Predictive Maintenance of Industrial Motors

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Smartbridge

INTRODUTION

- **Overview**

Industrial environmental conditions have been upgrading day by day with newly developing automation technology. And, as a result of getting rid of the conventional procedures of manufacturing, this leads to an increase in huge workloads. The next-gen industries will be more advanced and automated as compared with existing ones. This brings a new terminology; “Smart Industries”. In this new era, monitoring as well as controlling of various Industrial applications is challenging as ever. The Internet of Things (IoT), as an emerging technology that brought about rapid advancements in modern technologies, has attracted a lot of attention and is expected to bring benefits to numerous applications. The newly introduced concept is providing a helping hand to achieve Industrial automation through remote access.

- **Purpose**

In today’s highly competitive business environment, organizations want to increase production and operational efficiency, employee safety and drive financial results. Many manufacturing organizations are yet to leverage the use of big data, so that to maintain production and operational efficiency Industrial motor maintenance plays a key role in its operation. For proper working conditions, the equipment is continuously observed for its temperature, humidity in the environment and any vibration in its operation.so that we can maintain motors properly.

LITERATURE SURVEY

- **Existing Problem**

In most of the industries due to over use of motors and machines, they may be chance of overhearing, increase in humidity, current short circuits, any vibrations in its operation. To overcome all these problems, we can design an IoT sensor device which can be controlled by mobile or web app, so that the equipment is continuously observed for its temperature, humidity in the environment and any vibration in its operation. Current to and from the equipment is continuously monitored to avoid any short circuits and line breakage. Values ranging beyond the threshold are indicated

through LEDs at the equipment and also in the mobile, Web App and Users can stop the motor from working manually through switches and also automatically from the Web App.

- **Proposed Solution**

Predictive maintenance programs are crucial to an organization's ability to avert unplanned or unnecessary downtime that can adversely affect its ability to produce or operate. Predictive maintenance programs are most effective when all available means of measuring health and analysing health trends of electric motors, cables, power quality and load are rigorously implemented. In other words, safe and continuous operation of plants and facilities drives revenue and profit, and depends upon high motor reliability. Predictive maintenance of motor systems is a necessity when it comes to supporting reliability objectives that in turn support a company's or organization's business objectives.

THEORITICAL ANALYSIS

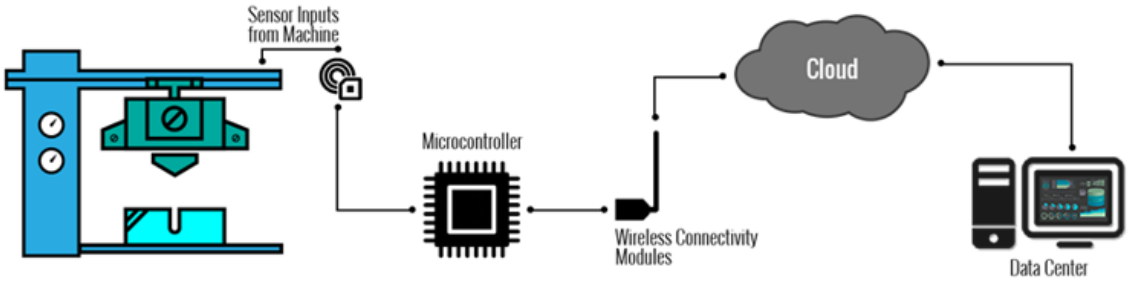
Predictive maintenance is a technique to predict when equipment might fail so that the component can be replaced before the failure. This helps in reducing downtime and maximizing the component lifetime.

The sensors used in this project are DHT11 sensor, vibrator sensor, current sensor, LED light for indication.

The service used in this project are IBM service.

Cloud computing — The sensors securely transmitted machine vibration data on a periodic basis to a cloud platform provided by the vendor. The data transfer to the cloud platform was secure, with traffic from the sensors to the cloud and access fully encrypted. personnel accessed and visualized the vibration data of these machines on their browsers and mobile devices.

- **Block Diagram**



- **Software Designing**

The following processes are carried out to make the system :

1. A Node Red Application is made , for wiring together hardware devices, APIs and online services . It provides a browser-based editor that makes it easy to wire together flows using the wide range of nodes in the palette that can be deployed to its runtime in a single-click. After this an MIT app is also made.

2. A python code is made for measuring humidity and temperature values sensed by a DTH11sensor,and also to measure other important parameters of a motor like vibrational values and current etc Sensed by the sensors also for making LED glow when the values are above a threshold value as specified by the python code and in a app it is notified and all these data are also published in IBM cloud.

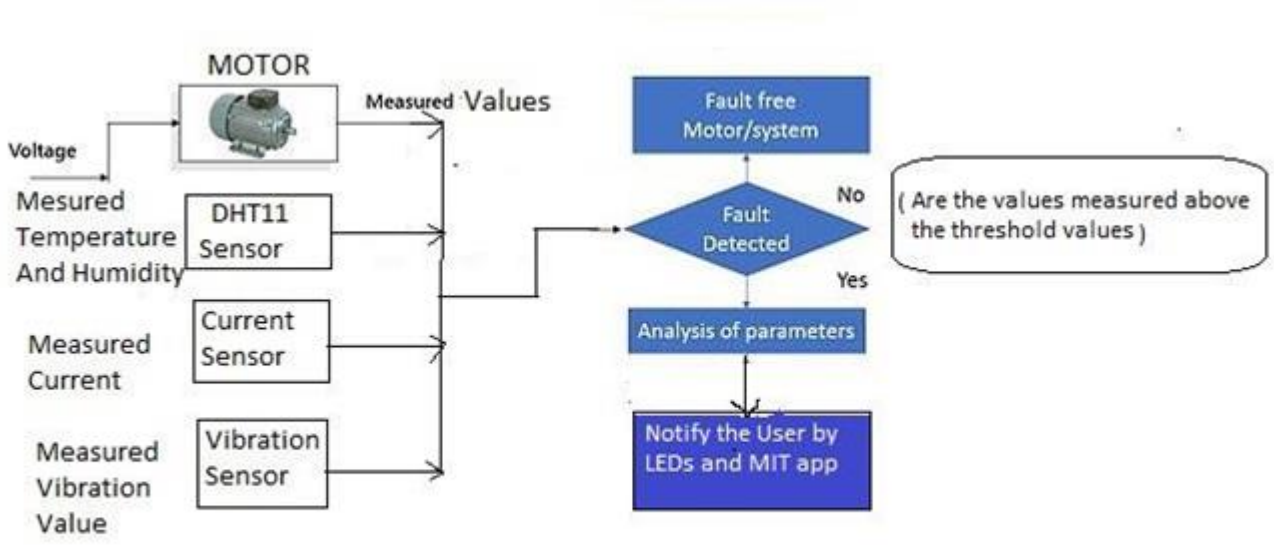
3. Node-Red flow is made for getting the values of the measured data from the devices. The dashboard nodes are used for creating the UI (Web app) and then Http requests are made for commute the value's information with the user. After this the mobile app is made and a UI is designed to show the temperature, humidity ,current

and Vibration values to the user and then it is configured to get the data from the cloud and for controlling the system or motors by buttons in mobile .

EXPERIMENTAL INVESTIGATIONS

Predictive maintenance consists of detecting the operation conditions of the motor at full load and under the effective temperature and wetness conditions while working. This is in contrast to regular methods where values are collected by starting the stationary machine. By having this knowledge of values, you can carefully and accurately predict when the equipment might fail. This further helps in preventing that failure on time.

FLOW CHART



RESULT

A device is created using sensors when those sensors detect any data that data is send to mobile app or web ,the device can be controlled by switches and leds for indication,when led light glows red there is a problem and that can be rectified.as the device shows temperature ,humidity ,current values.

ADVANTAGES AND DISADVANTAGES

Advantages:

- Reduction in maintenance costs.
- Reduction in machine failures.
- Reduced downtime for repairs.
- Reduced stock of spare parts.
- Increased service life of parts.
- Increased production.
- Improved operator safety.
- Verification of repairs.

Disadvantages:

- Amount of time it takes to access .
- Upfront cost-keeping equipment well maintained requires high investment.
- Potential for over maintenance.
- more labour intensive,you will more staff on hand.

APPLICATIONS

- Finding three-phase power imbalances from harmonic distortion, overloads, or degradation or failure of one or more phases
- Identifying motor amperage spikes or overheating from bad bearings or insulation breakdowns

- Locating potential overloads in electrical panels
- Measuring supply side and demand side power at a common coupling point to monitor power consumption
- Capturing increased temperatures within electrical panels to prevent component failures
- Detecting a drop-in temperature in a steam pipeline that could indicate a pressure leak.

CONCLUSION

This paper focused on the problem of carrying out predictive maintenance in a industrial motors and presented the results of the preliminary data analysis and feature selection that were performed on a sample of the collected data.The derived data from iot device gives the status of industrial motors about temperature,humidity,Current to and from the equipment is continuously monitored to avoid any short circuits and line breakage.so Predictive Maintenance of Industrial Motors plays a major roll in maintaining industrial production.

It is possible to have a successful preventive maintenance program. From a cost reduction viewpoint it is essential, but it does entail risk. ... In order to minimize risk, preventive maintenance has to be carefully planned and carried out by well-trained and motivated workers.

BIBILOGRAPHY

- Gupta, Stone, and Stein, “Use of Machine HIPOT testing in Electric Utilities.” 0-7803- 7180-1 IEEE, 2001 (IEEE Dielectrics and Eletrical Insulation Society)

- R.M. Tallam, T.G. Habetler, R.G. Harley, “Transient Model for Induction Machines with Stator Winding Turn Faults.” IEEE Transactions on Industry Applications, Vol. 38, No. 3, May/June 2002
- https://developer.ibm.com/recipes/tutorials/ui-dashboard-for-iot-device-data-using-node-red
- https://www.skf.com/binary/21- 285423/Motor-PdM-primer.pdf
- Smartbridge tutorial lectures
- IBM cloud blog

APPENDIX

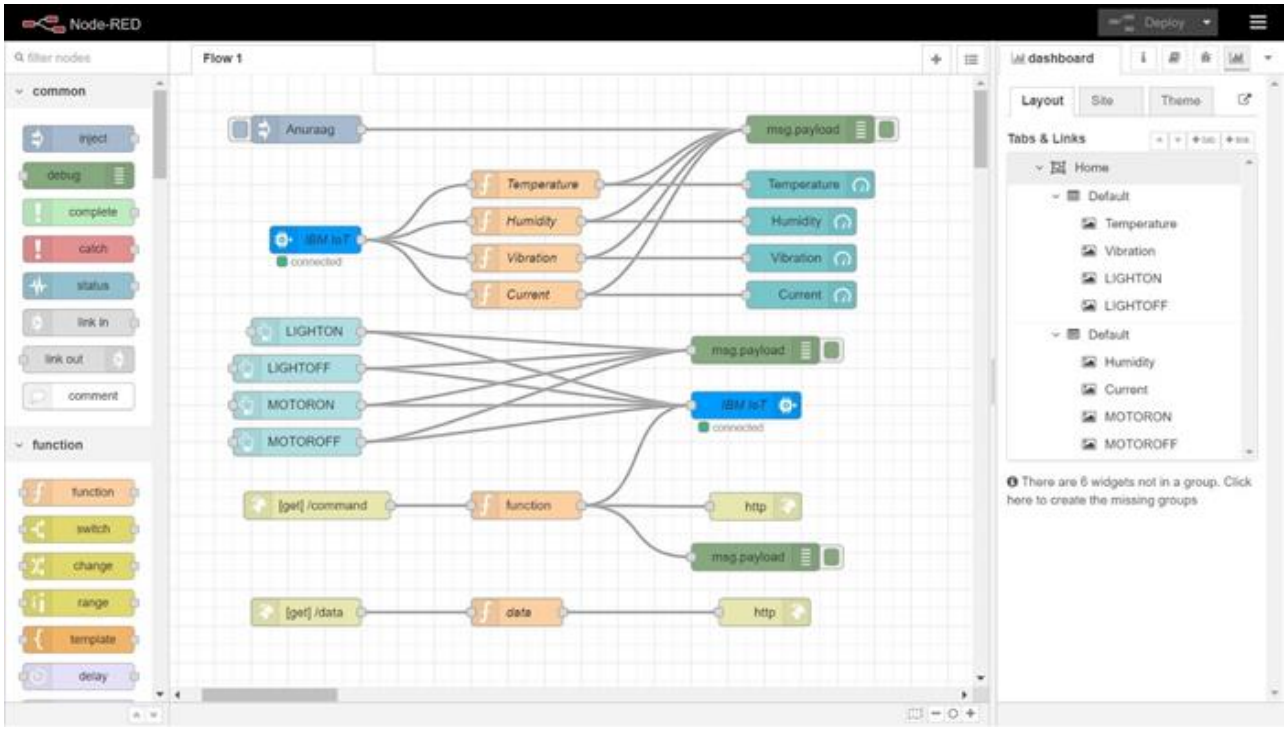
Source code:

```
import time

import sys

import ibmiotf.application

import ibmiotf.device

import random

#Provide your IBM Watson Device Credentials

organization = "mq4pvv"

deviceType = "raspberrypi"

deviceId = "123456"

authMethod = "token"

authToken = "12345678"
```

```
def myCommandCallback(cmd):
        print("Command received: %s" % cmd.data)
        print(type(cmd.data))
        i=cmd.data['command']
        if i=='motoron':
                print("Motor is on")
        elif i=='motoroff':
                print("Motor is off")
        elif i=='lighton':
                print("Light is on")
        elif i=='lightoff':
                print("Light is off")
try:
          deviceOptions = {"org": organization, "type": deviceType, "id": deviceId, "auth-method": authMethod, "auth-token": authToken}
          deviceCli = ibmiotf.device.Client(deviceOptions)
          #.....................................................


except Exception as e:
          print("Caught exception connecting device: %s" % str(e))
          sys.exit()
```

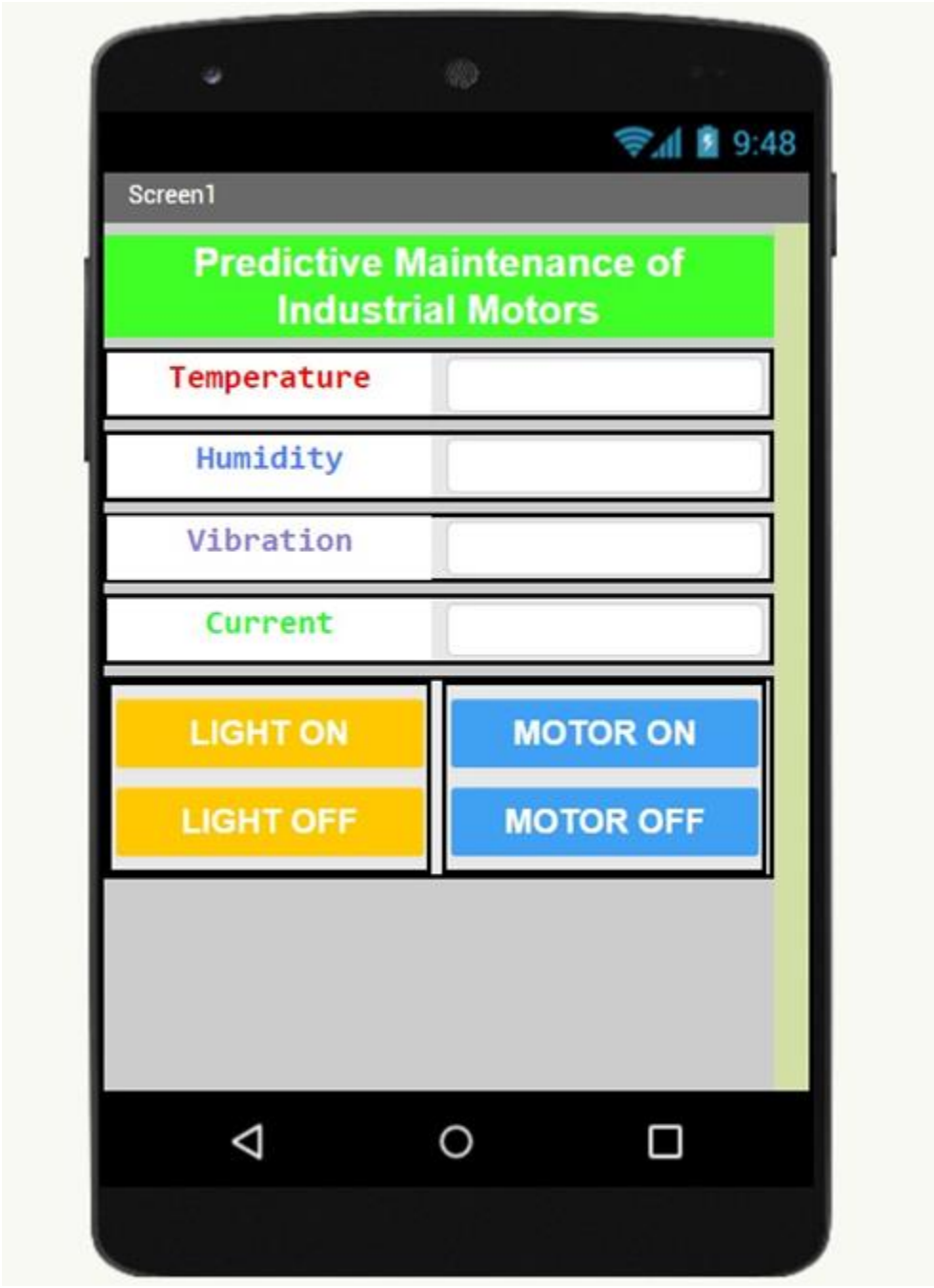
```
# Connect and send a datapoint "hello" with value "world" into the cloud as an event of type "greeting" 10 times

deviceCli.connect()



while True:

        #Send Temperature,Humidity,vibration,current value to IBM Watson

        temp =random.randint(30, 80)

        hum=random.randint(10, 40)

        vib = random.randint(50,100)

        curr = random.randint(5,30)

        data = { 'Temperature' : temp, 'Humidity': hum, 'Vibration':vib , 'Current':curr}

        #printing data

        def myOnPublishCallback():

            print ("Published Temperature = %s C" % temp, "Humidity = %s %%" % hum, "Vibration= %s HZ" % vib ,"Current = %s AMP" % curr, "to IBM Watson")



        success = deviceCli.publishEvent("DHT11", "json", data, qos=0, on_publish=myOnPublishCallback)

        if not success:

            print("Not connected to IoTF")

        time.sleep(2)



        deviceCli.commandCallback = myCommandCallback



# Disconnect the device and application from the cloud

deviceCli.disconnect()
```

UI Output Screenshots




Home
Temperature
62
Humidity
37
Vibration
50
Current
26
LIGHTON
MOTORON
LIGHTOFF
MOTOROFF


MIT APP INVENTOR
smart_sensor
Blocks
Viewer
Media
Upload File ...
Show Warnings


9:48
Screen1
Predictive Maintenance of Industrial Motors
Temperature
Humidity
Vibration
Current
LIGHT ON
LIGHT OFF
MOTOR ON
MOTOR OFF