Design of a Smart City Architecture Based on Internet of Things

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Abstract— **A proposed development of the internet in which everyday objects have network connectivity, allowing them to send and receive data. Smart city system which is a wide area, are separated by different application domains, which we use on our day to day life with an interlinked connection between the each & every things. In this paper i had proposed an automated smart parking system in which the arduino and the user application are connected by GSM were the parking spaces availability can be known and the pre-booking of the lot space can be made. So the user need not worry about the parking space availability.**

*Index Terms—***IOT, Arduino, GSM-GPRS module, parking, eclipse, mysql.**
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I. INTRODUCTION

The Internet of Things (IoT) is a computing concept that describes a future where everyday physical objects will be connected to the Internet and be able to identify themselves to other devices. It is significant because an object that can represent itself digitally becomes something greater than the object by itself. No longer does the object relate just to you, but is now connected to surrounding objects and database data. The Internet of Things extends internet connectivity beyond traditional devices like desktop and laptop computers, smart phones and tablets to a diverse range of devices and everyday things that utilize embedded technology to communicate and interact with the external environment, all via the Internet. As far as the reach of the Internet of Things, there are more than 12 billion devices that can currently connect to the Internet, and researchers at IDC estimate that by 2020 there will be 26 times more connected things than people.

Thus different devices can be connected to the IOT technology and monitoring also can be made easily with the help of the sensors which are available for all the fields which are used by the human being in our day to day life, other than that RFID, wifi, zigbee device are used, to connect these things and input these components arduino, raspebery pi, Intel gallilio etc are used to programming and connections. I proposed the smart parking technology for parking the car with intelligent parking

II. DEFINITION OF RELATED CONCEPTS

[A] IOT in automobile field:

Automobile filed is the one of major thing in which all the people will use as it has been an essential transportation medium. In the automobile the major thing is the parking, as day by day the population increases the usage of the vehicles are also increase in many numbers. So the parking lots has to be established in many and the parking may difficult when the vehicle enters the parking lot without knowing the available spaces, so I have proposed the automated parking lot system with the gsm based android application which helps to check the availability, book the parking space, safely and without any unavailability.

The basic concept of this paper is to implement the smart parking system which can reduce the time of the user and made them easy to make the parking without any disappointment of unavailable spaces through the pre enquiry of the parking spaces over the network connectivity. It uses the mobile application creation with the eclipse and java as front end and my sql server as the back end.

[B] Advantages of IOT in smart parking:

The following are the benefits of IOT on automated parking management:
1) Ease of use parking
2) Reduced time in booking parking
3) Network connectivity to the user
4) Low cost establishment
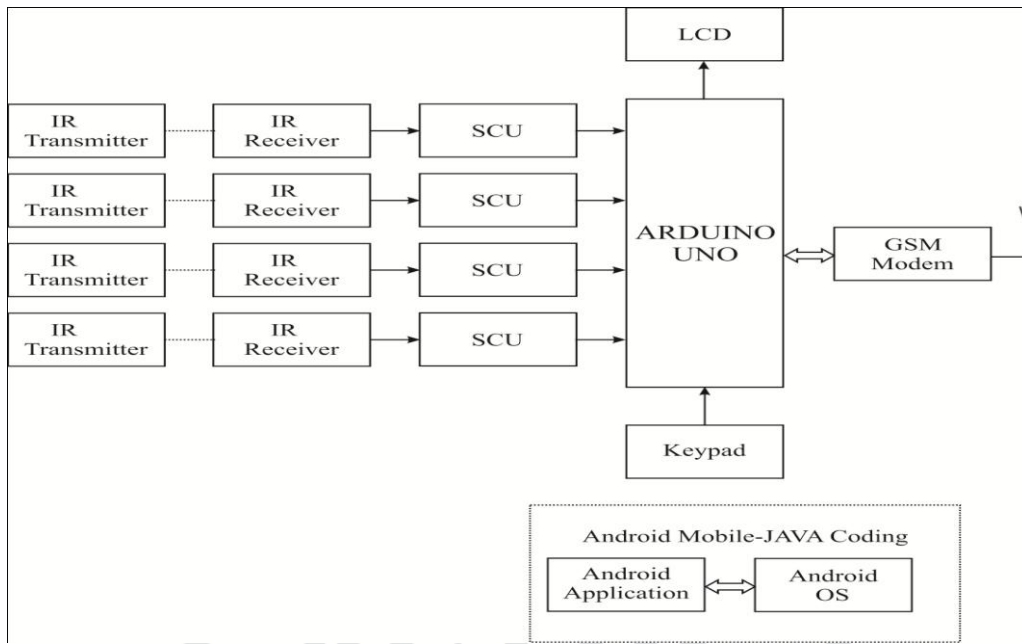5) Automated management system

[C] System diagram

FIGURE 1: System diagram

The automated parking which has been made was able to monitor the parking spaces and it uses mobile connectivity also which are made with IR transmitter and receivers which are connected to the system control unit for the power supply, arduino uno which connects all the gsm modem and lcd to monitoring the current status of the system. Arduino is used to programming the sensor actions, java is used for the mobile application development.
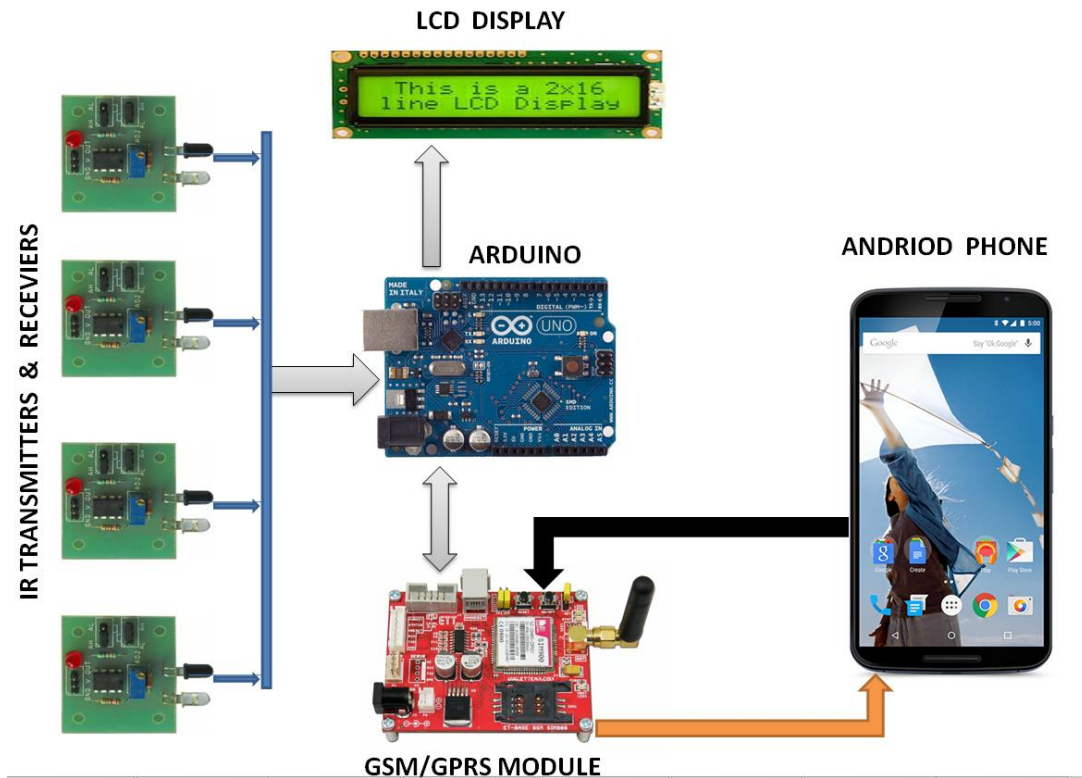
III. HARDWARE

FIGURE 2 : Block diagram of the system

The proposed hardware architecture of the automated smart parking system is shown in figure 2. It consist of the arduino uno, with the GSM/GPRS sim900a module as transceiver of the message sent from user android phone to the gsm module to book the parking space or lane in advance, Infra Red sensor is used to monitor on the car parking lane, lcd display which is attached to the arduino gives the live information of the parking environment with total number of the available spaces and spaces occupied .

[A] Infra Red sensor:

An Infra Red sensor (IR sensor) is an electronic device that measures infrared (IR) light radiating from objects in its field of view. Apparent motion is detected when an infrared source with one temperature, such as a human, passes in front of an infrared source with another temperature, such as a wall. All objects emit what is known as black body radiation. It is usually infrared radiation that is invisible to the human eye but can be detected by electronic devices designed for such a purpose.
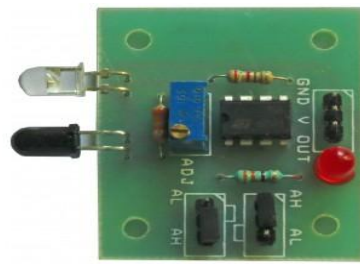

Infrared transmitter is one type of LED which emits infrared rays generally called as IR Transmitter. Similarly IR Receiver is used to receive the IR rays transmitted by the IR transmitter. One important point is both IR transmitter and receiver should be placed straight line to each other. The transmitted signal is given to IR transmitter whenever the signal is high, the IR transmitter LED is conducting it passes the IR rays to the receiver. When receiver receives the signal from the transmitter it resistance value is low. It resistance value become high when the signal was cut. By this sensor sense the value.
I had used the four IR sensor for the experimental purpose for small scale area with four parking lane , when the car enters and crosses the IR signal it will be shown as the parking space is occupied.

[B] Arduino UNO:

The Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

The Uno can be programmed with the Arduino Software (IDE). The ATmega328 on the Uno comes preprogrammed with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol .
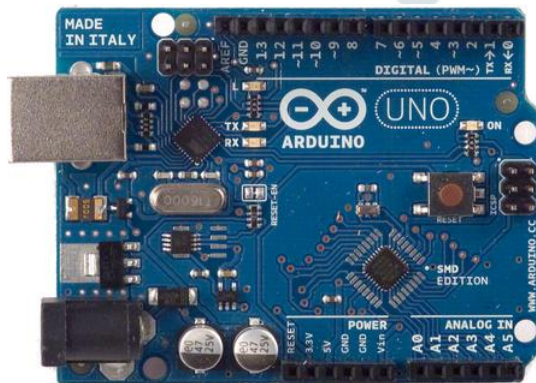
I have used the arduino for programming the IR sensor and transmission and reception of the signals through gsm/gprs module. It's also connected to the LCD display to show the current status of the parking spaces and if pre- registration is made by the user it will display the the place is waiting for parking.

[C] GSM/GPRS sim900 module:

GPRS module is a breakout board and minimum system of SIM900 Quad-band/SIM900A Dual-band GSM/GPRS module. It can communicate with controllers via AT commands (GSM 07.07 ,07.05 and SIMCOM enhanced AT Commands). It works on Quad-Band 850/ 900/ 1800/ 1900 MHz Dual-Band 900/ 1900 MHz with GPRS multi-slot class 10/8GPRS mobile station class B.
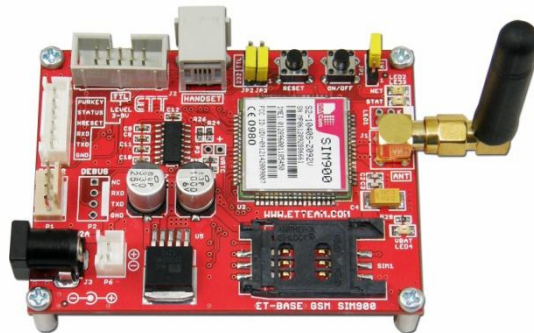
The connection from the arduino to the gsm module was made for the gsm connection to send and receive the message from the user and the parking management, The information is sent from the used android application to check the parking space availability & also to book the parking space if available. To make communication an GSM sim has to be inserted into the module for the information exchange over the network.

[D] LCD display:

LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical, easily programmable, have no limitation of displaying special & even custom characters , animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. The LCD will display the number of free space availability and other information which are sent from the user android application.

IV. SOFTWARE

[A] Eclipse

In computer programming, Eclipse is an integrated development environment (IDE). It contains a base workspace and an extensible plug-in system for customizing the environment. Eclipse is written mostly in Java and its primary use is for developing Java applications.

The Eclipse SDK includes the Eclipse Java development tools (JDT), offering an IDE with a built-in incremental Java compiler and a full model of the Java source files. This allows for advanced refactoring techniques and code analysis. The IDE also makes use of a workspace, in this case a set of metadata over a flat file space allowing external file modifications as long as the corresponding workspace "resource" is refreshed afterwards.

[B] MySQL

MySQL is offered under two different editions: the open source MySQL Community Server and the proprietary Enterprise Server. MySQL Enterprise Server is differentiated by a series of proprietary extensions which install as server plugins, but otherwise shares the version numbering system and is built from the same code base.

[C] Arduino IDE

Arduino IDE is use for programming in c/c++ language for the sensors and other external devices and components used in the arduino, its very easy to program with lesser knowledge.

V. CONCLUSION

IOT based automated smart parking system has been made successfully and the further improvement on the large scale parking   system is being developed , the automation of the parking system will monitor the parking and sends the data to the user with the help of the GSM network for the easy automated parking. The future development will be focused on the inter connection of multiple parking system and manage them automatically for the overall system monitoring and maintenance.

REFERENCES

[1] L. Atzori, A. Iera, and G. Morabito, "The internet of things: A survey,"Comput. Netw., vol. 54, no. 15, pp. 2787–2805, 2010.

[2] P. Bellavista, G. Cardone, A. Corradi, and L. Foschini, "Convergence of MANET and WSN in IoT urban scenarios," IEEE Sens. J., vol. 13, no. 10,pp. 3558–3567, Oct. 2013.

[3] M. Chen and T. Chang, "A Parking Guidance and Information System based on Wireless Sensor Network," in Proc. IEEE Int. Conf. Information and Automation, Shenzhen, China, 2011, pp. 601–605.

[4] S. Lee, D. Yoon, and A. Ghosh, "Intelligent Parking Lot ApplicationUsing Wireless Sensor Networks," in Proc. CTS 2008 Int. Symp. Collaborative Technologies and Systems, Irvine, USA, 2008, pp. 48–57.

[5] V. W. S. Tang. Y. Zheng, and J. Cao, "An Intelligent Car Park Management System based on Wireless Sensor Networks," in Proc. 2006 1st Int. Symp. Perva

[6] X.Li,W.Shu,M.Li,H.-Y.Huang,P.-E.Luo,andM.-Y.Wu,"Performance evaluation of vehicle-based mobile sensor networks for traffic monitoring," IEEE Trans. Veh. Technol., vol. 58, no. 4, pp. 1647–1653, May 2009.

[7] S. Lee, D. Yoon, and A. Ghosh, "Intelligent parking lot application using wireless sensor networks," in Proc. Int. Symp. Collab. Technol. Syst., Chicago, May 19–23, 2008, pp. 48–57.

[8] W. Kastner, G. Neugschwandtner, S. Soucek, and H. M. Newmann,"Communication systems for building automation and control," in Proc.IEEE, Jun. 2005, vol. 93, no. 6, pp. 1178–1203.