Research Article

An Experimental Access Control System For Enhancing Security And Safety In University Campuses

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Abstract: Security and safety is a critical factor of concern in Nigerian university campuses. Having a secured environment for learning can help students and staffs meet up with their expectations. The electronic security system is a major approach in reducing the risk against deliberate attack by intruders. This paper has shown that, integrating electronic security and lighting system can be a cost effective approach of security management in reducing the cost spent on tightly controlled university security budgets. Consequently, the savings from the security budget can be spent on other educational programs which are more beneficial to students and staff of the university.

Keywords: security, safety, campuses, electronic security, lighting, access control, intrusion detection

INTRODUCTION

Reducing the risk of accident or protecting against deliberate attack in our social environment is a function of the degree of safety and security in our social environment [1]. Using a preferred safety and security measures or technique depends on the absolute environment of application [2]. However some measures could be essential regardless of the environment of concern. All over the world, university campuses face unique challenges in managing the safety and security of students, staff, visitors and structures. The university campus serves as resident to some staff, students and embodiment to research projects, which requires restricted access and closer scrutiny [3]. The campus warrant special vigilance and access of administrative areas or buildings, visitors management, protection of high valued assets and emergency response. Thus, it is necessary to put in place an effective campus security system for the protection of students, staff and safeguard the campus property [4].

In recent years, many campuses in Nigeria have remained unsafe as a result of violent campus crimes. Meaningful academic progress cannot fully be accomplished by students when cult activities disrupt learning as the students experience inherent fear of homicide and assault on campus. Some campus leaders urgently close down campuses to douse the cult members' activities and disturbances [5]. Cultists have violated campus safety, students, faculty, and administrators in most Nigerian campuses [6]. In accordance with reports filed by the University of Benin Security Department, the rate of crimes committed on campus is a never ending story, since intruders are never being caught when carrying out an operation and are usually difficult to trace after a successful operation. Recently, a student was murdered in the University of Benin campus during a biometric exercise by unknown gunmen. The entire operation has been claimed successful by intruders since no atom of trace has been provided by security officers. Security officers on campus do their best to reduce crime, they employ few electronic security systems i.e scanners or detectors to exclusively search those who are coming in or going out of the campus against harmful instruments or illegal weapon possession. Yet, we still experience gunshots and murder on campus [7]. The lack of basic infrastructure like lightings in Nigeria campuses has proved disastrous to safety conditions [8].

Security and safety remains a critical factor of concern on our campuses and in Nigeria at large. It is important for the University of Benin to enhance the level of security by incorporating advanced security measures to assist security officers for effective monitoring and control. Such systems include:

a. Digital video recorder (DVR) surveillance
b. Access control
c. Intrusion detectors (Burglar alarms and sensors)
d. Fire protection systems
e. Security lighting
f. Badging ID cards e.t.c

These systems address different security needs. However, they can most likely be integrated as a single unit and used effectively.

SECURITY SYSTEMS
Electronic security system

Electronic security systems are; Access control, video surveillance and intrusion detection. These systems are independent of the security level needed or specific area to be applied [9]. If these systems are controlled and monitored by competent and capable security officers, there will be an absolute reduction in crime. Consequently, there will an improvement in tracing crimes that has been committed on campus.

Access control

Access control is the means by which people are granted or denied access to restricted areas, such as residence halls, laboratory, parking garages, and fee-for-service areas [10]. In University of Benin, the balance that must be struck in incorporating access controls, as it is in all security issues, is maintaining an open user-friendly environment while establishing safe and secured facilities at all times; including when the school is in session (i.e during working hours), when limited students and staff are present, and when the school facilities are unoccupied. As a component of a complete security solution, access control systems not only manage physical access to facilities and assets, but creates an audit trail that is valuable for both operational and crime solving purposes. Access control often represent the center of an overall security management implementation since the event database that integrates all security-related actions is most typically controlled by the access control systems.

Intrusion detection

Intrusion detection involves the combination of audible alarms with use of door or window contacts, glass contacts, or motion sensors. The alarm sounds when a person has forced entry into a building or room. An alert is then sent to the security station to notify authorities of the time and location of the incident. Security officers respond in person to treat the situation. This method of incident response can be adequate for detecting an event and quickly getting to the scene [11]. However, the degree of response at the scene and subsequent prosecution is dependent on:
   a.   Approximate location of security personnel to the incident
   b.   Number of people involved
   c.   Witnesses were present
   d.   seriousness of the incident, and other factors

Video surveillance system

Video surveillance systems are increasingly being used in security systems. The presence of video cameras acts as a deterrent to potential criminals [12]. One of the major advantages of video surveillance is that possible dangers can be detected at early stage. Rapid intervention by security officers will go a long way to save a situation on ground. Video surveillance is an extremely valuable and economical means of improving the security in an area [13]. Video surveillance has evolved significantly in the last decade. Older versions of video surveillance make use of so many video tapes for continuous recording. This may also require manual monitoring or administration in terms of tape swapping. However, recent technology makes use of embedded processors that enables video to be compressed within the device and transmitted. These video devices include:
   a.   Digital video recorder (DVR)
   b.   Network video recorder (NVR)

These video systems can continuously record in days, weeks or months, if no security incident should occur. A time-stamping index on the recent video recorder makes it easy to find an incident from a given date and time. Since the video is digitized, it can be shared through emails or backups on CDs DVD, media Cards e.t.c. Digital Video surveillance is cost effective and are highly competitive. The user can improve surveillance by integrating access control and intrusion detection systems. Thus the user improves surveillance and reduces the need for additional security personnel.

Lighting systems

Security lights can be used as a preventive or corrective measure against criminal activities. Security lights may be provided to aid the detection of intruders or simply increase the feeling of safety. Lighting is integral to crime prevention through environmental design. A simple electric bulb or halogens bulbs can be used to light up an area.

Fusing electronic security systems and benefits

Access control, video surveillance and intrusion detection systems can be fused together to provide a holistic solution to security challenges faced in the University campus. Security staff at a central monitoring station can view live images from surveillance cameras, or search for video clips stored on digital video recorders (DVRs) with the aid of a fused system. The design may be such that, when an alarm is triggered, it can command the DVR to begin recording, display live video from a linked camera at the location, map the alarm location, and send an e-mail to an administrator all at the same moment. Lights can be activated to survey the scene to observe the emergency, depending on the time of day. Lights are also useful for adding extra protection in remote areas, such as parking lots and garages on campus, especially late at night [14]. Universities with diverse populations and building types spread over large areas, integrating various building systems offers numerous advantages. Foremost, integration provides for reduced installation and operating costs because it eliminates component redundancy and allows customers to streamline operations. Fusing electronic security systems reduces training and empowers system operators by allowing

them to perform their duties more efficiently. Furthermore, integration allows for uniform monitoring and control across a campus and demonstrates that an institution has applied appropriate security strategies at all its buildings.

Experimental access control system

An experimental access control system was designed within the faculty of engineering, Bniversity of Benin. The system architecture includes the following major components:
 a. Field Controllers
 b. Recessed door
 c. Card Readers/Keypads

The flow diagram and circuit description of the system architecture is shown in Figures1 and 2.
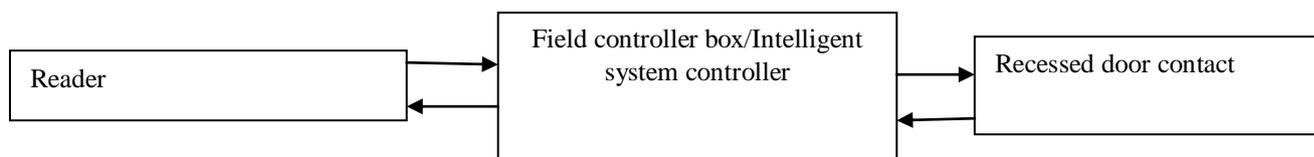

Figure 1: Flow diagram of access control system

System specification includes the following:
* Intelligent System Controller (ISC): 4 - LNL-1000 cut sheet.
* Input control, output control modules, and card reader interface modules are served by the ISC with operational characteristics as follows: AC input: 12 VAC+/- 15%, 600mA RMS; DC input: 12VDC+/- 15%, 350Ma, 3-volt lithium battery back-up, type BR2325.
* Alarm: Two Form-C relay contacts, 5A 30VDC or 125VAC, resistive. End-of-line (EOL) resistors are 1000 ohm, 1% tolerance.
* Magnetic card reader and 12 VDC electromagnetic locks with 1600 lbs. of holding force. Maximum current is 0.67 amps with residual magnetism within one second of 4 LBF, and inductive kick-back with maximum 53 volts.

Operating principle

Swiping the card through the reader or, (Magnetic cards), will transmit the data to the field controller. The field controller then compares this data to a verified database of information. If the cardholder is confirmed to have valid access to the door at the reader location, the door locking mechanism is released, and the user may enter. Another method of authorized entry is through a keypad.
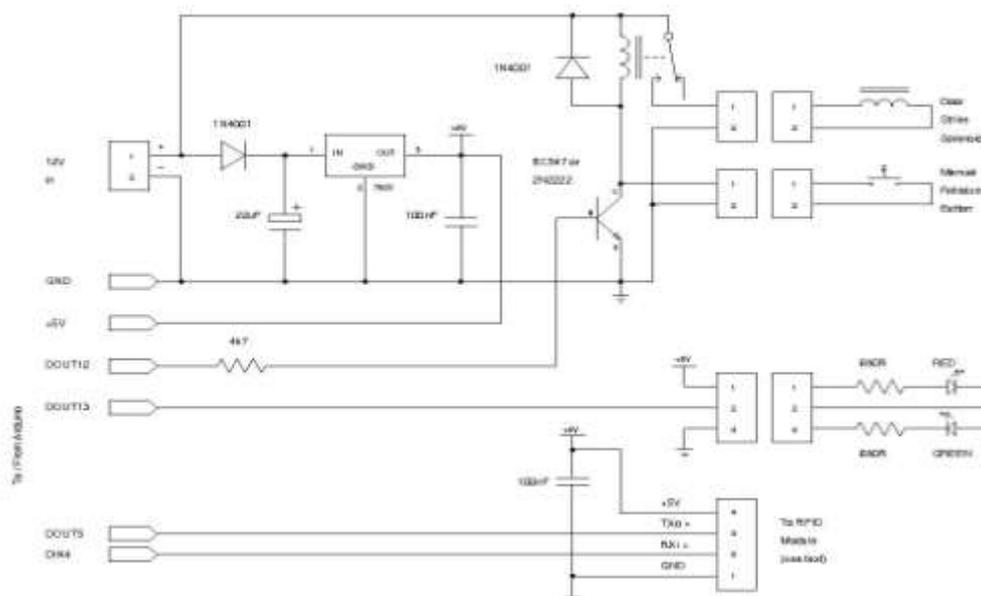

Figure 2: Circuit description of the access control system

Here the user is required to enter a specific PIN - Personal Identification Number. Figures 3, 4 and 5 shows the picture of the experimental mechanism built within the faculty of engineering. These systems shown are integrated with an output alarm.

DISCUSSIONS

A single integrated security system allows security officers to view an incident within a single or common interface. All hardware including video, alarm and printing equipment, can work seamlessly within its framework. One major advantage of fusing security system is that, it reduces the overall hardware and software requirements. This leads to fewer training issues.

Figure 3. Barrier entrance to Mechanical Engineering Department

Figure 4. Entrance from Civil Engineering Department
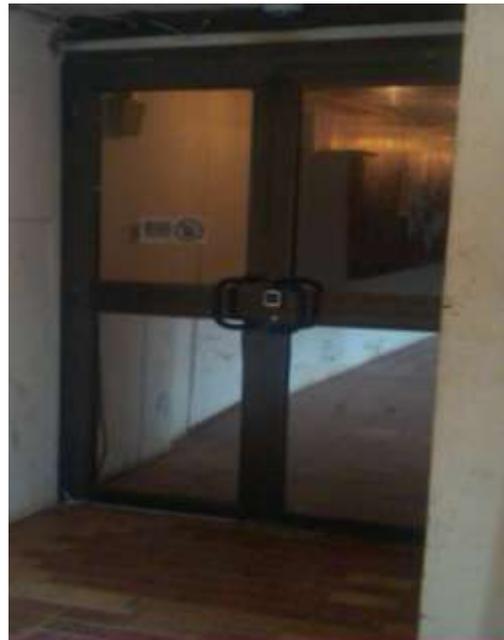
Figure 5. Dean of engineering entrance door

The following can maximally be prevented by incorporating electronic security and lighting systems;

   a. Crime can easily be prevented
   b. Murder/non-negligent manslaughter
   c. Negligent manslaughter
   d. Forcible sex offenses
   e. Non-forcible sex offenses
   f. Robbery
   g. Aggravated assault
   h. Burglary
   i. Motor vehicle theft
   j. Arson
   k. Kidnapping

Adequate lightingin the right places is important to the safety and security of school's property, staff and students.

CONCLUSION AND RECOMMENDATIONS

Safety and security is everybody's business. We all have a role to play in keeping our campus safe. Each of us can help promote campus safety by keeping our eyes and ears open and immediately reporting all crimes and public safety problems or concerns. Students require a safe and secured environment for quality learning in other to meet up with their high expectation. Fusing electronic security systems is a cost effective approach which has the capacity to enhance security and safety in university campuses. So far, this paper has been able to highlight the benefits associated with electronic security systems based on the access control experimental design.

It is recommended that university campuses in Nigeria should invest more on the electronic systems in other to cut down on the budget raised for security and

consequently increase budgets towards investing on new programmes that will be of optimum benefit to students. It is also, recommended that safety and security measures should be taught as a general course for the enlightenment of students in other to take caution, since safety and security is everybody business.

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