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Smart Phone App for Waiting Time in Airport Security Lines

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Abstract

This paper will highlight the importance of minimizing the amount of time passengers spend waiting, effective ways in which to track the waiting time, case studies of organizations that have implemented these methods, methods of relaying the information to passengers, and demonstrating that people are in fact willing to support this type of program. It will answer the question "What is the level of interest of airline passengers for an App that provides them with real-time information on the expected wait time at airport security checkpoints?"

Introduction

For any business, the time that customers spend in line is money lost. To help passengers traveling through today's commercial airports plan their travel more efficiently, it is important to be able to have as much information as possible regarding the amount of time they can expect to spend at each phase of their trip. While there are many different phases of "waiting" that passengers must make their way through when traveling on a commercial airline, the one line that everyone must negotiate is the security checkpoint line. The research will focus on the way in which an airport tracks the time it takes for people to be processed through security checkpoints, display it on a smart-phone app and then provide it to the traveling passengers. This study will help to determine if passengers would be willing to purchase an App that would provide them with information regarding the wait at the security checkpoint. By incorporating this kind of app into airport security lines, passengers will be able to more effectively plan ahead.

App – shorthand for application, which provides a function or service to the user through a smart device such as a phone or tablet.

Literature Review

Waiting in lines can be a miserable time. Places like Disney World have embraced the idea of queuing psychology. Eliminating "empty time" makes the wait seem shorter. Amusement parks have incorporated television screens and interactive games to keep customers amused (Pawlowski, 2008). While this helps to keep passengers not quite as irritated as they would have been just watching the clock, it only masks the wait rather than helping to eliminate it. If one can accurately determine how long he/she will be waiting to be served, one can make the process more efficient. Satisfied clients will continue to return for service. There are several ways to track the amount of time people are spending in line.

One way to track passengers as they move through the airport is to pass out a tracking card at the beginning of security and collect it at the end, providing the recorder with an approximate time required to pass through security. This method has been proven to work quite efficiently at places like Disney World (Theme Park Insider, 2006). Known for the rides and large volumes of people it serves, Disney has been able to track and predict the amount of time people can expect to spend in line for a specific ride. A ride attendant hands a passenger a card which is scanned at the beginning of the line queue. After passing through the line, the passenger then hands the card off to the next ride attendant just before getting on the ride. The time is logged and then relayed back to the front of the line where the sign displaying the expected wait is located. This system is accurate because of its regularity. At Disney World, these cards are passed out approximately every 10 minutes. This system provides passengers with an average amount of time they can expect to wait for that particular ride during that time frame. While it is accurate to a fair degree, there are some faults in the system. According to themeparkinsider.com, in most cases, the time is overestimated rather than underestimated. In this situation, it is better to overestimate so that the passengers are happily surprised, rather than

irritated after waiting 30 minutes longer than expected; however, accuracy is the goal. It is not guaranteed that passengers are going to hand over their cards at the proper time. As humans, we make mistakes and forget. It is not uncommon for riders at Disney World to return their cards after riding, which adds a significant amount of time to the displayed wait. Employees working the line may not be able to enter the time as often as they should be which would also extend the "expected wait time".

Another way to determine the average amount of time would be mathematically. The most widely-accepted method is Line Queuing Theory. This takes into consideration all components of waiting to be served (Investopedia, 2011). Hiray (2008) notes that, "A waiting line system or queuing system is defined by two important elements: the population source of its customers and the process or service system. The customer population can be considered as finite or infinite. The customer population is finite when the number of customers affects potential new customers for the service system already in use. When the number of customers waiting in line does not significantly affect the rate at which the population generates new customers, the customer population is considered infinite" (Hiray, 2008 Page 1.) By taking the total amount of passengers in line, multiplying by "x" number of minutes required to process each passenger and then dividing by the amount of people servicing them, one can get a reasonable estimate on how long it should take to transit the line. There are other factors that affect the amount of time it takes to be processed through lines, such as arrangements of servers and design of the line queue (Hiray, 2008). Airports can track and predict the number of people they can expect to be passing through security, based on ticket sales and historical data for a given time period. Using these data, they are able to extrapolate and determine how to staff the Transportation Security Administration (TSA) checkpoints, for specific shifts in order to efficiently process all passengers traveling during that time. This method provides airport

authorities and passengers with a general idea of how long lines at the airport should take. That is where the "arrive two hours before departure" rule of thumb was established. This method does not provide up-to-date, accurate numbers for a specific time. There are many variables that come into play. According to Maister (1985) mathematical theory of waiting lines for a given average is affected by adding or subtracting the number of people serving the passengers, altering "queue discipline" (the order in which customers are served), speeding up processing time, etc. This is far too broad a prediction; however it does supply the customers with a general idea of what they can expect.

While being able to predict how long it will take for a person to get through a line is a great tool for an airport to have, it does little for the passengers if they are unable to access this information. In today's fast –paced world, it seems like everywhere you look, you can see someone holding a smart phone or tablet. That would be the ideal platform for transmitting these data to passengers prior to their arrival at the airport. Other organizations are using this same idea to help boost their customer appeal. Disney World has teamed with Verizon Wireless to provide customers with a downloadable app that will transmit data to their phones. This app will have information regarding park maps, character locations, restaurants, and mobile games, as well as expected wait times for rides (Jablon, 2008). Other organizations, such as touringplans.com, have similar apps such as the Disney World app. By collecting data for 10+ years, combined with statistical models and real-time data sent in by users, customers are able to see real-time "waits" for whatever line they are interested in. Creating an app to serve a business has been simplified so that a person with basic computer skills is able to design and build it themselves. There are hundreds of quick guides and companies online that are available to help design and build an app for any operating platform on the market today. Apple has a large share of the current market today, making them the first logical place to start. iOS Developer Program

is the “fastest path from code to customer” (Apple, 2011, page 1.) Step 1 is to develop the app using the iOS development center. Step 2 is to test the app. This is where bugs in the program would be worked out and ease of operation would be finalized. Step 3 is to distribute and start making money (Apple, 2011). Incorporating an app into airport/TSA operations would not be a challenging task.

Many large companies like Disney World have found that the best way to track the amount of time spent in lines is by passing out cards before security and collecting them after (Jablon, 2008). It would not be a far stretch to apply this program to the aviation industry. To get these data to passengers, information could be collected at specific time intervals the airport finds appropriate; 10 minutes, 20 minutes, 30 minutes, etc. This information, collected over time, would then be catalogued and uploaded to the app where people would be able to see current expected wait times. Travel through an airport is not consistent. The amount of people traveling changes with the day of the week, month of the year and especially on holidays. By gathering data over time, an airport would be able to create a historical trend that would provide passengers with both a real-time wait as well as a historical wait for that day in previous years. More data means more accurate predictions for passengers.

There are many ways for an “app” to be distributed to the customers. For an airport to make money, the most efficient way would be to include the cost of the app in the ticket sale price, under the airport tax/user fee. With the purchase of the ticket, the customer could get a code that would enable them to have access to the data. The code would then expire at the end of the day of their scheduled departure. If they have a round trip ticket, a new code would be sent to them the day of their return flight. This ensures that the people using the app are the ones paying for it and that there is a steady income from the program with every purchase of the ticket compared to a one-time purchasing fee. Along with the expected wait times, other information

can be included such as TSA restrictions on travel items, available restaurants, departure/arrival delays and local weather. There are currently apps on the market like this but none with a system backing it up with consistent and regular data (Cfnew13.com). Most are based on passengers updating the app. This can become inaccurate when forgetful passengers upload times that do not directly reflect security line times. By bringing together real-time data with an app that has the potential to be profitable for each airport utilizing the system, passengers are able to save themselves a little stress getting to the airport by knowing what to expect. A less stressful passenger creates a safer and more efficient environment for everyone.

Methodology

Will passengers purchase an "App" that provides them with real-time information on the expected wait time at security checkpoints?

Participants

Participants for this study included Purdue University College of Technology faculty and staff. Participants' opinions were solicited on usefulness of a time reporting app and if they would be willing to purchase such an app.

Measures

A survey (located in Appendix A) was distributed to potential travelers in electronic format to determine how likely people are to find an App helpful enough to purchase.

Procedures

Participants were given a survey that asked their gender, age, whether they own a "smart device", how often they travel, how early they arrive at the airport before departure, if they believe an app that provided information regarding wait times would be helpful, if they would purchase the app, and how much they would be willing to pay for it. The survey was distributed using electronic methods online to gather data from faculty and staff from the Purdue University College of Technology, as a case study.

The researcher recorded the responses from the survey and used those data to determine

how likely passengers are to purchase this application. A detailed evaluation of these data can be found in Appendix C.

Results

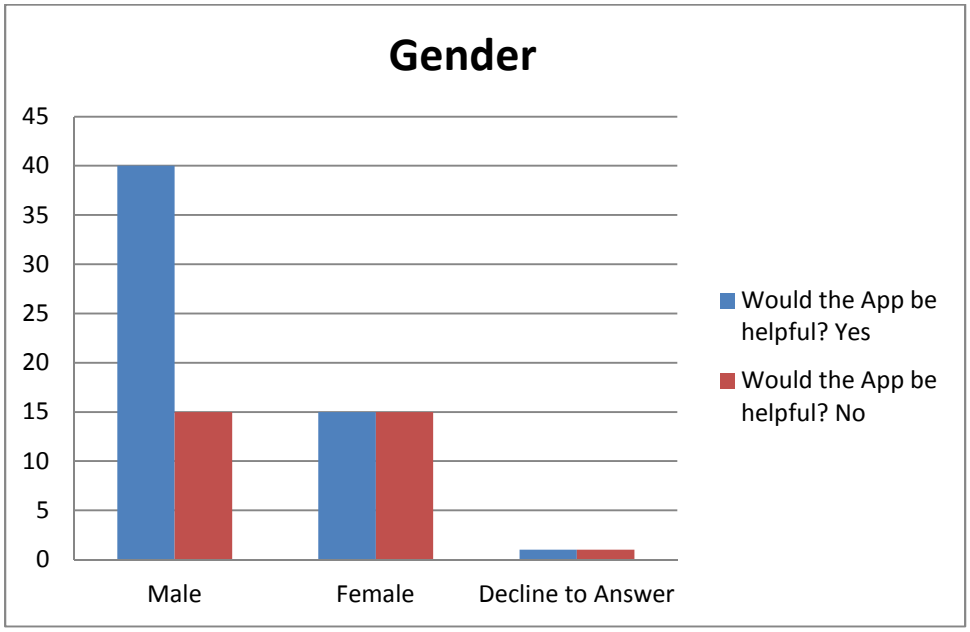

Figure 1. Gender vs. Perception of App helpfulness

Figure 1. Shows the relationship between Gender and If the passengers would find the app helpful. Of the 50 males surveyed, 40 responded yes while 15 responded no. Of the 30 females surveyed, 15 responded yes and 15 responded no. According to these data, men in the sample group are more likely to find this app helpful to their travel plans. Over 55 males and females said that they would find the app helpful compared to 30 males and females that said they would not.

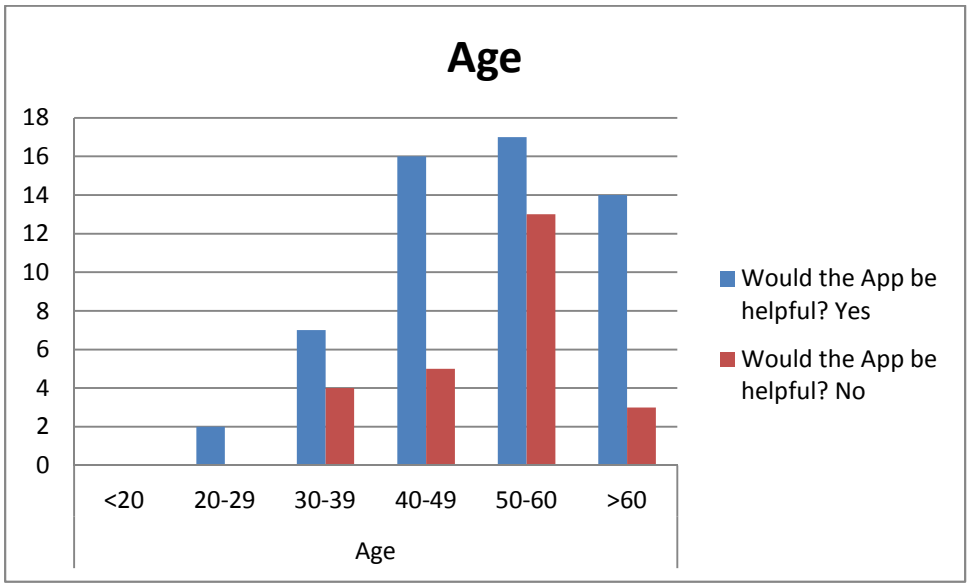

Figure 2. Age vs. Perception of App helpfulness

Figure 2. Shows the relationship between Age and If the passengers would find the app helpful. The majority of respondents were between the ages of 50 and 60. A total of 56 respondents between the ages of 20 and 60+ years, said that they would find the app helpful, compared to 35 who said they would not. While the majority of passengers that would find the app helpful are above age 30, those below 30 would also find it useful.

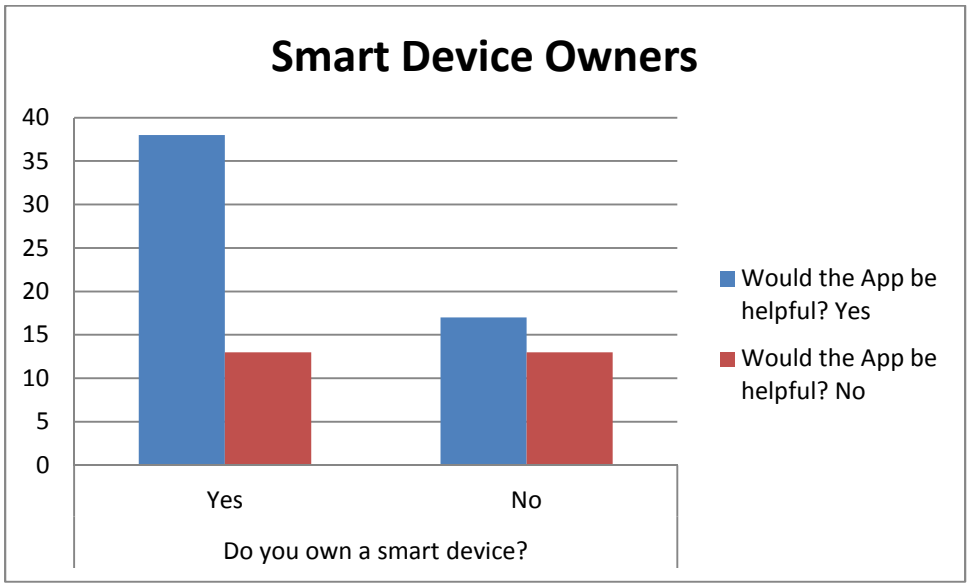

Figure 3. Do they own a smart device vs. Perception of App helpfulness

Figure 3. Shows the relationship between Owning a smart device and If they would find the app helpful. Most of the respondents that owned a smart device at the time of the survey, stated that having this app would be helpful. Of 51 respondents who own a smart device, 38 of them said that they would find the app helpful. Of the 30 respondents that do not have a smart device, 17 of them said that they would also find the app helpful. Over all, those that own a smart device would find the app helpful.

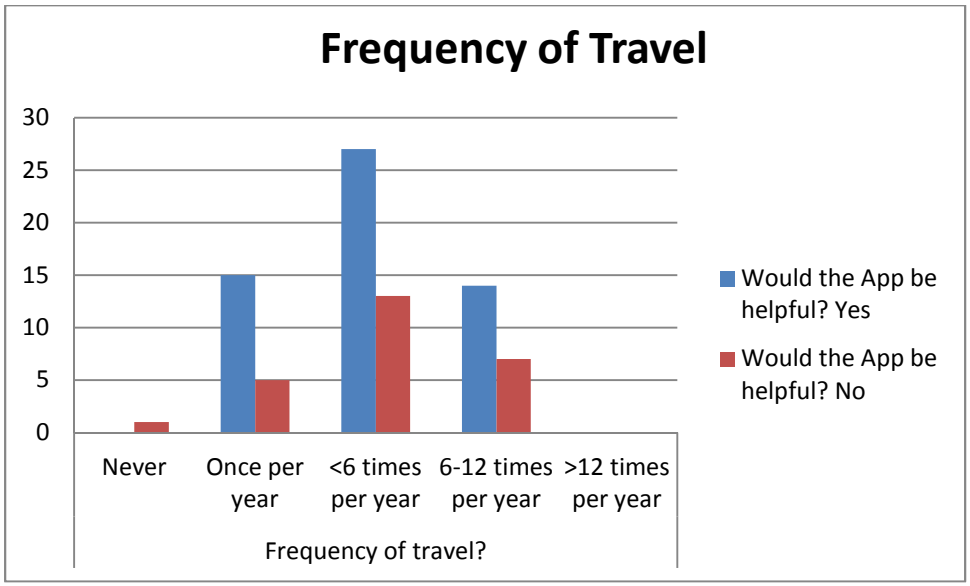

Figure 4. How often a passenger travels on an airline vs. Perception of App helpfulness

Figure 4. Shows the relationship between the Frequency of travel on a commercial airline and If they would find the app helpful. Most of the respondents traveled less than 6 times per year. There was only one person who never travels. That one person said that the app would not be helpful to them. Three times as many passengers that travel once per year said that the app would be helpful. Of the passengers that travel <6 times per year, more than twice the amount of passengers said that they would find the app helpful than those that did not. Exactly twice the

amount of passengers that travel 6-12 times per year said they would find the app helpful compared to those that did not. Over-all, 56 frequent traveling passengers said that they would find the app helpful compared to 26 who would not regardless of how often they travel on a commercial airline.

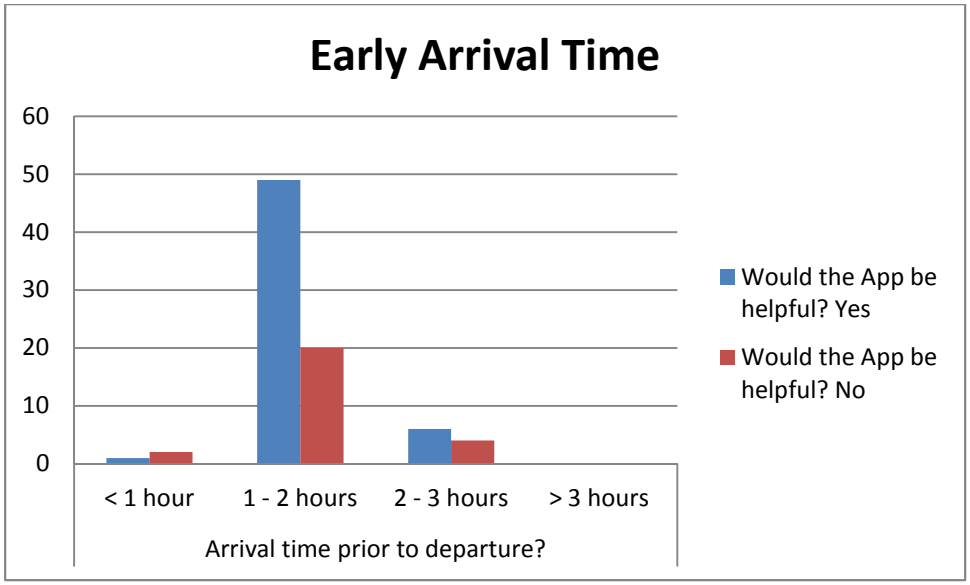

Figure 5. How often does a passenger arrive at the airport vs. If they would find the app helpful

Figure 5. Shows the relationship between How early a passenger believes they must arrive at an airport prior to departure and If they would find the app helpful. The vast majority of respondents stated that an appropriate time would be between 1-2 hours. Of those that responded, 56 said that they would find the app helpful compared to 26 who said they would not. Most of the respondents that said that they would not find the app helpful are those that arrive 2-3 hours prior to departure. This can most likely be attributed to the fact that these passengers already plan on arriving with plenty of time prior to departure, therefore an app to tell them the wait time would not be necessary. Over all, the majority of passengers believe the app would be helpful regardless of how much time they believe necessary for arriving before departure.

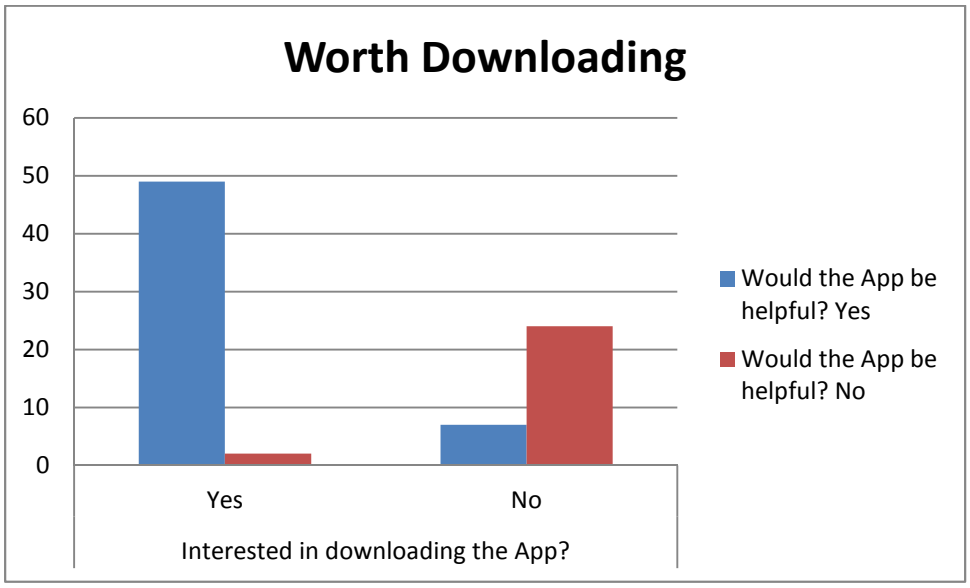

Figure 6. Will passengers be interested in downloading the app vs. Perception of App helpfulness

Figure 6. Shows the relationship between If the passenger would find the app worth downloading and If they would find the app helpful. Almost all of those that found the app helpful would also be willing to download the app. 49 said yes while only seven said no. There were however, two respondents that said the app would be worth downloading but would not be helpful. Over all, the majority would be interested in downloading the app and find it helpful.

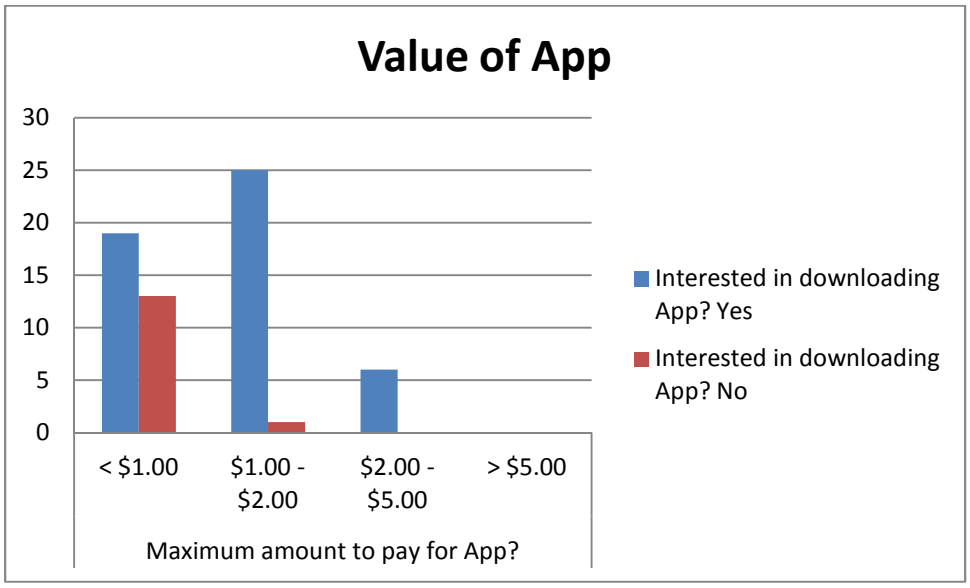

Figure 7. How much would a passenger pay for the app vs. Interest in downloading the App

Figure 7. Illustrates an important business question. While the respondents stated they would find the app helpful, knowing how much they would pay is equally important. During times of an economic slowdown, it makes sense that 32 of 64 respondents said that they would rather pay less than $1.00 for the app however, 26 stated that they would be willing to pay up to $2.00. There were also 6 passengers you said they would be will to pay between $5.00 - $6.00 for the app. One aspect of this question was the relationship between price and how many people thought that the app would be helpful. All of the respondents that stated they would pay $2.00 - $5.00 said that they would find the app helpful while only 19 of the 32 respondents that stated they would pay less than $1.00 said that the app would be helpful. This shows that the more passengers are willing to pay, the more helpful they would find the app.

Data tables used for Figures 1 – 7 can be found in Appendix C.

Discussion

After collecting a sample of data from Faculty and Staff in the Purdue College of Technology, it was determined that the majority of people who participated in the study believe an app that accurately predicts the expected amount of time it would take to be processed at the security checkpoint would be beneficial to their travel plans. This case study provided an answer to the research questions, that passengers will in fact find the App helpful and be willing to download it.

Results of the survey suggest that those respondents who are most likely to find the app helpful and be willing to pay for it, are males over the age of 30 who own a smart device, travel less than 6 times per year, arrive to the airport 1 – 2 hours prior to departure and are willing to pay between $1.00 and $2.00. It is postulated that this can be directly related to the frequency of travel on commercial airlines and the amount of disposable income this age group has, compared to the younger student population.

Conclusion

When doing this study on a larger scale, some limitations are likely to include the willingness of people to respond to the survey in a timely and accurate manner, passengers' budget restraints causing them to answer in a way that would not reflect their desire to have the app, and being able to gather enough data from a broader population to provide a more accurate representation. In this case study, the participants were limited to faculty and staff at Purdue University. This did not allow for younger students who are well versed in technology to provide their responses. A younger population would likely provide a different level of disposable income which may also alter the results. Other restrictions that would cause people to answer negatively towards this app would be if the participant does not own a smart device. This is still a fairly new technology with many unexplored possibilities. As the technology becomes more readily available and prices for these devices drop, people will likely be more willing to purchase smart devices, which may result in the increased sale of smart apps. Over all, results from this limited study imply that the app is something people would find helpful and be willing to pay for. Another major concern presented by the respondents is the accuracy of the information being displayed on the app. The more accurate the information, the more helpful the app would be and the more likely a passenger would be to download it.

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Appendix A

Copy of survey was used to conduct research regarding public use of wait time reporting App.

Select one answer for each of the following questions

1. **Gender**
   Male Female Decline to answer

2. **What is your age?**
   <20, 20-29, 30-39, 40-49, 50-60, >60

3. **Do you own a Smart device that is "App" capable?**
   Yes No

4. **How often do you travel, using a commercial airline?**
   Never, Once per year, <6 times per year, 6-12 times per year, >12 times per year

5. **How early do you believe it is necessary to arrive at the airport prior to departure?**
   <1 hour, 1-2 hours, 2-3 hours, >3 hours

6. **Do you believe that an "App" that provided information regarding the wait time at the security checkpoint would be beneficial to you as a traveler?**
   Yes No

7. **Would you be interested in downloading the "App" described in the previous question?**
   Yes No

8. **If you would be interested in downloading the "App", what is the maximum amount you would be willing to pay for it?**
   <$1.00 $1.00 - $2.00 $2.00 - $5.00 >$5.00

9. **Please provide additional comments or suggestions regarding the implementation and/or purchase of a Smart Phone App for Waiting Time in Airport Security Lines.**

_____
_____
_____
_____
_____
_____
_____

Appendix B

Participant Permission Form

Title of Study: Smart Phone App for Waiting Time in Airport Security Lines

Principal Investigator:
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Background:
You are being invited to take part in a research study. Before you decide to participate in this study, it is important that you understand why the research is being done and what it will involve. Please take the time to read the following information carefully. Please ask the researcher if there is anything that is not clear of if you need more information.

The purpose of this study is: To determine the public need/desire for a Smart "App" that will display the amount of time that it takes in "real-time" for a passenger traveling through a U.S commercial airport to complete the screening process at security checkpoint.

Study Procedure:
Your expected time commitment for this study is: (5 - 10 minutes)
After reading each question, please circle the answer that you believe best represents your opinion

Risks:
The risks of this study are minimal. These risks are similar to those you experience when disclosing work-related information to others. The topics in the survey may upset some respondents. You may decline to answer any or all questions and you may terminate your involvement at any time if you choose.

Benefits:
There will be no direct benefit to you for your participation in this study. However, we hope that the information obtained from this study may help to develop a security program that will better serve you in the future.

Confidentiality:
Please do not writing any identifying information on your questionnaire. Your responses will be kept anonymous. Every effort will be made by the researcher to preserve your confidentiality.

The researcher and the members of the researcher's committee will review the researcher's collected data. Information from this research will be used solely for the purpose of this study and any publications that may result from this study. Any final publication will contain the names of the public figures that have consented to participate in this. All other participants involved in this study will not be identified and their anonymity will be maintained. When no longer necessary for research, all materials will be destroyed.

Person To Contact:
Should you have any questions about the research or any related matters, please contact vmarino@purdue.edu

Institutional Review Board:
If you have questions regarding your rights as a research subject, or if problems arise which you do not feel you can discuss with the Investigator, please contact the Institutional Review Board Office at (801) 863-8156.

Voluntary Participation:
Your participation in this study is voluntary. It is up to you to decide whether or not to take part in this study. If you do decide to take part in this study, you will be asked to sign a consent form. If you decide to take part in this study, you are still free to withdraw at any time and without giving a reason. You are free to not answer any question or questions if you choose. This will not affect the relationship you have with the researcher.

Unforeseeable Risks:
There may be risks that are not anticipated. However every effort will be made to minimize any risks.

Costs To Subject:
There are no costs to you for your participation in this study

Compensation:
There is no monetary compensation to you for your participation in this study.

Consent:
By signing this consent form, I confirm that I have read and understood the information and have had the opportunity to ask questions. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and without cost. I understand that I will be given a copy of this consent form. I voluntarily agree to take part in this study.

Signature _____ Date _____

Appendix C

		Gender			
		Male	Female	Decline to Answer	Total
Would the App be helpful?	Yes	40	15	1	56
	No	15	15	1	26
	Total	50	30	2	82

		Age							
		<20	20-29	30-39	40-49	50-60	>60	Decline to answer	Total
Would the App be helpful?	Yes	0	2	7	16	17	14	0	56
	No	0	0	4	5	13	3	1	26
	Total	0	2	11	21	30	17	1	82

		Do you own a smart device?		
		Yes	No	Total
Would the App be helpful?	Yes	38	17	55
	No	13	13	26
	Total	51	30	81

		Frequency of travel?					
		Never	Once per year	<6 times per year	6-12 times per year	>12 times per year	Total
Would the App be helpful?	Yes	0	15	27	14	0	56
	No	1	5	13	7	0	26
	Total	1	20	40	21	0	82

		Arrival time prior to departure?				
		< 1 hour	1 - 2 hours	2 - 3 hours	> 3 hours	Total
Would the App be helpful?	Yes	1	49	6	0	56
	No	2	20	4	0	26
	Total	3	69	10	0	82

		Interested in downloading the App?		
		Yes	No	Total
Would the App be helpful?	Yes	49	7	56
	No	2	24	26
	Total	51	31	82

		Maximum amount to pay for App?				
		< $1.00	$1.00 - $2.00	$2.00 - $5.00	> $5.00	Total
Interested in downloading App?	Yes	19	25	6	0	50
	No	13	1	0	0	14
	Total	32	26	6	0	64