I J C T A, 9(17) 2016, pp. 8399-8406

Google's Project Loon

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ABSTRACT

In this advance world where every small thing is connected with each other is mostly done by internet. It is greatest gift that communication technology gives us. In short Internet reduces distances, time, and problems in communication among the people of the world. And now it is a very part of our life. But it is still observed that 2/3 for total earth population is still not able to use internet. By observing all these situations Google initiates a program called "Project Loon". The name "Loon" comes from the technology used in this project is balloons itself.

This paper provides a brief description of the Project Loon. Beside this it also provides previously used techniques of internet connection and why this project is been started. The paper also provides various problems occurs in this Project and try to give some solutions to these problems.

Keywords: Project Loon, Stratosphere, Different Layers of Stratosphere, Types of Internet connection, Polyethene, Patent Method.

I. INTRODUCTION

We are now living in a modern world or we can call it an advance world. A world in which everything is connected with each other. This is mainly with the help of internet. It is true that internet is a important part of human life. Day to day network carrier companies are making efforts for the better connectivity as the no of users are increasing continuously.

But According to a survey done by Google said that still 2 billion (or 2/3 of the total population of earth) is still not have any internet connection. Or many of them are still unaware of the internet itself. And many people which are living in harsh conditions or hilly areas are unable to get any internet connection.

II. CURRENTLY USED TECHNIQUES OF INTERNET ACCESS:-

The basic concept of accessing and transfer of internet is converting digital media to analog signals which are transferred through wires. This converting of digital media into analog signals is done by Modem. In a wired connection a computer which is using internet must be directly connected to a modem that is connected with ISP (Internet service provider). Basically there are two techniques for internet access:-

1. Wired Connection
2. Wireless Connection

2.1. Wired Internet Connection-

In this type of connection internet is transferred through wires and cables. Examples of these connections are:-

Broadband connection, Cable Internet connection, DSL (Digital Subscriber Line), Optical Fiber Connection, etc.

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2.2. Wireless Internet Connection

In this type of network internet is transferred through air. It does not require any cables or wires. Examples of these connections are Satellite broadband, Mobile broadband, etc.

III. PROBLEMS OCCUR WITH THESE TYPES OF CONNECTION

3.1. Increase of population

As the population increasing day by day it very hard to plant more towers or cables (underground). And it affects the quality of internet connection.

And it also increases the price of internet access as the demand is going high but the network growth is not much as compared to the demand.

3.2. Hilly Areas and Harsh Environment-

Building connections are very hard in hilly areas and harsh condition environment. Due to this problem 2 billion people on earth are unable to use internet. Because there is no coverage of internet.

3.3. Natural Disasters

Natural Disasters interrupt Internet access in many ways. But not only internet it also interrupts telecommunication, weather forecast, contacting with emergency crew at the time of natural disasters etc. The main way in which natural disasters interrupt internet access is by damaging sub-networks. Or by damaging antennas and towers. Another way is by damaging fiber optic cable placed on the ocean floor.

Fiber optic cable is very important in transferring network in long distances just like satellite connection.

3.4. Expensive Infrastructures

In developing countries underground infrastructure for internet connection is very costly and in developed countries underground construction in populated areas produces much more cost. As the developed countries has already infrastructure on the ground and underground infrastructure is to be done very carefully. So this proves much expensive. After observing all these types of internet connection and problems occurring in day to day life will show us the main reason behind why 2/3 of the earth population is still unable to use internet.

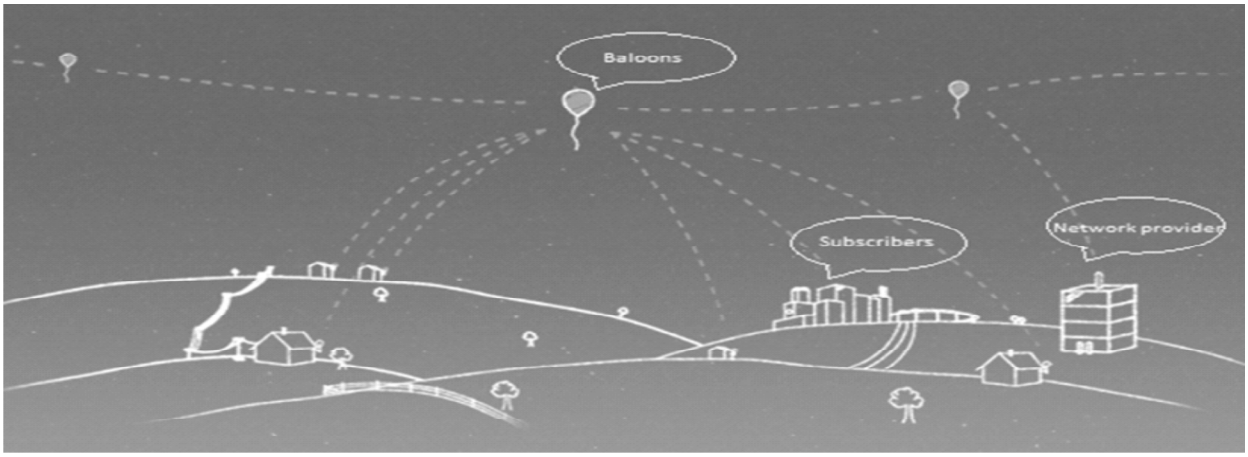
IV. A NEW TECHNOLOGY BY GOOGLE™- “PROJECT LOON” OR “PROJECT X”

After observing all the problems Google try to introduce a new different type of internet connection. Just like it will work like a chain but if the chain breaks then still the networks doesn’t break. So Google introduces it’s “Project Loon”. A balloon based project.

The basic concept of this project is that balloons are flying in the air and an height of 18 Kms from the earth crust. They fly on the stratosphere layer of the earth’s atmosphere. These balloons are connected with each other and give internet access to the whole world.

Apart from providing internet access to the whole world project loon also helpful in:-

1. Providing free internet facilities to the children of the rural areas. So they get same facilities which urban area children have.
2. At the time of natural disasters when all other means of communication goes down these balloons are still working and they helps the people which are in danger can ask for help.

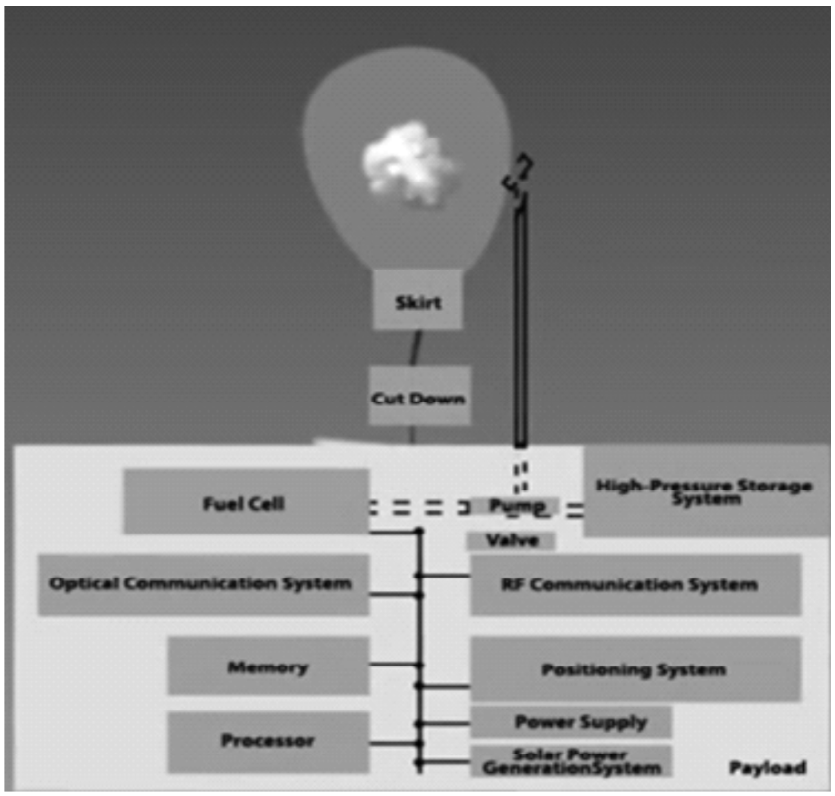


The figure shows a balloon based network: communicating with each other and places on ground.

3. At the time of Natural disaster when no internet connection is there. These balloons give internet connections to the people and also give the weather details.
4. More internet business is now possible.

V. TECHNOLOGY OF GOOGLE™ LOONS

These balloons are made up of polyethene plastic by a Hot air manufacturing company Raven Aerostar. These balloons are made up of polyethene plastic. It is of 0.076 mm thick. These balloons withstand high pressure so they are filled with helium at high pressure. When it is fully filled the dimensions of the balloons are 15m across and 12m tall. Each balloon has its own custom air pump system with release air of fill in it according to its need.



The figure shows different types of devices and technology used in Google Loons

Each balloon has a 10 kg weight box hanged to it. This box contains:-

5.1. Processor

This is main part of the Balloon. It handles all the functions of the balloons.

5.2. High Pressure Storage system

It is a type of tank with high pressure. It contains Helium gas which is used by the balloons to fly in sky (as the density of helium gas is low so it always tries to go upward). The main function of this storage system is to control the amount of helium in balloons according the altitudes (Increase or decrease accordingly or the direction in which it has to go).

5.3. Fuel System

Fuel system is the storage which is responsible for producing extra hydrogen gas when required by balloons to go at higher altitudes.

Extra producing of hydrogen gas involves some chemical reaction.

And when this hydrogen gas is not required by balloon then it again goes down to the fuel cell and held a chemical reaction **($2H_{2+}O_2=2H_2O$)**

And this reaction produces water.

5.4. Power Supply (Battery)

Power Supply is the main power source of the balloon. Every process of the balloon requires power as the main unit of process (Processor) also requires power to run.

5.5. Solar Power Generation System

Solar Power Generation System is basically solar panels. In day time it produces enough power so that it can be used at day time as well as at night time when there is no sunlight. Power is saved in Power Supply (Battery).

5.6. R.F Communication System

R.F Communication System is Radio Frequency Communication system. In these type of communication system signals are transferred through Electromagnetic waves (Basically of range 3 GHz to 300 GHz).

5.7. Optical Communication System

Optical Communication system is an alternate system in these balloons. In this type of communication light is used to carry information. In Google's loon LEDs are used.

5.8. GPS

Global Positioning System is a system which is used to find the location of a particular object. It is placed in every balloon so that Google has an eye on every balloon. And where it requires so is can be transferred.

VI. HOW GOOGLE™ LOON WORKS

In this project the balloons are situated in the stratosphere layer of the earth's atmosphere. Around 18 Km from the earth's crust.

There are two reasons why these balloons are situated on stratosphere layer:-

1. The height of the balloons is approximately 18 which mean it is almost double of the height of clouds and weather changes. This protects the balloons from weather problems such are high winds and thunder lights.

   Also there will be no clouds between sun and balloons. So they get proper sunlight on their solar panels which are the main source of energy.

2. In stratosphere layer of atmosphere there are very steady winds are there. With maximum speed of 20 Mph. So this make balloons last longer without damaging or crashing.

And there are many layers of wind in stratosphere. And each layer has different speed and direction.

So, for moving in different directions the balloons require different heights or altitudes.

In Google Loons there are 3 methods of switching altitudes:-

6.1. First Patent Method

To increase or decrease altitudes of balloons the helium gas is filled according to requirement. For ex

To decrease altitudes of balloons the helium gas is pumped out in the high pressure storage system.

To increase altitudes of balloons the helium gas is pumped in the balloons from these high pressure storage system.

6.2. Second patent method

As the box hanged to the balloons contains a fuel cell which generates hydrogen gas. And this hydrogen gas is filled in balloons to increase the altitude. And to decrease altitudes the hydrogen gas is pumped back into fuel cell. Fuel cell reacts with it and makes a reaction of the gas with oxygen to produce water.

6.3. Third patent method

In this method the balloon is colored half black and half as normal. At the day time when the sunlight is there and the balloons are half black and this black color absorbs more energy to the balloons are heated and it increases buoyancy this helps to increase altitudes. And all these balloons are connected with each other by their Optical Communication system and connected with Headquarters (Google Loon) by R.F Communication system. A special team is always there to control these balloons.

VII. THE PROBLEMS COMING IN FUTURE WHILE RUNNING THE PROJECT

7.1. Leaking of Balloons

Many balloons start leaking in sky without any reason .After leaking started they come down in few hours or in few days. Many balloons are crashed in New Zealand reported by peoples.

7.2. Energy Problems

In the day time the balloons get energy for processing and working with the get of solar panels. Besides these solar panels also saves energy in battery so as the balloons can work in night time (When there is no sunlight).But the problem is that sometimes this battery is not enough to work the whole night. This is because in winters there is low sunlight and the solar panels store less amount of energy in battery.

7.3. Problems in Civil Aviation

According to Google if their project is working in whole world then they require 100 of balloons launch in a day. So this makes a problem for civil aviation. It creates danger for passenger planes as well as defense plane.

7.4. Countries with internet restricted (Or some websites)-

This is much complex problem for Google. As many countries have restricted internet access or restricted some websites. In this case Google can't get permission if those websites are banned.

For ex- Facebook is banned from china. So if Google loons are flying in the china then they have to block the Facebook. But if the same loon is also flying in India then people in India also suffers from banned Facebook.

VIII. POSSIBLE SOLUTIONS TO THESE PROBLEMS:-

8.1. Leaking of Balloons

As Google already held detective jobs to identify the problem or to find the tiny leaks.

But this only fixes the problem only before launching of balloons (because many balloons have leaks before the launching, so they have been repaired) But still there is problem of leaking in sky. Mostly all the balloons are last longer for 100 days only. Solution for this problem is that Raven Aerostar has to use High-Density Polyethene so it reduces leaking problems. But if the density for polyethene is much high then is will not remain flexing for the purpose of balloon. Another way is to use synthetic polymers which are more durable and lighter than natural polyethene (formed by natural polymerization of ethane).

For ex- nylon can be used for making balloons rather than polyethene.

8.2. Energy Problems

In Energy problems whole balloons is in danger. Suppose if at the night time energies in batteries of the balloon ends. The processor stop working, by this whole balloon stops working and at the same time the GPS is also stops working. Google is then unable to track location of the balloons and they cannot recover it.

This problem can be deal by increasing the efficiency of solar panel or by increasing the area of solar panel. But efficiency of solar panel cannot be increased and increasing the area has also a limit (there is no much surface is available other than the surface of box in which all its system is there (ex-processor, batteries, communication system). In this case we can change is type of solar panels which have more efficient. For example we can use Monocrystalline Solar Cells rather than Polycrystalline Solar cells.

Monocrystalline solar cells are made of blocks of silicon (cylindrical in shape). Silicon Wafers are made by cutting the four sides of cylindrical blocks to optimize its performance.Whereas, Polycrystalline is produced by a process called as Siemens process.

Siemens process - Metallurgical grade silicon by a chemical purification process.

Monocrystalline solar cells Highly efficient in compared to Polycrystalline solar cells. And they are also highly space efficient. Means from very low area of solar cell it absorbs high amount of energy. So Monocrystalline solar cells help in storing high amount of energy in the balloons. But they are very costly compared to other solar panels. So the manufacturing cost of each balloon increases but they will now absorb sufficient amount of energy which requires for working in night.

8.3. Problems in Civil Aviation

According to the project these balloons will remain in stratosphere all the time. They just change the altitudes in the stratosphere layer of earth's atmosphere. But the problem comes during the launching of balloons. As it is obvious that they start flying from the land and from the duration of land to stratosphere they fly in the level of height at which the airplanes travel. And according to Google if the project will start working in whole country then they have to launch 100 balloons every day. So this develops very high chances of accidents.

So to deal with this problem there are two ways.

1. Using a specific region or specific time for launching of balloons: This solution clears the entire problem but this requires a lot of work. To deal with this problem Google can take permission from every country's civil aviation department. This works like Google manages to take permission from every country's civil aviation department to give a specific area for their launching of balloons. By this all the planes from every country will not fly over that specific region and this eliminates all the chances of clash of balloons and airplanes. If the management of specific region not works then they also manages to launch their balloons at specific time. By specific time they set a particular time and place from where no flights will go for a day or for some hours. So they launch their balloons at that time. This option is also good for rectifying this problem.
2. By launching the balloons at high altitudes areas: This method is easy as compared to first one. This method does not require and permission or any management but it is not safe just like the first one. In this method the launching of balloons takes place at high altitudes areas. For ex- At mountains which have high level of height. But in this process the launching team has to go to harsh climate areas. As the climate conditions at high altitudes are always too cold, less level of oxygen and high speed of winds or we can say that harsh climate conditions. As at these heights chances of planes are less so the chances of clash between balloons and airplanes are also less. So this solution can also be used to some extent. Steps for this solution is overall easy than the first solution.

8.4. Problem of restricted internet in some countries

Many countries had blocked specific websites and some countries have blocked whole internet too. This is due to different countries have different policies (in term of awareness, technology etc.). So in this case Google has to take care of every countries internet policy. But this is very difficult as different countries have different websites blocked and if any balloon goes from one country to another and that another country gets some kind of internet which its government not wants their citizen to access then this creates a big problem.

So to deal with this problem there are two ways:-

1. By making the balloons country specific: To deal with this problem Google has to make the balloons specific according to different countries. According to different countries different demand Google has to configure the balloons communication system. They have to put Internet censorship to the balloons of specific country according to their requirement.
2. By making the balloons that changes censorship according to location: This solution works with the help of GPS and some website blocker or Internet censorship service. In this solution Google has to make some configuration to their balloons according to particular locations (according to different location or countries Internet policy). By this method when a balloons changes its location from one country to another so the website blocker or censorship setting reconfigured according to the new location. By this solution Google can completely removes the problem of specificity of internet from different countries.

IX. CONCLUSION

The Project by Google™ still has to face many problems in running this project. But this project will be a revolution in the communication technology of whole world. Besides its problems it also has a very bright scope. One day this project is going to connect every people of the earth to the internet and gives everybody an equal opportunity of gaining information without any barriers like- Harsh climatic condition, hilly areas etc.

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