Chapter 61
Cyber Security Risks in Robotics

Ishaani Priyadarshini
KIIT University, India

ABSTRACT

With technology flourishing at a rapid rate, humans have been able to achieve considerable heights of success. Accomplishment of tasks nowadays is either a click away or a command away in most of the technological arenas. One such realm of technology is that of Robotics which has been there for almost a century and continues advancing day by day. The evolution of robotics has ranged from the basic remote controlled systems to humanoid robots. With applications as well as accuracy increasing for every new system implemented, security risks too have been making their way into the new invention. Since different robots have been created for different purposes in different fields like the defense, household, medical or the space, protecting systems against their exploitation is of utmost importance as these fields incorporate sensitive as well as intricate tasks. This chapter focuses on the security aspects of Robotics. The necessity of Cyber security in Robotics has been explored by taking different kinds of robots used in different fields. The current state of Robotics is vulnerable to many risks and several case studies have been highlighted to support the need of securing Robotics by identifying several risks to which it is vulnerable. Apart from that mitigation strategies have been discussed to secure the domain of Robotics. An attack comparison has been made for three robots in analyzing them against the vulnerabilities faced by them.

INTRODUCTION TO CYBER SECURITY

Cyber security may be defined as the state of being protected against the criminal or unauthorized use of electronic data or the measures to achieve this. It is a field which strives to defend attacks against computer systems which may incorporate control systems, critical infrastructures and technology transport systems. It ensures five security services namely Confidentiality, Integrity, Availability, Authenticity and Non repudiation of electronic, computer and network domains. Most of the organizations, corporations, institutions and governments collect, process and store magnanimous amount of confidential data and transmit it across the networks to other systems. One of the most contributing causes of cyber security is the constantly evolving nature of security risks. Even though the traditional systems have been successful

DOI: 10.4018/978-1-5225-5634-3.ch061

in protecting against significant threats, many possible threats still remain unchartered. As the volume and sophistication of cyber-attacks increase exponentially, it is necessary to safeguard information which might be of personal interest as well related to national security. Thus a body of technologies, processes and practices works towards securing the networks, computers, programs and data from attack, damage or unauthorized access. The National Institute of Science and Technology (NIST), defines cyber-attack as a means of using the cyber space for disrupting, disabling, destroying or maliciously controlling a computing environment or infrastructure (Kissel 2013). This will lead to destroying the integrity of the data or stealing controlled information. The cyber infrastructure generally comprises of Electronic Information and communication systems, hardware and software, storage, processing and communication. Cyber security being the biggest risk of technological operations finds its use in almost every realm of technology. Ranging from real time data analytics to Drones and Robotics, Cyber security becomes critically important as Internet of Things constantly grows. One element of the cyber infrastructure is the field of robotics which we will be considering in this article.

BACKGROUND

The history of robots can be traced back to the 20th century when a mere humanoid machine was introduced. Gradually it developed into what we call the robot nowadays. The first generation of robots saw stationary, non-programmable, electromechanical devices which lacked sensors. They were replaced by second generation robots which came with sensors and controllers. The third generation robot was an even more refined version of the second generation robot and was full of features. It could be stationary or mobile and could provide complex programming along with speech recognition and synthesis. The fourth generation of robots is currently undergoing research and is under the developing phase. Over the time, the definition for robots has kept on changing. A robot may be defined as a unit devised to carry out tasks in a repeated manner, keeping a track of speed and precision. The term robot comes from the Czech word ‘robota’ depicting ‘forced labor’. A robot may be controlled by a human operator as well as a computer (Struuk, 2014). Robots may be classified into two types depending on how they are controlled.

- **Autonomous Robots:** These are the robots which do not need human or operator intervention and can perform tasks by themselves (Bekey, 2015). For instance, the Bump and Go robot which has bumper sensors to detect obstacles. With respect to every bump that it faces as it hits the obstacle, it is given the command to change its direction.
- **Insect Robots:** A group of robots which function on the command of a single controller fall into the category of Insect robots (Rouse, 2007). It is similar to a colony of insects wherein the entire fleet follows a single leader. Antbo is an insect robot (Ashley, 2016).
- A more vivid definition for a robot focusses on a few characteristics followed by the device. The characteristics are as follows (Pratyusha, 2011).
- **Sensing:** A robot must be able to sense its surroundings. For this purpose it is equipped with light sensors, touch and pressure sensors, chemical sensors, sonar sensors and taste sensors. A robot lacking sensors is unaware of its environment.
- **Movement:** One of the characteristics which makes robot so proficient is its ability to move. A robot may be dependent on wheels or walking legs to move. The movement may depict either an actual displacement in the position of the robot or simple parts of the robot to move.