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IOT IN VEHICLE PRESENCE DETECTION OF SMART PARKING SYSTEM

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Abstract

More and more people cluster in major cities and thus causing urbanization challenges. In this scenario, many cities are employing technologies to lessen the impact on the environment and increase productivity and efficiency to cope with the high demand. Among which, smart transportation is essential in fulfilling the mobility in the urban areas and promising to meet the increasing demand of passengers. IoT application in a smart parking system has been facilitated in various ways. To achieve its full potential, we need to understand the associated issues and principals. Therefore, this paper focus on understanding the principals within IoT, the process for the layers to function in vehicle detection, and introducing different IoT sensors empowered by different technologies, including cloud computing, big data, RFID, and WSN, that facilitate the smart parking system. After assessing the potential use cases of the IoT in the vehicle presence detection of the smart parking system, this paper will identify and discuss the benefits and challenges along with the recommendation and consideration that serve as the manual to help the industries and the governmental institutions to select appropriate sensors according to different scenarios.

Introduction

The world population is distributed unevenly and highly concentrated in urban areas causing urbanization problems [19]. Besides, there is only a limited amount of parking facilitates provided for the citizens resulting in various parking problems such as illegal parking, traffic safety issue, and energy waste. Therefore, it encourages the government to develop a smart parking system so as to make good use of the existing parking utilities to meet the high demand of citizen needs. Along with the rapid

development of the Internet of Things (IoT), cloud computing, and big data, it helps the traditional parking system become smarter and move towards the Mobility as a Service goal [12] to achieve a sustainable transportation society. IoT is viewed as a global network to connect all items with the Internet through information sensing devices such as radio frequency identification (RFID) to realize intelligent identification and management. People may communicate and interact with each other and gain access to information from the machines through the Internet. IoT is identified in three visions (Fig.1.), which are things, internet, and semantics [2]. Things are viewed as a presentation tool that may be accessed through devices or platforms and present the visualization output; the internet is the middleware that stores and computes the different data resources; and semantics represents the knowledge of capability to organize and execute the system. The effectiveness of IoT can only be performed when three orientations are intersected with each other. IoT architecture can be divided into three layers (Fig.2.): the perception layer, the network layer, and the application layer. [21] Perception layer is mainly used to study various kinds of variables and collect data from the environment through sensors, RFID, or other actuators. The network layer transports the collected data and coordinates with the application layer. The application layer ultimately carries out data processing and calculation to perform the function to the end-users [18]. IoT is often used as a tool to enhance customer value in providing real-time monitor and control by collaborating with business analytics kits and capturing a great amount of personal data to trigger real-time services [10]. Wireless sensor networks (WSN) facilitate vehicle-to-infrastructure communication and the real-time locating systems in the smart parking to enable tracing and tracking system [20].

Literature survey

Akyildiz, I. F., Melodia, T., & Chowdhury, K. R. (2007). A survey on wireless multimedia sensor networks. Computer Networks, 51(4), 921-960. doi:10.1016/j.comnet.2006.10.002

The availability of low-cost hardware such as CMOS cameras and microphones has fostered the development of Wireless Multimedia Sensor Networks (WMSNs), i.e., networks of wirelessly interconnected devices that are able to ubiquitously retrieve multimedia content such as video and audio streams, still images, and scalar sensor data from the environment. In this paper, the state of the art in algorithms, protocols, and hardware for wireless multimedia sensor networks is surveyed, and open research issues are discussed in detail. Architectures for WMSNs

are explored, along with their advantages and drawbacks. Currently off-the-shelf hardware as well as available research prototypes for WMSNs are listed and classified. Existing solutions and open research issues at the application, transport, network, link, and physical layers of the communication protocol stack are investigated, along with possible cross-layer synergies and optimizations.

Atzori, L., Iera, A., & Morabito, G. (2010). The Internet of Things: A survey. Computer Networks, 54(15), 2787-2805. doi:10.1016/j.comnet.2010.05.010.

This paper addresses the Internet of Things. Main enabling factor of this promising paradigm is the integration of several technologies and communications solutions. Identification and tracking technologies, wired and wireless sensor and actuator networks, enhanced communication protocols (shared with the Next Generation Internet), and distributed intelligence for smart objects are just the most relevant. As one can easily imagine, any serious contribution to the advance of the Internet of Things must necessarily be the result of synergetic activities conducted in different fields of knowledge, such as telecommunications, informatics, electronics and social science. In such a complex scenario, this survey is directed to those who want to approach this complex discipline and contribute to its development. Different visions of this Internet of Things paradigm are reported and enabling technologies reviewed. What emerges is that still major issues shall be faced by the research community.

Chen, Z., & Xiaoping, Z. (2014). Toward the Internet of Things application and management: A practical approach. In (pp. 1-6).

With the accelerated development of Internet-of-Things (IoT), wireless sensor networks (WSNs) are gaining importance in the continued advancement of information and communication technologies, and have been connected and integrated with the Internet in vast industrial applications. However, given the fact that most wireless sensor devices are resource constrained and operate on batteries, the communication overhead and power consumption are therefore important issues for WSNs design. In order to efficiently manage these wireless sensor devices in a unified manner, the industrial authorities should be able to provide a network infrastructure supporting various WSN applications and services that facilitate the management of sensor-equipped real-world entities. This paper presents an overview of industrial ecosystem, technical architecture, industrial device management standards, and our latest research activity in developing a WSN management system. The key approach to enable efficient and reliable management of WSN within such an infrastructure is a cross-layer design of lightweight and cloud-based RESTful Web service.

Gartner, G. (2014). Chip sector to benefit from Internet of Things, Gartner says. Electronics News, p. Electronics News, Nov 2014.

Cisco, the company, has said, “The Internet of Things (IoT), sometimes referred to as the Internet of Objects, will change everything—

including ourselves."2 But what is the Internet of Things (hereinafter "IoT")? Different terminology has been used in association with IoT, such as "Machine to Machine (M2M)" and "smart products."4 Other terms, such as "ubiquitous computing"5 and "Big Data," have also been used in conjunction with discussing IoT.6 However, at the end of the day, IoT is a "network of items—each embedded with sensors—which are connected to the Internet."7 We interact with sensors on a daily basis without even realizing it. For example, sensors can be found in your car, cellphone, credit cards, gaming consoles, and inside clothing.8 The idea behind IoT is to take everyday, physical objects, connect them to the Internet, and monitor and analyze data while providing real-time feedback.9 While the original intent behind IoT was aimed at improving manufacturing efficiency,10 today the possibilities and applications of IoT are endless and can be applied in other industries and everyday life.

Existing system

The implementation of Internet of Things (IoT) technology in vehicle presence detection for smart parking systems has revolutionized urban mobility and parking management. In the existing system, sensors equipped with IoT capabilities are strategically deployed in parking spaces to detect the presence or absence of vehicles. These sensors can utilize various technologies such as ultrasonic sensors, infrared sensors, or cameras to accurately determine the occupancy status of each parking spot in real-time.

The IoT-enabled smart parking system not only provides precise information about available parking spaces but also offers additional functionalities. These include the integration of data from multiple sensors into a centralized platform accessible by both parking operators and users. Through a user-friendly mobile application or other interfaces, drivers can access real-time information about parking availability, reducing the time spent searching for a suitable spot.

Moreover, the system can be enhanced with predictive analytics and machine learning algorithms. By analyzing historical data and patterns, the smart parking system can forecast parking demand during specific times, events, or seasons, enabling better resource allocation and planning. This not only optimizes the parking experience for users but also improves the overall efficiency of urban parking management.

The IoT technology in vehicle presence detection also facilitates the implementation of dynamic pricing models and incentives. Parking operators can adjust pricing based on demand and availability, encouraging a more balanced distribution of vehicles across parking spaces. This approach not only maximizes the utilization of parking facilities but also helps mitigate traffic congestion and reduce carbon emissions associated with circling for parking.

In summary, the integration of IoT in vehicle presence detection for smart parking systems represents a significant advancement in urban infrastructure. This technology-driven approach not only enhances the efficiency of parking operations but also contributes to improved traffic flow, reduced environmental impact, and an overall smarter and more sustainable urban mobility ecosystem.

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Proposed system

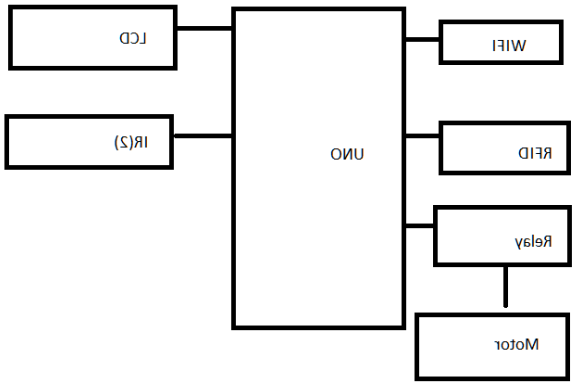
The proposed smart parking system integrates IoT technology to enhance vehicle presence detection, addressing the challenges associated with urban parking. Leveraging Internet of Things (IoT) devices, such as sensors and cameras, the system offers a sophisticated approach to monitor and manage parking spaces. Each parking spot is equipped with sensors capable of detecting the presence or absence of a vehicle in real-time. These sensors communicate wirelessly with a centralized control unit, creating a network that provides accurate and up-to-date information on parking space occupancy.

The key innovation lies in the system's ability to improve the overall efficiency of parking management through real-time data analytics. When a vehicle enters or exits a parking space, the sensor immediately relays this information to the central control unit. This data is then processed to update a user-friendly mobile or web application, allowing drivers to quickly locate available parking spaces. Moreover, the system can generate historical usage patterns, enabling municipalities and parking operators to analyze trends and optimize parking space allocation.

To further enhance user experience, the proposed system can incorporate additional features such as mobile app integration, payment processing, and reservation capabilities. Drivers can reserve parking spaces in advance, reducing the time spent searching for parking and enhancing overall traffic flow. Additionally, the system can provide alerts and notifications to users, informing them of parking availability or impending expiration of their parking session.

In conclusion, the integration of IoT technology into the vehicle presence detection system for smart parking represents a significant advancement in urban infrastructure. By providing real-time information on parking space availability and optimizing parking management, this system contributes to reduced traffic congestion, improved user convenience, and efficient use of urban parking spaces.

Block diagram



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HARDWARE COMPONENTS

LCD (Liquid Cristal Display)

Introduction:

A liquid crystal display (LCD) is a thin, flat display device made up of any number of color or monochrome pixels arrayed in front of a light source or reflector. Each pixel consists of a column of liquid crystal molecules suspended between two transparent electrodes, and two polarizing filters, the axes of polarity of which are perpendicular to each other. Without the liquid crystals between them, light passing through one would be blocked by the other. The liquid crystal twists the polarization of light entering one filter to allow it to pass through the other.

A program must interact with the outside world using input and output devices that communicate directly with a human being. One of the most common devices attached to an controller is an LCD display. Some of the most common LCDs connected to the contollers are 16X1, 16x2 and 20x2 displays. This means 16 characters per line by 1 line 16 characters per line by 2 lines and 20 characters per line by 2 lines, respectively.

ESP8266

The ESP8266 is a low-cost Wi-Fi microchip, with a full TCP/IP stack and microcontroller capability, produced by EspressifSystems[1] in Shanghai, China. The chip first came to the attention of Western makers in August 2014 with the ESP-01 module, made by a third-party manufacturer Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at first there was almost no English-language documentation on the chip and the commands it accepted.[2] The very low price and the fact that there were very few external components on the module, which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, the chip, and the software on it, as well as to translate the Chinese documentation.[3]

IR SENSOR

An infrared sensor is an electronic device, that emits in order to sense some aspects of the surroundings. An IR sensor can measure

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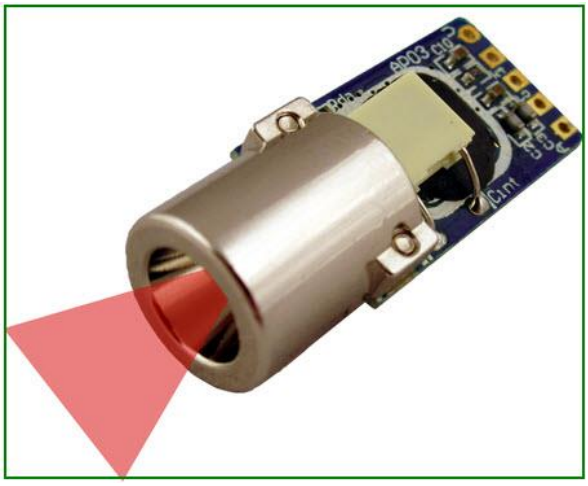
the heat of an object as well as detects the motion. These types of sensors measure only infrared radiation, rather than emitting it that is called a passive IR sensor. Usually, in the infrared spectrum, all the objects radiate some form of thermal radiation. These types of radiations are invisible to our eyes, that can be detected by an infrared sensor. The emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode that is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, the resistances and the output voltages will change in proportion to the magnitude of the IR light received.



IR Sensor

RFID READER

Active RFID and Passive RFID technologies, while often considered and evaluated together, are fundamentally distinct technologies with substantially different capabilities. In most cases, neither technology provides a complete solution for supply chain asset management applications. Rather, the most effective and complete supply chain solutions leverage the advantages of each technology and combine their use in complementary ways. This need for both technologies must be considered by RFID standards initiatives to effectively meet the requirements of the user community.

RELAY MODULE

Relay modules are simply circuit boards that house one or more relays. They come in a variety of shapes and sizes, but are most commonly rectangular with 2, 4, or 8 relays mounted on them, sometimes even up to a 16 relays.

Relay modules contain other components than the relay unit. These include indicator LEDs, protection diodes, transistors, resistors, and other parts. But what is the module relay, which makes the bulk of the

device? You may ask. Here are facts to note about it:

- A relay is an electrical switch that can be used to control devices and systems that use higher voltages. In the case of module relay, the mechanism is typically an electromagnet.
- The relay module input voltage is usually DC. However, the electrical load that a relay will control can be either AC or DC, but essentially within the limit levels that the relay is designed for.
- A relay module is available in an array of input voltage ratings: It can be a 3.2V or 5V relay module for low power switching, or it can be a 12 or 24V relay module for heavy-duty systems.
- The relay module information is normally printed on the surface of the device for ready reference. This includes the input voltage rating, switch voltage, and current limit.

Conclusion

There are three main IoT sensors for vehicle presence detection. For city street parking lots management, it is more suitable to install a wireless magnetometer sensor due to street parking may include both indoor or outdoor spaces which require flexibility on installation location. Besides, the wireless magnetometer sensor is able to withstand normal weather condition disruption. In addition, installing wireless magnetometer sensors only require a small inch drill hole which can be done quickly making it an ideal choice for large scale city implementation. However, an IoT smart parking system affects a whole network environment thus emphasizing the importance of personal security and privacy protection. It is the government's responsibility to establish related regulations to monitor data usage and avoid privacy issues from happening [4]. Besides, since the traffic system involves life safety issues, at the design stage, the government should take safety issues into consideration and educate the designers with effective prevention approaches such as mitigate the impact of security vulnerabilities through

patching and establish vulnerability management policies to promote security updates. According to the U.S. Federal guidance report of the automotive industry aiming to improve motor vehicle cybersecurity [13], it indicated that it is important for infrastructure operators and cloud computing service providers to bear the notification obligations. In other words, the government needs to clarify the data acquisition level among different official departments and local companies and sets up proper information security management systems to undergo key actions including education and training of information security, monitor and management approach, safety inspection, and testing, etc. IoT realizes the vision of connecting and communicating with individuals through computing and analyzing a vast amount of information sources. However, to successfully adopt new technology requires a proper framework and clear understanding of the potential challenges and associated issues.

References

[1] Akyildiz, I. F., Melodia, T., & Chowdhury, K. R. (2007). A survey on wireless multimedia sensor networks. Computer Networks, 51(4), 921-960. doi:10.1016/j.comnet.2006.10.002

[2] Atzori, L., Iera, A., & Morabito, G. (2010). The Internet of Things: A survey. Computer Networks, 54(15), 2787-2805. doi:10.1016/j.comnet.2010.05.010.

[3] Chen, Z., & Xiaoping, Z. (2014). Toward the Internet of Things application and management: A practical approach. In (pp. 1-6).

[4] FTC, Internet of Things: Privacy & Security in a Connected World (2015), retrieved from: https://www.ftc.gov/system/files/documents/ reports/federal-tr ade-commission-staff-report-november-2013-workshop-entitl ed-internet-things-privacy/150127iotrpt.pdf

[5] Gartner, G. (2014). Chip sector to benefit from Internet of Things, Gartner says. Electronics News, p. Electronics News, Nov 2014.

[6] Gubbi, J., Buyya, R., Marusic, S., & Palaniswami, M. (2013). Internet of Things (IoT): A vision, architectural elements, and future directions. Future Generation Computer Systems, 29(7), 1645-1660. doi:10.1016/j.future.2013.01.010

[7] Guilbert, D., Le Bastard, C., Sio-Song, I., & Yide, W. (2016). State Machine for Detecting Vehicles by Magnetometer Sensors. IEEE Sensors Journal, 16(13), 5127-5128. doi:10.1109/JSEN.2016.2560903

[8] Jeon, S., Kwon, E., & Jung, I. (2014). Traffic measurement on multiple drive lanes with wireless ultrasonic sensors. Sensors (Switzerland), 14(12), 22891-22906. doi:10.3390/s141222891

[9] Ji, Z., Ganchev, I., O'Droma, M., Zhao, L., & Zhang, X. (2014). A cloud-based car parking middleware for IoT-based smart cities: Design and implementation. Sensors (Switzerland), 14(12), 22372-22393.

[10] Reddy, Kallem Niranjan, and Pappu Venkata Yasoda Jayasree. "Low Power Strain and Dimension Aware SRAM Cell Design Using a New Tunnel FET and Domino Independent Logic." International Journal of Intelligent Engineering & Systems 11, no. 4 (2018).

[11] Reddy, K. Niranjan, and P. V. Y. Jayasree. "Design of a Dual Doping Less Double Gate Tfet and Its Material Optimization Analysis on a 6t Sram Cells."

[12] Reddy, K. Niranjan, and P. V. Y. Jayasree. "Low power process, voltage, and temperature (PVT) variations aware improved tunnel FET on 6T SRAM cells." Sustainable Computing: Informatics and Systems 21 (2019): 143-153.

[13] Reddy, K. Niranjan, and P. V. Y. Jayasree. "Survey on improvement of PVT aware variations in tunnel FET on SRAM cells." In 2017 International Conference on Current Trends in Computer, Electrical, Electronics and Communication (CTCEEC), pp. 703-705. IEEE, 2017

[14] Karne, R. K. ., & Sreeja, T. K. . (2023). PMLC- Predictions of Mobility and Transmission in a Lane-Based Cluster VANET Validated on Machine Learning. International Journal on Recent and Innovation Trends in Computing and Communication, 11(5s), 477–483. https://doi.org/10.17762/ijritcc.v11i5s.7109

[15] Radha Krishna Karne and Dr. T. K. Sreeja (2022), A Novel Approach for Dynamic Stable Clustering in VANET Using Deep Learning (LSTM) Model. IJEER 10(4), 1092-1098. DOI: 10.37391/IJEER.100454.