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Cellphone Based Interactive Voice Response System for College Students

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***Abstract*— The Interactive Voice Response System (IVRS) is an interaction between people who want to use IVR system and computer database by connecting the cellphone network with the computer database. The cellphone user can access the information from anywhere at any time simply by dialing a specified IVRS service number and following an instruction when a connection has been established between caller and IVRS service number. The ring detector circuitry detects caller and connects caller to computer. The caller gives input in the form of dual tone multi frequency signal, which is obtained when a caller presses a key from their cellphone set. According to the entered response from the caller when the connection is established, computer generates voice response. Voice response is generated dynamically according to the input from caller. As caller enters valid response the corresponding database is converted into voice format by "Text to Speech converter" which is inbuilt in computer with Operating System of the computer. The IVRS system comprises of ring detector circuitry, DTMF decoder section, AVR microcontroller, serial interface unit, computer and cellphone.Using IVR system user gets information about requested student in the form of voice simply by dialing the IVR system service number provided by college authority.**

***Index Terms*— Ring detector, Dual Tone Multi Frequency, AVR Microcontroller.**

I. INTRODUCTION

Interactive voice response (IVR) is an interaction between the caller and the computer provided with voice responses by the computer according to the caller response. IVRS uses ring detector circuitry for detecting and connecting the caller to the computer. The DTMF signal from the caller is provided from the caller's cellphone keypad [5]. Caller can access the information from anywhere at any time simply by dialing a specified IVRS number and following voice response according to user input. The input will be given by in form of dual tone multi- frequency signal, which is generated when a caller presses a key from keypad of a cellphone set. The voice responses to the caller are provided when the caller gets connected to the computer. Voice response is generated dynamically according to the caller's DTMF signal from caller's cellphone.

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IVRS allows caller or users i.e. parents to interact with a college host system via a cellphone, after which they can get service their own inquiries by following the IVR dialogue.

IVR systems can respond with dynamically generated audio to further direct users on how to proceed.

A. Cellphone

Cellphone (of specified contact number) used is acts host connecting device communicate caller with computer.

B. Ring detector circuitry

Ring detector unit detects the presence of incoming calls. Make incoming call compatible with microcontroller to connect the callers with the computer.

C. DTMF decoder

Dual-tone multi-frequency (DTMF) is an international signaling standard for cellphone digits. A DTMF signal consists of two superimposed sinusoidal waveforms whose frequencies are chosen from a set of eight standardized frequencies [3][8].

D. Microcontroller

Microcontroller is AVR microcontroller which plays very important role in overall process. Ring detector output signal and DTMF output BCD signal will be microcontroller input according to which it processes further.

The IVR system uses dynamically computer generated voice responses to provide information in response to an input from a caller's cellphone keypad. In this system, the voice response is generated dynamically by the computer using "text to speech" converter which is inbuilt along with the operating system of computer.

II. LITERATURE SURVEY

Research in speech technology predated the advent of digital computers. It starts with a speech synthesis project at Bell Labs in 1936 that resulted in a device called "the Voder" which was demonstrated at the 1939 World's Fair.Connection between speech and mathematics resulted in a breakthrough in the early 1970's [5]. Leonard E. Baum, and Lloyd R. Welch, developed an approach to recognition based on a statistical concept called the Hidden Markov Model. Bell System in 1961 developed a new tone dialing methodology. Bell unveiled the first telephone that could dial area codes using DTMF technology at the Seattle World Fair in 1962.Dual tone multi frequency telephones allowed the use of in band signaling. They transmit audible tones in the same 300

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Hz to 3.4 kHz range occupied by the human voice [2]. The blueprint for IVRS was born [6].

Despite the increase in deployment of IVR technology in the 1970's the technology was still complex and expensive to automate tasks in call centers. Early voice response systems were DSP technology based, and was limited to small vocabularies. In the early 1980's a first mainstream market competitor emerged when Leon Ferber (Perception Technology) realized that hard drive technology (read/write random-access to digitized voice data) had finally reached a cost effective point [6]. A system could play the appropriate spoken message, and process the human's dual tone multi frequency response.

A DTMF signal consists of two superimposed sinusoidal waveforms whose frequencies are chosen from a set of eight standardized frequencies [4]. For example, by pressing the button on the touch-tone telephone keypad, a signal consisting of a row frequency in Hz sinusoid and a column frequency in Hz sinusoid is produced. A DTMF detector ables to detect these frequencies in the presence of noise, and determines which button is pressed [4].

The AVR is a modified Harvard architecture 8-bit RISC single chip microcontroller which was developed by Atmel in 1996[7]. The AVR was one of the first microcontroller families to use on-chip flash memory for program storage which were opposed to One Time Programmable ROM, EPROM, or EEPROM used by other microcontrollers at the time [7].Atmega AVR microcontroller chips became very popular after they were designed into the 8-bit Arduino platform.

The AVR architecture was conceived by two students at the Norwegian Institute of Technology (NTH) Alf-Egil Bogen and Vegard Wollan.The original AVR microcontroller was developed at a local ASIC house in Trondheim, Norway known as Nordic VLSI technology at the time, now Nordic Semiconductor, where Bogen and Wollan were working as students [7]. It was termed as a Micro RISC and was available as silicon IP/building block from Nordic VLSI. Internal architecture were further developed by Bogen and Wollan at Atmel Norway, a subsidiary of Atmel, when the technology was sold to Atmel from Nordic VLSI,. The designers worked closely with compiler writers at IAR Systems to ensure that the instruction set provided for more efficient compilation of high level languages. Atmel says that the name AVR does not stand for anything in particular. The creator of the AVR does not given suitable answer as to what the term AVR stands for. But it is commonly accepted that AVR stands for Alf (Egil Bogen) and Vegard (Wollan)'s RISC processor. Note that the use of "AVR" in this article generally refers to the 8-bit RISC line of Atmel AVR microcontrollers [7].

III. PROPOSED SYSTEM

Fig -1: Proposed IVRS System

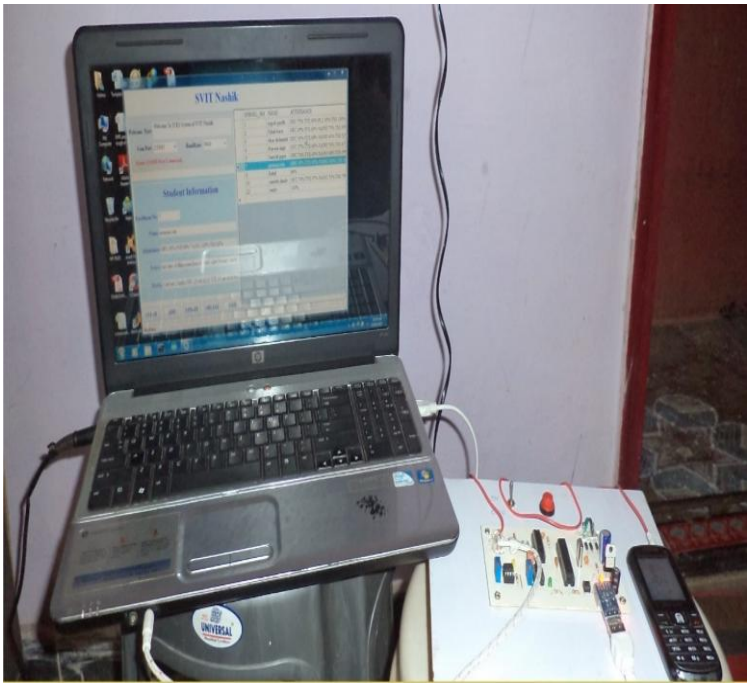

Fig -2: Implemented IVRS System

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A. Block diagram Interactive Voice Response system

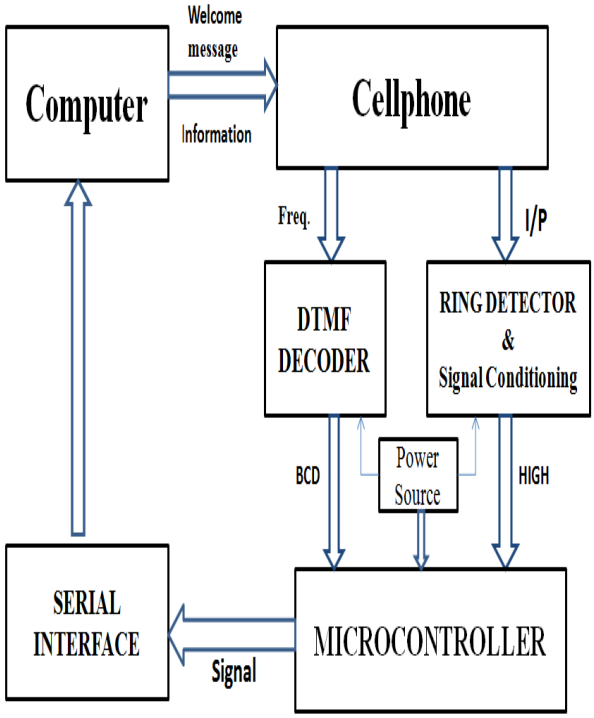

Fig -3: IVRS block diagram

B. IVRS Explanation

- *Cellphone Unit*

Cellphone is used for communication purpose. This cellphone has specified contact number using which caller can communicate with college host [1]. An input mechanism to allow the caller to interact with the phone.GSM feature phones require a small microchip called Subscriber Identity Module or SIM card.

- *Ring Detector Circuitory*

Ring Detector detects the presence of incoming calls. It also carries signal conditioning for compatibility with microcontroller for connecting caller to the computer. Using Ring detector unit caller get connected to the computer with the help of microcontroller.

- *DTMF detector*

It converts the DTMF tones into the BCD data.

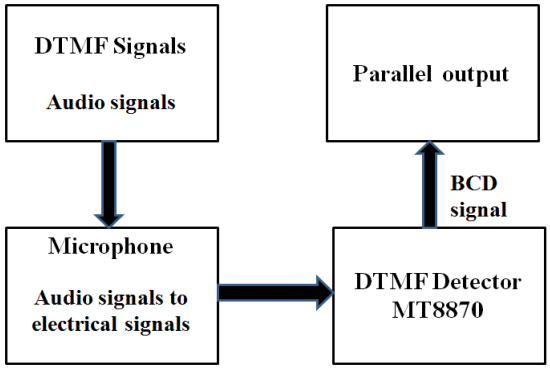

Fig -4: DTMF Block diagram

The architecture of DTMF Detector contains band split filter section, which separates high and low group tones followed by digital counting section which verifies frequency and duration of the received tones before sending the corresponding code to the output bus [3]. Pressing a single key will send a sinusoidal tone for each of the two frequencies (row and column frequency) [8].

DTMF Keypad Frequencies				
	1209Hz	**1336Hz**	**1477Hz**	**1633Hz**
697Hz	1	2	3	A
770Hz	4	5	6	B
852Hz	7	8	9	C
941Hz	*	0	#	D

Fig -5: Frequency structure for corresponding key

- *AVR Microcontroller*

It accepts the BCD signal, process them and transmit them serially to the computer. The Microcontroller is the component which controls hardware of the system [2].

The ATmega8 is a low-power CMOS 8-bit microcontroller based on the AVR RISC architecture [7]. By executing powerful instructions in a single clock cycle, the AVR achieves throughputs approaching 1 MIPS/ MHz, allowing the system developed to optimize power consumption versus processing speed [7]. As the caller is connect to computer, response to caller should be very fast this requirement is overcome by AVR so we are using AVR since it has high execution speed as compared to other microcontroller.

- *Serial interface*

Serial interface provide the serial interface from microcontroller to computer. The communication of the USB device is dependent on pipes. A pipe is a connection from the host controller to a logical point, found on a device, and named an endpoint.

- *Computer*

It contains the database. The database is accordingly referenced and the necessary information is obtained and provides to caller in the form of voice.

- *Text to speech converter*

A text-to-speech (TTS) system converts normal language text into speech; other systems render symbolic linguistic representations like phonetic transcriptions into speech [1][2].

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C. IVRS Flow chart

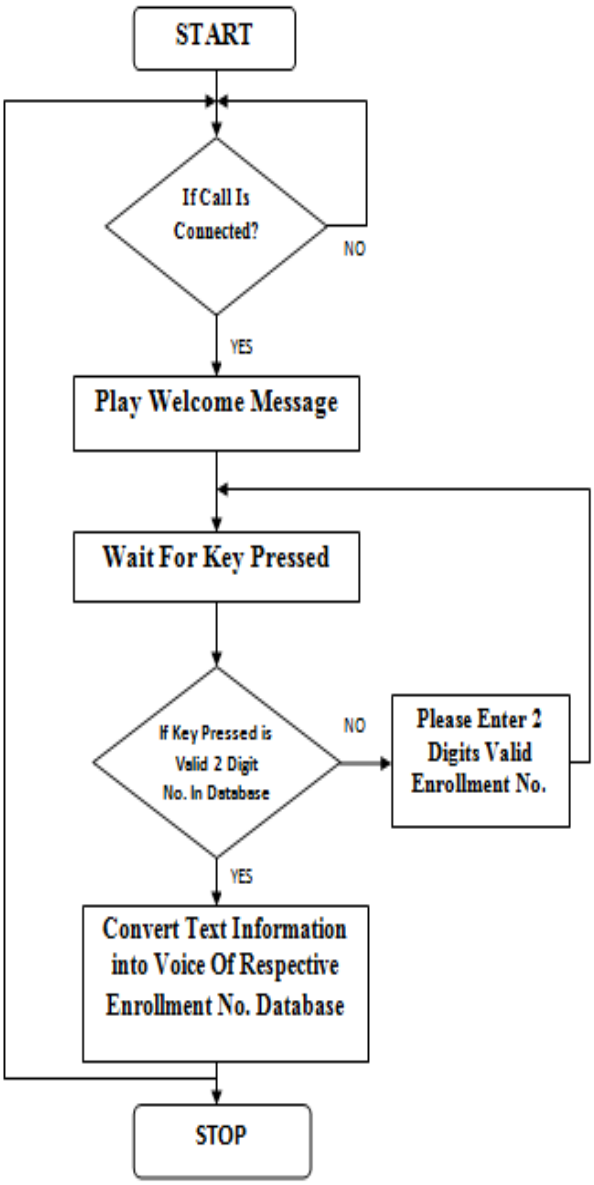

Fig -6: IVRS Flow Chart

D. IVRS Working

- When user wants to access IVR system, he/she simply dials IVRS service number.
- Ring detector circuitry detects the call; it will signal conditioning the incoming signal and feed to the microcontroller unit for connection establishment i.e. to connect with the computer.
- The connection is established by sending HIGH signal at microcontroller unit input.
- Microcontroller unit will then send a signal to computer for connecting caller to the computer.
- As caller is connected to computer, computer will greet or send a welcome message in the form of voice to the caller.
- Computer requests (in the form of voice) the caller for valid enrollment number.
- The caller enters the enrollment number by pressing keys of caller cellphone keypad.
- DTMF (Dual Tone Multi Frequency) decoder detects the tone frequency.
- The DTMF decoder circuit will convert DTMF tone to the BCD equivalent.
- BCD signal from DTMF Decoder output applied as input for microcontroller unit.
- Microcontroller accept BCD signal, process them and transmit them serially to computer.
- Database in computer for entered enrolment number student is verified accordingly.
- If user enters an invalid enrolment number, computer requests (in the form of voice) for valid enrolment number.
- If entered enrollment number is verified and found valid, then corresponding information is made available for inbuilt text to speech (TTS) system which is along with operating system of the computer.
- TTS system provides text analysis, linguistic analysis and wave form generation and converts into speech.
- Required database of requested enrolment number of the student is provided to the user in the form of voice and call is disconnected.

IV. HARDWARE AND SOFTWARE REQUIREMENT

A. Hardware used in system

- Laptop or Computer.
- Cellphone .
- Ring detector circuitry.
- DTMF detector.
- AVR Microcontroller.
- 5V Power supplys.

B. Software used in system

- IVRS software window using .net software.
- Arduino 1.015 version software.
- Text to speech synthesizer. (inbuilt with operating system)

V. APPLICATION OF IVRS

- *In educational institutes*

With IVR system parents and student as well can use this system to know students academics progresses, notice, etc.

- *In banking*

With the use of IVRS bank customers came to know about balance availability and any queries related to customers wish.

- *In Railway enquiry*

Using these system users knows train related enquiries and queries.

- *In Bus enquiry.*

- *In customer care services.*

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VI. ADVANTAGES AND DISADVANTAGES

A. *Advantages*

- IVRS is user friendly system can be access easily.
- IVRS is cost effective system.
- As system providing automatic voice response according to input it reduces human resource cost.
- With IVRS database can be secured as there is no use internet so no chances of hackers.
- This system can be available for 24 hours.
- System can be portable.
- It reduces human efforts for knowing bus, railway etc enquiry.

B. *Disadvantages*

- System provides service to single user at a time.
- System responds according to inbuilt voice response in computer which comes with operating system.
- As database limit for enrollment number is of 2 digit enrollment numbers, then user is supposed to enter 2 digit enrollment numbers. (E.g. for enrollment number "1"user is supposed to enter "01".)

VII. GOAL OF PROJECT

Our project allows the caller to know the student's academic status such as semester performance, academic progress, detention status, marks, oral/ practical Schedule, fees installment Paid/Due status of the student quickly through a single by the cellphone without the intention of the college authority. The hardware used in system includes ring detector circuitry, DTMF decoder section, microcontroller unit, serial interface unit, computer etc. It will be very useful to the parents to know the performance of their son/daughter in the college. The key feature of our system is that no requirement of college authority to receive calls, as we have used Ring Detector circuitry which detects incoming call and connects them automatically to the IVR system. As call is accepted automatically this reduces human authority efforts.

VIII. RESULT

By using this IVR system user/caller comes to know that academic status of particular student through a single call to IVR system service number and responds in the form of voice. Now days peoples are too much busy in their work it is not possible to visit college every time, so that using this system they come to know academic status of the student. Using this system whatever database for particular students responds in the form of voice.

IX. PURPOSE OF OUR IMPLEMENTED SYSTEM

The implemented system proves to be quite useful for the people livening in rural areas. Further there is no need of any an internet connection. It can be used by people who wish to get updated about the information on a daily basis. The implemented system uses auto answer mode to attend the incoming calls and hence there is no need of any human efforts. This system uses mobile network and hence it is not complex.

X. CONCLUSION

The implemented system is very beneficial to the user, to know the status of student in the form voice. Using this IVR system user gets information through a single call to the IVR system.

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