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Deploying an Algorithm Design to Analyze Guest Actions and Responses for the Development of a Guest Tracking System



Abstract: - Paper based systems used nowadays by the front desk staff and security officers in organizations are unreliable, inaccurate and inefficient when not utilized properly. It is for the organization's benefit to use an automated system that can enhance security and meet compliance mandates for the collection and auditing of guest data. By using the frequentist probability algorithm, the researcher was able to create a formula that is used to determine one's action through the frequency of their events.

The study is a combination of developmental and descriptive nature. Developmental research has been defined as the systematic and logical study of design, development and evaluation of the software product were the requirements that must be met. Students and employees from Quezon City Polytechnic University of the Philippines served as the main source of data used in the study. The major instrument used in this study is a survey questionnaire. It is used to identify the acceptance and hindrance in state establishments.

The study was conducted in order to assess the level of physical security in Quezon City Polytechnic University. The level of physical security manages the flow of guests in the university premises. A guest tracking system that was empowered by a predictive analytics using frequentist probability algorithm that was used to predict the next outcome of time-driven events and clustering algorithm where the idea was to describe data by extracting meaningful groupings or categories from a body of data that contains similar elements. The Guest Tracking System underwent a simulation test using the frequentist probability algorithm based on different scenarios.

Keywords: Polytechnic University of the Philippines, Master of Bachelor of Science in Information Technology, Frequentist, Guest Security, Predictive Analytics

Introduction

In many organizations, paper logs are still used to register guests. While it is perceived as a quick and easy method for the guests, it provides a risk of having low security and leaves their information vulnerable for anyone to see. In today's security conscious environment, organization's require a more secured entering, managing, and tracking of guests as a key task to handle.

Paper based systems used nowadays by the front desk staff and security officers in organizations are unreliable, inaccurate and inefficient when not utilized properly. It is for the organization's benefit to use an automated system that can enhance security and meet compliance mandates for the collection and auditing of guest data.

Organizations being able to centrally manage guests and personnel from the time they check-in to the time they leave is one of the critical success factors for the organization to be successful. Automated guest tracking systems may lend a more professional appearance, enhance the professionalism of the enrollment process and guest check-in, provide additional safeguards by screening against black lists if applicable, improve security by identifying who is in a facility quickly and accurately, especially in emergency situations and can help the organization itself to produce reports and analytics regarding the behavior of the guests based on their data.

Clause 11.1.2 of the ISO 27001-2013 on Physical Entry Controls, states that "Secure areas shall be protected by entry controls to ensure that only authorized personnel are allowed access." It is in this context that the Guest Tracking System will be developed and implemented.

Most predictive analytic systems come equipped with common algorithms that will help identify and predict solutions and patterns for an organization, these algorithms are the underlying mathematical formulas that help build a model for the system to utilize. A modified algorithm is developed for the use of the proposed system. The frequentist probability algorithm was used to develop the predictive analytics of the system.

By using the frequentist probability algorithm, the researcher was able to create a formula that is used to determine one's action through the frequency of their events.

Since data that will be used for the prediction are nevertheless a continuity or a pattern of time behavior based on each time interval calculated between the selected time variables, such use of the probability calculation as the base formula for the algorithm serves as the best pick for such type of data and information inferring.

The level of policy detail given to organizations in regards of guests to an organization can greatly vary, from, organizations having strict rules and some with loose guidelines.

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Methodology

The study is a combination of developmental and descriptive nature. Developmental research has been defined as the systematic and logical study of design, development and evaluation of the software product that requirements must be met (Richey, 1994). Therefore, this method of research is used in the study to mainly focus on the design and development of the proposed system using a predictive algorithm. Descriptive research method on the other hand was also used in determining the level of acceptance and usability of the proposed system as an instrument to an establishment to enhance the security capability of every establishments and infrastructures.

The study involved students and employees from Quezon City Polytechnic University of the Philippines. Table 1 shows the list of respondents while their number of years in the school/company is shown in Table 1.

Table 1. List of Respondents

| | Frequency | Percent |
|----------|-----------|---------|
| Students | 33 | 55 |
| Employee | 27 | 45 |
| Total | 60 | 100 |

The major instrument used in this study is a survey questionnaire. It is used to identify the acceptance and hindrance in state establishments. The researcher herself constructed the instrument.

Opposite of the questions are the five (5) columns with different equivalents in which the respondents will choose one for each question.

Table 2. Likert Scale

| NUMERICAL VALUE | RESPONSE |
|-----------------|----------------------------|
| 5 | Strongly Agree |
| 4 | Agree |
| 3 | Neither Agree nor Disagree |
| 2 | Disagree |
| 1 | Strongly Disagree |

Table 3. Corresponding Scale Range for the Likert Scale

| SCORE | CORRESPONDING REMARK |
|-----------|----------------------------|
| 4.6 – 5.0 | Strongly Agree |
| 3.6 – 4.5 | Agree |
| 2.6 – 3.5 | Neither Agree nor Disagree |
| 1.6 – 2.5 | Disagree |
| 1.0 – 1.5 | Strongly Disagree |

Table 3. Likert Scale for the Importance of the Additional Modules of the One-Stop-Shop

| NUMERICAL VALUE | RESPONSE |
|-----------------|----------------------|
| 5 | Very Important |
| 4 | Important |
| 3 | Moderately Important |
| 2 | Of Little Importance |
| 1 | Unimportant |

Table 4. Corresponding Remarks for the Likert Scales

| SCORE | CORRESPONDING REMARK |
|------------|-------------------------------------|
| 4.01 – 5.0 | Very Important/Strongly Agree |
| 3.01 – 4.0 | Important/Agree |
| 2.01 – 3.0 | Moderately Important/Slightly Agree |
| 1.01 – 2.0 | Of Little Importance/Disagree |
| 0.1 – 1.0 | Unimportant/Strongly Disagree |

The researcher conducted a survey to the students, employees and officials from Quezon City Polytechnic University. This will help the researcher know the respondent for this study. Every single information was noted and was used as the foundation of this research.

The questionnaire served as the research instrument of the study. Survey questionnaires were distributed to the respondents. The researcher gave instructions on how to answer the line items and made sure that they have understood their role in this study.

Afterwards, the results of the survey are tallied and interpreted through tables and figures. Scaling of the means are determined by the use of Likert Scale.

The study was subject to certain ethical issues. As mentioned before the start of the survey questionnaire, all participants reported their written acceptance regarding their participation in the research, through a signed Consent and Briefing Letter. At the same time, participants were asked to sign a Debriefing and Withdrawal letter. This aimed to reassure the participants that their participation in the research was voluntary and that they were free to withdraw from it at any point and for any reason.

The participants were fully informed of the objectives of the research and have been assured that their answers will be treated as confidential and be used only for academic purposes as well as only for the purpose of this particular research. Except from the above, participants were not harmed or abused, both physically and psychologically, during the conduction of the research. In contrast, the researcher attempted to create and maintain a climate of comfort.

IV. RESULTS AND DISCUSSION

The first part describes the respondents' perception on the level of importance of the standard physical entry controls for guests.

The second part presents the respondents' level of agreement on the embedded functionalities of the system: 1.) Guest Details, 2.) Access Rights and 3.) Guest Reporting.

The third and final part looks into the respondents' level of agreement on the following characteristics of the Guest Tracking System: 1.) Usefulness, 2.) Ease of use, 3.) Ease of learning, and 4.) Satisfaction.

1. Respondents' Perception on the Level of Importance of the Standard Physical Entry Controls for Guests. The summary of the respondents' perception on the level of importance of the standard physical entry controls for guests is presented in table 5.

As seen in the table, the respondents considered that the standard physical entry controls for guests is very important; this is revealed by the obtained overall mean assessment of 4.56.

Table 5. Respondents' Perception on the Level of Importance of the Standard Physical Entry Controls for Guests

| Statement | Mean Response | Interpretation |
|--|---------------|----------------|
| The date and time of entry and departure of guests should be recorded | 4.80 | Very Important |
| All guests should be supervised unless their access has been previously approved | 4.38 | Very Important |
| Guests should only be granted access for specific, authorized purposes | 4.47 | Very Important |
| Guests when granted access should be issued with instructions on the security requirements of the area and on emergency procedures | 4.53 | Very Important |
| Identity of guests should be authenticated by an appropriate means | 4.73 | Very Important |
| Access to areas where confidential information is processed or stored should be restricted to authorized individuals only | 4.70 | Very Important |
| A physical log book or electronic audit trail of all access should be securely maintained and monitored | 4.73 | Very Important |
| All employees, contractors and external parties should be required to wear some form of visible identification | 4.38 | Very Important |
| External party support service personnel should be granted restricted access to secure areas | 4.33 | Very Important |
| Access rights to secure area should be regularly reviewed and updated, and revoked when necessary | 4.52 | Very Important |
| Overall | 4.56 | Very Important |

2. Simulated Results of the Frequentist Probability Algorithm in the Identified Scenarios of the Proponent For the stimulation, we will be using a series of time records from all the visitations made by a certain guest. The said guest has made a total of 25 visitations, by which 10 are scheduled and 15 walk-in visitations. The figure below show the distribution of records based on their categorization earlier arrived for us to examine if the expected calculated results will match to the displayed probability of the analytics.

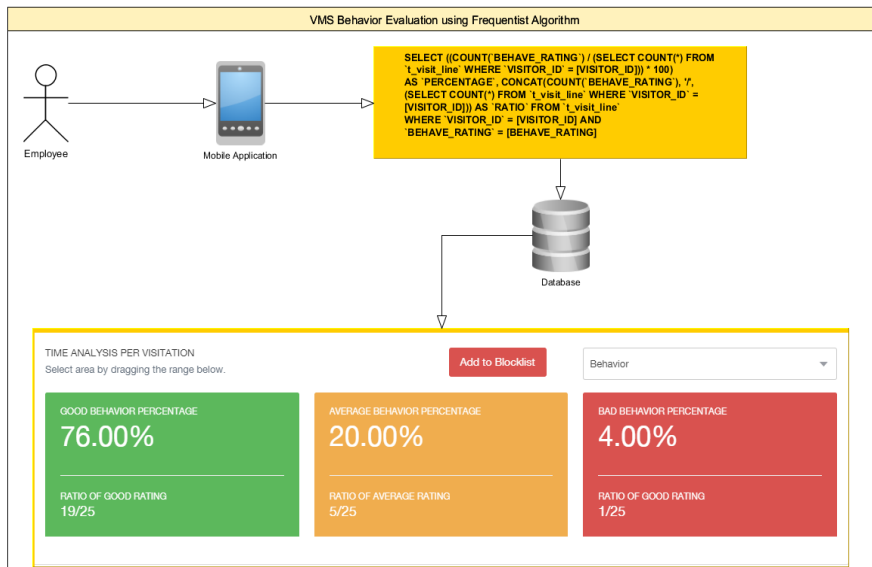


Figure 1. VMS Simulation on Behavior Evaluation using Frequentist Algorithm

The figure 1 shows the simulation of the Guest Tracking System on Behavior evaluation utilized by the employee, where the employee selects on the available choices which are good, average, and poor. The rating will count by the system over the count of visit line multiply by 100 as the percentage and count the behavior rating instance as the ratio of the behavior evaluation. The result of the behavior evaluation will automatically be saved on the database and will generate an analytical report for a particular guest. The analytical report will show the percentage of the result and its corresponding frequency.

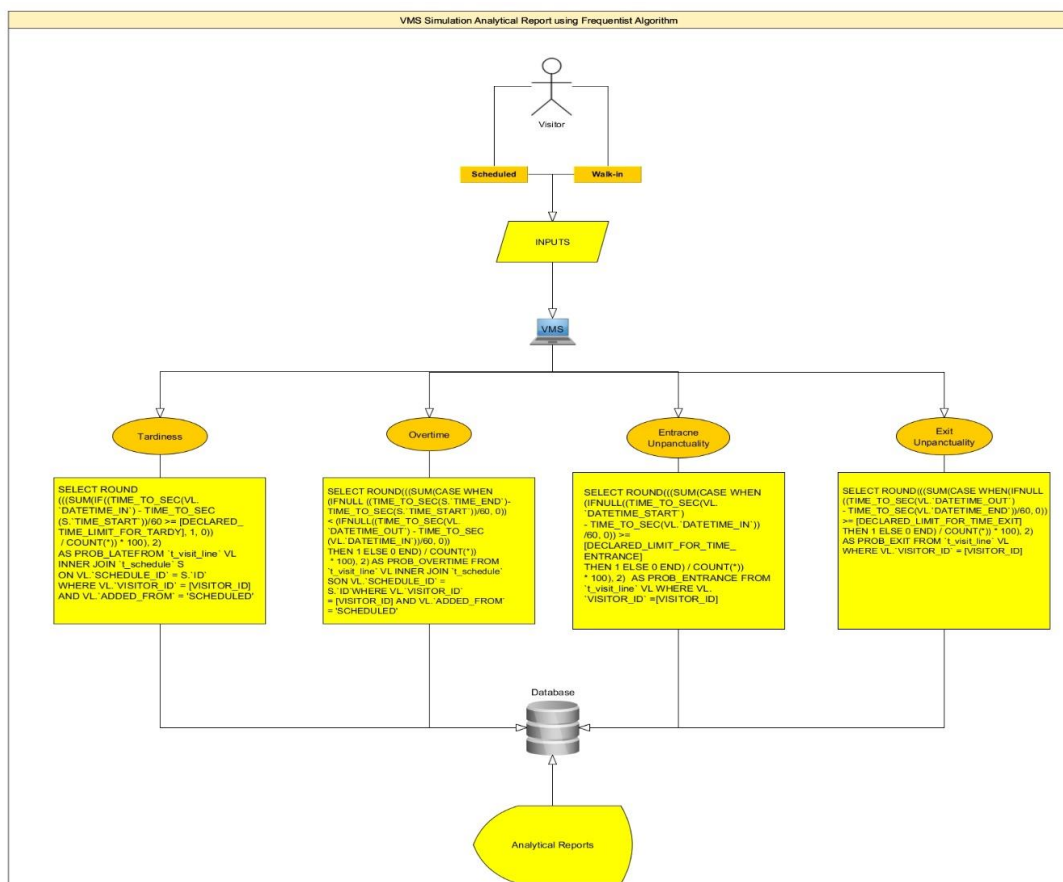


Figure 2. VMS Simulation of Frequentist Algorithm

Figure 2 shows the simulation process of Guest Tracking System on generating of an analytical report using frequentist algorithm. Guest may classify as walk-in or scheduled, the inputs of scheduled guests and inputs of walk-in guests will accommodate by the system. Scheduled guest may have a mark on tardiness when exceed to the allotted waiting time. However, overtime, entrance unpunctuality, and exit unpunctuality is applicable for both scheduled and walk-in guests. The record will automatically be saved on the database and the system is capable to generate an analytical report base on the record of specific guest.

3. Respondents’ Level of Agreement on the Embedded Functionalities of the System

The summary of the respondents’ level of agreement on the embedded functionalities of the system in terms of: Guest Details; Access Rights; and Guest Reporting is presented in table 6. Each embedded functionality will be discussed accordingly.

This shows that the respondents’ level of agreement in terms of guest details got a score of 4.23 which got a label of “Strongly Agree”; Access rights got a score of 4.25 which got a label of “Strongly Agree” and the guest reporting functionality got a score of 4.44 which got a label of “Strongly Agree”. The labels were based on the Likert scale range and interpretation that was mentioned in the previous discussions. The result of the level of agreement on the embedded functionalities of the system got an overall mean of 4.31 which got a label of “Strongly Agree”.

Table 6. Respondents’ Level of Agreement on the Embedded Functionalities of the System

| Statement | Mean Response | Interpretation |
|-----------------|---------------|----------------|
| Guest Details | 4.23 | Strongly Agree |
| Access Rights | 4.25 | Strongly Agree |
| Guest Reporting | 4.44 | Strongly Agree |
| Overall | 4.31 | Strongly Agree |

3.1 Guest Details

The respondents’ level of agreement on the inclusion of Guest Details as one of the embedded functionalities of the system is presented in table 7.

As seen in the table, the respondents strongly agreed on the inclusion of Guest Details as one of the embedded functionalities of the system. This is revealed by the obtained overall mean assessment of 4.23. Each item that was tallied and computed under the guest detail functionality were achieved through a mean of allowing the guests use the developed system for their experience in terms of inserting their details.

Table 7. Guest Details

| Statement | Mean Response | Interpretation |
|--|---------------|----------------|
| Up to 50 items of personal information can be entered and the details saved for re-use | 4.10 | Strongly Agree |
| The personal data titles can be changed as required | 4.08 | Strongly Agree |
| The personal data titles can be different from those used by employees | 4.30 | Strongly Agree |
| The name of the person who has authorized the visit can be stored with the guest details | 4.42 | Strongly Agree |
| Additional notes can be added to the details of each guest | 4.20 | Strongly Agree |
| Guest details can be entered at any client on the security tracking system | 4.25 | Strongly Agree |
| Overall | 4.23 | Strongly Agree |

3.2 Access Rights

The respondents’ level of agreement on the inclusion of Access Rights as one of the embedded functionalities of the system is presented in table 8.

As seen in the table, the respondents strongly agreed on the inclusion of Access Rights as one of the embedded functionalities of the system; this is revealed by the obtained overall mean assessment of 4.25. Each item that was tallied and computed under the access rights’ functionality were achieved through a mean of allowing the user to operate the developed system for their experience in terms of access rights.

Table 8. Access Rights

| Statement | Mean Response | Interpretation |
|--|---------------|----------------|
| Access rights (if required) can be assigned to a guest’s ID badge or access control card | 4.52 | Strongly Agree |

| | | |
|--|------|----------------|
| The access rights allow the guest access through selected doors at specified times | 4.25 | Strongly Agree |
| Access rights can be set up differently for each guest | 4.32 | Strongly Agree |
| Access rights can be assigned automatically from the selected ID badge design | 4.38 | Strongly Agree |
| A maximum validity period can be set for all guest access control cards | 4.23 | Strongly Agree |
| The card number assigned for access control can be automatically unassigned on card expiry | 4.17 | Strongly Agree |
| The card number can be re-used for another guest card | 3.88 | Agree |
| Overall | 4.25 | Strongly Agree |

3.3 Guest Reporting

The respondents' level of agreement on the inclusion of Guest Reporting as one of the embedded functionalities of the system is presented in table 9.

As seen in the table, the respondents strongly agreed on the inclusion of Guest Reporting as one of the embedded functionalities of the system; this is revealed by the obtained overall mean assessment of 4.44.

Each item that was tallied and computed under the guest reporting functionality were achieved through a mean of allowing the user to use and see the developed system for their experience in terms of guest reporting that is within the establishment.

Table 9. Guest Reporting

| Statement | Mean Response | Interpretation |
|---|---------------|----------------|
| Card Listing – Provides details of cards issued for access-control purposes | 4.47 | Strongly Agree |
| Access Listing – Lists details of access rights given to selected guest cards | 4.43 | Strongly Agree |
| Activity – Displays previous alarms and events generated by guest transactions at readers | 4.43 | Strongly Agree |
| Card Holders On Site – Lists the guests currently on site | 4.47 | Strongly Agree |
| Locator – Enables you to find the current location of selected guests | 4.35 | Strongly Agree |
| Roll Call – Enables emergency services to determine the people remaining in a building (requires Safety Roll Call module) | 4.47 | Strongly Agree |
| Overall | 4.44 | Strongly Agree |

4. Actual Test Results Based from the Scenarios Given in the Requirements Traceability Matrix

The requirements traceability matrix served as a mean to test the actual functionality of the system based on scenarios that the system encountered. This served as a testing ground for the system to see if whether the system achieved its functionalities that were proposed. Please refer to appendix 5 for the results of the requirements traceability matrix

1. Respondents' Level of Agreement on the Usefulness, Ease of Use, Ease of Learning, and Satisfaction of the VMS application

The summary of the respondents' level of agreement on the characteristics of the Guest Tracking System in terms of: Usefulness, Ease of use, Ease of learning, and Satisfaction is presented in Table 10. Each characteristic will be discussed accordingly.

As seen in the table, the respondents' level of agreement on the different characteristics of the guest tracking system gained an overall mean of 4.51 which got a label of "Strongly Agree". The interpretation was based on the Likert scale range and interpretation that was mentioned in the previous discussions. The level of the respondents' agreement in terms of the different characteristics offered by the system was received highly.

Table 10. Respondents' Level of Agreement on the Different Characteristics of the Guest Tracking System

| Statement | Mean Response | Interpretation |
|------------------|---------------|----------------|
| Usefulness | 4.49 | Strongly Agree |
| Ease of use | 4.49 | Strongly Agree |
| Ease of learning | 4.55 | Strongly Agree |
| Satisfaction | 4.49 | Strongly Agree |
| Overall | 4.51 | Strongly Agree |

4.1 Usefulness

The respondents' level of agreement on the Usefulness of the Guest Tracking System is presented in table 11. As seen in the table, the respondents strongly agreed on the Usefulness of the Guest Tracking System; this is revealed by the obtained overall mean assessment of 4.49. Each item that was tallied and computed under the usefulness characteristic were achieved through a mean of allowing the user to use, operate and see the developed system for their experience.

Table 11. Usefulness

| Statement | Mean Response | Interpretation |
|---|---------------|----------------|
| It helps the user become more effective | 4.48 | Strongly Agree |
| It helps the user become more productive | 4.53 | Strongly Agree |
| Things are easier accomplished by the user | 4.47 | Strongly Agree |
| It saves time of the user | 4.53 | Strongly Agree |
| It does everything the user would expect it to do | 4.43 | Strongly Agree |
| Overall | 4.49 | Strongly Agree |

4.2 Ease of Use

The respondents' level of agreement on the Ease of Use of the Guest Tracking System is presented in table 12. As seen in the table, the respondents strongly agreed on the Ease of Use of the Guest Tracking System; this is revealed by the obtained overall mean assessment of 4.49. Each item that is tallied and computed under the ease of use characteristic were achieved through a mean of allowing the user to use, operate and see the developed system for their experience.

Table 12. Ease of Use

| Statement | Mean Response | Interpretation |
|---|---------------|----------------|
| It is simple to use | 4.55 | Strongly Agree |
| It is user friendly | 4.62 | Strongly Agree |
| It requires the fewest steps possible to accomplish what the user wants to do with it | 4.45 | Strongly Agree |
| It is flexible | 4.48 | Strongly Agree |
| Using it is effortless | 4.47 | Strongly Agree |
| Anyone can use it without written instructions | 4.40 | Strongly Agree |
| There is no inconsistencies while using it | 4.50 | Strongly Agree |
| The user can recover from mistakes quickly and easily | 4.45 | Strongly Agree |
| Overall | 4.49 | Strongly Agree |

4.3 Ease of Learning

The respondents' level of agreement on the Ease of Learning of the Guest Tracking System is presented in table 13.

As seen in the table, the respondents strongly agreed on the Ease of Learning of the Guest Tracking System; this is revealed by the obtained overall mean assessment of 4.55. Each item that is tallied and computed under the ease of learning characteristic were achieved through a mean of allowing the user to use, operate and see the developed system for their experience.

Table 13. Ease of Learning

| Statement | Mean Response | Interpretation |
|---|---------------|----------------|
| The user can learn to use it quickly | 4.58 | Strongly Agree |
| Users can easily remember how to use it | 4.50 | Strongly Agree |
| Users quickly become skilful with it | 4.57 | Strongly Agree |
| Overall | 4.55 | Strongly Agree |

4.4 Satisfaction

The respondents' level of agreement on the Satisfaction the Guest Tracking System offers is presented in table 14.

As seen in the table, the respondents strongly agreed on the Satisfaction that the Guest Tracking System offers; this is revealed by the obtained overall mean assessment of 4.49. Each item that is tallied and computed under the satisfaction characteristic were achieved through a mean of allowing the user to use, operate and see the developed system for their experience.

Table 14. Satisfaction

| Statement | Mean Response | Interpretation |
|-----------|---------------|----------------|
|-----------|---------------|----------------|

| | | |
|---|------|----------------|
| Users are satisfied with it | 4.57 | Strongly Agree |
| Users are expected to recommend it to a friend/former classmate | 4.50 | Strongly Agree |
| The system is fun to use | 4.42 | Strongly Agree |
| It works the way the users want it to work | 4.48 | Strongly Agree |
| Users feel the need to have it | 4.47 | Strongly Agree |
| Overall | 4.49 | Strongly Agree |

Conclusion and Recommendations

Based on the enumerated data from the summary of findings and the computed means of each question on the Chapter 4, the researcher has concluded that:

1. The level of importance of the standard physical entry controls for guests are considered as a very important aspect in an establishment like Quezon City Polytechnic University which means a development such as this aspect will lead to increase of security level and trust rate. According to M. Rouse (2016), the development of physical security may mitigate serious lost or damage in a case such as natural calamities or attempted attacks.
2. The Guest Tracking System with the frequentist probability algorithm was suitable in the identified scenarios by the proponents. The embedded predictive analytics such as (1) Tardiness; (2) Overtime; (3) Entrance unpunctuality; and (4) Exit unpunctuality may support the need of the proponents in different identified scenarios. Using the following analytics, the university may reduce the possible risk and improve the operation, this is according to Software and Services.
3. The embedded functionalities of the system in terms of the following: Guest Details; Access Rights; and Guest Reporting. The following functionalities really ease the guests and tracking in terms of physical security. According to Jain (2012), a successful Guest Tracking System must contain the following characteristics: (1) policies are centrally defined and managed, (2) guests' data is integrated with other systems, (3) the system is easy to install, use and maintain.
4. Guest Tracking System is suitable for Quezon City Polytechnic University and it can cater the needs of the university in terms of securing the premises of the university to avoid serious damaged or loss of property, also it is very useful in part of the security personnel in order to monitor and predict the guests' behavior using the embedded analytics to the system.
5. The following characteristics of the Guest Tracking System are: (1) Usefulness, (2) Ease of use, (3) Ease of learning, and (4) Satisfaction. The characteristics as well as its embedded functionalities, this will increase the chances of the users' satisfaction rate that can lead to immediate implementation of an ideal establishment like Quezon City Polytechnic University.

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