

Security Technology: A New Field in Engineering Curriculum

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Abstract

Security of information as well as physical resources has become a crucial component in research and development. A significant amount of research interests and grants has been dedicated towards development of strong, efficient and robust security techniques and systems where both the academic institutions and industries have been involved actively. The computer or information security systems have been incorporated in several engineering and computer science curriculum. However, there has not been enough progress in developing an engineering curriculum dedicated to security technologies. The objective of this paper is to propose a new engineering and technology curriculum on security technologies which will introduce the students to different types of digital and physical techniques employed to maintain the security and privacy of any physical resources. Different algorithms and systems will be included in the program to deal with cryptographic techniques, biometrics, image processing concepts and hardware implementations. The curriculum will train the students on audio and video surveillance, access control, intrusion detection, forensic analysis and other advanced techniques that are useful to military and federal agencies as well as industrial organizations.

Keywords: digital technology, cryptography, biometrics, digital image processing, pattern recognition, target detection, security, forensics.

Introduction

Digital technology has revolutionized our professional, academic, social, political, cultural and even personal lives. However, along with the salient attractive features of digital technology, the issues with privacy, security, counterfeiting, intrusion and terrorism are also growing at an exponential rate. Significant research interests have been developed over the years in designing technologies to protect our physical resources, intellectual property, digital information, and to maintain the safety and peace of our daily life. Such research and development works have created a great demand for a new field in engineering, named security technology.

Computer security, or information security, has already been evolved and established in several institutions as undergraduate and graduate degree program. However, these programs deal mainly with access control, intrusion detection, and cryptographic techniques for the security of digital information and computer resources in network environment. As digital technologies have extended far beyond the computer technology and spread into every sphere of the society, new

degree programs and curriculum are required to deal with security and investigation technologies in all other areas of knowledge and practical applications.

The objective of this paper is to propose a new engineering degree program in security technologies. The security technology program will focus on applications of engineering and technology in security as well as law enforcement fields. Scope of the curriculum can be categorized broadly into fundamentals of digital technology, cryptographic techniques, biometrics security, digital audio, image processing, target detection, video analysis, and forensic technology. Students will be trained through analytical and software tools so that they can design, develop and maintain security technologies in practical field. Because of the growing need of protective techniques, the security technology program would be very attractive to the military, federal agencies as well as private industries.

Curriculum Goals

The proposed security technology curriculum will prepare the students with knowledge and skill in state-of-the-art technologies and related social and legal aspects that are applicable to the security and forensic fields. Graduates of this program are expected to design, install and maintain technical systems for security and forensic applications. The goals of the security technology curriculum can be outlined as below.

- (1) Introduce the students to the fundamental concepts of digital technology.
- (2) Introduce the students to the advanced technologies for security applications.
- (3) Train the students on software and hardware tools in security technology.
- (4) Coordinate with federal and private sectors for practical training.

Overall Curriculum

The proposed security technology curriculum will cover a range of courses in the following major areas, in addition to the areas of arts and sciences as required by the institution:

- (1) **Fundamentals of Digital Technology:** Courses in this area will introduce the students to the fundamental concepts of electrical engineering, and computer technology.
- (2) **Digital Media:** This group of courses will train the students on the basic concepts of digital processing of physical media, including audio, image and video.
- (3) **Cryptographic Techniques:** Fundamental concepts of encryption and decryption techniques and the cryptographic tools will be discussed in these courses.
- (4) **Biometrics Security:** This area will introduce the basic principle of biometrics and then discuss how biometric features can be utilized in security systems.

(5) **Video Surveillance:** These courses will cover the principles and applications of cameras and sensors in video analysis and security applications.

(6) **Pattern Recognition:** This area will discuss on the techniques for detection of a target or object of interest in a given still or video scene.

(7) **Forensic Technology:** Application of digital techniques in crime scene investigation and evidence collection will be introduced by this area of courses.

(8) **Hardware Design:** These courses will train the students on the design and implementation of the security logic and algorithm on hardware components.

A probable list of courses in each of the above-mentioned areas of knowledge is outlined in Table 1.

Table 1: Curriculum Display

Serial	Major Area	Courses
1	Fundamentals of Digital Technology	Introduction to Electrical Engineering
		Introduction to Computer Technology
		Digital Logic
		Introduction to Semiconductor Devices
		Computer Programming
2	Digital Media	Digital Audio, Image and Video
		Digital Image Processing
3	Cryptographic Techniques	Introduction to Cryptography
		Cryptographic Tools and Systems
4	Biometrics Security	Introduction to Biometrics
		Biometrics-based Security Systems
		Securing Biometrics
5	Video Surveillance	Video Analysis
		Cameras and Sensors
6	Pattern Recognition	Target Detection
		Target Tracking
7	Forensic Technology	Crime Scene Analysis
		Digital Forensics
8	Hardware Design	Programmable Logic Gates
		System Integration
		Smart Card Technology

Teaching Methodologies

The proposed curriculum will be highly application-oriented. So the courses need be taught preferably in lab environment. Each course will assign some practical problems to the students

who will design, develop and test the technology to solve the problems. In addition, a significant emphasis will be given to senior design and project, and internship training.

Students and Graduates

The security technology curriculum will involve a great amount of applied technologies. So the students will require a high level of background knowledge in mathematics and sciences. The program will also put emphasis on creativity and psychological aspects while designing and developing security technologies.

Graduates of this program are expected to work in public and private security fields. Federal agencies require Security Engineer to design and install technologies for enhancing security, protecting areas and resources from intruders, and doing forensic investigation. Large private organizations also require security experts to install and maintain technologies to protect their resources. Graduates of this program may also work in industries for developing innovative security technologies.

Conclusion

There has been a growing need for security technologies in almost every sector of a nation. The proposed security technology curriculum will prepare graduates with knowledge and skill in applied technologies for security and forensic applications. It will also enhance the research and development of advanced security technologies through collaboration between academic institutions, practical fields and research sponsors.