International Journal For Technological Research In Engineering
Volume 3, Issue 8, April-2016 *ISSN (Online): 2347 - 4718*

A FRAMEWORK ON BODY AREA NETWORK BASED AUTOMATED BANK TELLER MACHINE

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Abstract: This project proposes RedTacton based smart security for ATM system. RedTacton is a Human Area Networking technology that uses human body as a safe high speed network transmission path. RedTacton uses minute electric field on the surface of the human body as a medium for transmitting the data. A transmission path is formed at the moment a part of human body comes in contact with RedTacton transceiver. RedTacton transmitter consists of a DTMF encoder which generates both valid and invalid signals and can be transmitted through human body to RedTacton receiver (DTMF receiver) for further processing. In order to enhance the security for ATM cards, RedTacton based smart security card is presented.Here, the human body acts as a transmission medium supporting half duplex communication at 10Mbit/s.
Keywords: Body Area Networks, RedTacton, LPC 2148, DTMF, voice recording.

I. INTRODUCTION

So many technologies for networking are known and are in use. These technologies connect people, objects and other networks together so as to share data and thus make information ready for access. Now a day's electronic devices become smaller and lower in power Requirements, and they are less expensive. We have begun to adorn our bodies with personal information and communication appliances. Such devices include cellular phones, pagers and personal digital assistants and many more. But currently there is no such method for these kinds of devices to share data. Networking these kinds of devices can reduce functional I/O redundancies and allow new Conveniences and services. Human society is entering an era of modern computing, when networks are smoothly interconnected. The implementation of ubiquitous services requires three levels of connectivity: Local Area Networks (LAN), Wide Area Networks (WAN), and Body Area Networks (BAN) for connectivity to personal information, share data, media and communication appliances within the much smaller areas for communication. BAN is a technology that uses the surface of the human body as a high speed and safe network transmission path. In this project explains the unique new functional features and enormous potential of Body Area Networking technology in Automated bank teller machine. Here, the human body acts as a transmission medium supporting half duplex communication at 10Mbit/s. The objective of this project is to give a better security system to transmit a data via body. Since there is no problem of hackers as our body itself acts as transmission medium and can be used more in the fields where there is a need to upgrade the security in times of high theft rate.

II. DESIGN METHODOLOGY

RedTacton is a Human Area Networking technology, which is developed by Robin Gaur Jind that uses the surface of the human body as a safe, high speed network transmission path. It is completely distinct from wireless and infrared technologies as it uses the minute electric field emitted on the surface of the human body. A transmission path is formed at the moment a part of the human body comes in contact with a RedTacton transceiver. Communication is possible using anybody surfaces, such as the hands, fingers, arms, feet, face, legs or torso. RedTacton works through shoes and clothing as well. When the physical contact gets separated, the communication is ended.

- The RedTacton transmitter induces a weak electric field on the surface of the body.
- The RedTacton receiver senses changes in the weak electric field on the surface of the body caused by the transmitter.

This module consists of RedTacton transmitter, RedTacton receiver, Driver, Microcontroller unit and the Voice bank. RedTacton is a HAN; body of human being is used for transmission of signals. RedTacton transmitter consists of a DTMF encoder which generates both valid and invalid signals and can be transmitted through human body through the RedTacton receiver (DTMF decoder) for further processing. In RedTacton receiver by the use of DTMF decoder the transmitted signal is identified. As the transmitted signal is of very low voltage, buffers and drivers are used to send the received signal to the electromagnetic switch. Electromagnetic switch checks the received signal with the predefined valid code. If an invalid code is received and detected in the switch then the buzzer starts ringing indicating that an invalid card is trying to access the ATM. If a valid code is received, then only the switch sends the signal to the main control unit which is the controller. If controller gets active it switches on the keyboard where predefined options are stored to perform various tasks such as: Enter password, Change of password, New password, etc. After entering the valid password the voice bank gets activated. In voice bank predefined options with keys are present which guides the user to select appropriate action in the ATM such as: Cash withdrawal, Pin change, Account balance, etc…

III. PRODUCT ARCHITECTURE

A. Block Diagram:

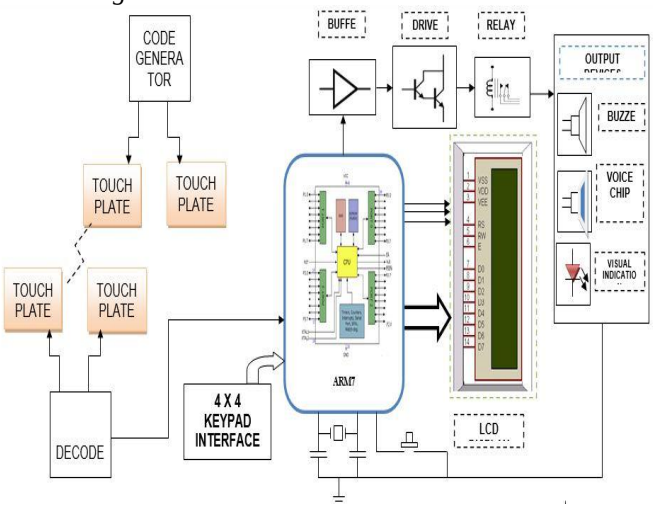

Fig. 1 Block Diagram

B. Power Supply

The circuit needs two different voltages, +5V & +12V, to work. These dual voltages are supplied by this specially designed power supply. The power supply, unsung hero of every electronic circuit, plays very important role in smooth running of the connected circuit. The main object of this 'power supply' is, as the name itself implies, to deliver the required amount of stabilized and pure power to the circuit. Every typical power supply contains the following sections:

1. Step-down Transformer: The conventional supply, which is generally available to the user, is 230V AC. It is necessary to step down the mains supply to the desired level. This is achieved by using suitably rated step-down transformer. While designing the power supply, it is necessary to go for little higher rating transformer than the required one. The reason for this is, for proper working of the regulator IC (say KIA 7805) it needs at least 2.5V more than the expected output voltage

2. Rectifier stage: Then the step-downed Alternating Current is converted into Direct Current. This rectification is achieved by using passive components such as diodes. If the power supply is designed for low voltage/current drawing loads/circuits (say +5V), it is sufficient to employ full-wave rectifier with centre-tap transformer as a power source. While choosing the diodes the PIV rating is taken into consideration.

3. Filter stage: But this rectified output contains some percentage of superimposed a.c. ripples. So to filter these a.c. components filter stage is built around the rectifier stage. The cheap, reliable, simple and effective filtering for low current drawing loads (say up to 50 mA) is done by using shunt capacitors. This electrolytic capacitor has polarities, take care while connecting the circuit.

4. Voltage Regulation: The filtered d.c. output is not stable. It varies in accordance with the fluctuations in mains supply or varying load current. This variation of load current is observed due to voltage drop in transformer windings, rectifier and filter circuit. These variations in d.c. output voltage may cause inaccurate or erratic operation or even malfunctioning of many electronic circuits. For example, the circuit boards which are implanted by CMOS or TTL ICs.

C. Buffer and Drivers

When the user programs the schedule for the automation using GUI [Graphical User Interface] software, it actually sends 5-bit control signals to the circuit. The present circuit provides interfacing with the Microcontroller and the controlling circuitry. This circuit takes the 5-bit control signal, isolates the CONTROLLER from this circuitry, boosts control signals for required level and finally fed to the driver section to actuate relay. These five relays in turn sends RC5 coded commands with respect to their relay position.

First the components used in this Module are discussed and then the actual circuit is described in detail.

HEX BUFFER / CONVERTER [NON-INVERTER] IC 4050: Buffers does not affect the logical state of a digital signal (i.e. logic 1 input results into logic 1 output whereas logic 0 input results into logic 0 output). Buffers are normally used to provide extra current drive at the output, but can also be used to regularise the logic present at an interface. And Inverters are used to complement the logical state (i.e. logic 1 input results into logic 0 output and vice versa). Also Inverters are used to provide extra current drive and, like buffers, are used in interfacing applications. This 16-pin DIL packaged IC 4050 acts as Buffer as-well-as a Converter. The input signals may be of 2.5 to 5V digital TTL compatible or DC analogue the IC gives 5V constant signal output. The IC acts as buffer and provides isolation to the main circuit from varying input signals. The working voltage of IC is 4 to 16 Volts and propagation delay is 30 nanoseconds. It consumes 0.01 mill Watt power with noise immunity of 3.7 V and toggle speed of 3 Megahertz.

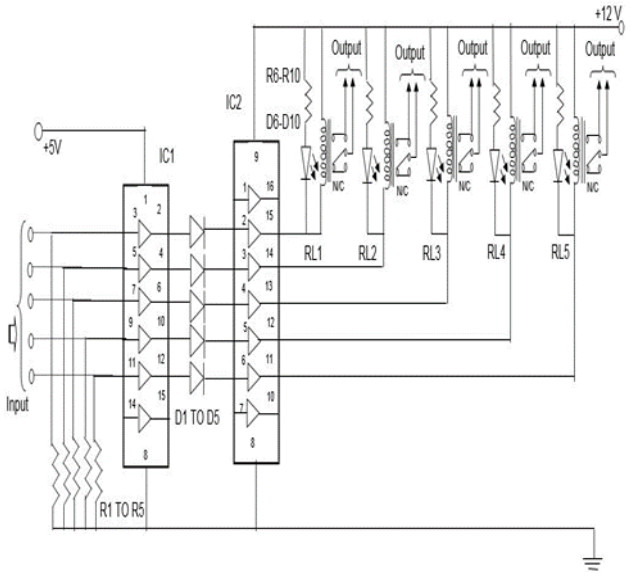

Fig. 2 Circuit Diagram of Buffer and Drivers

Since the digital outputs of the some circuits cannot sink much current, they are not capable of driving relays directly. So, high-voltage high-current Darlington arrays are designed for interfacing low-level logic circuitry and multiple peripheral power loads. The series ULN2000A/L ICs drive seven relays with continuous load current ratings to 600mA for each input. At an appropriate duty cycle depending on ambient temperature and number of drivers turned ON simultaneously, typical power loads totalling over 260W [400mA x 7, 95V] can be controlled. Typical loads include relays, solenoids, stepping motors, magnetic print hammers, multiplexed LED and incandescent displays, and heaters. These Darlington arrays are furnished in 16-pin dual in-line plastic packages (suffix A) and 16-lead surface-mountable SOICs (suffix L). All devices are pinned with outputs opposite inputs to facilitate ease of circuit board layout.

The input of ULN 2003 is TTL-compatible open-collector outputs. As each of these outputs can sink a maximum collector current of 500 mA, miniature Controller relays can be easily driven. No additional free-wheeling clamp diode is required to be connected across the relay since each of the outputs has inbuilt free-wheeling diodes. The Series ULN20x4A/L features series input resistors for operation directly from 6 to 15V CMOS or PMOS logic outputs.

1N4148 signal diode: Signal diodes are used to process information (electrical signals) in circuits, so they are only required to pass small currents of up to 100mA. General purpose signal diodes such as the 1N4148 are made from silicon and have a forward voltage drop of 0.7V.

D. DTMF Decoder

The DTMF signals transmitted over the FM Transmitter/Receiver units can be received and decoded using a DTMF receiver/decoder IC such as UM92870 or KT3170 or Motorola's MT8870. The decoded outputs can be suitably used along with certain additional circuitry to design a Call-Line-Identification-Product unit [popularly known as CLIP]. The four hexadecimal output obtained from the DTMF receiver/decoder IC corresponding to each digit on the FM Communication key-pad together with the associated dual-tone frequencies can be put-it in a table form for easy reference. The DTMF digits transmitted over the FM Communication lines would have a nominal width of 50 ms followed by a pause (no signal) of similar duration between consecutive digits. Thus, ten consecutive digits would be transmitted in one second. Note that the DTMF codes for the CLIP service are transmitted in between the handset is On-Cradle. Hence it is essential to detect On-Cradle and Off-Cradle status of called subscriber as well as the ringing signal. It is done by software program at both ends. The On-Cradle and Off-Cradle status of the handset can be detected, based on the voltage state, before the start of ringing (which is between 40 and 52V DC approximately).

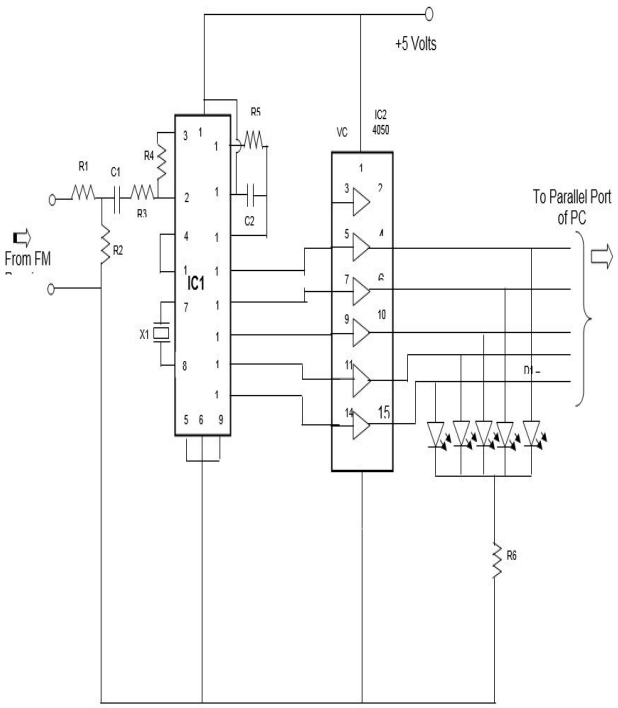

Fig. 3 Circuit Diagram of DTMF Decoder

The voltage drops to 10 to 12V DC on lifting of the handset from the cradle. The ringing status can be detected with the use of either a coactively coupled rectifier bridge or an AC Opto-coupler (or even a DC Opto-coupler with an external diode shunted in anti-parallel across the internal diode of the Opto-coupler together with a current limiting series resistor.

The circuit uses IC KT3170 (DTMF-to-BCD converter) and accepts fault code from Field Unit in the form of encoded DTMF signal convert them into 4-bit Binary Coded Decimal and fed to parallel port of monitoring PC for further processing. This circuit is to be connected to the FM Receiver output points. The DTMF Signals from FM Receiver are entering this stage through RC network formed by R1, R2, C1 & R3 components. Pin-3 of IC1 is biased with input telephone line through resistor R4. The Crystal X1 is fitted to pins 7 & 8 of IC1 for internal oscillation purpose. The pin-10 is Vcc and given to power supply line. Internal circuitry of IC1 needs biasing hence pin-16, 11, and 17 are connected with R5 and C2. The IC1 outputs DTMF signals coming from FM Receiver into 4-bit BCD form at pins 12, 13, 14 & 15. The Conversion checking bit is get from pin-18 of IC1. This pin output goes HIGH if DTMF-to-BCD conversion is successful. These outputs are fed to next stage Buffer for conversion indication and further taken out for PC's parallel port input. The Buffer section comprises of IC2, which has six buffers. Five Buffers of IC2 are used to drive five LEDs for output indication. These Buffers provide unit gain amplification to the DTMF outputted signals.

E. DTMF Encoder

Each digit in DTMF (dual tone multi-frequency) code corresponds to a combination of two discrete frequencies,

one each from a low and high group of frequencies, which are generated when any switch on a dialler key-pad is pressed. Such a key-pad along with the frequencies associated with each row and column. The key-pad is used in conjunction with a dialler IC such as UM9214 or UM9215 to generate the pair of frequencies as mentioned. The DTMF signals transmitted over the telephone lines can be received and decoded using a DTMF receiver/decoder IC such as UM92870 or KT3170 or Motorola's MT8870.

DTMF Signal Output Codes

Digit	Low Group (Hz)	High Group (Hz)	Row	Col.	Hexadecimal O/P) Q1 Q2 Q3 Q4
1	697	1209	1	1	0 0 0 0
2	697	1336	1	2	0 0 0 1
3	697	1477	1	3	0 0 1 0
4	770	1209	2	1	0 0 1 1
5	770	1336	2	2	0 1 0 0
6	770	1477	2	3	0 1 0 1
7	852	1209	3	1	0 1 1 0
8	852	1336	3	2	0 1 1 1
9	852	1477	3	3	1 0 0 0
0	941	1336	4	1	1 0 0 1
•	941	1209	4	2	1 0 1 0
#	941	1477	4	3	1 0 1 1
A	697	1633	2	4	1 1 0 0
B	770	1633	2	4	1 1 0 1
C	852	1633	3	4	1 1 1 0

Fig. 4 DTMF Signal Output Codes

The decoded outputs can be suitably used along with certain additional circuitry to design a Call-Line-Identification-Product unit [popularly known as CLIP]. The four hexadecimal output obtained from the DTMF receiver/decoder IC corresponding to each digit on the telephone key-pad together with the associated dual-tone frequencies can be put-it in a table form for easy reference.

The DTMF digits transmitted over the telephone lines would have a nominal width of 50 ms followed by a pause (no signal) of similar duration between consecutive digits. Thus, ten consecutive digits would be transmitted in one second. Note that the DTMF codes for the CLIP service are transmitted in between the handset is On-Cradle. Hence it is essential to detect On-Cradle and Off-Cradle status of called subscriber as well as the ringing signal. The On-Cradle and Off-Cradle status of the handset can be detected, based on the voltage state, before the start of ringing (which is between 40 and 52V DC approximately). The voltage drops to 10 to 12V DC on lifting of the handset from the cradle. The ringing status can be detected with the use of either a coactively coupled rectifier bridge or an AC Opto-coupler (or even a DC Opto-coupler with an external diode shunted in anti-parallel across the internal diode of the Opto-coupler together with a current limiting series resistor. The end of calling-number can be detected from the knowledge of inter-digital pause. A time-out e.g 150 ms or so, can be fixed for this purpose. This is termed as inter-digit time-out (IDT). For the purpose of calculation of IDT, as also for shifting of the consecutive digits, one can make use of active high DSO (delayed steering output) signal from pin 15 of IC8870/KT3170.

Hi-Group / Low-Group	1290	1336	1477	1633
697	**1**	**2**	**3**	**?**
770	**4**	**5**	**6**	**?**
852	**7**	**8**	**9**	**?**
941	*	**0**	#	**?**

This circuit makes use of radio frequency to transmit the control signals and hence it can be used for control from almost anywhere in the house. Here we make use of DTMF (dual-tone multi frequency) signals (used in telephones to dial the digits) as the control codes. The DTMF tones are used for frequency modulation of the carrier. At the receiver unit, these frequency modulated signals are intercepted to obtain DTMF tones at the speaker terminals. This DTMF signal is connected to a DTMF-to-BCD converter whose BCD output is used to switch-on and switch-off various electrical appliances (4 in this case). The remote control transmitter consists of DTMF generator and an FM transmitter circuit. For generating the DTMF frequencies, a dedicated IC UM95089 (which is used as a dialer IC in telephone instruments) is used here. This IC requires 3 volts for its operation. This is provided by a simple zener diode voltage regulator which converts 9 volts into 3 volts for use by this IC. For its time base, it requires a quartz crystal of 3.58 MHz which is easily available from electronic component shops. Pins 1 and 2 are used as chip select and DTMF mode select pins respectively. When the row and column pins (12 and 15) are shorted to each other, DTMF tones corresponding to digit 1 are output from its pin 7. Similarly, pins 13, 16 and 17 are additionally required to dial digits 2, 4 and 8. Rest of the pins of this IC may be left as they are. The output of IC1 is given to the input of this transmitter circuit which effectively frequency modulates the carrier and transmits it in the air. The carrier frequency is determined by coil L1 and trimmer capacitor VC1 (which may be adjusted for around 100 MHz operations). An antenna of 10 to 15 cms (4 to 6 inches) length will be sufficient to provide adequate range. The antenna is also necessary because the transmitter unit has to be housed in a metallic cabinet to protect the frequency drift caused due to stray Electro Magnetic fields. Four key switches (DPST push-to-on spring loaded) are required to transmit the desired DTMF tones. The switches when pressed generate the specific tone pairs as well as provide power to the transmitter circuit simultaneously. This way when the transmitter unit is not in use it consumes no power at all and the battery lasts much longer.

The LM386 is a power amplifier designed for use in low voltage consumer applications. The gain is internally set to 20 to keep external part count low, but the addition of an external resistor and capacitor between pins 1 and 8 will increase the gain to any value from 20 to 200. The inputs are ground referenced while the output automatically biases to one-half the supply voltage. The quiescent power drain is only 24 mill watts when operating from a 6 volt supply, making the LM386 ideal for battery operation.

F. LPC 2148 micro controller

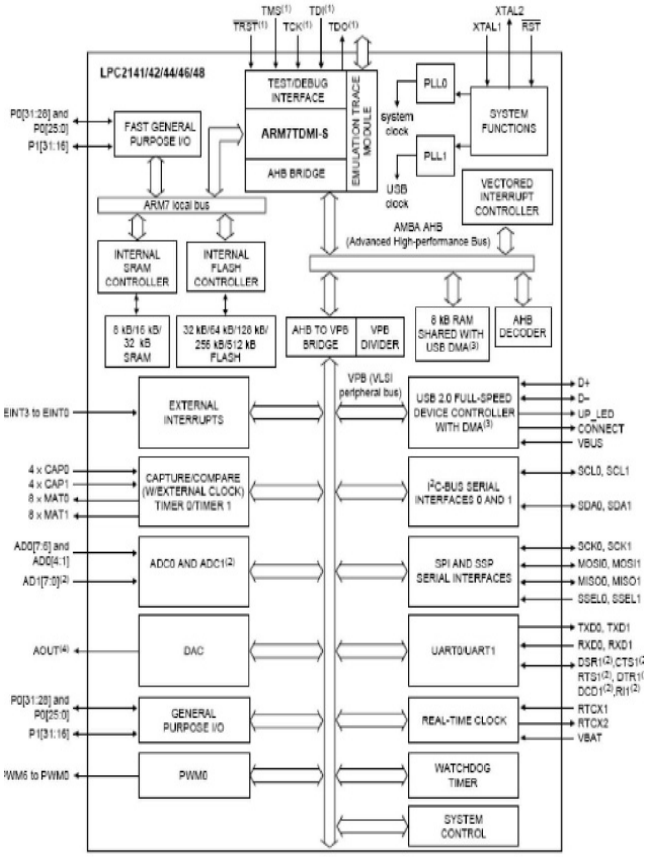

Fig. 5 Architecture of LPC2148

LPC2148 microcontroller board based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine microcontrollers with embedded high-speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30% with minimal performance penalty. The meaning of LPC is Low Power Low Cost microcontroller. This is 32 bit microcontroller manufactured by Philips semiconductors (NXP).Due to their tiny size and low power consumption, LPC2148 is ideal for applications where miniaturization is key requirement, such as access control and point-of-sale. The Thumb set's 16-bit instruction length allows it to approach twice the density of standard ARM code while retaining most of the ARM's performance advantage over a traditional16-bit processor using 16-bit registers. This is possible because Thumb code operates on the same 32-bit register set as ARM code. Thumb code is able to provide up to 65 % of the code size of ARM, and 160 % of the performance of an equivalent ARM processor connected to a 16-bitmemory system.

G. Voice Recorder

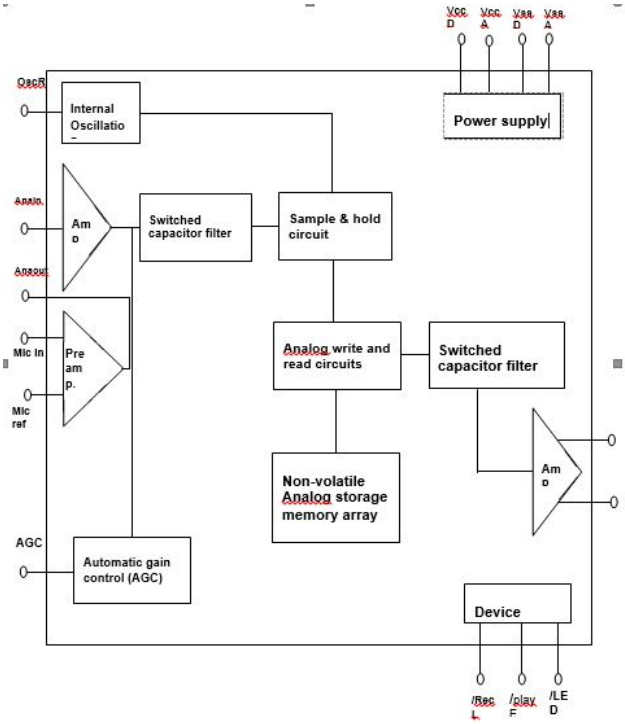

Fig. 6 Functional Block of Voice Recorder

The APR 33 device offers true single chip solid state storage capability and requires no software or microcontroller support. It provides high quality recording and playback with a single 20 to 30 sec message. It is deal for portable voice recorders, toys, and many other consumer and industrial applications. Invox proprietary analog/multilevel storage technology is implemented in advanced flash non-volatile memory cells, each of which can typically store more than 256 voltage levels. The APR 33 device stores and reproduces voice signals in their natural forms, eliminating the distortion that is often introduced by encoding and compression. The device combines a small size with low power consumption, non-volatility, and ease of use for cost effective solution to voice recording and playback.

IV. CONCLUSION

The proposed RedTacton based smart security card system for ATM has been implemented successfully and is tested on hardware. Experimental results verify the effective developed operation. When we compare RedTacton with other technologies, it can give a better security since there is no problem of hackers as our body itself acts as transmission medium and can be used more in the fields where there is a need to upgrade the security in times of high theft rate.

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