INTERNET BASED SERVICES OVER SMS AND VOICE CALL FOR GSM FEATURE PHONES

A partial major project report submitted

In partial Fulfillment of the Requirements For

the award of the degree of

BACHELOR OF TECHNOLOGY

In

Electronics and Communication Engineering

by

Nishant Nischaya　　　　**Nikhil Prakash**　　　　**Pratham Chhabra**

(Roll No. 03314802816)　　　(Roll No. 03214802816)　　　(Roll No. 03614802816)

Under the Supervision of

Ms Abhilasha Gokhale,　　　**Assistant Professor**

to

MAHARAJA AGRASEN INSTITUTE OF TECHNOLOGY

SECTOR 22, ROHINI, DELHI

GGSIP University, Dwarka, Delhi

February, 2020

1

INTERNET BASED SERVICES OVER SMS AND VOICE CALL FOR GSM FEATURE PHONES

1. INTRODUCTION-

- A feature phone is a class of mobile phone; the term is typically used as a retronym to describe low-end mobile phones which are limited in capabilities in contrast to a modern smart-phone.
- Feature phones typically provide voice calling and text messaging functionality, in addition to some other services offered by the user's wireless service provider.
- These phones either totally lack internet browsing capabilities or have very limited capability.
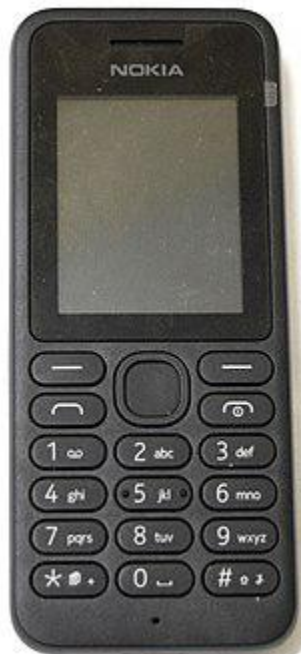
A Feature phone

2. STATISTICS

- According to a 2018 survey, 62% of the people of India own at least one mobile phone. Out of this population, surprisingly 61% of the people are using a basic feature phone which does not have internet access facility. Most of this demo-graph consists of rural population, urban poor population, farmers (SEC B and SEC C households) and students of tier-II and tier-III cities.
- India Ranks 40th in Smart-phone penetration in a list of 50 nations with only 27.7% percentage of population owning a smart-phone.
- In December 2019, India's rank was declared as 128th in a list of 140 countries in mobile data download speed by Ookla.
- Average speed recorded was 11.46 Mbps whereas the global average was 32.01 Mbps.

Mobile Phone* and Smartphone** Users in India, 2014-2019

	2014	2015	2016	2017	2018	2019
Mobile phone users* (millions)	581.1	638.4	684.1	730.7	775.5	813.2
—% of population	47.0%	51.0%	54.0%	57.0%	59.8%	62.0%
—% change	10.7%	9.9%	7.2%	6.8%	6.1%	4.9%
Smartphone users** (millions)	123.3	167.9	204.1	243.8	279.2	317.1
—% of mobile phone users	21.2%	26.3%	29.8%	33.4%	36.0%	39.0%
—% change	62.1%	36.2%	21.5%	19.5%	14.5%	13.6%

Note: *individuals of any age who own at least one mobile phone and use the phone(s) at least once per month; **individuals of any age who own at least one smartphone and use the smartphone(s) at least once per month
Source: eMarketer, July 2015

193900   www.eMarketer.com

Mobile phone and smart-phone user-base statistics

3. TARGET USERS-

The target users of this project covers all individuals owning a limited capability feature phone and people living or navigating to low areas with poor internet connectivity-

- Families of SEC-2 and SEC-3 category
- Urban Poor
- Students of Teir-2 and Teir-3 cities
- Agriculture Sector

4. AIM-

- Our project aims to bring basic internet based services to this user segment mentioned above using SMS (Short Message Service) or Voice calling over GSM.
- The project aims to construct a embedded server using Atmega 328p in conjugation with GSM module SIM900A that can take up multiple request for internet based service (as SMS requests) in a queue based manner and generate a response after web processing (also as an SMS to the user).
- The Atmega 328p can use AT commands for GSM communication and use either the wifi module or the TTL to USB converter to transfer the AT commands to the mainframe (RaspberryPi) for web processing of the query. Similarly, after resolution of the query the Raspberry Pi will generate a response that will be sent to the user in SMS format using the GSM module.
- The Atmega 328P MCU will also maintain a queue for multiple requests that would be fed to the RaspberryPi one after the other so collision of requests can be avoided. A LCD screen attached to the MCU will tell about the current status and queue information about the requests being made to the server.
- The project will also integrate a Voice-Assistant program like Google Assistant or Amazon Alexa for resolution of voice call based queries.
- The voice assistant program will on the Raspberry Pi single-chip computer.

5. GSM VS GPRS
5.1 GSM

- GSM stands for **Global System for Mobile Communication**. GSM is nothing but the digital mobile telephony system which is widely used in all over the world.
- It uses circuit-
- GSM is standard bearer of 2G technologies.
- In GSM location area concept is used. It's infrastructural cost is lesser.
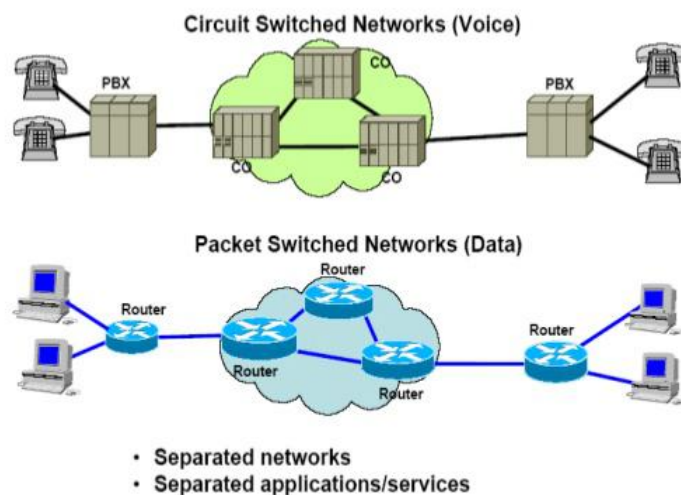- It is more widely available then GPRS networks.

5.2 GPRS

- GPRS stands for **General Packet Radio Service. I**t uses packet-switched data technique instead of circuit switching, and this technique makes much more efficient use of the available capacity.
- GPRS is a huge upgrade over the basic GSM features. It allow the mobile handset to obtain much higher data speed than what standard GSM can offers.

- In GPRS routing area concept is used. The infrastructural cost is higher than standard GSM.

6. CIRCUIT SWITCHING VS PACKET SWITCHING

Circuit – Switching	Packet – Switching
It is a connection oriented network switching technique.	It is a connection-less network switching technique.

A dedicated path has to be established between the source and the destination before transfer of data commences. Once, the data is transmitted, the path is relinquished.	There is no need to establish a dedicated path from the source to the destination.
It is inflexible in nature since data packets are routed along the same dedicated path.	Each packet is routed separately. Consequently, it is flexible in nature where the different data packets follow different paths.
It was initially designed for voice transfer.	It was initially designed for data transfer.
The entire message is received in the order sent by the source.	The individual packets of the message are received out of order and so need to be reassembled at the destination.
It is implemented at Physical Layer.	It is implemented at Network Layer.
It is not a store and forward transmission.	It is store and forward transmission.
Data is processed and transmitted at the source only.	Data is processed and transmitted, not only at the source but at each switching station.



Circuit Switching Vs packet switching

Circuit Switched Networks (Voice)

Packet Switched Networks (Data)

- Separated networks
- Separated applications/services

7. COMPONENTS USED

7.1 ATmega328:

- The high-performance Microchip 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1KB EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts,serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes.
- The device operates between 1.8-5.5 volts.
- By executing powerful instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed.
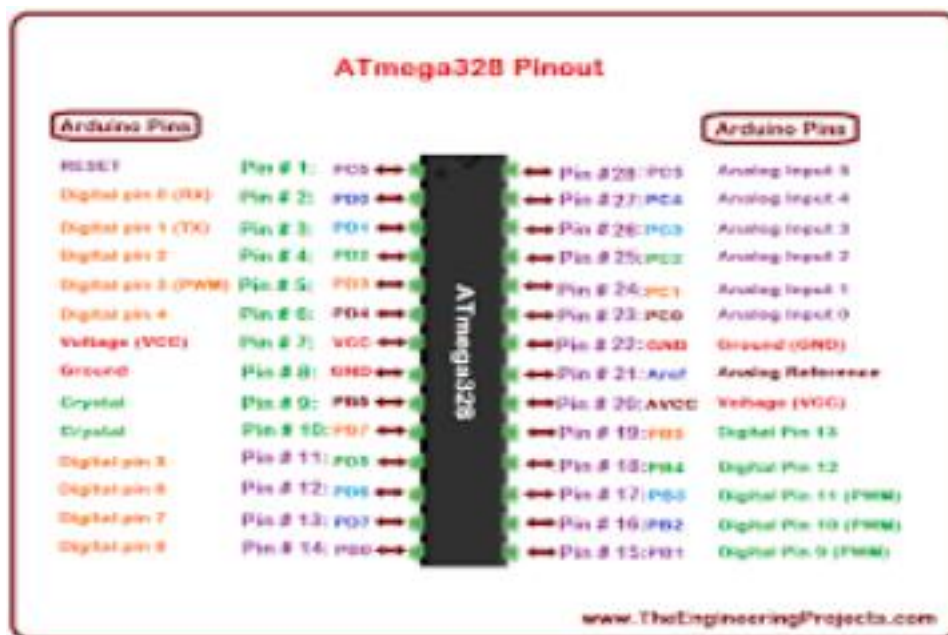
Atmega 328p Microcontroller

7.2 RASBERRY Pi 3b

- Broadcom BCM2711, Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz
- 1GB, 2GB or 4GB LPDDR4-3200 SDRAM (depending on model)
- 2.4 GHz and 5.0 GHz IEEE 802.11ac wireless, Bluetooth 5.0, BLE
- Gigabit Ethernet.
- Raspberry Pi standard 40 pin GPIO header (fully backwards compatible with previous boards)
- 2 × micro-HDMI ports (up to 4kp60 supported), 2 USB 3.0 ports; 2 USB 2.0 ports,2-lane MIPI DSI display port & 2-lane MIPI CSI camera port
- 4-pole stereo audio and composite video port
- H.265 (4kp60 decode), H264 (1080p60 decode,1080p30 encode),OpenGL ES 3.0 graphics
- Micro-SD card slot for loading operating system and data storage
- 5V DC via USB-C connector (minimum 3A*),5V DC via GPIO header (minimum 3A*)
- Power over Ethernet (PoE) enabled (requires separate PoE HAT)
- Operating temperature: 0 – 50 degrees C ambient

Raspberry Pi 3B

7.3 SIM 900A MODULE

- GSM/GPRS Modem-RS232 is built with Dual-Band GSM/GPRS engine-SIM900A works on frequencies 900/ 1800 MHz. The Modem is coming with RS232 interface, which allows you connect PC as well as a microcontroller with RS232 Chip(MAX232). The baud rate is configurable from 9600-115200 through AT command. The **GSM/GPRS Modem** is having internal TCP/IP stack to enable you to connect with internet via GPRS. It is suitable for SMS, Voice as well as DATA transfer application in M2M interface. The onboard Regulated Power supply allows you to connect wide range unregulated power supply. Using this modem, you can make audio calls, SMS, Read SMS, attend the incoming calls and internet etc through simple AT commands.
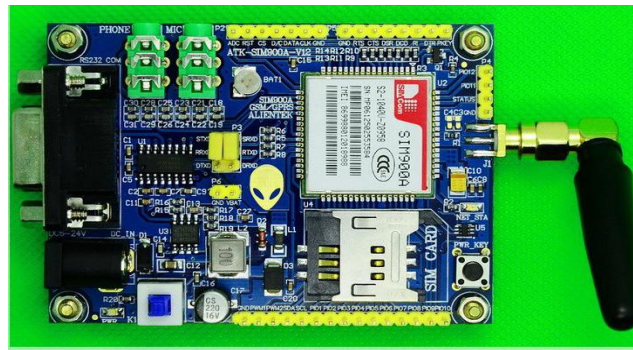
SIM900A Module

7.4 ESP 8266 WIFI MODULE

- ESP8266 is a Wifi module developed by Espressif systems. It is used in Internet of Things. It uses the Microprocessor Tensilica Xtensa Diamond Standard 106 Micro created by the company Tensilica.
- Processor: L106 32-bit RISC microprocessor core
- Memory:
- 32 KiB instruction RAM
- 32 KiB instruction cache RAM
- 80 KiB user-data RAM
- 16 KiB ETS system-data RAM
- External QSPI flash: up to 16 MiB is supported (512 KiB to 4 MiB typically included)
- IEEE 802.11 b/g/n Wi-Fi
- 10-bit ADC (successive approximation ADC)
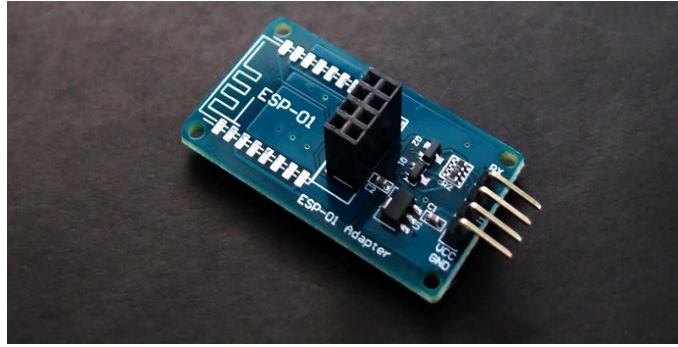
ESP 8266 Wifi Module

7.5 LCD DISPLAY MODULE

- We come across LCD displays everywhere around us. Computers, calculators, television sets, mobile phones, digital watches use some kind of display to display the time.
- An LCD is an electronic display module which uses liquid crystal to produce a visible image.
- The 16×2 LCD display is a very basic module commonly used in DIYs and circuits. The 16×2 translates to a display 16 characters per line in 2 such lines. In this LCD each character is displayed in a 5×7 pixel matrix.
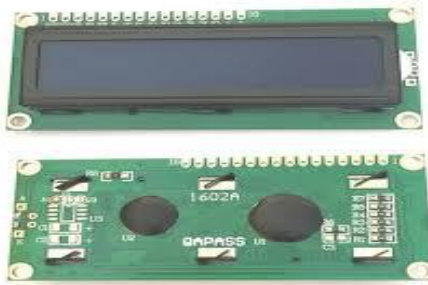

LCD 16X2 Display

7.6 VOICE RECORDER MODULE

The Voice module board is based on ISD18B20, which is a single-chip single-message record/playback device. Recordings are stored into on-chip non-volatile memory, providing zero-power message storage. With the embedded Flash memory employed, data retention up to 100 years and typical 100,000 erase/record cycles can be reached. Time for recording is 8-20 seconds.
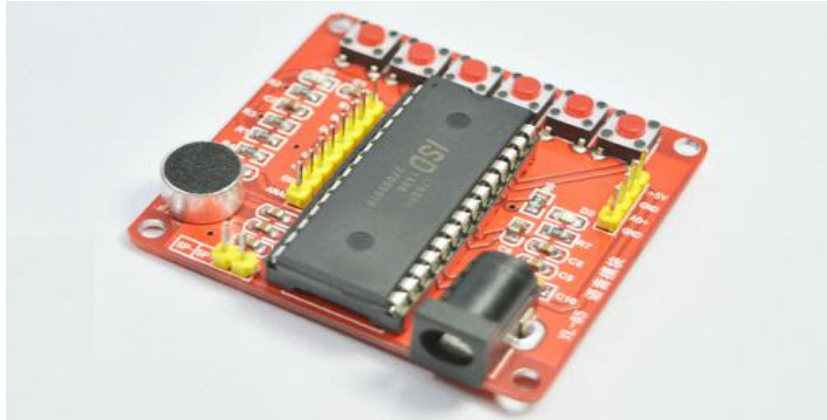
Voice Recorder Module ISD18B20

8. PROJECT WORKING
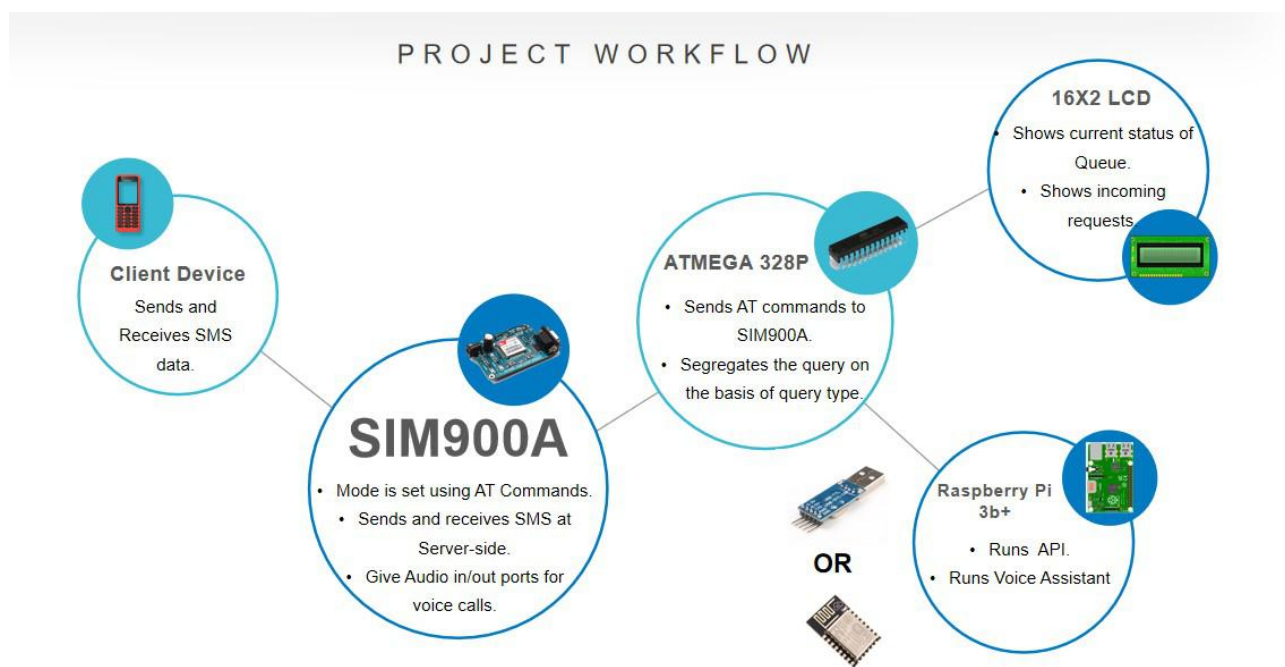
Project Workflow

- The voice call or SMS is forwarded via the circuit switched network to the server's SIM900A module.
- The SIM900A module is configured to handle Voice calls or SMS using required AT commands. AT commands are sent by the Atmega328p Micro-controller.

- If transmission type is 'Voice call' then data is introduced to a voice recorder module to deal with input/output lag.
- If transmission type is SMS then data is simple forwarded to Atmega328p.
- After that data is processed to retrieve "query type" and "keyword".
- The query is resolved using APIs running on the raspberry Pi.
- In case of voice call, Google Assistant is used as API and response is directly stored on the voice recorder module.
- The response is then sent back to the requesting phone using GSM transmission for which AT commands are used.

9. REFERENCES

- NPREF https://www.nperf.com/en/map/IN//1639.Airtel/download/?ll=15.572244602734123&lg=82.08105415105821&zoom=5
- OOKLA INTERNET DATA SPEED RECORDS
- WWW.EMARKETRS.COM
- NEWZOO'S GLOBAL MOBILEMARKET REPORT
- www.electronicsforu.com
- www.sparkfun.com
- www.researchdesignlab.com
- www.rhydolabz.com
- www.rasberrypi.org
- www.tutorialspoint.com

- www.iotdunia.com