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IOT Based Hardware Malware Detection for Power Sector Industrial Control System

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ABSTRACT: Industrial Control Systems monitor, automate, and operate complex infrastructure and processes that integrate into critical industrial sectors that affect our daily lives. With the increasing deployment of data network technologies in industrial control systems (ICSs), cybersecurity becomes a challenging problem in ICSs. During these ICS operation dangerous attacks, like machines malfunctions, increasing ambient temperature and unwanted gas particles may be released into the air also the attacks hazards. This project based on continuous monitoring ICS parameter such as load voltage-current, load condition (no-load/over-load), temperature, humidity and gas leakage, fire detection are monitored by wireless technology. A microcontroller based system is used for collecting and storing data and making decision accordingly the data cyber-attacks machines and environmental malfunction. Extreme environment conditions are detrimental for human health. This project focuses on the use of process analytics to detect attacks in the industrial control infrastructure systems and compares the effectiveness of threshold value signature-based detection methods. The proposed work presents a pattern recognition algorithm aptly named as “Capturing-the-Invisible (CTI)” to find the hidden process in industrial control device logs and detect Behavior-based attacks being performed in real-time.

I.INTRODUCTION

Smart sensor interfaces have evolved through the Internet of Things (IoT) which acquires heterogeneous sensor signals and connects them to the Internet, providing intelligent services in various applications such as healthcare systems, automotive systems and industrial monitoring systems. More specifically, healthcare systems have pursued the utilization of physiological and biomedical sensor data to improve the efficiency of health management of healthy subjects and patients. Automotive systems have introduced new vehicular services to connect various sensors and GPS-based location information to communication networks. The industrial manufacturing environment is also embedding new functions in the form of safety monitoring or smart factories. One recent trend of interest is the combination of heterogeneous systems and services from different fields such as by providing automated healthcare services in automotive environments.

Platform migration from bulky computers to smartphones is another important trend that has been accelerated by the proliferation of high-end mobile processors, but this is still limited in healthcare applications. Therefore, the project proposes a smartphone-centric multi-sensor platform that supports heterogeneous sensor signals from different application fields, and particularly for environmental and healthcare signals. For this purpose, the proposed platform needs to be flexible for adding different kinds of signal processing or functions. The system-level flexibility was achieved by migrating most of the signal processing and computation burdens from the sensor module to a smart phone. Then, the smartphone can also provide various auxiliary functions including display, sound, and GPS to facilitate newly combined services.

II.EXISTING SYSTEM

Traditionally, safety monitoring and automation systems were typically designed to meet the requirements of a single monitoring application. The industrial application has already gone beyond the interconnection of a few large back-end systems, and more and more underground physical devices make the state of objects and their surroundings seamlessly accessible to software systems. As a matter of fact, most works are based on monolithic system architectures, which are

brittle and difficult to adapt. The persons who are working in the industrial have to face various environmental parameters in their industrial. So to overcome that problem we are using Zigbee based intelligent helmet for coal miners. Industrial incidents were unpredictable and it has many factors the event of an accident, not only causes huge economic losses, but a direct threat to the safety of miners. As an ICS is a cyber-physical system, the process of cybersecurity risk propagation in ICSs is different from that in general network systems. Most ICS attacks aim to vandalize ICS assets, which include humans, environment, and equipment. Traditionally, safety monitoring and automation systems were typically designed to meet the requirements of a single monitoring application. The application has already gone beyond the interconnection of a few large back-end systems.

III. PROPOSED SYSTEM

Information Technologies (IT) & Operational Technology (OT) include critical software and hardware systems for the control and monitoring of physical sensor field devices. IT and OT provide essential, inherent integration and visibility for supply chain details about logistics, assets, processes, and completion times. This provides remote control and management units with information, thus keeping the ICS efficient and competitive. However, IT and OT are often targeted by cyber attackers, as most of the ICS do not have stringent security policies or the infrastructure to detect and monitor cyber-attacks. Human Machine Interface (HMI) provides a graphical user interface (GUI) application that assists the interaction of hardware, control system, human operators (staff). HMI displays trends, historical and real-time status from data and logs gathered from the ICS environment. MI provides the dashboards to monitor, customize, set control points, and establish the operational parameters required for the day-to-day sensor and controller. Micro Controller (MC) is the control component of the ICS ad that provides process management. MC provides supervisory, remote access, and control to devices such as actuators and sensors. Remote Terminal Units (RTU) & Master Controller Units (MTU) are microprocessor-based field devices. RTU receives commands from the MTU and sends back the information from the field.

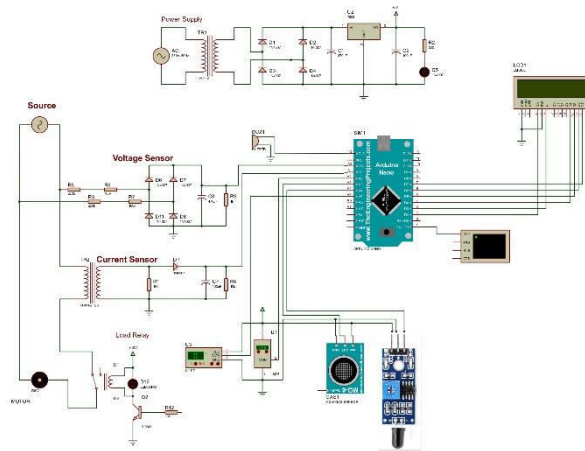


Figure.1. Proposed Simulation Diagram

Control Server & Loops host supervisory control systems, communicate with each low level, on-field control devices such as PLC and actuators to carry out tasks and complete processes. The control loop interprets sensor signals, motors, gears, control valves, breakers, and other electromechanical devices. Intelligent Electric Device (IED) are smart devices that acquire data, communicate with other devices to control and perform local processing automatically. Remote Maintenance & Diagnostics identifies and prevents abnormal operations or failures and helps to prevent hardware and software related problems inside ICS.

IV. SYSTEM REQUIREMENTS

Power Supplies

A power supply (sometimes known as a power supply unit or PSU) is a device or system that supplies electrical or other types of energy to an output load or group of loads. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others. This circuit is a small +5V power supply, which is useful when experimenting with digital electronics. Small inexpensive wall transformers with variable output voltage are

available from any electronics shop and supermarket. Those transformers are easily available, but usually their voltage regulation is very poor, which makes them not very usable for digital circuit experimenter unless a better regulation can be achieved in some way. The following circuit is the answer to the problem.

Transformer

A transformer is a device that transfers electrical energy from one circuit to another through inductively coupled wires. A changing current in the first circuit (the primary) creates a changing magnetic field; in turn, this magnetic field induces a changing voltage in the second circuit (the secondary). By adding a load to the secondary circuit, one can make current flow in the transformer, thus transferring energy from one circuit to the other. The secondary induced voltage V_S is scaled from the primary V_P by a factor ideally equal to the ratio of the number of turns of wire in their respective windings: By appropriate selection of the numbers of turns, a transformer thus allows an alternating voltage to be stepped up — by making N_S more than N_P or stepped down, by making it less.

A key application of transformers is to reduce the current before transmitting electrical energy over long distances through wires. Most wires have resistance and so dissipate electrical energy at a rate proportional to the square of the current through the wire. By transforming electrical power to a high-voltage, and therefore low-current form for transmission and back again afterwards, transformers enable the economic transmission of power over long distances. Consequently, transformers have shaped the electricity supply industry, permitting generation to be located remotely from points of demand. All but a fraction of the world's electrical power has passed through a series of transformers by the time it reaches the consumer. Transformers are some of the most efficient electrical 'machines', with some large units able to transfer 99.75% of their input power to their output. Transformers come in a range of sizes from a thumbnail-sized coupling transformer hidden inside a stage microphone to huge gigavolt-ampere-rated units used to interconnect portions of national power grids. All operate with the same basic principles, though a variety of designs exist to perform specialized roles throughout home and industry.

IC Voltage Regulators

Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC. Although the internal construction of the IC is somewhat different from that described for discrete voltage regulator circuits, the external operation is much the same. IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustable set voltage. A power supply can be built using a transformer connected to the ac supply line to step the ac voltage to desired amplitude, then rectifying that ac voltage, filtering with a capacitor and RC filter, if desired, and finally regulating the dc voltage using an IC regulator.

ARDUINO NANO

Arduino Nano has similar functionalities as Arduino Duemilanove but with a different package. The Nano is inbuilt with the ATmega328P microcontroller, same as the Arduino UNO. The main difference between them is that the UNO board is presented in PDIP (Plastic Dual-In-line Package) form with 30 pins and Nano is available in TQFP (plastic quad flat pack) with 32 pins. The extra 2 pins of Arduino Nano serve for the ADC functionalities, while UNO has 6 ADC ports but Nano has 8 ADC ports. The Nano board doesn't have a DC power jack as other Arduino boards, but instead has a mini-USB port. This port is used for both programming and serial monitoring. The fascinating feature in Nano is that it will choose the strongest power source with its potential difference, and the power source selecting jumper is invalid.

Humidity sensor

Humidity is the presence of water in air. The amount of water vapor in air can affect human comfort as well as many manufacturing processes in industries. The presence of water vapor also influences various physical, chemical, and biological processes. Humidity measurement in industries is critical because it may affect the business cost of the product and the health and safety of the personnel. Hence, humidity sensing is very important, especially in the control systems for industrial processes and human comfort.

Controlling or monitoring humidity is of paramount importance in many industrial & domestic applications. In semiconductor industry, humidity or moisture levels need to be properly controlled & monitored during wafer processing. In medical applications, humidity control is required for respiratory equipments, sterilizers, incubators, pharmaceutical processing, and biological products. Humidity control is also necessary in chemical gas purification, dryers, ovens, film desiccation, paper and textile production, and food processing. In agriculture, measurement of humidity is important for plantation protection (dew prevention), soil moisture monitoring, etc. For domestic applications, humidity control is required for living environment in buildings, cooking control for microwave ovens,

CO2 SENSOR

LCD Display

V.RESULTS AND DISCUSSION

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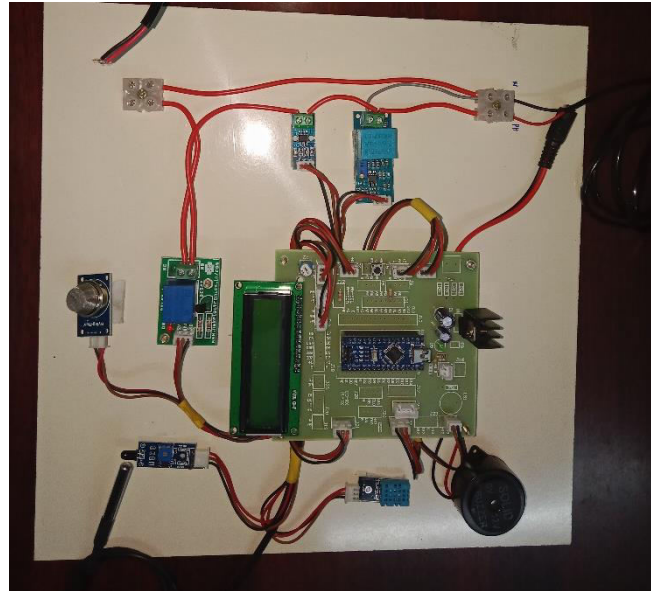


Figure.3.Implementataion Model

VI.CONCLUSION

Industrial Control Systems have migrated from being dedicated, air-gapped, centralized infrastructures and have adopted the distributed, corporate systems accessible via the Internet. Although the efficiency, speed, precision quality is increased, this has exposed ICS to the unsecured Internet. In this way, the proposed multi-sensor interface can achieve the compactness and the flexibility of the sensor module by utilizing two reconfigurable method for various sensor interfaces and also by migrating most of the burdens for signal calibration and analysis to a smartphone. Thereby the sensor module itself can achieve a low-cost bill of materials (BOM) and can maximize the usage time of its internal battery by powering a minimal number of components and by optimally reconfiguring its internal operations.

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