

SYSTEM AND METHOD TO PROVIDE INTEGRATED PLATFORM TO REMOTELY MANAGE A RAILWAY NETWORK

FIELD OF INVENTION

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[0001] The present invention relates to an integrated digital platform for managing a railway network, in particular to system and method for providing an integrated platform for remotely controlling, monitoring, and managing various operations of the railway network.

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BACKGROUND

[0002] The railway network operations, especially the urban railway operations, have undergone quantitative and qualitative changes. The operation management of the railway network is facing rapid internal and external changes. Typically, the transportation needs of an urban area are affected by a wide variety of factors such as total population, population distribution, geography, income levels, etc. An extensive railway network is needed to serve a large number of intra-city trips made by the increased population. The more extensive the railway network, the more comprehensive and efficient system will be needed to manage the various operations of the railway network.

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[0003] US patent number 8,942,859 B2 filed by Jurgen Rauch discloses a guidance and security equipment for a complex mass transport system to perform integrated passenger counting, security monitoring, monitoring tracks, and controlling trains. Further, the transport guidance system automatically evaluates the data for counting, monitoring and observing without any intervention of the personnel. However, the transport guidance system disclosed in the Jurgen Rauch reference is not able to provide an integrated system which can provide a single platform to remotely monitor the various activities and operations in the depot and the complete railway network. Further, the transport guidance system disclosed in the Jurgen Rauch reference cannot utilize predictive algorithms to predict the railway incidents, a number of passengers, arrival/delay timing of trains, etc.

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5 [0004] Chinese patent number CN 201049642 Y filed by Xiaoyan Xu et al. discloses a train operation comprehensive monitoring system for use as an urban traffic automatic control system. The comprehensive monitoring system has a train operation management server, and an operator/dispatcher working station connected with a center comprehensive monitor server. The train operation comprehensive monitoring system also integrates an online schedule adjustment module to automate the schedules of the trains. However, the system disclosed in the Xiaoyan Xu et al. reference does not provide an integrated automated system which can not only remotely monitor and manage the railway network but also automates the recovery operations on detecting any rail incident in real-time.

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SUMMARY

15 [0005] There is a need for an efficient, effective, and automated system and method to provide an integrated platform to remotely manage a railway network over a network. Further, there is a need for a system and method that predicts rail incidents, number of expected passengers, and arrival/delay time of the train. Furthermore, there is a need for a system and method to automatically initiate recovery operations on detection rail incidents.

[0006] The present invention mainly solves the technical problems existing in the prior art. In response to these problems, the present invention provides a system and method to provide an integrated platform to remotely manage a railway network over a network.

20 [0007] An aspect of the present disclosure relates to a method for providing an integrated platform for remotely managing a railway network over a network. The method includes a step of managing a plurality of operations pertaining to a depot and monitoring movement of a plurality of trains within the depot through a depot management module. Then the method includes the step of detecting a plurality of rail incidents and responding to the detected rail incidents by coordinating with a plurality of emergency trains to initiate a recovery operation through a maintenance management module. Further, the method includes the step of monitoring a plurality of routine operations pertaining to the trains and infrastructure of the railway network and projecting a plurality of responses on detection of faults in the trains and the infrastructure of the railway network through an operation management module.

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[0008] In an aspect, the step of managing the plurality of operations pertaining to the depot and monitoring movement of the plurality of trains within the depot comprises the step of receiving a first plurality of credentials from a first user through a first authentication sub-module. The first plurality of credentials comprises a first user identification information and a first password. Then the method includes a step of displaying a plurality of updates pertaining to the trains through a train overview sub-module. The plurality of updates comprises a number of trains available in the depot, a number of spare trains in the depot, a number of down trains in the depot, and a number of trains in mainline. The method then includes the step of providing an identification number of the spare train, locations of the spare train in the depot, and information of total distance travelled by the spare train through a spare train sub-module. Further, the method includes the step of providing an identification number of the down train, locations of the down train in the depot, and fault information pertaining to the down train through a down train sub-module. Furthermore, the method includes the step of providing a first view of a daily schedule of a plurality of railway tracks and further providing a second view of a weekly schedule of each of the railway track through a track schedule sub-module. The method then includes the step of assigning a task to an employee selected from a plurality of profiles stored in a local memory through an assignment sub-module. The assignment sub-module enables the first user to search and select a team from a plurality of team profiles stored in the local memory and further provides information pertaining to team members of the team.

[0009] In an aspect, the step of detecting the plurality of rail incidents and responding to the detected rail incidents by coordinating with the plurality of emergency trains to initiate a recovery operation comprises the step of receiving a second plurality of credentials from a second user through a second authentication sub-module, wherein the second plurality of credentials comprises a second user identification information and a second password. Then the method includes the step of providing a unitary interface to depict a first status pertaining to the plurality of trains, and a second status pertaining to an infrastructure of the railway network through a status sub-module. The status sub-module further predicts a probability of failure of a plurality of components pertaining to the train and the infrastructure of the railway network. Further, the method includes the step of displaying, a graphical map of a plurality of real-time situations of the plurality of trains, and the infrastructure of the railway network through an incident interface sub-module. The plurality of situations comprises detection of faults in a train in mainline, the location of

the trains in mainline, the location of the emergency train, and detection of a fault in the infrastructure of the railway network. Further, the incident interface sub-module on detection of faults coordinates with a plurality of emergency trains to move towards the location of the trains in mainline.

5 **[0010]** In an aspect, the step of monitoring the plurality of routine operations pertaining to the trains, and the infrastructure of the railway network and projecting a plurality of responses on detection of faults in the trains and the infrastructure of the railway network comprises the step of receiving a third plurality of credentials from a third user through a third authentication sub-module. The third plurality of credentials comprises a third user
10 identification information and a third password. The method then includes the step of displaying a geographical view of an operating fleet in a plurality of geographical regions through a geographical sub-module. The geographical sub-module further displays information pertaining to headway arrival, dwell time, and unable to board corresponding to each of the geographical region. The method then includes the step of monitoring a
15 plurality of status of trains concerning the geographical regions through a first monitoring sub-module. The plurality of status comprises running status of the train, scheduled arrival time, deviation from the scheduled arrival time, and platform number. Then the method includes the step of predicting and projecting a plurality of graphs pertaining to the number of passengers arrive in a predefined time duration, number of passengers affected on
20 detection of a fault in the train through a second monitoring sub-module. The second monitoring sub-module further monitors a plurality of key performance indicators pertaining to the plurality of trains and the infrastructure of the railway network. Furthermore, the method includes the step of assessing the severity of the detected fault to project a plurality of response plans through a response sub-module, wherein the response
25 sub-module enables a third user to select at least one of the projected response plan.

[0011] In an aspect, the plurality of profiles comprises a picture of the employee, a contact number of the employee, name of a team corresponding to the employee, designation of the employee, and current assignment of the employee.

[0012] An aspect of the present disclosure relates to a device in a network. The device
30 includes a non-transitory storage device having embodied therein one or more routines operable to provide an integrated platform to remotely manage a railway network over a

network. The one or more routines include a depot management module, a maintenance management module, and an operation management module.

5 **[0013]** The depot management module manages a plurality of operations pertaining to a depot and monitors movement of a plurality of trains within the depot. The depot management module comprises a first authentication sub-module, a train overview sub-module, a spare train sub-module, a down train sub-module, a track schedule sub-module, and an assignment sub-module. The first authentication sub-module receives a first plurality of credentials from a first user. The first plurality of credentials comprises a first user identification information and a first password. The train overview sub-module displays a plurality of updates pertaining to the trains. The plurality of updates comprises a number of trains available in the depot, a number of spare trains in the depot, a number of down trains in the depot, and a number of trains in mainline. The spare train sub-module provides an identification number of the spare train, locations of the spare train in the depot, and information of total distance travelled by the spare train. The down train sub-module provides an identification number of the down train, locations of the down train in the depot, and fault information pertaining to the down train. The track schedule sub-module provides a first view of a daily schedule of a plurality of railway tracks and further provides a second view of a weekly schedule of each of the railway track. The assignment sub-module to assign a task to an employee selected from a plurality of profiles stored in local memory.

15 **[0014]** The maintenance management module detects a plurality of rail incidents and responds to the detected rail incidents by coordinating with a plurality of emergency trains to initiate a recovery operation. The maintenance management module comprises a second authentication sub-module, a status sub-module, and an incident interface sub-module.

25 **[0015]** The second authentication sub-module to receive a second plurality of credentials from a second user. The second plurality of credentials comprises a second user identification information and a second password. The status sub-module provides a unitary interface to depict a first status pertaining to the plurality of trains, and a second status pertaining to an infrastructure of the railway network. The status sub-module further predicts a probability of failure of a plurality of components pertaining to the train and the infrastructure of the railway network. The incident interface sub-module displays a graphical map of a plurality of real-time situations of the plurality of trains, and the

infrastructure of the railway network. The plurality of situations comprises detection of faults in a train in mainline, the location of the trains in mainline, the location of the emergency train, and detection of a fault in the infrastructure of the railway network. The incident interface sub-module on detection of faults coordinates with a plurality of emergency trains to move towards the location of the trains in mainline.

[0016] The operation management module monitors a plurality of routine operations pertaining to the trains and the infrastructure of the railway network and projects a plurality of responses on detection of faults in the trains and the infrastructure of the railway network. The operation management module comprises a third authentication sub-module, a geographical sub-module, a first monitoring sub-module, a second monitoring sub-module, and a response sub-module.

[0017] The third authentication sub-module receives a third plurality of credentials from a third user. The third plurality of credentials comprises a third user identification information and a third password. The geographical sub-module to display a geographical view of an operating fleet in a plurality of geographical regions. The geographical sub-module further displays information pertaining to headway arrival, dwell time, and unable to board corresponding to each of the geographical region. The first monitoring sub-module monitors a plurality of status of trains concerning the geographical regions, wherein the plurality of status comprises running status of the train, scheduled arrival time, deviation from the scheduled arrival time, and platform number. The second monitoring sub-module predicts and projects a plurality of graphs pertaining to the number of passengers arrive in a predefined time duration, number of passengers affected on detection of a fault in the train. The response sub-module assesses the severity of the detected fault to project a plurality of response plans. The response sub-module enables a third user to select at least one of the projected response plan.

[0018] In an aspect, the plurality of profiles comprises a picture of the employee, a contact number of the employee, name of a team corresponding to the employee, designation of the employee, and current assignment of the employee.

[0019] In an aspect, the assignment sub-module enables the first user to search and select a team from a plurality of team profiles stored in the local memory.

[0020] In an aspect, the assignment sub-module further provides information pertaining to team members of the team.

[0021] In an aspect, the second monitoring sub-module further monitors a plurality of key performance indicators pertaining to the plurality of trains and the infrastructure of the railway network.

[0022] An aspect of the present disclosure relates to a system to provide an integrated platform to remotely manage a railway network over a network. The system includes a processor and a memory. The memory stores machine-readable instructions that when executed by the processor cause the processor to manage a plurality of operations pertaining to a depot and monitoring movement of a plurality of trains within the depot through a depot management module. The processor is further configured to detect a plurality of rail incidents and responding to the detected rail incidents by coordinating with a plurality of emergency trains to initiate a recovery operation through a maintenance management module. Then the processor is configured to monitor a plurality of routine operations pertaining to the trains and the infrastructure of the railway network and projecting a plurality of responses on detection of faults in the trains and the infrastructure of the urban railway through an operation management module.

[0023] The processor is further configured to receive a first plurality of credentials from a first user through a first authentication sub-module. The first plurality of credentials comprises a first user identification information and a first password. Then the processor is configured to display a plurality of updates pertaining to the trains through a train overview sub-module. The plurality of updates comprises a number of trains available in the depot, a number of spare trains in the depot, a number of down trains in the depot, and number of trains in mainline. The processor is further configured to provide an identification number of the spare train, locations of the spare train in the depot, and information of total kilometers traveled by the spare train through a spare train sub-module. Then the processor is configured to provide an identification number of the down train, locations of the down train in the depot, and fault information pertaining to the down train through a down train sub-module. Further, the processor is configured to provide a first view of a daily schedule of a plurality of railway tracks and further providing a second view of a weekly schedule of each of the railway track through a track schedule sub-module. The processor is

configured to assign a task to an employee selected from a plurality of profiles stored in a local memory through an assignment sub-module.

5 [0024] The processor is further configured to receive a second plurality of credentials from a second user through a second authentication sub-module. The second plurality of credentials comprises a second user identification information and a second password. Then the processor is configured to provide a unitary interface to depict a first status pertaining to the plurality of trains, and a second status pertaining to an infrastructure of an urban railway through a status sub-module. The status sub-module further predicts a probability of failure of a plurality of components pertaining to the train and the infrastructure of the urban railway. Furthermore, the processor is configured to display a graphical map of a plurality of real-time situations of the plurality of trains, and the infrastructure of the urban railway through an incident interface sub-module. The plurality of situations comprises detection of faults in a train in mainline, the location of the trains in mainline, the location of the emergency train, and detection of a fault in the infrastructure of the urban railway. The incident interface sub-module on detection of faults coordinates with a plurality of emergency trains to move towards the location of the trains in mainline.

20 [0025] The processor is further configured to receive a third plurality of credentials from a third user through a third authentication sub-module. The third plurality of credentials comprises a third user identification information and a third password. Further, the processor is configured to display a geographical view of an operating fleet in a plurality of geographical regions through a geographical sub-module, wherein the geographical sub-module further displays information pertaining to headway arrival, dwell time, and unable to board corresponding to each of the geographical region. Furthermore, the processor is configured to monitor a plurality of status of trains concerning the geographical regions through a first monitoring sub-module, wherein the plurality of status comprises: running status of the train, scheduled arrival time, deviation from the scheduled arrival time, and platform number. Then the processor is configured to predict and project a plurality of graphs pertaining to the number of passengers arrive in a predefined time duration, number of passengers affected on detection of a fault in the train through a second monitoring sub-module. The processor is then configured to assess the severity of the detected fault to project a plurality of response plans through a response sub-module. The response sub-module enables a third user to select at least one of the projected response plan.

[0026] Accordingly, one advantage of the present invention is that it provides an intelligent and integrated platform to manage, and strengthen the railway network.

[0027] Accordingly, one advantage of the present invention is that it predicts and projects faults and incidents to enhance the security of the railway network.

5 [0028] Accordingly, one advantage of the present invention is that it provides a platform to respond in a crisis and applies various algorithms to avoid any such crisis in future.

[0029] Accordingly, one advantage of the present invention is that it analyses various passengers and trains related data to simulate a plurality of scenarios to forecast the requirement and manage any crisis.

10 [0030] Accordingly, one advantage of the present invention is that it systematically and automatically analyses the operation scale, the proportion of the urban mass transit, the surge in the public demand, and security of operations in the urban mass transit networks.

[0031] Accordingly, one advantage of the present invention is that it enables the passengers to manage the travel over a mobile-application and can also interact with the railway
15 authorities.

[0032] Other features of embodiments of the present disclosure will be apparent from accompanying drawings and from the detailed description that follows.

BRIEF DESCRIPTION OF THE DRAWINGS

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[0033] In the figures, similar components and/or features may have the same reference label. Further, various components of the same type may be distinguished by following the reference label with a second label that distinguishes among the similar components. If
25 of the similar components having the same first reference label irrespective of the second reference label.

[0034] **FIG. 1** illustrates a network implementation of the present system and method to provide an integrated platform to remotely manage a railway network over a network, in accordance with an embodiment of the present invention.

- [0035] FIG. 2 illustrates a block diagram of the present system to provide an integrated platform to remotely manage a railway network over a network, in accordance with an embodiment of the present invention.
- 5 [0036] FIG. 3 illustrates a flowchart of the present method for providing an integrated platform to remotely manage a railway network over a network, in accordance with at least one embodiment of the present invention.
- [0037] FIG. 4 illustrates a flowchart of managing the plurality of operations pertaining to the depot and monitoring movement of the plurality of trains within the depot, in accordance with at least one embodiment of the present invention.
- 10 [0038] FIG. 5 illustrates a flowchart of detecting the plurality of rail incidents and responding to the detected rail incidents by coordinating with the plurality of emergency trains to initiate a recovery operation, in accordance with at least one embodiment of the present invention.
- 15 [0039] FIG. 6 illustrates a flowchart of monitoring the plurality of routine operations pertaining to the trains, and the infrastructure of the railway network and projecting a plurality of responses on detection of faults in the trains and the infrastructure of the railway network, in accordance with at least one embodiment of the present invention.
- 20 [0040] FIG. 7 illustrates an operational view of the first authentication sub-module of the depot management module, in accordance with at least one embodiment of the present invention.
- [0041] FIG. 8 illustrates an operational view of the train overview sub-module, in accordance with at least one embodiment of the present invention.
- [0042] FIG. 9 illustrates an operational view of the spare train sub-module, in accordance with at least one embodiment of the present invention.
- 25 [0043] FIG. 10 illustrates an operational view of the down train sub-module, in accordance with at least one embodiment of the present invention.
- [0044] FIG. 11 illustrates a first operational view of the track schedule sub-module, in accordance with at least one embodiment of the present invention.

- [0045] FIG. 12 illustrates a second operational view of the track schedule sub-module, in accordance with at least one embodiment of the present invention.
- [0046] FIG. 13 illustrates a first operational view of the assignment sub-module, in accordance with at least one embodiment of the present invention.
- 5 [0047] FIG. 14 illustrates a second operational view of the assignment sub-module, in accordance with at least one embodiment of the present invention.
- [0048] FIG. 15 illustrates a third operational view of the assignment sub-module, in accordance with at least one embodiment of the present invention.
- [0049] FIG. 16 illustrates a fourth operational view of the assignment sub-module, in
10 accordance with at least one embodiment of the present invention.
- [0050] FIG. 17 illustrates an operational view of the second authentication sub-module of the maintenance management module, in accordance with at least one embodiment of the present invention.
- [0051] FIG. 18 illustrates a first operational view of the status sub-module, in accordance
15 with at least one embodiment of the present invention.
- [0052] FIG. 19 illustrates a second operational view of the status sub-module, in accordance with at least one embodiment of the present invention.
- [0053] FIG. 20 illustrates a third operational view of the status sub-module, in accordance with at least one embodiment of the present invention.
- 20 [0054] FIG. 21 illustrates an operational view of the incident interface sub-module, in accordance with at least one embodiment of the present invention.
- [0055] FIG. 22 illustrates an operational view of the third authentication sub-module of the operation management module, in accordance with at least one embodiment of the present invention.
- 25 [0056] FIG. 23 illustrates a first operational view of the geographical sub-module, in accordance with at least one embodiment of the present invention.

[0057] FIG. 24 illustrates a second operational view of the geographical sub-module, in accordance with at least one embodiment of the present invention.

[0058] FIG. 25 illustrates an operational view of the first monitoring sub-module, in accordance with at least one embodiment of the present invention.

5 [0059] FIG. 26 illustrates an operational view of the second monitoring sub-module, in accordance with at least one embodiment of the present invention.

[0060] FIG. 27 illustrates an operational view of the response sub-module, in accordance with at least one embodiment of the present invention.

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DETAILED DESCRIPTION

[0061] Systems and methods are disclosed for providing an integrated platform to remotely manage a railway network over a network. Embodiments of the present disclosure include various steps, which will be described below. The steps may be performed by hardware components or may be embodied in machine-executable instructions, which may be used
15 to cause a general-purpose or special-purpose processor programmed with the instructions to perform the steps. Alternatively, steps may be performed by a combination of hardware, software, firmware, and/or by human operators.

[0062] Embodiments of the present disclosure may be provided as a computer program product, which may include a machine-readable storage medium tangibly embodying
20 thereon instructions, which may be used to program a computer (or other electronic devices) to perform a process. The machine-readable medium may include, but is not limited to, fixed (hard) drives, magnetic tape, floppy diskettes, optical disks, compact disc read-only memories (CD-ROMs), and magneto-optical disks, semiconductor memories, such as ROMs, PROMs, random access memories (RAMs), programmable read-only
25 memories (PROMs), erasable PROMs (EPROMs), electrically erasable PROMs (EEPROMs), flash memory, magnetic or optical cards, or other type of media/machine-readable medium suitable for storing electronic instructions (e.g., computer programming code, such as software or firmware).

[0063] Various methods described herein may be practiced by combining one or more
30 machine-readable storage media containing the code according to the present disclosure

with appropriate standard computer hardware to execute the code contained therein. An apparatus for practicing various embodiments of the present disclosure may involve one or more computers (or one or more processors within a single computer) and storage systems containing or having network access to computer program(s) coded in accordance with various methods described herein, and the method steps of the disclosure could be accomplished by modules, routines, subroutines, or subparts of a computer program product.

[0064] The present invention discloses a system and method whereby the depot management module manages the operations of a depot and monitors the movement of trains within the depot, the maintenance management module detects the rail incidents and responds to the detected rail incidents, and the operation management module monitors the routine operations of the trains and the infrastructure and further projects the responses on detection of faults in the trains and the infrastructure of the rail network.

[0065] Although the present disclosure has been described with the purpose of providing an integrated platform to remotely manage the urban railway control center over network, it should be appreciated that the same has been done merely to illustrate the invention in an exemplary manner and any other purpose or function for which explained structures or configurations could be used, is covered within the scope of the present disclosure.

[0066] Exemplary embodiments will now be described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein. These embodiments are provided so that this disclosure will be thorough and complete and will fully convey the scope of the invention to those of ordinary skill in the art. Moreover, all statements herein reciting embodiments of the invention, as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents as well as equivalents developed in the future (i.e., any elements developed that perform the same function, regardless of structure).

[0067] Thus, for example, it will be appreciated by those of ordinary skill in the art that the diagrams, schematics, illustrations, and the like represent conceptual views or processes

illustrating systems and methods embodying this invention. The functions of the various elements shown in the figures may be provided through the use of dedicated hardware as well as hardware capable of executing associated software. Similarly, any switches shown in the figures are conceptual only. Their function may be carried out through the operation
5 of program logic, through dedicated logic, through the interaction of program control and dedicated logic, or even manually, the particular technique being selectable by the entity implementing this invention. Those of ordinary skill in the art further understand that the exemplary hardware, software, processes, methods, and/or operating systems described herein are for illustrative purposes and, thus, are not intended to be limited to any particular
10 name.

[0068] Specific details are given in the following description to provide a thorough understanding of the embodiments. However, it will be understood by one of ordinary skill in the art that the embodiments may be practiced without these specific details. For example, circuits, systems, networks, processes, and other components may be shown as
15 components in block diagram form in order not to obscure the embodiments in unnecessary detail. In other instances, well-known circuits, processes, algorithms, structures, and techniques may be shown without unnecessary detail to avoid obscuring the embodiments.

[0069] The term “machine-readable storage medium” or “computer-readable storage medium” includes, but is not limited to, portable or non-portable storage devices, optical storage devices, and various other mediums capable of storing, containing, or carrying
20 instruction(s) and/or data. A machine-readable medium may include a non-transitory medium in which data can be stored, and that does not include carrier waves and/or transitory electronic signals propagating wirelessly or over wired connections. Examples of a non-transitory medium may include but are not limited to, a magnetic disk or tape, optical storage media such as compact disk (CD) or versatile digital disk (DVD), flash
25 memory, memory or memory devices.

[0070] **FIG. 1** illustrates a network implementation **100** of the present system and method to provide an integrated platform to remotely manage a railway network over a network, in accordance with an embodiment of the present invention. Although the embodiment is explained considering that the present system **102** is implemented on a server, it may be
30 understood that the present system **102** may also be implemented in a variety of computing systems, such as a laptop computer, a desktop computer, a notebook, a workstation, a

mainframe computer, a server, a network server, and the like. It will be understood that the present system **102** may be accessed by multiple users through one or more computing devices **104-1**, **104-2**...**104-N**, collectively referred to as computing unit **104** hereinafter, or applications residing on the computing unit **104**. Examples of the computing unit **104** may include but are not limited to, a portable computer, a personal digital assistant, a handheld or mobile device, smart devices, and a workstation. The computing units **104** are communicatively accessible to the present system **102** through a network **106**.

[0071] In one implementation, the network **106** may be a wireless network, a wired network or a combination thereof. The network **106** can be implemented as one of the different types of networks, such as an intranet, local area network (LAN), wide area network (WAN), the internet, and the like. The network **106** may either be a dedicated network or a shared network. The shared network 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), Wireless Application Protocol (WAP), and the like, to communicate with one another. Further, the network **106** may include a variety of network devices, including routers, bridges, servers, computing devices, storage devices, and the like.

[0072] **FIG. 2** illustrates a block diagram of the present system **102** to provide an integrated platform to remotely manage a railway network over a network, in accordance with an embodiment of the present invention. The system **102** may include at least one processor **202**, an input/output (I/O) interface **204**, and a memory **206**. The processor **202** may be implemented as one or more microprocessors, microcomputers, microcontrollers, digital signal processors, central processing units, state machines, logic circuitries, and/or any devices that manipulate signals based on operational instructions. Among other capabilities, the at least one processor **202** is configured to fetch and execute computer-readable instructions stored in the memory **206**.

[0073] The I/O interface **204** may include a variety of software and hardware interfaces, for example, a web interface, a graphical user interface, and the like. The I/O interface **204** may allow the system **102** to interact with a user directly or through the computing unit **104**. Further, the I/O interface **204** may enable the system **102** to communicate with other computing devices, such as web servers and external data servers (not shown). The I/O interface **204** can facilitate multiple communications within a wide variety of networks and

protocol types, including wired networks, for example, LAN, cable, etc., and wireless networks, such as WLAN, cellular, or satellite. The I/O interface **204** may include one or more ports for connecting a number of devices to one another or to another server.

[0074] The memory **206** may include any computer-readable medium known in the art including, for example, volatile memory, such as static random access memory (SRAM) and dynamic random access memory (DRAM), and/or non-volatile memory, such as read-only memory (ROM), erasable programmable ROM, flash memories, hard disks, optical disks, and magnetic tapes. The memory **206** may include modules **208** and data **210**.

[0075] The modules **208** include routines, programs, objects, components, data structures, etc., which perform particular tasks or implement particular abstract data types. In one implementation, the modules **208** may include a depot management module **212**, a maintenance management module **213**, an operation management module **214**, and other module **230**. The other modules **230** may include programs or coded instructions that supplement applications and functions of the system **102**.

[0076] The data **210**, amongst other things, serves as a repository for storing data processed, received, and generated by one or more of the modules **208**. The data **210** may also include a depot management data **231**, a maintenance management data **232**, an operation management data **233** and other data **248**. The depot management data **231** comprises a first authentication data **234**, a train overview data **235**, a spare train data **236**, a down train data **237**, a track schedule data **238**, and an assignment data **239**. Further, the maintenance management data **232** comprises a second authentication data **240**, a status data **241**, and an incident interface data **242**. The operation management data **233** comprises a third authentication data **243**, a geographical data **244**, a first monitoring data **245**, a second monitoring data **246**, and a response data **247**. The other data **248** may include data generated as a result of the execution of one or more modules in the other module **230**.

[0077] In one implementation, the depot management module **212** is configured to manage a plurality of operations pertaining to a depot and monitors movement of a plurality of trains within the depot. The depot refers to a railway facility or area where trains regularly stop to load or unload passengers or freight. Further, the depot can be utilized when trains are not being used, and require repairing or maintenance. The depot management module **212** comprises a first authentication sub-module **216**, a train overview sub-module **217**, a

spare train sub-module **218**, a down train sub-module **219**, a track schedule sub-module **220**, and an assignment sub-module **221**.

[0078] The first authentication sub-module **216** receives a first plurality of credentials from a first user. **FIG. 7** illustrates an operational view of the first authentication sub-module **216**, in accordance with at least one embodiment. The first plurality of credentials comprises a first user identification information **702** and a first password **704**. In an embodiment, the first user is a depot administrator who can access the depot management module **212** on providing his/her credentials.

[0079] The train overview sub-module **217** displays a plurality of updates pertaining to the trains. **FIG. 8** illustrates an operational view of the train overview sub-module **217**, in accordance with at least one embodiment. The plurality of updates comprises a number of trains available **802** in the depot, a number of spare trains **804** in the depot, a number of down trains **806** in the depot, and a number of trains **808** in mainline.

[0080] The spare train sub-module **218** (shown in **FIG. 9**) provides an identification number of the spare train, locations of the spare train in the depot, and information of total kilometers traveled by the spare train. The down train sub-module **219** (shown in **FIG. 10**) provides an identification number of the down train, locations of the down train in the depot, and fault information pertaining to the down train.

[0081] **FIG. 11** illustrates a first operational view **1100** of the track schedule sub-module **220**, in accordance with at least one embodiment. **FIG. 12** illustrates a second operational view **1200** of the track schedule sub-module **220**, in accordance with at least one embodiment. The track schedule sub-module **220** provides a first view **1102** of a daily schedule of a plurality of railway tracks and further provides a second view **1104** of a weekly schedule of each of the railway track.

[0082] **FIG. 13** illustrates a first operational view **1300** of the assignment sub-module **221**, in accordance with at least one embodiment. The assignment sub-module **221** assigns a task to an employee selected from a plurality of profiles stored in local memory. **FIG. 14** illustrates a second operational view **1400** of the assignment sub-module **221**, in accordance with at least one embodiment. In an embodiment, the plurality of profiles comprises a picture of the employee **1402**, a contact number **1404** of the employee, name of a team

1406 corresponding to the employee, designation of the employee **1408**, and current assignment of the employee **1410**.

[0083] **FIG. 15** illustrates a third operational view **1500** of the assignment sub-module **221**, in accordance with at least one embodiment. In an embodiment, the assignment sub-module **221** enables the first user to search **1502** and select a team from a plurality of team profiles stored in the local memory. **FIG. 16** illustrates a fourth operational view **1600** of the assignment sub-module **221**, in accordance with at least one embodiment. In an embodiment, the assignment sub-module **221** further provides information pertaining to team members of the team on utilizing a searching people option **1602** in the assignment sub-module **221**.

[0084] The maintenance management module **213** detects a plurality of rail incidents and responds to the detected rail incidents by coordinating with a plurality of emergency trains to initiate a recovery operation. The maintenance management module **213** comprises a second authentication sub-module **222**, a status sub-module **223**, and an incident interface sub-module **224**.

[0085] The second authentication sub-module **222** receives a second plurality of credentials from a second user. **FIG. 17** illustrates an operational view **1700** of the second authentication sub-module of the maintenance management module **222**, in accordance with at least one embodiment. The second plurality of credentials comprises a second user identification information **1702** and a second password **1704**. In an embodiment, the second user is a maintenance administrator who can access the maintenance management module **213** on providing his/her credentials.

[0086] **FIG. 18** illustrates a first operational view of the status sub-module **223**, in accordance with at least one embodiment. The status sub-module **223** provides a unitary interface to depict a first status pertaining to the plurality of trains, and a second status pertaining to an infrastructure of the railway network. The status sub-module **223** further predicts a probability of failure of a plurality of components **1802** pertaining to the train and the infrastructure **1804** of the railway network. **FIG. 19** illustrates a second operational view of the status sub-module **223**, in accordance with at least one embodiment. In an embodiment, the status sub-module **223** utilizes a plurality of algorithms to predict the probability of the failure **1902** of the railway components. In an embodiment, the plurality

of algorithms utilizes historical data of each of the railway components to build an analytic model to model the behavior of the railway components. Further, the maintenance management module **213** may use supervise learning to train the status sub-module **223** with the historical data to predict the failure **1902**. In another embodiment, the maintenance management module **213** may use general trend data to detect abnormal behavior from the sensor data to initiate a pre-warning signal for any potential failure and resolution required to pre-empt the failure, wherein the sensor data is collected from the plurality of sensors integrated with the railway components.

[0087] **FIG. 20** illustrates a third operational view of the status sub-module **223**, in accordance with at least one embodiment. In an embodiment, the status sub-module **223** further computes and displays **2002** the railway components which are over-utilized and high probability of breakdown. In an embodiment, the utilization of the railway components is computed from the meter readings that are collected from the various railway components. In an additional embodiment, the status sub-module **223** may also monitor the performance of the railway components to compute the over-utilization.

[0088] **FIG. 21** illustrates an operational view of the incident interface sub-module **224**, in accordance with at least one embodiment. The incident interface sub-module **224** displays a graphical map of a plurality of real-time situations of the plurality of trains, and the infrastructure of the railway network. The plurality of situations comprises detection of faults in a train in mainline, the location of the trains in mainline, the location of the emergency train, and detection of a fault in the infrastructure of the railway network. The incident interface sub-module **224** on detection of faults coordinates with a plurality of emergency trains **2102** to move towards the location of the trains in mainline. In an embodiment, the maintenance management module **213** is configured with an augmented reality (AR) device to enable the various resources to efficiently monitor and perform the maintenance work in real-time.

[0089] The operation management module **214** monitors a plurality of routine operations pertaining to the trains and the infrastructure of the railway network and projects a plurality of responses on detection of faults in the trains and the infrastructure of the railway network. The operation management module **214** comprises a third authentication sub-module **225**, a geographical sub-module **226**, a first monitoring sub-module **227**, a second monitoring sub-module **228**, and a response sub-module **229**.

[0090] The third authentication sub-module **225** receives a third plurality of credentials from a third user. **FIG. 22** illustrates an operational view of the third authentication sub-module of the operation management module, in accordance with at least one embodiment. The third plurality of credentials comprises a third user identification information **2202** and a third password **2204**. In an embodiment, the second user is an operation administrator who can access the operation management module **214** on providing his/her credentials.

[0091] **FIG. 23** illustrates a first operational view **2300** of the geographical sub-module **226**, in accordance with at least one embodiment. In an embodiment, the geographical sub-module **226** provides real-time locations and traffic of the running trains. **FIG. 24** illustrates a second operational view **2400** of the geographical sub-module **226**, in accordance with at least one embodiment. The geographical sub-module **226** displays a geographical view of an operating fleet **2402** in a plurality of geographical regions. The geographical sub-module **226** further displays information pertaining to headway arrival **2404**, dwell time **2408**, and unable to board **2410** corresponding to each of the geographical regions.

[0092] The first monitoring sub-module **227** monitors a plurality of status **2502** of trains concerning the geographical regions. **FIG. 25** illustrates an operational view of the first monitoring sub-module **227**, in accordance with at least one embodiment. The plurality of status **2502** comprises running status of the train, scheduled arrival time, deviation from the scheduled arrival time, and platform number. **FIG. 26** illustrates an operational view of the second monitoring sub-module **228**, in accordance with at least one embodiment. The second monitoring sub-module **228** predicts and projects a plurality of graphs **2602** pertaining to the number of passengers arrive in a predefined time duration, number of passengers affected on detection of a fault in the train. In an embodiment, the second monitoring sub-module **228** further monitors a plurality of key performance indicators pertaining to the plurality of trains and the infrastructure of the railway network. The response sub-module **229** assesses the severity of the detected fault to project a plurality of response plans. **FIG. 27** illustrates an operational view of the response sub-module **229**, in accordance with at least one embodiment. The response sub-module **229** enables a third user to select at least one of the projected response plan **2702**, **2704**, **2706**, **2708**. The response sub-module **229** enables the operation administrator to utilize the available resources and manage the railway track smartly.

[0093] **FIG. 3** illustrates a flowchart **300** of the present method for providing an integrated platform to remotely manage a railway network over a network, in accordance with at least one embodiment. The method initiates with a step **302** of managing a plurality of operations pertaining to a depot and monitoring movement of a plurality of trains within the depot through a depot management module. Then the method includes the step **304** of detecting a plurality of rail incidents and responding to the detected rail incidents by coordinating with a plurality of emergency trains to initiate a recovery operation through a maintenance management module. Further, the method includes the step **306** of monitoring a plurality of routine operations pertaining to the trains and infrastructure of the railway network and projecting a plurality of responses on detection of faults in the trains and the infrastructure of the railway network through an operation management module.

[0094] **FIG. 4** illustrates a flowchart **400** of managing the plurality of operations pertaining to the depot and monitoring movement of the plurality of trains within the depot which comprises the step **402** of receiving a first plurality of credentials from a first user through a first authentication sub-module. The first plurality of credentials comprises a first user identification information and a first password. Then the method includes a step **404** of displaying a plurality of updates pertaining to the trains through a train overview sub-module. The plurality of updates comprises a number of trains available in the depot, a number of spare trains in the depot, a number of down trains in the depot, and a number of trains in mainline. The method then includes the step **406** of providing an identification number of the spare train, locations of the spare train in the depot, and information of total kilometers traveled by the spare train through a spare train sub-module. Further, the method includes the step **408** of providing an identification number of the down train, locations of the down train in the depot, and fault information pertaining to the down train through a down train sub-module. Furthermore, the method includes the step **410** of providing a first view of a daily schedule of a plurality of railway tracks and further providing a second view of a weekly schedule of each of the railway track through a track schedule sub-module. The method then includes the step **412** of assigning a task to an employee selected from a plurality of profiles stored in a local memory through an assignment sub-module. The assignment sub-module enables the first user to search and select a team from a plurality of team profiles stored in the local memory and further provides information pertaining to team members of the team.

[0095] **FIG. 5** illustrates a flowchart **500** of detecting the plurality of rail incidents and responding to the detected rail incidents by coordinating with the plurality of emergency trains to initiate a recovery operation which comprises the step **502** of receiving a second plurality of credentials from a second user through a second authentication sub-module.

5 The second plurality of credentials comprises a second user identification information and a second password. Then the method includes the step **504** of providing a unitary interface to depict a first status pertaining to the plurality of trains, and a second status pertaining to an infrastructure of the railway network through a status sub-module. The status sub-module further predicts a probability of failure of a plurality of components pertaining to

10 the train and the infrastructure of the railway network. Further, the method includes the step **506** of displaying, a graphical map of a plurality of real-time situations of the plurality of trains, and the infrastructure of the railway network through an incident interface sub-module. The plurality of situations comprises detection of faults in a train in mainline, the location of the trains in mainline, the location of the emergency train, and detection of a

15 fault in the infrastructure of the railway network. Further, the incident interface sub-module on detection of faults coordinates with a plurality of emergency trains to move towards the location of the trains in mainline.

[0096] **FIG. 6** illustrates a flowchart **600** of monitoring the plurality of routine operations pertaining to the trains, and the infrastructure of the railway network and projecting a

20 plurality of responses on detection of faults in the trains and the infrastructure of the railway network which comprises the step **602** of receiving a third plurality of credentials from a third user through a third authentication sub-module. The third plurality of credentials comprises a third user identification information and a third password. The method then includes the step **604** of displaying a geographical view of an operating fleet in a plurality

25 of geographical regions through a geographical sub-module. The geographical sub-module further displays information pertaining to headway arrival, dwell time, and unable to board corresponding to each of the geographical region. The method then includes the step **606** of monitoring a plurality of status of trains concerning the geographical regions through a first monitoring sub-module. The plurality of status comprises running status of the train, scheduled arrival time, deviation from the scheduled arrival time, and platform number.

30 Then the method includes the step **608** of predicting and projecting a plurality of graphs pertaining to the number of passengers arrive in a predefined time duration, number of passengers affected on detection of a fault in the train through a second monitoring sub-

module. The second monitoring sub-module further monitors a plurality of key performance indicators pertaining to the plurality of trains and the infrastructure of the railway network. Furthermore, the method includes the step 610 of assessing the severity of the detected fault to project a plurality of response plans through a response sub-module, wherein the response sub-module enables a third user to select at least one of the projected response plan.

[0097] Thus the present system provides an efficient, simpler and more elegant platform that improves the level of urban railway transportation service, establishes a quantifiable safety assessment system and equipment quality index model. Further, the present system and method strengthen the quality controls for security, equipment and effectively manages the passengers/crowd. Additionally, the present system and method utilize machine learning algorithms to ensure the health of the urban mass transit network operation. The present system and method analyze various passengers and trains related data to simulate a plurality of scenarios to forecast the requirement and manage any crisis. The present system and method use commuter volume and train movement data as inputs to simulate the possible future scenarios. Further, the historical data can be used to forecast the future commuter volume. Consequently, abnormal build up can be used to pre-warn and relevant response plans proposed based on the commuters travel pattern. Further, the present system enables the passengers to manage the travel over a mobile-application and can also interact with the railway authorities.

[0098] While embodiments of the present disclosure have been illustrated and described, it will be clear that the disclosure is not limited to these embodiments only. Numerous modifications, changes, variations, substitutions, and equivalents will be apparent to those skilled in the art, without departing from the scope of the disclosure, as described in the claims.

CLAIMS:

1. A system to provide an integrated platform to remotely manage a railway network over a network , the system comprising:

a memory to store machine-readable instructions pertaining to operation, and maintenance of a plurality of trains and an infrastructure of the railway network; and a processor coupled to the memory and operable to execute the machine-readable instructions stored in the memory, wherein the processor comprises:

a depot management module to manage a plurality of operations pertaining to a depot and monitors movement of a plurality of trains within the depot, wherein the depot management module comprises:

a first authentication sub-module to receive a first plurality of credentials from a first user, wherein the first plurality of credentials comprises a first user identification information and a first password;

a train overview sub-module to display a plurality of updates pertaining to the trains, wherein the plurality of updates comprises a number of trains available in the depot, a number of spare trains in the depot, a number of down trains in the depot, and number of trains in mainline;

a spare train sub-module to provide an identification number of the spare train, locations of the spare train in the depot, and information of total kilometers traveled by the spare train;

a down train sub-module to provide an identification number of the down train, locations of the down train in the depot, and fault information pertaining to the down train;

a track schedule sub-module provides a first view of a daily schedule of a plurality of railway tracks and further provides a second view of a weekly schedule of each of the railway track; and

an assignment sub-module to assign a task to an employee selected from a plurality of profiles stored in a local memory;

a maintenance management module to detect a plurality of rail incidents and respond to the detected rail incidents by coordinating with a plurality of emergency trains to initiate a recovery operation, wherein the maintenance management module comprises:

a second authentication sub-module to receive a second plurality of credentials from a second user, wherein the second plurality of credentials comprises a second user identification information, and a second password;

5 a status sub-module to provide a unitary interface to depict a first status pertaining to the plurality of trains, and a second status pertaining to an infrastructure of the railway network, wherein the status sub-module further predicts a probability of failure of a plurality of components pertaining to the train and the infrastructure of the railway network; and
10 an incident interface sub-module to display a graphical map of a plurality of real-time situations of the plurality of trains, and the infrastructure of the railway network, wherein the plurality of situations comprises: detection of faults in a train in mainline, location of the trains in mainline, location of emergency train, and detection of fault in the
15 infrastructure of the railway network, wherein the incident interface sub-module on detection of faults coordinates with a plurality of emergency trains to move towards the location of the trains in mainline; and

an operation management module to monitor a plurality of routine operations pertaining to the trains and the infrastructure of the railway network and projects
20 a plurality of responses on detection of faults in the trains and the infrastructure of the railway network, wherein the operation management module comprises:

a third authentication sub-module to receive a third plurality of credentials from a third user, wherein the third plurality of credentials comprises a third user identification information, and a third password;
25 a geographical sub-module to display a geographical view of an operating fleet in a plurality of geographical regions, wherein the geographical sub-module further displays information pertaining to headway arrival, dwell time, and unable to board corresponding to each of the geographical region;

30 a first monitoring sub-module monitors a plurality of status of trains concerning the geographical regions, wherein the plurality of status comprises: running status of the train, scheduled arrival time, deviation from the scheduled arrival time, and platform number;

- a second monitoring sub-module to predict and project a plurality of graphs pertaining to the number of passengers arrive in a predefined time duration, number of passengers affected on detection of a fault in the train; and
- 5 a response sub-module to assess the severity of the detected fault to project a plurality of response plans, wherein the response sub-module enables a third user to select at least one of the projected response plan.
- 10 2. The system according to claim 1, wherein the plurality of profiles comprises a picture of the employee, a contact number of the employee, name of a team corresponding to the employee, designation of the employee, and current assignment of the employee.
- 15 3. The system according to claim 1, wherein the assignment sub-module enables the first user to search and select a team from a plurality of team profiles stored in the local memory.
4. The system according to claim 1, wherein the assignment sub-module further provides information pertaining to team members of the team.
- 20 5. The system according to claim 1, wherein the second monitoring sub-module further monitors a plurality of key performance indicators pertaining to the plurality of trains and the infrastructure of the railway network.
- 25 6. A method implemented by one or more processors for providing an integrated platform for remotely managing a railway network over a network, the method comprising:
- managing, by one or more processors , a plurality of operations pertaining to a depot and monitoring movement of a plurality of trains within the depot through a depot management module;
- 30 detecting, by one or more processors , a plurality of rail incidents and responding to the detected rail incidents by coordinating with a plurality of emergency trains to initiate a recovery operation through a maintenance management module; and
- monitoring, by one or more processors , a plurality of routine operations pertaining to the trains and infrastructure of the railway network and projecting a plurality of

responses on detection of faults in the trains and the infrastructure of the railway network through an operation management module;

wherein the step of managing the plurality of operations pertaining to the depot and monitoring movement of the plurality of trains within the depot comprises the steps of:
5 receiving, by one or more processors, a first plurality of credentials from a first user through a first authentication sub-module, wherein the first plurality of credentials comprises a first user identification information and a first password;

displaying, by one or more processors, a plurality of updates pertaining to the trains through a train overview sub-module, wherein the plurality of updates comprises a
10 number of trains available in the depot, a number of spare trains in the depot, a number of down trains in the depot, and number of trains in mainline;

providing, by one or more processors, an identification number of the spare train, locations of the spare train in the depot, and information of total kilometers traveled by the spare train through a spare train sub-module;

15 providing, by one or more processors, an identification number of the down train, locations of the down train in the depot, and fault information pertaining to the down train through a down train sub-module;

providing, by one or more processors, a first view of a daily schedule of a plurality of railway tracks and further providing a second view of a weekly schedule of each of the
20 railway track through a track schedule sub-module; and

assigning, by one or more processors , a task to an employee selected from a plurality of profiles stored in a local memory through an assignment sub-module , wherein the assignment sub-module enables the first user to search and select a team from a plurality of team profiles stored in the local memory, and further provides information pertaining
25 to team members of the team.

7. The method according to claim 6, wherein the step of detecting the plurality of rail incidents and responding to the detected rail incidents by coordinating with the plurality of emergency trains to initiate a recovery operation comprises the steps of:

30 receiving, by one or more processors, a second plurality of credentials from a second user through a second authentication sub-module, wherein the second plurality of credentials comprises a second user identification information, and a second password;

providing, by one or more processors , a unitary interface to depict a first status pertaining to the plurality of trains, and a second status pertaining to an infrastructure of the railway network through a status sub-module , wherein the status sub-module further predicts a probability of failure of a plurality of components pertaining to the train and the infrastructure of the railway network; and

displaying, by one or more processors , a graphical map of a plurality of real-time situations of the plurality of trains, and the infrastructure of the railway network through an incident interface sub-module , wherein the plurality of situations comprises: detection of faults in a train in mainline, location of the trains in mainline, location of emergency train, and detection of fault in the infrastructure of the railway network, wherein the incident interface sub-module on detection of faults coordinates with a plurality of emergency trains to move towards the location of the trains in mainline.

8. The method according to claim 6, wherein the step of monitoring the plurality of routine operations pertaining to the trains, and the infrastructure of the railway network and projecting a plurality of responses on detection of faults in the trains and the infrastructure of the railway network comprises the steps of:

receiving, by one or more processors, a third plurality of credentials from a third user through a third authentication sub-module, wherein the third plurality of credentials comprises a third user identification information, and a third password;

displaying, by one or more processors, a geographical view of an operating fleet in a plurality of geographical regions through a geographical sub-module, wherein the geographical sub-module further displays information pertaining to headway arrival, dwell time, and unable to board corresponding to each of the geographical region;

monitoring, by one or more processors, a plurality of status of trains concerning the geographical regions through a first monitoring sub-module, wherein the plurality of status comprises: running status of the train, scheduled arrival time, deviation from the scheduled arrival time, and platform number;

predicting and projecting, by one or more processors , a plurality of graphs pertaining to the number of passengers arrive in a predefined time duration, number of passengers affected on detection of a fault in the train through a second monitoring sub-module, wherein the second monitoring sub-module further monitors a plurality of key performance indicators pertaining to the plurality of trains and the infrastructure of the railway network; and

assessing, by one or more processors, the severity of the detected fault to project a plurality of response plans through a response sub-module, wherein the response sub-module enables a third user to select at least one of the projected response plan.

- 5 9. The method according to claim 6, wherein the plurality of profiles comprises a picture of the employee, a contact number of the employee, name of a team corresponding to the employee, designation of the employee, and current assignment of the employee.