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Magnetometer and NRF Based Automated Parking lot Reservation System

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ABSTRACT: Smart parking management and reservation systems has gained momentum worldwide due to rapid urbanization. But implementation of these systems still tend to have different limitations based on different countries and parking area metrics like differential size and type of the vehicle, complications in power supply and cost of implementations. Hence the proposed system concentrates to be an adaptive system for the different parking areas through the simplified and low cost vehicle detection units which are power independent. On the other hand, the applications increases the ease of usage. At Book your park we are opening up a world of potential, by providing access to a vast network of spaces. We aim to tackle the pain points in parking and to increase efficiency and revenue by using the data insights for the effective use of space. To move towards a smarter, digitally connected world with mobility and sustainability at its core. There is roughly 190 million trips a month and over 23 percent of car journeys involve some kind of parking pain with drivers suffering from both uncertainty and inconvenience on a daily basis. Our vision is focused on contributing to a world that prioritizes the communities and the environment that we live and work in. By empowering people to make smarter, seamless mobility choices, Book your park is a key destination on the road to a more prosperous, healthier and better connected future. At Book your park, we are on a mission to make parking easy. Our app helps drivers enjoy an intelligent digital parking experience and make more efficient use of their assets. Book your park is dedicated to solving parking problems by making parking easier and more efficient for everyone.

KEYWORDS: Wireless Networks, Intelligent Parking Systems, Real time reporting, Seamless operations, Smart parking management, Easy enforcement, Reservation systems.

I. INTRODUCTION

With about 130 million vehicles on its roads — and about 2.7 million cars being added each year— India's parking woes are only going to get worse, especially as there is no policy framework. In fact, IBM's first-ever Parking Index — a ranking of the emotional and economic toll of parking in 20 international cities, released in 2011 — put New Delhi and Bangalore as the worst. "In India, we have very few multilevel parking lots," said Surabhi Arora, associate director of research at real estate consultancy firm Colliers International. "Generally, it's open parking lots that are provided by the local authorities". India also has one of the lowest public parking rates in the world. Most people, has had to talk with themselves out of visits to malls, fearing that they may not get parking on reaching there. A couple of times people try the old Indian trick of leaving their car in the nearby by lanes and hoping nothing happens, only to find that it had been towed away by the police. Frustrated, most people avoid malls and areas that offered a slim chance of easyparking, also the best places to shop, that's why we created Book your Park, an online parkingnetwork.This allows customers to book parking slots ahead of their visits to shopping malls through online booking or a mobile phone application, helping them to plan better. "It is always better to pay for a good parking spot than paying a similar amount

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to a cop". Parking is such a pain in the city roads. Book your park believes in providing a comprehensive parking solution to the car driving community.

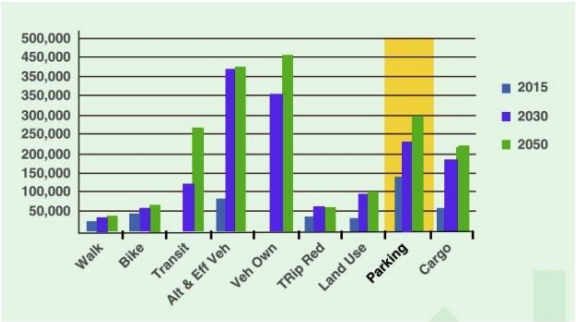

Fig. 1.Fuel saving till 2030

Book parking spots through Book your park is a great way to combine yourspend and double the fun by driving less on the roads. Help the community and yourself by reducing traffic congestion.

1. Register and Setup your profile
2. Search for the availability of the location
3. Select the parking locations from the list
4. Book the parking slot and receive confirmation on sms or email.

The proposed system is designed to be suitable for urban Indian users by reducing and overcoming the limitations.This can be achieved using smart data base systems which has dedicated and personalized storage space for multiple parking areas. The database is connected seamlessly with the hardware for detection of vehicle and allocation of lots. End applications makes it easier for the users and parking lot admins to reserve and manage the parking lots.

II. PROBLEM DEFINITION

Traffic congestion is an alarming problem at a global scale and it has been growing drastically. Car parking dispute is a major patron and has been, still a dominant problem with accumulating vehicle size in the extravagant segment and confined parking spaces in urban cities. Searching for a parking space is often an frustrating activity for many people in cities around the world. This search burns about one million barrels of the world's oil every day, that result in producing harmful gases like carbon dioxide, sulphur etc. As the global population progresses to metropolitanize, without a well prepared, accessibility driven retreat from the car these problems will worsen. According to a paper, Smart Parking put up result in 2,20,000 gallons of fuels saving till 2030 and approx. 3,00,000 gallons of fuels saved by 2050 , if implemented successfully.

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III. BACKGROUND AND RELATED WORKS

A. Wireless sensor networks

Both scholar and automated communities have a major attraction towards wireless sensor networks (WSNs). It can be unfolded in various kinds of entourage to monitor and collect information. This paper has described an intelligent car parking system based on WSN-based system. Modest wireless sensors are unfolded into a car park field through this system, and each of parking lot is equipped with one sensor node, which detects and monitors the occupation state of the parking lot. Primarily the sensor nodes detects the status of the parking field and periodically reports it to the database via the deployed wireless sensor network and its gateway. The upper layer management system is used for access the database and to perform multiple functions, such as finding vacant parking lots, automated toll, security management and report. In this paper a prototype of the system using crossbow motes is implemented. The evaluation of the system demonstrates the effectiveness of the design and implementation of the car parking system.

Merits: Wireless sensor networks is a very promising technology to be used in future intelligent car parking systems. This will enhance our existing work in the above mentioned aspects.

Demerits: Accuracy in the detection of mobility of the automobiles especially when the vehicle is moving in a high speed is a very important problem in designing a car parking and transportation system. There are some studies using magnetic sensors however, these sensors can be energy intensive. Deployment of sensors is still a challenging problem because of the factor of constraint on energy.

B. Transit-based smart parking

The evaluation of the first transit-based smart parking project in (BART) District station in Oakland, California is reviewed in this paper. The capital, operational, and maintenance costs are the major things that are reviewed finally the results of the survey analysis is presented Some key user response results such as usage of smart parking system 1-3 days and changeable message signs with parking information and information to decide whether to continue driving or take BART. BART mode share increased range, drive alone modal share reduction rate, average commute time reduction and overall reduction in total vehicle miles of travel are the major key changes in participant travel behaviour.

Merits: The smart parking service improved auto accessibility to the Rockridge BART station, and thus encouraged some respondents (11.2 percent) to use this station instead of one that was closer to their home. Among these 16 respondents the majority percent travelled further, and the minority percent travelled a shorter distance to the Rockridge station from the station they had used previously. In general, these results suggest that smart parking at BART, overall, tended to increase transit mode share and reduce auto mode share for the longest portion of respondents travel to on-site and off-site work locations, despite some shifts from carpool and bus modes.

Demerits: A number of factors affected the change in vehicle miles travelled (VMT) by field test participants to commute to their on-site place of work including BART as their primary mode in the place of driving alone, driving to BART in place of takingthe bus, biking, or walking and driving to Rockridge instead of driving to a BART station that was closerto their home.

C. Intelligent Parking Systems

The emergence and development are the major emerging techniques in sensors for intelligent parking. The major thing for parking managers and corresponding planners or researchers is parking survey. The survey has discussed the problem of making parking in an intelligent systems where parking spaces, entrance and exit are detected to acquire the occupation of the parking. To obtain the characteristic index needed for paring survey we have to present three possible sensor layouts and corresponding algorithms. With the same detection data from intelligent parking systems we can

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also do parking survey in different time and areas. Parking section or single parking space is majorly focused in the survey.

Merits: Information about vehicles and parking lot can be obtained easily through intelligent parking lot. Conventional parking survey is done in an efficient manner.Other parking survey terms can be used to obtain the arrival rate, service rate and other information.

Demerits: There are a number of researchers and planners that do parking surveys to discover planning problems or management disadvantages in parking lots. None of the intelligent sensors do parking survey efficiently. They have to keep doing it manually.

D. Automated guided vehicle systems

For the internal and external transport of materials automated guided vehicles (AGVs) are used. Traditionally, AGVs were mostly used at manufacturing systems. The design and control issues of AGV systems at manufacturing, distribution, trans-shipment and transportation systems are discussed in the literature.

It is closed that most designs can be practiced for layout problems atmanufacturing cents. In large AGV systems some of the models and new models are already proved to be successful. To overcome large computation times for large AGV systems new analytical and simulation models need to be developed. For the design and control of AGV systems in distribution, trans-shipment and transportation systems more specific research perspectives are specified.

Merits: Research on AGV systems is entering a new phase with the increased usage of large numbers of AGVs in new areas of application. For repeating transportation tasks in distribution, trans-shipment and transportation areas AGVs are currently used. The most important differences between the usage of AGVs in manufacturing areas and in these new environments can be noticed in the number of AGVs used, their utilization, the number of transportation tasks, distances to be travelled, the number of pickup and delivery points, amount of congestion, spatial dimensions and operational conditions. From the literature survey we can conclude that most of the literature address design and control problems at manufacturing systems. Almost all papers address one or two decision problems at the same time.

Moreover, barely any consideration has been indemnified to the relationship between AGVsystems and other material handling systems. To solve decision problems both analytical approaches and simulation are used. Mathematical programming, queuing theory, network models and Markov decision processes have been used to solve relatively small problems to optimality. To overcome high computation times and NP completeness problems heuristics is proposed. Someof the particular approach already proven to be acknowledged in large AGV systems.Furthermore, some new solution approaches have been imported for large AGV systems which are able of administration large numbers of AGVs efficiently.

Demerits: In design problems many decision variables arise. It might be difficult to predict the impact of decisions on mutual interactions and performance. It might be hard to decide on one thing without considering other decision variables. While designing an AGV system the following tactical and operational issues has to be addressed. In most literature the impact of equipment failures on the system is neglected. If only few AGVs are used, failures will have little effect on the occurrence of congestion in the system and, as a result, on the performance of the system. At container terminals and outdoor transport systems large numbers of AGVs are used. For these systems failures may occur more often. These failures might cause congestion and deadlocks in the system. Ebben (2001) developed control methods to deal with failures of full and empty AGVs in underground transportation systems. In research more attention should be paid to the relationship between control of AGVs and the occurrence of failures to ensure a high reliability of the AGV system

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E. Design Issues and Research Challenges

Aftera review we found that most authors consider the following design characteristics as necessary conditions for the success of the system:

Unrivalled marketing

1. Increase revenue with marketing via our app and website
2. Smart and targeted promotion of our sites using our digital marketing expertise.

Intelligent pricing

1 Dynamic pricing system
2 Monitor and analyze performance with ease via our online reporting software

Real time reporting

1. Easy access to car park performance figures via our online reporting software.
2. Valuable data on customer behaviour to inform decisions across your business
3. Increase customer satisfaction with the parking app Drivers can pay via the app in seconds, or pay on-exit.
4. Easy enforcement
5. Hassle-free enforcement to partnerships with leading providers
6. for patrols to manage cars
7. Seamless operations
8. Real-time support at every stage of the process with a dedicated account manager
9. Full car park set-up, on boarding and 24/7 in-house customer help desk provided.

IV. PROPOSED SOLUTIONS

A. Components used and their respective Description:

1. **Arduino Pro mini**: The Arduino Pro Mini supported ATmega328 could even be a micro-controller board. it's 14 digital input/output pins out of which 6 are often used as PWM outputs, 6 Analog inputs, a button, an on board resonator, and holes for mounting pin headers. The FTDI cable or Sparkfun breakout board is connected to a six pin header to produce USB power and communication to the board. The Arduino Pro Mini is proposed for nominal-durable fitting in objects or exhibitions. The panel comes after pre-seated headers, granting the use of varied description of connectors or direct soldering of wires. The pin layout is suitable with the Arduino Mini. There are two version of the professional Mini. One rush at 3.3V and eight MHz, the choice at 5V and 16 MHz.

   Features of Arduino Pro Mini:
   1. Microcontroller = ATmega328
   2. Board Power Supply = 3.35 -12 V (3.3V model) or 5 - 12 V (5V model)
   3. Circuit Operating Voltage = 3.3V or 5V (depending on model)
   4. Digital I/O Pins = 14
   5. PWM Pins = 6
   6. UART = 1
   7. SPI = 1
   8. I2C = 1
   9. Analog Input Pins = 6
   10. External Interrupts = 2
   11. DC Current per I/O Pin = 40 mA

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12. memory = 32KB of which 2 KB utilized by bootloader
13. SRAM = 2 KB
14. EEPROM = 1 KB
15. Clock Speed = 8 MHz (3.3V versions) or 16 MHz (5V versions)
16. Older boards were equipped with ATmega 168 with this spec

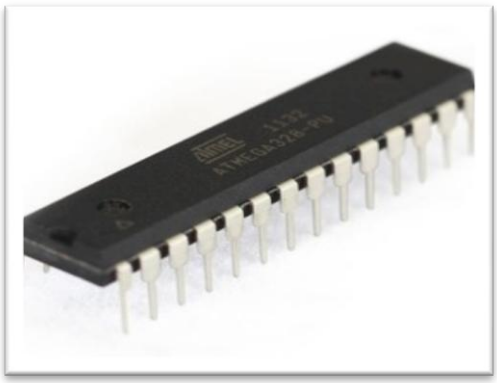

Fig. 2. Arduino Pro Mini (ATmega328)

2. **HMC5883L Magnetometer**:The HMC5883L could even be a surface-mount, multi-chip module designed for low-field magnetic Perceiving with a digital coordinate for operation like low cost circumscription and magnetometry. The HMC5883L Comprises an ASIC containing amplification, automatic degaussing strap drivers, offset cancellation, and a 12-bit ADC that allows 1 to 2 compass heading accuracy. The I2C serial bus acquiesce for accessible interface. The HMC5883L could even be a 3.0x3.0x0.9mm surface mount 16- pin leadless chip carrier (LCC). Applications for the HMC5883L include Mobile Phones, Netbook-ws, Consumer Electronics, Auto Navigation Systems, and private Navigation Devices. The HMC5883L utilizes Anisotropic Magneto resistive (AMR) automation that affords gain over other magnetic sensor technologies. These sensors construction is meant to live both the direction and also the magnitude of Earth's magnetic fields, from milligauss to eight gauss.

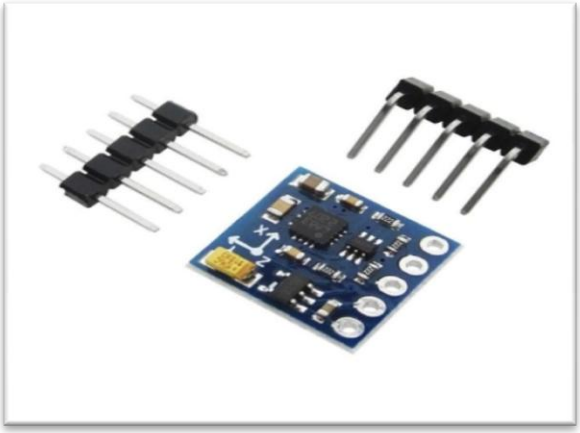

Fig. 3.HMC5883L Magnetometer- Flash memory: 16 KB, SRAM: 1 KB, EEPROM: 512 bytes

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3. **NRF24L01**:The The NRF24L01 module is that the latest in RF modules. This module uses the two.4GHz transceiver from Nordic Semiconductor, the nRF24L01+. This transceiver IC operates within the 2.4GHz band and has many new features.This board features a reverse polarized SMA connector for optimum RF range.This module comes with the two.4G antenna (2DB), with 250Kbps transmission rate on outside it can reach the 800-1K meters communication distance.

Fig. 4. NRF24L01

4. **AMS1117**:The AMS1117 series of adjustable and glued voltage regulators are designed to supply 1A output current and to work right down to 1V input-to-output differential. On-chip trimming adjusts the reference voltage to 1 percent. Current limit is additionally trimmed, minimizing the strain under overload conditions on both the regulator and power source circuitry. The AMS1117 devices are offered in the low profile surface mount SOT-223 package, within the 8L SOIC package and within the TO-252 (DPAK)

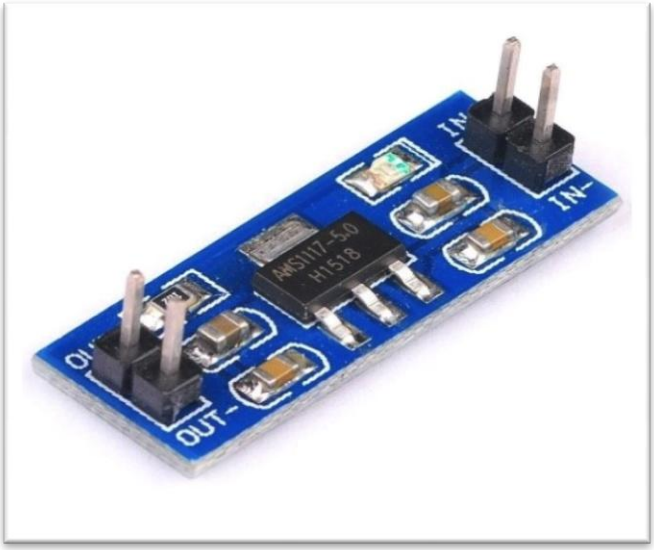

Fig. 5.AMS1117

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5. **PCB antenna**: Antennas are critical components for several wireless systems, with printed-circuit- board (PCB) antennas leading the pack because of their small size and easy integration with other high-frequency circuits. The performance and consistency of a PCB antenna depends heavily on the standard of its foundation circuit laminate, with size greatly afunction of the antenna.
   PCB antennas are available as fabricated components which will be added to a system design; several manufacturers also offer services to construct PCB antennas in step with CAE design files or custom mechanical requirements. Manufacturers offer extended capabilities for fabricating PCB antennas on a good range of circuit materials and in step with a customer's precise requirements. This PCB antenna is taken into account an assembly, with interconnecting cable and connector and adhesive for easy integration and mounting in numerous applications. The antenna 7 assembly (model 2118060-1) is meant to be used from 2.4 to 2.5 GHz. Low-profile PCB antenna assembly can support a good range of frequencies covering a complete range of 824 through 2170 MHz. This miniature flexible PCB antenna assembly is meant to hide the WLAN frequency bands of both 2.4 to 2.5 GHz and 4.90 to 5.85 GH

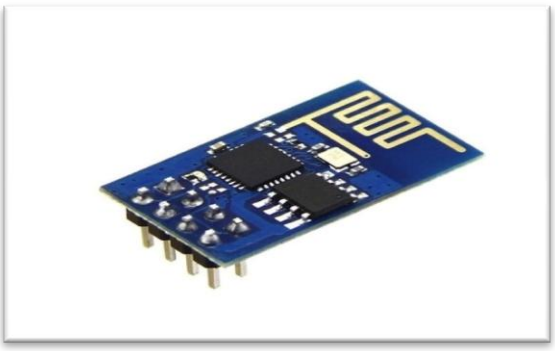

Fig.6.PCB Antenna

B. I2C Communication Protocol

The HMC5883L communicates using two wire I2C bus system as a slave. The HMC5883L uses an easy protocol with theinterface protocol defined by the I2C bus specification. The data rate is at the quality mode 100kbps or 400kbps rates as defined within the I2C Bus Specifications. The bus bit is an 8-bit Data/Address and a 1 bit acknowledge bit. The format of the information bytes (payload) shall be case sensitive ASCII characters or binary data to the HMC5883L slave, and binary data returned. Negative binary values are going to be in two's complement form. The default (factory) HMC5883L 8-bit slave is 0x3C for write, or 0x3D for read. The HMC5883L SCL and SDA lines require resistive pullups (Rp) between the master device (usually a number microprocessor) and therefore the HMC5883L. Other resistor values is also used as defined within the I2C Bus Specifications which will be tied to VDDIO. The SCL and SDA lines during this bus specification may be connected to multiple devices. The bus is one master to multiple slaves, or it is a multiple master configuration. All data transfers are initiated by the master device, which is accountable for generating the clock signal, and therefore the data transfers are 8 bit long. All devices are addressed by I2C's IRB7 etc IRC0 0 0 1 1 0 0 1 1 HMC5883L, 17 unique 7-bit address. After each 8-bit transfer, the master generates a 9th clock pulse and releases the SDA line. The addressed slavewill pull the SDA line low to ACK the successful transfer or leave the SDA high to negative acknowledge (NACK). Per the I2C spec, all transitions within the SDA line must occur when SCL is low. This requirement results in two unique conditions on the bus related to the SDA transitions when SCL is high. Master device pulling the SDA line low while the SCL line is high indicates the beginning (S) condition, and therefore the Stop (P) condition is when the SDA line is high while the SCL line is high.

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The I2C protocol also allows for the Restart condition within which the master device issues a second start condition instead of issuing a stop.

C. SPI Communication

Communication SPI is an interface bus commonly used to send data between microcontrollers and peripherals such as shift registers, sensors, and SD cards. It uses separate clock and data lines, together with a choose line to settle on the device you wish to speak to. SPI works in an exceedingly slightly different manner. It's a "synchronous" data bus, which implies that it uses separate lines for data and a "clock" that keeps either side in perfect sync. The clock is an oscillating signal that tells the receiver when to sample the bits on the information line. This could be the rising (low to high) or falling (high to low) fringe of the clock signal; the datasheet will specify which one to use. When the receiver detects that edge, it'll immediately have a look at the information line to read the next bit (see the arrows within the below diagram). Because the clock is distributed together with the information, specifying the speed isn't important, although devices will have a top speed at which they'll operate (We'll discuss choosing the right clock edge and speed in an exceedingly bit). One reason that SPI is so popular is that the receiving hardware is an easy register. This is a way simpler piece of hardware than the full-up UART that asynchronous serial requires.

D. Block diagram

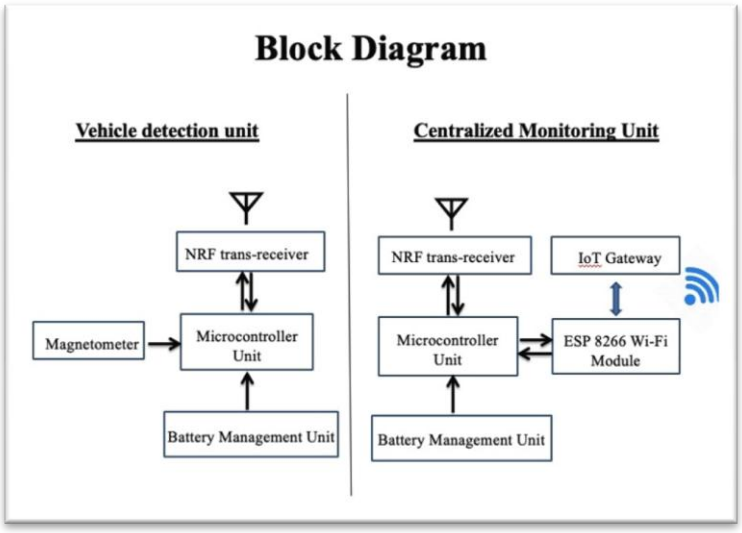

Fig. 7.Block Diagram

E. Vehicle detection using magnetic Anomaly

1. Magnetic anomaly detection may be a method for detecting ferromagnetic objects like automobiles, the utilization of three axis magnetometer outputs the moment field of force at a nominal rate 50Hz.
2. The high detection probability and therefore the simple implementation of the proposed method.

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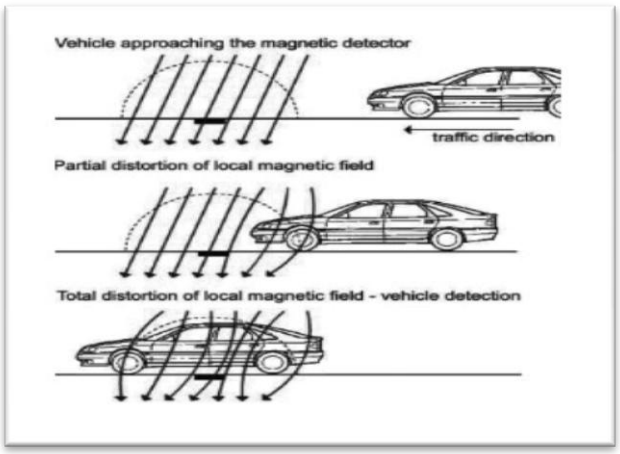

Fig. 8.Vehicle detection using magnetic Anomaly

V. RESULTS

The complete implementation of the circuit and its 3D Design is shown in fig.

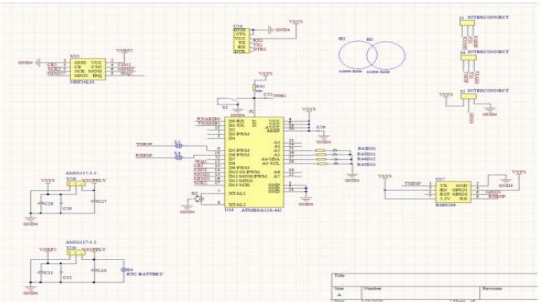

Fig. 9.Complete circuit

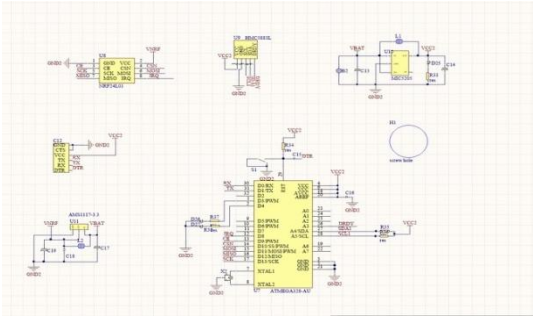

Fig. 10.Complete circuit

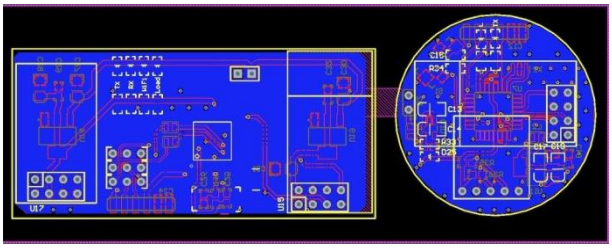

Fig. 11.PCB Design

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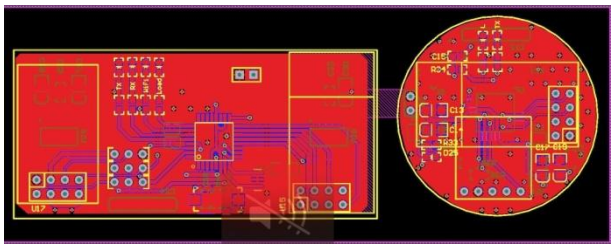

Fig.12.PCB Design

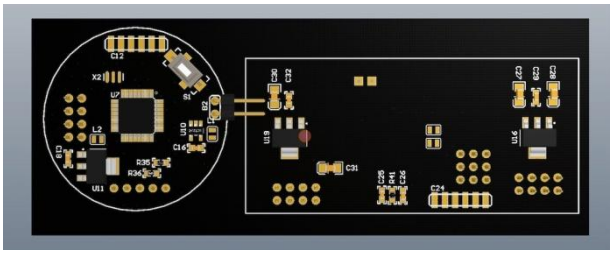

Fig. 13.PCB Design

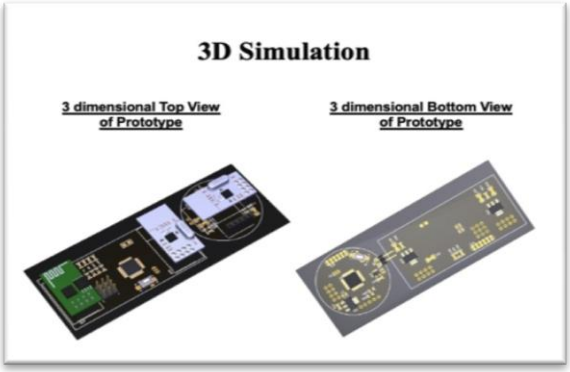

Fig.14. 3D Design

VI. CONCLUSION

Motivated by the need of a new smart parking management and reservation system to serve our community in the era witnessing the proliferation of fuel decimation, this position paper proposes Book your Park, magnetometer and NRF based automated parking lot reservation system. Due to the usage of RFID(Radiofrequency Identity) based parking lot system in which users will be provided with an RFID for accessing the parking slots in the location, ultrasonic sensor and Xbee communication for detecting the car and communicating back to the central node, ESPresso Lite 2.0 board and app built using BLYNK for collecting and displaying information about the available slots in a parking lot are executed by different entities without relying on a centralized third-party authority. The consensus mechanism offers tamper proof of transaction data in the trust less network environment. The smart application enables encapsulated rating and associated discounts. We aim to tackle the pain points in parking and to increase efficiency and revenue by using the data insights for the effective use of space. To move towards a smarter, digitalworld with mobility and

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sustainability at its core.The system is expected to improve the transparency to public events and allow individuals to oversee the operations conducted by those in power, organizations etc. It encourages people to actively reduce fuel wastage and participate in smart parking system construction. Consequently. Our vision is focused on contributing to a world that prioritizes the communities and the environment that we live and work in.

REFERENCES

1. Vanessa W.S. Tang, Yuan Zheng, Jiannong Cao. ”An Intelligent Car Park Management System based on Wireless Sensor Networks.” Hong Kong Polytechnic University.
2. Revathi, V. R. SarmaDhulipala.”Smart Parking Systems and Sensors Author.”2012 International Conference on Computing, Communication and Applications.
3. Greg Marsden, Marsden, G.R. (2006)” The evidence base for parking policies - a review”. Transport Policy, 13(6), pp.447-457
4. Caroline J. Rodier, Susan A. Shaheen, ”Transit-based smart parking: An evaluation of San Francisco Bay area field test”,Published in: Permalink https://escholarship.org/uc/item/6c6613ks Journal Transportation Research Part C: Emerging Technologies, 18(2) ISSN 0968090X Publication Date 2010-04-01
5. Chaudhary, Hemant, Prateek Bansal, and B. Valarmathi. ”Advanced CAR parking system using Arduino.” 2017 4th International Conference on Advanced Computing and Communication Systems (ICACCS). IEEE, 2017.
6. Kepuska, V., and Humaid Alshamsi. ”Smart car parking system.” International Journal of Science and Technology 5.8 (2016).
7. Abu, MohdAzlan, et al. ”Smart parking systems by using espresso lite 2.0.” 2017 International Conference on Engineering Technology and Technopreneurship (ICE2T). IEEE, 2017.
8. Yang, Kuo-pao, Ghassan Alkadi, Bishwas Gautam, Arjun Sharma, Darshan Amatya, Sylvia Charchut, and Matthew Jones. ”Park-a-lot: An automated parking management system.” Computer Science and Information Technology 1, no. 4 (2013): 276-279.
9. Dabbe, A., NagaSumukh, H. D., Navyashree, H. S., Kumar, K. P. (2019, March). Proposed Methodology for IoT Based Smart Parking System. In 2019 3rd International Conference on Computing Methodologies and Communication (ICCMC) (pp. 782-784). IEEE.
10. Herrera-Quintero, L. F., Vega-Alfonso, J., Bermudez, D., Marentes, L.´ A., Banse, K. (2019, May). ITS for Smart Parking Systems, towards the creation of smart city services using IoT and cloud approaches. In 2019 Smart City Symposium Prague (SCSP) (pp. 1-7). IEEE.
11. Kanteti, Dharmini, D. V. S. Srikar, and T. K. Ramesh. ”Smart parking system for commercial stretch in cities.” In 2017 International Conference on Communication and Signal Processing (ICCSP), pp. 1285-1289. IEEE, 2017.
12. Qadir, Zakria, Fadi Al-Turjman, Muazzam A. Khan, and Tayfun Nesimoglu. ”ZIGBEE based time and energy efficient smart parking system using IOT.” In 2018 18th Mediterranean Microwave Symposium (MMS), pp. 295-298. IEEE, 2018.
13. Soh Chun Khang; Teoh Jie Hong; Tan Saw Chin; Shengqing Wang;(2010) , ”Wireless Mobile- Based Shopping Mall Car Parkmg
14. System (WMCPS),” Services Computing Conference (APSCC), 2010 IEEE Asia-Pacific , pp.573-577.
15. Gongjun Yan; Weiming Yang; Rawat, D.B.; Olariu, S.,(2.o11) ”SmartParking: A Secure and Intelligent Parking System,” Intelligent Transportation Systems Magazine, lEEE , vo.3, no. I , pp.18-30.
16. J. P. Benson, T. O’Donovan, P. O’Sullivan, U. Roedig, and C. Sreenan. Car-park management using wireless sensor networks. In Proceedings of 31st IEEE Conf. Local Computer Networks, pages 588-595, Tampa, 2006.
17. Hemant Chaudhary, Prateek Bansal, and B Valarmathi. Advanced car parking system using arduino. In 2017 4th International Conference on Advanced Computing and Communication Systems (ICACCS), pages 1–5. IEEE, 2017.
18. V Kepuska and Humaid Alshamsi. Smart car parking system. International Journal of Science and Technology, 5(8), 2016
19. MohdAzlan Abu, Muhamad Farhan Mohamad Jalil, AizatFaiz Ramli, Hafiz Basarudin, Mohamad Ismail Sulaiman, MohdZubirSuboh, and Fairuz IzzuddinRomli. Smart parking systems by using espresso lite 2.0. pages 1–6, 2017.
20. Kuo-pao Yang, Ghassan Alkadi, Bishwas Gautam, Arjun Sharma, Darshan Amatya, Sylvia Charchut, and Matthew Jones. Park-a-lot: An automated parking management system. Computer Science and Information Technology, 1(4):276–279, 2013.
21. Aditya Dabbe, HD NagaSumukh, HS Navyashree, and KN Prashanth Kumar. Proposed methodology for iot based smart parking system. In 2019 29 3rd International Conference on Computing Methodologies and Communication (ICCMC), pages 782–784. IEEE, 2019.
22. Luis Felipe Herrera-Quintero, Julian Vega-Alfonso, Diego Bermudez, Luis Andres Marentes, and Klaus Banse. Its for smart parking systems, towards the creation of smart city services using iot and cloud approaches. In 2019 Smart City Symposium Prague (SCSP), pages 1–7. IEEE, 2019.
23. Zakria Qadir, Fadi Al-Turjman, Muazzam A Khan, and Tayfun Nesimoglu. Zigbee based time and energy efficient smart parking system using iot. In 2018 18th Mediterranean Microwave Symposium (MMS), pages 295–298. IEEE, 2018.
24. DharminiKanteti, DVS Srikar, and TK Ramesh. Intelligent smart parking algorithm. In 2017 International Conference On Smart Technologies For Smart Nation (SmartTechCon), pages 1018–1022. IEEE, 2017.