The laser door security alarm is designed for improving housekeeper’s safety and reducing property by preventing the entry of criminals. The alarm system contains two modules, the laser head and laser receiver, the laser head will emit high power laser to the laser receiver. If someone hinders the propagation of the laser and the laser receiver cannot receive the signal, the microcontroller will trigger the voice chip and buzzer to sound the alarm immediately. Depending on the directional light and high brightness of the laser, combination of mirrors could be used for expanding the range of the laser system.

Part I: DC Power Supply
The laser security system uses a 5V DC power supply to support the operation. This power supplying system includes an external DC power jack, the USB-A port can be plugged into the 5V power supply, such as computer USB, rechargeable battery, cell phone charger, etc. Also, this system contains a red LED, to detect the operation status, and the 1k resistor is used to prevent the current from burning out the LED unit.

Part II: Speech Synthesizer
The speech synthesis model is powered by JR6001, which is an OPT voice chip with a PWM output terminal. This unit contains several built-in resistors. Only a several filter capacitors is needed for stable operation, which keeps this solution at a low cost.

Part II: Microcontroller
The laser security system contains a STC9C50 processor, which is a low-power, high performance CMOS 8-bit microcontroller. This unit includes a 8K programmable space, and 512K RAM, which allows the STC9C52 to provide a flexible and efficient solution for many embedded control applications. This microcontroller is programmed by C codes to implement certain instructions.

The figure below shows the actual hardware setup of our system. The purchase price of all the above components is $14, which is lower than the planned budget of $20.

Programming the microcontroller eventually enables the whole system to perform two modes. The entire laser security system contains two operation modes. Once the power supply is on, the system will work under mode 1. During this mode, the buzzer will keep alarming until the receiver detects the laser. In mode 2, the alarm will not trigger no matter whether the laser hits the receiver or not. In the real-world application, mode 1 works as the operating mode and mode 2 as the silent mode. The code loaded to the microcontroller has been reviewed and modified by the whole team to enhance performance and efficiency.

Summary/Conclusions
To summarize, we have successfully designed different blocks including a power circuitry, a laser detector circuitry, a minimum microcontroller system, and a speech synthesizer. These blocks are then constructed and tested several times to ensure the functionality of the receiver system. After all our product meets the requirements of low cost, low power consumption and high performance that guarantees this product to remain compatible and trustworthy among other similar products in the market.

Key References

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