IOT Security Aspects

The Internet of Things (IoT) is a major evolving paradigm where objects such as home appliances, machines, monitoring sensors, vehicles, automated devices, etc are connected through the Internet to allow remote monitoring and control of these objects as well as collaborative operation between these objects. Objects can be connected to the Internet through Wi-Fi, Bluetooth, ZigBee, 3G or LTE techniques. The IoT provides a world where all the things around us are connected to the Internet and communicate with each other with minimal human interference. By 2020, several tens of billions of devices are anticipated to be connected. With the commercialization of the Internet, security issues are expanded to cover financial transactions and personal privacy. In IoT, security cannot be separated from safety. Whether accidental or malicious, hacking the controls of a pacemaker, a car, or a nuclear reactor places a big threat to human life. Accordingly, one of the major challenges that limits the expansion of the IoT technology is the security aspect. Security can be performed either in hardware (using dedicated real time ASIC chips) or software (using software authentication API). Both hardware and software security platforms are booming up recently to pave the way for the IoT deployment to move forward.

AI Power Signature Analysis for IOT Attack Detection: The internet of thing (IoT) has become a widespread phenomenon that has resulted in an exponential growth in data. The increase in the number of devices connected to the internet has raised a lot of security issues and privacy concerns. Users are susceptible to many forms of cyber-attacks; which could affect the functionality of their devices and their power signature. In this project, we are proposing the usage of Machine learning to model the power consumption patterns of IoT sensor nodes. Using such model, we were able to detect anomalies in the system's behavior and thus, identifying attacks and classifying them. Using the training data, a detection threshold will be computed to differentiate between normal and anomalous behavior as well as classify different types of this behavior.

Hardware Trojan Detection using Machine Learning: In our project, we propose a solution to one of the major trending security problems namely Hardware Trojans. HTs are intrusive actions that tend to corrupt the functional behavior of genuine designs, leak their sensitive information, or even downgrade their performance. We propose the usage of Machine learning techniques to build a Trojan attack model for different designs evaluate the performance of such designs using only input and output data and delays.

Low Power IOT Security Mechanisms: This project aims at implementing different levels of security for different applications such as light security (for the Bluetooth and ZigBee connected things), medium security (for the LTE connected things), and high security (for the connected local servers and the cloud server connections). The outcome of this project will be a complete IoT system that adopts hardware security at different levels (i.e., light, medium, and high) in terms of prototype chips and also an API for the cloud software security.

Smart Sports

Enhancing athlete's performance in current day competitive sports requires accurate monitoring of the athlete training sessions and detailed knowledge of the athlete movement dynamics. This allows for identifying the points of strength and weakens for every athlete and to tailor training sessions that are specific to this athlete. Emerging technology combines sensors and data analytics to create virtual representations of athlete that can be simulated into game situations and training regimes to identify what they need to improve or protect in real-time. The main objective of this project is to use information technology, to enhance the coach functionality and allow each athlete to get a useful feedback.

Smart Sports Personal Football Trainer (Shooting Tracking): The use of technology in sports training is progressing rapidly as it is revolutionizing sports training through live-tracking performances and perfecting athletic movements. This project aims to find an intelligent and efficient method to test and improve the accuracy of a player. This is done by projecting targets on the wall, and recording the ball continuously using a Stereo Smart Camera. With the use of OpenCV and color detection, we process the images to track the ball, calculate data about its location and check if it hits the required target.

Smart Sports Personal Football Trainer (Activity Tracking): In the project, we aim to analyze the data acquired by using a developed low-cost calf worn device to recognize soccer players' movements from running, jumping and shooting. These data is analyzed on a mobile phone and stored there, also shared with the coach to test and check players performance.

Sports Activity Classification using Deep Learning Mechanisms/Machine Learning Analysis for Smart Sports: The developed IOT device have the capability to collect detailed information about athlete movement and vital signs. We are going to use such device to collect information from these devices store it in a database and analyse to produce real time information about the activity of the athlete. The backend is expected to analyse such information over time and assess the progress of each athlete and predict its future performance.

Egypt in Depth: Machine learning and Data Analysis: Some of the most talented and hardworking people in Egypt never get the chance to introduce their authentic services/products to the tourism market, due to the closed cycle of cash flow that's preferred by the current major stake holders in the industry (Tour operators, Hotels, Travel agents and Destination Management companies) which cause the following major side effects:

- Tourists get to see very little from what Egypt 2019 can offer.
- Cash flow cycle for the available products and services kicks back 40-70% (12-20 EGPBN in 2017) to the same stake holder which minimizes the multiplier effect for the tourism dollar.
- Excluding thousands of hard working, talented Egyptians from connecting to the world and participating in the travel industry.
- Egyptians are becoming less friendly towards tourists as recently everyday person do not feel any benefits of tourism industry.

Our project aims to introduce a network that connect Egypt visitors who are willing to enjoy an off the beaten track local experience with a range of carefully selected activities and goods that's produced by hard working talented Egyptians who rarely get the chance to merge with the Tourism market. Beside the direct economic impact, the project will also provide a strong positive impact on Egypt's image definition in the west, as well as a direct impact on societal development and linking it to the tourism industry in an innovative way.

Road Surface Deterioration Analysis using Deep Learning Mechanisms: The proposed research project will combine the use of remote sensing and machine learning concepts in early detection of highway pavement damage. Remote sensors are attached to different vehicles during their commute to record vehicular motion and any unexpected vibration as an indicator of surface roughness or presence of rutting or pot holes. Data are remotely collected using cellular service and immediate data processing using subjective logic will take place to identify the location and severity of pavement damage. The research findings will provide highway professional and state DoTs with an efficient and cost-effective tool to be used in early detection of pavement damage, and assist in the early start of maintenance, repair, and/or replacement activities. Early detection of highway deterioration will result in improved highway conditions, minimize accidents and road blockage, and eliminate detours