

Smart Parking System using IoT

¹K.Eswaramoorthi,²R.Manikandan,³R.Balamurugan,⁴C.Ramkumar,⁵S.Saravanan
^{1,2,3}*U.G. Scholar, ⁴Assistant Professor, ⁵Professor,*
Department of Electrical and Electronics Engineering, Muthayammal Engineering College
Rasipuram 637408, Tamil Nādu, India.

Abstract: In recent years the number of vehicles increased drastically and many times the car owners struggle to find the proper parking space within the city. IoT has great potential in implementing many of the smart city infrastructure requirements. Traffic congestion and the scarcity of car parking space have given a lot of opportunity for the research scholars to work in this field. In this paper we have proposed a smart car parking and reservation system. The proposed system is being controlled by an android app so as to reduce human intervention. This system reduces the traffic congestion and hence fuel consumption. To book the free slot for parking in advance is being done with the help of web application either using PC or mobile phone. This system can be used to book a free car parking slot within city. Recently parking has become a serious issue and even worsen, because of the increasing number of automobiles everywhere.

KEYWORDS: Car parking slots, Arduino, IR Sensors, ZigBee, Android Application, Car Parking System.

I. INTRODUCTION

Internet of thing (IoT) has the ability to transfer data through network without involving human interactions. IoT allows user to use affordable wireless technology and also helps the user to transfer the data into the cloud. IoT helps the user to maintain transparency. The idea of IoT started with the identity of things for connecting various devices. These devices can be controlled or monitored through computers over internet. IoT contains two prominent words “Internet” and “Things”, where Internet is a vast network for connecting servers with devices. Internet enables the information to be sent, receive or even communicate with the devices. The parking problem causes air pollution and traffic congestion. In today’s scenario, parking space is hard to search in a day-to-day life for the people. According to the recent survey, there will be a rapid increase in the vehicle’s population of over 1.6 billion around 2035. Around one million barrels of world’s oil is being burnt every day. Thus, smart parking system is the key solution to reduce the waste stage of the fuel. The solution for the problems that is being raised.

The smart parking can be a solution to minimise user’s time and efficiency as well as the overall cost of the fuel burnt in search of the parking space. In this, the data is collected from the sensor and through analysing and processing, the output is obtained. This data gets transmitted in the devices which extracts the relevant information and sends it to the Arduino device which gives the command instruction for the data to the particular devices simultaneously.

Arduino sends the signal to the servo motor along with GSM module which further gives instructions and notification to the user. When the user enters in the parking area, RFID card allotted to the registered user is scanned by the reader module thus ensuring the security of the user identity. This enables the user to get the information of the available parking space as well as SMS notification to the registered user’s mobile number. It consists of three parts where first part is the parking area which include Arduino devices along with IR Sensor. The user interacts with the parking area with the help of these devices. The second section of the paper includes the cloud web services which act as a mediator between the user and the car parking area. The cloud is updated according to the availability of parking area. The cloud service is administered by the admin but it can also be viewed by the user to check the availability. The third section of the paper is the user side. The user gets notified for the availability via SMS through GSM module. The user interacts with the cloud as well as parking area. The user gets the notification when the parking availability is full which saves the time for the user.

II. LITERATURE SURVEY

IoT allows user to use affordable wireless technology and also helps the user to transfer the data into the cloud. Around one million barrels of world's oil is being burnt everyday Thus, smart parking system is the key solution to reduce the waste stage of the fuel. The smart parking can be a solution to minimise user's time and efficiency as well as the overall cost of the fuel burnt in search of the parking space. In this, the data is collected from the sensor and through analysing and processing, the output is obtained. 0/) This data gets transmitted in the devices which extracts the relevant information and sends it to the Arduino device which gives the command instruction for the data to the particular devices simultaneously. When the user enters in the parking area, RFID card allotted to the registered user is scanned by the reader module thus ensuring the security of the user identity. This enablesthe user to get the information of the available parking space as well as SMS notification to the registered user's mobile number.

The booking details will be stored in the cloud which finds the shortest path from the user to the parking space, the location of the user is updated regularly in the cloud with the help of GPS. When the user reaches the car parking the RFID is scanned and the user is allowed into the parking space. The main disadvantage is that the car parking space must be registered in the smart parking system for the user to use it. The aim of this project is to make it cost effective and user friendly. Car parking system helps the user to sustain the data with 90% of accuracy. Smart car parking system provides a comprehensive parking solution for the user as well as admin of the parking area. It provides the feature for a reserved parking slot and identify reserved user. In this, user can navigate to the nearest parking area depending upon the size of the vehicle.

III. PROPOSED WORK

First section is the parking area which includes Arduino devices along with IR sensor. The user interacts with the parking area with the help of these devices. The user cannot enter the parking area without the help of RFID card. The second section contains the cloud-based web services 8 which acts a mediator between the user and parking area. The cloud is updated depending upon the availability of the parking area. The admin administers the cloud services and it can also be viewed by the user for checking the availability. The third section is the user side. The user gets notification on the basis of the availability via SMS through GSM module.

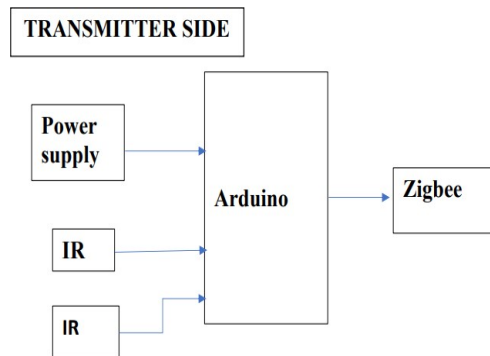


Fig.1. Block Diagram of Transmitter

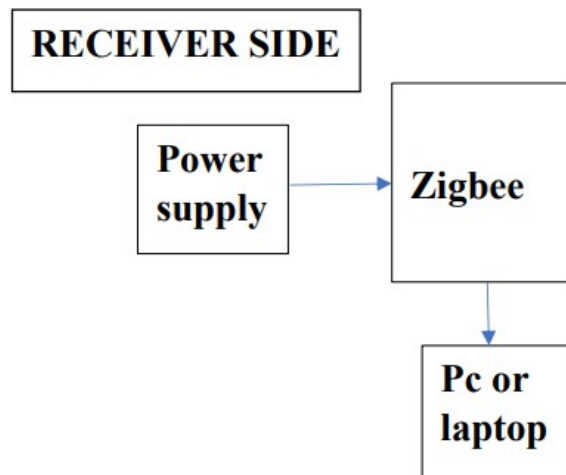


Fig.2. Block Diagram of Receiver

IV SIMULATION RESULTS

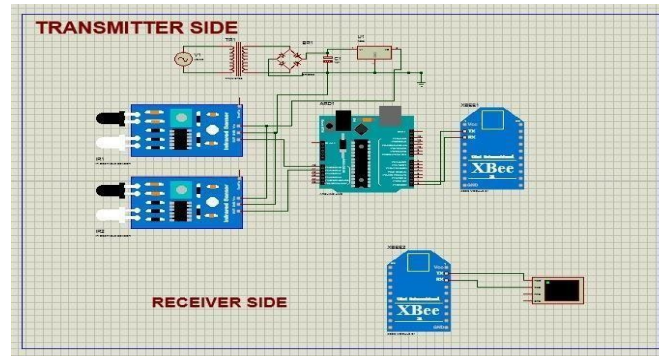


Fig.3.Simulation Diagram

In the simulation, there are two switches for on and off. The switches one On and other one-Off conditions to view the slots are Empty or Full. The parking area is fragmented into slots, where each slot is considered to be the maximum area that suffices for parking a light motor vehicle (i.e., $5.5 \times 2.5 = 165$ sq.m). For this project, a parking space of 15×6 slots is assumed. The maximum occupancy per floor possible for the conventional self-park garage of the given dimensions is 62.2 percent, for the circular APS is 34.1 percent and for the Robotic Valet APS is 78.89 percent. But this requires lot of rearrangements for the path clearance to retrieve the desired vehicle trapped within the other surrounding parked vehicles. The operation is optimal both in terms of space and power consumption when the occupancy is about 70 percent.

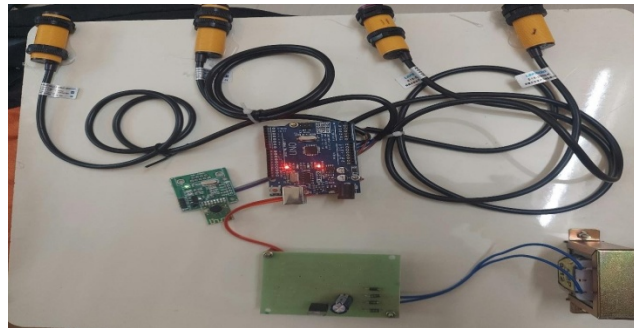


Fig 4: Hardware Implementation

There is a trade-off among space-optimization, power and parking fare. Also, a huge amount of fuel consumption can be reduced in turn helping us reach a pollution free environment.

V. CONCLUSION

The automated parking system has proved to be beneficial for its application in the existing conventional self-park garages due to its design adaptability. It is most suitable where the parking area is more with less height. The automated parking system can be implemented at the basement of shopping malls, tech parks, apartments and other commercial buildings. The parking system is advantageous in terms of operational speed, accuracy, safety, reliability, cost-effectiveness, convenience, space efficiency and eco-friendliness. Hindrance in the parking operations is considerably low due to the ease of service. Automated parking system fails to be effective in

comparison with the rack and rail type parking when the parking space requirement is low (for example, single row of space with multiple heights).

REFERENCES

- [1] J. Yang, J. Portilla, and T. Riesgo, Smart parking service based on wireless sensor networks, in Proc. 38th Annu. Conf. IEEE Ind. Electron. Soc.(IECON), Oct. 2012, pp. 60296034.
- [2] T. N. Pham, M.-F. Tsai, B. D. Nguyen, C.-R. Dow, and D.-J. Deng, A cloud- based smart-parking system based on Internetof-Things technologies, IEEE Access, vol. 3, pp. 15811591, 2015.
- [3] J. P. Benson et al., Car-park management using wireless sensor networks, in Proc. 31st IEEE Conf. Local Comput. Netw., Nov. 2006, pp. 588595.
- [4] L. Yu, D. Shao, and H. Wu, Next generation of journey planner in a smart city, in Proc. IEEE Int. Conf. Data Mining Workshop (ICDMW), Nov. 2015, pp.422429.
- [5] R. Souissi, O. Cheikhrouhou, I. Kammoun, and M. Abid, A parking management system using wireless sensor networks, in Proc. IEEE Int. Conf. Microelectron. (ICM), Hammamet, Tunisia, Dec. 2011, pp. 17.
- [6] C. Jin, L. Wang, L. Shu, Y. Feng, and X. Xu, A fairness-aware smart parkingscheme aided by parking lots, in Proc. IEEE Int. Conf. Commun. (ICC), Ottawa,ON, Canada, Jun. 2012, pp. 21192123.
- [7] R. Kumar, N. K. Chilamkurti, and B. Soh, A comparative study of different sensors for smart car park management, in Proc. IEEE Int. Conf. PervasiveComput. (IPC), Jeju, South Korea, Oct. 2007, pp. 499502.
- [8] J.-Y. Lee, UWB channel modeling in roadway and indoor parking environments, IEEE Trans. Veh.Technol., vol. 59, no. 7, pp. 31713180, Sep. 2010.
- [9] H. U. Yildiz, S. Kurt, and B. Tavli, The impact of near-ground path loss modeling on wireless sensor network lifetime, in Proc. IEEE Military Commun. Conf. (MILCOM), Baltimore, MD, USA, Oct. 2014, pp. 11141119.
- [10] Oentaryo, R. J.; Pasquier, M. (1 December 2004). "Self trained automated parking system". Control, Automation, Robotics and Vision Conference, 2004. ICARCV 2004 8th. 2: 10051010 Vol. 2. doi:10.1109/ICARCV.2004.1468981. Retrieved 9 November 2016.
- [11] V.Dhinesh, T.Premkumar, S.Saravanan and G.Vijayakumar," Online Grid Integrated Photovoltaic System with New Level Inverter System" International Research Journal of Engineering and Technology (IRJET), Vol.5, Issue 12, pp.1544-1547, 2018.
- [12] J.Vinoth, T.Muthukumar, M.Murugandam and S.Saravanan," Efficiency Improvement of Partially Shaded PV System, International Journal of Innovative Research in Science, Engineering and Technology, Vol.4, Special issue 6, pp.1502-1510, 2015.
- [13] M.B.Malayandi, Dr.S.Saravanan, Dr. M.Muruganandam, "A Single Phase Bridgeless Boost Converter for Power Factor Correction on Three State Switching Cells", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 4, Special Issue 6, pp. 1560-1566, May 2015.
- [14] A.Sasipriya, T.Malathi, and S.Saravanan, "Analysis of Peak to Average Power Ratio Reduction Techniques in SFBC OFDM System" IOSR Journal of Electronics and Communication Engineering (IOSR-JECE), Vol. 7, No.5, 2013.
- [15] P.Ranjitha, V.Dhinesh, M.Muruganandam, S.Saravanan, "Implementation of Soft Switching with Cascaded Transformers to drive the PMDC Motor", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 4, Special Issue 6, pp. 1411-1418, May 2015.
- [16] C.Sowmiya, N.Mohanandhini, S.Saravanan and M.Ranjitha,"Inverter Power Control Based On DC-Link Voltage Regulation for IPMSM Drives using ANN" International Research Journal of Engineering and Technology (IRJET), Vol.5, Issue 11, pp.1442-1448, 2018.
- [17] N.Yuvaraj, B.Deepan, M.Muruganandam, S.Saravanan, "STATCOM Based of Adaptive Control Technique to Enhance Voltage Stability on Power Grid", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 4, Special Issue 6, pp. 1454-1461, May 2015.
- [18] P.Manikandan, S.Karthick, S.Saravanan and T.Divya," Role of Solar Powered Automatic Traffic Light Controller for Energy Conservation" International Research Journal of Engineering and Technology (IRJET), Vol.5, Issue 12, pp.989-992, 2018.
- [19] R.Satheesh Kumar, D. Kanimozhi, S. Saravanan, "An Efficient Control Scheme for Wind Farm Using Back to Back Converter," International Journal of Engineering Research & Technology (IJERT), Vol. 2, No.9, pp.3282-3289, 2013.
- [20] K.Prakashraj, G.Vijayakumar, S.Saravanan and S.Saranraj, "IoT Based Energy Monitoring and Management System for Smart Home Using Renewable Energy Resources," International Research Journal of Engineering and Technology, Vol.7, Issue 2, pp.1790-1797, 2020.
- [21] J Mohammed siddi, A. Senthil kumar, S.Saravanan, M. Swathisriranjani, "Hybrid Renewable Energy Sources for Power Quality Improvement with Intelligent Controller," International Research Journal of Engineering and Technology, Vol.7, Issue 2, pp.1782-1789, 2020.
- [22] S. Raveendar, P.M. Manikandan, S. Saravanan, V. Dhinesh, M. Swathisriranjani, "Flyback Converter Based BLDC Motor Drives for Power Device Applications," International Research Journal of Engineering and Technology, Vol.7, Issue 2, pp.1632-1637, 2020.
- [23] K. Manikanth, P. Manikandan, V. Dhinesh, Dr. N. Mohananthini, Dr. S. Saravanan, "Optimal Scheduling of Solar Wind Bio-Mass Systems and Evaluating the Demand Response Impacts on Effective Load Carrying Capability," International Research Journal of Engineering and Technology, Vol.7, Issue 2, pp.1632-1637, 2020.
- [24] T.R. Vignesh, M.Swathisriranjani, R.Sundar, S.Saravanan, T.Thenmozhi," Controller for Charging Electric Vehicles Using Solar Energy", Journal of Engineering Research and Application, vol.10, Issue.01,pp.49-53, 2020.
- [25] V.Dhinesh, Dr.G.Vijayakumar, Dr.S.Saravanan," A Photovoltaic Modeling module with different Converters for Grid Operations", International Journal of Innovative Research in Technology, vol.6, Issue 8, pp.89-95, 2020.
- [26] V. Dhinesh, R. Raja, S. Karthick, Dr. S. Saravanan," A Dual Stage Flyback Converter using VC Method", International Research Journal of Engineering and Technology, Vol.7, Issue 1, pp.1057-1062, 2020.
- [27] G. Poovarasan, S. Susikumar, S. Naveen, N. Mohananthini, S. Saravanan," Study of Poultry Fodder Passing Through Trolley in Feeder Box," International Journal of Engineering Technology Research & Management, vol.4, Issue.1, pp.76-83, 2020.

- [28] C. Sowmya, N. Mohananthini, S. Saravanan, and A. Senthil kumar," Using artificial intelligence inverter power control which is based on DC link voltage regulation for IPMSM drives with electrolytic capacitor," AIP Conference Proceedings 2207, 050001 (2020); <https://doi.org/10.1063/5.0000390>, Published Online: 28 February 2020.
- [29] M.Revathi, S.Saravanan, R.Raja, P.Manikandan," A Multiport System for A Battery Storage System Based on Modified Converter with MANFIS Algorithm," International Journal of Engineering Technology Research & Management, vol.4, issue 2, pp.217-222, 2020.
- [30] D Boopathi, S Saravanan, Kaliannan Jagatheesan, B Anand, "Performance estimation of frequency regulation for a micro-grid power system using PSO-PID controller", International Journal of Applied Evolutionary Computation (IAEC), Vol.12, Issue.4, pp.36-49, 2021.
- [31] V Deepika, S Saravanan, N Mohananthini, G Dineshkumar, S Saranraj, M Swathisriranjan, "Design and Implementation of Battery Management System for Electric Vehicle Charging Station", Annals of the Romanian Society for Cell Biology, Vol.25, Issue.6, 17769-17774, 2021.
- [32] A Senthilkumar, S Saravanan, N Mohananthini, M Pushparaj, "Investigation on Mitigation of Power Quality Problems in Utility and Customer side Using Unified Power Quality Conditioner", Journal of Electrical Systems, Vol.18, Issue.4, pp.434-445, 2022.
- [33] V Kumarakrishnan, G Vijayakumar, D Boopathi, K Jagatheesan, S Saravanan, B Anand," Frequency regulation of interconnected power generating system using ant colony optimization technique tuned PID controller", Control and Measurement Applications for Smart Grid: Select Proceedings of SGESC 2021, pp..129-141.
- [34] C Nagarajan, B Tharani, S Saravanan, R Prakash," Performance estimation and control analysis of AC-DC/DC-DC hybrid multi-port intelligent controllers based power flow optimizing using STEM strategy and RPF technique", International Journal of Robotics and Control Systems", Vol.2, Issue.1, pp.124-139, 2022.
- [35] G Vijayakumar, M Sujith, S Saravanan, Dipesh B Pardeshi, MA Inayathullaa," An optimized MPPT method for PV system with fast convergence under rapidly changing of irradiation", 2022 International Virtual Conference on Power Engineering Computing and Control: Developments in Electric Vehicles and Energy Sector for Sustainable Future (PECCON), pp.1-4.
- [36] C Nagarajan, K Umadevi, S Saravanan, M Muruganandam, "Performance Analysis of PSO DFFP Based DC-DC Converter with Non Isolated CI using PV Panel", International Journal of Robotics and Control Systems' Vol.2, Issue.2, pp.408-423, 2022.
- [37] VM Geetha, S Saravanan, M Swathisriranjani, CS Sathesh, S Saranraj, "Partial Power Processing Based Bidirectional Converter for Electric Vehicle Fast Charging Stations", Journal of Physics: Conference Series, Vol.2325, Issue.1, pp.012028, 2022.
- [38] M Santhosh Kumar, G Dineshkumar, S Saravanan, M Swathisriranjani, M Selvakumari, "Converter Design and Control of Grid Connected Hybrid Renewable Energy System Using Neuro Fuzzy Logic Model", 2022 Second International Conference on Computer Science, Engineering and Applications (ICCSEA), pp.1-6, 2022.
- [39] C Gnanavel, A Johny Renoald, S Saravanan, K Vanchinathan, P Sathishkhanna, "An Experimental Investigation of Fuzzy-Based Voltage-Lift Multilevel Inverter Using Solar Photovoltaic Application", Smart Grids and Green Energy Systems, pp.59-74, 2022.
- [40] C Nagarajan, K Umadevi, S Saravanan, M Muruganandam, "Performance investigation of ANFIS and PSO DFFP based boost converter with NIC1 using solar panel", International Journal of Engineering, Science and Technology, Vol.14, Issue.2, pp.11-21,2022.