Design and implementation of Smart Parking using IOT

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Abstract.: In the past, there have been many works done on smart parking system approach in gan even smarter system in where researches have been done and still being done to create a system which is not technologically savvy butalsoatease.Thispaperproposesadesignofsmartparking system where it helps the users to reserve parking slots using Android application. This project is aimed to create a system that helps people with personal vehicles to find for parking easily at selected areas. Both software and hardware platform have been developed in thissystem.

I.   Introduction

Inthiscurrenteraof modern world, almost everyone owns a personal vehicle and ithasbecomeabasic need for the humans. Hence, it has been proven statistically that the usage of vehicles is increasing rapidly yearly [1]. Due to the growth, it is very difficult to find parking slots in cities, especially during the peaktime.

Thiscreatesanecessitytointroduceanautomatedsystemthatallowsuserstobooktheirspotjustby making a few clicks through a custom made Android Mobile Application. This serves to hassle free situationforeachandevery users.The mainmotivationbehind theSmartParkingSystemistohelpthe drivers to find areas where parking is a vailableinthatarea[2].Priortohisexpectedarrival,driverscan

bookaslotintheareaifitisavailable.Driverscansearchtheparkingslotthroughthemobileapplication installed and book the available slot. Besides that, user can also view the duration of parking usage through the application and chargescanbecalculatedthroughtheonlineapplicationsenttotheuserfor

notification.Notonlythis,usercanopttoextendtheirdurationbysimplyrequestingontheapplication by few clicks. All you need is a workingInternet.

The system works primarily on the detection of parking slots through sensors that are mounted on every parking slots which facilitates the information. Then this is then processed by microcontroller which helps to serve as a medium of communication between those peripherals or devices. The final stage would be when user uses their smart phones to retrieve the slot occupancy in selected areas prior to reservation

II.   Literature Review

According to previous related works, there are several methods used to develop the system. It is highly crucial to have knowledge on the systems that have been developed in order to ensure a better enhancement of theproposedsysteminthisproject.Insomestudies[3],imageprocessingisgivenmore importance instead of sensor based system. Driver's number plate is captured by Image processing is used to capture the number plateofthedriversandtheinformationisstoredindatabase.Thisistoavoid theft and illegal car entry. The users must register first before using the Android application. This application consists of basic information of the drivers which will be stored for future references. After registration, the driver is required to select the parking location and theserverwillimmediatelyprocess the data received and sends back the information needed to theuser.

Next,aninnovativeapproachcameasasolutionforthereservationtrafficinwhereQRcodeistaken into account for reservation confirmation. In research paper [4] "Smart Parking System based on Reservation",states thattheexpansionofmonetaryconductforeverydaycomforthasrapidlyincreases the ratio of people who owns vehicles giving boost to busy cities traffic. This is commonly why traffic congestion and air pollution occurs. The management will system will broadcast the details on the available parking slots todrivers.

Then, the drivers will select a particular parking slot to book. As soon as the driver reserve the slot, theservergeneratesauniqueQRcodeandquicklysendsittothedrivers.Afterplacingthereservation,thehostwilldemandf ortheQRcodesenttotheusertoverifydetailssentbeforeandlettheusertousethereservedplace.Thiscodestoresininforma tionsuchasparkingchargeandtheavailabilityoftheslotforthebothuserandproviderforreference.Thehardwarepartofthi ssystemisdividedintothreemainparts;QRscanner,serverandmobilephone.Figure1illustratesthelayoutoftheparkings ysteminbrief.
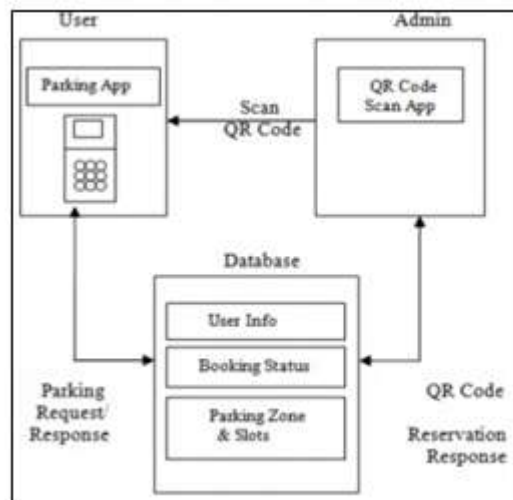
Figure 1: Layout of Parking System

III. Methodology

Methodologyisamodeltoexplainthemethodsortechniquesusedtodesign,developorplanaproject.   This chapter explains about the software and hardware that will be used for developing this project further. The results are going to be analyzed to achieve the objective of thisproject.

1.1 SystemOverview

The proposed system is used to indicate the user about the vacancy of the parking slots. A user can choose the parking slot in advance, instead of waiting in area of the parking, where the parking availabilityareshownthroughuser'ssmartphones.IRSensorswillbeattachedineachslotfordetecting the vacancy. The signal from the sensors captured by Arduino and these signal is then converted from electricalsignalintoanother formtodetectpresence of vehicleintermsoftheamountoflightreflected back from the obstacle such as wall of the parking lot. The output from Arduino depends on the measurement of amount of light and based on that, slot's allocation is done. On the other hand, the output from Arduino is changed into text format and sent to the smart phones through a developed Android application. Now the usersareprovided with the parking details and can choosetheappropriate slots toreserve.

Besides reservation, user also will be notified on details of parking such as extending or making payment via a simple text message with the help of GSM. The parking area are sensed by using the sensors which are placed in each slot. The sensors will detect each slot as input and the output of the sensors is preceded to the Arduino. Arduino will process the input of the sensors, analog to digital conversion aremade andbytrackingtheuserusingthedetailsoftheparkingslotsgiventotheuser.Thecomponentsneededforthisprojectaresen singdevice,communicationplatformandmobileapplication. Figure 2 shows the proposed block diagram of smart parkingsystem.

1.2   BlockDiagram

Figure 2 shows the block diagram of the proposed smart parking system.
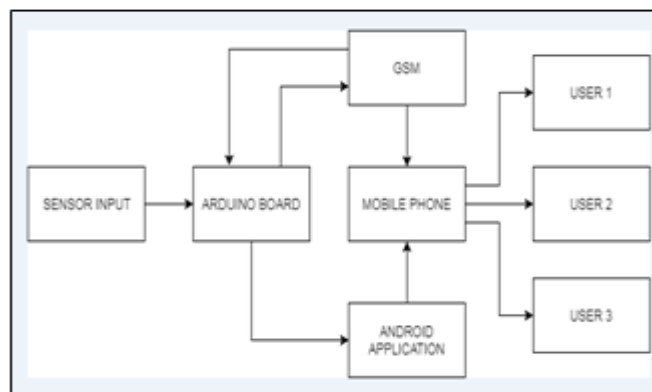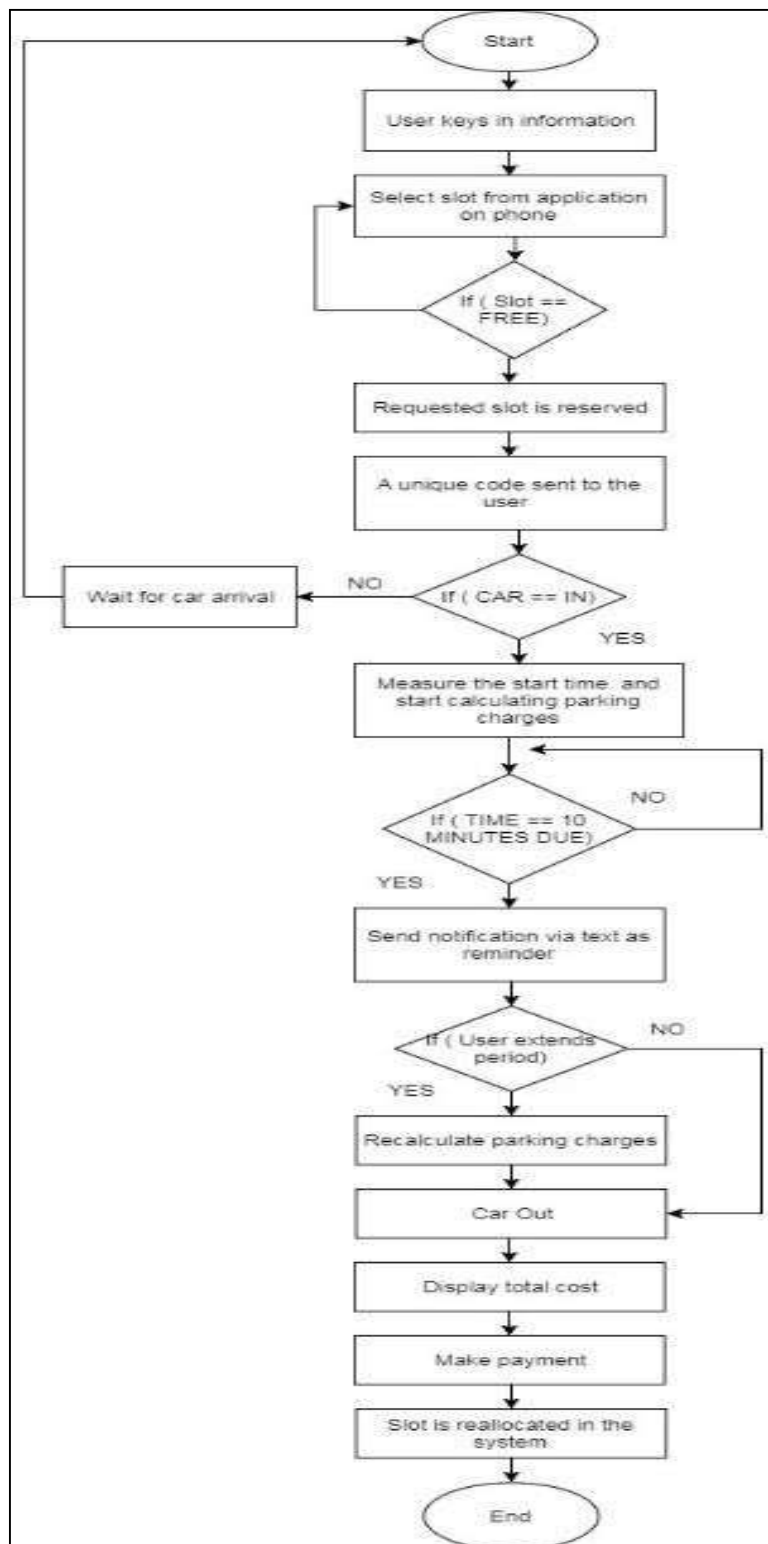

Figure 2: Block Diagram

1.3 Flowchart

Figure 3: Flowchart of the System

Figure3explainstheflowchartoftheproject.Theprocessflowofthesmartparkingsystemwhenusers start initialization through mobile application. Users are required to key-in important details such as name,vehicle'splatenumber,contactnumberanddurationtheywanttoparkfor.Onceregistered,usersaretakenintothene xtwindowwhereavailabilityofslotsbasedonrealtime.Redindicatestheslotsare occupied whereas green indicates free occupancy, thus users can choose to reservethem.

Normal users go through the normal ticketing process. Once the car enters in the parking bay, it starts to calculate the time and also parking charges. Else, wait for the car arrival within the time allocated. Next, when the time of the parking is 10 minutes due, a notification is sent to the user as a reminder where user can opt to extend their parking duration for a certain time and parking charges are recalculated. If no, car must exit from the parking lot. This is where the Android app will display the total cost, user can make payment. The slot will be reallocated in the system again.

1.4 MIT AppInventor
This helps in the application development for Androids by either using the application in a browser, phoneoremulator.ItalsostoresthedatawhereyouwillbeabletosaveitintotheGoogledrivendatabasewhichoperatesonC loudbased[5].AnappcanbesimplybuiltbyfinishingthetemplateofyourappbyusingTheAppInventorDesignerandthen completingyourapplication'sworkfloworthewayitworks on a phone by using The App Inventor Block Editor prior to running on an emulator or a phone. Smart parking reservation system would be developed using thisplatform.

Searchingforpublicationsusingseveralcriteria,thesecriteriacanbeseeninTable3.Thereafter,an extraction of the research publication on the assumption of attribute independence on Naïve Bayes required to obtain data relating to RQ is presented in Table 4. Furthermore, we conducted a quality research assessment to help interpret the quality of the findings and to determine the strength of the conclusions described. The last step, synthesize the data in which the purpose of collecting evidence from the survey paper that has been obtained to answer RQ.Synthesis data used in this study, will generally be a narrative synthesis. Some tables and visual tools will be used to support the explanation in thisstudy.

1.5 Arduino IDEWorkspace
Arduino Integrated Development Environment or also known as Arduino IDE Software is an open source platform which has a text editor to write coding with a series of functions and tools [6]. This software is connected to Arduino development board to communicate with them. This software has consolewhichdisplaysallerrorsinthecodingandotherinformation.Arduinoboardsarelessexpensive compared to other microcontroller. Arduino Software almost runs in all operating systems including Windows and Linux. This workspace is easy to use for the beginners as the complexity level is very low. Furthermore, it has built in examples for the beginners to play around with the coding. Figure 3.4 illustratesthebuiltinexamplesfoundinthesoftware.Sincethissoftwareisopensource,extensionsare available. There are several Arduino boards found in themarket.

1.6 Related HardwareTools
IRSensorswillbeattachedineachslottodetectthepresenceofthevehicles.[7]Thissensordetectsthe presence of a vehicle in terms of the amount of light reflected back from the obstacle and in this case it will be the wall of the parking slot. If no obstacle is present, IR light cannot be detected by the sensor. The typical Infrared Transmitter found is a Light Emitting Diode (LED) which functions by emitting infraredpulse.

Arduino Uno Wi-Fi board is integrated with Wi-Fi module which will be used in this project. This boardisbasedonintegratedESP8266Wi-FiModuleandATmega328P.TheWi-FimodulehasTCP/IP Protocol stack which gives direct access to the Wi-Fi network [8]. This board is programmed by using Arduino IDE software. This board is ideal as it can run both in online and offlinemode.

A GSM module is used to communicate between a mobile device and a computer. GSM operates at 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands to transmit mobile data services. GSM has many features such as international roaming, high quality speech, SIM phonebook and also short message service (SMS) [8]. GSM is considered very secure telecommunication available now. GSM is usedtotransmit SMS fromsendertoreceiver.Inthisproject,SMSissenttotheusertonotifythemthat the duration of the parking hours is going toend.

IV. Result
Theprocessflowofthesmartparkingsystemwhenusersstartinitializationthroughmobile application. Users are required to key-inimportantdetailssuchasname,vehicle'splatenumberandcontact number. Figure 4 shows the layout of the Android Application for the loginpage.

Figure 4: Layout of Android Application

The process flow of the smart parking system when users start initialization through mobile application.Usersarerequiredtokeyinimportantdetailssuchasname,vehicle'splatenumber,contactnumberanddurati ontheywanttoparkfor.Onceregistered,usersaretakenintothenextwindowwhereavailabilityofslotsbasedonrealtime. Redindicatestheslotsareoccupiedwhereasgreenindicatesfree occupancy, thus users can choose to reserve them. Then, user will be sent a unique code which later on they have to scan at the entrance of parking bay within the time given. The unique code differentiates between the mobile users and normal users. Normal users gothroughthenormalticketingprocess.Once the car enters in the parking bay, it starts to calculate the time and also parking charges. Else, wait for the car arrival within the time allocated. Next, when the time of the parking is 10 minutes due, a notification is sent to the user as a reminder where user can opt to extend their parking duration for a certaintimeandparkingchargesarerecalculated.Ifno,carmustexitfromtheparkinglot.Thisiswhere the Android app will display the total cost, user can make payment. The slot will be reallocated in the system again. Figure 5 shows the hardware components used for thisproject.
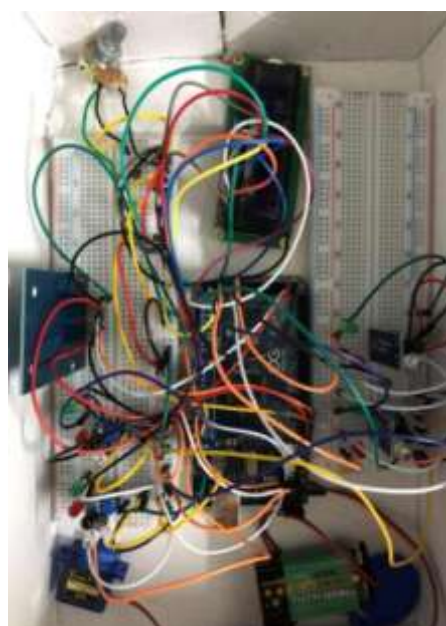
a.**Figure 5:** Hardware used in theProject

V. Conclusion

ThissystemistoeasethedriverstofindparkingslotsduringpeakhoursbyusingAndroidApplication. This is an efficient system as it helps to solve heavy traffic congestion and reduces the driver's frustrations. The system can be more enhanced by providing the route to the selected parking location with the help of Global Position Search (GPS)System.).

VI. Acknowledgment

References

[1]. P. Mane, R. Deoghare, S. Nagmote, S. Musle, and S. Sarwade, "Android based Smart Parking System," pp. 3981–3985,2015.
[2]. R.RenukaandS.Dhanalakshmi,"AndroidBasedSmartParkingSystemUsingSlotAllocation & Reservations," vol. 10, no. 7, pp. 3116–3120,2015.
[3]. M. Computing, "Smart Car Parking Using Arduino," vol. 5, no. 2, pp. 230–234,2014.
[4]. M. S. Rahul Patil,"Smart parking system based on reservation,"vol.2, Mumbai,India,2014.
[5]. T. N. A. M. Pham, M. Tsai, and D. U. C. B. Nguyen, "A Cloud-Based Smart-Parking System Based on Internet-of-Things Technologies," pp. 1581–1591,2015.
[6]. S. A. El-seoud, H. El-sofany, and I. Taj-eddine, "Towards the Develoment of Smart Parking System using Arduino and Web Technologies," no. 978, pp. 10–16,2014.
[7]. R. H. Giva Andriana, Anak Agung, "Sensor Comparation for Smart Parking System," pp. 4–9, 2012.
[8]. N.Hazrin,H.Mohamad,M.H.Badiozaman,andH.Daud,"SmartParkingReservationSystem using Short Message Services (SMS),"2008.
[9]. M. N. M. Yasin and S. K. Khamas, "Measurements and Analysis of a Probe-Fed Circularly Polarized Loop Antenna Printed on a Layered Dielectric Sphere," in IEEE Transactions on Antennas and Propagation, vol. 60, no. 4, pp. 2096-2100, April2012.
[10]. IsmahayatiAdam,M.NajibM.Yasin,Hasliza.A.Rahim,P.J.SohandM.FareqAbdulmalek, A compact dual - band rectenna for ambient RF energy harvesting, Microwave and Optical Technology Letters, 60, 11, (2740-2748),(2014).
[11]. SUBRAMANIAM,Devakumaranetal.AStackedPlanarAntennawithSwitchableSmallGrid Pixel Structure for Directive High Beam Steering Broadside Radiation. International Journal of Engineering & Technology, [S.l.], v. 7, n. 2.5, p. 122-127, mar. 2018. ISSN2227-524X
[12]. S.A.Z.Murad,S.N.Mohyar,A.Harun,M.N.M.Yasin,I.S.IshakandR.Sapawi,"Lownoise figure 2.4 GHz down conversion CMOS mixer for wireless sensor network application," 2016 IEEE Student Conference on Research and Development (SCOReD), Kuala Lumpur, 2016, pp. 1-4.
[13]. Adam, I., Malek, M.F., Yasin, M.N., & Rahim, H.A. (2015). RF ENERGY HARVESTING WITHEFFICIENT MATCHINGTECHNIQUEFORLOWPOWERLEVELAPPLICATION.