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Assessment of Automotive Tool Storage Monitoring Control Unit

Richel Lofranco Algunas
Student, Graduate Studies and Applied Research, Laguna State Polytechnic University, Main Campus Santa Cruz, Laguna, Philippines
Email address: richel.algunas@lspu.edu.ph

Abstract*—The study attempted to find out the relationship between the level of the key features of automotive tool storage, Specifically, it aimed to answer the following queries: (1) What is the level of key features of automotive tool storage in terms of compatibility, sensor location, functionality, power source, and safety? (2) What is the level of acceptability of developed Automotive Tool Storage Monitoring Control Unit in terms of Acknowledging, Determining, Communicating and Measuring (3) Is there significant relationship between the level of key features of automotive tool storage and the level of acceptability of the developed automotive monitoring control unit?

The proponent utilized the developmental method in dealing with the phenomenon of the cause-and-effect dynamics in evaluating the situation coupled with descriptive design in exploring the avenue to the approach of truth in order to surface the data in weaving out viable solutions to the problem areas of investigation. At this point, the proponent has to request the services of experts representing professors in the Graduate Studies and Applied Research including head technicians and property custodians as well as students as end-users of automotive devices and presently enrolled at the College of Automotive Technology, LSPU San Pablo City Campus in Laguna regarding their evaluative analysis of the proposed automotive tool monitoring device at the said university. The following were significant findings of the investigation: The level of key features of automotive tool storage in terms of Compatibility, Sensor Location, Functionality, Power Source and Safety was interpreted Very High as assessed by the respondents. This indicates further that the respondents believed that the key features of automotive tool storage device have a very high level of compatibility, Sensor Location, Functionality, Power Source and Safety. The level of Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit in terms of Acknowledging, Determining, Communicating, and Measuring was interpreted Very High as assessed by the respondents. The key features of automotive storage and acceptability of the developed automotive tool storage monitoring control unit shows significant relationship with very strong degree of correlation. Furthermore, it is established that the null hypothesis was rejected since the key features of automotive tool storage has a substantial relationship on the level of acceptability of the developed automotive tool storage monitoring control unit. On the basis of the research's findings and conclusions, it is therefore recommended that this strategy is effective in minimizing the yearly problem of missing essential equipment. The faculty member in charge of the selected tools in this regard, can create to help the teacher and tool keeper maintain track of the workshop tools. Additionally, the system's backup power supply needs to be accessible and simple for users to avoid unauthorized tool use within the vicinity in the event of an electrical outage. Likewise, strengthen the anti-theft system to preserve the quantity of tools at all times.

***Keywords*—** *Education, automotive technology,tool monitoring system*.

I. INTRODUCTION

Laguna State Polytechnic University takes an inventory of the tools, equipment, and teaching materials supplied to the faculty every second semester. As part of compliance, yearly reports on the dependability of trusted devices are necessary. The annual recurrence of lost branded tools is one of our primary issues in automotive technology. As a result of this concern, a method for monitoring automotive tools using borrower's form was developed. Students are tasked with monitoring the loaned tools' release and return. Each student who seeks a tool fills out a borrower's form with their information. Yet, this strategy is ineffective in minimizing the yearly problem of missing essential equipment. This problem added to the burden of a faculty member in charge of the selected tools. In this regard, the researcher created a study project titled "Automotive Tool Storage Monitoring Control Unit" to help the teacher and tool keeper maintain track of the workshop tools. This system features an Arduino Mega that may be programmed. It is in charge of interpreting analog signals. Its sensors can detect the location of the tools. You can gain entry to the tool store by using an RFID reader and a card as a key. The GSM module sends SMS messages to the instructor notifying them of the tools that have been returned or borrowed. The numbered tools borrowed by staff or students and the person in charge of returning them are listed. The door is held closed with a solenoid lock and, if necessary, opened with an RFID card. Battery storage provides the system with the necessary electricity: voltage regulator, limiter switch, buzzer, and 3A multi-top transformer.

When students or instructors ask to borrow something from the tool storeroom, the tool keeper unlocks the door with an RFID card. The sensor responds to tool removal by flashing the LED and communicating the location of the tools. This information is displayed on an LED board facing the work area to tell the tool keeper and students about the released tools in storage. The LED light remains on even after the gadgets have not been returned to the repository. At this point, the GSM Module sends SMS messages to the teacher. The message includes the tool's name, the keeper's tool type, and a list of the tools that have been released. This data will be gathered and saved to help identify any problems. Professors and students can use this soft copy to support the borrower's application to preserve the workshop's resources. The bundled,

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function-specific components may improve the workshop overall. These techniques teach students to value tools as part of their discipline. Precision, high-quality tools, and equipment are believed to be critical to a skilled technician's work.

Conceptual Framework

The conceptual framework model of the study is presented in the form of a research paradigm.

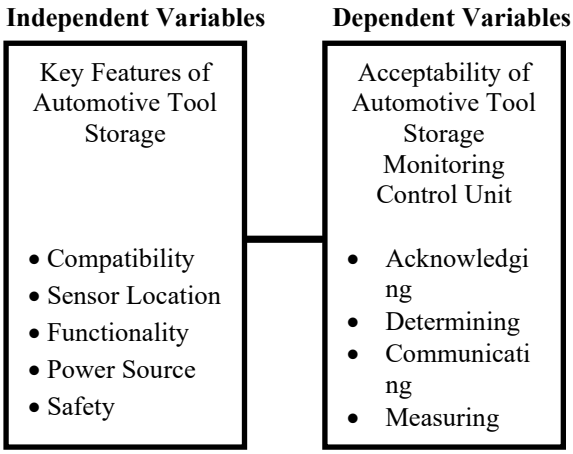

Figure 1. The Research Paradigm of the study

As shown in Box 1, the independent variables as input in designing the key features of automotive tool storage in the kinds and number of automotive tools borrowed in terms of compatibility, sensor location, functionality, power source, and safety. The process in converting input into output gauges out the degree of relationship established between the given variables in ensuring success for the automotive tool monitoring device at the restricted and localized LSPU San Pablo City Campus with respect to programmable key features, and recognizing tool borrowers. As enclosed in Box 2 are the dependent variables as outcome are the acceptability in recognizing automotive tool borrowers and best connect with them as to acknowledging, determining, communicating, and measuring. The conceptual framework integrates the key features of automotive tool storage with the functionalities required for an automotive tool storage monitoring control unit to be acceptable.

Statement of the Problem

The study aimed to assess the acceptability of the developed Automotive Tool Storage Monitoring Control Unit at LSPU San Pablo City Campus.

Specifically, it answered the following questions:

1. What is the level of key features of automotive tool storage in terms of:
   1.1. compatibility;
   1.2. sensor location;
   1.3. functionality;
   1.4. power source; and
   1.5. safety?
2. What is the level of acceptability of developed Automotive Tool Storage Monitoring Control Unit in terms of:
   2.1. Acknowledging;
   2.2. Determining;
   2.3. Communicating; and
   2.4. Measuring?
3. Is there significant relationship between the level of key features of automotive tool storage and the level of acceptability of the developed automotive monitoring control unit?

Hypothesis

The following main hypothesis in a null is hereby formulated for acceptance or rejection at five percent significant level as basis for analysis, synthesis and inferences of this study.

There is no significant relationship between the level of key features of automotive tool storage and the level of acceptability of the developed automotive monitoring control unit.

II. Research Methodology

This chapter provides the appropriate research design for actual description of subject under study, population parameter as basis for sampling technique, data gathering procedure, data gathering instrument, data processing and statistical treatment of data in order to synthesize the findings into a composite and elucidative description relative to the problem areas investigated in complete closure for the realization of the main and specific objectives advanced in this study.

Research Design

The proponent utilized the developmental method in dealing with the phenomenon of the cause-and-effect dynamics in evaluating the situation coupled with descriptive design in exploring the avenue to the approach of truth in order to surface the data in weaving out viable solutions to the problem areas of investigation. At this point, the proponent requested the services of experts representing professors in the Graduate Studies and Applied Research including head technicians and property custodians as well as students as end-users of automotive devices and presently enrolled at the College of Automotive Technology, LSPU San Pablo City Campus in Laguna regarding their evaluative analysis of the proposed automotive tool monitoring device at the said university.

As confirmed by Chapanes (2012), developmental study is offshoot of the series of experimental studies done in the past and thus nothing is left to uproot the cause and effect as everything lies hidden has been uncovered naked and nothing more to be experimented, then and only then, may suggest possibilities of further investigation in the form of developmental studies as discernment from laboratory experiment. Bradley (2013) proved supportive to the above viewpoint with his collateral line of confirmation that descriptive method gives teeth on observation for the acquisition of data wherein the same must be organized and

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presented systematically in order to avoid bias so that valid and accurate conclusions may be drawn from them. Thus, the proponent will give much credence on the vital importance of developmental and descriptive designs in tandem for this kind of research undertaking by initially starting it with the development of the proposed automotive tool monitoring device, and subsequently will be subjected to evaluation by the three (3) groups of experts representing professors, head technicians and property custodians as well as thirty-five (35) student-end users respectively, for finalization stage.

Respondents of the Study

Purposive sampling technique was used in this study by means of intentional selection of twenty (20) respondents representing professors, head technicians and property custodians at the College of Industrial Technology and Graduate Studies and Applied Research as well as thirty-five (35) students as end-users of automotive tools and presently enrolled for their four-year degree course at LSPU San Pablo City Campus in Laguna. Thus, in the selection of the above respondents, the proponent was guided by the process of sampling: an identification of the population, an analysis of its structure, an assessment of its characteristics, and the extraction of the data from the sample population. As confirmed by Bradley (2013), purposive sampling technique, a triangular terminology which has its own etymological beginning from Latin word, “proponere” meaning “propose” which generally means something set as an object or end; sampling from the same linguistic origin, “exemplum” which means “example,” a representative part or a single item from a larger whole; and technique, of Greek origin standing for “technikos” which denotes “art” or “skillful” having a practical knowledge done when confronted by the said groups of experts wherein the former has limit to their number, and the latter are abound but both of them meet at the common front due to the homogeneity of their characteristics during the actual gathering of data.

Toward this end, the purposive sampling of selected three groups of experts as well as student-end users of automotive tools fall into the established criterion as actual evaluators and therefore proved the assurance in establishing the validity and reliability of data in order to serve the purpose of this developmental-descriptive investigation.

Research Procedure

The research initiated with the concept of the “Assessment of Automotive Tool Storage Monitoring Control Unit” in order to assist with the workshop's missing branded tools in the College of Industrial Technology LSPU San Pablo City Campus. Subsequent the survey's completion, experts validate the survey's questions using additional pertinent research and literature. Additionally, they develop, assess, and contribute with a questionnaire for evaluation. Following extensive consultation, it was recommended to create an operations guide to generate exploratory views pertaining to the project's overall maneuver and utilization of the project. Then, a letter of approval signed by the thesis Advisor and the Dean of Graduate Studies at the Laguna State Polytechnic University's Santa Cruz Campus in Santa Cruz, Laguna was required. This letter was to be approved by the Campus Director of the LSPU San Pablo City Campus in order to conduct data collection in the aforementioned institution. Another letter of request to the associate dean of the college of industrial technology asking for authorization to formally carry out a survey under the auspices of the college. An intentional sample of twenty (20) respondents, who represented professors, head technicians, and property custodians, as well as thirty-five (35) students who were end-users of automotive tools and were currently enrolled in a four-year degree program, received questionnaires via Google form. In preparation for analytic interpretation, data were gathered and collected. The researcher requested the support of a statistician for data computation and tabular presentation based on the study’s subproblem. A final oral presentation to the panelists was used to assess the progress of the study. Afterwards, revision and recommendation were required to accomplish the research study.

Research Instrument

Only two (2) sets of evaluation questionnaire checklist were prepared, as the first set was issued to the three (3) groups of experts, representing mechanical, electrical, and computer engineers employed as professors, head technicians and property custodians; and the second set for students as end-users of the said automotive tools and currently enrolled at the College of Industrial Technology in the said university wherein the aforementioned sets have bearing on their evaluative analysis based on criteria set in terms of material, face, and technical validations as basis for gauging the viability of the said automotive monitoring device intended for effective instructional service delivery. The tentative draft of the said evaluation questionnaire checklist was submitted to the thesis adviser for judgmental evaluation coupled with the suggestions to be made by authorities as members of the panel of experts during the thesis proposal defense in order to improve further its organization and contents. The improved draft was still subjected to dry-run test involving the ten (10) randomly selected subjects who were not included as the actual evaluators during the actual validation of the said monitoring automotive device in order to ensure the validity and reliability of the said validation instrument by means of rho formula for rank correlations wherein the point of reference is the value of .90 or 1.0 as basis for validity and reliability of the evaluative instrumentation.

To avoid guesswork in answering the said evaluative instrument, a five-Likert scale checklist reflected the equivalent range and verbal description.

Scale	Range	Verbal Interpretation
5	4.21-5.00	strongly agree
4	3.41-4.20	agree
3	2.61-3.40	occasionally agree
2	1.81-2.60	disagree
1	1.00-1.80	strongly disagree

Statistical Treatment of Data

The responses of actual respondents were tallied and tabulated as basis for application of the following formulas:

Weighted mean formula for weight or centrality of data. Standard deviation formula to determine the percentage skew or variability of data from the focal point. To determine as to whether or not there is a significant difference in the evaluation ratings made by experts, parametric t-test formula was used as basis for empirical testing of null hypotheses at 5% level of significance.

III. Presentation, Analysis and Interpretation of Data

This chapter enumerates the different results and discusses the results that were yielded from the treatment of the data that was gathered in this study. The following tabular presentations and discussions will further characterize the Assessment of Automotive Tool Storage Monitoring Control Unit. This strategy is effective in addressing the yearly issue of missing crucial tools. "Automotive Tool Storage Monitoring Control Unit." to aid the instructor in keeping an eye on the workshop's equipment. This project reduces the missing tools employed and point out anyone who might cause misunderstandings that could result in subpar service output. It is a fact that the precision and quality of the tools a professional technician uses substantially impact their ability to perform excellent work.

Key Features of Automotive Tool Storage

The key features of programmable monitoring device in the kinds and number of automotive tools borrowed in terms of compatibility in terms of sensor as a major factor to consider when lending the same for use with particular car models or be used with a wide selection of vehicles for compatibility. The sensor location determines the tire pressure as assessed either external or internal along with functionality serving as guide in choosing the design and price for use in checking the tire pressure, relearn sensors, reset codes, and program sensors in the display of data in real time on an LCD screen; and coupled with power source in terms of battery powered, solar powered, or rechargeable conceived then as important when choosing a TPMS tool.

Table 1 demonstrates the level of key features of automotive tool storage in terms of compatibility. As gleaned from the above data, the respondents strongly agree that the automotive tools storage device electronic components can be operated using a power supply compatible with 220 and 12 volts, gaining the highest mean (M=4.85, SD=0.36). Similarly, respondents also strongly agree that the automotive tools storage device LED lighting system is complementary for linking to the sensors inside the storage, attaining the least mean (M=4.76, SD=0.43).

Overall, the level of key features of automotive tool storage in terms of compatibility attained a grand mean of 4.79 and was interpreted Very High as assessed by the respondents. This indicates further that the respondents believed that automotive tool storage device has a very high level of compatibility that would make it easy to utilized. Compatibility of all automotive tools for repairs of breakdown of two-wheel vehicles due to considerable will continue to play an important role in the global demand. Long-term growth will be dependent on the government incentives and regulations in the country.

TABLE 1. Level of Key Features of Automotive Tool Storage in terms of Compatibility

The automotive tools storage device ...	***MEAN***	***SD***	***REMARKS***
...electronic components can be operated using a power supply compatible with 220 and 12 volts.	4.85	0.36	Strongly Agree
...solenoid lock and RFID card are appropriate for key entry to access the tool storage.	4.78	0.42	Strongly Agree
...electrical and electronic parts used are suitable for running the system.	4.78	0.42	Strongly Agree
...LED lighting system is complementary for linking to the sensors inside the storage.	4.76	0.43	Strongly Agree
...Global System for Mobile (GSM) module's connection to the Arduino Mega 2560 interface is fit for ongoing tool status monitoring.	4.78	0.42	Strongly Agree
Weighted Mean	*4.79*		
Verbal Interpretation	*Very High*		

The latest report on automotive tools and equipment market focuses on offering a competitive compatibility of advantage to organizations operating in this business space through a comprehensive analysis of the key global developments and industry augmentation history. The report is compiled in such a way that it is easily understandable for companies to grasp complete knowledge of the existing trends in the losses of car importation with chilling effect on discouragement among car owners and motorists to run their vehicles for work, pleasure or enjoyment during tourist destinations with their family members, relatives and friends which ultimately tantamount to absence of vehicular breakdowns by losing income among mechanics and technicians for their basic household needs (Automotive Market Research Reports, 2020).

TABLE 2. Level of Key Features of Automotive Tool Storage in terms of Sensor Location

The automotive tools storage device ...	***MEAN***	***SD***	***REMARKS***
...simply detects the key card using RFID readers.	4.85	0.36	Strongly Agree
...locate the microcontroller the sensor of tools as indicated and assigned on the program.	4.78	0.42	Strongly Agree
...detect efficiently the removed tools placed on the sensor's hock.	4.82	0.39	Strongly Agree
...determine the tools that have been returned and installed equally.	4.80	0.40	Strongly Agree
...show accurately the tools being withdrawn from the storage using the LED lights.	4.80	0.40	Strongly Agree
Weighted Mean	*4.81*		
Verbal Interpretation	*Very High*		

Table 2 demonstrates the level of key features of automotive tool storage in terms of Sensor Location. As gleaned from the above data, the respondents strongly agree

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that the automotive tools storage device simply detects the key card using RFID readers, gaining the highest mean (M=4.85, SD=0.36). Similarly, respondents also strongly agree that the automotive tools storage device locate the microcontroller the sensor of tools as indicated and assigned on the program, attaining the least mean (M=4.78, SD=0.42).

Overall, the level of key features of automotive tool storage in terms of Sensor Location attained a grand mean of 4.81 and was interpreted Very High as assessed by the respondents. This indicates further that the respondents believed that automotive tool storage device has a very high level of sensor location that would make it easy to utilized. The foregoing developmental researches helped the present proponent see in his own study the historical and associational linkages in weaving out possibility in realizing the specific aims advanced of similar in nature with respect to the key features of programmable monitoring device in the kinds and number of automotive tools borrowed in terms of sensor location. A parallel developmental study was dispatched for sensor location tracking the position of the vehicle even in dark clumsy areas where there is no network for receiving the signals. In this project, the so-called Global Positioning System (GPS) is used for tracking the position of the vehicle, as well as for sending the message and the Adjustable-Rate Mortgage (ARM) controller is used for saving the mobile number in the electrically erasable programmable read-only memory (EEPROM) and sends the message to it when an accident has been detected (Automatic Vehicle Accident Research and Reviews, 2020).

TABLE 3. Level of Key Features of Automotive Tool Storage in terms of Functionality

The automotive tools storage device ...	***MEAN***	***SD***	***REMARKS***
...possess the capacity to access the tool storage	4.78	0.42	Strongly Agree
...send short message service (SMS) as monitoring by who is in charge as tool keeper.	4.84	0.37	Strongly Agree
...provide efficient information demonstrated by LED lights facing the workshop that designate the loaned tools.	4.84	0.37	Strongly Agree
...ability to run a system effectively with electricity from a nearby outlet.	4.82	0.39	Strongly Agree
...switch from 220 volts to 12 volts batteries without affecting the component's capacity to monitor tools during brownouts.	4.78	0.42	Strongly Agree
Weighted Mean	*4.81*		
Verbal Interpretation	*Very High*		

Table 3 demonstrates the level of key features of automotive tool storage in terms of Functionality. As gleaned from the above data, the respondents strongly agree that the automotive tools storage device send short message service (SMS) as monitoring by who is in charge as tool keeper and provide efficient information demonstrated by LED lights facing the workshop that designate the loaned tools with, gaining the highest mean (M=4.84, SD=0.37). Similarly, respondents also strongly agree that the automotive tools storage device switch from 220 volts to 12 volts batteries without affecting the component's capacity to monitor tools during brownouts, attaining the least mean (M=4.78, SD=0.42).

Overall, the level of key features of automotive tool storage in terms of compatibility attained a grand mean of 4.74 and was interpreted Very High as assessed by the respondents. This indicates further that the respondents believed that automotive tool storage device has a very high level of Functionality that would make it easy to utilized. Monitoring of a program or intervention involves the collection of routine data that measures progress toward achieving program objectives along with functionality of feature of programmable monitoring device of whatever nature or kinds and number of automotive tools so intended for trouble shooting of vehicles in order to liberate the valued vehicular customers from accident in their travel on both side roads and busy highways Subramanya (2020) shades light to the concept of functionality of automotive diagnostic scan tools found to have been beneficial to diagnose and reprogram several vehicle control modules. They are a vital part of automotive as they efficiently determine if the vehicle has issues with its exhaust, ignition coils, engine, transmission, throttle, and oil tank, among others. An on-board diagnostics (OBD) code reader is usually adopted to troubleshoot several systems and features of the vehicle that include suspension, airbag, anti-lock braking system, and other components.

TABLE 4. Level of Key Features of Automotive Tool Storage in terms of Power Source

The automotive tools storage device ...	***MEAN***	***SD***	***REMARKS***
...the power supply of 220 volts to operate the electronic components in monitoring the tools.	4.75	0.44	Strongly Agree
...the system can be operated by a 12 volts battery without interfering with the component's ability to manage the system.	4.76	0.47	Strongly Agree
it is simple to switch the power supply from the main source to the backup battery, if there is a localized brownout.	4.76	0.43	Strongly Agree
the wiring installation is properly tack for safety.	4.78	0.42	Strongly Agree
...selection of wires is suitable for running the system constantly.	4.85	0.36	Strongly Agree
Weighted Mean	*4.79*		
Verbal Interpretation	*Very High*		

Table 4 demonstrates the level of key features of automotive tool storage in terms of Power Source. As gleaned from the above data, the respondents strongly agree that the automotive tools storage device electronic components can be operated using a power supply compatible with 220 and 12 volts, gaining the highest mean (M=4.85, SD=0.36). Similarly, respondents also strongly agree that the automotive tools storage device LED lighting system is complementary for linking to the sensors inside the storage, attaining the least mean (M=4.76, SD=0.43). Overall, the level of key features of automotive tool storage in terms of compatibility attained a grand mean of 4.74 and was interpreted Very High as assessed

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by the respondents. This indicates further that the respondents believed that automotive tool storage device has a very high level of Power Source that would make it easy to utilized. Power source is inherent in tools with installed nine-volt batteries that last a long time, there are newer products that have rechargeable batteries or use solar energy. It is also important to know the status of the battery when it's time to replace it for continuity of vehicular speed running on the busy highways. Barzam (2020) sounds supportive to the above stand upon claiming that power source has something to do with the key feature of programmable monitoring device in the kinds and number of automotive tools borrowed in terms of battery powered, solar powered, or rechargeable conceived then as important when choosing a Total Project Management System (TPMS) tool.

TABLE 5. Level of Key Features of Automotive Tool Storage in terms of Safety

The automotive tools storage device ...	***MEAN***	***SD***	***REMARKS***
...the concept does not include any poisonous or dangerous elements.	4.75	0.44	Strongly Agree
...the prototype does not include any sharp edges.	4.76	0.47	Strongly Agree
...there are no broken components that might harm the user.	4.76	0.43	Strongly Agree
...the prototype can be used safely.	4.78	0.42	Strongly Agree
...the prototype's design cannot endanger its users.	4.85	0.36	Strongly Agree
Weighted Mean	*4.79*		
Verbal Interpretation	*Very High*		

Table 5 demonstrates the level of key features of automotive tool storage in terms of Safety. As gleaned from the above data, the respondents strongly agree that the automotive tools storage device electronic components can be operated using a power supply compatible with 220 and 12 volts, gaining the highest mean (M=4.85, SD=0.36). Similarly, respondents also strongly agree that the automotive tools storage device LED lighting system is complementary for linking to the sensors inside the storage, attaining the least mean (M=4.76, SD=0.43).

Overall, the level of key features of automotive tool storage in terms of compatibility attained a grand mean of 4.74 and was interpreted Very High as assessed by the respondents. This indicates further that the respondents believed that automotive tool storage device has a very high level of Safety that would make it easy to utilized. The complexity of contemporary designs particularly in the electrical and electronic domains has progressively risen. The safety aspects of the design are done without computer aid, it is done extremely late in the design process due to how time-consuming disciplines like failure modes and effects analysis are. To automate this process and spot issues early on, when they are still relatively affordable and simple to fix, design safety analysis software is required.

The bibliographical citation by Cengel and Cimbala (2020) on the tire pressure sensor location tool can ultimately measure the force exerted per unit area in the tires of your car. It sends the information to the car's on-board computer which by all means analyses the information and makes the correct adjustments for safety of drivers and riders therein.

Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit

Numerous of the contemporaries and apparently involved in teaching manufacturing, designing, and mechanical mechanisms at the leading colleges and universities as well as actually indulged in the operations of manufacturing of automobiles were indeed focused much for the functionality of software and safety elements fully designed in monitoring the tire pressure, relearn sensors, reset codes, and program sensors in completely liberating motorists raging from riding on motorcycles to cars, jeeps, buses, and big trucks from accidents as the common occurrence in the busy highways of the cities and urban areas.

TABLE 6. Level of Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit in terms of Acknowledging

The automotive tools storage device ...	***MEAN***	***SD***	***REMARKS***
...read the RFID code to recognize the key card holder.	4.82	0.39	Strongly Agree
...allow access to multiple key cardholders to access the tool storage.	4.91	0.29	Strongly Agree
...send SMS to the teacher once the microcontroller interprets the number of tools removed from the storage.	4.80	0.40	Strongly Agree
...continue the LED lights on once the tool is still in use.	4.82	0.39	Strongly Agree
...enable the teacher to supervise the borrowed tools without substantial assistance.	4.76	0.43	Strongly Agree
Weighted Mean	*4.79*		
Verbal Interpretation	*Very High*		

Table 6 demonstrates the level of Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit in terms of Acknowledging. As gleaned from the above data, the respondents strongly agree that the automotive tools storage device electronic components can be operated using a power supply compatible with 220 and 12 volts, gaining the highest mean (M=4.85, SD=0.36). Similarly, respondents also strongly agree that the automotive tools storage device LED lighting system is complementary for linking to the sensors inside the storage, attaining the least mean (M=4.76, SD=0.43).

Overall, the level of Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit in terms of Acknowledging attained a grand mean of 4.74 and was interpreted Very High as assessed by the respondents. This indicates further that the respondents believed that Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit has a very high level of Acknowledging that would make it easy to utilized. The more gestures in acknowledging the respondents by creating rapport with them at times when they were upset due to engine troubles with quick helping hands by manufacturers, the more patronage of support needed automotive tools and spare parts.

No point of departure in the findings revealed in the study made by Patrusky (2012) from the above research on the

customers' acknowledgement, a recognition as friendly output for policy of attraction displayed by car manufacturing industry in Maryland by disclosing significant findings along presenting unique opportunities in the automotive subsequent sales business, where brands can look at new ways of acknowledging an extended customer ownership cycle, through enhanced customer experience upon purchase of automotive tools for daily usage.

Table 7 demonstrates the level of Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit in terms of Determining. As gleaned from the above data, the respondents strongly agree that the automotive tools storage device electronic components can be operated using a power supply compatible with 220 and 12 volts, gaining the highest mean (M=4.85, SD=0.36). Similarly, respondents also strongly agree that the automotive tools storage device LED lighting system is complementary for linking to the sensors inside the storage, attaining the least mean (M=4.76, SD=0.43).

TABLE 7. Level of Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit in terms of Determining

The automotive tools storage device ...	***MEAN***	***SD***	***REMARKS***
...identify the RFID card holder to access the tool storage.	4.76	0.43	Strongly Agree
...state the decisive attainability of the instruments with solemn promise in beholding the security of the said mechanized devices.	4.73	0.45	Strongly Agree
...appreciate their being good borrowers under the agreement to pay back once destroyed or incurred losses.	4.75	0.44	Strongly Agree
...ensure that the tools are in good condition with the appropriate action.	4.78	0.42	Strongly Agree
...settle with the appropriate amount once the tools are stolen, with the probability of returning the same once recovered.	4.73	0.45	Strongly Agree
Weighted Mean	*4.79*		
Verbal Interpretation	*Very High*		

Overall, the level of Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit in terms of Determining attained a grand mean of 4.74 and was interpreted Very High as assessed by the respondents. This indicates further that the respondents believed that Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit has a very high level of Determining that would make it easy to utilized. Anchored on the ramblings of findings revealed by the above past research personalities helped a lot for the present proponent to realize the specific objective so advanced in this study particularly along the enhancement of possibilities in recognizing automotive tool borrowers and best connect with them as to determining.

The findings of Roosevelt (2014) in his study on automotive installations in determining tools for breakdowns of motor engines among automotive senior high school students in selected state secondary institutions in Indiana surely as they were able to scrutinize good tools which can give them access to self-employment opportunities after graduation, and more likely with the end in view in taking good care of them once they owned the same machine gadgets as their personal property.

TABLE 8. Level of Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit in terms of Communicating

The automotive tools storage device ...	***MEAN***	***SD***	***REMARKS***
...recognize the tool keeper by swiping the RFID card to access the tools inside the storage.	4.75	0.44	Strongly Agree
...interpret the RFID card and generates the information to the reader by allowing the solenoid lock actuator to unlock the storage entry.	4.75	0.44	Strongly Agree
...send information to the microcontroller once the tool is removed from its position.	4.78	0.42	Strongly Agree
...illuminate the LED lights facing towards the workshop, determining whether the tool is still in use or unreturned.	4.75	0.44	Strongly Agree
...process the information through the microcontroller towards the GSM module via short message service (SMS) to notify the instructor.	4.75	0.44	Strongly Agree
Weighted Mean	*4.79*		
Verbal Interpretation	*Very High*		

Table 8 demonstrates the level of Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit in terms of Communicating. As gleaned from the above data, the respondents strongly agree that the automotive tools storage device electronic components can be operated using a power supply compatible with 220 and 12 volts, gaining the highest mean (M=4.85, SD=0.36). Similarly, respondents also strongly agree that the automotive tools storage device LED lighting system is complementary for linking to the sensors inside the storage, attaining the least mean (M=4.76, SD=0.43).

Overall, the level of Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit in terms of Communicating attained a grand mean of 4.74 and was interpreted Very High as assessed by the respondents. This indicates further that the respondents believed that Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit has a very high level of Communicating that would make it easy to utilized. Communicating is indeed with significant bearing on the leeway in recognizing automotive tool borrowers and best connect with them through the best channels in reaching them either by local directory or certainly by means of webpages or online search campaigns to get best results in determining the kind of end-users. With this communication scheme sustains patronage of all vehicular parts ranging from small to large including automotive tools for repairs.

Sootin (2020) dug deeper into the online communication as linkage for retrieval of not returned borrowed automotive tools in Mississippi viewpoint of the communicating game

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plan is a systematized line of action in assuring 97% of people looking to purchase, repair, or customize a car start their journey online as manufacturing company's automotive marketing strategies. As no daunting by means of friendly customers' communication in making interface contact with buyers from all walks of life without discrimination as the ample basis in saying that customers are always right, hence the basis for success of the so-called automotive industry on both local and global.

TABLE 9. Level of Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit in terms of Measuring

The automotive tools storage device ...	***MEAN***	***SD***	***REMARKS***
...figure out how many key cardholders can access the storage at a given moment.	4.84	0.37	Strongly Agree
...measure the number of tools released in the storage.	4.76	0.43	Strongly Agree
...ensure that there are borrowed tools to suit the purpose of completing the task assigned to students.	4.82	0.39	Strongly Agree
...assess to gauge the workableness of the machine gadgets borrowed by students.	4.82	0.39	Strongly Agree
...monitor the number of tools removed in the storage are the same number of LED lights facing towards the workshop.	4.80	0.40	Strongly Agree
Weighted Mean		*4.79*	
Verbal Interpretation		*Very High*	

Table 9 demonstrates the level of Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit in terms of Measuring. As gleaned from the above data, the respondents strongly agree that the automotive tools storage device electronic components can be operated using a power supply compatible with 220 and 12 volts, gaining the highest mean (M=4.85, SD=0.36). Similarly, respondents also strongly agree that the automotive tools storage device LED lighting system is complementary for linking to the sensors inside the storage, attaining the least mean (M=4.76, SD=0.43).

Overall, the level of Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit in terms of Measuring attained a grand mean of 4.74 and was interpreted Very High as assessed by the respondents. This indicates further that the respondents believed that Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit has a very high level of Measuring that would make it easy to utilized. Measuring initiative of technology students' adamant behavior by not returning overdue automotive tools, the case unplugs the connotation of measuring as this could had been the seeming reason of the said students' behavioral laziness in returning not on time the said overdue machine gadgets to the rightful owners.

Weiss, H. (2014) delved deeper into measuring adamant exercises of selected automotive mechanics by not returning borrowed tools on time in Indiana deciphers the concept of measuring the degree of utmost need of car owners for repairs of their vehicular breakdowns while on their way to their respective work assignments as simply the basis for the delay in returning the said machine tools by the said mechanics.

Relationship between the Key Features of Automotive Tool Storage and the Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit.

TABLE 10. Significant Relationship between the Key Features of Automotive Tool Storage and the Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit

Variables		r-value	Degree of Correlation	p-value	• Analysis
Compatibility	Acknowledging	0.724	Strong	0.000	• Significant
	Determining	0.808	Very Strong	0.000	• Significant
	Communicating	0.625	Strong	0.000	• Significant
	Measuring	0.652	Strong	0.000	• Significant
Sensor Location	Acknowledging	0.737	Strong	0.000	• Significant
	Determining	0.793	Strong	0.000	• Significant
	Communicating	0.556	Moderate	0.001	• Significant
	Measuring	0.616	Strong	0.000	• Significant
Functionality	Acknowledging	0.737	Strong	0.000	• Significant
	Determining	0.793	Strong	0.000	• Significant
	Communicating	0.556	Moderate	0.001	• Significant
	Measuring	0.616	Strong	0.000	• Significant
Power Source	Acknowledging	0.694	Strong	0.000	• Significant
	Determining	0.785	Strong	0.000	• Significant
	Communicating	0.476	Moderate	0.000	• Significant
	Measuring	0.548	Moderate	0.001	• Significant
Safety	Acknowledging	0.691	Strong	0.000	• Significant
	Determining	0.674	Strong	0.000	• Significant
	Communicating	0.690	Strong	0.000	• Significant
	Measuring	0.790	Strong	0.000	• Significant

Two years back, Oliver (2018) in his research on key features of effective monitoring of the compatibility of automotive tools in the hands of borrowers, the more logically programmed are the key features of the aforementioned machine tools, the more effective in monitoring device in the recognizing tool borrowers who were adamant to return the same to the legitimate tool owners from where they had

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borrowed for repairs of their breakdown cars causing traffic jams on the busy streets of the city in Washington DC.

Table 10 disclosed the relationship between the level of the key features of automotive tool storage in terms of compatibility, sensor location, functionality, power source, and safety and the level of acceptability of the developed automotive tool storage monitoring control unit in terms of acknowledging, determining, communicating, measuring.

It can be manifested that the level of the key features of automotive tool storage convey a significant relationship to the level of acceptability of the developed automotive tool storage monitoring control unit as indicated by the obtained r-values ranging from (0.456) to (0.808) with a moderate to very strong degree of correlation and p-value (0.000 and 0.001) which was lower than the 0.05 level of significance that supports the result of the analysis.

This indicates further that the respondents' assessment on the key features of automotive tool storage contributes to its level of acceptability, the high standards of features of the product also equates to its high level of being acceptable in the above-mentioned aspects.

IV. Summary, Conclusion And Recommendations

This chapter presents the summary of findings, conclusions based on the hypothesis, and the corresponding recommendations.

Summary

The study attempted to find out the relationship between the level of the key features of automotive tool storage. Specifically, it attempted to answer the following questions: (1) What is the level of key features of automotive tool storage in terms of compatibility, sensor location, functionality, power source, and safety? (2) What is the level of acceptability of developed Automotive Tool Storage Monitoring Control Unit in terms of Acknowledging, Determining, Communicating and Measuring (3) Is there significant relationship between the level of key features of automotive tool storage and the level of acceptability of the developed automotive monitoring control unit?

It involves the participation of (20) respondents representing professors, head technicians and property custodians at the College of Automotive Technology and Graduate Studies and Applied Research as well as thirty five (35) students as end-users of automotive tools and presently enrolled for their four-year degree course at LSPU San Pablo City Campus in Laguna by means of purposive sampling technique to evaluate the validity and reliability of the Automotive Tool Storage Monitoring Control Unit through a locally-constructed five-scale checklist inquiries for realization. The proponent utilized the developmental method in dealing with the phenomenon of the cause-and-effect dynamics in evaluating the situation coupled with descriptive design in exploring the avenue to the approach of truth in order to surface the data in weaving out viable solutions to the problem areas of investigation. At this point, the proponent has to request the services of experts representing professors in the Graduate Studies and Applied Research including head technicians and property custodians as well as students as end-users of automotive devices and presently enrolled at the College of Automotive Technology, LSPU San Pablo City Campus in Laguna regarding their evaluative analysis of the proposed automotive tool monitoring device at the said university.

Questionnaire in the form of checklist was utilized in the gathering of needed information and in the completion of the investigation. The statistical treatments applied in the study consisted of frequency mean, standard deviation and Pearson r correlation. Related readings on the literature and studies were gathered in the formulation of the hypothesis and the conceptual framework which was presented in a form of paradigm.

The following were significant findings of the investigation:

The level of key features of automotive tool storage in terms of Compatibility, Sensor Location, Functionality, Power Source and Safety was interpreted Very High as assessed by the respondents. This indicates further that the respondents believed that the key features of automotive tool storage device have a very high level of compatibility, Sensor Location, Functionality, Power Source and Safety

The level of Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit in terms of Acknowledging, Determining, Communicating, and Measuring was interpreted Very High as assessed by the respondents. This indicates further that the respondents believed that Acceptability of the Developed Automotive Tool Storage Monitoring Control Unit has a very high level of Acknowledging, Determining, Communicating, and Measuring.

Furthermore, it is established that the null hypothesis was rejected since the key features of automotive tool storage has a substantial relationship on the level of acceptability of the developed automotive tool storage monitoring control unit.

Conclusion

A conclusion was formed based from the findings above. Based on the data, it can be manifested that the level of the key features of automotive tool storage convey a significant relationship to the level of acceptability of the developed automotive tool storage monitoring control unit as indicated by the obtained r-values with a moderate to very strong degree of correlation and p-value which was lower than the 0.05 level of significance that supports the result of the analysis. Thus, the rejection of the hypothesis stated is due to the significant relationship observed between the level of key features of automotive tool storage and the level of acceptability of the developed automotive monitoring control unit.

In addition, it was also found out that respondents' assessment on the key features of automotive tool storage contributes to its level of acceptability, the high standards of features of the product also equate to its high level of being acceptable.

Recommendations

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1. It is recommended that this strategy is effective in minimizing the yearly problem of missing essential equipment. The faculty member in charge of the selected tools in this regard, can create to help the teacher and tool keeper maintain track of the workshop tools.
2. It may be recommended that students can use this to support the borrower's application to preserve the workshop's resources. The bundled, function-specific components may improve the workshop overall. These techniques teach students to value tools as part of their discipline. Precision, high-quality tools, and equipment are believed to be critical to a skilled technician's work.
3. Further, it is recommended that educational institutions for this investigation. This will allow as part of compliance, these instruments and equipment are evaluated and checked regularly to ensure that they are functional for the benefit of the students. The concerned person is in charge of inventory management, being part of the shop work organization for students and teachers at the university.
4. Additionally, the system's backup power supply needs to be accessible and simple for users to avoid unauthorized tool use within the vicinity in the event of an electrical outage. Likewise, strengthen the anti-theft system to preserve the quantity of tools at all times.

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