Network of Troop-Hiking

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Abstract: Adventure hiking is defined and marketed as an experience of excitement, danger and risk. Nowadays hiking as a troop is a very interesting adventure type. Each and every member in the troop must have to climb the mountain all together. Sometimes a person get lost or delayed ,other members will able to communicate/find that person or else delayed-person will able to explore the map and communicate with other members in the troop. However to perform such tasks troop must able to access internet without connection failure. This paper provides a concept of network architecture for hiking troops including advance way of getting internet facility, exploring map and communication between members. Mainly Internetservice-provider (ISP) provides internet connection, but if it fails to provide internet connection GOOGLE-LOON (Technique of providing internet access through huge balloon) act as the provider of internet. This balloon provides internet coverage for an area of 40km in its diameter, special technology called LTE (LONG-TERM EVOLUTION) members can connect to network from their 4G-Mobiles, Mobile-LTE routers and other LTE-enabled devices. An emerging mobile technology, Bluetooth Low Energy (BLE) beacons (Bluetooth 4.0) enable smartphone application to pinpoint exact location of members and it gives proximity ranges(Member’s location as far, near). Beacon support circular range up to 75m, therefore using beacon troop member can easily find the range (measured using RSSI-received signal strength indicator) of other members. Through ALERT-beacon a troop member able to alert others, when Victim-hiker is in danger.Orux Maps (GPS application for android) allows hiker to use maps off-line and create waypoint (point on the map, created in order to locate an important place on the map). Joining ordered set of waypoints it create Route for the hike. Hikers can save this map as .gpx extension on the mobile.

Keywords: Troop-hiking, Alert-beacon, Google-Loon, LTE, Beacon, Proximity ranges, Waypoints, Route, Bluetooth 4.0, .gpx, RSSI, Walkie-Talkie, Huawei, Dialog, Mobitel, mobile WIFI router, WIFI, Victim-hiker, iOS, GPS(Global Positioning system.

1.0 INTRODUCTION

In this paper it introduce a new concept to held communication activities among members in the Hiking-troop. Communication is the most prominent activity when people go hiking as troop. Technologies and devices related to networking can be used to introduce a good concept of architecture which will help to held communication between each hiker. Mobile with some specific features, Mobile WIFI router, Shoes (special), Bluetooth 4.0(Beacon), LTE technology are use as technologies and devices. Internet connection redundancy using ISP (Internet Service Provider) and Google Balloon, Proximity range Indication and Alerts through Beacon signals, Off-line navigation using map and Recharge option are the main functions of this network of hiking. This architecture provides many benefits for the hikers who climb the mountain. Peer to peer communication and tracking where the other members are located can be shown as the main benefit. Victim hiker can send alert signals to other hikers using Beacon technology via mobile therefore, it has a high possibility of overcoming risks. Through redundant way of providing internet connection hikers can always connect each other and also able to climb as a team without any delay or unexpected accidents. Battery Power can be keep recharging through their power generating shoes while stepping. Recharging rate is directly proportional to the number of steps of the hiker who climb the mountain.

2.0 RESEARCH QUESTIONS

This section indicates the main research questions and sub questions which affect to the research. Main research question
How would network devices and mechanisms be used to hold communication between troop members?

Sub research questions

- What are the devices used to build the architecture?
- What are the device capabilities with the system?
- How internet is access when ISP connection lost?
- How to access internet through loon balloon via mobiles?
- How to show proximity ranges for each hiker where the others are located?
- How to alert other hikers, if someone in danger situation?
- How to recharge the devices used to build the network?

2.1 OBJECTIVES

The aim of this research is to introduce a network concept to communication between hiking members who participated in hiking. Along with the assistance of network devices, architecture for Troop-hiking can be demonstrated.

2.1.1 DELIVERABLES

The deliverables or the output of this research would be a report on hiking troop network communication architecture. The main purpose of this report is to cover the scope of the project aim as shown below:

F1: ACCESSES INTERNET CONNECTIVITY- Provide internet connectivity and redundancy.
   - MOBILE COMMUNICATION
   - LTE-ENABLED DEVICES

F2: PROXIMITY-RANGES - When hikers go hiking with a troop, Everybody have to climb with the team, Therefore F2 is introducing a concept to indicate proximity ranges, where each troop member is located in (as far, near).

F3: INDICATE DANGER SIGNALS - Victim hiker should able to send alerts to others in the troop.

F4: WAY OF RECHARGING THE MOBILE PHONE - Hiking takes long time to reach the destination, therefore hikers may needs to recharge the phone.

F5: EXPLORING THE HIKING MAP - Every member in the hiking troop must able to explore the hiking path.

Research function and comparison with other research papers shown (Table 1.0).

3.0 BACKGROUND

Hiking is one of the most inexpensive adventuresport available today. The idea of taking a walk in the countryside for pleasure developed in the 18th century, and arose because of changing attitudes to the landscape and nature. Frequently nowadays long distance hikes are undertaken along long distance paths. The equipment required for hiking depends on the length of the hike, but day hikers generally carry at least water, food, a map, and rain-proof gear. Hikers usually wear sturdy hiking boots for mountain walking and backpacking, as protection from the rough terrain, as well as providing increased stability. Group of hikers do hiking in a long distance path, it is essential to communicate between each other. Usually to held communication between set of hikers, Walkie-Talkie Technology (Walkie-talkies are handheld, portable radios: they communicate wirelessly using radio waves on a single, shared frequency band). Walkie-Talkie support communication distance up to 2 meters. Therefore if someone in the troop exceed this distance that person may not able to communicate between others. Signal strength of the mobiles also low from lower altitude to higher altitudes, therefore call quality is not very good. Actually long hikes takes long time to reach the destination. Sometimes communication fail due to inability of technique to recharge the communication devices.

4.0 LITERATURE REVIEW

In this paper it discusses about the loon project, which provide a way to access internet through a balloon floating in the sky. Provide internet facility in remote places and rural areas, need a high altitude platform. Google came up with an innovative solution to use balloons to provide internet connection in remote regions. Balloons are used for numerous purposes but here it is used to provide internet connection in remote regions. This project is a network of balloons floating in the stratosphere. It acts as a wireless station and provides internet service to the rural areas and remote regions. Once the entire setup is assembled then the balloon will be able to provide internet coverage for an area of 40 km in its diameter. Initially people can send and receive signals using the radios and antennas within the balloon network.
system alone. Special technology called LTE, people can connect to network using their mobiles and other LTE-enabled devices. If ISP(Internet Service Provider) unable to provide internet connection due to lower signal strength, Loon balloon act as the provider and hikers can connect to the network via mobile phones. This provide internet redundancy [1].

This paper discusses about how the loon technique affects the peoples of towns and villages get the benefit of no internet to high speed internet. This loon technique help to increase the connectivity between peoples and people able connect the network easily via mobile phones using LTE (Long Term Evolution) technology [2].

This paper gives an overview of the Long Term Evolution (LTE) of the Universal Mobile Telecommunication System (UMTS). LTE initiate the latest step towards the 4th generation (4G) of radio technologies designed to increase the capacity and speed of mobile communications. One of the important LTE-A benefits is the ability to take advantage of advanced topology networks; LTE provide opportunity to enter Loon network via mobile phones. According to the information provided in this research paper, hikers can connect to the Loon network through mobile phones using LTE (Long Term Evolution) technology [3].

Research is about Design and Implementation of Bluetooth 4.0 (known as BLE, Smart-Bluetooth, and Beacon) for mobile devices by Christian Alexander Goosen (2014) in UULM University. Paper discusses how to Design and Implement Bluetooth 4.0 (Low-energy Beacon) for mobile devices considering compatibilities, technology basics and Proximity ranges indication. Classic Bluetooth(Bluetooth 2.0) not able to find proximity ranges due to variations of Transfer rate, Channels and Connection establishment, but the version Bluetooth 4.0 able to find it. Characteristics such as High speed of transfer rate, Quick connection establishment are highly affected for hiking troop, because it is easy to identify each members’ location without any delay. This research paper discusses about exhibition called BLEXpo. BLEXpo is about a system which going to be used at exhibitions and conventions. Every exhibitionist, or companies as everyone referred to in BLEXpo, have beacons at their booths. When a consumer walks near that booth, it will receive relevant information concerning that company or its products. The BLEXpo client, which is an Android 4.4 application that runs on a mobile device, actively seeks beacon advertisements, and once found, displays the relevant information on screen using a predefined layout [4].

In the Romanian city of Bucharest, a bus company is set to eight-month pilot project in which Bluetooth beacons are being used to help visually impaired individuals navigate the bus system. System consists of beacon hardware, as well as a cloud-based content-management system (CMS) platform, to communicate with mobile devices via an application that runs on iOS and Android systems. Usually this system is based on Alert beacon technology and it can use situations such as crisis or danger. According to the facts provided, Hikers can use somewhat similar mechanism to find other hikers’ location range and send danger alerts using Bluetooth 4.0 (Beacon) [5].

The paper is discussing the method for determining a position of a mobile satellite positioning system (SPS) receiver. In one example of a method, determine cell site identifier or location for cell site which is in wireless contact with a mobile cell based contact system. The paper shows that determine an estimated for the mobile GPS receiver from the cell object details. The paper is built on the position is determined from a position solution algorithm. In the paper written by ourselves it is also pointed out that how use estimated to determine position of mobile GPS receiver [6].

The research is focusing on telecommunications assisted satellite position system. The wireless terminal then uses the in part processed details from the auxiliary system to the wireless terminal in acquiring the ranging signals from the directionfinding satellites quickly and when they are weak. When the wireless terminal is able of providing the functionality of a wireless contact terminal (e.g., a cellular phone etc.) the circuitry for determining the wireless terminal’s location. The functionality of a wireless contact terminal is addressed area of our work [7].

The topic is anonymous location wireless network service for apply in a wireless network that tracks the location and identify of network users. The service provides content providers with the location of network users without their identities. In our work using track the location and identify of network users [8].

This is an offline navigation. It doesn’t need an internet connection for finding location. First need to download the offline map. User can download new maps or update the existing one. The downloaded maps will not be like some image of a
street map but like a fully functional and active map allows the user to search for a particular place or area. The application will be capable of reducing the hiker’s frustration and stress to a great extent as he will have all the information [9].

This method is mobile communication continues to grow disaster situation. In particular disaster situations, the access to communications is serious for release operations. In this method demonstrate the concept of hybrid cellular mobile network to extend wireless coverage by showing a fully functioning microblogging system for smartphones and tablets without requiring modifications of the existing wireless infrastructure in a resembled disaster location. Participating devices connect to each other through WIFI signal to form the network [10].

In this paper it discusses about the implementation of Power generating shoe which can be used to charge mobile phone while walking or running. Special kind of pressure plates made out of Aluminium, Kapton need to be used to build the latter part of the shoe. Mainly Front-end and Backend has charging properties when pressing and releasing two ends while walking [11].

Nowadays various systems and methods are developed in group social networking field to set and manage social events and activities. Such system allows to people who are near and far to communicate and like interests, hobbies etc. The system developed for group activities is an example of group social network system which users can interact with system to display activities, add participants to activities, track group members and schedule the activities. Similar systems and applications are available through different devices which allows to network members to view a personal calendar, scheduled events and activities, invitations [12].

Wireless network connection has become major component almost in every device. It does not use costly wiring and cabling but provides flexibility, convenience, and remote monitoring and control. The number of applications increasing very fast including simple toy cars to automation devices. Nowadays almost every produced wireless ear pods of iphone 7 and etc. Different type of wireless systems exists now some of them are developed to do specific task while others are have many uses and all of them are available and most of them are standardized [13].

Development and quick growth of the android OS is the reason for invention of smart phones. The biggest and the most important feature of the smart phone is finding a person’s location use built-in Global Positioning System (GPS) tracking technology and location based services. In this research paper the research group indicates the Location Based Services (LBS) and its implementation. LBS services provide peoples current location using Global Navigation Satellite System (GNSS), Geographic Information System (GIS) and Wireless Communication (WC) technologies which is integrate with mobile computing technology. LBS services are also used in game industry. Company used Context Awareness (CAS) services. Location Tracking Service (LTS) is one of the services provide from LBS. LTS system mainly developed for safety purpose. There also a service called Cyber Minder which is an intelligent reminding service used to define complex conditions [14].

According the research paper, it build a mobile application in J2ME for sharing the location with friends and family member using GPS. The application giving alert with the family member are come nearby to them they are using an own client server for that. The server is using the open-source database MySQL with PHP language. Moreover that application support with all type of mobile. Server will get user location, if two member is near database will update at the same time that will give alert to the members. There is a one disadvantage using GPS that will not support in indoor place [15].

Mobile application based on GPS and 3G/GPRS build of a java application which will give the users current location sends this location using SMS (Short Message Service) and sharing location with friends and family and monitor them in the map. The application divided into five parts: a mobile client, a web server, a database, GPS system and a map service. Web server use for share this location the mobile client sends this location to the web server from there other users get this location if they have the authentication given by the user. The mobile client is developed using J2ME. The web server side programming is done using PHP and database is maintained by MySQL. This application can help users to be aware of their own location and send it to any valid mobile number using short message service. Users can also share their location with friends and family. Moreover, users can take advantages of emergency features which send user’s current location to emergency numbers and disadvantage of the application works in the open space areas only as it relies on GPS [16].

The present revelation relays generally to the field of wireless communications. Mostly the present
Disclosure relates wearable wireless devices. Over the past decade the growth of wireless technologies is rising rapidly. The idea of wireless and sensor wearable wireless devices are rising in medical field also. Most of the prestigious watch owners are interested in monitoring their health and activity with the aforementioned digital wearable tracking device [17].

5.0 Devices and Technologies Used to Build the Hiking Network

This section describes the technologies and devices used to build the network architecture.

5.1 Technologies

Technologies such as LTE (Long-Term Evolution), Bluetooth 4.0, Loon Technique will be described in this section.

5.1.1 Long Term Evolution (LTE) Technology

Long Term Evolution is the next-generation 4G technology for both Global System for Mobile communication (GSM) and Code Division Multiple Access (CDMA) cellular carriers. Using LTE technology people can connect to network using mobiles and other LTE-enabled devices. GOOGLE Loon balloon support LTE signals, therefore hikers able to access the connection directly through theloon balloon using LTE-enabled mobile phones and LTE-enabled mobile routers.

5.1.2 Bluetooth 4.0 (Beacon & Alert-beacon)

Bluetooth 4.0 is the new version of Bluetooth, which support circular range up to 75 meters. Bluetooth 4.0 is commonly known as Beacon. Beacon is essential for hikers to find proximity ranges between each hiker. Proximity ranges are calculate using RSSI (Received Signal Strength Indicator) value. Alert beacon can be used to send alerts to each hiker when someone in danger situation. Application of beacon should be coded according to the requirement of the hiker and install to the mobile phone.

5.1.3 Loon Technology

Balloons are used for numerous purposes but in this technology it is used to provide internet connection in remote regions. This technology is a network of balloons floating in the stratosphere. It acts as a wireless station and provides internet service to the rural areas and remote regions in a cost-effective manner. This balloon provides internet coverage for an area of 40km in its diameter. People can connect to network using their mobiles and other LTE-enabled devices.

5.2 Devices

The devices used in the network architecture can be categorized related to user types. There are two types of users in a hiking troop.

- Troop Captain
- Troop Members
Troop Captain - LTE Mobile Router, LTE & Bluetooth 4.0 support dual SIM smart mobile phone, Recharging shoes, Power Bank

Troop Members - LTE & Bluetooth 4.0 support dual SIM mobile phone, Recharging shoes, Power Bank

5.2.1 DEVICE SPECIFICATION

This section describes the details of the devices used to build the network.

- LTE Mobile Router - Huawei e5377t
  LTE mobile WIFI router

Figure 2.0 indicates how Huawei mobile WIFI router connect with mobile devices via LTE (Long Term Evolution) Technology.

(Figure 2.0) - Huawei LTE (Long Term) (point on the map, created in order to locate an Evolution) mobile router important place on the map). Joining ordered set of

Source: https://www.google.lk/search?hl=en&biw=911&bih=429&site=imghp&tbm=isch&q=huawei+mobile+wifi+router

- LTE & Bluetooth 4.0 support dual SIM mobile phone - For example: Nexus mobile brands support Bluetooth 4.0 or above, LTE (Long Term Evolution) and Dual SIM support.

6.0 METHODOLOGY

The methodology that will use to perform every task is very simple. First thing that hiker need is to collect every equipment as mention below:

- Recharging shoes
- Dual SIM LTE-enabled Bluetooth 4.0 smart phone
- LTE-enabled mobile router (Only Troop captain handle this)

Hiker must wear recharging shoes if that person need to charge the mobile or any other equipment. SIM cards from two service providers can be used to get internet to the phone. This will be the first redundant way of getting internet. If two service providers failed to provide internet connection, second redundant method of getting internet will be from the Google Loon balloon. Hikers having LTE-enabled mobile phones, therefore it provide direct access of internet connection through the balloon or Troop captain can access internet from the balloon through the LTE-enabled mobile router and other members can access internet from the router.

Bluetooth 4.0 or Beacon enable feature provide way to find proximity range of other hikers in the troop and also to send alerts to others in the troop when someone in danger situation. Beacon Application coded according to below 50 meter as near range above 50 meter as far range want to be install to the mobile phone to waypoints it create Route for the hike. Hikers can save this map as .gpx extension on the mobile. Mainly map is referred using GPS but the special feature of this map type is off-line navigation. Hikers can use it, without even less/no internet connection. GPS connection is needs to find the proper route and location. If internet connection drops, hikers can use this map offline mode.

7.0 DISCUSSION

The main goal is to provide a concept of network architecture for hiking troop members to held communication between each other. According to the deliverables 2.2 given first function is to access internet connectivity throughout the hike without any loss of connection. Secondly, the Proximity Ranges should indicate the location of each member in the troop. Third function is Danger signal indication: If someone in the troop in danger, that person need to indicate danger-signals to others in the troop.

Based on the first function to provide internet connection throughout the hike, ISP (ex: Dialog, Mobitel service providers in Sri Lanka) and Loon Balloon Connection were chosen. Mainly ISP provide internet connection; If ISP unable to provide connection due to less signal strength, Loon Balloon act as the provider of internet connection. All Troop members including Troop captain must have LTE enabled DUAL SIM mobile phones to get internet connection directly through the ISP.
Troop captain must have an LTE enabled mobile WIFI router (Huawei router) to use as a redundant way of accessing internet from the Loon Balloon. Actually if ISP connection lost, every member will able to access internet through this mobile router located inside the captain's back pack using their mobile phones.

When hikers do hiking with a troop, all members have to climb always with the team, therefore it needs to introduce a concept to indicate proximity ranges, to show where the each troop member is located in. Proximity Ranges (as far, near) can be illustrated by using Bluetooth signals in the mobile phone. Special and new version of Bluetooth called Bluetooth 4.0 or Beacon can be used to generate ranges (Figure 2.0). Bluetooth 4.0 support circular range up to 75m, therefore each hiker's location range can be measured. Range less than 50 meters indicate near range and greater than 50 meters as far range. Every member will able to see where the others are located in using the application installed on the mobile phones. Proximity Range will be calculate using RSSI (Received Signal Strength Indicator) or TX power (Received Signal Strength Indicator) value. Alert Beacon is also based on Bluetooth 4.0 (Figure 3.0). It can be used to give alerts to others in the troop when someone in danger. It will be the easiest way to give alert to others in the troop rather than sending a message and very much similar to proximity indication.

Every member in the troop can access or follow the route map which generated using Orux map, in order to find correct path for the destination. Main advantage of this map is able to use off-line mode. Off-line navigation gives the opportunity for hikers to use the map even at no internet situation. Hikers can re-follow the route back to the started point of the hike without connectivity.

Normally when hiking, it will take lot of time to reach the destination. In order to prevent battery down, there is a technology to charge the power banks while hiking. Technology is based on the structural design of the shoes. Charging capacity is based on number of steps of the hiker's walking. When hiker continuously climbs the mountain, mobile phone will charge. Charging is directly proportional to the number of steps of the hiker throughout the hike. According to that hiker can maintain the battery life of the mobile until the end.

8.0 FUTURE WORKS

Probing deeper, the results in this research also provide a strong foundation for future work in network architecture for hiking. One area of future work is in combining the knowledge gained about network devices with knowledge about the communication abilities of other media types. Another area is in applying the results studied here to the many real-world situations.

8.1 Building an Integrated system combining all the equipment

Actually building an integrated system will be the next step of this Hiking architecture. This integrated system will be a suit, gear, or any other portable device that can be carried by the hiker. It should have every features describe on this concept and also some additional features such as Night Vision, Temperature Control etc.

8.2 Building a more efficient way of charging the equipment

Hikers need to recharge their equipment soon as possible. In order to achieve this, Rate of charging needs to be more efficient. In addition to shoe-step charging, Technology of Solar panel can be used to increase the efficiency of charging. Solar panel rating are calculated in bright direct sunlight and it is durable than shoe-step charging.

8.3 Building maps for the specific hiking areas

As a vast project, any team can select one area where hikers prefer to go more, examine that area clearly marking the waypoints, routes and create the map using Orux map. Hikers can download and use that map to go hiking in that specific area.

9.0 CONCLUSION

Hiking has become more interesting and more advance with networking. In this paper the author has discussed not only the technical details of hiking, but also widespread implementations using real world equipment’s to held mobile communication between hikers in the troop. This concept merges the techniques in networking with the adventure hiking, in order to handle good communication between troop members until the destination. According to the research results, the concept combine with different latest technologies such as Bluetooth 4.0, Loon technique, Steprecharging etc. with the intention of introducing proper and suitable network for hikers.

10.0 ACKNOWLEDGEMENT

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REFERENCES


## APPENDIX

Research Function Table Indicate how Research Functions combine with other Research papers

<table>
<thead>
<tr>
<th>RESEARCH PAPERS</th>
<th>FUNCTIONS</th>
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<td></td>
<td>F1</td>
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<tr>
<td>1. Loon-project (Google Balloon)</td>
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<td>2. LTE-A an Overview and Future Research Areas</td>
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<td>3. Adaptive distance Estimation based on RSSI</td>
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<td>4. Handover Scenario and procedure in LTE – based Femtocell Network</td>
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<td>5. Neighbour Cell List Optimization for Femtocell-to-Femtocell</td>
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<td>6. Analysis of Promising Beacon Technology for Consumers</td>
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<td>7. Improving Distance Estimation in Object Localisation with Bluetooth Low Energy</td>
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<td>8. An iBeacon-based positioning System for Hospitals</td>
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<td>9. RFID JOURNAL Bluetooth Beacons Delivers Alerts to Bus Riders, Drivers</td>
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<td>10. Adaptive Distance Estimation Based on RSSI</td>
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<td>11. IMS signalling in LTE-based Femtocell network</td>
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<td>12. Improving Distance Estimation in Object Localisation with Bluetooth low energy</td>
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<td>16. A Review paper on Google LOON technique</td>
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<td>17. Quick start mobile wifi (manual)</td>
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<td>18. Global Satellite Communications Technology and Systems</td>
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<td>19. Handover management in Low Earth Orbit satellite Network</td>
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<td>20. Satellite based internet</td>
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<td>21. Loon balloon architecture and method</td>
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<td>24. System and method for developing and managing shortrange</td>
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<td>25. A smartphone Based local Danger warning System</td>
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<td>26. GPS tutorial for Hiking - OruxMap</td>
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<tr>
<td>27. Power-generating shoe insole based on triboelectric</td>
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**Proximity Range Indication**
(Figure 2.0)

**Alert Beacon**
(Figure 3.0)