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Drunk Driving Detection System based on a Single-chip Microcomputer

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Abstract

Economic growth has led to a surge in the number of private cars, so the number of traffic accidents is very large, the most serious of which is drunk driving and drunk driving. Therefore, a system for monitoring alcohol concentration in the blood at any time is designed. The controller uses a STC12C5A60S2 single-chip microcomputer, which consists of an 8-channel analog switch, a data latch, and decoder, an A/D converter, and a three-state output latch. The system detects the blood alcohol concentration through the near-infrared circuit, and when the alcohol content exceeds the limit, the acousto-optic warning circuit is started. At the same time, the alcohol concentration is displayed on the LCD display, and the SIM module will send vehicle information and owner information to the predetermined mobile phone number. In this way, the incidence of drunk driving and drunk driving can be effectively reduced in time.

Keywords

Near-infrared; Single-chip; Alcohol Detection; Drunk Driving.

1. Introduction

In recent years, with the growth of the Chinese economy, the automobile industry continues to expand. More and more motor vehicles are driven on the road, which seems to be convenient for people to travel around.

However, a controversial topic about paying more attention to the safety of transportation never fails to attract public attention. China has promulgated the policy of drunk driving for ten years, and the number of drunk drivers has decreased. On the other hand, with the development of transportation, the amount of motor vehicles has increased by nearly two hundred million and drivers have reached three hundred million.

Consequently, drunk driving cases are increasing dramatically. More than two million cases of drunk driving are investigated and punished nationwide every year. ‘Crime of Drunk Driving’ has become the top crime across the country. Addressing the drunk driving problem is a long process, which needs consistent efforts. Thus, curbing and avoiding drunk driving effectively is also one of the most popular research methods in the field of automobile safety.

As a result, one of the study hotspots in the field of car safety is the ways to successfully control and avoid drunk driving. Currently, blowing tests and blood testing are the primary methods of detecting drunk driving in China and around the world.

Blowing tests evaluate the degree of chromium ion conversion according to the spectral wavelength of the resulting solution, and they are the most prevalent roadside detection method for drunk driving in China and around the world. As an internal standard substance, a specific group of tert-butanol will be added to the blood during the blood test. The alcohol content is calculated using the peak area of the alcohol and tert-butanol after they have been volatilized and identified by gas chromatography.

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The blow test is not as exact as the blood test, but it is more convenient and faster. The blood test is not commonly utilized as a detection method. It is only carried out at the hospital when the party disagrees, which can easily lead to psychological resistance on the part of the party. Furthermore, blood tests and blood tests rely on manual inspection of traffic cops, and the increased workload and waste of the police force are also uncertain.

Near-infrared detection is advantageous in terms of convenience, speed, non-destructiveness, continuity, and accuracy. This research proposes a surveillance system based on near-infrared non-invasive human detection technology to help prevent the occurrence of drunk driving accidents. This system monitors the blood alcohol content of the driver in real-time. And if the data is abnormal, it will give an audible and visual alarm. At the same time, the vehicle information will be synchronously sent to the set mobile phone number.

2. Overall System Design

This design is an alcohol detector using STC12C5A60S2 single-chip embedded system. It is mainly composed of a gravity sensor, infrared detection circuit, LCD touchscreen display, sound and light alarm, analog-to-digital converter, and single-chip microcomputer.

When the driver sits in the driver's seat, the gravity sensor located under the driver's seat begins to detect the weight signal on the driver's seat. After the signal is conditioned, it is converted into an analog electronic signal and then converted into a digital signal by an A/D converter, and then sent to an infrared detection circuit. The infrared detection circuit is divided into a signal acquisition circuit, a filter circuit, and a signal amplification circuit. After the signal data is collected, filtered, and amplified, it is processed by a single-chip microcomputer and peripheral circuits. If the value reaches the set threshold, the alcohol concentration will be displayed on the LED. Simultaneously, the alarm starts. And sends information such as the location of the vehicle license plate to the stored mobile phone number through the SIM module.

The overall block diagram of the hardware circuit part of the overall system is shown in Figure 1.

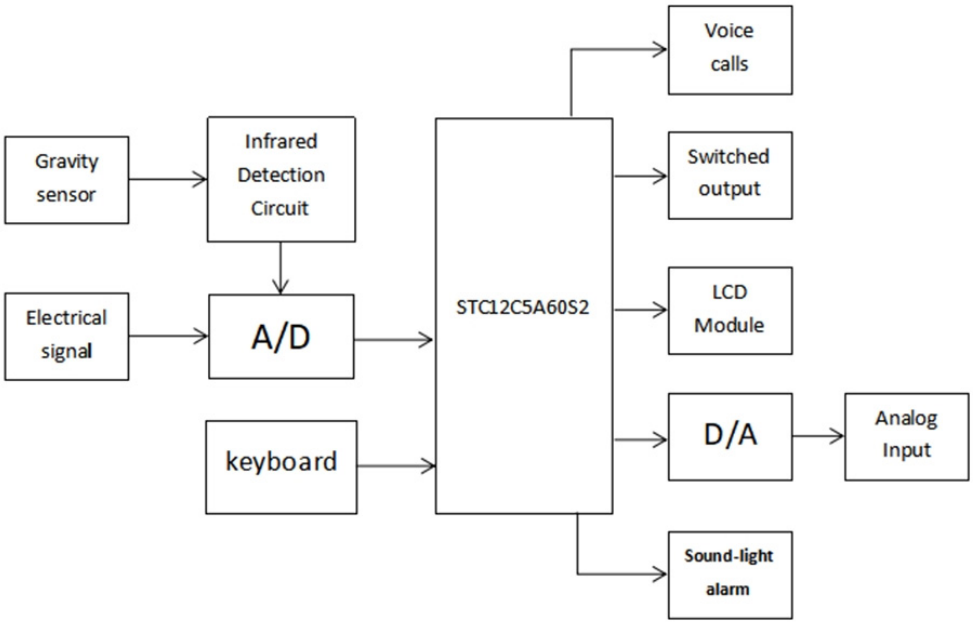

Fig 1. System design

3. The Hardware Design

The schematic module includes a gravity module, a display module, a voice module, an audible and visual alarm module, a keyboard, and an analog-to-digital conversion module.

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The ADC module adopts the chip ADC0809, ADC0809 is a sampling frequency of 8 bits and the principle of successive approximation of the analog to digital conversion device. The following is the ADC0809 working principle and pin diagram introduction. It has an 8-channel multiplexer switch inside and it can only select 8 single-break analog input signals in A/D conversion according to the address code latch decoding signal.ADC0809 is composed of an 8-way analog switch, an address latch and decoder, and an A/D converter. And a three-state output latch. The multiplexer switch is optional for 8 analog channels, allowing 8 analog inputs to be time-shared, and sharing the A/D converter for conversion.

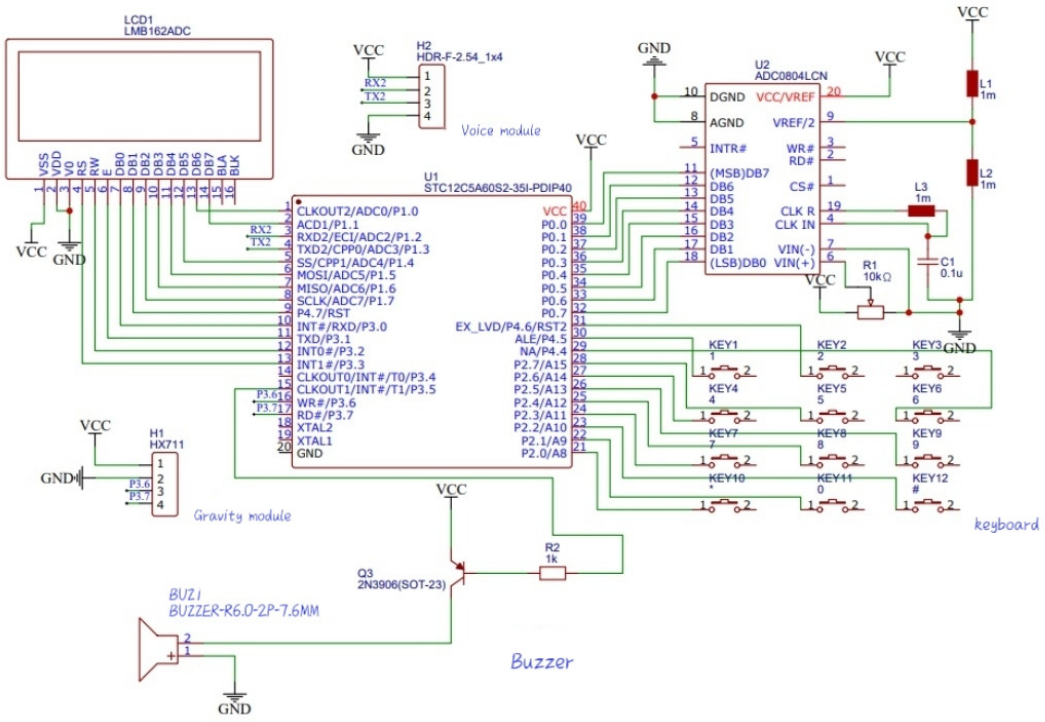

Fig 2. Hardware design

4. The Software Design

4.1 General Software Design

Software according to the system function is designed by modular programming, the main flow of the controller is shown in the figure.

It can detect if there is someone in the driver's seat, the amount of alcohol in the blood, and whether the alcohol content is above the limit. After that, the alcohol content is displayed on the screen, a sound-light alarm is selected on whether the alcohol content exceeds the standard. After the system is powered on and stable enough to work, each module initialization and automatic measurement. The voltage information of the gravity sensor is collected and compared with the set weight range. If the weight value is less than the set range, the system enters on standby. If it is at or above this range, the next step is to detect alcohol concentration by infrared ray. The collected information will be compared with the set data. If it is higher than the set data, the sound-light alarm will be made, the reservation number will be dialed and the alcohol concentration will be displayed. Otherwise, only alcohol concentration will be displayed. According to the requirements of different functions of the detection system, it consists of modules with alcohol detection, operating voltage setting, and sampling data upload.

As shown in Figure 3.

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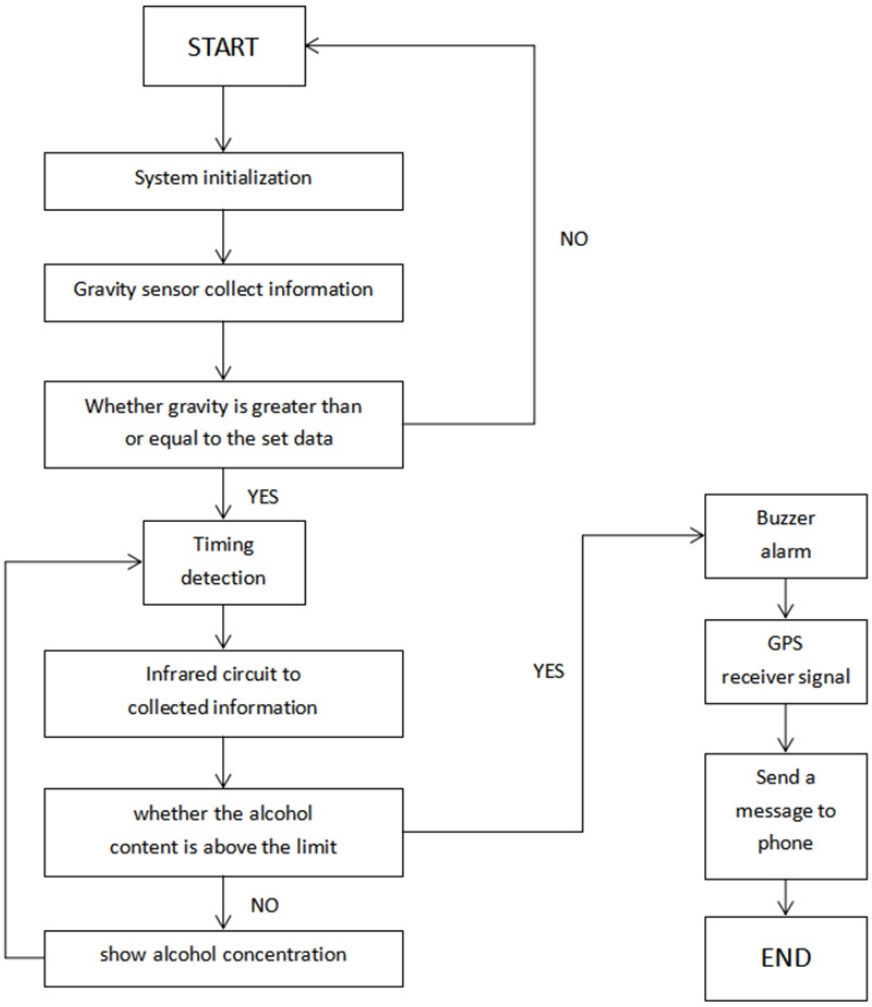

Fig 3. Software design

4.2 Concentration Detection Program

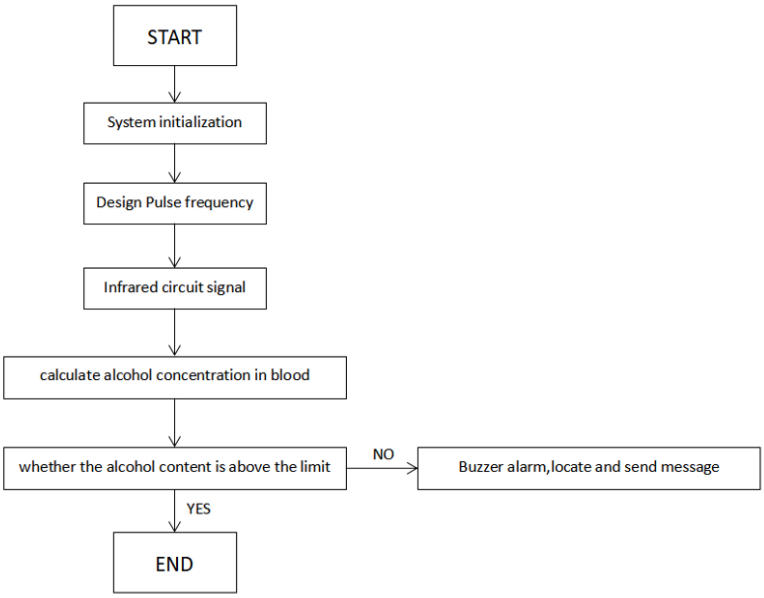

Fig 4. Concentration detection program

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The flow of the concentration detection program is shown in Figure 4.

The concentration detection program detects the alcohol in the blood through the sensor composed of an infrared emitting tube and receiving tube. The obtained signal is filtered and amplified into the single-chip microcomputer STC12C5A60S2 for data processing, and the detection result is obtained. If the amount of alcohol in the blood exceeds the preset standard, the driver will be immediately warned and the danger information will be relayed to the main system. If not, the safety information will be relayed to the main system for continued use.

5. Summarize

The alcohol detection system is intended to decrease and prevent drunk driving. The blood alcohol concentration is determined using a near-infrared beam. If the inebriated individual is determined to be a driver and the alcohol content is higher than the preset limit, the system will automatically broadcast the voice while the screen flashes to display the alcohol concentration. And use the mechanism to deliver information to the chosen mobile phone number. The system has the benefits of automatic detection, low cost, and ease of use. If everyone can use it, it will reduce drunk driving behavior by detecting alcohol when getting in the car and saving unnecessary police time.

Acknowledgments

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