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REMOTE HEALTH MONITORING of MACHINES USING IOT

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Abstract: System health monitoring is a set of activities performed on a system to maintain it in operable condition. Monitoring may be limited to the observation of current system states, with maintenance and repair actions prompted by these observations. Alternatively, monitoring of current system states is being augmented with prediction of future operating states and predictive diagnosis of future failure states. Such predictive diagnosis or prognosis is motivated by the need for manufacturers and other operators of complex systems to optimize equipment performance and reduce costs and unscheduled downtime. The proposed system use voltage and current sensors to measure machine parameters and sends this data over a cloud for analysis, helping in keeping track of the system health remotely and in real time.

Keywords: Health Monitoring, IOT, Sensors, Machine.

I. INTRODUCTION

Internet of Things(IoT) is an upcoming technology whose application are getting more pervasive as we progress. It is basically a network of physical devices talking to one another via the help of electronics like sensors, microprocessors etc. One of its greatest advantage is its easy integration with the existing tech-nology and machinery. the employment of sensors with the reduction in cost and size has augmented the way machines communicate with one another and has led to a manufacturing revolution. Manufacturing industries are tapping into this unprecedented technology to boost its process productivity and efficiency. Connectivity and data acquisition are key parameter that act as a foundation for smarter, more sophisticated and intelligent machines. With the appearance of knowledge, gaining insights regarding the machine has become more feasible. Predictive maintenance has emerged united of the most popular trends within the industry and is quickly gaining popularity to enhance efficacy and reduce erratic machine downtime, improving the labour productivity while efficiently utilizing time dedicated to maintenance of machines. Three phase induction motors are widely used in industries thanks to their high reliability, feasibility and wide range of torque output available with simple build and maintenance. As their failures could have catastrophic consequences financially and productivity wise, safe and reliable working of those motors should be ensured. Remote monitoring system using lot uses measurements taken while a machine is working, to see if a fault exists, differing types of sensors may be used to measure signals to detect various faults. Various signal processing techniques can then be applied to those sensor signals to extract particular features which are sensitive to the presence of faults. Finally, within the fault detection stage, a call must be made on whether a fault exists or not with previous knowledge.

II. LITERATURE SURVEY

IoT and wireless sensor networks act as base for equipment health monitoring. Here, we provide a brief insight of the papers we have referred and taken some inspiration for this project. Firstly, the study referred [1], An application based on AI technique of Knowledge Based Systems, is developed for assessing the Machine Health Monitoring. Various modules were embedded within the application to suit individual maintenance needs of various types of machines. The permissible limits for vibrational parameters were added from the standards available [ISO 10816]. The results obtained by system were verified with permissible values from the vibration standards and were found to be acceptable. Machine health management in smart factory 12), studies the industry4.0 and it working. This work focuses on reviews, and summarizes of different types of machine health managements techniques, classifying them by the types of monitoring components, physical measurements for the machine condition monitoring, and various algorithms used for the health managements As Industry 4.0 and smart factory lead the factory automation, the intelligent machines, and the production lines, the significance of machines' health managements for their diagnostics and prognostics will be more emphasized. The advanced network technologies, ICT, lol, cloud computing, and big data engagements will also leverage the development of the machine health managements towards future smart factory, as well as the realization of Industry 4.0. In this regard, this work tries to give an overall summary and perspective of the machine health managements in the smart

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factory and Industry 4.0. Design and Development of Techniques for Equipment Health Monitoring System [3] propose a system that uses a vibration and temperature sensors along with embedded computing and a wireless access point for the monitoring of machines. The sensors are placed on the conveyers belts of the machine with different speeds and loads tracking every parameter. A data processing model analyses the information and predicts the condition of the belt. Condition Based monitoring system using IoT [4] uses a simillar type of system setup. A dedicated hardware is used for data acquisition from the machine consisting of sensors modules. Further connected to a GSM module to connect to a mobile unit Wirelessley . The objective of this paper was to develop a novel and feasible technique of condition monitoring of critical machines used in daily life. It offers major benefits to both, the individual users as well in industry in terms of reliability, efficiency and cost saving. This technique could be further implemented in industries for major cost savings and avoiding major downtime of critical equipment for predictive maintenance and as well as to detect faults. Thus, developing an independent and economical condition monitoring system with lot technology has unprecedented potential which the industries could use to improve
the productivity of their system.

III. MAIN DESIGN OF THE PAPER

Data points such as Current consumption and Voltage (and any other data point which we may identify as essential as we progress) of the three-phase feed of cardboard punching machine will be captured.
The data will be stored locally as well as on cloud in real time over internet using WiFi/Ethernet as shown in Fig 1
On the cloud, data will be stored with timestamp and an application will process the data so as to calculate

1. Existing Current consumption of the machine
2. Power consumption of past one hour
3. Power consumption of past 24 hours and past one week
4. Existing voltage reading
5. Machine efficiency that is Production to power ratio

On the cloud one more application/service shall be responsible to represent this data in dashboard format and also to generate weekly report of the machine

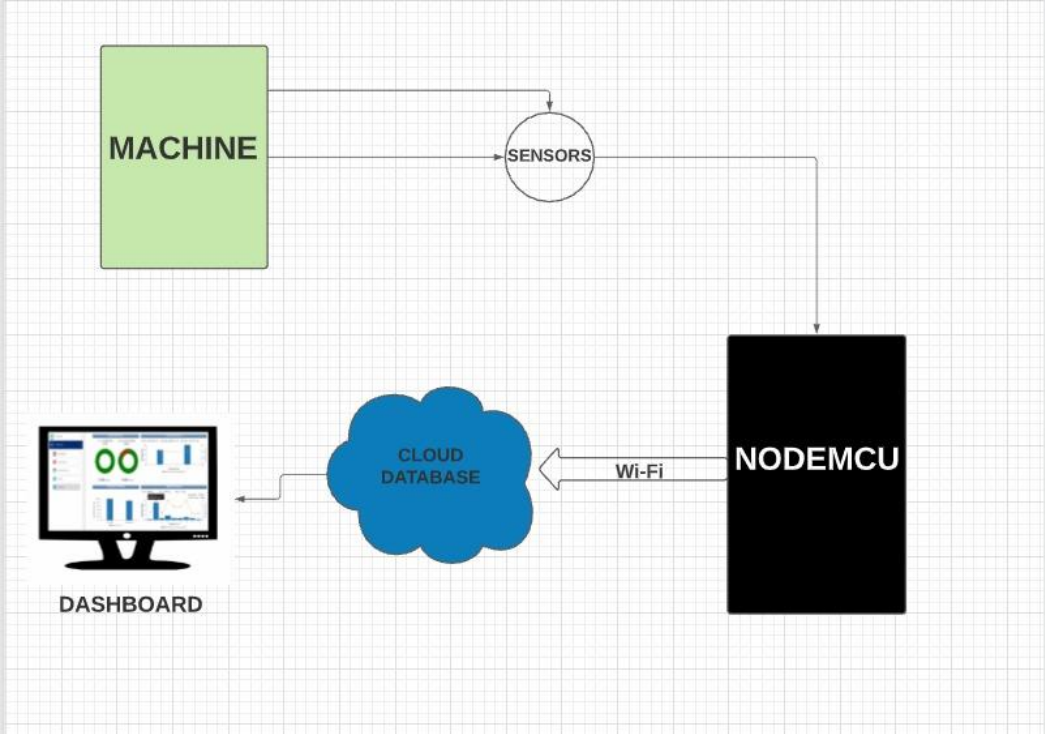

Figure: 1 Block Diagram of Health Monitoring system of Machine.

A. NodeMcu ESP8266

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NodeMCU is a wifi SOC (system on a chip) produced by Espressif Systems. It is based on ESP8266 -12E WiFi module. It is an highly integrated chip designed to provide full internet connectivity in a small package. NodeMCU is the WiFi equivalent of ethernet module. It combines the features of WiFi access point and station + microcontroller as shown in Fig 2

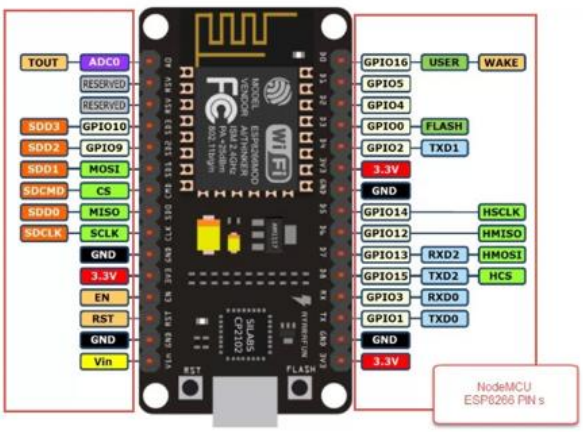

Figure: 2 NodeMcu ESP8266

B. DS18B20 Temperature Sensor Module

- The DS18B20 digital thermometer provides 9-bit to 12-bit Celsius temperature measurements and has an alarm function with nonvolatile user-programmable upper and lower trigger points.
- The DS18B20 communicates over a 1-Wire bus that by definition requires only one data line (and ground) for communication with a central microprocessor. In addition, the DS18B20 can derive power directly from the data line ("parasite power"), eliminating the need for an external power supply.
- Applications that can benefit from this feature include HVAC environmental controls, temperature monitoring systems inside buildings, equipment, or machinery, and process monitoring and control system.

Figure: 3 DS18B20 Temperature Sensor Module

C. *Current Sensor.(SCT-013-030 Non-invasive AC)*

- "Clamp-on" or "Cable clamp" Current Sensors are sensors that are used for measuring AC or DC currents. They are particularly useful for measuring currents flowing in a cable wire in a non-intrusive way.
- The "clamp-on" current sensors are particularly useful for easy and safe installation. They are installed straightforwardly onto a wire going into the electrical load without the need to do any high voltage electrical work
- This non-invasive current sensor can be clamped around the supply line of any electrical load to tell you how much current is passing through it. It monitors the magnetic field around a current-carrying conductor and outputs a voltage proportional to the current.

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• The clamp-on current sensors measure loads from +/-5 Amps to +/-230 Amps which makes it great for building your own energy monitor to keep your power usage down, or even building an over-current protection device for an AC load.

Figure: 4 Current Sensor

D. Voltage Sensor

• A voltage sensor is a sensor is used to calculate and monitor the amount of voltage in an object. Voltage sensors can determine both the AC voltage or DC voltage level.
• The input of this sensor can be the voltage whereas the output is the switches, analog voltage signal, a current signal, an audible signal , etc.

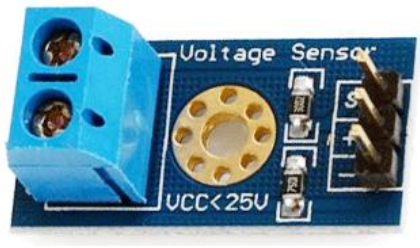

Figure: 5 Voltage Sensor

IV. PROPOSED METHODOLOGY AND DISCUSSION

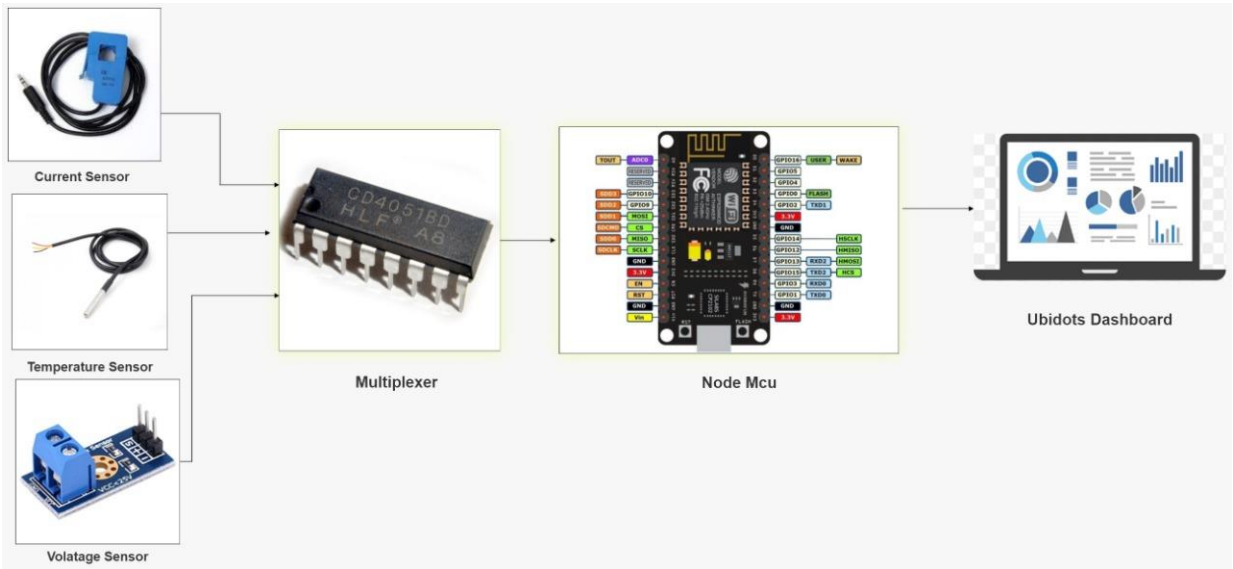

Figure: 6 Schematic Diagram of the Home Automation system

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This is the schematic representation of the project. The following diagram shows how inputs are taken from the machine and how different tasks are performed on this input data and following result is displayed on the dashboard. The Nodemcu is acting as main part of the system.
We have considered different sensors to measure the input values like temperature, current and voltage from the machine. In order to measure the temperature of the machine the temperature sensor DS18B20 is used. This sensor has range of about -55 to 125 degree Celsius and accuracy of about 0.5.
In order to measure the current consumption of the machine the current sensor SCT-013-000 30A Non-invasive AC current sensor is used which measure values up to 30ampere.The voltage sensor is used to measure voltage of machine. It measures up to 25 volts. The output from the different sensors are taken and are send to CD4051 multiplexer. It is a 8 channel analog multiplexer. The mux takes the input values and send it to nodemcu. The nodemcu take the values, perform certain operations like power consumption by using voltage and current values and send the following result to ubidots dashboard. The data is sent through MQTT protocol. On ubidots we can analyse the data. An alert is set if any input like temperature, current, voltage or power consumption exceeds a predefined condition. The measurement is done on per hour or per day basis and report of this results can be generated every day.

V. EXPERIMENTAL RESULT

In Fig 7, the graph displaying the temperature is shown. The temperature sensor will be placed at strategic location on the machine. The data will be fed to the system and the machine health will be assessed almost simultaneously.

Figure: 7 Temperature Graph

As the temperature of the machine will starts increasing , the temperature value on the serial monitor will also start increasing as shown.

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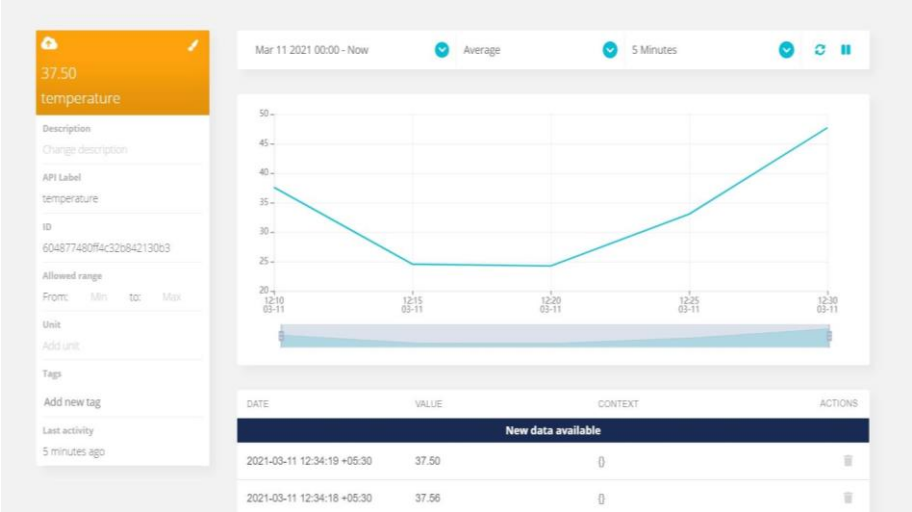


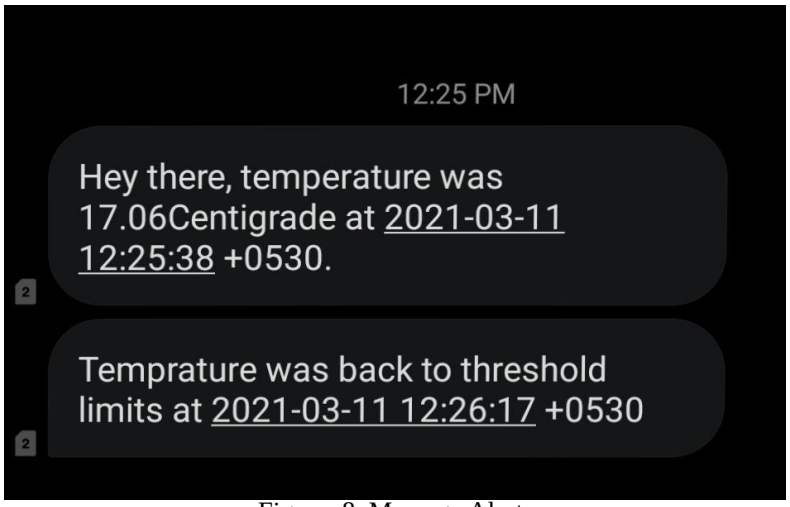
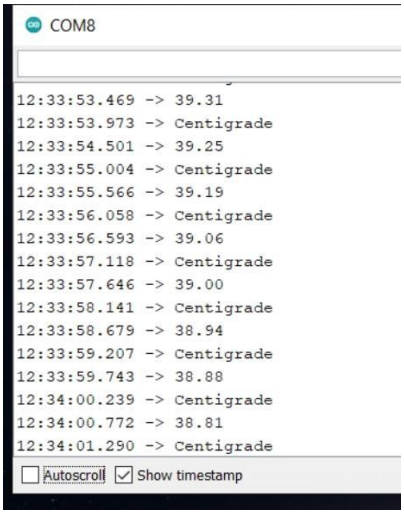


Figure: 8 Message Alert

When the temperature exceeds threshold limit for over a minute, an sms alert will be sent to the registered number with the information regarding the current temperature of the machine, After the temperature is back to threshold limits ,again we will get an sms alert notifying that the temperature was back to normal. Moreover, periodic reports can also be sent as per the need. A weekly or monthly report can be obtained in order to have a precise idea of the machine's health over a longer period of time.



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VI. CONCLUSION

This project deals with the Remote Health Monitoring Of Machine. The project will help to keep track of Machine Utilization, Energy Utilization, Downtime analysis and Production Overview of a machine using sensors and internet of things. It monitors the parameters in real time and can be further used to predict future faults in any machine based on the parameter data saved on the cloud. To remotely monitor health and efficiency of a corrugated box machine on regular basis through visual insight by capturing and processing important data points and parameters from the machine using retre4ofit sensors. The data is gathered and processed locally on the cloud to provide a precise analysis of health of the machine. The data is displayed on a dashboard in real time and also provides weekly or monthly reports of the machine performance.

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