Web-Based Smart Farm Data Monitoring System: A Prototype

Onine M. Mico[1*], Paul Bryan M. Santos[1], Rionel B. Caldo[1]
[1]Computer Engineering Department, Lyceum of the Philippines University - Laguna

Corresponding e-mail: *onine0803@gmail.com

Abstract
Hypertext Preprocessor (PHP) is the programming language that the proponents will be using for the proposed paper. This study aims to build a web-based system for smart farming. In addition, the proponents will be using temperature and humidity sensors and soil moisture sensors as inputs to the system. This secured web-based system is built with usernames and passwords for a user account. With the use of PHP, the updates on the information about the farm will be updated whenever the user wants to know about the plant environment. The information to be collected were monitored in different parameters such as Temperature and Humidity and Soil Moisture. The design of the system is such a user-friendly GUI which can be easily understand by the users. There will be a menu categorized by separate parameters which the users can decide on whatever they want to monitor. There will be a button for monitoring in every category in order to make it understandable for the users. The sense data will be stored in a database and with the use of crystal report, it will be outputted in control charts. This system will use microcontroller, which will be connected and interfaced on the web using PHP for effective Internet-based monitoring and data management system.

Keywords: *Hypertext Preprocessor (PHP), MySQL, security, temperature and humidity and soil moisture sensor, crystal report.*

1. Introduction

This chapter aims to discuss the motivation and obtainment of the study. It contains the background of the research and the stated problems. The objectives and scopes of the project are stated as well as the significance of the study. This chapter would serve as the validation in defining the feasibility of the study.

1.1 Background of the Study

Nowadays, large farms are being cultivated in different places in the country, and because of that, it is quite difficult for the farmers to check how or what is happening to their plants. As time goes by, the world is being innovated and human begin to develop and implement advanced technologies that can help through this kind of problem.

Hypertext Preprocessor has an acronym of PHP. This programming language is a server-side HTML embedded scripting language. HTML embedded means that the PHP statement can be in an HTML code and its return the data to web as empty HTML. It is not a paid software and is an open for every user. This language runs on the server meaning that the running process (starting point) codes are made on the server where the web is located. PHP supports many databases such as MySQL, Sybase, Oracle, etc. It also runs in distinct software such as Unix, Linux and Windows. It is compatible with almost all web-servers used today such as Apache, IIS, etc. and can have the following extensions: PHP, PHP3 and PHTML. A programming language which is Scripting language

supports scripts, human operator can execute the tasks alternatively one-by-one and the programs written for a special run-time environment can automate it [1].

However, PHP is the most popular server-side language on the web. It is designed get and replace the content in the repository. An SQL language written and combined with databases. Structured strictly for the web and said to be one of the most used language. Staying competitive with lots of new designs, easy to install, and is made up for a number of managing systems for the content [2].

The researchers are proposing a system that is necessary for the farmers to monitor the plant environment in a farm. The design system will help the farmers in monitoring the plant environment parameters in the web. In agriculture such as farms, manual checking of plant environment belongs to an old practice. The parameters of the system includes soil moisture, temperature and humidity that will be monitored by the sensors Thus, the proponents decided to make a study about a system that can monitor the plant environment through web. This will be implemented in the agriculture such as farms and other kind of planting business, in order to monitor the plant environment online. The development of the new system is important for influencing future agriculture.

In due time, the study tolerates today's farmers on using different technologies and measuring tools for an accurate information for better efficiency and quality. The system includes monitoring and storing information of plant environment that may be the possible cause of affecting the growth of plants. With the used of different monitored parameters, it will help the farmers and users to know the condition of the environment of plants via web. The time and effort that they need to provide can be lessen in the farms. In addition, it may help them to take action rapidly when the monitored parameters are not good and gives solution in order to maintain the quality of the plants. Furthermore, the proponents gives an approach by using Notepad++, PHP - MySQL, Crystal report and the sensors (temperature, humidity and soil moisture sensor). This will help the user to monitor the environment inside the farm and the information will be stored in the web.

1.2 Objectives of the Study

The main goal of this research is to develop and design a web-based system for data monitoring and management system.

Specifically, this study aims to:

a) design a user-friendly GUI for the system which allows real time sensing of the information on the plant environment;
b) monitor the plant environment in different parameters used;
c) provide a repository (database) for the sensed data using PHP programming language;

d) develop a database for the gathered data and to be organized in the form of control charts or graphical representation;
e) test the functionality and accuracy of the system by having some trials on actual monitoring of the parameters then comparing it to theoretical monitoring which is the use of sensors.

1.3 Significance of the Study

The main focus of the study was to observe and monitor the temperature, humidity and soil moisture of the plants in the farm that would help the farmers and users to check the parameters status using a web-based system.

In addition, the system will not only benefitted to farmer and users but also to the proponents because they will be able to gain deep knowledge that will largely help them in the near future. By conducting this study, it will give them a chance to sustain and to show their ingenuity and capability.

This project is capable of monitoring the plant environment in the farm such as temperature, humidity and soil moisture. It will be monitored using the following sensors: temperature, humidity and soil moisture sensor. The said sensors uses a solid-state strategy in order to observe the environment parameters of the farm. In this system, the proponents will use a programmable microcontroller that helps to operate the sensors to work on with its sensing ability. It will be stored in web with database that will produce control charts of the parameters monitored that will be seeing by the farmers and users. With the help of PHP programming language, they will create a GUI for the users that could serves as the server to monitor the current parameters in the farm and could presented in control charts using the crystal reports in the database. The server serves as the command of the microcontroller to instruct the sensors to sense the data and be the database for the records of the plant environment parameters of the system. The information gathered helps to determine whether the farmers need to take action on the farm environment. This will be a concern by the farmers as the readings of the environment parameters change time by time and knows that it affects the growth of plants for its quality. The proponents would provide more effective and accurate results that would serve as proof for the web-based data monitoring system.

1.4 Scope and Limitation of the Study

In this study, the proponents designed and developed a Web-Based Data Monitoring System that was capable of monitoring the plant environment parameters through web with the use of different sensors. The said system would be working after the farmer or user proceed to the web wherein the commands were placed whether to

monitor the temperature, humidity or soil moisture. The displayed output will be shown in the web after commanding the sensor to gather data in a specific parameter then flash in control charts in the database using crystal report. This will help the farmer or user to lessen the manual monitoring of the farm environment and could monitor it through web. The system will be implemented online in order to monitor the plant environment in not only a local area but also even if the farmers are not around the farm. Thus, the usage of mobile phone or tablets can be more efficient when it is an online based because it is reliable to use everywhere than bringing a laptop.

Notepad++ and PHP-MySQL will be used for developing the system. PHP is a server-side and embedded with HTML[1]. That is why the proponents make use of notepad++ for the graphical user interface of the system. The use of temperature, humidity and soil moisture sensor are part of the study that the proponents will provide their own sensors and Arduino microcontroller for data monitoring of plant environment parameters.

The system could not manage to solve the problems in the environment of the farm but once the farmer or user check it on the web, they could be alarmed if the condition of the plants were okay or not. The system could run in a personal computer or laptop with a require application of PHP-MySQL where in the database are recorded and can be viewed through web. However, by implementing it through online, it can be also run and open in other mobile gadgets such as mobile phones or tablets that wherever you go, as long as the users open the local host, the web could be view and monitor even if they are not in the farm area. The said system used wired communication on the serial port of the hardware and software. This system was only limited to the said functionality and cannot be beyond its measured.

2. Review of Related Literature

The related literature and studies that the proponents understands, has important aspect to the current study and will be included in this chapter. The researchers come up with different concept and perception for enhancing the data monitoring and management system by gathering many references. Through these researches, the proponent conducted with a firm understanding on implementing the system. The conceptual and theoretical frameworks has composed by the researchers using the reality of information acquired.

Going back from the review of related literature, this part is the summary of it. Gathering all those related studies is very important because it gives us an idea and knowledge for the improvement of our future paper. We have many understandings about the different web-based systems. Many researches about it and with different authors have shown their different strategies on how they work

using web. The use of different sensors are included in some other conducted researches that makes us know that it is possible. Web security plays also a very important role when it comes to web-based systems. To ensure that your necessary files inside the web has a strong security for those who wants to hack it. In addition, many programming languages used in different research papers that talks about web-bases, and it is very useful for us to know and how is it working. Furthermore, there are some concerns about the use of internet. They have found out that the usage of internet nowadays have big impact to the students, professors, workers, industries, etc. Therefore, they have an idea about to discover more on web that will benefit in many people and create a huge improvement in the field of internet. That is why children in the future should know how powerful the technology combined with the internet affects and innovates the world into an advanced society.

3. Conceptual and Theoretical Framework

In this chapter, we present and discuss the steps and methods that we need to design the system. The conceptual, theoretical framework and the proposed design to use in developing system. This includes processes, tools and equipment used in developing the software and hardware system of the project.

3.1 Conceptual Framework

Our study aimed to make, design, and develop a web-based data monitoring system that will monitor, check, and update the user on the environment of plants using charts. In this chapter, the proponents created a diagram showing the order and procedure on how the system created. Using the diagram, we the proponents determined the tools needed in doing this research. In addition, this helps the proponent in building the idea of the whole system.

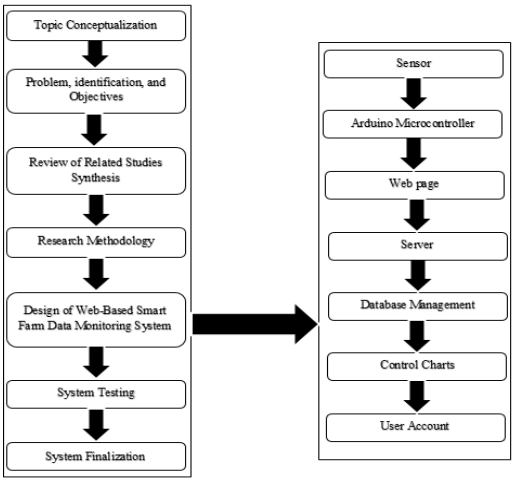

Figure 1. Methods of Research

In Figure 1 this shows the methods of research needed to follow until the finish of the system. First of all, the topic conceptualization, we the proponents studied the idea we have, and that idea came up in developing the "Web-Based Smart Farm Data Monitoring System using PHP" second is Identifying the problem and objective, this is to find the problem and specify the goals in making the system. As the proponents of this study, we observed the problem in a manual way of operation. Next is the Review of Related Literature and Synthesis, in this part, the

proponents needed to create a research which is related to their study a well as getting the important parts in the related literature to see how past researchers make used of the methods in developing a system. Fourth one is research methodologies, in this step we the proponents will show you the different frameworks of the system and methods that will use to design the system. Fifth is to design the Web-Based Smart Farm Data Monitoring and Management System using PHP in the design there are Sensor, Web page, Server, Data Management, Control Charts, Admin and Farmer. The systems testing is next this will show if our system is on the right track or if it has defects or the objectives has been set. Then next is system finalization. This is where the proponents will take a look at the system for small fixes and to stabilize it for the users. Last is the implementation after all has been achieved it is time to implement the system to help the users.

Table 1. Conceptual Framework of the System

Input	Process	Output
• Account for the system • Temperature and Humidity DHT 11 sensor • Soil moisture sensor	• Detect the account inputted • Get the monitored data • Analyze the data • Put the data in the database • Manage the data in the control charts	• Recognition of the accounts • Information of the plants environment will be shown • Display the result of data monitored using charts

In Table 1 this shows the Input, Process and the Output of the system. The Input shows the monitoring of the plants and vegetables. In the Process is to get the data and check if the monitoring of the chart is correct then analyze it. Last the Output it will show on how to control charts of the plants, solutions to the problem and will update the system for the users.

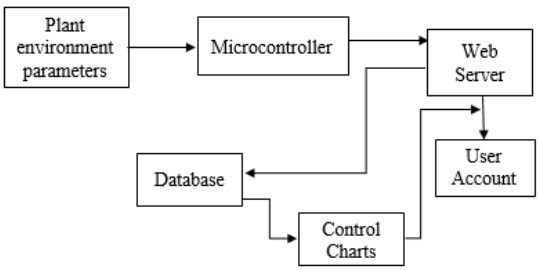

Figure 2. Block Diagram of the System

In Figure 2 shows how will the data flow in the whole system. The diagram is composed of Plant environment parameters as the input, Database Management, Control Charts, Web Server, Microcontroller and User account.

The input will be the gathered data of the temperature, humidity, soil moisture. These inputs will be gathered in the Database management, created from PHP language. Then after the input, the system will create a Control charts using crystal report to show the diagrams to the user. By the help of the control charts, the user will see where the corresponding problems is.

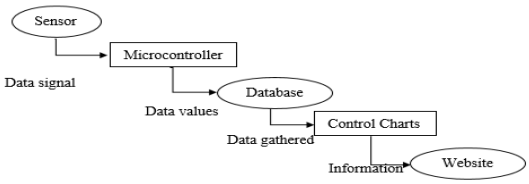

Figure 3: Data Flow Diagram of the System

In Figure 3, Data Flow Diagram of the system it illustrates the function of the system, it includes what happened to the data from the start until to the last stage.

3.2 Theoretical Framework

3.2.1 Hypertext Preprocessor (PHP)

The proponents for the conducted research will use this programming language. Based on the researches, it has five characteristics, which are security, flexibility, familiarity, simplicity and efficiency. Therefore, this makes the language quite easy to understand rather than the other languages. In addition, the security of the important files in the databases or other information that are secured are very safe because the codes are cannot be viewed as the code revamp into HTML before the page was accessed. However, some says that a lot of syntax of PHP was burrowed from other languages like Java, Perl and C. Even though, there are a lot of functions and features that are unique were built in PHP. The goal of this is to allow the web designers to have a quick and easy way to write directly to the pages and it is very good for creating Web sites that has databases [27].

3.2.2 Notepad++

Don Ho. developed this in September 2003. At first, the developer used JTEXT (a Jave-based text editor) and try to develop again another one. This is because of the poor performance of the first and it is written in C++ with Scintilla. This was built for only Microsoft windows can access but they rebuild it with wxWixdget so that it can be used on Mac OS X and UNIX platforms. In the research, it says that this is distributed as free software. In addition, this is one of the most popular editor of source codes in the world. That supports code folding and syntax highlighting for over 50 scripting, markup languages and programming.

3.2.3 MySQL

Many researches says that it is an open-source relational database management system (RDBMS). This is the most widely used open-source client-server model RDBMS in July 2013. In our research, this will serve us our database for our displayed output. Database is an application, which is separated that, has the function of storing the data that has been collected. It can manage and store a large capacity of data.

3.2.4 Arduino Microcontroller

An Arduino microcontroller is an 8-, 16-, 32-bit AVR microcontroller. With integral segments that will encourage programming into the circuit. The imperative part of the Arduino it is a standard connector, which can give the client to interface the CPU a chance to board to a tradable extra module. Without a microcontroller old kind of system create a manually type of controlling system, but with the use of this microcontroller just input a program language and the microcontroller will do the rest.

3.2.5 Arduino IDE

An Arduino IDE is the software that being used for Arduino Microcontroller. By using the Arduino IDE you can control the whole circuit with a simple program language. In over the years Arduino has been the main brain of the millions of projects, in everyday objects to complex one. Students use this system to make a hard project easier

3.2.6 Temperature Sensor

Temperature sensor this device a thermocouple or RTD, providing a temperature measurement through electrical signal. A temperature sensor is two dissimilar metals that creates electrical voltage that is the same or proportional to change of temperature. Electrical voltage that is the same or proportional to change of temperature. Temperature has a major effect for the plants, we the proponents use this kind of sensor to measure how is the change of temperature will affect the plants by getting the data and put in our system.

3.2.7 Humidity Sensor

Humidity sensor a device that reports and measure humidity in the air. Humidity is a ratio of air temperature and moisture. Other plants or vegetable prefers high humidity that is why we the proponents use this kind of sensor to know what or how humidity will affect the plants.

3.2.8 Crystal Report

It is an application that allow the programmer to produce reports in an organized presentation. It can collect different types of information with a minimum usage of codes. It could integrate passes multiple and commonly used database within one report. Developed by Seagate Software [28][29].

3.2.9 Temperature and humidity Sensor

The DHT11 sensor highlights the complexity of a calibrated humidity and temperature using digital signals as output. It assures excellent long-term solidity and high consistency with a digital-based signal. The proponents used this sensor to create the idea of a web-based smart farm data monitoring system it provides the information needed in giving the user information about the environment of the plants.

3.2.10 Soil moisture sensor

The used of soil moisture sensor is to measure the content of water to the soil, the water lever in volume. By the plant uptake and evaporation, it will lead to the loss of moisture, the sensor is capable in measuring and analyze the desire soil moisture contents. We the proponents use this kind of sensor because soil moisture has a great effect in the plants. This will be a valuable data.

3.3 Proposed Design

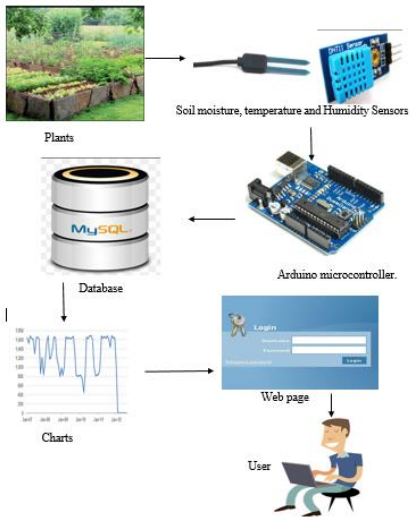

Figure 4. Proposed Design of the System

In figure 4, web-based data monitoring system will be developing by the proponents. The system is having a temperature, humidity and soil moisture sensor that will be controlled by the Arduino microcontroller. After that, it will go to the database, then by using crystal reports it will create charts that will be outputted to the web page that the user will see

References

[1] [Online]. PHP Tutorial - Language Introduction. Accessed May 24, 2016. Available Online: https://www.codingunit.com/php-tutorial-language-introduction

[2] [Online]. Server-Side Scripting: Back-End Web Development Technology. Accessed May 24, 2016. Available Online: https://www.upwork.com/hiring/development/server-side-scripting-back-end-web-development-technology/

[3] [Online]. Website that Satisfy Users: A Theoretical Framework for Web User_Interface_Design_and_Evaluation. Available: https://pdfs.semanticscholar.org/0cc7/d7c4187e872f62fcac8a296534a20f99fc79.pdf [Accessed: April 24, 2016]

[4] S.A. Conger, a nd R.O. Mason, Planning and Designing Effective Web Sites. Retrieved MA, 1998 from IEEE Course Technology, Cambridge.

[5] A.L. Lederer, D.J. Maupin, M.P. Sena and Y.Zhuang. The Role of Ease of Use, Usefulness and Attitude in the Prediction of World Wide Web Usage

[6] V. Flanders and M. Willis. Web Pages that Suck. Retrieved from 1998 SYBEX Inc., San Francisco.

[7] [Online]. Spatial Decision Support System for Precision Farming Based on_GIS_Web_Service. Available: http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=5231336&newsearch=true&queryText=Spatial%20Decision%20Support%20System%20for%20Precision%20Farming%20Based%20on%20GIS%2

0Web%20Service%20 [Accessed: May 2, 2016]

[8] [Online]. Research on remote monitoring system of petrochemical farm tanks_based_on_Web_and_CAN. Available: http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=5231336&newsearch=true&queryText=Spatial%20Decision%20Support%20System%20for%20Precision%20Farming%20Based%20on%20GIS%20Web%20Service%20 [Accessed: May 2, 2016]

[9] [Online]. Wind Farm SCADA System's Web Implementation Based on the Comet_Technology. Available: http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=6394430&queryText=Wind%20Farm%20SCADA%20System's%20Web%20Implementation%20Based%20on%20the%20Comet%20Technology&newsearch=true [Accessed: May 2, 2016]

[10] [Online]. A low-power wireless UHF/LF sensor network with web-based remote supervision — Implementation in the intelligent container. Available: http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=6688422&newsearch=true&queryText=A%20low-power%20wireless%20UHF%2FLF%20sensor%20network%20with%20web-based%20remote%20supervision%20%E2%80%94%20Implementation%20in%20the%20intelligent%20container [Accessed: May 2, 2016]

[11] [Online]. Cloud-based monitoring and analysis of yield efficiency in precision_farming. Available: http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=7051886&newsearch=true&queryText=Cloud-based%20monitoring%20and%20analysis%20of%20yield%20efficiency%20in%20precision%20farming [Accessed: May 2, 2016]

[12] [Online]. Research on and Realization of Interactive Wireless Monitoring and Management System of Processed Grain Based on Web3D. Available: http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=7373819&newsearch=true&queryText=Research%20on%20and%20Realization%20of%20Interactive%20Wireless%20Monitoring%20and%20Management%20System%20of%20Processed%20Grain%20Based%20on%20Web3D [Accessed: May 6, 2016]

[13] [Online]. A Web-based integrated the protection relays data and the Power Quality Databases enhancement Power Quality of

Provincial Electrical_Authority_2.0. Available: http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=6254151&newsearch=true&queryText=A%20Web-based%20integrated%20the%20protection%20relays%20data%20and%20the%20Power%20Quality%20Databases%20enhancement%20Power%20Quality%20of%20Provincial%20Electrical%20Authority%202.0%20 [Accessed: May 6, 2016]

[14] [Online]. The development of project monitoring information system (Case_study:_PT_Tetapundi_Prima_Kelola). http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=7042172&newsearch=true&queryText=The%20development%20of%20project%20monitoring%20information%20system%20.LB.Case%20study:%20PT%20Tetapundi%20Prima%20Kelola.RB. [Accessed: May 6, 2016]

[15] [Online]. A Web-Based GIS for Urban Environment Management: The Technology_and_Development. Available: http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=5190107&newsearch=true&queryText=A%20Web-Based%20GIS%20for%20Urban%20Environment%20Management:%20The%20Technology%20and%20Development [Accessed: May 6, 2016]

[16] [Online]. Sensor.Network: An open data exchange for the web of things. Available: http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=5470533&newsearch=true&queryText=Sensor.Network:%20An%20open%20data%20exchange%20for%20the%20web%20of%20things%20 [Accessed: May 6, 2016]

[17] [Online]. An adaptation of the web-based system architecture in the development_of_the_online_attendance_system. Available: http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=6417619&newsearch=true&queryText=An%20adaptation%20of%20the%20web-based%20system%20architecture%20in%20the%20development%20of%20the%20online%20attendance%20system [Accessed: May 10, 2016]

[18] [Online]. An Access Control Scheme for Web-Based E-Learning Systems. Available: http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=4141659&newsearch=true&queryText=An%20Access%20Control%20Scheme

%20for%20Web-Based%20E-Learning%20Systems [Accessed: May 10, 2016]

[19] [Online]. A conceptual framework of web-based academic advisory information_system. Available: http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=6269012&newsearch=true&queryText=A%20conceptual%20framework%20of%20web-based%20academic%20advisory%20information%20system [Accessed: May 10, 2016]

[20] [Online]. Web Based UNIX File Management System. Available: http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=5581309&newsearch=true&queryText=Web%20Based%20UNIX%20File%20Management%20System [Accessed: May 10, 2016]

[21] [Online]. Using Semantic Web Technologies in a Web Based System for Personalized_Learning_AI_Course. Available: http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=7009584&newsearch=true&queryText=Using%20Semantic%20Web%20Technologies%20in%20a%20Web%20Based%20System%20for%20Personalized%20Learning%20AI%20Course [Accessed: May 10, 2016]

[22] [Online]. A java-based enterprise system architecture for implementing a continuously supported and entirely web-based exercise solution. Available: http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=1613966&newsearch=true&queryText=A%20java-based%20enterprise%20system%20architecture%20for%20implementing%20a%20continuously%20supported%20and%20entirely%20web-based%20exercise%20solution [Accessed: May 14, 2016]