A real spider web by Alexandre Desjardins

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Project summary

I designed an alarm system and a software program that interacts with the other components of my system. When the laser beam is broken, the photoelectric cell no longer sends electricity to the parallel port, thereby triggering a voice alarm.

Project report

INTRODUCTION

I designed and developed an infallible alarm system for the Science Fair. The executive director of the Canadian Security Intelligence Service (CSIS) asked engineers to design a high-precision security system for a top-secret project. I decided to try outsmarting the scientists by designing an alarm system in two weeks that would be practically impossible to bypass. I succeeded and the executive director of CSIS purchased my project! I decided to exhibit my state-of-the-art alarm system at the Science Fair. Obviously, I cannot divulge every aspect of my system, since I have been sworn to secrecy. I was, however, given permission to present Section L of my project. This section involves one of the systems that is practically impossible for a special agent from a terrorist organization to bypass.

O.K., I admit that this is not entirely a true story. It's only a pretext to present my alarm system and to demonstrate its effectiveness. The system that I designed is Section L of the SAT.

The aim of my project was to design and construct an inexpensive alarm system using a laser and a light detector. I wanted to design an interface between the computer (the brain) and the various system components (magnetic card reader and photoelectric cells). Mostly, I wanted to design an infallible alarm system—a type of spider web with lasers that bounce off mirrors to reach a photoelectric cell.

Choice and use of scientific instruments:

What is a laser? Why did I choose it?

The word laser is an acronym for Light Amplification by Stimulated Emission of Radiation. There is a big difference between the light produced by a laser and the white light that we see every day. White light is a mixture of colours of varying wavelengths that move in every direction. A laser beam has only one wavelength—and therefore only one colour—and its waves coincide perfectly. This makes it possible to create very fine beams and to focus a large amount of light on a minuscule point. It is therefore possible to produce a reaction by focusing a laser beam on a photoelectric cell.

I chose to use a laser for the following reasons. Thanks to its very fine beam, I was able to direct the laser on a specific path and have it bounce off mirrors. I was therefore able to protect a specific object. Thanks to its highly concentrated light, the laser reduces the resistance of the photoelectric cell to its lowest level. Since infrared light is imprecise in that it cannot follow a specific path, a criminal can reproduce the signal using another emitter.

The photoelectric cell

The other component that is essential to my system is the photoelectric cell. This electronic component uses light to create or modulate an electric signal. The conductivity of semiconductive materials (which make up most of the photoelectric cell) varies according to light exposure.

Design stages

1. Designing a software program that is able to interact with the system components.
2. Finding the pins of the parallel port that correspond to my software program commands.
3. Assembling and soldering the alarm system components (e.g. laser, photoelectric cells).
4. Constructing the prototype.
5. Testing to see whether the system works and making any necessary adjustments.

To test my system, I created a frame on a wooden plank. I drilled two holes: one for the laser and one for the photoelectric cell. I then installed six mirrors with blue adhesive gum so that they could be repositioned. When I broke the laser beam, the LED (tiny light) would go out.

Ready at the keyboard!

Now, I will discuss the SAT software program that I designed, which is the brains of my system. I started by drawing a diagram. Let me explain.

When the magnetic card is placed in front of the reader, it changes. Each time a change takes place, a special relay (called a toggle) alerts SAT to activate or deactivate the system. When SAT is activated, it asks whether it is receiving current from my photoelectric cell. If not, it activates the alarm. My voice message is then heard by the person responsible for security.

I used four loops (Do and Loop) to write my software program in Visual Basic 6. A certain condition (Until) has to be satisfied in order to exit these loops. Within each loop, it is also possible to ask questions that begin with “If”. If the answer is yes, write what happens immediately below. If the answer in no, write “else” and what happens next.

Problems encountered:

1. ***Photoelectric cell***: I had to verify whether the photoelectric cell reacted to the laser beam and ensure that no other laser could be used to bypass it. RESULT: It worked!
2. ***Mirrors***: Would the system work if the laser beam bounced off the mirrors several times? I was worried that the beam’s luminosity would decrease when passing through the mirror and that the photoelectric cell would be unable to detect the beam. RESULT: It worked!
3. ***Interface between the computer and the components***: I had to find a way to read and send signals. I wanted to use a serial port. In order to read the signals, however, I would have had to create a complicated interface, so I used a parallel port instead. RESULT: It worked!

SAT performance

SAT is not appropriate for residential use since the system is permanent and it is impossible to move objects. Also, if an object is mistakenly dropped in front of the photoelectric cell, the alarm will be activated unnecessarily as soon as the system is reactivated.

This system is therefore designed for commercial or industrial use. It would be ideal for a museum or a government agency like CSIS for the protection of a particular (and highly valuable) object.

CONCLUSION

I designed a SAT alarm system using a laser and a photoelectric cell. In order for my alarm system to work, I had to find a way of communicating with my computer. I created a link between the computer and the alarm system components. To do so, I used a parallel port and designed a Visual Basic software program. If my system were to be marketed, I would make the following changes:

- Once the alarm was activated, a voice message would notify the police and owners by telephone.
- The system components would be verified automatically prior to the system's activation.
- A gas laser could be used to cover greater distances, even several kilometres (obviously at a higher cost).
- The lasers and photoelectric cells would be modulated. Their intensity and sensitivity would change, and they would flash at different speeds, making it impossible to reproduce the laser beam.