IARJSET

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Vol. 6, Issue 3, March 2019

Real Time Monitoring of Industrial Machines using IOT with SMS Alert System

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Abstract: In industries, wide variety of machines is performing variety of processes. Corrective maintenance is a maintenance task performed to identify, isolate, and rectify a fault so that the failed equipment can be restored to an operational state. The main focus of the paper is to alert on breakdown occurrence and to display the machine status visible in one view and also to calculate machine performance to improve machine efficiency. As soon as the fault/breakdown occurs it should be conveyed to responsible person, sooner we can convey the problem; the lower the communication time loss and sooner the equipment breakdown handled lower the production time loss. So we have developed an instant approach in industrial equipment breakdown handling via SMS which results in 1) Real time machine breakdown status monitoring using IoT 2) Alert System for effective communication 3) Visibility of all machines in one view for transparency in working. This kind of approach will lead to a unique system with different solutions along with Internet of things.

Key words: IoT, ESP8266 WIFI Module, GSM, Raspberry Pi, Arduino Nano, WIFI Router, Proximity sensor, Visual Monitor

I. INTRODUCTION

In manufacturing industries Machine breakdown handling is most important task. If the breakdown is not conveyed to a responsible person it takes time to get solved and it leads to direct or indirect customer dissatisfaction. This system is primarily developed as a unique system for real time monitoring of reactive maintenance of industrial machines along with SMS alert system, the different variety of machines can communicate through wireless network and Integration with the Internet implies that machines will use an IP Address as a unique identifier. The main concern for the project is to increase the communication efficiency; visual monitor will give up the transparency in working. On time machine maintenance will lead in increment in productivity through. As development happened we have developed a system in which the machine life with the past history of the machine can be withdrawn.

In this system Real time machine status can be observed and reactive maintenance happens as soon as the breakdown occurred, here we have developed as system model representing some of the examples of industrial machines which represents Oven machine, Oil level indicator and one of the machine shows model of machine triggered by Human intervention. Currently in some companies still industrial machines are not interfaced with computers so in case of these machines we have developed a system which will work with human intervention. This system describes how any machine can be monitored in real time and can be kept perfectly breakdown free by resolving breakdown issues at the instant of time. We can implement this system in any kind of industry as it can be used for data transfer of the status of machine whether it is working or under maintenance will be done to the common platform.

IoT an IIoT comparative study

IoT, Internet of Things, is often referred to a “smart” object. Everything from cars, home appliances to shoes and light switches that connect to the internet, passing and receiving data and connecting the physical world to the digital world are considered as smart object. There are two concepts used in defining IoT. Other than IoT there is another similar concept called IIoT, stands for Industrial Internet of Things. Both concepts have the same main character of availability, intelligent and connected devices. The only difference between those two is their general usages. While IoT is most commonly used for consumer usage, IIoT is used for industrial purpose such as manufacturing, supply chain monitor and management system.

II. LITERATURE SURVEY

Related Work

According to research in real time monitoring systems authors R.S. Ciuo', A. Chen, C.L. Tseng4, I.K. Fong, A. Yang, C.L. Lee, C.H. Wu, S. Lin' S.J. Huang', Y.C. Lee', S.G. Chang', M.Y. Lee states that in semiconductor industries fabrication process of wafer fault detection become critical as most problems reveal themselves first on the equipment

performance and much later on the wafer quality [1]. They focused on method of dartboard display of real time data for providing an easy reading of equipment's overall status; there approach in paper is towards equipment's overall health. In paper Wireless Industrial Monitoring and Control using a Smart Sensor Platform [2] the author Harish Ramamurthy, B. S. Prabhu and Rajit Gadh presents the design and implementation of a wireless smart sensor platform targeted for instrumentation systems and predictive maintenance. They have carried out tests to determine system performance for both the instrumentation and maintenance applications, and as the results suggest were quite satisfactory. The experimental results show that a sustained near-real-time system can be set up with the smart sensor nodes and the versatility of the smart sensor interface can be used in implementing diverse applications.

The author N.B.Shaikh described in his paper Online off-site condition monitoring of three phase induction motor by using GSM technology that the GSM module can be used to monitor remotely the condition of three phase induction motor.[3] In a motor monitoring system the motor is connected with one microcontroller based hardware unit, which is also connected to Global System for Mobile Communication (GSM) modem. His system is basically having the approach of condition monitoring of three phase induction motor. In primary level of fault in operation was diagnosed by Fast Fourier transform in MATLAB and the fault details are also reported to the assigned operator through SMS. According to author Kuang-Yow Lian in his article Mobile Monitoring and Embedded Control System for Factory Environment,[4] he has explained the similar approach as the plant operator will remotely monitor the status of various plant machines through mobile app. For upper management the managers can monitor plant areas after inputting their user name and password. This is similar method we used in our project but here in this paper the author was not able to send alert message to maintenance person and every time the operator used to log in into the system or app which is time consuming so we have overcome such issues in our project.

Sadeque Reza Khan in his paper GUI Based Industrial Monitoring and Control System says visual based GUI provides the accessibility form any PC as GUI provides an installation file[5]. The developed system can be used in different variety of machines also number of machines may vary. This GUI based system can only sense and monitor the parameters of industrial machines but it is not possible to alert the responsible for any breakdown. Such kind of approach we are using in our project to completely understand the requirements of industrial machines monitoring and alert system.

As per author Mr. Niteen V. Deshmukh in his paper Design and implementation of Embedded Remote Monitoring System for Electric Drive[6] he states that electric drives are important aspect in automation industries so it should be taken care for good machine health. In his paper he discussed various wireless standards and selects the one Zigbee as short distance communication. A WSN system is realized having high measuring accuracy and low cost. According to his work the maintenance management monitoring work will be done easily. But in this paper the Zigbee module is used as WSN module which is having lower data transfer rate than WIFI and Wifi is preferable choice for internet connection based network.

Author S.Boopathi, M.Jagadeshraja, L.Manivannan and M. Dhanasu in their paper GSM based Generator Monitoring System for steel Melting Shop[7] implements the ideal solution to the problems caused in situations when a wired connection between a remote appliance/device and the control unit might not be feasible. But the system is based on GSM module the time for receiving messages may fluctuate due to the public GSM network traffic which is actually a major drawback of a system.

Author Ashwini Deshpande, Prajakta pitale and Sangita Sanap in there Industrial Automation using Internet of Things (IOT)[8] developed a system which will automatically monitor the industrial applications and generate Alerts/Alarms or take intelligent decisions using concept of IoT. Using IoT they have built powerful industrial system and applications by using wireless devices, Android, and sensors. But the measure limitation was the status of system was not getting monitored in real time and the connectivity was via Bluetooth module which will restrict the number of devices connected and so which is not suitable for industrial applications.

III. SYSTEM MODELLING

Figure 1 gives an overview of designed system. The various functional Blocks and terminologies related to designed system are discussed below. In this paper we have developed three industrial machine models as given below

- **Node 1-Manual Machine with Wireless module as Client 1**

This Manual machine model is basically a machine model representing human interfaced machines, nowadays in industries maximum machines are interfaced with computers or more often machines are computer controlled but in some cases this is not possible to connect with PC, wherever the machines are not interfaced with computers this type

IARJSET

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Vol. 6, Issue 3, March 2019

of model is suitable. Node 1 contains 12V output adapter to input power supply. We have used IC 7805 which is a 5V Voltage Regulator that restricts the output voltage to 5V output. With 470µF capacitors and IC 7805 we have built pretty solid and reliable voltage regulator. In each node ESP 8266 operates only on 3.3V so it is developed using the feedback resistor constant 1.25V reference voltage, Vref produced between Output and "adjustment" terminal.

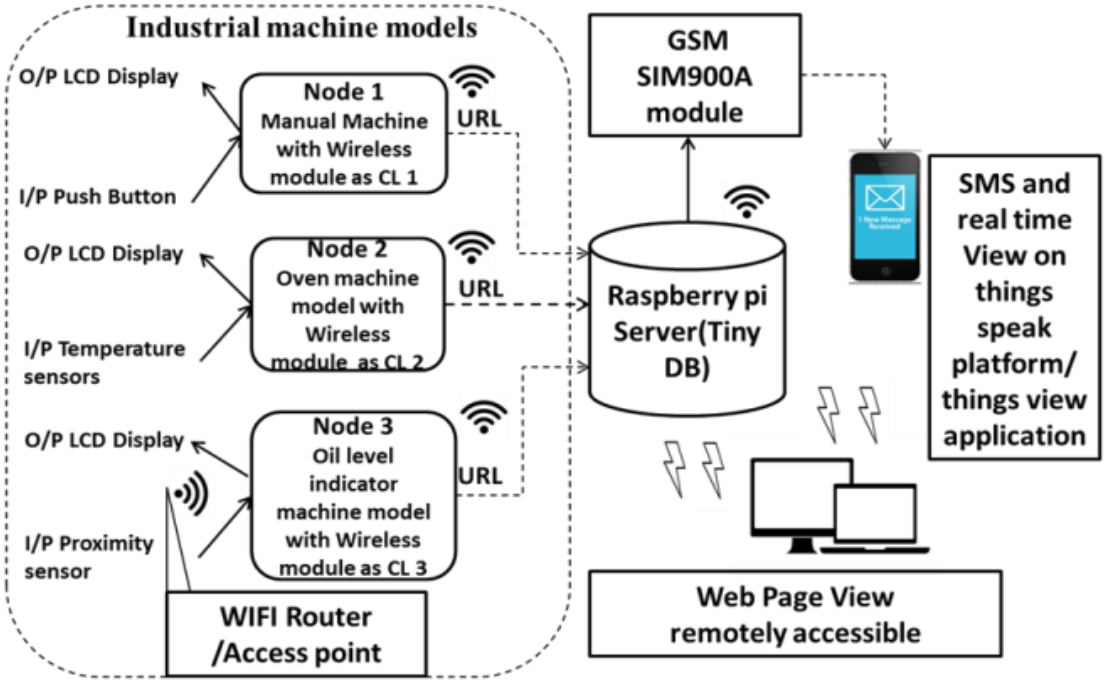

Figure 1: General block diagram of system

- **Node 2-Oven machine model with Wireless module as Client 2**

This Oven machine model is representation of Oven machine in industries. Generally most of the manufacturing industry has oven machine, so here we have taken it as model. In this machine two temperature sensors are used for continuously monitoring temperature level and if the temperature of the machine goes below 30ºCelsius then the indicators shows the status as breakdown has happened and the red light turns ON and the LCD display shows status Temp Low, when the respective person finds out the problem why temperature is low and while resolving issue machine status goes under maintenance and yellow light turns ON and red lights turns OFF. When machine starts working properly again and status shows OK and green light turns ON and yellow light turns OFF. Also LCD display shows temperature status. Node 2 contains temp sensors DS18B20 which operates on 3 to 5.5V. A0, A1, A2 analog pins of Arduino nano are connected to D7,D8 and D9 LED connection pins.

- **Node 3-Coolant/oil level indicator machine model with Wireless module as Client3**

This Coolant/oil level indicator machine model is representation of coolant level or oil levels in industrial machines. Generally most of the manufacturing industry has oil level indicators in machine, so here we have taken it as model. In this machine proximity sensor is used to sense the displacement of oil level and if the coolant level goes low then the indicators shows the status as breakdown has happened and the red light turns ON and the LCD display shows status Coolant Low , when the respective person finds out the problem why coolant is low and while resolving issue machine status goes under maintenance and yellow light turns ON and red lights turns OFF. When machine starts working properly again and status shows OK and green light turns ON and yellow light turns OFF. Also LCD display shows machine OK status. Node 3 contains Proximity sensor for displacement indicator of oil/Coolant level. Reed proximity sensor/ switch closes on falling liquid level. Thus the output is ON when the piston of the liquid level indication is below proximity sensor and thus output is OFF when oil level is above proximity sensor. Here data flow is from arduino via ESP8266. It sends continuously data through url, this data continuously getting forwarded to pi via TPLINK router, In raspberry pi CGI script decodes data and saves it into text file as log but this is indicating the status of all machines. This log should be divided into individual machine status. So then the text file log is divided into log 1, log 2, log 3 files as per each machine. Also in python GSM coding is done to send SMS when breakdown happens. Here for development of Web page Flask Web framework is used on python.

IARJSET

ISSN (Online) 2393-8021
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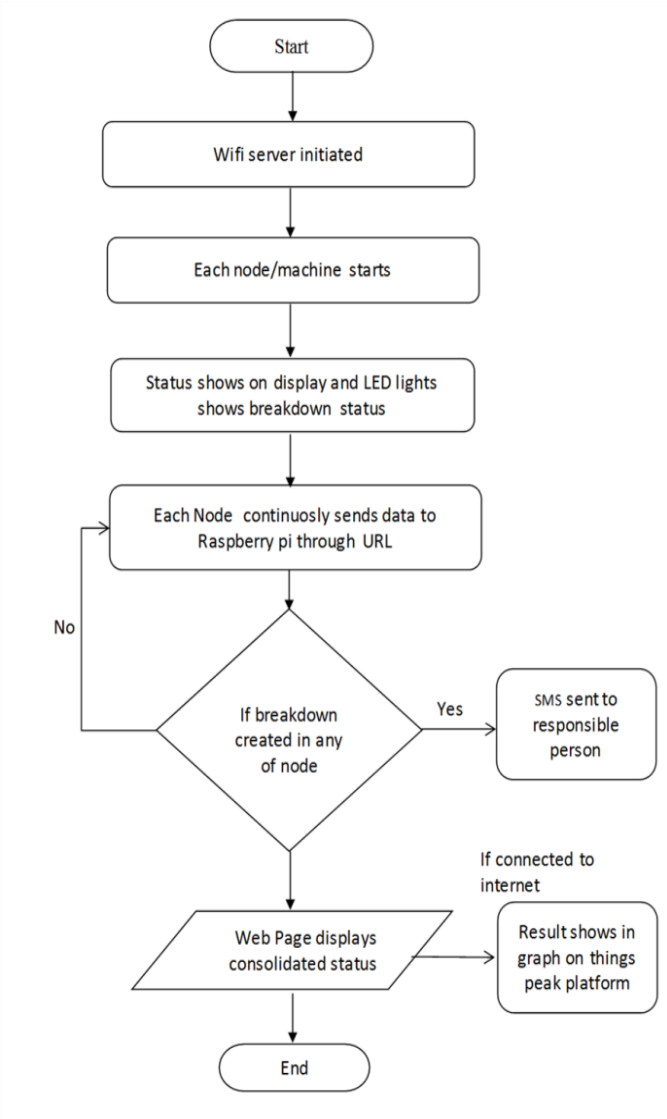
IV. SYSTEM FLOW CHART



V. RESULTS EXPECTED

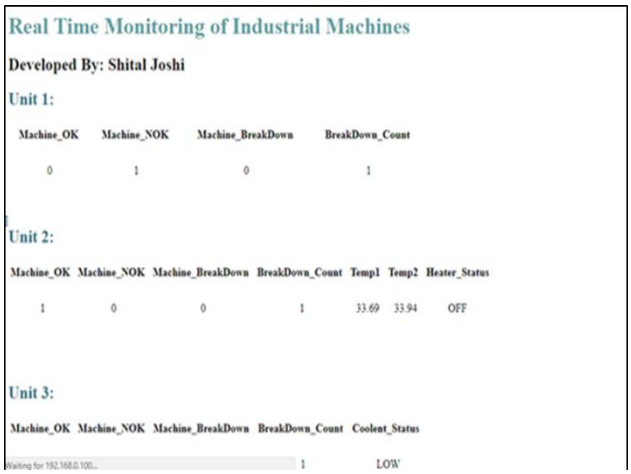


Figure 2: Result on Web Page

Figure 2 shows the result on web Page, here we have built web page that displays the status of all machines that can be

IARJSET

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ISSN (Print) 2394-1588

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Vol. 6, Issue 3, March 2019

monitored continuously by responsible person so that as soon as it reflects on the web page and the respective person gets an alert with SMS.

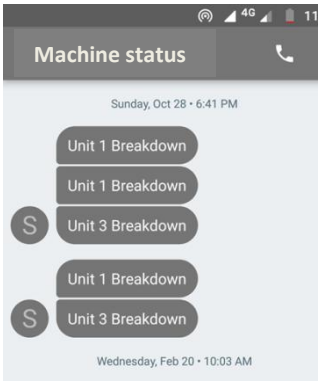

Figure 3: SMS alert on phone

VI. PERFORMANCE ANALYSIS

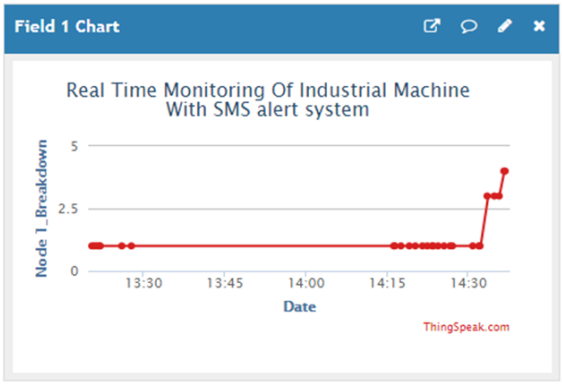

Figure 4: Node1 Performance result on Thing SPeak platform

Sources : www.ThingSpeak.com/ Mychannel

Node1, Node2 and Node3 performance can be calculated from breakdown happened with respect to time. We have created channel on ThingSpeak platform and when the system is connected to Internet then we can view real time graph on ThingSpeak channel. This will help to reduce the risk of breakdown and this will probably be like predictive maintenance. If ever the system is not connected to internet means it is only connected to local intranet then from the log we can calculate the performance manually.

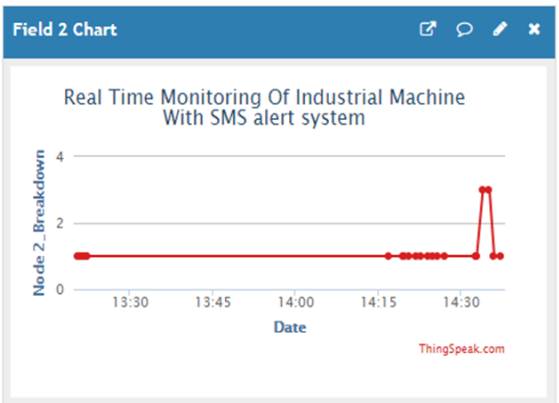

Figure 5: Node2 Performance result on ThingSPeak platform

IARJSET

ISSN (Online) 2393-8021
ISSN (Print) 2394-1588

International Advanced Research Journal in Science, Engineering and Technology

Vol. 6, Issue 3, March 2019

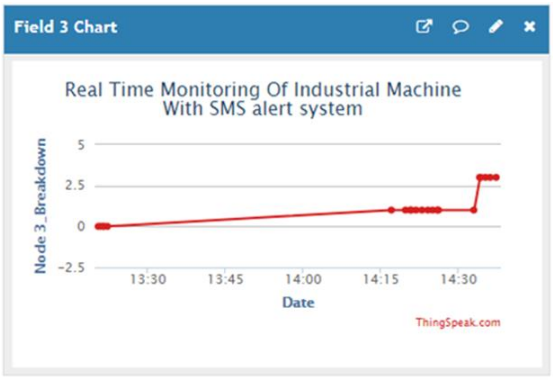

Figure 6: Node3 Performance result on ThingSPeak platform

With the help of real time data on things peak platform we have calculated Performance of each machine. We have downloaded files from things peak Channel in csv format and then calculated consolidated performance of all machines below is the graph that indicates according to past or log data node1 breakdown count is much higher than node2 and node3. So that it is required to do root cause analysis of breakdowns and to correct them. This approach benefits cost savings over routine or time-based preventive maintenance

VII. CONCLUSION

In this dissertation we have developed a system which will do Real time machine breakdown status monitoring and give Alert for effective communication also which will show the status of all machines in one view for transparency in information at every level industrial management. This kind of approach leads to a unique system with different solutions along with Internet of things. The basic purpose by developing this system is to improve industrial machines monitoring resulting in productivity through will be gained. On the other hand, installing very expensive systems to monitor, collect and store megabytes of data is not needed each day so it will save the cost and time to repair. In addition, We have developed a machine model which will be Add ON to any kind of industrial manually operated equipment. So whether the computer/desktop is available or not the breakdown alert can be reported via Node 1 Module.

REFERENCES

[1]. Guo, R.S., Chen, A., Tseng, C.L., Fong, I.K., Yang, A., Lee, C.L., Wu, C.H., Lin, S., Huang, S.J., Lee, Y.C. and Chang, S.G., 1998, June. A real-time equipment monitoring and fault detection system. In 1998 Semiconductor Manufacturing Technology Workshop (Cat. No. 98EX133) (pp. 111-121). IEEE.
[2]. Ramamurthy, H., Prabhu, B. S., Gadh, R., & Madni, A. M. (2007). Wireless industrial monitoring and control using a smart sensor platform. IEEE sensors journal, 7(5), 611-618.
[3]. Shaikh, N.B., Dhamal, S.S., Hadpe, S.S. and Varade, K.P., 2013. Online Off-Site Condition Monitoring Of Three Phase Induction Motor by Using GSM Technology. International Journal of Emerging Technology and Advanced Engineering, pp.693-696.
[4]. Lian, Kuang-Yow, Sung-Jung Hsiao, and Wen-Tsai Sung. "Mobile monitoring and embedded control system for factory environment." Sensors 13, no. 12 (2013): 17379-17413.
[5]. Khan, Sadeque Reza, and M. S. Bhat. "GUI based industrial monitoring and control system." In 2014 POWER AND ENERGY SYSTEMS: TOWARDS SUSTAINABLE ENERGY, pp. 1-4. IEEE, 2014.
[6]. Deshmukh, Niteen, and Pravin N. Matte. "An Application of ZigBee for Machine Health Monitoring."
[7]. Boopathi, S., Jagadeeshraja, M., Manivannan, L. and Dhanasu, M., 2015. GSM Based Generator Monitoring System for Steel Melting Shop (SMS). International Journal of u-and e-Service, Science and Technology, 8(2), pp.313-320.
[8]. Deshpande, Ashwini, Prajakta Pitale, and Sangita Sanap. "Industrial automation using Internet of Things (IOT)." International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) 5.2 (2016): 266-269.
[9]. https en.wikipedia.org wiki Raspberry Pi# Use_in_industrial_automation
[10]. https://www.google.com/search?q=raspberry+pi+architecture&oq=Raspberry+Pi+architecture&aqs=chrome.0.0l6.256j0j9&sourceid=chrome&ie=UTF-8
[11]. https://www.arduino.cc/