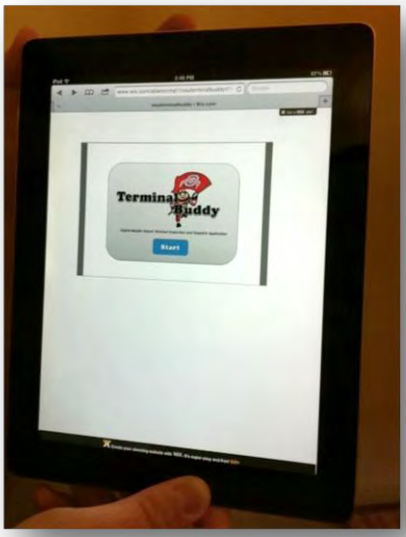
2011-2012 FAA Design Competition for Universities,
Airport Management and Planning Design Category

"Terminal Buddy"

Design and development of a mobile digital inspection, dispatch, and data analysis application to improve airport terminal operations management



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April, 2012

Executive Summary

This report addresses the FAA Design Competition for Universities' Airport Management and Planning Challenge for the 2011-2012 academic year. The product proposed in this report is designed to provide a tool to enhance airport terminal operations, specifically the inspection, maintenance, and repair of facilities within the airport terminal. It is proposed that application of the solution described within this report may improve safety and customer service quality of the terminal.

The proposed solution is a digital terminal inspection checklist, dispatch, and data analysis application, for use on mobile tablet devices such as the Apple iPad. The team has named their application *Terminal Buddy*. This application, based on a universally applicable software engine programmed using mobile html5 code, was created to be easily customizable to an individual airport terminal environment. The application allows for terminal operations personnel to perform facilities inspections comprehensively and consistently, with guidance using mapping and visual representation of facilities. Upon the recording of any discrepancies found during an inspection, the application automatically sends the discrepancy to a centralized dispatching station, as well as places the discrepancy, along with other completed checklist activity into a centralized database. Repair of discrepancies is also recorded into the database. The database portion of this application may then be used to effectively track, thus manage, facilities within the terminal environment more effectively.

Terminal Buddy was developed and tested with support from the Port Columbus International Airport. Estimates based on development and analysis reveal that, over time, this proposed application can produce significant cost savings by reducing inefficiencies in the terminal facilities inspection process, as well as lead to safety improvements by more efficiently removing any discrepancies that may be considered hazards.

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1. Problem Statement/Background

This report describes research performed in response to the Federal Aviation Administration's *Airport Design Competition for Universities'* call for proposals for the 2011-2012 academic year. The research conducted for this proposal was performed by a team of students at The Ohio State University; Victoria Haky, a senior majoring in aviation, Stephen McGirr, a senior, majoring in aviation, and Guy Jacks, a senior (graduated Winter 2012) majoring in computer science. The faculty advisor for this project was Dr. Seth Young, Associate Professor in The Ohio State University Department of Aviation.

The focus of this research falls under the "Airport Management and Planning Challenges" competition category with a focus on improving the overall management of the airport passenger terminal environment. Specifically, this proposal describes the potential for improving overall safety and customer service quality of the airport terminal by introducing digital mobile technology to the terminal building facilities inspection, repair, and maintenance process. The product proposed within this research is a mobile technology digital inspection checklist, which includes functionality for digital recording of discrepancies, automatic dispatching, and digital recording of corrective action. The team has named their application, *Terminal Buddy*.

As this proposal describes, the results of this research provide a solid foundation supporting the group's hypothesis that effective digital methods to assist in the inspection and management of terminal area facilities would significantly contribute to an enhanced atmosphere of operability, customer service quality, and ultimately safety for airport terminal users.

This proposal begins with a literature review that describes the current state of airport terminal facilities management, as well as the early development of mobile digital technologies within the

aviation and airport management environment in general. The proposal then describes the potential of integrating such technologies into terminal facilities management, through the development of a prototype tool, through interviews and beta testing in partnership with the Port Columbus International Airport.

The findings of this research reveal that such systems may significantly improve the efficiency, customer service quality, and safety at the airport terminal by facilitating more formal processes for inspection, dispatch, and data recording and analysis of terminal facilities in a cost effective manner.

2. Motivation for the Research

The problem which was identified and addressed with this design project at its outset was a simple one. It was believed that airport terminal management will face increasing challenges to adequately address customer concerns in the terminal in the future at many airports around the country due to the predicted increases in the use of air transportation system. According to the FAA, average annual enplanements will increase at a rate of 2.4 percent between 2010 and 2030, reaching over 760 million enplanements in 2030. (Source: FAA Fact Sheet, 2012)

Upon identifying this shortfall, the team began to investigate how best to approach the problem with a viable solution that would potentially help airports and their customers. It was agreed that this solution should be cost effective, easy to use, and above all else, have a positive impact on airport operations and the customers of the airports. The team took these findings and ideas about possible solutions to Mark Mulchaey, Manager of Customer Service & General Aviation Business Development, at the Columbus Regional Airport Authority. Mark was very enthusiastic about the idea from the outset and provided the team with a wealth of information.

It was decided from the beginning that the team wanted to create a mobile, electronic based computer application that would address the concerns with airport terminal management. Mobile technology is advancing by leaps and bounds. With the creation of Wi-Fi, iPads, iPhones, and smart phones, nearly everyone is capable of using a mobile application. It is believed that a better way to address management concerns at such large facilities as airports is to build an application that allows its users to be mobile while utilizing this new technology to improve the management of these facilities. There are many reasons to support this approach, not the least of which is that the newest generation of travelers, users and airport managers are more Internet savvy because of more frequent exposure to technology. More than just the demographic advantages of a mobile application were enticing, however. It was also realized that this could save airports a great deal of money and improve the quality of their services, all of which would translate to a better experience for future customers.

The original idea upon which the final design has been based, was to create an application which was a consolidation of a plethora of already existing applications, all focused on customer service, as well as implementing a wholly new application designed to track data and create a "dispatch" system for the airport management staff. It was intended to combine applications for weather, news, flights, local attractions, restaurants, hotels, car rentals, retailers, language translation, an interactive map, estimated wait times, and even a search feature into one all-encompassing program. The team eventually came to realize that this was not feasible due to its sheer size, exceeding the scope of this competition. Once the team had realized that a "Swiss Army knife" approach was excessive in scope, the focus turned to evaluating the core components of what an application needed to accomplish. The result of this brainstorming was the conclusion that the application should focus primarily on the terminal management aspects of

the problem in order to best support the solution of improving airport terminal operations management. To accomplish this, the team removed all of the plans for a customer service application and set them aside. The team would revisit them later, but this application would not be utilized by the customer, instead, it would be put directly into the hands of the airport staff.

The primary focus throughout the development of this design has been to increase the efficiency of the airport operations such that the customers at the airport will take notice and be able to appreciate the improvements. The team members worked closely throughout the development process with industry experts and individuals currently employed at airports in the Central Ohio region to supplement the team's knowledge as well as gain as many perspectives as possible. The team made numerous visits to various airports and conducted multiple interviews, and all of these have repeatedly led to the conclusion that the design being pursued is not only viable, but could potentially have a significant impact upon airport operations.

Some other positive effects of improving the airports' operations efficiency in the terminal area include reduced operating costs as well as increased customer satisfaction with the facilities and services. Additionally, through some of the peripheral features which are designed to work in conjunction with the application, the design team intends to provide airport management with a comprehensive presentation of problems frequently encountered in the airport terminal as well as an indication of customer needs, all in real time. This is made possible through the implementation of a data tracking system which will document every request made through the application on behalf of a customer as well as presenting all of the data collected through routine inspections.

3. Literature review

The first step in performing the research for this competition involved the team doing an extensive literature review on airport terminal operations management, as well as the early development of mobile technologies within the aviation industry.

The team did substantial research into the available technology being utilized by aviation related entities and found that Delta Airlines and Alaska Air were both utilizing some new tools to draw customers in and recover some of their lost revenue. Delta opted for using the newly available iPad to order food to their gate while Alaska Air used new software to decrease the use of costly free miles, and rely more upon better customer service.

In his book *The Passenger Has Gone Digital and Mobile: Accessing and Connecting through Information and Technology,* Dr. Nawal Taneja cites how airline passengers are more and more frequently utilizing newly available technologies to increase their own satisfaction with their travel experience.

> …the new-generation technology is enabling firms to leverage their old and new sources of data to improve both their internal productivity and their strategic external collaboration to provide greater value for customers. (Taneja, 11)

The fact that the passengers are using this technology with such frequency and such satisfaction should be an indication to airports and airlines that the time to catch up with their customers is now; providing useful and even entertaining new technology to customers in order to improve their experience will give them a memorable interaction with the service provider and can help to generate more revenue over the long term.

In reference to airport terminal facilities, there is not an abundance of available literature or guidance in regulations on how to best operate and maintain the facilities. There are, of course, general guidelines. However, every management group handles and interprets these guidelines differently and as such, operates and maintains the facilities differently.

This is very different from the airfield. There is a vast wealth of literature and much guidance which pertains to the airfield operations. The airfield is very strictly and heavily regulated by necessity. The complexity and highly technical nature of airfield operations demands that those operations be heavily monitored. Some of the regulations regarding the airfield are 14 CFR Part 139, 150, 153, and 157. All of these sections of the Code of Federal Regulations pertain to the operation and maintaining of the airport airfield. By contrast, there are a handful of regulations that pertain to airport terminals in 49 CFR Part 1542, but not nearly as much regulation in regard to the overall use and maintaining of the terminal facility. The terminal area is not nearly as complex or technical. However, it does still require a detailed monitoring and safety implementation system.

In the near future, safety monitoring and implementation will be generally accomplished through Safety Management Systems. A Safety Management System, or SMS for short, is a concept to be used by airports and also by many industrial firms to define the policies and procedures for properly handling safety incidents as well as implementing new safety procedures to better utilize resources dedicated to safety and handle emergencies.

Airport Service Quality (ASQ) is an Airports Council International initiative run on behalf of the airport industry worldwide. Day to day management of ASQ is conducted by aviation business analysis specialists DKMA. (Airports Council International, 2012.)

Upon reviewing provided ACI/ASQ survey data from Port Columbus, the team located a few important factors regarding customer wants and needs within the airport. Summarizing the data, the top three customer concerns for airport terminals were ambiance, cleanliness of the restrooms and cleanliness of the airport. It is believed that the structure of the team's application and its planned usage will compliment and improve facilities to improve customer and passenger satisfaction.

4. Problem Solving Approach

Upon taking a course in Airport Management, a project was provided to the team to write a paper and present a possible solution and entry to the FAA Design competition. A team of three students started discussing possible options for improvements to current airports. A few different ideas were proposed, however, the discussion of ways to use recent mobile technology to improve operations was a direction the team wanted to go. The option of improving methods for airports to do Part 139 inspections, improve customer service, and improve relations to airlines and passengers alike were all discussed.

Due to the complexity of Part 139 inspections, and the possibility of having to adjust many critical parts of the certification manual, clearance with FAA inspectors, and unfamiliarity with current inspection availability and methods, this route was not chosen. It was decided that due to the attention that airport operations departments provide to the Part 139 inspections and the detail that is already available and provided, this is not an area of immediate concern. With the addition of SMS, and its strong participation within airports, many areas of research are currently being provided to address these issues.

The group decided that it should go forward with a method to improve customer service within airports while providing important safety and security features simultaneously. The team proposed creating a mobile application for a tablet based device for airport employees to be able to provide customer service features to passengers. The initial proposal provided many links to internal and external locations, services, as well as links to community events. The application also had a very important feature that included the ability for the employee to record and dispatch departments to items they found to be unsatisfactory within the facility. This feature would allow immediate notification to departments for issues such as broken lights, signs and doors, unsatisfactory restroom conditions, security concerns, passenger needs, fires, medical emergencies, management concerns, and more.

During the initial research for the proposal, the team discussed their ideas with Mark Mulchaey and learned about some new technology that will be implemented soon as well as some technologies at other airports. Currently, there are plans to provide interactive kiosks to passengers within the facility that provides many of the customer service items the team wished to provide, including gate information, flight information, local and worldwide weather, local transportation and lodging contact information, and airline contact information. Mark remained enthusiastic about the team's plans for the application and believed that the dispatch and tracking ideas could possibly be helpful to management. Other airports and airlines have provided stand-alone iPads at gates that allow passengers to order food to be delivered to them at the gate while waiting for their flight. According to Delta Airlines Newsroom, an initiative has been launched at JFK and LaGuardia airports to provide iPad kiosks located at departure gates which, in conjunction with OTG Management, will enable passengers to order meals that will be delivered to them at their gate within ten minutes (Delta 2010). This information gave the team

encouragement that airports and airlines are excited and interested in using technology to improve their methods and the quality of the experience for passengers.

One of the important points that the team wanted to push for this project was that so much attention has been made to the safety and security of air travel today; however, sometimes the quality and enjoyment of air travel has been lost. The team wanted to find a way to improve the experience for passengers while continuing to provide features that increased productivity, safety and security.

Once the team completed the initial proposal ideas and presented the findings in class, they were approached by their advisor, Dr. Seth Young, with the idea of continuing the idea and entering it into the formal FAA Design Competition. After discussing the opportunity amongst the group, two decided to continue with the project and take the steps to make the concept a reality and learn much more about Airport Management in the process. The next step was to revisit the idea in more detail, interact with the aviation community for additional feedback and research, as well as find another student to participate to program the application and make it a reality. The team was very lucky to find an engineering computer science student who was interested in learning mobile application programming and was interested in the project.

One of the first challenges encountered was the multitude of different perspectives, knowledge bases, and expectations on the project. The aviation students in the group spent a lot of time introducing the computer science student to the world of airports and aviation. There were meetings during the team's winter break spent talking for hours about airport management structure, operations within facilities, FAA regulations, TSA factors, infrastructure of the national aviation system, how airports and airlines interact, and aviation in general. This turned

out to be a very educational experience for the entire team due to questions that arose that could not be immediately answered. It gave everyone a different perspective on the industry, as well as the wants and needs of travelers.

To further explore this perspective, it was decided that the team should obtain data from passengers about their experiences, expectations, wants, and needs. A survey was created and reviewed by the team's advisor and then given to travelers in order to obtain outside opinions on terminal facilities. A copy of this survey can be found in Appendix G. A large percentage of responses indicated an overall satisfaction with customer service, signage, and terminal layouts; however, ambiance, cleanliness and condition of the restrooms and facilities was of highest concern. This data was consistent with ACI/ASQ survey data from CMH as well as opinions and concerns expressed by airport management staff.

Another problematic aspect of the project was creating the application, *Terminal Buddy*, itself. There were many difficulties properly expressing ideas and visions for *Terminal Buddy* as well as technical challenges. The team was able to request and obtain the hardware needed to create the application as well as iPads for development and implementation through the OSU Center for Aviation Studies. It became clear that communicating ideas between technical and non-technical viewpoints was a challenge. Being able to clearly visualize, sketch, describe and manipulate the ideas to each other became a key item and a method for tracking and communicating these ideas was needed. An interactive website was used by the team that allowed each of the team members, including the advisor, access to notes, files, links, a calendar, and comments by each other. This *wiki*, as it was called, was vital to the group to be able to communicate and easily share the abundance of information that was being obtained.

The wiki page became the digital scratch pad for the project as well as a large collection of research, links, and information. By building the wiki, the team was able to effectively coordinate from remote locations and increase the amount of team knowledge transfer with no loss of time. Sections were created to keep track of contact information for the group, the advisor, as well as all industry and educational contacts that were consulted or planned to consult. Other sections included resources, such as links to the NPIAS, FAA Airport Statistics, Advisory Circular AC 150-5200-18c, University program information, competition information, local airport specific information, technology links for programming, servers and database management, API options and information from various sources, as well as national and international aviation organizations. Additional sections that were created included an acronym list for both the aviation side as well as the programming side, developing notes, updates and estimated completion timelines, copies of lecture notes from applicable aviation courses, and a multitude of uploaded files. The acronym list was very valuable once meetings with industry professionals became frequent and allowed all members of the group to have the knowledge to understand and participate while the accessibility of having all of the research from the team in one location allowed for exceptional productivity and communication.

With the creation of the wiki, one of the items that began to grow was the idea list of the features *Terminal Buddy* would provide. Figures 1 and 2 illustrate the list of items that were considered, accepted, and rejected for the initial version of the application.

Minimally Viable Product (aka MVP)

Features in this list must be implemented for the competition in April. This application will not add value without all of these features.

- Dispatcher (Dispatcher Features) (1)
- ~~Weather/delay data Data to pull (1)~~
- Airport Map (1)
- Data Tracking (1)
- ability to reassign requests from one dept. to another (1)
- ~~arrival/departure data (1)~~
- dispatch status screen/display (1)

Figure 1: Initial application required items list.

Secondary Features

Features in this list are supplementary to the primary features listed above. These will add significant value to the application.

- ~~baggage claim info (2)~~
- ~~parking info (3)~~
- ~~rental car info (3)~~
- ~~separate tiers of accessibility for different users, i.e., a level for management, a level for CSR's and a level for customers (2)~~
- ~~local hotel info (3)~~
- ~~local attractions info (dining, entertainment, services, events, etc.) (3)~~
- ~~airline contact info (2)~~
- ~~airport announcements (SMS feed for employees) (3)~~
- ~~corporate car/limo service info (3)~~
- email from contacts (2)
- photo attachment to dispatch (2)
- ~~security wait times (3)~~
- ~~language assistance/translation (3)~~
- ~~vendor items search (3)~~
- ~~general search feature (3)~~
- ~~loyalty program info/display (2)~~
- ~~lost and found info (2)~~

Figure 2: Initial application additional features list.

Once the list of required, possible, and optional features began to grow, certain features were looked into with much more detail. The core of *Terminal Buddy* became the dispatch and data tracking abilities; however, the group was still looking to continue with customer service information as well.

At a meeting at Port Columbus with Dr. Young and Mr. Mulchaey, an updated task list was presented. This meeting became a very important turning point for the entire application. A simple question was brought up, "What are we trying to solve?" Many answers to this question were proposed, including "to provide a better experience for passengers, to provide terminal managers more real time data on the status of their facilities, provide customers with simplified versions for ease of travel through the airport, and a general solution to provide better customer service overall." Eventually it was concluded that a successful application would be a simple tool that would make a significant improvement. The goal was to make this improvement to the terminal facilities themselves, which in turn, will improve the safety, security and quality of experience for passengers and guests within the airport.

Once a specific and more streamlined direction was agreed upon, many aspects of the application were removed. It was decided that the team should concentrate on a specific review of the conditions of the terminal buildings and systems on a routine and timely basis. The all-in-one application was streamlined into a facility specific terminal quality checklist on a mobile tablet device that allowed an airport employee to inspect and review specific areas of the terminals for aesthetic, safety, and emergency concerns. While traveling through specific areas, the airport employee is able to use *Terminal Buddy* to appropriately pass or fail a specific area or item. For each item, the application provides the option to immediately record a request for service, or dispatch, to be sent to a central database and departmental dispatcher. The dispatcher will then

contact the specific employee responsible for fixing, replacing, or servicing that necessary task. A flow chart of the final app design is illustrated in Figure 3. This figure shows the process for performing a terminal facilities inspection using the pre-programmed checklist as well as the application's dispatch options.

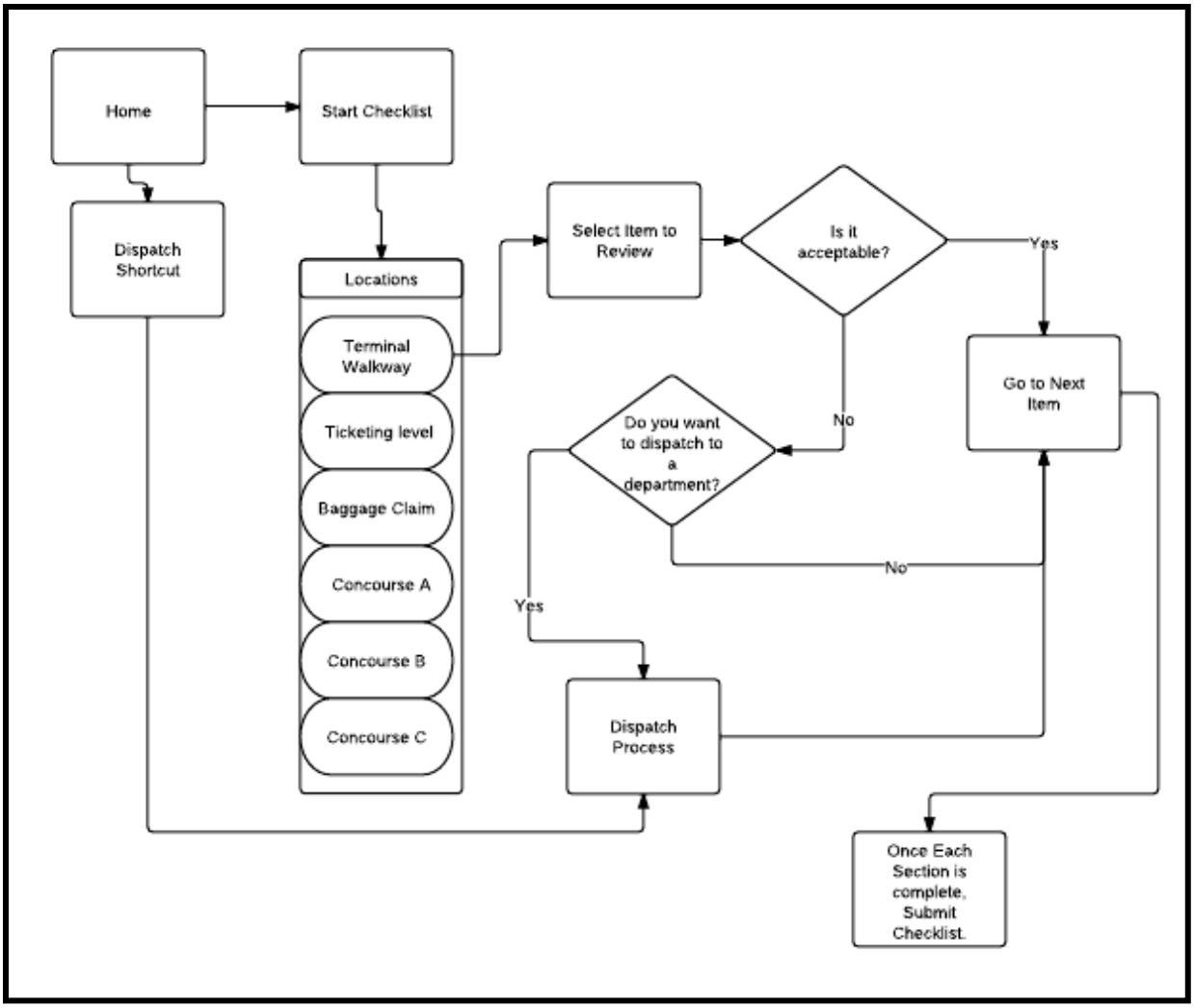


Figure 3: Flow Chart of Final Application

The application is intended to provide a more streamlined and efficient process for airport management staff to effectively manage the airport terminal. This is accomplished through the use of several functionalities. The primary functionality is a checklist which is designed to allow

airport staff to quickly and easily inspect the airport terminal facilities and determine if they are in any need of attention. A good example of this may be if the restrooms in a particular area need cleaned, even if this has not been reported by passengers, a staff member can inspect the restroom, determine that it needs to be cleaned, and with just several button clicks, not only note that they need cleaning, but also create a log of data which can then be tracked and through which trends can be observed. This data logging and tracking is accomplished through the management of a database which compiles the checklist information into an easy to utilize format which can then be accessed for later analysis by management staff.

In addition to the checklist functionality, there is also a dispatch functionality. This has been designed to work harmoniously with the checklist functionality to provide seamless interaction and further enhance the efficiency of management in the terminal area. To revisit the example of the unclean restroom, if the staff member who has noticed the restroom in need of cleaning was using this application, he/she would check that the restroom is not clean and immediately upon doing so a notification would be sent through a dispatch process to the appropriate department. This notification would then be received by the appropriate department and acted upon accordingly. Because of the proximity and cooperation of the management and staff of Port Columbus International Airport, it was determined that this airport would be an ideal to location for which to prototype this application.

5. Application development: Port Columbus International Airport

The team traveled to the Port Columbus International Airport on several occasions for meetings and various other events, but among the most interesting trips were the two times the team visited with the sole intent of inspecting areas of the terminal for the development of *Terminal Buddy*. The Port Columbus International Airport, identification code CMH, is a medium-hub sized airport with domestic and international service. There is one terminal building which consists of three levels and three concourses. The airport is reported to create $2.2 billion in annual economic activity, over 23,000 jobs and nearly 3 million enplanements a year. Figure 4 illustrates a terminal area map of the Port Columbus International Airport, not including post-security areas.

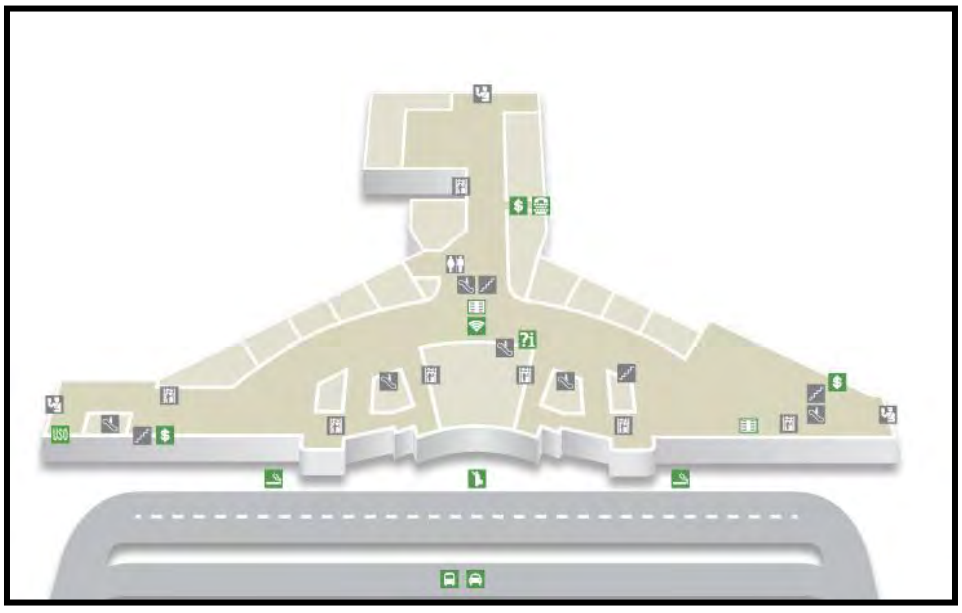


Figure 4: Basic Map of Ticketing Level of Port Columbus International Airport.

Figure 5: Damaged Loading Dock

On the first inspection activity, the team walked purposefully around the airport terminal, prior to the security checkpoints, making notes on all the things in the terminal that could potentially need to be fixed or replaced in the course of maintaining the building. On this trip, numerous discrepancies were found, such as; chipped tiles, dim lights, and litter on the floors. Some of these discrepancies are illustrated in Figures 5 through 8. During ambling about the terminal, the TSA supervisor on duty politely intercepted the team members and inquired as to their intentions. She was very cordial and allowed them to continue without argument once they had explained themselves.

Figure 6: Damaged Restroom Plumbing

Throughout the process of documenting all the potential concerns of the terminal area, there were quite a few rather significant items that should have garnered the immediate attention of the airport staff. Interestingly, when the team returned several weeks later to photograph areas of the terminal, many of the same problems still existed, having not been addressed at all. This

provided excellent evidence to support the theory that the current facility management process is not sufficient, and that perhaps the application design could help to alleviate this issue thanks to its easy tracking and accountability.

Figure 7: Damaged Wall Tiles

Figure 8: Drainage Concerns in Passenger Pickup Area

On the second excursion to inspect areas of the terminal, the team photographed different areas of the terminal, such as elevator bays, stairwells, and signage. This posed quite obvious concerns for the security staff, and the team was quickly approached by a very concerned police officer and a TSA agent. They were both quite relieved to find that the team had permission to be photographing in the terminal and no further difficulties were experienced.

In additional meetings and discussions with airport professionals, it was admitted that often airports do not have processes in place for tracking and reporting terminal conditions. The concept that was proposed for *Terminal Buddy* is a standardized application that provides a level of consistency that is often not currently found in airport terminal management. There is little consistency from airport to airport, or within one airport. Different management teams have different methods of ensuring a positive atmosphere within their terminals.

At the next meeting, the team was able to discuss more with CMH management, even as far as their current systems within terminal management as well as other airport operations. Currently the provider of their Part 139 digital inspection software does not provide terminal management applications or checklists. Currently the airport utilizes a paper based system for creating and distributing work orders to their facilities staff. The team discussed the possibility of linking the checklist and dispatch application to the airports current inventory management system, CMMS. The information technology department was consulted, but further investigation into this possibility was postponed, pending the completion of the application.

Terminal Buddy not only provides a specific checklist to review terminal conditions, but logs the information in an accessible web based server database for management to review. The data can be extracted and manipulated to review sections of the terminal that require more frequent service and can be used to model needs for improvement. Future investments in upgraded facilities, for example, additional restrooms, can be predicted and justified by creating models from data exported from the application.

6. Design/Application Development

The application that has been developed by the team is based for use on mobile devices with a basic reviewing capability on static devices. It is an interactive, easy to use, user-friendly application, which is intended to provide the greatest functionality with the greatest ease and least training time. *Terminal Buddy* integrates multiple interfaces into a simple format that allows for the use of an inspection checklist, dispatching, and event logging capabilities. This application is designed for the sole purpose of improving the functionality and efficiency of airport terminal operations for the benefit of both the airport and the passengers it serves. Figure 9 provides an illustration of the application's home screen.

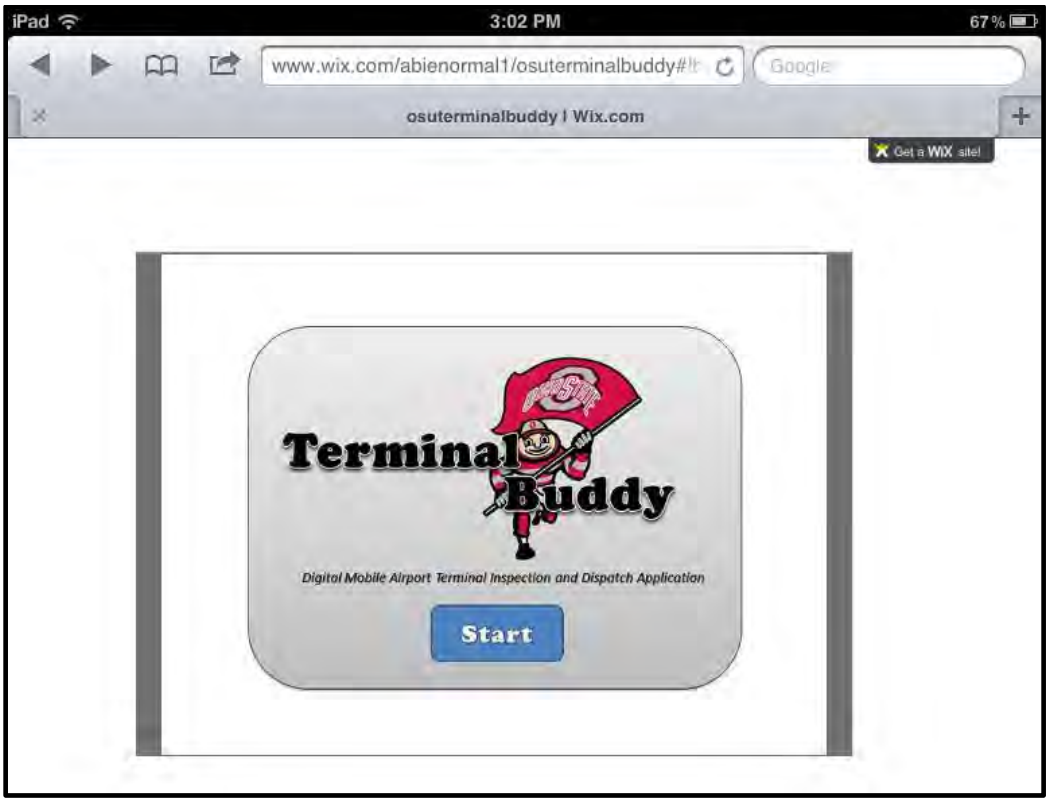


Figure 9: Home Screen for Application

Terminal Buddy provides its ease of use through the utilization of graphical aids, such as an interactive map of the terminal area, as well as providing location recognition via GPS to assist in inspection processes. Furthermore, the application includes graphical aids to clarify specific inspection items. By including photographs of the items to be inspected in the terminal area, it allows for a quicker recognition of inspection items and helps to streamline the inspection process. In addition to its simple graphical design, *Terminal Buddy* has the added benefit of eliminating costly and inefficient paper processes and manual data entry. This saves time and money through the more cost effective use of resources.

The application provides near instantaneous reporting of inspection discrepancies to a central dispatching center in order to allow for the timelier addressing of concerns within the terminal. This is accomplished through the use of text message technology; *Terminal Buddy* will send a

text notification to a central dispatch center upon a discrepancy being realized in the terminal area, pending authorization from the user.

Also, the application logs all event information automatically, including inspection information, discrepancy identification and resolution of discrepancies and provides the information to staff in an easy to use format. It is designed to interact with already existing systems to facilitate the tracking and modeling of trend information.

From a software design perspective, *Terminal Buddy* was designed using HTML5 technologies, rather than as a "native" application. Native applications are built and optimized for a specific type of device such as an Apple, Windows or Android. Multi-platform applications are compatible with more than one device but lack the optimizations that make native applications run more smoothly. The team felt that its customers should be free to choose any tablet platform to run the application. That is, this application will work on Windows tablets, Android tablets, and on Apple iPads. This allows for implementation with much more flexibility among airports.

Once the decision was made to use HTML5, the team needed to select technology platforms that were low cost and minimized the effort required to build a functional prototype. The team discovered several open source technologies that were freely available. After researching dozens of technology offerings, the team settled on the following stack; Linux, Apache Server, PHP, Javascript, MySQL database, CakePHP, and SenchaTouch.

The team first designed the database and then implemented the server side application logic to move data between the database and the mobile user interface. Once the server logic was complete, the team was able to implement the mobile-friendly user interface. The team then

began testing *Terminal Buddy* and populating the database with real data for Port Columbus International Airport. At this point the team has developed a functional prototype that can be used for demonstrations and testing at airports.

While the underlying engine has been designed to accommodate any airport environment, each individual airport will configure the application to meet custom needs, reflecting the airport's specific terminal environment. Configuration for the Port Columbus International Airport was a very quick process, once the underlying software engine was completed.

Configuration involved four steps. The first was to set the theme so that the app matches the airports brand standards. The second was to input airport areas and create task lists for each area. The third step was to upload pictures of airport facilities so that they can be associated with tasks and areas. The final step was to integrate the tool with existing airport software.

Figure 10 illustrates an example of *Terminal Buddy's* inspection checklist screens, customized for the Port Columbus International Airport. Figure 11 illustrates the dispatching functionality of the application.

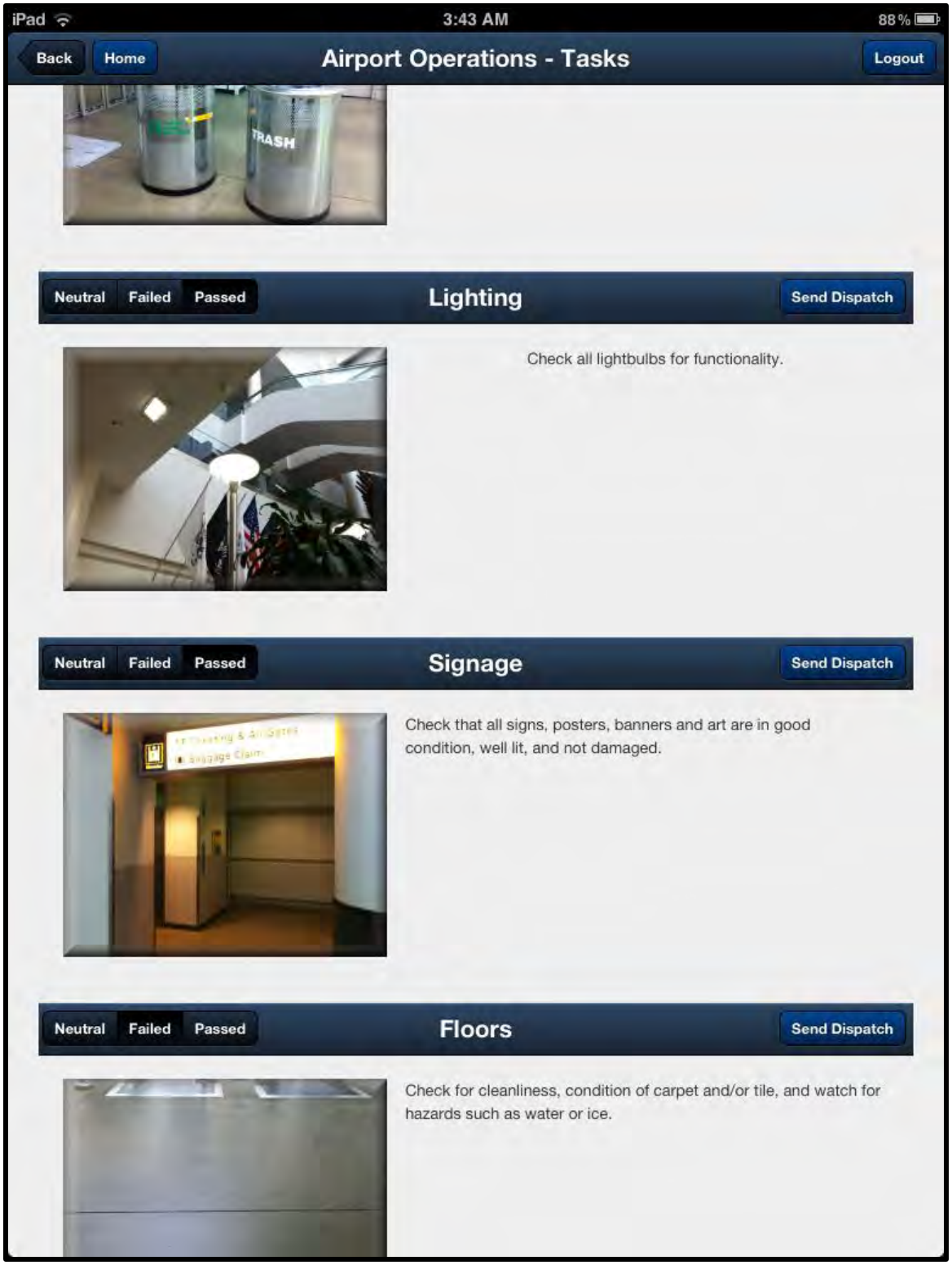


Figure 10: Screen Shot of Application Checklist Screen

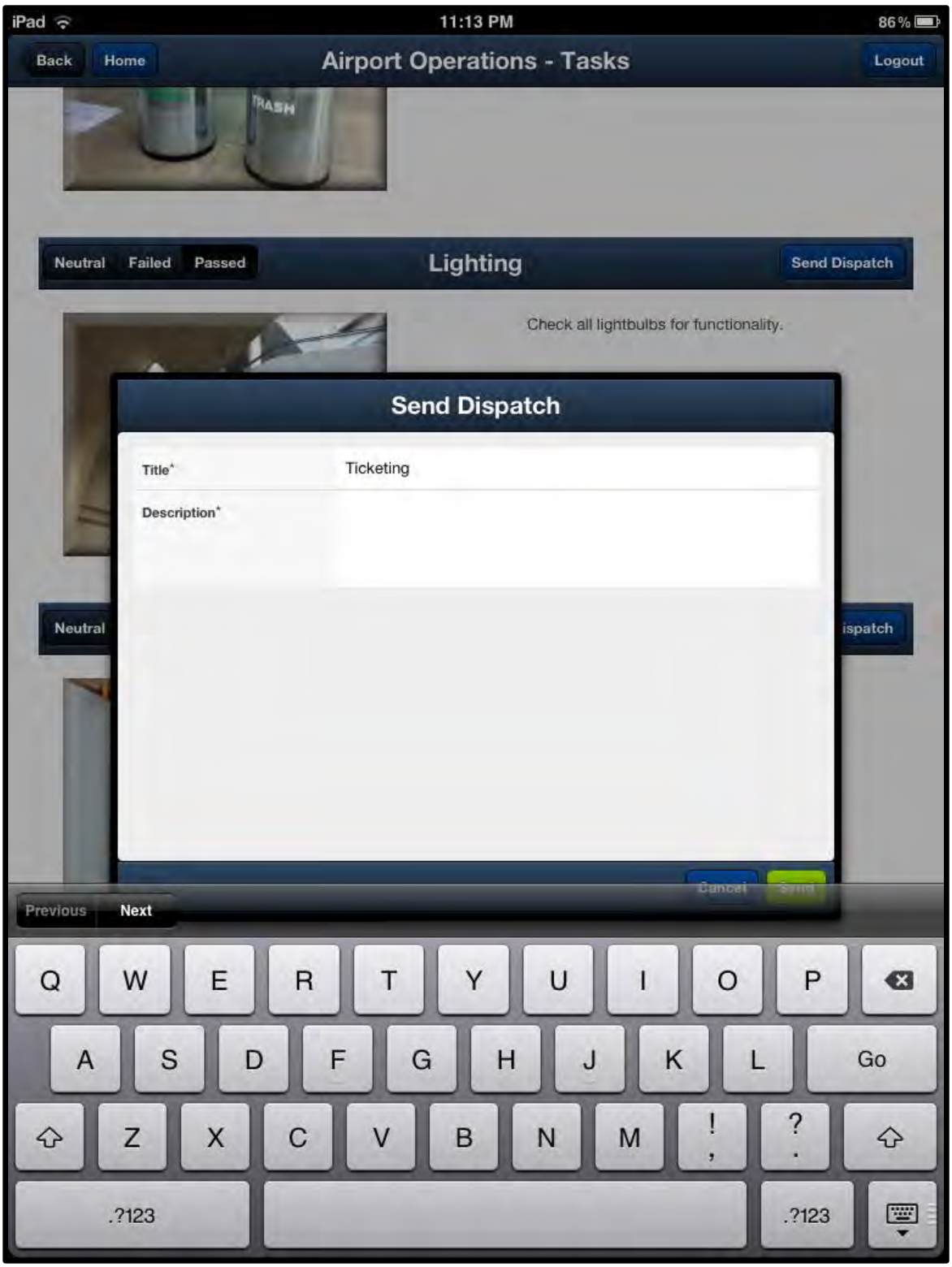


Figure 11: Screenshot of Dispatch Request Screen

7. Application Operation

Airport employee operation of *Terminal Buddy* is designed to be a simple and user-friendly process. Upon initial opening of the application, the employee selects the area of the terminal that they will be inspecting. The screen then shifts to subsections of the specific areas to provide more detail. Once the subsection of the terminal is selected, the checklist screen appears. Each specific task item is listed, along with a photograph depicting the task that is to be reviewed, along with the option to mark the task item as Neutral (not-inspected or deferred), Passed (no-discrepancies) or Failed (one or more discrepancies found, action required). In addition, a Send Dispatch button is available for the items to provide immediate access for employees to add requests to the dispatch database. If a dispatch is needed for a specific task item, the employee will press the send dispatch button and a window will appear requesting a title and description of the required dispatch. Upon entering their dispatch information, and pressing the send button, this information will immediately be sent to the dispatch server listing. The employee can then continue with the remaining items of the checklist. Each item individually updates to the checklist server database as the "Passed" or "Failed" options are pressed which will allow for information to be stored on the checklist database regardless of whether or not the entire checklist is completed for each individual area. Once each subsection task checklist is completed, the employee only has to press the back button to return to other areas of the terminal for additional inspections.

Dispatch Database Operation

Once airport employees create dispatch requests from the mobile applications, the dispatch server will immediately update with these requests. Once dispatches are listed, an employee responsible for reviewing and coordinating dispatches can then edit them with an update on the action required and airport facilities informed of the needed repairs or attention. Management can also access and update all requested dispatches to further provide immediate attention to task items.

Server Operation

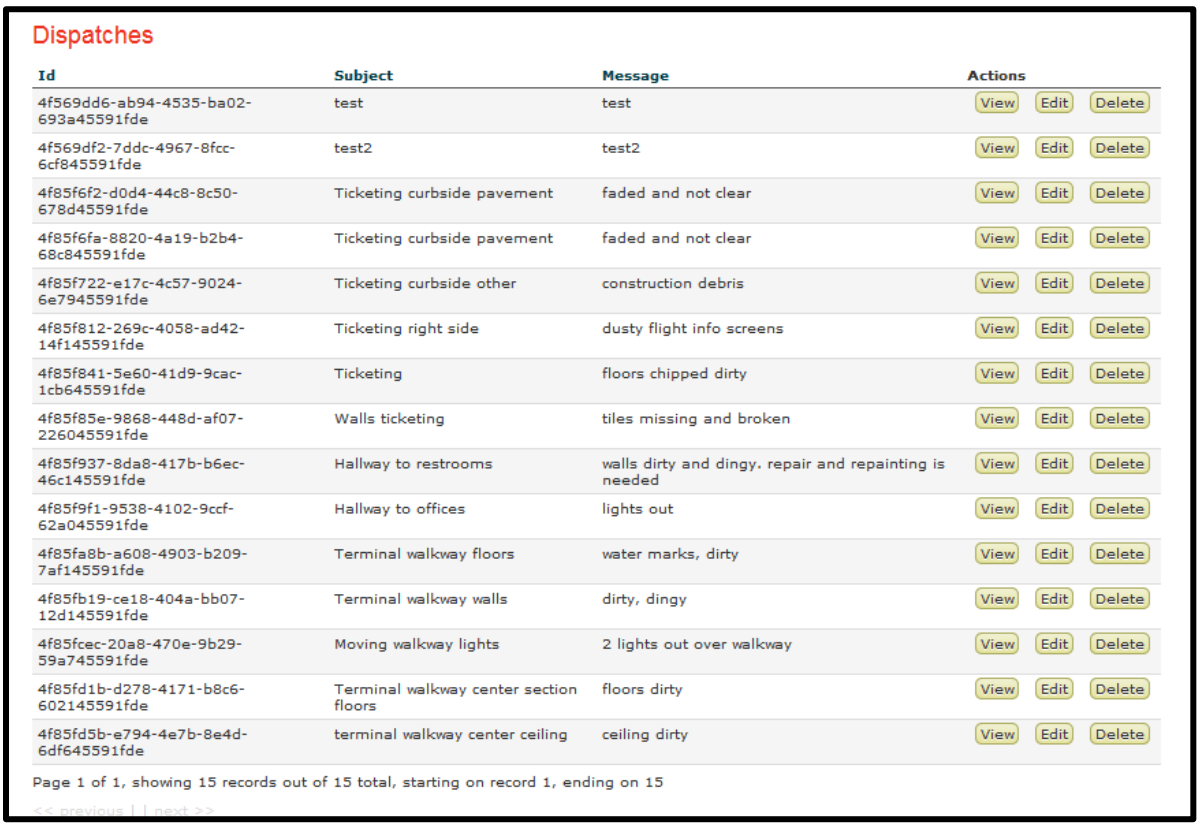
Management will have access to all aspects of the server including the ability to edit locations, sub locations and task list items, review and edit dispatches, review completed checklist items, and export checklist and dispatch data in order to review trends in conditions of areas of the terminal.

8. Testing and Evaluation

The first attempt at beta testing at Port Columbus was unfortunately not a success. *Terminal Buddy* was presenting difficulties after the large addition of task and sub task items to each of the public areas. In the terminal walkway connecting the check-in lobby with the parking facilities, the application was used to check the initial and second sections; however, saving the checklist items and sending dispatches was not functional at the time. It was also agreed that linking of the dispatch request to the task item should be a priority moving forward.

After additional technical functionality was added, including automatic entry of task items into the dispatch request screen, improvements on connectivity between *Terminal Buddy* and the

server, and individual images added for task items that correspond with those items in Port Columbus' facility, another beta test was performed. This time, checklists were completed for all areas of the terminal walkway and the ticketing and check-in level of the airport. Overall the application performed well while completing the tasks and corresponding dispatch requests. Figure 12 illustrates the database view of completed task items and a summary of dispatches created during this beta test.



Dispatches

Id	Subject	Message	Actions
4f569dd6-ab94-4535-ba02-693a45591fde	test	test	View Edit Delete
4f569df2-7ddc-4967-8fcc-6cf845591fde	test2	test2	View Edit Delete
4f85f6f2-d0d4-44c8-8c50-678d45591fde	Ticketing curbside pavement	faded and not clear	View Edit Delete
4f85f6fa-8820-4a19-b2b4-68c845591fde	Ticketing curbside pavement	faded and not clear	View Edit Delete
4f85f722-e17c-4c57-9024-6e7945591fde	Ticketing curbside other	construction debris	View Edit Delete
4f85f812-269c-4058-ad42-14f145591fde	Ticketing right side	dusty flight info screens	View Edit Delete
4f85f841-5e60-41d9-9cac-1cb645591fde	Ticketing	floors chipped dirty	View Edit Delete
4f85f85e-9868-448d-af07-226045591fde	Walls ticketing	tiles missing and broken	View Edit Delete
4f85f937-8da8-417b-b6ec-46c145591fde	Hallway to restrooms	walls dirty and dingy. repair and repainting is needed	View Edit Delete
4f85f9f1-9538-4102-9ccf-62a045591fde	Hallway to offices	lights out	View Edit Delete
4f85fa8b-a608-4903-b209-7af145591fde	Terminal walkway floors	water marks, dirty	View Edit Delete
4f85fb19-ce18-404a-bb07-12d145591fde	Terminal walkway walls	dirty, dingy	View Edit Delete
4f85fcec-20a8-470e-9b29-59a745591fde	Moving walkway lights	2 lights out over walkway	View Edit Delete
4f85fd1b-d278-4171-b8c6-602145591fde	Terminal walkway center section floors	floors dirty	View Edit Delete
4f85fd5b-e794-4e7b-8e4d-6df645591fde	terminal walkway center ceiling	ceiling dirty	View Edit Delete

Page 1 of 1, showing 15 records out of 15 total, starting on record 1, ending on 15

<< previous | | next >>

Figure 12: Server Dispatch Request Log

The convenient listing of items of immediate concern from the dispatch screen can be a valuable real time account of conditions within the terminal for management. By having the dispatch server accessible via any internet browser, management can follow and review failed items while employees are in various areas of the airport completing the checklists.

9. Cost Benefit Analysis

According to the FAA, as of 2010 there were 401 commercial airports serving a total of 712 million enplaned passengers each year. The 115 busiest airports serve 95% of these passengers. Collectively these airports serve 679.5 million passengers each year. If industry professionals are able to provide some form of *Terminal Buddy* to these 115 busiest airports, the application could potentially affect the service provided to nearly 700M passengers per year. This is a tremendous impact. Furthermore, if efficiency is improved as predicted, it will reduce operating costs significantly. The effect of these improvements is dependent upon each individual airport, however, if it were estimated that the cost reduction would be as little as approximately $.10 per passenger on average across all airports served, in terms of potential safety and customer service improvements, as well as reductions in labor costs as well as the costs of lagging facilities maintenance, that would be a system-wide reduction of nearly $70 million in operating costs, which in turn may be used to provide even better services, safety and security to the public. At Port Columbus, specifically, where the airport sees approximately 3 million enplanements annually, an annual benefit of $300,000 or so may be achieved, with this conservative estimate.

According to management at Port Columbus Airport, there is not a mobile application with the functionality that has been demonstrated thus far in the way that the application developed for this competition has. Research has also been conducted individually by team members and they are yet to find a comparable tool. This can be a sign that there is low demand; or simply a matter of the fact that the technology is so new, that such applications have yet to be developed. However, the team has discovered that airports are under pressure to reduce costs through increased efficiency. Concerns of this nature have been discussed with industry contacts and the Port Columbus International Airport, who both have expressed that proving efficiency gains will

all but ensure success. As stated earlier, in order to proceed with full development and implementation an estimated six months to design, complete, and test all aspects of *Terminal Buddy* would be required.

The projected funding needed in order to create a full commercial viable product would approximately be $200,000 to cover all production and labor costs. Estimated cost of completing the application as well as customizing and implementing the application for a particular airport are included in Figure 13. These costs also account for the programming labor costs associated with completing the application.

Production and Development Costs

Process/Item	Initial Cost
Underlying Engine of Checklist and Dispatch Structure	(Complete)
Base Programming for full Completion	$50,000
Dispatch Database Design Completion	$30,000
Operational Equipment (Central Computers, Servers)	$10,000
Airport Equipment (Approx. 20 Tablets @ $500 ea)	$10,000
Individual Airport Customization	$50,000
Estimated Annual Airport Cost (Training, updates, etc.)	$10,000
Estimated Annual Dispatch Employee Labor Cost	$40,000

Figure 13: Production and Implementation Cost Breakdown

The benefits provided by the fully implemented version of the application include: reduction in administrative costs associated with paper management, more efficient maintenance of airport facilities, and the reduction of safety related risks. Furthermore, the application offers a performance measurement system through data tracking. All of these features lead to an overall positive cost-benefit, where the benefits granted far outweigh the costs of operation and implementation.

10. Safety and Risk Assessment

Due to their highly public nature, terminal areas are prone to many risks. These risks can come from deliberate harmful acts as well as inadvertent breaches of safety. Terminals come in all different sizes, greatly dependent upon the size of the airports they serve, but there are several key factors which they all share. All terminals act as access points to the airside of the airport, though some are more restricted than others. With this in mind, it is imperative that this access be controlled and undesired access is prohibited. Many examples of points of access are unsecured as well as secured doors, fences, gates, and vendor locations which are connected to the terminal area.

A Safety Management System, as referenced in FAA Advisory Circular 150/5200-37, encourages safety within the airport area by setting a guideline and reference for safety concerns. In regards to the terminal area, the application can further enhance the safety culture which created through SMS. The application accomplishes this through allowing airport staff to report and track security concerns during routine inspections.

From analysis of a risk assessment matrix, illustrated in Figure 14, when applied to the airport terminal area, the likelihood of a severe risk occurring is minimal. Therefore, minor risks can be mitigated by the routine checking of problem areas and maintaining secure access points. Major risks can also be mitigated through the same process of consistent monitoring of potential hazards.

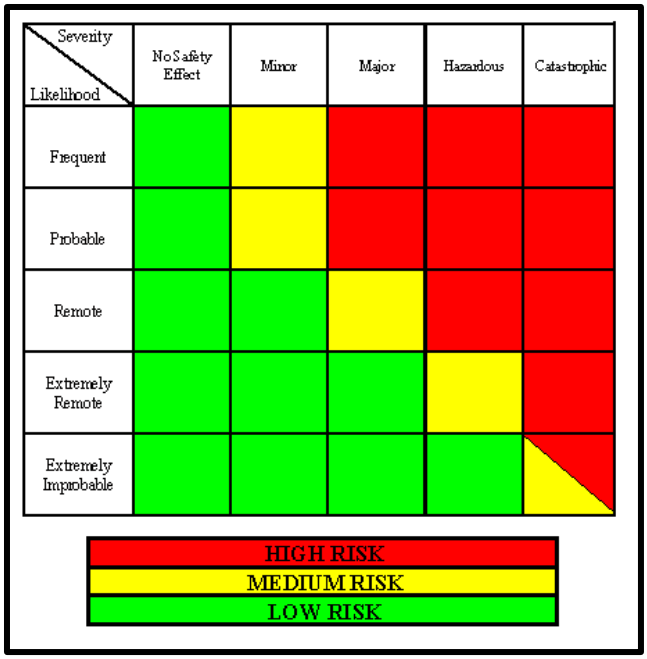


Figure 14: FAA SMS Risk Matrix

The teams' particular focus has been upon all areas inside and immediately connected to the terminal itself with the goal of removing hazards that may increase the probability of a minor to major injury. One focus of the application has been to assist in the routine inspection and tracking of all terminal functions. This ranges from people movers, to lighting and signage, to doors and access points. A particular focus in regard to safety of the terminal area has been unsecured doorways. The team observed many instances in which access is not greatly restricted, which may allow undesired access to the terminal area. Thus, the team has made the inspection and securing of these access points a priority.

11. Summary and Conclusion

The application developed and described in this report was designed with the specific intent of improving the efficiency and effectiveness of airport management efforts in airport terminal areas. As an additional positive effect, this application design may also help to improve the

airports users' experiences. It is the ultimate goal of the team to leave a lasting beneficial legacy on airport terminal management operations that can be observed at airports around the world through increased efficiency and effectiveness. Furthermore, the team wishes to provide a better overall experience for the passengers, because it is the passengers that ultimately allow our aviation system to continue functioning.

As the effort to improve upon our current systems continues onward, the team would like to take any opportunity to participate in the further implementation of the application and expanding their knowledge further in regards to airport terminal management.

The team thoroughly enjoyed working on the application and learned a great deal about not only airport terminal management, but also airport operations, customer service, professional relationship development, and software programming.

Appendix A – Contact Information

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Guy Jacks
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Dr. Seth Young, Adviser
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Appendix B – Description of University

The Ohio State University (OSU), located in Columbus, Ohio is a public land-grant university supported by the State of Ohio Board of Regents. Founded in 1870, OSU is currently the largest single-campus university in the United States with more than 60,000 undergraduate and graduate students. Ohio State is ranked among the top 20 public universities in the United States according to U.S. News & World Report. The university offers more than 160 academic programs, through 20 colleges and schools.

Ohio State is considered to be one of the most comprehensive and diverse research institutions in the United States. In 2007, OSU ranked 7th of all public universities in research expenditures with more than $650 million in funded research. Ohio State University ranked 10th in engineering research in 2006, according to the U.S. News and World Report.

The Ohio State University College of Engineering supports academic programs in Aviation. The OSU Center for Aviation Studies offers undergraduate programs in aircraft systems (flight education) and aviation management. The Center also works across the College of Engineering to foster graduate research. OSU Aviation operates an FAR Part 141 Flight School and The Ohio State University Don Scott Airport, and associated fixed based operations and FAR Part 145 Repair Station.

The Ohio State University is accredited by the Higher Learning Commission (HLC) of the North Central Association of Colleges and Schools (NCA).

Appendix C – Description of Non-University Partners Involved

Our non-university partner was Mark Mulchaey, Manager, Customer Service & General Aviation Business Development for the Columbus Regional Airport Authority. Mark's assistance with educating the team on customer service within Port Columbus International Airport, professional advice and opinions regarding the direction of the design idea, as well as his cooperation in providing additional research and industry information made him a valuable asset to the development and success of the application.

Mark Mulchaey

4600 International Gateway, Columbus, OH 43219

614-239-5036

Mmulchaey@columbusairports.com

Industry Contacts

- Irene Batty - Customer Service Manager, Landmark Aviation, Prior experience at NetJets, Lecturer OSU
- Jim Oppermann - Lecturer OSU, former executive AmericaWest
- Martin Rottler, Lecturer OSU

Meeting notes with Industry contacts available in Appendix H

Appendix E – Evaluation of Educational Experiences Provided by the Project

Student Evaluations:

Stephen McGirr

I believe that through this competition, I have learned a great deal about both aviation and about how things operate interactively with aviation that I would not have learned if I had not participated in this competition. This competition has provided me with an excellent learning experience because it has allowed me to engage with industry professionals and individuals at the top of their field. I have been able to have open discussions with these experts and see what they believe the future of aviation is going to be.

One of the biggest challenges that the team has overcome during this competition is to present ourselves to industry and to be recognized as equal and not inferior to experienced professionals. It was difficult at first to demonstrate that our team was knowledgeable and capable, however, once we were able to demonstrate to these professionals that we were serious in our endeavors and understood current industry issues, they were quick to accept us, listen to our ideas and even provide feedback on how we might improve it further.

At the outset of the competition, our team began with just a knowledge that we wanted to focus on airport management. Our method of determining what issue we might be able to address was then to research airport management and learn what problems existed. Through literature reviews and speaking with professors, we learned that customer service is always a concern of any management team. Upon acquiring this information, the team sat down and bounced ideas between us. We brainstormed and eventually concluded that a mobile application could be designed that would help to improve customer service, from this point on; we would work on a mobile application.

Throughout the project, participation by industry was a very important component. We made sure to get an industry perspective on nearly every aspect of the design to try to ensure that what we were designing would be the most useful and customer-friendly. Without the help of industry participants, this design would not have been possible.

I feel that working on this project has given me the opportunity to learn how to interact appropriately with industry professionals, it has given me a great deal of knowledge regarding the aviation community that I would not have otherwise gained, and in addition, I have gained valuable experience with pitching a product idea to industry representatives. I feel that my involvement in this project has given me the necessary skills to enter the industry and immediately impact an operation positively. I have knowledge and skills that I would not have otherwise gained, and I am better for it.

Victoria Haky

The initial idea to create a customer service based application for airport terminal management began in an Airport Management course at The Ohio State University. When the option to continue on our initial idea and submit an entry into the FAA Design Competition was approached, the opportunity seemed to be a very exciting and educational experience. Through working with aviation and non-aviation students, faculty members, and industry professionals, I learned so much more about aviation and airport management than any university course could have taught me. The experience of creating an entry into the FAA Design Competition was very rewarding and taught me many lessons that will be valuable to my future.

One of the most valuable lessons that I learned throughout the competition was the ability to clearly express ideas to other individuals and obtaining the skills to adjust your perspective to additional knowledge bases. When initially explaining our application idea to our student programmer, it was very difficult to clearly express ideas in a way he could envision as well. After many meetings amongst the team, a clear form of communication was created, knowledge of both aviation and computer science was shared, and an online system of storing and editing internal information was created.

When initially trying to create an idea to improve terminal conditions and customer service in airports, the concept of mobile technology and the ability to immediately provide a service from anywhere in the terminal was a priority. Once we agreed on an application for customer service, we had grandiose plans on what all could be possible from a mobile device given to an airport employee. We also considered limited versions for customers as well. When discussing ideas for the application features, one idea that seemed to have the most potential was the ability to immediately notify other departments of needs within the terminals. This idea then grew to be the main priority of the application and other general customer needs, such as local information, gate information, and airport facilities, were dismissed in order to provide a more effective and streamlined program.

One of the most valuable and essential aspects of the design process was our ability to coordinate with Mark Mulchaey from Port Columbus International Airport. His perspective of customer service concerns within airport terminals was important to creating an application to fit needs of airport management. Through many conversations and meetings with Mr. Mulchaey, we were able to keep our plans and ideas steered towards a more central idea while being able to provide a valuable service to airport management.

Throughout the entire process of the FAA Design competition, I had the opportunity to learn many valuable lessons that I will be able to use in the future. I learned ways to organize and track large amounts of information, notes, resources, contacts and ideas, obtained skills to improve communication skills to express and share my ideas and visions, as well as skills needed to work

within a group to jointly create and accomplish a goal. The lessons learned throughout this process, especially the communication and teamwork skills obtained, will be essential to any career paths that I may choose.

Guy Jacks

I did not know anything about airports and aviation when Victoria and Stephen approached me to help them build the Airport Operations Management tool. My background was Internet technology and marketing. The FAA Design Competition forced me to learn a lot about airport operations really quickly. Our team met with management from Columbus Airport several times which helped me understand the practical use cases for the tool our team was building. I've been writing software for over ten years but had never built a mobile device application or worked directly worked with HTML5 both of which are exciting cutting edge technologies in the software industry. I learned how to write mobile applications using the best new technologies and best of all I got to build something useful.

My role on the team was to build the application. I faced many technical challenges, most stemming from my own inexperience with a new programming language and a new framework. Fortunately, I was able to draw on my experience learning new technologies and building Internet applications to meet the most of the team's goals. My biggest challenge was getting familiar with the SenchaTouch Mobile Applications Framework for Javascript. I spent many hours learning how to get certain features of the application to work correctly. The other challenge was the timeline. The application was pretty large and I did not have much time to build it. I wrote all of the code for the application in about two months all on nights and weekends.

We took a hands-on approach to developing our hypothesis. We visited with Columbus Airport half a dozen times to talk about the purpose of our application and to practice using it. The input we received there helped us completely change direction early on from developing a customer service application to developing a terminal operations application. We also spent time taking hundreds of pictures of the airport for use in our application and to figure out where our application could be used.

As a software engineer, I have no doubt that the tool we designed will be an excellent addition to my portfolio. I was thrilled to have the opportunity to compete in the competition and although at times there was a lot of pressure, I'm happy that I got involved. I would certainly say that the competition was a valuable learning experience and will positively impact my job search.

Seth Young, Ph.D., Adviser

As part of the course I teach in Airport Management at The Ohio State University, I ask students to team up for their final projects, involving the investigation of an issue of importance to airports, and to hypothesize a solution to the issue at hand. It is within this course that the team of Victoria Haky and Stephen McGirr came up with the issue of ensuring compliance with airport certification, particularly with respect to ensuring that proper management was in place to effectively conduct airport inspections, and further to ensure that any discrepancies found during inspections were properly mitigated, and also properly recorded. As part of their work, they began to outline the use of a mobile application, for use on an i-Pad or similar device, to facilitate and perhaps improve the airport inspection process. This initial work showed excellent potential in further developing a product that may actually be marketable, and thus was the motivation for the work described in this entry to the FAA Airport Design Competition.

Ms. Haky and Mr. McGirr recruited Guy Jacks, a Computer Science major at Ohio State, with no formal education in the aviation area, to help develop the code underneath their eventual product design, that of a digital inspection checklist, dispatch, and data analysis tool, that focused on the passenger terminal environment rather than the airfield. Mr. Jacks had no formal education or experience in the aviation sector prior to this competition. It was exciting as an adviser to see the two aviation students educate the computer science student, and vice versa. It should be noted that the team worked on this project entirely as an extra-curricular activity, which speaks to the dedication that the students had towards this project.

The team made frequent visits to and based their initial design on the terminal at Port Columbus International Airport, where they had the opportunity to go "behind the scenes" in the airport terminal, "ride along" on inspections, and interact directly with airport operations staff and management. This activity was highly valuable to the team, both for this competition as well as part of their general education.

One of the expected challenges was the learning curve with respect to digital technology. However, for the most part, the challenge wasn't as insurmountable as initially thought. However, some technological restrictions did cause the team to forego some planned functionalities, such as using location data. In addition to this challenge, the typical security issues with respect to roaming an airport with a camera and restrictions from entering the sterile area existed, which resulted in some limitations to the final design and prototype.

One suggestion for the competition would be to create a more formal set of writing guidelines. With a multi-year history of this competition, students are tending to rely on the styles of previous entries to formulate their own entries. This works to a point, but perhaps a standard template would be more appropriate at this time. However, I must say that this competition has done a very good job with guiding student teams overall.

I am proud to have advised Ms. Haky, Mr. McGirr, and Mr. Jacks on their entry, and am grateful to the FAA and the Virginia Space Grant Consortium for the opportunity for our students to participate in such a worthy program.

Appendix F – Reference List

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Appendix G – Airport Passenger Survey

Airport Passenger Survey

1. What part of your trip are you currently on?

☐ Departing from Columbus ☐ Transferring through Columbus ☐ Arriving in Columbus

☐ Other (please specify) _____

2. On average, how often do you fly?

☐ Less than once a year ☐ 1-2 times a year ☐ 3-6 times a year ☐ 7-9 times a year ☐ > 9 times a year

3. Which of the following services did you use in the airport today? (check all that apply)

		Please rate your experience (Poor to Excellent)				
☐	Restrooms	1	2	3	4	5
☐	Gift shops/stores	1	2	3	4	5
☐	News and weather information	1	2	3	4	5
☐	Airport Parking	1	2	3	4	5
☐	Restaurants	1	2	3	4	5
☐	Wi-Fi internet service	1	2	3	4	5
☐	Arrivals and departures information	1	2	3	4	5
☐	Other (please specify):					
	_____	1	2	3	4	5

4. Which of the following are the most important to you in an airport?

☐ Clean restrooms
☐ Fast service
☐ Easy to find information like maps, weather, news, and flight information
☐ Personalized, face-to-face customer service

5. How have the airport facilities and/or staff made your trip more enjoyable?

_____

6. How can we improve the facilities and/or staff to make your trip more enjoyable in the future?

_____

7. Please list any services that you would like which are not currently available at the airport:

_____

8. Please list any services currently at the airport that you would like to see discontinued: (besides security.)

_____

Please take the opportunity to write any comments, suggestions or ideas you may have on the back of this survey. All surveys are being reviewed by OSU students for a research project and are not associated with the airport. Thank you for your time!!

Appendix H - Meeting Notes

December 5, 2011

Initial meeting with Mark Mulchaey

The team summarized the plan for the application design, discussed important customer service aspects from customer perspectives and inquired about airport terminal procedures. Also discussed potential sources of funding for development/purchase of working application. This meeting served as the team's initial introduction to further communications with the airport authority.

December 27, 2011

Initial meeting with Martin Rottler

The team introduced their FAA design competition idea to Martin Rottler, a lecturer on staff with the OSU Department of Aviation. Martin made several suggestions in regards to the application design, including adding an option to add a comment and/or picture on every dispatch. Martin also recommended that the team look into various airport and airline mobile applications for comparisons and ideas as to information that is already available. His experience with airports, both domestically and internationally, gave a valuable perspective towards the application.

January 20, 2012

Second meeting with Mark Mulchaey

The purpose of this meeting was primarily to update Mark Mulchaey on the progress of the application development as well as get his feedback on what has been conceptualized and completed so far. In addition, the team discussed how the application might be utilized if it were to be fully functional in its current design.

January 27, 2012

Third meeting with Mark Mulchaey

In this meeting, the team discussed the growing concern that a "one size fits all" application may not be a viable option to satisfy the needs of the airports. Determined that the management process needs to be streamlined, asked how app can help to accomplish this? Application should specialize in specific area of terminal management to allow for best use.

February 16, 2012

Fourth meeting with Mark Mulchaey

During this brief meeting, further progress on the application was discussed, as well as the viability of a checklist based functionality as a terminal management tool. Team asked permission to do mock "inspection" of airport terminal area; permission for mock inspection granted.

March 7, 2012

Meeting with Irene Batty

Irene Batty, guest lecturer at Ohio State University, works professionally in customer service for Landmark Aviation, a premier FBO at Port Columbus. She also has extensive experience working for the fractional ownership company, NetJets. Upon reviewing the application with Mrs. Batty, she emphasized the importance of the condition and quality of terminals to customers she is familiar with in general aviation and expressed approval for the direction of the application.

March 26, 2012

Meeting with Mark Mulchaey

Our final meeting with Mr. Mulchaey was to discuss further possible implementations, results of our initial beta testing as well as marketing and cost/benefit information. An overall review of previously discussed information was completed and the current application was reviewed and tested.

Multiple Dates throughout the Design Process

Meetings and consultations with Jim Oppermann

Mr. Oppermann was very helpful to the team with his marketing, business and airline perspective towards the application and the solution that it was designed to provide. Through discussion with him, cost analysis and benefit analysis was reviewed as well as marketing possibilities.

Appendix I - Code

```
<?php
class DispatchesController extends AppController {

	var $name = 'Dispatches';

	function index() {
		$this->Dispatch->recursive = 0;
		$this->set('dispatches', $this->paginate());
	}

	function view($id = null) {
		if (!$id) {
			$this->Session->setFlash(__('Invalid dispatch', true));
			$this->redirect(array('action' => 'index'));
		}
		$this->set('dispatch', $this->Dispatch->read(null, $id));
	}

	function add() {
		if (!empty($this->data)) {
			$this->Dispatch->create();
			if ($this->Dispatch->save($this->data)) {
				$this->Session->setFlash(__('The dispatch has been saved', true));
				$this->redirect(array('action' => 'index'));
			} else {
				$this->Session->setFlash(__('The dispatch could not be saved. Please, try
again.', true));
			}
		}
	}

	function send(){
		$this->data['Dispatch']['subject'] = $this->params['form']['title'];
		$this->data['Dispatch']['message'] = $this->params['form']['message'];
		if(!empty($this->data)){
			$this->Dispatch->create();
			$this->Dispatch->save($this->data);
		}
		echo('successProperty===true');
		$this->autoRender=false;
	}

	function edit($id = null) {
		if (!$id && empty($this->data)) {
			$this->Session->setFlash(__('Invalid dispatch', true));
			$this->redirect(array('action' => 'index'));
		}
		if (!empty($this->data)) {
			if ($this->Dispatch->save($this->data)) {
				$this->Session->setFlash(__('The dispatch has been saved', true));
				$this->redirect(array('action' => 'index'));
```

```
                        } else {
                                $this->Session->setFlash(__('The dispatch could not be saved. Please, try
again.', true));
                        }
                }
                if (empty($this->data)) {
                        $this->data = $this->Dispatch->read(null, $id);
                }
        }

        function delete($id = null) {
                if (!$id) {
                        $this->Session->setFlash(__('Invalid id for dispatch', true));
                        $this->redirect(array('action'=>'index'));
                }
                if ($this->Dispatch->delete($id)) {
                        $this->Session->setFlash(__('Dispatch deleted', true));
                        $this->redirect(array('action'=>'index'));
                }
                $this->Session->setFlash(__('Dispatch was not deleted', true));
                $this->redirect(array('action' => 'index'));
        }
}
?>

<?php
class TasksController extends AppController {

        var $name = 'Tasks';

        function index() {
                $this->Task->recursive = 0;
                $this->set('tasks', $this->paginate());
        }

        function listByLocation($locationId){
                $this->layout = 'ajax';

                $conditions = array('location_id' => $locationId);
                $fields = array('id', 'name', 'description', 'passed', 'failed', 'modified');
                $findArgs = array(
                        'conditions'=>$conditions,
                        'fields'=>$fields,
                        'recursive'=>-1
                );
                $json = $this->Task->find('all', $findArgs);
                // HACK - I am currently checking modified date against cliet side date use javascript which would
not work since the browser timezone is likely different from the server timezone.  I need to compare the dates
here before I send them to the client.
                $this->set(compact('json'));
                $this->render('/json/json');
        }
```

```
	function view($id = null) {
		if (!$id) {
			$this->Session->setFlash(__('Invalid task', true));
			$this->redirect(array('action' => 'index'));
		}
		$this->set('task', $this->Task->read(null, $id));
	}

	function togglePassed($passOrFail, $id){
		$this->data['Task']['id'] = $id;

		if($passOrFail == 'pass'){
			$this->data['Task']['passed'] = true;
			$this->data['Task']['failed'] = false;
		}
		elseif($passOrFail == 'fail'){
			$this->data['Task']['passed'] = false;
			$this->data['Task']['failed'] = true;
		}
		else{
			$this->data['Task']['passed'] = false;
			$this->data['Task']['failed'] = false;
		}

		$this->Task->save($this->data);

		$this->autoRender = false;
	}

	function add() {
		if (!empty($this->data)) {
			$this->Task->create();
			if ($this->Task->save($this->data)) {
				$this->Session->setFlash(__('The task has been saved', true));
				$this->redirect(array('action' => 'index'));
			} else {
				$this->Session->setFlash(__('The task could not be saved. Please, try again.',
true));
			}
		}
		$parents = $this->Task->ParentTask->find('list');
		$locations = $this->Task->Location->find('list');
		$users = $this->Task->User->find('list');
		$this->set(compact('parents', 'locations', 'users'));
	}

	function edit($id = null) {
		if (!$id && empty($this->data)) {
			$this->Session->setFlash(__('Invalid task', true));
			$this->redirect(array('action' => 'index'));
		}
		if (!empty($this->data)) {
			/*if($this->data['Task']['file']){
```

```
                                        $file = new File($this->data['Task']['file']['tmp_name']);
                                        $fileData = $file->read();
                                        $file->close();
                                        $file = new File(WWW_ROOT . 'img/' . $id . '.' . 'jpg', true);
                                        $file->write($fileData);
                                        $file->close();
                                }*/
                                if ($this->Task->save($this->data)) {
                                        $this->Session->setFlash(__('The task has been saved', true));
                                        $this->redirect(array('action' => 'index'));
                                } else {
                                        $this->Session->setFlash(__('The task could not be saved. Please, try again.',
true));
                                }
                        }
                        if (empty($this->data)) {
                                $this->data = $this->Task->read(null, $id);
                        }
                        $parents = $this->Task->ParentTask->find('list');
                        $locations = $this->Task->Location->find('list');
                        $users = $this->Task->User->find('list');
                        $this->set(compact('parents', 'locations', 'users'));
        }

        function delete($id = null) {
                if (!$id) {
                        $this->Session->setFlash(__('Invalid id for task', true));
                        $this->redirect(array('action'=>'index'));
                }
                if ($this->Task->delete($id)) {
                        $this->Session->setFlash(__('Task deleted', true));
                        $this->redirect(array('action'=>'index'));
                }
                $this->Session->setFlash(__('Task was not deleted', true));
                $this->redirect(array('action' => 'index'));
        }
}
?>

<?php
class MasterTasksController extends AppController {

        var $name = 'MasterTasks';

        function index() {
                $this->MasterTask->recursive = 0;
                $this->set('masterTasks', $this->paginate());
        }

        function view($id = null) {
                if (!$id) {
                        $this->Session->setFlash(__('Invalid master task', true));
                        $this->redirect(array('action' => 'index'));
```

```
		}
		$this->set('masterTask', $this->MasterTask->read(null, $id));
	}

	function add() {
		if (!empty($this->data)) {
			$this->MasterTask->create();
			if ($this->MasterTask->save($this->data)) {
				$this->Session->setFlash(__('The master task has been saved', true));
				$this->redirect(array('action' => 'index'));
			} else {
				$this->Session->setFlash(__('The master task could not be saved. Please, try
again.', true));
			}
		}
		$locations = $this->MasterTask->Location->find('list');
		$parentMasterTasks = $this->MasterTask->ParentMasterTask->find('list');
		$this->set(compact('locations', 'parentMasterTasks'));
	}

	function edit($id = null) {
		if (!$id && empty($this->data)) {
			$this->Session->setFlash(__('Invalid master task', true));
			$this->redirect(array('action' => 'index'));
		}
		if (!empty($this->data)) {
			if ($this->MasterTask->save($this->data)) {
				$this->Session->setFlash(__('The master task has been saved', true));
				$this->redirect(array('action' => 'index'));
			} else {
				$this->Session->setFlash(__('The master task could not be saved. Please, try
again.', true));
			}
		}
		if (empty($this->data)) {
			$this->data = $this->MasterTask->read(null, $id);
		}
		$locations = $this->MasterTask->Location->find('list');
		$parentMasterTasks = $this->MasterTask->ParentMasterTask->find('list');
		$this->set(compact('locations', 'parentMasterTasks'));
	}

	function delete($id = null) {
		if (!$id) {
			$this->Session->setFlash(__('Invalid id for master task', true));
			$this->redirect(array('action'=>'index'));
		}
		if ($this->MasterTask->delete($id)) {
			$this->Session->setFlash(__('Master task deleted', true));
			$this->redirect(array('action'=>'index'));
		}
		$this->Session->setFlash(__('Master task was not deleted', true));
		$this->redirect(array('action' => 'index'));
```

```
	}
}
?>
<?php
class LocationsController extends AppController {

	var $name = 'Locations';

	function index() {
		$this->Location->recursive = 0;
		$this->set('locations', $this->paginate());
	}

	function listChildren($parentId){
		$this->layout = 'ajax';
		$conditions = array('parent_id' => $parentId, 'published'=>true);
		$fields = array('id','parent_id','name');
		$findArgs = array(
			'conditions'=>$conditions,
			'fields'=>$fields,
			'recursive'=>-1
		);
		$json = $this->Location->find('all', $findArgs);
		$this->set(compact('json'));
		$this->render('/json/json');
	}


	function view($id = null) {
		if (!$id) {
			$this->Session->setFlash(__('Invalid location', true));
			$this->redirect(array('action' => 'index'));
		}
		$this->set('location', $this->Location->read(null, $id));
	}

	function add() {
		if (!empty($this->data)) {
			$this->Location->create();
			if ($this->Location->save($this->data)) {
				$this->Session->setFlash(__('The location has been saved', true));
				$this->redirect(array('action' => 'index'));
			} else {
				$this->Session->setFlash(__('The location could not be saved. Please, try
again.', true));
			}
		}
		$airports = $this->Location->Airport->find('list');
		$parents = $this->Location->ParentLocation->find('list');
		$this->set(compact('airports', 'parents'));
	}

	function edit($id = null) {
```

```
		if (!$id && empty($this->data)) {
			$this->Session->setFlash(__('Invalid location', true));
			$this->redirect(array('action' => 'index'));
		}
		if (!empty($this->data)) {
			if ($this->Location->save($this->data)) {
				$this->Session->setFlash(__('The location has been saved', true));
				$this->redirect(array('action' => 'index'));
			} else {
				$this->Session->setFlash(__('The location could not be saved. Please, try
again.', true));
			}
		}
		if (empty($this->data)) {
			$this->data = $this->Location->read(null, $id);
		}
		$airports = $this->Location->Airport->find('list');
		$parents = $this->Location->ParentLocation->find('list');
		$this->set(compact('airports', 'parents'));
	}

	function delete($id = null) {
		if (!$id) {
			$this->Session->setFlash(__('Invalid id for location', true));
			$this->redirect(array('action'=>'index'));
		}
		if ($this->Location->delete($id)) {
			$this->Session->setFlash(__('Location deleted', true));
			$this->redirect(array('action'=>'index'));
		}
		$this->Session->setFlash(__('Location was not deleted', true));
		$this->redirect(array('action' => 'index'));
	}
}
?>

<?php
class AirportsController extends AppController {

	var $name = 'Airports';

	function index() {
		$this->Airport->recursive = 0;
		$this->set('airports', $this->paginate());
	}

	function view($id = null) {
		if (!$id) {
			$this->Session->setFlash(__('Invalid airport', true));
			$this->redirect(array('action' => 'index'));
		}
		$this->set('airport', $this->Airport->read(null, $id));
	}
```

```
	function add() {
		if (!empty($this->data)) {
			$this->Airport->create();
			if ($this->Airport->save($this->data)) {
				$this->Session->setFlash(__('The airport has been saved', true));
				$this->redirect(array('action' => 'index'));
			} else {
				$this->Session->setFlash(__('The airport could not be saved. Please, try again.',
true));
			}
		}
	}

	function edit($id = null) {
		if (!$id && empty($this->data)) {
			$this->Session->setFlash(__('Invalid airport', true));
			$this->redirect(array('action' => 'index'));
		}
		if (!empty($this->data)) {
			if ($this->Airport->save($this->data)) {
				$this->Session->setFlash(__('The airport has been saved', true));
				$this->redirect(array('action' => 'index'));
			} else {
				$this->Session->setFlash(__('The airport could not be saved. Please, try again.',
true));
			}
		}
		if (empty($this->data)) {
			$this->data = $this->Airport->read(null, $id);
		}
	}

	function delete($id = null) {
		if (!$id) {
			$this->Session->setFlash(__('Invalid id for airport', true));
			$this->redirect(array('action'=>'index'));
		}
		if ($this->Airport->delete($id)) {
			$this->Session->setFlash(__('Airport deleted', true));
			$this->redirect(array('action'=>'index'));
		}
		$this->Session->setFlash(__('Airport was not deleted', true));
		$this->redirect(array('action' => 'index'));
	}
}
?>
```