

IoT: Weight Sensing Smart Parking System

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Abstract:- In today's world the concept of smart cities has gained great value. In this project, we present an IoT based smart parking system, because nowadays the number of personal vehicles usage is increasing on a large scale. People prefer personal vehicle than public transportation. In most metropolitan areas it is quite difficult to find parking space in, especially during the rush hours. Finding proper and secure parking space in almost every major city in the world is difficult and costly. Due to this there is a need to provide sufficient parking space providing plenty of slots to help the user park his vehicle. For that we proposed Weight Sensing Smart Parking consists of an on-site deployment of an IoT module that is used to monitor and signalize that state of availability of each single parking space.

Key words: Internet of Things (IoT), Weight Sensing Smart Parking, Parking.

I. Introduction

Today India is facing a new problem which is lack of sufficient and secure parking space. Due to rapid growth in population the total number of motor vehicles increasing, the parking scenario is falling short of the current requirements in the country. People in today's world prefer to own cars because cars offer an unmatched combination of speed, autonomy, and privacy. But in reality most of this private vehicle spends most of its time in rest, either during working hours or over the night.

Due to the regular construction of buildings and factories in urban areas, the problem of parking increases. The imbalance between parking space offers and parking demand is considered as the main reason for metropolis parking problems. Due to insufficient parking space and lack of proper management people park their vehicle randomly. The parking system plays an important role within the metropolitan traffic system, and lacking of it shows closed relation with traffic congestion, traffic accident, and environmental pollution. Although efficient parking system can improve urban transportation and city environment besides raising the

quality of life for citizens, parking problem is an often-overlooked aspect of urban planning and transportation.

There are various advanced method are proposed in order to provide efficient parking facility. A Multi-storey automobile parking system for avoiding wastage of car parking zone [1]. This proposed system enables the parking of vehicles, floor after floor and thus reducing the usage of space in turn making the system modernized[1].

In the paper, Zigbee and GSM Based Secure Vehicles Parking System Management and Reservation by Ashwin Sayeeraman and P.S.Ramesh [2], secure parking reservation is provided by victimization world system for mobile communication (GSM) technology. In this proposed system two modules have been developed, one to monitor the parking space and other to provide security reservation. Parking lot watching could be a layout that is employed to show the parking standing. In security reservation module the user needs to send a sms in order to reserve the free parking space. Patil and Bhonge in "Wireless Sensor Network and RFID for Smart Parking System" suggested the use of wireless sensor network, Radio Frequency Identification (RFID) and Sayeeraman and P.S.Ramesh in "ZigBee and GSM based secure vehicle parking management and reservation system" suggested Zigbee technology[2][3]. A wireless sensor has been installed in every area of interest. The information obtained from this sensing nodes is transferred to management centre via Zigbee which is processed to evaluate the time of parking, billing system etc. P.Dharma Reddy, A. Rajeshwar Rao and Dr. Syed Musthak Ahmed in "An Intelligent Parking Guidance and Information System by using image processing technique" proposed image processing technique to present a smart parking space detection system. The proposed system captures and processes the image drawn at parking lot and produces the information of the empty car parking spaces and many others [4].

II. Problem Identification

In above mentioned systems are not flexible enough for solving parking problems and providing smart parking systems. In "Microcontroller based multi-storey parking," by Mehta, Soni and Patel, the major drawback was it needs a lot of maintenance and therefore the vehicles ought to be designed among the given area[1]. Similarly according to Ashwin Sayeeran and P.S.Ramesh, the ZigBee system requires an sms module. This sms module makes the system pricey and since sms module contains entry/exit watchword for reservation thanks to network congestion it may not be successful[2], and according to Manjusha Patil and Vasant N. Bhonge, the entire system uses the node to node implementation which requires more time and also the use of RFID increases the cost[3]. According to Dharma Reddy, Rajeshwar Rao and Musthak Ahmed, the system uses image processing technology. Drawback with this is weather condition, the weather conditions affects the system and also the camera should be positioned where it can see all the car parks without any destruction by objects[4].

There are different types of vehicle used by people in which bikes and cars are most common. The existing systems are designed by considering all type of vehicles as an object like two wheeler and four wheeler are treated same so it is required to separate parking space for both, which again requires a lot of management. Using only an IR sensor based parking system will create a problem that a small size vehicle can occupy more space than it requires and this can lead to problem of available space. So, here we are proposing a Weight Sensing based parking system, such that the parking space should be occupied by the relevant type of vehicle, as per the requirements.

III. Methodology

A prototype is developed for making the car parking better, flexible and secured, for this we have developed a frame work. This proposed architecture having an Arduino nano board with internet connectivity this board is small sized but it works like a computer, Cell load, Weight Sensor HX711, Centralized server. Modules are:

1. Arduino Nano and ESP 8266 Wi-Fi module
2. Cell Load and HX711 weight sensing module

Arduino Nano and ESP 8266 Wi-Fi Module :-

The Arduino Nano is a small microcontroller, which is breadboard-friendly and based on the ATmega328 (Arduino Nano 3.x) or ATmega168 (Arduino Nano 2.x). It doesn't have a DC power jack, and works with a Mini-B USB cable rather than a regular one. The ESP 8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability.

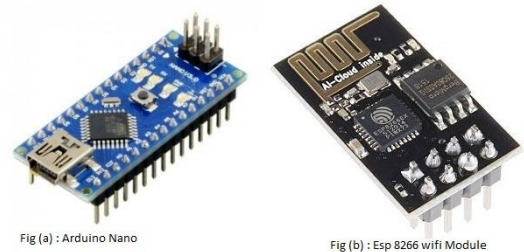


Fig. 1: Arduino Nano and ESP 8266 Wi-Fi Module

Cell Load and HX711 weight sensing module:

A load cell is an electrical device that transforms force or pressure into electrical output. The magnitude of this electrical output is directly proportional to the force being applied. Load cells have a gage, which deforms when pressure is applied to it. And then gage generates an electrical signal on deformation as its effective resistance changes on deformation. A load cell sometimes consists of 4 strain gauges during a Wheatstone bridge configuration. Load cell comes in varied ranges like 5kg, 10kg, 100kg and a lot of, here we've used Load cell, which may weigh up to 40kg.



Fig 2: Cell Load (5 kilograms)

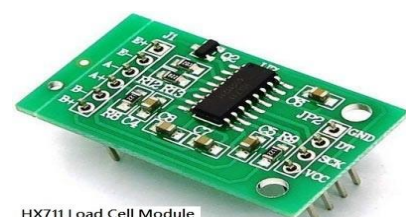


Fig 3: HX711 Weight Sensing Module

Flow Diagram

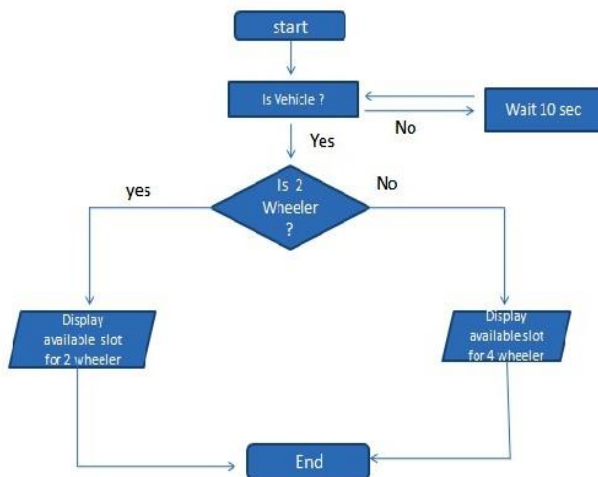


Fig. 3 : Checking Vehicle type

Flow diagram 2

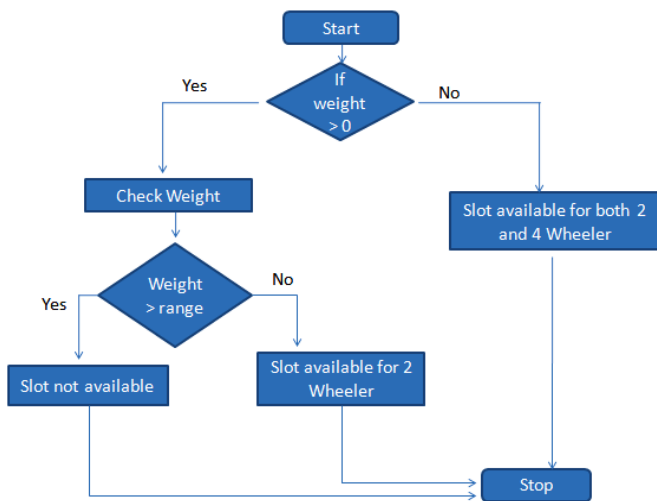


Fig. 4: Checking for parking slot availability

Fig. (3) Defines the working of the weight sensor present at the ENTRY which is connected to the arduinonanowhich is further connected to the server. The process starts with the vehicle enter to the parking area the weight sensor at the entry detect whether there is vehicle standing over it or not, if no then it will wait for some time and then again check for the vehicle, if vehicle is present then it will identify its weight to determine whether it is 2 wheeler or 4 wheeler and then it will check the server for the available slots and display the available slots to the person parking the vehicle.

Fig. (4) Describe how weight sensor in the base of parking slot updates the server for the slot available. First, the sensor will check for the presence of vehicle if the result is NO then it will update the server that the slot is available for both 2 wheeler and 4 wheeler. If the result if Yes then it will compare the measured

weight with the range (which is the minimum weight for 4 wheeler), if the weight is greater than range it means that a 4 wheeler is occupied the slot and the slot will get removed from the availability and if the weight is less than range means a 2 wheeler is standing and the server will show the availability of slot only for another 2 wheeler.

If any of the vehicles move out from the parking the sensor will detect it and update the server about the free space so that others can park their vehicle.

IV.Result

The model based on proposed system works as follows :-

Initially all the slots are empty and and it is shown in LCD as E in front of slot no. and in server it indicated as green light as shown in figure 6.



Fig. 5: Display on start



Fig. 6: Empty Slots

Now if a two wheeler arrives at checkpoint the weight and a slot is availed to it and it indicated by a green light to show the availability and parking slot is displayed on LCD.



Fig. 7: Slot allotment for two wheeler

After allotment the slots details are updated on both LCD and Server as shown in below figure.

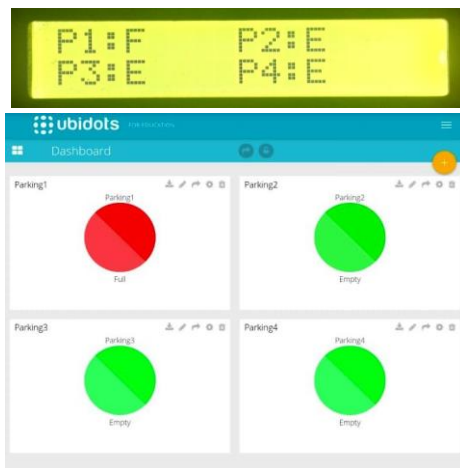


Fig. 8: Updated slot detail

Similarly if a four wheeler arrives two slots are allotted to it and both server and LCD are updated as shown below.



Fig. 9: Slot allotment for four wheeler

If no slot is available for new vehicle in that case red led will glow and buzzer starts as an alert for vehicle at checkpoint with “No slot available” indication in LCD.

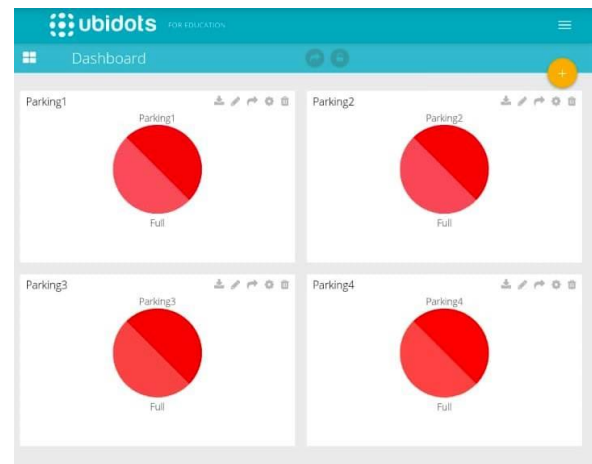
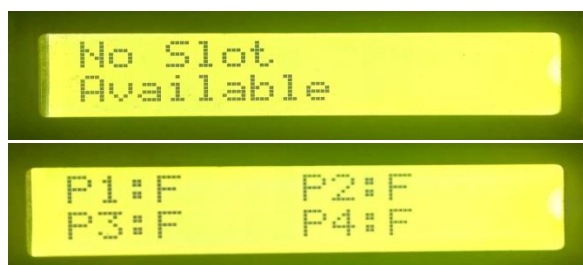


Fig. 10: No slot available

V.Conclusion

In this paper we have addressed some of the issue of parking and presented IoT based smart parking system. The system that we have designed provides real time information regarding availability of parking slots in parking area .The efforts made in this paper are intended to improve the parking facilities of a city or any specific place and its aim is to enhance quality of management of parking area.

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