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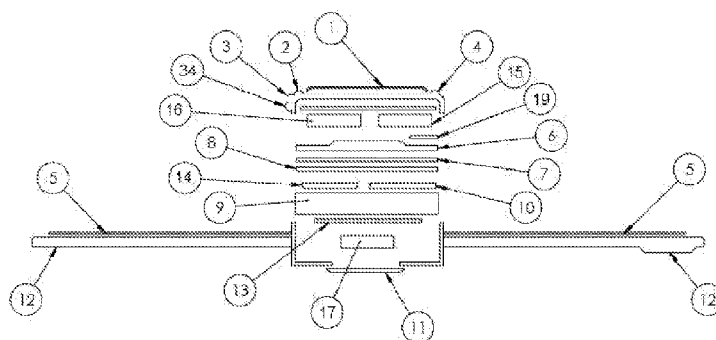
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(54) Title: PROJECT SAFETY AND EXECUTIVE MANAGEMENT BASED ON IOT AND AI



[Fig. 1]

(57) Abstract: The project management wristband helps project managers to manage their projects more accurately and in the form of an integrated system and to be informed about the exact process of project implementation online. The project safety manager can use the built-in sensors by defining conditions appropriate to the group to have complete control over the performance of employees and prevent possible accidents. All wristband sensor information will be stored in the cloud server and this possibility will help the project managers to establish a more accurate plan based on this information. Calculating the progress percentage of the project is done in two ways declaration by the worker and image processing which increases accuracy and reduces human errors. This wristband helps the workers to feel more secure while doing the work and to see the relevant training regarding how to do the work correctly and safety tips if needed.



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Project Safety and Executive Management based on IOT and AI

- [0001] The project management wristband is a tool designed to help project managers manage their projects with greater accuracy and efficiency. It provides an integrated system that allows project managers to monitor and track the exact process of project implementation online. The wristband is equipped with built-in sensors that can be used by the project safety manager to define conditions that are appropriate to the group. This allows for complete control over the performance of employees and helps prevent possible accidents.
- [0002] All the sensor information collected by the wristband is stored in the cloud server, which allows project managers to establish a more accurate plan based on this information. The progress percentage of the project is calculated in two ways. Firstly, the worker can declare their progress, and secondly, image processing is used to increase accuracy and reduce human errors.
- [0003] One of the significant benefits of this wristband is that it helps the beneficiary workers feel more secure while doing their work. It provides relevant training to workers on how to do their work correctly and also offers safety tips if needed. This helps to reduce the risk of accidents and ensures that workers are equipped with the necessary knowledge to complete their tasks safely and efficiently. Overall, the project management wristband is an invaluable tool that can help project managers achieve better results while keeping workers safe and secure.

Technical Field

- [0004] F05D 101/10 - G16Y 30/00

Background Art

- [0005] IN202211013520
- [0006] AI-BASED SYSTEM FOR MONITORING PERSONAL PROTECTIVE EQUIPMENT (PPE) USAGE BY WORKERS AT CONSTRUCTION SITES FOR BETTER SAFETY
- [0007] The present invention provides a real-time system for monitoring and ensuring the safety of workers at the construction sites by making sure the proper use of the personal protective equipment by the workers with the help of a network of connected edge devices installed at suitable places with unobstructed view to continuously monitor and alarm the monitoring unit in case of any non-compliance of the use of safety wearables. The real-time monitoring system comprise of an edge device consisting of a camera (100), a computing unit (101), an alert system (102); consisting

of hooter and red LEDs; and a RF modem (102). The edge device is trained by data sets of workers not wearing personal protective equipment by machine learning which recognizes whether a worker has worn safety wearables or not. In case of absence of any of the personal protective equipment, the edge device sends the data to the monitoring unit (250). The monitoring unit comprises of a RF modem (300), a computing unit (301) and a display (302). Based on the data received on the display of the monitoring unit, the concerned authority can take suitable action against the worker and warn the same of repeating the mistake again. The present invention can be used in remotest construction sites devoid of mobile network signals and internet or Wi-Fi facilities.

[0008] This mentioned patent and our claimed patent have similarities such as both of them are AI-based and can be used in construction sites, and both of them have cameras, but although both of them aim for the safety of the workers this mentioned patent does not contain the communication and planning features which our claimed patent focuses on.

[0009] CA2925321

[0010] SMART WRISTBAND SAFETY WARNING SYSTEM

[0011] A pedestrian and worker safety system, comprising: a) at least one smart wristband unit; and b) one or more machines, vehicles and/or trains, each comprising i) a communication unit comprising a wireless transceiver capable of transmitting and/or receiving at least one warning information to/from at least one smart wristband unit; and ii) a warning display unit, wherein warning information is transmitted via wireless communication between one or more machines, vehicles and/or trains and at least one smart wristband unit.

[0012] This invention is a wristband like our claimed patent and it is suitable for workers to use because it helps them prevent danger, it is also a smart device and communicates with vehicles, on the other hand, our claimed wristband creates this opportunity for connection between the whole project team and the managers and inspectors.

[0013] United States Patent Application 20220058659

[0014] System and Method for Location Awareness of Workers to Enhance Safety and Productivity

[0015] Disclosed is a system and a method for location awareness of workers to enhance safety and productivity.

[0016] This invention is close to our patent due to its being wearable though it is not a wristband, its user interface, and safety awareness, generally, this mentioned design also controls even worker's productivity like ours but it does not send training videos and safety workwear checklists, does not measure and calculate worker's salary and does not contain internet of thing to monitor the vehicles.

[0017] US20230031942

[0018] SYSTEM AND METHOD FOR MONITORING THE LOCATION OF WORKERS IN A WORKSITE TO ENHANCE SAFETY AND PRODUCTIVITY

[0019] A system and a method for monitoring the location of workers in a worksite to enhance safety and productivity are used to facilitate the monitoring of every worker to determine the individual performance and the condition of the worker. A present signal is broadcasted with each wearable beacon from a plurality of wearable beacons. The present signal from an arbitrary beacon is received with a proximal detector from a plurality of proximal detectors. The present signal of the arbitrary beacon is relayed from the proximal detector to a remote server. A current approximate location of the arbitrary beacon from the worksite location of the proximal detector is assessed. The current approximate location of the arbitrary beacon is logged into a location history of the arbitrary beacon with the remote server. Then, a plurality of iterations for the process is executed to continuously monitor the location and condition of each worker.

[0020] This patent monitors both the safety according to their location and the productivity of the worker, while our patent contains a broad system of communication, calculation, and overall observation based on AI and IOT.

[0021] US10772538B1

[0022] System and method for monitoring safety and productivity of physical tasks

[0023] Methods and systems for monitoring workplace safety and evaluating risks is provided, the method comprising receiving signals from at least one wearable device, identifying portions of the signals corresponding to physical activities, excerpting the portions of the signals corresponding to the physical activities, and calculating risk metrics based on measurements extracted from the excerpted portions of the signals, the risk metric indicative of high risk lifting activities.

[0024] Our patent is a wristband that is easy to use but this one is a wearable device and its method works through signals and is not as complicated as ours, for example, it is connected to heavy vehicles and operates under the surveillance of the managers of the project.

[0025] US20240071613

[0026] SYSTEMS AND METHODS FOR AUTOMATIC WORKER HEALTH AND SAFETY ASSESSMENT USING MACHINE LEARNING

[0027] A safety system for providing a real-time health and safety assessment of a worker performing a task includes a telemetry and video database to store biometric telemetry data and video data of the worker performing the task, an environmental database to store environmental data associated with the worker performing the task, a threshold database to store a threshold for a safety parameter of the worker performing the task, a machine learning-based model to automatically determine the safety parameter of the worker based on the stored biometric telemetry data, video data, environmental

data, and threshold, a dashboard to provide access to the stored biometric telemetry data, video data, environmental data, and threshold, and provide the real-time health and safety assessment of the worker based on the determined safety parameter, and a controller to control an operation of the safety system.

[0028] IN202211013293

[0029] A SYSTEM OF RF COMMUNICATION-BASED SAFETY TRACKING GADGET FOR THE COAL MINE WORKERS AT THE TIME OF CONTINGENCIES UNDER THE MINE

[0030] This invention says that at the time of contingencies or accidents in the coal mines, the coal mine workers have been stuck inside the mine. To save the life of these coal mine workers, a personal electronic gadget should be designed to be carried by each miner and automatically decodes acoustically transmitted text messages or sirens sent to the rescue operations team and automatically through encoding these text messages or any other signals or siren, the rescue team frequently reach to that location to save the life of that miner. Signals are synchronized between the miner and rescue operation teams.

[0031] As mentioned in the title of this invention, it is special and only works for the workers in the coal mines while our claimed invention is for all the workers but in the construction sites and workshops and also the managers and inspectors of the projects. On the other hand, this patent is only for communication so does not contain the extra features of our claimed design but they also have similarities such as using the cloud server and containing servers to store data and measure heart rate and blood pressure.

[0032] US20200241525

[0033] COMPUTER-BASED APPARATUS SYSTEM FOR ASSESSING, PREDICTING, CORRECTING, RECOVERING, AND REDUCING RISK ARISING FROM AN OPERATOR'S DEFICIENT SITUATION AWARENESS

[0034] A computer-based apparatus system for assessing, predicting, correcting, recovering, and reducing risk arising from an operator's deficient situation awareness (SA). This system identifies operator situation awareness by computer-apparatus and method that utilizes neurogenic-psychophysiological-neurocognitive-artificial intelligence processes. This system is configured to receive psychophysiological data from the operator via the neurogenic sensor(s) and configured to be loaded with data corresponding to the operator's baseline SA capacity and/or possesses AI algorithms to learn and calibrate the operator's baseline SA capacity and sound a warning in response if an SA deficiency threshold has been exceeded. Optionally, an autopilot/auto-driver/auto-operator/auto-worker/student alert/player & coach alert interface is configured to activate an autopilot/auto-driver/auto-operator/auto-worker command in response an SA deficiency threshold has been exceeded.

[0035] The mentioned invention is based on computers which can also be smartphones and it uses artificial intelligence but not the Internet of Things, it works with a machine learning algorithm, it has finger worn sensor, and wrist-worn sensor, and a camera while our system has two cameras, more modules plus more safety features rather than preventing risks like this mentioned design.

[0036] US11540716

[0037] WEARABLE DEVICE FOR MONITORING THE HEALTH AND SUPERVISION OF A SUPERVISED PERSON AND RELATED SYSTEMS AND METHODS

[0038] Systems and methods for aiding, supplementing, and/or increasing the monitoring capabilities of responsible persons over a supervised person are disclosed herein. In some implementations, the system includes one or more controlling persons, one or more supervising persons, a supervised person, and a cloud server. Each of the controlling persons and the supervising persons can have a personal electronic device. The supervised person can have a wearable electronic device. The electronic devices allow the controlling persons and the supervising persons to actively communicate with the cloud server to upload data related to the supervised person that is accessibly stored in the cloud server. In turn, the wearable device can include one or more sensors to measure and communicate various bioindicators to the cloud server. The system allows the controlling persons to monitor the health of, development of, and/or current control over the supervised person.

[0039] This device is wearable and has an operator to observe and monitor things, it has a server and storage to store instructions of the device but not what the worker has to do or wear. This patent can also detect locations. Generally, it is similar to ours but not as vast as it.

[0040] IN201721015996

[0041] SYSTEM AND METHOD FOR WORKER SAFETY MANAGEMENT

[0042] The system comprises a wearable device, a gateway device and a central processing unit, wherein, the wearable device is configured for, measuring one or more values of one or more physiological parameters of the worker when the worker is within an area defined by the gateway device, processing the one or more value of the one or more physiological parameter; and initiating a first action based on a result of the processing. The gateway device is configured for, defining an area within the workplace, measuring one or more values of one or more environmental parameters within the area defined by the gateway device, processing the one or more values of the environmental parameters and a first data received from the wearable device, and initiating a second action based on a result of the processing. The central processing unit is configured for, recording a first data received from the gateway device, and processing the first data received for initiating a third action.

- [0043] This device and our device are both wearable, both can measure physical actions, and body temperature and check worker's safety but our claimed system methods are different than this mentioned one because it is based on AI and AOT in the first place and then it focuses on more capacities and has a wider range of features.
- [0044] WO2021053479
- [0045] CONTEXT-AWARE SAFETY ASSISTANT FOR WORKER SAFETY
- [0046] In some examples, a computing device may receive audio data that represents a first plurality of utterances from a worker, wherein the first plurality of utterances represents at least one expression of the worker about a safety event. The computing device may select a set of safety context data that characterizes at least one of the worker, a worker environment, or an article of PPE. The computing device may determine, based at least in part on the safety context data and applying natural language processing to the first plurality of utterances, safety response data that represents a second plurality of utterances that is semantically responsive to the expression of the worker. The computing device may generate an output based at least in part on the safety response data that represents a second plurality of utterances that is semantically responsive to the expression of the worker about the safety event.
- [0047] This device has a memory to store the instructions for workers and it focuses the most on safety, our claimed invention contains these features and more to focus on.
- [0048] US20210005072A1
- [0049] Smart safety apparatus, system and method
- [0050] The disclosed device, system, and method may comprise one or more devices for digital personal protective equipment. These devices may be network enabled wearables. A plurality of sensors, data transmission mechanisms, self-illuminating LEDs, and communication mechanisms may be embedded in a suspension or harness in various embodiments. A number of sensors may likewise be provided in a glove or earbud (ear plug). The device may measure various aspects of a wearer's movement and transmit that data over a data connection (such as a wifi or mobile connection) to a server. The server may house project and human resources data, worker and condition information, and materials and supplies data, according to various examples of embodiments. The system may further comprise one or more applications which may interpret the data provided.
- [0051] This mentioned device is wearable like our patent but it is a helmet and it is only for safety, although it has an audio feature for communicating with networks too, it is not suitable for managing projects.
- [0052] KR101866677B1
- [0053] Safety management system in construction site based on wearable devices and method thereof.

[0054] The present invention relates to a safety management system in a construction site based on a wearable device and a method thereof. The safety management system in the construction site comprises: a wearable device which is mounted on the body of a worker, measures health data including temperature, heart rate, blood pressure, oxygen saturation, and pressure of the feet of the worker through a plurality of sensors, and collects location information and altitude information of the worker in real time; a risk management server which compares the measured health data with a reference value set for each item to calculate a risk score, and calculates a fall risk score of the worker using the location information and the altitude information; and a safety management server which applies a weighted value according to the characteristics of the worker, weather, and a construction site environment for each health data item, sums risk scores, to which the weighted value is applied, to calculate a total risk point, and transmits a notification signal to a connected smart device or an external rescue organ according to a risk step corresponding to the calculated total risk point. According to the present invention, since a safety manager can easily recognize the risk degree of a health state of a worker through a risk index, and thus, it is possible to more efficiently manage a construction site by arranging a work in a workplace after determining whether the worker is able to work.

[0055] This device is wearable and it is used for workers but it manages the safety of them not the whole project, it also measures heart rate, blood pressure, and body temperature which are related to health management but our claimed wearable device calculates salaries and other things too.

[0056] United States Patent 10096230

[0057] Safety device, system and method of use

[0058] A safety device that is worn by a worker in a manufacturing facility is presented. The safety device includes a microprocessor, memory, an antenna and transceiver and a plurality of sensors that sense environmental conditions surrounding the worker such as light levels, noise levels, temperature, humidity, air quality and CO levels. The safety device also tracks the position of the worker and includes an accelerometer that detects trips and falls. The safety device also includes an event trigger which can be activated by the worker when a notable event or near miss occurs. The environmental information recorded by the safety device is used to both track accidents and near misses and is aggregated in a database for datamining purposes so as to predict future accidents and near misses. This information is also used to create correlations and better understand the root cause of accidents and near misses.

[0059] Like other mentioned patents, this patent is only for safety, it has many sensors, and all of them are suitable for the protection of the workers but our claimed patent

supports more than the safety of the worker, and its main core is to manage the whole process of the project.

[0060] CN208922327

[0061] PERFORMANCE MANAGEMENT SYSTEM BASED ON SMART BRACELET

[0062] The utility model discloses a performance management system based on an intelligent bracelet, which belongs to the technical field of performance management and comprises the intelligent bracelet, a cloud server and a monitoring terminal. The intelligent wristband transmits vital sign information, monitored in real time, of the construction personnel to the cloud server; the cloud server judges whether each vital sub-sign parameter value is within an index range corresponding to the cloud server within the working time or not, and transmits an obtained first judgment result to the monitoring terminal; and the monitoring terminal executes a first performance management strategy according to the first judgment result. Monitoring vital sign information of the construction personnel through the smart wristband and transmitting the vital sign information to the cloud server, and determining performance of the construction personnel distributed in different intervals by the cloud server according to the received vital sign information; and the first judgment result is transmitted to the monitoring terminal, and the monitoring terminal executes a first performance management strategy according to the performance of different intervals. Therefore, the management effect of the construction industry is improved and the development of the construction industry is promoted.

[0063] One of the most important differences between this invention and the stated invention is that in this invention, the vital information of the workers is continuously transmitted to the server, and the project manager will give access to the project workers based on the tasks and job group, and in case of violation of any of the conditions, the relevant device will be turned off and an alert will be sent to the safety team.

Summary of Invention

[0064] An administrative wristband with sensors monitors workers and construction site information in real time, sending it to a server for processing. The wristband includes cameras, a GPS sensor, an altimeter, and an accelerometer. The data is used to analyze and check project progress. Additionally, the wristband includes a controller module, safety manager, and access control. The system also provides the user with the least risky and shortest path to reach the place of execution. A heart rate and temperature sensor, gas detection sensor, microphone, speaker sensor, and wristband charger base are included as well.

Technical Problem

[0065] In most executive projects, the progress process is recorded manually and then entered into the relevant software by an operator, and due to various busy schedules and the need for manpower, these things are sometimes not done, which causes the project managers to not have accurate information about the physical progress of the project, and sometimes even the cases recorded by human resources have errors.

[0066] The workers' lack of knowledge about the high-risk environments of the project or the lack of visibility of the environment of the drivers of heavy machines will cause a stop and disruptions in the implementation process of the projects.

[0067] Failure to know the rules and safety tips related to any work or failure to comply with the conditions and rules of the construction site by the project staff, such as not having a helmet while doing the work, or lack of skill in working with a specific device and equipment will cause irreparable damage to the project.

[0068] One of the most common problems during the implementation of projects is the lack of accurate writing of the text by the supervisor and project workers due to the unavailability and lack of written conditions during the execution of the work, which causes various conflicts in evaluation and management. It becomes a project.

[0069] By using this wristband, all project employees can communicate with each other in the form of an integrated platform, and project managers can be informed about the exact execution process of the project and prevent possible injuries and damages by constantly checking the construction site's conditions, which increases efficiency and reduces costs.

Solution of Problem

[0070] Project management is a process to achieve a considerable economical balance between three factors of cost, time, and quality during the execution of a project which gets help from special techniques and tools to do it.

[0071] The project management wristband is designed to improve the scope of project management and reduce the possible damages during it based on the Internet of things and artificial intelligence, and it will help managers as assistant-help to control the project better.

[0072] To examine the progress and safety of the process, this patent is divided into two parts administrative and executive. In the administrative part, it is required to enter the data carefully so the examination of the project's process and safety inspection condition can be done accurately.

[0073] The administrative part is described as follows:

[0074] First, the project ground surveying is done by the surveying team, and a GIS map is inserted into the Revit software then the designing team will model the project in the software, after the modeling of the project, it is required to specify the details of each element (element name, type of element, definite weight and size, material, cost,

designer's identity, work break down structure) by using the designed plug-in for Revit software.

- [0075] In the designed plug-in for Revit software, all the elements contain defined covering and structures which only demand the specification of structure and material. (to increase the speed of the process in the material designing section and structure of each element which is made for any family and object defined in the Revit software and defined in this amount by default, and will be applied if the designer needs changes. The exact location of each element is automatically put in that element's detail.)
- [0076] The executed samples of each element are thought to picture processing neural network (for example, concrete cover, plaster ...) and the designed neural network identifies the executed elements coverings to analyze the project's process percentage based on the accomplished physical work and it compares them with the final surfaces covering of the designed elements or element's lower layers.
- [0077] For example, an example of column A that is typed, its details are defined as follows {JSON object}:
- [0078] A type column:
- [0079] Size: 3* 0. 2*0. 2
- [0080] The height from the ground floor of the project is 3 meters (second-floor column).
- [0081] Material of the final body: Concrete
- [0082] Project progress review conditions
- [0083] If the building was not built, 0% progress
- [0084] If the bars were built (rebar mesh) and the material was iron element, 35% progress
- [0085] If it was molded and the material was the iron element, 55% progress
- [0086] If the column concrete was poured and the element material was concrete, 80% progress
- [0087] If the white work is done and the element material is plaster, 100% progress
- [0088] Schedule (the duration of each section is determined based on the breakdown structure of the project's progress)
- [0089] Start time: 5 October 2021
- [0090] Required time for rebar weaving: 5 days
- [0091] Duration of column shuttering: 3 days
- [0092] Duration of concreting: 7 days
- [0093] The required time for the skim coat column: is 2 days
- [0094] The required time to execute each element: is 17 hours
- [0095] The related occupational group to execute each element:
- [0096] ordinary workers
- [0097] safety examining condition (personal safety):
- [0098] -The helmet is examined.

- [0099] -The workwear is examined.
- [0100] Safety tips (training):
- [0101] -Put your helmet on.
- [0102] -Put your workwear on.
- [0103] Steel fixer:
- [0104] safety examining condition (personal safety):
- [0105] -The helmet is examined.
- [0106] -The workwear is examined.
- [0107] Safety tips (training):
- [0108] -Put your helmet on.
- [0109] -Put your workwear on.
- [0110] -Put your gloves on.
- [0111] Related workers to do this part:
- [0112] -Name (ordinary worker) – ID number....
- [0113] -Name (Steel fixer) – ID number....
- [0114] -Name (Ordinary worker) – ID number...
- [0115] Each element's details of the project are entered in the designed plug-in as in the mentioned example, and similar elements are typed to increase the speed and make it easier.
- [0116] To control the safety section of the workplace, some important elements and related safety conditions are defined permanently (these conditions are changeable by the executive team) and each person's safety condition will be examined regularly using picture processing based on the defined conditions. Picture processing neural network (Corner Detection, Yolo, Open Cv) is thought based on the introduced elements in [Fig.2], and
- [0117] As an example, the following conditions are defined for tower crane drivers and are examined regularly:
- [0118] 1- putting on a helmet
- [0119] 2- putting on a workwear
- [0120] 3- age under 40 years old
- [0121] 4- Workers should not use the device for more than 5 hours a day.
- [0122] 5- Only the related worker is allowed to turn on and off the related device.
- [0123] 6- If the height difference of the two tower cranes is less than 5 meters, first the alarm and then the devices must be turned off.
- [0124] 7- If the distance between the heavy machine driver and the worker is less than 5 meters, an alarm will be sent to the worker and the driver.
- [0125] 8- If the distance between the worker and dangerous areas is less than 3 meters, an alarm must be sent.

- [0126] At the beginning of the day, the project members hold their fingerprints on the charger's base or stand in front of the wristband's camera, the magnetic lock of the wristband is opened, and pick up the wristband from the charger's base to wear it and then, the camera number 1 will be examined the safety condition of the person based on the defined conditions, then the related activities will be displayed on its screen and the system will suggest the shortest or the least dangerous path to go to the workplace based on the ant colony optimization algorithm, if the worker gets close to the dangerous areas or heavy vehicles, the wrist band will be vibrating. To execute the defined safety conditions in the administrative section, the controller module will be installed on all of the electric devices and construction machines.
- [0127] Camera number 2 pictures the whole people at the construction site, elements of the project, and other environmental factors, and sends them to the server. Also, camera number 2 is sensitive to fire and deep surface dips so it will send them to the settled team ON the construction site after spotting them. To analyze all the elements, if an element is not evaluated after a certain period, the route suggestion system suggests routes where the information of those elements can be received by the project members.
- [0128] After the worker reaches the specified area, it is necessary to press the button to start the activity and while doing the work, the wristband records the heart rate, body temperature, number of steps, hours of inactivity of the worker, and geographical location of the worker and according to the defined conditions and wristband sensors, all safety related parameters are continuously checked, and if the points are not followed, his activity will not be calculated, and after 5 minutes, if the points are not followed, an alert will be sent to the safety team settled on the construction site, then the wristband will start to vibrate.
- [0129] After the work is completed by the worker, based on the defined breakdown structure of each section, the checklist related to the performance of that activity is displayed to the worker, and the corresponding worker selects the completed options based on the completed tasks, and then uploads one or more photos of the work done and, if needed, it records explanations in audio format and uploads them to the system.
- [0130] Workers and members of the project while doing daily work, can record their report by holding the answer button, additionally, all project stakeholders will be able to create discussion groups with different accesses in a unified platform and create in-line with the project and discuss with each other that all these correspondences and reports will be stored in the system. The communication method of all the project people will be through this wristband and the information of the wristbands will communicate with the cloud server through the 3G, 4G, 5G network or the internal WIFI network. To reduce errors in communication interruption Wristband with the cloud server, the

information is stored on the external memory, and after connecting to the first network, the information is sent and the information on the external memory is deleted.

- [0131] According to the defined access, the project members can access the project documents (executive plan, schedule, information on each element, etc.) Reduce the project and focus more on work.
- [0132] All this information will be recorded in the system and the project managers can use this information to provide a more accurate and appropriate plan for future projects, and they will also be informed online about the amount of progress and the entered results.
- [0133] According to the defined access, the project members can access the project documents (executive plan, schedule, information of each element, etc.) and it minimizes the things that workers and spectators should have with them so they can focus more on their work.
- [0134] All this information will be recorded in the system and the project managers can use this information to provide a more accurate and appropriate plan for future projects, and they will also be informed online about the amount of progress and the entered results.
- [0135] Moreover, other systems such as salary systems, insurance, and other systems can access system information through API. It should be noted that all this information will be uploaded to cloud servers.
- [0136] Element's processing is employed for a more specific calculation of the percentage of the project's progress in addition to workers announcing their fulfilled tasks. Calculation of the progress percentage of each element of the project is received from the project members' receiver camera during the day and their passage through the project's related routes.
- [0137] To identify each element, first the picture, time, location of each person (RTK GPS), and height from the project's surface are sent to the server. Then, the details in each picture are recognized by picture processing algorithms and artificial intelligence (Yolo, Open CVI, Neural Network), and finally, their center is pointed by using RTK GPS and Photogrammetry technique (Resection) and wor sensor's data, the location of each element's center in the picture is identified, then the percentage of each element's physical progress is calculated based on elements' defined location in technical maps (Output of Revit's plug-in) and processing the covering, each element's material and equivalent of the received information of the executed elements with technical map's elements according to the defined rules.
- [0138] It is demanded that at least 3 pictures of each element from 3 people be sent to the server in less than 3 hours. After averaging the received numbers, if the distance between the averaged calculated numbers is more than 5 percent, the number that

has the highest distance is deleted. It is necessary to say, that the announced progress percentage by the worker and the calculated progress percentage in different lines are stored in the system, and if the announced percentage difference is more than 10 percent, this case sends a warning to the executive and administrative team so it gets examined accurately.

- [0139] Senior managers of the project and safety section managers can implement the system's output online such as fulfilled activities percentage, workers' safety condition, location of each, and other important information to make administrative decisions.
- [0140] The project manager can specify the number of processing each element during the day to increase the system's function. For example, each element is examined 3 times a day. Also, the project manager can define some servers to increase the processing power of the system, and then define the related server for processing each worker's information. Also, the project manager can modify the program to receive and process pictures from the wristband every 30 seconds.
- [0141] Because the system is Android, spectators and engineers can install this system on their devices and use it. Furthermore, the designed software is installed on every set's cloud servers which makes it available for other devices such as laptops, tablets, and smartphones to have access to this information and make some changes according to their level of accessibility.

Advantage Effects of the Invention

- [0142] -Analysis and project progress: analysis and project progress are executed regularly based on two factors (announcement by worker/ picture process) and managers can be informed of the process of the project accurately and with the least errors.
- [0143] -Regular examination of construction site's safety tips based on occupational groups: according to wristband sensors and device's camera.
- [0144] -Training safety tips for working display: first, the worker receives the training related to that day's defined tasks, and after approval, he is allowed to enter the construction site.
- [0145] -Accessibility feature and device control by the related worker: by using this device, only the allowed worker can operate the interrelated devices which increases the worker's safety.
- [0146] -Suggesting the shortest and the lowest risk route: At first, after announcing the worker's presence at the construction site, the day's task list will be displayed on the screen, and then the shortest and shortest path to the construction site will be defined on the screen.
- [0147] - Documentation of project reports: due to the lack of writing conditions, people can put their report in the form of a voice file about the project elements and also attach

the images to the relevant file. This feature reduces project conflicts; additionally, by using this wristband, all project stakeholders will be able to talk to each other in an integrated platform in the form of a multi-person group or an individual, and all these correspondences will be saved in the system as the project documentation.

- [0148] -Access to project documents: project members can access the defined documents, which means they no longer need to carry executive maps and other documents.
- [0149] -Optimizing the schedule: The software uses artificial intelligence algorithms based on defined working times, workers, and resources allocated to perform an activity.
- [0150] -Software installation: due to the design of the software on the web platform, IOS and Android, the device software will be installed on all mobile devices.
- [0151] -Simplicity and practicality: This wristband is designed so workers with slight knowledge can work with it.
- [0152] -Ability to connect to API: by using the information registered in the system, through API, other systems such as the payroll system can accurately calculate the salary by connecting to this information.
- [0153] -Accessibility via computer, mobile, and web: due to the integration of data and the use of cloud technology, all information is uploaded to the cloud server and information can be accessed through other means of communication such as computers and mobile phones. Also, other stakeholders. The project and the customers will be informed about the project's progress online.
- [0154] -Registration of worker information: During work, worker information such as heart rate, temperature, calories consumed, worker steps, and worker inactivity hours are stored in the system, and based on this information, project managers can have more detailed and practical planning in the future project and be informed about the progress of the project online.
- [0155] -The ability to define high-risk areas: the project safety manager can identify high-risk areas and start shaking the bracelet when workers approach these areas.
- [0156] Wristband security: These wristbands can only be used through the defined worker's fingerprint, and all the received and sent information is coded.
- [0157] - Tracking people: by using the device tracker, all the worker's location information is transmitted to the server, and in case of an unfortunate incident, we can perform rescue operations.

Brief Description of Drawings

- [0158] [Fig.1] shows an explosive view of the wristband and its parts which are:
- [0159] 1- Screenplay
- [0160] 2- Camera 1 with 16-megapixel quality
- [0161] 3- Camera 2 with 32-megapixel quality

- [0162] 4- Microphone
- [0163] 5- Solar cells
- [0164] 6- Mainboard of the system
- [0165] 7- GPS RTK module
- [0166] 8- Connection to network module
- [0167] 9- Battery
- [0168] 10- Accelerometer Sensor
- [0169] 11- Heart rate and body temperature sensor
- [0170] 12- Magnetic locket of the wristband
- [0171] 13- Charger of the device (wireless)
- [0172] 14- Vibrate module
- [0173] 15- The sensor detects toxic gases in the environment
- [0174] 16- Altitude and barometer module
- [0175] 17- Bottom
- [0176] 18- Memory
- [0177] 19- Speaker
- [0178] 20- LIDAR module
- [0179] [Fig.2] shows a view of the wristband from above:
- [0180] 1- Camera 1
- [0181] 2- Camera 2
- [0182] 3- microphone
- [0183] 4- Answering bottom
- [0184] 5- SOS/ Home bottom
- [0185] 6- The speaker
- [0186] 7- LIDAR module
- [0187] [Fig.3] shows the charger of the device:
- [0188] 1- Fingerprint sensor
- [0189] 2- Magnetic locket
- [0190] 3- Adaptor's body
- [0191] 4- Electricity
- [0192] [Fig.4] is a flow chart for recognizing the elements.
- [0193] [Fig.5] is a flow chart for the administrative and safety section.
- [0194] [Fig.6] is a flow chart of the executive section.
- [0195] [Fig.7] is a flowchart of sending data to cloud servers.

Description of Embodiments

- [0196] [Fig.1] shows an explosive perspective of the management wristband and every little piece in it which are:

- [0197] 1- Screenplay which displays activities, training videos, task lists, and everything on it.
- [0198] 2- Camera 1 with 16-megapixel quality examines the safety condition of the person based on the defined conditions.
- [0199] 3- Camera 2 with 32-megapixel quality depicts the whole people at the construction site, elements of the project, and other environmental factors, and sends them to the server. Additionally, camera number 2 is sensitive to fire and deep surface dips so it will send them to the settled team ON the construction site after spotting them.
- [0200] 4- Microphone to record voice messages and send them.
- [0201] 5- Solar cells are set in such a way that they can supply the energy (electricity) required for the operation of the wristband.
- [0202] 6- The mainboard of the system body provides the possibility of connecting the wristband to the local server of the project to send information.
- [0203] 7- The GPS RTK module shows the location of each person.
- [0204] 8- Connection to network module helps to tribute data.
- [0205] 9- Battery for the device to remain working.
- [0206] 10- Accelerometer Sensor for users.
- [0207] 11- Heart rate and body temperature sensor
- [0208] 12- Magnetic locket of the wristband
- [0209] 13- Charger of the device (wireless), the wristband can be put on it to get its battery charged.
- [0210] 14- Vibrate module
- [0211] 15- The sensor detects toxic gases in the environment so the workers will not be in danger.
- [0212] 16- Altitude and barometer module
- [0213] 17- Bottom
- [0214] 18- Memory for documents to be kept.
- [0215] 19- The speaker to listen to the voice messages and watch the videos.
- [0216] 20- The LIDAR module records the environmental information of the construction site.
- [0217] [Fig.2] shows a view of the wristband from above on which the details are:
- [0218] 1- Camera 1 captures 16-megapixel images to assess individual safety under defined conditions.
- [0219] 3- Camera 2 captures 32-megapixel photos of the construction site, including people, project elements, and environmental factors. The photos are sent to the server.
- [0220] 3- Microphone
- [0221] 4- Answering bottom
- [0222] 5- SOS/ Home bottom

[0223] 6- The speaker

[0224] 7- LIDAR module

[0225] [Fig.3] shows the charger of the device of which the parts are:

[0226] 1- Fingerprint sensor to identify the worker as a user

[0227] 2- Magnetic locket

[0228] 3- Adaptor's body

[0229] 4- Electricity

[0230] [Fig.4] is a flowchart that shows the process of the device sending the location of the elements to the main server and calculating the process progress of the project plus the construction site's safety.

[0231] [Fig.5] is a flow chart for the administrative and safety section: After surveying the construction site, they will be inserted in the Revit software to be modeled and defined as conditions of the project and safety, occupational group, etc... Then, they will be uploaded into the system and if the system gets updated, this process will be repeated.

[0232] [Fig.6] is a flow chart of the executive section: First, the lists of daily tasks are shown then the safety ones and their tips, the worker must be present at the construction site to begin the work so the device measures heart rate, body temperature, steps, etc..., after finishing the tasks, the workers submits them to the system so the project's progress will be calculated.

[0233] [Fig.7] is a flowchart showing that the information received from the user's wristbands is stored in the servers and then processed in the cloud servers.

Examples

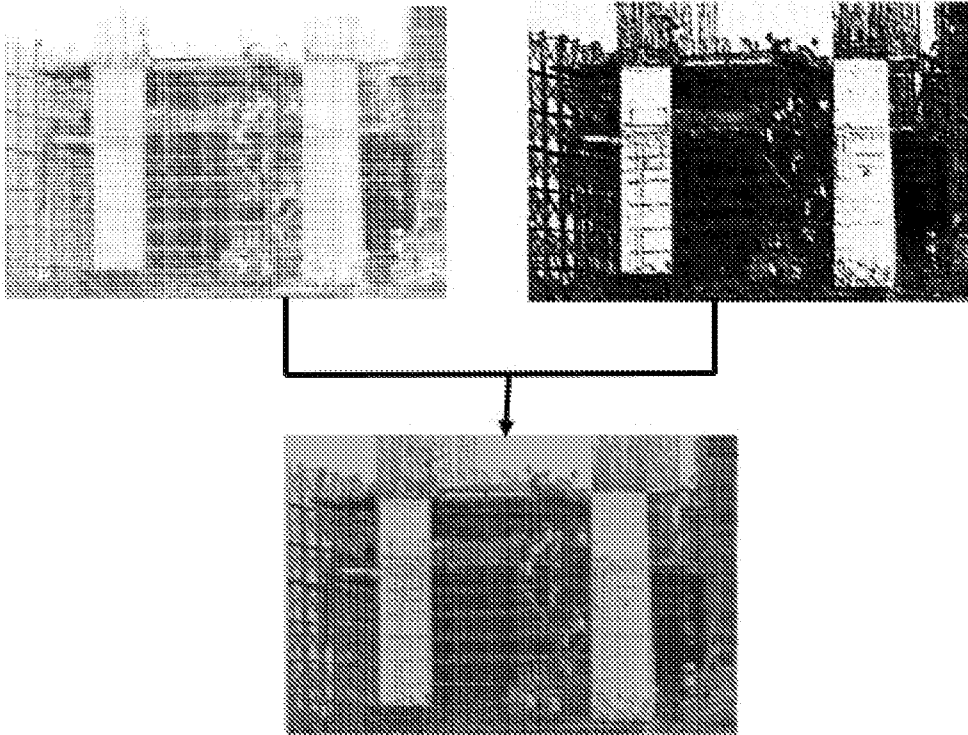
[0234] By using this wristband, project management of construction sites will be easier and the security will increase. This wristband is used in construction sites and workshops, public and private organizations, etc., for example:

[0235] -Project managers can define specific safety standards for tower crane drivers, for example, if the total working hours of the worker exceeds 5 hours, the automatic device will be turned off, and if the height of the adjacent tower crane is less than 7 meters, the bracelet will start to vibrate. The device should be turned off if it is less than 5 meters.

[0236] -To increase personal safety, at the beginning of the day after workers enter the construction site, safety tips are displayed on the wristband display, and at the end, it is necessary to hold the confirmation button after the image processing operation and check compliance with safety tips, the worker is allowed it will take the entrance to the construction site.

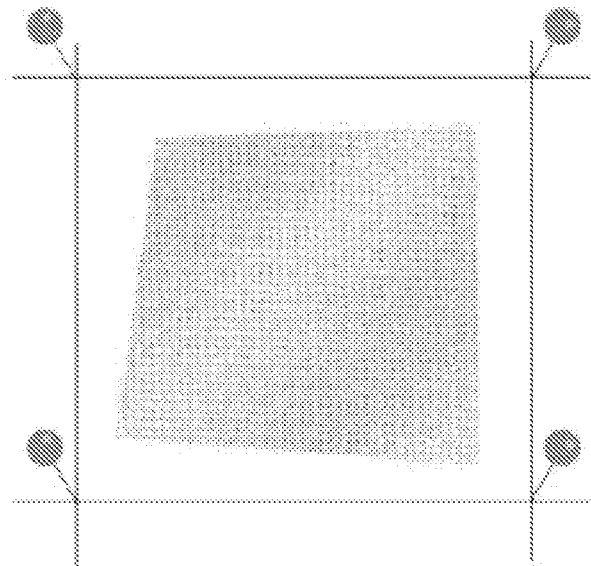
[0237] [Picture. 1] shows how environmental elements are being processed.

[0238]



[0239] [Picture. 2] shows the step where the dangerous areas are being located.

[0240]



[0241] [Picture. 3] is an example of how the Internet of Things works in the claimed smart wristband:

[0242] 1- The wristbands that monitor the project

[0243] 2- the Internet of Things network

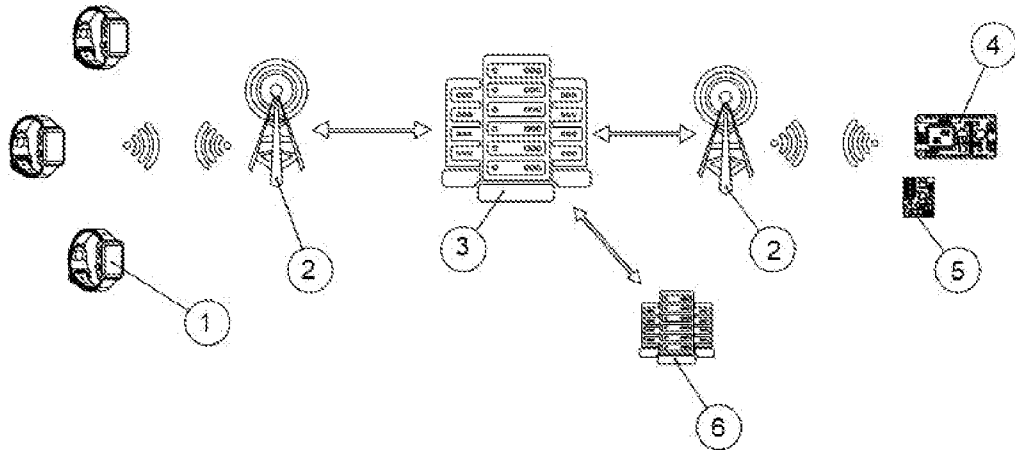
[0244] 3- Cloud servers

[0245] 4- esp8266 module

[0246] 5- Relay module

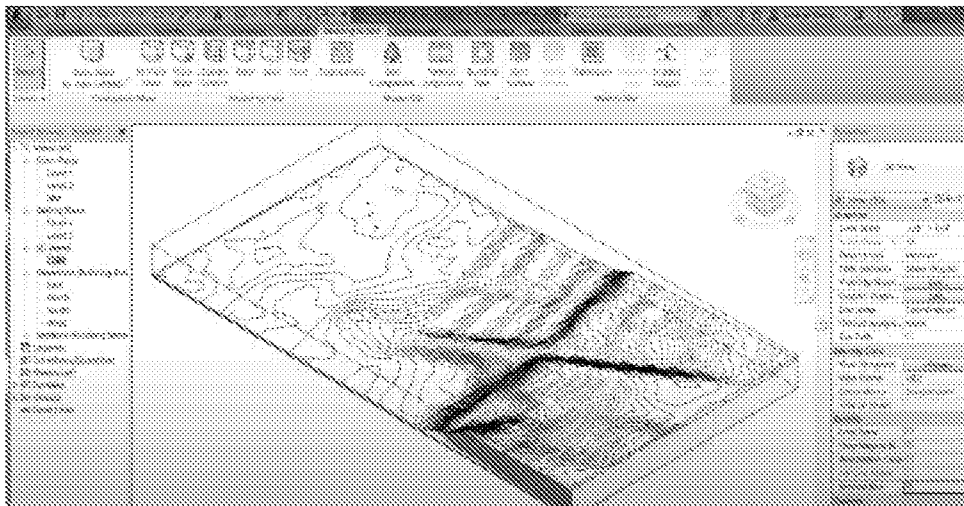
[0247] 6- connecting to other systems via API

[0248]



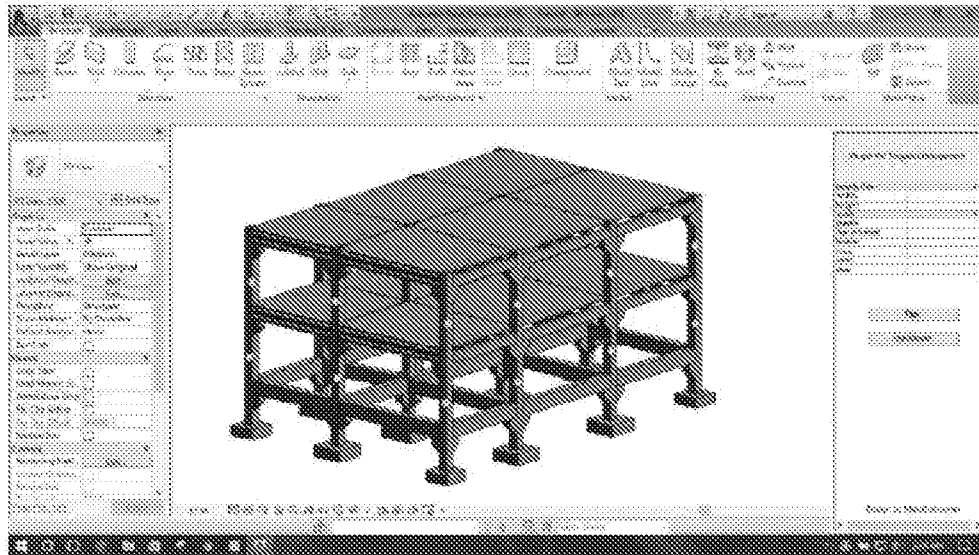
[0249] [Picture. 4] is a GIS map of the ground in Revit software:

[0250]



[0251] [Picture. 3] is modeling in Revit software:

[0252]



[0253] [Table. 1] displays the safety equipment the wristband wants the users to wear during the project.

Working-place safety equipment	
safety head-band	Helmet
Safety Shoes	Uniform
Gloves (leather-water)	Welding goggles/goggles
Safety Belt	Safety mask
Safety rope	Ear protection

[0254] [Table. 2] displays the elements and objects defined in the designed plug-in for Revit software and picture processing neural network.

Described objects	Elements cover
Door frame	Bar
Door	Concrete
Window	Steel arrow
molding the Concrete columns	Gypsum
Rock	Brick
Ceramics	Tiles
Door frame	Window
Foundation reinforcement	Toilet & wash basin
Foundation molding	Blockage
Foundation concreting	Electrical panel
Glass	Lamp
Guardrails	Piping
Gas piping	Faucets
Pipe and channel	Sewer piping
Switches & Sockets	Window
Basinboards	Partite
Foundation	Wall

Industrial Applicability

- [0255] When a worker gets on the crane, he needs to click the start button on his wristband, and the machine can no longer be turned on and off using a switch or key.
- [0256] The project managers must enter the project specifications and information in the system and then explain the construction site’s tasks based on this and determine the conditions for the analysis of each part, which can complete the projects more quickly and safely. This wristband helps managers view the current information of the project in an integrated and real-time manner and make decisions accordingly.
- [0257] By using this wristband, workers are informed of their duties at the beginning of the day, and during work, the defined individual safety conditions are continuously checked, and at the end of the work, after pressing the end of work button, the end of the activity is recorded, and then on Based on the information received from camera number 2 of some people present in the system processing environment, the implemented activity will be carried out.
- [0258] Project managers can define conditions based on built-in sensors to have more precise control over workers, for example, they can define conditions for drivers and workers if workers do not have helmets or glasses first. An alarm will be given to the driver and if they do not comply, their working hours will not be calculated and the bracelet will start to vibrate. After 5 minutes, an alert is sent to the safety team located at the construction site.

- [0259] For example, the project safety manager can define the following conditions for the active groups in the project:
- [0260] -Electrical and telecommunication workers: checking helmets, gloves, and safety shoes
- [0261] -Welder and welder's assistant: examination of safety helmets and shoes, welding glasses
- [0262] -Mining worker or well digger: Check helmet, rubber gloves, safety belt equipped with rescue rope
- [0263] -Mechanical worker: Checking the lathe glasses, leather gloves, safety shoes

Claims

- [Claim 1] An administrative wristband that uses sensors to monitor workers' and construction site information each second and sends them to the server for processing, then the result will be available for project managers.
- [Claim 2] According to claim 1, this wristband has a main body on which the display of the device is placed and the user can communicate with the wristband through it.
- [Claim 3] According to claim 2, two cameras are placed on the main body of the device and are set in such a way that camera number one captures the face and body, and camera number two and the LIDAR module located on the upper part of the main body of the wristband captures the environmental information of the construction site.
- [Claim 4] According to claim 3, A GPS sensor, altimeter, and accelerometer are placed inside the main body of the wristband and are set in such a way that sends the user's geographic location information to the server.
- [Claim 5] According to claim 4, a communication module located inside the main body provides the possibility of connecting the wristband to the local server of the project to send information.
- [Claim 6] According to claim 5, to analyze and check the progress of the project based on the information received from the images (camera number two), geographic location, and LIDAR module, the position of the center of each element is determined and by comparing the coverage of the elements designed in the software with the elements implemented in the project. The percentage of physical progress of the project will be calculated. Also, to increase the accuracy of project progress calculation, the workers will mark the completion of the activity on the screen after performing the relevant activity.
- [Claim 7] According to claim 6, first, all the elements are modeled in the View software, and then with the plugin designed for the View software, the output of the design section is uploaded to the cloud system in the form of a JSON file.
- [Claim 8] According to claim 7, a controller module is installed on the device, which includes a relay and a communication module. This

- module is installed on all construction site elements and will work by connecting to the server according to the defined conditions.
- [Claim 9] According to claim 8, the project safety manager can have full supervision of the workers by defining occupational groups and related safety issues.
- [Claim 10] According to claim 9, training and important safety tips based on the worker's daily tasks are displayed on the screen at the beginning of the day, and at the end, by processing the user's image and defined safety conditions, it checks the position of the defined safety elements on the worker's face and body parts. And then he gets permission to start work.
- [Claim 11] According to claim 10, all project information and documents are digitally stored in the system, and other systems will have the ability to access this information through API, and project members can access project documentation information based on defined access levels.
- [Claim 12] According to claim 11, the access of competent people to work with the construction site's devices and machines is checked, and the high-risk areas of the project are identified by the project safety managers, if people approach these areas, a warning is sent on the wristband.
- [Claim 13] According to claim 12, based on the defined sensors, the project safety manager can apply conditions to the information received from the sensors.
- [Claim 14] According to claim 13, the project manager can determine the number of processing of each element per day to check the progress of the project and increase the performance of the system.
- [Claim 15] According to claim 14, based on the information received from the user's position and based on the defined tasks, the system provides the user with the least risky and shortest path to reach the place of execution.
- [Claim 16] According to claim 15, a heart rate and temperature sensor, which is located under the main body of the wristband, is set in such a way that it sends the user's personal and vital information to the server to check the user's safety.
- [Claim 17] According to claim 16, the gas detection sensor located on the display screen is set in such a way that it sends an alert to the

worker and the project safety team if toxic gases are detected in the environment.

[Claim 18]

According to claim 17, a microphone and speaker sensor are located on the display screen and it is set in such a way that the user will be able to send and receive voice messages, and users can send voice messages for any defined activity by holding the reply button.

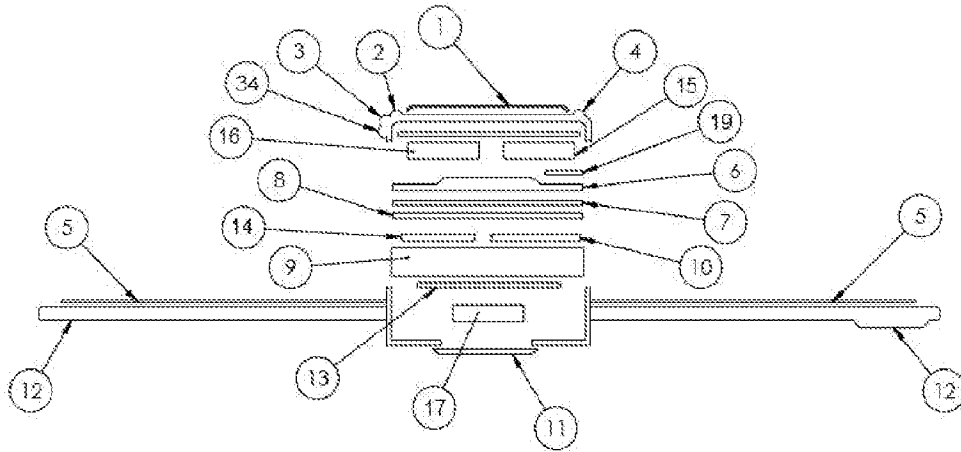
[Claim 19]

According to claim 18, there is a wristband charger base on which a magnetic lock is placed, which is deactivated after authentication through the user's fingerprint, and the user can remove the wristband from the wristband charging base.

[Claim 20]

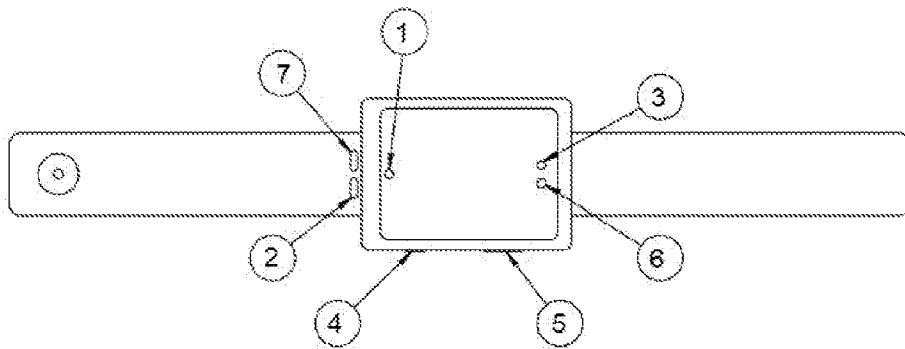
According to claim 19, the solar cells are placed on the wristband, and the solar cell is set in such a way that it can supply the energy (electricity) required for the operation of the wristband.

[Fig. 1]



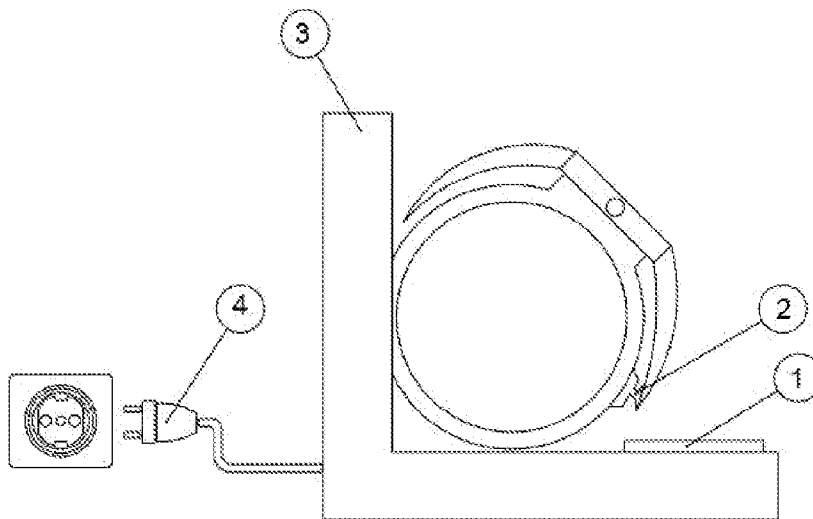
[Fig. 1]

[Fig. 2]



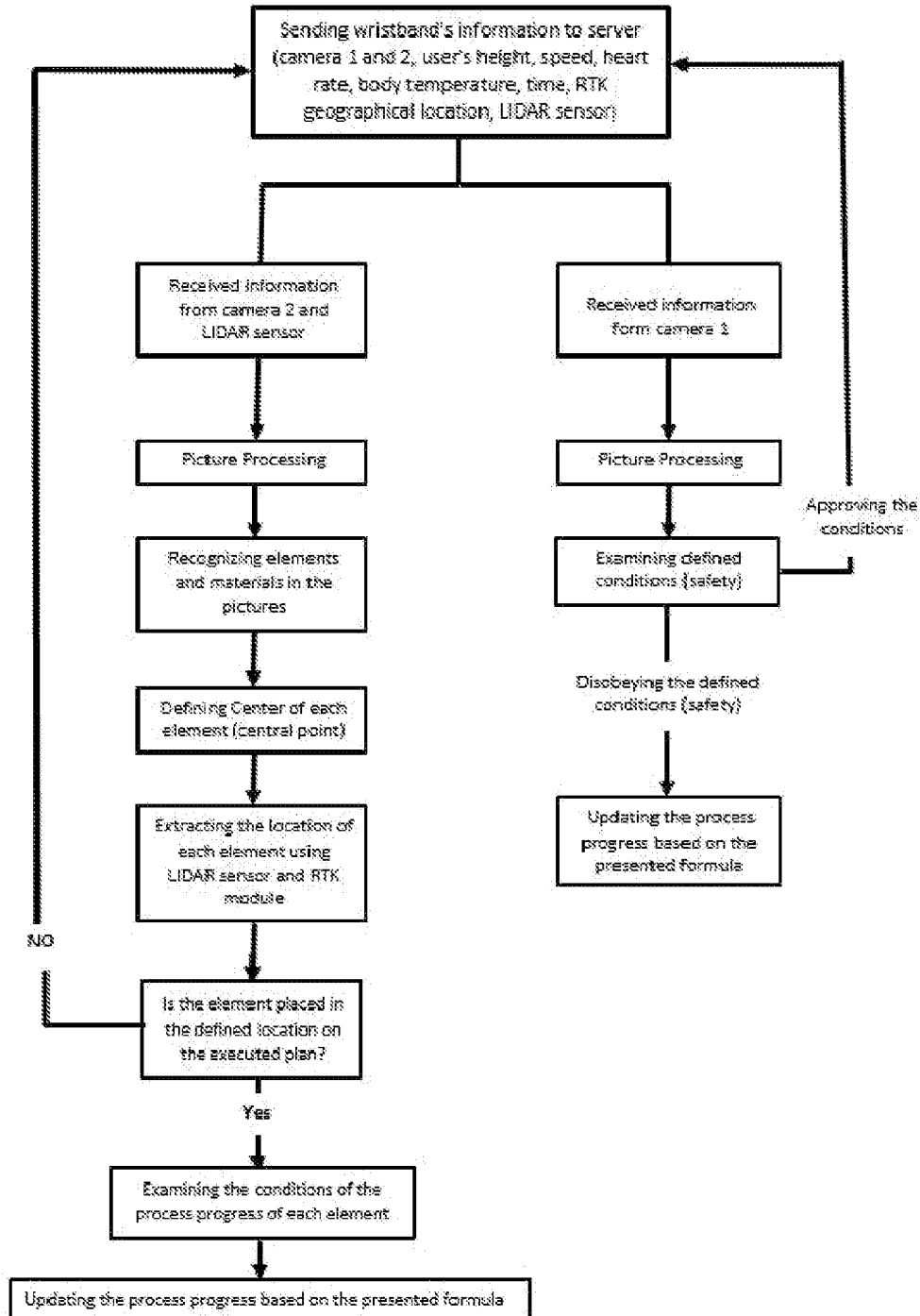
[Fig. 2]

[Fig. 3]



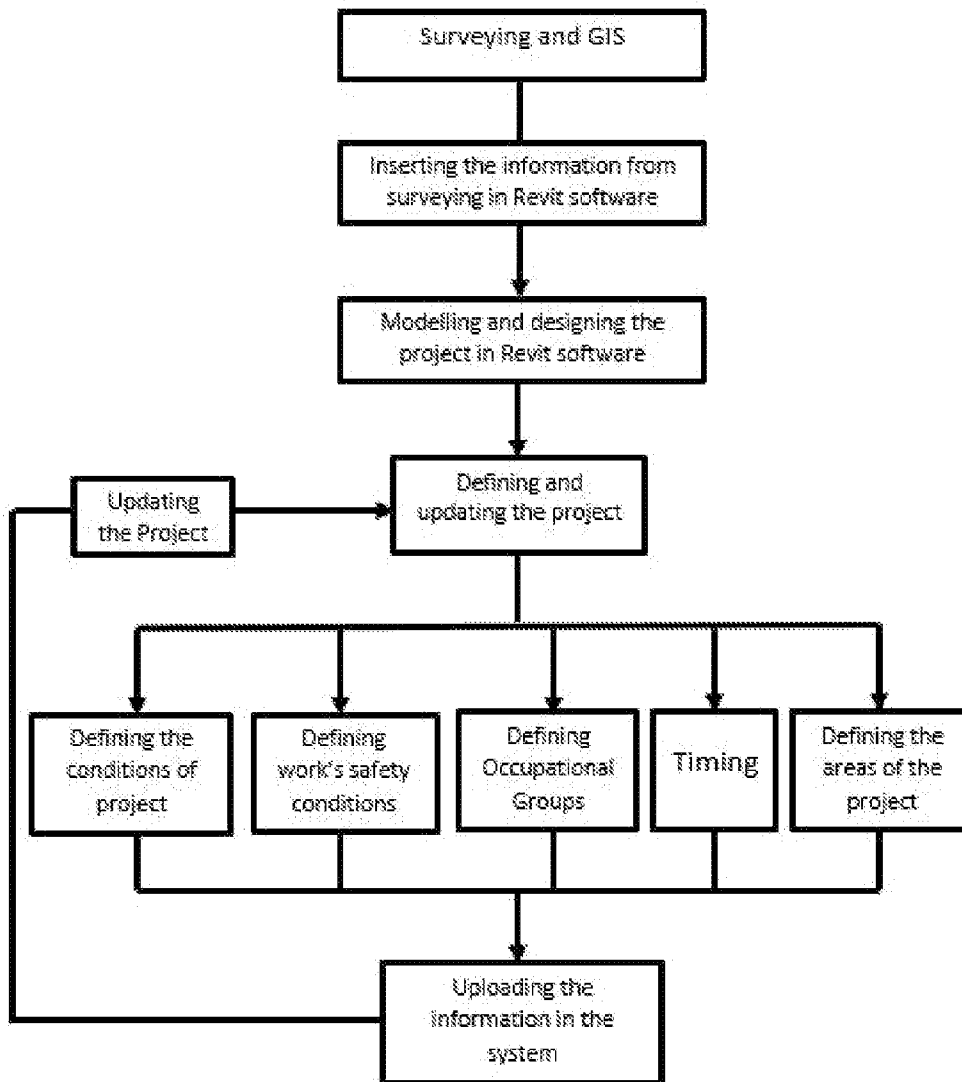
[Fig. 3]

[Fig. 4]



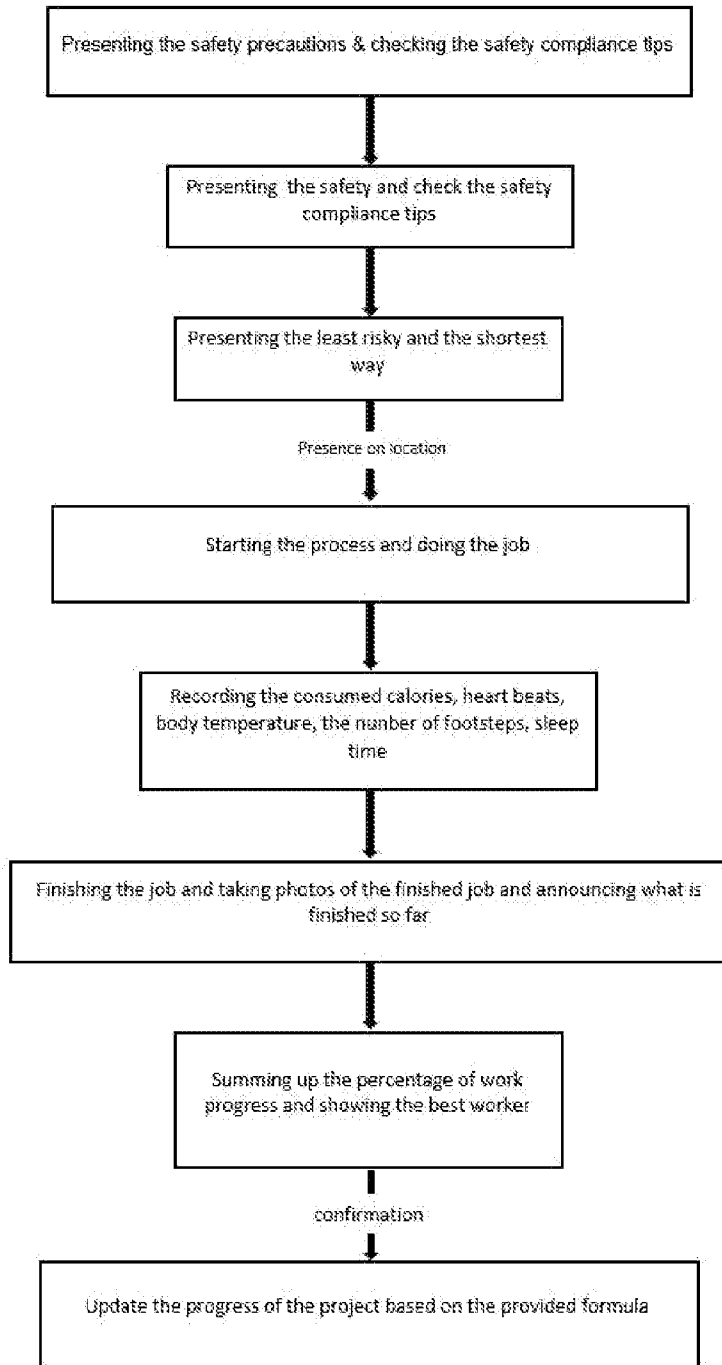
[Fig. 4]

[Fig. 5]



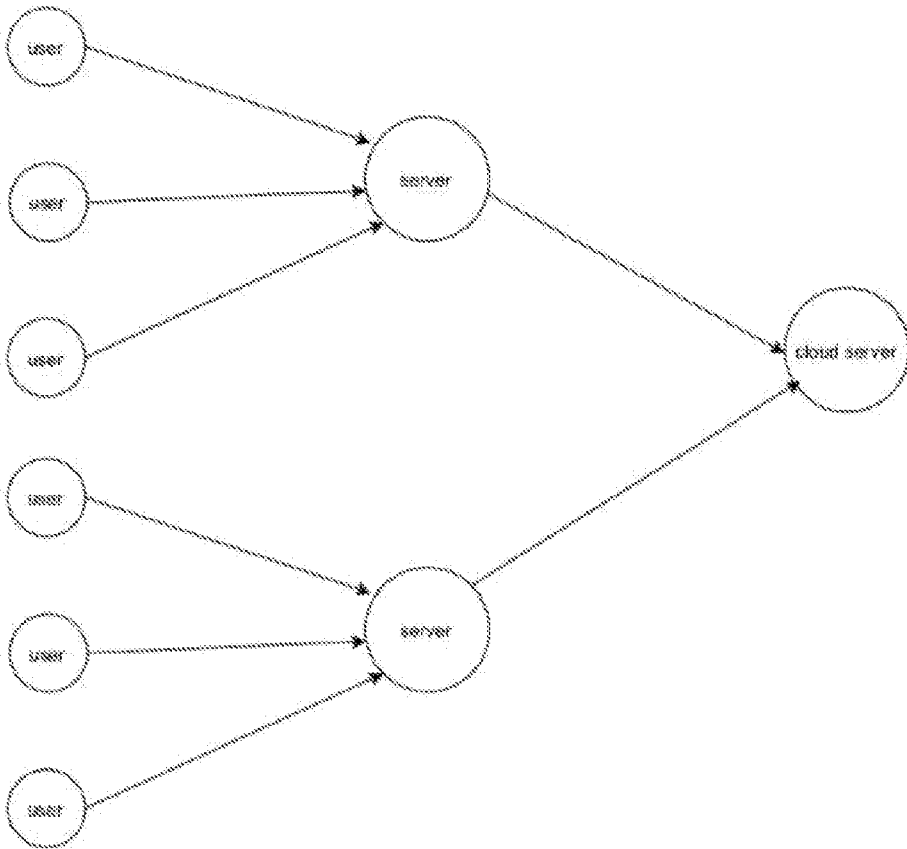
[Fig. 5]

[Fig. 6]



[Fig. 6]

[Fig. 7]



[Fig. 7]

INTERNATIONAL SEARCH REPORT

International application No.

PCT/IB2024/054900

A. CLASSIFICATION OF SUBJECT MATTER

G06Q10/06, G08B21/02, G08B25/10, H04W4/029 Version=2024.01

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G06Q, G08B, H04W

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic database consulted during the international search (name of database and, where practicable, search terms used)

PatSeer, IPO Internal Database

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US20220100148A1 (META PLATFORMS TECHNOLOGIES LLC) 31 March 2022 (31-03-2022) abstract; figs. 1A-1B, 2A- 2C, 3; paragraphs [0039], [0043], [0045], [0068], [0077]	1- 20
Y	CN114469024A (GUANGDONG JIANCAI NET TECHNOLOGY CO LTD) 13 May 2022 (13-05-2022), (English Translation Copy From Espacenet) whole document	1- 20

 Further documents are listed in the continuation of Box C. See patent family annex.

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Date of the actual completion of the international search

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Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/IB2024/054900

Citation	Pub.Date	Family	Pub.Date
US 20220100148 A1	31-03-2022	US 2022091564 A1	24-03-2022
		US 2021333759 A1	28-10-2021
		US 12001171 B2	04-06-2024
		US 11662692 B2	30-05-2023
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