Intelligent Cloud Alarm and Fire Extinguishing System for Electric Vehicles

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Catelog

Schematic of the finished product

I.   Project background

Fires are frequently sparked while charging electric vehicles, causing a chain of electric vehicles to burn in the carport! Causing significant property damage and endangering lives. Many electric car owners charge at night, resulting in accidents occurring the first time no one knows, delaying the best time to put out the fire!

The disaster to achieve rapid detection, rapid alarm, timely fire extinguishing to protect personal safety and more property is particularly critical, I designed and produced: efficient, accurate, fully automated intelligent carport fire extinguishing system for fire detection, alarm, fire extinguishing. The equipment uses sensors to detect the flame, stepper motor fast response, the affected vehicles high-speed water spray to extinguish the fire, at the same time, the wisdom of the cloud alarm system the first time to dial 119 and the security, the owner of the phone to the police, to minimise the chances of ignition of other vehicles, goods and buildings to minimise property damage and casualties.

II.   Production process

1.   Overall design electronic circuit diagram
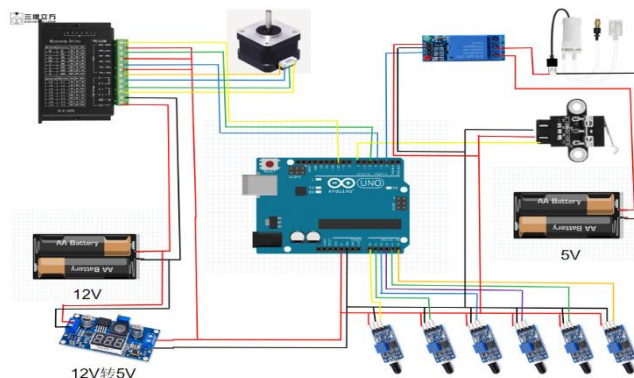
Overall design electronic circuit diagram

2. elected materials

A） UNO Intelligent Platform and 4G Cloud Alarm System

UNO Intelligent Platform   4G Cloud Alarm System
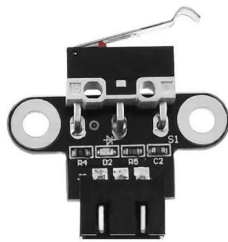
B） Flame Sensor, Relay, Limit Switch, LM2596SS Adjustable Buck Module
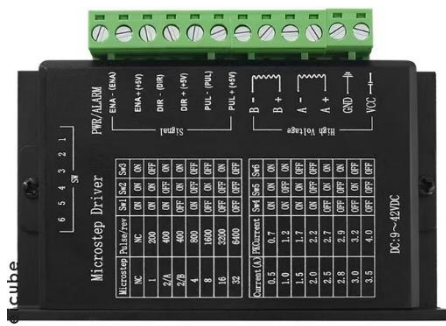

Flame Sensor   Relay

Limit Switches   Adjustable Buck Modules

C） TB6600 driver with 42 stepper motors

TB6600 Driver   42 Stepper Motors

3. Printing of special connecting parts by 3d printing technology
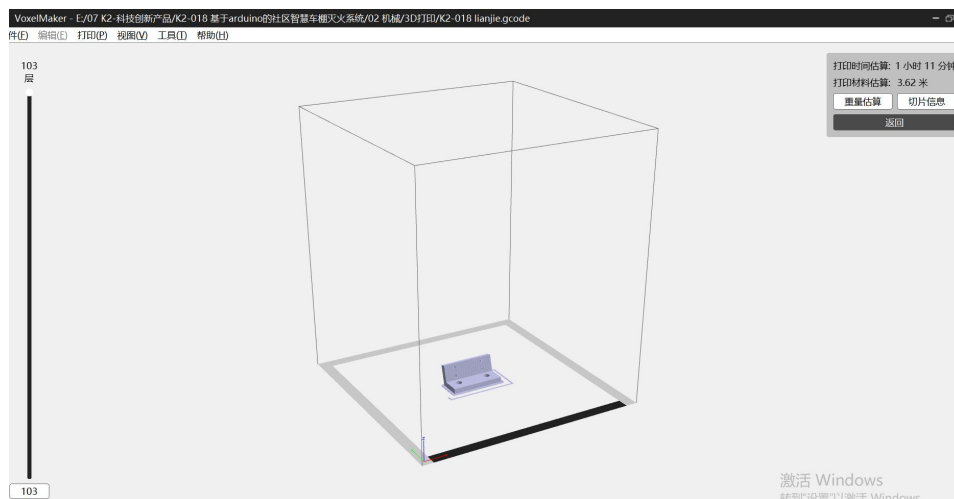
4. through the arduino IDE programming technology on the arduino microcontroller programming control
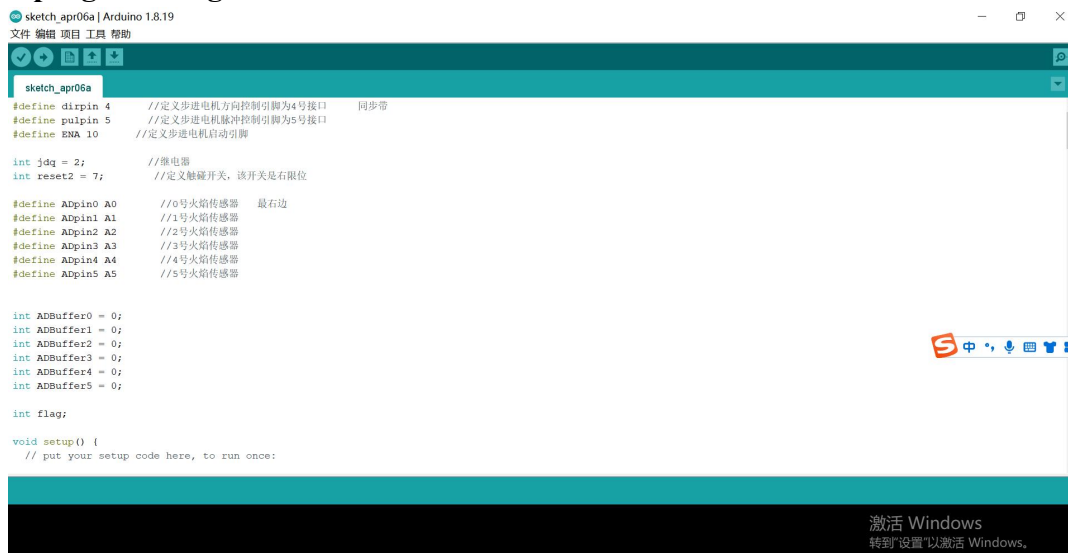
5. Equipment installation and debugging

Correctly install the components according to the electronic wiring diagram, and then, artificially set up fire scenarios, and constantly debug the performance of the synergistic operation between the modules.

6. Difficult breakthroughs

(1) How to achieve "stepping motor" to accurately find the fire point?

When the flame sensor receives the "flame" signal, it triggers the TB6600 driver through the UNO intelligent platform, and then the TB6600 driver sends start-up information to the stepper motor. Where does the stepper motor find the fire point precisely? Here we use the Arduino platform to program the stepper motor travelling route, through the accurate setting of the "displacement" parameter, to achieve the "target locking", and ultimately let the stepper motor to accurately find the fire point to complete the point-to-point fire-fighting task.

(2) How to synchronise the work of "stepper motor" and "4G cloud alarm system"?

In UNO Intelligent Platform, when any one of the input ports A0, A1, A2, A3, A4, A5 receives the signal from the flame sensor, the output ports B3 (connecting to the stepper motor) and B7 (connecting to the 4G Cloud Alarm System) will respond at the same time, and then use the bi-directional voltage converter to realise the synchronous work of the 4G Cloud Alarm System and the stepper motor.

(3) How to achieve the "4G Cloud Alarm System" accurate dialling of the phone numbers of the affected car owner and security guard?

With the help of Arduino platform to 4G cloud alarm system information fusion, using physical logic "and" gate circuit editing programmed, guide 4G cloud alarm system at the same time to the security guard and the affected car owners dial alarm, prompting the completion of timely fire extinguishing.

(4) How to realise the precise reset of "stepping motor"?

When the fire extinguishing is finished, the flame sensor interrupts the transmission signal, and the UNO Intelligent Platform triggers the TB6600 driver, which transmits a reverse voltage signal to the stepping motor, so that the stepping motor returns to the movement in the reverse direction. A "touch limit switch" is set in the initial starting position, when the stepper motor touches the limit switch, the stepper motor stops working, completes the reset task, and is in standby mode, ready for the next fire.

III. Working Principle and Implementation

Arduino is a software and hardware platform (Arduino board, Arduino IDE) based on open-source code, supporting Java and C language development environment. UNO is also a piece of Simple i/o platform based on open source code, with Processing/Wiring development environment using similar Java,C language, it is a powerful and lightweight web development framework.

With the help of Arduino and UNO platform, this device effectively integrates the detection, alarm and fire extinguishing systems to work together and achieve efficient fire extinguishing tasks.

Step 1: Initialisation and standby

The device is placed on the desktop, the pump inlet is placed in the sink, the assembly switch is turned on, and the LM2596 buck-type power management monolithic integrated circuit is used to provide different values of voltage to multiple circuits. One to the arduino microcontroller power supply, one to the stepper motor driver TB6600 power supply, the stepper motor to complete the initialisation, synchronous belt control mobile device reset.

Step 2: Detection, alarm and fire suppression

Flame sensor is a kind of "trigger class" sensor, when it detects the "infrared radiation" data exceeds

a certain threshold, it will trigger a high (low) level, and output a warning level signal, which in turn triggers the TB6600 driver to drive the "stepper motor" to start the fire fighting work. The "stepping motor" starts to extinguish the fire. Using a lighter to simulate the fire point for testing, when the flame sensor corresponding to the No. 2 parking space detects the flame, it will immediately trigger the 4G cloud alarm system, which makes use of the 4G intelligent networking function, triggered by a certain signal, and the modbus data acquisition system collects the signal data and opens the cloud alarm to alert the security guards and the corresponding vehicle owners, while the driver TB6600 drives the 42 stepping motor to drive the spray device on the synchronous belt to move to the fire point quickly, and then trigger the TB6600 driver to drive the "stepping motor" to start the work. At the same time, driver TB6600 drives 42 stepper motor to drive the spray device on the synchronous belt to move quickly to the No.2 parking space, and spray the fire through the "atomised" nozzle.42 stepper motor is a kind of motor that converts the electric pulse signal into corresponding angular displacement or line displacement.42 stepping motor is a professional two-phase stepping motor driver, which is compatible with Arduino and many other kinds of master controllers, and can achieve the motor positive and negative. The TB6600 driver is a professional two-phase stepper motor driver, compatible with Arduino and many other master controllers, which can realise the functions of motor forward and reverse control and rotation angle control. In this device, once the TB6600 driver receives the signal from the flame sensor, it can drive the 42 stepping motor, so that it drives the high-pressure water gun to the specific location of the fire to achieve high-precision co-operation and efficiently complete the fire-fighting operation. When the open fire is completely extinguished, the flame sensor interrupts the transmission of the signal, the UNO Intelligent Platform triggers the TB6600 driver and the pump control switch, and the TB6600 driver transmits a reverse voltage signal to the stepper motor, which causes the stepper motor to return to the movement in the reverse direction, and, at the same time, the water pump control switch is turned off to stop spraying. In the initial starting position set up a "touch limit switch", the switch is also known as travel switch, is a "contact" switch, the switch is installed in the designated position of the moving parts, when the mechanical switch mechanical contacts touch the block, change the control circuit, the motion Mechanical stop moving, the stepper motor stops working, the water spray device is completed to return to the initial position standby.

Step 3: Repeat the experiment in a different position

Test other parking space fire detection, alarm and fire fighting operations, the results are identical with the second step, indicating that the device is fully equipped with accurate detection, timely alarm, rapid fire fighting powerful features.

IV. Innovation Points

1. **Integration of engineering technology, communication technology and intelligent platform to achieve efficient and accurate fire extinguishing**

The device uses flame sensors, TB6600 driver, 42 stepping motor, relay, limit switch, LM2596SS adjustable buck module, bidirectional voltage converter and other engineering components, with the

help of the UNO wisdom platform and 4G cloud alarm system for precision and depth of fusion, to achieve the Internet of Things and the combination of traditional charging carport for efficient and accurate fire extinguishing, and to strongly protect the people's lives, property Safety.

2. **Using Arduino and UNO dual wisdom platform, to achieve efficient intelligent fire extinguishing**

Traditional portable fire extinguishers must be found in the fire and fire, can only be manually operated to extinguish the fire, and Arduino and UNO are based on the wisdom of the open original code platform, both support Java, C language development environment. The device makes full use of the compatibility of the two platforms, perfect implementation of the flame sensor, TB6600 drive, 42 stepper motor, 4G cloud alarm system for in-depth integration, with the Internet of Things, mobile Internet and other new technologies, to achieve efficient and accurate fire extinguishing at the first time of the occurrence of the fire, nip the fire in the bud, to achieve efficient and intelligent fire extinguishing.

3. **Fire extinguishing is timely, accurate and efficient.**

The device uses flame sensor rapid detection, flame sensor sensitivity is very high, using dual-spectrum or tri-spectrum detector, the spectrum of multiple bands have high sensitivity, the response time to the flame can be controlled within 5 milliseconds. The detection signal is transmitted to the TB6600 driver, which will drive the stepping motor to accurately locate the fire point, and extinguish the fire quickly and accurately, in a timely and efficient manner.

4. **to achieve the integration of fire extinguishing and alarm, maximum protection of people's lives and property safety**

The device uses Arduino and UNO dual intelligence platform, the fire extinguishing system and 4G cloud alarm system to achieve the perfect integration, once the fire occurs, the fire extinguishing system and the 4G cloud alarm system work at the same time to extinguish the fire at the same time, also complete the timely and accurate alarm, so that more relevant personnel involved in fire extinguishing, so as to maximise the protection of life safety and reduce property losses.

5. **Atomised "spray nozzle, effectively increase the fire fighting area, more efficient fire extinguishing.**

Considering that electric cars and electric bicycles use mostly lithium batteries, their fires have the characteristics of fast combustion, thick smoke, toxicity, easy to explode, difficult to extinguish, etc., and the effect of extinguishing the fire with firefighting sand, CO_2, ABC dry powder is not ideal. Water-based fire extinguishers in the water added surfactants, flame retardants, stabilisers and other chemical additives, with "atomised" nozzle spray, into a water mist, effectively increasing the fire area, instant evaporation of a large amount of heat from the fire, quickly reduce the fire temperature, inhibit heat radiation, so as to achieve the purpose of rapid fire extinguishing.