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Final Project

The Hidden Savior

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In conclusion, the completion of the Hidden Savior project is a testament to the collective efforts.

sincerely,

Samah Abdel Rahman, Amira Shobaki

Disclaimer

Samah Abd Al-Rahman and Ameera Shobaki collaborated on the completion of this paper. The authors acknowledge full responsibility for any errors identified within. The ideas, suggestions, findings, and opinions expressed in this paper solely belong to the authors and do not reflect the viewpoint of An-Najah National University.

Abstract

With the increase in suffocation incidents in cars, especially among children, there has become an urgent need for technological solutions capable of detecting risks and mitigating their effects effectively. Our “Invisible Rescuer” project aims to prevent suffocation and detect other dangers such as fires and accidents caused by children while playing. In the car, they start it. This is where our project comes into play, as it allows the car owner to stop it remotely. Our project also provides continuous alerts for immediate responses. In short, we have developed a comprehensive safety system that addresses the safety of cars and people, especially children.

The system uses Co2 sensors to monitor oxygen levels throughout the car. When oxygen levels are detected below safe limits when there are passengers in the car, an internal alarm is activated and a notification is sent to the car owner, and the system automatically opens the windows to let in fresh air. Furthermore, the system includes smoke and flame detection sensors. When detected, an SMS message is sent to the fire services and the car’s location is sent using the Global Positioning System. One of the features of “The Hidden Savior” project is that if there are children in the car and they start it, the car can be stopped through the application. In addition, if the car is locked with the key inside, the owner can unlock it through the mobile application after verifying the identity of the car owner by entering a secure code that interacts with the door opening system.

This safety system aims to prevent suffocation and accidents and flexibly deal with fire situations in cars, which greatly enhances safety. By leveraging advanced sensor technologies and wireless communications capabilities, they play a critical role in saving lives and mitigating risks associated with suffocation and fires inside cars.

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Chapter 1

Introduction

1.1 Background

In light of the increase in incidents of child suffocation inside cars in recent years, the need for innovative technical solutions has become an urgent necessity to ensure the safety of passengers, especially children, according to Dr. David Diamond, professor of psychology at the University of South Florida. This incident leads to the death of 37 children on average every year in the United States, The matter is also related to high temperature and the occurrence of suffocation. According to the “Pediatric Vehicular Heatstroke PVH” report entitled “Children in Hot Cars” [1] issued by the National Safety Council, it only takes 10 minutes for the temperature inside the car to rise by 20 degrees, and this increase is sufficient to lead to Death, especially when it comes to children.

There is a need to provide an integrated safety system to prevent suffocation incidents and detect fire inside cars, while providing rapid responses to ensure the safety of passengers. The idea of the “The Hidden Savior” project came as a necessary response to reduce the increasing cases of children suffocating inside cars as a result of lack of oxygen and high temperatures and an immediate response to fires. , which enhances the safety of passengers and provides immediate protection from potential dangers. The “The Hidden Savior” system aims to provide a comprehensive and effective solution to a serious problem that threatens the lives of people every day, especially children. This system is characterized by four main advantages.

Automatically opening windows in case of lack of oxygen or high temperature When a lack of oxygen or high temperature inside the car is detected by the installed sensors, the windows are opened automatically when there are people in the car and a notification reaches the car owner alerting him to the presence of a potential danger. This feature aims to provide immediate ventilation and prevent suffocation resulting from lack of oxygen or excessive heat.

Sending alerts to emergency services in the event of a fire. When a fire is detected inside the car, the system sends an automatic message to the fire brigades that includes the location of the car, which contributes to speedy response and reducing damage. This feature ensures that fires are dealt with immediately, reducing the risk of fire spread and saving lives and property.

Unlocking the car via the application In the event that the key is forgotten, the system provides the ability to open the car remotely via the mobile application after confirming the owner's identity by entering a password, which facilitates access to the car in emergency situations. This feature adds an additional layer of security and provides an effective solution for situations in which the owner may forget the key inside the car or lose the key.

Turning off the car remotely, in case children start the car, the owner can stop it immediately via the app, ensuring that no accidents result from operating the car without supervision. This feature enhances safety and prevents children from driving the car unsupervised, reducing the risk of unexpected accidents.

The development of the "The Hidden Savior" system is a decisive step towards enhancing the safety of cars and passengers, as it combines technological innovation with rapid response to emergency situations. Implementing this system can contribute significantly to reducing the number of tragic accidents that occur as a result of children being forgotten inside cars, and ensuring a safer and more comfortable environment for all car users.

Chapter 2

Literature Review

Hidden Savior offers an innovative approach aimed at protecting passengers, especially children, and enhancing safety in cars by preventing suffocation, fires and accidents. Hidden Savior provides suitable solutions for car owners. Our Hidden Savior project draws inspiration from several previous works related to safety systems, intelligent surveillance, and emergency response technologies. Here are some notable examples:

Smart home security systems

A smart home works by connecting various devices and systems in the home to a wireless network, such as Wi-Fi. This network allows devices to communicate with each other, allowing users to control them remotely. Smart devices use different technologies to connect to the network, such as Wi-Fi, Bluetooth, and Zigbee. There are several different sensors in the system to monitor and enhance the safety of homes and residents, user comfort, and facilitation of lifestyle, in addition to well-being. The smart home security system includes smoke detection sensors, carbon monoxide sensors, and motion detection that alert homeowners when an emergency occurs in real time. The Hidden Savior project adapts these concepts to the automotive context, focusing on preventing suffocation, accidents, and dealing with fires inside cars.

Wireless communications and remote control

Projects using wireless communications technologies for remote control have shown very promising results. For example, wireless mice, keyboards, and heart rate smart watches offer better comfort and ease of use. The Hidden Savior project uses ESP modules for wireless communication (ESP8266), allowing car owners to control their cars remotely and control vehicle functions, such as stopping the engine if children accidentally start it. This ensures enhanced security and comfort for car owners.

It has been shown that sensor technologies, wireless communications, and automated response

systems can be used to significantly enhance safety and comfort. It provides a valuable basis and inspiration for the Hidden Savior project which aims to provide a comprehensive and effective solution to prevent child choking, detect fires and provide convenient remote control features for car owners.

Chapter 3

Methodology

In this section, we provide a detailed explanation of the methodology as following :

3.1 Technical Choices

Arduino UNO is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header and a reset button [2], Arduino is an open source, It's user-friendly platform that enables people to create various electronic projects without needing extensive technical expertise . Arduino board have different parts that work together.

The most important part of Arduino called a microcontroller. You can program it what to do by writing commands. It also has some extra stuff inside [3] , In simple terms, a microcontroller is like the brain of an Arduino. It processes instructions (commands) and executes tasks based on the program code uploaded to it. Arduino microcontrollers are programmed using the C/C++ programming language. Users write programs, often referred to as sketches in the Arduino environment, which consist of commands (instructions) that tell the microcontroller what to do. These commands can include tasks such as reading sensor inputs, controlling motors, sending data over the network, and much more.

We also used the Blynk platform to work on the mobile app. Blynk connects to hardware to integrate the process into the project. Blynk is an Internet of Things (IoT) cloud platform with an excellent user experience at its core. Blynk allows us to easily create fully customized mobile and web applications for IoT. We use the Blynk app to control the car in real time and set up alerts in Blynk to notify users in case of an emergency.

3.2 Hardware Components

Arduino UNO :

We used an Arduino UNO as the main controller for the project, it handles inputs from sensors, processes data and makes decisions based on the code.



Figure 3.1: Arduino UNO .

ESP8266 :

The role is a Wi-Fi module, the ESP8266 of the project provides the ability to connect to the Internet. The system allows alerts and notifications to be sent over the Internet, such as notifying the car owner depending on the event.



Figure 3.2: ESP8266 .

Relay :

The relay is used to control the lockout of the solenoid. The relay ensures that the lockout of the high power solenoid can be safely controlled through low power signals from the Arduino.



Figure 3.3: Relay .

DC Motor :

The DC motor with H-Bridge Driver is used to move the car.



Figure 3.4: dc motor

Buck Converter :

We used the buck converter as a voltage regulator, the voltage converter steps down the voltage from the lithium batteries to the appropriate level required by the Arduino and other components.

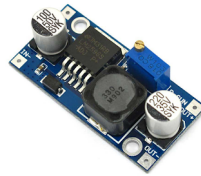


Figure 3.5: buck converter .

Buzzer :

We used it as an alarm device, as the buzzer provides an audio alert to alert vehicle occupants when dangers occur, such as high temperature, lack of oxygen, or the presence of smoke.



Figure 3.6: Buzzer .

Flame Sensor :

Flame sensor detects the presence of fire or high temperatures.

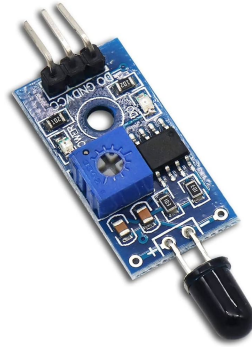


Figure 3.7: flame sensor

Smoke Sensor :

It works in conjunction with the flame sensor to provide early fire detection.



Figure 3.8: smoke sensor .

Co2 Sensor :

We used Co2 as an alternative to the oxygen sensor due to the high price of the oxygen sensor. The CO2 sensor detects carbon dioxide levels inside the car. High carbon dioxide levels indicate the need to open the window if there are people in the car and send appropriate notification of this danger.



Figure 3.9: Co2 sensor .

IR Sensor :

The infrared sensor's role is to detect presence. We used it to detect the presence of people inside the car. It ensures that the system only activates the window opening feature when there are people inside the car.



Figure 3.10: IR Sensor

Global Positioning System(GPS) :

We use a GPS unit to locate car in emergency situations and send the location to firefighters when a fire is detected.



Figure 3.11: GPS .

Servo Motor :

It is used to open and close car windows. When the sensors detect high temperature or lack of oxygen, the Arduino activates the motor to open the windows.



Figure 3.12: Servo Motor .

GSM module :

We used Sim 800 n to allow the system to send SMS alerts to emergency services.



Figure 3.13: Sim 800 n .

Regulator 7805 :

Role: voltage regulator



Figure 3.14: Regulator 7805 .

Driver h bridge :

H-bridge driver is used to control the direction of DC motor.

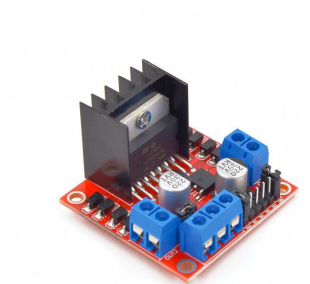


Figure 3.15: Driver h bridge .

Solenoid Lock :

Solenoid lock is used for car locking system. It is controlled remotely via a mobile phone application to lock or unlock the car doors.



Figure 3.16: Solenoid Lock .

Lithium Batteries :

We used lithium batteries as the power source.



Figure 3.17: Lithium Batteries

3.3 Main Features

The picture below shows the interface of the Blink application, with which the user interacts to control his car remotely and monitor the car through notifications that arrive through the application.

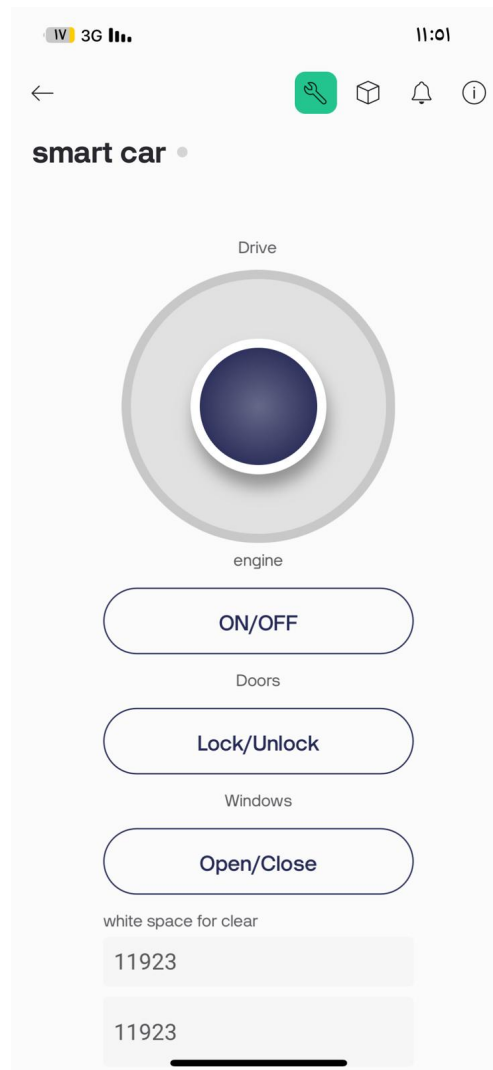


Figure 3.18: Blynk Application

Implementation Features:

Opening the Window Automatically When There are Children in the Car

The objective is to ensure the safety of children by automatically opening the windows in hazardous conditions.

Sensors (Co2, Flame, Smoke) detect hazardous conditions, The Arduino processes the sensor data, The Arduino commands the stepper motor to open the windows automatically, The ESP8266 sends notifications to the Blynk app, the Buzzer alerting the user.

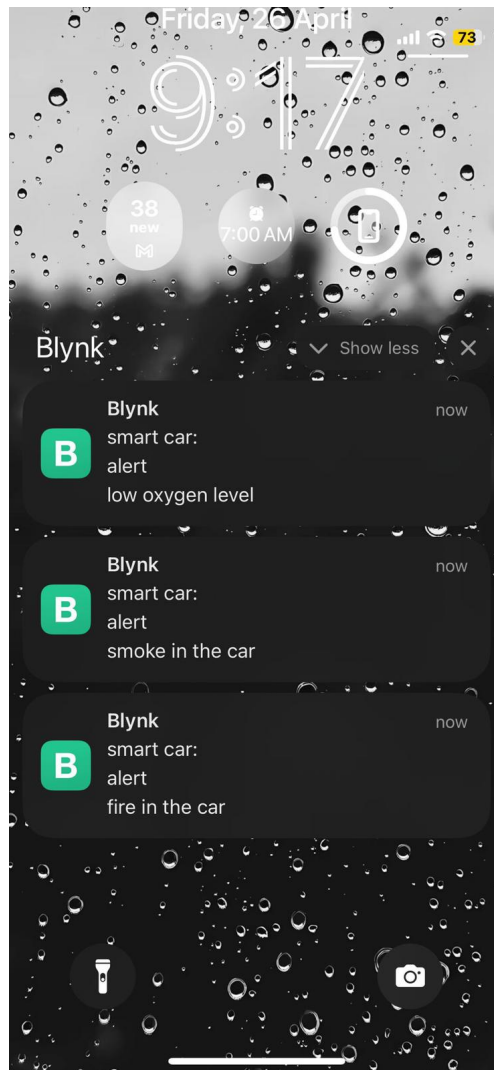


Figure 3.19: Blynk App Notifications

Action in the Event of a Fire

To Provide immediate alert and location information in case of a fire.

Whether there are people in the car or not, when flame and smoke sensors detect a fire, the GPS module provides vehicle location data, and the Arduino requests the SIM 800 N module to send SMS alerts with location data to emergency contacts and also send the appropriate notification via Blynk and open The window.

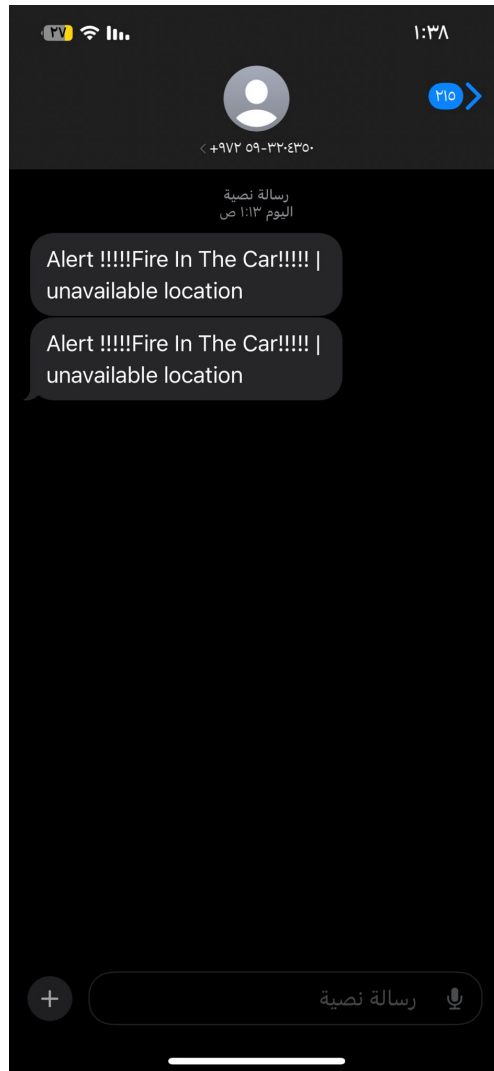


Figure 3.20: Message to the fire services

Moving the Car Remotely via the Application

We implemented this idea in order to move the car and then demonstrate the possibility of stopping the car remotely (to demonstrate the idea of controlling the car and stopping it remotely).

The user sends a movement command (forward or backward) via the Blynk app , the command is transmitted to the Blynk server, the Blynk server sends the command to the ESP8266, the ESP8266 checks if the command is to move forward or backward, then the ESP8266 transmits the movement command to the Arduino to activates the motors (DC motors) to move the car in the specified direction.

Stopping the car Remotely via the Application

The objective is to ensure safety by preventing the car from starting remotely When there are children playing with it.

The user sends a stop command via the Blynk app, the command is transmitted to the Blynk server, the Blynk server sends the command to the ESP8266, The ESP8266 transmits the stop command to the Arduino, then The Arduino de-energizes the DC motors.

lock/Unlock the Car Lock via the Application

The objective is to Provide remote access to unlock or lock the car, Especially if the car owner forgot the key inside the car.

The user sends an unlock or lock command via the Blynk app, The command is transmitted to the Blynk server, The Blynk server sends the command to the ESP8266, The ESP8266 transmits the command to the Arduino, The Arduino energizes the relay, controlling the solenoid lock to unlock or lock the car.

Open/Close the Window via the Application

The objective is to Provide control for opening or closing the car windows.

The user sends an open or close command via the Blynk app, The command is transmitted to the Blynk server, The Blynk server sends the command to the ESP8266, The ESP8266 transmits the command to the Arduino, then The Arduino commands the stepper motor to open or close the windows.

3.4 Process System

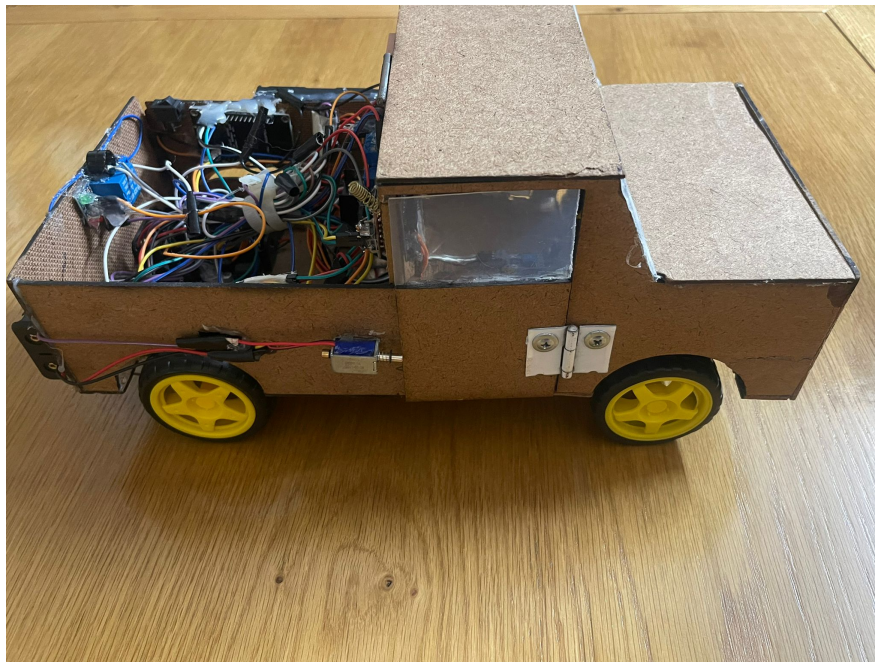


Figure 3.21: The Hidden Savior

In this system, emergency situations such as fire, smoke, and high CO₂ levels are detected through various sensors, and the necessary notifications are sent to the Blynk application and appropriate measures are taken according to each case, in addition to controlling the windows, motor, and doors via commands sent from the application.

Processing is divided into two parts:

- 1- Commands sent from the Blynk application are received via the ESP8266 to control the motor, windows, and doors. The commands include moving the engine forward or backward, stopping the engine, changing the door lock state (open/close), and moving the window (open/close).
- 2- Various sensors are used to detect emergency situations such as fire and high CO₂ levels and take appropriate measures.

In the Arduino code, the signals of various sensors such as CO₂, smoke, flame, and IR are read to determine the emergency situation as follows:

If high CO₂ levels are detected (indicating low oxygen levels) with people inside the car, the windows are opened, the alarm is triggered and a notification is sent via the Blynk app.

If high CO₂ levels are detected while there are no people inside the car, the alarm is triggered and a notification is sent via the Blynk app only.

If smoke is detected with people inside the car, the windows are opened, the alarm is triggered, and a notification is sent via the Blynk app.

If smoke is detected while there are no people inside the car, the alarm is triggered and a notification is sent via the Blynk application only.

If a flame (fire) is detected, whether with or without people present, the windows are opened, the alarm is activated, a notification is sent to the car owner, and a text message is sent to the fire services with the car's location.

In the ESP8266 code we used the BlynkSimpleEsp8266 library to integrate with the Blynk platform, we integrated the ESP8266 module with the Blynk platform to control the smart car and send notifications to the Blynk app when emergency situations such as fire, smoke or low oxygen levels occur, Data is read from the Arduino via serial communication and checks for emergency conditions such as fire, smoke, low oxygen and then notifications are sent to the Blynk app using 'Blynk.logEvent',but When emergency situations are detected, signals are sent from the Arduino to the ESP8266 then the ESP8266 sends notifications to the Blynk app to display warnings.

The process in case the sensors detect an emergency is as follows: The sensors detect emergency

situations such as fire, smoke, and low oxygen → The Arduino receives signals from the sensors and sends the data to the ESP8266 → The ESP8266 connects to the Blynk platform to send notifications to the app → The Blynk app displays notifications and gives the user control In the car, there is a remote dimension such as moving or stopping the movement, (opening/closing) the window, (opening/closing) the window, and locking the door.

The process if the command is sent from the Blynk application is as follows: The user enters the password (to confirm his identity) and then sends the command from the Blynk application → The application sends the command to the Blynk cloud server over the Internet → The Blynk server receives the command and sends it to the ESP8266 module connected to the Wi-Fi network → The ESP8266 module acts as a bridge between the Blynk server and the Arduino. The ESP8266 module receives the command from the Blynk server and then determines the desired action based on the received command → The ESP8266 module sends the received command to the Arduino via serial communication → The Arduino receives the command from the ESP8266 module and executes it, for example if the command is to open a window, the Arduino activates Move the window to open it.

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Chapter 4

Future Work

There are many areas for future development to enhance the capabilities and effectiveness of the “Hidden Savior” system. The following is an outline of potential directions for future work:

Developing the system to be more comprehensive for safety within vehicles By collecting data from various sensors for lane departure warning and collision detection, the safety system can provide more accurate and timely responses to potential dangers.

Developing the mobile application interface to become more user-friendly and improving user interaction with the system.

Chapter 5

Conclusion and Recommendations

5.1 Conclusion

The Hidden Savior project addressed a critical and growing concern regarding vehicle safety. This innovative system includes advanced technological solutions to detect and respond to life-threatening situations such as suffocation due to lack of oxygen and rapid temperature rises inside vehicles.

The system's four main features – automatic window opening, emergency service alerts, remote unlocking and remote engine stopping – provide a comprehensive safety net that enhances the security of occupants, especially vulnerable children. By using sensors to monitor oxygen levels, temperature and fires, and combining them with a quick-response notification system, The Hidden Savior ensures immediate action is taken when danger is detected. In addition, the ability to control the vehicle remotely through a mobile app adds an important layer of security, ensuring that the vehicle can be accessed or disabled in emergency situations.

In conclusion, the development of the “Hidden Savior” system represents an advanced measure to ensure the safety of cars. And by proactively addressing the risks associated with leaving children unattended in cars. In spite of obstacles such as time limits and the requirement to obtain new technology, the project team showed adaptation and flexibility. A dedication to innovation and user happiness may be seen in the use of machine learning models and the emphasis on user interaction.

5.2 Recommendations

We recommend focusing on practical projects. By using Arduino and its tools, students can save time and enhance their effectiveness in learning. Arduino simplifies the process of creating systems. With an emphasis on hands-on learning and project development, students can save time and enhance their learning effectiveness.

5.3 Constraint and Challenges

Despite the obstacles we faced, we demonstrated our ability to adapt and be flexible. Among these obstacles:

- The difficulty of determining the features on which the system will depend, and the availability of the parts needed to build it.
- Lack of experience in the field of hardware projects, we had difficulty determining the type of problem: whether it was a network, a damaged piece, or an error in the voltage accumulator.
- Learn the necessary techniques as we learned how to deal with Arduino via YouTube.
- Lack of time.

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