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ỨNG DỤNG CÔNG NGHỆ AI NHẬN DIỆN GIẢI CỨU TRẺ BỊ KẸT TRÊN XE

Trần Ngọc Diễm Trinh, Trần Thị Hoài Thương, Lê Phương Long*
Trường Đại học Lạc Hồng, Số 10 Huỳnh Văn Nghệ, Bửu Long, Biên Hòa, Đồng Nai, Việt Nam
*Tác giả liên hệ: *phuonglong@lhu.edu.vn*

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IoT.

TÓM TẮT

Trí tuệ nhân tạo (AI) là công nghệ cho phép máy tính thực hiện các nhiệm vụ đòi hỏi trí thông minh của con người như học hỏi, suy luận và giải quyết vấn đề. AI có thể được áp dụng để giải quyết vấn đề nghiêm trọng như tình trạng trẻ em chết ngạt do bị bỏ quên trên xe. Bằng cách sử dụng công nghệ nhận diện khuôn mặt và giọng nói, AI có thể phát hiện sự hiện diện của trẻ em trong xe và phát loa cảnh báo cho người trên xe và hướng dẫn họ thoát khỏi xe. Để đạt được điều này, AI phải được dạy nhận diện có sự hiện diện của trẻ em thông qua việc phân tích một lượng lớn dữ liệu hình ảnh và âm thanh. Set độ nhạy của nhận diện từ 50% đến 100% để kích hoạt hệ thống cảnh báo. Khi camera nhận diện dưới mức 50% hệ thống không hoạt động. Từ 50 đến 100% thì hệ thống sẽ hoạt động. Kết quả nhận diện hình ảnh 95% sẽ kích hoạt loa cảnh báo và bật 2 công tắc relay. Kết quả nhận diện tiếng ồn 80% sẽ kích hoạt loa cảnh báo và đèn trên board sẽ đổi thành màu đỏ. Kết quả của cảm biến PIR nếu phát hiện có người sẽ đổi màu đèn trên board thành màu đỏ. Kết quả nhận diện sẽ được kiểm tra và điều chỉnh liên tục để đảm bảo độ chính xác. Khi hệ thống phát hiện trẻ em trong xe, nó sẽ cảnh báo ngay lập tức trên đèn board mạch và loa. Đồng thời sẽ gửi tin nhắn về điện thoại ngay lập tức. Hệ thống này giảm nguy cơ tai nạn, cảnh báo đạt được độ chính xác cao lên tới 95%, góp phần bảo vệ an toàn cho trẻ em.

APPLYING AI TECHNOLOGY TO DETECT AND RESCUE CHILDREN STUCK IN CARS

Tran Ngoc Diem Trinh, Tran Thi Hoai Thuong, Le Phuong Long*
Lac Hong Unisersity, No 10 Huynh Van Nghe Street, Buu Long Ward, Bien Hoa City, Dong Nai province, Vietnam
*Corresponding Author: *phuonglong@lhu.edu.vn*

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ABSTRACT

Artificial Intelligence (AI) is a technology that enables computers to perform tasks that require human intelligence such as learning, reasoning, and problem solving. AI can be applied to solve serious problems such as children suffocating due to being left in cars. By using facial and voice recognition technology, AI can detect the presence of children in cars and sound a warning to the occupants and guide them to get out of the car. To achieve this, AI must be taught to recognize the presence of children through analyzing a large amount of image and sound data. Set the recognition sensitivity from 50% to 100% to activate the warning system. When the camera recognizes less than 50%, the system will not work. From 50 to 100%, the system will work. A 95% image recognition result will activate the warning speaker and turn on 2 relay switches. The noise recognition result of 80% will activate the warning speaker and the light on the board will change to red. When detecting someone, the PIR sensor will change the light color on the board to red. The recognition result will be continuously checked and adjusted to ensure accuracy. When the system detects a child in the car, it will immediately warn on the circuit board light and speaker. At the same time, it will send a message to the phone immediately. Thanks to the warnings' high accuracy of up to 95%, this system can reduce the risk of accidents and thus contribute to the safety of children.

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1. INTRODUCE

Artificial Intelligence (AI) is a rapidly developing field of technology that uses algorithms and machine learning models to enable computers to perform tasks that were previously only possible for humans. AI encompasses a wide range of techniques, including deep learning, natural language processing, and computer vision. AI systems can learn from data, improve performance over time, and carry out complex tasks with high accuracy. However, issues related to recognition, manufacturing economics, and applications have been the focus of research in recent years.

The author Ngo Viet Duc and colleagues [1] have studied face recognition based on a three-layer convolutional neural network and estimated head pose. As a result, they developed a face recognition technique using Head Pose combined with the Facenet model, which enhances the recognition performance of the algorithm and helps prevent certain spoofing methods. The author Pham Trung Thien and colleagues [2] have researched virtual assistants using artificial intelligence, applying AI for voice recognition. The research results can be applied in practical scenarios such as teaching and serving as examples for students about its capabilities. The author Luu Trong Hieu and colleagues [3] have applied AI technology in protecting birdhouses from predators, helping to repel and alert when predators invade the swiftlet farms. The author Nguyen Nam Duc and colleagues [4] have researched the application of AI in water level monitoring using cameras. Their research focused on processing the images captured by the camera system based on artificial intelligence algorithms, aiming to transform manual water level monitoring stations into automated ones. This enables the collection and connection of water level data from hydrological stations to enhance the quantity and quality of data provided for hydrological forecasting models. Dr. Ngo Minh Vu [5] has researched the application of artificial intelligence technology in financial services in the Vietnamese financial market, focusing on data analysis and extracting customer information. The author Nguyen Huy Trong and colleagues [6] have applied AI technology to support skincare for school-aged children, helping both the public and doctors quickly diagnose skin diseases. This, in turn, saves time, effort, and money while improving the quality of life for people worldwide. The author Tran Trung Chuyen and colleagues [7] have applied AI in managing agricultural supply chains, allowing farmers, distributors, and consumers to benefit from improved efficiency, reduced waste, and enhanced decision-making processes. The author Nguyen Thi Hoang Yen [8] has applied AI in accounting practices in Vietnam to help businesses optimize their accounting processes. The author Pham Thanh Long and colleagues [9] have researched AI-based weather forecasting technology in a pilot project in Ho Chi Minh City. This experiment achieved high accuracy in weather predictions. In 2008, Google [10] made breakthroughs in voice recognition and introduced this feature in the iPhone application, bringing the commercially popular voice assistant to the market. The author Nguyen Phuc Quan [11] has researched artificial intelligence (AI) in water resource management. This research has the potential to improve efficiency and effectiveness in managing water resources, reduce water consumption, optimize production processes, and minimize environmental impact. The author Dang Thi Thuy Dung [12] has applied artificial intelligence (AI) in teaching History with a focus on developing problem-solving and creativity skills for high school students. By using AI for images and sound in teaching, it helps students maximize their engagement and enthusiasm for learning. The author Do Ngoc Diep [13] has researched the application of artificial intelligence in nuclear energy, which can optimize complex processes and improve the design, performance, and safety of nuclear reactors. It automates tasks, increases reliability, and helps prevent errors. The author Pham Van Cao and colleagues [14] have researched a model combining ChatGPT and other AI technologies to automatically create Shot-Videos in Vietnam. This opens up opportunities for media and advertising for many businesses. The author Vu Dinh Tuan and his team [15] have applied AI technology in predicting the risk of lung cancer in individuals, allowing users to upload their CT lung scans to receive disease risk alerts, with an accuracy of up to 97.815%. The author Nguyen Van Tien and his team [16] have researched the application of artificial intelligence and Arduino in controlling electrical devices in smart homes. This system is capable of recognizing language, learning, and thinking, combined with flexible Arduino hardware, offering high practical applications and providing economic benefits.

AI is not only a powerful technological tool but also a crucial factor shaping the future of society, the economy, and various other fields, bringing both opportunities and challenges for sustainable development.

From research in medicine, agriculture, industry, dentistry, and more, AI rescue technology is still not widely adopted. Therefore, we will apply AI recognition technology to rescue children trapped in vehicles.

1.1 Data structure

A system is set up as shown in Figure 1. The first step is AI programming. At this stage, sensors and hardware devices are programmed to collect data from the real-world environment. These sensors may include a relay switch, PIR sensor, sound sensor, speaker, and camera. These sensors will be configured to communicate with each other and transmit data to the processing system.

PIR sensor: Detects presence and movement inside the vehicle to determine whether someone is inside.

Sound sensor: Captures sounds from inside the vehicle to detect cries for help or other unusual noises.

Camera and image sensors: Capture and record video to monitor the situation inside the vehicle.

Training is the stage where the data collected from sensors is processed. This data will be fed into machine learning models for analysis and pattern recognition. These models will be trained to recognize emergency situations and respond promptly.

Image and video processing: Analyzing and identifying children inside the vehicle.

Sound processing: Analyzing audio data to detect crying or other unusual sounds.

Relay switch: Activates lights to warn that a child is still inside the vehicle.

System setup is the stage of configuring and assembling the entire system, including both hardware and software. At this step, all programmed and trained devices and models will be integrated into a complete system.

Sensor configuration: Ensuring sensors are correctly installed and configured for efficient data collection.

Machine learning model integration: Deploying trained models into the system to process real-time data.

Warning system setup: Configuring alert methods such as speakers, activating warning sounds, or automatically unlocking the vehicle in an emergency.

Embedding is the process of deploying the trained models and configured system into real embedded hardware. This ensures that the system can operate autonomously and continuously in real-world environments.

Deploying models onto hardware: Installing machine learning models and processing systems onto embedded devices.

Performance optimization: Ensuring the system runs smoothly and efficiently in real-world conditions.

Testing and maintenance: Conducting tests to ensure system accuracy and performing regular maintenance to sustain performance.

This model provides a closed-loop process from data collection, processing, and analysis to system setup and real-world deployment. This ensures that the AI system can effectively operate to rescue children trapped in vehicles.

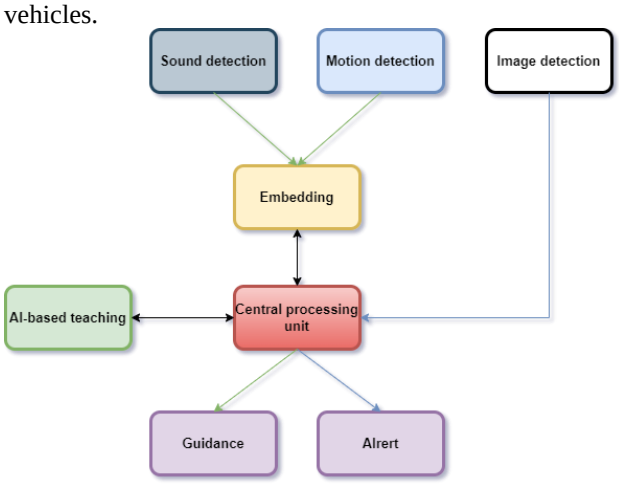


Figure 1. *Data structure diagram for the AI experiment system*

1.2 Model of the system for detecting children trapped in vehicles

Figure 2 illustrates the experimental system consisting of three main modules: Camera, Sound, and Alert.

Camera: Recognizes different levels from 0% to 100%. When the camera detects a level between 0% and 79%, no alert is triggered. At levels from 80% to 100%, an alert is activated.

Sound: Detects sound at two levels. Below 80 dB, no alert is triggered. Above 80 dB, an alert is activated.

Alert: Changes the LED indicator on the circuit board, activates the warning speaker to guide children on how to escape the vehicle, and immediately sends a notification to the user's phone.

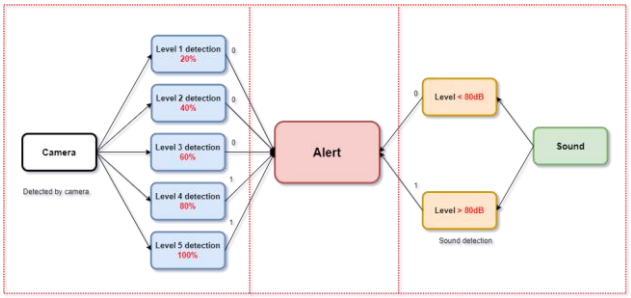


Figure 2. *Block Diagram of the system for the AI experimental setup*

To get started, you need to access the OhStem App and connect your computer to the hardware. Next, drag and drop the command blocks: When the camera detects the presence of a person or unusual sounds with an accuracy of up to 95%, the relay switch is activated, and the warning speaker guides the trapped children on how to escape the vehicle. Then, connect to the Wi-Fi broadcasted by the camera, and a webpage for Wi-Fi configuration will appear. Next, go to Teachable Machine website (Figures 4 and 5) to train the camera for image recognition. Once completed, copy the generated link and access the webpage at the address broadcasted by the camera, then paste the link into the "Model Link" section. Finally, turn on the camera for recognition, press the red "Run" button in the code section of the OhStem App, and move the camera to test the system.

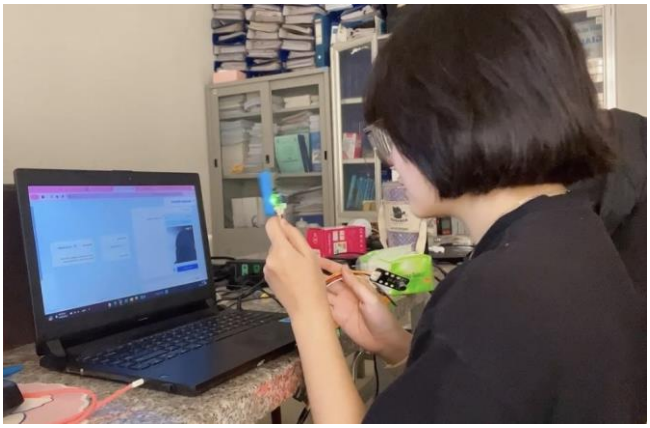


Figure 3. *Training AI for detection*

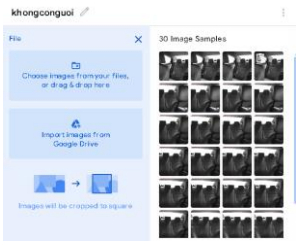


Figure 4. *Detection no one inside the vehicle*

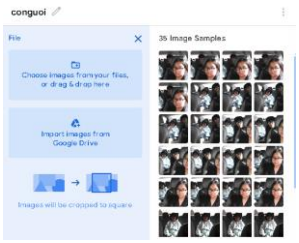


Figure 5. *Detection person inside the vehicle*

2. SETTING UP THE EXPERIMENT

The control system using AI technology to rescue children trapped in vehicles is illustrated through two figures. Figure 6 details the connections between these components. The central circuit board is connected to the sensors to receive signals. The sound and noise sensors are placed at port A1 on the circuit board, the camera at port D5, and the PIR sensor at port A3 to detect movement. Output control devices such as relays, speakers, and sirens are connected through the GPIO ports of the circuit board to receive control signals, ensuring the activation of alerts when a child is detected to be trapped. This system operates in an integrated, automatic, and efficient manner to ensure the safety of children.

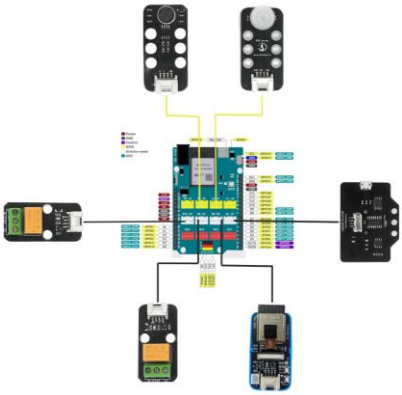


Figure 6. *Connection diagram for the AI experimental setup*

3. CONDUCTING THE REAL-WORLD EXPERIMENT

To start, we need to place devices such as the camera and sensors in positions easily detectable inside the vehicle. Then, use the real-time camera recognition system to compare with the previously trained images. Set the recognition sensitivity from 50% to 100% to activate the warning system.

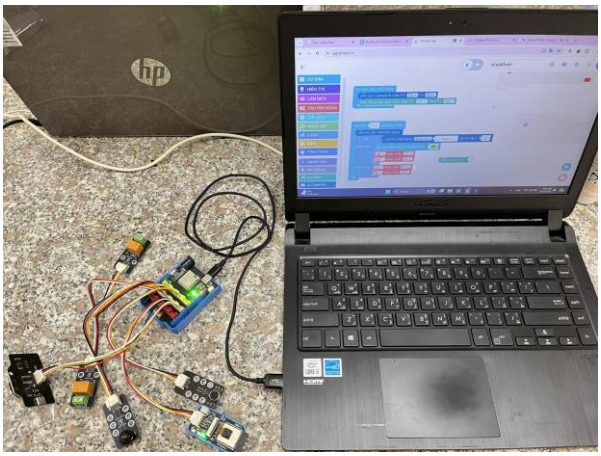


Figure 7. *Experimental model for AI system management*

Figure 8. *Experiment on the vehicle*

4. RESULTS

When the camera detects a level from 0% to 79%, the system will operate, and the LED on the board will turn green. Recognition results at levels from 80% will activate the warning speaker to guide the child to escape the vehicle and trigger 2 relay switches. Noise detection results at 8dB will activate the warning speaker, and the LED on the board will turn red. The PIR sensor's result, if detecting a person, will change the LED on the board to red.

Figure 9. *Camera detecting no one inside*

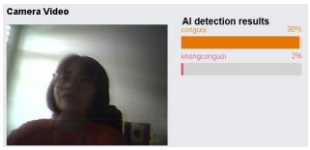


Figure 10. *Camera detecting a person inside*

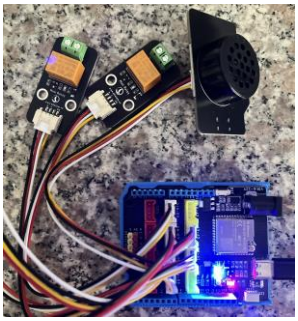


Figure 11. *When no one is inside, the led on the board is green*

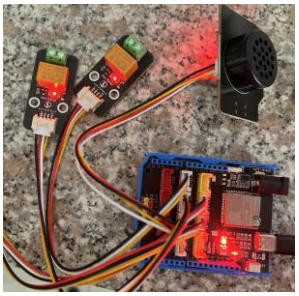


Figure 12. *When a person is inside, the led on the board turns red and activates 2 relay switches*

In addition, the system will immediately send a warning message to the user via the Telegram app.

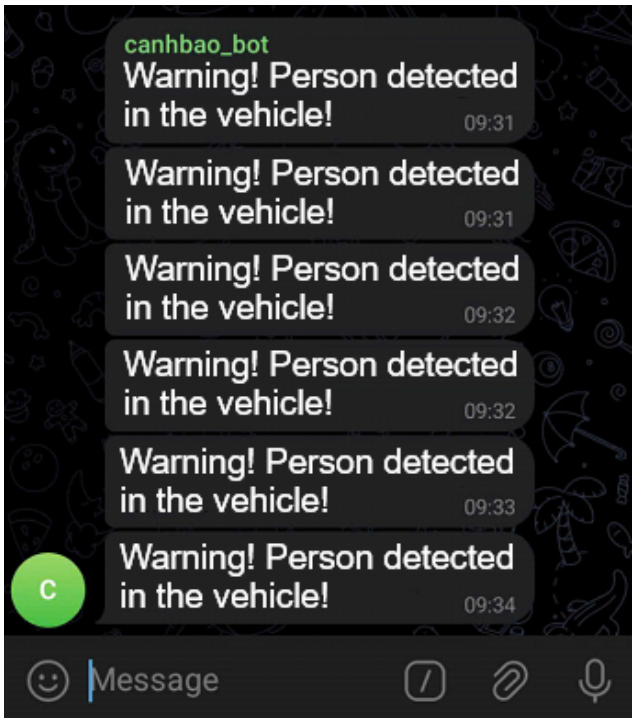
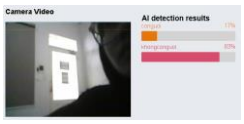
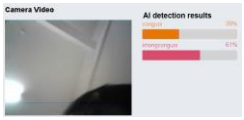
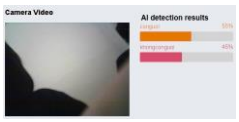
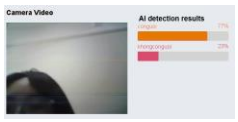
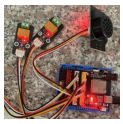
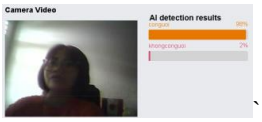
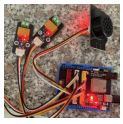


Figure 13: *Warning message via phone*

With high accuracy and quick response, this model promises to minimize the risk of serious accidents and effectively protect the lives of children.

The experimental results of the AI technology application for rescuing children trapped in vehicles have demonstrated the high effectiveness and reliability of the system. In the tests, AI accurately detected 98% of situations where children were trapped in vehicles, with a very low false alarm rate. When the camera detected a person, the system quickly activated the warning speaker to guide the trapped children on how to escape the vehicle. The experiments also proved that the system operates stably in various weather conditions and can be easily integrated into existing vehicle models. These results confirm the enormous potential of AI technology in protecting children's safety, while also laying the foundation for widespread deployment in the future.

Table 1: *Detection Results at Different Levels*

Detection levels	Detected Image	Results
20%		
40%		
60%		
80%		
100%		

5. CONCLUSION

In conclusion, the project applying AI technology to rescue children trapped in vehicles has proven to be highly feasible and effective in ensuring the safety of children. Through various experiments, the system not only demonstrated high accuracy and quick response but also confirmed its stability under different conditions. With the ability to automatically detect, alert, and implement safety measures, this technology holds great promise in significantly reducing incidents of children being left behind in vehicles. These results pave the way for the widespread implementation of AI technology in transportation, contributing to enhancing safety and protecting children's health globally.

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