



WEATHER MONITORING USING CANSAT

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Abstract

An Amateur Satellite is a little satellite that is the dimension of a 330ml beverage canister. It is a simulation of an actual satellite, yet it is incorporated right into the form and quantity of a soft drink canister. The key objective of an Amateur Satellite is to instruct the procedures required to develop a little satellite. Trainees are tested to fit all the significant elements of a satellite, such as sensing units, power, plus an interaction system right into the very small quantity of an Amateur Satellite. CanSats are normally introduced by little rockets, balloons, or drones from elevations of 10's to 100's of meters.

Keywords: *Amateur, Canister, CANSAT etc.*

I. Introduction

Satellites are particularly created for telecom objectives. These devices find extensive application in mobile technology, serving diverse purposes ranging from communication

with ships, vehicles, and aircraft to handheld terminals[1-2]. Additionally, they play a crucial role in the realm of TV and radio broadcasting. They are in charge of supplying these solutions to a designated area (location) on the planet. The power plus data transfer of these satellites relies on the recommended dimension of the impact, the intricacy of the website traffic control method plans plus the expense of ground terminals [3]. A satellite functions most effectively when the transmissions are concentrated in a preferred location. They are in charge of supplying these solutions to a designated area (location) in the world. The power and transmission capacity of these satellites rely on the recommended dimension of the impact, the intricacy of the website traffic control method plans, and also price of ground terminals. A satellite functions most effectively when the transmissions are concentrated in a preferred location. When the location is concentrated after the exhausts put on "t go outside that marked location therefore



decreasing the disturbance to the various other systems. This leads to extra reliable range use. Satellite antenna patterns play an important function and should also be made to cover the assigned geographical location (which is usually an unequal fit). Satellites need to be created by remembering their functionality for brief along with long-term impacts throughout their life time. The planet terminal ought to remain in a setting to regulate the satellite if it wanders from its orbit it goes through any kind of type of drag from the exterior pressures. Satellite to Satellite/ Earth Communications describes straight interaction in between gadgets utilizing any type of interaction network, consisting of wired plus cordless. Satellite interaction in telecoms, using synthetic satellites to supply interaction web links in between numerous factors on Earth[4,5,6,7]. The Satellite interaction making use of IoT plus RF Technology is an extremely helpful and also efficient facet of the system. It describes modern technologies that enable both cordless and wired systems to connect with various other gadgets. Web of Things (IoT) based cordless interaction system is made use of for the user interface in between 2 Machines or 2 equipment devices[8,9,10]. Utilizing these kinds of systems we can conveniently relocate maker from one location to various another with no rerouting of equipment cords. The Smart Grid (SG) offers as an advanced assimilation system, combining details from electrical energy grid individuals, generators along circulation networks with the key goal of attaining effective, lasting, affordable coupled with safe and secure electrical energy distribution. In its advancement from the typical source of power, the SG leverages automation to improve control over power circulation advertise environment-friendly performance as well as handle usage. Taking on obstacles such as long-distance transmission losses the SG stresses the growth of modern technologies that lower these losses, straightened with more comprehensive ecological preservation goals [7]. Wireless together with satellite-based systems become critical parts for efficient grid control specifically in huge or remote areas where conventional techniques encounter restrictions. SGs verify crucial in reacting to the developing landscape of transmission plus circulation systems, resolving the surge in dispersed renewable resource generation, and also the intensifying power needs from organizations as well as customers. The combination of Information and also Communication Technologies (ICT) right into



power sector procedures causes the production of SGs, covering varied techniques like Advanced Distribution Network Architectures, Smart Metering, Demand Response, as well as more. Maker-to-machine (M2M) solutions, important to the Internet of Things (IoT), play an expanding function in SG applications, specified by ETSI requirements. Satellite-based M2M solutions acquire prestige particularly in backwoods, sustaining the transmission and also circulation room field. These solutions reach SGs, promoting information collection, ecological tracking, environment evaluation, as well as applications in police along with off-shore tasks. The short article stresses the importance of cordless modern technologies, highlighting narrow-band IoT (NB-IoT) together with various other remedies for SG applications. EC-GSM, LTE-M, plus NB-IoT arise as scalable options for cellular-based IoT, with an emphasis on boosting protection, tool level of sensitivity, cost therefore, and also power intake. The need for energy-saving options enhances, SGs go through continual technical improvements requiring accessibility to details from countless residences. Terminals as well as control facilities such as SCADA, play critical duties in keeping an eye on power usage plus readjusting sources, working as

main factors for information gathering, evaluation as well as decision-making while of power effectiveness. Within the previous years, the area of room education and learning has experienced quick development significant by the appearance of numerous modern technologies. Tiny satellites particularly have come to be essential to scholastic programs worldwide, playing a vital function in advertising area education and learning. Pico-satellites, personified by CanSats have carved out a one-of-a-kind specific niche within area instructional programs using trainees a fundamental understanding and also an inspirational background to start or seek their grad research. These tiny satellites do not just function as instructional devices but additionally stand for the preliminary steps towards the layout, building, and construction together with the advancement of tiny satellites geared up with miniaturized tools for innovation trial and error as well as area screening.

Additionally making use of pico-satellites such as the one discussed in the objective consisting of the HDC1000 (Integrated Low Power Humidity in addition to Temperature Digital Sensor) includes crucial info for climatologically investigations specifically



geographical areas. The sensing unit's capacity to tape physical standards at elevations listed below 1km shows the value for atmosphere security at the Astronomical Observatory of Universidad Autónoma de Nuevo León (OA-UANL) in north Mexico (Colin, Valdes-Sada, et al. 2016; Colin, Ayala, et al. 2016). This is especially substantial for astronomical observatories like OA-UANL, where ideal weather conditions are essential for unhindered skies monitoring (Ayala et al. 2016; Erasmus & Van Staden 2002). Furthermore, the unification of a dependable Global Positioning System (GENERAL PRACTITIONER) such as the GMS6-CR6 (9600bps) in the gone over pico-satellite, improves the satellite's capacity by offering specific area collaborates to explain the kept an eye on location. In this paper, we define the outcomes as well as the procedure for constructing coupled with screening a pico-satellite installed right into a container of polyethylene terephthalate (ANIMAL) of 345ml. The setting up as well as examinations were made in the summertime of 2015 throughout the 6th CanSat Leader Training Program (CLTP-6 2015) hung at the University Hokkaido-Japan along with the University Space Engineering Consortium (UNISEC 2015). The pico-satellite was

introduced in the centers of Uematsu Electric Co. Ltd. in Akabira-Japan by a paper design rocket, which attained an elevation of about 100m. The objective was developed to gauge physical variables, such as temperature level coupled with moisture, making use of digital sensing units. Throughout the trip, we observed that the temperature level inside the rocket was $\hat{\approx} 0.5$ ° C greater than the temperature level of the setting. We signed up a moisture distinction of $\hat{\approx} 5\%$ gauged in between the optimum elevation as well as the touch-down factor. The trip pattern was forecasted to an airplane that covers a location of around 50m \times 50m through the works with a GENERAL PRACTITIONER. CanSat functions as a unique sort of rocket haul created for academic objectives in training area innovation, carefully appearing like the modern technology utilized in scaled-down satellites. It is necessary to keep in mind that no CanSat has ever before ventured past Earth's environment or gotten in orbit, according to readily available referrals. In CanSat competitors, a collection of rigid requirements remain in the area. The haul should fit within the confined quantity of a common soft drink can, with measurements of 66mm in size plus 115mm in elevation. Moreover, the haul's mass is required to be



listed below 350g. While antennas can be on the surface their size can not be enhanced up until the CanSat has been released from the spacecraft. The launch elevation differs depending on the details of competitors. Generally, CanSats are launched from little rockets at established altitudes. To help with recuperation as well as decrease damages CanSats are furnished with an air recuperation system, frequently a parachute, permitting their recycling. The portable dimension as well as the economical nature of CanSats make them an optimal device for training room innovation in academic setups.

A CanSat is a substitute variation of an actual satellite cleverly incorporated within the portable measurements as well as a form of a soda can. The difficulty depends on effectively suitable all the significant parts necessary for satellite procedure consisting of power, sensing units, and also an interaction system right into this restricted area. Ultimately, the CanSat is released utilizing a rocket or a drone from a specific elevation. This hands-on method allows pupils to acquire a thorough understanding of satellite performances by embarking on numerous jobs plus getting rid of difficulties. For pupils along with scientists desiring to add to the satellite field the CanSat task functions as a very useful based on

learning from, providing understandings that can be put on extra comprehensive satellite-related jobs. In the context of establishing nations like Bangladesh participating in CanSat jobs can spark inquisitiveness amongst satellite research enthusiasts, promoting skill advancement as well as adding to the nation's breakthroughs in this arising area. A satellite's antenna patterns are crucial making ensuring ideal insurance coverage of unevenly designed locations. Style factors to consider ought to focus on functionality for both brief together with long-lasting results with planet terminals with the ability of satellite control to avoid orbital wander or outside pressures' effect. Satellite-to-satellite and also Earth communications include straight interaction in between gadgets making use of different networks, consisting of wired plus cordless alternatives. Satellite interaction, using fabricated satellites, offers to develop interaction web links between various Earth factors, with IoT as well as RF innovation playing a substantial function in boosting these systems. Smart Grids (SGs) are developing power systems for effective, lasting, cost-effective safe, and secure electrical power distribution. They incorporate info from individuals, generators, and also circulation grids, taking on difficulties like dispersed



renewable resource generation together with boosting power needs. ICT consolidation right into power market procedures, consisting of SGs, gets on the increase with a concentrate on progressed circulation network designs, wise metering, need action, combination of renewable resource sources together with personal privacy. The evaluation post reviews cordless coupled with satellite-based Machine-to-machine (M2M) solutions' function in SG applications, highlighting the requirement for cost-efficient interaction networks. Innovations like NB-IoT, LTE-M, and also satellite-based M2M solutions are discovered thinking about metropolitan together with local suitability for SGs. The paper likewise discusses room education and learning plus the expanding function of tiny satellites specifically in the context of pico-satellites like CanSats. These gadgets add to area academic programs, using hands-on experience as well as laying the structure for future advancements in tiny satellite modern technology.

II. Literature Review

In 2016, a comprehensive survey focused on analyzing the enhancement of satellite network infrastructures, particularly in the context of satellite backhauling services for 4G/5G

networks, and the integration of satellite-terrestrial hybrid access services. The survey highlighted key technologies such as Satellite Network Virtualization, Satellite Backhauling, and Satellite-terrestrial Hybrid Access. Notably, this survey was SDN-oriented, emphasizing the integration of Software Defined Networking (SDN) principles into the discussed technologies and infrastructure improvements. In 2016, a significant study was conducted, introducing an integrated satellite-terrestrial network design based on Software-Defined Networking (SDN). This innovative approach not only emphasized seamless connectivity between satellite and terrestrial networks but also incorporated efficient resource management and transmission systems into its framework. The integration of SDN brought a dynamic and programmable dimension to the network architecture, allowing for enhanced control and adaptability in managing resources and optimizing data transmission processes. This study marked a notable advancement in the field, paving the way for more sophisticated and integrated satellite communication systems. This survey outlined key technologies including Resource Management and Routing and Networking. Importantly, the survey was also SDN-oriented, underscoring a deliberate



focus on integrating Software Defined Networking (SDN) principles into the proposed architecture and mechanisms. In 2018, a survey was conducted with a focus on defining the energy and spectral efficiency optimization problem and introducing related resource allocation strategies. The survey emphasized key technologies such as Resource Allocation. However, unlike the previous surveys, this one was not SDN-oriented, indicating a departure from the integration of Software Defined Networking (SDN) principles into the discussed optimization and resource allocation approaches. In 2019, there was an expanding need for satellites defined by compactness, light-weight building along price. Amongst the services suitable to these requirements, the CanSat got prestige as a significant area design. This paper presents an extensive CanSat design real estate both mechanical as well as electric systems within the restricted room of a soft drink can leaving out the parachute. Especially the CanSat includes a parachute-based recuperation part that runs individually of ruptured elevation enabling versatile healing at any type of selected time. The recommended CanSat version effectively achieves its key goal concentrating on picking up crucial climatic specifications such as temperature level, stress,

and also elevation. The real-time transmission of these specifications to a ground terminal GUI for the screen makes up a basic facet of its capability. In addition, the CanSat takes on an additional goal of catching as well as keeping images for future usage. The paper looks into thorough conversations on ascent plus descent rates, in addition, to haul computations customized to the certain style of the CanSat. In functional terms the CanSat functions as a powerful gadget, offering a substantial system to understand the essential elements of a genuine satellite[11]. Its portable and economical nature places it as a beneficial property for both research study and also instructional ventures making remarkable payments to the progressing landscape of mini satellite modern technology. Satellites have ended up being essential to contemporary interaction systems, triggering nations to introduce their satellites for improved navigating as well as interaction capacities. Nonetheless the price plus minimal accessibility to satellite innovation position difficulties for pupils as well as scientists desiring to add to this industry[12]. A practical remedy to conquer these constraints is the building of a CanSat, which matches all the genuine systems of a room satellite. By carrying out numerous jobs along with



obstacles, people can get important expertise regarding satellite procedures, suitable to bigger satellite-related tasks. This thesis offers a detailed layout and also system for a CanSat covering haul setting up to station house advancement[13,14].

The CanSat created for this task includes a GPS sensing unit for place monitoring, a compass sensing unit for heading decisions an RF interaction component for station house interaction along with numerous sensing units gauging temperature level, air pressure moisture, elevation, and also battery voltage. Complying with parachute style guidelines an effective decline examination was carried out, with all sensing units transferring information to a custom-made developed station house. A distinct element of this task is the intro of the "Comeback" objective making it possible for the CanSat's automated go back to the station house making use of the Haversine formula for range as well as heading. Mistake minimization was attained with the experimentation technique of PID control generating a precision of 15 ~ 20%. A custom-made station house linked to the web server instantly creates a CSV declaration post-processing of the information. The outcomes show the dependability of the recommended

CanSatComeBack objective approach, opening up opportunities for raised precision with actual information simulation[15]. In 2019, CubeSats arose as preferred additional payloads in area goals because of their portable dimension coupled with very little weight, making it possible for economical together with quick advancement for dangerous examinations. The success of cube-shaped CubeSats stimulated the advancement of CanSats a brand-new course of small clinical systems defined by their distinct cyndrical tube form. CanSats provide an even more affordable choice for dangerous examinations commonly restricted to run within Earth's ambiance, adding to their cost-efficiency. While their key restriction is climatic procedure the CanSat's capability to check along with improve space-bound equipment settings it as a possible arbitrator innovation for ongoing area expeditions. This study paper intends to supply a technological interpretation of CanSats together with supply an introduction to the present state of CanSat-based study. Covering the background mainstream applications and also possible effect on the modern technology pipe for area expedition the paper discovers CanSats' convenience in Earth scientific research, aeronautics along with academic contexts. The

reduced expense of CanSats expands availability for scientists as well as academic organizations supporting near-space scientific research expeditions. The paper additionally looks at prospective future applications of CanSats especially as a moderator innovation for screening along with improving space-bound equipment, providing possible advantages for approaching area objectives. The understandings collected from this study can direct further research study plus advancement of CanSats and also add to forming the trajectory of future area expedition undertakings.

IV. Schematic Diagram & Proposed System

In this envisioned system, the implementation revolves around the incorporation of IoT-based technology for the purpose of monitoring various sensor statuses, all managed through a Blynk-based cloud application. The communication link connecting the satellite and the ground station is established using IoT technology, contributing to a seamless flow of data between these key components. The design is structured in a CAN (Controller Area Network) or cylindrical shape, adding an element of efficiency and practicality to the project.

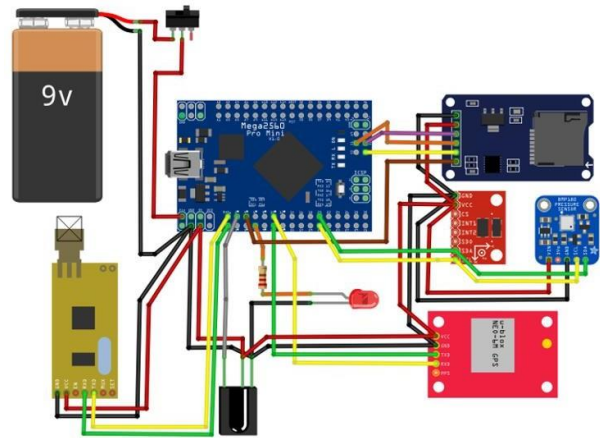


Figure 1: Schematic circuit of the system

Within the system, a diverse array of sensors, including those designed to measure light and temperature, are strategically placed to monitor the prevailing environmental conditions comprehensively. This strategic deployment ensures that the collected data provides a well-rounded perspective on the monitored area. Users can access this information through a dedicated Android application, which serves as a user interface for viewing and interpreting the sensor data. The CAN protocol, known for its robustness in embedded systems, facilitates reliable communication among different nodes within the project. Meanwhile, the cylindrical design not only adds an aesthetic aspect but also optimizes the placement of sensors for enhanced environmental monitoring. The data collected by these sensors is transmitted to and processed within the Blynk-based cloud



application. This cloud platform serves as a centralized repository for data storage and visualization, offering an intuitive interface for users. The Android application, in turn, enables users to conveniently access and analyze real-time sensor data, ensuring that crucial environmental insights are readily available. This holistic system showcases a synergy of advanced technologies, such as IoT and CAN, coupled with a thoughtful and practical design. The result is an innovative environmental monitoring solution that empowers users with actionable insights, facilitating better decision-making and more effective environmental management. The proposed

V. Project Design / Working Methodology

In the proposed system, the project revolves around the development of a Can Size Satellite designed for the purpose of measuring environmental data and transmitting it to Earth using IoT-based Communication Technology. This satellite is ingeniously crafted, employing key components such as the Arduino UNO, Temperature and Humidity Sensor, and Ambient Light Sensor. The primary objective of this Can satellite is to monitor the ambient light conditions, along with temperature and humidity levels in the atmosphere. The

Arduino UNO Microcontroller processes the sensor values, and the results are then displayed on an attached LCD Module, providing real-time information about the environmental parameters. To facilitate remote monitoring, the system incorporates an IoT-based Monitoring System. Processed data from the Arduino UNO is transmitted to an Internet-based cloud server, specifically the 'Blynk' platform, utilizing the Node MCU Wi-Fi Module. This connectivity enables users to remotely access and view the satellite sensor values through the Blynk Application from anywhere around the globe, fostering real-time environmental awareness.

The system is powered by a Lithium Ion Battery, and to ensure its efficient operation, a Battery Management System (BMS) charge module is implemented for charging purposes. The voltage regulation is maintained using 7805 and 7812 voltage regulators, providing a stable output of 5V and 12V, respectively. Additionally, filter capacitors are incorporated to minimize ripple in the DC voltage, contributing to a more stable and reliable power supply for the entire system.

This comprehensive methodology showcases a well-thought-out approach, integrating



hardware components, microcontroller programming, IoT connectivity, and power management to create a functional and remotely accessible environmental monitoring system using a compact satellite design.

VI. Conclusion

The offered paper presents a novel strategy to satellite interaction by leveraging the Web of Points (IoT) for keeping an eye on climatic criteria. The system's style incorporates a mix of equipment elements, consisting of Arduino, Temperature Level Sensing Unit Moisture Sensing Unit, Light Sensing Unit, and also NodeMCU (Wi-Fi Component). Via cordless interaction strategies making use of the Controller Location Network (CONTAINER) method these tools equally accumulate plus transfer real-time ecological information. The NodeMCU functions as a vital web link making it possible for smooth connection to a Cloud Web server where the accumulated information is methodically sent out for more evaluation coupled with storage space.

In useful application the IoT-based system shows its effectiveness by constantly checking the atmosphere and also communicating the gotten information to a cloud facilities. The application efficiently undertakes screening on a cloud application highlighting its

dependability and also capability. Completion of this job offers a thorough service for climatic specification surveillance via a linked ecological community of sensing units, microcontrollers, satellite interaction as well as cloud modern technology. This not just breakthroughs the abilities of ecological information collection yet likewise develops a system for remote surveillance easily accessible with straightforward applications like the Blynk Application.

VII. References

1. S. Nakasuka CanSat Lecture - Its Educational Value 2012.
2. P. Anderson et al. "Integration of IoT along with Satellite Technologies for Environmental Monitoring," International Conference on Advanced Technologies in Engineering (ICATE) 2018.
3. M. Johnson and also R. Smith, "Advancements in Arduino UNO Microcontroller Applications for Satellite Design," Journal of Embedded Systems vol. 24 no. 2 2017 pp. 115-130.
4. A. Patel et al. "Real-time Environmental Data Monitoring making use of IoT: A Case Study with Blynk Platform" IEEE Internet of Things Journal vol. 6 no. 3 2020 pp. 4502-4510.



5. K. Tanaka et al. "Lithium Ion Battery Management Systems for Small Satellites" Proceedings of the International Symposium on Power Electronics 2019 pp. 187-192.
6. J. Kim and also H. Lee, "Wireless Communication Solutions for Small Satellites: A Review" Journal of Space Communication vol. 35 no. 4 2019 pp. 321-335.
7. R. Gupta as well as S. Sharma "Applications of Arduino UNO in Satellite-based Sensing Systems" International Journal of Electronics along with Communication Engineering vol. 5 no. 1 2016 pp. 20-26.
8. Siridhara, A.L., Ratnam, D.V. Mitigation of Multipath Effects Based on a Robust Fractional Order Bidirectional Least Mean Square (FOBLMS) Beamforming Algorithm for GPS Receivers (2020) Wireless Personal Communications, 112 (2), pp. 743-761. 2-s2.0-85078944515
9. Siridhara, A.L., Ratnam, D.V. Multipath mitigation in GPS receiver using Taylor integrated bidirectional least mean square algorithm (2019) Transactions on Emerging Telecommunications Technologies, 30 (12), art. no. e3760,
10. Siridhara, A.L., Reddy, M.S. Study of typical signal in a Global Positioning System's receiver (2018) Journal of Engineering and Applied Sciences, 13 (6), pp. 1523-1525
11. G. Gopal, B. Harith, R. Raj, J. Savyasachi as well as C. Umadi, "Weather Monitoring Using Parachute Satellite-CanSat," Journal of Satellite Technology, vol. 6 2016.
12. A. Colin, "A Pico-satellite Assembled as well as Tested During the 6th CanSat Leader Training Program," Journal of Applied Research plus Technology, vol. 15 2017.
13. E. S. Agency as well as N. Aeronautical "International CanSat Workshop," Proceedings of the Workshop on CanSat Technology 2007.
14. Tooba Islam Ayesha Noureen, Muhammad Rizwan Mughal M. Aseem Nadeem, "Design as well as Development of a Weather Monitoring Satellite," CanSat 2019 Proceedings.
15. "Rosetta CanSat Team" European CanSat Competition, 2015.