



A method performed by a computing device for processing at least one image in conjunction with a digitized auditing form

Field & Background

5 The present invention relates to a method performed by a computing device for processing at least one image in conjunction with a digitized auditing form. It also relates to a corresponding device.

10 Quality audits are typically performed for organizations to independently verify that there is conformance to standards through review of objective evidence gathered from the organizations. It is appreciated that quality audits report on conformance, non-conformance, recommend corrective actions, and highlight areas of good working practice. Understandably, this enables organizations to find out exactly what areas of their existing practices need to be amended for
15 continual improvement, and consequently improves the overall effectiveness of the organizations. The Construction Safety Audit Scoring System (ConSASS) auditing tool for the construction industry, provided by the Workplace Safety and Health Council of Singapore, is one example of such quality audits.

20 Conventionally, quality audits are carried out by appointed auditors physically going down to the organizations to do onsite auditing. Onsite auditing generally involves a sequence of steps, for example, interviewing relevant personnel within the organizations, gathering related documents from the organizations (which need to be copied and digitized for subsequent processing to be
25 submitted as part of an audit report), taking photos of any necessary details (not already in documentary form), manually calculating overall scores of each category of the audit report (from the mentioned results gathered) for submission, and the like. Indeed, it will be appreciated from the above that the existing manner of performing quality audits is complex, laborious, error prone,
30 not to mention that it is also costly for the organizations being audited due to inefficiency of the entire process, as explained above.

One object of the present invention is therefore to address at least one of the problems of the prior art and/or to provide a choice that is useful in the art.

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Summary

According to a 1st aspect of the invention, there is provided a method performed by a computing device for processing at least one image in conjunction with a digitized auditing form. The device has a camera module and the auditing form
5 has a plurality of checklist entries. And the method comprises receiving a selection of one of the checklist entries; capturing the image using the camera module; and associating the captured image with an identification number of the selected checklist entry to enable retrieval of the captured image, wherein the identification number is unique to the selected checklist entry.

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The proposed method advantageously enables efficiency of performing audit to be improved by reducing mistakes that might otherwise be committed by the auditor, thereby resulting in less disruption during auditing. That is, the productivity of the auditor may beneficially be enhanced. Consequently, this
15 reduces disruption and non-productive time incurred by an auditee, thus providing potential costs savings related to the auditing. Moreover, the proposed method improves the overall quality of auditing carried out by the auditor, since more quality time may be spent on performing core auditing tasks, instead of focusing on managing audit documentation. Further, the method
20 enables documentary evidence necessary for the purpose of auditing to be easily collected in digitized form, without requiring hard copies of those documentary evidence.

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Preferably, the at least one image may include a plurality of images. Also, information relating to the plurality of images may be stored in a linked list. Further, the plurality of images may preferably be chronologically arranged within the linked list. And the linked list may be implemented using XML, whilst the digitized auditing form may be implemented using JAVA programming language and Android APIs. More preferably, the method may further comprise
30 transmitting the at least one image and information stored in the checklist entry to a server for processing.

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In addition, each checklist entry may have a plurality of data fields, and the method may further comprise configuring a selection menu to enable selective display of only some of checklist entries based on selection of desired data

fields via the selection menu, and displaying the only some of the checklist entries on the device. Preferably, the selection menu may be configured with a plurality of selection options related to the plurality of data fields. Also, the selection menu may be configured as a dropdown menu or a popup dialog window. Further, the auditing form may be configured for use by the construction industry. And the digitized auditing form may be a native application configured to be executed on the device. Further preferably, associating the captured image with the identification number of the selected checklist entry to enable retrieval of the captured image may also include retrieving the captured image together with any data stored in the selected checklist entry. Also, the digitized auditing form may be configured to generate a positive conformance audit report for use by the WSH Awards OSHMS Checklist for any industry.

According to a 2nd aspect of the invention, there is provided a computing device for processing at least one image in conjunction with a digitized auditing form having a plurality of checklist entries. The device comprises a processor for receiving a selection of one of the checklist entries; and a camera module for capturing the image. Specifically, the processor module associates the captured image with an identification number of the selected checklist entry to enable retrieval of the captured image, and the identification number is unique to the selected checklist entry.

It should be apparent that features relating to one aspect of the invention may also be applicable to the other aspects of the invention.

These and other aspects of the invention will be apparent from and elucidated with reference to the embodiments described hereinafter.

Brief Description of the Drawings

Embodiments of the invention are disclosed hereinafter with reference to the accompanying drawings, in which:

Figure 1 is a screenshot showing a relevant section of a digitized auditing form for processing captured images in conjunction therewith, in accordance with an embodiment of the present invention;

Figure 2 is a schematic diagram of a computing device for processing the captured images in conjunction with the digitized auditing form of Figure 1;

Figure 3 is a flow diagram of a corresponding method performed by the computing device of Figure 2, based on the same embodiment;

5 Figure 4 is a screenshot showing relevant finalized results of the digitized auditing form of Figure 1 after submission to a server for processing;

Figure 5 is a schematic diagram of a selection menu provided by the digitized auditing form of Figure 1, according to a further embodiment; and

10 Figure 6 is another schematic diagram of a submenu of the selection menu of Figure 5.

Detailed Description of Preferred Embodiments

Figure 1 shows a screenshot of a relevant section of a digitized auditing form 100 for processing captured images (i.e. photos) 102a, 102b in conjunction
15 therewith, in accordance with an embodiment. In this case, the digitized auditing form 100 is configured for use by the construction industry and specifically directed in relation to the ConSASS auditing tool, but it will also be understood that equivalent auditing forms for a variety of other industries (e.g. marine) are possible too depending on application requirements. Also, the digitized auditing
20 form 100 is locally stored on a computing device 200, in which a schematic diagram is depicted in Figure 2, while Figure 3 shows a flow diagram of a proposed method 300 performed by the computing device 200 for processing the captured images 102a, 102b in conjunction with the digitized auditing form 100. The computing device 200 comprises a display module 202, a storage module
25 204 (e.g. a display screen of the device 200), a processor module 206, a camera module 208, and a transmitter module 210, in which the functionality of each module 202, 204, 206, 208, 210 will be elaborated in detail further below. And the computing device 200 may be, for example, a tablet such as an Android-based device (or the like).

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The digitized auditing form 100 is realised and implemented in the form of a native software application and loaded onto the storage module 204 of the computing device 200, prior to carrying out auditing. In this embodiment, the native software application has a product trade name of "eAudit", and is
35 developed by Montdell Pte Ltd of Singapore. Understandably, the digitized

auditing form 100 is displayed via the display module 202 of the computing device 200 when auditing is being carried out. More specifically, the native software application, in this instance, is implemented using the JAVA programming language and Android-based APIs, notwithstanding that other types of suitable programming languages are also usable depending on the type of computing platform the digitized auditing form 100 is configured to run on (i.e. to execute the native software application). The storage module 204 is implemented using any suitable components known to skilled persons.

10 In particular, the digitized auditing form 100 is presented as a checklist with a plurality of different checklist entries that list and define the necessary audit requirements (for compliance) against which an organization being audited is measured. Each checklist entry, which is assigned a unique identification number (for example based on a serial number according to its defined documentary position in the checklist), includes a plurality of data fields such as
15 "S/No", "Guidance notes and standard specifications", "Audit Question", "Auditor's Remarks", "Risk Level", "Photographs" and the like. During auditing, an appointed auditor will then enter relevant data (obtained in the course of auditing) under the corresponding data fields of each checklist entry. Note that,
20 it is of course possible for the digitized auditing form 100 however to be arranged with only one checklist entry, notwithstanding its utility for auditing purposes.

With reference to Figure 3, the proposed method 300 performed by the computing device 200 for processing at least one image in conjunction with the digitized auditing form 100 will be described. At step 302, the processor module 206 of the computing device 200 receives a selection of one of the plurality of checklist entries, the selection being made by the appointed auditor through the display module 202 (for example, by tapping on the display screen of the device 200). Then at step 304, the computing device 200 is instructed (by appointed auditor) to capture an image using the camera module 208. Specifically, the captured image relates to (for example) necessary details to be noted for the auditing, but is however not in a convenient documentary form that can be entered into the corresponding data fields of an associated checklist entry that is
35 selected. Then at step 306, the processor module 206 associates the captured

image with the corresponding selected checklist entry via the assigned identification number thereof. Already explained above, this identification number is unique to the selected checklist entry, and therefore ensures that the association will tag the captured image to the selected checklist entry. As will
5 be appreciated, this association enables convenient subsequent retrieval of the captured image (using the computing device 200) together with any data entered into the respective data fields of that selected checklist entry for submission, when required (e.g. at the end of the auditing). For clarity, it is also to be understood that this method 300 applies to any checklist entry of the digitized
10 auditing form 100, which can be selected by the appointed auditor in the course of auditing. Also, the above three steps 302 to 306 of the method 300 are to be repeated if other new images are subsequently to be captured for that particular selected checklist entry, or if it is desired that new images are required for a different checklist entry.

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For the situation where there is a plurality of captured images 102a, 102b for a specific selected checklist entry (for example as shown in Figure 1), information relating to the plurality of images 102a, 102b is stored in a linked list, specific to that selected checklist entry. In other words, each checklist entry is configured
20 with its own linked list to store information pertaining to any images captured for that associated checklist entry. Also, the information stored in the linked list, as referred above, include an ordering of the plurality of images 102a, 102b (relative to one another), and (any optional) description provided to each image (by the appointed auditor who took the images). Not to be understood in a
25 limiting way, the linked list is implemented using XML in this case. Also, it is to be appreciated that the plurality of images 102a, 102b is chronologically arranged within the linked list, in the context of their relative ordering to each other. This means that images having an earlier date/time of capture are arranged to be closer to the header of the linked list than those images having a
30 later date/time of capture, as will be appreciated by skilled persons. It is to be understood that once the appointed auditor has completed filling in the digitized auditing form 100 at the end of the auditing process, he can then transmit all the information entered into the digitized auditing form 100, for example by way of tapping a "Send" button provided by the native software application, which will
35 be shown to the appointed auditor on the display module of the computing

device 200. The computing device 200 then instructs the transmitter module 210 to carry out transmission of the necessary information. Transmitting the information includes transmitting all of the captured images 102a, 102b in accordance with the information entered into the respective checklist entries to a server (not shown) for processing. Specifically, Figure 4 is a screenshot 400 showing (to the auditor) a relevant portion of the completed digitized auditing form 100 of Figure 1, after the digitized auditing form 100 has been submitted to the server to be processed.

10 Further embodiments of the invention will be described hereinafter. For sake of brevity, description of like elements, functionalities and operations that are common between the embodiments are not repeated; reference will instead be made to similar parts of the relevant embodiment(s).

15 According to a further embodiment, Figure 5 shows a schematic diagram of a selection menu 500 provided by the digitized auditing form 100 of Figure 1 (through the native software application being the implementation thereof, as afore explained). In particular, the selection menu 500 is configured to allow the appointed auditor using the native software application to selectively display
20 certain checklist entries based on values entered into certain data fields of the checklist entries, and the selection menu 500 is implementable as a dropdown menu or as a popup dialog window (which is independent to the native software application).

25 More specifically, the selection menu 500 is configured to include the following selection options: (1). "NO element only" 502a, (2). "YES element only" 502b, (3). "Without auditor written comment element only" 504a, (4). "With auditor written comment element only" 504b, (5). "Without fotos element only" 506a, (6). "With fotos element only" 506b, (7). "UnAnswer element only" 508a, (8). "Answer
30 element only" 508b, (9). "Not closed interview element only" 510a, (10). "Closed interview element only" 510b, (11). "NA element only" 512a, (12). "All element only" 512b, and (14) "Generate selection display" 514. It will be appreciated that the selection menu 500 is thus configured with a plurality of the selection options that are related to the data fields of the checklist entries, and those data fields
35 are common to all the checklist entries. Based on those selection options, the

selection menu 500 is thus purposefully arranged to display only checklist entries having associated data fields entered with values, for example, "NO" (i.e. corresponding to "NO element only" 502a), "YES" (i.e. corresponding to "YES element only" 502b), "NA" (i.e. corresponding to "NA element only" 512a), and blank (i.e. corresponding to "UnAnswer element only" 508a). This is beneficial when it is necessary to conduct a subsequent follow-up audit, because the earlier audit is incomplete due to certain missing information, as well as enabling the auditor to more quickly and easily locate unintentionally omitted information, or wrongly entered information in any of the checklist entries during auditing.

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In addition, the selection menu 500 is arranged to enable selective display of checklist entries that are without any tagged captured images (i.e. corresponding to "Without fotos element only" 506a), without written comments entered by the auditor (i.e. corresponding to "Without auditor written comment element only" 504a), and checklist entries not yet completed (i.e. corresponding to "Not closed interview element only" 510a). That is, by selecting any or a combination of the selection options listed above, the appointed auditor is able to desirably view (on the computing device 200) any checklist entries with data fields having values corresponding to the selected option(s). So, the selection menu 500 essentially enables the auditor to configure the selection menu 500 provided by the digitized auditing form 100 to allow selective display of only some of the checklist entries based on selection of desired data fields via the selection menu 500, and thereafter command the computing device 200 to display the some of the checklist entries.

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To illustrate usage of the selection menu 500, a few examples are briefly set out below. If it is desired to identify any checklist entries where there are interviews not yet conducted (i.e. missed interviews), the auditor will then select all of the following options under the selection menu 500: "YES element only" 502b, "Answer element only" 508b, "Not closed interview element only" 510a, and "Generate selection display" 514, in order to display those checklist entries that fulfill the combination of the selected options. This also prevents the auditor from viewing checklist entries that are classified in failed bands (i.e. bands that fail to achieve more than a 70% score for passing audit compliance as per the digitized auditing form 100), even if those checklist entries may have interviews not yet conducted. Yet further, if it is desired to identify any checklist entries

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with no written comments previously entered, the auditor will select the following options under the selection menu 500: "YES element only" 502b, "Without auditor written comment element only" 504a, and "Generate selection display" 514. On the other hand, if it is desired to identify any checklist entries with no written comments previously entered and also without any associated captured images, the auditor then selects the following options under the selection menu 500: "YES element only" 502b, "Without auditor written comment element only" 504a, "Without fotos element only" 506a, and "Generate selection display" 514.

10 Figure 6 shows another schematic diagram of a submenu of the selection menu 500 of Figure 5. Particularly, the submenu relates to the option: "Not closed interview element only" 510a (see Figure 5), which comprises a list of interviewee designation levels, including (1). "Management (Manager, Department/Section Heads etc)" 602, (2). "OSH Persons and WSH Committee" 604, (3). "Line Management (Supervisors, Engineers, Team Leaders etc)" 606, (4). "Employees" 608, (5). "Others (Contractors, Suppliers, Visitors etc)" 610, and (6). "All of the above levels" 612. That is, the list of interviewee designation levels provided within the "Not closed interview element only" 510a enables the auditor to selectively view checklist entries, where there are interviews not yet conducted, based on the designation level of the associated interviewee(s). For example, if it is desired to view checklist entries having yet to be conducted interviews with interviewees have designation levels belonging to "Management (Manager, Department/Section Heads etc)" 602, the auditor first selects the option "Not closed interview element only" 510a under the selection menu 500 of Figure 5, which consequently opens the submenu shown in Figure 6. Once the submenu is displayed (on the computing device 200), the auditor proceeds to select the interviewee designation level "Management (Manager, Department/Section Heads etc)" 602, and then thereafter returns to the selection menu 500 to further select the options "Answer element only" 508b, and the "Generate selection display" 514. With that, any checklist entries that fulfill the selected options will then be displayed to the auditor for viewing.

In summary, the proposed method 300 performed by the computing device 200 for processing at least one image in conjunction with the digitized auditing form 100 advantageously enables the efficiency of performing audit to be increased

as compared to using the ConSASS auditing tool, in part by reducing mistakes that might otherwise be committed by the auditor, thereby resulting in less disruption during auditing. That is, human error is minimised in using the proposed method 300. It is also to be appreciated that an amount of time to
5 complete an audit using the digitized auditing form 100 is about half of that required using the ConSASS auditing tool, and also the digitized auditing form 100 is able to instantaneously provide audit findings carried out so far to the auditee. Indeed, the productivity of the auditor is enhanced by using the proposed method 300. Consequently, this reduces disruption and non-
10 productive time incurred by an auditee, thus providing potential costs savings related to the auditing to both auditees and auditors parties alike.

Moreover, the proposed method 300 improves the overall quality of auditing carried out by the auditor, since more quality time may be spent on performing
15 core auditing tasks, instead of focusing on managing audit documentation. Specifically, lesser time will be spent by the auditor on sorting, uploading, managing and arranging the collected documentary evidence (e.g. captured images), since the collected documentary evidence are organised under the intended data fields of each checklist entry of the digitized auditing form 100.
20 This allows convenient checking and confirmation of those collected documentary evidence. Furthermore, the proposed method 300 enables documentary evidence necessary for the purpose of auditing to be easily collected in digitized form, without requiring hard copies of those documentary evidence. Also, it enables searching of outstanding incompleted data fields in
25 the digitized auditing form 100 for doing follow-up audits, without need to recall what data fields are actually incompleted, as is the case under existing practices. In addition, a complete audit report may be easily generated using the digitized auditing form 100 in a relatively short period of time (in minutes) since there is no longer a need to do this manually; this is all the more useful if
30 there are more than one auditor auditing an organization, where there is a need to integrate the separate audit report of each auditor into a final audit report.

The described embodiments should not however be construed as limitative. For example, it is to be appreciated that the computing device 200 may be any other
35 types of suitable mobile devices that may execute the native software

application embodying the digitized auditing form 100. Additionally, the selection options in the selection menu 500 of Figure 5 may be adapted accordingly based on the type of industry which the digitized auditing form is to be used for, since the afore described embodiment of Figure 5 is in the context of the construction industry. The same thus consequently applies to the submenu of Figure 6, as will be understood in a similar manner. In another variation, it is to be appreciated that the digitized auditing form 100 may be configured to separately generate a positive conformance audit report for usage by the WSH Awards OSHMS Checklist (2014), which is administered by the Workplace Safety and Health Council (WSH) of Singapore. Importantly this can be used for all types of industries, and not limited to just the construction industry. For avoidance of doubt, OSHMS is an abbreviation for Occupational Safety and Health Management System, and the positive conformance audit report means a report which includes only checklist entries that have received a "YES" answer from the auditee during the process of auditing. In other words, the positive conformance audit report comprises only answered checklist entries that fulfil the necessary auditing requirements set out.

While the invention has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary, and not restrictive; the invention is not limited to the disclosed embodiments. Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practising the claimed invention.

Claims

1. A method performed by a computing device for processing at least one image in conjunction with a digitized auditing form, the device having a camera module and the auditing form having a plurality of checklist entries, the method
5 comprises:
 - receiving a selection of one of the checklist entries;
 - capturing the image using the camera module; and
 - associating the captured image with an identification number of the
- 10 selected checklist entry to enable retrieval of the captured image,
 - wherein the identification number is unique to the selected checklist entry.
2. The method of claim 1, wherein the at least one image includes a plurality of images.
- 15 3. The method of claim 2, wherein information relating to the plurality of images is stored in a linked list.
4. The method of claim 3, wherein the plurality of images is chronologically
20 arranged within the linked list.
5. The method of claim 3 or 4, wherein the linked list is implemented using XML.
- 25 6. The method of any preceding claims, wherein the digitized auditing form is implemented using JAVA programming language and Android APIs.
7. The method of any preceding claims, further comprises transmitting the at least one image and information stored in the checklist entry to a server for
30 processing.
8. The method of any preceding claims, wherein each checklist entry has a plurality of data fields, further comprises:

configuring a selection menu to enable selective display of only some of the checklist entries based on selection of desired data fields via the selection menu; and

displaying the only some of the checklist entries on the device.

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9. The method of claim 8, wherein the selection menu includes being configured with a plurality of selection options related to the plurality of data fields.

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10. The method of claim 8 or 9, wherein the selection menu includes being configured as a dropdown menu or a popup dialog window.

11. The method of any preceding claim, wherein the auditing form is configured for use by the construction industry.

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12. The method of any preceding claim, wherein the digitized auditing form is a native application configured to be executed on the device.

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13. The method of any preceding claim, wherein associating the captured image with the identification number of the selected checklist entry to enable retrieval of the captured image includes retrieving the captured image together with any data stored in the selected checklist entry.

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14. The method of any preceding claim, wherein the digitized auditing form is configured to generate a positive conformance audit report for use by the WSH Awards OSHMS Checklist for any industry.

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15. A computing device for processing at least one image in conjunction with a digitized auditing form having a plurality of checklist entries, the device comprising:

a processor for receiving a selection of one of the checklist entries; and

a camera module for capturing the image,

wherein the processor module associates the captured image with an identification number of the selected checklist entry to enable retrieval of the

captured image, and the identification number is unique to the selected checklist entry.