

SMART PARKING IN VEHICULAR ENVIRONMENTS USING ZIGBEE IEEE 802.15.4 AND RF TRANSMITTER

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Abstract: In this work we propose a smart parking technique in heavy traffic environments using ZigBee wireless transmission module. The major problem in transportation systems is that the controlling of the traffic in cross roads. Smart car parking technique finds a solution using the ZigBee technology. ZigBee technology is a low data rate, low power consumption, low cost; wireless networking protocol targeted towards automation and remote control applications. ZigBee, Depending on the RF (Radio Frequency) environment and the power output consumption required for a given application, and will operate in the RF. The power consumption and transition delay are the main advantages when compared to the other wireless technologies like WIFI, Blue tooth, etc...

Key words: Zigbee, smart parking, 8051, RF Module.

I. INTRODUCTION

With fast development of economy in India, the demand of electricity is higher and higher, and the problem between lag of construction of network and inadequacy of transmission capacity becomes increasingly prominent. A system for the intensive use of parking spaces proposed in [1]. It is an automated system based on monitoring the situation in parking places using a mobile camera set equipped with data storage and means for data transfer to the central database. The data is evaluated in a suitable GIS-based software according to parking rules. It is this evaluation that is a critical part of the whole system. In practice, there have been cases where a complaint was sent to municipal police on parking rules violation, which was not fully justified. Therefore, the further development of the described system will be aimed at improving the evaluation process in order to minimize unauthorized cases. Detailed information about the parking system is very well presented on the web or in the form of a smartphone application [1].

The system in [2] consists of hardware components and software modules which closely interact with each other. Using this system, drivers of cars can park quickly, and will save fuel, time and money. The experimental result shows very fast runtime and high success rate. This approach can save billions of wasted dollars in the US alone. The saved fuel, time and money can be reapplied in more productive places. By causality, it will help the environment as well. In this era of rapid urbanization, designing the city system modern and systematic by maintaining everything is a major challenge. Under the pressure

of increasing population, Dhaka is becoming tougher to change. Proposed solution is to keep the city parking system as a fully automated and additionally use garage management controllers system so that user can get parking facilities with the android application as well as without android application [3]. Proposed a new VANET-based smart parking scheme (SPARK) for large parking lots in [4]. With SPARK scheme, RSUs installed across a parking lot can surveil the whole parking lot, and provide three convenient services for drivers: 1) real-time parking navigation; 2) intelligent anti-theft protection; and 3) friendly parking information dissemination. In addition, the SPARK scheme also provides conditional privacy preservation for OBUs. Extensive simulations have also been conducted to demonstrate that the SPARK scheme can efficiently reduce the searching time delay for an available parking space, and subsequently save the fuels and driver's parking time. A wireless personal area network (WPAN) is meant to span a small area such as a private home or an individual workspace. It is used to communicate over a relatively short distance. The specification does not preclude longer ranges being achieved with the trade-off of a lower data rate [5][6].

In contrast to other network types, there is little to no need for infrastructure with a WPAN. Ad-hoc networking is one of the key concepts in WPANs. This allows devices to be part of the network temporarily; they can join and leave at will. This works well for mobile devices like PDAs, laptops and phones. Some of the protocols employing WPAN include Bluetooth, ZigBee, Ultra-wideband (UWB) and IrDA. Each of these is optimized for particular applications or domains. ZigBee, with its sleepy, battery-powered end devices, is a perfect fit for wireless sensors. Typical ZigBee application domains include: agricultural, building and industrial automation, home control, medical monitoring, security and, lest we take ourselves too seriously, toys, toys and more toys [5].

Wireless local area networks (WLANs) are meant to span a relatively small area, e.g., a house, a building, or a college campus. WLANs are becoming more prevalent as costs come down and standards improve. A WLAN can be an extension of a wired local area network (LAN), its access point connected to a LAN technology such as Ethernet. A popular protocol for WLAN is 802.11, also known as Wi-Fi. Among all of the wireless networks ZigBee gained It's renewed interest because of less complexity and usage of power.

The main problem in traffic areas is the parking the vehicles by searching an exact place to park the vehicle. The aim of this paper is to solve this problem in highly traffic affected areas. Equipping vehicles with various on-board sensors and implementing vehicle-to-vehicle (V2V) communication will allow for large-scale sensing, decision, and control actions in support of these goals. The parking process can be a straightforward and non-stop process. From the point of management's view, Smart Parking is an intelligent parking system. The parking process can be modeled as birth-death stochastic process and the prediction of revenues can be made [6].

II. PROPOSED SYSTEM

The smart vehicle parking is a tremendous technology in automobile field. Our proposed system is a smart vehicle parking using ZigBee module. The figure 1 shows the Proposed smart vehicle parking system.

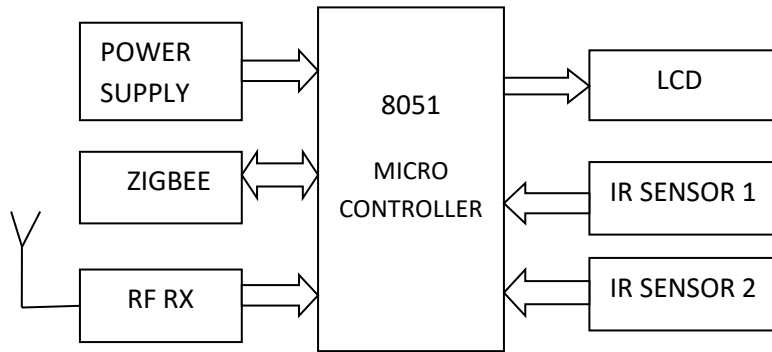


Figure 1 (a)

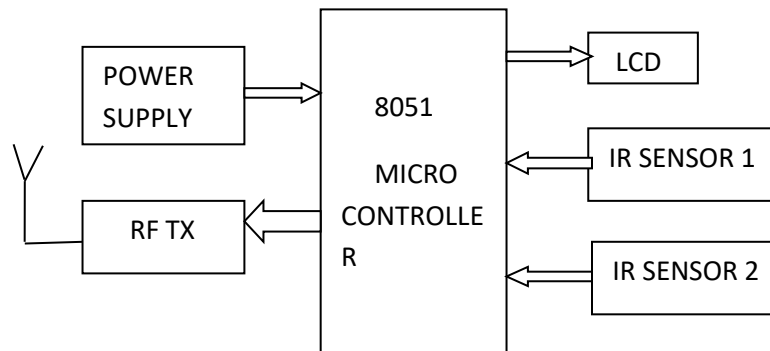


Figure 1(b)

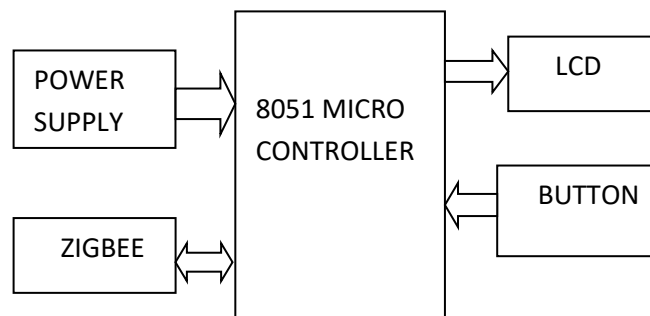


Figure 1(c)

The proposed system contains three modules which are shown in figure 1. The vehicle section shown in figure 1(c), contains a switch, ZIGBEE module and LCD. The vehicle section is kept in the vehicle, when the person in the vehicle wants to know the information about the free parking slots then he will press the button in the vehicle then a missed call goes to the ZIGBEE section in the first section shown in figure 1(a) about the free parking space from the ZIGBEE in the vehicle section. Then on receiving the message from vehicle section, the parking space for the vehicle whether it is empty or full is checked with IR sensors and sends an SMS to the vehicle section regarding the space. This is received by ZIGBEE and displayed on the LCD like section 1 is available. When section 1 is not empty then it takes the information about the second section using RF communication Shown in Figure 1 (b). We have RF TX in section 2 and RF RX in section 1. The information about the space in section 2 is continuously given to the RX section whether empty or full. If it is empty or full then this information is given to the vehicle section by section 1 using ZIGBEE.

III. 8051 MICRO CONTROLLER

Microcontroller manufacturers have been competing for a long time for attracting choosy customers and every couple of days a new chip with a higher operating frequency, more memory and upgraded A/D converters appeared on the market.

The whole story has its beginnings in the far 80s when Intel launched the first series of microcontrollers called the MCS 051. Even though these microcontrollers had quite modest features in comparison to the new ones, they conquered the world very soon and became a standard for what nowadays is called the microcontroller.

Besides, the software has been developed in great extend in the meantime, and it simply was not profitable to change anything in the microcontroller's basic core.

The 8051 microcontroller has nothing impressive in appearance:

- 4 Kb of ROM is not much at all.
- 128b of RAM (including SFRs) satisfies the user's basic needs.
- 4 ports having in total of 32 input/output lines are in most cases sufficient to make all necessary connections to peripheral environment.

The whole configuration is obviously thought of as to satisfy the needs of most programmers working on development of automation devices.

IV. ZIGBEE and IEEE802.15.4

ZigBee technology is a low data rate, low power consumption, low cost, wireless networking protocol targeted towards automation and remote control applications. IEEE 802.15.4 committee started working on a low data rate standard a short while later. Then the ZigBee Alliance and the IEEE decided to join forces and ZigBee is the commercial name for this technology ZigBee is expected to provide low cost and low power connectivity for equipment that needs battery life as long as several months to several years but does not require data transfer rates as high as those enabled by Bluetooth. In addition,

ZigBee can be implemented in mesh networks larger than is possible with Bluetooth. ZigBee compliant wireless devices are expected to transmit 10-100 meters, depending on the RF environment and the power output consumption required for a given application, and will operate in the RF worldwide (2.4GHz global, 915MHz Americas or 868 MHz Europe). The data rate is 250kbps at 2.4GHz, 40kbps at 915MHz and 20kbps at 868MHz. IEEE and ZigBee Alliance have been working closely to specify the entire protocol stack. IEEE 802.15.4 focuses on the specification of the lower two layers of the protocol(physical and data link layer). On the other hand, ZigBee Alliance aims to provide the upper layers of the protocol stack(from network to the application layer) for interoperable data networking, security services and a range of wireless home and building control solutions, provide interoperability compliance testing, marketing of the standard, advanced engineering for the evolution of the standard. This will assure consumers to buy products from different manufacturers with confidence that the products will work together. IEEE 802.15.4 is now detailing the specification of PHY and MAC by offering building blocks for different types of networking known as "star, mesh, and cluster tree". Network routing schemes are designed to ensure power conservation, and low latency through guaranteed time slots. A unique feature of ZigBee network layer is communication redundancy eliminating "single point of failure" in mesh networks. Key features of PHY include energy and link quality detection, clear channel assessment for improved coexistence with other wireless networks [7].



Figure 2 ZigBee module

V. RADIO FREQUENCY SIGNALS

Radio frequency communication signals are engineered to trade off efficient use of the electromagnetic (EM) spectrum with the complexity and performance of the RF hardware required to process them. The process of converting baseband (or low-frequency) information to RF is called modulation of which there are two types: analog and digital modulation. In analog modulation, the RF signal has a continuous range of values; in digital modulation, the output has a number of prescribed discrete states. There are just a few modulation schemes that achieve the optimum trade-offs of spectral

efficiency and ease of use with hardware complexity [8][9]. The figure 3 represents the hard ware modules of RF Transmitter and Receiver.



Figure 3 RF Transmitter and Receiver modules

VI. RESULTS

Figure 4 shows the kit photographs of the proposed system.





Figure 4. Kit Photographs.

VII. CONCLUSION

We have designed a smart car vehicle parking system using ZigBee 802.15.4, 8051 advanced micro controller and RF module. This architecture is faster and power consumption is very less than the other wireless technologies. This can implement in the future cars and can be avoid the traffic problems in the heavy parking areas like shopping malls, theatres, and etc.. other busy areas.

REFERENCES

- [1]. Pavel Kubíček 1, Dalibor Bartoněk 2,* , Jiří Bureš 2 and Otakar Švábenský 2 ,” Proposal of Technological GIS Support as Part of Resident Parking in Large Cities–Case Study, City of Brno”, Symmetry 2020, 12, 542;MPDI
- [2]. Siddharth Das, “A Novel Parking Management System, for Smart Cities, to save Fuel, Time, and Money”, 2019 IEEE 9th Annual Computing and Communication Workshop and Conference (CCWC)
- [3]. Samrat Kumar Dey, R. M. Rubayet Shamim, Md. Atiqul Islam, Md. Mahbubur Rahman, “ ParkEasy: An Embedded Model to Mitigate Car Parking Problems Using IoT Technology”, 1st International Conference on Advances in Science, Engineering and Robotics Technology (ICASERT 2019)
- [4]. R. Lu ; X. Lin ; H. Zhu ; X. Shen, “SPARK: A New VANET-based Smart Parking Scheme for Large Parking Lots”, IEEE INFOCOM 2009, 19-25 April 2009
- [5]. M.V.Vijaya Saradhi, S. Nagaraju “Development of a Low-Cost ZIGBEE and GSM SMS-Based Conductor Temperature and Sag Monitoring System”, International Journal of Engineering Science and Technology Vol. 2(4), 2010, 372-381
- [6]. “Dynamic C, an introduction to ZIGBEE” Digi International inc.

- [7]. Gwo-Jiun Horng, Chi-Hsuan Wang, and Sheng Tzong Cheng “Using Cellular Automata on Recommendation Mechanism for Smart Parking in Vehicular Environments” IEEE 2012.
- [8]. Sinem Coleri Ergen “ZIGBEE/802.15.4 SUMMARY”, 2004
- [9]. Steer Jobs, “Modulation, Transmitters and Receivers”, a text book.