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Access the Role of IoT in Smart Cities for Smart Parking System

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ABSTRACT:Due to rapid technological development in the metro cities in India facing some challenges towards the journey to becoming a smart city. One of the biggest problems is parking the vehicles in malls, working places or so many junctions in the city. The many traditional methods of finding a parking place are manual by finding open space. This takes users longer and more energy to cause traffic jams.Many valet parking space areas are therefore not utilized. The same is true of traditional parking systems where issues are created for consumers such as a lack of parking space, a lack of paper tickets, and a lack of location. The purpose of this work is to propose a Smart Parking System with the help of the Internet of Things. The implemented design gives an impressive parking issue solved by many smart cities based projects. The SPS enables mobile-based online slot booking and paperless token generation followed by cashless payments.

KEYWORDS:Smart Cities, Internet of Things, Raspberry Pi, Ultrasonic sensor, Pi camera.

I. INTRODUCTION

The term IoT generally refers to the increasing number of digital devices – nowadays the amount is thousands – which are capable of communicating and interacting with others worldwide via the Internet/network and can be monitored and managed remotely. Only smart and other gadgets are included in the IoT. For instance, weather data is gathered at the operational level of IoT. IoT provides cities new possibilities for traffic management using data, cuts pollution, improves infrastructure, and safeguards the safety and cleanliness of inhabitants. The ongoing population expansion in the city favored by a huge rural migration led cities to optimize their urban resources. In this respect, the will of city actors and the advances in IT (ITC) has given rise to the "intelligent cities". A smart city works by collecting, processing, and exchanging data and then makes decisions (by both the city government and individual residents at different levels). The data required are collected via connected sensors and IoT equipment. Due rapid increase in population in cities, it starts expands areas, One of the rising and demanding study fields is the Smart Cities idea in today's reality. The cities are bordered by woods, farmland, or open zones, in which fires can affect human lives and cause the extinction of numerous resources. [1]. According to the census, this massive expansion will impose various obstacles on cities, including the sustainable administration and development of metropolitan areas and the capacity to provide inhabitants with an outstanding quality of life. To serve the numerous demands of this rising population, the creation of smart cities should thus also be seen as a practical and essential solution [2]. On the other hand, the rapid development of IoT and Big Data Analytics is usually regarded to be the key element in smart city services deployment [3].

These technologies allow physical subjects the capacity, to interact, share information, and coordinate activities, to imitate human characteristics such as viewing, hearing, thinking, and decision-making. These skills convert ordinary items into intelligent gadgets which can work in real-time, adapt and work without human involvement or monitoring. The Advent of t cities is an increasing world trend. They aspire to incorporate ICT solutions that enhance their residents' quality of life and their engagement with government authorities. Transport and urban mobility are hence some of the main urban development issues. In light of the increased demand for parking spaces, they confront various obstacles to sustainable mobility in particular those connected to the limited capacity of city transport, traffic, and parking systems. The utilization of public transport applications and the provision of customized data routines for users are some of the usual Smart City instances. The fundamental aim of intelligent cities is to offer a better urban living environment that is based on ICT, IoT, WSN, and other relevant computer technologies. In addition, IT-enabled infrastructure can control and monitor the normal operating activities of cities, such as transit, monitoring, resource planning, etc. It is also assumed that smart cities improve the living standard of human beings while utilizing the resources effectively [4]. Most of the metro cities have shopping malls that were the favored



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destination for urban society. The retail centers that you visit are already part of their lives. It's not surprising that at shopping malls people find nearly anything. Mall management has given its customers different amenities to ensure that consumers feel comfortable during their visits to the shopping centers, one of which is parking areas.

One of the key concerns is that these cars are parked. The growing number of personal vehicles is likely to be insufficient to carry these vehicles than public transit. Even if there are sufficient car parks, it still takes a long to discover the available parking space as people do not know exactly where the car park is without it. As a result, fuel consumption will grow and not be kind to the environment. Parking in most of the urban regions, notably in the early hours, such as malls, hospitals, etc., is extremely difficult and irritating. In this work, focus on how IoT is playinga key role in the building of Smart Cities because of smart parking systems.



The paper is organized as follows. Section II gives the full details on the state-of-the-art of IoT in Smart Cities, Section III focuses on methodology for Smart parking for an urban environment, Hardware and software requirements for smart parking described in Section IV followed by some experimental analysis. The last section gives the conclusion and future scope of this work to achieve the best solution.

II. RELATED WORK

Since the vehicles were widespread in the 20th century, drivers began to have difficulty parking their cars because of several causes, from drivers' followers to the town facilities. One of the first efforts to decrease the time spent looking for unoccupied places is based on car parks, which also provided revenues to governments. Existing parking solutions relying on sensors would be enhanced by the interruptive IoT shift, which allows each item to connect to the Internet and share data between them. In the era of embedded systems, these parking management systems are developed using ultrasonic sensors and microcontrollers [5]. In this work authors designed a system to detect the vehicle using an ultrasonic sensor and send some alerts to the controller via Bluetooth. The microcontroller processes the incoming data and sends it through the Ethernet shield to the cloud. Cloud access may be used to reserve parking space through a desktop or app.

The authors gave a vehicle park and booking system in paper [6]. The technology would discover the client entering the parking lot free parking space. The camera is used to detect the number of the automobile to check its car owner and identify the closest plate to the car park. The camera uses image treatment and the system also provides the parking lot booking service and payment may be made using the wallet. SPS is a parking management system that integrates cloud, database, and mobile parking technologies [7]. This system is not simply an operating system for the management of parking lots; it also stores information and accesses up-to-date parking status information. To provide quick, safe, monitored, and transparent parking services, the purchase of an automated parking system operational. While accessing parking information, including the position/profile and current circumstances, is provided to make it easier for users to identify parking lots and track parking conditions [8]. The parking system has moved from the history of manual tickets to relying heavily on IT and sensor development. This service provides customers with access to internet services including mobile apps, features like easy parking and backup [9].

In [13] addresses the car theft problem of disclosed system uses RFID and GSM technologies to allow for smart cards with RFID tags. Authorization is given. An alarm will be triggered in the case of robberies and SMS alerts the appropriate user. An easily maintained, the current low-cost system takes a big group of persons into account while collecting data about car parks. This is followed by a method of cross-sensitivity, and data is typically examined and used to forecast every element of the common interest [10]. The Wazeapp, which calculates the quickest route based on traffic volumes, is a notable example of crowdsensing. The problem with smart parking crowdsensing is that registered users need to exchange data constantly to make the system efficient and highly vulnerable to fraudulent users that transmit fake data [11, 12]. An ultrasound-like and infrared-like solution employs optical sensors. They



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sense light differences and should be used where the car obstructs the normal light. The downside of optical sensors is that they would require a steady light source and this might be a problem in outdoor parking in particular. Laser sensors function in a similar concept as infrared and have the drawback of being visible as opposed to prior alternatives. The infrared or ultrasound problem affects both laser and optical sensors. Kazi et al. [14] are aiming to reduce the difficulty by allocating space to a user and helping them navigate the allocated spot. Payment can then be made either on a digital basis or via a sales machine. Wireless connection is utilized by the system[15] to arrange the closest parking spots by use of the GPS. Every 2 minutes, the system communicates available spots. If no action is taken in all parking spots available; Any user, on the contrary scenario, is willing to order a place within 2 kilometers of its location. There was a system in [16] the ideal vehicle park, user-supported space neighborhood calculatesTime and trajectory. The system did not have the reservation function and was subject to space accessibility at that moment.

During the journey of implementation of smart parking, systems required more robust designs to control complex and crowded areas. With this motivation, we have proposed a new way of IoT-based solution for SPS given smart cities.

III. METHODOLOGY& SYSTEM ARCHITECTURE

This section gives the details of, hardware and software requirements along with the methodology to design the SPS using IoT. Most of the authors proposed the solutions for SPS using some basic microcontrollers, Arduino, or NodeMCU based designs. These designs not that much secure reliable and less processing speed due to their internal architectural specifications. The designs using NodeMCU and Arduino bases SPS not suitable for real-time scenarios. Very few of the authors started implementation using Raspberry Pi-based solutions for SPS. In this work, we have selected a Raspberry Pi-based board along with some additional components like a camera and sensors. The reason behind selecting Raspberry Pi boards is having capable of performing complex processing and it supports open source programming like python.

The layout of the proposed Smart Parking System for Smart Cities using IoTis shown in Figure 3.



Figure 3: Block-Level layout of Proposed IoT based SPS



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The hardware requirements and block diagram smart parking system shown in Figure.



Figure4: System architecture for proposed SPS

Road traffic has become the apparent problem that our cities have to cope with. In addition, the search for a station generates gridlock on our highways that contribute to the wasting of gasoline and especially time. There is hence a need to know publicly in advance the empty parking places near a specific locality. Therefore, a mechanism has to be developed for users to discover unoccupied car parks. The angle parking system is proposed to optimally use existing parking spaces by arranging in a specific angle, parking slots fit more cars. The IR sensors used would identify if a parking place was a Parking place using a smartphone application that is either empty or filled. This is transmitted to the pi for the first time. Transmitted through the server and relayed to the user via the mobile app. The user can book a free account A parking space will be created with basic information like the number of the car, time in, time out, and a QR code.

IV. EXPERIMENTAL RESULTS

Every user may check the parking status and can book a car park. Every user who has a parking space reserved is authenticated using the mobile application QR-code as the USB camera scans it and then the slot door opens. The number and slot numbers of the car and click on the reservation button to make reservations for the parking space. Free panels are shown as FREE green with FREE text, reserved panels as RESERVED in yellow, occupied panels in red with OCCUPIED text are visible. Once the vehicle is parked, the IR sensors identify the presence of certain objects and communicate the status of the mobile applications to raspberry pi, and that is the same as the car leaves. The entire booking method and the departure of a specific car park and parking in the car park are explained with the aid of the flowchart.



Figure5: Overall flowchart of proposed SPS for Smart Cities



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The proposed SPSimplemented with latest Raspberry Pi4 board along with cloud storage model, which will store the sensor data into the cloud. The experimental-based results are shown in Figure 6,7&8.



Figure 6: Parking slots dashboard Figure 7: Reserved parking slot Figure 8: Status of parking slot As per the experimental results, finally collects the fee from the user. Hence, this system process more data within a stimulated time and achieved impressive results with minimal connection services. The proposed work, more robust

V. CONCLUSION

The idea of the concept of smart cities is the buzzword all over the world to making many smart-based applications and minimal time-saving. As per the statistics, their many improvements held because of smart cities during the last three years. The services provided by the smart parking systems got more attention in IoT-based smart cities systems. The proposed system has several applications such as verify the parking slots availability, status of the slot after booking, and payment options. Hence, the role of the Internet of Things in smart cities, especially, metro cities likes Hyderabad, Bangalore, and Delhi faces one of the essential challenges is the parking of vehicles in malls, organizations, and some crow places. This work designed an attractive application for mobile phones. This work opens room for further will upgrade using some pi cameras data and on-demand cloud storage models with more security concerns.

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