Televoting System for rural development using VSAT

Brayan Dialle
Department of Electronic and Telecommunication
Don Bosco Institute of Technology
Mumbai, India.
Brayandialle76@gmail.com

Kevin D'souza
Department of Electronic and Telecommunication
Don Bosco Institute of Technology
Mumbai, India.
Fkevin1997@gmail.com

Ryan Fernandes
Department of Electronic and Telecommunication
Don Bosco Institute of Technology
Mumbai, India.
Ryanfernandes701@gmail.com

Aparna Telgote
(Assistant Professor)
Department of Electronic and Telecommunication
Don Bosco Institute of Technology
Mumbai, India.
aparna.dbit@dbclkurla.org

***Abstract*—this article presents an overview of the expansion of Satellite communication technology as one of the keys to rural area development. The project deals with televoting system that facilitates a user to vote mainly in rural areas through televoting where transportation of EVM machines is difficult. The voting system will be 'computerized voting' using biometric or aadhar card for voter's authentication and vote validity. The vote casted (data) will be sent directly via VSAT to the Election Commission Head Office where all votes will be counted automatically. Due to this we will get instant results and the data will be much secure. Different voting centres will be connected by implementing mesh topology due to which the system becomes more effective and reliable.**

Keywords: IPSTAR, Cisco Packet Tracer, IUAT, VSAT, C band Modem, MPLS cloud.

I. INTRODUCTION

As the population is going on increasing, the number of voters are increasing day by day. The task for conducting an election on inter-state level is of great responsibility. There are many places in India where there is no possible way for conducting a voting because the transportation of EVM machines is a big challenge. But there is a possibility of conducting vote by using satellite communication. Moreover, while in transporting the EVM machines from their respective poll stations there is a possibility that hackers may tamper or change the data of EVM.

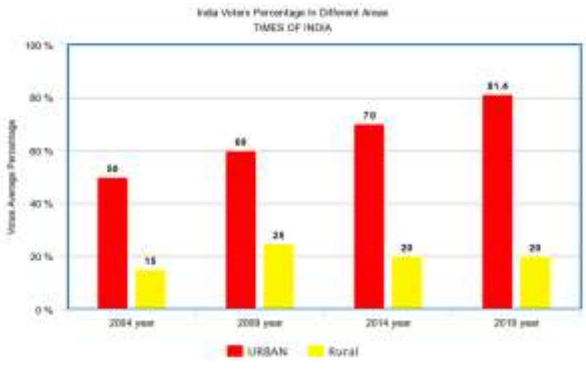

Figure (1): Indian voting analysis by Times of India.

In order to solve all these problems and reduce the complexity of EVM machines we came up the idea to work on a project where the idea is to develop a system "Application of satellite communication as centralized voting system through authentic satellite centre to avoid proxy" which will be using VSAT technology for transmitting and receiving data. For the availability of the resources, this project is in collaboration with BSNL Satellite Earth Station at Thane (Yeur). The said station is well equipped with the recent technologies such as IPSTAR gateway. It is located at Bendipada, Yeur Hills, Thane West, Maharashtra.

II. PROBLEM STATEMENT

To implement and test televoting system for rural development using VSAT technology.

III. OBJECTIVES

- To reduce the complexity of the current existing system and to implement a better and reliable voting system.
- To reduce the time required for counting the data.
- To avoid malpractices.
- To develop a strong system which is efficient and easy to operate.
- To develop a system which can then be used in rural as well as urban elections.
- To obtain fast and accurate results without any tampering.
- To provide flexibility in terms of casting a vote from anywhere in India.

IV. SCOPE

Satellite Communication utilisation has become wide spread and ubiquitous throughout the country for such diverse applications like Television, DTH Broadcasting, DSNG and VSAT to require advantage of the unique capabilities in terms of coverage and outreach. The technology has matured substantially over past three decades and is getting used on commercial basis for an outsized number of applications.

The potential of the technology for societal applications still fascinates ISRO and efforts are on to leverage the advantages of technology to the betterment of mankind. Important

initiatives pursued by ISRO towards societal development include Tele-education, Tele-medicine, Village Resource Centre (VRC) and Disaster Management System (DMS) Programmes. The potential of the space technology for applications of national development is enormous. [2]
It can be used for providing connectivity in remote areas where wired communication is not possible also be used for providing education in rural areas where internet is not available.

V. PROPOSED PROJECT MODEL

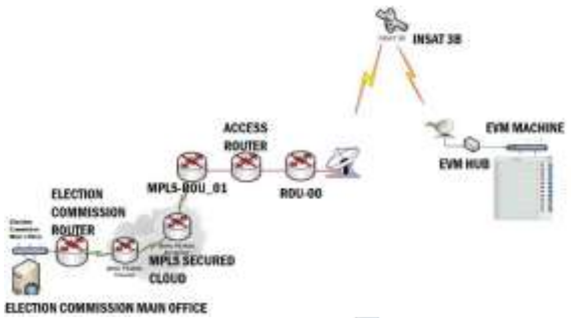

Figure (2): Overview of proposed model

The above system is the main architecture of the proposed project model. It consists of MPLS cloud, routers, VSAT terminal for (transmission and reception), hub, EVM (Electronic Voting Machine) and election commission main office server. The system is designed using Mesh topology and for security IPSTAR server is used.
The function of MPLS cloud is traffic management and to maintain quality of service. The access router is the main node which performs user authentication and validation using the IPSTAR server. The user database is preloaded in the IPSTAR server from the election commission which makes sure only valid voter's vote. IPSTAR gateway operates on two principle that is authentication and authorization. At the time of voting the user is authenticated using biometric and the user data is verified across election commission database via IPSTAR gateway. Once the authentication is done the user is authorized to vote and his voting data is directly sent to the election commission.
Thaicom-4 is also known as IPSTRAR 1 is a high throughput satellite build by space system/Loral (SS/L) for Thaicom public company limited. It is the world's first high throughput satellite, capable of providing service to up to two million broadband users or nearly thirty million mobile phone subscribers in the Asia pacific region. In the satellite communication the Thaicom 4 is going to act as repeater. It is used to convert the incoming frequency into suitable downlink frequency signals. The above-mentioned task performed by satellite is by using transponders, power amplifiers, and low noise amplifiers, block converters, etc.
Hence the proposed system focuses on reducing the time required for counting the data (votes) and also removes the probability of proxy.

VI. VSAT

A very small aperture terminal (VSAT) is a two-way satellite ground station with a dish antenna that is smaller than four meters. The majority of VSAT antennas range from 75 cm to 1.2 m. Data rates, in most cases, range from 4 Kbit/s up to 16 Mbit/s. VSATs access satellites in geosynchronous orbit or geostationary orbit to relay information/data from a remote earth station to other terminals, that may be connected in a mesh topology, or master earth station "hubs" that are connected in star topology. A VSAT end-user needs a box that interfaces between the user's computer and an outside antenna with a transceiver. The transceiver receives or sends a signal to a satellite transponder. The satellite sends and receives signals from an earth's station that acts as a hub for the system.
A star Topology is used to interconnect each end-user with the hub station via the satellite. An end-user wanting to communicate with another end-user, each transmission has to first go through the hub station which retransmits it via the satellite to the other end user's VSAT. VSAT handles data, voice, and video signals. [3]
Typically, VSAT installation requires the following items: Outdoor Unit (that comprises of RF Transceiver, RF LNA, RF Power Amplifier, Antenna, and OMT), Indoor Unit (that comprises of Satellite modem, MUX, telephone or data connection interface cards) and a Link cable between indoor and outdoor units. [3]
VSAT terminal operation: VSAT is a two-way communication and hence one frequency pair (or two frequencies) is needed for establishing a connection. It is also referred to as duplex communication. Modern VSATs uses FDMA/TDMA /CDMA/DAMA based techniques for access to communication.

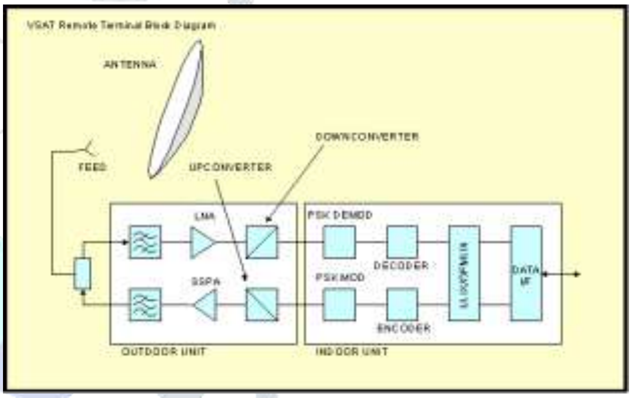

Figure (3): VSAT Configuration

VSAT terminal is broadly classified into two parts. The baseband part and RF part.
Baseband part consists of modem (modulator, demodulator), EDU (Encryptor, Decryptor), Mux/Demux and data/voice connection circuitry. RF part consists of an antenna, RF Power amplifier, RF LNA, frequency converters (up converter and down converter)

VII. OUTDOOR UNIT

The Outdoor unit is generally mounted close to the antenna systems outside. It consists of RF frequency converters (Up Down converter), Power Amplifier, Low Noise Amplifier (LNA), OMT and Antenna system. The Up Down converters help to convert IF frequencies to RF frequencies and vice versa. For example, an Up converter will convert 70MHz to 6175 MHz and Downconverter will convert 3950MHz to 70MHz frequencies used for C band application. [1]
A Power Amplifier will amplify the signal before transmitting to the feed horn of the Antenna system. Now, the LNA is designed to amplify the received signal with noise added which is received from the satellite. The LNA is designed such that it will amplify the signal, but will not amplify the noise. Noise temperature defines LNA performance. Antenna system basically comprises of a reflector, feed horn, mount, and cables. A VSAT usually varies from 1.8 to 3.8 meters.
The feed horn is mounted at the focal point of the antenna. The transmitted power is guided by the feed horn towards the antenna dish and will go to the medium consecutively. It also collects the received power from the dish and will enter into the LNA. The feed horn is made of an array of microwave

passive components. Coaxial cable is used to connect the outdoor unit to the indoor unit, which is situated inside the room or a building. The length of the cable is usually about 300 feet (approx. 90 meter). [5]

VIII. INDOOR UNIT

The Indoor Unit mainly consists of MUX/DEMUX, EDU (Encryption Decryption Unit) and a Modem (modulator-demodulator). MUX will interface with end-user types of equipment viz. telephone, computers and sometimes with LAN or router if it has to carry more information. A MUX will multiplex all the channels using the TDM technique. On the receiver side, a DEMUX is used to de-multiplex the channels and passed on to respective end-user types of equipment. EDU is basically the Encryption-Decryption unit which modifies the information and also provides security to the information to be transmitted. [3]

On the receiver side, the Decryption technique will be conveyed so that the information can be retrieved back again. MODEM is basically performing modulator-demodulator functionality on transmit and receive side respectively.

The modulator inserts information on intermediate frequency (IF), usually called carrier. This is done based on a modulation scheme set. Usually, the QPSK scheme is used in satellite communication. Forward Error Correction technique is also employed in modem which helps to enhance the Bit Error Rate (BER) for the same transmitter power usually used in non-FEC systems. [5]

When VSAT 1 wants to communicate with VSAT 2, the modulator frequency of VSAT 1 and demodulator frequency of VSAT 2 need to be the same and vice versa in order to have a complete full-duplex communication channel. Based on VSAT frequency assignments as per FDMA, frequency settings in various modems and RF transceivers are set appropriately.

IX. C-BAND EQUIPEMENT

An add-drop multiplexer (ADM) combines, or multiplexes

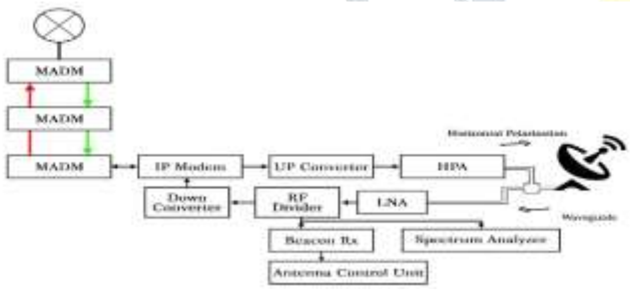

Figure (4): C-Band Block Diagram

several lower bandwidth streams of data a single beam of light. An add-drop multiplexer also has the capability to add one or more than one lower-bandwidth signals to an existing high-bandwidth data stream. At the same time, the add-drop multiplexer can extract or drop other low-bandwidth signals, removing them from the stream and redirecting them to some other network path. The MADM represents various BSNL stations located at Dadar, Yeur and Port Blair.

A modem is a device that enables a computer to transmit data over, for example, telephone or cable lines. Information stored in a computer is usually in digital form, whereas any information transmitted over a telephone line is transmitted in the form of analog waves. Here the IP Modem basically converts digital data into analog form. A block up converter is used in the transmission (uplink) of satellite signals. It converts a band of low frequencies to a higher frequency. This is done due to the fact that lower frequencies get reflected by atmospheric bands and cannot penetrate through it to get to the satellite. In satellite communication, the signals have to cross the atmosphere which presents a great deal of attenuation. The higher the frequency, the more is the signal loss which ultimately means that more power is needed for reliable transmission. Hence, we use a High-Power Amplifier. After the HPA block, the output signal is of very high frequency (microwave) which is why we need to use a Wave Guide. Waveguides help to conduct microwave signals or microwave energy at lower loss than coaxial cables. Waveguides are used in practice only for signals of extremely high frequency, where the wavelength approaches the cross-sectional dimensions of the waveguide. [4]

The waveguide acts as a high pass filter which will allow most of the energy above a certain cutoff frequency to pass through the waveguide, whereas most of the energy that is below the cutoff frequency will be attenuated by the waveguide. At the receiver end, we have the LNA: that amplifies a very low-power signal without significantly degrading its signal-to-noise ratio. An amplifier is used to increase the power of both the signal and the noise present at its input, but the amplifier will also introduce some additional noise. The LNAs are designed to minimize that additional noise. [1]

Finally, we use a spectrum analyzer which is a device that helps display the signal amplitude (strength) as it varies by signal frequency. On the display of the Spectrum Analyzer, the frequency appears on the horizontal axis, and the amplitude is displayed on the vertical axis. The Spectrum analyzer is used to examine the frequency spectrum of radio frequency (RF) and audio signals.

L- These devices display the individual elements of these signals, as well as the performance of the circuits producing them. Through the use of spectrum analyzers, organizations can determine what modifications may be needed to reduce interference and thus improve the performance of the system.

X. IPSTAR SERVER

The IPSTAR server is divided into four sections which are as follows:

- Head-End Equipment
- RF Equipment
- OSS (Operation Support Servers)
- NMS(Network Management Servers)

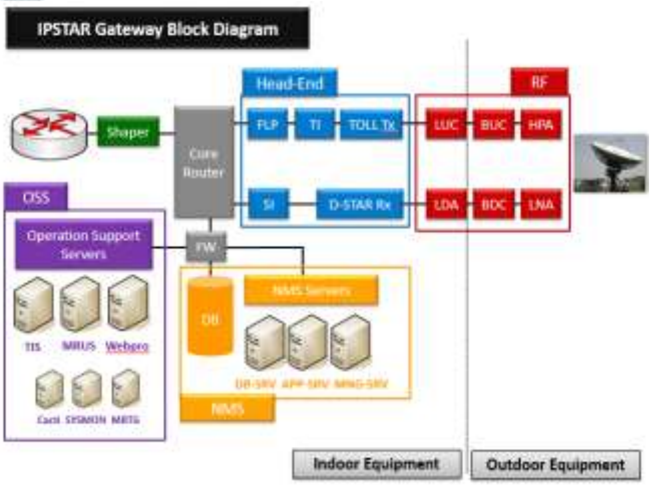

Figure (5): IPSTAR Block Diagram

Head –End Equipment:

Consists of FLP (Forward Link Processor), TI (TOLL Interface), TOLL Tx (TOLL Transmitter), SI (STAR Interface), D-STAR Rx (Double STAR Receiver).Provides transformation function of Binary Digit IP packets to Analog Radio Frequency system before transmission to the user terminal and vice versa.

Forward Link (TOLL Chain): FLP + TI + TOLL Tx

Return Link (SI): SI + D-STAR Rx (One SI can handle up to 10 D-STAR Rx)

FLP is responsible for performing packet filtration, TCP accelerating, Prioritizing of IP packets (QoS) and Enforcing of contractual minimum bit rates (CoS). TI is responsible for Queuing and formatting of data packet, forming the TOLL frame to be sent to TOLL Transmitter, Calculating suitable modulation, coding and power for resource allocation in forward link and return link for terminals. TOLL Tx performs Multiplexing, modulation and coding as instructed on TOLL frame, and forwarding the output of TOLL Tx which is IF signal to RF section. D-STAR Rx is responsible for receiving the L band signal from the LDA of RF section and Demodulating the signal and extracts the STAR frames.SI performs merging of IP packet fragments from D-STAR RX, Packet filtering, and processing and forwarding to Core Router

RF Equipment:

Band up Converter (LUC): Performs Up-conversion of IF 140 MHz to L-Band 950-1450 MHZ. Is an indoor unit with serial interface with LUC controller. LUC controller can control the redundancy switching up to 12 switches for 12 LUCs and it can display every status of each LUC in the system. Each GW can have up to 3 LUC subsystems with 3 LUC controllers.

Block Up Converter (BUC): Performs Up-conversion of L-Band to Ka Band 27-29 GHz. It comes with 3 models for 3 frequency bands (Low, Mid, High). It is located inside the antenna hub. The Output from BUC to HPA goes through the waveguide. [4]

High Power Amplifier (HPA): Its function is to amplify Ka-Band signal with high gain (depends on required EIRP). There are 2 models, Linearized and Non-Linearized HPA. It has a maximum gain 75 dB, connecting to Feed Horn with the waveguide and is located inside the Hub.

Low Noise Amplifier (LNA): Its function is to amplify Ka Band signal from Satellite with high gain and low noise. It is located inside the Hub and its nominal gain setting is around 55 dB.

Block Down Converter (BDC): Similar to BUC but down convert the output from LNA to L-Band signal. Need 10 MHz reference and is located inside the Hub. Nominal gain is around 10 dB. [6]

Line Drive Amplifier (LDA): A single LDA has 2 built-in amplifier which is working in parallel to amplify L-Band signal. Only one output is sent to D-STAR receivers. Built-in redundancy system and has nominal gain setting is around 25 dB.

OSS (Operation Support Servers):

The function of OSS is subdivided in to two formats i.e.

• Provisioning:

Terminal Installation Server (TIS): Responsible to support IUAT process in user terminal installation.

Multi Remote Upgrade Server (MRUS): Responsible to support upgrading software and image version of user terminals remotely from gateway

Webpro Server: Webpro could be used by service provider. It is responsible to manage user terminals belonging to ISP such as activation, de-activation or monitoring status.

• Monitoring:

Cacti Server: TOLL & STAR Radio Resource Monitoring, TOLL & STAR Traffic.

MRTG Server: Shows UT based MRTG graphs for TOLL and STAR

SYSMON Server: Monitoring Servers, Equipment's in Gateway, the graphs in Cacti and providing the alarm if there is something abnormal.

MR BEAN Server: Located inside gateway private network and is used to gather real time parameters form the UT, such as TOLL Es/No and CRC error.

NMS (Network Management Server):

The NMS consists of various databases and servers which are as follows:

Database Cluster: Network Management Database Storage.

Database Server (DB-SRV): Providing access to Network Management Database and providing address & Software image to Head-End equipment's.

Application Server (APP-SRV): Running RRM, User Authentication Authorization and Accounting, BGP Routing Manager. Providing Terminal's WAN IP address.

Management Server (MNG-SRV): Acting as SNMP Server & providing fault management in gateway system.

Core Router:

Forwards IP packets to and from the Internet to Gateway and from Gateway to Internet.

Firewall:

Protect NMS & OSS from the outside and provides security to the network.

XI. THREAT TO VSAT TERMINAL

A VSAT network terminal is susceptible to many hacking types that may adversely affect or disrupt the functioning of a network. VSAT terminals are considered to be only a communication device. The vast majority of people think the VSAT terminals tend not to be worth hacking. But however, not protecting a VSAT terminal against the simplest ways of hacking can put your data and other connected devices at risk. [8]

Firstly, the typical and common way of hacking seen in the field is automated port scans, where programs operating on the internet will scan the ports of all IP addresses in certain IP ranges, including VSAT terminals, and then depending on the ports, try to log in. With this, we see a massive flood of TCP connections and IP ping messages to terminals and any other devices connected behind those terminals. Generally, when logging in does not succeed they hop to the next IP address and in this way, they just scan the entire internet and when they are not successful, they just move on. Providing not an easy-to-guess password combination is normally enough to fend off these login attempts.

Secondly, VSAT terminals generally offer more services than pure IP routing, like file sharing or some HTTP web-servers services. The next step in hacking a VSAT terminal is trying to exploit the vulnerabilities of these services on the terminal. This is typically done by exploiting buffer overruns in the software implementation of these services and when this method is successful, the hacker is typically able to force the device to run any type of malicious software.

Thirdly, low-end routers or terminals are opted by hackers to use it as a distributor for viruses, since these devices are always powered on and hence infected devices can cause a fast and rapid spread of viruses in the local network.

Fourthly, if there is a network behind your terminal which is publicly accessible, someone may try to hack and/or access the VSAT terminal from within this public network with any of the above methods. Once the hacker gains access to the terminal, it can be used for snooping any passing internet traffic, for example stealing credit card data or ID-passwords. No information is stored on the VSAT terminal itself, but that information can be intercepted on the terminal. [8]

XII. SECURING VSAT TERMINAL.

Despite multiple ways to hack it is still possible to protect VSAT terminals by not allowing them direct connectivity to the internet. We may remotely connect to the VSAT terminal, but only if we pass by the VSAT hub, using the hub as an intermediate hop. When you set your network up in this way, there is no direct connectivity between the terminal and the internet which helps to protect against the bulk of the first three types of hacking. However, blocking connectivity between the terminal and the internet does not, in any way, impact the client's ability to use the VSAT terminal for bidirectional internet access. [8]

The second and fourth types of hacking given above consist of exploiting open ports to login typically using Telnet or SSH. This approach is taken on our VSAT terminals is to make sure that none of the terminal's ports are accessible from the internet. However, the customer premises network can access only a limited set of ports (i.e., HTTP, DNS, DHCP, etc.), but the services that the customer premises network are able to access have limited system access and so even if a service is hacked, there is another barrier to overcome before any data is accessed and/or intercepted.

We may also protect the devices in the customer premises network by filtering, blocking or detecting that they are undergoing a hacking attempt. Protecting the various devices connected is generally not done by the manufacturer of the VSAT equipment, but it is up to the clients to do so. Protecting the devices is typically done just before the VSAT hub where you can implement some sort of blocking policy. [8]

XIII. SECURING THE COMMUNICATION LINK

Finally, it is important to secure the satellite communication link as well, because sensitive data could be intercepted between the hub and the terminals, since satellite communication is distributed over a very large geographical area, meaning that almost anyone can listen in. Hence to prevent this, the approach taken is to encrypt all user data that is flowing via the VSAT link. This is done by separating all user data immediately as soon as it enters the VSAT terminal and isolates the traffic inside an encrypted tunnel. [6]

Another threat to the communication link of a satellite is a rogue VSAT terminal taking over the satellite link of another VSAT terminal. This would offer unauthorized access to a malicious user in a network. Hence to counter this, your VSAT terminal can add an X.509 certificate-based authentication to its encryption key exchange protocol. This creates a secure communication link between the intended VSAT terminal and the satellite link and as such prevents rogue VSAT terminals from accessing your network. [8]

XIV. HARDWARE & SOFTWARE REQUIREMENT.

- IPSTAR Uplink Access Test (IUAT)
- Cisco Packet tracer

IUAT: IUAT is a free-to-use IPSTAR transmission access check tool for Windows OS that helps to align the antenna to attain the desired quality of transmitted and received signal. It additionally calibrates the foremost appropriate transmission power of UT and also verifies whether or not the received and transmitted signal quality met the calculated reference level at every installed location.

Cisco Packet Tracer: Packet Tracer is virtual networking simulation software developed by Cisco, to learn and understand various concepts in computer networks. Networking devices appear in packet tracer as they look in reality and a student can interact with various networking devices, by customizing the configurations, by turning them on and off etc. [7]

Packet tracer has both Logical and physical workspace to create customized scenario-based labs and it has got both Real-time and simulation Modes to understand various networking concepts, the same way as it would have happened in real time. Packet tracer also has got user friendly GUI and CLI interfaces, which are easy to work with and doesn't need any experience or expertise. [7]

XV. IMPLEMENTATION AND RESULTS:

A) Cisco Packet Tracer:

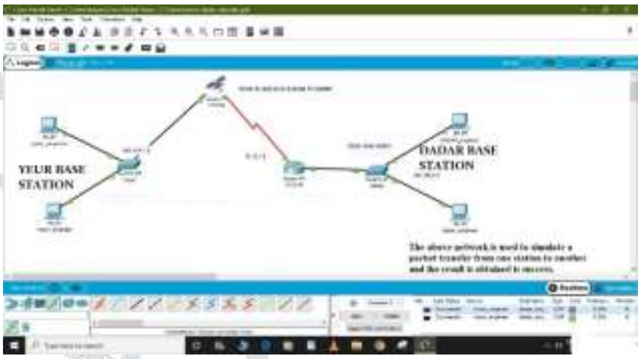

Figure (6): Yeur-Dadar Network Architecture

A virtual network between Yeur base station and Dadar Base station has been implemented in figure (6). The Yeur-Dadar networks comprises of various router which are used to create a secure path way for error free packet transmission, communication satellite which is used for transmission and reception between the network and a switch terminal for proper packet traffic routing.

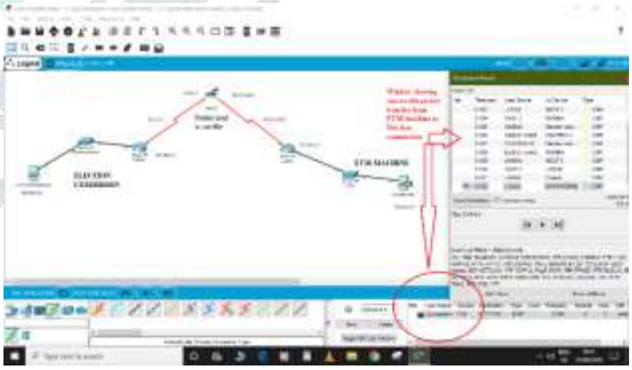

Figure (7): Network between EVM and Election Commission Office.

Figure (7) demonstrates a virtual network link between Election commission and EVM machine. The objective behind this network was to develop a physical link between the Election commission and EVM machine. When a user inputs a vote, the vote is converted into packet by the router and based on the routing table algorithm the router will sends the packets to the destination address. The data packet containing the voters ID and vote is transmitted via the satellite to a secure router of election commission where it is down converted and the information is obtained. Once the packet is received the Election commission will send a positive acknowledgement to the source indicating proper data packet transmission. If the signal is lost during then time interval the Election commission will send a negative acknowledgement which will be received by all active device in the network. This is done in order to determine the current location of the packet and will further notify the source address for retransmission.

Figure (8): Network between EVM and Election Commission Office Using MPLS Cloud

Figure (8) show a network architecture which has the same operation of the above network but an MPLS cloud is added to provide proper traffic management in order to avoid propagation delay. The major function of MPLS Cloud is to provide traffic management while transmission and to provide proper packet routing using label switching algorithm.

B) Designed VSAT Terminal:

Figure (9): VSAT components.

Figure (10): Feed Horn which consists of LNA, BUC and HPA.

Figure (11): Designed VSAT terminal.

The VSAT terminal consists of Feed horn, parabolic reflector, Co-axial output port, LNA (Low Noise Amplifier), BUC (Block UP Converter), and HPA (High Power Amplifier).

Design Steps:

- Connect all the body components of the VSAT terminal.
- Once the components are connected, using a magnetic base angle finder calibrate the angle between the equipment to 0°. It is done so that when we align the VSAT to an elevation and azimuth angle once the all the components are connected, their inter equipment angle doesn't cause any errors during alignment.

Figure (12): Calibration of the equipment using Magnetic base angle finder.

- Once the VSAT terminal is assembled draw a line marking true north and place the center of the terminal on the line.
- Using the compass and taking the true north line as reference align the VSAT terminal to 108° Azimuth angle and 33° Elevation angle.
- Connect co-axial cable from the Feed horn output port to the IPSTAR modem.
- Connect the IPSTAR modem to a computer or laptop and run the iUAT software for link establishment.

The designed VSAT terminal is a two-way transmission medium which means it acts as a transmitter and receiver. For transmission the antenna is horizontally polarized and for reception the antenna is vertically polarized in order to avoid and interference.

C) iUAT Software:

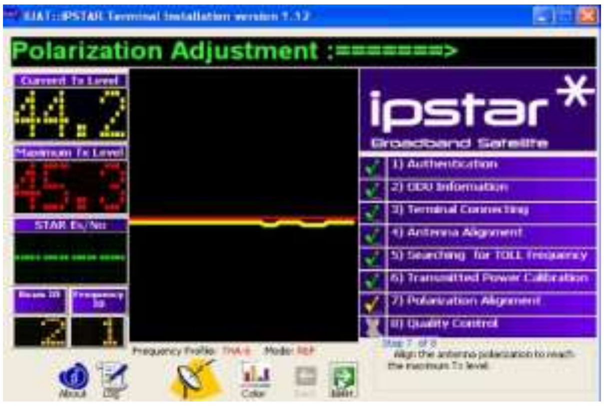

Figure (13): iUAT initialization for link set up

Figure (14): Conformation of link set up.

Figure (15): iUAT Link setup successful.

D) Output:

Figure (16): Testing calling service

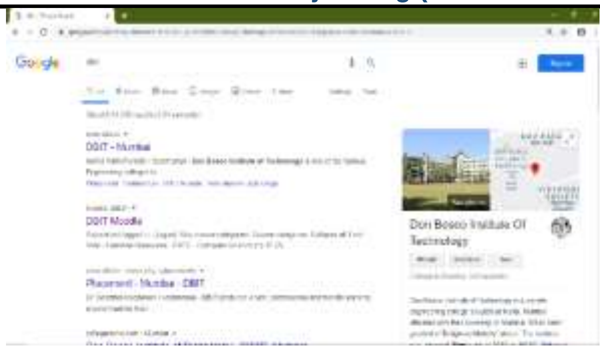

Figure (17): Testing Internet service.

The designed network was used to perform Calling service and Internet service using VSAT. For calling service a BSNL secured landline device using an APD (Analog Phone Detector) converter was used. The internet service was tested and is demonstrated by accessing our college website using google shown in Figure (17). Figure (14) shows the demonstration of calling service. As there was no access to EVM machine equipment the use of EVM machine to demonstrate results was not possible. But the demonstration of calling and internet service using designed VSAT shows similarity of using an EVM machine which can be used to cast votes.

XVI. CONCLUSION

In this paper the application of VSAT technologies have been presented & discussed. The important technologies required for achieving desired specifications were also discussed. Satellite communication obtains the tool technology to interconnect and integrate all the network types and thus gains the needed advantage of reducing network infrastructure. By using Cisco packet tracer, the simulation is performed. The basic idea of this project is to authenticate and authorise transmission of votes which are in form of data packets to the Election Commission by using satellite. The simulation shows successful transmission of votes between the polling station and Election Commission. The designed network was tested for calling and internet service which shows similarity of using an EVM machine Which can be used to cast votes. The objective of this project is to make sure that there is minimum possibility of malpractices. Since there is no need of transportation of EVM machines, hence there is very less possibility to alter the data of EVM machine. Once the election is conducted in a particular rural area the system can be used to provide internet and calling services.

XVII. FUTURE SCOPE

The addition of smart antenna in the system alone can increase spectral efficiency and quality of services manifold. In the future, there is a need to develop a new detection algorithm that can support the broad level of network integration promised by wireless

ACKNOWLEDGEMENT

The authors would like to thank Dr.Revati B, Mr. Arjun Gupta and the staff at BSNL earth station for their constant support and guidance. We would also like to appreciate our guide Mrs. Aparna Telgote for her guidance during this project.

REFERENCES

[1] Gerben W. de Jong, et al., "A fully integrated Ka-band VSAT down-converter," *IEEE J. Solid-State Circuits*, vol. 48, no.7, pp. 1651-1658, Jul. 2013

[2] Mason, "A digital video broadcasting standards for satellite, terrestrial and cable television transmission," *in IEEE Microw. Symp*. Dig., 2007, pp.61-66.

[3] Z. Deng, et al., "A CMOS Ku-band single conversion low noise block front-end for satellite receivers," *in Proc. RFIC,2009*, pp. 135–138.

[4] " IEE Colloquium on 'VSAT Requirements for Future Applications' (Digest No.212)," *IEEE Colloquium on VSAT Requirements for Future Applications, London*, UK, 2012, pp.12-20.

[5] P. Wang et al." Design of fully integrated receiver front-end for VSAT applications," 2015 *IEEE 15th Topical Meeting on Silicon Monolithic Integrated Circuits in RF Systems, San Diego* 2015, pp.45-70.

[6] Y. Gao et al." Modelling of satellite communication systems design with physical layer security," 2017 *International Conference on Wireless Communications, Signal Processing and Networking* (WiSPNET), Chennai, 2017, pp.1-20.

[7] Sheikh Raashid Javid,"Role of Packet Tracer in learning Computer Networks" (PDF). *International Journal of Advanced Research in Computer and Communication Engineering.* pp 9-18, May 2017.

[8] "Televoting System Using VSAT" *2nd International Conference on Advances in Science & Technology (ICAST*) 2019 K J Somaiya Institute of Engineering & Information Technology, Mumbai, India, pp.1-4.