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Accomplishing Outreach, Engagement & Facilitating Learning: A Digital Application for the Wilma H. Schiermeier Olentangy River Wetland Research Park

Robin Iritz, Rachel Metzler, Mara Momenee, Graham Spangler, and Brian Trainor

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A program of Energy Services and Sustainability
Aparna Dial, University Director, Energy Services and Sustainability
Dial.15@osu.edu

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Executive Summary

The Wilma H. Schiermeier Olentangy River Wetland Research Park (ORWRP) has a need for publicity and a desire for a better public understanding of wetland ecosystems and the role each person plays in protecting them. To address the lack of visitation at the ORWRP and the lack of awareness surrounding the relationship between the industrial agriculture system and wetland ecosystems, we propose the development of an interactive smartphone application. We plan to utilize the application platform to create an interactive, self-guided tour of the park that focuses on communicating the connections between the human food system and wetland ecosystems. This project will solve the lack of visitation by providing a way for visitors to learn about ORWRP and wetland ecosystems in general without the help of an employee. The interactive nature of the application will appeal to visitors by conveying information in an enjoyable way that will lead to a deeper understanding and appreciation of wetlands. Finally, by focusing our interactive tour on agricultural food systems, systems that everyone depends upon and plays a part in, the application we have proposed will offer information that is relevant to all guests. Our application will draw in more visitors through social media connectivity and address the lack of awareness surrounding the relationship between the food system and wetlands by educating people about the impacts agriculture has had and continues to have on these valuable ecosystems.

The application we have proposed and detailed in this review fits the objectives of the Olentangy Wetlands and lies within their financial means. The development and facilitation of the application will be handled by the research park. If not funded by The Ohio State University (OSU), we have found several grants that could potentially cover the costs of our project. This funding would cover development and facilitation costs of the application and any equipment needed such as tablets for visitors without smartphones. A student internship position will be created at the wetlands to provide the necessary labor for updating the application and handling all social media accounts for the park. This position will tie together various themes of the wetlands, including their goals of outreach and education. By focusing on several related issues associated with the current system of visitation and education at the wetlands, we have created a feasible plan that will address current problems and provide a platform for further development that can evolve as ORWRP continues to grow.

Introduction: Defining the Problem

One of the issues we wish to address with our project proposal is the lack of visitation at the ORWRP. Despite the facility's rank as the 24th Ramsar wetland of international importance (USFWS, 2014), few people within the Ohio State and Columbus community visit the research facility. A potential cause of this is that the park does not offer opportunities for self-guided tours. In order to gain access to the park's boardwalks and learn more about research being conducted within the park, people must schedule a tour by calling or emailing the facility. Brent Macolley, the Facilities Research Manager, noted that this is an inconvenience for both visitors and facility employees, as tours take planning from both parties and cost the facility potential research time (personal communication, 2014). A lack of educational and interactive activities at the ORWRP also contributes to low visitation. Without an employee to relay important information and grant visitors access to the locked boardwalk, people are limited to walking the outskirts of the wetlands and reading dated signs that are located near the pavilion and elsewhere in the park. The final reason for low visitation is the lack of relevant information available to visitors. With the exception of environmental students and researchers, park visitors may not see the value in learning about the material presented on current signs. This is because the information on the signs is presented in a way that is not relatable to most people, and therefore, of little interest to them. Overall, self-guided tours, interactive educational activities, and relevant information are missing at the facility. These factors could account for the low number of people taking advantage of this world-renowned research facility. Low visitation results in the even larger issue of many people being unaware of basic wetland functions. Without wetland awareness, these people are more likely to undervalue the important services these ecosystems provide.

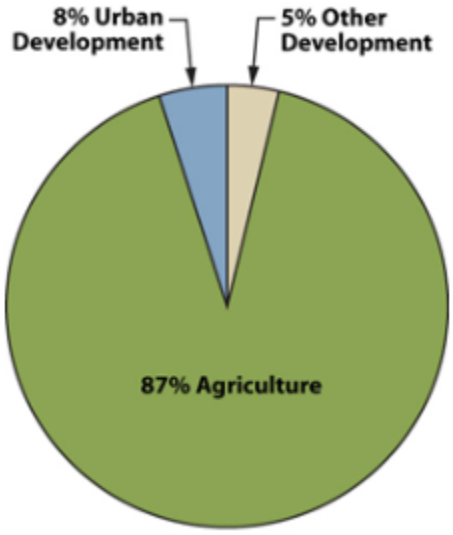

Figure 1: Causes of Wetland Loss (USDA)

The second problem we wish to address with our project is the lack of awareness that people have of the relationship between the food system and wetlands. This relationship dates back to when European immigrants first began settling North America and converting wetlands

into farmland. According to the Natural Resources Conservation Service, only 54% of the United States' original 212 million acres of wetlands remained by the 1970s (USDA, 2014), with the dominant cause of this 116 million-acre loss being agricultural activity (Figure 1). The conversion of wetlands to farmland continued until recent decades, when wetlands were found to contribute as much as 40% of the Earth's renewable ecosystem services, despite covering only 1.5% of the planet's surface (Zedler, 2003). After realizing the value of wetlands, federal agencies implemented protection regulations to reduce and reverse the negative impacts of wetland conversion. Through extensive restoration projects administered by programs such as the Wetland Conservation Provisions and the Agricultural Conservation Easement Program, the United States has actually experienced a net gain of wetland acres in recent years (USDA, 2014). Despite this progress, however, agriculture continues to affect wetlands through the diversion of water, sediment erosion, and harmful nutrient runoff from fertilizers. In a state that contains 14.3 million acres of farmland (OFB, 2009), it is important for Ohio citizens to be aware of the relationship between agriculture and wetlands. With our digital application project, we hope to make the Ohio State community and Columbus residents cognizant of these connections so they can help ensure the integrity of both wetlands and the food system.

Education Models & Accessibility

There are certainly arguments that technology can deter, or take away from, interactions with the natural world (Eliasson et al., 2011). However, the majority of our research found that, when properly developed and assessed, digital technology can facilitate interacting with and learning about nature. With this in mind, this next section addresses and justifies the features of the app within the context of successful educational models.

Our desire for the project to be an app, rather than a pamphlet or other trail guide format, was based largely in our own experiences of interesting and engaging educational tours or visits. This interest and support of digital technologies was also widely supported in research around education, especially those in free choice learning environments. It has been shown that intrinsic motivation to learn can be linked with participants' feelings of choice, contextualization, and personalization (Cordova & Lepper, 1996). Our application will allow participants to choose different activities, while learning information that is placed in the context of wetlands and food systems. Participants will also have the opportunity to build, and therefore personalize, different

aspects of the application through connecting to social media by posting their own images, videos, and text. These three different characteristics will help garner intrinsic motivation within participants to learn about the wetlands.

Through an interface that asks participants to observe, question, search for, and imagine aspects of the natural surroundings, the application will help facilitate interaction with both other people and the natural surroundings. Yocco et al. (2011) show that this interaction based on technology is adopted by participants due to a variety of factors, including perceived ease of use, perceived usefulness, attraction to technological object, and experiences with initial use. They also explain that in order for technology to be adopted or used in informal settings, it is extremely useful for it to "foster interactions between and within groups of visitors" (Yocco et al., 2011). This is why our questions and application guides will aim to give groups a platform to think about complex questions and problems, all while participating in the activities.

As an aspect of integrating social media, participants will be able to use digital photography to capture points along the trail that they find interesting. The use of digital photography in environmental education has been shown to increase interest and interaction with nature (Ardoin et al., 2014). Fostering interest and engagement with environmental education can lead to increased feelings of connectedness to nature and, from this, move people to engage in environmentally responsible behaviors (Frantz & Mayer, 2014). The application can therefore be thought of as both a guide for the natural surroundings of the wetlands and a tool with which to develop environmentally responsible behaviors of participants.

A large reason we chose the application format was for expanding accessibility and interest around digital technologies. Increasingly, mobile technologies are being introduced as guides for informal learning outdoors (Yocco et al., 2011). Our project can expand on these current and exciting trends, in order to draw more visitors to the ORWRP. While not every visitor can be expected to have, or know how to use, a mobile device, this potentially 'lost' audience could be captured through different methods. The ORWRP could offer paper copies of the guide and there could be tablets available for checking out from the center, which offer free access and a larger screen to engage with the guide. However, this would also only be available when the ORWRP building is open and staff is available.

The digital application gives the ORWRP a chance to engage with visitors; through social media and interactive tour stops, the application can provide a space to learn about and engage

with the ORWRP. As digital media can more easily and cost effectively be updated, room for expansion and alteration is readily available. As was mentioned before, an intern could serve to facilitate development and upkeep of both the application and social media in order to garner continuing interest in the ORWRP. The application will serve as a hub of activity and information for the ORWRP and its visitors.

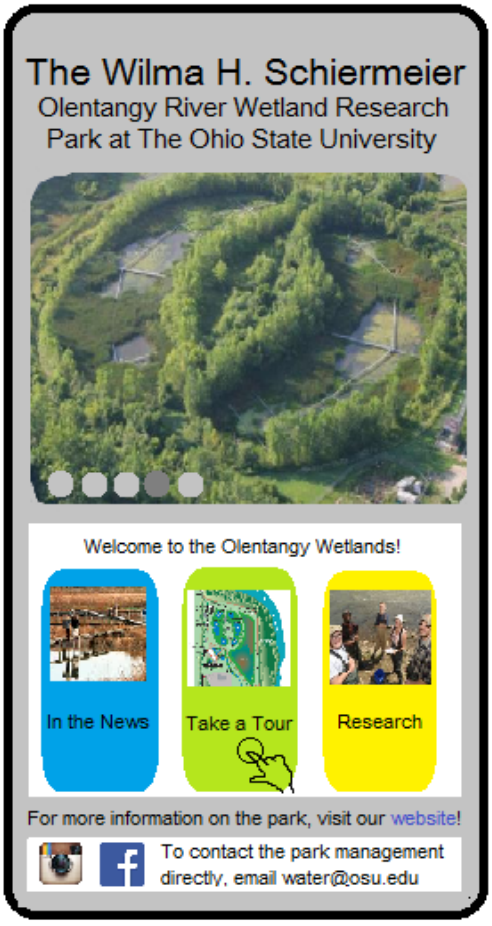

Figure 2: Application Home

Application Layout

This section will outline the details of what the application should include, as well as the format and order of information. The application can serve as a foundation from which the ORWRP can add information about research, news, links to social media, and, as we're suggesting, provide informational and interactive tours. This will allow visitors, and even those exploring the app off-site, to be better connected and informed about the ORWRP.

Figure 3: Application Tour Screen

The home screen (Figure 2) of the application will welcome visitors, include a bar at the top with scrolling pictures, and have different buttons to expand and explore the above options, including tours, social media, news, and research. The "tours" button will provide a place to house the aspect of the application we're most interested in. After clicking this button, the tours page will open to show the different options, including the "Food Systems and

the Wetlands" tour. Selecting this tour will then lead to a screen that will allow users to select their starting point from a map. Three entrance points, east from the bike path, north from the bike path, and the Heffner Wetland Research and Education Building, are available to users. Upon choosing the starting point, the tour will start (Figure 3).

Figure 4: Point Launch Screen

Figure 5: Interactive Prompts Screen

The different points of the tour along the path will appear on a map as dots, with the starting point appearing highlighted. For example, if the center is chosen on the previous screen as the starting point, the Oxbow Lake might appear highlighted with a dot. The name of the point and a picture of the point will appear below the map (Figure 4). At the bottom of this screen will be a "Start" button which will launch this point's interactive features.

As an example, the Oxbow Lake stop features would start by asking users to look and explore the wetland visually, recording what they see in a box provided. Once they had entered information, such as "cattails, fish, flowering plants, greenish water," they would press "Next."

Figure 6: Interactive Widget Screen

The application would then ask users if they had recorded or observed algae, along with showing a picture of algae. It would then ask users, "Image if this entire wetland were covered in algae! What would that look like? What might some of the effects be and look like?" Below this prompt, the application would have a space for users to draw their responses. (Figure 6) Touching "Next" after completing the drawing, the application would then present pictures of algae-covered wetlands and explain issues that occur with this such as fish being starved of oxygen and decreased water quality. (Figure 7) Again, by touching "Next," when finished, users would be prompted to think about what could cause extreme amounts of algae, known as algal blooms. Below this question would be a checkbox list of answers which users could guess which of these might cause algal blooms. These would be accompanied by an explanation of what causes algal blooms and which answers, such as sewer overflow or agricultural runoff, were correct. This information, on agricultural runoff leading to eutrophication, would contextualize the information on wetland algal blooms with our food system, making it more interesting and easy to understand. Lastly, it would include links to more information on algal blooms, agriculture, and wetlands. This progression of questions, activities, and answers would be a typical process across the application. It would therefore give users an opportunity to

Figure 7: Information Presentation Screen

interact with their surroundings, think through different information themselves, and engage with others in problem solving.

Application Development

The increase in mobile application use has grown steadily and consistently in conjunction with the increased accessibility and affordability of mobile devices over the past half-decade. According to the Cellular Telecommunications and Internet Association (CTIA), "As of 2010, there are over 303 million US mobile phone users; this is up three fold from 110 million users in 2000" (2014). This shows that almost 90% of the United States population has a mobile phone device. This increased connectivity has grown exponentially and the ORWRP has not yet taken advantage of this rapidly expanding, and increasingly integral, part our society. To bring the park into the digital age, we have designed the framework for an app that will encompass all aspects of the wetlands in order to give the park increased visibility and accessibility to The Ohio State University community and to the general public.

Currently, there are three types of mobile applications being run on mobile devices: Native-based, HTML5 (Web-based), and Hybrid (Gagern, 2013). Each of the three implementation options have advantages and disadvantages that must be considered by the development team. Native-based applications are the most widely used and most user-friendly application type. This option incorporates downloadable software that is directly installed onto the mobile device from the carrier's app store (Charland, A., & Leroux, B., 2011). Each carrier, such as Apple, Android, and Blackberry, requires different codes and provides individual downloadable programs for the device. This software is then updated by the user as the hardware improves. The software of the application interacts with the mobile operating system directly, giving greater functionality to the app. Having a direct link to the operating system makes the application run more smoothly increases user friendliness, and allows the use of hardware, such as the camera, GPS, and other native applications to be accessed. Native apps require complex development and a high initial startup cost that is dependent on the complexity of the application's design. This implementation option also requires software maintenance and updates, along with frequent software updates of the device that the application is downloaded onto.

HTML5 applications, also known as Web-based applications, use existing web technologies, such as JavaScript and CSS 3, to run the application. It is not directly downloaded onto the device and is accessed solely through an internet connection (Charland, A., & Leroux, B., 2011). Web-based applications are much cheaper and easier to build than native applications. Administrators can make fast and frequent updates to the application, allowing the user to forgo the process of updating the application on their own. HTML5 is a very common platform that browsers can interpret and run effectively, leading to a high range of functionality for both the user and the administrator. Web-based applications are very effective for mobile devices with LTE, 3G, and other wireless connection methods to the internet. However, being tied to a wireless connection leads to a significant decrease in convenience by leaving the user unable to access the application in an offline setting (Gagern, 2013). This can be problematic in "dead-zones" (areas of no cellular coverage) or places where there is no Wi-Fi available.

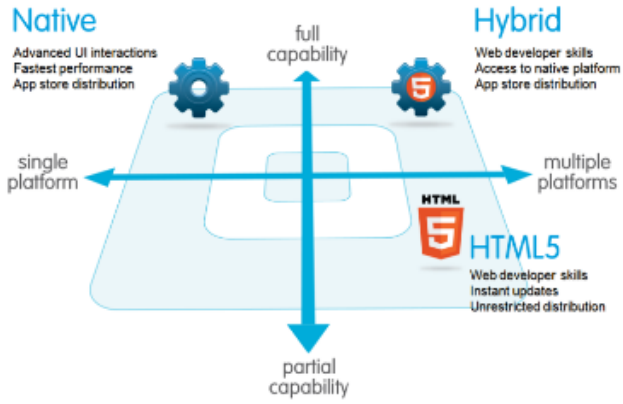

Figure 8: Comparison of Application Types (SalesforceDevelopers)

The third type of application, Hybrid, utilizes a mix of aspects of both Native and Web-based platforms. This method takes the functionality of integrating the application into the operating system while also incorporating the ability to update portions of the application without having to update the entire product (Gagern, 2013). This is an attempt to combine the best of both major platforms to increase performance on the user side as well as the administrator's. Although hybrid applications pull positive aspects from both the Native and Web applications, the problem of connectivity for the user still exists when attempting to connect to the internet in an area that is out of range of a LTE, 3G or Wi-Fi signal.

The most practical application development method for our project in the current situation would be a downloadable, native-based or hybrid application. The ORWRP does not have the capability for complete Wi-Fi coverage over the entire area of the park, making it difficult for devices without cellular data plans to have access to the app. Web-based platforms require an internet linkage of some degree, leading to the conclusion that HTML5 is not a viable

option for our project. If there was an investment in loaner tablets for visitors and school groups with 3G or LTE capabilities, the option of a Hybrid platform would bring increased connectivity for the user. The ability to utilize internet-based applications such as Instagram, Twitter, and Facebook while on the tour will give the user the ability to share their experience, giving the ORWRP further visibility to the public. Hybrid platforms also have the interconnectivity with the operating system that gives the user a reliable experience with a smooth interface without being dependent on internet connection.

The Ohio State University currently has a mobile app that is informative and useful for both students and visitors. OSU Mobile is a free mobile app and a "One University" collaboration led by University Communications, Student Life and the Office of the Chief Information Officer (CIO), with various partners throughout Ohio State. Students have had a hand in creating the app, helping with content, design, and development. Features include the ability to view grades and class schedules, real-time bus tracking, and an interactive map with the nearest parking, computer labs, and other points of interest. USA Today recognized Ohio State in the summer of 2013 as one of "five colleges with great mobile apps" (Honkonen, 2014).

Recent updates to the app include robust course catalog and master scheduling capabilities. This gives students quicker and easier access to search for classes and instructors on their mobile devices. The new parking garage capacity data that has been added to the maps section of the app gives up-to-date data on the current capacity of parking garages on campus. This is a substantial increase in convenience for visitors to the campus when trying to find parking. These updates greatly diversify the application's capabilities and increase its functionality for the user. Updates to the application continue to be developed to keep students, faculty, and visitors running efficiently. When referring to the most recent update in the summer of 2013, Jim Burgoon, director of Web and Mobile Development in the University Communications Department stated, "The focus was improving the core functionality and ease of use while also building a strong foundation/platform for future improvements" (Honkonen, 2014). The University is actively pursuing the expansion of the OSU Mobile platform and plans on adding SEI's, Statement of Accounts, and Advising Connect in future updates (Honkonen, 2014). Integrating the ORWRP application into the existing application will bring increased visibility from the Ohio State and Columbus community that the ORWRP has been lacking. Integrating the application into the existing system will increase connectivity to an area that is

today perceived as far away, disconnected, or unknown to many students, faculty members and, visitors.

The University can do all the design and development of the ORWRP App in-house, so there will be no need for outside contracting of an independent web developer. University Communications can take the lead on the project, and with input from students and staff at the park, develop a viable app that can be a platform for tours, social media outreach, academic research updates, and other general information for visitors. In the current OSU Mobile app there is a section entitled "OSU APPS" that highlights other downloadable apps such as Tour OSU, O-H-I-O, Buckeye Stroll, and ParkMobile. These apps are all free, linked into the existing app, and can be easily downloaded from the Application stores for IPhone and Android. Incorporating the application into this section of OSU Mobile would increase the apps visibility and accessibility, making it the most viable option for the success of the application.

Project Funding

The Ohio State University has experience developing and funding these free apps for the convenience of visitors to the school. We would push for our proposed application to be integrated into the next planned update. Ohio State Mobile and Web Development could incorporate the cost of the development of the applications into the next budget request. If Ohio State is opposed to funding our project as a means of increasing community awareness of and connection to the ORWRP, there are several alternative financial avenues we can pursue to implement our proposal.

The first funding opportunity would be to apply for a grant through the Ohio Environmental Education Fund. This is a program through the Ohio EPA Office of Education whose goal is to increase interactive environmental initiatives and water quality education. In order to qualify for State Fiscal Year 2015, our group must submit a Request for Proposal this November and a completed grant application by January 2014 (Office of Environmental Education).

Other opportunities for funding exist through the federal EPA website. With a project focused on both environmental education and technology as an interactive platform for outreach, we are eligible for multiple federal grants. One potential funding source is the People, Prosperity, and the Planet Grant, which awards college students who have developed solutions to address

challenges from a range of categories, including agriculture and water. Another potential source is the Water Grants program, which includes monetary assistance for wetlands protection projects. A final EPA grant that we could apply for is the Environmental Information Exchange Network and Grant Program. This program provides funding to develop an electronic-based network that promotes the collection and sharing of environmental information. The possibility of earning a grant for our project is promising, as the EPA has proven its commitment to wetland protection through awards given this year alone. Just recently, Delaware, Ohio became one of six recipients to earn a portion of the $2.6 million EPA investment in wetland management (Chen, 2014). In addition, the state of Ohio has just received an EPA grant of nearly $7.5 million to deal with the nutrient runoff problem that has caused harmful algae blooms in Lake Erie. This award is only a portion of the $12 million expenditure the EPA has promised the state (Troy, 2014). If our grant proposals were to convey how this project would enhance the quality of Ohio's water, we might be able to earn a portion of that funding as well.

Internship Position

Internship positions have also played an important role in spreading knowledge and awareness about environmental problems that affect communities. In one study, interns analyzed data, created educational fact sheets, drafted letters to decision makers within the communities, and presented at research fairs and expositions, all while working with a university and an assortment of community-based organizations (Close et al., 2010). As a direct result of the work the interns performed, the community itself gained knowledge and awareness about local environmental issues and were able to communicate more effectively with their community leaders and decision makers. Our app, when managed by an intern, will also spread awareness and knowledge to the public. With this increased understanding of how wetlands function and, more specifically, how conventional agriculture impacts wetlands, community members would be better equipped to communicate their wants and needs to legislators and other powerful community figures. Community-based organizations involved with the study developed educational brochures, databases, reusable templates for newsletters, and fact sheets. The organizations also received assistance with grant reporting. The ORWRP will receive many of the same benefits through both our app and the internship position. The app itself could serve as a database for research from the wetlands and other ecological information. Our main vision for

the app is for it to be an educational tool and a digital fact sheet. This will only be continually effective, however, if the app is constantly updated and made current by new research, photos, and information. An intern at the ORWRP will be the perfect person to ensure the sustainability and continuing effectiveness of our app. The student intern will also benefit from the position. Besides receiving college credit, the intern will gain essential organizational, marketing, presentation, and facilitation skills, all while learning about environmental issues impacting wetlands and the science behind them. The internship position is an ideal way to bring education outside of the classroom, applying learned knowledge to a professional setting while constantly increasing and adding new facets to that knowledge.

The Role of Social Media

Social media use is becoming more and more prevalent in the global mainstream society. The term "social media" itself can be broadly defined as an array of technologies and tools that highlight social functions of the internet as a means of collaboration and communication (Dabbagh & Kitsantas, 2011). Users of social media engage with these electronic platforms for a number of uses including enjoying entertainment options, networking socially and professionally, and conducting research. A digital app is, itself, a form of social media. Our app will be able to function as a platform for almost all elements of social media. Users will be able to take photographs with their smartphones or tablets and upload these photos to the app, sharing them with other users. The ORWRP will be able to disseminate scientific data and cutting-edge research through the app, providing users with new, data-based information. Our app will create the potential for ORWRP visitors to develop a stronger relationship with the ORWRP and the people who work at the facility. The student intern working at the ORWRP will manage the compilation of data from different experiments at the wetlands and sharing select findings with the public through a series of Tweets or Facebook statuses. It is important to note, however, that there is some danger in sharing scientific information without also sharing the credentials of the source of information (Pirraglia & Kravitz, 2012). Therefore, information about the intern will be visible so followers feel information is credible. Our goal in integrating a social media element into the app is to give visitors increased access to ORWRP information as well as the option of responding to this information with a comment or a question.

The app will also serve as a hub for all other social media platforms the ORWRP currently utilizes. For example, a photo of a wood duck on the Olentangy River posted on the ORWRP's Instagram account could be tagged to a specific geographic location within the facility and then be linked to a corresponding point within the app. The student intern could issue a Tweet about the app and the new wood duck photo within the app. A visiting family participating in the app's interactive tour features could reach that specific location, tap the photo icon on their smartphone screen, and see the image of the wood duck. This image could be accompanied by a caption that includes a link to the ORWRP's Facebook page. Research shows that a consistent thread or style that ties all marketing platforms together is an effective way to share information and publicize a product (Sharma, 2014). Our app will provide that consistent thread for the ORWRP. Having one intern as the social media voice of the wetlands would create this consistency and ensure that all social media outlets remain current and continuously updated.

As already described, a social media intern at the wetlands will take on many important responsibilities and play a large role in the effectiveness of our app. Brent Macolley, Facilities Research Manager at the ORWRP, noted that an intern at the ORWRP recently finished her work there (personal communication, October 17, 2014). Hiring another intern to handle the upkeep of our app will simultaneously fill the previous intern's position and create a new and exciting job for the intern to gain experience. For any Ohio State student studying marketing, communications, environmental science or studies, or any other field similar to these, this position could be a perfect real-world experience to cap off four or five years of undergraduate study. For the ORWRP, an intern would be a no-cost opportunity to fulfill responsibilities beyond our app and social media postings alone. Macolley shared that one of the responsibilities of the previous intern was to calibrate water quality sensors once every few weeks (personal communication, October 17, 2014). He showed our group a beautiful photo the intern had taken of this sensor and subsequently posted to the ORWRP's Twitter account. This is exactly the kind of intern activity that will support and benefit our app. Any time the intern snaps an interesting or unusual photo at the ORWRP, it could be posted on at least one social media platform and then linked into the app. Macolley also shared with our group two video recordings simulating a walk along the boardwalk over the main kidney wetlands that the previous intern had taken (personal communication, October 17, 2014). These areas are off-limits to the public so that experiments remain undisturbed, but also harbor key features of wetlands that we will share in our app. An

intern will be able to make more of these videos exploring restricted areas, bringing off-limits regions of the wetlands to public sight.

Conclusion

By creating a thoroughly interactive and accessible application to facilitate learning, our proposed app can effectively draw visitors to the Wilma H. Schiermeier Olentangy River Wetland Research Park (ORWRP) and inform them of the wetland systems and their importance. Utilizing appropriate and current learning models and applying them to relevant and easily accessible technology is the perfect way to engage visitors. The development of our app is well within our means. With university sponsored development teams and financing, our app could easily become a part of the OSU Mobile app collection. Should this option fail, state and federal grants are a potential source of funding. While the lack of internet access available at the park has been a point of concern, a hybrid application could resolve this issue. By creating this framework for the park, we are enabling them to further develop the app over time so that it can dynamically evolve as the facility grows or has a change in its needs. Additional tours may be added that highlight the various aspects of the wetlands such as bird watching, ecological processes, and the study of plants and wildlife. Furthermore, the technology can be adapted for different situations, including school visits led by a teacher who could use the app as a guided lesson plan to build off of the ideas presented at each tour point. The multiple possibilities our app presents make for the most viable and beneficial option the park has for instituting a visitor-friendly, low-labor, interactive activity.

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