6. RESULTS, SUMMARY AND CONCLUSIONS

The SCWM prototype was the outcome of the modeling research. Hence the result of this research is the cloud based design. This was developed based on the technology stack specified in the chapter 3, using Zend Framework, Apache web server and PHP scripting language on the Netbeans IDE platform. The model designed had to be tested if it was cloud ready, by deploying on the cloud platform. Jelastic was the testing platform identified. The steps for deployment are detailed below:

6.1 Steps for Deployment on the Cloud

6.1.1. Cloud Container

- This container will hold the application or in other words the application is deployed in this container.
- This container will contain the environment set up, application server and database server
- Testing of deployment, Hamby & Steve (2012) was done at the Cloud Jelastic.com

6.1.2. About Jelastic.com
This Cloud was choosen to test the deployment as it this Cloud hosting services offered easy steps for deployment.

1. The environment set up is done with a preset for autoscaling if needed. If offers a wide range of software stacks that included Apache, PHP and MySQL as required.
2. If the application needs multiple computing instances, the deployment automatically updates them.
3. Jelastic offers vertical scaling so if the PHP application deployed needs additional resources when the load grows, the Cloud provisions for the same.
4. Jelastic offers horizontal scaling so that if additional app servers are required, the load is distributed evenly by the balancer between different instances.
5. It also offers application version control, so if the code can be shared at Git and pushed to the Cloud.
6. It offers tools to analyze and monitor the application regarding the usage of the resources like load, memory, CPU, traffic consumption and historical data.

6.1.3. Steps for Deployment

1. Setting up an account in the Jelastic Cloud.
2. Creating the Environment with Apache, PHP and MySQL.
3. Uploading the package.
4. Deployment of the package.
5. Configuring the production environment.

The SCWM model designed had to be tested if it was Cloud ready, by deploying on the Cloud platform, Hamby & Steve (2012). The steps for deployment are executed and the details are given below:

6.1.4. Execution of Deployment

1. An account was set up in the Jelastic Cloud for free trial version. After logging into the dashboard, the Create Environment option was selected.

   Apache server ver 2.2, PHP 5.4 and MySQL 5.5 was choosen to set up the environment.

2. The environment URL: http://env-1353725.jelastic.planeetta.net/ was received in the email account.

3. The details for the MySQL node were received in the email account.
   Access URL : http://mysql-env-1353725.jelastic.planeetta.net [ This is also the hostname]
   Login : root
   Password : KJC82uLbd7

4. The essential services module deployment package was zipped and uploaded to the container.

5. The database for the essential services was exported into a zip format and this was imported in the MySQL node of the jelastic.planeetta.net

6. The user root was given privileges for the database of essential services.

7. The essential services module was deployed to the container.

8. The production environment was configured as follows
   Connection name: conn_mysql
hostname: mysql-env-1353725.jelastic.planeetta.net, userid: root, Database: eservices

The application link was tested from the dashboard and it successfully got redirected to the landing page. The essential services module was successfully hosted on the Cloud. This way all the other modules also can be mounted on the Cloud. The success of the deployment on the Cloud helps to conclude that the design for SCWM is suitable for Cloud hosting. With this we can say that the proposed Cloud based model for SCWM is a technically feasible model. The testing of the deployment is shown in the Fig 6.1.

6.2 Discussion of Results

The Indian society is gifted with the presence of the senior citizens who are a precious lot to the society. The seniors are a treasure of knowledge and they have made played a marvelous part to the building of the nation, home and society along their journey of life. India is a country with the world’s second largest number of senior citizens. Trends indicate that the elderly population will rise and by 2050, 20% of Indian Population will be senior citizens. The bulging population bubble of the elderly is a cause of concern; hence it is vital to plan for the future of the senior citizens, as it will benefit both the individual and the country. The Government of India and some NGOs are taking efforts for their welfare, but they are unable to reach out to the entire community of senior citizens. The focus of the research was to understand and support the initiatives taken by the NGOs and Government of India for the senior citizens and identify the additional requirements if any. The outcome of the study was a cloud based model to support the Government of India’s initiative for the senior citizen’s cause so that it can reach out and serve a larger section of the community by building an elder friendly eco system that promotes wellness, and thus makes ageing a pleasant experience. The research was pursued with a socio-technical approach to serve humanity by the innovative use of technology. The work flow for collecting and consolidating the user requirements was based on iterative and incremental development. As the IT industry has grown into a service oriented industry, software applications are built based on the usability of the software by human interaction and behavior. Adopting this approach, the main focus of the research was to understand the needs of the senior citizens and design and develop the prototype of SCWM system by incorporating user requirements at every stage. This is to ensure that the final product is usable by the end users. This technique resulted in the evolution of both requirements and solutions through collaboration with the user.
Figure 6.1 Testing of Deployment Screenshot
6.3 Summary of Execution of Research Objectives

The study of proprietary reports of various research organizations formed the main motivation for the research. Government of India suggested the necessity to establish a senior citizen’s service and information center through which they wanted to create awareness among senior citizens about the different programmes, services, camps and other services available for the senior citizens. They also want to provide services required by the senior citizens by planning, assessment of the needs of the senior citizens. The needs assessment was accomplished from primary sources and some of it was extracted from secondary sources also. Agewell Foundation wanted to extend wide across to a huge section of the aging community and help so that they become a point of motivation for transformation so the divide that prevails between the generations is bridged and also bring about a life of comfort and respect for senior citizens. Helpage India wanted their services to reach out to a large community of senior citizens. They wanted to develop a solution which enabled the elders to form groups that were of common social goal and collaborate for projects of social nature that are useful and benefits the general section of the public but additionally it is of enormous advantage to the senior citizens community themselves. The Silver Innings team also wanted to provide services for the ageing community, so that they could support their mantra for aging gracefully through the internet gateway. This motivation was realized by executing the research in two stages.

Research stage I involved user requirements gathering and functional design. The approach was a combination of explorative and survey research. The explorative part involved review of pertinent literature and requirements gathering from end users by survey, discussions with domain experts, and other beneficiaries. The primary data from survey and the secondary data from the reports both were analyzed to identify the services required so that the system could be designed accordingly.

The research stage II involved design of functional model, business model, and technical feasibility study. This helped to determine the technology to design and develop the prototype. Cloud computing was proposed as the optimal technical option for the same. The prototype was designed and its features were demonstrated to the end users. The user feedback was collected and
the end user responses were analyzed. This helped in identifying the additional requirements to be added to the prototype.

The modeling research involved the detailed design of the Cloud based model for SCWM. The user requirements specifications from research stage II helped in designing the basic functional model. This was followed by the detailed high level and low level design of the modules. The prototype was designed, developed and demonstrated to the end users. Their response was collected, analyzed and additional requirements were identified and incorporated. This cycle continued till all the user requirements were covered. The deployment of this model on the Cloud was tested only for the essential services module on the Jelastic Cloud as a reference. This way the end users were made an integral part of the research and development process. This ensured that the end product catered to their requirements and it was also easy to use by them.

6.3 Evaluation of the Prototype by End Users

The repetitive and development done in phases helped to refine the requests and design system that is the by-product of continuous association with the user. This approach helped in adaptive planning, design of the interface, decision of business model, development and implementation based on an iterative approach. This model involved the active involvement of the user throughout the entire lifecycle thus; it ensured that user expectations were clearly understood. Prototyping helped the users visualize and request changes to the system as it was being built, this ensured that the system being built is according to the user’s needs. The final evaluation of the prototype by the end users was set as the benchmark to determine if the approach adopted for the prototype design and development of SCWM was correct. A demonstration of the working of the prototype of SCWM was conducted at senior citizens associations and at the NGO Silver Innings. A survey response form to collect the user feedback was designed; this form can be found in Appendix A [Form-C]. This survey was conducted on paper. The application was hosted on the JElastic Cloud and link of the system and the link of the Google docs feedback form\(^1\) was floated through web sites, blogs and email. This step was essential to conclude if the end users, whose opinion was taken for formulating the user requirements, have finally approved

\(^1\) [https://docs.google.com/spreadsheet/formResponse?formkey=dDB5Q0V2OVN0VHBNNWGNMI0zRjJiZmc6MQ&iq](https://docs.google.com/spreadsheet/formResponse?formkey=dDB5Q0V2OVN0VHBNNWGNMI0zRjJiZmc6MQ&iq)
the end product. The online survey was conducted for a period of four months from Nov 2011 to Feb 2012 since this was the time period for which the subscription of JElastic cloud service was valid.

Table Error! No text of specified style in document.-I Sample Details of End Users Response about SCWM

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Questionnaire for Survey on Health Care Services

1. The system interface will be very easy to use but still you will be given training for using this system on the internet/mobile are you comfortable with this idea?

2. The system will store your health records and you can access them from anywhere, anytime. Do you welcome this idea?

3. Location-based query for hospitals or specialists or doctors, do you think this will be a useful feature?

4. Online help with video tutorial of medical devices. Do you think this will be a useful feature?

5. Online medical dictionary. Do you think this will be a useful feature?

6. Online tracking of vital parameters. Do you think this will be a useful feature?

7. Appointment reminders or medical reminders. Do you think this will be a useful feature?

8. Online consultation with doctors. Do you think this will be a useful feature?

9. Does idea of complete cashless health care interest you?

10. Access to home health care services like doctor/nurses/pathologists is necessary?

11. Tips for health, diet, and regular exercise for your overall well-being will help you?

Questionnaire for Survey on Essential Services

12. You will prefer to hire home care services like maid/attendants/drivers/cook from authentic sources?

13. Assistance for bill payment/banking services in day-to-day life will help senior citizens at some point of time?

14. Tiffin service for normal daily meal/special diet/occasion do you think this is a useful feature?

15. Will it benefit you to get access to authentic legal/financial/tax consultants through the system?

16. Do you support the idea of travel assistance within the country/abroad will benefit senior citizens?

Questionnaire for Survey on Information Assistant

17. Would you like to get information about religious/social events in your locality through this system?

18. Would you like to get access to employment/volunteering opportunities?

19. Are you open to the idea of social networking with your peers through this system?

20. If you upload the details of your property/investment details onto the system it will be stored securely as a portfolio and you will get timely reminders for maturity/payment of premium, etc., does this idea interest you?

21. You can enter the entire family information/contacts/upload photos and it will be shaped like a family tree/album/Portfolio does this idea interest you?
Survey Results of End User Feedback on SCWM System

Figure 1: Questions and Responses

- Familiarity with internet (%): 120
- Comfortable using mobile (%): 80

Figure 2: General Opinion about the Services
- Health Care: 0.7
- Essential Services: 0.3
- Information Assistant: 0.1
- All of the above: 0.6

Figure 3: Overall Rating for SCWM
- Needs improvement: 10%
- Satisfactory: 20%
- Good: 30%
- Excellent: 40%

Figure 4: Opinion of the system to promote overall wellness
- Yes: 90%
- No: 10%
6.4 Summary of User Response and Conclusions

The response from the senior citizens community about the SCWM prototype indicates that they have welcomed the idea of SCWM. The results reveal that 80% of them are comfortable using a web based system. Major part of the survey was conducted online using a Cloud based tool as a research instrument and the senior citizens were very comfortable using it. This method also helped in reaching out to many of them with ease. Most of them have opined that the health care services that could be provided through the system would be very beneficial. The online health portfolio, video tutorials, storing of vital parameters, location based query for health centres, practitioners, and home visits of doctors, care givers through the system was very well appreciated. Handy tips for diet, prevention measures for NCDs, by tracking of vital parameters and trends, options to talk to health practitioners to help them adopt and a healthy lifestyle would enable the reduction in the incidence of NCDs, they opined. The seniors also preferred to get information from authentic sources about essential service providers. They also felt that the assistance for bill payment, tax consultants, banking, and travel assistance would be really beneficial for them on a day to day basis as, many of the next generation have migrated overseas and most of the seniors required assistance in this area. The access to the information and opportunities through the information assistant also was well received. The personal and wealth portfolio was also favoured as a useful feature. Exclusive opportunities for senior citizens for employment, training and the most important of all, being connected to their peers by social networking on the forum received a good response from the senior citizens. The SCWM system, can provide them the necessary health care services, essential day-to-day services, keep them socially connected with their peers and also keep them well informed with necessary information needed for their wellness. Since health is a by-product of emotional well-being, this will promote healthy aging and overall Wellness. This is an attempt to support the Government of India’s programme to assist the senior citizens. The use of Cloud technology can help in their initiative to reach out and serve a larger section of the senior citizen community.
6.4 Summary of the Benefits of SCWM

The online method used to collect the end user response enabled to develop an understanding about how comfortable were the senior citizens to use a web based system. They could easily fill the online survey that was Cloud based Paas -Google Docs Forms. This method also helped to reach out to many senior citizens with ease; this demonstrates the power of the Cloud to reach out to a large section of the community. So we can conclude that leveraging of Cloud computing for this social cause is beneficial. Apart from this, the benefits to the different users of SCWM system can be consolidated as follows:

Benefits to Senior citizens - End Users

- The senior citizens could use the interface of SCWM system with ease, without any formal training.
- SCWM provides every senior citizen with a user id and password, using which they can login and they get access to their medical record which would be now their possession and they can take complete charge and have full control of their record.
- The senior citizens who are members can decide and control whom they would like to grant access to the patrons they decide. Only if required they can share the access of their medical record with the health practitioners.
- Online health portfolio can help the senior citizens to access to their records virtually from anytime, anywhere with just an internet connection.
- The system is a gateway to many add-on health services like video tutorials, storing of vital parameters, location based query for health centres, practitioners, and home visits of doctors, care givers through the system.
- The system provides awareness and prevention measures for NCDs by handy tips for diet, tracking of vital parameters and trends, options to talk to health practitioners. This helps senior citizens to adopt and a healthy lifestyle would enable the reduction in the incidence of NCDs.
- The senior citizens have access to various essential service providers for assistance in various day-to-day activities like bill payment, tax consultants, banking, and travel assistance.
- The system also provides access to the information and many opportunities, and very useful feature of personal and wealth portfolio.
- The SCWM system would provide access to a bundle of opportunities for employment, training for senior citizens exclusively and also help them to be connected to their peers by social networking on the forum.

**Benefits to Health Practitioners**

- The SCWM system enables the health practitioners and professionals to access health related information, it also enables transactions online and automate and streamline practices in health care on an enormous scale.
- Health care services can be reached out to the entire community of senior citizens.

**Benefits to NGOs or Government Organizations - System Administrators**

- The Cloud based model of SCWM proposed would not require a very high capital investment for space to house data storage, infrastructure. The Cloud can self-provision if the number of users grow.
- The management and control of the administrative functions, billing and customer management can be easily managed by the Cloud interface. It provides user friendly interface for billing and metering the usage of resources. So infrastructure and resource management is no longer a concern for the system administrators.
- The system administrators found it easy to use the system interface, so there would be no need of experts to handle the IT operations so they can be more focussed in their core task of service to the community.
- The Cloud based SCWM system design has the potential to sustain concurrent, transactions, load balancing and for a huge customer base. It also can efficiently utilize the resources and offer good processing power.
6.6 Concluding Remark

The cloud based design of SCWM that is delivered as a result of the study with a socio technical approach, is a cost efficient web based model with a user friendly interface. The senior citizens’ response shows that the functionality provided by the system is as per their needs. The system is easily accessible by every senior citizen, or NGO or any other organization working for the cause, across the country anywhere, anytime. The system design will enable the administrators to use the system, without the need of huge investment for infrastructure or training of IT operations staff. The design also supports the business model needed for sustainability, management of the billing, administrative operations, utility of the system, and customer support operations.

Hence the research objective to support the Government of India initiative to establish a senior citizen’s service and information center through which they wanted to create awareness among senior citizens about the different programmes, services, camps and other services available for the senior citizens can be realized by implementing this system in the center. The system provides awareness and prevention measures for NCDs by handy tips for diet, tracking of vital parameters and trends, options to talk to health practitioners. This helps senior citizens to adopt and a healthy lifestyle would enable the reduction in the incidence of NCDs.

The Government of India also wanted to provide services required by the senior citizens by planning, assessment of the needs of the senior citizens. As mentioned the needs assessment was accomplished from primary sources and some of it was extracted from secondary sources also. Additionally, the repetitive and development done in phases helped to refine the requests and design system that is the by-product of continuous association with the user. This approach helped in adaptive planning, design of the interface, decision of business model, development and implementation based on an iterative approach. Agewell Foundation, Helpage India and Silver Innings The Foundation wanted to reach out to bigger section of population of older persons and narrow the divide that prevails among the two cohorts and thus establish a life of
comfort and respect for the aged. The SCWM has been designed on the Cloud platform and the reach out to a large section of the community is evident when the survey was conducted online using a Cloud based tool as a research instrument and the senior citizens were very comfortable using it. This method also helped in reaching out to many of them with ease.

### 6.7 Scope and Limitations

The success of the project entirely depends on building the eco-system that can make the digitization happen. The cloud based software model is the first step in this direction. It aims to bind the health care services with other essential services to provide a holistic and exclusive solution for the senior citizens. The big picture still depends on implementing digitization at the hospitals, the data entry by the doctors, digitization at the diagnostic centers, building of the data of the entire Indian localities related to health care, formulation of the support service provider organizations and the senior citizens interest to provide timely feedback for the system to improve and develop. The health care sector is booming with plans to implement digitization. In the current scenario if a senior citizen wants to take a second opinion from a doctor, there are no digitized reports. Only with digitization, the records can be available online, and second opinion from other experts can be taken. This will also help to preserve the records and avoid re-conducting the tests again and again.

### 6.8 Future Enhancements and Suggestions

The screen name for the SCWM project has been proposed as Jyeshta Ayush, which means “Elder’s Long Life” with the motto “Your wellness is our concern”. The secret to the elders’ long life is their wellness management, which is provided by the Senior Citizens Wellness Management System.

**Services Expansion**

The system design provides scope for different services to be integrated as per the needs of the Senior Citizens and for lateral expansion to add new services. This can be achieved by the flexibility of the cloud. The data of different health care centers can be collected from different
web sites by data sharing. E-commerce can be integrated to include the shopping module. Third party service providers get a platform market their services.

Social Networking
The system can integrate different social forums for the seniors to stay in touch with their peers and also promotes marketing of the services. Authentication is currently based on the system login id and password but, the system also provides login through social forums like facebook. This enables the sharing of profile and the user can access all his account information using the single sign on mode. Social networking will help the senior citizens to overcome their laziness. Social networking also enables marketing of the services, and products available for their use.

Mobile App
Currently India has a customer base of 904.56 million mobile subscribers\(^2\). India’s ranking among the countries with a large customer base of users of the smartphone users is number three and it has subscriber population of approximately 117 million. The health care industry is already responding to the increase in the popularity and availability of technological innovations, such as tablets and smartphones in many developed countries. With a huge customer base, India has the potential market for health care delivery through smartphone apps. Many Health care and wellness applications are being developed and is estimated to make up to approximately 40% of new smartphone apps. Health applications can be adapted both by healthcare professionals and customers that will revolutionize this sector. This is a cost effective solution that can be used with much of formal training by the end users. Community health care products are thus being launched via social care apps and other online services.

The current design can also be made available as a mobile app as the forms and interface are designed on those lines; however, the packaging of the app has not been tested. The mobile app will empower the seniors living in the rural areas. Mobile is easily affordable so this way it will reach out to many more seniors in the different terrains and remote locations of India. The

\(^2\) http://en.wikipedia.org/wiki/List_of_countries_by_number_of_mobile_phones_in_use
A mobile app will enable the health practitioners to view x-ray results, tracking symptoms and vital statistics, and help them to diagnose, monitor and treat many common diseases.

The mobile app can enable the training of the service providers and other volunteers who are working for this cause in remote locations. It has built-in connectivity that facilitates a blended learning platform with easily access to information that can be updated. This mobile app would be a flexible solution that would be available anytime, anywhere; ideal for both time-poor professionals and students. Mobile phones are easily affordable hence the mobile app also can bring huge cost savings. People are used to it so the applications are designed to be simple to be used and there is no new learning curve.

**Kiosks**

As an enhancement, kiosks could be set up in pharmacies that will help senior citizens to measure their vital parameters that could be automatically uploaded into the system by logging in with their secure access. These kiosks could measure vital parameters like blood sugar, pressure, weight, temperature etc, and the senior citizens can login into the system and as these parameters are measured, they can be uploaded. This will save a lot of time and will empower the seniors to track their vital parameters independently.

**Integration of SCWM with remote medical diagnostics**

The SCWM system could be integrated with a remote medical diagnostics device which could be a boon if it is implemented in rural areas. As in these areas though the Government of India has set up quite a few facilities for delivery of health services and care, but unfortunately amenities are not sufficient to cover the complete population living in the rural areas. Many facilities currently being run do not have sufficient resources and also lack well-trained medical professionals, as a result the rural population does have access to good healthcare facilities. Young people in rural areas have to travel to places in the cities in order to get access to basic medical services. But the elders who dwell in these localities are too weak to travel. Facilitates

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3 http://healthmarketinnovations.org/sites/default/files/ACCESS_NSCPL_Case_study_Final%20(1).pdf
should be made to aid in remote diagnosis in order to achieve this provision to transmit the different vital parameters collected from the patient to a doctor should be available. This will enable them to make a primary diagnostic judgement. For this a system was proposed to monitor six health parameters like Electro cardio graph (ECG), Blood pressure, Body Temperature, Heart Sounds, Oxygen Saturation (SPO2), Heart and Pulse rate. The device The ReMeDi Solution is a system that is intended for working across different type of communication protocols – “the store and forward”. From this the conclusion that can be drawn is that this system can allow the entry of all the health data and later in the future when there is a possibility of a connection, then all the digital information can be transferred. There is a second mode in which if it goes live then depending on the available bandwidth for real time data transfer, it establishes connection and transmits the entire health parameters in a low bandwidth channel on a real time basis. The transmission operation is possible at a very low bandwidth (upward of 32Kb/sec). The data from such a device could be used to capture the data and store it on the SCWM health portfolio. This will help the doctors to observe the trend of change in the vital parameter. Data entry also would be automatics which saves the health practitioners a lot of effort and time.

**Data mining for Health care**

When the system becomes operational and the database of members begins to grow, the data will be a significant resource for many organizations. The data could be mined and the patterns studied, to understand the ongoing challenges faced by Senior Citizens related to health and sustenance of day-to-day life. Health practitioners can identify better methods for treatment that can give them better results and it helps them to improve their services, from the vital parameters and health portfolio this in turn helps them to deliver better health care services for the needy that is also more cost effective. The huge amounts of data generated by healthcare transaction can be processed using Data mining techniques. Using these techniques, these dunes of records can be transformed into knowledge that can prove to be useful to make decisions. Data mining can help the health practitioner and the other applications in healthcare to evaluate how effective has the medication been as a remedy for dealing with diseases and other facilities for health management, management of consumers and the uncovering of issues. It also enables the
healthcare practitioners to identify the potential threat that can be identified and prevent the occurrence of NCDs like diabetes.

Data Analytics for Business Entrepreneurs

Business entrepreneurs can use the data for performing analytics so that they are able to understand and address the evolving needs of the Senior Citizens. The senior citizens themselves can notice the trend in their vital parameters and plan to visit the doctors when the vital parameters cross the safe limits. The health data would be a valuable source for health ministries, health practitioners and insurance agencies, for e.g., the data could provide insights to insurance companies to come up with a Senior Citizen friendly insurance health cover. The system is an enabler for the development of all the support services that could eventually result in the building of a senior friendly eco system to serve the Indian elders of today and tomorrow. The research work is a modest attempt to make aging a pleasant experience, help the elders live with dignity and live life to its utmost.