Research Article
The use of CCTV in Crime Combating in a Ghanaian University

[1]K.K. Ansong and [2]G.O. Ofori-Dwumfuo
[1]Methodist University College Ghana,
[2]Wisconsin International University College, Ghana

Abstract: This study assesses the effectiveness of crime combating on the campuses of KAAF University College, Ghana, assesses the possibility of using CCTV to enhance the security systems and provide a more reliable and cost effective way of monitoring crime-prone areas. KAAF University College is located in a busy and highly populated suburb. This brings with it peculiar security and safety implications. To deal with this, a 31-man team is in place to provide security services. This is, however, inadequate to address the security concerns. The project seeks to address the inadequacies by examining modern alternatives that will complement the present system. The study has identified loopholes in the present system and pinpoints de-motivated personnel, inadequate equipment and resources as major weaknesses. To address the situation, it is proposed that a modern upgradable CCTV system is installed to complement the human system. Since the initial costs can be high, it is recommended that implementation is carried out in phases, starting with the most sensitive areas such as the Administration Block, examination halls and computer labs. The project team is convinced that the cost benefits far outweigh the capital outlay in the long run and the system will be robust enough to assure stakeholders of security and meet the needs of the University far into the future.

Keywords: CCTV, crime combating equipment, KAAF university college Ghana, surveillance equipment, security systems

INTRODUCTION

In the wake of modernization and technology, negatively coupled with crime and terrorism, sophisticated crime keeps rising. This may be attributed to factors like urbanization, poverty and lack of adequate security in communities worldwide. Automated surveillance systems are now core when it comes to effective infrastructures that enhance crime detection, prevention and the apprehension of criminals (Norris and McCahill, 2006). Close Circuit Television (CCTV) systems have also become part of this infrastructure and are now very important and effective systems to implement in today's environments (Williams, 2008; Farrington *et al*., 2007).

This project attempts to design and propose a CCTV system that, when implemented on the campuses of KAAF University College, (KAAFUC), an accredited private university college in Ghana, will not only complement and enhance the present security setup, but improve and extend visual coverage over its sensitive areas. The study assesses the effectiveness of crime combating on the campuses, assesses the possibility of using CCTV to enhance the security systems and provide a more reliable and cost effective way of monitoring crime-prone areas (Ansong, 2014).

Objectives of the study: The following objectives are expected to be achieved for this study:

- To evaluate the current security situation at KAAFUC
- To identify existing weaknesses in the current security system at KAAFUC
- To propose and design a CCTV system to address such weaknesses.

Significance of the study: This study is to bring to the authorities of KAAF University College, the weakness in the current security system on campus; the strength of CCTV and how it could be used to protect the integrity and assets of the institution as well as the property of students, lecturers and guests during their stay on campus.

LITERATURE REVIEW

Security systems: Security has been defined as precautions taken to guard against crime, attack, sabotage, espionage, etc, (APA (American Psychological Association), 2015). It is the degree of protection against danger, loss and criminals. Such protection may be provided by using personnel, animals, robots, etc. Security comes in different types; including Information Security, Network Security,

Physical Security, Human Security, Public Security, etc. In Ghana, the most common type is Public Security-which is the task of the Government. Public security guarantees the safety of citizens, organizations and institutions against threats to their welfare, wealth and neighborhoods. Public and private institutions such as KAAF University College of Ghana hire or setup their own security systems (KAAFUC-Security, 2013).

Closed circuit television: Ratcliffe (2015) gives an overview of the use of CCTV systems as a problem-oriented policing response to a crime problem. CCTV is a surveillance technology; it incorporates a number of video cameras connected in a closed circuit, with the images produced being sent to a central television monitor or recorder (Goold, 2004). It differs from broadcast television in that the signal is not openly transmitted. CCTV is often employed for surveillance in areas which need security, such as accident prone road networks, banks, shops, airports, prisons, military installations, etc. (Allard *et al*., 2008; Conche and Tight, 2006; Coupe and Kaur, 2005). They allow management staff of institutions to view and deter theft, improve employee safety and control inventory and increase productivity (Bonta *et al*., 2000; Finn and Muirhead-Steves, 2002). In industry plants, CCTV may be used to observe processes that are remote from a control room, or where the environment is not conducive to human operation for long periods (Hier, 2004).

CCTV systems have become extremely popular in surveillance and security applications over the last few decades as the technology has improved and become more affordable and various authors have written on CCTV installation evaluation (La Vigne *et al*., 2011; Gill and Spriggs, 2005; Ratcliffe and Makkai, 2004; Hood, 2003; Phillips, 1999). Harada *et al*. (2004) examined the effects in Japan, Flight *et al*. (2003) discuss a case study in Amsterdam, Winge and Knutsson (2003) evaluated CCTV scheme in Oslo, Wilson (2005) in Australia and Squires (2003) considered Brighton in the UK. In Ghana, one can find CCTV systems in almost every bank, top-class hotel, some shopping malls and some sensitive security installation of the Government. In this project, we considered the use of CCTV to monitor areas that are vulnerable to crime on the campuses of KAAFUC.

CCTV as a surveillance system: The earliest usage of CCTV dates back to the 1940's when it was used by the US and German military to observe the launch of rockets and testing of atomic weapons. Since then, CCTV has become very common in institutions and public places (Mackay, 2006). Mazerolle *et al*. (2002) and Gill *et al*. (2007) considered social behavior, public perception and attitude towards CCTV in public places and Hickey *et al*. (2003) discussed constitutional issues relating to CCTV use in public places (Gill and Loveday, 2003; Bennett and Gelsthorpe, 1996).

Fig. 1: Dome camera

CCTV cameras have changed over the years. They were once large white boxes that could not zoom in or out or follow objects closely. Today, some systems are extremely sophisticated, employing bullet-proof casing, night-vision capability, motion detection, high definition and advanced zoom and automatic tracking capacities, with a number of cameras connected to a control room where human operators watch a bank of television screens. They can be small in size and camouflaged so as not to be easily noticed and are able to detect and follow motion in areas where there should be none (Surette, 2005) (Fig. 1).

Although most CCTV schemes employ overt cameras which are obvious, (e.g., Fig. 2), there are some in which the cameras are mounted into protective shells or within frosted domes (e.g., Fig. 1 and 3). Often termed semi-covert, these camera systems make it more difficult for people under surveillance to determine if they are being watched; as it is usually impossible to figure out in which direction the camera is facing (Leman-Langlois, 2002). Some cameras even employ dummy lenses to conceal the surveillance target (Short and Ditton, 1998).

A CCTV system is not meant to be a physical barrier. Thus it does not limit access to certain areas, or make an object harder to steal or a person more difficult to assault and rob. However, it does have some crime prevention capacity; to trigger a perceptual mechanism in a potential offender (Makkai *et al*., 2004). It seeks to change offender perception so the offender believes that if he commits a crime, he will be caught (Welsh and Farrington, 2004). In other words, CCTV aims to increase the perceived risk of capture; a factor which will de-motivate the potential rational offender once he is aware of the cameras' presence (Ditton, 2000; Honess and Charman, 1992).

Basic features of a CCTV system: Some features of a modern CCTV system include the following. There would be a camera for capturing images and video/audio signals, a video/audio recording device (VCR or a Digital Video Recorder) that allows scenes to be recorded and saved, a transmission medium (cable or wireless) to transmit captured video/audio signals to a video recorder and some management software that would allow multiple cameras to be viewed simultaneously on a monitoring screen (Ratcliffe, 2015).

Fig. 2: Wall camera

Fig. 3: Hidden camera in a smoke detector

Fig. 4: External DVR

Fig. 5: Computer-based DVR

Components: A CCTV system is made up of several components. These components vary in their nature and include cameras, digital video recorders, video cassette recorders, microphones and monitors.

Camera/Lenses: Cameras and lenses that are used in a CCTV setup come in different types and shapes. There are three main types: *Dome Cameras*-usually placed inside dark dome-shaped housings and may not be seen from outside (Fig. 1). They may rotate or may be fixed; *Wall Cameras*-which are big and visible (Fig. 2). They may be simple, or have options, such as a waterproof or bullet-proof shell, infrared light, or zooming facility. These are usually used for outdoor installation and *Hidden Cameras*-small and covert cameras hidden inside other objects and is not easily detectable (Fig. 3). Hidden cameras may be planted in smoke detectors, door bells and even wall clocks.

Recorders: Video recorders are electronic devices used to capture scenes onto storage media such as video cassettes, CD ROMs and hard disk drives. They may either be digital or analog (see below): *Digital Video Recorders (DVR)* and *Analog Video Recorders* (Fig. 4 to 6).

Microphones: CCTV Microphones capture audio signals usually from the location of cameras (Fig. 7). They are usually very sensitive and capable of picking up very discrete sounds. They can be added to any surveillance system with an audio input. (Some CCTV cameras have in-built microphones that capture audio along with the video images.).

Monitors: These are screens that allow live events to be viewed. They are also used to view video during playback. This screen may either be a television or a computer monitor. Some CCTV systems are all-in-one,

Fig. 6: Analog video recorder

Fig. 7: A surveillance camera microphone

Fig. 8: A monitor

usually referred to as the combo DVR. It is a complete system that is equipped with a DVR (Fig. 8).

Transmission medium: Once the image has been captured by a lens of a camera, it is then converted into an electrical signal, which is further taken to a switch, a monitor or a recording device. In order for the video signal to get from point A to point B, it has to go through some kind of transmission medium. The most common media used for video and data transmission in CCTV include coaxial cables, twisted pair cables, microwave links, RF open air transmission and Infrared facilities, telephone line and fibre optic cables. Among the lot, the coaxial cable and the wireless mediums are the most common for CCTV video signals.

Types of CCTV systems: There are basically two types of CCTV systems that can be implemented today. They are either digital or analog (Fig. 4 to 6).

Digital CCTV systems: These systems consist of hardware and software components that collect and transmit vital surveillance camera information over fibre optic lines, wireless or cable to control rooms and equipped with Digital Video Recorders (DVRs) and monitors. A DVR records the video in digital format onto a disk drive or some other memory medium. The system is equipped with digital surveillance cameras that range from compact, fixed cameras to direction-controlled models that can operate in the dark under various lighting conditions. Also available are weatherproof surveillance cameras equipped with heaters, if the cameras are to be mounted in an outdoor environment. There are various proprietary applications that allow the manipulation of features such as the capturing mechanism, play back, editing and storage.

Analog CCTV systems: Analog CCTV systems (based on analog video recorders) are still widely used. They provide very little opportunity for remote access. Storage is limited to tapes which may have relatively short recording times as compared to the digital systems that may record for up to 10 weeks, non-stop. The maintenance of analog systems is often very high and search capabilities on them are not very encouraging. In an analog CCTV system, a VCR is usually used to record images. The video is usually not compressed and if recording is at full frame rate, one tape lasts a maximum of 8 h.

EXISTING KAAFUC SECURITY SYSTEM

As stated earlier, public and private institutions like KAAF University College of Ghana, (KAAFUC), hire or setup their own security systems. KAAFUC is currently using the Industrial type of security. This involves the organization recruiting, training and equipping individuals to provide security services. The

present security personnel are recruited under the supervision of well-trained security personnel. The recruited personnel are screened for questionable character with support from the National Police Service. They are then made to undergo a training course in basic security schedules before assuming regular duties (KAAFUC-Security, 2013).

Duties of campus security men: KAAFUC's security practices the "detect, deter, observe and report" method. A major duty of the security men is to ensure that movable equipment (such as air conditioners, refrigerators, computers, etc.) is monitored constantly to ensure their safety against theft. Their physical presence on the compound also deters potential criminal activity. They patrol various facilities and areas of the compound and this serves as effective deterrent against potential criminals as they risk detection and/or arrest. The security personnel also assist management of the university to investigate crimes already committed and help to apprehend and interrogate suspects. These may sometimes lead to retrievals of stolen items and other belongings of crime victims.

Another significant function of these personnel is to infiltrate disgruntled student groups on campus and make reports to management to preempt student uprising. Very often, most institutions in Ghana experience various forms of student unrest on campuses which may lead to destruction of property and sometimes lead to the suspension of academic programmers. KAAFUC, in its effort to curb the agitations of students and rumpus on their premises, has tasked their security personnel to pick up signals of potential threats by students and alert management to ward off any disturbances. The security personnel are also trained and tasked to assist in vehicular traffic control on campus. They demarcate, direct and assist drivers of various vehicles which enter the compound, for them to park appropriately as demarcated (KAAFUC-Security, 2013).

Strengths of the current system: The present security system of KAAFUC has a total of 31 trained men who work day and night, grouped into three teams of eight personnel per group, with three on off-duties on any day. They shuttle a three-shift system-morning, afternoon and night. The advantages of this arrangement include the following:

- The physical human presence of security personnel deters potential wrong-doers from committing crime.
- The personnel can patrol various facilities to either secure property, or take into their custody for protection, property which was left at places where they were not supposed to be. They could also shut

and lock offices and other property, such as cars, which were mistakenly left, unlocked, to protect their contents.
- This system allows the conduct of on-the-spot interrogations of suspicious offenders, where necessary, to prevent unauthorized persons from gaining access to restricted areas.
- By interacting with the students and others on campus, the security men may hear hints of intended student uprisings and other security threats to the school.
- The security staff is also capable of combining intelligence and experience, in order to know where and when a threat may be eminent and thereby make quick rational decisions.

Weaknesses of the current system: We found out that the security staff on campus is not adequately motivated, financially and this tends to make them prone to corruption:

- Considering the size of the compound and the property thereon, the security men may compromise on discharging their duties by not covering all the sensitive areas on campus, e.g., out of laziness, or fatigue.
- The physical limitation of sight of some people, i.e., night vision, could be a major weakness of this system.
- Prohibited nationally, the security men are not adequately equipped with weapons. This exposes them to personal danger. There is a possibility of them being attacked in an attempt to prevent criminals from committing an unlawful act.
- The current security system seems inadequate during examination periods. This may result in examination malpractices.

Opportunities of the current situation: There is the opportunity to improve upon the capabilities of human security personnel by re-training and equipping them with useful gadgets to enhance their work:

- Combining human physical patrols with surveillance equipment, security officers would enhance their daily duties.
- Uniformed security men and surveillance equipment tend to leave the perception of one being watched. With this perception, a potential wrong-doer may hold back his intentions of committing crime.
- Most of the security staff was once in the public security forces, such as the military, police and navy. When their security knowledge and experience are tapped, it will help build a more sophisticated and reliable security system.

Threats of the current situation:

- The security personnel, with little or no technological monitoring, could themselves tamper with the very property they are supposed to protect. They could also, unwittingly, leak vital information to outsiders, thereby exposing the security system of the institution.
- The physical weakness or tiredness of human security personnel could also be taken advantage of by criminals to the detriment of the institution.
- The security personnel could falsely accuse innocent individuals as culprits of incidents and thereby cause their arrest and possible conviction.

METHODOLOGY

Data collection: The source of information for this project was based on both primary and secondary data. To a large extent, we depended on the internet and literature. Using the survey approach, data was also collected through 68 questionnaires issued to our research population of security officers, students, lecturers and other stakeholders on the campuses (out of which 60 were returned, as our research sample size). We benefitted from the knowledge these people have on the security set-up and issues of the institution through their experience in the school, since they are part of the institution's body.

The main purpose of our questionnaire is to assess the need of CCTV surveillance system and how it could be used to enhance crime combating on the KAAFUC campus. We adopted the systematic random sampling technique to select the sample size since this is simple and can be easily administered by us and also it would give each member of the population a fair chance to be selected. Our data was then analyzed using quantitative and qualitative methods.

Data analysis and findings: The responses from our questionnaire justified our proposal for CCTV surveillance system for KAAFUC. The following are some of the responses.

We asked respondents as to how they would rate crime on the campus. Seven of them, representing 11.67%, stated that it was *low*, 19 representing 31.67%, stated that it was *medium* and the majority 34 representing 56.67%, said that they found it to be *high* (Table 1). Thus crime rate on KAAFUC campus is rated to be high (Fig. 9).

Respondents were asked as to how they would rate the current security on campus. None of them (0%) rated it to be *Excellent*, 5 of them, representing 8.33%, stated that it was *Very Good*, 18 of them, representing 30%, stated that it was *Good* and the majority 37 representing 61.67%, said that they found it to be just *Satisfactory* (Table 2). Thus the current security system on campus is rated to be just satisfactory (Fig. 10).

Table 1: How would you rate crime on campus?

Rate crime on campus	Frequency	Percentage
Low	7	11.67
Medium	19	31.67
High	34	56.67
Total	60	100

Table 2: How would you rate the current security on campus?

Rate current security on campus	Frequency	Percentage
Satisfactory	37	61.67
Good	18	30.00
Very good	5	8.330
Excellent	0	0.000
Total	60	100.0

Table 3: Do you think there is a need for alternative security system on the campuses?

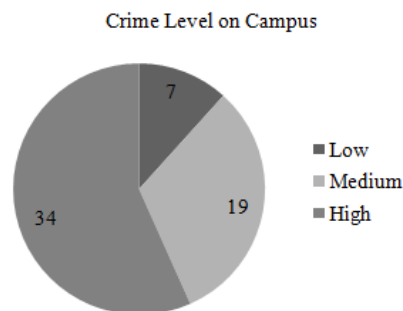| Need alternative security system on campus?	Frequency	Percentage
Yes	49	81.67
No	11	18.33
Total	60	100.0

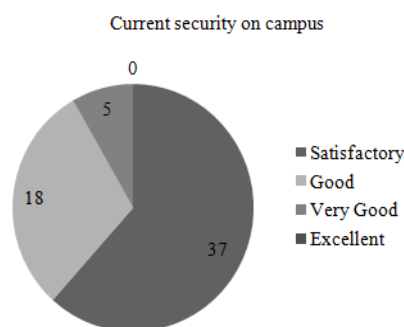Fig. 9: How would you rate crime on campus?

Fig. 10: How would you rate the current security on campus?

As to whether respondents think there is a need for an alternative security system on the campus, 11 of them, representing 18.33% responded in the negative while the majority 49 representing 81.67% responded in the affirmative (Table 3). Thus, we can say that there is a need for an alternative security system on the campus (Fig. 11).

We asked respondents on how they would rate CCTV surveillance systems, generally. Only 3 of them, representing 5% rated them to be *Not Effective*, 13 of them, representing 21.67%, stated that it was *Effective*,
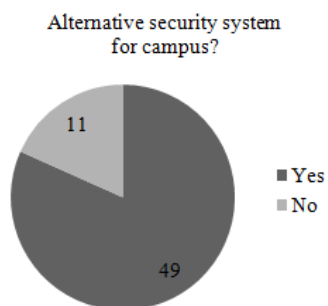
Finally, we wanted to know if respondents would prefer the use of CCTV on campus to the present security. Two 2 people representing 3.33% responded in the negative while 14 were not sure; they said *Not Really*. The majority 44 representing 73.33% responded in the affirmative (Table 5). Thus, we can say that respondents would prefer the use of CCTV on campus to the present security (Fig. 13).

THE PROPOSED SYSTEM

As mentioned earlier, the aim of this study is not to totally replace the current human security system of KAAFUC, but to enhance it by introducing CCTV system to complement it, as modern CCTV surveillance systems are known to play an important role in fighting and preventing crime.

Advantages of the proposed CCTV system: Some flexibilities and advantages of our proposed system include the following:

- CCTV systems can record video images on hard disk drives for several weeks.
- A digital system allows the user to instantly retrieve relevant data.
- Data is stored in a database which can be searched by camera, time, date, alarm-activation or motion.
- CCTV allows the user to replace their switching unit, monitor and time-lapse recorder with one centralized system, which can be accessed and controlled from different locations.
- With hard disk drives or other permanent storage media, the system allows minimum intervention from the system controller.
- CCTV systems produce images that are stored and can be viewed repeatedly without image deterioration.
- Recordings can be done by schedule (i.e. time or date), alarm activation or via smart motion detection capability.
- The system may be set to commence recording only when motion or other pre-defined events are detected to avoid wasted "dead taping".
- Important recorded information can be archived for later retrieval.
- Most CCTV systems' software is upgradeable to extend the systems' lifetime and currency.

Addressing weaknesses of the existing system: Our proposed system is to address the weaknesses and threats that the current security system has, such as:

Motivation: KAAFUC security men do not feel highly motivated, with respect to remuneration. The new system, when implemented, will mean fewer people doing the jobs of many. The system would cover and monitor a wide area of the campus more effectively

Fig. 11: Do you think there is a need for alternative security system on the campuses?

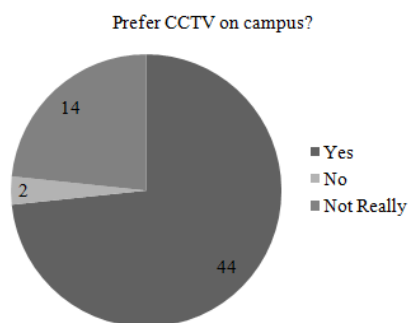Fig. 12: How would you rate the CCTV surveillance system?

Fig. 13: Would you prefer the use of CCTV on campus to the present security?

Table 4: How would you rate the CCTV surveillance system?

Rate CCTV surveillance system	Frequency	Percentage
Not effective	3	5.000
Effective	13	21.67
Very effective	44	73.33
Total	60	100.0

Table 5: Would you prefer the use of CCTV on campus to the present security?

Prefer the use of CCTV on campus?	Frequency	Percentage
Yes	44	73.33
No	2	3.330
Not really	14	23.33
Total	60	100.0

and the majority 44 representing 73.33%, said that they found it to be *Very Effective* (Table 4). Thus CCTV surveillance systems are known to be very effective (Fig. 12).

than humans could. The cost benefit of using the new system could then be used to motivate the security staff better.

Physical limitations of security men: Human beings have some physical limitation in the provision of security, e.g., eye-sight visibility, fatigue, the need to sleep, etc. These limitations can be a major weakness of the existing pure manual security system. On the other hand, CCTV systems would neither get tired nor slumber; they even have the capability of capturing images in total darkness through the use of night vision technology.

Safety of security men: A CCTV system, when implemented will not expose the unarmed security men to any physical danger, since they will have the chance to monitor and assess the type of danger or threat they face before going to the scene of the incident.

Examination malpractices: A CCTV system will be able to monitor examinations invigilation from remote locations and keep evidence.

DESIGN

Designing a CCTV system requires us to fit a number of important pieces together. Individually, these pieces are crucial, but how they interact is just as important. There are various design elements to consider; scene or environment, camera, transmission medium, monitors, video signal management and control equipment. There are interdependencies between these elements. For example, the environment or scene will determine the type of camera and lens; the location of video signal management and control equipment (such as the DVR) will determine the type of transmission medium.

Scope and limitation: This project is centered strictly on the use of CCTV to combat crime on the campuses of KAAF University College, Ghana. It is intended to comply with CCTV standard code of practice-with respect to design, installation and maintenance. It is to capture the following areas of the University (based upon responses we had from our questionnaire): a) examination halls, b) car parks, c) computer labs and d) the school entrance.

General layout of KAAFUC: Figure 14 depicts an entire layout of KAAFUC. This layout is subdivided into three areas; Area 1, Area 2 and Area 3:

- Area 1 (Fig. 15), covers KAAFUC Main Gate, the Administration Building and the Car Park.
- Area 2 (Fig. 16), covers the Main Campus Hostel Area, Main Campus Cafeteria.

- Area 3 (Fig. 17), Appendix) covers the Main Car Park, the Students Car Park, the Lecturers Car Park and the Lecture Halls.

The cameras will be located in these areas and will be supplemented by street lighting off daylight hours. Offices/Interior lighting will be provided by KAAFUC, controlled by motion sensors outside of office hours.

Area 1: (Fig. 15): The scope of Area 1 is the University Main Gate, Administration Building and the Car Park. The cameras to be used here would be wall cameras in waterproof casing (Fig. 2). Four 12V-DC Power Supply Units (PSU) will feed cameras to be installed at the outside of the block. The interior of the Administration building will be fitted with cameras capable of identifying persons entering the building through any of the four entry points.

Camera 1: This is to be located at University Main Gate. Its purpose will be to monitor movement in and out of the University compound to detect unauthorized entry.

Cameras 2 and 3: These are to be located on the main road leading to the University premises to monitor movement in that area.

Cameras 4 to 7: These would be placed at the Administration Block car parking area, to take care of the car parks at the front and back of the Administration block.

Cameras 8 to 11: These shall be located at the ground floor of the Administration Block to monitor movement within the building's ground floor.

Cameras 12 to 16: These shall be located on the first floor of the Administration Block to monitor movements within the building's first floor. They will be positioned at the two extreme ends of the corridor on the first floor. They will be powered by one power supply unit on the floor.

These cameras will either be the dome type or the hidden type, (Fig. 1 and 3 respectively) and will be installed in the interior of the Administration Block; one each will be installed at the four entrances of the Administration Block. Two other cameras will be installed at the two extreme ends of the corridor in the building. They will be powered by two 12V-DC power supply units.

Area 2: (Fig. 16): The scope of Area 2 is the Main Car Parking Area, the Lecturers' Car Park and the Lecture Halls. These cameras will be a combination of all three types of CCTV cameras and they will provide surveillance in the car parks, detect apprehensive movements and prevent anti-social activities. Wall cameras in waterproof casing will be installed outside the area. The dome and the hidden camera types will be
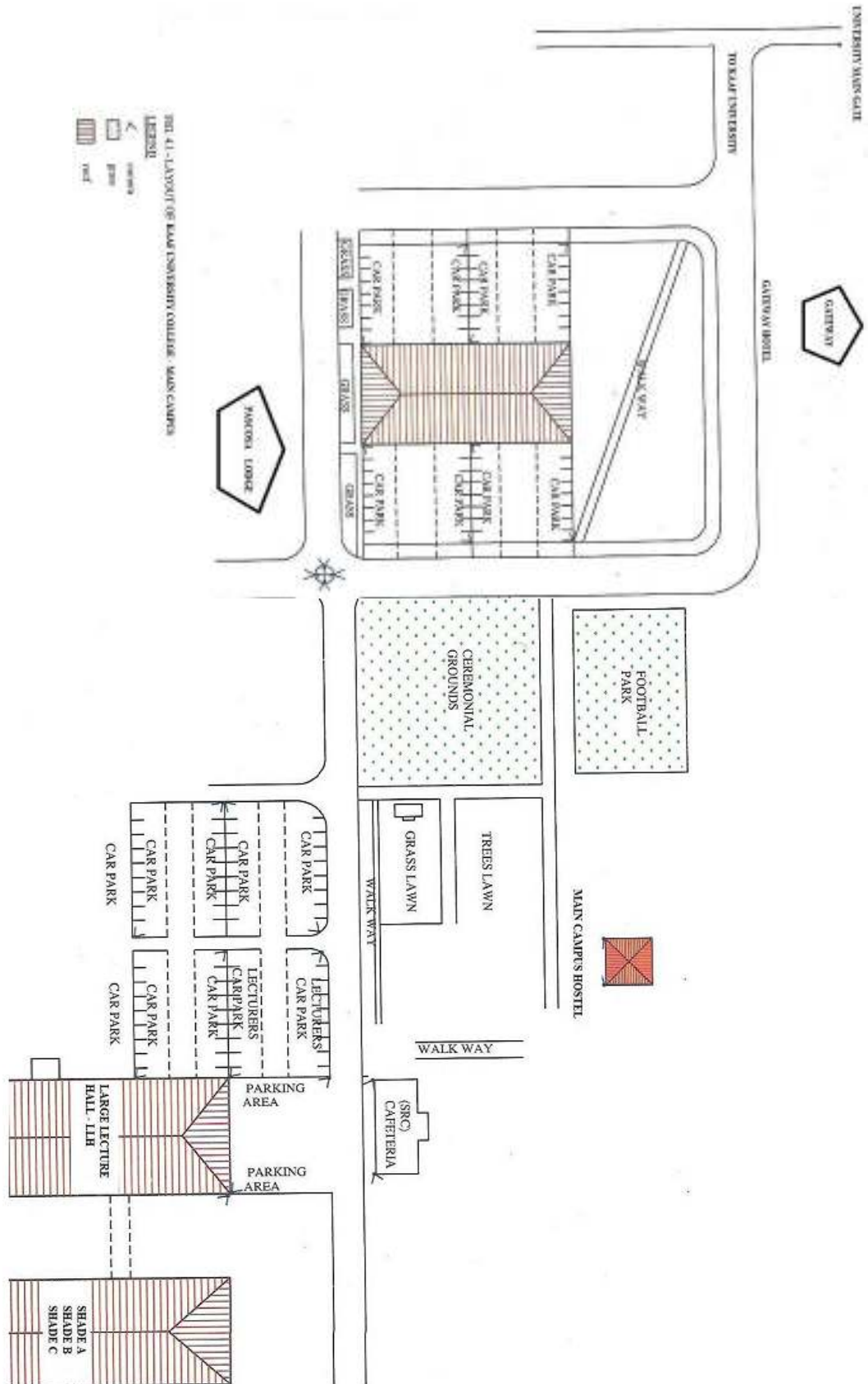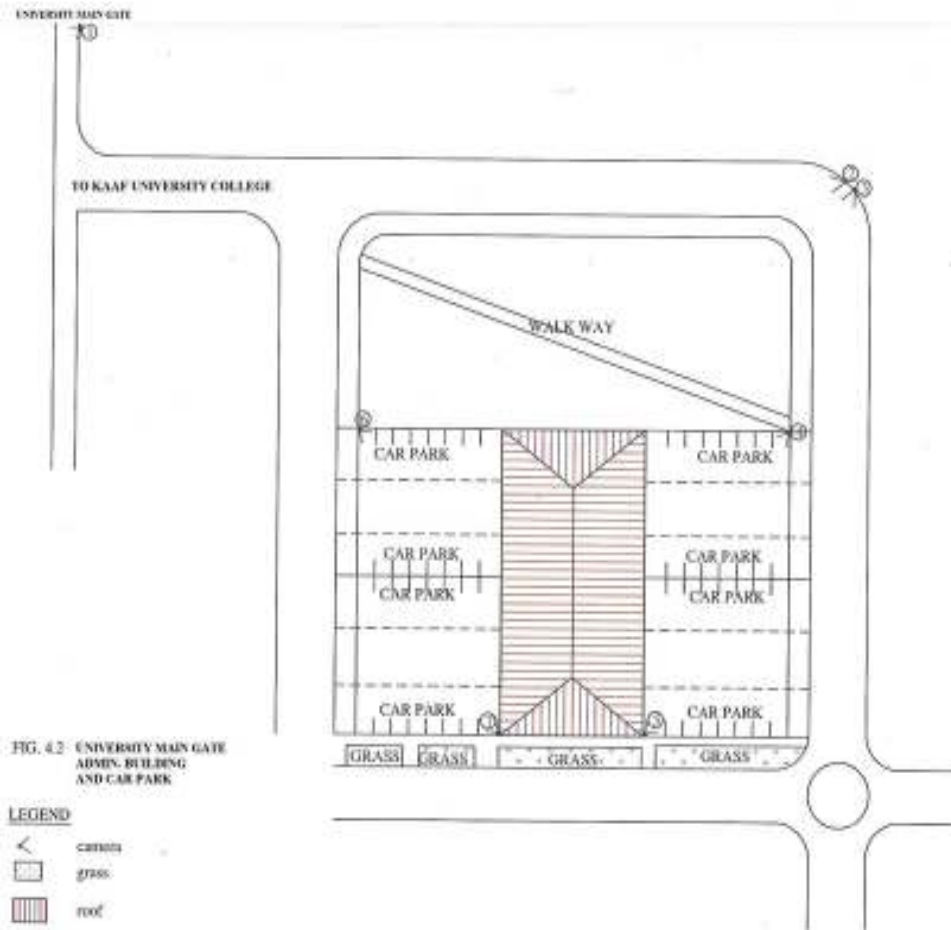
Fig. 14: Depicts an entire layout of KAAFUC

Fig. 15: Area 1-KAAF university college main gate, administration building and car park
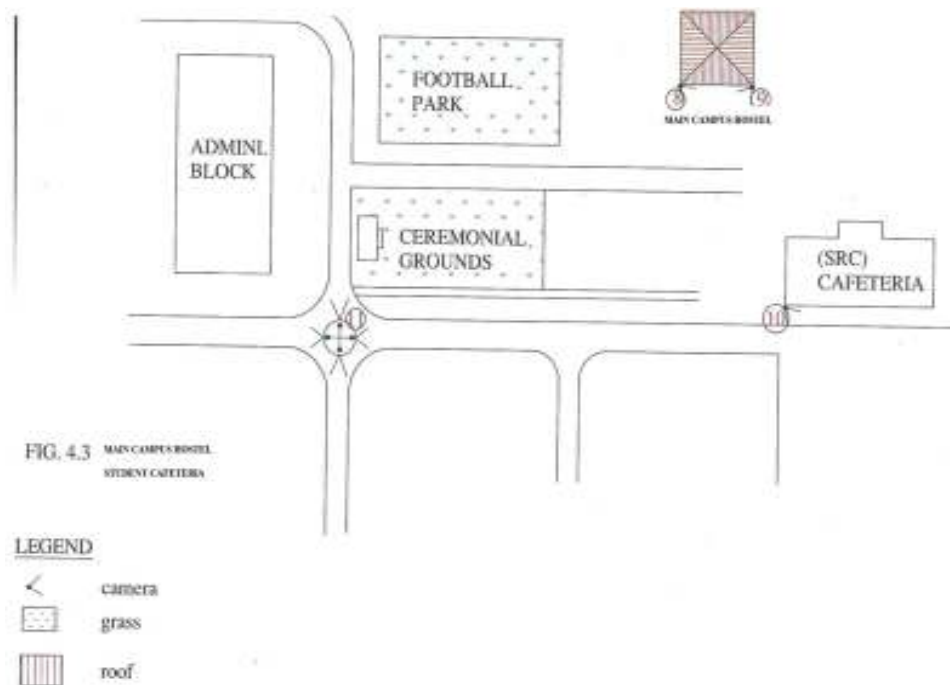

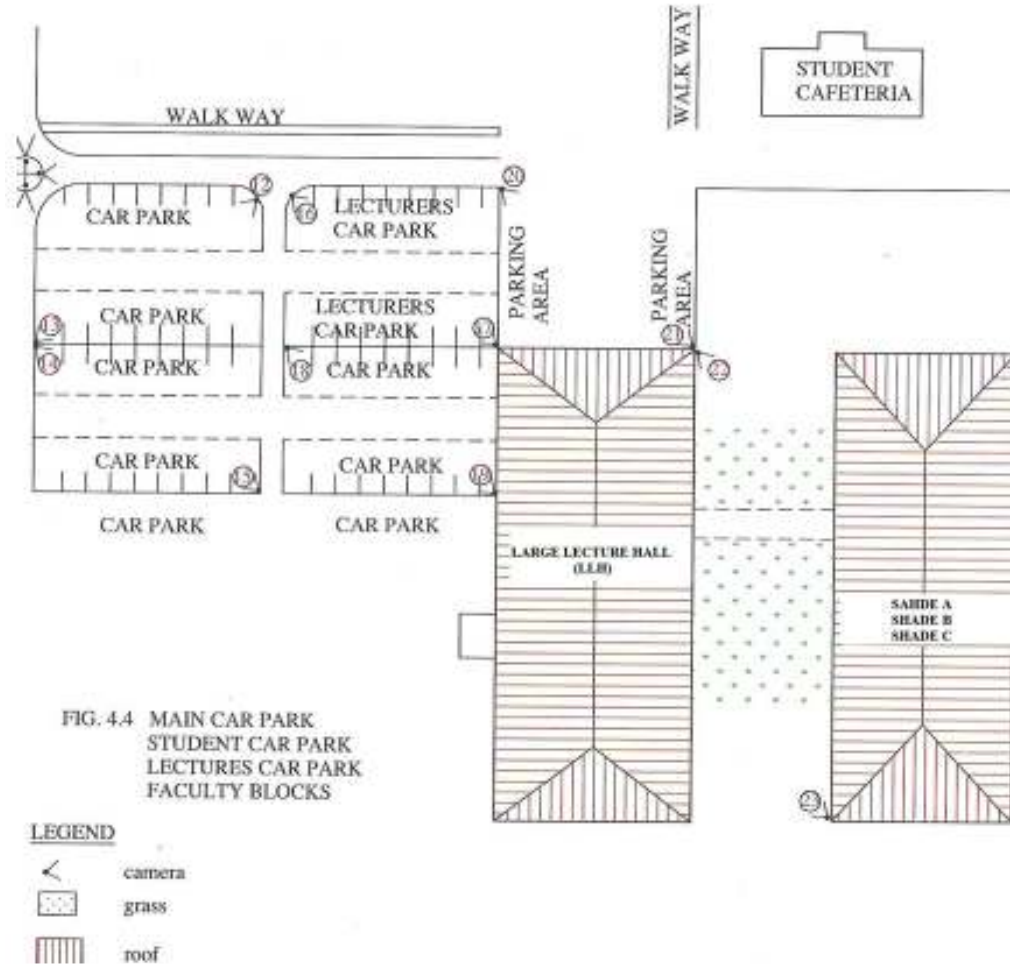Fig. 16: Areas 2-main campus hostel area, main campus cafeteria

Fig. 17: Area 3-main car park, student car park, lecturers' car park and lecture halls. Large Lecture Hall (LLH-) and shade A, Shade B, Shade C

installed inside the faculty blocks and they will be powered by 12V-DC power supply units.

Cameras 17 to 28: These will be located at the car parks at the two faculty blocks to monitor the entire parking areas which are the lecturers' car park, the main car park and other areas of interest around the lecture and examination halls.

Cameras 29 and 30: These two will be installed at the base of the two staircases of the large lecture hall to monitor entry into the faculty block.

Area 3: (Fig. 17): The scope of this area is the Main Campus Hostel Area and the Main Campus Cafeteria. The cameras here will be the outdoor type with waterproof casing and will be powered by a 12V-DC power supply unit.

Cameras 31 and 32: These cameras will be located at the extreme left and right ends of the hostel's front area to provide surveillance for the hostels car parking area and the open space in front or the hostel.

Cameras 33 and 34: These are to be installed at the base of the two staircases of the north-wing faculty block to monitor who or what is entering the faculty block.

IMPLEMENTATION

This section contains implementation examples. Effectively, these are installation considerations that apply to any CCTV systems (Fussey, 2004). The typical examples shown here give prompts to help the installer to obtain the best possible results from the proposed system and to avoid any pitfalls in the installation process. Although the application of CCTV and the range of available components is extremely diverse, one can say that in its most basic form any system must consist of a number of essential devices namely: camera, lens, cables, recording and monitoring equipment, system operators and power source. These devices must be compatible and work together efficiently if the CCTV system is to be truly effective.

Table 6: A sample estimated cost for CCTV implementation at KAAFUC

Quantity	Description	Unit price ($)	Total ($)
3	APC Online UPS 6KVA	4, 000.00	12, 000.00
4	HP PowerEdge Server/1Terbit Sata HDD *4	6, 220.00	24, 880.00
3	8-Channel DVR-Expandable to 32	1, 300.00	3, 900.000
35	Outdoor Cameras-Waterproof	350.000	12, 250.00
20	Indoor Cameras (Dome/Hidden)	270.000	5, 400.000
3	CAT5E Cable (Boxes)	500.000	1, 500.000
8	Coaxial Cables (Bundles)	100.000	800.0000
2	Miscellaneous Expenditure	4, 385.00	8, 770.000
Total			69, 500.00

Camera/Lens: In this project, we shall use the external wall mount cameras in waterproof casing, capable of withstanding harsh weather conditions, for all outdoor installations. For indoor installations, we shall use a combination of hidden and dome type cameras. These cameras will be mounted at such heights that an individual would not be able to reach them.

Cables: The principal cable forms used as the traditional medium for carrying the CCTV signals are co-axial cables. Coaxial cables will be used to connect all cameras to the control room in our implementation.

Recording and monitoring equipment: In order to view and also record the images from a camera, one needs control equipment. This equipment is to work with the monitor screens. There will be two separate recording equipments in our project. One will be located in a control room at the administration block and the other in the main faculty block of the campus. The control room must be soundly constructed to ensure physical security, safety and integrity for the operators and equipment.

System operators: The operator is regarded as the most important factor in a CCTV setup. All the security men in the existing system should normally be trained on how to handle the system. (They would be expected to behave professionally, bearing in mind that everything about their duties is confidential and should not be discussed with people not connected with the system).

Cost considerations: We present in Table 6 an estimate of the proposed implementation.

SUMMARY OF FINDINGS

The questionnaires we administered and the interviews we had revealed that:

- The current security system on campus is not very effective and needed an enhancement.
- Technology has improved and is readily available which can be used to complement the current system.

- A great proportion of the people we encountered within the course of our research endorsed the use of CCTV.
- The study in some organizations where CCTV has been installed revealed that it has had a positive impact in crime combating.

RECOMMENDATION

Based on the findings, we make the following recommendations:

- KAAFUC Management should integrate the implementation of CCTV as part of the existing security system.
- KAAFUC should commit itself financially and devote some other resources in the implementation of this project.
- KAAFUC should allocate a suitable room to serve as a control room for the recorders. These recorders should be housed in the Administration block and in a room in one of the Lecture Halls.
- Personnel in the KAAFUC security should be trained to operate the CCTV system as well as the professional code of ethics associated with it.
- On successful implementation, the project may be replicated in other areas of the campus not covered in this work.

CONCLUSION

In this study, we analyzed the security system on the campus of KAAF University College, Ghana; found that there was the need to enhance the strictly manual system with a CCTV system. We gave a design of a proposed CCTV system that has the potential to enhance safety on the campus. The system, when implemented as indicated, will help the present security men fight crime on the campus.

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