ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 4, Issue 2, March 2015

Rotary Automated Car Parking System

Chandni Patel[#1], Monalisa Swami [#2], Priya Saxena [#3], Sejal Shah[#4]

Abstract —Lack of space availability has always been a problem in urban areas and major cities and to add to it there are cars parked callously on the streets that further limit the space. In order to handle the issue of parking in busy places various types of vehicle parking systems are used worldwide namely Multi-level Automated Car Parking, Automated Car Parking System, Volkswagen Car Parking[1] and many more. The present project work is aimed to develop a reduced working model of a car parking system for parking 6 to 24 cars within a parking area of 32.17 m². It is an amalgamation of the already developed parking systems with the added advantage of reduced space occupancy by the design of a simpler and compact parking system that is rotary and occupies vertical parking space. The chain and sprocket mechanism is used for driving the parking platform and a one fourth hp brake motor shall be implemented for powering the system and indexing the platform. The platform is fabricated to suit the working model. The procurement and manufactured items are in hand and are ready to be assembled with the structure. This model is further useful for various branches of engineering in order to develop different types of automations like PLC, micro controller and computerization. By testing and analyzing the working model we can definitely get the view to develop the parking lots at difficult and busy commercial places.

***Index Terms*— design automation, load modeling, Mechanical parking system, rotary parking system.**

I. INTRODUCTION

The Rotary Automated Car Parking System (RACPS) belongs to the class of rotary smart car parking systems. The traditional parking systems such as multilevel or multi-storey car parking systems (non-automated), robot car parking systems, automated multilevel car parking systems etc have been implemented on a huge scale. But these systems have a major disadvantage of large space consumption which is successfully eliminated with the use of a rotary car parking system [2]. Moreover, the latter provides the added benefits of flexible operation without the need of an attendant and added security and least chances of vehicle damage. Since the model makes use of composite parts, it is easy to assemble and dismantle and is thus more convenient than the traditional car parking systems. The rotary model is specifically designed to accommodate multiple cars in the horizontal space of two. The structure can accommodate six cars in the space of two and can even be customised to hold a greater number depending upon the requirements of the user and can be efficiently put to use in much space crunched areas. Parking spaces cannot cope with the growth of the number of vehicles. In many urban housing societies, the parking space ratio is 1:1. The vehicles parked randomly, cause the major problem faced in most of the metropolitan cities.

The basic structure of the RACPS can be described with the help of following block diagram. Fig.1 depicts the interconnection between the various subsystems of the project. Mechanical parking equipment is also called stereo garage. As compared to the existing parking arrangements, the most obvious advantage is maximum space utilization; it is safer and more convenient. The RACPS is totally automated with the user being given a unique ID corresponding to the trolley being allocated to him/her. This kind of equipment is useful to solve the issue of limited parking space available in busy cities.

Evidently, it can be seen that the number of private cars is increasing every year. Private garages, where only a single car can be housed at a time, do not provide a feasible solution to the problem since many families own more than one car. So the task was to design mechanical equipment that can store 6 cars in one normal garage. It is called a rotary parking shaft.

The idea is to park and move cars with no disturbance to the already parked cars in RACPS.

ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 4, Issue 2, March 2015

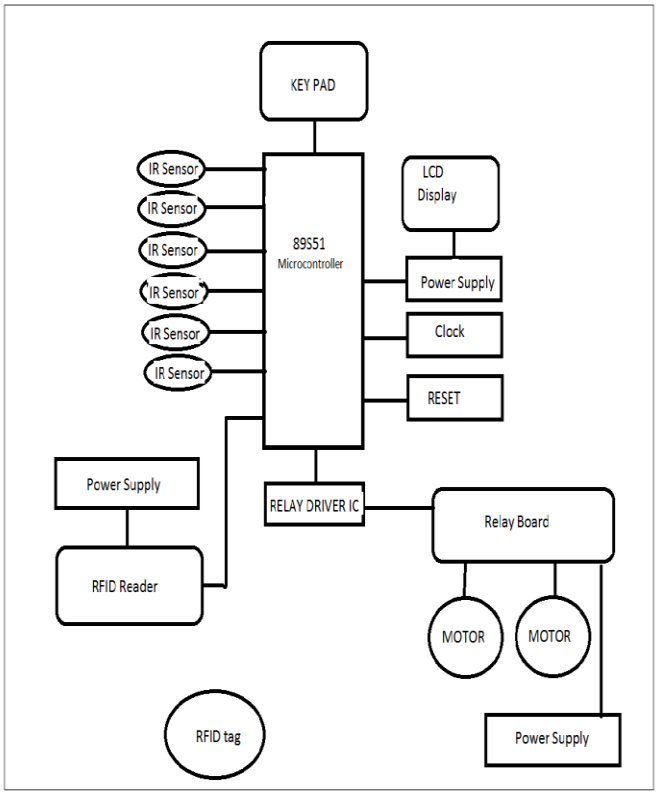

Fig 1. Block diagram of Rotary Automated car parking systems

II. POWER

In a RACPS the power used for functionality of different component are obtained by normal power supply circuit as shown Fig.2. The distribution of power is mainly done in two ways one is for main unit i.e. one is given to relay and other to RFID. This is done for ease of power distribution equally and necessarily in required areas.

There are many types of power supply. Most of them are used to convert high voltage AC mains electricity to the required low voltage supply for electronic circuits and other devices. The power supply system comprises of a series of blocks, with every block performing a different task in various stages. The transformer functions to step up or step down the input line voltage and isolates the power supply from the power line. The rectifier section is responsible for the conversion of the alternating current input signal to a pulsating direct current.

The smoothing block eliminates any unwanted spikes or harmonics present in the signal being applied to it. The final block, i.e., the regulator does just what its name implies. It helps maintain the output of the power supply at a constant level in spite of major changes in load current or input line voltages.

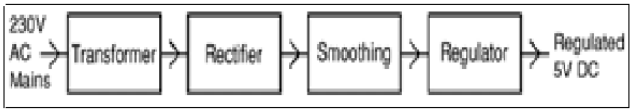

Fig.2 Regulated Power Supply System

III. LINEAR CONTROL SYSTEM

The linear control system controls the relay which directly has control on the motor. The trolley movement of parking is dependent on the movement of the motor shaft. This movement can be clockwise as well as anticlockwise in both the directions according to the users' requirement. Not only the relay operation but also the Radio Frequency Identification (RFID) controls the users' details and sensors ie. InfraRed Sensors are used

ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 4, Issue 2, March 2015

for getting the details of the trolleys ,i.e., whether it is occupied or not. All these systems are controlled by the microcontroller 89S51. All the details are then displayed on the LCD display.

The circuit diagram depicting the interconnection of the linear control system is as shown in Fig.3.

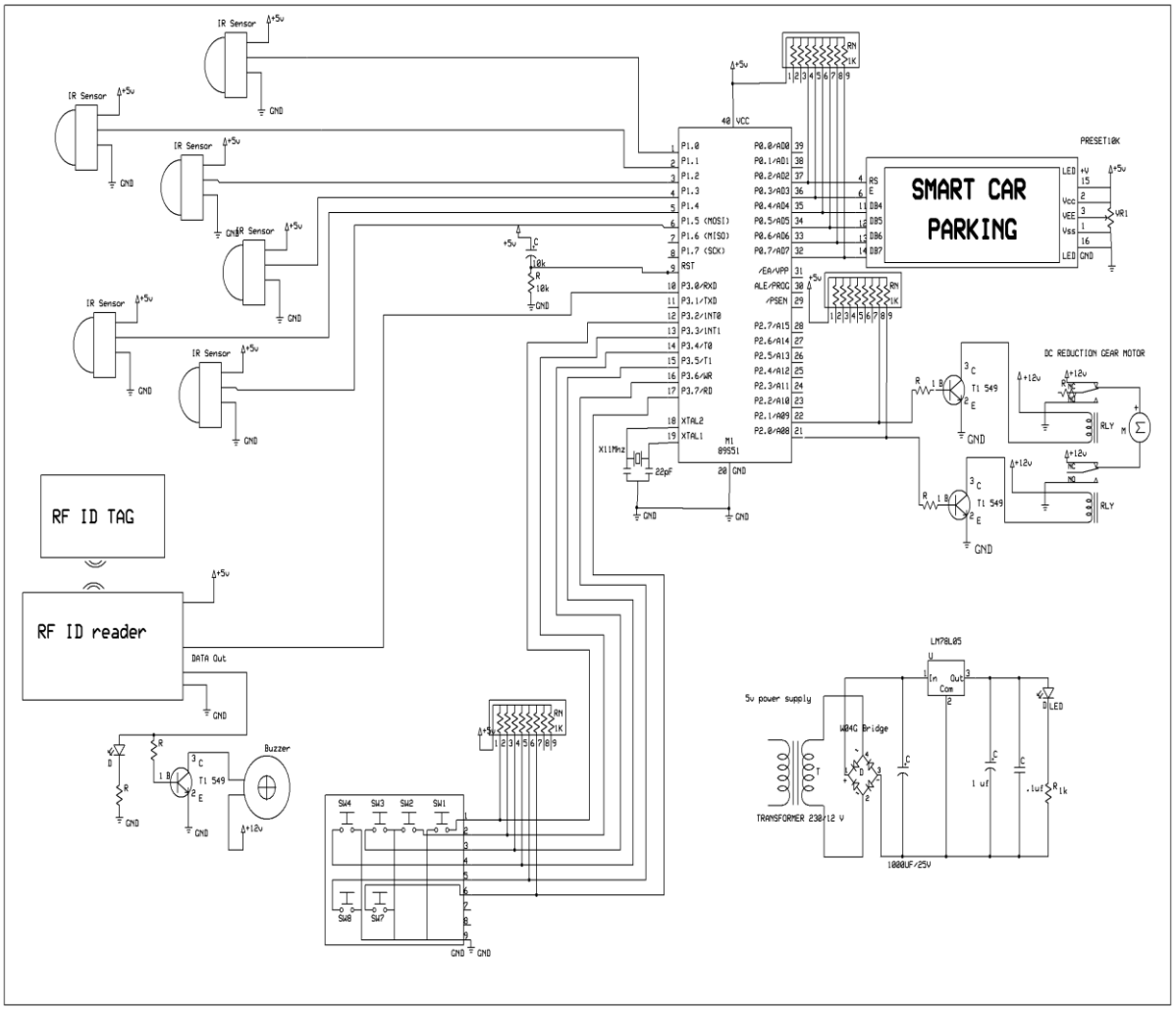

Fig.3: Linear Control System

[a] InfraRed (IR) Sensor

The schematic for an infrared sensor which allows one to detect an object's distance is as shown in Fig.4.

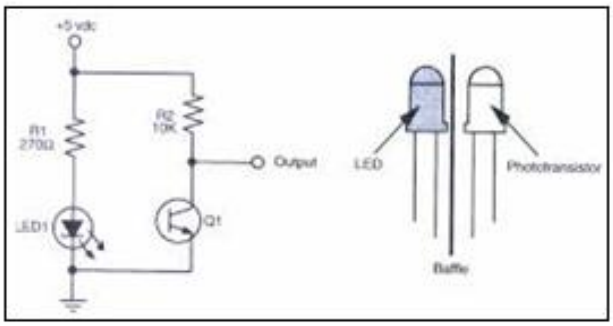

Fig.4: Infrared Sensor (Source: www.pages.drexel.edu)

ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 4, Issue 2, March 2015

Every trolley is fitted with a Light Emitting Diode (LED) and an IR sensor at the opposite ends on the inner side. This combination is used to check the status of the trolley, i.e., whether or not it is occupied.

[b] RFID Tag/Reader

RFID [18],[19] is an abbreviation for Radio Frequency Identification. An RFID system consists of two parts .i.e., a reader, and one or more transponders, which are also known as tags. RFID systems have evolved from barcode labels as a means to automatically identify and track products as well as people. In the RACPS, the user is assigned a unique ID corresponding to the specific trolley. This helps in quick identification and movement of the same.

[c] Microcontroller 89S51

The IC AT89S51[15] is a low-power, high-performance CMOS 8- bit microcontroller and has 4K bytes of in-system programmable flash memory. This chip is manufactured using Atmel's high-density non-volatile memory technology and it is compatible with the industry- standard 80C51 instruction set and pin out. The on-chip flash memory allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. Microcontroller 89S51 is preferred over 89C51 in this project due to the fact that the former requires 5V for its operation whereas the latter needs to be supplied with 12V.

[d] Relay Driver

There are 8 NPN Darlington pairs in this family of arrays and are ideally suited for interfacing between low logic level digital circuitry as well as the higher current or voltage requirements of relays, printer hammers or other similar loads for a broad range of applications in computers, industries and consumer applications. It features open–collector outputs and free-wheeling clamp diodes for transient suppression.

[e] LM7805 Series Voltage Regulators

A voltage regulator[20] is an electrical device designed to automatically maintain constant voltage levels in a circuit. It makes use of an electromechanical mechanism or passive or active electronic components. Based on the design, it may be used for the regulation of one or more AC or DC voltages. Except the shunt regulators, all voltage regulators operate by first comparing the actual output voltage with some internal fixed reference voltage. The difference, if any, is amplified and used to control the regulation element. This will form a negative feedback servo control loop. If the output voltage is very low, the regulating element is commanded to produce a higher voltage. If the output voltage is very high, the regulating element is commanded to produce a lower voltage. In this way, the output voltage is maintained roughly constant.

IV. SOFTWARE

The software is responsible for taking into consideration the sensor data and give the required output signal to the linear control system. For this, we require an action perception loop, sensor polling and controlling movement. We have selected microcontroller 89S51 and the code for it is written in Embedded Basic language. The programming of the microcontroller has been accomplished by using the "Bascom Compiler" (BC) software. It has been designed to execute codes on W95/W98/NT/W2000/XP versions and Vista. The Embedded Basic language code has been successfully executed and programmed into the microcontroller IC 89S51.The BC is structured basic with labels. It supports structured programming with if-then-else-end if, do-loop, while-when, select- case. Variables and labels in BC can be as long as 32 characters. Bit, Byte, Integer, Word, Long, Single and String variables. Processors. The Compiled programs work with any 8051 microcontroller such as AT89C1051, AT89C2051, 8031, 8032, 8051, 8052, 80552, 80535 and 80537.There are special commands for LCD-displays, I2C chips and 1WIRE chips. BC has integrated terminal emulator with download option .Integrated simulator for testing .It is integrated flash programmer and also supports SPI, PG2051, PG302, SE512, SE514, TAFE and many more. It is context sensitive. For compatibility with BASCOM LT.

To make a program takes just a few steps

- Write the program in BASIC.
- Compile it to fast machine binary code.

ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 4, Issue 2, March 2015

- Test the result with the integrated simulator (with additional hardware you can simulate the hardware too).
- Program the chip with one of the integrated programmers (hardware must be purchased separately).

V. MECHANICAL ASSEMBLY

Although the construction of this system seems to be easy, it will be difficult to understand without the knowledge of materials [4], chains, sprockets, bearings, machining operations[4], kinematic and dynamic mechanisms. The rotary model [3] or the parking lot will be as shown in the figure. All the calculations are done and accordingly each and every part of the parking system is bought into reality.

Fig.5: Mechanical assembly (Source:www.ecvv.com)

VI. ASSEMBLY OF PARKING SYSTEM

For designing the parking system proper views of the design were made. Top, Front and Side views are made, as shown below, according to the model of Rotary Automated Parking.

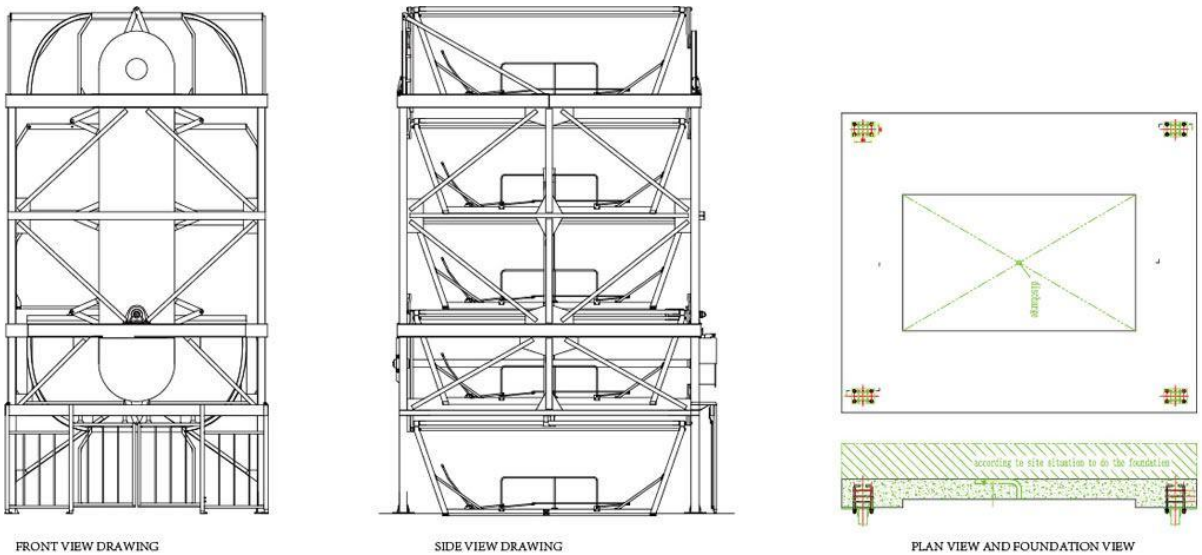

Fig. 6: Front view, side view and plan view of the RACPS (Source: www.asiaparking.co)

ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 4, Issue 2, March 2015

VII.FEATURES

- It ensures quick and automated parking and easy retrieval of vehicles.
- Up to 6 cars can be easily and safely parked in the designed model.
- The surface space required is equivalent to the parking space of two cars only.
- Most suitable for parking in offices, malls and similar places .
- The RACPS is engineered to ensure driver safety by use of an electronic safety zone.
- Low maintenance levels are required by the system.
- Does not require any parking attendant.
- It can be easily constructed in a small area, just requiring a simple concrete base and 3 phase electricity.

VIII. CONCLUSION

The RACPS has been designed and all the composite parts in it have been manufactured and assembled. Analysis of the model has to be done while developing a life size model. The mechanical model has been designed and the software as well as the control circuit has been implemented successfully. It demonstrates the working of the planned rotary parking system. The size and number of trolleys can be customized according to the needs and capacity of the organization or garage space availability.

VIII. FUTURE ENHANCEMENT

The RACPS can be installed with a safety installation such as, whenever there is human movement in the system, the rotation of the system should be immediately stopped. The platforms can also be equipped with safety sensors guiding the movement of vehicles in the platforms. Moreover, the model can be programmed in such a way that the trolleys traverse the minimum possible distance during parking as well as the retrieval of the vehicle.

ACKNOWLEDGMENT

The authors wish to acknowledge the assistance and support of Mrs. Sejal Shah, Assistant Professor, K.J Somaiya Institute of Engineering and IT (K.J.S.I.E.I.T). Also, Mrs. Vrinda Ulhas, HOD, Department of Electronics, K.J.S.I.E.I.T, for her able guidance and suggestions. Last but not the least, K.J.S.I.E.I.T, for providing us the right environment and necessary equipment that was crucial for the completion of this project.

REFERENCES

[1] M Childs, "Parking Spaces; A Design, Implementation and Use Manual for Architects Planners and Engineers" McGraw-Hill, 2009.

[2] D Y Park, "Vertical Rotary Parking" http://www. freepatentsonline.com/y2004/0156699.html (accessed on 11 November, 2010).

[3] H Hwang, S Lee, "Expected Service Time Model for A Rotary Parking System", Computer Industrial Engineering, vol 35, pp 559-562, 1998. (Pubitemid 128674778).

[4] F. B. Beer, E. R. Johnston Jr., "Mechanics of Material, Second Edition", McGraw-Hill, pp 701, s1992.

[5] R. Cabrera-Cosetl, M. Z. Mora-Alvarez, and R. Alejos- Palomares," Self-Parking System Based in a Fuzzy Logic Approach," in Electrical, Communications, and Computers, Conielecomp 2009. International Conference on, 2009, pp. 119- 124.

[6] Z. L. Wang, C. H. Yang, and T. Y. Guo, "The design of an autonomous parallel parking neuro-fuzzy controller for a car-like mobile robot," in Proceedings of the SICE Annual Conference, Taipei, 2010, pp. 2593-2599.

[7] Norazwinawati Basharuddin by R.K.Jain, R. Yusnita Fariza Norbaya, "Intelligent Parking space detection system based on image Processing", International Journal of Innovation, Management and Technology, vol. 3, no. 3, pp. 232-253.

[8] M.A.R. Sarkar, A.A. Rokoni, M.O. Reza, M.F. Ismail, "Smart Parking system with image processing facility", I.J. Intelligent Systems and Applications, 2012, vol. 3, pp. 41-47.

[9] International Symposium on V.W. S. Tang, Y. Zheng, Sensor Networks," Proceedings of the 1st and J. Cao, "An Intelligent Car Park Management System based on Wireless Pervasive Computing and Applications, pp. 65-70, Aug 2006.

ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 4, Issue 2, March 2015

[10] N. True. "Vacant parking space detection in static images". University of California, San Diego, 2007.

[11] Jermsurawong J., Ahsan, M., et al. (2012) "Car Parking Vacancy Detection and Its Application in 24-Hour Statistical Analysis." 10th International Conference on Frontiers of Information Technology, Islamabad, 17-19 December 2012, 84-90.

[12] P. Vijay Kumar and Siddarth T.S, Asst. Prof. (Sr.G) ECE Department, SRM University, Chennai, India, (2008) "A Prototype Parking System using Wireless Sensor Networks" International Journal of Power Control Signal and Computation (IJPCSC) Vol. 1 No. 4 ISSN : 0976-268X (pp 1-10).

[13] Jae KyuSuhr · Ho Gi Jung · Kwang hyuk Bae Jaihie Kim (2010) "Automatic free parking space detection by using motion stereo-based 3D reconstruction",: Machine Vision and Applications 21: 163–176DOI10.1007/s00138-008-0156-9.

[14] Pijush Kanti Babu,Kousik MandalJatindra Bimal Mukherjee, (2006) "Coin Operated Automatic Car Parking System", A note on car parking. (pp 1, 2, 6).

[15] Muhamad Ali Maizidi," Microcontroller & Embedded system." Edition 2nd, 2010.

[16] [BOO+06] J. P. Benson, T. O'Donovan, P. O'Sullivan, U. Roedig, and C. Sreenan. "Car-park management using wireless sensor networks". In Proceedings of 31st IEEE Conf. Local Computer Networks, pages 588-595, Tampa, 2006.

[17] R. Charette, "Smart Parking Systems Make It Easier to Find a Parking Space," http://spectrum.ieee.org/green-tech/advanced-cars/smart-parkingsystems-make-it-easier-to-find-a-parking-space/0, 2007.

[18] Manish Bhuptani, Shahram Moradpour, "RFID Field Guide –" Deploying Radio Frequency Identification System" by Sun Micro system Press, A Prentice Hall Title, Myrna Rivera, USA, Feb 2005.

[19] Rajeet Chatterjee, Philip Wolfe, "Evaluation of using RFID Passive Tags for monitoring product location/ownership", Jan 22 .

[20] C.B. Gray, "Electrical Machines and Drive System" Synchronous machines pp 264-295, 1989.

AUTHOR BIOGRAPHY

1. Chandni Patel

Chandni Patel is currently studying in the final year in the Electronics Engineering Department of K.J.S.I.E.I.T.

2. Monalisa Swami

Monalisa Swami is currently studying in the final year in the Electronics Engineering Department of K.J.S.I.E.I.T.

ISSN: 2319-5967
ISO 9001:2008 Certified
International Journal of Engineering Science and Innovative Technology (IJESIT)
Volume 4, Issue 2, March 2015

3. Priya Saxena

Priya Saxena is currently studying in the final year in the Electronics Engineering Department of K.J.S.I.E.I.T.

4. Prof. Sejal Shah

Prof. Sejal Shah is an Assistant Professor in Electronics Engineering Department of K.J.S.I.E.I.T. She has completed her M.E. (Electronics) in 2012 from Mumbai University. She has 2 international journal publications to her name in the field of Speaker Recognition. Her area of interest is Digital Signal Processing and Embedded Systems.