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Industrial Safety and Power Measurements through IoT

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Abstract: ***Internet of things is not only used in smart homes but much broader idea in itself. It connects all the things with web. By executing intelligence with sensors, it is utilized in various areas such as industrial automation. This application imbibes in the industrial field for safety, security, energy conservation, automatic control and quality control.***
Safety of worker, energy conservation and maintenance of machine are considered to be pillars of an industry. So, maintaining the steady temperature level and preventing smoke / gas leakage is mandatory. For this purpose, MQ-6, DHT 11 and Flame Sensors are used in this project. There will be real time monitoring in mobile through MIT application. This module is kept at different places in industry. So particularly at which location alert is generated that can also displayed.
In any plant it's necessary to continuously monitor the power consumption of devices which has a significant impact on the energy saving. So rather than measuring the power consumption of the whole plant, measurement of power is done of individual devices. Energy meters are the best solution which shows real time data about all the individual machines and gives alert if any machine is consuming more power and needs maintenance. Current and Voltage sensors are attached with energy meters. This is possible for both single and three phases. Here all the real time data will be obtained into mobile through IoT.
Keywords: Firebase, Ubidots, MIT App Inventor, ESP12E

I. INTRODUCTION

Internet is flourishing platform for Automation which has made advancements that one can easily supervise and restrict the process using internet. By using internet system remains ensure and live data monitoring can also be done using IoT. It can be obtained using local networking standards, remotely governing & supervising device parameters using embedded technology [1].
There are many harmful gases inside the industry which are processed so it is essential to provide safety to employees those who are working within those industries. Any leakage of gas takes place in industry, system alerts by turning ON the alarm which notifies the employers. There are some other measuring parameters like temperature, humidity, and flame which are measured by the system. This will help us to maintain the industrial environment as per product requirements and will benefit us to take necessary decisions from any part with certain distance. This system comprises of different sensors like flame, gas and temperature which are interfaced with controller. The sensor regularly records values and transmit data online. Here WIFI module is kept for IoT functionality [2]. The internet of things (IoT) server then displays this information online, to achieve the desired output.
Energy conservation is increased nowadays due to scarcity of resources. Here circuit is designed in such a way that it can be directly plugged-in into main power supply for getting power in circuit. Simultaneously plug the device to any machine whose parameters are likely to check. This method will eliminate extra need of wires which were used regularly. It is applicable for both temporary and long-lasting installation. This will help user to measure power even for separate device so power usage optimization can be done. To measure voltage, VT sensor is used and for the current CT sensor is used. ESP12-E is interfaced with CT and VT sensors. This circuit is used for single and three phase. Single phase electricity is used for household and office purpose while three phase alternating current are used universal for distributing electric power and to provide electricity to higher power consuming equipment. Energy meter is a device which will show amount of electrical energy consumed. By measuring voltage and current, power is calculated. Keeping fixed unit charge we can able to calculate bill also at regular interval of time. In single phase system VT sensor is connected to Atmega to reduce the stack overflow errors. Three CT sensors are used to measure three phase currents so 16 channel multiplexer is used to get 3 outputs from having one input.
Both circuits of safety and power are kept in industries for continuous monitoring of industry environment and machines. Here we have used two servers Firebase and Ubidots. For mobile application we have used MIT app inverter [3].

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II. LITERATURE SURVEY

Firebase is the real-time database. Firebase provides battery efficient network between server and devices which allows you to send & receive messages & notifications on iOS, Android & the web at no cost. When any application requires very minimum level of integration with third party services Firebase is perfect choice. When application don't require heavy data processing Firebase is good choice. To connect any application with Firebase it is not connecting with normal HTTP. It is connecting through WebSocket. WebSocket are much faster than HTTP. It's not necessary to make individual WebSocket call as one socket connects with plenty. Firebase provides battery efficient network between server and devices which allows you to send & receive messages & notifications on iOS, Android & the web at no cost. When any application requires very minimum level of integration with third party services Firebase is perfect choice. When application don't require heavy data processing Firebase is good choice.

Ubidots is consider to be best platform for virtual representation just by simply taking sensor data and transmit data through connection protocol to Ubidots's cloud. It is an IoT data analytics and visualization association. Application program interface provide easy & secure connection for sending & retrieving data to & from our cloud service in real-time. This service is performance optimized for Internet of Things data storage, commutation & its retrieval. Basic aim of Ubidots is to get data from device to visualization.

MIT App Inventor is a web application integrated development environment which was initiated by Google & presently managed by Massachusetts Institute of Technology. It gives opportunity to newcomers to do programming for making application software. It is working for both operating systems android & iOS. It is free and opensource software. MIT uses graphical interface which is similar to programming languages scratch so the star logo which gives permission to users to drag & drop visual. It supports the use of cloud data through preliminary Firebase database. It includes two main editors block editor and design editor. Design editor is a drag & drop interface to layout the elements of the application's user interface. Block editor is the editor which helps app inventors can visually design logic of their apps using colored coded blocks that can be attached together like puzzle pieces. App inventor provides a mobile application called App Inventor Companion. Using this App Inventor Companion developers can test the behavior of own apps in real-time. This the way anyone can rapidly build mobile application.

III.CONCEPT OF SAFETY IN MODERN INDUSTRY

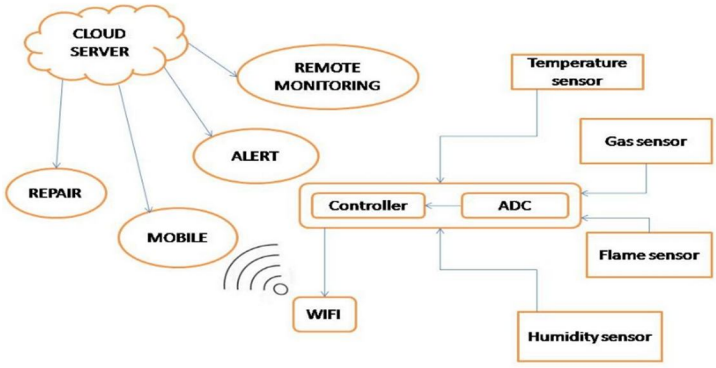


Fig. 1 Safety Block Diagram

A. *Hardware And Software Requirements*

1) Sensors: DHT 11, MQ-6, Flame sensor
2) ESP12E
3) AMS1117
4) Push buttons
5) Resistors
6) Capacitors
7) Firebase server
8) Ubidots server
9) MIT mobile application
10) Arduino ide software

B. Working

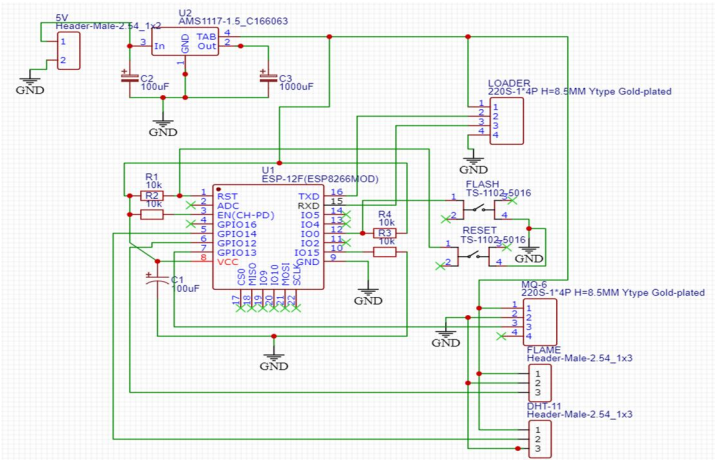


Fig. 2 schematic circuit of safety

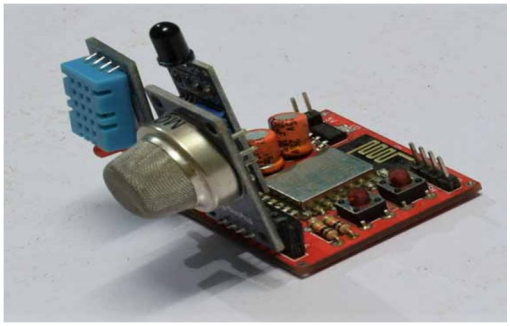


Fig. 3 PCB along with sensors

C. Circuit Description and Working

Three input sensors are used in the circuit which will interface with the Wi-Fi module ESP -12E with its I/O pins. MQ 6, flame and DHT 11 sensor's data pin is connected to GPIO13,12,14 respectively [4]. The VCC pins of all sensors are connected with the AMS 1117. The ground pins of all sensors are grounded commonly. Code is uploaded into the ESP 12E module using USB to TTL converter to send the data serially. The 5V port in the PCB is connected with the 5V adapter which gives DC voltage to the circuit. The 5V input power source needs to be covert into the 3.3V by AMS 1117.The loader port in the PCB is used as a connector between ESP12E and USB to TTL for serial communication which has a 4 pins VCC, ground, RX and TX .For loading the program ground the enable pin of ESP 12E [5]. The data is transferred to MIT app by adding a generated token ID by the Firebase server [6]. Once it gets restarted values of Firebase server gets deleted so to store data and to analyse its performance Ubidots server is been used which gives data in different chart forms. For alerting an SMS system by the app inventor is used and also email facility for the user to get emergency report. The common access point like a router is used to provide the internet connectivity for the system.

IV. CONCEPT OF MONITORING INDUSTRIAL PERFORMANCE

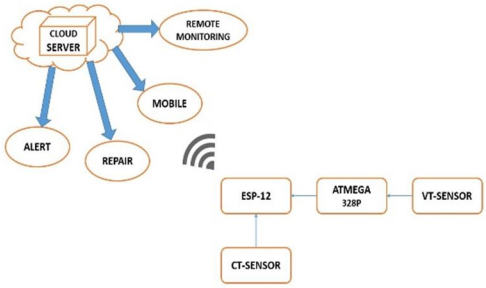


Fig. 4. Single phase power block diagram

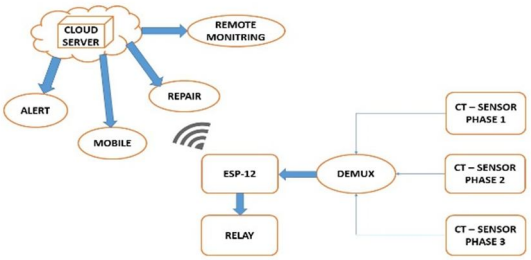


Fig. 5. Three phase power block diagrams

A. Hardware and software requirement

1) 5v SMPS
2) 5v Relay
3) AT-Mega328-P
4) 16-Channel Analog Multiplexer
5) ESP-12e
6) Resistor
7) Capacitor
8) Crystal
9) PCB mounted Push Button
10) Voltage Regulator
11) Firebase server
12) Ubidots server
13) MIT mobile application
14) Arduino ide software

B. Working

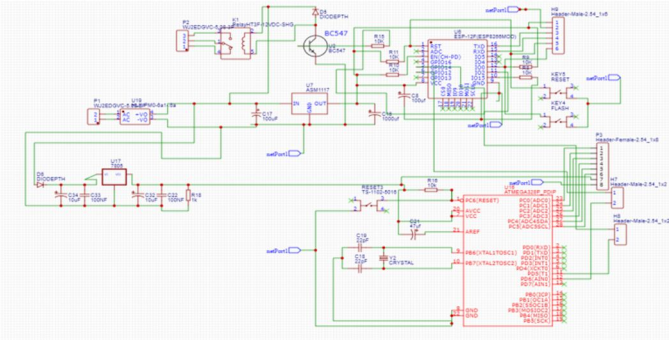


Fig. 6. schematic circuit of Power

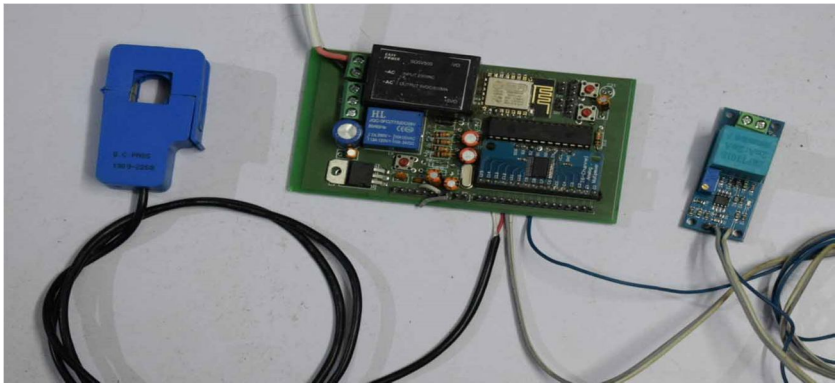


Fig. 7. PCB along with sensors

C. Circuit Description And Working

This circuit is designed for the purpose of continuous monitoring of voltage and current of individual machines. From voltage and current power can be calculated [7]. As the system works on real time system power can be calculated on daily basis. From power units will be calculated and bill can be generated easily [8]. If any machine in plant consuming more current than its predetermined value with little buffer given, it will give automatically maintenance alert. This is the best way to conserve our resources.

In this circuit SMPS is used which will convert 230AC to 5V DC. Due to fluctuated output from SMPS, 7805 voltage regulators are used which will give 5V precisely. Relay is used for switching the load. For single phase calculation Atmega is used for calculating values of VT sensor. VT sensor is analog sensor so it is connected with analog pin of Atmega. This data will serially communicate to ESP 12E [9]. CT sensor directly connected to ADC pin of ESP12E. For three phase calculation 3 CT sensors are used so 3 input analog pins are required therefore 16 channel demultiplexer is used. It is connected to ADC pin of ESP 12E. This data will be transferred to the Firebase to MIT app and Ubidots as mention above.

V. CALCULATION

A. For VT Sensor

Vmax =Sensor value (Analog sensor will give output between 0-1024)
Vmax= 620
VeffD= Vmax/ sqrt (2)
= 438.406
Veff=(((VeffD-420.76)/-90.24)*-210.2)+210.2
Veff= 251.303V

B. For CT Sensor

VREF=3.3 (voltage given to ESP 12E)
Non-invasive AC Current Sensor tection range=100 (Range=0-100amp)
Analog data=550 (Range=0-1024)
Peak Voltage = Analog data / 5
=110
Voltage Virtual Value = peak Voltage * 0.707 (Peak value for current=0.707)
=77.77V
Voltage Value = (Voltage Virtual Value / 1024 * VREF) / 2
= 0.1253
AC Current Value = Voltage Value * Non-invasive AC Current Sensor tection range
=0.125*100
=12.5A
Power=voltage *current
=3141.2875W

VI. RESULTS

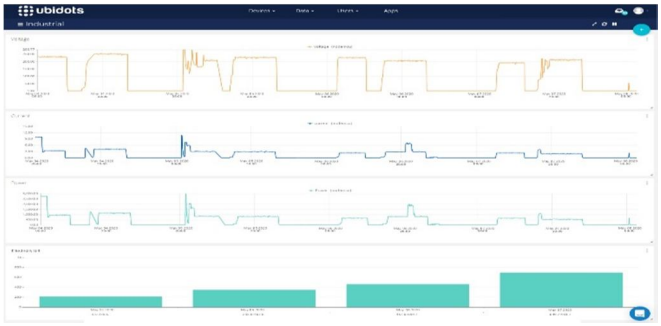


Fig. 8. Single phase Ubidots dashboard

Fig. 8. shows data simulation of single phase in Ubidots with history also. Values of voltage and current are zero when machines are not working. With fixed number of units regularly electricity bill can also calculate.

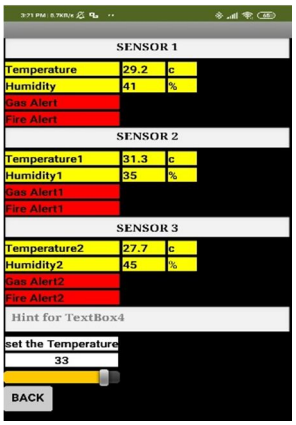


Fig. 9. Safety reading in MIT app

Fig. 9. shows the safety screen of MIT application. It shows that temperature is set at 33c so if temperature of any sensor goes above or below that with the buffer of 5c alert will be generated. It also shows real time monitoring of temperature and humidity values. For gas and flame it only have to give alert if there is any problem.

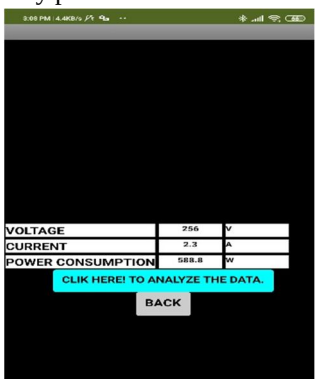


Fig. 10. Single phase readings in MIT app

Fig. 10. shows real time data in MIT application for single phase load. Here current is calculated by CT sensor and voltage by VT sensor. From that power is been calculated. To study old data click on analyze the data which will directly open to Ubidots screen

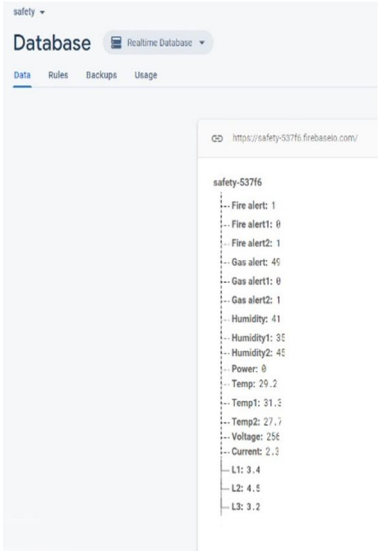


Fig. 11. Firebase server

Fig. 11. describes Firebase server which constantly captures real time data from all the sensors and send it to MIT application.

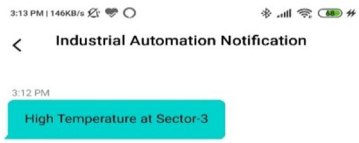


Fig. 12. Safety alert message

Fig. 12. shows alert message in mobile when the temperature was high.

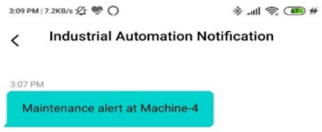


Fig. 13. Maintenance alert message

Fig. 13. shows alert message in mobile when maintenance is required to any machine.

VII. CONCLUSIONS

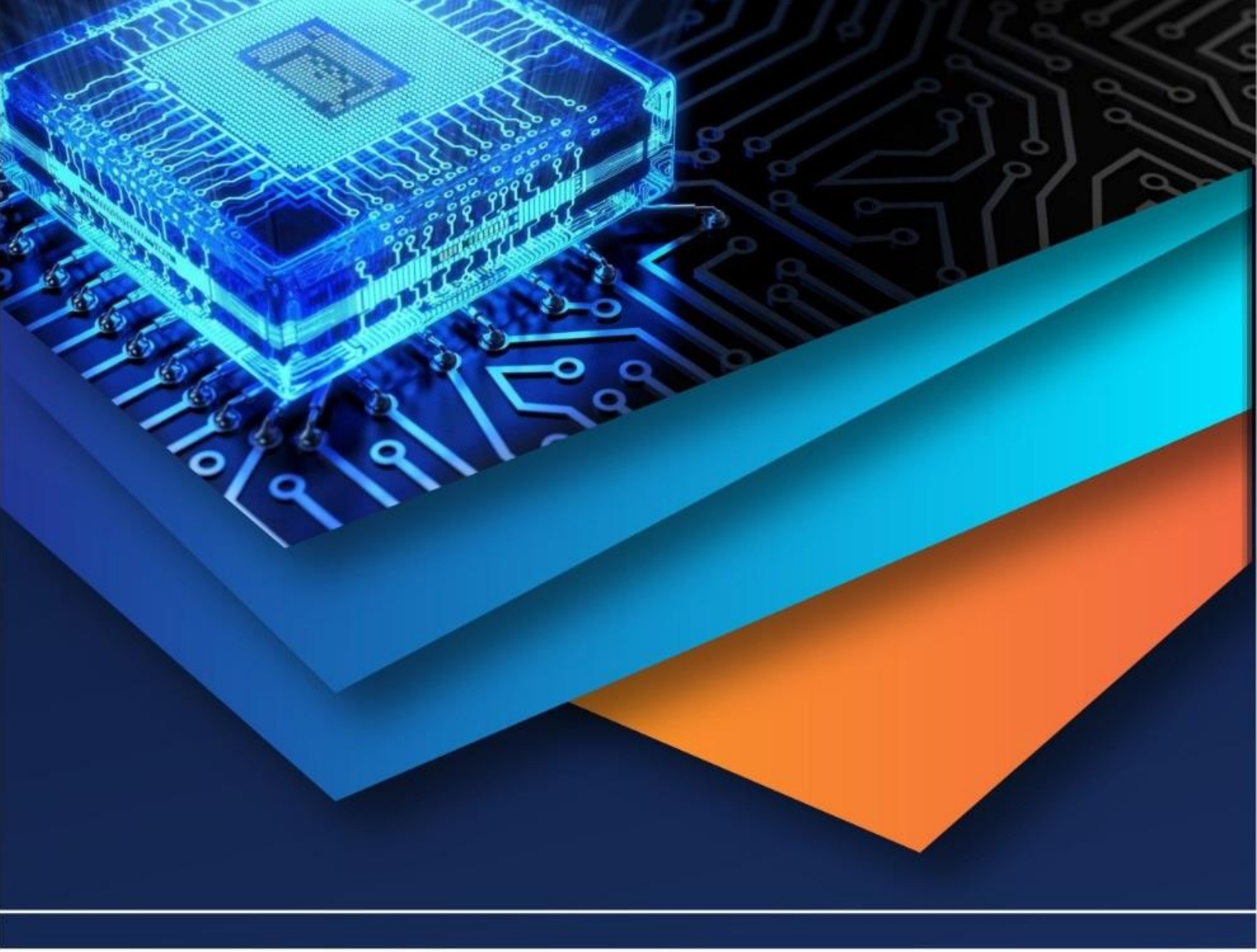
This paper describes improved method of security for worker and performance of machine through IoT. Firebase and Ubidots are considered as one of the smartest platforms for IoT. Through this all the real time data can be received with its history also. Experimental results show that both the modules work proper and giving results when it is kept in any industry. When this both modules are kept in the industry it will reduce man power who runs whole day for checking temperature and other parameters. As there will be alert for regular maintenance life of machines in plant will increase.

VIII. ACKNOWLEDGMENT

Here with we express our heartily gratitude towards HOD of Electronics department of Birla Vishvakarma Mahavidyalaya Dr. T. D. Pawar for encouraging in doing technical activities. We are really thankful that Mr Chetan Jaiswal guided us in our journey and showed the path of success. By his experience and effort we are able to complete this paper.

REFERENCES

[1] K.Bharath reddy, Ch. Rajendra prasad "The Embedded Web server based Electrical Ethernet Monitoring system using ARM" International Journal of Advanced Research in Computer and Communication Engineering Vol. 2, Issue 5, May 2013
[2] Bhavna, Dr. Neetu Sharma "SMART HOME SECURITY SOLUTIONS BASED ON INTERNET OF THINGS (IOT) USING WIFI INTERFACE" INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY ISSN: 2277-9655
[3] Mohammed Shahab, Rida Fatima, Payal Verma "Internet of Things (IoT) based Emergency Reporting and Management System using Ubidots and Firebase" International Journal of Engineering Research in Electronics and Communication Engineering (IJERECE) Vol 5, Issue 6, June 2018
[4] Khin Kyawt Kyawt Khaing "Temperature and Humidity Monitoring and Control System with Thing Speak" International Journal of Scientific Research and Engineering Development– Volume 2 Issue 5, Sep – Oct 2019
[5] Anuradha Patel, Dr. P. Devaki "Survey on NodeMCU and Raspberry pi: IoT" International Research Journal of Engineering and Technology (IRJET) Volume: 06 Issue: 4 | Apr 2019
[6] Gyanendra Kumar Pal, Sanjeev Gangwar, Neeta Yadav "HOME AUTOMATION USING NODE MCU AND ANDROID APPLICATION" Journal of Emerging Technologies and Innovative Research (JETIR) July 2018, Volume 5, Issue 7
[7] Jalpa Patel, K. Avinash Reddy, M. Kirti, Dr. D. B. K. Kamesh, Dr. J. Sasi Bhanu "MEASURING ELECTRICITY CONSUMPTION OF APPLIANCES AND MONITORING THEM USING IoT AND MACHINE LEARNING" International Research Journal of Engineering and Technology (IRJET) Volume: 05 Issue: 04 | Apr42018
[8] Harsha Khandel, Suchitra Pandey and D. Reynolds "IoT BASED POWER CONSUMPTION MONITORING AND CONTROLLING SYSTEM" International Research Journal of Engineering and Technology (IRJET) Volume: 05 Issue: 07 | July 2018
[9] Nadar Prince, Abhishek Sengupta, Ms.Keerthi Unni "Implementation of IoT Based Attendance System on a Dedicated Web-Server" International Journal of Scientific & Engineering Research, Volume 7, Issue 6, June-2016



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