Locating an iBeacon with GPS, using amateur radio VHF and the AMSAT satellite PSAT, NO-84, cubesat, using AX.25.

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Abstract:

Resupply by airdropping or drone-shipping is a new resupply strategy in backpacking. In preparation for reconnaissance in long distance backpacking and SAR activities in remote areas, with little or no development, we consider the use of amateur radio with GPS beacons for resupply tracking and geo-tagging.

While 6G communications using GPS satellites are available for mountaineering beacons, we use a dual strategy with an additional amateur radio based AX.25 packet radio using the PSAT based cubesat for publishing location information.

Additionally, two cargo iTag locating satellites, bot cubesats are also used for iTag location and the automatic publication of tag locations on geocaching.com. The satellites are AENEAS and PTecSAT. A logistics exercise is introduced, proposed to be conducted at Uncas Scientific Area, near Big Lake, MN, with an operations logistik for the spanning of drop locations and radio fox hunt, using a reconnaissance track, mobile cache device.

Keywords: iTag, iBeacon, AMSAT, cubesat, AENEAS, PTecSAT, 6G, AX.25, resupply, mountaineering and backpacking, SAR.

What:

The AMSAT AENEAS(“Technical Details for Satellite AENEAS” n.d.), PTecSAT(“IARU Sat Coordinator” n.d.) satellite is used for resupply iBeacon tracking, with a payload of water sachets and soylent coffee packs, for mountaineering resupply logistics. Radio Fox Hunting combined with alpinism is defined as a newer, ultralight backpacking technique.

How:

iBeacons, defining 100msec bursts at 2.425GHz are designed with the minimum wattage needed for detection on the field by the AENEAS satellite. 100 such packages containing 1-liter pouches of potable water and three meals of soy lent of 87 grams each. This proof of concept study is to be conducted at Uncas Dunes Scientific and Natural Area (SNA), with an area of 658.3 acres, we have a density of airdropping of 6.58 acres per package, leading to an average distance of 26628.32 square meters, by $\pi/4 d^2$, d is 184 meters in circle close packing model.

We determine an optimal trajectory for the radio fox hunt over a published geotag distribution of 100 resupply caches.

Why:

Resupply strategies, form an important role in long distance mountaineering and backpacking missions, for wilderness areas with little or no little development, for example the pacific crest trail, in the united states, a strong resupply strategy along with an armada of reconnaissance track mobile caches are needed

for effective mountaineering and/or search and rescue operations, with a resilience plan for extreme weather operations.

The use of 6G like simulated communication is possible by using better encryption and packet compression over a slower AX.25 network, with the use of A.I based technologies like image cartoonization and feature representation and speech to text conversion for lower bandwidth requirements.

So What:

The use of reconnaissance tracks, along with airdropped resupply, will improve the efficiency and quality of mountaineering and provide vital air support for search and rescue operations. Resupply beacons also provide supplies for hikers or backpackers lost in the wilderness and also provide emergency communication hotspots as the beacons are still active to transceiver emergency messages.

Summary:

Main Points:

- 6G network using cubesats, PSAT NO - 84, AENEAS, PTecSAT
- Operation Logistics for a proposed resupply air dropping over Uncas Scientific Area in MN.
- Algorithms for the automated resupply from caches using an autopilot based track mobile cache.

Applications: tele-medicine, 360 photography.

[Code Base:](#) by VU2CSZ, Dr Bheemaiah, Anil Kumar.

Introduction.

An implementation using wireless radio and AMSAT cubesat satellites is described.

Problem Definition.

6G is defined as the integration of anywhere wireless, independent of the carrier frequencies, with intelligent routing, uniformly from satellite based networks to terrestrial networks with or without drone support.

This network is for increased edge reliability, scalability and enhanced use of A.I in routing, for scalable and distributable IOT support and LandBot support.

Encryption and error correction codes, along with compression in packet switched networks scales with the generation of wireless networks. In the legacy of timeless innovations, we represent timeless Machine learning based solutions for text, data and image transreceivers, using text to speech, speech to text, image and 1D feature representations, like cartoonizers.

Given the locations as geotags [L], of the 100 airdropped, we optimize the fox hunting trajectory of a LandBot track based mobile

cache, to visit each of the 100 box coordinates for an experiment in resupply.

This is the multi-visit operations problem with [C] denoting the charge point geo locations.

Let T be the path of the landbot, denoted by [P] as the list of P the geotags of waypoints, for a limited mileage m of the landbot, with automated recharging at charging points.

Bounds on time of travel are easily calculated from [P], using defined heuristics.

Background.

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Formal Definitions:

PSAT NO-84

Packet Up/Downlink . . . [145.825 1200](#) baud

APRS (shared with ISS, PCSAT, UO11 and others!) **Aliases are ARISS and APRSAT**

PSK31 Downlink 435.350 MHz +/- 5 kHz FM (300 mw)

PSK31 Uplink 28.120 MHz +2 kHz PSK31 SSB (75 watts into omni vertical authorized)

Latest TLE's [from AMSAT.org](#)

[PSAT Talk by DK3WN](#)

[ocean or bay oceanographic data buoys](#)

For a review on psat satellites and APRS network for data for telemedicine applications, see this paper in the AMSAT 2010 conference. (“[No Title]” n.d.)

AENES:

iTag:

Downlink: 437.600 1200 bps AFSK.

audio frequency-shift keying (AFSK)(Contributors to Wikimedia projects 2002)

Download Decoder [Software](#).

PTecSAT:

iTag: 2425 MHz

Downlink: A downlink frequency of 436.00MHz has been coordinated for the AFSK beacon. 437.00-427.200MHz for the spread spectrum transmissions over the main ground station on a non-interference basis.

More recent cubesats including, recent nanosats and phonesats can be sourced, with upload and download frequencies and AX.25 based software. (“AFSK – AMSAT-UK” n.d.)

Design of the iTags:

Standard off the shelf iTags are used.

Many iTag architectures are described in the literature for a range of 2.420 GHz designs and VHF/UHF designs.

Operations Research.

An all terrain tracked landbot with the NVIDIA Redtail (NVIDIA-AI-IOT n.d.) for integrated autonomous navigation with vSLAM and deep learning is considered with a mileage of m miles before recharging at the closest waypoint in [C]. Multi-Goal Path Planning (MTP) Problem

“The problem is to find the path τ^ for a cost function c such that $c(\tau^*) = \min\{c(\tau) \mid \tau \text{ is admissible multi-goal path}\}$ ” (“[No Title]” n.d.)*

The algorithms are: Dijkstras, SyCLOP, Random nets, deep optimization, steering RRG, A*, Multi RRT, with bias. (“Website” n.d.)

“Several approaches can be found in literature, e.g., Considering Euclidean

distance as approximation in solution of the TSP as the Minimum Spanning Tree (MST) – Edges in the MST are iteratively refined using optimal motion planner until all edges represent a feasible solution Saha, M., Roughgarden, T., Latombe, J.-C., Sánchez-Ante, G. (2006): *Planning Tours of Robotic Arms among Partitioned Goals. IJRR. Synergistic Combination of Layers of Planning (SyCLoP) – A combination of route and trajectory planning* Plaku, E., Kavraki, L.E., Vardi, M.Y. (2010): *Motion Planning With Dynamics by a Synergistic Combination of Layers of Planning. T-RO. Steering RRG roadmap expansion by unsupervised learning for the TSP* (“[No Title]” n.d.)

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Discussion.

We have defined several iTag designs and the use of common AMSAT satellites using AX.25 for beacon tagging and monitoring. We consider uploading the tag coordinates to geocaching.com with a simple web-bot software.

We have also described multi visit operation calculus optimizers, for the landbot optimization problem.

Future Work.

In future work, we present , browser based landbot logistics for waypoint and automatic recharge, with a added trailhead or trail based

caching for resupply as a multi goal path planning problem as a TSP derivative. We do hope amateur radio enthusiasts would expand to landbot based radio fox hunting, with resupplies to add to the radio hunt.

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