Design of Anti-suffocation Monitoring System in Vehicle

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Abstract. In order to avoid the risk of suffocation in the car for children and other vulnerable groups, an alarm system based on single chip microcomputer is designed. Arduino UNO R3 is used as processor, and he-sr501 human body infrared sensor, sound and light alarm module, A6 GSM communication module, DC motor and l9110s motor drive board are used. When it is detected that a person in the vehicle is locked and in a closed environment, the alarm information is sent to the emergency contact person and the skylight is forced to open for ventilation. If the vehicle does not have a skylight, the vehicle itself will send an alarm to attract passers-by's attention, so as to rescue the passers-by in case of emergency, so as to prevent the personnel in the vehicle from suffocating.

Keywords: Sensor, Anti-suffocation In Vehicle, Arduino, GSM Module

1. Introduction
Cars are increasingly becoming an important means of transportation. Every family basically has a car. However, due to the carelessness of drivers or parents, they often leave their children in the car for a long time and lock the door, which leads to heat shock or suffocation death of children[1-2]. Especially, the cases of suffocation death caused by children left in the car by the drivers of kindergartens often happen. Studies have shown that when the temperature reaches 35 ℃, the temperature in the enclosed compartment can rise to 65 ℃ after 15 minutes of sunlight exposure, and half an hour in such an environment can be fatal. This phenomenon has aroused widespread concern of the society[3-5].

At present, there are safety warning devices for children staying in the market. It’s necessary to detect whether the children are present and complete the corresponding treatment if the car stops. The device is mainly used to detect the status of child seats, which has certain feasibility, but the scope of application is small. It can only detect the car with child seat, and the detection method is relatively simple[6-8]. Therefore, design and research an alarm system based on single-chip microcomputer to prevent suffocation monitoring in the car, using a variety of sensors mixed mode, to avoid misjudgment, improve the safety of the car in use, make the car more intelligent and humanized.

2. Overall Design of the System
The alarm system of anti-suffocation monitoring based on single chip microcomputer sends alarm information to the emergency contact when it detects that someone is locked in the car and is in a closed environment, and forced to open the skylight for ventilation. If the vehicle does not have a
skylight, the vehicle itself will send an alarm, thus causing passers-by's attention to rescue the broken window in emergency. People suffocate in the car. The system architecture is shown in Figure 1.

![Figure 1. System architecture](image)

Infrared sensor module: using hc-sr501 human body infrared sensor, compared with similar products, has higher sensitivity and stronger reliability, used to detect whether there are people in the car.

Control module: the module includes sound and light alarm module st011, A6 GSM communication module and DC motor. Compared with a single buzzer, the audible and visual alarm greatly improves the recognition of the car in rainy weather, night and foggy days, so that passers-by can locate the vehicle more quickly and accurately.

The switch is used as a vehicle start stop simulator. The infrared sensor module of human body is placed on the roof. The information collected by the sensor is transmitted to Arduino processor. The processor analyzes and processes the acquired information. When the vehicle is off, when the infrared sensor module senses that there is someone in the car, the window will roll down automatically.

At the same time, the active buzzer will give an alarm and send a short message to the owner through the communication module.

The system flow chart is shown in Figure 2.

![Figure 2. The flow chart of the system](image)

According to the position of the switch to judge whether the vehicle is off. If it is judged as flameout, Arduino reads the level. When high level is detected, it indicates that there is someone in the car; when low level is detected, there is no one in the car. If there is someone in the car, Arduino controls pin A output high level to motor drive module, and output low level to pin B of motor drive.
module to control motor rotation. At this time, buzzer simulates alarm. At the same time, A6 module will encapsulate the SMS content "car SOS!" At command is used to send the information.

3. System Test Result
The system is tested. The physical diagram and test results are as follows. Figure 3 shows the physical picture of the system, figure 4 shows the physical image of the human body infrared module, and figure 5 shows the serial port monitor displaying the actual environment information of the system.

![Figure 3. The physical picture of the system](image)

The system is mainly composed of hc-sr 501 infrared sensor, sound and light alarm module, A6 GSM communication module, DC motor and motor drive board.

![Figure 4. The physical image of the human body infrared module](image)
Figure 5. The test chart of SMS distress function

Collect environmental information of human body infrared module. The received information will be fed back to the serial port monitor. The principle of the human body infrared module is that when there is a person in its sensing range, it will output high level. Otherwise it will output low level (high level corresponding to 1 and low level corresponding to 0 in the figure). The test shows that the monitoring function of the infrared module of the system is normal.

4. Conclusion

The monitoring and alarm system for preventing suffocation in the car based on single chip microcomputer can send alarm information to the emergency contact person and realize the function of forced window opening and ventilation when people are trapped in the state of flameout and locked door. The system greatly improves the safety factor of the car, making the vehicle system more intelligent and humanized.

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