Use of Micro Satellites for Global Connectivity, High Speed Transmission & Data Analysis

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Abstract

This project depends on relative planned swarming system of inter-connected cube satellites, these satellites will be connected and will drift relative to each other which means that the level of coverage and service will change with time. The governing parameter of the drift is the relative velocity difference received at the time of deployment. These inter-connected satellites will be equipped with HET (High efficiency thrusters) for higher orbital stability and collectively these satellites can give very low latency data rates at data latencies down to about 20-30 milliseconds, which is done End to End Quantum Data transmission with an additional feature.
This study helps on data analysis also the relative drift is solved using constantly changing satellite connections which has a very stable and planned orbit using the Teran celestial coordinate system in order to provide uninterrupted high-speed data connectivity as well as other facilities.

This is a phase by phase developmental project of the project "Use of micro satellites for rural connectivity and data analysis". The main theme of this project revolves around the use of cube-based satellites in Very Low Earth Orbit in order to provide global connectivity, high rates of connectivity speed using quantum qubit data packets for compressed and fast connectivity as well as data analysis such as weather, disaster alarming and scientific data analysis.

These satellites being very small at the size of 1U cube satellites, are relatively very cheap to conventional approaches to satellites and are much easier to mass produce and mass launch as they are light and easy to deploy.

The results expected from this project is that, the people of the rural areas can get connected to the internet so that they can have a better education and can know about the various technologies of the outer world that can enhance their development as well. Many parts of world are disconnected to road systems or even sufficiently advanced technologies, these mobile and portable satellites will be able to connect practically each and every part of the making global connectivity possible. Not just that but already connected urban areas too can enjoy very fast and easy to afford high speed connections and accurate weather data. Using quantum data transmission means we can use these later on as a way to do deep space communication as well! Having this in constellation also provides us a new opportunity of data analysis through constant earth observation. Technologies like these can signal wildfires and flood etc. and can help reduce loss of property and life in a natural accident etc. Realizing the need of this, this is what I would like to present and research on would like to work on this project.

Keywords: Cube satellites, VLEO, Quantum data, swarming, HET

Table of Contents

1. Abbreviation

- I/O Input/output
- HET High efficiency thrusters
- Can sat Can Satellite
- Cube sat Cube Satellite
- RA Right Accession
- Dec Declination
- EQ Equatorial
- RADAR Ratio Detection and Ranging
- LASER Light Amplification by simulated emission of radiation
- VLEO Very low earth orbit
- HF high frequency
- LF low frequency
- UHF ultra-high frequency
- VHF very high frequency
- VLF very low frequency
- RF radio frequency
- PV Photovoltaic
- X- OR Excusive OR gate
- H gate Hadamard gate
- CX gate Controlled-X gate
- ID gate the identity gate

- U3 gate 3 parameter qubit gate
- U2 gate the two parameters control two different rotations within the gate
- U1 gate Rz equivalent gate
- Rx gate rotating the qubit state around the x axis by the given angle on a bloach sphere
- Ry gate rotating the qubit state around the x axis by the given angle on a bloach sphere
- Rz gate rotating the qubit state around the x axis by the given angle on a bloach sphere
- X gate Pauli x gate flipping the |0⟩ state to |1⟩ and vice versa (angle π)
- Y gate Ry for angle π (X+Z = Y)
- Z gate flipping the |+⟩ to |−⟩ and vice versa for Rz at angle π
- S gate Rz for angle π/2 Clifford gate
- Sdg gate S^-1 gate
- T gate Rz for the angle π/4
- Tdg gate T^-1 gate
- cH gate controlled-Hadamard gate
- cY gate controlled-Y gate
- cZ gate controlled-Z gate
- cRz gate controlled-Rz gate
- cU1 gate controlled-U1 gate
- cU3 gate controlled-U3 gate
- ccX gate Toffoli

- SWAP Swaps condition of 2 qubits
- Barrier Operation barrier gate
- $|0\rangle$ operation Reset operation
- IF operation conditional if
- Z measurement Measuring operation
- BS_s Bloach Sphere
- U (1U) 1 Unit Cube
- a semi-major axis
- R_e Equatorial Radius of Earth
- e Eccentricity
- μ standard gravitational Parameter of Earth
- Cd is the drag coefficient of the satellite
- V_{rel} satellite velocity
- ρ Density of earth's atmosphere
- CCS Celestial Coordinate System
- CMOS Complementary Metal-Oxide Semiconductor
- CCD charge Coupled Device

2. Introduction

The project is a step by step project with an ultimate goal of deploying huge global swarms of interlinked satellites that can provide high speed internet facilities, meteorological data analysis and disaster monitoring, alarming. The project will be a huge asset in global connectivity, accurate weather prediction and science data as well as disaster monitoring systems when it will be at its final phase. These satellites being portable and easily deployable to anywhere and on a custom orbit, can provide very high-speed internet from ~10Gbps and other data in places where even transportation facilities are hard to get too. The speeds provided are much higher than that of optical fiber and it is much easier and cheaper to achieve too! I really believe that this project can play an important role in achieving global connectivity, as well as providing new technological breakthrough later on as End to End Quantum Data transmission starts in the inter connected networks. Transmission of data in quantum states also allows to transmit data in much faster as well as a much safer way using Quantum cryptography based on the laws of Quantum Physics. It results in Global connectivity, broadening of the education reach worldwide and step towards achieving practical and technologically possible quantum end to end wireless data transmission as well as an all-round development of the whole world.

3. Motivation

The motivation came along the way of studying Astrophysics and Physics as a whole, I realized that the problem of global connectivity was very much solvable and that I could possibly create an impact for global internet connectivity possibly with the help of high speed interconnected repeating systems, further development and research led me to find out that these can be done using cube satellites much more effectively and efficiently and provide a solution that was a new innovation to the world itself. Soo starting from April 5th 2017(05/04/2017) I started this project as my very own research mission and to make it a market viable and commercial product in the future. It has been 2 years ad 5 month since and I still am finding better and more efficient ways to make it a reality soon. As of now I am at Phase 2 of the work and I aim to complete this project by the next 4 years. My main motivation is my love towards science and Physics and Astrophysics specifically. My theoretical developing understanding along with my developing skills in engineering motivates me to make the world a more connected and secure place as well as be more informed of the earth we live and love. I am and still will continuously work on these satellites until I fulfill the final goal of High-speed connectivity, and global connectivity using these cube satellites

4. Related work

The work related to this satellite stated about 2 years and 5 months ago, since the there have been developments of various versions of the satellite at various phases of development

1. Phase 0: Can sat Design, RND, Development (Alpha, Beta, Final version development)
    1.1. Can sat V. 1.0 alpha & Development of Graphical User Interface V 1.0
    1.2. Can sat V. 1.1 alpha
    1.3. Can sat V. 1.2 alpha1(Young Scientist's Summit Nepal 2018 – Selection for APCYS 2018) Winning Project Engineering Category & Development of Graphical User Interface V 1.0.1 (bug fixes, adding sensors and optimization of software hardware linking)
    1.4. Can sat V. 1.3 beta
    1.5. Can sat V.1.4 Beta
    1.6. Can sat V 1.5 Beta (APCYS 2018 – Silver Medal in Engineering Category) & Development of Graphical User Interface V 1.1
    1.7. Can sat V. 1.6 beta
    1.8. Final Can sat V. 1.7 with custom CNC printed and etched PCB & Development of Graphical User Interface V 1.1.1 (bug fixes, fixing real time GPS reading error, enhanced sensors added)
2. Phase 1: Cube Sat Design & Training
3. Phase 2: Materials Research And R&D, Prototype (alpha, beta, gamma)
    3.1. Cube sat V 1.8 Alpha (Young Scientist's Summit Nepal 2019 – Selection for APCYS 2019) Winning Project Engineering & Development of Graphical

User Interface V 1.2 (For cube satellite with control sending and receiving system integration and better antenna synchronization)

3.2. Cube sat V 1.9 Alpha & Development of Graphical User interface V 1.2.1 (easier interface, bug fixes, faster execution times, higher efficiency of code)

5. Proposed Method

The purposed method is devised of interconnected constellation of 1U cube satellites (10cm^3 dimension) cube sats that stay inter connected in a celestial coordinate system called the RA and Dec system, this system is much more efficient than the standard Tourrus and gibbous or gaussian swarming systems. The systems will constantly emit and receive data and signals to and from the earth station and node receivers the satellites will be set in the Dec system at the first stages that can enable us to set the transmission scales through the use of 24-hour Geological Timescale Measures. The later stages of the mission will carry Pico sats which will densely cover the RA system of the earth too. The satellites on the Dec orbit will act as the main transmission units where as the ones on the RA orbit will work as boot modules and error correction modules. The satellites in the Dec orbit will have variable no. of satellites per line of Dec. but will have equal densities in all sections of the orbit.

5.1.Drift Velocity and Orbital Mechanics

These satellites will be relatively drifted from each other to avoid collision as well as plan maneuvers and stability issues. The relative drift velocity is given by:

$$\mathbf{H = (1/2 *(v*v))-\mu/r}$$

where μ is the gravitational parameter defining the potential and r is the magnitude of the position vector r. The position and velocity of this satellite defines co-ordinates in a 6-dimensional phase space, and Hamilton's equations define the motion of the satellite through this phase space at all later times. Position and velocity of 2 satellites can be given as:

$$\mathbf{(r \pm (1/2)\delta r,\ v \pm (1/2)\delta v)}$$

2 satellites and keeping midpoints as (r,v) Consider the first order Hamiltonian that describes the motion of the satellite for which the small increments in phase space co-ordinates are added to the midpoint co-ordinates:

$$H= (½(v.v))+ (1/2(v. \delta v))- \mu/r[1-1/2*(r. \delta r/r.r)]$$

The first order Hamiltonian for the second satellite (H_2) can be found from the above by reversing the signs of δr and δv. According to the theory of Hamiltonian systems, both these quantities are conserved by the motion.

The relative drifting is cited and inspired by "Using Differential Drag for Management of Nano-Satellite Constellations", "Relative Motion Between Satellites on Neighbouring Keplerian Orbits"

Here for Keplerian orbits

$$T=2\pi\sqrt{(a^3/\mu)}$$

The above cubes will experience identical perturbations that are functions of attitude, mass, and cross-sectional area. The cubes will still experience different perturbations due to effects that are functions of satellite position. For example, the effect of drag follows

$$Vector(a)= -1/2*(C_D)*(A/m)*(\rho v^2_{rel})*(vector\ v_{rel}/ |vector\ v_{rel}|)$$

5.2.Orbital Plane and Coordinate System

The RSW frame, also 18 referred to as Local Veridical Local Horizontal (LVLH), is centered at the satellite with the R axis pointing from the Earth's center along the radius vector towards the satellite and shown in Figure 11 below. The S axis points in the direction of the velocity vector and is perpendicular to the radius vector. The W axis is normal the orbital plane

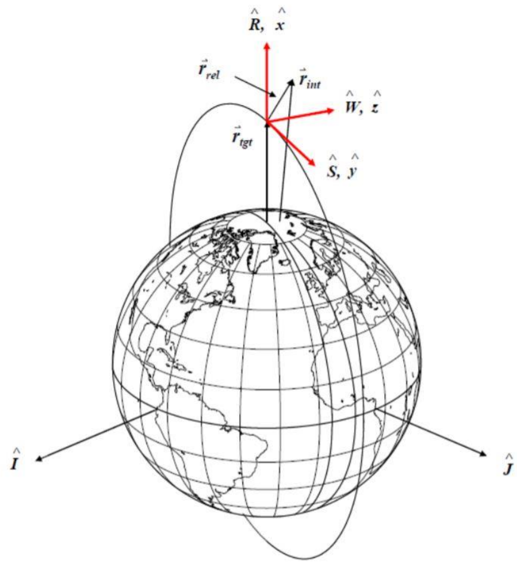

Fig. RSW system of satellites

Moreover, the satellites will follow the orbital mechanics of the celestial coordinate system, usually known as the equatorial coordinate system. The plane of the Earth's orbit is called the ecliptic when it is projected onto the imaginary celestial sphere. The Earth's axis of rotation is at an angle of 23.5° to the plane of the Earth's orbit, so the celestial equator and the ecliptic are also at a 23.5° angle to each other. The Equatorial Coordinate System uses two measurements, right ascension and declination. Right ascension (abbreviated RA) is similar to longitude and is measured in hours, minutes and seconds eastward along the celestial equator. The distance around the celestial equator is equal to 24 hours. Declination is similar to latitude and is measured in degrees, arcminutes and arcseconds, north or south of the celestial equator. Positive values for declination correspond to positions north of the equator, while negative values refer to positions south of the equator. The declination of the north celestial pole is 90° 0' 0" and the south celestial pole's declination is -90° 0' 0". The equator is 0° 0' 0". The advantage of the equatorial coordinate system is that it expresses the position of a star or galaxy in a way that is independent of the observer's position on Earth. However, the right ascension and declination of a given object change slowly over time, mainly due to a phenomenon called precession. Precession happens because both the ecliptic and the equator are slowly moving, as a result of tidal forces from the Sun, Moon and planets. The main effect is from the Moon, which makes the celestial pole orbit around the ecliptic pole once every 26,000 years. So along with the RA and Dec of an object, you will usually see the date, expressed in years, when those coordinates were approximately valid. This date, or "epoch", defines the precessing equator and equinox used to construct the star catalog.

Following this orbital system for the cube sat orbit will result in more precise and accurate tracking alongside the advantage of the ease of orbital collision avoidance

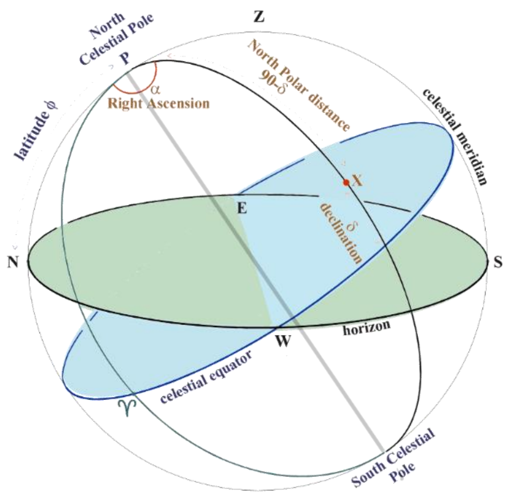

Fig. RA DEC Celestial Sphere

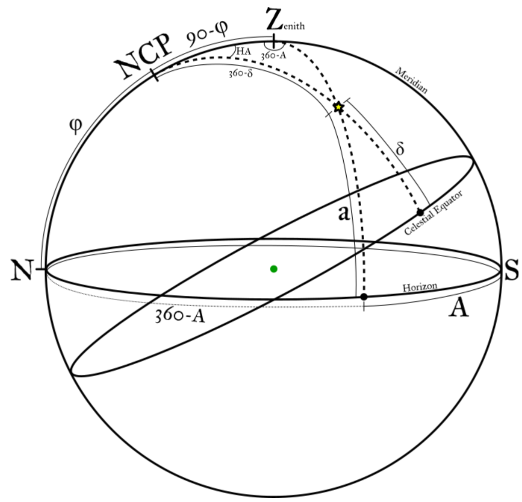

Fig. Celestial Sphere angles

While traditional constellation networks by Spacex, SWARMS, ROSCOSMOS, NASA etc. are in a helical, spheroid, gaussian, Tourrus systems of interconnection, using them is a harder option as higher accuracy systems of tracking would be needed for this to successfully happen whereas the CCS is already is in place and is more accurate than the systems used as of now.

5.3.Orbital Mechanics of Motion

The cube sats constantly on orbit will have about ~89.3427 mins/revolution of the earth , calculated using

$$\mathbf{T^2/R^2= (4+\pi^2)/(G+M_E)}$$

Because of which only one satellite doesn’t cover the whole system, so the purposed solution is a swarmed and planned cluster of satellites, Clusterness is a metric created to analyze how evenly satellites are distributed from a single PPOD and is custom created for this thesis. Clusterness is defined between 0 and 1, where satellites are at maximum separation will result in a metric value of 0 and no separation will result in 1. While it is trivial to visually compare a 0 and a 1 it is much harder to compare clusters of Cubes in states between the two extremes. Here,

$$\textbf{Clusterness} = ||\sum \theta_{max} - \theta_n|| \,/\, (n-1)\theta_{max}$$

Here, θ_n is the true anomaly separation between satellite N and N + 1 and, θ_{max} is,

$$\theta_{max} = 360/N$$

Because Clusterness is a moment-in-time metric the “Consistency” metric was developed to track Clusterness over time. Consistency is reported as a graph of Clusterness versus time

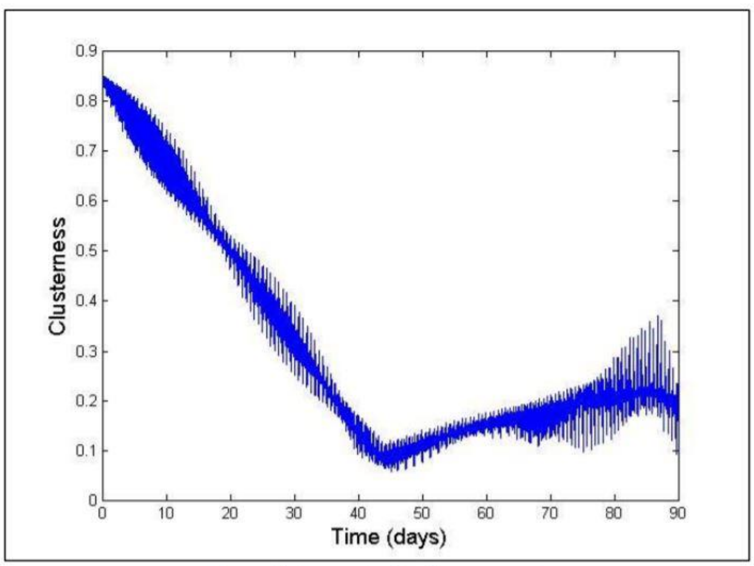

Fig. Example of consistency graph

5.4.Data Transmission in Inter connected satellites

Space laser communication system operates in a frequency range, which is several orders shorter than microwave communication. In this short frequency range space laser communication possesses many advantages like high data transmit rate, high bandwidth, small optical antenna size and weight, narrow field of view, narrow laser emit beam, power efficiency, high precision, broad band and etc. a previously researched on apparatus for this application was used for this purpose named " Inter-satellite laser communication system"

High speed transmission between satellites will enable constant host changing in server satellites and thus will result in high speed connectivity

5.5.Cube sat Model and Dimensions

The satellite be of 1U design based on the universal specifications of 1U cube sat which is

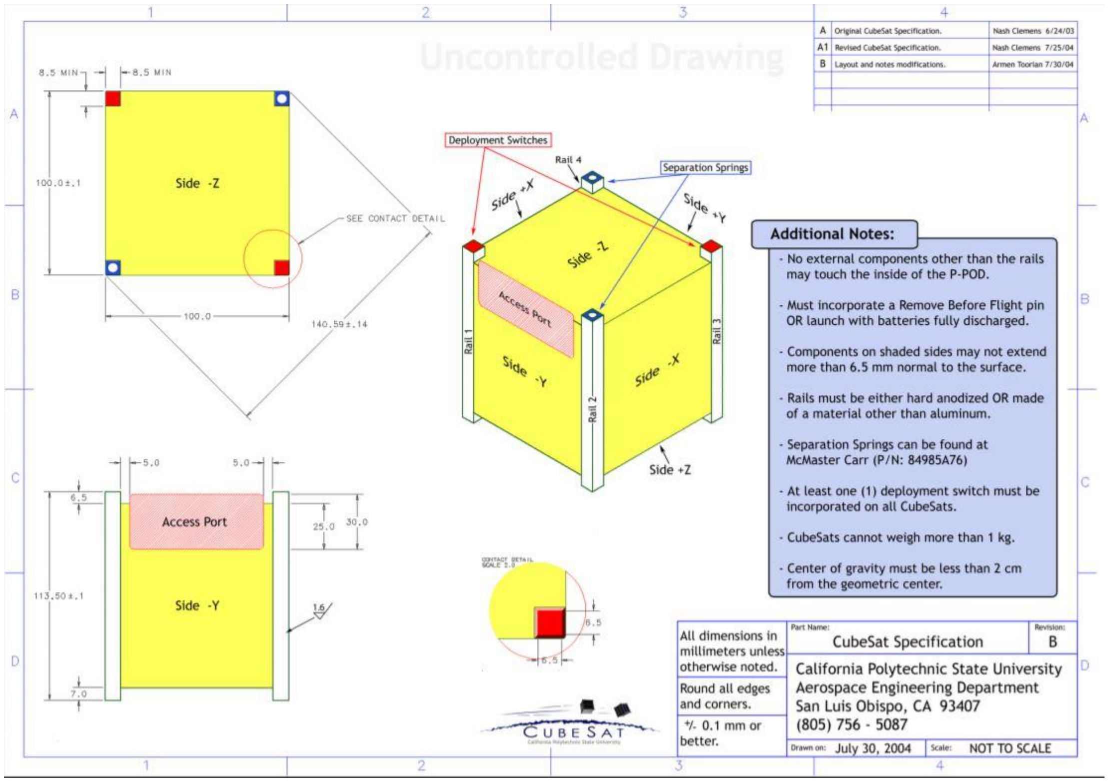

Fig. Specification of Cube sat Model Dimensions

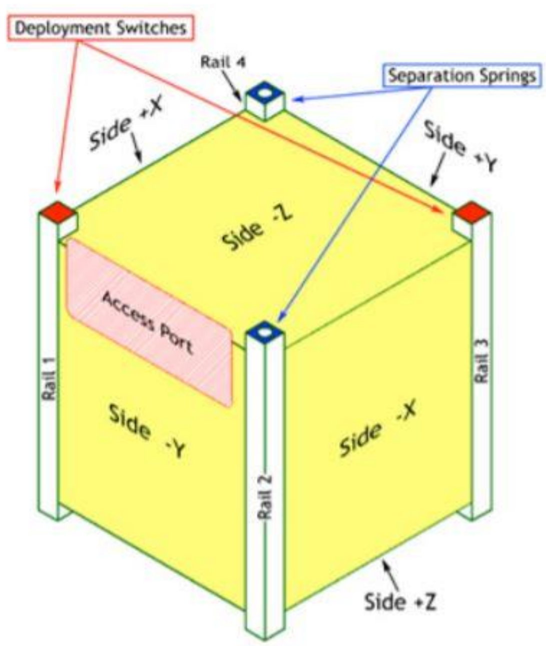

Fig. Specification of Cubesat model dimensions Universal

I have made my satellite as per this dimension along with many other changes below is the block model of the satellite.

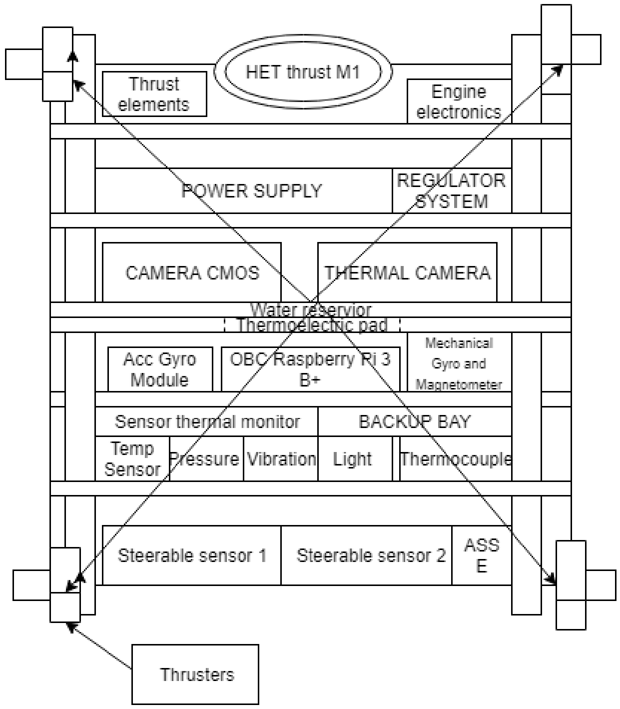

Fig. Model Block Diagram for Cube sat V. 1.9 Alpha

The satellite will consist of onboard computers as Raspberry pi 3B+ which was programmed using python to use various components like CMOS CCD camera, Thermal camera, thermoelectric pad , Sensor Bay, Backup Bay, as well as the antennas and the experimental laser system.

The antenna Host Server system will have a layout of:

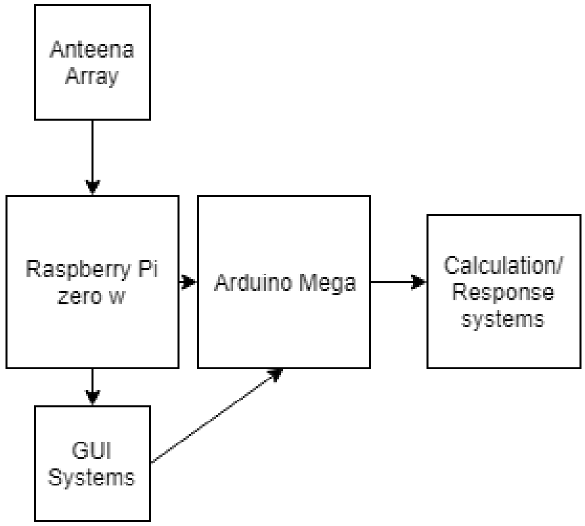

Fig. Host Server Antenna Block Diagram

5.6.Entanglement Based Quantam Data Transmission Systems

On compeleting the LASER Tests by the gamma phase of phase 2, instrumentation of Quantam Entanglement based data transmission will start, this will be done using IBM's quiskit and IBM Q Cloud Based Quantam Computers, while the reserch on this is still ongoing and is surely possible,this will take atleast 4 years to become a reality to any extent .

Here, entanglement is given by:

$$|\Psi\rangle = \frac{1}{\sqrt{2}}\left(|H\rangle_A |V\rangle_B - |V\rangle_A |H\rangle_B\right),$$

The articles like "Entanglement-based quantum communication over 144 km" and "Quantum End to End Data Transmission" were used for this research along with other local resources

a. **Error Mitigation of quantum states**

The effect of noise is to give us outputs that are not quite correct. The effect of noise that occurs throughout a computation will be quite complex in general, as one would have to consider how each gate transforms the effect of each error. A simpler form of noise is that occuring during final measurement. At this point, the only job remaining in the circuit is to extract a bit string as an output. For an nn qubit final measurement, this means extracting one of the 2n2n possible nn bit strings. As a simple model of the noise in this process, we can imagine that the measurement first selects one of these outputs in a perfect and noiseless manner, and then noise subsequently causes this perfect output to be randomly perturbed before it is returned to the user. Given this model, it is very easy to determine exactly what the effects of measurement errors are. We can simply prepare each of the 2n2n possible basis states, immediately measure them, and see what probability exists for each outcome. The information gathered from the basis states $|00\rangle|00\rangle$, $|01\rangle|01\rangle$, $|10\rangle|10\rangle$ and $|11\rangle|11\rangle$ can then be used to define a matrix, which rotates from an ideal set of counts to one affected by measurement noise. This is done by simply taking the counts dictionary for $|00\rangle|00\rangle$, normalizing it it so that all elements sum to one, and then using it as the first column of the matrix. The next column is similarly defined by the counts dictionary obtained for $|00\rangle$. There will be statistical variations each time the circuit for each basis state is run.

Taking the vector describing the perfect results for a given state, applying this matrix gives us a good approximation of the results when measurement noise is present.

$$\mathbf{C}_{\mathbf{noisy}}=\mathbf{M}\ \mathbf{C}_{\mathbf{ideal}}$$

Either way, the resulting counts found in C_{noisy} C_{noisy}, for measuring the $(|00\rangle+|11\rangle)/2$–$\sqrt{(|00\rangle+|11\rangle)/2}$ with measurement noise, come out quite close to the actual data we found earlier. So this matrix method is indeed a good way of predicting noisy results given a knowledge of what the results should be.

Unfortunately, this is the exact opposite of what we need. Instead of a way to transform ideal counts data into noisy data, we need a way to transform noisy data into ideal data. In linear algebra, we do this for a matrix MM by finding the inverse matrix M−1M−1,

$$\mathbf{C_{ideal}=M^{-1}\,C_{noisy}}.$$

Then it is mitigated using calibrated qubits in quiskit

5.7.Propulsion and Minor adjustment controls

The propulsion in the CubeSat will be done using [PATENT PENDING] High Efficiency thrusters enabling recursive propulsion and high obital stability of ~60 years. There are 2 propulsion systems in the system along with 1 adjustment mechanism.

The Propulsion systems are:

a. **HET Engine**
b. **Water based thrust and control system**

The Minor adjustments system are:

a. **Gyroscope and Accelerometer system (Digital/Mechanical**

b. **HET**

The HET system is being developed and researched and has about 2 working prototypes as of now, V. 1.8 alpha HET, V. 1.9 alpha HET, it is a [PATENT PENDING] High Efficiency thrusters enabling recursive propulsion and high obital stability of ~60 years. Which I am combinedly researching upon with Petrone One, Flavius Quasae And My Astronomy and astrophysics club as well as Robotics Club mates.

a. **Water Based thrust and control systems**

This is cited from the paper "*Development of a Water Propulsion System for Small Satellites - IAC 2017*" the main difference in my system is that it uses conventional thermoelectric pads to evaporate Ejecta water as well as cool the processor on the OBC.

The thermoelectric effect is the direct conversion of temperature differences to electric voltage and vice versa via a thermocouple. A thermoelectric device creates voltage when there is a different temperature on each side. Conversely, when a voltage is applied to it, heat is transferred from one side to the other, creating a temperature difference. At the atomic scale, an applied temperature gradient causes charge carrier in the material to diffuse from the hot side to the cold side.

This effect can be used to generate electricity, measure temperature or change the temperature of objects. Because the direction of heating and cooling is determined by the polarity of the applied voltage, thermoelectric devices can be used as temperature controllers.

The term "thermoelectric effect" encompasses three separately identified effects: the Seebeck effect, Peltier effect, and Thomson effect. The Seebeck and Peltier effects are different manifestations of the same physical process; textbooks may refer to this process as the Peltier–Seebeck effect (the separation derives from the independent discoveries by French physicist Jean Charles Atnase Peltier and Thomas Jhon Seebeck). The Thomson effect is an extension of the Peltier–Seebeck model and is credited to Kelvin

In the satellite they are placed in such a way so that their cool side is at the OBC of the satellite and hot side s at the water reservoir

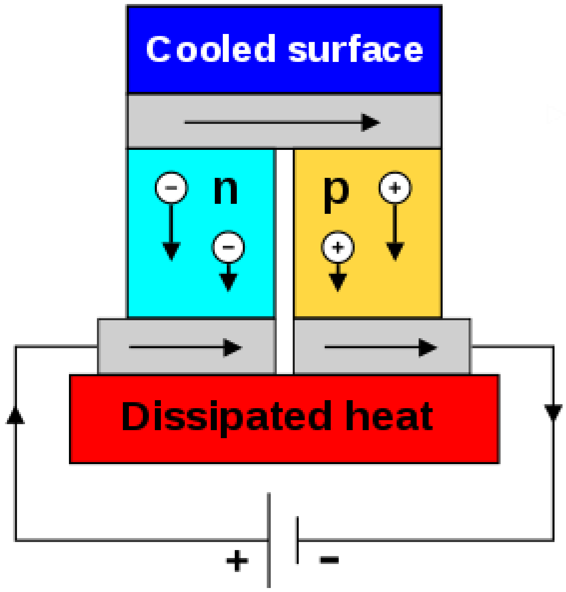

Fig. Seebeck’s Current used for cooling and heating in satellite

When an electric current is passed through a circuit of a thermocouple, heat is evolved at one junction and absorbed at the other junction. This is known as Peltier Effect. The Peltier effect is the presence of heating or cooling at an electrified junction of two different conductors.

When a current is made to flow through a junction between two conductors, A and B, heat may be generated or removed at the junction. The Peltier heat generated at the junction per unit time is

$$\mathbf{Q^{\cdot} = (IIA+IIB) * I}$$

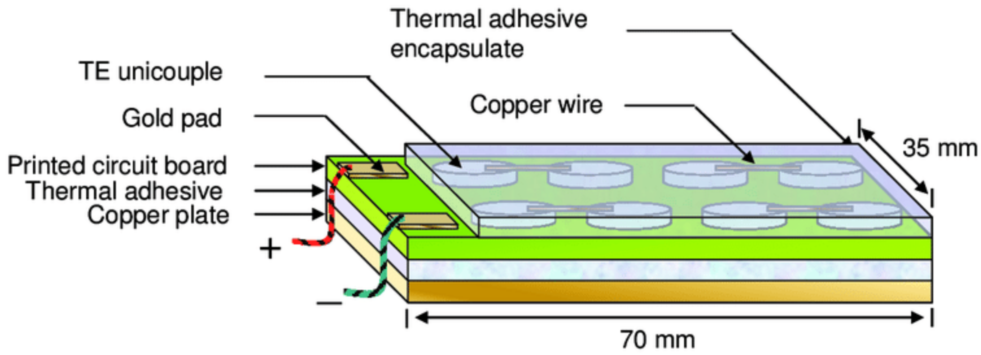

Fig. Schematic of Thermoelectric Peltier Pad

5.8.Build Material Research and Development

I plan to use β- Titanium Carbon Fiber Alloy (Carbotitanium/ Titanium Carbon Fiber Composite) instead of traditionally used materials like steel, alumunium etc. this is because Carbotitanium, When the combination is adhesively bonded both parts will approach maximum yield strength and fail at a similar amount of total strain. The components of carbotanium; carbon fiber and titanium, are woven together to form a strong, light material that can withstand significant amounts of heat and strain. This is because carbon fiber has the highest strength-to-density ratio of any current fiber and titanium has the highest strength-to-density ratio of any current metal. As a result, carbotanium can withstand temperatures up to around 315 °C. The material properties of carbotanium are a mixture of those of a titanium alloy and a carbon fiber.

The titanium and carbon composites are combined by first abrading the titanium to be bonded, coating the titanium with platinum. The titanium is then aged by heating the specimen in an oven at 500 degrees Celsius for several hours then A primer is then sprayed onto the coated titanium. Next, an adhesive agent is applied to the primer side of the titanium and then finally, the carbon is applied to the adhesive. This allows the carbon composite to bond securely to the titanium.

Stable β alloys : Mo Eq. 25-40,

Metastable β alloys : Mo Eq. <25

Here, the M_0% equivalent is given by:

$$Mo_{equiv}\% = 1.0Mo + 0.67V + 0.44W - 0.28Nb + 0.22Ta + 1.6Cr + \ldots - 1.0Al$$

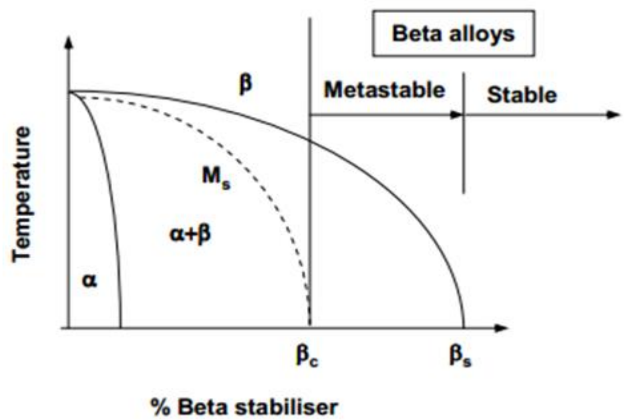

Fig: Temperature Vs % of β stabilizer graph

Using beta alloys are better then using conventional alumunium, etc because, β titanium alloys possess a BCC crystal structure, which is readily cold-worked (than HCP α structure) in the β phase field, and also because Metastable β Ti alloys are hardenable while stable β Ti alloys are non-hardenable

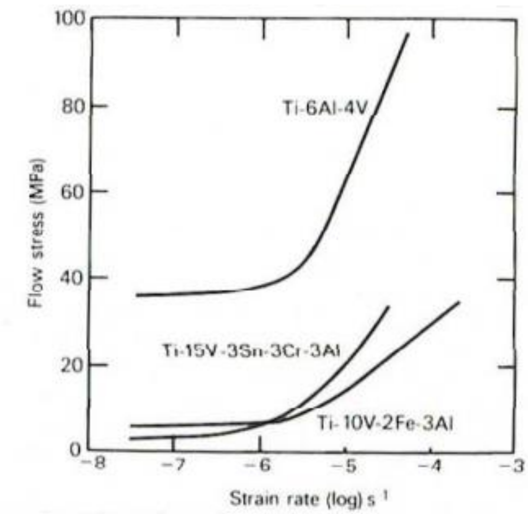

Fig. Stress rate vs Flow Stress of Material analysis

a. Bonding of Titanium and Carbon Fiber

Using Adhesive and enhanced ion beam deposition techniques

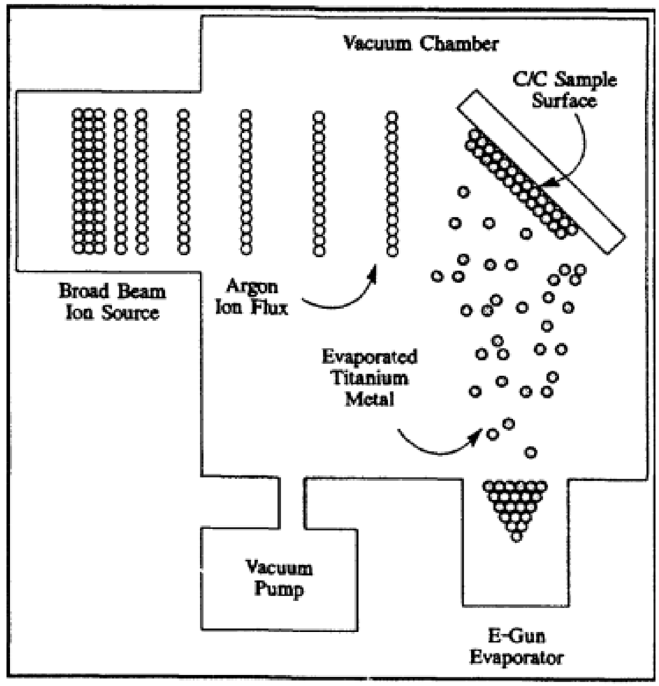

Fig. Ion beam Deposition system for bonding

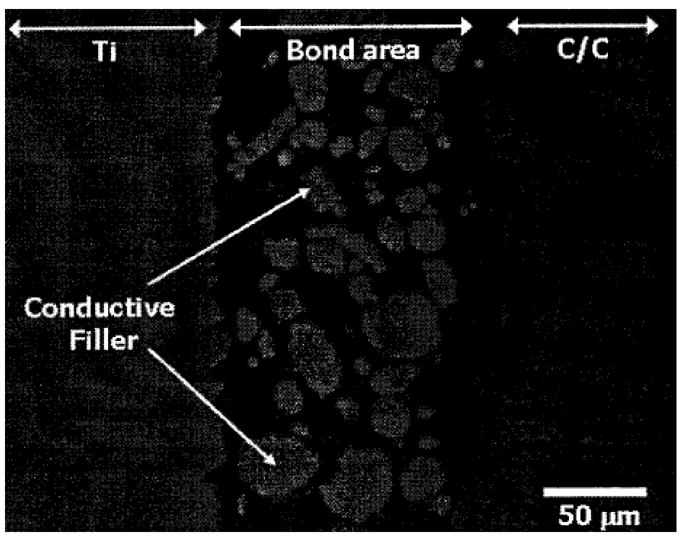

Fig. Bonding Under Macroscopic imaging (SIM)

6. Methodology

How I plan to do this is by accomplishing a step be step developmental process making numerous cubes as well as can satellites in the midst of the process. This is a full of 7-year planned project and is to be completed by Late 2024 A.D. And to be launched and monitored and more research and development for the quantum process and much advanced and efficient systems is to be done. The methodology in imple words is to launch internet transmission as well as weather and data analysis capable satellites in VELO and have a to and from connection in exponential matters of speed with high orbital positioning precision

The phases of the project are as follows:

- Phase 0: Can sat Design, RND, Development (Alpha, Beta, Final)- 8 versions
- Phase 1: Cube Sat Design & Training -models and design prototypes
- Phase 2 (CURRET STATUS): Materials Research And R&D, Prototype (alpha, beta, gamma) – 7 to 8 versions
- Phase 3: Starting the Development of Cube Sat (2 versions for 2 orbits {RA And DEC}
- Phase 4: Prototyping and Test Flights (alpha, beta, final)- 3 versions
- Phase 5: Final Design, Finishing and Launch/ Monitoring and Maintenance

7. Plan of work

1) Phase 0: Can sat Design, RND, Development (Alpha, Beta, Final)

1.1) Research and Planning, material collection

1.2) V 1.0 Alpha

1.3) V 1.1 Alpha

1.4) V 1.2 Alpha 1

1.5) V 1.3 Beta

1.6) V 1.4 Beta

1.7) V 1.5 Beta

1.8) V 1.6 beta

1.9) V 1.7 beta Phase 1 final

1.10) Data Compilation and planning

2) Phase 1: Cube Sat Design & Training

2.1) Trainings and Planning

2.2) Numerous classes

2.3) Planning and Research

3) Phase 2: Materials Research And R&D, Prototype (alpha, beta, gamma)

3.4) V 1.8 Alpha

3.5) V 1.9 Alpha

3.6) V 1.10 Beta

3.7) V 2.0 Beta

3.8) V 2.1 Gamma

3.9) V 2.2 Gamma

3.10) V 2.3 Final

3.11) Data Collection for Final Development

4) Phase 3: Starting the Development Of Cube Sat

5) Phase 4: Prototyping and Test Flights (alpha, beta, final)

5.1) V 2.4 Alpha

5.2) V 2.5 Beta

5.3) Satellite UNISION Constellation Final Design

6) Phase 5: Final Design, Finishing and Launch/ Monitoring and Maintenance

6.1) Mass Manufacturing

6.2) Testing and Error mitigation

6.3) Final making and Finishing

6.4) launch test and data analysis

6.5) Launch of 1st ring to space (65 more successive launch)

6.6) Monitoring and Data Analysis

6.7) Launch of 2nd Ring to space

7) Research on Advanced laser Tech and Quantum Data Transmission

8. Conclusions and Results

- Affordable High-Speed Connectivity for all at every part of the world
- Rapid response systems.
- Accurate Remote Sensing Data.
- Disaster Management.
- Better Educational Opportunities
- Better and More Practical Uses of IOT
- Easy launch systems
- More data for scientific research purposes
- Achieving global connectivity Realistically
- Cheap yet much more efficient and effective options

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