International Journal on Future Revolution in Computer Science & Communication Engineering
Volume: 5 Issue: 8

ISSN: 2454-4248
71 – 74

# Analysis of Producing Real Time Device Knowledge Exploitation IOT and R Programming to Discover Early Errors

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**Abstract**: Nowadays, cyber physical systems (CPS), big data analytics, cloud computing and Internet of Things (IoT) are more significant in industries and day-to-day life with its autonomous, design and implementation. Still now, many industries are doing manual checking of their hardware which prompts loss of cash and notoriety. So every time it is not possible to monitor the hardware and generate reports whenever it is required. So for the betterment, it is proposed to make a device which wills monitored all the time and generate reports when needed. In this proposed technique, various sensors are proposed to record the details of the device such as the vibration frequency and temperature levels at different time intervals to detect the health of the hardware. Those real sensor data are obtained into systems, processed using Eclipse IDE using java language and are saved in data storage. The data which is used by everyone including the workers, operating officers, owner, supervisor, service team, service vendors and admin will store in public cloud so all will be able to view the real time data whenever and from wherever they are. Using code written in Eclipse will gather the require data, then the data is processed in an excel file to R studio where it is converted to a csv file and then used as a data-set. Then, with the help clustering and classification technique the big data is been is processed. Finally, the data is summarized, and the status of the device is predicted. Thus, the workers will be notified in advance when the device is about to get damaged. This aims at evolving the physically operating factories into smart factories which make every device resourceful.

***Keywords:** – hardware, productivity, manually monitoring, inefficiency, real time, sensor data, serial port, Eclipse, database, cloud, clustering, classification, R studio, smart factories.*

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## 1. INTRODUCTION

Numerous enterprises are developing towards innovation giving a way to improve streamline business. Utilizing a cloud stage, gathered assembling huge information can be additionally dissected and used to make inventive applications, for example, dynamic preventive upkeep [1], advancement of a generation line, and vitality utilization enhancement. Information handling including continuous dynamic support and disconnected investigation and expectation in the cloud is given. To upgrade the procedure and streamline efficiency it is significant for the makers to ace modern informatics. In Large-scale modern apparatus it is exceptionally mind boggling procedures to cover the requests put on them. So while getting the deficiency in the machines, it sets aside loads of effort to precisely find where the definite shortcoming is and afterward they settle it, or prompting a shutdown in the creation procedure which makes substantial misfortune the assembling firms. So with the help of enormous information examination, gadget information can be gathered continuously, including gadget alerts, gadget logs, and gadget status, so as to assess the wellbeing state of assembling hardware and preemptively recognize breakdowns. Along these lines in this we give a framework model which recognizes the shortcoming in the machines preceding their event utilizing AI systems for that Real time sensors have been utilized for gathering of information from the machines.

## 2. EXISTINGWORK

Equipment maintenance plays a vital role in intelligent producing, and directly affects the service lifetime of the instrumentality and its production potency. Current ways for instrumentality maintenance rely upon system alarms, associate degreed an operator reports faults to instrumentality maintenance personnel. The fault then must be specifically settled and resolved, resulting in a conclusion within the production method as a result of the employee or the alarm cannot predict the fault of the device before it happens. Once the device has less productivity importance, then it's not a difficulty. However if the device has higher expectations of productivity, then this current technique of alarms can more deteriorate the machine.

The other downside of the present technique is that the time unskillful. Whenever the device fails and it's noted, it'll take a while to repair the machine and build it work. Sometimes, bound flaws within the device also will result in the replacement of it. These procedures will take a while which can more build the assembly inefficient. So, it's vital and necessary to actively maintain a tool to predict its fault earlier.

## 3.PROPOSEDMETHODOLOGY

The proposed system focuses fault detection system in manufacturing companies / manufacturing devices at a low cost. Industries in smart cities turn up so many opportunities for the development of the city and economy. Also emergence of Internet of Things (IoT) and data analytics have lead to huge advancements and automations in the industries. [4] [5]

In the proposed architecture, two parameters are analyzed such as the vibration frequency of the machine and the heat emission at different periodic time intervals using vibration sensor and temperature sensor respectively to detect the manufacturing device health. The data collected from the sensors are periodically sent to the cloud server for monitoring. The monitoring session can be shared with workers, operating officer, owner, supervisor, service team, service vendors and admin. Finally machine learning algorithms are to be performed for the data Analysis. In this, clustering and classification is performed using the data that is stored in the cloud. K-means algorithm is used for clustering of the data and Naïve Bayes algorithm is used for the classification from the clustered data. Thus the proposed system can be used to predict the early fault and alert the workers in advance thus creating smart factories.

**SYSTEM ARCHITECTURE**

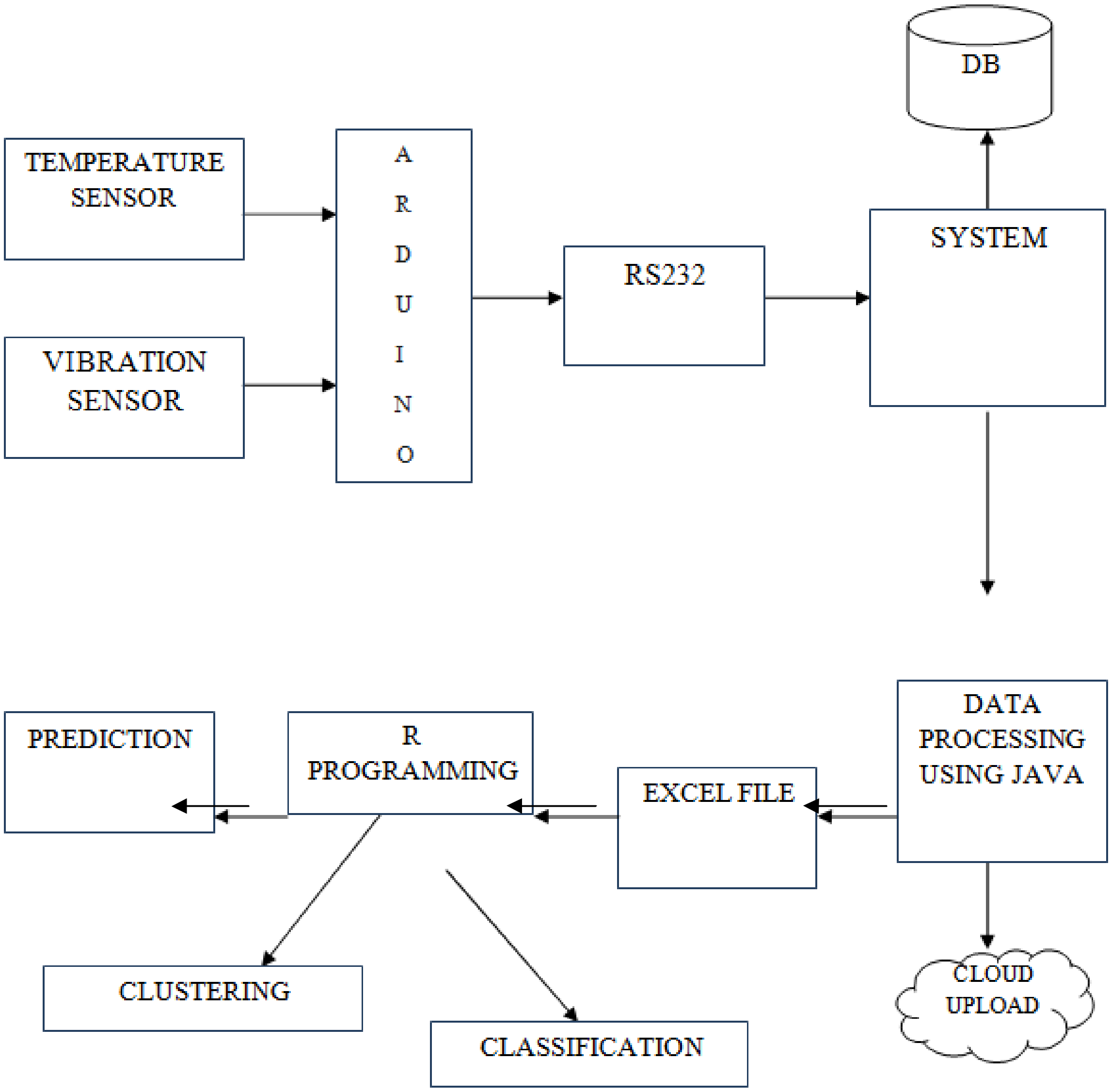


**Figure.1 - System Design for analyzing real time data of an AC motor**

ISSN: 2454-4248
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## OBTAINING VALUES USING SENSOR

In the proposed technique, two sensors namely the temperature sensor and the vibration sensor is used to sense the heat levels and the vibration frequency of the machine respectively. The temperature sensor used is the LM 35 sensor. The vibration sensor detects any disturbance in the smooth flow of energy in the device. The vibration level tends to be high when the device is nearly to fail.

## PROGRAMMING MICROCONTROLLER

The microcontroller used is the Arduino UNO. This has an integrated chip and is used in interfacing the system and the hardware. The output of the hardware could be processed using software through this interfacing. The Arduino uno is used because it differs from all preceding boards in that it does not use the FTDI USB- to-serial driver chip.

## DATA COLLECTION USING JAVA

The values that are sensed by the sensors through the microcontroller is obtained into the systems through serial port by programming in Java. The values will be continuously obtained unless and until the build is stopped by the user manually. Whenever the data is collected, it is directly stored in database and in excel file.

## STORAGE IN CLOUD

Cloud storage is done to store the data in a remote location so that the users of the device can retrieve and view the data from wherever they are. Public clouds are used for this. The people who wish to check the data can authenticate for logging in cloud. The data that is being lively monitored here is stored in the public cloud cloud Me for the workers, admin and the other staff to view the data.

## DATA ANALYTICS

R is a programming language used for analysis, graphical outputs and report generations. Mining big data in the field of manufacturing, smart cities, medical, agriculture are in high demand. It uses machine learning algorithms to mine and predict the results. Also it discovers the knowledge in the multidimensional big data obtained. Thus, we use this programming to cluster and classify the large sets of data that we have obtained from the sensors.

## K-M EANSCLUSTERING

K-Means calculation is utilized for making and examining bunches. Bunching is a solo learning calculation that attempts to group the information dependent on their comparability. Solo learning implies that there is no result to be anticipated, and the calculation just attempts to discover designs in the information. In k means bunching, the quantity of groups must be indicated for the gathering of information. Along these lines k implies calculation arbitrarily allocates every perception to a group, and finds the centroid of each bunch. At that point, the calculation performs two stages:

- Reassign the respective data points to cluster for which the centroid is nearest.
- Manipulate the new centroid for each cluster.

```
Manufacture_samp<-Manufacture
kmeans_Manufacture<-kmeans(Manufacture_samp ,3)
kmeans_Manufacture $cluster
Manufacture1<-table(Manufacture$DEVICE_STATUS, kmeans_Manufacture$cluster)
plot(Manufacture_samp[c("VIBRATION", "TEMPERATURE")],
     col = kmeans_Manufacture$cluster)
points(kmeans_Manufacture$centers[,c("VIBRATION", "TEMPERATURE")],
   col = 1:3,pch = 8, cex=2)
```

**Figure.2 - K – means algorithm pseudo code**

## NAÏVE BAYES ALGORITHM

Naïve Bayes is a classification / machine learning algorithm to resolve multi-class classification problems.

**Class Probabilities**: The probabilities of each class in the training dataset

**Conditional Probabilities**: The conditional probabilities of each input value given each class value

**Working:**

Stage 1: Convert the informational collection into a recurrence table

Stage 2: Create Likelihood table by finding the probabilities like Overcast likelihood = 0.29 and likelihood of playing is 0.64.

Stage 3: Now, utilize Naive Bayesian condition to compute the back likelihood for each class. The class with the most elevated back likelihood is the result of forecast.

```
split <- sample.split(Manufacture_new$DEVICE_STATUS,SplitRatio = 0.75)
train <- subset(Manufacture_new, split==F)
test<- subset(Manufacture_new, split==T)
train$DEVICE_STATUS<- as.factor(unlist(train$DEVICE_STATUS))
test$DEVICE_STATUS <- as.factor(unlist(test$DEVICE_STATUS))
train_class<- train[,-3]
model<- naiveBayes(test,test$DEVICE_STATUS)
summary(model)
pred<- predict(model, test[,-3],na.action=na.pass)
summary(pred)
confusionMatrix(pred, test$DEVICE_STATUS)
```

**Figure.3 - Naïve Bayes classification pseudocode**

## 3. PERFORMANCEANALYSIS

The performance of the device in both the existing and the proposed system is analyzed using the vibration levels of the device. In the proposed system, when the vibration levels reach the abnormal condition, maintenance is done immediately and the status of the device is turned to normal without allowing it to reach the critical state, whereas in existing system, when the abnormal level is reached, it is not taken care of and so the system reaches the critical level soon and then fails.

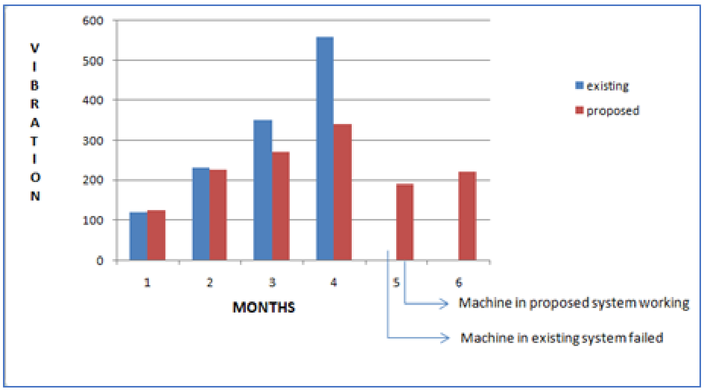


**Figure.4 - Performance analysis of the machine**

## 4. CONCLUSION

The major goal is the design a low cost preventive maintenance measure for manufacturing firms using big data analytics for the prediction of faults in the hardware and to reduce manual work done on the hardware like checking the conditions and generating the reports. The proposed architecture uses real time data collection, data sharing and data analytics. This proposed technique aims in making a revolution in the manufacturing firms, providing smart factories.

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