

## IoT based Automatic Smart Parking System with EV- Charging Point in Crowd Sensing Area

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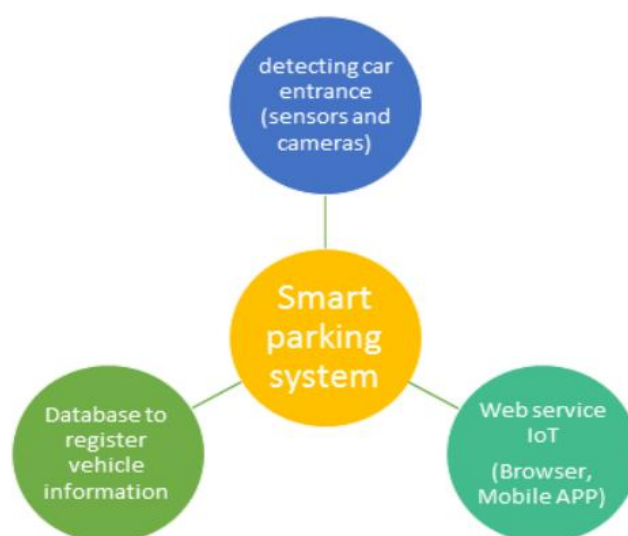
**Abstract:** Parking is a major problem, especially for big cities. In future everybody's having their own vehicle to park their vehicle in the crowd sensing area is a major problem in current situation. The solution for this smart parking improvement suggests an IoT founded scheme that directs information about open and full parking spaces via mobile or web application. The IoT expedient, includes microcontroller and sensor devices with Electric Vehicle (EV)–charging point, is situated in respective car parks place. The customer obtains an alive apprise around the available all car parks spaces and selects the finest one. The main aim of this research is used to identify the available parking places using IoT and ultrasonic sensors. The HC-SR04 distance dimension instrument, ESP8266 microcontroller, MQTT grid rules, and AWS IoT, AWS Lambda cloud analytics are utilized for this project to implement the smart car parks system in smart metropolises. The application of smart car parks methods is Shopping Malls, Restaurants, Theatres, Crowd Sensing Area etc.

**Keywords:** IoT, Ultrasonic sensor, ESP8266 microcontroller, HC-SR04, MQTT, AWS.

### 1. Introduction

Finding for a car parks space becomes an everyday problem for most of the public entirely to the world. It commonly takes more period overwhelming method for most of the people in everyday life. Smart parking provides parking solution which includes smart car parks devices, cameras or calculating devices.

These expedients are commonly fixed in car parks places which is used to identify whether the car parks spot is open or not. Smart parking and parking sensors are portion of smart metropolises. Smart metropolises are motivated by IT substructure to improve the superiority of lifetime and expand commercial improvement. Smart city can collect historical data in easy way, so that parking can be optimized. The smart parking system saves the driver time for parking a car in vacant place. The amount of time is considering for car parks spot is will be minimalized. The advantages of smart car parks systems are less pollution, safety, real time parking analytics, the space of a metropolis will be used extraproficiency, reduce street congestion, the drivers will get the benefit for reduce stress related to parking, save time and money. The general parking construction is shown in fig 1.



**Fig.1.** General Smart Parking architecture

The general smart Parking architecture consists of three parts. The sensor and cameras are used to detect the car in entrance, Browser and mobile app used for Web service IoT, the database is used to register vehicle information.

## 2. Literature Review

To utilize optimum parking space instead of horizontal space vertical space is utilized in MLCPS technology. The car is lifted and place with free slot with the help of automated multilevel car parking technology [1]. The parking detection is reliable and parking slot identification using image segmentation measure. The vehicle theft is measured using theft alarm system [2]. Sensor based IoT technologies to reduce traffic congestions using microcontroller with sensors. This method uses Node MCUs, Arduino UNOs, and Raspberry Pi 3 has structures for example RFID entrance/leaving and Numeral Platter Recognition [3]. The keen car parks mobile solicitation utilizes IoT and RFID technologies to detect the

available parking space which save time and reduce the fuel consumption [4]. Automated car parking system utilizes arduino uno microcontroller based IoT technologies to find free parking space to park the vehicle in appropriate place [5]. The intelligent transportation system solves the problem of traffic management in city areas. This can significantly reduce the parking time in vacant area [6]. The smart parking sensors are fixed in cars to relieve deadlock problem during parking time [7]. Smart parking components like instruments, communiqué procedures and s/wresults to enhance parking period, decreasepetrol/dieseldepletion, and CO<sub>2</sub> emissions [8].

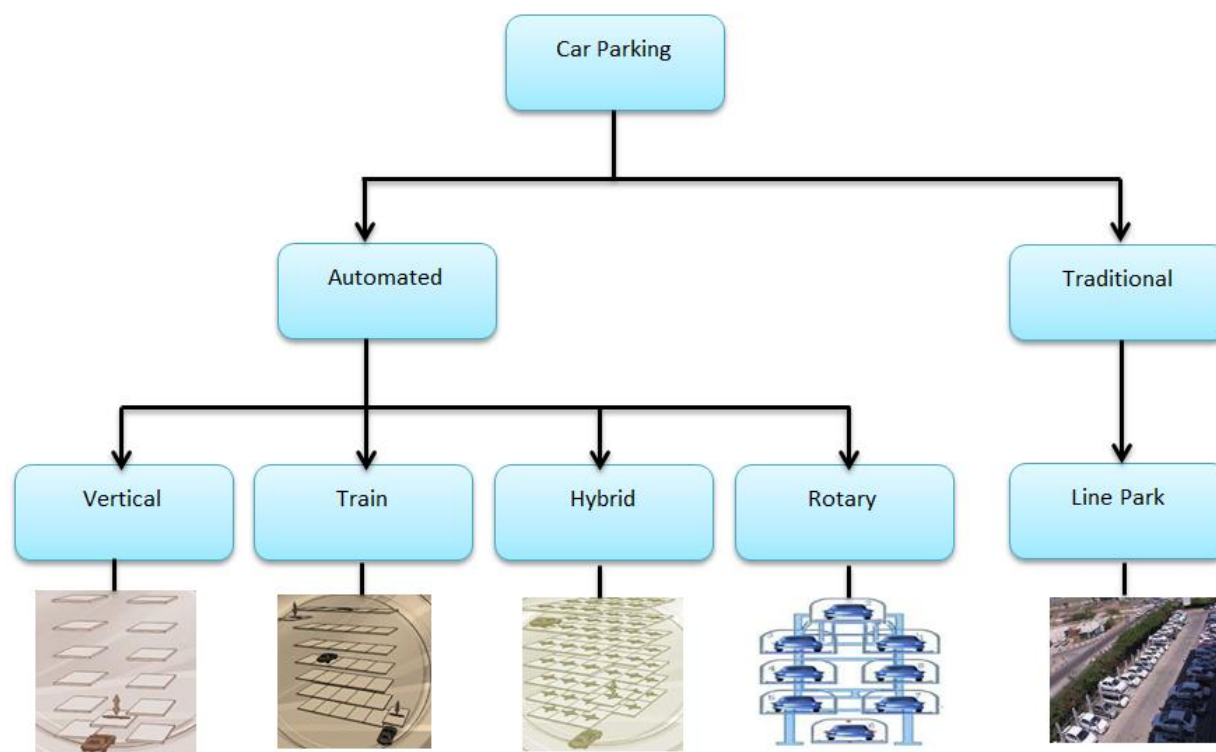
IoT based smart car parks integrates with mobile application which provides reserving a parking space according to the size of the car. IR devices are used to find the free slot and RFID tags are used to authenticate a user to parking a vehicle hourly, daily, weekly or monthly basis [9]. The RSPS techniques are utilized to parking a vehicle effectively with corresponding vacant places [10]. The parking slot is deployed with sensor to identify the slot availability and inform the slot availability to the node server controller. The user can find the free slot availability with the help of Node MCU through internet [11]. The intelligent transport system utilizes mobile expedients to executeseveralpurposesfor example discovers free car parks slot, and statistical information [12]. The smart city application with solution survey results provides the solution for parking management [13]. IoT based android application uses vehicle number plate to authenticate vehicle and it also reserve the free slot for parking the vehicle. The KNN algorithm is used to identify the vehicle number plate accurately. This system contains the major components such as Ultrasonic Sensor, USB camera, IR sensor and raspberry pi3 [14].

Multiple Attributes Decision Making (MADM) theory to find vacant parking space is an important attribute for degree of finding available parking places [15]. The android based application to park the cars in free slots automatically. It saves the time and prevents traffic while they are parking [16]. IoT based smartphone will the users to identify the free slot for parking the vehicle. The sensor is located on upper limit of every car parks slot to identify the vehicle existence [17]. The presence of vehicle is identified through mobile application using ultrasonic sensor and parking fee payment done through mobile applications via PayPal [18]. The intelligent transport system used parking guidance, parking facility and economic analysis of the system [19]. The SPIN-V contains computer, sensor to measure the distance, Camera, LED indicator, Battery-operated and Buzzer to get the position of a car parks space [20].

### 3. Methodology

A smart car parksscheme which aids the car driver to discover free slot utilized sensor devices in for eachcar parks place to identify the existence or nonappearance of a car. The smart parking system utilizes the IoT centeredscheme that directsinformation about open and fullcar parksspace via web or mobile

applications. The IoT expedient includes sensor and microcontroller which is situated on for each car parks space. The customer gets living appraise information around smart parking area ease of use of all car parks areas and selects the finest one in real time. The main aim for creation of smart parking uses IoT and ultrasonic devices, wherever the vacant car parks space is showed in a web presentation. Due to the population increase the vehicle usage also increased every day. This leads to unmanaged parking in real time environment. The number vehicle increase creates problems like overcrowding, waste of place, waste of period, congestion complications and many other difficulties.

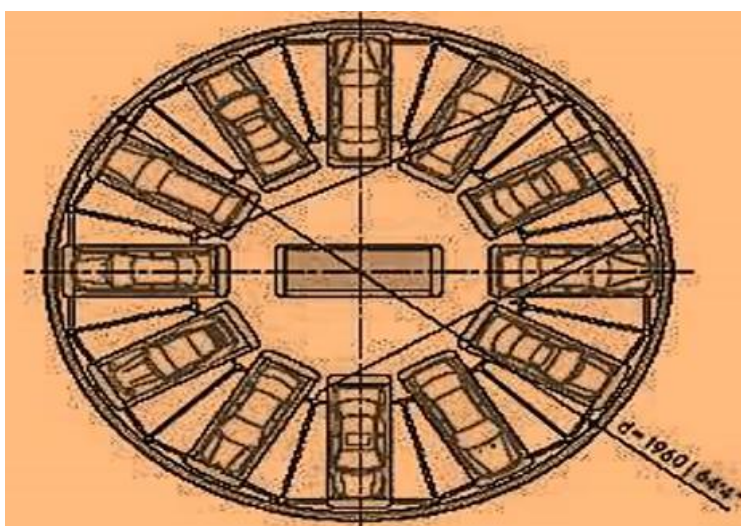


**Fig.2.**Categories of Car Parking

The categories of car parking are shown in fig 2. The car parking generally classified into two categories: automated and traditional car parking. The automated car parking further classified into four categories: vertical, train, hybrid and rotary. The traditional car parking further classified into one category: Line Park. The traditional car parking take more times to park the vehicle compare to automated car parking. The automated vehicle parking capacity are: perpendicular car parks volume is 10-30 cars, sequence car parks volume is 10-60 cars, mixture car parks volume is 10-70 cars, and rotational car parks volume is 8-10 cars. But the major problem for automated car parking category is utilization of parking space is more. It leads to create major problem in crowd sensing area within a city. So, the smart city needs smart solutions to park the vehicle in less space in crowd sensing area within the city.

The proposed method goals to make a scheme that enhances the safety with streamlining carparks scheme. The smart parking scheme utilizes less space to park the number of vehicle in crowd sensing area within a city. The proposed method utilizes circular path design from single floor to multiple floors as shown in fig 3. Less space is necessary for similar amount of cars which meaningfully reduce the price. Safety is achieved through finger photocopy entrance in turn there is no necessity to recall the secret code. The parking volume of circular path design is 60-70 cars. The number of floor is increased, and then the parking capacity also increased.

The circular path design smart car parking utilizes the circle diameter with 1960. In fig 3 design within single circle 12 cars are parked with less space compare to automated car parking. This method significantly reduces the parking space for crowd sensing area within the city.



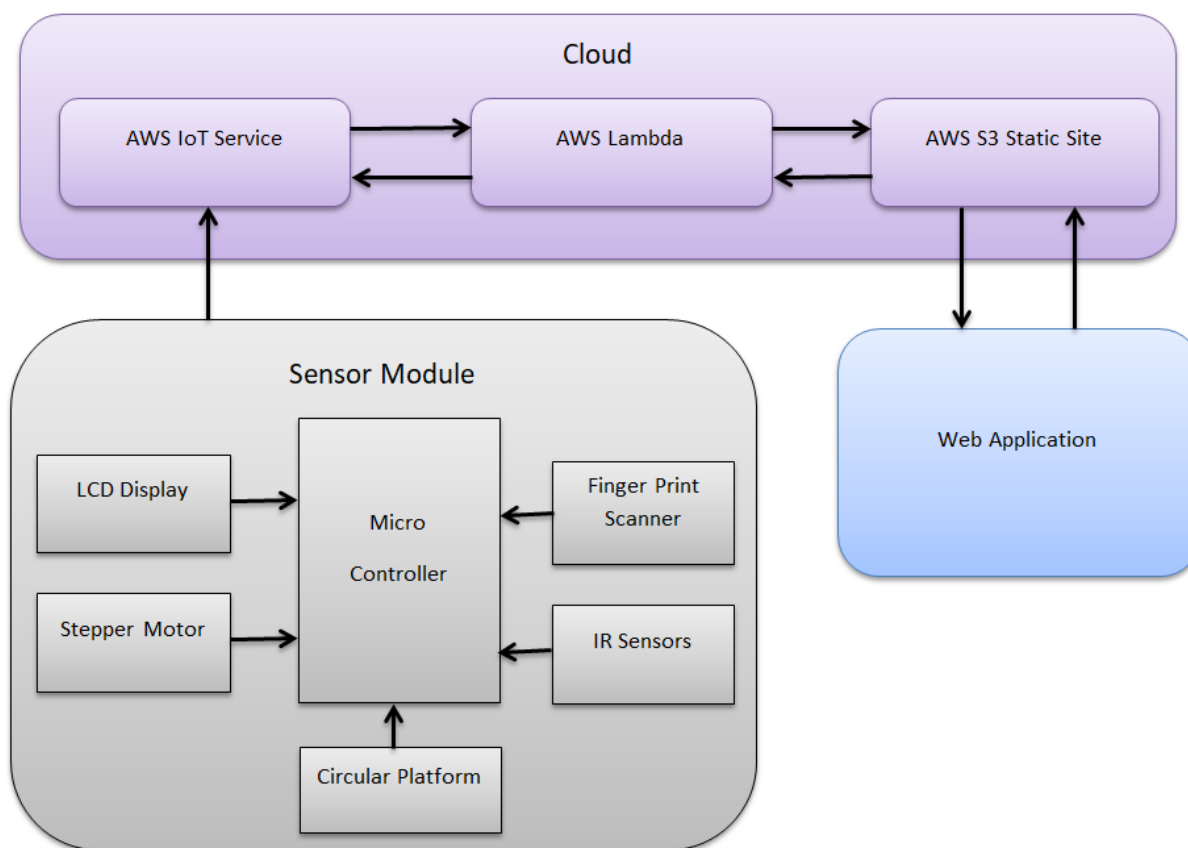
**Fig.3.**Circular Path Design Smart Car Parking

The circular path design smart car parking comprises of the following features. They are

- The smart parking system equipped with the fingerprint of an individual and provide a space if vacant.
- The slot statistics is demonstrated on the seven section demonstration or LCD screen.
- The ultraviolet sensor detects the presence/nonappearance of a car and is connected with microcontroller which shows the statistics of spaces on for each seven section demonstration.
- To take the parked compartment, the person fingerprint is verified with database. If it is matches and then the parked car will be provided to the concerned person.

- The circular path smart car parking will robotically swap and will offer specific ID equivalent to the spacepresence situated in which partition of spaces is established on panel of 360 degree conferring to the dimension of garage.

The IoT based smart car parks block illustration is displayed in fig 4. The IoT based smart hardware Components are ESP8266 microcontroller, HC-SR04 distance measurement infrared sensor, Fingerprint scanner, LCD display, Circular structure/platform, software such as MQTT Protocol, AWS IoT, AWS Lambda, Micro Python, python and Java Script.



**Fig.4.** IoT based Smart Parking Block Diagram

The sensor module equipped with ESP8266 microcontroller which controls the circular path design smart car parking. The finger print scanner is used to take user finger print and then allocate the parking space for the vehicle. The HC-SR04 IR sensor device is utilized to measure the distance of a car within the car parks place. The stepper motor is used to move the vehicle from one place to another space. The LCD display is used to display the presence/absence of the vehicle in the car parks area. The sensor device module information is stored in the cloud storage. The cloud storage provides AWS IoT, Lambda and S3 static site service to the user. The user can get live update information about smart parking using web application.

### **Algorithm for Circular Path Design Car Parking**

1. Start
2. Check the condition if park or retrieve
3. If (park == true)
4. Check the availability space in the database
5. If the space is available then
6. Take the finger print of the user then
7. Gate opens to park the vehicle
8. Vehicle is parked with circular path of s slot
9. else
10. exit
11. If (park == retrieve) then
12. Finger print is matched with cloud database
13. If (finger print == true) then
14. Gate opens to retrieve the vehicle
15. Vehicle is retrieved with circular path of s slot
16. Else
17. Exit
18. End

The smart parking avoids time wasting for parking the vehicle. The smart metropolises to grow totally combined multi-modal intellectual transport schemes with inordinate safety and efficacy. The smart car parks solution inside a metropolitan resolves the destruction and contamination difficult. As a result, smart parking which gains fuel saving and minimize the electric vehicle battery storage in real time.

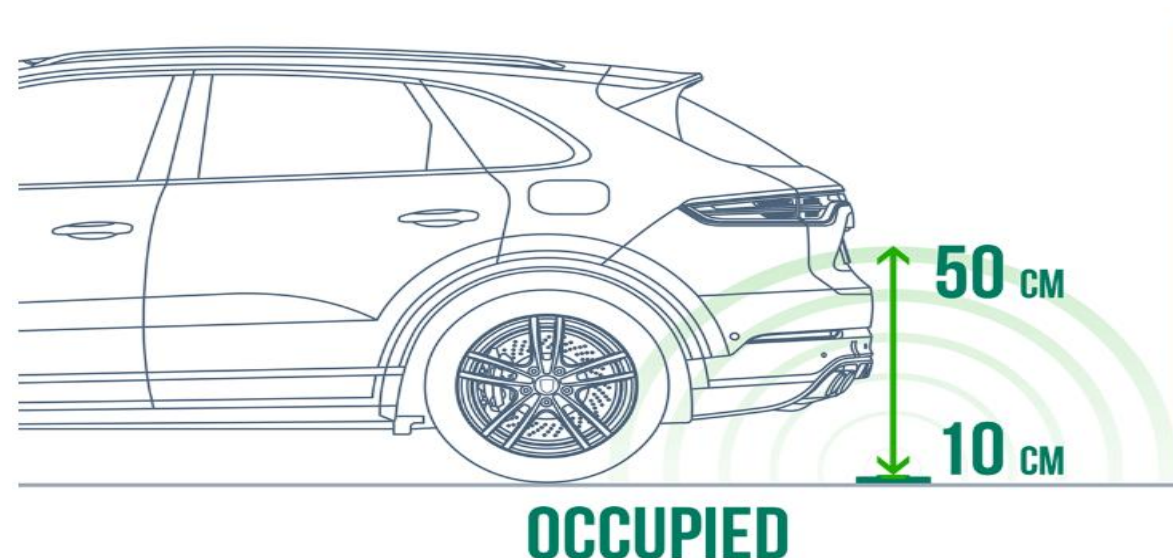
The IoT expedient contains of an ESP8266 micro-controller and an HC-SR04 space dimension sensor device. The sensor device occasionally processes the space and transfers this information to the micro-controller, which is joined to AWS IoT facility through the MQTT rules. A sensor device identifies a parked space by assessing the space to the nearby problem to the bottommost of the carriage. The space is in the assortment of 100mm-500mm and then LCD displays occupied state. If the distance is more than

500mm and then LCD displays free state. If the distance is less than 100mm and then LCD displays dirty state which resources the device may be unhygienic. All these ethics can be simply constructed with the help of distance measurement sensor. Based upon these values the sensor can easily identify both free and occupied parking slots. The device senses not anything up to 50 cm, the position is set to “open or free” and is shown in fig 5.



**Fig.5.** Sensor discovers not anything up to 50 cm with Free State

The sensor detects the obstacle between 10 cm to 50 cm, the position is fixed to occupied is shown in fig 6. Lower than 10 cm, the position is “unclean”. It means the device influence be concealed with dirt or a problem, and needs inspection.



**Fig.6.** Sensor Detects between 10 cm to 50 cm with Occupied State

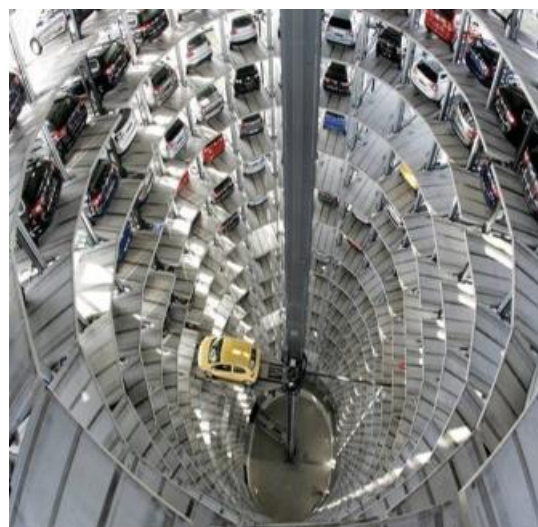


The driver can access the scheme via web solicitation, an indication is directed to the Lambda purpose. It read out the device state standards from AWS IoT tracker and shows car parks places dependent on the state. Green paint indicates available place, red paint indicates unavailable space, and yellow paint indicates contamination. Mobile and/or network solicitation structures play a large part in the IoT structured design. Every parking slot have electric vehicle charging point to recharge the electric vehicle during parking time. When they are retrieving the car the user has to pay the parking fee to controller.



**Fig.7a.** Automatic Smart Parking System

Horizontal View



**Fig.7b.** Automatic Smart Parking System

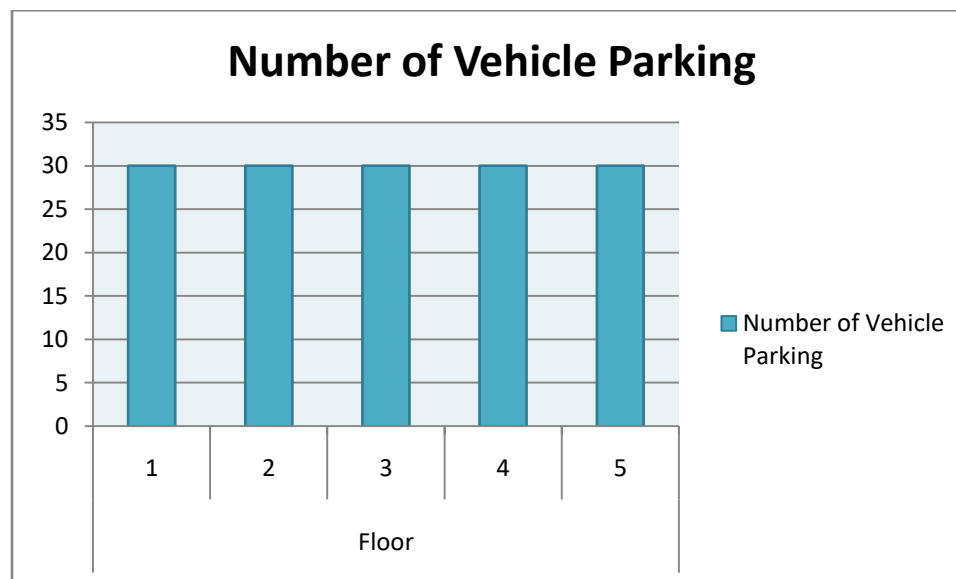
Vertical View

The fig 7a and 7b shows the automatic smart parking system horizontal and vertical view. An automated smart parking system is an automated scheme planned to minimize the space and/or capacity essential for car parks. It also delivers car parks for numerous stages arranged precipitously to make best use of the amount of car parks places although minimizing property utilization especially in crowd sensing area.

The major goal of this method is to decrease the area of parking spaces. The car is park or relocated robotically to its car parks place. Compare to all other model this model is suitable for crowd sensing area within the city. The car parks place breadth and depth is intensely compact. No driving tracks are required to drive the carriage to/from the entry/leaving to a car parks place. This method also has some other features like the parked carriages and their substances are further protected.

The damage such as predicaments and hollows are also removed. Motorists and travelers are harmless not taking to way of walking over car parks loads or garages. Motorists nearby in find of a car parks place are removed. The capacity and graphical influence of the car parks construction is minimized. The floor

versus number of vehicle parking is shown in fig 8. The graph shows five floors approximately equipped with 30 vehicles in every floor.



**Fig.8.** Floor vs Number of Vehicle Parking

#### 4. Conclusion

This work is useful for the car parking people to park their vehicle effectively. The electric vehicle charge point provision is provided for the all the parking slot to recharge their vehicle during parking time. Further, the automatic smart parking were reduces the parking time and utilized less space for parking the vehicle in crowd sensing area within the smart city. The benefit of this work is to minimize the parking area, make clean city and financial business startups. Finally the automatic smart parking system have features like pre booking parking space (daily/monthly), check availability of parking spot nearby, application platforms, computerized parking, safety of vehicle, cleaning, servicing and maintaining and online payment method.

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