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BIOMES: A CITIZEN SCIENCE-BASED RECORD MANAGEMENT SYSTEM FOR BIODIVERSITY MONITORING AND MANAGEMENT

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Abstract

This study introduces BIOMES: a citizen science-based electronic record management system for monitoring biodiversity. It is a web and mobile application designed to store the collected data from the biodiversity of the 23 wildlife-protected areas of Region IV-A under the office of the Conservation and Development Division of the Department of Environment and Natural Resources (DENR). The researchers used the principles and concepts of citizen science in collecting data for monitoring and managing biodiversity, while the Agile Scrum methodology was employed in the software development of the proposed system. This capstone project assesses using the citizen science-based record management system for biodiversity monitoring and management through user testing and evaluation. The results of this capstone project have contributed to developing more efficient and practical approaches to biodiversity monitoring and management efforts and the broader implications for citizen science.

Keywords: *Citizen Science, Biodiversity Monitoring, BIOMES, Record Management, DENR*

Introduction

Biodiversity is the variety of all different kinds of organisms on the planet. The Philippines is home to approximately two-thirds of the earth's biodiversity. Given its exceptional biodiversity, the Philippines is considered one of the world's biodiversity hotspots. This makes it a crucial location for global conservation efforts (Ong et al., 2002). The Philippine government has an executive department responsible for governing, managing, protecting, and ensuring the sustainable use of the country's resources and environment. This department is called the Department of Environment and Natural Resources (DENR).

In recent years, citizen science has emerged to engage the public in biodiversity monitoring (Goudeseune et al., 2020). Citizen Science is a means of conducting scientific research and monitoring. Citizen science involves the participation of volunteers in scientific endeavors, offering the advantage of contributing to 'real' scientific research and engaging a broad audience in the scientific process (*Citizen Science – Importance and Benefits | Maritime Forum*, n.d.; Tweddle et al., 2012). Citizen science involves the participation of non-professional scientists in scientific research projects, often in collaboration with professional scientists. This approach has engaged a broad range of participants and can provide valuable data and insights that would otherwise be difficult or impossible to obtain (*Citizen Science – Importance and Benefits | Maritime Forum*, n.d.). Citizen science has emerged as an innovative and effective approach for engaging the public in scientific research and can be particularly useful for monitoring and managing biodiversity.

This capstone project aims to design and develop a web and mobile application that incorporates citizen science principles for biodiversity monitoring and management. The web and mobile applications will allow citizen scientists to collect and record data on local

biodiversity, which researchers and policymakers can then use to inform conservation efforts and management strategies. The applications will also incorporate features such as data validation and quality control to ensure the accuracy of the collected data.

Review of Literature Review

This chapter provides a literature review on citizen science, biodiversity monitoring, and record management systems.

Citizen Science as a Tool for Biodiversity Conservation

The study of (Chandler et al., 2017) examines how citizen science might be used to monitor biodiversity on a global scale. The study highlights the benefits and challenges of citizen science. It has an advantage in cost-effectiveness, efficiency, and the ability to engage many volunteers. Despite its advantages, it faces difficulties and constraints, including data quality, volunteerism, and standardization. This study also cites some successful citizen science initiatives for biodiversity monitoring, including programs focused on birdwatching, butterfly monitoring, and invasive species tracking. Citizen science should be viewed as a complementary tool to traditional biodiversity monitoring approaches rather than a replacement.

The study of (Pocock et al., 2018) employs different instances to illustrate how monitoring can involve diverse participants, maximize various technologies, and employ various sampling approaches to capture various variables. These collectively highlight the transformative potential of citizen science in revolutionizing our capacity for biodiversity monitoring, enabling us to address threats comprehensively across all levels, from local to global.

Record Management and Electronic Record Management

The study (Manikas, 2015) emphasizes the key ideas in the record management and how an electronic document record management system (EDRMS) could greatly affect a business

setup. This research is a qualitative exploratory case study in nature. It analyzes the experiences of 4 individuals working in a company that uses EDRMS. Results show that proper implementation and adoption of an EDRMS is proven efficient and effective. It also proves that the associated costs are considered reasonable and justifiable. This makes it beneficial to an organization. This study concludes that EDRMS is beneficial to an organization.

Synthesis

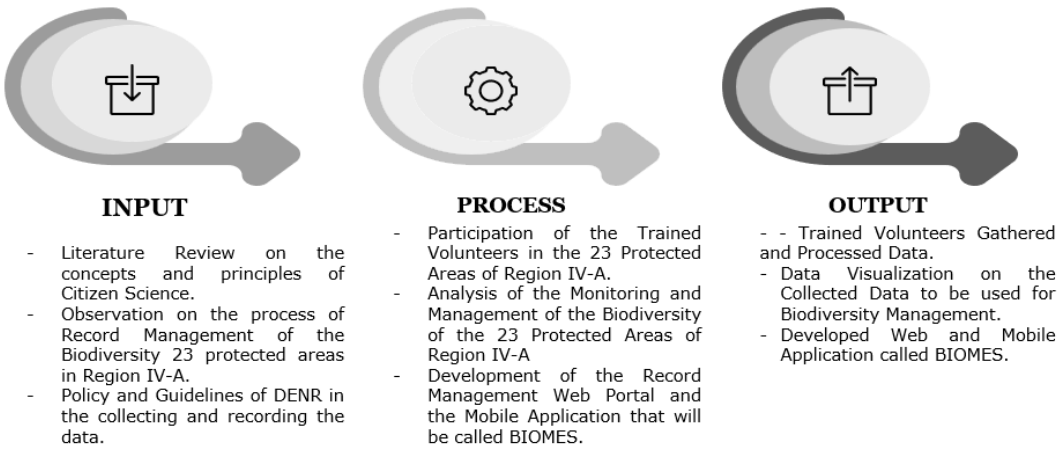
The application of concepts and principles of citizen science in a record management system has the potential to contribute significantly to biodiversity monitoring and management. This will be possible if the following are followed (1) have a transparent and mutually agreed upon process for all citizen-science or participants, (2) efficient record management policy, (3) efficient implementation of an Electronic Record Management System.

Framework

Figure 1 below illustrates the graphical representation of the framework of the study.

Figure 1

Conceptual Framework (IPO) for BIOMES



As shown in Figure 1, the researcher started reviewing the concepts and principles of citizen science for biodiversity monitoring and management. In addition, the researcher

examined the current data collection and recording processes in the 23 protected areas of Region IV-A and the relevant policies and guidelines of the Department of Environment in Natural Resources (DENR) on this matter. Taking all of this into consideration, the researcher was able to list the issues and challenges using the current process of collecting and storing data. The researcher then started the development of the BIOMES Web Portal and Mobile Application. In the development of BIOMES, the researcher set the scope following the focus of the study. BIOMES consists of (7) the following features: (1) Public Page, (2) Mobile Application for Protected Areas Superintendent, (3) Mobile Application for the Trained Volunteers, (4) Conservation and Management Division Module, (5) Administrator Module, (6) Dashboard for Data Visualizations, and (7) Report Generation.

Methodology

This chapter covered the methods used in data analysis and software development.

Research Design

The study's nature is developmental and descriptive. A descriptive research approach was used to evaluate the proposed system. The study's respondents came from the Conservation and Development Division of DENR Region IV-A. The division was composed of 30 employees in overall counting. The said respondents evaluated the proposed system's level of acceptability. On the other hand, the developmental research approach was used in software development.

Software Development

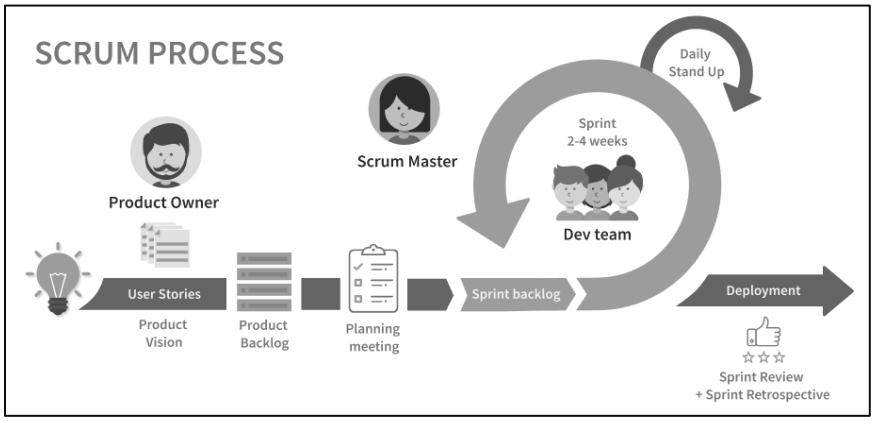
The proponent used Agile Scrum Methodology in Software Development. Agile Scrum highlights collaboration and continuous improvement, making it suitable for developing BIOMES Web and Mobile Applications. It also emphasizes flexibility and adaptability to the changing needs and requirements of the client. Identifying problems is also easier since testing is

conducted more often, giving the developers and the client a glimpse of how the project will work and potential problems.

During the BIOMES Web and Mobile Application development process, six sprints were undertaken with a duration of 2 weeks per sprint.

Figure 2

Agile Scrum Process



https://www.tuleap.org/agile/agile-scrum-in-10-minutes

Discussion of Results

This study's proponents use the formula for arithmetic mean and percentage distribution. The interpretation of the computed data was represented using the Likert Scale. The respondent's level of acceptance of BIOMES was tested and evaluated based on the following criteria: (1) Functionality, (2) Reliability, (3) Consistency, (4) Security, (5) Accuracy, (6) User-Friendliness, (7) Portability, and (8) Speed.

Table 1

Likert Scale Interpretation

Value	Response	Description
5	Strongly Agree	It means that the respondents agreed with the given statement
4	Agree	It means that the respondents agreed for the most part
3	Neither Agree nor Disagree	It means that the respondents agree with some part of the statement
2	Disagree	It means that respondents disagreed with the statement for selected parts
1	Strongly Disagree	It means that the respondents disagree with the whole statement

Table 2.0 illustrates the summary of findings for system performance. According to the respondents' evaluation, the overall performance rating got an average of 4.28 with the verbal interpretation of Agree.

Table 2

Summary of Findings for System Performance

Criteria	Average Weighted Mean	Verbal Interpretation
Functionality	4.5	Agree
Reliability	4.5	Agree
Consistency	4.12	Agree
Security	4.0	Agree
Over-All Performance	4.28	Agree

Meanwhile, table 3.0 illustrates the summary of findings for the system usability. It got a rating of 4.41 with the verbal interpretation of Agree.

Table 3

Summary of Findings for System Usability

Criteria	Average Weighted Mean	Verbal Interpretation
Accuracy	4.17	Agree
User-Friendliness	4.46	Agree
Portability	4.5	Agree
Speed	4.5	Agree
Over-All Usability	4.41	Agree

Conclusions

Based on the result of the study, the researcher arrived at the following conclusions:

1. Implementing citizen science in a record management system effectively monitors and manages the biodiversity in the 23 protected areas of Region IV-A. The collected data through the developed record management system can be utilized to suggest potential solutions and measures address issues in biodiversity.
2. The respondents were generally satisfied with the features of BIOMES, specifically in storing, recording, transmitting, and consolidating data.
3. The respondents were generally satisfied with BIOMES, the developed record management system for biodiversity management and monitoring.

Limitations and Recommendations for Future Research

The limitations of the proposed system are as follows:

(1) It does not generate possible solutions to different biodiversity issues but instead gives a graphical visualization and analysis of the collected data to help assess the scale of the problem.

(2) The study is limited to implementing principles and concepts of citizen science in the developed record management system. The training of locale volunteers is under the jurisdiction of the Department of Environment and National Resources.

The researcher recommends exploring more ways to engage the locale in biodiversity monitoring and management and evaluating the long-term impacts of citizen science on the attitudes and behaviors of the locale in conserving the environment and its natural resources.

References

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Appendix

Appendix A – Sample User Interface

The following figures are the sample interface of the system:

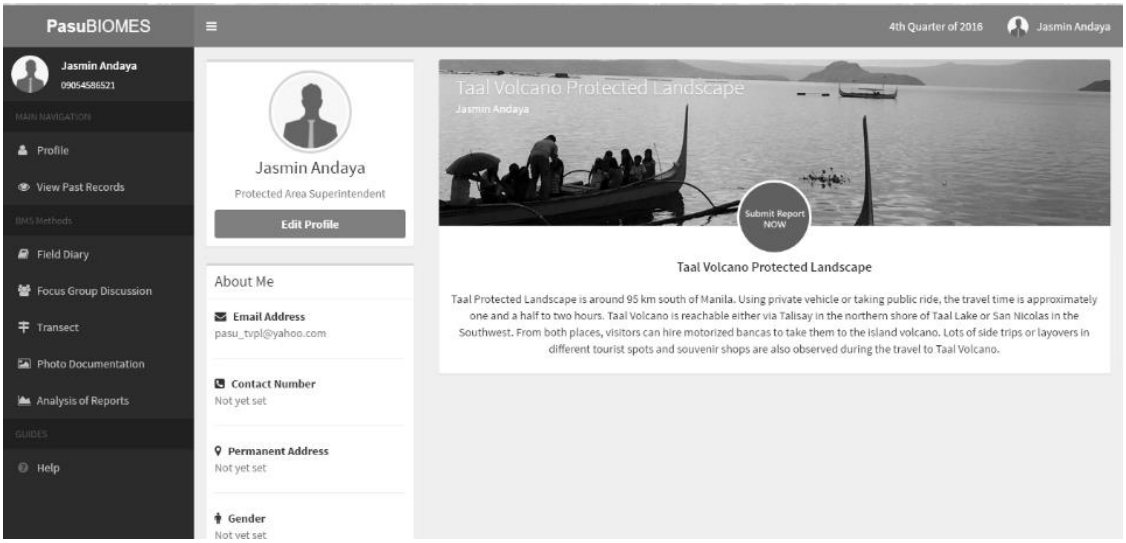

Figure 3: The Protected Area Superintendent Module

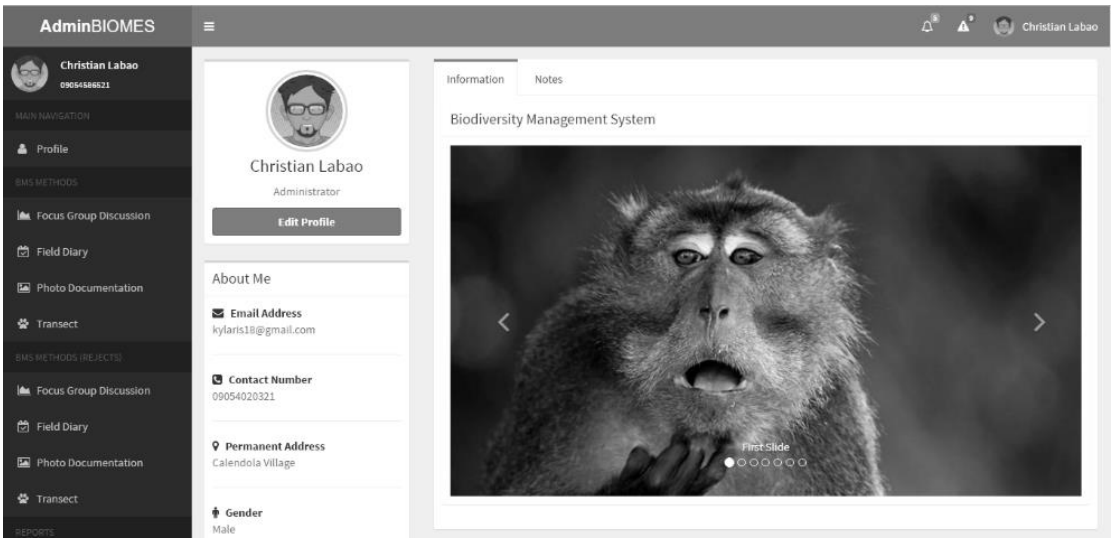

Figure 2: The Administrator Module