1.INTRODUCTION

In 2008, Google had considered contracting with or acquiring Space Data Corp a company that sends balloons carrying small base stations about 20 miles (32 km) up in the air 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 a Google project on 14 June 2013.

On 16 June 2013, Google began a pilot experiment in New Zealand where about 30 balloons were launched in coordination with the Civil Aviation 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.[1] After this initial trial, Google plans on sending up 300 balloons around the world at the 40th parallel souththat would provide coverage to New Zealand, Australia, Chile, and Argentina. Google hopes to eventually have thousands of balloons flying in the stratosphere.

2.WHAT IS A PROJECT LOON?

Project Loon is a research and development project being developed by Google with the mission of providing Internet access to rural and remote areas. The project uses high-altitude balloons placed in the stratosphere at an altitude of about 20 mi (32 km) to create an aerial wireless network with up to 3G-like speeds. Because of the project's seemingly outlandish mission goals, Google dubbed it "Project Loon".

The balloons are maneuvered by adjusting their altitude to float to a wind layer 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 network using a special Internet antenna attached to their building. The signal travels through the balloon network 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 De Vaul, chief technical architect, who is also an expert on wearable technology; Mike Cassidy, a project leader; and Cyrus Behroozi , a networking and telecommunication lead.

Naturally, the balloon itself is not just your average birthday party accoutrement. These massive structures are 15-meters wide and made a from polyethylene film that's only three times thicker than a supermarket carrier bag, but still thick enough to withstand high altitude air pressures without exploding.

However, the responsibility of the balloon, and its helium gas filling, is to get the real tech wizardry in the air and keep it there. Each unit carries a mini Linux-based computer, toting the all-important Wi-Fi radios, GPS and several sensors recording air temperature, altitude and speed of movement. All of this information is sent to Google's Command Centre on the ground below where the each balloon can be controlled to a certain degree

Once it has reached the altitude of 20km (65,000ft), it's will end its ascent. Then, as Google explains: "Signals are transmitted from the balloons to a specialized Internet antenna mounted to the side of a home or workplace that use radio frequency technology.

"The Internet antenna is connected to a consumer grade router. Web traffic that travels through the balloon network is ultimately relayed to ground stations, where it's connected to pre-existing Internet infrastructure, like fiber cables and our local telecommunications partners."

Once the trifecta of balloon, antenna and local ISP is complete, Each balloon is theoretically capable of bringing internet connectivity for everyone in a 12 mile radius. Get a few thousand of these up in the air, shove some antennas on a few houses and voila! Internet for all

3.THE TECHNOLOGY

The technology designed in the project could allow countries to avoid using expensive fiber cable that would have to be installed underground to allow users to connect to the Internet. Google feels this will greatly increase Internet usage in developing countries in regions such as Africa and Southeast Asia that can't afford to lay underground fiber cable.

The high-altitude polyethylene balloons fly around the world on the prevailing winds (mostly in a direction parallel with lines of latitude, i.e. east or west). Solar panels 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 (62 mi) apart, or two balloon hops, and bounce the signal to other 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.[8] Currently, the balloons communicate using unlicensed 2.4 and 5.8 GHz ISM bands,[9] and Google claims that the setup allows it to deliver "speeds comparable to 3G" 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 mobile phones where the signal may have to relay through multiple balloons before reaching the wider Internet.[10][11]

The first person to connect to the "Google Balloon Internet" after the initial test balloons were launched into the stratosphere was a farmer in the town of Leeston, New Zealand, who was one of 50 people in the area around Christchurch who agreed to be a pilot tester for Project Loon. The New Zealand farmer lived in a

rural location that couldn't get broadband access to the Internet, and had used a satellite Internet service in 2009, but found that he sometimes had to pay over $1000 per month for the service. The locals knew nothing about the secret project other than its ability to deliver Internet connectivity; but allowed project workers to attach a basketball-sized receiver resembling a giant bright-red party balloon to an outside wall of their property in order to connect to the network.[8][12]

The high-altitude balloons fly twice as high as airplanes, but below the range of satellites.[2] Each balloon provides Internet service in a 20 km (12 mi) radius covering an area of about 1,256 km^2(485 sq mi).

INTERNET GIANT Google has revealed some additional details regarding the technology behind its Project Loon that aims to bring WiFi connectivity to everyone on the planet.

Google network engineering lead Cyrus Behroozi showed off the project's internet antenna technology in a Youtube video, popping the lid off a bulbous shell to talk through what's inside and how it works.

Google's venture aims to liberate those five billion or so people on Earth without internet access by using balloons carried by the wind at altitudes twice as high as commercial planes to beam internet access to the ground at speeds similar to today's 3G networks.

In the video, Behroozi explained that there are two main components inside the shell: the radio in the bottom and the antenna towards the top, separated by a reflector plate.

The top is made up of two green parts that together are called a "patch antenna". These receive reflected waves that bounce off the reflector and go up into the patch along with direct waves. "These interfere constructively for the correct wavelengths the device needs to receive," Behroozi said.

The technology differs from that of a geostationary satellite dish because the balloons are not at a uniform distance from the antenna at all times.

"As most satellite rotate around the earth at the same rate that it revolves, and stay in the same spot overhead, the satellite dishes on the side of your house can be aimed in a particular direction and hit that satellite," Behroozi explained.

4. HOW LOON MOVES?

The Project Loon is a network of balloons which are places in the stratosphere at an altitude of about 20 km in order to create a wireless network. The algorithms determine where the balloons need to travel which moves from one layer to another along with the wind and hence a large network is formed by arranging balloons. Each of the balloon provides connectivity of upto 40 kms in diameter with the speed similar to that of 3G. There are antennas with specialized radio frequency technology which are used by balloons to communicate between them and the ground.

Each balloon is networked to one another with a radio transceiver as in a mesh, designed to ensure signal reliability. A second transceiver keeps the balloon in contact with a network station on the ground and beams an Internet signal to specialized antennas that can be placed on homes, much like a very small satellite TV receiver.

There is also a back-up transceiver and a GPS on each balloon, so Google can monitor a balloon's location. And each balloon will carry weather instruments, too.

5.HOW LOON CONNECTS?

Far below the loons, ground stations providing connectivity to backbone Internet can transmit signals to the balloons up to 65 miles far. The signals would hop forward, from one balloon to the next, along a chain of up to 5 balloons. Each balloon is networked to one another within 30 miles with a radio transceiver as in a mesh, designed to ensure signal reliability. A second transceiver keeps the balloon in contact hundreds of antennas on ground area about 25 miles in diameter at speeds comparable to 3G. The specialized antennas can be placed on homes, much like a very small satellite TV receiver. Project Loon currently uses ISM bands (specifically 2.4 and 5.8 GHz bands) that are available for anyone to use. There is also a back-up transceiver and a GPS on each balloon, so Google can monitor each balloon's location.

Not much happens in Geraldine, a small farming community in the interior of the South Island of New Zealand, about 85 miles from Christchurch. So when Hayden MacKenzie, a fourth-generation farmer there, picked up the phone last Tuesday and got a request to participate in a secret project—one that he wouldn't even learn about until he signed a vow of silence—he and his wife Anna figured that they'd take a shot. That evening, two men showed up at his cozy farmhouse. They bore a peculiar red device, a sphere slightly bigger than a volleyball perched on a short collar, and attached it to his roof. Then they left.

Only when the men returned the next day did they reveal what they were up to. Inside the red ball was an antenna that would give the MacKenzies Internet access. It was custom-designed to communicate with a similar antenna that would be floating by in the stratosphere, over 60,000 feet above sea level. On a solar-powered balloon.

Oh, and the men work for Google.

"It sounded crazy," says MacKenzie, who bears a slight resemblance to the actor Colm Meaney. "But at the end of the day, you hope things will work out."

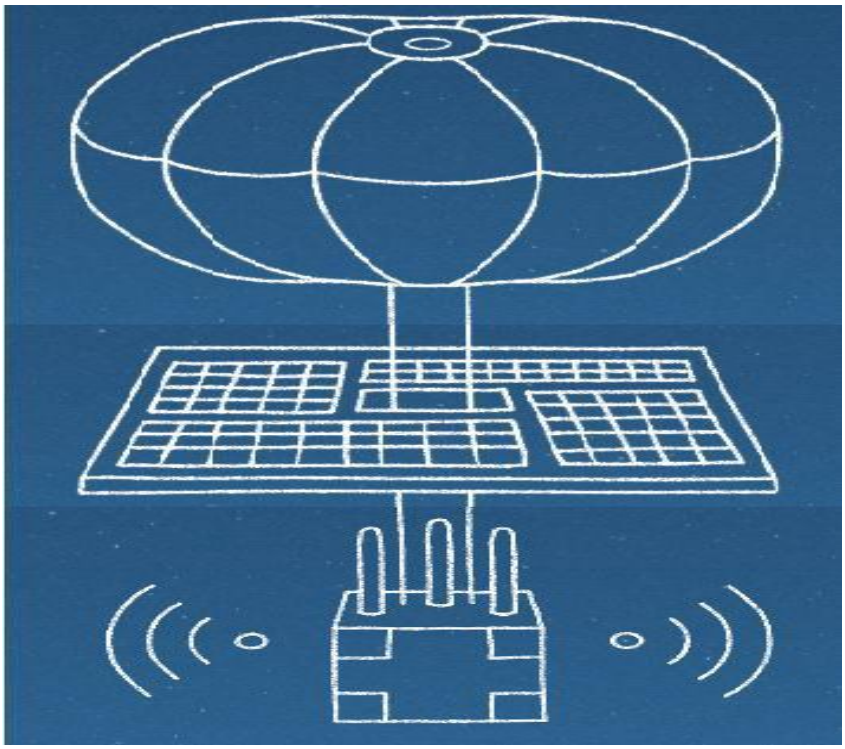
The idea does sound crazy, even for Google—so much so that the company has dubbed it Project Loon. But if all works according to the company's grand vision, hundreds, even thousands, of high-pressure balloons circling the earth could provide Internet to a significant chunk of the world's 5 billion unconnected souls, enriching their lives with vital news, precious educational materials, lifesaving health information, and images of grumpy cats.

It is an audacious proposal, and today in Christchurch, Google is holding a press conference with New Zealand's prime minister to formally unveil it. Google will

also stage Project Loon's biggest trial yet: 50 testers in Christchurch within the 12-mile range of the balloons will see if they can get connected from the sky.

6.COMPONENTS

The loon is comprised of three parts: an envelope, solar panels and equipment. Project Loon's balloon envelopes, inflatable part of the balloon, are made from sheets of polyethylene. They are specially constructed for use in Superpressure balloons, which are resistant to UV radiation, and is capable to function at temperature as low as -58 °F, and at pressure as low as 1/100 atm. Balloons filled with Helium and air mixture are launched, recycled and re-launched at a designated collecting point. After 100 days from the launching, the balloon is ready to be taken out of service and the gas is released from the envelope to bring down the balloon in a controlled descent to the ground. Each balloon includes a parachute to ensure a more controlled landing. The balloons and equipment on board can be re-used and each loon has an approximately 2-years life time.
Solar panels power each unit's electronics. In full sun, these panels produce 100 watts to keep the unit running while also charging a battery for use at night. By moving with the wind and charging in the sun, the Loon is able to power itself using only renewable energy sources..



➢ ENVELOP

BALLOON ENVELOPE STRUCTURE Filed Aug. 2, 1961 United States Patent 3,369,774 BALLOON ENVELOPE STRUCTURE Arthur D. Struble, Jr., 2101 Rosita Place, Palos Verdes, Calif. 90274 Filed Aug. 2, 1961, Ser. No. 128,799 7 Claims. (Cl. 24431) This invention relates generally to improvements in balloons and balloon systems. More specifically this invention pertains to balloons which are capable of achieving altitudes as high as 230,000 feet or more. In a specific embodiment this invention pertains to balloon vehicles constructed of a combination of very thin plastic film and relatively thin high-strength load carrying members.

s is well known, there is a continuing and increasing interest in the atmosphere above the earth. Daily weather reports and long-range meteorological forecasts are in large part possible because of the data gathered at high altitudes. Research in the

upper atmosphere has also been stimulated within recent years because of the interest of the military forces of the world, who have not only been interested in the weather data which can be obtained but have also been intrigued with the reconnaissance possibilities at high altitudes. While great strides have been made in recent years in studying the characteristics of the upper atmosphere and in making flights through the atmosphere, such advances have been limited by the type of exploration equipment which is available.

It is of course well known that balloons have often been employed to obtain data in the upper atmosphere. Balloons have less frequently been used to transport human beings from one point to another. However, in order for a balloon to carry either a payload of instruments or a human being to a high altitude, the material of which the balloon is constructed must meet two requirements. It must first of all be constructed of very lightweight material (in order to maximize the buoyant effect of the gas contained therein) and secondly it must at the same time be strong enough to withstand the rigors of launching and flight through sometimes turbulent weather conditions. Since strength is usually inversely proportional to thickness and weight, those in the balloon art have heretofore been effectively limited insofar as the thickness of their balloon fabric material is concerned. This in turn has usually limited the height to which the balloon may rise.

➢ SOLAR PANNEL

Each unit's electronics are powered by an array of solar panels that sits between the envelope and the hardware. In full sun, these panels produce 100 Watts of power - enough to keep the unit 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 only renewable energy sources.

➢ EQUIPMENT

A Project Loon research balloon

The balloon envelopes used in the project are made by Raven Aerostar, and are composed of polyethylene plastic about 3 mil or 0.076 mm (0.0030 in) thick. The balloons are superpressure balloons filled with helium, stand 15 m (49 ft) across and 12 m (39 ft) tall when fully inflated, and carry a custom air pump system dubbed the "Croce"[] that pumps in or releases air to ballast the balloon and control its elevation. A small box weighing 10 kg (22 lb) containing each balloon's electronic equipment hangs underneath the inflated envelope. This box contains circuit boards that control the system, radio antennae and a Ubiquiti Networks Rocket M2 to communicate with other balloons and with Internet antennae on the ground, andbatteries to store solar power so the balloons can operate during the night. Each balloon’s electronics are powered by an array of solar panels that sit between the envelope and the hardware. In full sun, the panels produce 100 watts of power, which is sufficient to keep the unit running while also charging a battery for use at night. A parachute attached to the top of the envelope allows for a controlled descent and landing when a balloon is ready to be

taken out of service.[] In the case of an unexpected failure, the parachute deploys automatically. The balloons typically have a maximum life of about 55 days, although Google claims that its tweaked design can enable them to stay aloft for more than 100 days.

The prototype ground stations use a Ubiquiti Network Rocket M5 radio and a custom patch antenna to connect to the balloons beaming down the Internet when the balloons are in a 20 km (12 mi) radius. Some reports have called Google's project the Google Balloon Internet.

7.ADVANTAGES

Initially, when the project was announced, it appeared as if Google is spending millions of dollars on a project providing internet to billions of people without any form of payment in return. So, how will Google make any profit from this project? Considering that Google is an advertisement company, increasing the volume of internet users would invariably increase traffic on the world's leading search engine, Google Search. This accrual in search users implies that more ads will be displayed, swelling Google's pockets even deeper.

Also, considering that today's internet marketing model requires purchasers to manually install a router in their houses, Loon will already have a distinct dominance. Adopting Loon as your internet connection would require no external hardware, decreasing barriers that users would have to deal with when deciding whether or not to get an internet connection. Google's competitors that also provide similar services like Time Warner Cable will automatically have a reduced market share. Also Space Systems would also be at a disadvantage since their satellites cost more to maintain by multiple levels of magnitude than the Loon balloons do.

PROS FOR WORLD

Project Loon is clearly an asset to Google. However, it is also a convenience to the rest of the world. One of the most obvious avails of the project is the *Availability of Information*. Assuming all the mechanisms of the project are functioning as planned, every single person who has access to some device that has wifi access would be able to search for almost any form of media online. Farmers in remote corners of third world countries would be able to research and analyze multiple techniques that could increase their yield, a father would be able to stay in

touch with his daughter no matter which township either one of them lived in, villagers across an country would be able to transparently examine the countries political scenario and vote appropriately.

- The second benefit is naturally *Education*. With millions of uneducated children all across the world, this program might be able to successfully provide schooling through online classes on topics ranging anywhere from disaster management to literary analysis.
- *Health and Medicine* is another area that will be affected by Loon. With globally available data on disease outbreaks and medical breakthrough, the entire population will be able to adjust to epidemics or adopt new drugs or medications
- Loon's *Use of Renewable Energy* will greatly influence and inspire future projects as well. Creating an interplay between solar energy to keep the balloon functional while using wind energy to define its motor controls will help reduce the burden on coal, petroleum and other non-renewable energy sources.
- *Collaboration* between people across the globe will become much easier with the constant connectivity to the each other through the internet, allowing newer more complicated projects to arise. .

8.DISADVANTAGES

The main problem with launching any hardware project is the certainty of eventual hardware failure. In most cases, the hardware is usually accessible and can be fixed. However, for airplanes, rockets, satellites, and now Loon balloons, hardware failure is a huge problem as they can not be reached. If a Loon balloon fails, it can either remain up in the air floating, making it difficult to bring down or it might go down in unwanted areas. Both of these scenarios are a huge concern to the stability as well as the safety of people whose lives might be affected by unwanted balloon landings.

Another concern over this project is internet privacy since it gives Google more power over a wider range of consumer behavior. This information can become a security issue if it is shared with Government agencies like the NSA.

Finally, the last apprehension about this project is its monopolistic tendency. In the future, assuming no other company manages to initiate such a wide scale project, Google can utilize its monopoly over the internet by either charging money for Project Loon usage or even converge on favouritism by marketing Chromebooks and Android phones but limiting the accessibility of other company's laptops and devices on the Loon web service.

9.CONCLUSION

Project Loon is a network of balloons traveling on the edge of space, designed to connect people in rural and remote areas. People connect to the balloon network using a special Internet antenna attached to their building . Project loon is a research and development project being developed by Google. It is a network of balloons traveling on the edge of space, designed to provide ubiquitous Internet connectivity. The balloons float in the stratosphere, twice as high as airplanes and the weather. They are carried around the Earth by winds and they can be steered by rising or descending to an altitude with winds moving in the desired direction. People connect to the balloon network using a special Internet antenna attached to their building. The signal bounces from balloon to balloon, then to the global Internet back on Earth. Loon provides intenet to all that, its main aim!!

10.REFERENCES

- ✓ Official website (http://www.google.com/loon/)
- ✓ Project Loon (https://plus.google.com/+ProjectLoon/posts) on Google+
- ✓ Project Loon (https://www.facebook.com/googleprojectloon) on Facebook
- ✓ Introducing Project Loon (https://www.youtube.com/watch?v=m96tYpEk1Ao) on YouTube
- ✓ Project Loon: The Technology (https://www.youtube.com/watch?v=mcw6j-QWGMo) on YouTube

11.COMMENTS