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Abstract

This project presents a novel approach to vehicle security and monitoring, leveraging advancements in embedded systems and artificial intelligence. The proposed system integrates a GPS tracker, a SIM card, and advanced facial recognition technology to provide real-time vehicle location, unauthorized driver detection, and remote vehicle control capabilities. The core component of the system is an embedded device strategically placed within the vehicle. This device continuously collects and processes vehicle data, including location, speed, and driver information. Advanced facial recognition algorithms, trained on a comprehensive dataset of driver images, are employed to accurately identify authorized drivers and detect unauthorized access attempts.

To enhance the system's capabilities, a cloud-based platform is developed. This platform serves as a centralized hub for data storage, analysis, and visualization. Real-time vehicle tracking information, driver behavior analytics, and alerts for unauthorized access are made accessible through a user-friendly web interface. The system's remote-control features allow authorized users to remotely lock or unlock doors, activate alarms, and even immobilize the vehicle in case of theft or unauthorized use. These functionalities are enabled through secure communication protocols and SMS-based commands.

Furthermore, the system incorporates intelligent features such as geofencing, which triggers alerts when the vehicle enters or exits predefined zones. Additionally, the system can analyze driver behavior patterns to identify potential safety risks, such as speeding or aggressive driving. The project's outcomes demonstrate the potential of AI-powered solutions in revolutionizing vehicle security and providing valuable insights for fleet management. By combining embedded systems, advanced facial recognition, and cloud-based analytics, this system offers a comprehensive and efficient solution for protecting vehicles and improving transportation safety.

خلاصة

يقدم هذا المشروع نهجًا جديدًا لأمن المركبات ومراقبتها، مع الاستفادة من التقدم في الأنظمة المدمجة والذكاء الاصطناعي. يدمج النظام المقترح جهاز تعقبGPS ، وبطاقةSIM ، وتقنية التعرف على الوجه المتقدمة لتوفير موقع السيارة في الوقت الفعلي، واكتشاف السائق غير المصرح به، وقدرات التحكم في السيارة عن بعد. المكون الأساسي للنظام هو جهاز مدمج يتم وضعه بشكل استراتيجي داخل السيارة. يقوم هذا الجهاز بجمع ومعالجة بيانات السيارة بشكل مستمر، بما في ذلك الموقع والسرعة ومعلومات السائق. يتم استخدام خوارزميات التعرف على الوجه المتقدمة، المدربة على مجموعة بيانات شاملة من صور السائق، لتحديد السائقين المعتمدين بدقة واكتشاف محاولات الوصول غير المصرح بها.

لتعزيز قدرات النظام، تم تطوير منصة سحابية. تعمل هذه المنصة كمركز مركزي لتخزين البيانات وتحليلها وتصورها. يمكن الوصول إلى معلومات تتبع المركبات في الوقت الفعلي، وتحليلات سلوك السائق، والتنبيهات المتعلقة بالوصول غير المصرح به من خلال واجهة ويب سهلة الاستخدام.

تتيح ميزات التحكم عن بعد في النظام للمستخدمين المصرح لهم قفل الأبواب أو فتحها عن بعد، وتنشيط الإنذارات، وحتى شل حركة السيارة في حالة السرقة أو الاستخدام غير المصرح به. يتم تمكين هذه الوظائف من خلال بروتوكولات الاتصال الآمنة والأوامر المستندة إلى الرسائل القصيرة.

علاوة على ذلك، يشتمل النظام على ميزات ذكية مثل تحديد الموقع الجغرافي، والذي يطلق تنبيهات عندما تدخل السيارة أو تخرج من مناطق محددة مسبقًا. بالإضافة إلى ذلك، يمكن للنظام تحليل أنماط سلوك السائق لتحديد مخاطر السلامة المحتملة، مثل السرعة أو القيادة العدوانية. تُظهر نتائج المشروع إمكانات الحلول المدعومة بالذكاء الاصطناعي في إحداث ثورة في أمن المركبات وتوفير رؤى قيمة لإدارة الأسطول. ومن خلال الجمع بين الأنظمة المدمجة والتعرف المتقدم على الوجه والتحليلات المستندة إلى السحابة، يقدم هذا النظام حلاً شاملاً وفعالاً لحماية المركبات وتحسين سلامة النقل.

Steps of approach

1. GPS Tracking

- Search on available GPS Modules
- Make an Arduino code to get lat and lon data
- Apply window size filter to enhance the data
- Search on how to get speed of car
- Select Suitable Format of Speed (km per hour or m per sec)
- Search on available modules which provide digital compass
- Select Suitable Module for our project
- Test the compass on Self-Driving Car
- Search on how to save location data in local server(SD card)
- Make an Arduino code to save data on SD card
- Integrate GPS tracking with Monitoring web application
- Search on how to make a Safe Radius zone for the car
- Make an Arduino code to alert if moves out of the safe zone
- Search on how to make a path for the car to go to specific location on map.
- Draw the path in web application tracking part

Member to work on this part :

- Mohammed Alaa
- Mohammed Hossam
- Mahmoud Mohamed Gab-Allah

2. GSM Connectivity

- Search on available SIM modules which provide (2g , 3g or 4g)
- Select Suitable module with its antenna for our needs
- Make An Arduino code to test AT commands In module
- Provide a list of useful AT commands
- Make a function to perform AT commands
- Make a function to Send SMS to Specific numbers
- Make a function to provide call making
- Test sending message to the owner in case of un-known driver
- Send SMS with location data to the owner if required
- Make a function to read received SMS
- Make a function to receive calls
- Send SMS emergency message is network is un-available
- Search on how to make HTTP request
- Make a function to perform HTTP request
- Make a connection with Firebase or web endpoints

Member to work on this part :

- Sondos Reda
- Abdelrahman Shrief

3. 3d Printing

- Search on samples of required design
- Select a demo size and shape for the project
- Start design with blender or any 3d design apps
- Specify the inner part design
- Search on how to import the battery on design
- Select suitable place for battery and antenna
- Provide the overall design
- Search on some 3d printing places to print the design
- Make a cost plan for the design and materials
- Perform the design and install the components

Member to work on this part :

- Mohammed Alaa
- Moamen Murad

4. Power Management

- Search on the power specs for all used components
- Provide a list of required voltage and ampere for the parts
- Specify the voltage and capacity of required battery
- Select suitable type of batteries for the project
- Search on how to make a BMS or Recharging circuit
- Make a suitable circuit to recharge battery from the car battery
- Make the battery and test it with recharging circuit
- Test the battery in all conditions of the project

Member to work on this part :

- Mohammed Alaa
- Moamen Murad

5. SD card (Local Server)

- Search on SD card Modules
- Select suitable module for the project needs
- Integrate the module with the main controller
- Make an Arduino write function for the module
- Make an Arduino read function for the module
- Search on how to write GPS data in SD card
- Save un-sent GPS data while connectivity is dropped
- Retrieve un-sent GPS data to send it again to the server

Member to work on this part :

- Mohammed Hossam
- Mahmoud Mohamed Gab-Allah

6. Machine Learning and Face Recognition

- Search on available AI models for object detection
- Search on Neural Network and how to test and train models
- Provide a suitable model providing Animal detection
- Provide a suitable model providing Animal classification
- Provide a suitable model providing Car detection
- Provide a suitable model providing Car Classification
- Provide a suitable model providing Stop-Sign detection
- Provide a suitable model providing Stop-Sign Classification
- Provide a suitable model providing Traffic Lights detection
- Provide a suitable model providing Face detection
- Provide a suitable model providing Face recognition
- Train the model for known drivers
- Test if the model can detect un-known drivers
- Send a message to main controller if there is un-known driver

Member to work on this part :

- Abdelrahman Shrief
- Asmaa Mohamed

7. Self-Driving Car Updates

- Test the car in the last conditions of Sequences
- Test an Arduino perform path function
- Connect the car with a local server using ESP8266
- Search on how to make a connection between car and server
- Design the web app of the local server
- Connect the car with server and make a path selected from server app
- Search on how to send status of the car to the server
- Enhance the Arduino code to Send Car status to the server
- Design the Sequence execution part in the server app
- Test (Square, Rectangle, Triangle) of the Sequence part of server app
- Add turn speed in corners to the Web app design
- Search on how to use Ultrasonic in the car and select suitable place for 3 of them
- Make an Arduino function to avoid obstacles
- Apply obstacles avoidance in path part
- Try applying obstacles avoidance in sequence part
- Enhance the distance calculation in the Arduino code

Member to work on this part :

- Abdelrahman Shrief
- Asmaa Mohamed
- Sondos Reda
- Mohammed Nageh

8. Server Side (Remote Server)

- To be added later...

Member to work on this part :

- Mohammed Nageh

9. Camera Streaming to server

- To be added later...

Member to work on this part :

- Mohammed Nageh

10. Monitoring app Figma Design

- To be added later...

Member to work on this part :

- Mohammed Nageh

11. Web Application Development and Front-End side

- To be added later...

Member to work on this part :

- Mohammed Hossam
- Mahmoud Mohamed Gab-Allah

12. Endpoints Developments and Back-end Side

- To be added later...

Member to work on this part :

- Abdelrahman Shrief
- Mohamed Nageh

13. Documentations and Graduation Book

- To be added later...

Member to work on this part :

- Asmaa Mohammed
- Moamen Mourad

14. Presentations

- To be added later...

Member to work on this part :

- Sondos Reda