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IoT Based Smart Parking System using Laser Range Sensor

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Abstract- This paper introduces the concept of "Smart Parking System" using Laser Range Sensor. In car parking services in cities, the increasing number of vehicles on the road along with the mismanagement of available parking space; Leads to parking related problem as well as increase traffic congestion in smart parking management system that would help the driver very quickly. Although ample amount of research work on the development of smart parking system exit in the literature but most of they have not addressed the problem of real time detection of improper parking and automated collection of parking charges. In this paper, a prototype of Internet-of- Things based smart parking system is proposed. The smart parking system will uses on laser range sensor for detection of parked cars and send the data to microcontroller, ESP8266 microcontrollar with Wi-Fi module will send the data to server and to the Interface and manage the parking throughout parking area.

Keywords – Smart Parking System, IoT, ESP8266, Laser Range Sensor

I. INTRODUCTION

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and machines, objects, animals or people that are provides with unique indentifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. An IoT ecosystem consists of web-enabled smart devices that use embedded systems, such as processors, sensors and communication hardware, to collect, send and act on data they acquire from their environments. The Internet of Things is the interconnection of uniquely identifiable embedded computing devices within the existing internet infrastructure Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond Machine-to-Machine communications[5]. Large commercial areas such as malls, hospitals, city centers and residential societies demand extensive parking areas due to increasing quantity of vehicles[1].

A commonly imposed solution for such a system is multi-storied parking need to search for an empty parking space, thus unnecessarily spending time around the parking IoT instead of spending it productively. Multistoried parking spaces require commodities such as illuminations, air ventilation and manpower for handling the traffic at all times[1]. In multi- level parking system, lighting system consumes the most energy since illumination is required during all working hours. The smart parking system is a green solution that provides user time saving and energy conversation.The user is instructively guided to the empty parking space,

without necessitationg user to manually find for one[2].The smart parking & management system provides accurate positioning, monitoring and online control. This solution is highly cost effective and user convenient[1]. A simple and easy task such as parking is throught as a tedious and time consuming process due to mismanagement of parking system[1]. Current parking system involve huge manpower for management and requires user to search for parking space floor by floor. Such conventional system utilize more power, along with user's valuable time[2].

The automatically controlled light illuminance helps reduce energy usage, along with lighting up the parking space to the user whilst in the parking spaces. The entire system being fully automatic leads to reduces manpower involved and improves illuminance aesthetics of the parking area[3]. WSN is Wireless sensor network refer to networks of spatially dispersed and dedicated sensors that monitor and record the physical conditions of the environmental and forword the collected data to a central location. WSN can measure environmental conditions such as temperature, sound, pollution levels, humidity and wind[9].
The sensor network consists of Laser Range Sensor for detecting the incoming vehicle and illuminates the aisle lights[1]. Arduino is an open-source computer hardware and software company, project and user community that designs and manufactures kits for building digital devices and interactive objects that can sense and control the physical world[5]. Laser Range sensor is a kind of sensor which uses laser technology to measure. It is generally composed of laser, optical parts and photoelectric devices. The sensor network consists of Laser Range Sensor for detecting the incoming

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vehicle and illuminates the aisle lights. The parking sensor detects human presence or vehicle prence in any given area. It operates on laser renge sensor technology. Laser Range Senser is a kind of sensor which uses laser technonology to measure. It is generally composed of laser , optical parts and photoelectric devices. ESP8266 is a wifi SOC produced by Espress if system. It is a highly integreated chip designed to provide full internet connectivity[8].

II. RELATED WORK

Prof. Denis Ashok, Akshat Tiwari and Vipul Jirge [1] Department of Design and Automation Vellore Institute of Technology vellore, India. This paper presents a Smart Parking and Energy Management solution for structured environment such as a multi-storied office parking area.This system propose implementation of State-of-the-art Internet of Things(IoT) technology to mold with advanced Honeywell sensors and controllars to obtain a systematic parking system for users.

Sachet Rajbhandari, Bhumika Thareja, Vikas Deep and Deepti Mehrotra [2] Department of Information Technology Amity University Noida, India. In this paper, they proposed a smart parking system which continuously monitor and check for the available area for parking and engage the area in the particular place it is designed for. This would be the most efficient system designed for the smart cities which would definitely help in the betterment of the traffic conditions that people have been facing over a decade now.

Pampa Sadhukhan [3] School of Mobile Computing and Communication Jadavpur University Kolkata, India. In this paper, a prototype of internet-of-thing based E-parking system is proposed. The proposed E-parking system uses an integreated component called parking meter to address the above mentioned issues as well as to provide smart parking management throughout the city.

M. Suresh, P.Saravana Kumar and Dr.T.V.P.Sundararajan [4] Department of ECE, Bannari Amman Institute of Technology, Sathyamangalam, TamilNadu, India. The proliferation of technology paves way to new kind of devices that can communicate with other devices to produce output mostly on wireless communication. IoT Based Airport Parking System is discussed here to implement Arduino environment as IoT application.

Vaibhav Hans, Parminder Singh Sethi and Jatin Kinra [5] Centre of information Technology University of petroleum and Energy Studies Dehradun, India. This paper introduces the concept of using IoT and Cloud based technology in car parking services in cities. A number of software solution, including Python, PHP web gateway with MySQL database, Cloud based storage and mobile applications are proposed to provide pleasant parking experience to mobile users.

Yanxu Zheng, Sutharshan Rajasegarar, Christopher Leckie [6]
National ICT Australia ICT Australia Victoria, Dept. of Computing and Information Systems, The University of Melbourne, Australia. This paper present a prediction mechanism for the parking occupancy rate using three feature sets with selected parameters to illustrate the utility of these features.
Joao Mesquita, Diana Guimaraes, Carlos Pereira, Frederico and Luis Almeida Instituto de Telecomunicacoes. [7] using IEEE 802.11 devices can connect to existing Wi-Fi infrastructures directly and access the Internet with shorter communication delays and lower system cost. In this work we characterize a recent Wi-Fi-enabled device, namely the ESP8266 module,that is low cost and branded as ultra-low- power but whose performance for IoT applications is still undocumented.
Luca Mainetti, Luigi Patrono, Maria Laura Stefanizzi and Roberto Vergallo [8] Department of Innovation Engineering University of Salento Lecce, Italy. This paper present a novel Smart Parking System based on the jointly use of different technologies, such as RFID, WSN, NFC, Cloud and mobile.

Jatuporn chinrungrueng, udomporn sununtachaikul, Satien- triamlumlerd [9] In this paper they present an application of wireless sensor network specially to motor vehicle monitoring. It delivers several advantages including smaller size, easier installation and maintainance and relocatable.

III. PROPOSED WORK

It is well known that drivers spend a considerable time searching for a parking spot. For example, in every metro city, 40% of the time that a driver spends while drivers the car is to look a spot. Moreover, in cities, there are many private parking lots where a driver can pre-book a spot even before of get off home. Most of the parking lots have an electronic system to manage the spots and their price. Although there are computer solutions to get a parking spot or check if it is available, as we know, it is uncommon parking systems that have a smart used to manage and allocate the parking spots in an autonomous way. The parking system face many problems in the parking environment. In order, to solve those problems, smart parking system has been developed. Various approaches and researches are made to overcome the difficulties of parking area. As a result, many systems and technologies are developed for parking. The categories of various

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systems and technologies are explained in following sections. The technologies of the parking system uses wireless sensor network (WSN) for identification and communication process.

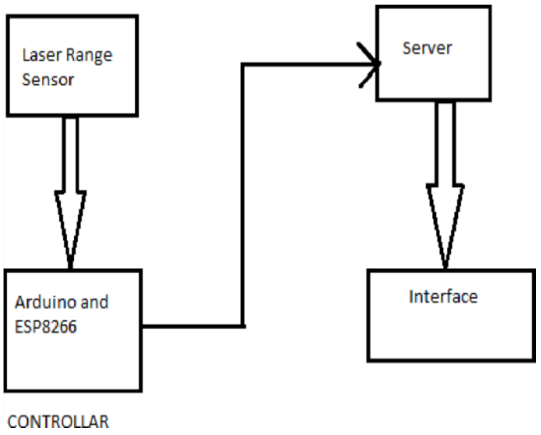
IV. PROBLEM DEFINATION

Every time the driver enters the parking lot they had to turn to find an empty parking, it is more effective if the area has a automated car parking system that can help drivers to park their car automatically. Time Wasting in searching parking space searching for a parking space may waste driver time especially when traffic congestion in the area. This may efforts on their routine activities and cause productivity loss. With increase in the population, number of vehicles increase and due to unmanaged parking it leads to many problems. Finding a parking space in most metropolitan areas, especially during the rush hours, is difficult for drivers.

V. METHODOLOGY

In Smart Parking System We can access the data from laser range sensor. Laser range sensor send the data to the microcontroller arduino. Arduino microcontroller collect the data and send the data to server with the help of ESP8266 microcontrollar. ESP8266 microcontrollar have inbuilt Wi-Fi module and there is no range limitation to send the data from microcontroller to server. When laser range sensor send the data to the microcontroller they check the activity of the laser range sensor. If laser range sensor is not activated then directly send the error message to the server and display on interface. If Laser range sensor is activated then they check parking, if any parking space is available then check the vehicle parking time greater than 30 min or not. If time is greater than 30 minute then send the penalty massege to the interface otherwise send the real time to the interface and if any parking space is not available then send the green signal to the interface.

Fig 1. Block diagram of Smart Parking System



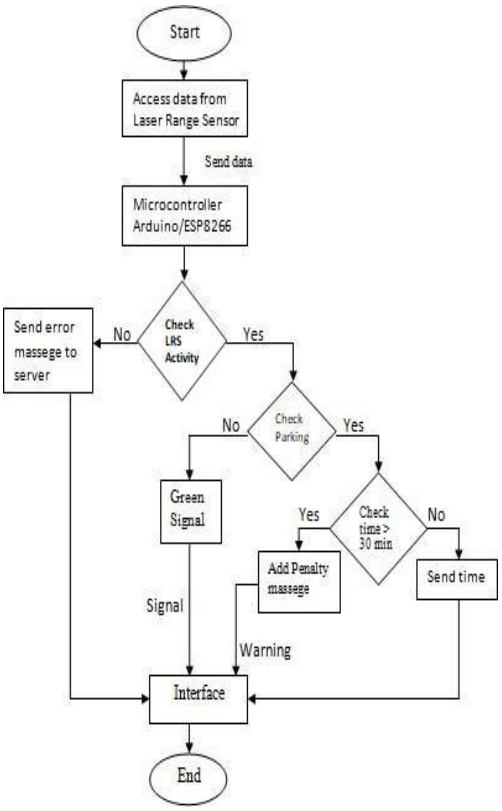


Fig 2. Flowchart

VI. HARDWARE REQUIREMENTS

1. **Arduino Microcontrollar**
2. **ESP8266 Microcontrollar**
3. **Laser Range Sensor**

1. Arduino Micro-Controllar :

Arduino UNO is a microcontroller board. It has 28 pins. 14 input/output pins, 6 analog pins. It is the most widely used and user friendly microcontroller. Arduino UNO is a low-cost, flexible and easy to use programmable open-source microcontroller board that can be integrated into a variety of electronic projects. Arduino UNO board is used to collect the data from the sensor and forward directly to the sensor.

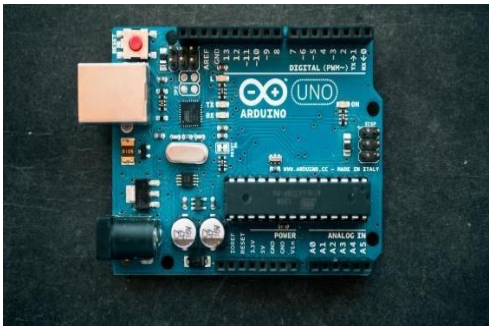


Fig 3 : Arduino microcontroller Board

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2. ESP8266 Micro-Controllar:

ESP8266 is a Wi-Fi network solution device that can order and convey to software applications or through another application using Wi-Fi. ESP8266 is Wi-Fi enabled system on chip module developed by Espresso system. It is mostly used for development of Iota. ESP8266 when the device is made and to satisfy the main use of application processor, the flash memory can be externally started by transferring the cache memory in it will help to increase the performance of the system and reduce the requirements for the memory.

Fig 4: ESP8266 Microcontroller

3. Laser Range Sensor:

It will decides or detects information of connected network and passes to microcontroller.

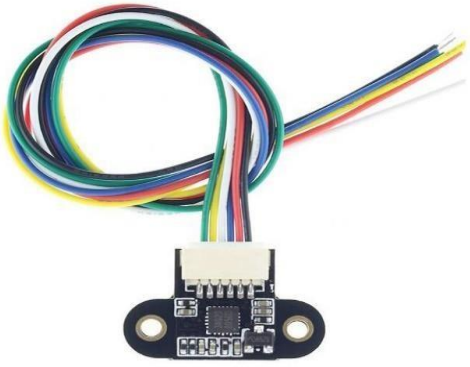


Fig 5: Laser Range Sensor

VII. IMPLEMENTATION WORK

A. User Interface:

In smart parking system, first created user interface which have six parking slots. Each parking slot have 30 minute timer. If any vehicle parked more than 30 minute then send the penalty massage to the server and display on the user interface.

B.

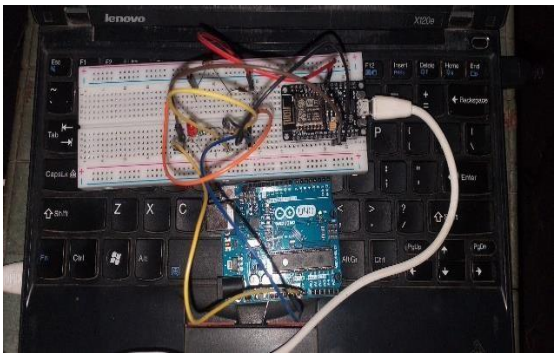
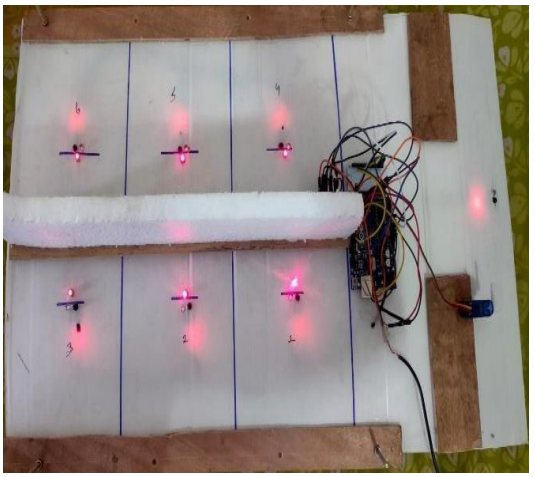


Fig 6: Hardware Testing

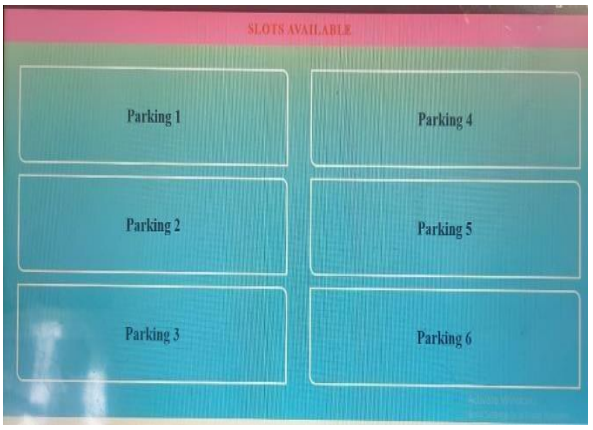
In above figure white board is bred board which is used to check the connectivity of arguing board and ESP8266 wife module.

C. Empty Parked area:



In above figure the parking area is empty and output for this parking area is shown below.

Output:



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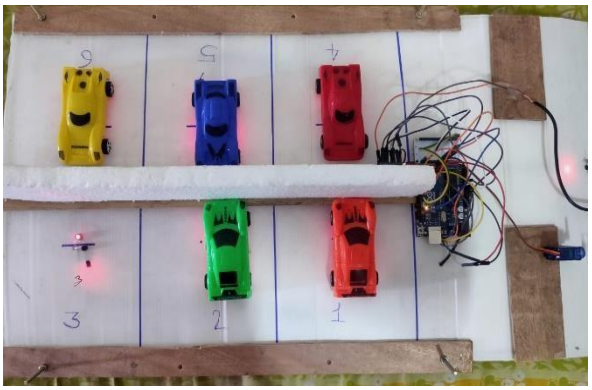
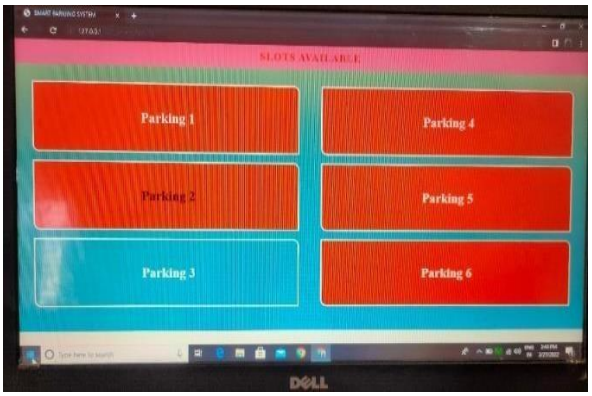
D. Parked Area:



In above figure vehicles parked on slot no 1, 2, 4, 5 and 6 and output for this parking area is shown below.

Output:



VIII. CONCLUSION

This system emphasize on Laser Range Sensor based Smart Parking System. It described the architecture and connectivity of parking system as well as improves the parking management. This system improves the range of connectivity over the first reference paper in which Zig bee protocol is used and which is costly than current system. Over the protocol I will use ESP8266 microcontroller to send the data over server directly without emerging third party communicator like Ethernet module. Through these we can implement this system into hospitals, shopping malls and colleges etc. The purpose of this system is to reduce the challenges, which are faced in conventional smart parking system such as real state.

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