



Tracking Devices Incorporated in The Clothing for Adventure Sportsmen

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ABSTRACT

This study is aimed at analysing the need for wearable tracking devices for adventure sportsmen while they are out in remote areas. The need analysis is aimed at developing a specialised tracker that can be built into the costume or the attire with a self-rechargeable battery. Thus, the aim is to establish a costume incorporated tracking device that need not be worn separately on the body. The research and the project will take shape with the help of primary as well as secondary research methods such as interviews and surveys along with secondary methods of literature reviews. Once the initial information is gathered, the idea is to work with IT professionals to develop a solar rechargeable tracking device that can be installed inside the clothing. This sort of a device will ensure better safety for adventure sportsmen and will make sure that they are not lost in tough terrain. We may say that this will be an important and useful innovation in the field of adventure sports gear that will make the activities like mountain climbing or hiking much safer and far less stressful for the sportsmen if stranded in remote areas. Once the research is completed and the device is designed, a recommendation to the sports gear companies with a design focus will be developed, advising them as to how to incorporate it into the clothes they create. This is thus an innovative model that takes the clothing and fashion industry to another level when it comes to the sportswear.

Keywords: Wearable technology, smart garment, thermal wear, safety outdoor wear, sports apparel, smart adventure clothing, adventure sports.



1. Introduction

“Mrs Redway became disoriented and didn’t find her way back to the rest spot. She failed to return to the campsite at the Salt Creek rest area” (Garrick 2015). This was the news that we all read in the month of June this year. The woman simply went for a morning walk and wandered off into the dessert area near the King Canyon in NT. For almost 48 hours she walked and huddled in the bush to keep warm during the night. Excessive rescue efforts did find her and united her with her family but it was surely a life-threatening ordeal (Garrick 2015). In Bankhead National Forest, USA more hikers wind up lost as Copeland (2007) reported. The author spoke to the district ranger and the county sheriff who informed that the national forest was a maze of canyons and ridgetops where there is nothing certain and extremely easy to get lost but people think that it is serene and they can experience nature at its best. “People always underestimate the mountains” as Lorch (2015) quoted the Director of Ops at SAR Dogs Nepal, the group that engaged in the search for the lost foreign hikers in Nepal this year. The author rightly mentioned in the article about the low odds of finding lost trekkers and hikers in the mountains who only go there in the pursuit of adventure.

After the tragedies there is not much one can do. Governments and officials always warn visitors not to trek alone in the high mountain ranges and forests and also to register with the embassies in the foreign lands. But is that enough to rescue them if they are lost in the wilderness? There is a lot of risk that outdoor adventure sportsmen take when they venture out for such sports and adventure trips. Many outdoor activities today that involve extreme physical exertion, speed, heights or so to say a high degree of danger involved are termed ‘extreme sports’ (Air Combat Command Safety, 2012). The other terms used to describe such sporting activities are action or adventure sports. The difference between the traditional sports and the extreme or the adventure sports is that these sports rely completely on one’s own skills and endurance and that these sports are not played in controlled environments like the sports played inside a stadium. In the adventure sports the environment is never constant, no one knows what might be the next circumstance they will face.

Nevertheless, camping, hiking, rocks climbing all have attracted more and more people lately. People engage in such off-road activities more often these days. Worldwide people’s interest in adventure sports is increasing. The Australian Sports Commission (2013) reported six mega trends in the future of Australian sports. Among these one of the most prominent features was that the extreme sports are now shifting to mainstream. It states that there is a steep rise in the lifestyle, adventure and alternative sports which involve complex and advanced skills and also have an element of inherent danger which is covered by the thrill that it brings along (Australian Sports Commission 2013). People engage in planned adventure events as well as off road adventure activities like mountain biking, camping, bushwalking etc. Off-road adventure sports engagement is increasing for the young as well as old alike (Allianz 2015). This trend definitely indicates that we need to be geared up better to ensure safety of the sportsmen. And the very first thing that comes to mind when thinking of safety on such endeavours is ‘what if we get lost?’... What can one do if



they discover they are hiking in circles and not reaching anywhere? There are measures that can be taken to avoid such circumstances.

Adventure sportsmen are using tracking devices to keep in touch with the world while they are on their pursuit in the wilderness or the heights or somewhere in the middle of some canyons. Tracking devices that are sometimes called detection systems are really powerful devices that observe a person or an object on the move and supply a timed sequence of their locations. The technology has advanced enough to have these tracking devices made small enough that they can be carried with the people. It is now increasingly being referred to as 'wearable technology'. But as PR Newswire (2015) explains, most of the wearable technology that is being used by the sportsmen today deals with the health monitoring and is at a boom. But there is a definite need to use tracking devices more often with the adventure sportsmen as they are prone to getting lost on adventure trails and at times they may even be subject to health conditions arising from the difficult trails that they chose which lead to their getting disoriented and lost.

As seen in the cases of dementia and alzheimer's patients, tracking devices are of great help because the medical condition makes the person disoriented to the surroundings (Sauer 2014). When the adventure sportsmen wander off and are subjected to conditions of extreme weather and lack of water etc., they are in somewhat similar condition (Johnson n.d). The brain doesn't function as expected due to the lack of nutrients and electrolytes and thus they are disoriented (Badii & Yu, 2012). With the patients the tracking devices are a life saver as they allow them to be tracked and found soon (Sauer 2014). The report on the future of wearable technology given by PSFK (2014) states, "wearable technology is harnessing the power of haptic feedback to create a tangible connection between loved ones over a distance." This is exactly the thought around which the idea of tracking devices for adventure sportsmen revolves. There are a number of devices installed in phones and/or are otherwise carried to track the hikers and climbers too while they are on the go. This body of work is devoted to the study of such tracking devices and how we can make them even better by having them within our sports gear so that there is no fear of losing them of forgetting to wear them while on the go.

2. Research Question:

In order to address the topic of the study the research will attempt to answer the following questions:

1. What are the available wearable technologies for adventure sportsmen?
2. What are their shortcomings?
3. Is it possible to develop a better device that can be incorporated into clothing to improve tracking on rough terrain?

3. Objectives:

1. To identify the current technology that is being used for tracking adventure sportsmen while they are in a remote terrain as well as the possible shortfalls of the tracking devices.
2. To analyse different options to overcome the shortfalls and to examine whether the attire that the sportsmen wear can play a role in formulating a solution.



3. To develop a new device and investigate ways in which it can be incorporated into the clothing and textiles so that tracking is easier and more efficient.
4. To evaluate the proposed device and the attire, and to make recommendations to the sportswear manufacturers about how to incorporate the same in their garments.

4. Research rationale and significance:

The main idea for this research stemmed from the realisation that a lot of the tracking devices that are used by adventure sportsmen aren't user friendly, as these sometimes are not chargeable when the outdoor stay is long or are not easy to track in remote areas. Thus, the idea is to develop a tracker that is built into the jackets or vests or the clothes that can be recharged automatically through solar energy. The idea of having them built inside the attire makes them more user-friendly, as the chances of forgetting the devices or the devices getting damaged are lowered. Studies have shown that there are quite a few tracking devices being used these days but none are built into the clothes. There are tracking devices in use now which are wearable, but are not built into the clothing. Other studies have also shown that the current wearable tracker devices are highly expected to fall down in the near future due to changes of consumer demand and buying behaviour (PR Newswire, 2015). If we are able to transform the devices from wearable ones to something that is incorporated in the clothing, then it will be easier to wear, as well having additional features such as solar recharge ability. Thus, the rationale of this study is to establish the use of such technology along with GPS so as to monitor the positioning of adventure sportsmen and to reduce the chances of them becoming lost.

5. LITERATURE REVIEW

Looking at what is available today, one might identify that most of the wearable technology that is available is for health or physiological monitoring in sports activities. There are very few tracking devices being used. To take this research further, we will analyse the various technologies already available for tracking. Technologies like the Radio Frequency Identification (RFID) and Radio tracking systems have been used in tracking pets and farm animals. Radio Frequency identification (RFID) is a term used to describe all technologies that use radio waves in order to find objects or people. The system involves storing a unique serial number in the form of a tag on the person or object that is being tracked. This information stored in the tag can then be transmitted to the reader that converts it back into information for the end use (Rfidjournal, 2010). Research suggests that in order to manage the safety of workers in hazardous environments some of the workplaces that are spread over a large area do use active RFIDs in Real Time Location Systems (RTLS). These make it easy to find, track and monitor people as well as equipment for them. Similar systems are being used to monitor the patients in the healthcare sector (Salvador, Zani & Gentili 2011). Similarly, Bluetooth is another wireless technology that helps communicate between the compatible devices though it is only helpful in communication between two devices that are in short range. The principle is actually the same as used in the GPS communication system (Franklin & Layton 2000). Local Area Wireless Network (LAWN) is a network type that uses high-frequency radio waves in order to establish a communication between two nodes. This



kind of network was used in the tracking people or objects in a closer vicinity (Indiana University 2015). After thorough research and analysis, the most widely used tracking device would still turn out to be the cell phones. Cell phones have been used a number of times to track the position of people. When the cell phones are tuned to the signals it is receiving from the towers and it answers that signal it can be the most powerful tracking device available (Maass & Rajagopalan 2012).

A navigational system that has two important components i.e. the space or the satellites and the control or the computers is known as the Global Positioning System (GPS) (Spencer et.al 2008). GPS based tracking systems have already entered many aspects of our lives like the paper maps replaced by the car navigation systems and smartphone electronic maps (The Conversation 2014). Tracking devices are commonly used in vehicles today. For example, devices used for monitoring the schedules for buses, tracking devices used for monitoring people's driving behaviour such as teenagers who drive without parent's supervision. They are also popular today as they act as theft prevention and retrieval devices (Bajaj et al 2002). Apart from these uses parents are also using this technology to monitor their children's whereabouts (Tracking System Direct 2011). Looking at the ways in which these devices are used we observe that most of the GPS devices even though they are wearable are in the form of bands and bracelets are inbuilt in the phones used by the users. Though there are a few cases where implants in human body have been seen. These tracking devices are most likely being used to monitor the health of patients and are being installed by doctors. A durable and rice grain size microchip is implanted under the skin and the information it stores stays forever (Gillespie 2014). Though it is an excellent idea to have a tracking device installed in the body, it may be a painful procedure to start with and it really depends on the will of the user whether they wish to get one installed for the purpose of adventure sports or not.

With a better understanding of the various tracking technology being used today for all different purposes, it is clear that GPS is by far the best technology that suits the purpose of tracking people that are not in the near vicinity. It has to be established though as to how this technology is already being utilised for the purpose. Bajaj et al (2002) mentions that GPS is the technology that is capable of providing extremely accurate information about the location of the mobile objects or people. So far, the wearables mainly concentrate on the function of health monitoring with a few exceptions like the smart shirt designed by CuteCircuit in Britain, which gives a feeling of being hugged when the wearer receives a message from someone (The Economist 2015). There is also enough evidence and market research that suggests that more and more people will be starting to use the wearable technology from the year 2015 (PR Newswire 2015). Some of the wearable technology used by adventure sportsmen today are wrist bands or pocket finders. The GPS trackers that the sportsmen carry or wear can provide all the position information required for them to be spotted and to ensure a degree of safety. In the adventure racing world championship, the participants carry satellite tracking devices which provide their exact location even when they are in the remotest of terrains (AR World series 2014).



Having researched and understood the importance of the position tracking device not only in the fields in which it is being used today but also extending it to adventure sports, there is a need to further evaluate the potential market growth of such devices in the future. The Economist (2015) cites IDC, a research firm stating that 21 million wearable devices were sold in the year 2014. The popularity of technology of this kind is definitely gearing up and people are getting attracted for the obvious reasons of staying in the mainstream and also for the benefits it provides. Spot personal tracker is an example of the GPS personal trackers available today. These GPS Messengers provide location-based communication to friends and family or the professional services one is attached to (Spot n.d). These are pocket devices that need to be carried. There is a very high expectation of the wearable technology today but the interest in actually buying them is lagging behind the interest the hardware companies are showing in upgrading the technology (The Economist 2015). This could be because of the exorbitant prices that accompany the added features of the product. But it is not difficult to understand that the most important feature in adventure sports is that of being traceable. If a piece of wearable tech is handy enough to be with you while you are on a tough terrain and makes you traceable by family and friends then that adds to the safety element while one enjoys the thrill of the adventure sports. In the same light another important aspect researched was whether the wearable technology can be embedded into clothing. The idea stems from the fact that in tough terrains there might be a chance that one loses devices carried in pockets or worn on hands but clothes stay more or less on the person while they are out there. As Cho (2009) states, there is a need for personalised, implanted, inconspicuous 'ambient intelligence' that can be used anytime and anywhere. It's not difficult to perceive the fact that human beings are extremely close to and are very familiar with the clothes they wear. And thus, clothes become a very promising medium for any kind of electronic components to be added. And in this regard clothes are the best option to have this kind of technology embedded in as there is no extra effort required to have them around with us (Cho 2009).

The clothing and textile industry has evolved greatly and there is great potential to manufacture various types of textiles. For a few years now there has been quite a lot of development on the 'smart clothing' front. The textile industry offers amazingly automated and controlled textile manufacturing means. 'Smart clothing' are fabrics that have electronic parts and are better known as 'e - textiles' (Cho et al 2009). The authors went onto explain that the e- textiles are processing systems that are being designed with many practical applications in mind. Though there is much more research required in actual practical applications of the same so as to make it more often and better used. Ariyatun et al (2010) explains that - textiles are actually the next generation of textiles and clothing that haven't yet found their actual place in the markets as it has not yet been realised as to what all could be the actual applications of the same for the mass market. Over the last few years the concept has seen quite some development in various fields. However, smart clothing comprises of systems that consist of: the interfaces, which is a medium for managing information between the wearer and the device; the communication component; the data management



component, which is the memory and the data processing; the energy management component and the small electronic integrated circuits (Cho 2009). An example of the initial interactive fabric designed was a musical keyboard incorporated within the clothing which could be folded and would create the same kind of music through the keyboard notes as a normal keyboard would do through speakers (Edmison et. al 2002). In providing evidence of previous work done with e-textiles the authors also pointed to the 'Glove-based user interfaces'. Edmison et. al (2002) have talked about the tablecloth that was created with RFID coasters so that it could identify the people sitting at the table. Early this year we heard that Google announced its work with Levi Strauss where they are experimenting with making clothes from specially woven fabrics that have touch screen control capabilities (ABC News 2015). The news cited a Google official mentioning that they are developing 'interactive textiles'. As rightly mentioned, such smart clothing definitely is interactive, making our clothes aspirational and functional. E-textiles can prove to be an excellent location tracker in adventure sports as the sportswear can easily embed such technology and in almost all circumstances the clothes are on the sportsmen even when they are facing the gravest situations.

6. RESEARCH METHODOLOGY

The research project is aimed at making a modern, economical, and easy to use tracking device with the use of GPS technology. So, the basic purpose of the proposed methodology for this research is to find out the best possible design for this tracking device and the methodology is proposed by keeping this purpose in view. In order to find out the best possible design for this tracking device we have studied the suitable software and appropriate battery required for an effective tracking device.

What has to be researched always determine the type of research methodology that is used to support the work and methods that are to be used for the data collection. If there is a need to measure variables in order to verify the existing theories then quantitative data in to be collected. On the other hand, qualitative data collection is carried out when we need to establish significances, describe the values and importance of certain aspects in the research (Wisker 2007). The author further explained that most of the research though is a combination of collection of quantitative as well as qualitative data as it helps to 'triangulate' or back up findings from one type of research with that of the other. In the present study we have used quantitative research methods like questionnaires and surveys as well as the qualitative ones like the interviews.

Before describing the methods of research adopted, it is important to establish the prime participants of the research or the stakeholders in the research.

6.1 Participants:

This refers to the volunteers who took an active part in the research project. The services of various experts were acquired for the designing of the tracking device. These experts are:

IT Expert: An IT expert was engaged in this study in order to find the best, suitable, cost-effective and appropriate software for the tracking device. The expertise and



skills of the IT expert also helped in selecting suitable batteries for the tracking device.

Engineer: A skilful and competent engineer was a major consultant for the development of the tracking device. He was also helpful in studying the current tracking devices that are available in the market. The choice of an engineering expert made it possible to study and research the tracking device designs better.

The design and development of this tracking device thus took shape with extensive research and the works with these experts. The results and findings of research by these experts provide credible information for the development of an effective tracking device. Other than the expert help, the primary tools to use to conduct this research were surveys and interviews with the stakeholders of such a device. The stakeholders included all those people who may actually use these tracking devices, like the adventurers, mountaineers, hikers, trekkers etc. Other than those, the family of the adventure sportsmen and sportswear companies also have a big stake in formation of such a device.

Management & Employees of Sportswear Companies: The interviews with other concerned personnel like the people who are currently employed in the sportswear companies especially those who are involved in designing of the sportswear helped in establishing a clearer picture of the current sportswear designs in fashion and also helped in determining the most suitable design for tracking devices to be use effectively in this sportswear. The views of the management of these sportswear companies also eventually proved helpful in the development of the project as a market proposal.

Retailers & Manufacturers of Top Sportswear: The validity of this idea was initially tested primarily by conducting surveys with manufacturers of outdoor gears. The retailers of outdoor gear like Anaconda and Kathmandu were a big part of the surveys as they were able to give an insightful information about what might be the concerns of the people who buy such clothing.

General Public: Eventually the general public was involved in order to construct a bigger picture or interests into the idea. This was done through surveys about the initial idea and there will be more surveys once the product is made available in the market as a part of Post Marketing Surveillance. This will help in the determination of usefulness of the tracking device. The purpose of this post market surveillance is to gather wider information about the public response towards the device. This will be carried out by asking the users to fill the carefully designed questionnaire.

Police Department: In addition to these participants, the research focussed on another important stakeholder for conducting the research. This was the police department as they are the ones who are responsible for tracing of the lost adventure sportsmen along with the special search patrols in certain incidents. This was done through carefully designed surveys and planned interviews. It was established that currently the police department is experiencing a lot of problems in tracing of these tracking devices and the persons are difficult to locate because of the inactive tracking devices. The newly designed tracking device will be linked ideally to the



police department as this is absolutely necessary step in order to satisfy the aim of this research project. This allowed us to gather a wide variety of data and information owing to the extensive experience of police department in this regard.

Customers of Sportswear Brands:

The customers of the sportswear brands who would eventually become the consumers of this tracking device incorporated clothing are the most important and actually the primary stakeholders of this project. Initial surveys conducted on customers helped formulate a point of view of the consumer towards the intended product to be developed. Not only did it help gather the data but also created an interest in the consumers and helped in attracting them. It has been found that there is an increased awareness for the self-safety and the use of GPS tracking devices is gaining widespread recognition all over the world. This awareness is leading to an increased demand of these self-safety products and everyone wants to benefit from this new technology. This surging demand of tracking devices will provide this project with a great opportunity in the market especially if some or all of these above-mentioned participants express interests in the implementation of proposed tracking device in the target market.

These research methods were designed to target the population in the age group of 15 years to 50 years. This age group is most probable candidates for indulging in activities which require the use of tracking devices. The methods are also suitably designed to target such individuals who are directly involved in the adventure sports to take into account their viewpoint about an ideal GPS tracking device.

6.2 Measures:

A wide variety of measures were used for the collection of data. The type of measures used was dependent upon the particular participant from which the data was to be collected. Different methods of data collections used were:

6.3 Interviews: Interviews were carefully designed to collect the necessary data for this project by asking direct open-ended questions from the concerned personnel. Emphasis was laid upon ensuring that the questions were valid, valuable and to the point. A pilot study was initially conducted by interviewing a few people and the data collected was then analysed to check if it gave any valid findings. Then the same was conducted with the remaining population. The candidates for this type of data collection were from the police department and the sportswear manufacturers.

6.4 Questionnaire: Questionnaire is a written form of data collection tool in which the data is collected in the written document. A questionnaire was prepared by taking into account the purpose and requirements of study. The questions had multiple answer choices and the respondents were required to choose the options to the best of their knowledge. There were a few open-ended questions as well to generate better feedback. This was used for the customers of the sportswear brands and those who were a regular at adventure activities. A similar procedure of the pilot study was used for this tool also as described earlier.



6.5 Procedures:

6.5.1 Collection of Primary Data: All the data collected through interviews and questionnaires was then compiled. This constituted the primary data for the project. This data was eventually entered in suitable computer software for the statistical analysis.

6.5.2 Collection of Secondary Data: The secondary data was collected by the desk top literature researching. This helped in validation and support of the previously collected primary data. The sources for these secondary data are online journals, research articles, text books and official books on the related subject. Extensive research of the already present data has been conducted on the literature. The online research articles and journals provide excellent sources for the secondary data because these articles contain the most recent and up to date information on the related subjects that has been peer reviewed in most of the cases. Official books and textbooks also provide extensive literature on the related subject with sufficient and decisive evidence on the validity of the information provided.

6.5.3 Further Research: Further research methods may be applied according to the demands of the project as the project is developed. These new research methods will be based on the results and findings of the ongoing project.

7. DATA ANALYSIS, PRESENTATION & INTERPRETATION

Analysing data is one of the most important domains required for this research. This chapter will cover a thorough analysis of the data conducted by the two primary methods used in this study interviews and surveys. This study data has been conducted throughout the beginning of the study in a period of four months. Statistics have also been used to effectively analyse the data quantity and quality. This has been done by calculating and presenting the percentages and frequencies in charts and tables forms from the survey responses. In addition, summaries of the information from the interview's discussions are presented in texts format.

This chapter includes presentation and interpretation of the data in three major sections: survey return rate, demographics and characteristics of all participants. All original data is available in the appendices one and two for further clarification.

7.1 Questionnaire:

7.1.1 Response Return Rate:

The survey was uploaded to SurveyMonkey online, and the link was sent to approximately 100 persons via email, Facebook and Twitter. However, the research got a low response rate to the survey due to the lack of time and the limited demographic of responses required that is sportsman only. Out of the total one hundred, only 31 persons responded to the survey, while the rest of people were not interested in filling in the online survey. The table below shows the responses return rate on the survey.

**Table 1: Response Return Rate**

Communication Tool	# of surveys sent	# of returned responses	#of unreturned responses	Response Rate
Email	42	18	13	%42
Facebook	25	9	27	%36
Twitter	33	4	29	%12
Total	100	31	69	%31

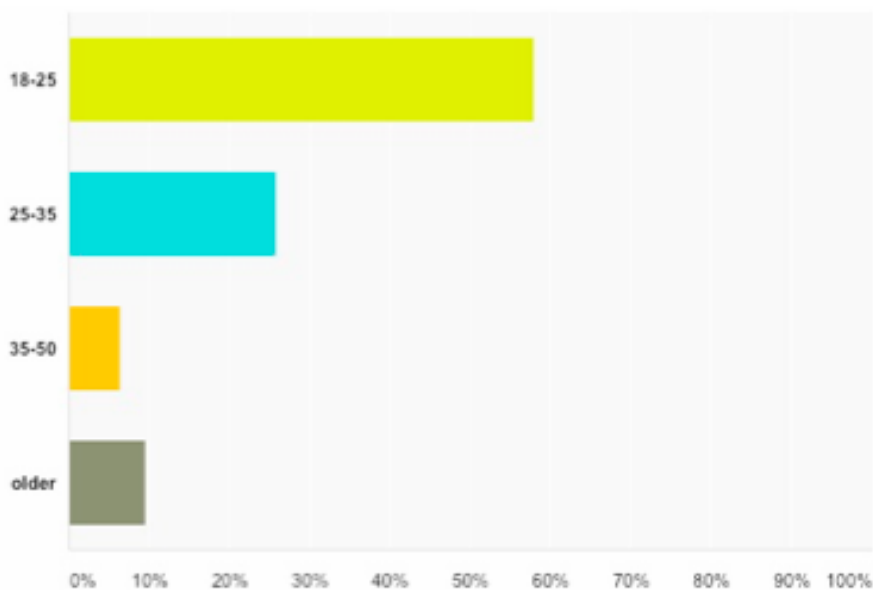
Source: Researcher's Field Data

Email submission to people was considered the best medium to communicate with people online as 42% people responded and filled out the survey when it was emailed to them. On the other hand, Facebook was the second-best medium considered where people took interest in filling out the survey whereas response return rate was the lowest in Twitter where only 12% filled out the survey. Here, it can be implied that most people use their social media accounts such as Twitter and Facebook for personal purposes whereas people prefer to use Emails for professional purposes.

7.1.2 Demographics of Respondents:

Understanding the demographics and characteristics of the respondents is important in this study that able the researcher to narrow down the targeted audience for this project. Therefore, the first question sat on the survey is aimed at demonstrating the basic demographics of the respondents that is the age of each respondent. This helped to understand the potential customers for this particular product.

The bar chart below shows the ages of the questionnaire respondents.

Table 2: Respondents ages**Source: Researcher's Field Data**



7.1.3 Demographic Characteristics of respondents:

As internet being popular in the younger generation, people aging from 18-25 were the most responsive people for filling out the survey. Similar pattern was observed for people who fall from 25 to 35 age period. However, a little older generation i.e. 35+ showed very little interest in filling out the survey as they don't take interest participating in online activities. They seldom use internet for their professional activities. This age separation can really help the online businesses to customize their products and services to a preferable audience i.e. youth and pursue their business in the right direction.

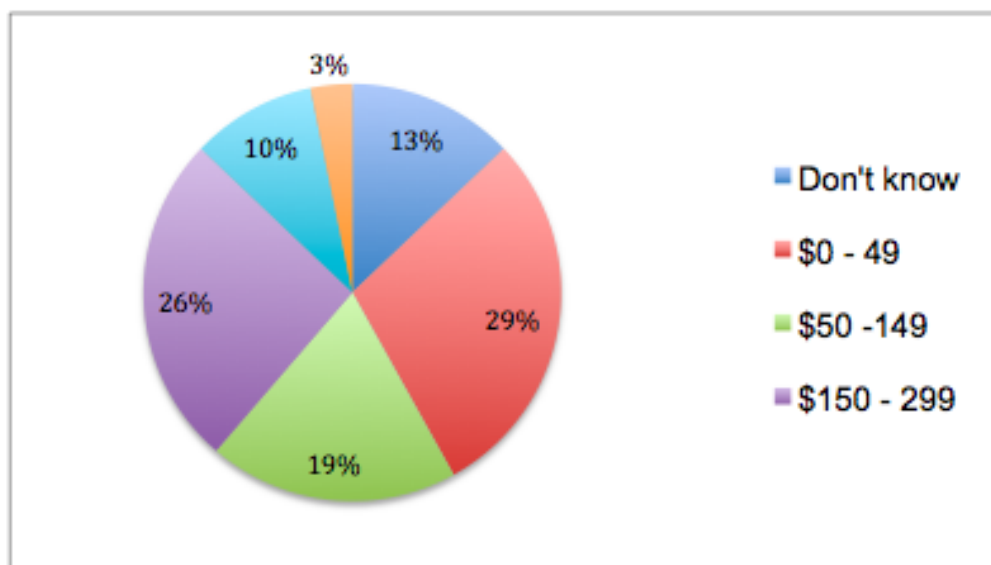
7.1.4 Response Spending Behavior:

The survey was also aimed at knowing the average cost of the tracker devices that responses already use when going on adventure to have a clearer idea of the approximate price of the proposed device. Because this product is a two-in-one product which means the cost of the suit and the tracker device attached will include the total price for both.

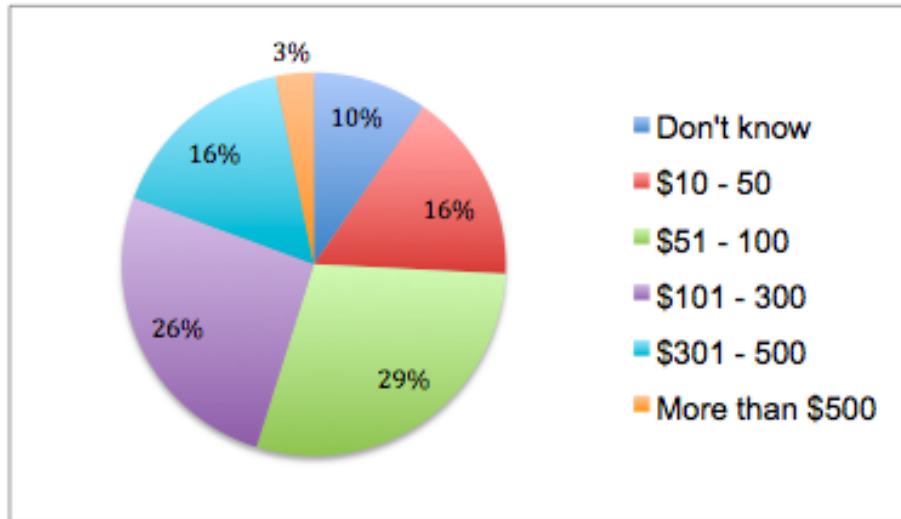
When response spending behaviour was observed through the survey, most people lie in two categories. In the first category, people have no or little interest to purchase tracker devices as they are only interested in spending \$0 to \$49 for tracking devices. In the second category, there are people who are most likely to be interested in spending more for tracking devices. Such people are currently spending \$150 to \$299 on tracking devices. The age group for such people can be crucial for online businesses as it can show how businesses can target their tracking devices knowing the perfect target audience and boost their business opportunities.

The Following charts show the respondents approximate spend on tracker device and adventure suits.

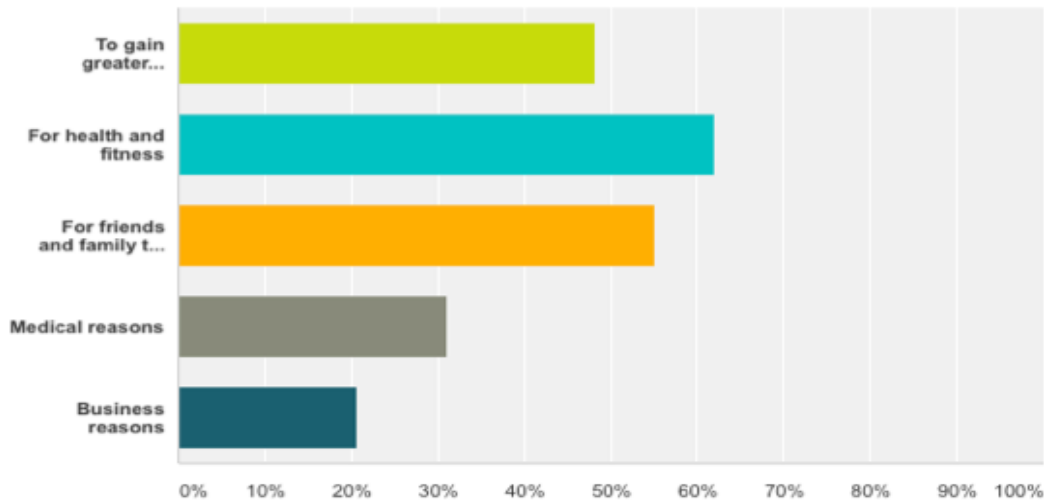
Table 3: approximate spend on tracker devices:



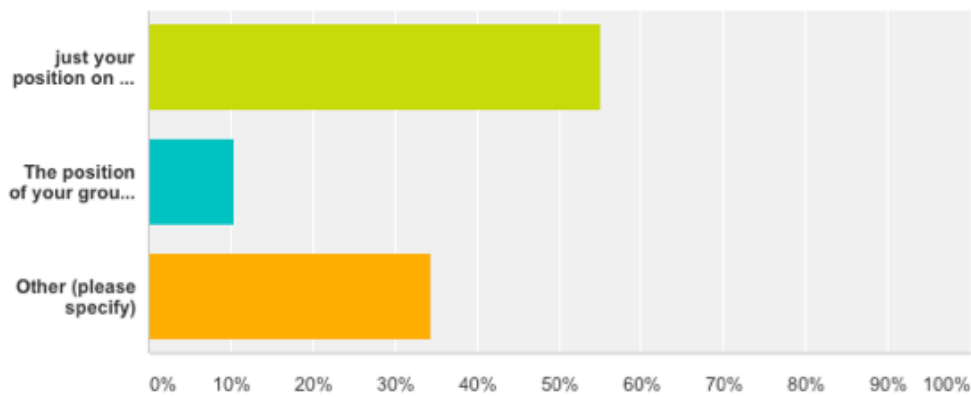
Source: Researcher's Field Data

**Table 4: approximate spend on adventure sportswear:****Source: Researcher's Field Data****7.1.5 Purpose of Using Tracking Devices:**

Two other questions were set to know the major purposes people use tracker devices for when going on adventures. It shows why would they carry on trackers, and what does their own trackers track. The five options provided for the purpose of using self-tracking device were: to get greater of the oneself, for health and fitness purposes, for friends and families to use, medical reasons and business reasons. On the other question that aimed at knowing the ability of their own trackers the researcher sat three possible answers. The options were: it tracks the position of the person himself, friends and families and others. The last option sat to give a chance for further description of the device tacking ability.

**Table 5: Purpose of having self-tracking device**

Source: Researcher's Field

Table 6: Respondens Tracking Devices Ability

Source: Researcher's Field

Most of the people think that the major purpose of tracking devices is health and fitness whereas the second major feature people like to have in their tracking devices is how they can effectively save their family and friends by using them. Other features which people prefer in a tracking device entail that self-security, medical and business usage to secure their personal as well as professional life. This kind of survey will definitely help businesses to prioritize the features in their tracking devices so that more and more people could be interested in purchasing them.

7.1.6 Respondent tracker devices battery life:

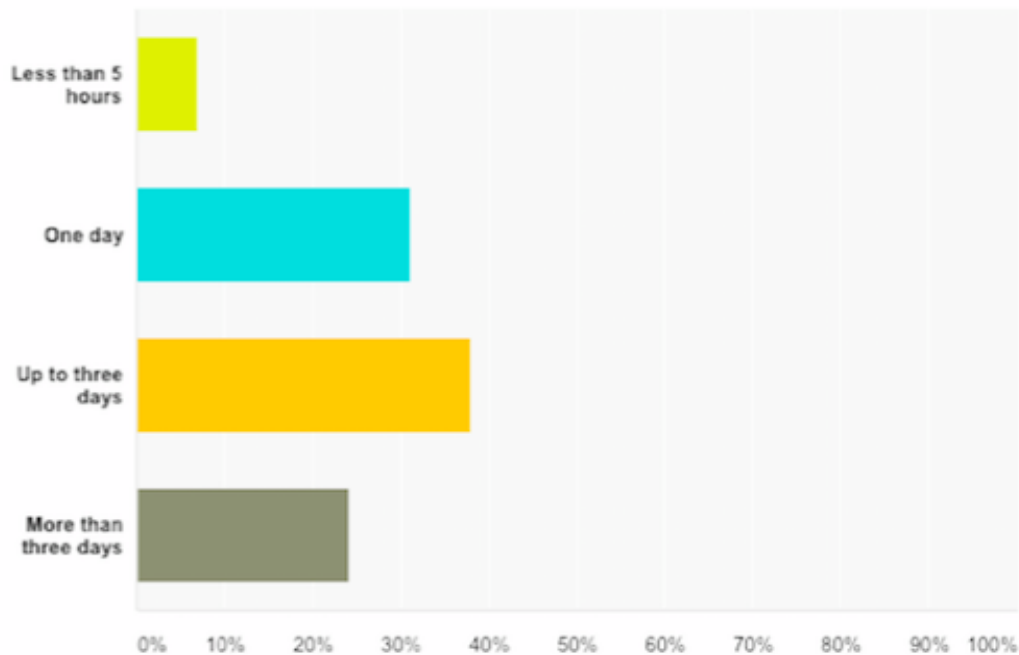
This project is aimed at producing a better device than what excite in the current market, and the battery life is a very important feature that customers look for. Therefore, the researcher had to ask the potential customers about the battery life of their own trackers to compare it



between what excite on the market and to solve the problem in the produced device. In this multiple-choice answer question, four options were given: the battery stays for less than 5 hours, one day, up to three days and more than three days. The bar chart below shows respondents answers in percentages.

In any electronic device, battery efficiency can boost the chances of products' success if they are up to the expectations of people. This survey indicated that most of the people who are using tracking devices like their device's memories last up to 3 days or more than 3 days. Few people were interested for having a battery that could only last for a few hours. It can be concluded that those devices which have efficient battery timing as compared to that of others can really attract more customers for their tracking devices and increase their business revenue effectively.

Table 7: Respondent's trackers battery life:



Source: Researcher's Field

7.1.7 Respondents' Opinions:

For this purpose, open-ended questions were sat at the end of the questionnaire. The researcher wanted to give each respondent a chance to express any further thoughts about the possible improvement of their current tracking devices, and about the produced idea. This helped to know how can we improve the produced device with the best for the customer, and know people's opinion about the new product as well. Improvement such as lower the weight of the device because sportsman already have to carry too many things on their adventure journeys, and improving the device to be more helpful with features that can be used like sending current location to someone else to come for assistance in emergency situations and other such circumstances.



The purpose of this open-ended section was to gather the inside thoughts from the point of view of customers as to know how they think of their tracking devices and what kind of features or facilities attracts them to purchase tracking devices conveniently. Most of the people preferred to have an efficient GPS system to recognize activities from a remote location along with effective health tracking system. Similarly, people prefer to use smartphones, tablets and smart watch to control their remote devices. When people were questioned about what kind of activity, they would most likely to know through their tracking devices, most of them liked to see position on the GPS map whereas only 10% people like to know the location of their family members or friends.

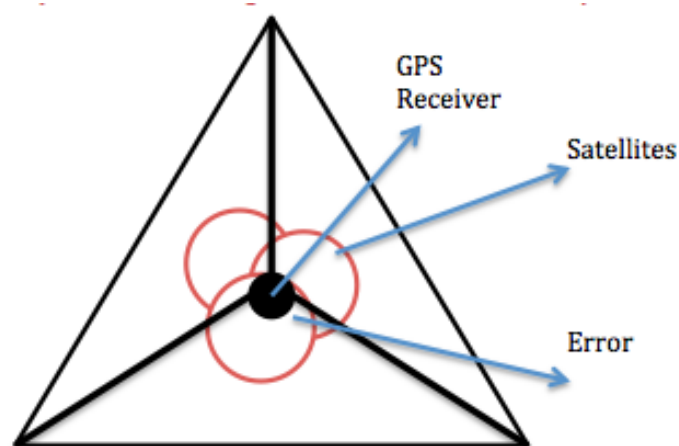
7.2 Interviews:

Human intervention methods conducted one-to-one interviews in order to gather primary data for studies. It helped to get a better understanding of the current market especially in tracking devices industry. In addition, it also assists to comprehend basic functionality of the tracking systems. Through tracking systems' functionalities, researchers derived efficient ideas for designing and developing the proposed project during the study period. This particular method has also been utilized in the whole study and updated as requirement delivered during the research using different types of communication tools such as online video call, phone call and face-to-face conversations. Interview discussions and summaries delivered in the methodology section have also been explained in this section.

The following paragraphs describe interview summaries:

7.2.1 Electrical Engineer:

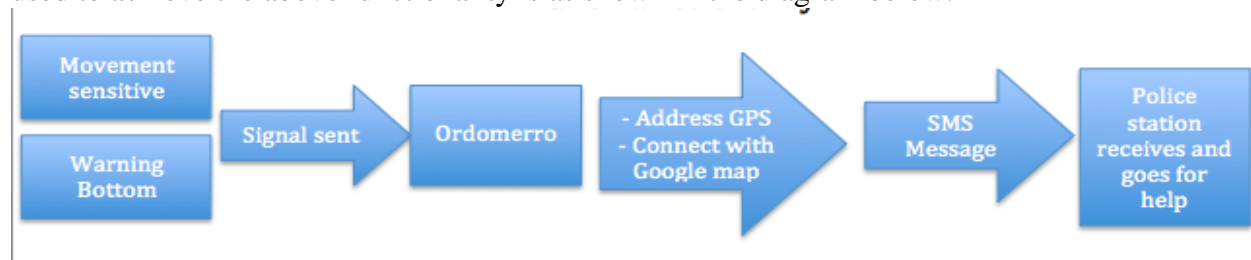
According to the first interviewer, the electrical engineer from Canada, the basic mechanism of a GPS is the connection between the GPS and the satellites and the power source basically looks like the diagram below. An error is simply the space between the satellite and the GPS receiver which could be any distance like 5mitres for example.



GPS Functionality



The GPS device can be designed in a way that can make it receive a signal when there is an emergency and be able to response to that. The possible model that could be used to achieve the above functionality is as shown in the diagram below.



The interviewer also suggested that the model comprise of several components including the movement sensor which can check the movement of the person thus supporting the device. This can happen by a movement sensor and / or an alarm button. It will send signals with current position on Google map to the nearest police station. The second component is the warning Bottom. This is used in activating or de-activating the device. When the person is sleeping or resting then it can be deactivated. While on the go in risky areas it may be activated so that whenever the sportsman stops moving the device would beep. The sportsman can then respond if he or she is safe by pressing the button to deactivate it indicating they are fine. When it comes to sending signals, if the button is not pressed even after three repeated beeps in small intervals and the sportsman is still stationary the device will then automatically send an SMS message to the nearest police station giving the current location on map because it is connected to the satellites already.

Sending and SMS is easy since it is the best way to respond to the signal and it can be sent directly to the police station if you wanted to. This can be made possible since there is a service in every phone that not many people know about it. You can dial 112 by any phone even without a SIM card. This is an international number that everyone in the world can reach it anywhere according to the engineer. So the device can send information about the current position to a global emergency organisation, probably to the current police in the country. This can be easily programed into any GPS device. He suggested that this kind of programming can be done by any programmer. Provided they have some basic knowledge in programming, they can do it for you since it's very simple and can happen. They are not support to be necessarily IT experts or programmers. This task can be accomplished by the programmer in a short duration like one week.

The interviewer then contained the description of the model as followed. From there is an odometer that plays a critical role in the process. This device includes SIM card that we will need to send an SMS by. It's connected to Google map to find the position of the device and send it as text message to the police automatically. Although phones have the ability to call 112 without any SIM card for emergency situations, this device can be provided with a SIM card to be able to send the messages directly to the police as in cases when the sportsmen are not in a condition to make calls this will be handy.



The device can be built in clothes for portability. In the case of charging it, there are two options to charge the device battery offered by him. Renewable power energy source like solar, hydro, biogas or wind energy form different sources of power that \ can be used to charge the device battery. However, in this application, the option that he can suggest to the researcher to use is the shoes charger that was invented by a young boy last year. The device has to be at all time for any emergency situations and hidden in the clothes so as not to lose it in any chance. To achieve this requirement, there are many genius ways to charge the devices. He gave another possibility of even using the wireless charges like the one used by Samsung hence make it easy to achieve.

When he was asked about the weight, he asserted that the adventure sportsmen prefer to carry as less weight as possible to ease the journey. Therefore, the sportsmen have got many things included in it which include the GPS that will be used, the battery, the SMS card, other accessories like buttons and the cover of the device. For each part there are many choices in the market to go with and find the more useful one for this particular project with less weight. Plus, it is possible to even remove things that you don't need to reduce the weight! In the space, there is water which can enter the device and spoil it. Thus, to avoid such he recommended the researcher to protect the device from water damages and other possible damages. This can be achieved by the use of a leather cover or make a strong case for the device. This can be made by a 3D printer in the fashion school where the researcher is studying. However, due to the radiations, the interviewer thinks this device can be harmful to the human beings just like the mobile phones. In this research, background information about GIS (geographic Information System) is very critical as this will help in resolving some issues.

7.2.2 IT Expert:

From the consultation with the IT expert about this project proposal, the researcher was informed that creating such a device one need more than six months to do it. This could be a master idea by itself based on the IT expert thoughts. However, the best option for in this case suggested might be using a tag with barcode to be attached to the clothes. For example, the RFID Aramco tags that the Saudi oil company use on their cars to track it anywhere. It depends on the kind of reader you use to track anything. Another suggestion by this interviewer was adding a magnetic field like a compass to able the person to know the position of him. If the researcher wants to build her own device, she won't be able to integrate with GPS according to him.

7.2.3 Engineer:

From the other interview with another engineer, the researcher learned that Motorola 3060 is a great example of the new technology that he was heading toward. The engineer advised the researcher to choose the Lithium Polymer Cells battery for this project because 90% of devices weight is because of the battery but this kind of batteries is very thin. The normal lithium batteries usually stay for up to three days only which might not be enough when going on adventures. He assured that it is possible to get any GPS device and program it the way wanted. He also said that he can add software to its system since it's all about programming it. Such a device will



cost about \$30 plus \$10 for the battery so the total cost will be approximately \$40 only. The interviewer, personally use a tracking device that costed him about \$300 and it only tracks his position on the map. With the Nano technology, it can easily minimise the whole device to the size that fit any purpose which can be the size of 3x3 cm. The engineer advise was to check out Garmin Magellan the well-known GPS producer company, and check Anaconda the adventure tools and accessories brand to give better idea of what is the best option for customers in the market. Or just go on eBay and shop online for the best device that suite this project. It would be great if we can create a tracker device that do more than telling the position on the map, which is already available in most electronic devices, and find a way to give help to people by their tracking devices. For example, let their families or group members track them or in this situation the police itself which is the best help a lost person can get. However, this engineer himself still has to carry on at least two different trackers when he goes for adventure to survive. This is why he claimed that the researcher needed to solve all the problems she can in this project such as having a tracker device that stay for long enough or can be charged by different sources of energy, thin enough to be easy to carry, can be carried and kept at all times to lower the chances of losing it by any chance. Ideas were developed based on his consultations and knowledge until the researcher got to the end.

8. Summary of the findings:

The researcher established that there exist technologies that can track people in remote areas which work on the principle of GPRS positioning system. These technologies have been applied to track people. However, these technologies are not efficient because they can malfunction, the battery life of the tracker system is not long lasting and the respondents were not sure about the possible side effects of those devices. The studies found that these shortfalls can be rectified through adoption of technologies that guarantee user safety while guaranteeing their health concerns.

The research also established that many respondents were concerned about the need of having to carry more devices arguing that in most cases travellers in remote areas are often forced to carry heavy luggage on their back. Many responds wanted devices that would be minute, smart, and easy to carry without having to increase the weight of their luggage. The researcher concluded that it was possible to attach a tag to clothing

The researcher also concluded that it was possible to develop a new device that would not just show the position on the map but also enable loved ones and other concerned people to track them at a modest fee. The researcher was able to find out that it was possible to develop a simple device that would use GPS positioning system. The device would be shock and damage proof, waterproof, with a battery life of up to 12 hours or more an error margin of only 12 meters and could be attached to the jacket.



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