to communicate with the outside world using cellular networks. The GSM module is a wireless modem that can send and receive SMS messages. It is connected to the Raspberry Pi via a serial interface. When it receives an SMS message from the smartphone, it passes it on to the Raspberry Pi. The GSM module can also send SMS messages to the smartphone to provide status updates or alerts. The module is powered by the vehicle's battery, and it is usually located near the Raspberry Pi. This is the brain of the system. It receives commands from the smartphone via the GSM module and controls the vehicle's movement. The Raspberry Pi is a small, low-cost, credit card-sized computer that runs Linux. It is connected to the GSM module via a serial interface and to the Pi camera via a CSI (Camera Serial Interface) bus. The Raspberry Pi runs software that interprets the SMS commands, controls the GPIO (General Purpose Input/Output) pins to move the vehicle, and captures images using the Pi camera. The Raspberry Pi also communicates with the GPS module to get the current location of the vehicle. This component provides location information to the Raspberry Pi. The GPS module is a small device that can receive signals from GPS (Global Positioning System) satellites. It is connected to the Raspberry Pi via a serial interface. The GPS module continuously tracks the vehicle's position and sends the coordinates to the Raspberry Pi. The Raspberry Pi can use this information to update the vehicle's location on a map or to perform other location-based tasks. The GPS module is powered by the vehicle's battery, and it is usually located near the Raspberry Pi. This component is used to capture images of the vehicle's surroundings. The Pi camera is connected to the Raspberry Pi via a CSI bus. The camera is controlled by software running on the Raspberry Pi, which can initiate image capture, adjust camera settings, and process the images. The images are transmitted to the smartphone via the GSM module and can be viewed by the user.

III. PROPOSED ALGORITHM

The first step is to install an operating system onto the device using a boot device. In our case, we will be using a micro-SD card to perform this task. To begin, we need to download the Raspberry Pi Imager tool from the official website of Raspberry Pi. Then, we can insert the memory card into a card reader on our computer. Next, launch the Raspberry Pi Imager tool and select the appropriate operating system. For our project, we will be using the recommended 32-bit Raspberry Pi OS. Once the operating system is selected, press CTRL + Shift + X to access the settings menu. Click on 'Choose Storage' to select the memory card from the list of options. A new menu will appear where you can rename your device by toggling the 'Set Hostname' feature. If you prefer to keep the name as "raspberry pi," you may skip this step. Also, ensure that the 'Enable SSH' feature is toggled on, and set the username to "pi" and the password to "raspberry" by scrolling down the menu. Upon completing the steps, it is imperative to configure the wireless LAN settings. To achieve this, locate the 'Configure Wireless LAN' option in the settings menu and enter your Wi-Fi network credentials. This will enable the Raspberry Pi to connect to your wireless network and allow remote access to the device from a connected PC. Save the changes made and click on the 'Write' button to write the operating system onto the micro-SD card. The process may take a few minutes. After the operating system is written onto the SD card, remove it from the computer and insert it into the Raspberry Pi. Connect the device to a power source using a micro-USB cable. A red and green LED light should illuminate on the Raspberry Pi, indicating that the SD card is correctly connected to the device. To remotely access the Raspberry Pi, you will need to download and install three software applications: Advanced IScanner, puTTY, and VNC viewer. Once installed, open the Advanced IScanner and select the 'Scan' option to identify devices connected to your Wi-Fi network. Look for the 'raspberry pi' device in the list of identified devices and copy its IP address. This IP address will be used to access the Raspberry Pi remotely. After that, proceed to launch the puTTY software on your PC. Paste the previously copied IP address of the 'raspberry pi' device into the application and click the 'Open' button. Upon being prompted, allow access to the device. This will open a command window, and the system will prompt you to login. Use 'pi' as the username and 'raspberry pi' as the password to log in successfully. After logging in, enter the command 'sudo raspi-config' at the prompt. This will open the Raspberry Pi configuration app. From here, select 'Interfacing Options' (number 5 on the list) and then select 'VNC' (number 3 on the menu). Next, select 'Yes' and hit 'Enter' to confirm that the VNC server is enabled. Finally, select 'Finish.' Next, download and install the VNC Viewer application on your PC. Launch the application and enter the IP address of the Raspberry Pi that was copied earlier into the 'Enter a VNC Server Address' bar. If prompted, click 'OK' to acknowledge any security warnings. Finally, enter the Pi's username and password when prompted. Once

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authenticated, the Raspberry Pi desktop will appear in a window on your main computer's desktop. From here, you can control everything on the Raspberry Pi.

IV. APPLICATION

1. Vehicle tracking and management: It helps in monitoring and managing the location, speed, and status of the vehicle in real-time. This can be useful for fleet management, logistics, and transportation companies.
2. Security and surveillance: The camera module in the system can capture photos of any unauthorized access or theft attempts. This can help in identifying the intruder and taking necessary actions.
3. Emergency services: In case of an emergency, the GPS technology can help locate the vehicle and provide the necessary assistance.
4. Personal tracking: The system can also be used for personal tracking of individuals, such as elderly or children, for safety and security purposes.
5. Agriculture and farming: The system can be used for tracking and managing the agricultural vehicles and equipment in the fields.

V. CONCLUSION

Thus, we have developed a Vehicle Tracking System using GPS, GSM, and Camera Module which is an efficient and reliable way to track the location of a vehicle and capture any intruders. The project successfully met its objectives of studying and investigating the basic operation of the GPS module, designing and developing the GPS/GSM tracking system, and coming up with a hardware GPS/GSM tracking system. The system has various applications in fleet management, logistics, and security, making it a useful tool for businesses and individuals alike. The advantages of the system include real-time tracking, remote monitoring, and instant notifications, enhancing safety and security measures. Overall, this project provides a valuable solution for vehicle tracking and security needs.

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