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Feasibility Study of Bangabandhu Satellite – 2

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ABSTRACT

Bangabandhu Satellite-1, a powerful emblem of the country's ambitions, is aiming to boost economic development and create employment. The tiniest changes in this software sparked a frenzy on social media and sparked unparalleled excitement. Defense, remote patient monitoring, literacy, science, web conferencing, and other business sectors in the area have all benefited from the satellite. With the advent of the Bangabandhu Satellite-1, Bangladesh's satellite communication exploration has taken a new direction. We must first research and evaluate satellite operation principles before we can make a significant contribution to this exciting wake of globalization. The overall goal of the research is to recognize a feasibility review for the Bangabandhu Satellite-2. Only certain case study on Bangabandhu Satellite-1 is included in the research. It is possible that it would not include all aspects of the country's first satellite because doing so will be too time intensive and unclear. Furthermore, the data collection process was halted due to the Covid-19 epidemic, which made conducting a printed survey method impractical. We have fixated on the Bangabandhu Satellite-1 in depth. The motivating forces for us are technical, socioeconomic, and resource availability. The principle of satellites was first adopted. Afterwards, we included an outline of satellite communication systems along with various satellite types. We largely focused on its various facets, benefits, and drawbacks. The standing of the Bangabandhu Satellite-2 was also distinguished. The thesis winds down with rational conclusions and debate. It clearly highlights the potential of the Bangabandhu Satellite-2.

Keywords:-*Bangabandhu satellite-1, bit error rate (ber), geo satellite networks, turbo codes, VARION algorithm.*

INTRODUCTION

A satellite is a man-made object placed for a particular purpose in the orbit. Those objects are also known to differentiate them from natural satellites like the Earth Moon. The satellites are man-made. In more than 40 nations artificial satellites have been launched with 10 countries employing their satellite launch. The earth is space trash with thousands of abandoned spaceships and satellites, while only a few hundred satellites are presently operating. With the launch of the Bangabandhu-1, Bangladesh's first geostationary communication satellite, it entered an elite club of 57 countries [1].

The satellite was launched from Cape Canaveral's historic Kennedy Space Center aboard SpaceX's upgraded Falcon 9, the company's most current rocket.

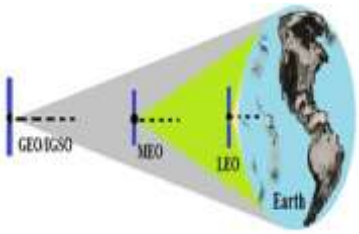
In January 2015, it was purchased for $28 million from the Russian satellite company Intersputnik. The satellite, which orbits at 119.1 degrees east longitude, delivers

direct-to-home (DTH) services, video distribution, and very limited VSAT services throughout Bangladesh [2].

The weight of the BS-1 is 3600 kg. The three major components of a satellite are the communication system, which includes an antenna and transponder for receiving and transmitting signals, the electricity framework, which includes the PV Module for supplying power, and the propulsion framework, which includes the rocket that propels the spacecraft [4]. A satellite requires its acceleration framework to reach the appropriate orbital area and adapt to it regularly. The gravitational influence of the Moon and Sun causes a satellite's geostationary orbit to move gradually from north to south or east to west [5]. The minute the satellite is illuminated by the Sun, the power supply facility uses a solar cell plant to transform solar radiation to electrical energy.

Through launching its first satellite, BTRC has begun collaborating with the project to add another layer of credibility to Bangladesh's broadcast communications. Because of its geographical zone, Bangladesh is particularly vulnerable to cataclysmic disasters, but we can now communicate with others through satellite communications during a catastrophic event.

(a)



(b)

(c)

Fig.1:-*(a) Satellite, (b) Positions of Satellites, (c) Orbits of Satellites [15]*

LITERATURE REVIEW

S. M. Rezaul Karim [6] in their paper namely "A Review of Communications Satellite by Focusing on 'Bangabandhu Satellite-1', the First GEO Communications Satellite of Bangladesh", focused solely on the first GEO satellite of Bangladesh, 'Bangabandhu Satellite-1'. They analyzed its cost, specifications, description of each section the satellite, its application and the impacts.

They came to a conclusion which indicates that the 'Bangabandhu Satellite-1' would enable a drastic development in the telecommunication, connectivity of Internet and weather forecasting as well. They stated their hope as the satellite will add a new dimension to the country's economy and information technology.

According to Igor Bisio and Mario Marchese's statement in their paper named "Power Saving Bandwidth Allocation over GEO Satellite Networks" highlights on the bandwidth allocation called W-UMD [7]. They showed how W-UMD makes a balance between loss and power needs.

Courville et al. (2007) carried out a study where they assessed the major source of satellite communications in combined satellite/terrestrial networks, as well as the direct consequences that should be performed to maximize hybrid bandwidth is discussed. Following that, some typical networks that are expected to account for a large portion of the future telecommunications business industry and benefit from hybrid architectures are presented [8].

Iapichino et al. (2008) proposed a different framework in their paper that recognizes IPv6 and thus can combine hybrid satellite and cellular terrestrial networks which provide mobile emergency responses. The optimized diverse infrastructure's goals are to include maximum versatility to emergency teams and to serve multimodal voice and data connectivity requirements throughout the first critical hours [9].

VCGs in the effective hybrid satellite and terrestrial infrastructure configuration incorporate two modes of communications: V2I communications via satellite connections and V2V information systems via ad hoc connectivity.

Md. Sazal Miah [et al.] in their paper regarded as "Comparative Study and Performance Analysis of Different Modulation Techniques Relevant to Bangabandhu Satellite Communication System" introduced the concept of artificial satellites and discussed some early artificial satellites [10]. They conducted the research with a view to presenting a comparative study and analysis of the performance of various modulation techniques regarding Bangabandhu Satellite-1. They have concentrated on some fundamental data identified with the modulation frame works and focused on all conceivable modulations plans utilized in the satellite inter-changes.

Nasrin Mustafa in her article named as Bangabandhu Satellite: A Journey to Space, clearly stated that the BS-1 is one of the bold steps taken by the government. She also predicted that soon the government will be able to launch BS-2, 3 and many more in near future.

In a study, Savastano et al (2019) used the VARION algorithm on WAAS-GEO satellites for about the first time in a realistic specific circumstance to explain the atmospheric reaction linked with the Falcon 9 rocket launch from Vandenberg Air Force Base in California on August 24, 2017 [11]. They showed that using GEO satellites as a supplement to GPS offers useful geophysical data, allowing for a more accurate explanation of the ionosphere's time and space evolution. We developed a de - noising algorithm to bring WAAS GEO L1/L5 TEC solutions into line with GPS L1/L2 TEC solutions in terms of satellite-based disturbance.

METHODOLOGY

Feasibility studies are often used to see whether an approach is suitable for even further validation; in other cases, they allow researchers to see how their theories and results can be formed to be applicable and long-lasting. Such studies can reveal how and what, if anything, needs to be changed in the research methodology or procedures, but also how those modifications may proceed.

When mutual relationships ought to be developed, expanded, or stabilized; when there are few previously scientific reports or project background using a specific intervention tactic; when there are few previously published studies or actual data using a specific intervention technique; when previous intervention strategies using a similar approach have failed, but better versions which succeed; or previous techniques have had good effects but in settings other than the one of concern; feasibility study is done there.

The study is limited to only "Case Study" on Bangabandhu Satellite-1. It may not cover all the facts of the country's very first satellite as that will be too time-consuming and may not be lucid. Besides, data collection process could not be conducted as printed questionnaire survey was impossible to carry out due to Covid-19 outbreak.

A case study was an acceptable technique to research as we sought clear, contextual, and in-depth information on a specific issue in the actual world. It helped us to determine the essential characteristics, interpretations, and consequences of the case. It keeps our study limited and manageable because we have no resources or funds for extensive research.

We choose the particular case that we want to concentrate on after we have established our issue statement. This feature was emphasized in order to:

- Offer additional distinct or surprising perspectives on the topic;
- Present hypotheses and ideas can be questioned or complicated;
- Make recommendations for realistic solutions to a dilemma;
- Broaden testing avenues in the long term.

Although case studies are more particular than generic assumptions, there are some theoretical linkages in the field. This results in more than a description of the case study; it is also linked to the existing understanding of the issue. It might be used for:

- Show a hypothesis by describing the present situation.
- Extend philosophy by the identification of new thoughts and hypotheses.
- Search an extraordinary case that violates conventional ideas to test a theory.

We wanted to draw together all of the different elements of the scenario in order to provide as accurate a description of the subject as feasible when writing it. We made an effort to provide meaning for the situation, tie it back to literature, and clarify how it blends into larger trends. It is outlined in a more descriptive form to discuss and assess the topic from different perspectives.

MOTIVATION

Bangabandhu Satellite-1, the first satellite in Bangladesh, launched a Falcon 9 rocket from Cape Canaveral. The goal of satellites was to deliver a variety of services to consumers, including home-to-home television, radio, telemedicine. This sophisticated satellite has been greatly anticipated, because it would allow the government in neighboring countries such as Nepal, Burma, and Bhutan to provide telecoms, including direct broadcast and other television services.

Bangabandhu Satellite-1 is a strong representation of the ambitions of the country and works to promote economic growth and create jobs. The least advancements in this program have inspired social media fervor and unparalleled enthusiasm. The Satellite supports several businesses around the region, such as defense, telemedicine, education, research, video conferencing, and many more.

OBJECTIVE

A feasibility study analyses a planned initiative's efficacy. A feasibility overview strives to critically and prudently discover the benefits and disadvantages of a current planned plan, including the possibilities and challenges in the natural world, the capital required to accomplish the venture and, eventually, the project's chances of execution. In perhaps the most basic form, the two way to determine feasibility are the considered necessary expenditure and the worth to be obtained. Feasibility studies are critical in the growth of a sector. They will help a company choose when and how it can work. It might see possible roadblocks to its activities and estimate the profitability of the project to keep the project up and operating.

Fig.2:-*Bangabandhu Satellite-1 [2]*

By 2023, Bangladesh will deploy its second satellite, the "Bangabandhu Satellite-2." France is involved in working with Bangladesh on the construction of the Bangabandhu Satellite 2. PricewaterhouseCoopers and Bangladesh Satellite Company Limited (BSCL) have signed a contract (PwC). On behalf of their respective sides, BSCL Managing Director Shahriar Ahmed Chowdhury and PwC Global Space Practice Leader Luigi Scatteia signed the contract. After receiving feedback from the consultancy, BSCL Chairperson Shahjahan Mahmood said they can evaluate costs. They got proposals from 21 consultancy firms. Following that, they choose PwC because of its affordable rate and strong reputation. I2.1Launching of Bangabandhu Satellite-1.

Bangabandhu Satellite-1 is equipped with 26 Ku-size band transponders and 14 C-band transformers, based on Spacebus 4000B2 platforms from Thales Alenia Space. Its service area includes Bangladesh and the outlying neighborhoods. This system will provide the Ku-band with capacity across the Bengal Bay, India, Nepal, Bhutan, Sri Lanka, the Philippines and Indonesia, and will be located at 119. 1° East. This would also offer C-band capacity throughout the region.

Fig.3:-*Bangabandhu Satellite-1 [2]*

Bangabandhu-1, the country's first commercial satellite, was only used for communication operations since it was a geostationary communication satellite and the frequency band of Bangabandhu Satellite 1 are shown in Table 1.

Table 1:-*Frequency band of BS-1[12]*

BAND	UPLINK FREQUENCY	DOWNLINK FREQUENCY
Ku band (fix service)	12750-13250 MHz	10700-10950MHz and 11200-11450 MHz
Ku band (broadcast service)	14500-14800 MHz and 17300-18100MHz	11700-12500 MHz
C band (broadcast service)	6725- 7025 MHz	4500-4800 MHz

Modulation Techniques of BS-1

The method of transforming data into electrical signals that are designed for transmission is known as modulation. Video, speech, and other data signals are tuned to elevated signals in this process, which is also defined as a transporter wave signal. In old days satellite communication analog modulation techniques had been used, but optical modulation is now being used. PSK is a digitally modulated technique which uses the phase of an analog carrier wave to reflect digital binary data. The phase of the carrier wave is moved into the binary inputs (1 or 0). The two-level PSK uses a 180-phase shift from 1 to 0. There are many other different modulation techniques that use the framework to relay binary digital data [12]. It includes, for example, two-level PSK (BPSK), four-level PSK (QPSK), etc. To demonstrate binary data, 16-QAM, 64-QAM, 256-QAM, and other models have used both amplitude and phase difference. In a two-level PSK, each signal transduction element describes a particular bit, whereas each signaling element in a four-level PSK symbolizes two bits.

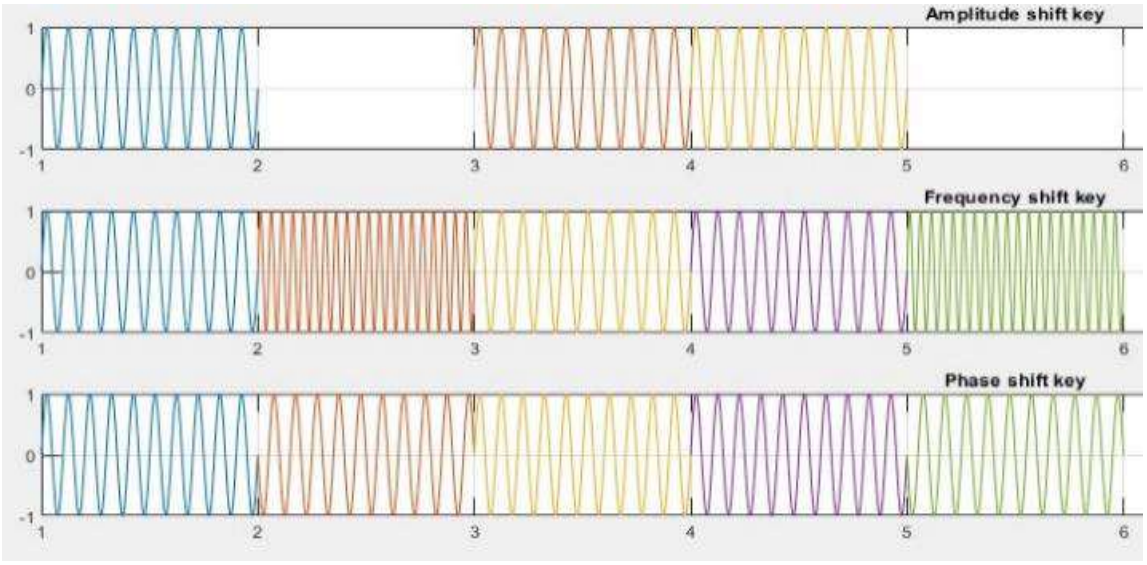
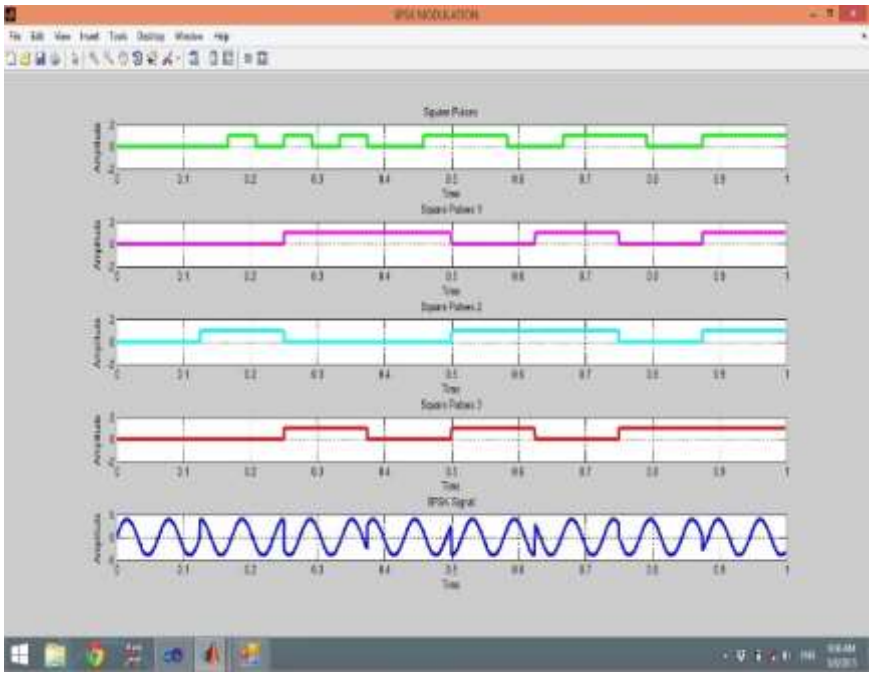
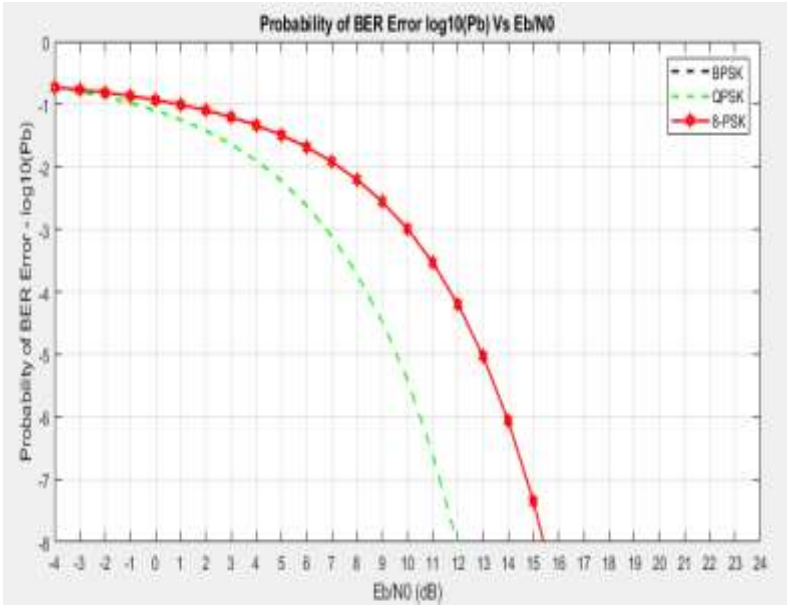


Fig.4:-*Basic digital modulation technique*



(a)



(b)

Fig.5:-*(a) 8-PSK Modulation Scheme, (b) Bit Error Rate for BPSK, QPSK, 8PSK [12]*

BS-1 employs 8-PSK modulation scheme. Each signaling unit in 8-PSK represents three bits. Eight discrete phase shifts are used in 8PSK, or Eight Phase-Shift Keying. Eight Phase Shift Keying.

The production of eight phases is shown in diagram. The final 8-PSK is made up of Square Pulses, Square Pulses 1, Square Pulses 2, and Square Pulses 3. At 0°, 45°, 90°, 135°, 180°, 225°, and 315° degrees, phase shifts occur.

In comparison to other modulation schemes, it transports data more effectively over RF signals. As a

consequence, it uses less energy than ASK and FSK modulation strategies. It is less prone to making mistakes than ASK modulation and utilizes the same bandwidth. High-level PSK modulations, such as QPSK (2 bits per constellation), 16-QAM (4 bits per constellation), and others, will enable higher transmission rate. PSK has a high level of noise immunity and a low error rate.

On the contrary, its bandwidth utilization is poorer. The binary data is demodulated by assessing the phase states of the signal. These verification and retrieval algorithms are extremely complex. PSK modulation techniques with multiple levels (QPSK, 16QAM, and so on) are more susceptible to phase shifts. This is also a type of FSK, so it has a relatively low bandwidth efficiency than ASK modulation. PSK is not a highly power-efficient modulation technique than those of other modulation styles since two bits take more power to transmit.

Earth Control Station

Any satellite transmission network will be incomplete without earth stations. An earth station's role is to retrieve or relay data from the satellite system in perhaps the most premium and efficient way possible while maintaining the optimal signal strength.

An earth station may have both communicate and exchange capability, or it may only be sufficient of transmitting or receiving, based on the specification the category of operation may be used to further categorize it. The Fixed Satellite (FSS) and Broadcast Satellite (BSS) and Mobile Satellite (MSS) specifications are currently separate from each other.

An earth station consists of a reflector antenna (or parabolic dish), a feed system to receive and transmit the RF carrier, data processing equipment, and mechanical surveillance equipment to retain the satellite well within antenna's data send/receive field [13-14].

The bureau that gathers data from satellite system invariably owns earth stations, and they must operate within those boundaries in order for the network to remain unchanged. Earth stations are key component of the ground segment of a satellite network, which includes all earth stations in a satellite system. This can be placed at each end user's equipment directly or via a terrestrial connection.

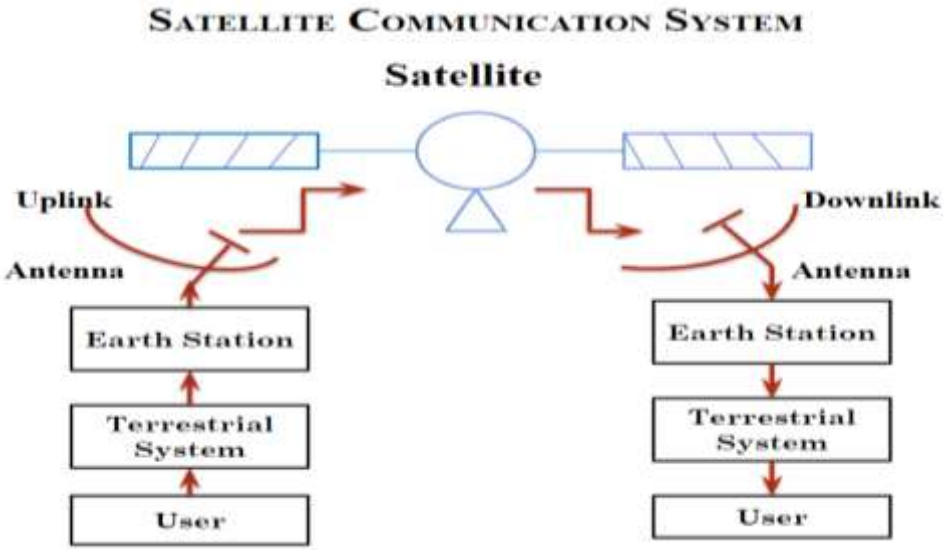


Fig.6:-*Satellite Communication System*

As a main and standby site for BS-1 service and monitor, there are two ground stations. Joydevpur in Gazipur and Betbunia in Rangamati are the core and alternate areas. Correspondingly, the primary ground station for the Bangabandhu-1 satellite, the Sajeeb Wazed Ground Station, is located adjacent the Telecommunications Staff College in Telipara, Gazipur. The station, named after the prime minister's son and ICT adviser, Sajeeb Wazed Joy, was launched through teleconference from Dhaka's Bangabandhu International Conference Centre.The satellite's backup ground station, which is also titled after Sajeeb Wazed and is centered in Betbunia, Chittagong, was also officially launched.

Bangladesh's first satellite, Bangabandhu-1, was launched into orbit, and the Betbunia Ground Station in Rangamati is acting as the supplementary control center for it. The Bangabandhu Satellite Primary Ground Station in Telipara, Gazipur, is the primary control station for the satellite. Bangabandhu Sheikh Mujibur Rahman launched Betbunia, Bangladesh's first satellite earth station, on June 14, 1975.

At the Betbunia Satellite Earth Station in Kawkhaliupazila, the Rangamati Ground Station is situated on a five-acre plot. Spectra Engineering Limited, a Bangladeshi company employed by Thales Alenia Space in France, designed the project's framework. Development on the initiative started in 2016. Basically, there is no distinction between this station and the one in Gazipur. Both are built in the same way. The main building is an oval-shaped structure that monitors house satellite operations, a control center, and a network service center. SpaceX extracted the satellite from the 2nd phase enhancer 33 minutes after launch from the Kennedy Space Center in Florida to place it in geostationary orbit.

(a)

(b)

Fig.7:-*(a) Gazipur Ground Station, (b) Betbunia Ground Station*

The gap between the two ground stations is 340 kilometers that is sufficient to prevent logistical issues in the occurrence of rough weather. Both stations are directly linked by a very high-speed network that allows data to be mirrored between one and the other. Land section, mission preparation, and space operations monitoring software were developed by Thales Alenia Space. A satellite control and network management center is positioned at each earth station.

The Thales Alenia Space offered mission coordination and space activities monitoring resources for the ground segment. The satellite control and network operations centers are housed in two field facility buildings. The civil activities for the field infrastructure were assigned to

Spectra Engineers. Again, Thales Alenia Space will be in charge of the ground portion, and will use Thales Alenia Space's SpaceOps software for mission planning and tracking. Depending on the SpaceGate Thales Alenia Space comprehensive approach which comprises two ground buildings that is the house for the use of Satellite Control and Network Operations Center.

The ground section was also handled by Spectra Engineers Ltd., Thales Alenia Space, using the specialized SpaceOps solution for operation setup and tracking. The satellite control center and operating network center are part of this work kit, which is focused on Thales Alenia Space's robust SpaceGate implementation. Thales' Bangladeshi partner is in support of the ground facilities' legal function. The Bangabandhu Satellite-1 has sent test signals to ground stations in Gazipur and Betbunia. The test signals from the country's first communications satellite were obtained by the two ground stations.

Although the satellite's activities were initially supervised by international experts supplied by the satellite's maker, officials involved in the project say that 30 Bangladeshi scientists ultimately took charge of the entire operation.

The two ground stations at Gazipur and Rangamati will be operated by 18 of them, while the others will be in full control of the stations' structural and infrastructure facets. Since their recruitment, the physicists, a group of young men and women, have undergone training abroad. They were already being trained by overseas instructors of Thales Alenia.

Table 2:*-Parameters of Different Earth Station [15]*

Earth Station	**Latitude**	**Longitude**	**0ºC Isotherm Height**	**Point Rain Rate For 0.001% Per year**	**Transmit Power (W)**	**Antenna Diameter (m)**	**Uplink Freq. (GHz)**		**Down Link Freq. (GHz)**	
Dhaka	23.7º N	90.367º E	5600	66	174	4	Ku	C	Ku	C
New Delhi	28.61º N	77.23º E	5500	66			14	5.925	11.7	3.7
Kathmandu	27.7º N	85.3333º E	5540	66						
Colombo	6.9344º N	79.8428º E	5500	66						
Thimphu	27.4667º N	89.6417º E	5550	66						
Male	4.1753º N	73.5089º E	5450	66						
Islamabad	33.7167º N	73.0667º E	5400	78						
Kabul	34.5333º N	69.1667º E	5200	78						

The main advantage is how straightforward it is to reverse engineer them by using "syndrome decoding" method. It is incredibly flexible, permitting for supervision over block period and detailed error levels, contributing to the creation of user interface to meet stringent guidelines. BCH codes are effective in mathematics and computer science due to the relatively low replication and easy implementation in devices.

The key benefit is how simple it is to decrypt them using the "syndrome decoding" process. It is extremely adaptable, allowing for control over block duration and appropriate error levels, allowing for the creation of custom code to meet particular requirements. Because of their low replication and simplicity of implementation in devices, BCH codes are indeed effective in theoretical computer science.

However, owing to the iterative and complex decoding algorithm, it can become complicated. Since the demodulator is unable to determine whether a decoded packet is true or false.
In the field of satellite systems, compact disk players, DVDs, disc drives, two-dimensional bar codes are frequency codes Reed–solomon, which are indeed BCH, among other applications. Irving S. Reed and Gustave Solomon established the Reed-Solomon codes, a compendium of error-correction codes, in 2000. They have a variety of applications, among which electronics are the most well-known.

Reed–Solomon coding is a technique for correcting burst errors caused by media faults that is commonly used in mass storage systems. Parchive files, which are often shared alongside multimedia files on USENET, use Reed–Solomon error correction as well. When splitting up archives, the distributed online storage provider Wuala (discontinued in 2015) used Reed–Solomon. In contrast to BCH codes, RS codes do not perform well in BPSK modulation techniques. Reed-Solomon Codes have a lower Bit Error Ratio (BER) than BCH codes.

TURBO CODE

Turbo codes had been suggested by Berrou and Glavieux and were first used in 1993. The most significant advantage is that turbo codes do not have a fixed limit for reducing bit error rates. The iteration demodulation theory is often used to lessen the bit error rate, and the amount of iteration steps can be boosted endlessly.

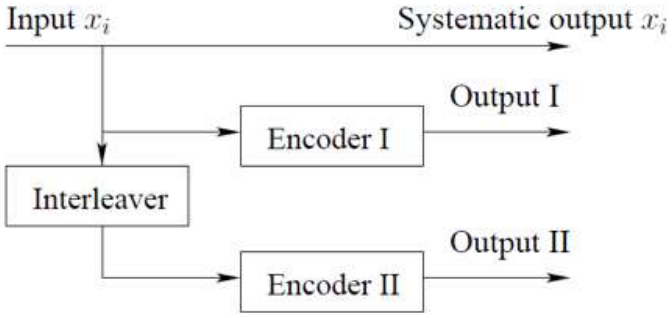


Fig.8:-*The Structure of Turbo Encoder [19]*

Turbo Codes make use of very long block lengths. It has a decoding complexity that is conceivable and performs very closely to potential. About the fact that Turbo Codes are still used in BS-1. Alterations for each implementation of a communication device, different conditions on turbo code properties are

demanded. As a base code, the telemetry turbo code was used for short data message transmission. The telemetry turbo code is designed for fast data block transmission and can operate with extremely low Eb/N0 [18].

Turbo codes are used in a variety of areas in addition to encoding all of our data in 3G and 4G networks. They are used by NASA to communicate with space probes that have been developed since 2003. The space group, which has to deal with many restrictions on communication processes, is particularly fond of these codes, which are often used by ESA for many of its probes [19]. Turbo codes are a much more sophisticated way of integrating redundant data. They depend on the initial message being transmitted in three different formats. The raw, uuencoded data is included in the first copy.

The second is modified by encoding each piece of data with an algorithm that the coder and decoder exchange. Lastly, another variant of the message is encoded, but this time with several changes (specifically, a permutation). It is not the initial message that is encoded and then transmitted in this third instance, but rather a transformed version. The initial message is then decoded and matched to the three iterations.

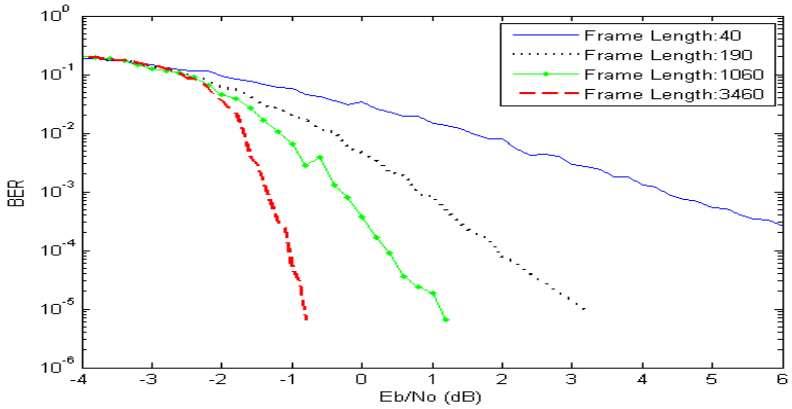


Fig.9:-*BER performance of turbo codes concatenated with STB codes for different frame lengths.*

Technical Feasibility

This evaluation is focused on whether or not the firm has the necessary technical skills to complete the venture. The government has chosen PricewaterhouseCoopers (PwC) as the contractor for Bangabandhu-2, the country's second satellite. Under the PwC name, PricewaterhouseCoopers is a multinational telecommunications network comprised of collaborations of companies. PwC is the world's second-largest consulting company network, following Deloitte, EY, and KPMG. It is one of the Big Four financial institutions. They have a regional launch business to ensure self-sufficiency in space entry. PwC Strategy&, which has a 100-year history of tech consulting, uses a distinct "capabilities-driven strategy" methodology to help companies achieve their goals. There have been 518 launch activities in Russia, the United States, China, and Europe since 2011 and 2017.PricewaterhouseCoopers (PwC) has successfully accomplished five years of service in Bangladesh. PwC Bangladesh has figured prominently in enabling the state's financial prosperity since its

inception in 2015, supporting both the domestic and foreign investors.

As a matter of fact, we can confidently state that the corporation has the resources to carry out this execution. The problem at this stage is that the plan is theoretically and legitimately viable.

Economic Feasibility

Economic feasibility is concerned with the study's economic ramifications. It evaluates a potential venture's economic feasibility by analyzing initial costs, operating expenditures, profitability, and identifying possible results.

Bangabandhu-1 was launched as part of a Tk. 27.65 billion program. Bangabandhu-1 is expected to break even in nine years, as it was expected to gain Tk 125 crore annually from the selling of 26% power. By trading the available capacity, Bangabandhu-1 stands to make more often than Tk 200 crore.

Bangladesh Television, a state-owned television station, is BCSCL's initial customer, paying Tk 18 crore annually. Other private television channels would bring in Tk 60 crore for the venture. It will also receive Tk 4 crore from the shipping and fisheries ministries. Apart from that, the remaining funds came from Beximco Communications Limited’s Direct-to-Home (DTH) operation.

BCSCL predicted that recovering the entire cost of the Bangabandhu-1 satellite would take just nine years, based on a conservative assessment of unsold availability. The government has agreed to pay PwC $200,000 in the event launch of Bangladesh's second commercial satellite.
Bangabandhu-2 would not be short on funding, according to the authority, since the government has designated it as a prioritized project.

Furthermore, the expense of the second satellite is estimated to be smaller than that of the first. When the launching is finished of the Bangabandhu-1 satellite, we now have all of the required infrastructure, particularly ground stations.

As a consequence, those expenditures will not be needed for the second satellite's launch. Thus, we do not need to look for a business, establish a ground station, or reserve an orbital slot, which will make our path smoother. Two satellites may be placed side by side in the existing orbital slot. This will help save more funds.

Resource Feasibility

In this government's tenure, there is a lot of hope around releasing the second satellite. This satellite would be launched at the government's expenditure. There will be no contractionary monetary policy for Bangabandhu-2, according to high government officials, since the government has designated it as a preference project. They anticipate that the second satellite would be less expensive than the first one.

BCSCL has signed agreements with Dutch-Bangla Bank and Eastern Bank to enlarge the satellite's advertisement global presence. As a result, because of government is involved about this, there will be no competing priorities in attempting to launch the activity. The government has the sufficient financial resources to handle out this project.

Operational Feasibility

Operational feasibility is a statistic for how far a suggested fix outlines hurdles and encounters opportunities discovered throughout requirements analysis, and therefore how well that it fulfills the performance requirements confronted in during service retailer specs evaluation process.

Bangabandhu-1 is mostly a communications satellite, after all. The second Bangabandhu Satellite will not be deployed solely for marketing purposes. It will cover rural locations of the region, including char and coastal locations. Since the second satellite is launched, our capability will be doubled.

Bangabandhu-1 focused mostly on television channel programming, but Bangabandhu-2 would place a greater emphasis on all other issues. The operation of Bangabandhu-2 places a premium on weather forecasts, Earth observation, and mapping.

The satellite's commercial feasibility is largely dependent on the market approach chosen. Since Bangabandhu Satellite-1 will not reach all regions, television Stations will be hesitant to hire its transponders. As an outcome, this issue will be given a lot of attention in Bangabandhu Satellite-2.

Schedule Feasibility

Schedule feasibility report would consider how long it will take to complete the proposal. If a venture takes so long to finish until it is usable, it may crash. Typically, this entails calculating what period the system would take to implement and determining if it can be done in a specific amount of time using techniques such as repayment method.

The schedule viability of a project is an indicator of how realistic the project's schedule is. It evaluates whether the project timelines are fair given to the technological expertise. Any ventures are started with a deadline in mind. It's important to figure out whether the deadlines are required or attractive.

The timeframe for BS-2 is not really set in stone; rather, this is hoped to finish in a certain amount of time. What matters is what timeframe BS2 has after launch in order for the project to be successful.

Market Feasibility

Amongst the most important sections of the feasibility study is market feasibility, which explores the marketability of the goods or services and persuades participants that there is a future market for them. There is no venture if a substantial demand for the goods or services cannot be identified.

Since this BS2 satellite is a composite satellite. The operation of Bangabandhu-2 places a premium on weather forecasts, Environmental sensing, and navigation. As a result, it will serve a larger demand than BS1. Since it would be much simpler and quicker to use than international satellites, the demand for this initiative will be completely open.

Project Requirements

This initiative has certain project requirement considerations that must be considered. For the build, you'll need the following tools and equipment: Construction, needs Qualified and unqualified labor, as well as financial and operational labor, are all needed. Expenditures of plans and consultations, as well as the costs of fabrication and other tools, are included in the building phase.

PWC will determine the Bangabandhu-2 satellite's technological and commercial conditions in Bangladesh. Installation, professional and inexperienced labor would all be provided by the firm. We've also built a base station or rented an orbital slot, so the project's requirements are taken very seriously.

Bangabandhu Satellite-2

BCSCL had taken the initiative to build the second satellite after the successful launch of the country’s first communication satellite, Bangabandhu-1,

as the government had promised to launch the second one within its tenure by 2023. According to BCSCL that as the first satellite was a geo-stationary communication satellite, the second one would be a hybrid satellite which can support weather forecast and surveillance along with other activities. Bangladesh had applied to the International Telecommunication Union (ITU) for a dedicated national orbital slot in four positions — 69E, 74E, 102E and 133E — in the space for the second satellite.
Bangabandhu satellite-1 is nothing more than a communications satellite. That being said, the government plans to introduce a satellite that will provide us with weather, climate, and geographic information system data (GIS).

From afore considerations, some drawbacks of BS-1 are crystalized. The BS-1 satellite is just a communications satellite. It would not be effective to lessen the outages of broadband internet access. The satellite's entire frequency cannot be used to solve any technical issues, such as overcoming the limits of internet access in distant regions. The 40 transponders on BS-1 have a total bandwidth of 1600 megahertz, but Bangladesh will indeed be able to use 1400 megahertz. The cost of maintaining uninterrupted internet access would be significantly increased. Satellite bandwidth is slowly being depleted. Satellite transmission has a longer propagation delay and more noise disruption. Repairing and maintaining seems to be impossible.

On the bright side, the satellite corporate entity has begun to make profits on its own two years after the flight of Bangabandhu satellite-1. The satellite does have 40 transponders, 14 C-band and 26 Ku-band. The profits from the satellite is now expanding. BCSCL has entered into a contract with Dutch-Bangla Bank and Eastern Bank to enlarge the satellite's business reach.

BS-2 can help with weather forecasting and monitoring as a hybrid satellite. As a hybrid satellite, Interconnection of network components in and between organizations and authorities should be a top priority for BS-2.The coordination networks for crisis response and disaster recovery developed by BS-2 would be able to operate in potentially inhospitable environments. Transponder size can be doubled with the BS-2. To enable emergency responders to focus on their duties, the emergency network must be mobile, quickly deployable, and low-maintenance. As a result, computers must be able to automatically organize themselves into a network.

Horizontal scalability in BS-2 will guarantee the network's ability to expand geographically quickly and expenditure, while vertical scalability will improve the network's potential to effectively service a thousands of users.

In point-to-point connectivity in integrated satellite/terrestrial telecommunication networks, over than one path is normally open, and traffic should be transferred over a single path for "Load Balancing. "In hybrid environments, the interoperability of QoS (Quality of Service) processes is crucial for providing reliable end-to-end Qos requirements.

The BS-1 satellite was deployed as part of a Tk. 27.65 billion program. The break-even point is expected to be achieved in nine years. So far, it was projected to earn Tk. 125 crore per year from the sale of 26 percent electricity. BS-1 could be able to gain more than Tk 200 crore by selling the remaining capacity. This is a really optimistic estimate of the waiting to be sold capacity; it will take less than nine years to heal the entire value of the

Bangabandhu-1 satellite, as per the estimate. Bangabandhu-2 would not be short on funding, according to the authority, since the government has designated it as a priority project. Since we have all of the necessary infrastructure in place, particularly base station, the BS-2 is supposed to be less expensive than the BS-1.

There may occur some technical issues just like any other cases of satellite:

Incorrect Orbit

It is impossible for a spacecraft to fly into orbit on its own. It needs anything to drive it along. During a rocket launch, there is a chance that the satellite will be put in the wrong orbit. During the launch of an Ariane 5 rocket, communications were lost for more than 9 minutes. As a result of the error, two satellites were launched into space with wildly inaccurate angular inclinations of 21 degrees, compared to the planned 3 degrees.

Internal Issues

Electrical, networking, atmospheric, fuel, and orbital maneuvers are only a few of the subsystems that make up a spacecraft. Just like a vehicle can break down or our bodies can become ill, spacecraft modules can malfunction.

Space Weather

The sun, our pleasant neighbor, emits radiation that can harm electronic components and cripple satellites, specifically during geomagnetic storms. Satellites, including their defensive shielding, are not necessarily able to tolerate a large stream of high-energy molecules or electromagnetic current.

Inter-orbit satellite tech transfer

Apart from GEO satellites, the orbits of LEO and MEO satellites are not stable with respect to the Earth. This gives a clear idea that the satellite is not always perceptible to the earth station. Devices communicate between a LEO and MEO satellite at any time using an inter-satellite connection and a GEO satellite as a gateway. If two LEO satellites have a clear line of sight, data can be relayed between them. The transmission of data from Earth to satellite has a significant time lag.

Collisions

As the number of man-made buildings has increased exponentially over the past decade, space is becoming highly congested. Furthermore, there are still defunct satellites in orbit that no one orders or monitors. Land crews could be unaware of an imminent danger if data transmission is interrupted. Problems like these played a role in the notorious 2009 Iridium satellite disaster.

Furthermore, the cost of designing, developing, investing in, and ensuring a satellite is higher and the transmission delay can generate echo over telephone connections. Satellites are difficult to restore and sustain. Any factors, such as temperature or sunspots, disrupt the satellite's signal, causing disturbances and making proper satellite service difficult. So, while deployed, the BS-2 must be tracked and operated on a routine basis to ensure that it stays in space.

We may also need to build another earth station for Bangabandhu Satellite-2, either as a main or backup. We have already built two earth stations for Bangabandhu Satellite-1, one of which serves as a backup.

We're still debating whether we need to build another earth station for Bangabandhu Satellite-2 or if the existing ones would suffice. This necessitates a great deal of anxiety. With the research we've done for this thesis and all of the feasibility considerations in mind, we can confidently predict that the BS2 project will be feasible in the future.

CONCLUSION

Satellite connectivity is a major research field for Bangladesh, which has taken a new direction with the launch of the Bangabandhu Satellite-1. To be able to contribute to this promising engineering area, we must first learn and research the operating principles of satellites. The aim of this research is to present a Bangabandhu Satellite-2 feasibility study.

We also concentrated on the information about Bangabandhu Satellite-1. Our deciding factors are technical, socio-economic, and resource availability driven. The type of channel, earth station necessities, equipment limits, band-width restrictions, power confinements, and other factors all play a role in determining modulation procedures for a given communication device. We have shown some parameters of various Earth stations as well. We continued by introducing the idea of satellites. Following that, we gave an outline of satellite communication networks as well as various satellite types. Following that, we concentrated on the Bangabandhu satellite-1.

We concentrated on its various facets, benefits, and drawbacks. We also recognized the importance of the Bangabandhu Satellite-2. By defining seven different types of feasibility, we brought a new dimension to this research. The analysis sequentially considers organizational, fiscal, plan, sector, capital, and project specifications. As a consequence, the analysis comes to a conclusion with fair conclusions and debate. It candidly demonstrates the feasibility of the Bangabandhu Satellite-2's efficiency.

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