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A Novel Smart Car Parking System Using IoT for Smart Cities

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Abstract- The idea of the smart cities had become very popular in the 21st century. With the development of the smart cities a major key issue is the car parking area and traffic management. Ultra-sonic sensor and microcontroller ATtiny 2313 were used at the gate of the parking system for opening and closing of the door and for calculating the availability of the slot in the car parking system. The parking system is designed for the open space parking areas, multi-level parking areas. The proposed work is one of the applications of the Microcontrollers (ATtiny 2313),combination of Internet of things and low cost IR sensors. The IoT based smart car parking system helps to create a smart environment and connect the things to internet and makes easy to access those things from any remote location.

Index Terms- Internet of things, Microcontroller ATtiny 2313, Smart parking, Smart cities.

I. Introduction

In large cities due to heavy vehicle like trucks , tractors ,etc. The cars and bikes stuck in between them due to in search of parking slots in the area. Due to this the wastage of gas, petrol, and diesel occurs. People waste away liters of gas and petrol just trying to park, on an average 40% of traffic is looking for available parking slot. There are numerous technologies for finding a Parking slot like GPS navigation for searching a parking slot on the map, but finding available and vacant parking slot is difficult and they need some more updates. To solve the parking issue many technologies has been developed in recent years in various parts of the world many researches are going on to solve the parking system issue. The parking ratio of big cities are about 1:0:8. So that is needs more parking space for the vehicles. There is lack of intelligent parking system. Without the help of intelligent parking system, car owners cant find free parking spaces in real-time.Its takes about 15 to 18 min time to park a car in average time. According to a survey of

traffic management and pollution , about 30% of the traffic jams could cause when the car owners are looking for the parking spaces in the particular area. Moreover the utilization of the parking area is about 10% of a particular area because the car owner didn't know about the information interaction for parking resources. An urban area needs intelligent parking system to relieve traffic pressure and save time and fuel. How to design and implement on an smart car parking system foe smart cities has been concerned by more and more scientists and engineers. Iot based smart car parking system in this paper [1] ultrasonic sensor are used for detecting the availability of the parking slot. Each sensor is attached with the Bluetooth module. ATtiny 2313 Microcontroller is comprises on the board with the display screen. Mobile application is provided for the user to know about the availability of the parking slot in the particular area.

Parking availability prediction for the sensor- enabled car parks in the smart cities the waiting time is based on the variable

parameters such time of the day , day of week, weather, temperature, and the humidity.

A cloud based intelligent car parking services for smart cities in paper [2] the entire system developed with three layerssensor, communication, and application layer. The server finds the best available car parking lot for the user based on his preference and driving direction is returned to him. Intelligent parking lot application using wireless sensor networks proposed the use of a combination ofmagnetic and ultrasonic sensors [3] for accurate and reliabledetection of vehicles in a parking lot, also describing amodified version of the Min-max algorithm for detection of vehicles using magnetometers.

II METHODOLOGY

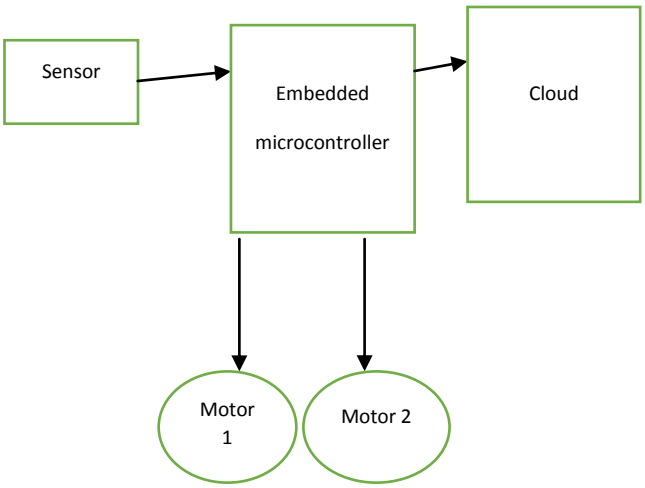


Fig.1 System block diagram

Embeddedmicrocontroller-The embedded microcontroller ATtiny 2313 takes the input from the parking lot system a comparator is embedded with the Attiny 2313 on the board it converts the analog data into digital form for the microcontroller [7].

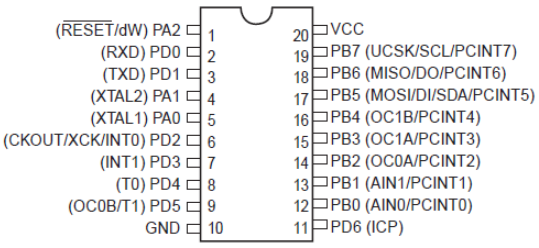


Fig.2.Pin configuration of ATtiny 2313

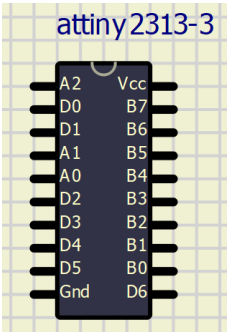


Fig.3.ATtiny 2313 Microcontroller

The ATtiny2313 provides the following features:

1) 2K bytes of In-System Programmable Flash

2)128 bytes EEPROM, 128 bytes SRAM,

3)18 general purpose I/O lines, 32 general purpose workingregisters, a single-wire Interface for On-chip Debugging, two flexible Timer/Counters with compare modes, internal and external interrupts

4) Serial Interface with Start Condition Detector, a programmable Watchdog Timer with internal Oscillator, and three software selectable power saving modes.

A) PIN DISCRIPTION:

Port A (PA2..PA0): Port A is a 3-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). ThePort A output sheild have symmetrical drive characteristics with both high sink and source capability.

Port B (PB7..PB0): Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). ThePort B output buffers have symmetrical drive

characteristics with both high sink andsource capability.

Port D (PD6..PD0): Port D is a 7-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). ThePort D output buffers have symmetrical drive characteristics with both high sink and sourcecapability.

DC Gear motor: It is used for the opening and closing of the main gate of the parking slot when the user enters the parking slot. Gate will automatically open if the user has valid user ID otherwise it will not open. It is controlled by the Embedded microcontroller[8-9].

Ultra-sonic sensor: ultra-sonic sensor is embedded with the parking area system on the particular slot , it was programmed to be set on a particular distance that the user don't hit the wall of the parking area and other cars.

Fig.3. Ultra-sonic sensor

OLED display screen: The OLED screen will display the availability of the parking slot in the parking area at the entrance of the parking area whether the slot is vacant or not.

III Hardware Integration and Prototype design

Fig.4 represents the prototype of the proposed system. The prototype consists of only one parking slot, parking slot is monitored by the ultrasonic sensor [4] and connected to the microcontroller ATtiny 2313 which is embedded on the breadboardWith comparator which converts the input analog signal into digital signal for the microcontroller. The slot consists of LED indication red color for the vacant and green color for the occupied and when there is no vehicle enter in the parking slot it remain off, when a particular vehicle enters the LED indication is red. DC gear motor controllers the opening and closing of the entrance of the parking area which is controlled by the microcontroller[5].

The microcontroller ATtiny 2313 has different pin configuration and each pin has its functionality to control the sensors, gear motor , and OLED display.

Table.1 Functionality of pins

Port pin	Alternate function
PD6	Port D, Bit 6
PD5	Port D, Bit 5
PD4	Port D, Bit 4
PD3	Port D , Bit 3
PD2	Port D , Bit 2
PD1	Port D , Bit 1
PD0	Port D , Bit 0

Bit5-The pin has to be configured as an output to serve this function

Bit3- The pin can serve as an external interrupt source to the microcontroller unit. INT1

Bit2-The pin can serve as an external interrupt source to the microcontroller unit. INT0

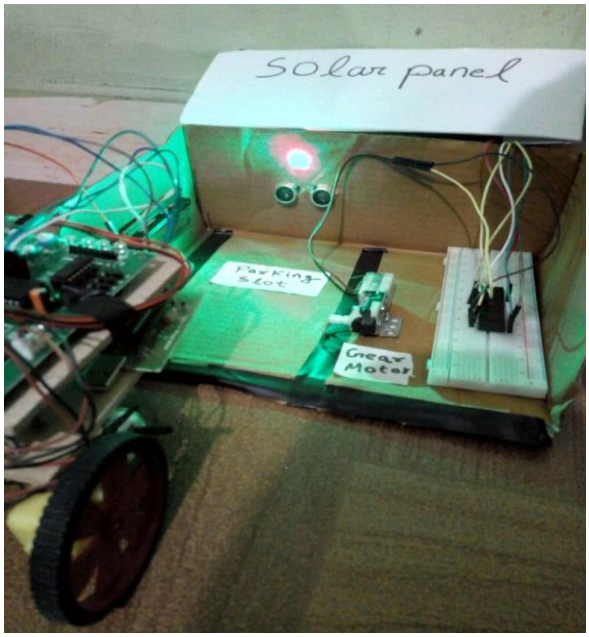
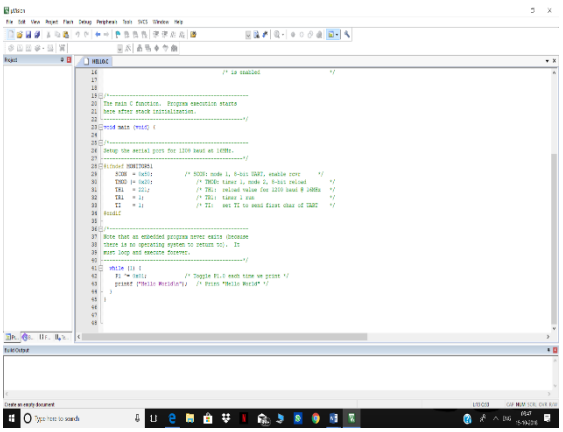


Fig.4. Hardware prototype

After integrating the hardware, coding the microcontroller using the software KeiluVision 5 , Bit burner , AVR Dude shown in Fig.5.The Code is written in the C language. Compiling the code for the microcontroller, each function of the code generates signal which is taken by the



sensor Fig.6. shows the [6] signal wave of

Fig.5. coding ultrasonic sensor for distance detection

```
long duration, distance;
  digital Write(trigPin,LOW);
  delay Microseconds(2);
  digital Write(trigPin,HIGH);
delay Microseconds(10);
 digital Write(trigPin,LOW);
   duration = pulse In(echoPin,HIGH)
   distance = (duration/2)/29.1;
   if(distance>=200|distance<=0)
```

Basic code for ultrasonic sensor shown in fig.5. it shows that how the ultrasonic sensor maintain the distance between the car and the wall of the parking system. Two or more ultrasonic sensorare mounted on the rear bumper to detect an obstacle up to 2 to 2.5m away. The distance is communicated to the driver in real time using varying buzzer sounds. Even another

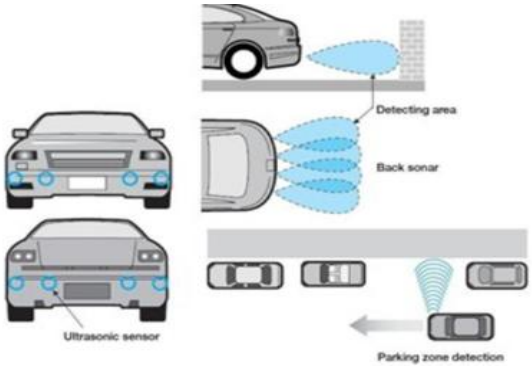


Fig.6. Detection of the wall and another car

car can be detected if it is close enoughin Fig.6. When the wall or the another is near the car or the car is near the parking slot the ultrasonic senor transmitter (trig pin) sends a signal: a high-frequency sound [9-10]. When the signal finds an object, it is reflected and the transmitter (echo pin) receives it.

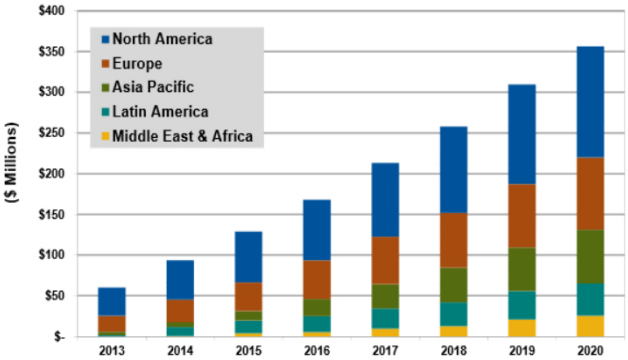


Fig.6. Annual report for the revenue spent on smart car parking system (Source internet)

Fig.6. shows that the annual revenue spent on the smart car parking system in each country. In this year north America spent $ 250 million dollars for the car parking system as you can see in Fig.6.Millions of dollars were spent each year for the car parking system [11]. It may also take lacs for the maintenance of the parking system of each slots every month. In my proposed were low cost ultrasonic sensors , OlED display screen, gear motor, solar panel for powering the whole parking system and AVR microcontroller ATtiny 2313 for the parking system for budget friendly and save money, power , and energy. For my proposed work it only needs two or 3 solar plates to power the system for the whole week.

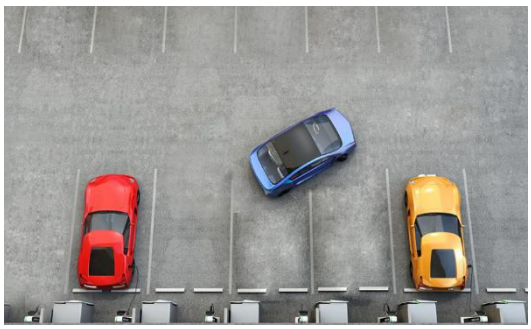


Fig.7. low cost smart parking system (source internet)

the ultrasonic sensor. The echo pin receive the pulse in the ultra-sonic sensor.

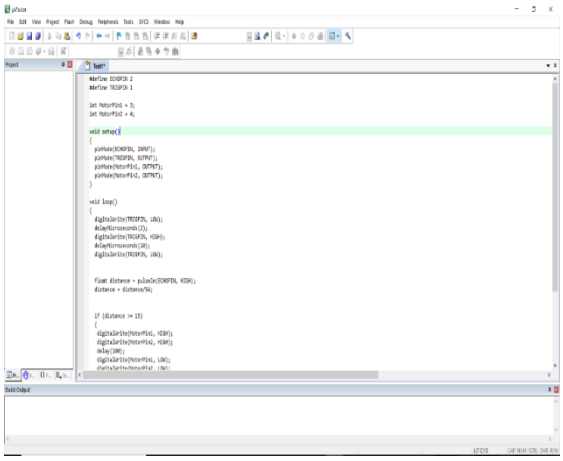


Fig.. Coding the microcontroller

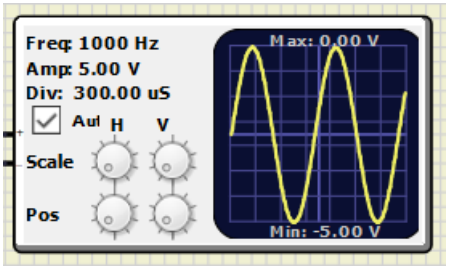


Fig.. Ultra-sonic sensor wave signal

IV Conclusion

Work proposed in this system represents the issue of the parking system in the smart cities. This system is implemented using low cost Ultra sonic sensor, Microcontroller ATtiny 2313, Geared motors, Comparator and OLED display. The developed parking area provides the information about the vacant, occupied slots and the parking distance between the wall and vehicle. The ultra-sonic sensor has adjustable sensing range up to 117cm. The proposed system not only reduces the traffic , save fuel , save time and help in reducing the pollution. The parking system updates itself by cloud server.

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