Enabling museums to benefit from the mobile revolution

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Abstract:

South Africa's mobile penetration is very high, with more than 95% of the population having access to a mobile phone. The mobile web revolution is underway with a Broadband Strategy to roll out broadband data access to all underserviced areas, with the largest mode of access expected to be mobile phones and tablets.

This paper presents our ongoing work in enabling museums to exploit this mobile web revolution to help create the communication channels to both visitors and to the community. Every museum should have a personalised web page designed for mobile, which we refer to as the "mini web page", which is used as a digital brochure for the museum. Virtual exhibitions can be created to help to introduce tourists and the community to new exhibitions at the museum. Virtual guides can be provided for improving the visitor experience, even for smaller and poorer museums. Community engagement through mobile phones can be achieved by publishing of the calendar of events and by creating the digital community of volunteers and friends of the museum.

This is merely the start of this mobile revolution, and museums, together with other memory institutions, can lead the way into this revolution and become the conduit for accelerating the introduction of the Information Society in their local communities.

Keywords: museums, communications, mobile web, ETHER, eternal heritage, mobile phones, tablets, visitor experience, virtual guide, virtual scene

1. Introduction

> *"Never send a human to do a machine's job"*
> Agent Smith, The Matrix

1.1 Communicating with Stakeholders

We have been engaged in a number of projects and activities in the "digital heritage", combining computers with museums, libraries and archives. This included digitisation and the development of digitisation strategies, policy development and collection management systems. We have now shifted our focus onto improving the visitor experience in museums using mobile technologies as well as improving communications between the museums and its stakeholders in a variety of ways. I share some of these with you in this short paper.

All museums have a responsibility to communicate with stakeholders about their activities and exhibitions. These stakeholders include tourists, school, the general public, the local community, researchers, and the museum management and staff. Whereas most museums are measured by "feet through the door" it is becoming important to adapt to the changing world and to also measure success in "clicks through the digital door".

Museums need to adapt to the changing face of technology, in which there is a radical shift from the usage of the Web on desktops and laptops to smartphones and tablets. The significance of this shift is that many people already use the Web from their mobile devices no matter where they are and are using the Web increasingly to discover information while they travelling. Museums should be providing the right information to all of these identified stakeholders.

1.2 What is a museum?

I find it interesting that after 76 years of running annual conferences, SAMA still has debates about what it a museum! In order to position my work into this field I have coined my own definition that "Museums are the owners of the interface between the past, the present, and the future", and that among their key functions are the collection and management of information, and the communication of this to various stakeholders. In essence, museums are inherently ICT organisations as soon as they start to use technology to help them with managing the information and their communications.

1.3 What role can Mobile Technologies play in the museum?

Everyone today carries some form of mobile phone wherever they go, including while they are visiting museums, and many modern travellers also carry tablets. These mobile phones and tablets are now highly powerful computers capable of a wide variety of functions. Many people in museums throughout the world are realising that they need to have a mobile solution, and based upon this I ask the question

"if mobile technology is the answer, then what is the question?"

I have identified two key questions for which mobile technology is an answer and these are:

- how to get more visitors?
- how to give them a better experience?

Arising from this are a number of other questions which concern how the mobile technology can be used, in terms of the benefits that may accrue to the visitors and the institution:

- who is visiting?
- what are they doing during their visit?
- what do they prefer?
- did they have a good experience?
- what can they take away with them?
- how can they recommend the museum to others
- how much information to they want? depth vs breadth?
- how to create a balance between PHYSICAL and DIGITAL visits?

1.4 Existing technologies for Visitor Experience

There are many technologies which are in place to improve the visitor experience at museums, such as audio players which are collected at the entrance to museums and heritage sites, and then handed back after the visit. These audio players are in common

usage throughout major museums and sites internationally, and locally I have noted their usage at the Origins Centre. They offer audio guidance in a variety of languages, and are easy to use. They are limited in that they have only audio content and no visual information, and they cannot link to other items of interest automatically. They are also expensive technology and only available to the largest and wealthiest of museums and heritage sites.

As an alternative, mobile technologies offer a more modern approach, which combines audio, image, video and text, and which can be delivered with virtually no technology, since the visitors all carry their own mobile devices. This offers a considerably improved visitor experience, using technologies which visitors are already familiar with.

1.5 The role of World Wide Web

The World-Wide Web (the "Web") was conceived and developed in early 1990s as a generic application for the interlinking of documents, and has outgrown its initial purpose to become the predominant usage of the Internet. This usage is now set to grow exponentially with access by "the other 90%" who have never had the opportunity to learn and use computers, but who are gaining access to the Web from their phones. There is rapid growth in smartphones and tablets when compared to non-featured phones, and there is every indication that every phone in usage will be Internet connected within a few years, and that every person will carry some form of tablet with them at all times. I personally carry a Samsung Galaxy Note, which is a 5" screen running Android, and an Apple iPad 1.

2. Mobile Technologies

2.1 Mobile Apps

There are two predominant trends in mobile development for smartphones and tablets at this time. These are the "Apps" and the Mobile Web, and it is important to understand how they fit into the future of mobile devices.

The Apps are self-contained programs which are developed for the particular devices and which run as programs on the devices themselves. Each type of device runs on one of a few operating systems so that different programming is required for each device. These Mobile Apps are downloaded from various App Stores, and some Apps may have charges levied to purchase the App or to upgrade. The operating systems include Apple IOS (iPhone, iPad, …), Android (most non-Apple phones are now using this operating system), Windows 8 (released October 2012 for a range of new phone and tablets), as well as the existing application structures of Blackberry and Nokia. The development cost for Apps is high and is also specialised, and many organisations only build for one or two of these technology architectures, such as IOS and Android. From our experience, a good App may cost anything around R500,000. The benefit of the Apps is that they can exploit the full power of the mobile devices and that they run fast. The disadvantages are they the are many types of App, and also that the devices are changing rapidly, so that an App designed this year may not work on devices or updated operating systems which are due for release next year.

2.2 The Mobile Web

The Mobile Web is a technology which uses the standard Web technologies and which runs on mobile devices using a Mobile Web Browser. These are cut-down variations of the larger laptop Web Browsers, and more recently the limitation of these Mobile Web Browsers has been rapidly reducing. The most commonly used Mobile Web Browsers are

FireFox, Opera, Safari and Chrome, and at this time Internet Explorer has not made an impact on mobile devices, although this may change with the advent of Windows 8. As with all Web technologies, the web browsers provide a means of moving information between the client (the mobile phone), and the server (the Web server), using a protocol called HTTP (the Hypertext Transport Protocol). The messages sent to the servers are called URLs (Uniform Resource Locators), with the messages sent back from the server to the client devices being in a language called HTML (Hypertext Markup Language).

All modern devices have Mobile Web Browsers that support the HTML5 standard, which is a major advancement in web technologies, and these web browsers also provide for formatting and layout of information using stylesheets, mostly using the CSS3 (Cascaded StyleSheet Standard 3). The web browsers also provide support for an internal programming language, called Javascript, which provides for programming instructions to be executed directly on the mobile device without having to use an App. Collectively, the Web Browsers, the HTTP protocol, and the HTML5, CSS3 and Javascript languages make up the technologies referred to as the Mobile Web when this is used on a mobile device.

The benefit is that Mobile Web applications can be built using standard technologies which is the same for all devices; that they are relatively inexpensive to build; and that they can operate on any device which has access to the Internet via a Web Browser, no matter how limited. The disadvantage of the Mobile Web is that they do not capitalise on the full power of the mobile devices. However, modern interfaces within the Mobile Web Browsers through the Javascript language is making available some device functions, such as access to the in-built location-awareness ("where am I"), and linkage to the telephony (to make a call directly from the web pages). One emerging advantage of the HTML5 language is the capability to play audio and video directly without special software being loaded, in cases in which these functions are provided with the Mobile Web Browser.

2.3 Mobile Apps vs Mobile Web

Our work on building mobile web pages for museums and other institutions has led us to adopt the Mobile Web, rather than to build Mobile Apps. We came to this technology decision after a number of years of developing Mobile Apps, since we believe that the Mobile Web is the technology with the greatest potential to adapt quickly to changing demands, and which also works within the budgets of the museums and other heritage institutions.

Whereas there are many institutions who are being told that "they need an App", it is important to question whether this is the best approach in the fast changing world of technology, or whether the Mobile Web may prove to be the most economical approach, providing a better user experience, delivered faster, and at lower cost, than using the more complex and lengthy implementation cycles of the Mobile Apps.

2.4 Social Media

There is also the consideration that many museums are being told "we need to be on the social media" and who wish to set up Facebook and Twitter accounts, and this does help to some degree, but these are not special-purpose to the needs of the museum and its extended community of stakeholders and visitors. These are increasingly being used on mobile phones rather than on conventional computers.

2.5. Barcodes and QR Codes

Some museums have adopted the QR ("quick response") technologies which provide a two-dimensional structure that can hold enough information for a URL. When read by a mobile device this can direct the user directly to a web page. Whereas these can be found in many places including in magazines and on posters, in which they provide a linkage between the physical page and the digital world, they require specialised Apps on the mobile phone or device and the ability to recognise the QR code requires that the mobile phone is sufficiently close to be able to read the code. From my experience this requires that you are no more than 30cm away and that your hands are steady.

In museums these are put onto the exhibits to provide a link to a web page. However, there is not much evidence that these are used by the general public, except for technology geeks, although they are popular among technology directors at major museums[1].

2.6 Augmented Reality

Yet another usage of mobile phones in museums has been for Augmented Reality (also referred to as AR). This is where the phone camera is used to identify an item and on top of the picture is further information displayed. The real world is overlaid by a virtual world of information and data. One example of this has been the new exhibits at the Science Museum in London, in which James May (from Top Gear fame) will talk you through nine exhibits in the "Making the Modern World Gallery" after you point the camera at the exhibit and the App has been downloaded.

2.7 Our recommended technology

Our approach is to use the Mobile Web as the preferred technology choice for a number of core reasons when compared with others include the choice not to use Mobile Apps. We also have decided not to use social media as a core platform, and also not QR codes or augmented reality.

The Mobile Web is far easier for the development of mobile applications then the Mobile Apps which can be downloaded. We can deploy a new mobile web page in hours rather than weeks and this also then decreases the costs. We have built a large mobile portal to help us with the development of these web pages, which greatly reduces the effort, time and costs of getting these implemented, and yet it also provides the functionality of the larger web sites.

The Mobile Web has increased in power over the past few years, and the devices have also increase. The largest single benefit is that the Mobile Web is independent of the changes in operating systems and devices which is occurring almost daily.

3. Who needs what information?

Now that I have considered the various mobile technologies, and have argued for the usage of the Mobile Web over Mobile Apps, I now need to consider what should we do

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[1] http://museumtwo.blogspot.com/2011/08/qr-codes-and-visitor-motivation-tell.html

with this – in essence who needs what information? This question is best answered by examining the range of stakeholders and what information they each need.

There are many types of stakeholders who have an interest in the museum. These include the management, visitors, the service providers, and the community. The visitors themselves can be divided into the potential visitors, who are planning to visit, and the actual visitors, who are in the process of visiting. For each of these groups there is a need for information, and this information is different for each group.

The potential visitors would like to know about the museum in order to make an informed decision of whether to visit or not. At present this information will be available through brochures and leaflets as well as through the museum's web site. But this is mostly not available through mobile devices. What is needed is a small web page designed for the proportions and structure of mobile devices, which we refer to as "Mini Web Pages".

The actual visitors would like to know more about the museum exhibits as they move the rooms or outside areas. Designing and creating a modern professional museum is expensive and through mobile web technologies it is possible to create virtual exhibits which complement the real exhibits. Some of the top sites have done this by using audio players to help to guide the visitors as they walk around, and we are now exploring the next generation of the visitor experience which uses their own mobile devices as the medium for communication of information about the exhibits.

The community, as well as the visitors, will want to know about the events that are on at the museum, including temporary exhibitions, talks and lectures, and field trips. This community include the local schools, for whom the museum has an important educational and social responsibility.

Finally, the museum board, management and staff need to know how the museum is progressing, and will greatly benefit from feedback and ratings provided by visitors and other users, which is essential information to inform strategy, planning, and action.

4. What are others doing?

I have conducted a general search for museums which indicate they are using mobile technologies in some way, and I have selected a few random examples of what appears to be current practice. At present these are all international, since I could not find local examples.

The Museum of Contemporary Art of Australia (www.mca.com.au) has a Mobile App for providing access to its collections. I loaded this from the Google Play store for Android Apps, and this said it was a 2MB download. During the download process it opened up the home page and then proceeded to download other files of sizes 9PM, 2MB, another 2MB, yet another 2MB, and then said that it could not continue. This was on my Samsumg Galaxy Note, and this highlight a significant problem of the Mobile Apps – that they are generally designed for a limited range of devices and do not work for other devices. The Android operating system has a number of versions, as well as a number of device-specific implementations, and it is not possible to test for every combination. Perhaps this app (MCA Insight) works on your phone! This App has had very poor reviews from those who have used it and reviewed it.

The Brooklyn Museum has a mobile web site (m.brooklynmuseum.org) which provides information on their current exhibitions, a calendar of events, limited help for those visiting the museum, and some information on their objects. This mobile web site sometimes jumps into the full web site, rendering the information unreadable using a mobile phone. The Exhibitions link provides a one page link
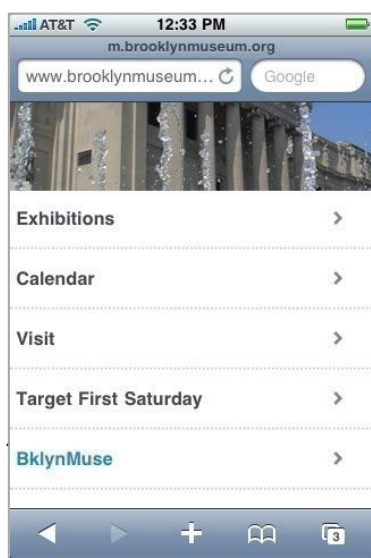
to selected exhibitions, with explanatory text and how to find it within the museum. The Calendar provides information on what is on today, but its links thereafter move you to the main web site. The Visit information is largely confined to how to get there, but with no information on how to get around within the museum, and information such as where are the bathrooms and the restaurants. My impressions of this are that this provides really basic information, but most of this could be provided with a single leaflet handed out at the entrance, and the mobile web does not add value to the visitor experience.

The Los Angeles County Museum of Art promised the most for me. The Associate VP of Technology, Amy Heibel, was the keynote at the recent (Oct 23-25 2012) Museums & Mobile online conference. However, on my phone, the Samsung Galaxy Note, the images did not display and the instruction to swipe did not work. However this did work on my iPad 1 and the experience was very good. This is certainly among the best practices available at present, and it provides useful information on admission and access. However, it lacks a large amount of information which could be provided and which is not, such as the floor plan (and the location of the restrooms!).

5. Where are we now?

International Best Practice

I use the term "best practice" in this context not to indicate that I see these examples as using the best designs and approaches, but that they are the best I have been able to find.

From the brief analysis of international experience in the previous section, I have concluded that we are only at the start of the process of exploiting the power of modern mobile devices to enhance the visitor experience in museums, and to provide a rich environment for useful content.

Even today's best museum mobile apps and web sites are far from the ideal, and all have either limited information, or are limited in which devices they can be used on. There is no consistency between what information they provide and most appear to be directed at the information visitors need before they get to the museum rather than enhancing the visitor experience during their visits.

The usage of augmented reality is being considered, as are QR codes, but both require expensive setup and implementation, and there is no indication of these being widely used anywhere in the international museum world at present.

Analysis of local museum web sites and mobile accessibility

A second part of my analysis was to explore the local museum sector in terms of their current web sites, and also to what extent they are using mobile technologies. This was based upon a user experience of the websites rather than being conducted as a survey, although we will be conducting a survey of museums at the SAMA conference itself.

For this study, I identified around 400 museums as the population, and from this extracted a randomised sample of 80 museums, representing all provinces, cities, towns, and both large and small museums.

The analysis, conducted by my colleague Bongiwe Nzuza, examined the user experience of these web sites in terms of the information offering, the ease of finding this, and how the web site provided access to the collections and exhibitions.

The method involved analysis of the web site in terms of a number of dimensions, using qualitative and quantitative data. The qualitative data concerns the first impressions of the web site, and the perception of the information content available, both of which were

scored on a scale of 1 (poor) to 5 (excellent). Quantitative data concerned where the museum was found on searches on Google, as well as whether particular types of information was found on the web site. An attempt was made to find the web site using Google searches, and in particular which position on the Google search results it was found in. In some cases no web site was found, and in others a link was found to an alternative web site in which the museum information was found, but no evidence of a web site for the museum itself.

The findings include the following:

- 3/80 did not appear to have a web presence at all, thus the sample was reduced to 77 for this study
- 39/77 of those with web sites did not have their own domains but were on another domain (such as a regional domain or a provincial government domain)
- this web site for the 77 was found in Google search position 1 for 54 of the museums, in position 2 for 8 of the museums in position 3 for 6 of the museums, with the rest appearing in positions 4-9 – which means that all of these web sites appeared on the first page of the Google Search. However, this was when the full museum name was entered as the search string.
- when searching Google for the name of the town and the word "MUSEUM" the results were not so encouraging, using the full sample of 80, with 16 not found at all (we only looked 5 pages into the search results), 27 being found on the first page, 26 found on the second page of results, 10 found on the third page, and 1 found only on the fourth page of the search results. This means that many museums may not be found at all from a search if the name of the museum is not known, and based upon the general habit that if the results are not found on the first page then the users do not look further.
- the information content of the web sites were analyses on a 5-point scale as follows (1= none, 2=old with no new content, 3=minimum new content, 4=relatively up to date, 5=up to date), and of these only 25% were considered to have relatively up to date to up to date with their content.
- Specific items of information relevant to visitors was analysis and the percentages of the web sites which have this information was determined (for selected data only – many more data elements were analysed):
  - Hours of Opening: 78%
  - Costs : 78%
  - Contact Details: 94%
  - Email Address: 96%
  - Telephone: 93%
  - After Hours Numbers: 31%
  - Physical Address: 93%
  - GPS Coordinates: 80%
  - Staff Details: 25%

We had wanted to examine the accessibility of online collections and digital resources, but there were none found within this study and so this was omitted. Also we had wanted to see how mobile phones were being used within the museums, and again we found not a single museum with a purposely-built web site or web pages for mobile devices. In all cases the web sites we examined on our mobile devices were difficult to read since they were designed for standard screen sizes for desktops and laptops.

6. Where should we be? A proposed maturity model.

The Mobile Web provides a considerable opportunity for making information available to visitors with mobile phones, as well as to provide an enhanced visitor experience. However, even the best museums in the world are in the process of learning how to create an ideal structure for the visitor experience using mobile devices. From our analysis of the current practices in international museums; as well as from futuristic ideas; and from our own existing work; I have created a maturity model which can be used to assess where an institution is, where they would like to be, and from this to determine how to get there.

I have created a number of maturity models in the past within the heritage sector, and this model follows the same structure as a 5-point scale representing the least to the more mature of organisations. At the outset I need to mention that there are no institutions in the world at present which meet the highest level of this maturity. This is also a first attempt at creating a maturity model, and this will undergo much change and refinement until this stabilises.

Level 1 : No mobile capability

The institution has no mobile capability and no strategy in place. They have not considered how mobile technologies may benefit the museum and will consider that it is too expensive to be implemented.

Level 2 : Publicity. Electronic brochure on mobile / mobile web site

An initial set of web pages are provided in the form of an electronic brochure, similar in content to the range of brochures provided. This may be small or larger (multiple web pages). This is primarily of interest to visitors who intend to visit the museum, and this is in effect similar to the full size web pages which many museums have at present. However, since most tourists travel using mobile phones and tablets, this has a considerable benefit to attract tourists who have not previously made a decision to visit the museum.

Level 3 : Visitor Support. Mobile exhibition support / updating

At this level, the institution provides more information for the visitor during their visit using their mobile phones. This includes support for interpretation of exhibits, providing this information in various media forms (test, image, audio, video), and in various languages to support the visitor profiles.

The web site is updated regularly with news and a calendar of events, and information on permanent and temporary exhibitions is provided.

Visitors who register for the museum mobile web site are profiled in terms of their demographics and biographical information which is then collected for further usage.

Level 4 :Engagement. Community engagement / virtual tours

There is engagement with all stakeholders and the community, including feedback provided by the visitors, with ratings and suggestions. Regular newsletters provided to the stakeholders, and the community or the museum "friends of the museum" is organised using their mobile phones and tablets as the primary means of interaction and interface.

Virtual tours are provided for people who visit and want to move through the museum or heritage site in different ways or different route, or to follow different stories.

Access is provided to digital collections using a search engine.

Management information is provided to support all needs of the institution.

Level 5 : Total mobile strategy

The connection between the stakeholders and the museum or heritage site is conducted primarily through their mobile phones. Notifications are made for all upcoming events through SMS, email or other technologies. The museum or heritage site is as much a "digital institution" as it is a physical institution, so that the memories which the institution preserves and which it makes available are an integral element of the total museum strategy. All museums and heritage sites will eventually become digital, and some may be totally digital, with no need for physical access.

All collections are available in digitised form, including a range of forms and formats. There are integrated collection management processes which are conducted with support through the mobile phones.

There are technology and format watching processes in place to continually upgrade and improve the experience and benefits to the users.

7. What we are doing - Mini Web Pages and Virtual Exhibits

Our approach in the ETHER Initiative has been to focus exclusively on the Mobile Web, and to build special-purpose web pages for museums on top of our existing mobile portal structure, which is called XtownX. This portal is a fully-featured environment for delivery of mobile web services which provides around 90% of the mobile web applications as pre-built components. As a result, this greatly reduces the time and cost of implementing a new mobile web facilities.

The XtownX Initiative has the goal of making local information available to residents and visitors within a community, using a "town-based" model of information management. XtownX is focused on three primary areas being tourism, local economic development and eGovernment, and the core offering is a "mini web page" which any business, museum or government service can have to complement their primary web site.

When applied to museums and to heritage sites we refer to this as the "Virtual Museum" and it is used to enhance the capability of all museums, large and small, rich and poor, to greatly improve their communications with their visitors and other stakeholders.
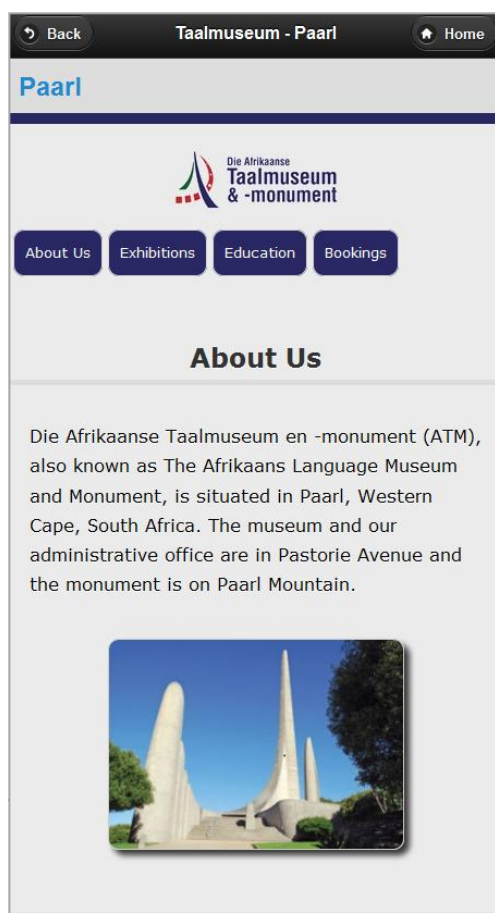
Mini Web Pages

The first part of the Virtual Museum is to provide for a basic web page which is customised for each museum, and which provides the essential information to visitors through their mobile devices. The previous section outlined what we are looking for in terms of a maturity model and simply having a Mini Web Page already provides the first level of maturity.

We have hired young people in many towns around the country, and have trained them to research the towns and to build these Mini Web Pages. We expect that they will be able to design, build and implement a small Mini Web Page within a few hours, and the largest of these Mini Web Pages within 2-3 days.

Virtual Exhibits

A second part of our Virtual Museum structure is to provide for mobile-based exhibit support, in which the visitors can enter a simple code while viewing the exhibit and then to get a range of interpretive information, which is far more than is possible to place on a small label or information sheet.

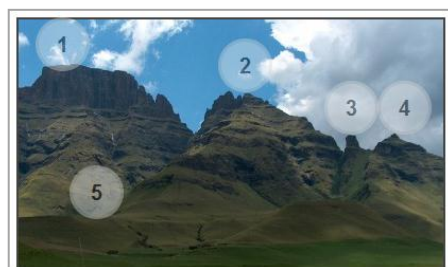For this, we have rejected the alternative approaches of QR codes, and social media, and have rather developed a special purpose approach using the Mobile Web.

For example, we have created a pilot for the Fort Nonqgayi Museum Complex, using a few sample exhibits, which is available through simply typing in a code which is a number 1-11.

In this example we have the Mission Museum Chapel from the complex, with a single web page which is access by simply entering "1" into the code entry block.

This can be provided in a variety of languages as required (including Norwegian, which is the nationality of many visitors to Eshowe), as well as Zulu.

Other Features of the Virtual Museum

Further work is progressing on the design components of the Virtual Museum to ensure that this keeps pace with new technologies and heritage requirements. These include support for audio and video, and more advanced interfaces. For example, in the Drakensberg we are building a mobile web interface for the various walks in the World Heritage Site which allows visitors to gain information about what they see when standing in different places.

In this example I have shown the picture of the Cathkin region and showed a number of the peaks and places. At an information board on the hiking routes the visitor will be able to select the coded number and be able to see the individual mountain peaks on the mobile web page which they can see in front of them, and can get further information on these. The visitor in this case simply touches the various numbers 1, 2, 3, 4, 5 and the information is provided in the block below the page.

We are using this to also build up a digital repository of local knowledge of the various sites including local legends and history.

8. Discussions - Lessons Learned and Future Plans

The largest single problem is to introduce the mobile technologies to the visitors, since this is new approach and they have not seen their phones as having the power to interface in this way. It is for this reason that we are focussing on developing proof of concepts in order to be able to offer this a new alternative for museum and site publicity, promotion, and to improve the visitor experience.

My research has shown that very few institutions in the world as yet at this level of integration and usage of mobile with museums and heritage sites, and yet there is no technical reason why not.

We have also learned what information is important to place onto the mobile web pages, to be of benefit to the visitors, and most of this information is already readily available.

We are learning all of the time in how to improve the usage of mobile technologies in museums and heritage sites and would welcome the opportunity to work with your institution.

Finally, we are learning daily what more we can do with mobile technology to improve museums and heritage sites, and look forward to exploring the potential of these in pilot situations.

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