Building Safety System Using LASER Sensors

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Abstract

Safety system is a device or number of devices and tools in integral way to guarantee the protection of the target building, car, office, etc. In this paper we propose the design of safety system that can be controlled by the computer by using the keyboard and the connection point between the computer and the safety system is the parallel ports of the computer (LPT1). This system is built to save the home or office or building (the system is developed as the size and importance of the building) where the building saved by using the lasers and that are connected with the sensors to guarantee that no one can enter the building without permission then the system will record that penetration and its time and take a photo to the person who entered and make the alarm working and calling the user or the security administrator of the building, this system is designed in two parts the physical part(hardware) and the programming part (software).

Keywords-*component; Sensors; safety systems; Control Systems, LASER, Electronic Siren*

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1. Introduction

Programmable electronic systems (conventional computers, programmable logic controllers (PLCs) and specialized microprocessors) are playing an increasing role in applications where a failure or incorrect operation could lead to serious injury or even the death of one or more people, to significant environmental damage or to other major accidents .On the one hand, the correct and well-considered use of programmable electronic systems can improve both the overall safety and the efficiency of the processes which they are used to control. On the other hand, the increased flexibility and complexity which programmable systems permit can, if not properly designed and managed, pose at heart to safety .It is therefore important from the point of view of both competitiveness and safety that organizations developing ,supplying and using programmable electronic systems in safety-related applications use the best and most up-to-date techniques in the development and management of these system [1]. Because of the necessity and the needs to build this systems and because of the security and economic reasons and for example saving a project or organization or persons or to guarantee the accuracy and integrity in some projects or organizations that name it the critical system, the necessarily to this system grown that because this systems guarantee not happening the risks (errors) that may happened if the guard is oversight in his job that make the organization in fail or the worker oversight in his work and to guarantee the best accuracy in the measures that uses the sensors to measure it like(Wight , distance ,heat degree ,…..) ,and this system that connect with the computer or(the programmable) that have many properties like the efficiency and the reliability and the flexibility ,to design a building safety system needs the experience in computer sciences and in the engineering that to give the system the flexibility and the accuracy to do it job because this system have a program that control it in some times its complex the designer must understand the system and the problems or risks that the system deal with it and may understand who to convert that system to codes and algorithms in accursed way the systems involves bringing the information from the environment from the sensors and cameras and processing that information in a speed way at it can after that the system will control the properties (tools) that the designer build it by executing the code of the control program of the system to process the risks that may be happened to the system in the worst case it destroyed the organization ,and the designer that designing this system must build this properties like the reliability and the flexibility and the availability and the maintenance and the ability to develop.

The basic aim of implementing this project is, to design a system safety building within the laser and laser sensors to used for protect the buildings(organization) or homes or offices from the thief's and the strange intruders , and made it cheap, available to everyone , this system will take a picture and save it in an existing file in the computer hard within it date , and it make a call to the owner or the administrator of the building or any number that the user determine it , and running the electronic siren all these tools in the user hand that can use it or not.

2.Contribution of the Paper

The importance of this project based on its applicability to protect building from breaking-throw instead of using many guards to saving this building, there is three important reasons to using the safety system:

- Save lives.
- Protect our homes and families from thieves and toreros.
- Minimize the probability of the damage in personal resources.

3.Safety Systems

Residential security systems provide us with personal safety. They protect our homes, our families, save us money, and reduce the risk of damage to our investments. In the mid nineteen century they were a luxury only the very rich could afford in today's world they have become a necessity. They are critical to home protection and family safety. They are also very affordable .Programmable electronic systems (conventional computers, programmable logic controllers (PLCs) and specialized microprocessors) are playing an increasing role in applications where a failure or incorrect operation could lead to serious injury or even the death of one or more people, to significant environmental damage or to other major accidents .On the one hand, the correct and well-considered use of programmable electronic systems can improve both the overall safety and the efficiency of the processes which they are used to control. On the other hand, the increased flexibility and complexity which programmable systems, if not properly designed and managed, pose a threat to safety. It is therefore important from the point of view of both competitiveness and safety that organizations developing, supplying and using programmable electronic systems in safety-related applications use the best and most up-to-date techniques in the development and management of these system[1].

A-Safety Systems Lifecycle

Structured via a Safety Lifecycle: It uses the concept of the Safety Lifecycle to provide a frame work for addressing all relevant phases associated with safety-related systems (concept; design; implementation; maintenance; functional safety assessment etc.) in a systematic and coherent manner. For all phases of the Safety Lifecycle specifics

- The Objectives to be achieved
- The Requirements to meet the Objectives
- The Scope of each phase
- The required Inputs to the phase
- The Deliverables required to comply with the Requirements.[1].

B-Computerized Building Controls Systems

Large centralized building computerized control systems first appeared in the 1960s. These evolved from industrial process control systems into mini-computer-controlled systems deployed in the late 1960s. Initially, they appeared in only the largest new buildings where the first cost of the system could be broadly amortized and reductions realized in buildings operation and maintenance staff (BCS Partners 2002). Energy became a significant concern in the early- and mid-1970s as a result of the oil embargoes. Energy cost pressures increased the market share of EMCSs. In addition, the functionality of EMCSs expanded, incorporating energy-saving features such as separate day and night schedules for HVAC and lighting, and demand control (BCS Partners 2002). Early systems used pneumatic communications and controls. In the early 1980s, direct digital controls (DDC) were introduced to the building controls market. The "Big 3" – Johnson Controls, Honeywell, and Siemens – came to dominate this market (~80% market share in the mid-1980s) with competing, proprietary systems (BCS Partners 2002). The move to electronic-based DDC, enabled by the dramatic increases in computing power and the concurrent miniaturization and cost decrease of electronic components, lowered barriers to entry and placed increased emphasis on the technical qualities and capabilities of these systems. Software controllers began to supplant hard-wired control logic. This enabled many smaller players to enter the market and eroded the market share of established manufacturers (BCS Partners 2002). In the 1990s, interoperability of systems became a significant concern of end-users. As such, the market began to move toward open protocols such as BACNet™ and LonTalk® (BCS Partners 2002). User interaction with building controls also changed with the development of more user-friendly graphical interfaces. These included web-based interfaces with enhanced graphics and the possibility of cost-effective control from remote locations [2].

C-Sensors

The sensor is a device that convert the physical stimulus or input into a readable output , which today would preferably by electronic , bout which can also be communicated via other means , such visual and acoustic, as perhaps the simplest example, consider the sensor on a keyboard switch actuator-which provides a signal when the associated key is pressed , the key board switch sensor has several designable features , it is expensive a high signal –to –noise ratio (it's on\off impedance ratio), over a wide range of environmental conations or also exemplary . unlike other sensors a keyboard switch sensor tacks an analog input rang, and its output is binary, temperature, pressure, and flow sensor are more typical examples, in these case the output is not binary quantity but a value that is sensitive to a range of these physical conditions, many advanced sensors today microscopic, microstructure devices that leverage the economies of scale and the fabrication technologies of semiconductor manufacturing. Well-designed photodiode is linear over eight orders of magnitude in intensity and provides a primary standard for light

intensity measurement within cameras and are ubiquitous in video information systems. Still other types sensors operate on chemical principles and many consist of signal molecules, for example a phenolphthalein molecule (the dye in litmus paper) signals a change in hydrogen ion concentration (i.e., ph value) by opening its color .the generic block diagram for sensors show in "Fig.1" [5].

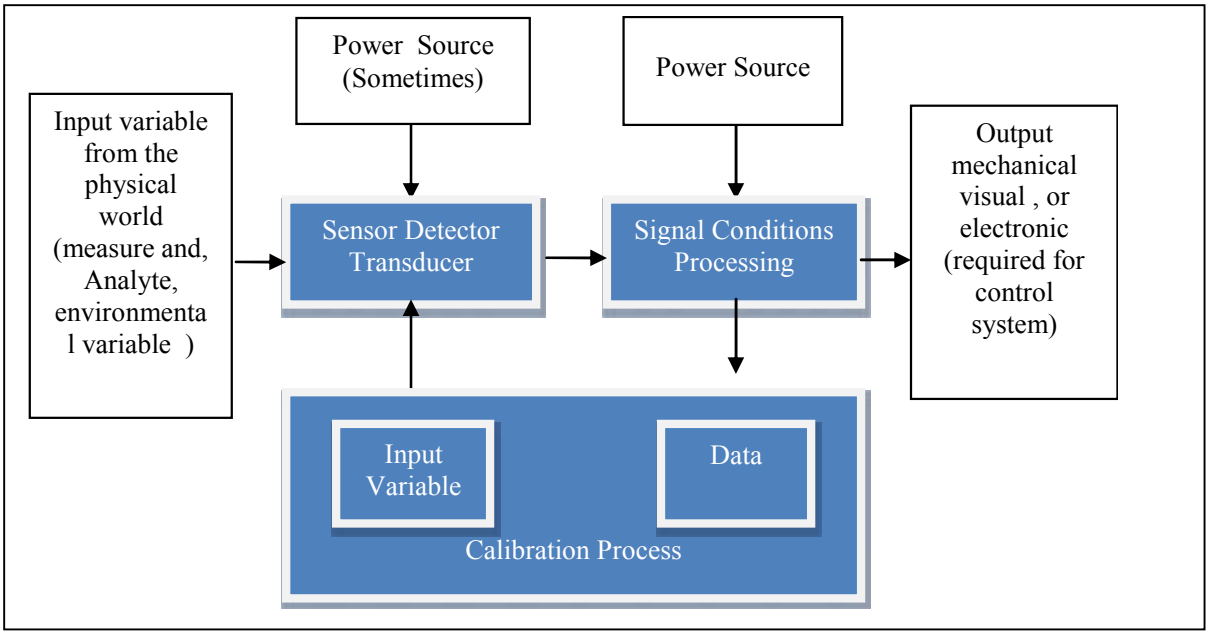


Fig.1 Sensor Block Diagram

A classification focusing on the physical effects that sensor can respond to the basis of "Table 1". One may argue about the classification of some examples, in view of their principles of operation being based on mixed effect, for example the Hall effect depends on an electric current as well as magnetic field [5].

Table 1 .

Sensing principles	Examples
Mechanical motion (including mechanical resonance)	***Pendulum-clock , quartz clock , spring balance odometer, accelerometer, gyro***
Thermal(including, temperature difference)	***Thermometer, thermostat, thermal conductivity detector, transistor built in voltage, air floe sensor, thermocouple***
Optical energy(photon)	***Photodiode, CCD camera, Geiger-Mueller tube, color sensor, turbidity sensor***
Magnetic field	***Compass, hall effect, magneto resistance, inductive proximity sensor***
Electric field	***Electrostatic voltmeter , field effect transistor***

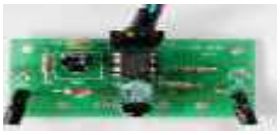
Also the following "Table 2". Explain each sensor and its work and application [5].

D-Control System Integration

The utilization of sensor data for multiple purposes (fire, security, energy) will ultimately help reduce cost to the building owner. In the near-term, cost savings are associated with operational improvements by utilizing data that otherwise would not have been available. Using the example mentioned above, an occupancy sensor installed for a lighting control system may also be used as an input for determining the heating or cooling demands of that particular zone in a building.

As the sensor technology advances, we expect more product offerings of multi-sensor devices that can be networked into the wired or wireless building automation systems.

Table 2 . Sensor Types

Image of Sensor	Sensor work
	***light sensor*** ***Read the change in light intensity.***
	***water Sensor*** ***In the case of the existence of water touches the sensor it will give signal.***
	***Infra-red Proximity Detector*** ***This IRPD module uses infra-red to detect whether an object is to the left, right or centre.***
	***Line Detector*** ***This module has three IR sensors to detect if a black line is on the left, right or centre.***
	***Fire Sensor*** ***give a signal in the case of a fire.***

This trend is likely to support and perhaps expedite the integration efforts that we already observe in the building automation industry. Systems integration is likely to lead to operational improvements by sharing data across all buildings functions and by maximizing the informational content of measured and collected data. As sensor and control networks become more integrated, adequate data security and safeguarding measures must be developed and applied to prevent access violations and intrusions by unauthorized personnel. Data access and firewall protection methods need to be developed to limit access to control actions, alarm notification, and system-critical information dissemination [3].

E-Building Control Systems

In today's building control systems, each sensor takes measurements and transmits this data to the control system to which it is connected. The utilization of sensor data across multiple control systems is not common, primarily because today's sensors are highly specialized single-use sensors, which may not measure data that are relevant for other control systems. In applications where sensor data could be shared, stringent code requirements limit or even prevent cross-utilization of sensor data. Fire alarm systems must meet rigid sensor monitoring requirements. Therefore, sensors sending data to a fire control panel must possess the necessary monitoring capabilities required by the national and local fire codes. However, sensor data collected for a fire alarm system could be shared with control systems with less

- Increasing the compatibility of control devices to achieve true plug and play across controls from many different vendors
- Developing low-cost, yet effective, controls retrofits for common problems, such as interfacing pneumatically controlled equipment with digital BASs
- Increasing the flexibility of control systems to meet new, even currently unanticipated, needs of the future
- Developing safety and security retrofits for existing controls and equipment to provide security for the public at reasonable cost [3].

F.LASER

The word LASER is an acronym for Light Amplification by Stimulated Emission of Radiation. Stimulated emission of radiation is a natural process first identified by Einstein. It occurs when a beam of light passes through a specially prepared medium and initiates or stimulates the atoms within that medium to emit light in exactly the same direction and exactly at the same wavelength as that of the original beam .Lasers are devices that amplify or increase the intensity of light to produce a highly directional, high-intensity beam that typically has a very pure frequency or wavelength. They come in sizes ranging from approximately one-tenth the diameter of a human hair to that of a very large building.

Lasers produce powers ranging from some watts to a billion trillion watts (1021 W) for very short bursts. They produce wavelengths or frequencies ranging from the microwave region and infrared to the visible, ultraviolet, vacuum ultraviolet, and into the soft-X-ray spectral regions. They generate the shortest bursts of light that man has yet produced, or approximately five million-billionths of a second (5 × 10–15 sec). Lasers are a primary component of some of our most modern communication systems and are the probes that generate the audio signals from our compact disk players. They are used for cutting, heat treating, cleaning, and removing materials in both the industrial and medical worlds. They are the targeting element of laser-guided bombs and are the optical source in both supermarket checkout scanners and tools (steppers) that print our microchips. Because of the special stimulated nature of

the laser light source, and the apparatus needed to produce laser light, laser photons are generally not as cheap to produce or to operate as are other light sources of comparable power.

We presently do not use them to light our rooms, as lamp bulbs for our flashlights, as headlights for our automobiles, or as street lamps. Lasers also don't generally provide "white light" but instead produce a specific "color" or wavelength, depending upon the laser used. "Fig.2" consists of an amplifying or gain medium, a pumping source to input energy into the device, and an optical cavity or mirror arrangement that reflects the beam of light back and forth through the gain medium for further amplification. A useful laser beam is obtained by allowing a small portion of the light to escape by passing through one of the mirrors that is partially transmitting [4].

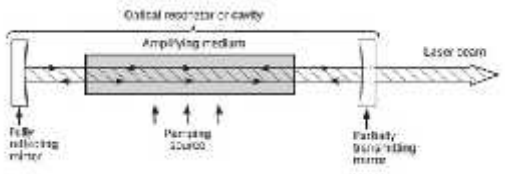


Fig. 2 Design of LASER

4.The Proposed Building Safety System

The main idea from project is to design safety system, The main task performed by the system designer is to monitor a building from the external risks through the computer through the laser and it sensor installed at the exits space of the building that you are sending a signal to a computer and through the parallel port by the computer the system program can check the signal of port if is on or off ,if it's on then the program will execute the code of program by doing some functions such as it send a order to the camera by the UBS port to take a picture (or more than one picture) and save that picture in an exist folder in the computer, or send an order to the cellular phone by the USB port as a modem to make a call to the number that the user determine it in the program (number of the user or the police…) or send a message to that number as what the user like, the massage may contain an warning or information about the system such as the number of cuts in laser through that day ,and the program can switched on the electronic siren or not as what the user determine in the program , the user can control the system tools by the user interface he can use these tools or not ,the mode like in "Fig.3".

A.Software Design

The language used in this program is Visual Basic Programming Language Version 6. The program is designed in this project to control the sensor, which is divided into two parts of implementation. The first part of the program is to make the control of the sensor and the other parts represent the response action of the sensing operation which respond in one of three actions such as mobile phone calling, captured image - from live camera- of the object make sensing and electronic siren.

Fig.3 Building Safety System

These operation are possible through the user interface for simulation software, where a user can pressing buttons identified through the program to make the sensor causes the run specified (all that mean test component or tool that connect to computer), either the second part of the program makes the sensor run automatically.

B-Hardware Design

The hardware design is be created by using many electronic component such as variable resistor, transistor and LDR, connected with each other using some wires and put it in internal box .these component is attached by using electronic circuit to perform the function requirement .

The sensor is linked to computer by using cable LPT, it is deal with computer by sending signal when cut in laser is occur, in these state the sensor is work as sender, the Statues Pins is receive the signal from sensor and deliver it to program and perform some function requirement by sending signal to the sensor by using data pins to run the electronic siren that is above sensor or we con put it in other place.

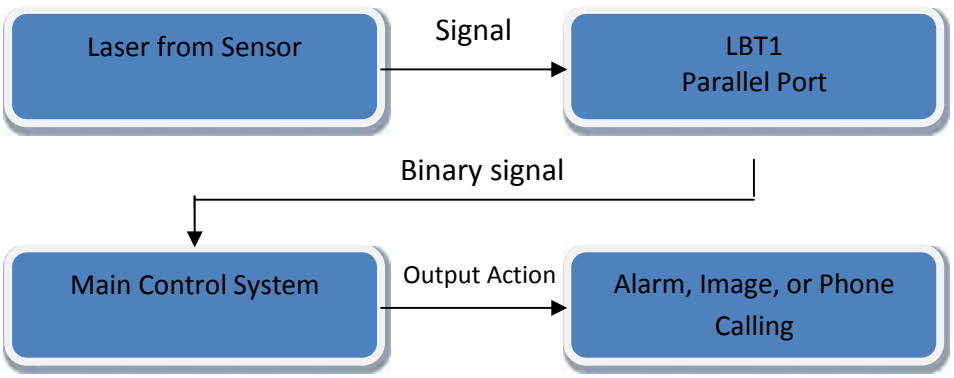


Fig.4 System hardware Architecture

5.Results and Discussion

The base result that we get it from the work in this project is design a system to protect the building from the robbery and breaking in minimal cost and maximum security can managed it by the computer, The speed of the safety system depend on the specification of the computer and the speed of call that depends on the strength of the signal of the mobile network.

We can improve the project by using the USB port instead of the parallel port but it too difficult to deal with it, and need long time more than the given time to finish the project this option we can implement it in the future ,and we can improve it by using the image processing to determine who is the intruder and recognize it if he a stranger or one of the family ,and in the power that is too importance today we use the buttery in the project but we can improve it by using the sun power within the old power this option benefit if the owner of the system leave it for long period if he traveled to another place, and in the future with the help of the company we can add this project within the project of safety system from fire to make an optimal safety system.

Also there are three important reasons of using the laser and laser sensor in instead of other sensors these are:

Security: the security of the laser and it sensor is efficient than the other sensors because the intruder can stop them or avoid it, or maybe stop if some dust be on the sensor but that not happened with the laser because we reflex the laser many times that make it like the spider web, and it is invisible that make the avoiding to this system is like impossible.

Flexibility: the laser is too easy control, I can reflex it in the place that I want to save it but the other sensors cannot do that with it you can put it in a specific place to use it.

Cost: the laser is available to everyone and it is not expensive (some types of it are cheap), and the laser sensor can made it by hand, it is not hard, but the other sensors you must buy it .

6. Conclusion

The physical part (hardware) it consist of many tools like laser and laser sensor that connected with the computer by the LPT1 to ensure that no one can enter the building without permission and if anyone do that he will cut the laser then the sensor will send a signal to the computer ,and the camera that will take a picture to the thief and the alarm that will work when the last case is done ,the cellular phone that connected with the computer that make a call to the owner or the security administrator or sending a message to that man, and we must not forget the most important part of the system that control all tools of the safety system (laser sensor, camera, alarm , cellular phone) to insure its work and the ability to on and off the tools. The programming part (software)it's a program to controlling the safety system, it consist of many pieces (sub programs) ,the first one to ensure if any person enter the building without permission and cut the laser then the sensor will send a signal to the program that will save the cut and the exits time of cut and the second one will make the camera working to take the photo to the stranger and save it ,make the alarm working ,the third one will send a message or make a call to the owner or the security administrator ,these program have the ability to work or not work these properties as the user need.

نظام كشف الدخلاء باستخدام الحساسات الليزرية

ا.م.د. علي مكي زغير* حسين علي حسين *

المستخلص

ان نظام الحماية هو جهاز أو مجموعة من الأجهزة والأدوات تعمل بشكل متكامل لضمان حماية الهدف سواءً كان بناية أو منظمة أو مكتبا أو سيارة ...الخ, في هذا البحث تم اقتراح تصميم نظامَ أمن تَحْتَ سَيْطَرَة الحاسوبِ باستعمال لوحةِ المفاتيح ونقطةِ الاتصال بين الحاسوبِ ونظام الأمانَ. هذا النظام تم بنائه لتَوفير الأمان في البيتِ أو المكتبِ أو البنايةِ (وتتم عملية تطوير النظام حسب أهمية وحجم البناية) حيث إن أمنية البناية يمكن تحقيقها باستعمال الليزر والذي يرتبط بالمتحسسات لضمان انه لا أحد يُمْكِنُ أنْ يَدْخل البناية بدون رخصةِ ثمّ يقوم النظام بتسجيل ذلك الاختراق تسجيل وقت الاختراق ويَلتقطُ صورة إلى الشخص الذي دَخلَ او اخترق حاجز الامان ويَجْعلُ جرسَ الإنذار يَعْملُ ويَدْعو المستخدم أو مديرَ أمنَ البنايةِ عن طريق الاتصال بهاتفه أليا. والنظام مُصَمَّمُ من جزأين، جزء المعدات (ألاجهزة) وجزء البرمجيات (بناء البرامج). بعد تطبيق البحث حصلناعلى نتائج جيدة في حفظ أمن الابنية ويعد النظام فيه مرونة لانه هنالك خيارات متعددة لكشف الاختراق حتى لو قام المخترق بتعطيل الكاميرا او تعطيل جرس الانذار فلا يمكنه من قطع خدمة اتصال الهاتف النقال، وفي حالة التشويش عاى شبكة الهاتف النقال فاجهزة الهاتف الحديثة توفر امكانية اتصال الطوارئ حتى لو لم توجد خدمة الاتصال.

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