BUSITEMA UNIVERSITY

FACULTY OF ENGINEERING

DEPARTMENT OF COMPUTER ENGINEERING

AN IP BASED PARKING SLOT MONITORING AND REPORTING SYSTEM

BY

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Declaration

This Project report is my original work and has not been presented for a degree in any other University or any other award.

Signed: …….. **Date: ……**

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Approval

The undersigned certify that they have read and hereby recommend for acceptance of Busitema University a Project report entitled An IP Based Parking Slot Monitoring and Reporting System.

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Abstract

In Kampala, the capital city of Uganda as the population increases, the number of vehicles hitting its streets also increases. However there is a decrease of parking spaces due to the construction of commercial buildings in the previous parking spaces and also lack of a mechanism of monitoring the slots availability in the few parking spaces available. This has resulted to pavement parking with its disadvantages and also wastage of a lot of time in searching where to park.

This project was therefore aimed at developing a system that would solve the above problem through the following ways namely; monitoring the status of every slot in a given parking lot, transmitting the slot status information to the central server and displaying the number of parking slots available in a given parking lot in real time using a web interface.

The work is arranged mainly in six chapters, Chapter one includes the introduction of An IP Based Parking Slot Monitoring and Reporting System. Chapter two discusses the literature related to the system, Chapter three illustrates the methodologies used in coming up with the working prototype of the system. In data collection, methods such as document review, observation among others were used. In the design, three major blocks were considered, this is to say; user interface, hardware design and finally database and networking system block. Chapter four includes system design and analysis, this is where all the system requirements are listed and its where the actual system designs are described. Chapter five contains the implementation and testing of the system. This explains the system development platforms, the system code design, the circuit design, the operation of the system and testing. Finally, chapter six contains the summary of the work, discussions and recommendations.

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List of Acronyms

APS……. Automated Parking System

ETSI…… European Telecommunications Standards Institute

GPRS……General Packet Radio Service

GSM……. Global System for Mobile Communications

KCCA……... Kampala Capital City Authority

SIM……Subscriber Identity module

SoC…… System on Chip

TDMA……Time Division Multiple Access

URA……Uganda Revenue Authority

CHAPTERTER ONE

INTRODUCTION

1.0 Introduction

This chapter gives a brief introduction of background, problem statement, objectives, justification/ significance, the scope of the study and challenges of An IP Based Parking Slot Monitoring and Reporting System.

1.1Project background

There are limited private parking lots in the Kampala business districts so far including ones on Dewinton road, Martin Road, William Street, the National Theatre and the Pioneer Mall Parking lot among others forcing most motorists to park along the roads. KCCA is moving forward to increasing parking space in the city by encouraging private investors to come on board to develop public parking spaces. From here on, they say they will only approve storied buildings with parking space on their construction plans [**1**].The council is the overall in charge but it already identifies private entities that can perform particular services better. As of now, Multiplex Uganda is the firm that manages street parking for the KCCA including collecting parking fees and remitting a monthly contract sum to the Council.

The Pioneer Mall Parking lot services a handful of complexes in the area that includes Ivory Plaza, Zainabu and Sunset Arcades. According to Mary Atuheire, the lot is considered "strategic" and preferred spot for many. However customers sometimes wait up to 40 minutes to get space [1].This is because the current way of parking slot location in Kampala is through the physical presence on site. There is currently no way of remotely monitoring and reporting free parking slots in Kampala thus customers are always unaware of the existence of parking slot at any particular time, so they end up waiting for long[1].

1.2 Problem statement

As the population grows, the number of vehicles hitting the streets of Kampala increases while parking spaces are lost to new buildings. This has increased the competition to occupy the few parking lots available, thus leading to wastage of a lot of time in trying to locate an available parking slot by the private vehicle drivers due to lack of information. Luck of information on the available parking slots results in road-side parking which leads to theft of vehicle parts, property in vehicles, at times vehicles themselves, and sometimes accidents.

My system is able to monitor the available parking slots around the parking space of Kampala and transmit that information to a cloud server which avails the information to the users over IP.

1.3 Objectives

1.3.1 Main objective

The main objective was to design and develop an IP based parking slot monitoring and reporting system.

1.3.2 Specific objectives

The specific objectives of the system were;

- To study and review the literature related to the IP Based Parking Slot Monitoring and Reporting System.
- To analyze the data in order to draft the system requirements.
- To design the circuit, database and user interface of the system.
- To interconnect the database, user interface and the circuit for proper communication of the system components.
- To test and write a report of the system.

1.4 Justification

Drivers in urban centers such as Kampala have no means of remotely monitoring the available parking slots in the few parking lots available in the city. Drivers waste a lot of time and fuel moving around in search of the available slot for parking. In addition, the available methods used in some of the parking lots focus mainly on the security and the finance challenges forgetting the important factor of convenience and saving time for the drivers.

1.5 Significance

With the IP Based Parking Slot Monitoring and Reporting System, drivers will be able to access the number of available parking slots in the parking lots remotely with the help of the internet. Knowing "time is money" this will help drivers save time in locating where to park, save fuel, reduce pollution and avoid pavement parking with its negative results.

1.6 Scope of the project

1.6.1 Geographical scope

Geographically this system is meant for monitoring and reporting the availability of parking slots in parking lots of around Kampala.

1.6.2 Technical scope

The system consists of three modules that is the software, hardware and networking module. The hardware module consists of sensors, raspberry pi among others and it is responsible for sensing the status of every parking slot available in a parking lot, the software is a web interface accompanied with a central database that is used to view the status of the parking slots over IP and finally the networking module interconnects the system hardware to the software through an internet connection. This allows the data collected from the sensors in the parking lot to be transmitted over IP and real time in order to be viewed at the user side.

1.6.3 Time scope

This project started in August 2015 and ends in May 2016.

1.7 Limitation

The operation of the proposed system entirely depends on the GPRS/EDGE/3G cellular network during communication which is unreliable especially in Uganda.

In addition the proposed system requires Internet yet some drivers don't know how to use the internet.

The system can be more expensive for autonomous parking lots since every slot will require a sensor.

References

[1] Mary Atuheire. (2012) www.monitor.co.ug. [Online]. www.monitor.co.ug/artsculture/Reviews/Paving-way-for-private-parking-space-in-Kampala-/-/691232/1404864/-/fmcocl/-/index.html

[2] Jeremy Fichter. (2005, July) depts.washington.edu. [Online]. http://depts.washington.edu/open2100/pdf/2_OpenSpaceTypes/Open_Space_Types/parking_lot_parks.pdf

[3] Lionel Thorens, Manfred Reisky, Oliver Rulik and Stefan Deylitz Geoff Sanders, GPRS Networks, 2nd ed., Germany GmbH, Ed. Chichester, England: WILEY, 2003.

[4] I. J. S. and Ding, Y. Chien, Applications of Artificial Neural Networks in Prediction of Transit Arrival Times‖, 1999 Annual Meeting of ITS America, 2nd ed., Chien Ding, Ed. Washington D. C, USA: WILEY, 1999.

[5] Robert E. Kahn Vinton G. Cerf, "IEEE Transactions on Communications ," A Protocol for Packet Network Intercommunication, vol. 22, no. No. 5, pp. 637–648, May 1974.

[6] ICANN. (2006, April) www.icann.org. [Online]. https://www.icann.org/en/system/files/files/ip-addresses-beginners-guide-04mar11-en.pdf

[7] D.A. Godse and P.Godse, Microprocessor and its applications, 2nd ed., D.A. Godse, Ed. London, England: WILEY, 2000.

[8] Dr Eben Upton. (2010, October) www.element14.com. [Online]. https://www.element14.com/community/servlet/JiveServlet/previewBody/44424-102-1-240260/element14_RPi_Webinar_040412_V1.0_FINAL.pdf

[9] Simon Monk, Free Sample Raspberry Pi Cookbook, First Edition ed. California, USA: O'REILLY, 2014. [Online]. https://www.adafruit.com/images/product-files/2274/2274sampler.pdf

[10] Magnus Lie Hetland, Beginning Python From Nonvince Tto Profession, 1st ed., Magnus Lie, Ed. New York, USA: APRESS, 2005.

Alex Samuel, David Aitel, Eric Foster-Johnson, Leonard Richardson, Jason Diamond, Aleatha Parker,Micheal Roberts Peter Norton, Bigining Python, 3rd ed., Alex Samuel, Ed. Indiana, USA: Wiley Publishing, Inc, 2005.

[12] Ahmed El-Rabbany, Introduction to GPS: The Global Positioning System, 1st ed., El-Rabbany, Ed. LONDON, England: ARTEC HOUSE, 2002. [Online]. www.artechouse.com

[13] Emily Vander Vee, JavaScript FOR DUMMIES, 2nd ed., Emily Vander, Ed. Indianapolis,Indiana, U.S.A: Wiley Publishers, Inc, 2005.

[14] Abiodun Musa Aibinu, MD. Ataur Rahman, Nur Farahana Binti Mohd Suhaimi, Ainul Farhana Binti Mohd Yunus Muhammad Muhbubur Rashid, "Automatic Parking Management System and Parking Fee Collection Based on Number Plate Recognition," Mechatronics Engineering, International Islamic University Malaysia, Malaysia, phD Thesis ISBN/ISSN, 2010. [Online]. http://www.ijmlc.org/papers/95-A009.pdf

[15] Tae Kwon Ha Jung-Ho Moon, "A Car Parking Monitoring System Using Wireless Sensor Networks," Maple University, Dublin, Thesis IBBS/IMSA, 1999. [Online]. http://waset.org/publications/17079/a-car-parking-monitoring-system-using-wireless-sensor-networks

[16] Joey Hess (6 April 2007). "Integrated issue tracking with Ikiwiki". NetworkWorld.com. IDG. Retrieved 10 November 2014.

[17] Winston De Armas, "Design of a Non-intrusive 2-lead ECG System Using the Active Insulated Electrode," 4-22-2010.