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"PROVIDE HIGH ALTITUDE NETWORK BY USING PROJECT LOON"

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Abstract:

PROJECT LOON is a research and development project. With the mission of providing internet access to rural and remote areas.

There are many terrestrial challenges to internet connectivity jungles archipelagoes. Mountains. There is also major cost challenge .Solving these problem isn't simply a question of time; it requires looking at the problem of access from new angles.

PROJECT LOON is one such initiative taken up by Google to solve the above mentioned problems. The idea may sound a bit crazy and that's part of the reason were calling it Project Loon but there s solid science behind it.

The balloons are maneuvered by adjusting their altitude to float to a wind after identifying the wind layer with the desired speed and direction. Using wind data from the National Oceanic and Atmospheric Administration [NOAA]. Users of the service connect to the balloon networks using a special internet antenna attached to their building. The signal travels through the balloon networks from balloon to balloon then to a ground based station connected to an internet Service Provider [ISP] then onto the global internet the system aims to bring internet access to remote and rural areas poorly served by existing provisions and to improve communication during natural disasters to affected regions. Key people involved in the project include Rich Devalue chief technical architect who is also an expert on wearable technology Mike Cassidy a project leader and Cyrus Behroozi a networking and telecommunication lead.

Key Words: Project Loon, Solar Panels

1. INTRODUCTION

In History 2008 Google had considered contracting with or acquiring Space Data Corp a company that sends balloons carrying small base stations about 20 miles [32km] up in tne for providing connectivity to truckers and oil companies in the southern United States, but didn't do so Unofficial development on the project began in 2011 under incubation in Google X with a series of trial runs in California's Central Valley. The project was officially announced as Google project on 14 june 2013.

1.1 Envelope

The inflatable part of the balloon is called a balloon envelope A well made balloon envelope is critical for allowing a balloon to last around 100 days in the stratosphere Loon 's balloon envelopes are made from sheets of polyethylene plastic. and they measure fifteen meters tall when fully inflated When a balloon is ready to be taken out of service gas is released from the envelope to bring the balloon down to Earth in a controlled descent in the unlikely event that a balloon drops too quickly a parachute attached to the top of the envelope is deployed.

Fig .1: *Envelope*

1.2 Solar Panels

Each balloon s electronics are powered by an array of solar panels The solar array is flexible plastic laminate supported by alight weight aluminum frame it uses high efficiency solar cells The solar array is mounted at a step angle to effectively capture sunlight on short winter days at higher latitudes the array is divided into two sections facing in opposite directions allowing us to capture energy in any orientation as the balloons spin slow through to keep Loon 's electronics running while also charging a battery for use at night

By moving with the wind and charging in the sun project Loon is able to power itself using entirely renewable energy sources.

1.3 Network Equipment

A small box containing the balloons electronics hangs underneath the inflated envelop, like the basket carried by a hot balloon. This box contains circuit boards that control the system. Radio antennas to communicate with other balloons and with internet antennas on the ground, and lithium ion batteries to store solar power so the balloons can operate thought the night.

Inside each box is a mini command center: radio sensors, satellite receivers, and Wi-Fi electronics along with a stack of custom Google X circuit boards. These computers measure acceleration. Take temp measurements, run communications between satellite and Wi-Fi networks, and who knows what else. This is how Google Mission control talks to each loon and tells it what to do.

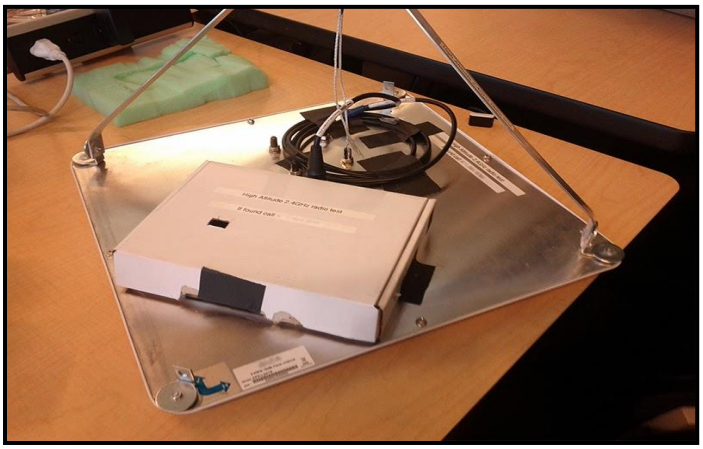

Fig.2: *Network Equipment*

1.4 Loon Antenna

The loon antenna shaped in circular manner marking the symbolism of balloon. They are attached to the households or workplaces wherever the internet connectivity needs to be established.

The loon antenna consists of the following parts:

- Patch Antenna,
- Reflector,
- Radio

The patch antenna receives reflected radio waves from the reflector disc as well as direct waves. The two sources interfere constructively for the correct wavelength to be received. The radio transmits signals to the devices.

Fig.3: *Loon Antenna*

2. Working of Loon

Project Loon balloons travel approximately 20 km above the Earth s surface in the stratosphere. Winds in the stratosphere are stratified and each layer of wind varies in speed and direction. Project Loon uses software algorithms to determine where its balloons need to go then moves each one a layer of wind blowing in the right direction. By moving with the wind the balloons can be arranged to form one large communications network. Situated on the edge of space between 10 Km and 60 Km in altitude the stratosphere present unique engineering challenges air pressure is 1% that at sea level and this thin atmosphere offers less protection from radiation and dramatic temperature swings. Which can reach as low as 80 C By carefully designing the balloon envelope to withstand these conditions Project Loon is able to take advantage of the stratosphere's steady winds and remain well above weather events wildlife and airplanes.

The technology designed in the project could allow countries to avoid using expensive fiber cable that would have to be installed underground.

The high altitude polyethylene balloons fly world on the prevailing winds [mostly in a direction parallel with times of latitude i.e. east or west]. Solar panels supplied by Power Film' inc about the size of a card table that are just below the free flying balloons generate enough electricity in four hours to power the transmitter for a day and beam down the internet signal to ground stations. These ground stations are spaced about 100 KM [62mi] apart or two balloon hops and bounce the signal to other net to the internet .Google feels this will greatly increase internet usage in developing countries in regions such as Southeast Asia that can't afford to lay underground fiber cable. Relay balloons that send the signal back down.

This makes internet access available to anyone in the world who has a receiver and is within range of a balloon. Currently the balloons communicate using unlicensed 2.4 and 5.8 GHz ISM bands and Google claims that the setup allows it to deliver speeds comparable to 3Gto users it is

unclear how technologies that rely on short communication times [low latency pings] such as VoIP might need to be modified to work in an environment similar to mobile phones where the signal may have to relay through multiple balloons before reaching the wider internet.

Powering it all is a 600watt battery charged by solar panels on a carbon fiber frame atop the box. These large extra light photovoltaic cells amorphous silicon without landing. During the daytime the batteries charge and at night they switch on to vent out excess air and keep the computers running.

And thought the balloons are mostly steerable Google has done a lot of programming to make them work on their own as well in addition to mission Control Google s Loon balloons can talk to each other and control themselves We use a distributed mesh network so each balloon is pretty autonomous and has pretty much the same hardware in it Sameera Ponda a lead aerospace engineer at the Dos Palos site that day said on the video stream As one balloon floats over a certain area that balloon is talking to the ground antennas ans as that balloon floats over a certain area that balloon is talking to the ground antennas as that balloon floats away another balloon comes area that balloon is talking to the ground antennas and as that balloon floats away another balloon comes in and takes its place so it's place so it's a pretty seamless operation.

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3. Experimental Implementation

On 16 June 2013 Google began a pilot experiment in New Zealand where about 30 balloons were launched in coordination with the Civil Authority from the Tekapo area in the South Island. About 50 local users in and around Christchurch and the Canterbury Region tested connections to the aerial network using special antennas After this intial trial Google plans on sending up 300 balloons around the world at the 40th parallel south that would provide coverage to New Zealand Australia Chine and Argentina Google hopes to eventually have thousands of balloons flying in the stratosphere.

The first person to get Google Balloon internet access this week was Charles Nimmo a farmer and entrepreneur in the small town of leeston. He found the experience a little bemusing after he was one of 50 locals who singned up to be a letter for a project hat was so secret, no one would explain to them what happening. Technicians came to the volunteers homes and attached to the outside walls bright red receivers the size of basketballs and resembling giant Google map pins

In May 2014 Astro Teller announced that rather than negotiate a section of bandwidth that was free for them worldwide they would instead become a temporary base station that could --be leased by the mobile operators of the country it was crossing over.

In May June 2014 Google tested its balloon powered internet access venture in piaui Brazil making its first LTE experiments and launch near the equator. In 2014 Google partnered with France's Centre national detrudes satiates [CNES] on the project.

Each balloon would provide internet services for an area twice the size of New York City about 1,250 square kilometers and terrain is not a challenge. They could stream internet into Afghanistan's steep and winding Khyber pass or online. Google engineers studied balloon science from NASA the Defense Department and the Jet Propulsion Lab to design their own airships made of plastic made of plastic films similar to grocery bags. Hundreds have been built so far.

4. Recovery of Balloon

Balloons are controlled by raising and lowering them to an altitude with winds blowing in the desired direction of travel. We plan to our balloons down over preselected, safe recovery zones so we can easily collect them to reuse and recycle their parts. In the event of an unexpected leading, every loon balloon is equipped with a parachute to slow its descent.

The project loon teams include several recovery specialists who track down and collect landed balloons. We track our balloons continuously in the air using GPS and we take note of their location when they land. Once the landing location is known the recovery team will be on their way. Ultimate, we plan to land the balloons in various collection points around the world.

5.1 Advantages

1. To provide internet through a network of high altitude.
2. Minimise the network problem in remote areas.
3. By implement this project to develop and provide internet and high altitude network.
4. Development of communication system.

5.2 Disadvantages

1. High initial cost/ investment.
2. High maintenance cost.
3. Requirement of skill of engineer.
4. Face more initial challenges.

6. CONCLUSIONS

Google vision for project loon procures schooling for those currently without education, brings doctors for people who cannot travel to see one, and provides important weather data to assist farmers.

Disease and famine could be dealt a swift and telling blow with a little Wi–Fi and according to Team Loon, balloons stationed so high above the earth they can only

be seen with a telescope is the most affordable and best way to achieve this.

"The materials are pretty inexpensive" Says Project Loon's Richard Devalue. "The plastic of the balloons is similar to that in shopping bags and the electronics aren't that different from consumer electronics. This is a every cost effective way to connect the world."

There is near about 75/ comment is in the favors of project loons. As per the experts there would great Success for this project in future. And we hope balloons could become an option for connecting rural, remote, and underserved areas and for helping with communications after natural disasters.

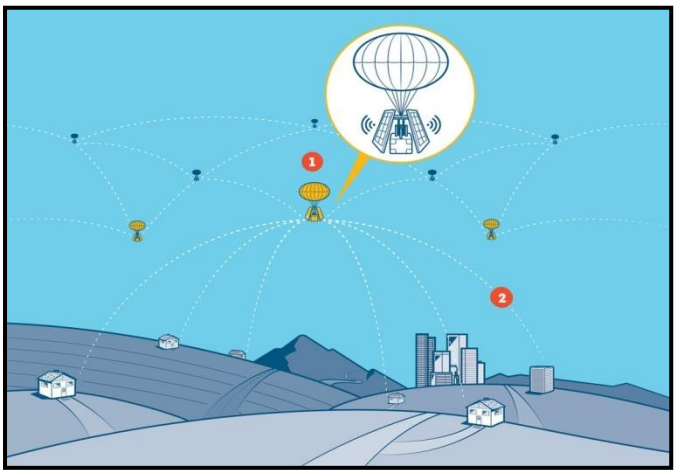

Fig.4: *Experimental Implementation*

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