Delphi Web Tool

Project Description and Clarification

Scalable Algorithms for Data Science Laboratory (SCADS)

Cyber3

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I. Introduction

According to the World Economic Forum, as the demand for cybersecurity professionals continues to rise, the global shortage has reached nearly 4 million [1]. This critical gap presents a significant challenge in a world where cybersecurity threats are ever present and growing more sophisticated by the day. Addressing this issue requires not only making the field more enticing but also providing accessible, high-quality education and tools for those interested in entering the industry.

In this context, our team plans on developing a web application aimed at facilitating research utilizing the Delphi method. The Delphi method is utilized to gather consensus from subject matter experts while keeping identities anonymous and maintaining quality control on the results, a scientific method for consulting a group of experts. Utilizing multiple rounds of activities, the administrators can refine results until a reasonable consensus is reached by administrators. With the development of our platform, we aim to provide a tool for cybersecurity educators and professionals with integrated tools, user protection, and a clean user experience for both administrators and survey takers.

II. Background and Related Work

The state-of-the-art for our project is the current state of education and development of curriculum in the domain of cybersecurity, along with existing web applications. The domain of our project is a web application tailored for the Delphi method, built within the context of cybersecurity and education. We will highlight pre-existing sites that offer similar services and discuss how our project will be differentiated from the rest.

Checking online resources, we can find that the current goals of institutions are aimed at the kindergarten through 12th grade levels of education. [2] This is an important audience, as it is vital to spark an interest early on in students' educational careers. In addition, instilling basic cybersecurity practices in students to carry forward into their professional and daily lives is key. However, education aimed at the university level seems to be less of a focus. While our application could certainly still be used for k through 12th education, it can also be utilized for university level education curriculum.

As we develop our project, it is important to understand exactly what the Delphi method is. While we will not necessarily be the ones developing the surveys, understanding the goals and preferences of survey administrators is key. Rather than simply observing and analyzing the perspectives collected from single surveys, we can gather consensus through the Delphi method, iteratively building activities that can generate consensus from a group of subject matter experts. Anonymity, controlled feedback, and statistical group responses are key to this method and will be emphasized in our project. [3]

Some pre-existing sites offer services for both the Delphi method and data analysis post-survey. Welphi is a one such web application that incorporates automation into the process of the Delphi method, with pre-developed questionnaires. It utilizes the standard features of web services, giving user anonymity, reminder emails, real-time monitoring, and other expected utilities. [4] We will be tailoring our web application to the needs of our primary client to differentiate ourselves appropriately.

An example of research being done using the current online Delphi web application Welphi is seen in a paper published by Caitlin Muhi et al. [6]. In this paper the researchers utilized Welphi to survey a panel to establish an agreed definition of social prescribing. This paper is a good

example of being able to gather panelists on an international scale to allow them to participate in research. One limitation noted by the researchers while using Welphi is “panel attrition” [6]. This can be an inheritable issue when it comes to distributing a Delphi study over the web since panelists could always not accept an invitation to participate in another round of surveying. Through our development and planning we will be conversing with our client to be able to come up with ways to fix this issue.

Technical knowledge: due to the existing experience of our team members, we plan on utilizing the MERN stack for our web application. The MERN stack we will use consists of MySQL, Express, React, and Node which are all tools and frameworks that will allow us to build a high-end web application. Team members will refresh themselves on the state-of-the-art for development within this stack and other tools we may use for our application. At the beginning of the project, we will also be using GitHub for our source control and AGILE needs since both provide functionality in one product. As we are using the AGILE software development approach, we may find additional tools or resources during the process that we will incorporate into our project. In this event, we will ensure that the necessary documentation and tools are prepared for code review and the end users.

Team members will also familiarize themselves with the Delphi method. While the team members will not be the ones implementing or administering the surveys, it is essential that we understand how the end users will interact with our product. With a greater understanding of the method, we will learn how to best develop our application with users and use cases in mind.

III. Project Overview

As cybersecurity threats evolve, educational institutions must continuously update their curricula to equip students for their professional careers. However, gathering expert insights on what developing an evolving curriculum presents challenges. It is difficult to collect unbiased feedback due to social pressures, personal biases, or the influence of authoritative figures. At round table discussions, the identities of those engaged in the conversation can influence the answers of the panel, whether consciously or not. Without an effective platform for gathering and processing expert input, educational institutions risk relying on outdated or incomplete information when designing their cybersecurity courses.

The project will consist of a web application that allows end users to create and deliver surveys for subject matter experts in the field of cybersecurity. These surveys will be developed and administered following the Delphi method to gather consensus. The Delphi method will be integrated into the creation of the surveys to allow effortless for research capabilities.

A benefit to porting the Delphi research method to a web application will be the speed at which surveys can be completed, and the ability for anyone to participate in the surveys no matter their location. Within the paper “Using the Delphi Technique in EducationalTechnology Research” by John Nworie, he identifies two main challenges in utilizing Delphi for research. These two challenges included Delphi being a lengthy process and the experience of the panelists involved in the survey [5]. Our web application will inherently be able to provide a solution to both challenges. Administrators will be able to have short survey times since the survey will be available over the internet, and the application will provide a greater availability of properly experienced panelists since location is not an issue.

At the end of this project, we expect to deploy our first questionnaire. This will allow our primary client to ensure proper collection and follow-up analysis of results. While we will test throughout

our development process, likely including small-scale tests, engaging in a full stress test of our product will be beneficial for future development.

Our project's backbone is allowing administrators to develop and deliver questionnaires to subject matter experts. The results from these questionnaires will be compiled and viewable by the administrators in a secure environment. These results should be delivered and displayed in a clear and concise manner, with readability of data being a key concern. In tandem with being able to view the results, the survey administrators will have the ability to publish the results upon completion of the survey to the survey takers. This is intended to be an optional function that is left up to the administrator's discretion to actuate.

It is also of high importance that the web app is intuitive and easy to use. Through client and user feedback we will be able to refine the entire survey user interface. If a user comes across a functionality that they are not sure how to use, there will be user tutorials or manuals provided within the web app which they will be able to follow.

As a project based on cybersecurity, one of our core principles will also be user protection. In addition to cybersecurity, it is important for the Delphi method that the identities of users remain anonymous, to avoid altering the opinions of others through perceptions of authority or status. A user's involvement and responses to a survey should be always kept confidential and secure.

While our project initially will be focused on meeting the survey needs identified by our clients, it will also be built to handle a wide variety of survey types to be used in any research capacity. Since the function of the web application is to build and distribute surveys, the user should be allowed to customize any part of the survey to fit their specific needs. With the customizable functionality comes the ability for this project to fit multi-purpose use cases.

At the conclusion of the project, the web application should be fully operational, with the first questionnaire deployed. The project will undergo extensive testing, including small-scale tests and the first deployment acting as a final stress test, to ensure that it meets performance and security standards. In the long term, we hope that our platform will serve as a reusable tool for future studies, not only at CySER and Washington State University (WSU) but also for other institutions engaged in cybersecurity education. This reuse and adaptability are key to the project's sustainability, providing a lasting contribution to the field. Our objectives are guided by the needs of our primary client. We will ensure that we engage in continuous communication during the development of our project such that the processes and outcomes are satisfactory.

IV. Client and Stakeholder Identification and Preferences

Our primary clients are CySER and Washington State University, with our point of contact being James Crabb. CySER and WSU require a secure, reliable system that will assist in developing the cybersecurity curriculum. The solution should support the Delphi method, allowing multiple rounds of input and enabling consensus-building. It should ensure that user identity and data are protected, in line with the general goals of cybersecurity. Our project requires a completed build of the web application and an expected trial run for the first survey.

Subject matter experts that will respond to the questionnaires are also stakeholders in this project. Their responses may help to inform the future of cybersecurity education. As users of the web application, they should be able to expect security, privacy, and a good user experience. Other stakeholders that will benefit from the results of this project include

cybersecurity professors and students, those who will engage with the results of the research conducted. Professors will be able to develop curriculums based on the feedback of subject matter experts and students will receive the results through an enhanced education.

Potential clients include other institutes developing cybersecurity curricula. Whether as administrators of their own questionnaires or as viewers of gathered results, our product should appeal to a variety of users through strong coding practices, adaptability, and responsiveness.

V. Glossary

Delphi Method – A research method for scientifically gathering consensus from a panel of subject matter experts

CySER – Cybersecurity Education and Research. Specifically, the VICEROY Northwest Institute for CySER. Created to foster the next generation of cybersecurity professionals

WSU – Washington State University

MERN – MySQL, Express, React, Node

VI. References

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