Ilkogretim Online - Elementary Education Online, 2021; Vol 20 (Issue 1): pp. 4696-4703
http://ilkogretim-online.org
doi: 10.17051/ilkonline.2021.01.507

# Intelligent Automatic Decision Making Car Parking And Slot Allocation Management System Using Raspberry Pi

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**Abstract**- In today's world, the concept of a Smart city has gained many applications, which integrates the concept of Information & Communication Technology where various devices are connectedto optimize the efficiency of citizen usage. One of the important considerations of being a smart city is the availability of a smart parking facility for vehicles. It has been observed that people face many difficulties to find a slot to park their vehicles in areas like malls, theatres, and other commercial centers. A major problem in parking is the time consumption, as the driver struggles to find the halting extent,the slot availability. The proposed system discusses an innovative car parking management system based on IR sensors. The suggested system would provide car drivers with accurate information about the location and availability of parking slots. Its corresponding sensor node, which comprises a number of IR sensors, detects the status of each parking slot and it is reported periodically to a database. Later, the collected data is converted into meaningful information, which can be viewed via an LCD display. This display is placed at the entry gate of the parking. In this system, advanced sensor networks are used to find the free slots. The system will automatically transmit the real-time parking space availability data to the knowledge of the users. First, IR (Infra-red sensor) sensors are placed in every slot and then connected to the raspberry pi for detecting the vehicle's presence in the slot. And two IR sensors are placed at the entry and exit gate for detecting and counting vehicles. Information from these sensors will be displayed on the LCD. The gate control depends on this sensor's value. If no slot is available the gate will not open, displaying "No slots available" in LCD. Web-cam is placed in the gate area for capturing vehicle's number plate and it updates the image to the web page for further reference.

**Index Terms-**Smart Parking System**,** IR sensor**,** LCD, Raspberry pi, web-camera.

## I. INTRODUCTION

More than half of the world's people are living in cities. So cities have reached full of its occupancy. In recent times, concept of Smart Cities have gained great popularity. As of 2016,there are around 80 million vehicles in usage by the people in India.As large number of vehicles exists for people convenience,problems such as traffic congestion, limited car parking facility are rising high.According to the report,Smart Parking System could benefit in saving 2,20,000 gallons of gas by 2030,if it is executed properly. So the manual car parking system in commercial spaces is creating hurdle which is causing wastage of time and some economic losses as well. Therefore, we need a solution to alleviate this problem. Smart city development is in beginning stage and there is no common architecture exists till today [1]. There is lot of researches and implementations are currently being going on in all the respective areas. Thusthere is no guidelines or boundaries exists to define the definition of "Smart". So depending on the context, application the internet of things has different definitions. Shortly it is defined as the things present in the physical world or in an environment are attached with sensors or with any embedded systems and made connected to network via wired or wireless connections [2], [3]. These connected devises are called as smart devices or smart objects. And it consists of smart machines which communicating interacting with other machines, environment, objects etc. And also it incorporates to connect any two machines, machine to human and vice-versa etc. this communication is called as M-M communication. As M-M communication is developing by the various standardization bodies such as Open Mobile Alliance (OMA), European Telecommunication Standards Institute (ETSI), Institute of Electrical and Electronic Engineers (IEEE), 3rd Generation Partnership Project (3GPP) organization have performed some activities on M-M communication [4]. It makes daily life things to equip with transceivers, sensors, actuators and microcontrollers etc. for communication. Sensing by the sensor includes sensing the speed of vehicles and humans or any objects (accelerometer), sensing of temperature, pressure etc. [9].

More than half of the world's people are living in the cities. So the cities have reached full of its occupancy. As people uses vehicles for transportation so there is large number of vehicles exists for people convenience. Most of the time people spend their precise time on searching parking lots to park their vehicles. Thus congestion occurs in the traffic it leads to a hectic job to find the parking space to park their vehicle. The most traffic occurs only because of vehicle congestion in the urban areas thus people are wasting time in searching the parking area abnormally to park their vehicles.

Our system is a Raspberry pi based parking sensor, which contains pi-camera to detect the empty parking spaces, and sends this data to server, this stored data is

accessed by users [5], [6]. This enhances the user to check the status/availability of parking spaces before setting their journey.

| | Raspberry Pi 3 Model B | Raspberry Pi Zero | Raspberry Pi 2 Model B | Raspberry Pi Model B+ |
|---|---|---|---|---|
| Introduction Date | 2/29/2016 | 11/25/2015 | 2/2/2015 | 7/14/2014 |
| SoC | BCM2837 | BCM2835 | BCM2836 | BCM2835 |
| CPU | Quad Cortex A53 @ 1.2GHz | ARM11 @ 1GHz | Quad Cortex A7 @ 900MHz | ARM11 @ 700MHz |
| Instruction set | ARMv8-A | ARMv6 | ARMv7-A | ARMv6 |
| GPU | 400MHz VideoCore IV | 250MHz VideoCore IV | 250MHz VideoCore IV | 250MHz VideoCore IV |
| RAM | 1GB SDRAM | 512 MB SDRAM | 1GB SDRAM | 512MB SDRAM |
| Storage | micro-SD | micro-SD | micro-SD | micro-SD |
| Ethernet | 10/100 | none | 10/100 | 10/100 |
| Wireless | 802.11n / Bluetooth 4.0 | none | none | none |
| Video Output | HDMI / Composite | HDMI / Composite | HDMI / Composite | HDMI / Composite |
| Audio Output | HDMI / Headphone | HDMI | HDMI / Headphone | HDMI / Headphone |
| GPIO | 40 | 40 | 40 | 40 |
| Price | $35 | $5 | $35 | $35 |

Fig 1.Raspberry pi Specification table

## II. EXISTING SYSTEM

The time consumption in parking is the major problem that most of the people are facing. In the existing system, labor is required to monitor the parking slot and allot the free slot to the vehicles in the shopping malls and other places. So there is a need for a system that replaces the man power and performs efficiently.

## III.PROPOSED SYSTEM

In recent years,there is a lot of developments in communication technology. This technologycan be used to develop a better parking management system. In the proposed system, advanced sensor networks are used to find the free slot. The system will automatically transmit rreal-time parking space availability data to the knowledge of the users via a LCD display. The display provides information like the status of each slot, whether it is in parked state or free state, count of vehicles entering and exiting the parking area. The system also includes a web camera, which is used to capture the license plate of vehicles entering the parking area. This image is stored as information that comprises of the entry and exit time of the vehicles, the driver's image and the vehicles number plate, in the webpage.These stored images can be used in times of theft or any security issues to find required information.

## IV.RELATED WORK

The Smart Parking System is designed by making use of some IOT supportable hardware's such as raspberry pi, auridino boards etc. here we focussing on less power consumption and more performance device so raspberry pi is the suitable microcontroller for our implementation. And NOOBS installer is loaded into the storage device of microcontroller. This installer which consists of various hardware supportable operating systems such as mac os, tiny os, openelec, raspbianos etc. where these operating systems which consumes less power.

Advanced driver assistance systems (ADAS) are becoming more common in safety and convenience applications. The computer vision based ADAS described in this paper, is an add-on system, suitable to variety of cars. It detects vacant legal parking spots, and safely guides the vehicle into the selected parking. Detection can be performed in both indoor parking lots and along roadsides. The system is composed of three standard computer-connected webcams, which are attached to the vehicle. Upon slowing down, the system starts searching automatically for a right hand-side vacant parking spot, while being aware to parking colour signs. Once detected, the parking orientation is determined, and the driver is notified. Once the driver selects a parking, the relative position between the vehicle and the parking spot is monitored. Vocal and visual parking guidance instructions are presented to the driver. In addition, if an object is moving on the road towards the car during parking, a safety alert is given. The system is universal in the sense that, as an add-on system, it can be installed on any private 4-wheeled vehicle, and is suited to urban driving environment[7].

Localization is a key issue of the navigation system to guide unmanned ground vehicle in an intelligent Space. Intelligent Space is an environmental system. This intelligent Space able to support informative and physical ways. The proposed system includes sensors information fusion, position estimation, path planning and tracking. Camera is used to get image information of the robot. Image processing and FPGA embedded together to identify position and orientation of UGV very correctly and accurately. The proposed architecture works on distributed image processing pixels, which causes the amount of data to be transmitted through communication network, will be minimum. This causes a reasonable, very efficient solution, simple, adaptable. The hardware/software localization setup described in this paper is cheap and easy to use and may provide support in several industrial and domestic sceneries [8].

**V.BLOCK DIAGRAM**

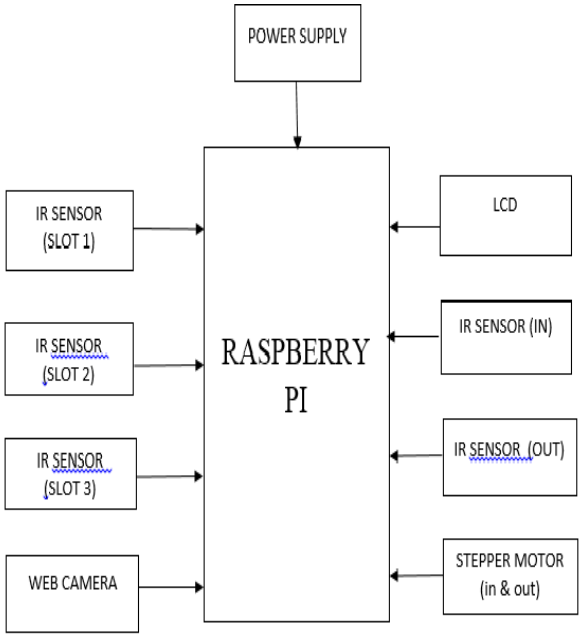


Fig 2. Block Diagram

In this project, Automatic car parking and slot management system is implemented. Here, Infra-Red sensors are placed near the parking slot to detect the presence of vehicles and update the availability of slots. And also, sensors are placed at the entry and exit points to obtain information about the vehicles entering and exiting the place. All these informations are displayed in the LCD display and stored in the database. The status of each parking slot is detected by its corresponding sensor node and reported periodically to a database. Later, it converts the collected data into meaningful information, whichcan be viewed via LCD display at the entrance of the parking.Furthermore, a camera is used to take images of the entering cars and stores it in a database.

**VI. IMPLEMENTATION**

The design flow of the system is first, the Raspberry Pi is interfaced with the required number of IRsensors to form a sensor network that monitors the slots to check the availability of slots. The number of slots required depends the slots required. Two sensors are separately placed at the entry and exit gate to detect the vehicles entering and exiting the parking area and to accordingly control the opening and closing of gate.

For the gate control mechanism,two-steppers motors are used at the gate points. These motors are interfaced with the sensors at the entry and exit point and IT opens the gate whenever these sensors detect a vehicle and automatically closes the gate after that. And the motors at the entry gate is programmed such that it never opens the gate if all the slots present in the parking are in parked state.

For display purpose an LCD display is being interfaced with the Pi and is situated near the entry gate, so that it provides information like which slot is presently available to the user who is entering the parking area. The LCD display also displays the count of vehicles present in the parking area,each time when a vehicle enters or leaves the parking area.

Finally, a webcam is interfaced to the Raspberry Pi. This helps in capturing the license plate of the vehicles entering the parking area and stores it in the database. These stored images can be used at times of theft or security issues for obtaining required informations.

## VII. RESULTS

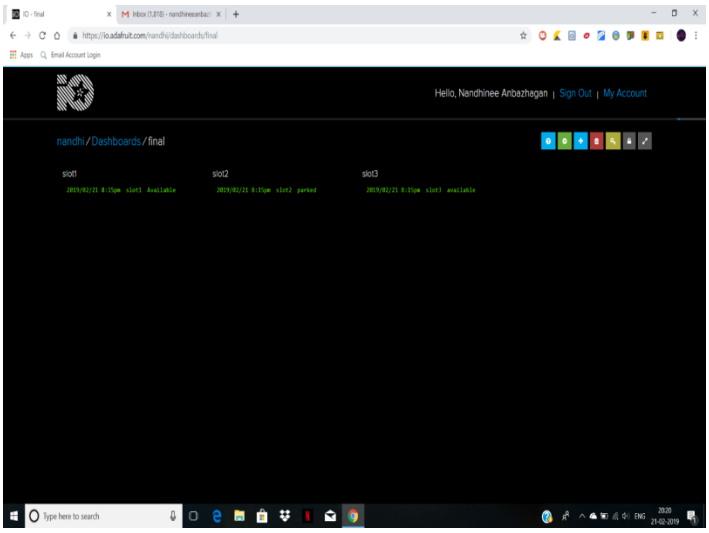


**Fig 3.**Information stored in web page

## VIII.CONCLUSION AND FUTURE SCOPE

The system demonstrates a fully automated car parking system. For this purpose,IR sensors along with motors, LCD display and Raspberry pi are used for controlling the system's working. IR sensors are to detect the vehicle's motion at the entry, exit and also at the slots. The LCD displays the available slot to the driver for parking in the slot. If parking space is not available, the barrier gate is not activated and indicated in the display as **"PARKING FULL"**. Ifthe slot is free, then allows the vehicle to enter the slot and displays **"FREE"** where the user can park the vehicle. The raspberry pi is used to facilitate the working of the entire system. In addition,it takes the count of the number of cars entered and exited. At the entry point, the camera is fixed so that it will take a picture of the vehicle's license plate and the image will be stored in the database by converting the image to data usingdigital image processing. In case of any theft occurs in the parking area, to identify the vehicle or to obtain the details of the like time at which car entered and exited, the data is retrieved from the database. In short, the smart

parking management system helps in parkingwithout any human intervention, byknowing the availability of the slots. So the convenience for the people in parking is optimized.

Because of quantitative evaluation using practical databases, the proposed systemachieves 97.8% recall and 95.8% precision for parking slot-marking detection, 98.1% classification rate for parking slot occupancy. Furthermore, it is revealed that the proposed system can operate in real-time, i.e., 47.1 ms for parking slot marking detection and occupancy and 32.0 ms for parking slot marking tracking.

This system can be improved in future works by adding other applications such as online booking by using GSM. The driver or user can book their parking lot at home or on the way to the shopping mall. This can reduce the time of the user to search the vacant parking lot.

As a further study, different sensor systems can be added to improve this system to detect the object and efficiently guide the driver or users.

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