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IOT BASED PARKING LOT

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ABSTRACT

Automated parking systems can provide parking space easily with the help of a smart way with the help of IoT. Wireless access to the system is provided by this IoT technology. In metropolitan cities, the number of vehicles is increasing day by day which needs to be maintained by proper management. IoT based parking systems provide knowledge about the management system. Normally users waste their time finding out any parking space, IoT based parking space can reduce this problem and save time, cost, and effort of users. To avoid car theft RFID cards are used. All information about users is stirred in a cloud database

Keywords: Internet of Things, Cloud database, RFID card, automated parking system, GSM module

INTRODUCTION

In this modern era, the number of vehicles is increasing rapidly. This increases vehicles that need a proper parking system. Traffic congestion in urban areas increases due to the mismanagement of available parking space. To maintain these factors it is important to compose automated smart parking management. This smart parking system is able to help drivers to find parking space easily. Car owners are able to be aware about parking lots. Drivers and motorists are able to generate 30% traffic in urban areas. The Internet of Things is involved in data transmission without human participation. Affordable wireless technology is used by users by IoT. A survey reveals that vehicle population will be increased to 1.6 billion around 2035 and to conduct these vehicles around one million barrels of oil will be burnt. Proper parking space is provided by IoT based smart parking systems that is considered a key solution of wastage of the fuel.

IMPORTANCE FOR IOT CLOUD INTEGRATION

IoT is directly related to cloud computing. Both technologies consist of various advantages which can increase their efficiency. Technological constraints are identified by the Internet of Things, for example, by leveraging the ultimate resources and capabilities of cloud, processing, storage, and energy of systems is identified by IoT. To deal with real-world entities clouds are also able to extend their capabilities with the help of high perming IoT systems (Sadhukhan 2017). Cloud computing process is implemented as an intermediate between applications and things. This process is involved in maintenance of all complexities and fundamental necessities of applications. Few factors are described below that can justify the cloud and the Internet of Things.

- Storage capacity: Large numbers of information sources are accessed by Internet of Things. A huge number of non-0structured and semi-structured data is created by IoT. Collecting, visualizing, accessing, and processing a large amount of data is maintained by the Internet of Things. Low-cost and unlimited storage capacity is provided by IoT which is an important aspect.
- Computation power: devices which are maintained by IoT, consist of limited processing capabilities. Various sensors are involved to provide data, these data are mainly transmitted from more powerful nodes, aggregation and processing processes are also conducted in this stage.

- Communication resources: communication between IP enabled devices is treated as the main functionality of the Internet of Things. Way of connecting, tracking, and managing devices is provided by cloud computing towards the Internet of Things. Real-time basis things are controlled and monitored by the Internet of Things with the observation of built-in applications.
- Scalability: A scalable approach towards the internet of bongs is provided by cloud providers. Increase and decrease of resources are dynamically maintained by this process. Observing requirements of things and application resources are provided by the cloud.
- Availability: availability of resources is an important factor that is maintained by cloud integration. Cloud providers are able to provide running and continuous services towards end-users with the presence of cloud applications.
- Interoperability: The use of heterogeneous devices is maintained by the Internet of Things. Different hardware and software configurations are involved in these devices.it is too difficult to evaluate interoperability among these devices. This pp[roblem is identified by cloud. An authentic platform is created by a cloud where various devices are conducted and they are able to interact with each other.

SMART PARKING SYSTEM FUNCTIONALITY

The modern parking system is conducted by a few important electromechanical transmission controls such as automated placement, security control, and detection system, these systems are maintained by Internet of Things. Vehicle measurement, image analysis, automated retrieval, and electronic payment scanning processes are maintained by the Internet of Things. In IoT based parking lots, the image of a car is attached and provided towards the controller where the license plate and dimension of the car are observed. According to Rane et al. (2017), voice recognition system is involved to provide authorization after completing payment processes. Automatic moving and parking system is started by observing the entry of the planet or cabin. Elevators or a carousel system are able to shift the car and park into a proper space. The automated parking system is conducted with precise controls, system maintenance, reliable, and robust networking processes. These processes are conducted with the observation of the Internet of Things.

A programmable logic controller process is implemented by IoT to maintain various factors such as driving the automatic parking, improvement process, and electromechanical systems. A unique programming language is used in programmable logic controllers, which is treated as a closed model. Internet of Things gateway is attached with a programmable logic controller. Field data of sensors and other edge devices are monitored, stored, and restored in the cloud. This process left a positive impact on IoT based parking and helped them to analyze and manage the whole system from a remote control system in real-time. Management of parking systems can collect significant benefits from the Internet of Things.

The Internet of things provide data towards local servers. Mahendra et al. (2017) stated that,despite this, an appropriate alert is provided by IoT towards the admin of the system and helps them to mitigate problems promptly. To improvise value-added services new applications are evolved by the Internet of Things. These new applications can help drivers to find out any nearby parking lot with the help of a GPS or many webs based mobile devices accessing cloud data. A smart parking system is a crucial process, which can enhance knowledge of management. Image processing parking systems are much better than sensor-dependent parking systems, however, both are conducted by the Internet of Things. To avoid theft and any illegal activities driver's number

plate is captured by image processing and this information stored in the database, this information is also used as future references.

SYSTEM ARCHITECTURE

4.1 A proposed system

High-level architecture is needed for a smart parking system, which consists of mathematical models. This system is conducted with three important parts, the first part is the parking area. Arduino devices are involved in this stage with IR sensors. These devices help users to interact with the parking area. Without the presence of RFID, card users are unable to enter the parking area. Cloud-based web services are considered as a second part, this factor is implemented as a mediator between users and parking areas. Fort checking availability users can observe admin administers and cloud services. User side elements are located in the third part. In this part notification provided towards users about the availability of parking space, this notification is provided via SMS with the help of the GSM module (Rao 2017).

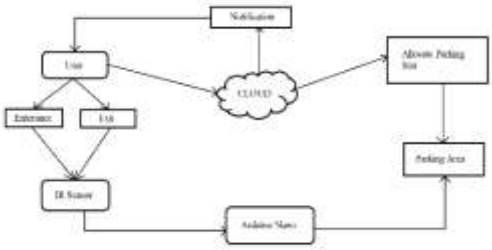

Figure1: system Architecture
(Source: Rao 2017, p. 243)

4.2 Hardware

To conduct IoT based parking systems three main hardware components are used such as RFID card, GSM module, and IR sensors. RFID cards help users to enter parking spaces. Information of registered users is loaded in the RFID card. All information of the user is scanned by the reader module when a car enters the parking slot. To check the availability of the car, user-related information is provided towards the Arduino. Therefore, users are notified by this system about the status of the parking area. According to the availability, GSM module provides massages. According to the presence of vehicle IR sensors can provide signals.

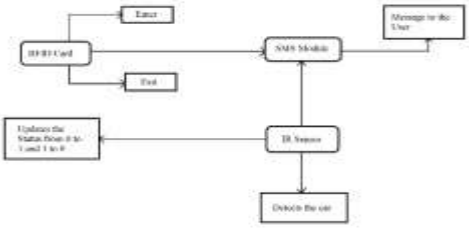

Figure 2: Hardware architecture
(Source: Shi et al. 2017, p. 345)

4.3 Software

The cloud server is implemented as an intermediary between the modules.The cloud server misconnected with a wi-fi module. With the help of this cloud, server users can collect messages via the SMS module when cars

enter and exit the parking area by using RFID cards. To manage cloud SMS modules play a significant role. The status of the cloud is updated from 0 to 1 depending on the detection ability of the IR sensor (Shi et al. 2017).

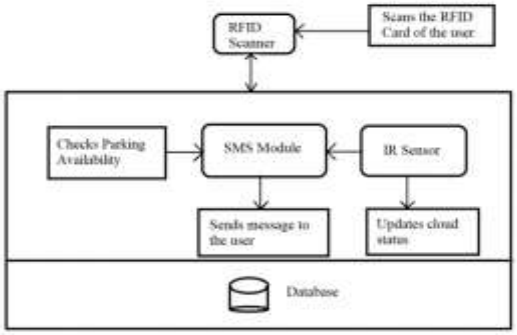

Figure 3: software architecture
(Source: Shi et al. 2017, p. 456)

DETAILS OF THE MODULE

4.4.1 GSM module

To maintain communication setup between mobile phones and microcontrollers this GSM module is used, which is considered a circuit. This module is mainly used to send SMS, MMS, and voice messages with the help of the internet. High data transmission is allowed by GSM with the help of GPRS extension. This module is involved in the time division multiple access approaches, which directly has an impact on transmission.

Figure 4: GSM module

(Source: Thangam et al. 2018, p. 678)

4.4.2 IR sensor

IR sensor device can emit infrared lights. According to Thangam et al. (2018), if this device is unable to find out any IR light then these devices are reflected. This reflection process is conducted due to the absence of any object when any object observed then this light is able to detect.

Figure 5: IR sensor

(Source: Thangam et al. 2018, p. 688)

4.4.3 RFID card

Integrated circuits, an antenna, and a substrate are present in RFID cards. It is treated as an identification badge, which is used to save user's information and provide this information towards the controller. RFID cards are able to provide all kinds of information towards controllers with the help of radio waves. According to Ling et al. (2018), this RFID tag is attached to the car to track the car.

Figure 6: RFID card
(Source: Ling et al. 2018, p. 568)

4.4.4 READER module

This READER module is used to analyze and gather data information from the RFID. objects are tracked by this READER module. When cards enter the parking area then the RFID card is scanned by this READER module. Therefore, all information is transferred to the admin with the help of modules.

Fig.7. Reader Module

Figure 7: Reader module
(Source: Ling et al. 2018, p. 566)

4.4.5 Servo motor

Control of angular as well as linear motion is controlled by these rotator devices. This servo motor is implemented to open or close gates. Servo motor is conducted with servo drive transmit an electrical signal, producing motion is maintained by this servo motor.

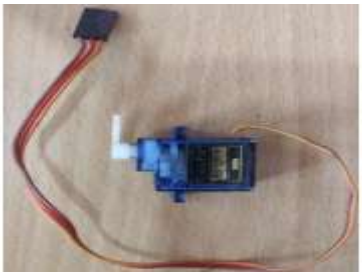

Figure 8: Servo motor
(Source: Qadir et al. 2018, p. 456)

4.4.6 Arduino nano

This module is used in various fields and various devices, it is treated as a compact board. This module is conducted with 22 input/output pins, among them, 14 are treated as a digital pin. 32 kb flash memory is present in this Arduino module. Operation of the digital pin, as well as analogy pin, are involved in this module. Qadir et al. (2018) stated that this module is a breadboard-friendly board which is used in every place.

Figure 9: Arduino

(Source: Venkanna et al. 2018, p. 342)

4.4.7 Wifi Module

With the help of this module, data is transferred to the internet from the embedded system by using the URL by HTTP POST method using TCP/IP protocol. Expressif system is also used in this case to develop this module. 32-bit microcontroller and 80 kb user data is present in this module, 16 gpio pin is also present in this case.

Figure 10:WiFi module

(Source: Latif et al. 2018, p. 234)

1. *Parking sensor*

High performing sensors are used in this case to improvise this IoT based parking system. Various sensors are used in parking systems such as Infrared, passive infrared, and ultrasonic sensors (Latif et al. 2018). The work of these sensors is the same, these sensors are used to sense the parking area and identify the availability of parking slots. Ultrasonic sensors are used to detect the presence of cars. Raspberry pi is wirelessly connected with ultrasonic sensors by using the ESP8266 chip. This ESP8266 chip is conducted with a self-contained SOC and integrated TCP/IP protocol, microcontrollers are also able to be connected with WiFi with the help of this sensor. 5V supply is connected with this sensor as an external source.

IMPLEMENTATION

RFID cards are mandatory for users which help them to enter the parking area.READER module scan RFID card to collect all kinds of information which are loaded in the RFID card. These pieces of information are transferred to the controller of the system. The availability of parking slots is controlled by an IR sensor. Parking barrier gates will not open due to the absence of available space. According to Enríquez et al. (2017),

therefore, the GSM module can provide a massage towards users. Devices are also collected with cloud servers with the help of this module.

Figure 11: massaged received by the user
(Source: Enríquez et al. 2017, p. 235)

The above diagram denotes that, if space is available then the user can receive a message and then the parking gate will open and the user can park their car. Therefore, during the time of exit, RFID cards are scanned again and provide a message by using the GSM module. All important information of the user is stored in a cloud database (Coulibaly et al. 2018).

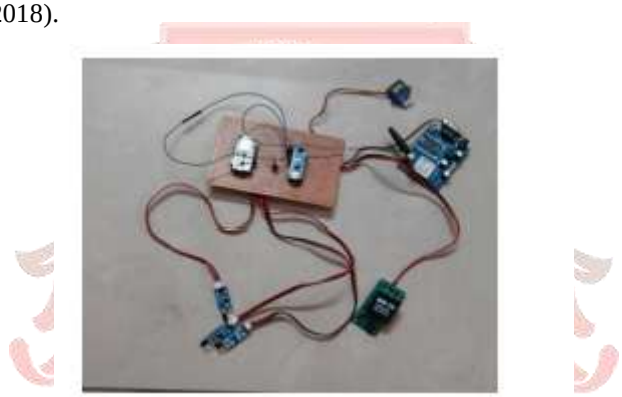

Figure 12: Model
(Source: Coulibaly et al. 2018, p. 564)

A particular space for users is provided by cloud status. IR sensor detects the presence of a card during the time of parking of a card and provides information about cloud status from 0 top 1.

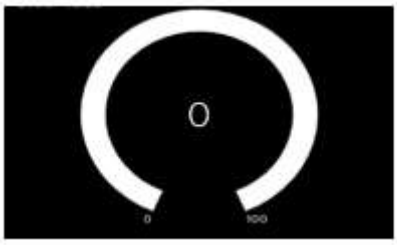

Figure 13: cloud status

(Source: Venkanna et al. 2018, p. 231)

ADVANTAGES AND DISADVANTAGES

7.1 Advantages

- **Reduced traffic:** Traffic flows are improved by this IoT based parking system. Fewer cars are needed to drive around in search of an open parking space.
- **Optimized parking:** users can find out the best parking spot by this IoT based parking system. Time and effort are also saved by this technology. With the help of commercial and corporate establishment parking, lots are filed appropriately and spaces are used correctly.
- **Enhanced user Experienced:** the improvisation of user experience is dependent on the performance of smart parking solutions (Venkanna et al. 2018). The destination arrival process is conducted with few effective parts such as driver's payment, spot identification, time notifications, and location search.
- **New Revenue Streams:** A smart parking system is conducted with many new revenues. The bank payment option is provided by the IoT owner which depends on the parking space location. Along with this, various kinds of rewards are also combined with this.
- **Improved safety:** Employees' safety and privacy regarding all issues are maintained by this IoT based parking system. Along with this, parking breaches and skeptical activities are also maintained by this technology. Automated license plate recognition cameras can collect all kinds of footage which is important for safety-related issues.

DISADVANTAGES

Real upfront costs are considered a disadvantage of this system. Ground sensors are involved in smart parking systems. However, this process is conducted with high costs. A car parking over the sensor may interrupt your mesh if the admin operates an ant mesh network. Despite this, enforcement is also an important issue. A smartphone is required to maintain this application, which is difficult in smaller cities. The city tourism industry has an effective impact on this.

CONCLUSION

Based on this paper it is concluded this IoT based parking system is useful for smart cities. Various modules are involved in IoT based parking systems to maintain this system such as IR sensor, RFID card, and READER module. Various sensors are also used in IoT parking systems, such as IR sensor and parking sensor which is concluded in this paper. Implementation of IoT technology in the parking system consists of advantages and disadvantages. IoT based parking systems provide high-performing sensors. Based on this paper, it is concluded that this IoT technology-based parking system is a very costly process.

REFERENCES

1. Coulibaly, M., Belkhala, S., Errami, A., Medromi, H., Saad, A., Rouissiya, M. and Jaafari, A., 2018, May. Development of a demonstrator «smart-parking». In *2018 19th IEEE Mediterranean Electrotechnical Conference (MELECON)* (pp. 172-176). IEEE.
2. Enríquez, F., Soria, L.M., Álvarez-García, J.A., Velasco, F. and Déniz, O., 2017, June. Existing approaches to smart parking: An overview. In International Conference on Smart Cities (pp. 63-74). Springer, Cham.
3. Latif, S., Afzaal, H. and Zafar, N.A., 2018, December. Modelling of graph-based smart parking system using internet of things. In 2018 International Conference on Frontiers of Information Technology (FIT) (pp. 7-12). IEEE.

4. Ling, X., Sheng, J., Baiocchi, O., Liu, X. and Tolentino, M.E., 2017, June. Identifying parking spaces & detecting occupancy using vision-based IoT devices. In 2017 Global Internet of Things Summit (GIoTS) (pp. 1-6). IEEE.
5. Mahendra, B.M., Sonoli, S., Bhat, N. and Raghu, T., 2017, May. IoT based sensor enabled smart car parking for advanced driver assistance system. In 2017 2nd IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT) (pp. 2188-2193). IEEE.
6. Qadir, Z., Al-Turjman, F., Khan, M.A. and Nesimoglu, T., 2018, October. ZIGBEE based time and energy efficient smart parking system using IOT. In 2018 18th mediterranean microwave symposium (MMS) (pp. 295-298). IEEE.
7. Rane, S., Dubey, A., and Parida, T., 2017, July. Design of IoT based intelligent parking system using image processing algorithms. In 2017 International Conference on Computing Methodologies and Communication (ICCMC) (pp. 1049-1053). IEEE.
8. Rao, Y.R., 2017. Automatic smart parking system using Internet of Things (IOT). Int J Eng Technol Sci Res, 4(5).
9. Sadhukhan, P., 2017, September. An IoT-based E-parking system for smart cities. In 2017 International Conference on Advances in Computing, Communications and Informatics (ICACCI) (pp. 1062-1066). IEEE.
10. Shi, J., Jin, L., Li, J. and Fang, Z., 2017, September. A smart parking system based on NB-IoT and third-party payment platform. In 2017 17th International Symposium on Communications and Information Technologies (ISCIT) (pp. 1-5). IEEE.
11. Thangam, E.C., Mohan, M., Ganesh, J. and Sukesh, C.V., 2018. Internet of Things (IoT) based smart parking reservation system using raspberry-pi. International Journal of Applied Engineering Research, 13(8), pp.5759-5765.
12. Venkanna, U., Sharma, S., Katiyar, B. and Prashanth, Y., 2018, February. A wireless sensor node based efficient parking slot availability detection system for smart cities. In 2018 Recent Advances on Engineering, Technology and Computational Sciences (RAETCS) (pp. 1-6). IEEE.