A Smart Security Solution to Prevent any Mischief with the Vehicles

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Abstract-The security issue has become one of the alarming problems in society. Many researchers are working relentlessly to make solutions which can solve the various security problem of the community. Vehicles are ubiquitous in everyone's life. Nowadays, stealing vehicles is one of the ordinary incidents in everyday life. So we need elements which can ensure the safety of the vehicles. In our research, we worked to make a complete model using an Arduino, GSM & GPS to solve the security problem of the vehicles. The vehicle owner can control the vehicle's engine by sending a command through the SMS system. If the owner can realize that he/she is not started the vehicle, then the owner can be sent back the SMS to stop the vehicle and check the vehicle's location, and the device provides the latitude-longitude value of the vehicle.

Keywords—Smart Security Solution; Vehicle Tracking System; VehicleControlling System; VehicleMischiefPrevention

I. INTRODUCTION

Nowadays, security has become one of the most critical issues in the present world. People have always wanted their things to be secured at any cost. Nowadays people have much work to do in their daily life, and most of the works are in different places. As a result, it becomes a new challenge for anyone to ensure the security of their belongings. So they need something to ensure the safety of their belongings remotely. By the grace of modern science and technology, we have many tools and software designed to ensure the safety of our belongings [1-4].

At present time vehicles are one of the most common phenomena in everyone's life. There are lots of varieties of vehicles in the world. Most people can afford these vehicles according to the budget. They can also use these vehicles for their livelihood. But with these vehicles, there comes a significant problem of security issue. People cannot be present with their vehicles all the time. They need to park their vehicles and go to do their works. Parking places often do not provide proper security. As a result, there remains a considerable risk of stealing the vehicle. This risk is always a high tension for the owner [5-8].

To solve the problem, we have designed a system that can relieve the vehicle owner about the security problem. We have developed a device to which we are connected to the vehicle. Moreover, we have combined the device with our cell phone. The cellphone is ubiquitous in everyone's life in the present world, making our system more efficient. When any Mischief happens with the vehicle, our device notifies the owner's cellphone. As a result, the owner can take the necessary steps to stop the Mischief.

Moreover, our system is also connected with the ignition system of the vehicle. So the owner can stop the vehicle by sending the command to our device from our cellphone. We can also get the location of the vehicle through our machine.

The economic problem is a significant problem for people to use new technologies because of the high price. In developing countries like Bangladesh, where many people live under the poverty line, cost minimization is vital for any research. Acknowledging this problem, we have tried to make the device with low-cost and productive elements in our study so that many people can use the tool. It is also connected with the mobile SMS system to use any mobile phone for this purpose. They are low-cost security, ensuring that our device's vehicle can be used among multiple classes of people in society.

Moreover, artificial intelligence has a significant impact on smart solution and tracking system. Especially rule-based expert systems [9-11] and machine learning techniques [12-15] are top-rated for the smart solution.

The paper explores these ideas. In section 2, we discussed the previous work in this field. Section 3 describes the research methodology of the article. In part 4, we have discussed the test results and discussion of our research. In conclusion, we have summarised our findings and talked about the effectiveness of our device. We have discussed our research findings on the security issue. We believe that our invention can be effective and efficient in developing countries.

II. Related works

Smart security solution system connected with mobile phones for vehicles become popular in south Asian countries like Bangladesh, India, and Srilanka [16-20]. Some of the previous works based on thief prevention or tracking location are given below:

In this research [21], the authors developed a tracking system for the vehicle. An embedded system connected to the vehicle provides the vehicle's position to the owner. In this paper, the proposed method works using the global positioning system (GPS) and a comprehensive system for mobile communication (GSM) technologies. This device is based on the embedded system. This device monitors the movement and sends the vehicle's position on the users' request/command.

In another paper, the authors' Shaikh, J.A.I et al. designed"Advanced Authentication and Security System for Call Centre" [22-23]. This system is designed with the Global positioning system of mobiles, which can be used for tracking vehicles. The proposed device generates a warning based on the movement of the vehicle. In this way, we can get the report of the vehicle if any mischief happens with it. The system is designed as an electronic device connected to the vehicle. This device sends an SMS containing the vehicle position.

To know more about GSM and GPS technologies, we studied a lot of research paper. Among all these papers, we found one paper named "Experimentally Evaluation of GPS/GSM Based System Design", which was very helpful in our study. This paper helped us to design the hardware and software of our system. It gives a clear concept to understand the communication between the GSM and GPS technologies through the devices.
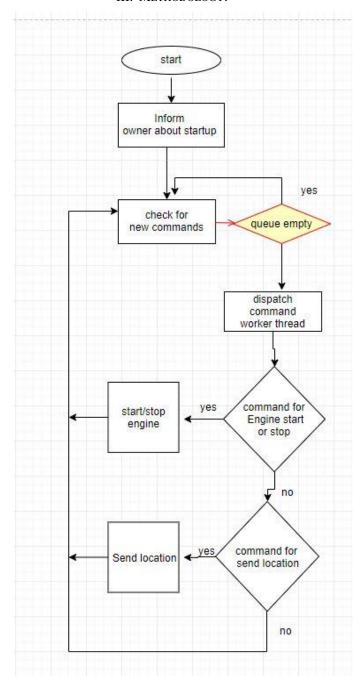
III. Methodology:

Fig. 1. Flow Chart of the system

Figure 1 shows the methodology of the system. We have designed and developed the system in an easy and user-friendly way so that all kind of users can use it without any difficulties. When the vehicle's engine starts, it notifies the user about the start of the vehicle. After getting the notification user sends a command to start or stop the vehicle based on the current situation of the vehicle. We maintain a queue to store the command of the user. We en queue commands from the queue and execute them. If there is no start or stop command from the user, the system detects suspicious activities around the vehicle and sends the vehicle's current location to the user mobile.

A. Block Diagram

Block diagram is used for developing and describing the hardware and software systems. It is also used for representing the workflows and processes of hardware and software.
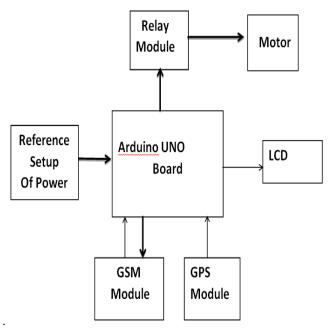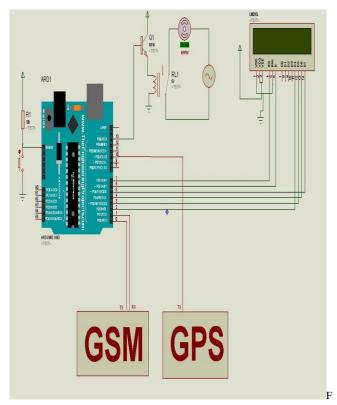

Fig. 2. Block Diagram

Components: Arduino Uno, GSM-Module, GPS Module, Liquid Crystal Display (LCD), Relay Module

In this system, as shown in Figure 2, we use a reference setup of power, which supplies the power to the Arduino Uno board. A relay module is connected to Arduino for control. After that, it powers up the motor (Engine), and the motor takes the start. We also use an LCD; it shows the present position of the vehicle. A GPS module is connected with the Arduino; it is a satellite-based navigation system. It can only send the signal to the Arduino. A GSM module is connected with Arduino, which can receive and transmit signal data to the Arduino.

B. Schematic Diagram

Schematic diagrams can analyze the complicated working process of a system with ease. In figure 3, the schematic diagram shows that the Arduino Uno is connected with a GSM and GPS module to find the vehicle's location and send it to the user. A relay module is used with the Arduino to start or stop the engine. The LCD shows the command messages and the current location of the vehicle.

ig. 3. System Diagram

C. Cost calculation of the device:

Cost-effectiveness is very important for any research. The acceptability of the study in mass people largely depends on the cost behind the machine. Our study tried to use the smallest cost element to get the maximum quality device. The total cost of the equipment is very negligible, comparing to the vehicle price. But it can ensure the proper safety and security of the invention. The cost calculation of the device is shown in the following table.

TABLE 1. ESTIMATED COST FOR THE PROPOSED SYSTEM

Item	Price (BDT)
GSM Module (SIM900)	3200
GPS Module (GY-NEO-6M)	900
Arduino UNO R3	650
DC Motor (12V 400RPM)	600
Cable	100
Total	5450

IV. TEST AND RESULT

We used Arduino UNO R3 to control the whole process based on the project's GPS and GSM module data. We used the GPS to locate the vehicle and the GSM module for the SMS system. We also used a 16X2 LCD to show command messages and vehicle position. We use an electric motor as the replacement of the engine of a vehicle. We connect the device with the power supply properly, power it up, and ensure that all the modules are working correctly, as figure 4.

Fig. 4. System after power connection

When the system starts, the LCD automatically show the present location of the vehicle. That informs the Owner/User about the location of our vehicle, which is shown in figure 5.

Fig. 5. LCD with latitude and longitude value

When we power up the device, the motor takes the start. When the device is on, we receive a Mobile Call from the device through the GSM module in our fixed-mobile number (Owner number). It means the Engine (Motor) is on.

After that, if this incident is unauthentic, we can stop the engine by sending an SMS "# off", and the device stops the engine, then the unauthorized person cannot run the vehicle until the owner wants, like figure 6. If that incident is known, then the user or owner can ignore it.

Fig. 6. Sending SMS # off to stop the ignition of the engine

When the engine stops, the green light of the relay module will glow. Again when the engine starts, the green led light will off, as figure 7.

Fig. 7. Relay power up mood engine on so that Green LCD is off

Fig. 8. Relay green led on means Engine off

The owner/user can check the location of his/her vehicle by sending an SMS "@ACW" through GPS Module. It gives a latitude and longitude value to find the vehicle's exact position, which shows in figure 9.

Fig. 9. Send SMS "@ACW" to find the location of the vehicle

If the Owner/User needs to start his/her vehicle again after stopping the engine's ignition, She/he can start the vehicle again by sending an SMS "#ON".

V. CONCLUSION:

Researchers always try to find practical solutions which can solve the problems of society. The success of the answer depends mostly on cost-effectiveness. So in our research, we have developed a cost-effective solution for the security problem of the vehicles. Our study shows that this project is a very suitable and useful measure to prevent stealing vehicle with the gathered data and results. Vehicles are often

being stolen in large numbers, but we can avoid these vehicles stealing, and crimes can be reduced greatly by using this system. Moreover, the cost-effectiveness of the project has made the solution more acceptable among the people.

REFERENCES

[1] L. Zhang, "OTIBAAGKA: A New Security Tool for Cryptographic Mix-Zone Establishment in Vehicular Ad Hoc Networks," in IEEE Transactions on Information Forensics and Security, vol. 12, no. 12, pp. 2998-3010, Dec. 2017.

[2] Z. Lu, G. Qu and Z. Liu, "A Survey on Recent Advances in Vehicular Network Security, Trust, and Privacy," in IEEE Transactions on Intelligent Transportation Systems, vol. 20, no. 2, pp. 760-776, Feb. 2019.

[3] H. Shin, D. Turchi, S. He and A. Tsourdos, "Behavior Monitoring Using Learning Techniques and Regular-Expressions-Based Pattern Matching," in IEEE Transactions on Intelligent Transportation Systems, vol. 20, no. 4, pp. 1289-1302, April 2019.

[4] A. H. Meghdadi and P. Irani, "Interactive Exploration of Surveillance Video through Action Shot Summarization and Trajectory Visualization," in IEEE Transactions on Visualization and Computer Graphics, vol. 19, no. 12, pp. 2119-2128, Dec. 2013.

[5] A. P. Sreedevi and B. S. S. Nair, "Image Processing Based Real Time Vehicle Theft Detection and Prevention System," 2011 International Conference on Process Automation, Control and Computing, Coimbatore, 2011, pp. 1-6.

[6] A. O. Pachica, D. S. Barsalote, J. M. P. Geraga, J. M. Ong and M. D. Sajulan, "Motorcycle theft prevention and recovery security system," 2017 14th International Conference on Electrical Engineering/Electronics, Computer, Telecommunications and Information Technology (ECTI-CON), Phuket, 2017, pp. 850-855.

[7] P. Chen, Y. Shih, S. Chang and Y. Hung, "An intelligent on-line route guide system in a fleet," 13th International IEEE Conference on Intelligent Transportation Systems, Funchal, 2010, pp. 291-294.

[8] S. Abbott-McCune and L. A. Shay, "Intrusion prevention system of automotive network CAN bus," 2016 IEEE International Carnahan Conference on Security Technology (ICCST), Orlando, FL, 2016, pp. 1-8.

[9] F. Ahmed, et al., "A Combined Belief Rule based Expert System to Predict Coronary Artery Disease," in 2020 International Conference on Inventive Computation Technologies (ICICT), 2020, pp. 252-257.

[10] S. Hossain, et al., "A Belief Rule Based Expert System to Predict Student Performance under Uncertainty," in 2019 22nd International Conference on Computer and Information Technology (ICCIT), 2019, pp. 1-6.

[11] S. Hossain, D. Sarma, R. J. Chakma, W. Alam, M. M. Hoque, and I. H. Sarker, "A Rule-Based Expert System to Assess Coronary Artery Disease Under Uncertainty," in Computing Science, Communication and Security, Singapore, 2020, pp. 143-159: Springer Singapore.

[12] S. Hossain et al. "A Critical Comparison between Distributed Database Approach and Data Warehousing Approach." International Journal of Scientific & Engineering Research, Article 5.1 (2014): 196-201.

[13] K. Noor et al., "Performance analysis of a surveillance system to detect and track vehicles using Haar cascaded classifiers and optical flow method," 2017 12th IEEE Conference on Industrial Electronics and Applications (ICIEA), Siem Reap, 2017, pp. 258-263.

[14] S. Hossain, A. Abtahee, I. Kashem, M. M. Hoque, and I. H. Sarker, "Crime Prediction Using Spatio-Temporal Data," in Computing Science, Communication and Security, Singapore, 2020, pp. 277-289: Springer Singapore.

[15] H. Alqahtani et al., "Cyber Intrusion Detection Using Machine Learning Classification Techniques," in Computing Science, Communication and Security, Singapore, 2020, pp. 121-131: Springer Singapore.

[16] D. Mukhopadhyay, M. Gupta, T. Attar, P. Chavan and V. Patel, "An Attempt to Develop an IOT Based Vehicle Security System," 2018 IEEE International Symposium on Smart Electronic Systems (iSES) (Formerly iNiS), Hyderabad, India, 2018, pp. 195-198.

[17] G. Paul, D. Thomas and J. Irvine, "Privacy Implications of Smartphone-Based Connected Vehicle Communications," 2015 IEEE 82nd Vehicular Technology Conference (VTC2015-Fall), Boston, MA, 2015, pp. 1-3.

[18] M. Hadded, O. Shagdar and P. Merdrignac, "Augmented Perception by V2X Cooperation (PAC-V2X): Security issues and misbehavior detection solutions," 2019 15th International Wireless Communications & Mobile Computing Conference (IWCMC), Tangier, Morocco, 2019, pp. 907-912.

[19] C. Lupu, A. J. Văduva and R. Rughiniş, "Invictus: Open-source solution for an intelligent vehicle system," 2016 15th RoEduNet Conference: Networking in Education and Research, Bucharest, 2016, pp. 1-5.

[20] A. M. Krishna and A. K. Tyagi, "Intrusion Detection in Intelligent Transportation System and its Applications using Blockchain Technology," 2020 International Conference on Emerging Trends in Information Technology and Engineering (ic-ETITE), Vellore, India, 2020, pp. 1-8.

[21] A. T. Hapsari, E. Y. Syamsudin, and I. Pramana, "Design of vehicle position tracking system using short message services and its implementation on FPGA," in Proceedings of the ASP-DAC 2005. Asia and South Pacific Design Automation Conference, 2005., 2005, vol. 2, pp. D/19-D/20 Vol. 2: IEEE.

[22] J. Shaikh, A. J. I. J. o. A. R. i. E. Subhangi, Electronics, and I. Engineering, "Advanced Authentication and Security System for Call Centre Employee's with Live GPS Tracking," vol. 3, no. 7, pp. 10533-10536, 2014.

[23] A. M. Al-Hindawi and I. J. J. o. E. S. V. Talib, "Experimentally Evaluation of GPS/GSM Based System Design," vol. 2, no. 2, p. 67, 2012.