Blocksat

Problem Solved for USSOCOM: - Every year hundreds of military equipment like weapons & vehicles are lost or stolen from U.S Military. Most of the military equipment are at risk of being falling into the hands of terrorists. There is no mechanism to stop its misuse if it falls into wrong hands.

Solution:-

Short summary: - CubesSat that can send out signals to block military weapons & vehicles remotely from space which have been lost or stolen with blockchain security.

My concept proposes to use blocksat which is cubesat that can remotely deactivate military weapons & vehicles which were

lost or stolen from military custody and ensure that these military equipment doesn't fall in the hands of terrorists or gets misused. The cubesat receive information about the lost equipment from a blockchain network, military command center on ground or soldier can easily raise a deactivation request for a lost military equipment via a secure blockchain network using a simple smartphone but with a blockchain level security. The idea is not to build a tall wall to build a castle but to identify quickly if the wall is crossed or intrusion is detected. This is possible with blockchain, even a small change in blockchain can easily be detected, so this ideal for something as secure as deactivation of a weapon. Once the request for deactivation is raised the system verifies if the equipment is tagged for loss or marked as stolen. If the military equipment is stolen or lost then the satellite beams a cyrptokey from space onto earth on the possible area of loss on earth. This signal is picked up by the military equipment or even drone and is instantly deactivated as soon as this key is received by the equipment. All military equipments are sealed and usually tamper proof this is done to avoid reverse engineering of technology, the signal receiver for the crytokey will have a life of 6 months and is placed inside the military equipment in a way it cannot be removed without destroying the equipment.

Challenge questions answers

Short description

CubesSat that can send out signals to block military weapons & vehicles remotely which have been lost or stolen with blockchain security.

Bio

Introduce yourself or your team

I am a passionate Innovator, inventor and the winner of 41 grand innovation challenges till date, spanning across various industries solving a variety of problems, I use cross pollination of technology across industries to solve simple & complex problems.

I am a graduate in Mechanical engineering & I have acquired various professional skills and certifications as part of my innovation projects in multiple fields of Engineering. I am also the founder of Givemechallenge.com an online platform which is an innovation portal for making innovation opportunities accessible to all.

I am currently working as Climate colab catalyst at MIT and help people to come up with various innovations & technologies to tackle the problem of climate change remotely.

Where are you from?

Bangalore, India

What makes you an ideal candidate for this Challenge?

I am a mechanical Engineer & have expertise working on various innovation projects. I love solving simple & complex problems by cross pollination of technologies across various industries, I have been successful till now in solving various problems and I have been awarded various innovation awards for the same. I used some of the grants & funds from my previous innovation challenge win to fund some exciting projects and solving various problems.

Solution

Describe your solution.

My concept proposes to use blocksat which is cubesat that can remotely deactivate military weapons & vehicles which were

lost or stolen from military custody and ensure that these military equipment doesn't fall in the hands of terrorists or gets misused. The cubesat receive information about the lost equipment from a blockchain network, military command center on ground or soldier can easily raise a deactivation request for a lost military equipment via a secure blockchain network using a simple smartphone but with a blockchain level security. The idea is not to build a tall wall to build a castle but to identify quickly if the wall is crossed or intrusion is detected. This is possible with blockchain, even a small change in blockchain can easily be detected, so this ideal for something as secure as deactivation of a weapon. Once the request for deactivation is raised the system verifies if the equipment is tagged for loss or marked as stolen. If the military equipment is stolen or lost then the satellite beams a cyrptokey from space onto earth on the possible area of loss on earth. This signal is picked up by the military equipment or even drone and is instantly deactivated as soon as this key is received by the equipment. All military equipments are sealed and usually tamper proof this is done to avoid reverse engineering of technology, the signal receiver for the crytokey will have a life of 6 months and is placed inside the military equipment in a way it cannot be removed without destroying the equipment. By using a variety of messaging and consensus techniques,

blockchains ensures data integrity by both rejecting invalid data and preventing valid data from

being secretly modified or deleted here for example deactivation request for a weapon or military equipment.

What is the size of your proposed solution?

1.5 U, 2.0 Kg Mass.

Does your solution help Special Operations Forces missions? How?

Yes, it will help special Operations Forces mission. The proposed technology will help identify and immobilize military weapons & vehicles that have been lost or stolen, the Blocksat technology can block these lost or stolen military equipment from space. The Cubesat get information about deactivation request from a blockchain network, once a deactivation request is raised in the blockchain, the cubesat beams signal to deactivate these military equipment, which will ensure that these technology cannot get into hands of terrorists and it will help avoid misuse. Currently we see for example many military technologies have been confiscated by terrorists and terrorists are using these weapons against the countries who have manufactured it and worst case they are trying to find the blueprint from the confiscated unit & trying to replicate the same. So I think the proposed technology will help solve a major menace for USSOCOM. It may be also noted that the proposed technology can be implemented with the existing cubesat technologies and by integrating the recent advancements in miniaturized technology.

Where known, identify platform accommodation requirements for power.

The power required can be derived from solar power. Currently there are deployable solar panels designed specifically for cubesats that can provide 80 watts of peak power.

Where known, identify platform accommodation requirements for thermal control.

Thermal control can be achieved by a device that measures about four inches on a side and it can be accommodated in almost any small satellite, just like the Venetian blinds, the louvered flaps will open or close depending heat conservation or loss.

Each unit consists of flaps, springs. front and back plates, The back plate is painted with a white, highly emissive paint boron nitride nano mesh (BNNM) developed by Goddard materials expert Mark Hasegawa. The front plate and flaps are made of aluminum, which aren't as emissive. The thermal system doesn't contain any electronics, the opening and closing of plates is controlled by bi-metallic pates attached to the highly emissive back plate, they uncurl if one of the metals gets too hot, forcing the flaps to open. It reverts back to its original shape and closes when the spring cools.

https://phys.org/news/2016-05-nasa-repurposes-passive-thermal-control-technology.html

Where known, identify platform accommodation requirements for data transfer rate.

The data transfer here is less as we are sending only few Kilobytes of data to identify stolen or lost military equipment and beaming a cryptokey from space. 1 mbps data transfer rate is the minimum requirement, If we use an X-band transmitter then very high data transfer rates can be obtained even high resolution images can be obtained which will help in also tracking the lost military equipments and targeting the cryptokey signal beams.

http://www.syrlinks.com/en/products/cubesats/hdr-x-band-transmitter.html

Where known, identify platform accommodation requirements for data transfer volume (per orbit).

As mentioned above the volume of data transferred is less, however if we are using high resolution images to identify military equipments or target the beaming of cryptokey signals then we are looking at a volume of a few Mega Bytes of data over a period of 48 hours.

Where known, identify platform accommodation requirements for bus stability and attitude control.

It is important in the above application to point the antennas towards earth for beaming the cryptokey and receiving information from the ground.

For the above application it is proposed to use a satellite attitude control system design using low-cost hardware and software for a 3U CubeSat. For any satellite mission, the attitude control system architecture is a crucial subsystem for precise pointing, it is often required to meet mission

objectives. It is often challenging for small satellites to obtain the accuracy and precision requirements where limited power, mass & volume is available for the attitude control system hardware. In this proposed 3U CubeSat embedded attitude control system design pointing is obtained through a two-stage approach involving coarse and fine control modes. Fine control is obtained through the use of three reaction wheels or three magnetorquers and one reaction wheel along the pitch axis. Already a significant design work has been conducted to realize the proposed architecture in various research papers. More information can be obtained from the link to the research paper below this gives a complete overview of the embedded attitude control system design; the verification results from numerical simulation studies to demonstrate the performance of a CubeSat-class nanosatellite; and a series of air-bearing verification tests on nanosatellite attitude control system hardware that compares the performance of the proposed nonlinear controller with a proportional-integral-derivative controller.

CubeSat ACS Hardware includes the following

1. Attitude Sensors

Honeywell HMC5883L three-axis MEMS magnetometer for magnetic field measurements.ngular rate information is obtained in three axes from three orthogonally mounted Analog Devices ADXRS614 MEMS gyroscopes. The attitude control system is managed by an AT91SAM9260 32-bit ARM9 microcontroller that runs embedded Linux, with 32 MB SRAM, and 256 MB NAND Flash attached for volatile and nonvolatile

storage. All programming of control algorithms is accomplished in the C language using the GNU C compiler for the ARM processor. The power is provided by the solar panels.

2. Magnetorquer Design

Magnetic torque coils, also referred to as magnetorquers, in CubeSat-class nanosatellites provide baseline control in many small satellites. The rod configuration is often preferred because of its compactness and rigidity and the use of high-permeability, , materials for the core.

3. Reaction Wheel Design

For Maneuvering of satellites a rotating mass such as a reaction wheel and momentum wheel, which provide maneuvering torque and momentum storage is used. Reaction wheels can provide a high degree of attitude control accuracy with the limitation that the wheel may reach saturation after continued use, requiring an additional momentum control method such as magnetorquers to desaturate the wheel in a process known as momentum dumping.

4. Electronic Integration of ACS Components

To control the reaction wheel and magnetorquers hardware and house the attitude sensors and actuator drivers, a printed circuit board is required. The board makes a HMC5883 three-axis magnetometer, an ADXL345 3-axis accelerometer, and an ITG-3200 3-axis MEMS rate gyroscope available on the OBC I2C bus.

References:-

https://www.hindawi.com/journals/jcse/2013/657182/

Design of Attitude Control Systems for CubeSat-Class Nanosatellite

Junquan Li, Mark Post, Thomas Wright, and Regina Lee

Department of Earth & Space Science and Engineering, York University, 4700 Keele Street, Toronto, ON, Canada M3J 1P3

Can you identify any additional platform accommodation requirements for your solution?

The proposed technology requires a setting up of a blockchain technology system, a web and smartphone app. The Smartphone and webapp will be front user interface using which the user can access and make use of the proposed technology. The engineers of the Defense Advanced Research Projects Agency (DARPA) are currently experimenting with Blockchain to create a messaging service that is secure and impenetrable to foreign attacks.

http://www.dtic.mil/doctrine/education/jpme_papers/barnas_n.pdf

https://i-hls.com/archives/78395

Can your concept can be implemented with current state-of-the-art flight-qualified components, or will it require additional development? Please describe.

Yes the proposed technology can be implemented with current state-of-the-art flight-qualified components, it will not require additional development.

Intellectual Property: Do you acknowledge that this is only the Concept Phase of the competition, and all ideas are to remain the property and ownership of USSOCOM for future discretionary use, licensing, or inclusion in future challenges?

Yes