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METHOD AND SYSTEM FOR A VOICE ASSISTED QUALITY INSPECTION

Abstract

The embodiments of present disclosure herein address unresolved problems of handwritten notes or digital diaries for logging defects during quality inspection. Also, these kinds of inspections in the industries are time bound. In certain sensitive inspection cases inspectors are required to use gloves while inspecting which leads to added overhead of working with gloves while noting down the defects. Sharing of these defect logs also becomes difficult as they first must be digitized to be shared across the different units in the industry. Embodiments herein provide a method and system which logs the defects identified by inspectors using inspector's voice. The system identifies defect type, location and sub-section from inspector speech and marks the defect in an orthogonal view, a two-dimensional (2D) view, a three-dimensional (3D) view of the artifact being inspected for verification. The system also allows for marking the defects as resolved during the repair or rework process.

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Background/Summary

PRIORITY CLAIM
[0001] This U.S. patent application claims priority under 35 U.S.C. § 119 to Indian application Ser. No. 20/242,1010270, filed on Feb. 14, 2024. The entire content of the abovementioned application is incorporated herein by reference.
TECHNICAL FIELD
[0002] The disclosure herein generally relates to the field of a voice assisted defect inspection, and more particularly, a method and system for a voice assisted defect logging and quality inspection.
BACKGROUND
[0003] At present, industries like paint shops use handwritten notes or digital diaries for logging paint defects during quality inspection. These kind of inspections in the industries are time bound. This method of registering defects during quality inspection can take a lot of time as inspectors have to inspect the parts and then note down the defects in a notepad or a tablet, in certain sensitive inspection cases inspectors are required to use gloves while inspecting which leads to added overhead of working with gloves while noting down the defects. Sharing of these defect logs also becomes difficult as they first must be digitized to be shared across the different units in the industry.
[0004] Some of the technical component such as voice processor with noise reduction, large language models (LLM) are available as siloed technological advancement. However, these solutions focus on leveraging the domain model of artifact under inspection to utilise the listed technologies in a way that provide radical benefits, including higher accuracy of speech to text conversion by combining voice processor and LLM with domain models. It is due to domain model structure ability to map defect on artifact during visualisation, due to domain-based persistence seamless digitised integration with other ecosystems.
SUMMARY
[0005] Embodiments of the present disclosure present technological improvements as solutions to one or more of the above-mentioned technical problems recognized by the inventors in conventional systems. For example, in one embodiment, a method for a voice assisted defect logging and quality inspection is provided. The processor-implemented method includes receiving, via an Input/Output (I/O) interface, one or more voice inputs from an inspector while inspecting an artifact, wherein the artifact is a physical entity subjected to inspection. The one or more voice inputs of the inspector are pre-processed to remove noise using a predefined filtering technique. The one or more pre-processed voice inputs is converted into a predefined language text using a predefined language translation technique to ensure uniformity, wherein the predefined language translation technique includes a universal language model, and a custom speech model. Herein, a voice to text conversion model is integrated with the large language model and a domain model of artifact to convert one or more defects spoken by the inspector into the one or more structured defects represented by the domain model. The defect type, the defect location and the sub-section of the artifact is identified from the one or more voice inputs from the inspector. The predefined

language text is transformed into one or more structured defects for a structured defect log on a domain model of artifact under inspection using a large language model (LLM). Further, the structured defect log is analyzed to map a defect name, a defect type, and a defect location to each sub-section of the physical entity represented in the domain model using the large language model (LLM). Finally, the analyzed one or more structured defects are converted into a voice format to facilitate an effective communication to a user for repair and for reporting purpose. Herein, the one or more structured defects are represented in at least one of an orthogonal view, a two-dimensional (2D) view, a three-dimensional (3D) view of the artifact being inspected for verification.

[0006] In another embodiment, a system for a voice assisted defect logging and quality inspection is provided. The system comprises a memory storing a plurality of instructions, one or more Input/Output (I/O) interfaces, and one or more hardware processors coupled to the memory via the one or more I/O interfaces. The one or more hardware processors are configured by the instructions to receive, via an Input/Output (I/O) interface, one or more voice inputs from an inspector while inspecting an artifact, wherein the artifact is a physical entity subjected to inspection. The one or more pre-processed voice inputs is converted into a predefined language text using a predefined language translation technique to ensure uniformity, wherein the predefined language translation technique includes a universal language model, and a custom speech model. Herein, a voice to text conversion model is integrated with the large language model and a domain model of artifact to convert one or more defects spoken by the inspector into the one or more structured defects represented by the domain model. The defect type, the defect location and the sub-section of the artifact is identified from the one or more voice inputs from the inspector. The one or more hardware processors are configured by the instructions to transform the predefined language text into one or more structured defects for a structured defect log on a domain model of artifact under inspection using a large language model (LLM). Further, the structured defect log is analyzed to map a defect name, a defect type, and a defect location to each sub-section of the physical entity represented in the domain model using the large language model (LLM). Finally, the one or more hardware processors are configured by the instructions to convert the analyzed one or more structured defects into a voice format to facilitate an effective communication to a user for repair and for reporting purposes. Herein, the one or more structured defects are represented in at least one of an orthogonal view, a two-dimensional (2D) view, a three-dimensional (3D) view of the artifact being inspected for verification.

[0007] In yet another aspect, there are provided one or more non-transitory machine-readable information storage mediums comprising one or more instructions, which when executed by one or more hardware processors causes a method for a voice assisted defect logging and quality inspection is provided. The processor-implemented method includes receiving, via an Input/Output (I/O) interface, one or more voice inputs from an inspector while inspecting an artifact, wherein the artifact is a physical entity subjected to inspection. The one or more voice inputs of the inspector are pre-processed to remove noise using a predefined filtering technique. The one or more pre-processed voice inputs is converted into a predefined language text using a predefined language translation technique to ensure uniformity, wherein the predefined language translation technique includes a universal language model, and a custom speech model. Herein, a voice to text conversion model is integrated with the large language model and a domain model of artifact to convert one or more defects spoken by the inspector into the one or more structured defects represented by the domain model. The defect type, the defect location and the sub-section of the artifact is identified from the one or more voice inputs from the inspector. The predefined language text is transformed into one or more structured defects for a structured defect log on a domain model of artifact under inspection using a large language model (LLM). Further, the structured defect log is analyzed to map a defect name, a defect type, and a defect location to each sub-section of the physical entity represented in the domain model using the large language model (LLM). Finally, the analyzed one or more structured defects are converted into a voice format to facilitate

an effective communication to a user for repair and for reporting purpose. Herein, the one or more structured defects are represented in at least one of an orthogonal view, a two-dimensional (2D) view, a three-dimensional (3D) view of the artifact being inspected for verification.
[0008] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
[0009] The accompanying drawings, which are incorporated in and constitute a part of this disclosure, illustrate exemplary embodiments and, together with the description, serve to explain the disclosed principles:
[0010] FIG. **1** illustrates a block diagram of a system for a voice assisted defect logging and quality inspection, according to some embodiments of the present disclosure.
[0011] FIG. **2** is a functional block diagram to illustrate a system for a voice assisted defect logging and quality inspection, according to some embodiments of the present disclosure.
[0012] FIG. **3** is an exemplary flow diagram illustrating a processor-implemented method for a voice assisted defect logging and quality inspection, according to some embodiments of the present disclosure.
DETAILED DESCRIPTION OF EMBODIMENTS
[0013] Exemplary embodiments are described with reference to the accompanying drawings. In the figures, the left-most digit(s) of a reference number identifies the figure in which the reference number first appears. Wherever convenient, the same reference numbers are used throughout the drawings to refer to the same or like parts. While examples and features of disclosed principles are described herein, modifications, adaptations, and other implementations are possible without departing from the scope of the disclosed embodiments.
[0014] At present, industries like paint shops uses handwritten notes or digital diaries for logging paint defects during quality inspection. These kind of inspections in the industries are time bound. This method of registering defects during quality inspection can take a lot of time as inspectors have to inspect the parts and then note down the defects in a notepad or a tablet, in certain sensitive inspection cases inspectors are required to use gloves while inspecting which leads to added overhead of working with gloves while noting down the defects. Sharing of these defect logs also becomes difficult as they first must be digitized to be shared across the different units in the industry.
[0015] Embodiments herein provide a method and system for a voice assisted defect logging and quality inspection. The system is configured to log the defects identified by inspectors using inspector's voice. Further, the system identifies the defect type, defect location, and defect part from inspector speech and marks the defect in an orthogonal view, a two-dimensional (2D), and a three-dimensional (3D) view of artifact being inspected for easy verification. The system also allows for marking the defects as unresolved/being corrected/resolved during the repair or rework process.
[0016] The system is a solution transforming the defect inspection and correction during inspection process for artifact during manufacturing. The system helps in seamlessly integrating a voice to text conversion model with the large language model and a domain model of artifact to convert one or more defects spoken by the inspector into the one or more structured defects represented by the domain model of artifact. From the user's perspective, this approach offers many benefits. The system provides inspectors with real-time display of defect details on a screen as they voice-record them. This feature ensures immediate confirmation and enhances the inspector's situational awareness during the inspection process. Leveraging a domain model of artifact (for example, car),

system automatically maps the recorded sentences to specific car details, including car type, inspector name, defect count, part type, specific part, defect type, and defect location. This automated mapping significantly reduces the manual effort required and enhances accuracy.

[0017] Further, the system introduces a standardized, digital approach to defect recording, addressing the need for consistency in automotive inspection practices. This simplifies the workflow for inspectors, contributing to a more efficient and organized inspection process. By combining voice-based input with advanced language models, the system significantly improves the accuracy and speed of defect logging. This minimizes errors in defect descriptions, enhances overall inspection efficiency, and contributes to a more effective automotive inspection process.

[0018] Referring now to the drawings, and more particularly to FIG. **1** through FIG. **3**, where similar reference characters denote corresponding features consistently throughout the figures, there are shown preferred embodiments, and these embodiments are described in the context of the following exemplary system and/or method.

[0019] FIG. **1** illustrates a block diagram of a system for a voice assisted defect logging and quality inspection, according to some embodiments of the present disclosure. Although the present disclosure is explained considering that the system **100** is implemented on a server, it may be understood that the system **100** may comprise one or more computing devices **102**, such as a laptop computer, a desktop computer, a notebook, a workstation, a cloud-based computing environment and the like. It will be understood that the system **100** may be accessed through one or more input/output interfaces **104-1**, **104-2** . . . **104-**N, collectively referred to as I/O interface **104**. Examples of the I/O interface **104** may include, but are not limited to, a user interface, a portable computer, a personal digital assistant, a handheld device, a smartphone, a tablet computer, a workstation, and the like. The I/O interface **104** is communicatively coupled to the system **100** through a network **106**.

[0020] In an embodiment, the network **106** may be a wireless or a wired network, or a combination thereof. In an example, the network **106** can be implemented as a computer network, as one of the different types of networks, such as virtual private network (VPN), intranet, local area network (LAN), wide area network (WAN), the internet, and such. The network **106** may either be a dedicated network or a shared network, which represents an association of the different types of networks that use a variety of protocols, for example, Hypertext Transfer Protocol (HTTP), Transmission Control Protocol/Internet Protocol (TCP/IP), and Wireless Application Protocol (WAP), to communicate with each other. Further, the network **106** may include a variety of network devices, including routers, bridges, servers, computing devices, storage devices. The network devices within the network **106** may interact with the system **100** through communication links.

[0021] The system **100** supports various connectivity options such as BLUETOOTH®, USB, ZigBee, and other cellular services. The network environment enables connection of various components of the system **100** using any communication link including Internet, WAN, MAN, and so on. In an exemplary embodiment, the system **100** is implemented to operate as a stand-alone device. In another embodiment, the system **100** may be implemented to work as a loosely coupled device to a smart computing environment. Further, the system **100** comprises at least one memory **110** with a plurality of instructions, one or more databases **112**, and one or more hardware processors **108** which are communicatively coupled with the at least one memory to execute a plurality of modules **114** therein. The components and functionalities of the system **100** are described further in detail.

[0022] FIG. **2** is a functional block diagram **200** to illustrate a voice assisted defect inspection, according to some embodiments of the present disclosure. In one embodiment, the system **100** is also configured for marking the defects as resolved during the repair or rework process. An inspector visually identifies defects on the artifact and communicates this information to the system **100** using voice-based input. Following this, the inspector engages with the system **100** to verify the defect details, both in audio and textual formats, ensuring accurate and complete defect logging.

[0023] The system **100** receives defect details from the inspector through voice input, converting and storing them in a structured format in the system database. It facilitates verification with the inspector, ensuring precision in defect logging. Additionally, the system supports the off-station verification of defects logged by the inspector, enhancing the thoroughness and accuracy of the quality inspection process. The system **100** communicates identified defects to the repairman for necessary actions and input on the Repaired defects. It also engages with the plant manager for defect analysis. The system **100** ensures a seamless process of defect identification, verification, storage, analysis, and rectification. It leverages voice-assisted technology to enhance the efficiency and accuracy of the quality inspection process.

[0024] FIG. **3** is a flow diagram illustrating a processor-implemented method **300** for a voice assisted defect logging and quality inspection implemented by the system **100** of FIG. **1**. Functions of the components of the system **100** are now explained through steps of flow diagram in FIG. **3**, according to some embodiments of the present disclosure.

[0025] Initially, at step **302** of the processor-implemented method **300**, the one or more hardware processors **108** are configured by the programmed instructions to receive, via an Input/Output (I/O) interface, one or more voice inputs from an inspector while inspecting an artifact. Herein, the artifact is a physical entity such as a car subjected to inspection. Voice input initiates with the capture of user speech through recording using a microphone, resulting in a representative speech sample. The extracted voice sample forms the foundational input for subsequent processing, setting the stage for structured transformation. The structured transformation represents the organized format in which defect information is logged. The system database updates the structured defect logs with details such as defect type, defect part, and defect location. This structured data aids in efficient defect analysis and reporting.

[0026] The artifact represents the physical entity which is subjected to inspection. The inspector visually examines the artifact for any defects during the inspection process. Identified defects are communicated to the system via voice for further processing.

[0027] At the next step **304** of the processor-implemented method **300**, the one or more hardware processors **108** are configured by the programmed instructions to pre-process the one or more voice inputs of the inspector to remove noise using a predefined filtering technique.

[0028] At the next step **306** of the processor-implemented method **300**, the one or more hardware processors **108** are configured by the programmed instructions to convert the one or more pre-processed voice inputs into a predefined language text using a predefined language translation technique to ensure uniformity. Wherein the predefined language translation technique includes a universal language model, and a custom speech model.

[0029] At the next step **308** of the processor-implemented method **300**, the one or more hardware processors **108** are configured by the programmed instructions to transform the predefined language text into one or more structured defects for a structured defect log on a domain model of artifact under inspection using a large language model (LLM). Text to defect involves transforming the converted text into structured defect information, incorporating language translation, structural organization, and detailed logging.

[0030] Leveraging the LLM, the translated text is structured and organized to create a structured defect log. The structured defect log serves as a centralized repository, systematically categorizing identified issues for subsequent analysis. Herein, each defect is associated with specific parts and engineer details, thus providing a comprehensive overview within the complete defect log. The complete defect log, enriched with detailed defect information, is stored for future reference and analysis.

[0031] At the next step **310** of the processor-implemented method **300**, the one or more hardware processors **108** are configured by the programmed instructions to analyze the structured defect log to map a defect name, a defect type, and a defect location to each sub-section of the physical entity represented in the domain model using the large language model (LLM). Herein, the inspectors are allowed to view the logged defects in a structured format, providing an organized overview. Additionally, the one or more structured defects are represented in at least one of an orthogonal view, a two-dimensional (2D) view, a three-dimensional (3D) view of the artifact being inspected for verification.

[0032] In one example, wherein an inspector identifies a defect in the paint job of a car. At the inspection area, the inspector utilizes the voice command interface to log a paint defect on the car. Speaking into the system, the inspector articulates, “Dirt nib on right front door center.” The voice processor of the system, powered by text to speech API, adeptly captures, and converts inspector's spoken words into accurate text. The transcribed defect description is then presented on the speech verification screen. Inspector reviewing the text in his/her native language, if identifies a slight error and inspector can promptly corrects it using voice commands, ensuring the utmost accuracy in the representation of the defect.

[0033] Following the correction, the system processes the defect description, extracting key aspects such as defect type (“Dirt nib”), defect part (“right front door”), location (“Centre”), and the relevant sub-section (“door”). This information is then transformed into semantic structure, providing a structured and standardized format for defect data. Inspector verifies the defect details, confirming their accuracy on the verification screen and completeness before proceeding. Upon Inspector's confirmation, the system seamlessly pushes the verified defect information to the plant's data systems. This ensures that the defect is accurately recorded, facilitating further analysis and appropriate actions to rectify the identified issue.

[0034] Finally, at the last step **312** of the processor-implemented method **300**, the one or more hardware processors **108** are configured by the programmed instructions to convert the analyzed one or more structured defects into a voice format to facilitate an effective communication to a user for repair and reporting purpose. For repair personnel, this involves accessing detailed defect information, enabling them to carry out repairs efficiently. After addressing the issues, the repair personnel updates the defect log to reflect the rectification, completing the cycle of defect identification and resolution.

[0035] The written description describes the subject matter herein to enable any person skilled in the art to make and use the embodiments. The scope of the subject matter embodiments is defined by the claims and may include other modifications that occur to those skilled in the art. Such other modifications are intended to be within the scope of the claims if they have similar elements that do not differ from the literal language of the claims or if they include equivalent elements with insubstantial differences from the literal language of the claims.

[0036] The embodiments of present disclosure herein address unresolved problems of handwritten notes or digital diaries for logging defects during quality inspection. Also, these kinds of inspections in the industries are time bound. This method of registering defects during quality inspection can take a lot of time as inspectors have to inspect the parts and then note down the defects in a notepad or a tablet, in certain sensitive inspection cases inspectors are required to use gloves while inspecting which leads to added overhead of working with gloves while noting down the defects. Sharing of these defect logs also becomes difficult as they first must be digitized to be shared across the different units in the industry. Embodiments herein provide a method and system which logs the defects identified by inspectors using inspector's voice, the system identifies the defect type, location and part from inspector speech and marks the defect in an orthogonal view, a two-dimensional (2D) view, a three-dimensional (3D) view of the artifact being inspected for verification. The system also allows for marking the defects as resolved during the repair or rework process.

[0037] It is to be understood that the scope of the protection is extended to such a program and in addition to a computer-readable means having a message therein; such computer-readable storage means contain program-code means for implementation of one or more steps of the method, when the program runs on a server or mobile device or any suitable programmable device. The hardware device can be any kind of device which can be programmed including e.g., any kind of computer like a server or a personal computer, or the like, or any combination thereof. The device may also include means which could be e.g., hardware means like e.g., an application-specific integrated circuit (ASIC), a field-programmable gate array (FPGA), or a combination of hardware and software means, e.g., an ASIC and an FPGA, or at least one microprocessor and at least one memory with software processing components located therein. Thus, the means can include both hardware means, and software means. The method embodiments described herein could be implemented in hardware and software. The device may also include software means. Alternatively, the embodiments may be implemented on different hardware devices, e.g., using a plurality of CPUs.

[0038] The embodiments herein can comprise hardware and software elements. The embodiments that are implemented in software include but are not limited to, firmware, resident software, microcode, etc. The functions performed by various components described herein may be implemented in other components or combinations of other components. For the purposes of this description, a computer-usable or computer readable medium can be any apparatus that can comprise, store, communicate, propagate, or transport the program for use by or in connection with the instruction execution system, apparatus, or device.

[0039] The illustrated steps are set out to explain the exemplary embodiments shown, and it should be anticipated that ongoing technological development will change the manner in which particular functions are performed. These examples are presented herein for purposes of illustration, and not limitation. Further, the boundaries of the functional building blocks have been arbitrarily defined herein for the convenience of the description. Alternative boundaries can be defined so long as the specified functions and relationships thereof are appropriately performed. Alternatives (including equivalents, extensions, variations, deviations, etc., of those described herein) will be apparent to persons skilled in the relevant art(s) based on the teachings contained herein. Such alternatives fall within the scope of the disclosed embodiments. Also, the words “comprising,” “having,” “containing,” and “including,” and other similar forms are intended to be equivalent in meaning and be open ended in that an item or items following any one of these words is not meant to be an exhaustive listing of such item or items or meant to be limited to only the listed item or items. It must also be noted that as used herein and in the appended claims, the singular forms “a,” “an,” and “the” include plural references unless the context clearly dictates otherwise.

[0040] Furthermore, one or more computer-readable storage media may be utilized in implementing embodiments consistent with the present disclosure. A computer-readable storage medium refers to any type of physical memory on which information or data readable by a processor may be stored. Thus, a computer-readable storage medium may store instructions for execution by one or more processors, including instructions for causing the processor(s) to perform steps or stages consistent with the embodiments described herein. The term “computer-readable medium” should be understood to include tangible items and exclude carrier waves and transient signals, i.e., be non-transitory. Examples include random access memory (RAM), read-only memory (ROM), volatile memory, nonvolatile memory, hard drives, CD ROMs, DVDs, flash drives, disks, and any other known physical storage media.

[0041] It is intended that the disclosure and examples be considered as exemplary only, with a true scope of disclosed embodiments being indicated by the following claims.

Claims

1. A processor-implemented method comprising: receiving, via an Input/Output (I/O) interface, one or more voice inputs from an inspector while inspecting an artifact, wherein the artifact is a physical entity subjected to inspection; pre-processing, via one or more hardware processors, the

one or more voice inputs of the inspector to remove noise using a predefined filtering technique; converting, via the one or more hardware processors, the one or more pre-processed voice inputs into a predefined language text using a predefined language translation technique to ensure uniformity, wherein the predefined language translation technique includes a universal language model, and a custom speech model; transforming, via the one or more hardware processors, the predefined language text into one or more structured defects for a structured defect log on a domain model of artifact under inspection using a large language model (LLM); analyzing, via the one or more hardware processors, the structured defect log to map a defect name, a defect type, and a defect location to each sub-section of the physical entity represented in the domain model using the large language model (LLM); and converting, via the one or more hardware processors, the analyzed one or more structured defects into a voice format to facilitate an effective communication to a user for repair and for reporting purpose.
2. The processor-implemented method of claim 1, wherein a voice to text conversion model is integrated with the large language model and a domain model of artifact to convert one or more defects spoken by the inspector into the one or more structured defects represented by the domain model.
3. The processor-implemented method of claim 1, wherein the defect type, the defect location and the sub-section of the artifact is identified from the one or more voice inputs from the inspector.
4. The processor-implemented method of claim 1, wherein the one or more structured defects are represented in at least one of an orthogonal view, a two-dimensional (2D) view, a three-dimensional (3D) view of the artifact being inspected for verification.
5. A system comprising: a memory storing instructions; one or more Input/Output (I/O) interfaces; and one or more hardware processors coupled to the memory via the one or more I/O interfaces, wherein the one or more hardware processors are configured by the instructions to: receive one or more voice inputs from an inspector while inspecting an artifact, wherein the artifact is a physical entity subjected to inspection; pre-process the one or more voice inputs of the inspector to remove noise using a predefined filtering technique; convert the one or more pre-processed voice inputs into a predefined language text using a predefined language translation technique to ensure uniformity, wherein the predefined language translation technique includes a universal language model, and a custom speech model; transform the predefined language text into one or more structured defects for a structured defect log on a domain model of artifact under inspection using a large language model (LLM); analyze the structured defect log to map a defect name, a defect type, and a defect location to each sub-section of the physical entity represented in the domain model using the large language model (LLM); and convert the analyzed one or more structured defects into a voice format to facilitate an effective communication to a user for repair and for reporting purpose.
6. The system of claim 5, wherein a voice to text conversion model is integrated with the large language model and a domain model of artifact to convert one or more defects spoken by the inspector into the one or more structured defects represented by the domain model.
7. The system of claim 5, wherein the defect type, the defect location and the sub-section of the artifact is identified from the one or more voice inputs from the inspector.
8. The system of claim 5, wherein the one or more structured defects are represented in at least one of an orthogonal view, a two-dimensional (2D) view, a three-dimensional (3D) view of the artifact being inspected for verification.
9. One or more non-transitory machine-readable information storage mediums comprising one or more instructions which when executed by one or more hardware processors cause: receiving, via an Input/Output (I/O) interface, one or more voice inputs from an inspector while inspecting an artifact, wherein the artifact is a physical entity subjected to inspection; pre-processing the one or more voice inputs of the inspector to remove noise using a predefined filtering technique; converting the one or more pre-processed voice inputs into a predefined language text using a

predefined language translation technique to ensure uniformity, wherein the predefined language translation technique includes a universal language model, and a custom speech model; transforming the predefined language text into one or more structured defects for a structured defect log on a domain model of artifact under inspection using a large language model (LLM); analyzing the structured defect log to map a defect name, a defect type, and a defect location to each sub-section of the physical entity represented in the domain model using the large language model (LLM); and converting the analyzed one or more structured defects into a voice format to facilitate an effective communication to a user for repair and for reporting purpose.

10. The one or more non-transitory machine-readable information storage mediums of claim 9, wherein a voice to text conversion model is integrated with the large language model and a domain model of artifact to convert one or more defects spoken by the inspector into the one or more structured defects represented by the domain model.

11. The one or more non-transitory machine-readable information storage mediums of claim 9, wherein the defect type, the defect location and the sub-section of the artifact is identified from the one or more voice inputs from the inspector.

12. The one or more non-transitory machine-readable information storage mediums of claim 9, wherein the one or more structured defects are represented in at least one of an orthogonal view, a two-dimensional (2D) view, a three-dimensional (3D) view of the artifact being inspected for verification.
