CLAIMS

1. A computer-implemented method for fault diagnosis in an industrial environment having a plurality of components, the computer-implemented method comprising:

providing a plurality of sensors to the industrial environment, each of the plurality of sensors operatively coupled to at least one of the plurality of components and configured to generate a plurality of sensor data values in response to one or more sensed parameters;

processing the plurality of sensor data values to determine a recognized pattern therefrom;

retrieving at least one industrial-environment digital twin corresponding to the industrial environment, the at least one industrial-environment digital twin comprising a plurality of component digital twins, with each of the plurality of component digital twins corresponding to one of the plurality of components in the industrial environment, and wherein the at least one industrial-environment digital twin and the plurality of component digital twins are visual digital twins that are configured to be rendered in a visual manner;

updating the at least one industrial-environment digital twin and at least one respective component digital twin of the plurality of component digital twins based on the plurality of sensor data values, at least in part, in response to the determination of the recognized pattern for the corresponding component;

receiving a request from a client application to check an operational condition of a particular component from the plurality of components in the industrial environment; and

rendering the at least one industrial-environment digital twin and the at least one respective component digital twin corresponding to the particular component in the client application in response to the received request and based on the operational condition of the particular component.

2. The computer-implemented method of claim 1 further comprising determining if the recognized pattern relates to at least one system characteristic including at least one of: a fault operation for a given component of the plurality of components, an off-nominal operation for the given component of the plurality of components, or an exceedance value for the given component of the plurality of components.

3. The computer-implemented method of claim 2 further comprising generating a notification in the client application in response to a determination that the recognized pattern relates to the at least one system characteristic for the given component; and configuring the client application to allow selection of the notification, wherein the rendering the at least one industrial-environment digital twin and the at least one respective component digital twin corresponding to the given component is in response to the selection of the notification.

4. The computer-implemented method of claim 1, wherein the rendering further comprises executing a simulation for the at least one industrial-environment digital twin and the at least one respective component digital twin based on the recognized pattern, and wherein the simulation simulates an effect of the recognized pattern on an operation of the corresponding component.

5. The computer-implemented method of claim 4, wherein the rendering further comprises executing another second simulation for the at least one industrial-environment digital twin and the at least one respective component digital twin based on a normal operation of the corresponding component.

6. The computer-implemented method of claim 1 wherein the rendering the at least one industrial-environment digital twin and the at least one respective component digital twin to the client application is via at least one of a display device of a user device, an augmented reality-enabled device,or a virtual reality headset.

7. The computer-implemented method of claim 1, wherein the plurality of sensors comprise at least one vibration measurement sensor coupled to a motor of the corresponding component, and wherein the one or more sensed parameters comprise vibration parameters related to a wobble in the motor of the corresponding component.

8. The computer-implemented method of claim 7, wherein the recognized pattern comprises at least one of: a broken bearing in the motor, broken or cracked rotor bars in the motor, a misalignment in the motor, an imbalance in the motor, or a material build-up in the motor.

9. The computer-implemented method of claim 1, wherein the one or more sensed parameters include at least one of: a set of temperature parameters, pressure parameters, humidity parameters, wind parameters, rainfall parameters, tide parameters, storm surge parameters, cloud cover parameters, snowfall parameters, visibility parameters, radiation parameters, audio parameters, video parameters, image parameters, water level parameters, quantum parameters, flow rate parameters, signal power parameters, signal frequency parameters, motion parameters, velocity parameters, acceleration parameters, lighting level parameters, analyte concentration parameters, biological compound concentration parameters, metal concentration parameters, or organic compound concentration parameters.

10. The computer-implemented method of claim 1, wherein the plurality of component digital twins is generated based on properties of the corresponding component imported from at least one of: respective manufacturers of the components, onboard libraries, crowdsourced material, or subscription marketplaces.

11. The computer-implemented method of claim 2 further comprising providing an executive digital twin configured to provide forecasted financial information for the given component based, at least in part, on the at least one system characteristic determined to be related to the recognized pattern or workflow information for performing maintenance for the given component based, at least in part, on the at least one system characteristic determined to be related to the recognized pattern.

12. The computer-implemented method of claim 1, wherein the rendering the at least one industrial-environment digital twin includes at least one of rendering the at least one industrial-environment digital twin as a digital representation of a real world element, or rendering the at least one respective component digital twins as a set of discrete component digital twins embedded within the at least one industrial-environment digital twin.

13. The computer-implemented method of claim 12, wherein the rendering the at least one industrial-environment digital twin further includes at least one of mimicking, copying, or modeling behaviors of the real world element in response to at least one of inputs, outputs, or conditions of an environment.

14. The computer-implemented method of claim 12, wherein the rendering the set of discrete component digital twins includes rendering the set of discrete component digital twins based on imported properties of the particular component and on historical behavior of the particular component for implementation in the industrial environment.

15. The computer-implemented method of claim 1, further comprising providing an operator digital twin configured to generate visual cues indicating potential problems with an identified component of the plurality of components that includes generating a selector for selection by a user to direct maintenance on the identified component, and wherein the method further includes directing the maintenance on the identified component in response to selection of the selector.

16. The computer-implemented method of claim 1, wherein the rendering the at least one industrial-environment digital twin and the at least one respective component digital twin includes rendering the at least one industrial-environment digital twin and the at least one respective component digital twin in a visual manner, the method further comprising drilling down on a particular element to view additional information regarding the particular element in response to a selection by a user on a display corresponding to the at least one industrial-environment digital twin and the at least one respective component digital twin as rendered in the visual manner.