Literature survey

Industry-specific intelligent fire management system

Automation systems in smart buildings:

AUTHORS: DS Vijayan, A Leema Rose, S Arvindan, J Revathy, C Amuthadevi

Journal of Ambient Intelligence and Humanized Computing, 1-13, 2020

In the present scenario everyone turned into smart applications by including the intelligence into the applications, reducing the burden of frequent interruption or control by humans. Smartness makes the ability to interconnect more real time parameters by M2M (Machine to Machine) interaction and make wise decisions in harmful situations. Many low-cost devices are available in the market to collect the real-time data and transmit them using Internet of Things (IoT). So, the control can be done remotely. In this work, few basic applications in smart buildings will be studied to analyze with the technical advances which can automatically bring better solutions. The details collected from different sensors will be useful for analytics and the need for smart design models for better buildings. The services needed in smart building such as security control, energy management, control and monitoring of HVAC system, water management, lighting systems, health system of elders and fire detection are going to be surveyed. The major objective of this study is to identify the issues faced by current methodologies with these applications and give a guideline for future research. From analyzing the relevant methods and needs it is observed that, the buildings construction and usage can depend on the applications, the smart system can respond intelligently for further events. In future all the traditional buildings will be automotive based on HVAC.

An intelligent fire warning application using IoT and an adaptive neuro-fuzzy inference system

AUTHORS: Barera Sarwar, Imran Sarwar Bajwa, Noreen Jamil, Shabana Ramzan, Nadeem Sarwar

Sensors 19 (14), 3150, 2019

Recently, a few fire warning and alarm systems have been presented based on a combination of a smoke sensor and an alarm device to design a life-safety system. However, such fire alarm systems are sometimes error-prone and can react to non-actual indicators of fire presence classified as false warnings. There is a need for high-quality and intelligent fire alarm systems that use multiple sensor values (such as a

signal from a flame detector, humidity, heat, and smoke sensors, etc.) to detect true incidents of fire. An Adaptive neuro-fuzzy Inference System (ANFIS) is used in this paper to calculate the maximum likelihood of the true presence of fire and generate fire alert. The novel idea proposed in this paper is to use ANFIS to identify a true fire incident by using change rate of smoke, the change rate of temperature, and humidity in the presence of fire. The model consists of sensors to collect vital data from sensor nodes. Fuzzy logic converts the raw data into a linguistic variable trained in ANFIS to get the probability of fire occurrence. The proposed idea also generates alerts with messages sent directly to the user's smartphone. Our system uses small, cost-effective sensors and ensures that this solution is reproducible. MATLAB-based simulation is used for the experiments and the results show a satisfactory output.

Smart facility management system based on open bim and augmented reality technology

AUTHORS: Suwan Chung, Chung-Suk Cho, Jinwoo Song, Kyuhyup Lee, Seojoon Lee, Soonwook Kwon

Applied Sciences 11 (21), 10283, 2021

With the Fourth Industrial Revolution wave, the construction industry is also witnessing the application of numerous state-of-the-art technologies. Among these, augmented reality (AR) technology has the advantage of utilizing existing 3D models and BIM data and is thus an area of active research. However, the main area of research to date has either been in visualizing information during the design phase, where architects and project stakeholders can share viewings, or in confirming the required information for construction management through visualization during the construction phase. As such, more research is required in the application of AR during the facility management (FM) phase. Research utilizing BIM in the FM phase, which constitutes the longest period during the lifecycle of a building, has been continuously carried out but has faced challenges about on-site application. This is because information required for BIM during the design, construction and FM phases is different, and the reproduced information is vast, so identifying the required BIM data for FM and interfacing with other systems is difficult. Advanced countries such as the US and UK have developed to overcome this limitation. They are using Construction Operations Building information exchange (COBie), an open-source BIM-based information exchange system. To effectively convert open-source BIM data to AR data, this research defined COBie data for windows and doors, converted them to a system and validated that it could be applied for on-site FM. The results of this system's creation and validation showed that the proposed AR-based smart FMS demonstrated faster and easier access to information compared with existing 2D blueprint-based FM work, while information obtained through AR allowed for immediate, more visual and easier means to express the information when integrated with actual objects

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Smart-building management system: An Internet-of-Things (IoT) application business model in Vietnam

AUTHORS: Duc Nha Le, Loc Le Tuan, Minh Nguyen Dang Tuan

Technological Forecasting and Social Change 141, 22-35, 2019

Academicians and policy makers have recently appreciated IoT's accelerating significance and prevalence (Internet-of-Things). The emergence of ubiquitous sensors, intelligent devices, and broad-band Internet capacity has enabled the integration of networks for synchronous data collecting and processing, which ultimately facilitates prompt decision-making and physical responses to changes in a real-time manner. The virtual interconnectedness of humans and objects exerts managerial efficiency and emotional comfort for network operators, end users, and other third-party actors, which results in the embrace of IoT-based platforms in production and consumption. The skyrocketing urbanization has chronically caused the dense concentration of population in buildings, which yields market prospects for smart-building management system solutions based on IoT applications. Nevertheless, IoT application business models have remained nascent in emerging and transitional economies. In this paper, the authors exploit the Business Model Canvas to assess an IoT start-up in Vietnam and to establish an output Business Model Canvas for entrepreneurs. Findings indicate high competitive advantages of local enterprises and propose vertical integration in joint ventures as the entry strategy for foreign investors.

Intelligent algorithms and control strategies for battery management system in electric vehicles: Progress, challenges and future outlook

AUTHORS: MS Hossain Lipu, MA Hannan, Tahia F Karim, Aini Hussain, Mohamad Hanif Md Saad, Afida Ayob, Md Sazal Miah, TM Indra Mahlia

Journal of Cleaner Production 292, 126044, 2021

Globally, the research on battery technology in electric vehicle applications is advancing tremendously to address the carbon emissions and global warming issues. The effectiveness of electric vehicles depends on the accurate assessment of key parameters and proper functionality and diagnosis of the battery storage system. However, poor monitoring and safety strategies of the battery storage system can lead to critical issues such as battery overcharging, over-discharging, overheating, cell unbalancing, thermal runaway, and fire hazards. To address these concerns, an effective battery management system is crucial in enhancing battery performance including precise monitoring, charging-discharging control, heat management, battery safety, and protection. This paper aims to comprehensively review different intelligent approaches and control schemes of the battery management system in

electric vehicle applications. In line with that, the review evaluates the intelligent algorithms in battery state estimation concerning their features, structure, configuration, accuracy, advantages, and disadvantages.

Moreover, the review explores the various controllers in battery heating, cooling, equalization, and protection highlighting categories, characteristics, targets, achievements, benefits, and shortcomings. The key issues and challenges in computation complexity, execution problems, and various internal and external factors are identified. Finally, future opportunities and directions are delivered to design an efficient intelligent algorithm and controller toward developing an advanced battery management system for future sustainable electric vehicle applications.

Flexible architecture for intelligent management systems

AUTHORS: Ralph Holland-Moritz, Ralf Vandenhouten

3rd IEEE International Symposium on Logistics and Industrial Informatics, 83-86, 2011

Different approaches come into question for an intelligent management system that evaluates data utilizing artificial intelligence. Each approach has its advantages and disadvantages. Different systems must be combined properly to get the best out of all. This is where Complex Event Processing comes into play.

Iot based intelligent energy management system

AUTHORS: Vignesh Mani, Gunasekhar Abhilasha, Suresh Lavanya

International Journal of Applied Engineering Research 12 (16), 5455-5462, 2017

Energy is essential for any household, industries, agriculture, etc. Managing the energy efficiently and conserving it intelligently for appliances is very important. The energy usage is directly affected with Coal, oil and so towards power generation.

Towards this, much research has been carried out in developing some intelligent lighting system for classroom conserving energy. In another research, researchers developed an Android-based Smart home system to monitor power usage to avoid any anomaly.

Intelligent fire alarm system with person detection and thermal camera

AUTHORS: Yibing Ma, Xuetao Feng, Jile Jiao, Zhongdong Peng, Shenger Qian, Hui Xue, Hua Li

International Conference on Computational Science, 353-366, 2020

Fire alarm is crucial for safety of life and property in many scenes. A good fire alarm system should be small-sized, low-cost and effective to prevent fire accidents. In this paper we introduce a smart fire alarm system used in kitchen as a representative scenario. The system captures thermal and optical videos for temperature monitoring and person detection, which are further used to predict potential fire accidents and avoid false alarms. Thermal videos record the temperature change in region-of-interests, for example, cookware. YOLOv3-tiny algorithm is modified for person detection and can be iteratively improved with the hard examples gathered by the system. To implement the system on an edge device instead of a server, we propose a high-efficiency neural network inference computing framework called TuringNN. Comprehensive rules enable the system to respond to different situations appropriately. The proposed system has been proved effective in both experiments and numerous cases in complex practical applications.

A comprehensive review of lithium-ion cell temperature estimation techniques applicable to health-conscious fast charging and smart battery management systems

AUTHORS: Akash Samanta, Sheldon S Williamson

Energies 14 (18), 5960, 2021

Highly nonlinear characteristics of lithium-ion batteries (LIBs) are significantly influenced by the external and internal temperature of the LIB cell. Moreover, a cell temperature beyond the manufacturer’s specified safe operating limit could lead to thermal runaway and even fire hazards and safety concerns to operating personnel. Therefore, accurate information of LIB cell internal and surface temperature is crucial for effective thermal management and proper operation of a battery management system (BMS). Accurate temperature information is also essential to BMS to accurately estimate various important states of LIB, such as state of charge, state of health and so on. High-capacity LIB packs, used in electric vehicles and grid-tied stationary energy storage system essentially consist of thousands of individual LIB cells. Therefore, installing a physical sensor at each cell, especially at the cell core, is not practically feasible from the solution cost, space and weight point of view. A solution is to develop a suitable estimation strategy which led scholars to propose different temperature estimation schemes to establish a balance among accuracy, adaptability, modelling complexity and computational cost. This article presented an exhaustive review of these

estimation strategies covering recent developments, current issues, major challenges, and future research recommendations. The prime intention is to provide a detailed guideline to researchers and industries towards developing a highly accurate, intelligent, adaptive, easy-to-implement and computationally efficient online temperature estimation strategy applicable to health-conscious fast charging and smart onboard BMS.

An IoT Based Efficient Fire Supervision Monitoring and Alerting System

AUTHORS: B Prabha

2019 Third International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)(I-SMAC), 414-419, 2019

The industry's dynamic nature presents special challenges to fire management and occupational welfare. High infrastructure concentration and stored inventory have increased fire risks with massive losses. Internet of Things (IoT) is a framework of multiple concurrent devices embedded and can function for data transmission across the Internet. It consists of all world wide web-enabled devices responsible for gathering, transmitting and functioning on information extracted from the surrounding atmosphere by utilizing sensors, detectors and computing hardware. In industrial security and control, IoT plays a major role. This research work presents a new device capable of detecting fire and providing a warning to users. To monitor the integrated devices with several sensors and a cameras, the Raspberry Pi 3 has been used. The sensors continuously sense and begins to broadcast values over a Wi-Fi association to the online digital server. Whenever fire is sensed, the camera starts to record the image and the device starts to send the message with the affected spot images. Once the fire transmitter senses the explosion, this will stimulate the smoke alarm and activate a sprinkler motor. For sensor information the database can be configured by the administrator and monitored anywhere.

Research on escape strategy based on intelligent firefighting internet of things virtual simulation system

AUTHORS: Hai Wang, Guiling Sun, Yi Gao, Xiaochen Li

Artificial Intelligence in China, 102-110, 2021

Intelligent firefighting accomplishes the intellectualization of city fire protection by utilising the latest technologies such as the Internet of Things (IOT), artificial intelligence, virtual reality, and mobile Internet. Besides, it cooperates with the professional application of big data cloud computing platform, fire alarm intelligence judgment, and so on. Intelligent fire control is not only the digital foundation of fire information service, but also an important part of smart perception, interconnection, and intelligent application architecture in smart

city. In this paper, the virtual simulation technology is used to simulate the real fire scene. The appropriate network framework and communication protocol are selected according to the specific scene. Different types of sensors are utilized to collect the real-time fire data. Through the simulation calculation and mathematical manipulation, the escape strategy and escape route are determined for the trapped people.

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Applied Sciences 11 (21), 10283, 2021

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Industrial Network Security: Securing critical infrastructure networks for smart grid, SCADA, and other Industrial Control Systems

AUTHORS: Eric D Knapp, Joel Langill

Syngress, 2014

As cyber-attacks' sophistication increases, understanding how to defend critical infrastructure systems—energy production, water, gas, and other vital systems—becomes more important and heavily mandated. Industrial Network Security, Second Edition arms you with the knowledge you need to understand the vulnerabilities of these distributed supervisory and control systems. The book examines the unique protocols and applications that are the foundation of industrial control systems, and provides clear guidelines for their protection. This how-to guide gives you thorough understanding of the unique challenges facing critical infrastructures, new guidelines and security measures for critical infrastructure protection, knowledge of new and evolving security tools, and pointers on SCADA protocols and security implementation. All-new real-world examples of attacks against control systems, and more diagrams of systems Expanded coverage of protocols such as 61850, Ethernet/IP, CIP, ISA-99, and the evolution to IEC62443 Expanded coverage of Smart Grid security New coverage of signature-based detection, exploit-based vs. vulnerability-based detection, and signature reverse engineering

An intelligent system for smart buildings using machine learning and semantic technologies: A hybrid data-knowledge approach

AUTHORS: Ioan Szilagyi, Patrice Wira

2018 IEEE Industrial Cyber-Physical Systems (ICPS), 20-25, 2018

The Internet of Things allowed us to seamlessly integrate communication and computational capabilities into everyday things, resulting in a technologically enhanced environment. However, we still need to work on integrating high level understanding and intelligence in this connected system. The IoT is a mean that enables the possibility of integrating intelligent behavior and services into surrounding environments. One of the most representative examples of artificial environments are buildings. Residential buildings (e.g. homes, apartment blocks) or dedicated public buildings (educational, medical, commercial, governmental) serve different purposes and needs, and therefore they have different characteristics and constraints. However, every building uses some form of resource (e.g. energy, water) to assure the required level of comfort, safety and conditions for carrying out the desired activities. In this paper we look at some questions regarding the construction and the exploitation of knowledge related to different types of buildings to optimize the use of different resources while still assuring the occupants' comfort. We enumerate some of the elements that characterize a building as smart and finally, we present a model for a building management system based on hybrid knowledge

Design of disaster management system using IoT based interconnected network with smart city monitoring

AUTHORS: Prabodh Sakhardande, Sumeet Hanagal, Savita Kulkarni

2016 international conference on Internet of things and applications (IOTA), 185-190, 2016

IoT deals with intricate systems that integrate multiple disperse components towards their synergetic use. In this paper, a system of interconnected smart modules is developed to enable centralized data acquisition and provide an interlinked network for transmission of data without any existing infrastructure. Emphasis is given on how sensing and communication technologies of IoT can effectively be used in smart city monitoring as well as in case of disaster management. The hardware of the module used for this purpose is studied and elaborated in a detailed manner.

Intelligent Traffic Management System Using Industry 4.0

AUTHORS: Aman Panwar, Saagar Bafna, Arjun Raghav, Somya Goyal

Advances in Micro-Electronics, Embedded Systems and IoT, 357-364, 2022

Traffic is the most drastic effect of this ever-increasing urbanization, the inclusion of cutting-edge technologies in traffic management systems will be effective in reducing traffic-related issues, and thus the commute time. In mid-2020, urbanization stood at around 56%. This rapidly increasing traffic not only affects us directly but has severe implications on our mother nature by unbalancing the biological life cycle and thus has indirect effects on us too. According to a research, urbanites lead more connected lives than their rural counterparts, so a modern traffic management system is the need of this era. Our proposed method uses cutting-edge technologies like Internet of things and has a genuine approach to minimize traffic. This system uses algorithms to manage all kinds of traffic issues prevailing at the time. The system will help overcome the flaws of previous traffic management systems. In this system, traffic density is taken as input from the cameras which is then abstracted via digital image processing technique (called as DIP which is a step ahead the analogue one) and sensors data, resultantly giving the output as a signal management. Algorithms can be applied to predict the density of traffic to assist and planning to diminish traffic congestion subsequently. The system has a feature to prioritize emergency vehicles like fire brigade, police vehicles and ambulances by using RFID tags in those vehicles. In case of firebreak or explosion, sensors specific to fire and smoke get deployed to detect

Research on the Construction of Intelligent Fire Protection Virtual Simulation Teaching Platform Based on Internet of Things

AUTHORS: Guiling Sun, Sirui Wang, Hai Wang, Yi Gao

International Journal of Information and Education Technology 11 (10), 450-455, 2021

Aiming at the teaching challenge of cultivating integrated talents of Internet of things worldwide, and combining them with the social background of fire rescue and management problems, We propose a virtual simulation teaching platform for the Internet of Things under the knowledge of intelligent fire protection applications. Based on the overall structure of the Internet of Things, different fire scenarios that cannot be simulated in real life are constructed through virtual simulation technology. OMNet++ technology is adopted to carry out the virtual deployment of fire nodes for the overall structure of the building, and experiments such as cluster routing simulation, communication transmission simulation and wireless sensor node data acquisition simulation are designed. Meanwhile, a 3D fire data model is established using big data to simulate the best fire extinguishing scheme and escape strategy. From aspects of the Internet of Things system design and development, sensor principle and application, Internet of Things communication technology and Internet of Things data storage and application, we have realized the efficiency, innovation and challenge of the Internet of Things teaching. The virtual simulation teaching platform we built has been deployed and put into practical teaching, which has received positive student responses and achieved excellent teaching effects.

Design and Manufacture of Indoor Intelligent Fire Fighting Robot

AUTHORS: Ligang Chen

2020 International Workshop on Electronic Communication and Artificial Intelligence (IWECAI), 201-204, 2020

To meet the needs of fire prevention and rescue for families with high floors and no one at the time, a family fire fighting robot with STM32F103ZET6 as the core was designed. The robot carried out firefighting operations. Robots are mighty. The one-to-many communication mode is adopted to carry out real-time monitoring of each easy fire point. Data transmission is carried out through the industry-level NRF24L01 module. The remote control is carried out with the camera and the WIFI module connected to the Internet. The experimental results show that the robot's power through the WIFI wireless module is stable, achieving the expected effect of extinguishing agent injection, reducing the workload of firefighters to a certain extent, effectively reducing household fire risk and reducing social losses.

Design of a smart fire detection system

AUTHORS: KB Deve, Gerhard P Hancke, Bruno J Silva

IECON 2016-42nd Annual Conference of the IEEE Industrial Electronics Society, 6205-6210, 2016

Conventional fire detection systems tend being triggered by false positives. This paper discusses the design and implementation of a smart fire detection system using a Wireless Sensor Network (WSN) and Global System for Mobile (GSM) communication to detect fires effectively and reduce false positives. The proposed system uses smoke and temperature sensors. SMS capability via GSM was implemented so occupants can interact with the fire detection system and aid in detecting false positives. This work aimed to design and implement a fire detection system that detects fires effectively and reduces false positives. The results show that the system meets the specifications.

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