

Internet Through Balloons – A Study

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Abstract— The internet is like oxygen for every human being on this earth and still we do not have this internet for every human being. There are too many obstacles located on the earth. In most of the countries the cost of an Internet is not payable most of the peoples. So to solve this problem today we are uncovering latest moon shot from Google X: balloon-powered Internet access.

It is possible for us to create chain of balloons flying in stratosphere to provide internet in the some regions on earth. This balloon technology contains the balloons at the height of 66000 ft, to spread the Internet access to the earth with very high speed. We hope this project loon could become a good option for providing internet connectivity to rural, remote, and mountain area This has no effect in case of natural disaster even if there is natural disaster the balloons will remain there for the purpose internet connection. The idea may sound a bit crazy-and that's part of the reason it will called as Project Loon-but there's a solid science behind it. This idea is based on concept of freeing the balloons over the wind and let them sail. It is possible for balloons to move up or down in appropriate wind by using solar power.

This project loon is developed by Google to provide internet to the Remote Mountain and rural area. These balloons will place at high altitude in stratosphere and provide internet at the high speed about 4G LTE. This is very ambitious research and development project by Google.

The mission statement of this Loon Technology says –# is balloon powered internet for everyone.”

Index Terms— Stratosphere, balloon etc.

1 INTRODUCTION

THE balloon network are design for connecting the people, it travels on the edges of space. Through the network of balloons people in rural and remote areas are getting connected. These balloon structures are 15-meters wide and made from polyethylene film.

Once it has reached the altitude of 20km (65,000ft), it will adjust helium gas to stay there. Each balloon contains a bag of near about 10kg Linux-based computer with the important radios, GPS and several sensors recording air altitude, temperature and speed. All information collected over the balloons is sent to Google’s Command Centre on ground below, where the each balloon can be controlled to fly in certain direction. Here we can move these balloons to desired layer of wind in stratosphere. Wind in stratosphere moves in different direction in different layers. [1]

We can give any direction to the balloons by taking it in to the appropriate layer of wind. To bring balloon in appropriate layer of wind in stratosphere we have adjust altitude of balloons. We can adjust the altitude of balloons by adjusting helium gas in the balloons.

By taking data from National Oceanic and Atmospheric center balloons can maneuvered by adjusting height and get come in proper wind.

For this Google explains: “Signals are transmitted through the project loon’s balloons to an specialized Internet antenna mounted at the workplace that use technology of radio frequency”. “The Internet antenna is connected to consumer grade router. Network signals that travels through the balloon are relayed to ground stations, where it’s connected to pre-existing internet infrastructure, like our local telecommunication infrastructure and fiber optic cables.”[2]

2 DESIGN OF BALLOON

2.1 Review Stage

The balloon envelope structure used in the project are made by Raven Aero star company, and are composed of polyethy-

lene plastic about 3 mm or 0.076mm thick. These super pressure balloons are filled with helium. Stand almost 50ft across and 40ft tall when fully inflated carry a custom air pump system that pumps in or releases the air to stable the balloon and control its elevation. The envelop bag of balloons thickness is only thrice than a supermarket shop carrier bags but still capable to remain there at very high altitude at very high pressure without exploding.

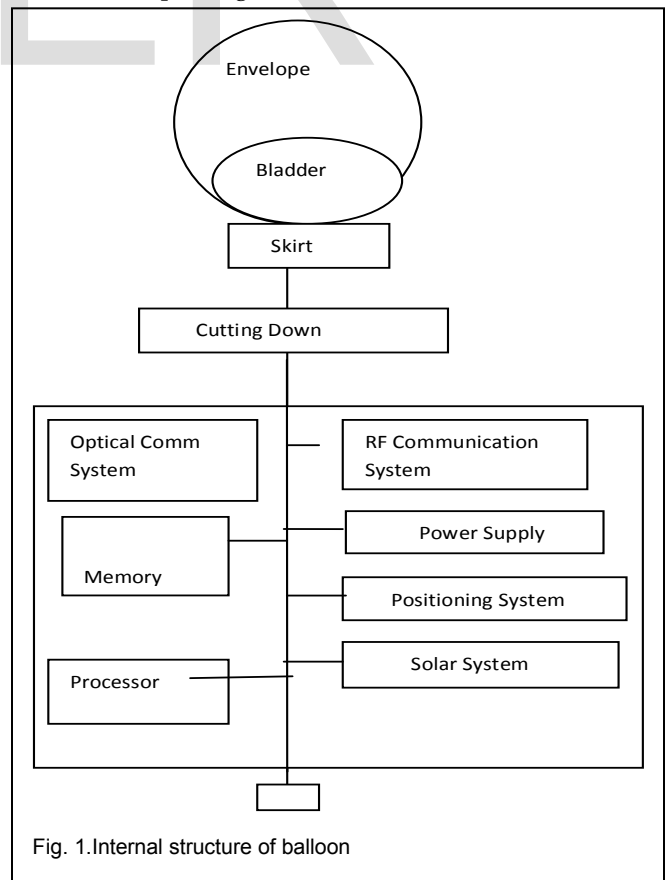


Fig. 1. Internal structure of balloon

A small box of weight 10kg contains each balloon with electronic equipment that hangs underneath the loons balloons. That small box consist the various circuit board which control the radio antennae system, other system functions, and all networks rocket M2 to communicate with the other balloons as a Wi-Fi as a transceiver and with the antenna on the ground, and a battery to store power so balloons can operate during the time when light is not there. A customized Linux OS is also loaded on the processor chip to manage and transmitter network and positioning data. Each balloon is powered by an array of solar panels that sit between the envelope and the hardware. A parachute attached at the top of the envelope allows for a controlling of balloon and landing when a balloon ready to be taken out of service. In any case if there is an unexpected failure, the parachute gets deployed automatically.

Three components are required for designing a Google Loon Balloon:

1. Envelope
2. Solar panels
3. Equipment

Balloon's electronic equipment is placed in a small box, it hangs underneath loon's balloons, like the basket which is carried by a hot air balloon. That small box consist circuit board and it controls the system, radio antennas are used to communicate with the other loon's balloons and with internet antenna on the ground, and loon's batteries to store solar power.

The project Loon's pilot test was done on June 2013 at the 40th parallel south in New-Zealand. Thirty balloons, launched from New-Zealand's south island, will beam internet to a small group of pilot testers will be used to refine the technology.

Those countries who don't have economy for underground fiber cable infrastructure to provide internet to the all end user in their country. It will be more difficult if the internet user is at mountain areas or those areas which frequently face problem of calamities. For those countries this Google loon system will very effective because this needs comparatively less money and it has no effect of any natural disaster.

The high altitude loon's balloons fly over the world on the prevailing winds flowing mostly in the direction parallel with the lines of altitude, i.e. east or west. Solar panels of flying balloons are capable to generate enough electricity in four hours to power the transmitter for a day. The project loon's balloons spread the internet to ground stations which is about 60 miles apart, or two balloon hops and may bounce

come under the range of balloons and have receiver. Currently, the balloons communicate with the unlicensed 2.4 and 5.8 GHz ISM bands, this system claims that the setup allows it to deliver speeds about to 4G LTE to users. It is unclear how technologies that rely on short communications times (low latency pings), such as VoIP, might need to be modified to work in an environment similar to the mobile phones where the signal may have to relay through multiple balloons before reaching the wider Internet.[3][4].

1. Balloons can move because the Winds in the stratosphere are generally steady and slow moving at between 5 and 10 mph, and each layer of wind varies in direction.
2. The Project Loon uses software algorithm to determine where it's balloon need to go, then moves each one into a layer of wind blowing in the right direction which helps in the travelling of balloons.
3. By moving with the wind, the balloon can be arranged to form one large communication network.

3 WORKING OF LOON TECHNOLOGY

As A user with the specialized antennas sends signal via radio frequency over ISM bands to a balloon close to him. The balloon sends the signal to the neighboring balloons. Eventually, the signals reach balloon which is connected to the local internet. The wireless mesh network is constantly adjusting as balloon move. Any balloon is able to connect the internet to the base station which has internet connectivity and then receives internet data and forwards them via balloon in the sky to the destination. Finally, the balloon close to the request user broadcast the data to the ground via a radio frequency over ISM bands. [5][6]

The special antenna installed the outside of home receives data and decrypt the data. The wireless mesh network should be constantly adjusting the balloons move. It covers an area of an around 40km (28mi) diameter circle which is twice the area of New York City. Thousands of balloons can cover the whole world. Currently, its lifetime is only a few weeks, but Google anticipates that can be in the sky hundreds of days in future.

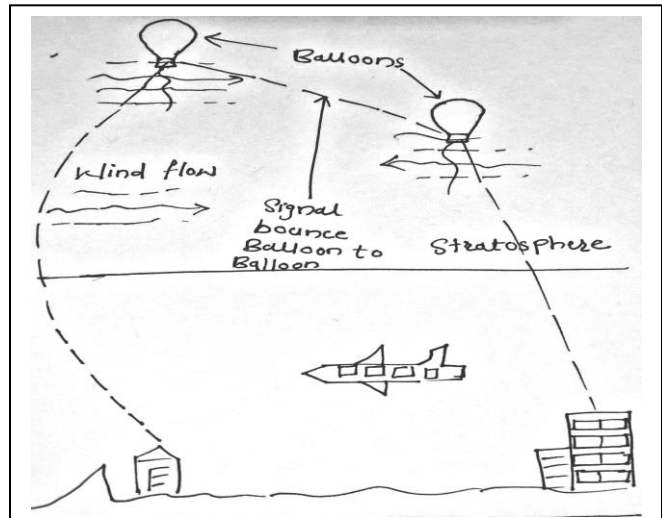


Fig. 1. Loon Balloon Working.

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(This information is optional; change it according to your need.)

signal to other balloons that send signal back to the ground. This makes possible to provide internet for the people who

3.1 Connectivity

1. Each balloon can provide connectivity to a ground area about 40km in diameter at speed comparable to 3G.
2. Locations of balloons get tracked as each balloon is equipped with a GPS.
3. The radio transceivers are use for-
 - i. Balloon to balloon communications.
 - ii. Balloon to ground communication
 - iii. Third for backup.
4. The balloon use antennas equipped with specialized radio frequency technology.

There are several ground stations with transceivers similar to that on the balloon, but they are high powered ubiquity Rocket M5 (operating at 5.8 GHz). The network is designed as mesh layout to ensure reliability. A ground station already connected via either fiber or other backbone infrastructure to the internet, beams signals to any nearby balloon. The first balloon that receives the signal, then forwards or hops the signals up to 5 other balloons on its same path in sequence, a distance of about 100km (62 miles) [7].

4 ADVANTAGES AND LIMITATIONS

4.1 Advantages

1. By using this system internet connection will be available for free to every person in the world.
2. This loon system will provide information to all human being, irrespectively of their location.
3. Project Loon will be transmit e able to text, audio, video, and applications to any Wi-Fi enable device, including mobile phones, anywhere in the world.

4.2 Limitations

1. "Cost" was high as we have to take permission, buy antenna and fix it in home.
2. The Maintenance cost will be very high for the loon technology as the equipment which is required, very costly and complicated.

It is nessecery that the Balloons must be replaced for every two or three weeks. As they must be refills the gas and should correct the balloon's equipment if any damages occurs when they are moving in the stratosphere.

4.3 Challenges

1. Politics is biggest obstacle in front of this project loon rather than costing.
2. Google wants to build a network that knows no border. Not only does Google want to implement in every country with an undeserved internet populations, but the network itself will be stateless, coasting from continent to continent.

3. It is possible that the balloon may fly over from one country to another country which has clashes between them.
4. There might be security threat over data.

4 CONCLUSION

Project loon defiantly will be very useful for those countries which has huge gap of people who are still not connected to the internet. It is also easy to connect internet to the mountain areas by using project loon, where it is difficult spread the network of optical fiber. There is one more obstacle in front of this project loon is politics as this balloons not know concept border. Also it needs a strict regulation for spectrum band as it want totally new band for this. Project loon will help the world for education, business, and wifi connectivity for peoples and many more.

Project loon by Google is very ambitious project to help the world to connect each other through the internet.

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