

# **Integrated Lifelogging System with Association of Cloud Computing**

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## INDEX

### ❖ CHAPTER 1:

1. Introduction.....	2-4
A. Prominent Lifelog Capturing Tools.....	3
B. Prominent Lifelog Visualization Tools.....	3

2. Related Works.....	5
<b>❖ <u>CHAPTER 2:</u></b>	
1. Proposed Lifelog Architecture.....	8
<b>❖ <u>CHAPTER 3:</u></b>	
1. Input Subsystem.....	9
<b>❖ <u>CHAPTER 4:</u></b>	
1. Storage.....	11-12
A. Security Issues in Cloud.....	11
2. Processes.....	12
<b>❖ <u>CHAPTER 5:</u></b>	
1. Output And Performance Evaluation.....	13-14
A. Web And Media history to define VAS.....	13
B. Music as Memory cue.....	13
C. Summarizing.....	14
<b>❖ <u>CHAPTER 6</u></b>	
1. Development tools.....	16
2. Visualization tools.....	16-17
<b>❖ <u>CHAPTER 7</u></b>	
1. System Flow.....	18
2. Our Advancement So Far.....	19-32
3. Future Prospects .....	33
4. Conclusion.....	34
• References.....	35

## **Chapter 1:**

### **Introducing LifeLog**

## 1. Introduction:

Life is nothing but a collection of memories. You are whatever memories you made. So it is long cherished desire of a man to archive every single moment of his life. This is where the concept of lifelogging begins.

The purpose of life logging is to record and archive everything that happens in our life or during selected periods of our life. The motivation of life logging is the humans desire for reminiscence and also the usage associated with helping patients of diseases who have problem remembering a particular useful events (like patients of Alzheimer's disease). So the development of an optimal lifelogging system is of utmost importance. However, the systems now in place these days are either incomplete or not effective.

Our goal in this research would be to show architecture for a complete and efficient lifelogging system. Our proposed system incorporates concepts of cloud computing and uses existing tools that are in place today. We not only want to capture the data but also present it in a suitable way to the user, help him to share it and use the data to help him in various ways. Our model will also use the concept of using sound as a reminiscence tool or memory cue. Again it will also contain the concept of giving suggestions based on a user's media history. Our expected result is to give a model of a lifelogging system that incorporates all the best features of existing lifelogging systems and performance is optimized. Performance measure is how effective it is in remembrance and how well it takes care of the privacy issues incorporated with lifelogging.

Remembrance has a prime importance in people's lives. Humans have a natural tendency to capture and preserve their experiences. So we come across stories, photos and other mementos that give us a narration of the lives of different people. Due to the portability of enabling devices now-a-days, capturing life events is becoming more spontaneous. Systematic collection of information about life and behavior is called lifelogging. Many precious moments of life pass without people obtaining any particular memories. Lifelogging, i.e. automatic and continuous recording of information of a person's life events, would relieve the users from manually capturing important events. The ultimate vision of lifelogging can be regarded as a form of pervasive computing, consisting of a unified digital record of the totality of an individual's experiences, captured in a multimodal manner through digital sensors and stored permanently as a personal multimedia archive [6]. A lifelog may contain

(1) information about the person's activities such as when and where the activity took place, and

(2) the content of what was done, and said, etc. [6].

Lifelog architecture is a complex issue. Inefficient designing has resulted into the failure of many lifelogging systems. So it should be carefully designed. The systems that are in use today are incomplete as either they don't encompass all the lifelogging techniques. Again others are not efficient. Our expected result is to give a model of a lifelogging system that incorporates all the best features of existing lifelogging systems and performance is optimized. Performance measure is how effective it is in remembrance and how good it takes care of the privacy issues incorporated with lifelogging.

## **Chapter 2:**

### **The Works Related to Lifelog and key terminology**

In this chapter we are going to discuss related works and terminology related to lifelog system. To have a better understanding, let us first have a look at the key concepts. First, let's have a look at the various tools that can be used. There are 2 types of Lifelogging tools. Lifelogging capture tools and visualization tools [2]. Some of the most prominent of the capturing tools are:

#### **A. Prominent Lifelog Capturing Tools**

##### **a) Sensecam**

It is a wearable digital camera. This normally goes around the user's neck and is used to take photos that are logged in to a lifelogging system. The whole idea is to take a Snap of whatever the user's sees and experience. However, the picture taken has to be meaningful as well. A scads of picture that has little significance is not desired at all. For that purpose, takes picture in two modes, temporal and sensor based. In temporal mode, the pictures are taken after a certain time lag. The pictures are taken at random based on the user's current position and thus a picture of user's surroundings is taken. On the other hand in sensor based mode the photo capturing is triggered by certain events. The camera 'senses' change in the surroundings and takes a picture of it's surroundings automatically. The triggering can be events like light, motion or temperature etc. An example of this could be invocation of the Sensecam whenever the user leaves the place.

##### **b) GPS:**

GPS is the short form of global positioning system. It shows longitude and latitude as well as time of a particular place based on data collected from 4 simultaneous satellites that gives geo-location data. In other words it is a satellite navigation system that provides location and space if an unobstructed LOS is present for 4 or more satellites. The GPS data can be provided by

services like Google Earth. We can use that data as well. The GPS data is usually saved so that we can get an idea of user's position during different times of the day. This data can be used on a map to create a record of daily movements of a user [2].

Next are the Lifelog Visualization Tools. The most important of them are as follows

**B. Prominent Lifelog Visualization tools:**

**a) Snaps:**

Snaps is a picture viewer where the user can see his/her daily pictures in a sequential manner base on the timestamp of the picture. This can facilitate remembrance by showing how the whole day was. The user can remember in a temporal order with the help of Snaps the order the events in a day occurred and how the user ended up in a particular place. For example- A typical day of an ordinary man can be getting up in the morning, having a breakfast, taking a cab, reaching office, taking a coffee break etc. Photos that determine each of these events can trigger effective recall or inference of how the day actually progressed as there is a particular sequence in the data [2].

**b) Tracks:**

It is the logging of timestamp data on a map that signifies the overview of a user's whereabouts within a day. It maps geo-location data to a map and shows a daily log as a mapping of points on the map. The output is a collection of timestamps that is situated on a map and it shows individual waypoints. Users can access these timestamps to identify their whereabouts during different parts of the day and the idea is to use these timestamps for memory invocation. Tracks has seem to facilitate better remembrance than Snaps[2].

**c) SnapTracks:**

To put it in simpler terms, it is just as its name suggests, a combination of Snaps and Tracks. This uses GPS co-ordinates and SenseCam data temporally on a map visualization that displays user routes. For instance when a person walks down a street, their position is automatically logged every minute on their GPS unit with an accompanying a time stamp. At the same time, SenseCam automatically captures pictures and assigns a time stamp. SnapTracks compares the two timestamps and pairs GPS and SenseCam data based on a time range. We shall use this in our system to some extent. However there are some more features that could be incorporated with this data. SnapTracks is the best tool in facilitating remembrance. So we shall use it in our proposed system architecture [2].

**2. Related Works:**

Several field studies were conducted to explore the user experience of different activity and context logging, a technically feasible form of lifelogging. The beginning of Lifelogging was the human cyborg concept by Steve Mann and the wearable systems that followed. Steve Mann started with a system that had heavy gadgets that had to be worn by the user and it was pretty tough indeed. However, later the wearable systems were gradually upgraded to what they are today .Then came today's software context loggers. Significant amount of work has been done to improvise on both of these types of systems. Now-a-days social networking sites like flickr.com, youtube, myspace and facebook timeline has added a new dimension to this concept [6]. There have been extensive studies on mobile context logging as well [5].



Fig: Evolution of lifelogging wearable systems by Steve Mann.



Fig:FacebookTimeline

There are studies that show providing digital cues about past events generally improve recollection. However such studies do not determine whether these recollections are inferred or actually remembered. In fact, few studies have examined the ways in which Lifelogging data might cue memory for normal people in the course of their everyday lives. Other works have shown that Lifelogging tools should be considered more broadly as not just for memory support, but for helping people look back at the past differently and creatively. There are two types of remembrance-recall and inference.

Recalling is actually remembering what actually happened. In other words the incident can be seen through our 'mind's eye'. The user can playback the event. A very small portion of our remembrance is recalling.

Inference can be again of two types- 'knowing' and 'guessing'. Knowing is assuming a event to have occurred as the event occurs regularly (e.g.- a habitual fact). Guessing is used to fill in the gaps in a way that would make sense.

The results also indicate that users quickly stop to pay attention to the logging, but they want to be in control of logging the most private information. Although logging personal content, such as messages, is experienced as a possible privacy threat, browsing the content and getting



insight to the revealed life patterns was considered interesting and fun.[5] As far as lifelog tools that are of concern to us we have visualization tools like Snaps, Tracks, SnapTracks etc. ad mentioned earlier[2].

## **Chapter 3**

### **Proposed Architecture For Integrated System**

There are several issues that are to be addressed in our integrated lifelogging architecture. In this chapter we will discuss on these issues and try to give a complete integrated architecture for life logging system.

#### **3.1**

##### **Storage**

One of them is the storage issue. The bulk storage devices that are in use these days can be used for storing data. With storage devices cheaper these days, this has become pretty easy. However there are some problems that call for finding storage alternatives in storing logged data. Storage device being vulnerable to data loss is one of the prime concerns. The device can become unusable any time due to data loss. This does not help us in keeping a log at all. Again there is privacy issue. If the data is stored in a pc's hard drive, it can be seen by any user of that particular pc. User privacy and security of user's personal info is violated which is not desirable at all. We can elaborate this with the simple example. Let

us suppose a person has diary. He writes his daily activities in it. Now this diary is vulnerable to the same potential dangers as our lifelogging system. The diary can be destroyed by fire or water can ruin the writing on its page, resulting in loss of valuable data. Again, anyone can read the diary. This violates the user privacy and security issues. So there has to be an alternative for the content logging process.

The solution is cloud architecture. Though there are various differences in the typical definitions of what cloud actually is, generally, it is the concept of using the computer as a service, rather than a product. This means resources are shared and provided to computers and other devices as a utility (like the electricity grid) over a network (typically the Internet). Our use of cloud lies within the obvious advantages provided by cloud. With Cloud computing comes Device and location independence, Reliability, Scalability, Performance monitoring, Security and empowerment of end users. These allow us to use the network as a service in a reliable and efficient manner. As a result, our proposed architecture suggests the use of cloud to facilitate the implementation of a comprehensive Lifelogging system.

### **Data Uploading**

Except for a safe storage, the data uploading process is tedious and tiresome. So an efficient architecture must provide mechanism for that. Data can be uploaded in the cloud automatically. There are several applications that facilitate this.

### **Ubiquitous and scalable accessibility**

Ubiquitous and scalable accessibility is another advantage provided by cloud architecture. Data can be accessed from anywhere and any device. So the user and other authorized persons can access the information whereas there is no way to do so in a computer with dedicated storage.

### **Multilevel view and Privacy**

Multilevel view can be provided with processed data. This means various types of access permissions can be given to various users and thus users can also share information that they are at liberty to do so. Again, they can hide details that are personal.

### **Remembrance**

The next phase of our work is to facilitate better remembrance. There are various means that can help in this regard.

### **Photo**

Now the existing systems use picture as a primary media to facilitate remembrance. However, scads of photos can be the cause of poor remembrance and also the source of user vexation. So we would like to decrease the number of photos.

### **Sound and Music**

To improve the performance, we can use Music or sound as a media. Sound and music is proved to trigger memory. So this can be incorporated in a lifelogging system. Music that the user is listening during a log data is taken or surrounding noises are inputs of our new proposed system. Music and sounds are pretty important for remembrance [3]. The reasons are as follows

- When we go to places and listen music that music become incorporated with the place or person. So saving the music played and playing it back with the pictures helps better reminiscence. For example- if we hear a song when we are going on a journey, that song sort of is stored in our memory. Whenever we hear that song again. It will surely invoke the memories associated with that particular trip.
- The system will capture the background noise while taking a picture and play it with the picture. This is also expected to improve performance of the system.

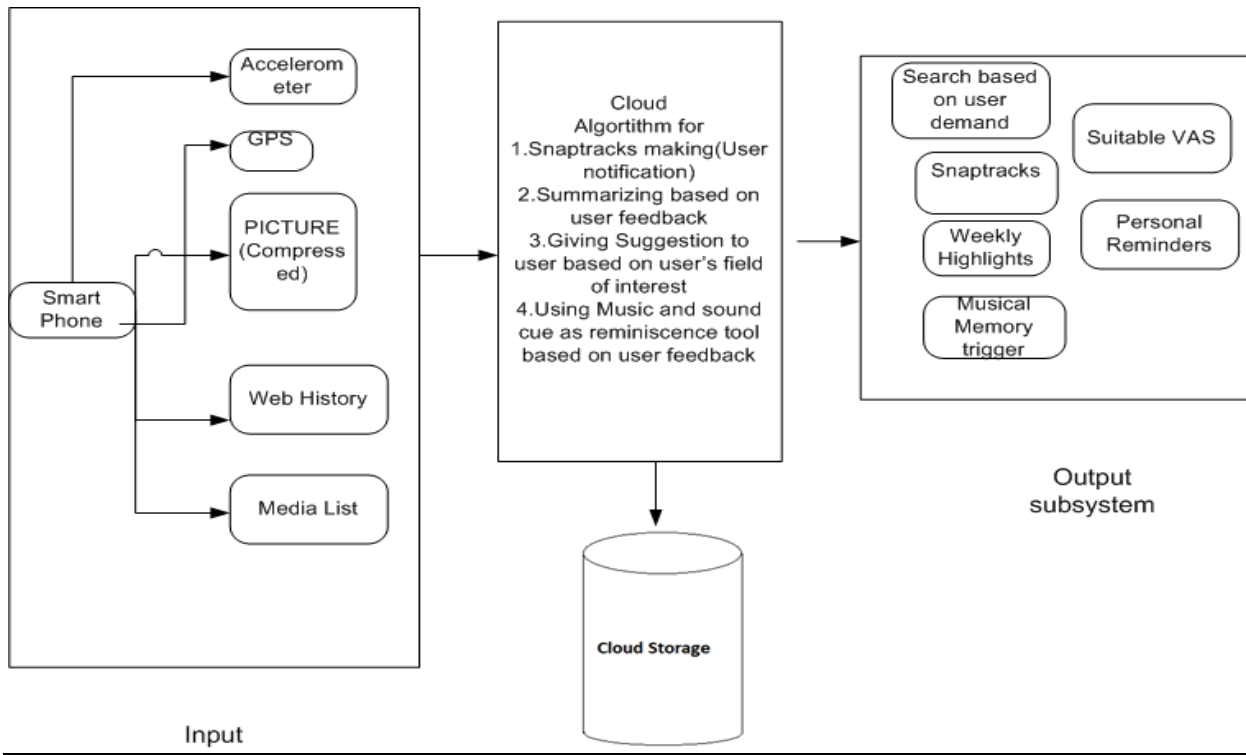
### **Summarizing Data**

Summarizing the data into a concrete form is of utmost importance. This must be part of a complete Lifelogging system as well.

### **Use of Data**

Finally, the logged data is not used effectively. However, this data can be used to find patterns in user's daily life. This can result in an alert or reminder of an upcoming event. This data can be used to suggest VAS to the users.

### 3.2 Proposed Lifelog Architecture:



**Figure: Proposed Architecture**

The tools used in our proposed architecture are a Smartphone with software for accelerometer, GPS tracking system, camera, web browser and multimedia. This is a great development from the usual wearable systems. The traditional wearable systems would need a sensecam and a GPS receiver to collect and store data. This data had to be uploaded manually. However, now these two things we take our inputs of the system. The inputs are gps data that will be needed for Snaptracks, picture that will facilitate reminiscence, web browser web history and multimedia software for media list. The inputs will be taken, processed (if needed) and stored in the cloud. the cloud will provide services for:

- 1) Snaptracks generation based on gps data, timestamp and pictures.
- 2) Summarizing based on feedback from the user (both daily and weekly).
- 3) Give suggestion based on user's field of interest.
- 4) Use acoustic sounds (picked up automatically) or music (user feedback) for reminiscence. Our proposed system will give us the following outputs :

- 1) Search based on user input
- 2) Suitable VAS(Value added service) for the user.
- 3) Snaptracks
- 4) Reminders of upcoming events
- 5) Weekly highlights 6) Music or sound based memory trigger.

### **3.3 Subsystems**

#### **1. Inputs**

**Input Subsystem:** The Input subsystem consists of the following components:

**Accelerometer:**

The accelerometer is used for taking movement input for the system. User's movements and hid positional information is used and logged into the system. However we would not use a traditional accelerometer. Instead an application will be used.

**GPS:**

Gps data is needed for Snaptrack positioning. Source is a smart phone. Google map and similar apps will be used for this purpose. GPS works with a time stamp i.e. it is used for mapping a event to a timestamp where GPS data provides the positioning information. In a nutshell it will give track record of users day to day activities as a feedback which is a top priority of Lifelogging systems. The acquired track record is displayed to the user. Using this data, eventually we shall learn from the track record the regular human routine and provide reminders to efficiently maintain the user's daily activities.

**Camera:**

Camera is an essential tool of lifelogging systems. Source is Smartphone camera. Activation according user demand or activation with time stamp in a place shall remove the problems associated with traditional systems. One of the major problems is the database will contain less amount of pictures and better reminiscence will be achieved due to the use of Snaptracks.

**Music and media history:**

Music that the user is listening during a log data is taken or surrounding noises are inputs of our new proposed system. Music and sounds are pretty important for remembrance [3]. The reasons are as follows

When we go to places and listen music that music become incorporated with the place or person. So saving the music played and playing it back with the pictures helps better reminiscence. For example- if we hear a song when we are going on a journey, that song sort of is stored in our memory. Whenever we hear that song again. It will surely invoke the memories associated with that particular trip.

The system will capture the background noise while taking a picture and play it with the picture. A sound of the time when the picture was taken is surely to improve performance of the system.

**Media History:**

Our system will also collect genre of the music and video one likes to watch and organize the media list. Giving user chance to hear his favorite music which he once liked to listen will trigger memories associated with the song and user can add it with particular timestamp. Music starts memory cue as photos, so it is an important part of reminiscence and thus included in our system. As an additional feature we can also provide him with the news of album release, hit list.

**Web History:**

This data shall also be collected from his smart phone to understand the user's field of interest. Keeping log of history and providing news and links can be a key to a better system. As every human today spends much of his time in the internet, this carries substantial weight.

## **2.Storage System And Cloud**

**Storage:**

Lifelog requires a huge database support. It is often hard to get from a Smartphone memory card. So to overcome this problem cloud storage will be a great idea. From the user device data will be transferred and processed in the cloud. The system will be benefited in two ways from this feature.1) Size of database will not be a problem 2) One can access his lifelog from anywhere he wants. This can help to locate people. Parents can look after their children; doctors can help patients even old people can be taken care of.

Uploading will be done instantly with the internet connection. Thus the storage will be done using cloud computing. When talking about a cloud computing system, it's helpful to divide it into two sections: the front end and the back end. They connect to each other through a network, usually the Internet. The front end is the side the computer user, or client, sees. The back end is the "cloud" section of the system. The front end includes the client's computer (or computer network) and the application required to access the cloud computing system. Not all cloud computing systems have the same user interface. Different systems have different applications that provide network access to clients. On the back end of the system are the various computers, servers and data storage

systems that create the "cloud" of computing services. At its most basic level, a cloud storage system needs just one data server connected to the Internet. A client (e.g., A computer user subscribing to a cloud storage service) sends copies of files over the Internet to the data server, which then records the information. When the client wishes to retrieve the information, he or she accesses the data server through a Web based interface. The server then either sends the files back to the client or allows the client to access and manipulate the files on the server itself. Cloud storage systems generally rely on hundreds of data servers. Because computers occasionally require maintenance or repair, it's important to store the same information on multiple machines. This is called redundancy. Without redundancy, a cloud storage system couldn't ensure clients that they could access their information at any given time. Most systems store the same data on servers that use different power supplies. That way, clients can access their data even if one power supply fails.

### **Privacy and Security Issues in Cloud**

To secure data, most systems use a combination of techniques, including: Encryption, which means they use a complex algorithm to encode information. To decode the encrypted files, a user needs the encryption key. While it's possible to crack encrypted information, most hackers don't have access to the amount of computer processing power they would need to decrypt information.

Authentication processes, require creating a username and password. Authorization practices – the client lists the people who are authorized to access information stored on the cloud system. Many corporations have multiple levels of authorization. For example, a front-line employee might have very limited access to data stored on a cloud system, while the head of human resources might have extensive access to files. The corporations who provide these services are bound to give the best of security. The most important thing is there are too many other options available on the market. Again, there is multilevel viewing. This enables a certain level of abstraction that hides certain data to others who have access to a particular user's lifelog. So that the user can share his desired experiences and information with his friends. As abstraction depends on user's choice it gives better security of user data.

### **Processes:**

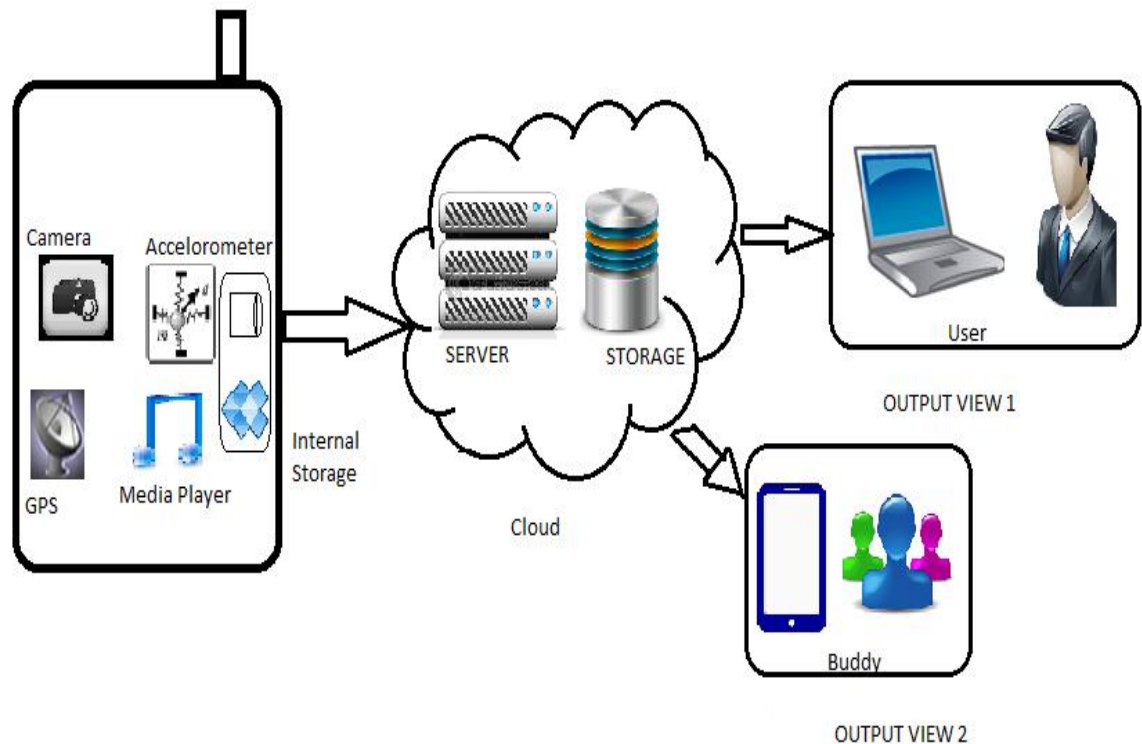
A number of processing needed to be done. Some of them will be done in the smart device and the others will be done in the cloud. Smartphones will do the task of gps tracking and upload the information in the cloud. Photos will be captured automatically and manually with a timestamp. Then the photos will be stored in the cloud for further processing. Data of media and web history will also send into cloud for further processing. Algorithm to find the field of interest from web and media history is needed to complete the task. Moreover, a Snaptrack process is needed to be built. Supervised learning strategy should be applied to build the notifications and alarm system. This algorithm will work in the cloud.

### 1. System Flow:

The following figure shows the system flow of the system we are going to build. The smartphone collects all the data. Those are: photos, Accelerometer, GPS, Media History, Web History. Then it is stored in the limited space of the internal memory and supplied to cloud storage.

In cloud we can automatically synchronize the data. It works on the background so user is not disturbed.

As the output multilevel views are provided using access to the cloud database. Friends can access certain amount of data that the user wants to provide. Data can be viewed from any device which is one of the main reasons to use cloud in the first place.



**Figure: System FLOW**



## **Output Subsystem**

### **1. Outputs And Performance Evaluation:**

The system will track record with pop up photo on the map(SnapTracks).Again it will learn regular routine and notify the user of upcoming events. Photo history and news from Google search are shown to the user based on understanding the field of interest from media and web data. This will also help mobile operator to provide suitable value added services (VAS).

**A. Web And Media history to define VAS:** As we are using Smartphone as our lifelogging device it is easy to get web and media history from the mobile. We can use this to help companies to find desired value added services for a specific user. Moreover, we often get bothered by a huge number of value added service offered by mobile operator companies. It gives a negative growth of using vas of the operators. If thorough web and media history we can find field of interest of a person it will help the companies to offer right set of vas for a specific person. People are using internet in their daily life in an increasing number. They are doing social networking, playing games and surfing the web. So internet surfing history is a part and parcel of our life. We can no longer discard internet history from our life. But what we need to do is to find an effective way to use our web history in our lifelog system. We can use web history to find our field of interest. Like an football fanatic surfaces through football related news in the internet , downloads football related video from youtube and so on. Again this field of interest changes with age of a people which is very important part of lifelog. So from web history we can say his field of interest and it's evolution through ages.

### **B. Music as Memory cue:**

Music can work as an amazing memory cue trigger. Besides, when we go to places we often listen to music. This music gets associated with the place and person. Whether the music of your youth was classical, modern, pop or disco, psychology research at Kansas State University shows that even just thinking about a particular song can evoke vivid memories of the past. Harris and Elizabeth Cady, a 2006 K-State doctoral graduate in psychology, recently published a study of music as a memory cue in the journal *Psychology of Music*. J. Bret Knappenberger, a 2004 K-State bachelor's graduate in psychology, also was co-author. Most of us have the idea that music can be a powerful memory cue. Hearing a song on a radio station can bring up your memories of school life or friends. That is why Old songs are so popular. It is not because the music is so good but because it reminds us of specific times in our lives. The researchers wanted to find whether the memories were cued by actually hearing the song or by thinking about it in other ways. They

tested 124 subjects between the ages of 18-20 in spring 2003. A pilot study had the subjects list songs from five stages of life:

- 1) early childhood,
- 2) grade school,
- 3) middle school,
- 4) high school and
- 5) college.

In the second part of the study, the subjects were given a short list of the songs that were chosen with the most frequency in the pilot study. The subjects were asked to pick one song from each category that had a strong memory attached to it, write about the memory and rate how vivid it was. The result was surprising. Most people had strong memories associated with the song. So it can be concluded that music is a very emotional stimulus. It's autobiographical in that we remember events from a long time ago with strong emotion. So part of music is very important and unique in a man's life and so in lifelog. It gets associated with parts of our life and thus becomes a part of life. Harris said that music can be a powerful memory cue because it's multimodal. That is, it combines words and instrumentation, for which we generally use different sides of our brains. "Music is a rich stimulus," Harris said. "If we can't remember the words, we remember the music. I can remember advertising jingles from my childhood, but I don't remember the slogans without the music. Music may be something that our brains are primed to understand and enjoy in the same way we are primed to understand language, although language is much more fundamental."

In short the goal of our proposed system is to facilitate as much remembrance as possible by combining all the best kinds of Lifelogging tools in practice today. It is also supposed to use learning algorithms to make it a system that increases user efficiency.

### **C. Summarizing:**

Summary of daily and weekly events is another of the inputs of the system proposed. The logged data will be summarized that will highlight the prominent events within a certain time period. Therefore, the system shall understand user's daily routine and notify him for daily events (e.g. Office time alarm).

Summarizing has other advantages. This helps in deriving other data that are consistent with our system for example- patterns in lifelog data.

## CHAPTER 6

### SELECTION OF DEVELOPMENT AND VISUALIZATION TOOLS

#### **Development Tools:**

The selection of perfect development tools is an important part of giving shape to an idea. The use of good development tools increases the effectiveness of a system. On the other hand using a less effective tool might serve the initial purposes but in the long run the whole system is wasted. Now for our system's first objective was integration thus the system is to be more portable, the number of devices used is to be reduced down to one. Now the platform was obvious. It was a phone and particularly an android phone. The reason behind using a phone is the smart phones these days are gaining popularity due to their smaller sizes and the pc like performance and flexibility they provide these days. So an application that works as an integrated lifelogging system that is both portable and also uses a single device has to be built for a phone. But what about a phone that is not an android phone. The system will be useless for that phone. So we can understand reusability and platform independence is a feature to go for sure. This was the primary drive in the development of such a system. To maintain this above mentioned qualities we have used Phonegap. Let us have a look at what Phonegap does.

**Phonegap:** Phonegap uses html and JavaScript for coding and interface. Phonegap does not provide the typical drag and drop feature. Instead the interface is developed more like a web interface. However, the flexibility it provides is massive. Javascript adds the extra edge with its extra-ordinary event-handling capabilities. Then this could be used to run the application on IOS, Blackberry, and Windows Java and Symbian phones. This gives us the desired reusability and platform independence we opt for. These features make Phonegap the perfect and widely used professional phone based application development platform it is today.

Then there was the website development; a slightly different approach was used. As far as typical development tools are concerned, the amount of flexibility it provided was not enough. So html and php were used and the development tool was Notepad++. Notepad ++ is GNU free source code editor. It can be used to code in a variety of languages and s a perfect tool if one wants to develop a website from the bottom up.

**Visualization tools:**

As we have mentioned earlier, there are a lot of visualization tools Snaps, Tracks and SnapTracks. Again, it was also mentioned that they give varied level of performance when it comes to the amount of reminiscence they provide individually. And among them SnapTracks was the best. Next there was music. The music was to be heard in the browser. So we needed a plugin for that. The GPS data and associated information was received from Google Earth. The accelerometer application was a regular one. The photo along with background noise was taken easily and is to be uploaded where in the website it has to be seen.

The website must provide necessary handling of the content given or submitted by the user either using a mobile or using the website itself. The visualization of the SnapTracks shall be in the website. Users can also use the website to see other users and their recent activities.

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## **Chapter 7**

### **System Building And Implementation**

#### **2. System Flow:**

The following figure shows the system flow of the system we are going to build. The smartphone collects all the data. Those are: photos, Accelerometer, GPS, Media History, Web History. Then it is stored in the limited space of the internal memory and supplied to dropbox.

Dropbox can automatically synchronize the data. It works on the background so user is not disturbed.

As the output multilevel views are provided using access to the cloud database. Friends can access certain amount of data that the user wants to provide. Data can be viewed from any device which is one of the main reasons to use cloud in the first place.

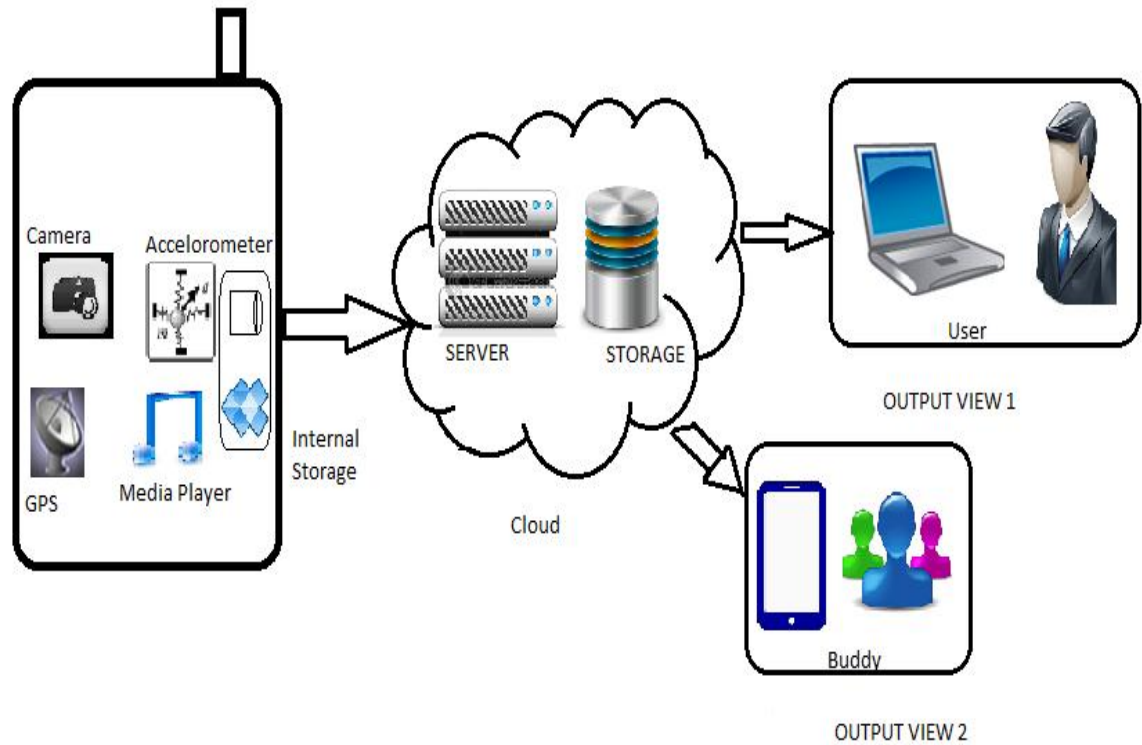


Figure: System Flow

### 3. Our Advancement So Far:

We have already started the implementation of the system. Our first task was to build an effective snaptrack system. As people are intended to use Smartphones more than ever, this is a valid choice. Smartphones basically provides all the inputs we need. Thus Smartphone is our favorite choice to build the system.

For developing we took eclipse as the IDE and Phonegap as the platform. The reason behind choosing Phonegap as the platform is Phonegap has unique functionalities in case of building mobile applications. For phone gap we need to work on html and JavaScript. Phonegap then transforms the code into suitable form to apply in different os platforms of mobile phones.

- ✓ Take photos
- ✓ Record background noise

- ✓ Identify the geo-location of the place
- ✓ Based on the geo-location it can track the location on the Google map
- ✓ Can show the satellite image.
- ✓ Can show the accelerometer data such as speed, heading, coordinates.
- ✓ Show SnapTracks.
- ✓ Upload it in the server through mobile application and web page.
- ✓ See how others are logging their life.
- ✓ Manage their personal log data.

Our achievements can be mentioned in the following broader categories

- The development of an integrated lifelogging architecture that takes care of the problems with traditional lifelogging systems. First of the problems is the lack of integration itself. There is no lifelogging system that incorporates all the lifelogging systems that are in place. The different type of data that can be used to log our life pictures, music, tracks, gps location data, accelerometer. The problem with these tools is that they are not in a single device. Though the advancement of technology has made these to be more portable than before, it is still not enough. We still need 2 to 3 devices to log data effectively. Moreover, carrying all these of devices is strictly inconvenient and troublesome for the user. So all of the traditional lifelogging systems are not in wide use. The idea here was to put together all of these into a single device. A Smartphone is the best choice as there are different kinds of application in existence. Some of them are even for logging your life data. However, still the problem of lack of integration remains. There are hardly any implementation that incorporates any more than 2-3 of the visualization and context logging tools. However, today we need more and more applications that integrate all these. Finally there is not an effective architecture for this yet. The storage issues are a liability as with the bulk storage that come with PCs and laptops are not much to hold a users whole life. And as for mobile this problem is even more engraved as the Smartphone don't have that much storage to have a log of user's whole life. Hence, we feel the need of an architecture that takes care of storage and data retrieval issues. Again, user would like others to see some of his life and also maintain a subtle amount of privacy. A multilevel view that supports this is of utmost importance. In a nutshell, the word integration shows the total integrity of a lifelogging system or architecture, not just tools. So we have created a lifelogging architecture and prototype of a system that incorporates the needed functionalities both client and server side. A picture of the made application is as follows:

# Android(Cell Phone Application)

- Android phone worked as the tool for capturing life events

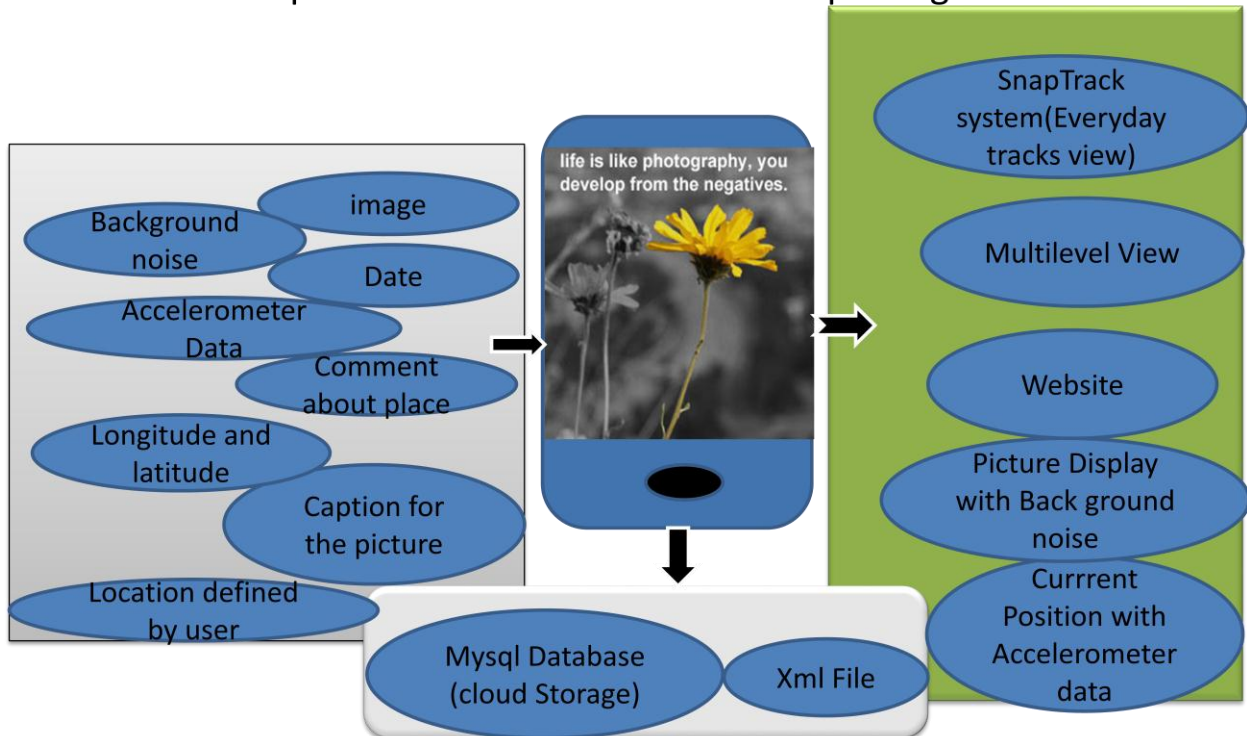


Fig: Mobile Application architecture.

- Development of SnapTracks based system that has all the best features incorporated. This issue actually takes the idea of an integrated system even a step further. The systems that are used or the tools that are used for lifelogging have variant level of performance. For example accelerometer data is pretty relevant to a person's life but it is still not a good indicator of a person's life. Next in the list are pictures of the day, namely Snaps. They give good remembrance than usual. But they don't say a person's position data or tracks. A better idea would be to use SnapTracks as it provides better remembrance than usual. As SnapTracks is said to have both Snaps and Tracks, it would give the optimum result for remembrance. The system would take data from user either through mobile or through the website to update his log information. Then he could see his/her SnapTracks of a particular day. For that we will use Google maps and show SnapTracks data. Each location has links on it that will show its own pictures depend on the location. This would provide reminiscence for the user about that particular place. After user upload data, user will go to the website and login. Then all he has to do is go to his main menu and click to 'Show SnapTracks'. This will refer to the Google Earth Map. Then by selecting a particular date and telling it to show



markers the user will be able to see his/her SnapTracks data. The Snaptracks loading needs the existence of the markers\*.xml file where “\*\*\*” means the date of the particular days SnapTracks that is to be loaded. If the file is not there is nothing to load in particular. This file is loaded when the user has any data to upload. If any data of that particular date is uploaded then the user would see that in his SnapTracks. This is a view of the system

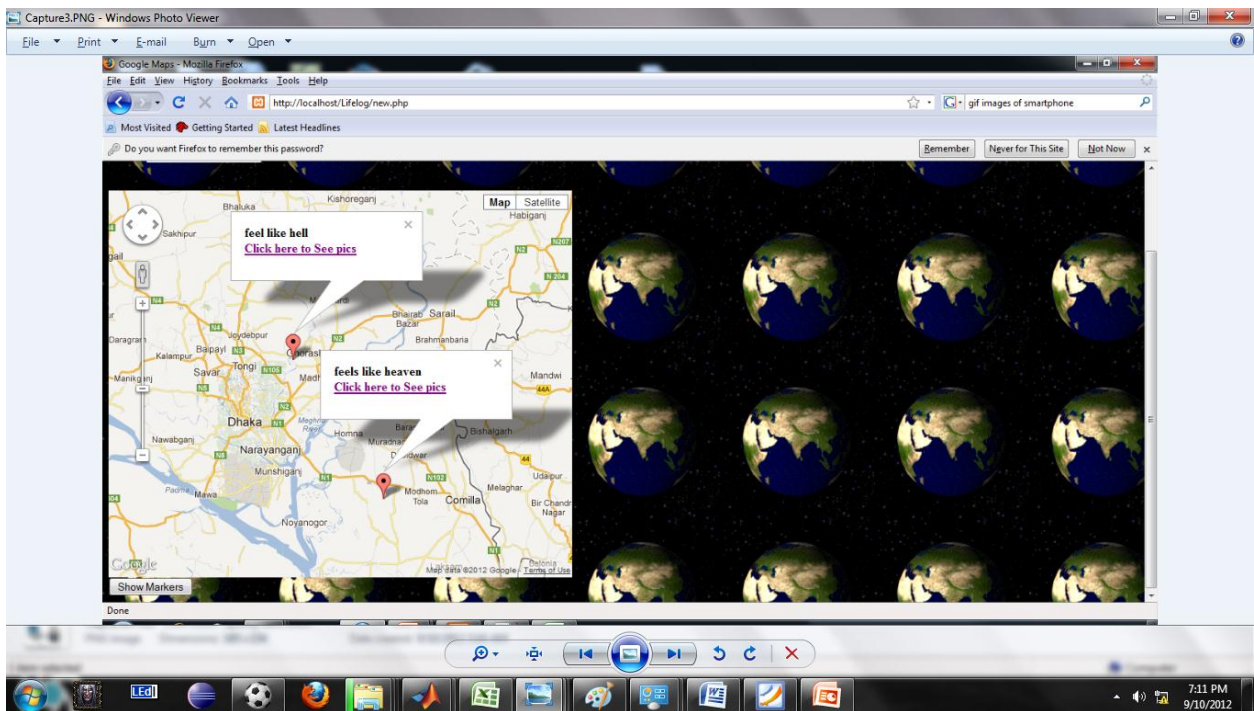


Fig: SnapTracks System

- Use of music and background sounds as a reminiscence tool. The implementation of this has been done using a code that will take picture and automatically pick up background noise. Then if the users upload it the music file is also uploaded into the server. There are two ways a user could do that. First use the content uploading option given in the website. This way the user can incorporate his/her personal pictures or music in the database. This covers the case when users take pictures using any other source. He may incorporate any music with that particular picture. This is how the uploading is done. The read one of these results in easy access and uploading facilities. Now the user can go to the website and check 'show user content'. The user will then be able to see his/her pictures and music. The whole reason

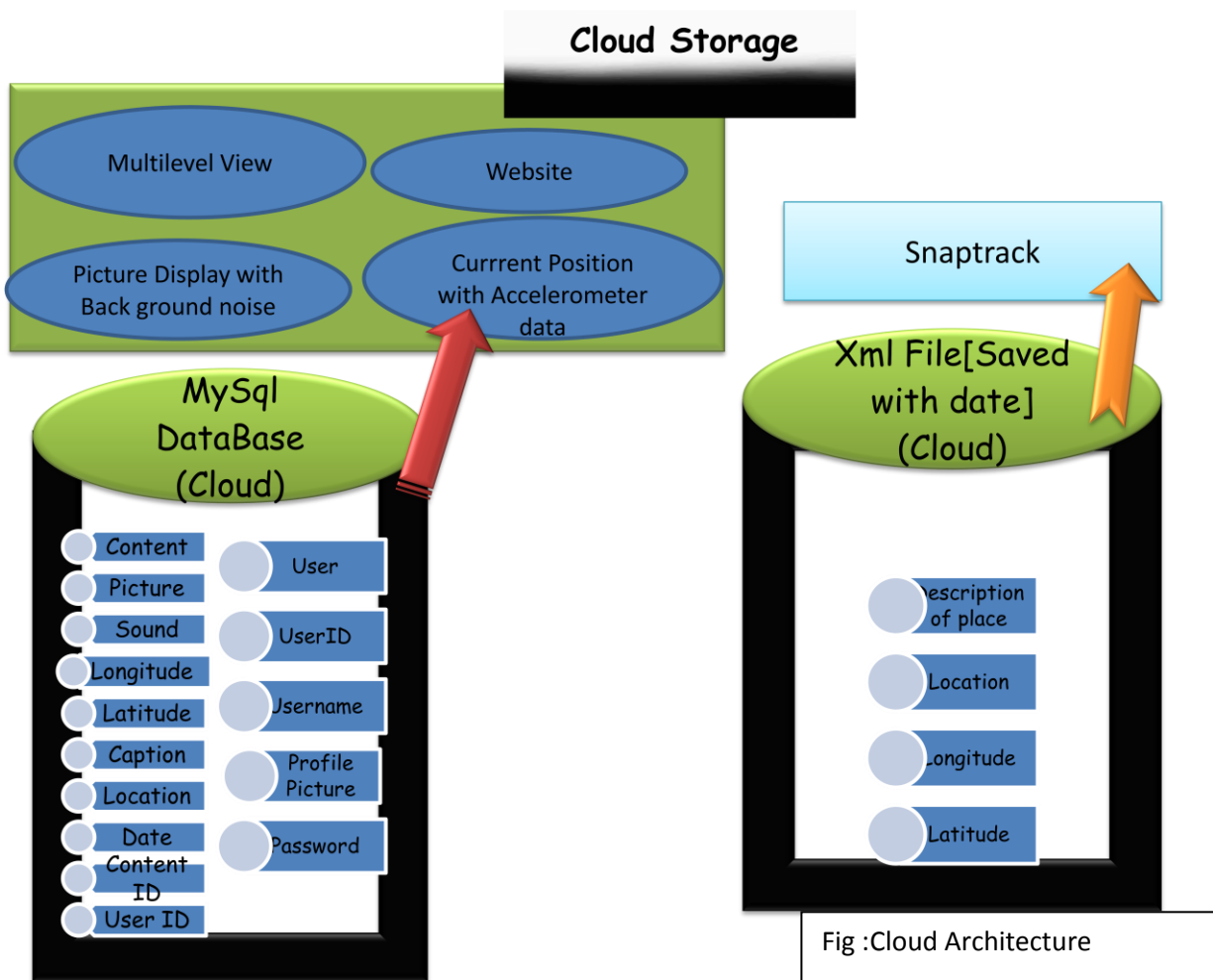
for this is better remembrance than usual. The mobile data uploading process can be seen as follows:

Password:   
 Current Location :  
 • Latitude : 23.9490342  
 • Longitude: 90.381644  
 Latitude:   
 Longitude:   
 Picture:  
  
 Background Sound:  
  
 Date is:   
 Caption:   
 Location:   
 Comment About Location:

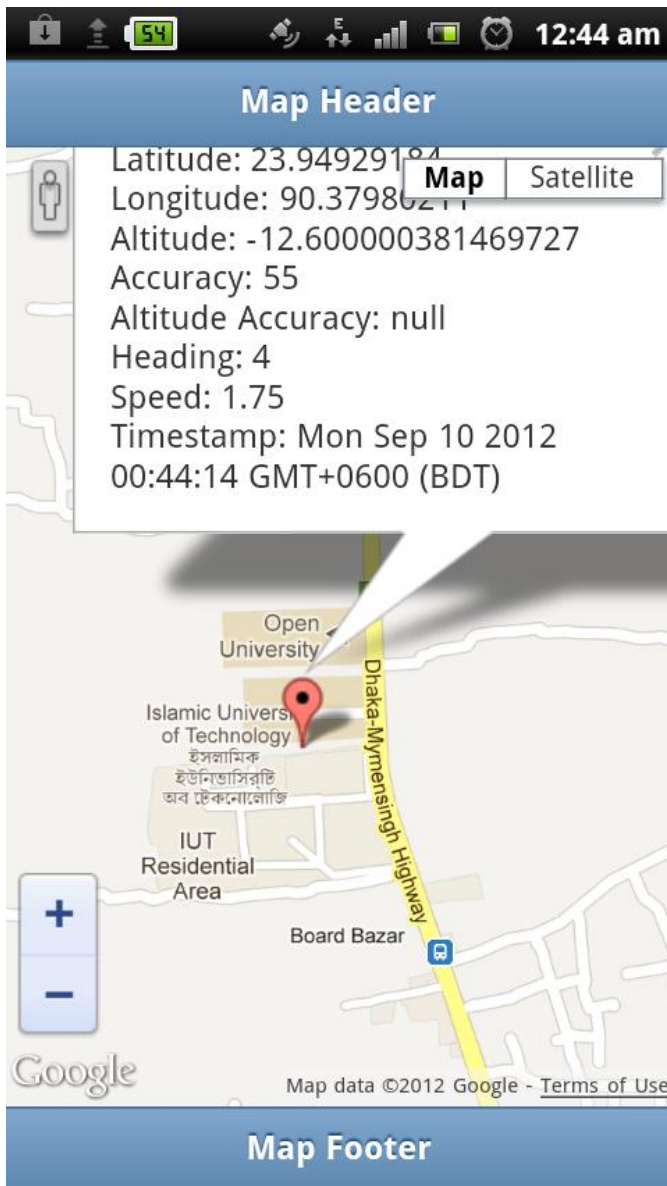
Fig: Uploading Process

- As we have mentioned earlier that storage is an issue. We wanted to incorporate to our system. The benefit of cloud would be better data storage that provides better robustness, security. Moreover, lot of the processing could be done at the server side. The cloud server helps us with Snaptracks generation, data uploading, data processing. Again the cloud also maintains the server side processing of the web site. All the processes of the website are done by the cloud server. Our implementation uses localhost as the cloud. That is we have

not used a particular cloud. We used our local hard drive to simulate cloud services. However, the deployment from the local machine to a web-server will not be troublesome. The database maintaining and the code written have been formatted in a way to support a quick change to server deployment. The server side security issues are to be handled then. The client side of the user that is to be accessed by the primary user is also secure as data is to be uploaded to the web-server and uploading uses a validation process. In a nutshell, all the security issues that are to be handled by the user side or the application is maintained. This has resulted in huge reusability of code. As far as question of storage capability comes into play, the no. of users we are handling is a lot less than we will in a real system. But the system here serves our purposes. Just as cloud we have several backups in place. So the robustness is still there. In a nutshell, we have a simulated cloud here. The cloud architecture can be shown as follows:



- Now let's have a look at the Identify the geo-location of the place. Based on the geo-location we can track the location on the Google map and show the satellite image. This is done from the website. The website uses Google earth facilities for that. In case the android phone, the geo-location is generated by the android code. We can also track accelerometer data using this implementation.



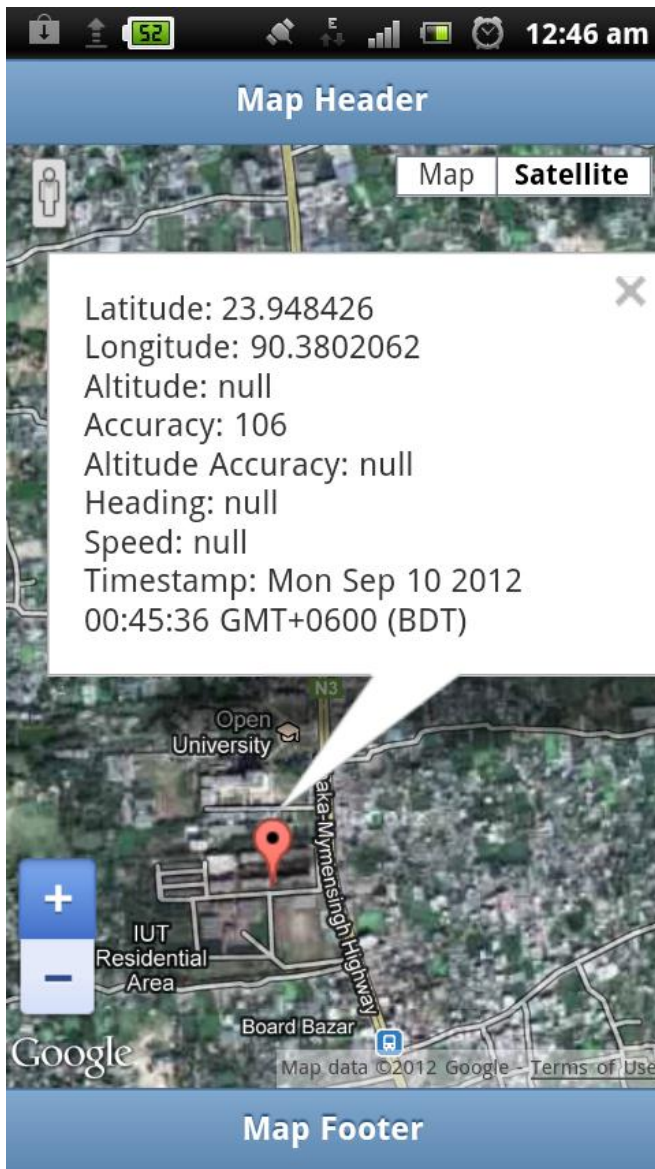


Fig: Accelerometer Data Views

- See how others are logging their life. Our system provides a multi-level user view. The users can see what other users are like. This view includes seeing the username and picture of the user. They can also see some of the recent pictures to have a better idea of the user's life. This uses the subtle line between privacy and letting other people see one's own content. An architecture view of the website is as follows:

# Website

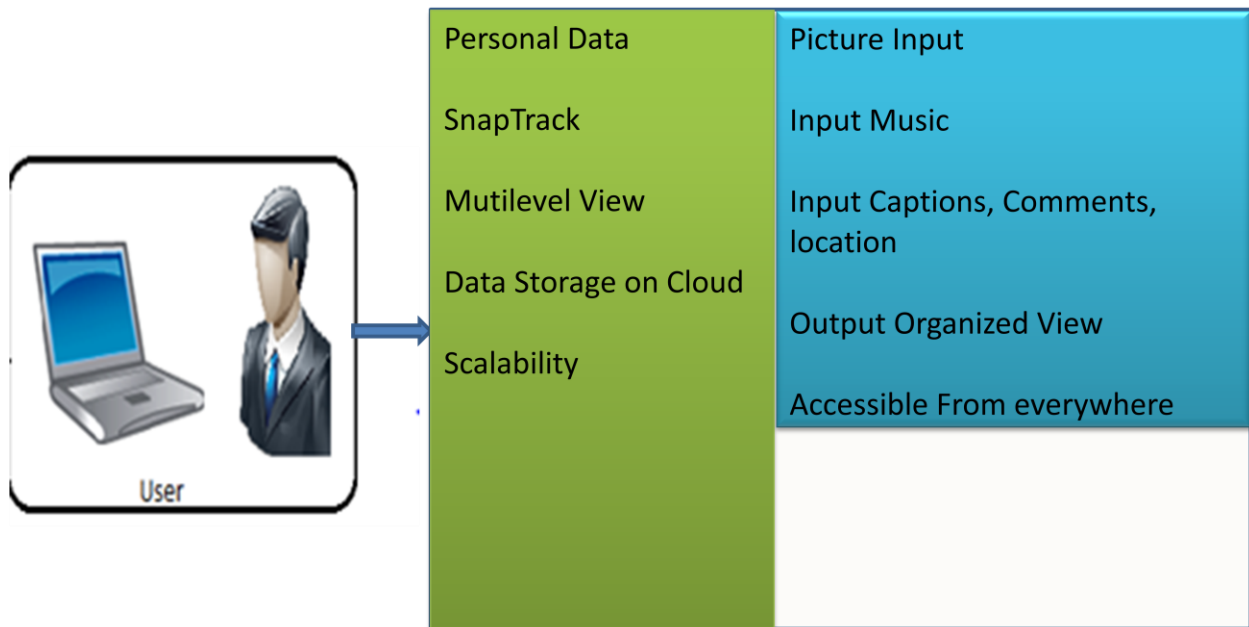


Fig: Website Architecture

- The Website interface was done using notepad++. The CSS script was used to support menu view and having a distinct page view as well. The screenshots are as follows:

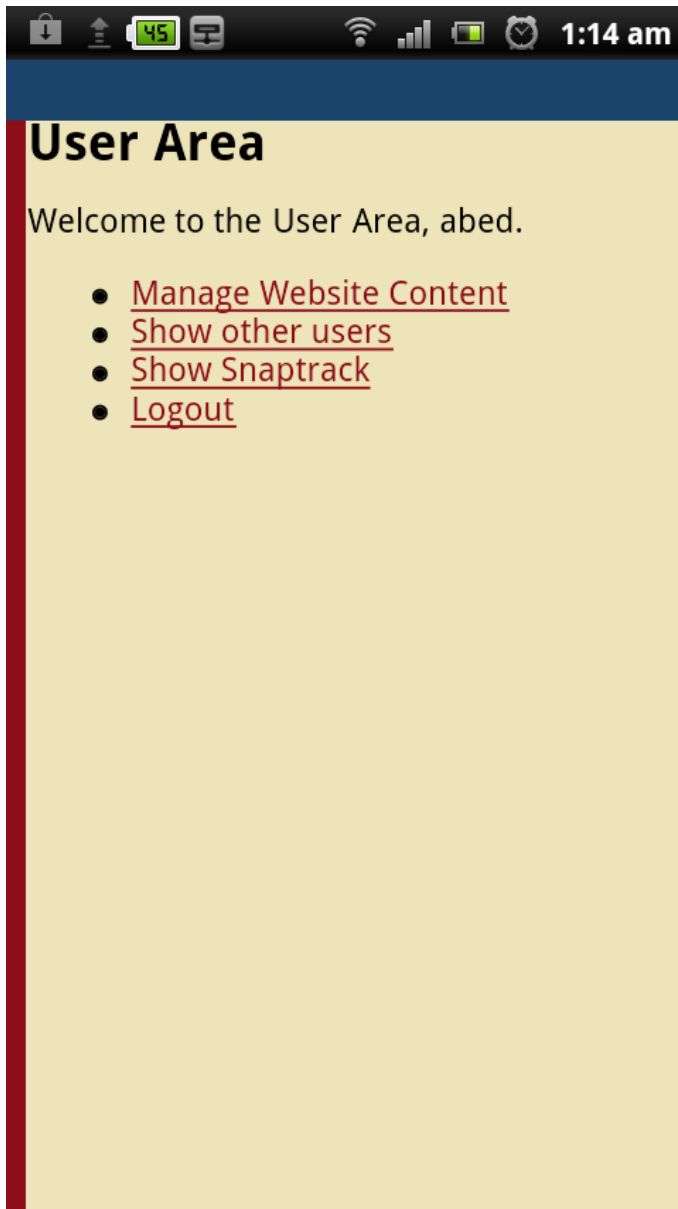


Fig: Website

- We have used our own evaluation system. This evaluation was done on 10 people. We have asked the subjects to take photos of the same event. One with background noise and one without any background noise. The users were then asked questions on 3 separate criteria. The criteria were when the picture was taken, where it was taken and the situation behind the picture. There were three particular considerations when the field study was conducted. The 3 graphs from the received data are as follows :

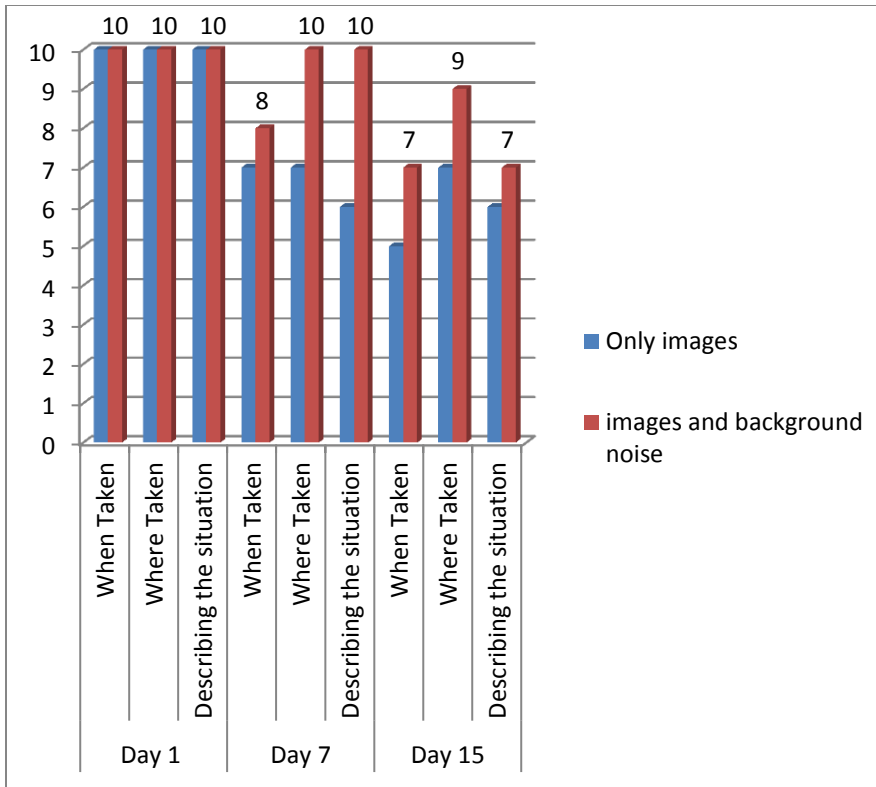


Fig: Overall score Of system over given days

The graph shows how only an image system and an image system with music incorporation works. As far as the first day is concerned both systems scored 10/10 in every criterion. However, as time elapsed, the question of memory fading and hence comes the effectiveness of each system's memory triggering capabilities. As we can see in day 7 the when, where and situation description gets 7,7 and 6 respectively whereas our system scores 8, 8 and 10. Again, after 45 days the traditional system scores 5, 7, 6 and our system scores 7, 9, and 7. This is indeed an improvement.

The next graph is no. of people having full remembrance vs. no. of days. Full remembrance is taken to be 3/3 in the 3 categories defined. Based on the received data the following graph was obtained.



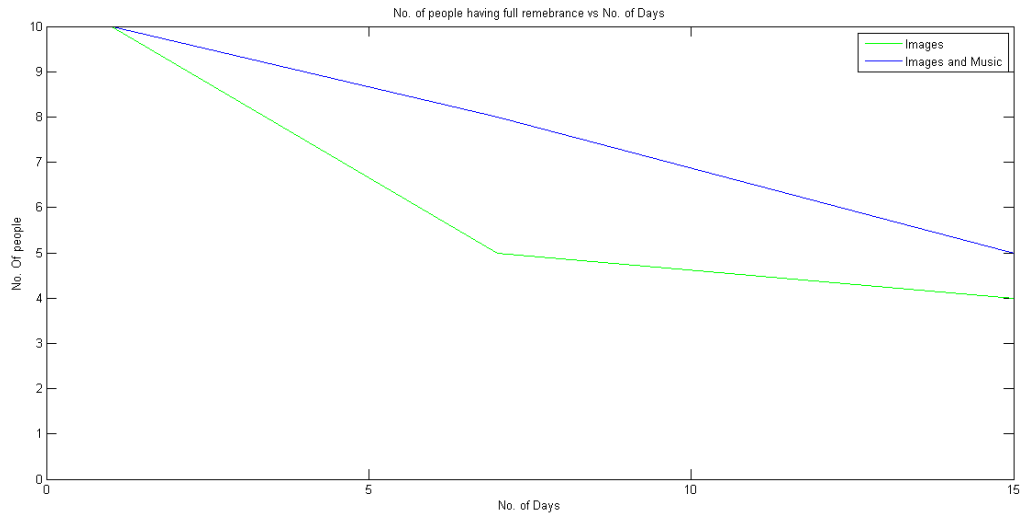


Fig: No of People(full remebered) vs No. of days

Finally is the scoring of the systems. Based on different days (1, 7, and 15) the old system scored 100, 70 and 60 and our system scored 100, 93 and 76. The graph is as follows:

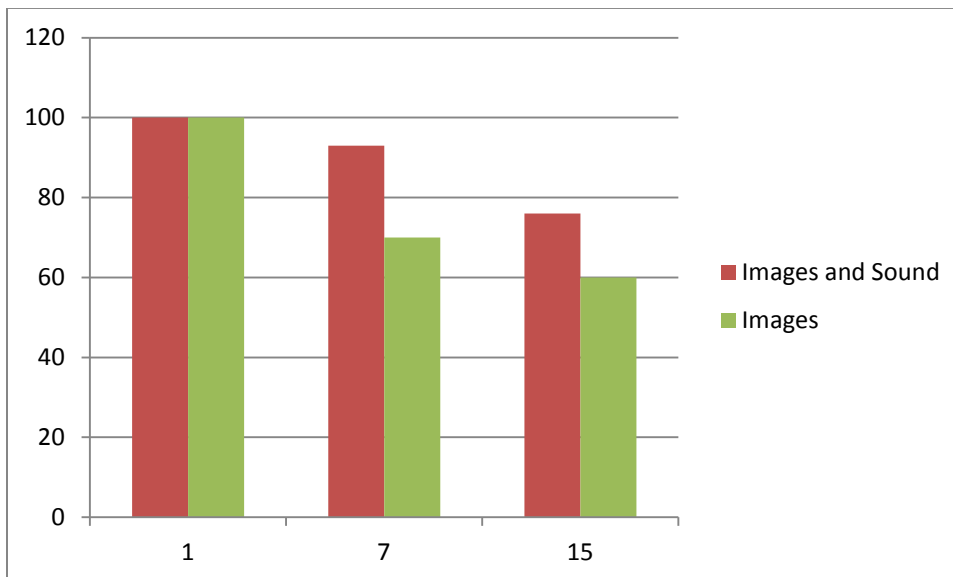


Fig: Scoring of Systems(Old and Prototyped)

The Interface of the System has several views such as the mobile view and the website view> here are some of the screenshots.

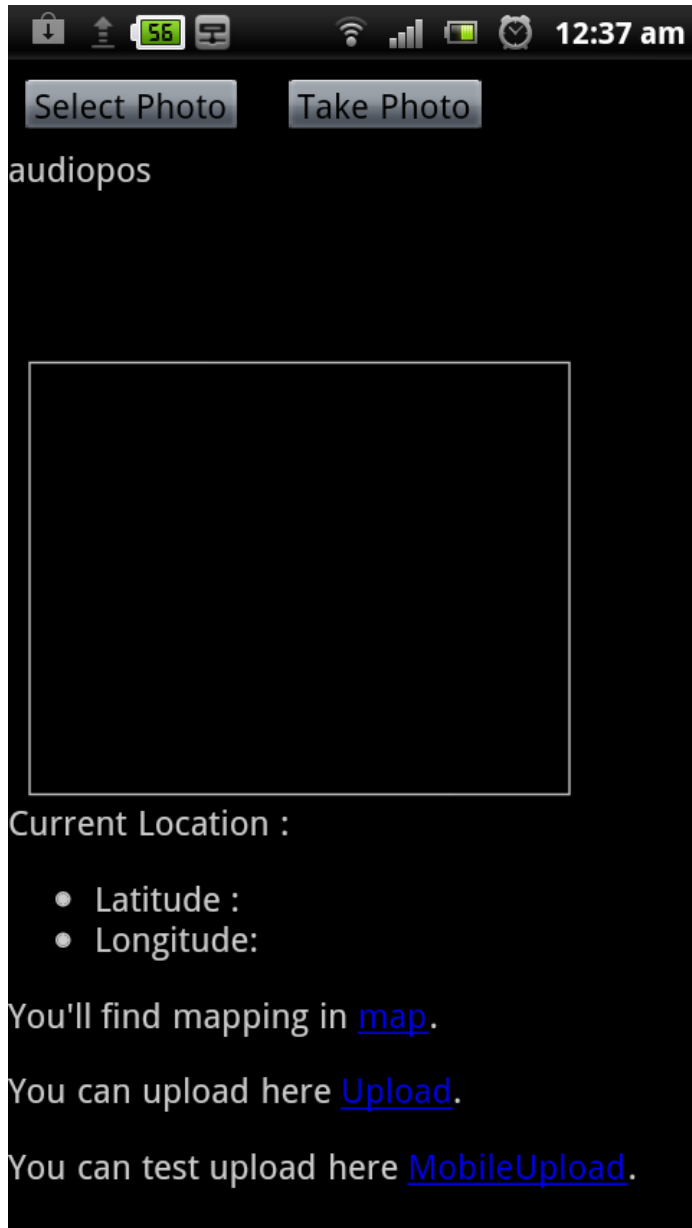


Figure: Interface of the system

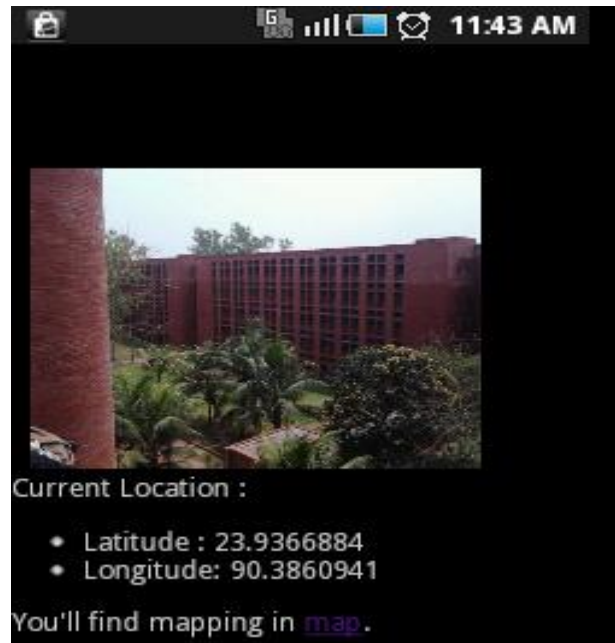


Figure:Map showing geolocation of photo.

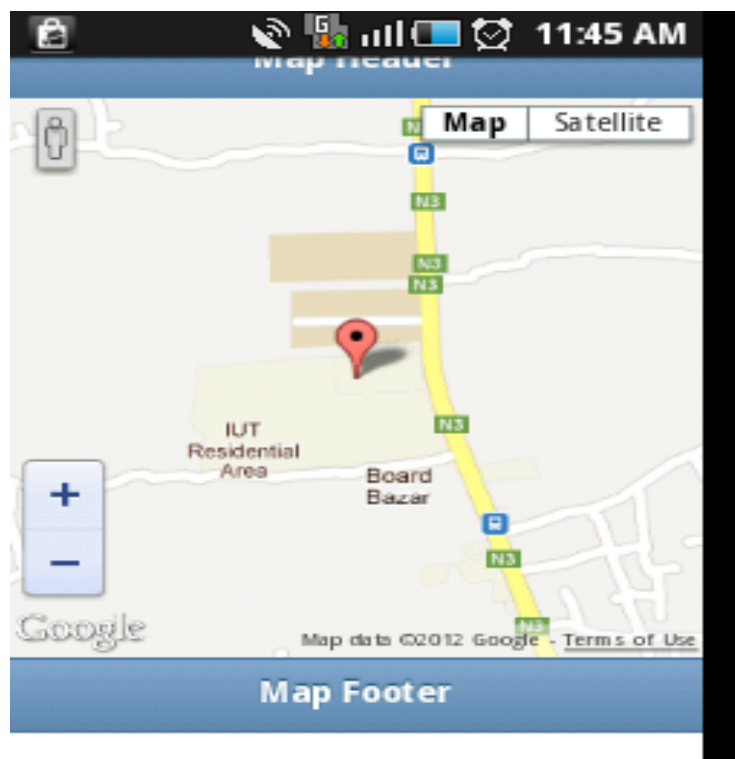


Figure:Map showing the track on google map

#### 4. **Future Prospects:**

We have tried to give a prototype of the system. However, the futuristic vision is yet to be widened. There are several works that are to be done in the future. Here we share some of our ideas for future work on better integration and also redefinition of a lifelog.

##### **Media And Web History:**

- People now-a-days spend much of their time in web surfing and technology has made entertainment an all-time concept. We can listen to music and surf the web on the go.
- People surfs through their favorite sites, reads recent news, listen music which changes over time.
- So these things are today a part of lifelog which should not be underestimated.

As we are collecting these data we can use them effectively for various type of useful outputs.

##### **New Types of Inputs to be introduced:**

- **Homepage Customization:**

User will be given news feeds based on web history.

Recent news related to music and other entertainment media news will be provided analyzing media history

- Understand field of interest from media and web data and help mobile operator to provide suitable value added services(VAS). Thus operators can offer right set of VAS for the users

- **Daily or Weekly Summary:**

Summary of daily and weekly events can be an output. Therefore understand user's daily routine and notify him for daily events (e.g. Office time alarm).

- **VAS(Value Added Service) Suggestion:**

We want to further explain on the issues:

- One of the primary problems in building in an effective system is that there is no existing use of the data. Our concept to give user's news feed and VAS suggestion is an important feature that cans be integrated with our system.
- We are taking web history as part of the System. We know people usually browse through their field of interest. Therefore it can used to find interests and offer appropriate VAS for the user. Cell phone operator companies will greatly benefitted from the application.

## **5. Conclusion:**

Our goal was to create an integrated Lifelogging architecture. We have shown how our proposed architecture is more appropriate based on empirical data and how it integrates all necessary aspects. In a nutshell a complete lifelog system can change human life; human can value their life as well as learn from mistakes to make the life beautiful. The proposed system can complete human needs of reminiscence in life. Nothing and no one from life will ever get lost. There is of course a lot to be done as we have outlined already. What we did was a mere prototype of how a lifelogging system can do. However, there is yet a lot to be done. These could be mentioned as both improvisation and extension of the lifelogging definition itself. Although it can have some cons, but pros of it is huge. It can completely change people attitude of life.

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