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IOT BASED VEHICLE PARKING ASSISTANCE SYSTEM

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ABSTRACT

With the expansion in vehicle creation and world populace, more parking spots and offices are required. In this paper another stopping framework called Smart Parking System (SPS) is proposed to help drivers to discover empty spaces in an auto park in a shorter time. The new framework utilizes ultrasonic (ultrasound) sensors to identify either auto park inhabitancy or uncalled for stopping activities. Distinctive locations advances are checked on and contrasted with decide the best innovation for creating SPS. Elements of SPS incorporate empty parking spot identification, discovery of disgraceful stopping, showcase of accessible parking spots, and directional pointers toward empty parking spots, instalment offices and distinctive sorts of parking spots. This paper additionally depicts the utilization of a SPS framework from the passageway into a parking garage until the finding of an empty parking spot. The framework is outlined in such a way showing the geological area of the guide in our cell telephone with the assistance of the android application.

Keywords: smart parking system (sps), vision based detection technology (VBDT), sensor based detection technology (SBDT.

1. INTRODUCTION

Modern vehicles are largely equipped with the actuators, sensor and communication devices like GPS. Mobile phones. In particular, numerous vehicles have possessed powerful sensing, networking, communication, and data processing capabilities, and can communicate with other vehicles or exchange information with the external environments over various proto-cols, including HTTP .As a result remote diagnosis, have been developed to enhance drivers' safety, convenience, and enjoyment.

The advances in cloud computing and internet of things (IoT) have provided a promising opportunity to further address the increasing transportation issues, such as heavy traffic, conges-tion, and vehicle safety. In the past few years, researchers have proposed a few models that use cloud computing for implement-ing intelligent transportation systems (ITSs). For example, a new vehicular cloud architecture called ITS-Cloud was proposed to improve vehicle-to-vehicle communication and road safety [3].

As the Wireless Sensor Networks have technologically developed more rapidly and more efficiently, they have become the key source for the development of IoT. They find application in almost all areas including smart grid, smart transportation systems, smart home, smart hospitals, and so on. The achievement of the above lead to the development of smart city. The idea of internet of things (IoT) was developed in parallel to WSNs. The term internet of things was devised by Kevin Ashton and refers to uniquely identifiable objects and their virtual representations in an "internet-like" structure.

These objects may range from huge buildings, planes, cars, machines, any sort of goods, industries, to human beings, animals and plants and even their specific body parts. One of the major evolutions of WSNs will be after they are integrated with IoT. This paper aims to develop an intelligent transportation system.

Time and cost are two vital elements of human life, whether for a business. As personal satisfaction builds, increasingly individuals occupy urban areas. Urban life requires concentrated open offices. Shopping buildings are a vital purpose of interest both for a city's tenants and additionally for guests. With the rise of advanced shopping edifices which give an assortment of administrations, more individuals are pulled in to visit them. Henceforth, more shop proprietors like to find their business in shopping buildings to target more clients and expansion income [1]. Giving adequate stopping to guests is one of the principle issues in creating shopping edifices. Offering protected and secure parking areas with an adequate number of spaces and paying consideration on debilitated drivers are a couple of the components which can expand client faithfulness and pull in clients to visit a shopping center all the more as often as possible. Among the different sorts of parking garages are multilevel stopping, roadside, roadside with ticket and boundary entryway and roadside with stopping meter; of these, the multilevel parking garage is the most favored by benefactors [3]. Wellbeing, climate conditions, closeness and auto park charges individually are the primary variables by which benefactors pick a particular parking area.

Subsequently, multilevel parking garages are favored, and thus were chosen as the parking garage sort for this study. SPS distinguishes auto park inhabitancy through ultrasonic sensors which are situated over every parking spot. Empty, involved, impaired or saved spaces are shown by various shades of LEDs. "Inappropriate stopping" is the circumstance in which one auto is stopped straddling two empty spaces and possesses both. Location of despicable stopping and giving headings to empty spaces and instalment offices are different administrations offered by SPS. The targets of this study are to highlight parking areas' significance, show the trouble drivers have in stopping their vehicles at shopping edifices, propose a pertinent answer for take care of the previously stated issues, and diagram a SPS engineering plan. This paper is

sorted out as takes after: the presentation subtle elements the significance of shopping buildings and parking garages, talks about current parking area issues and the challenges that clients experience in parking garages. Next Section clarifies identification innovation and contrasts ultrasonic sensors and different sorts of finders. At square graph plots SPS design and the gadgets required to execute it. This paper is sorted out as takes after: the presentation subtle elements the significance of shopping buildings and parking garages, talks about current parking area issues and the challenges that clients experience in parking garages. Next Section clarifies identification innovation and contrasts ultrasonic sensors and different sorts of finders. At square graph plots SPS design and the gadgets required to execute it.

2. RELATED WORK

The decision of suitable location innovation relies on upon the goal and extent of the undertaking [6]. Two sorts of discovery innovation, vision-based and sensor-based, are examined in this study. Vision-based strategies use shut circuit TV (CCTV) generally one camera is in charge of more than one parking spot and picture handling programming to identify parking.

Observing parking area opening is a noteworthy innovation which can be utilized for controlling autos to empty spaces and for productive utilization of parking spots. Observing discovery innovation can be isolated into two classes. The primary gauges the quantity of staying empty spaces for the whole counting so as to park garage approaching and active vehicles. The second screens the status of every individual space and can be utilized to control an auto to an empty space. To offer drivers some assistance with finding an empty parking spot without much exertion, canny stopping frameworks ought to give the particular area of empty spaces and not only the aggregate number of spaces [7]. To distinguish the status of an individual parking spot distinctive techniques have been used, for example, ultrasonic sensors put at every space (in this manner it requires numerous sensors), or reconnaissance cameras set at a high position (permitting supervision of a wide range by a couple of cameras, which is more valuable in open air parking area) [6].

Another identification innovation utilizes sensors to recognize empty spaces in a parking area. With the accessibility of different sorts of sensors, selecting a suitable discovery framework is a critical piece of actualizing a savvy stopping framework. Diverse elements assume a part in picking the best possible sensor, including size, unwavering quality, adjustment to ecological changes, power and cost [8].

Sensors innovations are arranged as either nosy or non-meddling. Meddlesome sensors should be introduced specifically on the asphalt surface, so burrowing and burrowing under the street surface are required. Magnetometers, pneumatic tubes, inductive circles, weight-in-movement sensors and piezoelectric links are viewed as nosy sensors [9]. Non-nosy sensors just require altering on the roof or on the ground. Ultrasonic sensors are arranged as non-nosy sensors, implying that they require less difficult establishment contrasted with meddling sensors.

Ultrasonic sensors transmit sound waves between 25 kHz and 50 kHz. They utilize the reflected vitality to break down and distinguish the status of a parking spot. Ultrasonic waves are discharged from the leader of a ultrasonic vehicle discovery sensor each 60 milliseconds, and the vicinity or nonattendance of vehicles is controlled by time contrasts between the radiated and got signals. Ultrasonic sensors can be utilized for tallying vehicles and evaluating the inhabitancy status of every parking spot [10]. Notwithstanding the minimal effort and simple establishment of ultrasonic sensors, they do have a few detriments, especially affectability to temperature changes and amazing air turbulence

A. IoT in automotive domain

The integration of sensors and communication technologies provides a way for us to track the changing status of an object through the Internet. IoT explains a future in which a variety of physical objects and devices around us, such as various sensors, ultrasonic sensor, GPS devices, and mobile devices, will be associated to the Internet and allows these objects and devices to connect, cooperate, and communicate within social, environmental, and user contexts to reach common goals [24], [25]. As an emerging technology, the IoT is expected to offer promising solutions to transform transportation systems and automobile services in the automobile industry. Speed and Shingleton [26] propose an idea to use the "unique identifying properties of car registration plates" to connect various things. As vehicles have increasingly powerful sensing, networking, communication, and data processing capabilities, IoT technologies can be used to harness these capabilities and share under-utilized resources among vehicles in the parking space or on the road. For example, IoT technologies make it possible to track each vehicle's existing location, monitor its movement, and predict its future location.

By integrating with cloud computing, wireless sensor net-work, Ultrasonic sensor networks, satellite network, and other intelligent transportation technologies, a new generation of IoT-based vehicular data clouds can be developed and deployed to bring many business benefits, such as predicting increasing road safety, reducing road congestion, managing traffic, and recommending car maintenance or repair.

B. Ubiquitous computing-Internet of things

The continuous enrichment of the services offered over the mobile communication infrastructure, along the rapidly increasing the capabilities of the end user mobile device, enable provides to deploy the rich and more advance applications. The purpose of the service provider is to increase the customer satisfaction and revenue.

The key component of smart urban infrastructure is a collection of devices that having sensing and wireless communication capabilities. Spread over the building, open areas and street, such devices gathered the data and

use for communication. The collected data is forwarded to central location so that collectively processed.

Parking in public area is one of the major problems facing in the urban environment. Many systems have been deployed to industries for parking assistance. The individual parking spot is managed by using the ultrasonic sensor. The processed data available from the basis of parking Guidance systems. The mobile application is available whether the location is available or not.

3. SMART PARKING SYSTEM ARCHITECTURE

The architecture of the system consists of the hardware and software requirements. Hardware requirements are Raspberry pi2 and ultrasonic sensor and software requirements are Apache is web server tool is used run the php code and Myphp admin is used as tool for sql data base management. The Parking Management System is explained in the block diagram Figure-1.

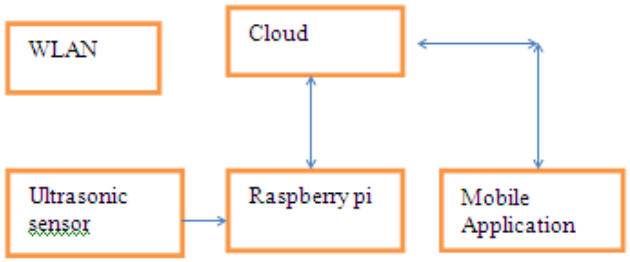

Figure-1. Parking management system.

A. Raspberry pi

The Raspberry Pi credit card sized single board developed having Broadcom BCM2835 system on chip (SoC) computer developed in the UK. Which includes an ARM1176JZF-S 700 MHz, 512 megabytes of RAM, CPU speed range from 700 MHz, Video Core IV GPU and 10/100MBit Ethernet compatibility? It does not include a built-in hard disk, but uses an SD card for booting to store the data and configuration network by using Ethernet or Wi-Fi and your router, but it is easy configure. The Ethernet connection, connect a cable to router and it should work automatically. For USB Wi-Fi dongle, to use the GUI that comes with Raspbian operating system to find your wireless network and enter your WEP/WPA password.

B. Ultrasonic sensor

Ultrasonic HC - SR04 is used to calculate the distance of human from restricted area, it provides 2cm - 400cm non-contact measurement function, and the ranging accuracy can reach to 3mm. The modules includes ultrasonic transmitters, receiver and control circuit. The basic principle of work, it using IO trigger for at least 10us high level signal, The sensor Module automatically sends eight 40 kHz and detect whether there is a pulse signal back. IF the signal back, through high level , time of high output IO duration is the time from sending ultrasonic to returning. Test distance = (high level time X velocity of sound (340M/S) /2.

C. Cloud storage

Data spark fun is cloud private cloud storage is used the reading and write of the data of the sensors, which can be accessed by the public key and private key which is generated by the service provider.

To convey measurements of reality to the Internet of Things hype.Data.sparkfun.com is a free, powerful administration for use with the majority of your undertakings. The fundamental motor is open source so in the event that you would prefer not to utilize our servers you can introduce phant on your preferred server.

Information stockpiling ought to be as simple as string connection. In the first place, make a stream and you'll get an open url and a private key. At that point, utilizing the equipment of your decision (Ethernet shield, RasPi, BBB, Electric Imp, WiFly) just make a string with the information according to prerequisites.

4. INTELLIGENT PARKING MODEL

In this section, the parking process has been modeled as a birth–death stochastic process. The parking revenue could be predicted by using such a model. The birth and the death of parking mean that a vehicle enters and exits a parking lot at time t, respectively. We were able to obtain the birth and death rate by using traffic detectors or other sensors [3]. We assume that there is a huge number of parking slots and this number can be considered infinite for practical purposes. Let X(t) be the number of slots in occupied time s. We write {X(t); s≥0} as a birth and death process. Therefore, we can read for all t>0,i>0and j=0,1,2…. The occupied slot at time is s

$$P\{ X(t+i) = j+1 \mid X(t)=j\} = \lambda i+o(i) \quad (1)$$

$$P\{ X(t+i) = j-1 \mid X(t)=j\} = \mu i+o(i) \quad (2)$$

where λ is the birth rate and μ is the death rate. We note the probability of a car parking event that occurs in (t+h) is independent from the number of occupied parking slots at time t.

If $P_k(t)$ refers to the probability when the number of parking cars at time t is I,then derive the probability of $P_k(t)$

$$P_k(t) = \exp\{-\frac{\lambda}{\mu}(1-e^{-\mu t})\}\sum_{k=0}^{min\{i_o,j\}}\binom{i_0}{k}\left(\frac{\lambda^{j-r}}{\mu}\right) X\ e^{-\mu+k}\ \frac{(1-e^{-\mu t})^{i_0+j-2k}}{(j-k)\ !} \quad (3)$$

Based on $P_k(t)$, we can compute the mean value

$$E\{X(t)\} = i_0 e^{-\mu t} + \frac{\lambda}{\mu}(1 - e^{-\mu t}) \quad (4)$$

Designed an infrastructure to publish advertisement from the parking lot. There are wireless transceiver towers in the parking lot and multiple transceivers installed on the parking lot here raspberry pi connected over wifi network. The wireless tower in the parking lot can obtain vacant slot information from the

cloud services where the status of the parking lot is constantly monitored. Therefore, wireless tower can broadcast the parking lot information and parking plan as business strategies for economic benefits.

We designed a parking lot with WIFI network, ultrasonic sensors for detection of the vehicle. To avoid misplacement of the vehicle at spot arranged an LED lights to indicating that whether vehicle placed in correct slot or mismarked. It indicates with green light if the position or slot placed by vehicle properly.

Figure-2 Parking Model

5. SMART PARKING METHODOLOGY

a) Android applications is built to get the map of the parking location and it helps to monitoring the parking lot

b) Launch the androsid application then login in to that and select the area of the map required.

c) Map displays the geographical view of the location and status of the position either free or not

d) Select the location which available for parking and ultrasonic sensors are used to park the in the correct position which indicates with led lights.

e) The ultrasonic sensors are arranged in the particular position according the map of the parking lot and it measure the distance of the vehicle.

f) If the distance is reached threshold limit it indicates with red lead to halt the vehicle.

g) Raspberry pi upload the status in to the cloud of the particular position are occupied or empty, it depends on the data received from the ultrasonic sensor.

h) If the distance is not reached threshold limit it indicates with green led Raspberry pi upload the status in to the cloud of the particular position is empty, it depends on the data received from the ultrasonic sensor.

A. Smart parking work flow

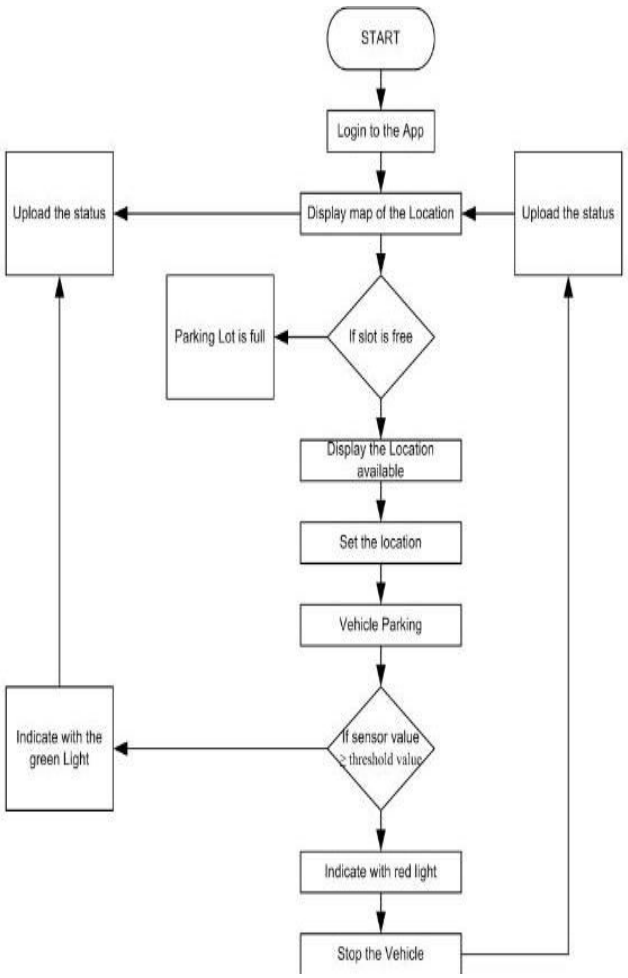

Figure-2. Smart parking work flow.

6. IMPLEMENTATION OF SMART PARKING SYSTEM

Ultrasonic sensor is the parking sensor in this project for N number of places required N number of parking sensors. Raspberry pi is interfaced with ultrasonic sensor then uses python script for triggering the parking sensor. Enabling the IPV6 protocol in Raspberry pi for send the sensor value over the internet in to cloud services

A. hardware implementation of parking sensor

Raspberry pi is interfaced with the Parking sensor as shown Figure-3 to get the distance of the particular location and uploaded the sensor value in to the private cloud.

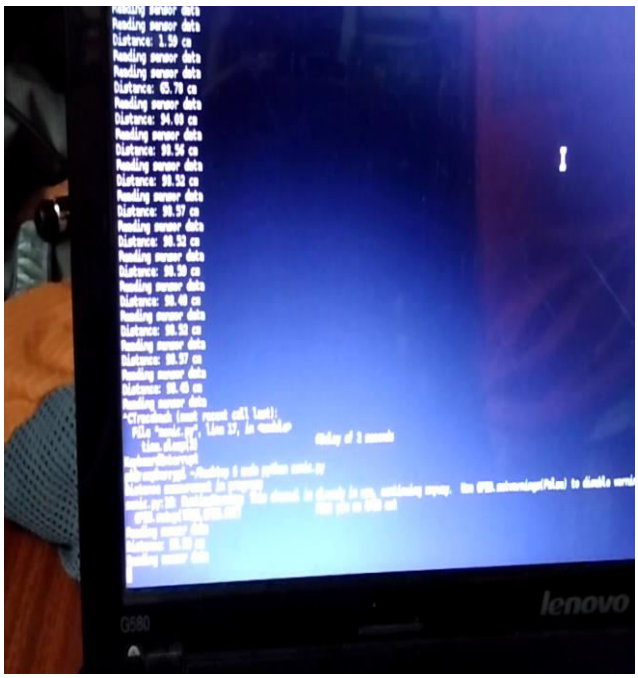

Figure-3. Parking sensor distance calculated values.

Raspberry pi enables the IPV6 internet protocol to upload the data in to cloud then python script is used to establishes the connection between microcontroller sensor data and cloud services then uploaded the sensor data in to cloud as shown in Figure-4. In spark fun cloud services the data fields are customized as user wish .In this project user opted the fields as ultrasonic sensor value as title, distance as fields.

ultrasonic sensor values

JSON | CSV | MySQL | PostgreSQL | Atom

distance	timestamp
75.99	2016-01-20T14:01:13.630Z
3636.33	2016-01-20T14:01:09.746Z
8.64	2016-01-20T14:01:05.215Z
7.08	2016-01-20T14:01:00.399Z
8.4	2016-01-20T14:00:57.026Z
9.81	2016-01-20T14:00:53.022Z
10.26	2016-01-20T14:00:49.762Z
75.1	2016-01-20T14:00:46.354Z
3627.91	2016-01-20T14:00:42.552Z
70.91	2016-01-20T14:00:33.388Z
3602.77	2016-01-20T14:00:25.292Z

Figure-4. Sensor values deployed in data spark cloud.

Android application is implemented which shows the layout of the map. It collects the data from the cloud and updates the status of the each and every location. If slot is available it show as empty otherwise it will projected it as full as shown in Figure-8.

7. IMPLEMENTED RESULTS

Andriod appication is written to display the geographical view of the map and it updates the states of the locations

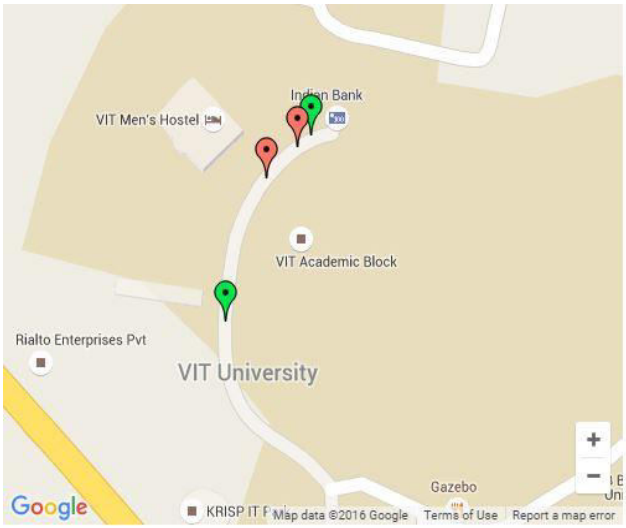

Figure-5. Implemented map.

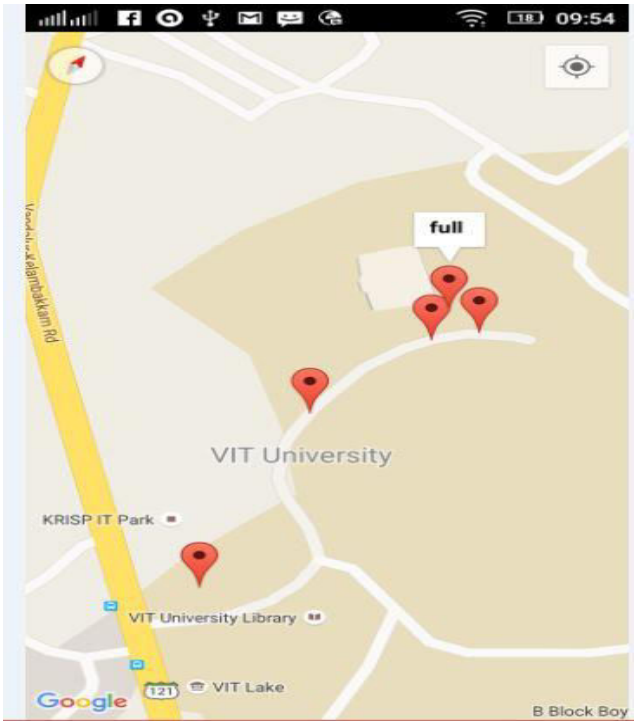

Figure-6. Android application displays the status of locations.

8. CONCLUSIONS

The paper presented Iot based Android application for car parking. This application shows the vacant position availability on the free slots for parking in graphical manner.

If this project is implemented it helps to prevent the unnecessary fuel wastage of searching for parking

place and if facilitate the effective use of the parking space.

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