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Industrial Plant Automation

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Abstract: ***Now-a-days, marketing demands are increasing continuously. If you are unable to give the required results then it'll be hard to succeed. Our project satisfies this need by using a data analysis by making use of high-end technology. The proposed project is to provide industrial automation which is useful for monitoring and automating the devices for better maintenance. An Arduino Uno is used which monitors the components according to the given message, with the sensed information sent from the sensors. This paper discusses the working of temperature, voltage and product count of the machines. As the automation is Arduino based it easily monitors the temperature changes.***
Keywords: Arduino, Data Analysis, Temperature, Industrial Automation

I. INTRODUCTION

Today's highly increasing competitiveness over the industry for the most consistent products with a competitive price makes use of automated devices for better results and products. Industrial automation helps for the betterment of the product quality, it's reliability and also the production rate while reducing production and design cost by using new, innovative and integrated technologies and services.

In today's busy life, the company's owner or engineer can't always be at company and look over machines. And we know the drastic improvement in technology, they'll need some platform on which they can have the situation of machines from anywhere at anytime. Now consider a case, you need to monitor few parameters in the industry, say humidity in a paint shop machine or a critical thing like LPG gas leakage, then you need to be present in the industry/plant.

Our project meets this requirement, it monitors the parameters on the laptop screen and then we can take necessary actions when these parameters cross threshold limit.

The sensor information should be available at various locations simultaneously to take accurate decisions Our project provides the required solution to the problem. Using few sensors and Arduino we can fetch data from machines and can be displayed on the laptop screen. This job should be done accurately. Our system will analyze that particular data and determine exact loss or profit of company.

II. PROBLEM DEFINITION

Most of the times CEO or head of the company won't know the exact floor production detail, that's why company can loss huge amount of profit due to machine problem or raw data problem. This project will be helpful to take quick necessary decision at the high-level management. This project is helpful to maintain production smoothly as well as to save lot of wastage of money on production floor.

III. LITERATURE SURVEY

A. *Kamrul Islam, Weiming Shen, Xianbin Wang, "Wireless Sensor Network Reliability and Security in Factory Automation",* ***Volume: 42 , Issue: 6 , Nov. 2012***

Industries can benefit a lot by using integrated sensors as it uses their sensing and monitoring power, abilities to deliver sensed information. Proper use of wireless sensor networks (WSNs) can lower the rate of damages to the machines which helps in improving the efficiency and productivity of factory operations.

WSN can be accepted as viable and dependable technology in industry domain by ensuring the reliability and providing adequate security in crucial situations.

In this paper, we got to know the examined results of reliability and security challenges of WSNs. We also got to know the unique characteristics that differentiates the factory environment from the rest, also the reliability and security challenges and their solutions, and the analysed results of the existing WSN architectures and standards.

B. V. M. Chadeev, N. I. Aristova, "Control of Industrial Automation", November 2017

Automation is the only humane way to increase labour productivity in the country. The control theory of automation invariant to technological operation types, an invariant model and automation capabilities frontier are discussed. The connection between the cost of a robot and the production automation of its components is analyzed. An invariant theory allows estimation of the product cost in automated production. The synergetic effect is estimated arising from the industrial feedback, when robots are used to automate the production of elements of the robots themselves.

C. Lars Dürkop, Lukasz Wisniewski, Sascha Heymann, Benedikt Lücke, Jürgen Jasperneite, "Analysing the engineering effort for the commissioning of industrial automation systems", September 2015

Reconfigurable manufacturing systems (RMS) are seen as a key enabler for the required changeability of future production companies since they can reduce the engineering effort needed for the reconfiguration of existing or the construction of new production systems. However, it is not clear how the companies can benefit from RMS in detail. For example, the reduction of engineering effort cannot be expressed in figures by today. But such information is necessary to convince the industry of the advantages of the new production principle. Indeed, existing RMS paradigms like Service-Oriented Architectures are rarely used in the practice of automation. The basis for analyzing the advantages of RMS is an analysis of the status quo in the industrial automation. Regarding the engineering effort of current automation systems, this paper will present a case study considering the effort occurring during the commissioning process of a production system constructed by state-of-the-art components. The evaluation of the study can serve as a reference when comparing the engineering effort of RMS with today's systems.

IV. DESIGN AND IMPLEMENTATION METHOD

A. Hardware Requirements

1) LM35 Temperature Sensor

For measuring temperature we have used LM35 sensor which is a accurately Integrated circuit Temperature sensor, whose output voltage varies, based on the temperature change in the surrounding. It is a small and cheap and easily available IC. It is used to measure temperature anywhere between -55°C to 150°C. It can easily be interfaced with Arduino which is being used in the project. Power the IC by applying a regulated voltage like +5V (V_S) to the input pin and connected the ground pin to the ground of the circuit. Now, you can measure the temperate in form of voltage as shown below.

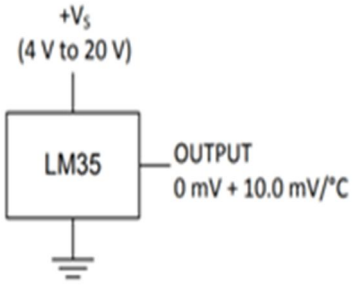

Figure 1: LM35 temperature sensor architecture

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2) *IR Speed Sensor:* A speed sensor is a type of tachometer that is used to measure the speed of a rotating object like a motor. There are many types of Speed Sensor. In this project, we have used a pretty inexpensive Infrared based Speed Sensor. In spite of the type of implementation, all speed sensor performs the same duty which is to help us determining the rotational speed of a rotating object
3) *0-25 Voltage Sensor:* This is a simple but very useful module as when using it with a 0-5V analog input range, you are able to measure a voltage up to 25V.
4) *Arduino Uno*

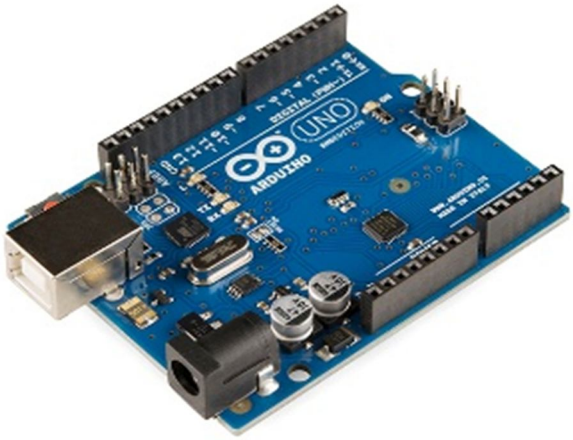


Figure 2: Arduino Uno

The Arduino Uno is an open-source microcontroller board. It is based on the Microchip ATmega328P microcontroller and is developed by Arduino.cc. The board consists of sets of digital and analog input/output (I/O) pins. The board consist of 14 Digital pins and 6 Analog pins. It is programmable using the Arduino IDE (Integrated Development Environment) using a type B USB cable. In this project it can be powered by the USB cable. An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. No external driver is required as the 16U2 firmware uses the standard USB COM drivers. On Windows, a .inf file is required. The Arduino Software (IDE) includes a serial monitor using which a simple textual data can be sent to and from the board.

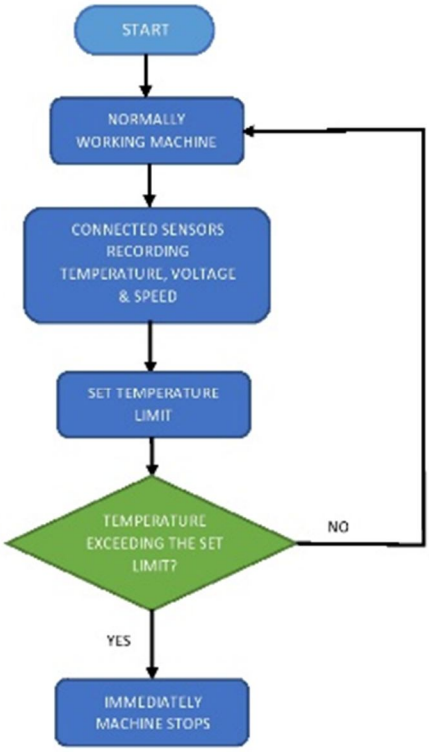
5) *Breadboard:* Breadboard is a base used for construction of prototypes of electronics. It is reusable as the solderless breadboard does not require soldering. And so it is easy to create temporary prototypes and experiment with circuit design. And that's the reason why solderless breadboards are also majorly used by students and in technological education.

B. Implementation

The existing system right now is that in a particular factory a person has to be there present at that particular time in the industry for recording the particular temperature, voltage or speed of that particular machine.
Physically recording the parameters takes a lot of time which is bad for fast and precise decision making if any problem regarding the machines arises. Because when the data is collected by the operator, it takes time to reach till supervisor then project manager then head of department and then finally CEO. By that time the machine is already too much damaged.
So, to overcome these problems of this existing system we designed this project in which directly the CEO can ask for these parameters on a web application which is developed on Django Framework using Python language.
This project consists of the following components:

1) Sensors recording the required data of the working machine.
2) Arduino fetching and database storing the recorded data.
3) Displaying the data on the Website.
4) To stop the working machine the moment when it crosses a mentioned limit.

The flowchart is shown as below:



The system architecture for Industrial Plant Automation is shown below: -

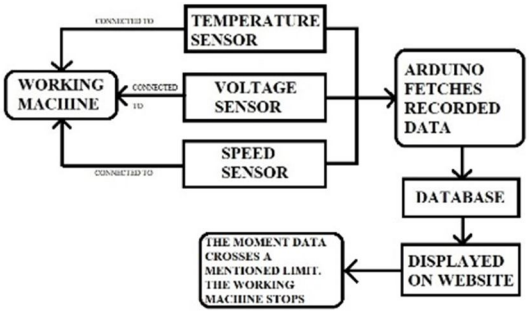


Figure 3: System Architecture of Industrial Plant Automation

V. RESULT

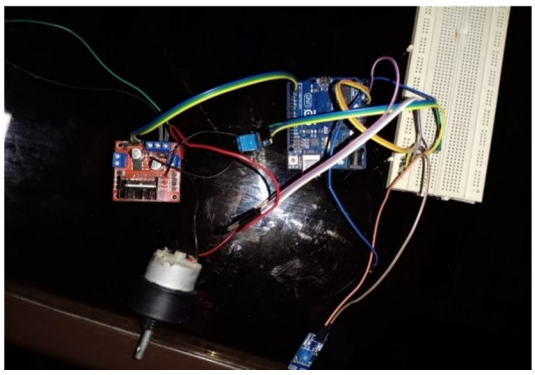


Figure 4: Hardware Module of the Project

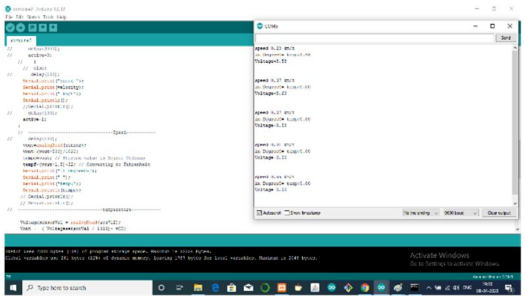
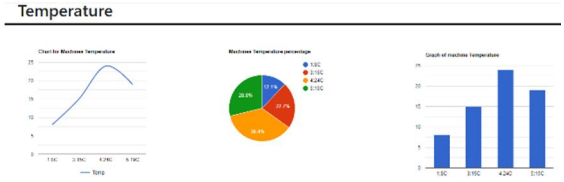


Figure 5: Parameters measured.

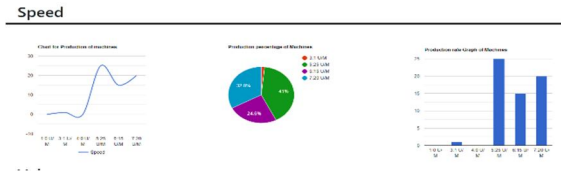
The recorded parameters displayed on website as shown below:



SECOND	1ST	3RD	4TH	5TH
TEMPERATURE	8°C	15°C	24°C	19°C

The temperatures recorded of the working machine is in Degree Celsius(°C). The LM35 temperature sensor record the temperature every second and keeps a record of it.

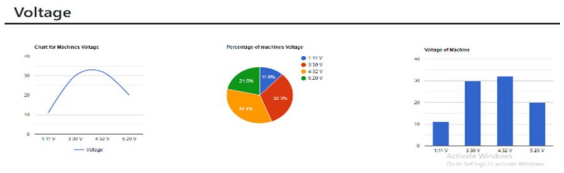
Here, according to our proposed project, if we set the temperature limit at 25°C, as soon as the sensor capture the temperature greater than 25°C it will automatically stop the machine and will let it to cool down. This helps in avoiding any severe damage to the machine which can eventually result in saving money. And also, this automation will help in reducing human labour which is the utter purpose of our project.



SECOND	1ST	3RD	4TH	5TH	6TH	7TH
SPEED (U/M)	0	1	0	25	15	20

The IR speed sensor captures the speed at which the products are produced or as in this project how many rotations are taking place. Here, the unit used is U/M which is Units/Minute.

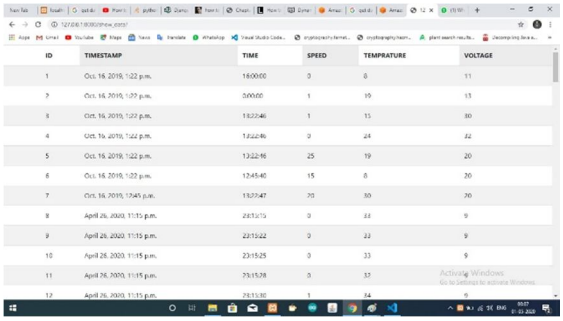
Using this parameter, we can actually keep a track of our progress and which can help in analysing the need to increase the production rate.



SECOND	1ST	3RD	4TH	5TH
VOLTAGE	11 V	30 V	32 V	20 V

Here, in this parameter, the voltage sensor is used to keep a record of the voltage used by the machine. The unit in which voltage is measured in Volts (V).

By this included parameter, we can keep track of the voltage consumed by the machine for a record.
The recorded parameters are also shown in a tabular format as shown below



ID	TIMESTAMP	TIME	SPEED	TEMPRATURE	VOLTAGE
1	Oct. 16, 2019, 1:22 p.m.	16:00:00	0	8	11
2	Oct. 16, 2019, 1:22 p.m.	0:00:00	1	16	13
3	Oct. 16, 2019, 1:22 p.m.	13:22:46	1	15	30
4	Oct. 16, 2019, 1:22 p.m.	13:22:46	0	24	22
5	Oct. 16, 2019, 1:22 p.m.	13:22:16	25	19	20
6	Oct. 16, 2019, 1:22 p.m.	12:45:40	15	8	20
7	Oct. 16, 2019, 1:22 p.m.	13:27:47	20	30	20
8	April 26, 2020, 11:15 p.m.	23:13:15	0	33	9
9	April 26, 2020, 11:15 p.m.	23:13:22	0	33	9
10	April 26, 2020, 11:15 p.m.	23:15:25	0	33	9
11	April 26, 2020, 11:15 p.m.	23:15:28	0	33	9
12	April 26, 2020, 11:15 p.m.	23:15:30	1	34	9

VI. CONCLUSION

We have implemented a Hardware part of the system which consist of LM35 temperature sensor, 0-25V voltage sensor, IR speed sensor and Arduino Uno and Breadboard. Also, we have implemented Software part using language Python and MySql. Our project provides the specified parameters anywhere anytime which eventually helps for better decision making for maintenance of machines. And it also stops the device after a particular limit which is set by the engineer working there. Here, we have implemented all the hardware and software components to give output as desired which is calculating three parameters Temperature, Voltage and Speed which is displayed in bar charts separately.

So, we can conclude that using this project we can ease the maintenance of devices or machines. Eventually, it can reduce the possibility of damage of devices or machines. Improves decision making as well as the safety and effectiveness of troops.

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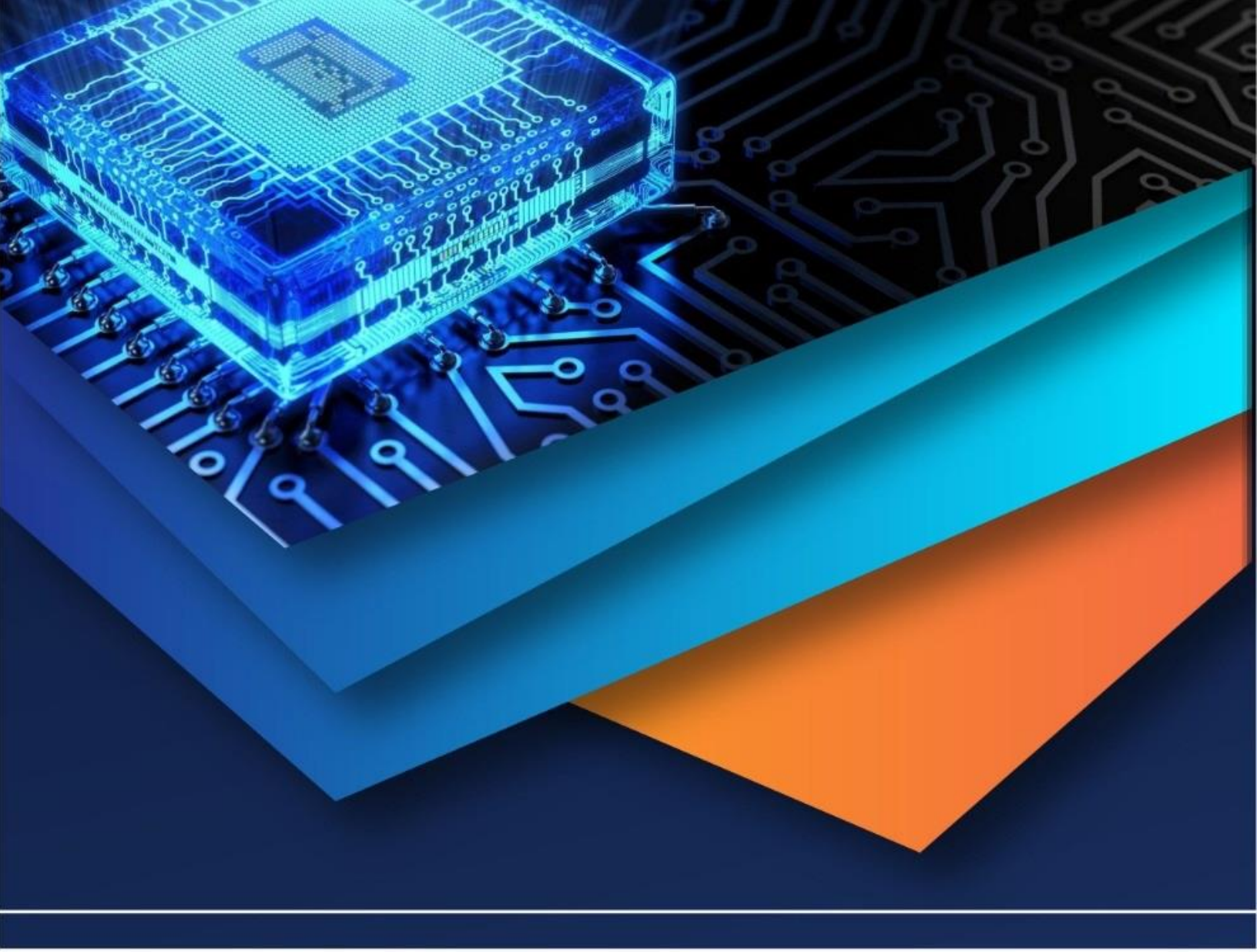
[1] Kamrul Islam, Weiming Shen, Xianbin Wang, "Wireless Sensor Network Reliability and Security in Factory Automation", Volume: 42, Issue: 6, Nov. 2012
[2] V. M. Chadeev, N. I. Aristova, "Control of Industrial Automation", November 2017
[3] Lars Dürkop, Lukasz Wisniewski, Sascha Heymann, Benedikt Lücke, Jürgen Jasperneite, "Analysing the engineering effort for the commissioning of industrial automation systems", September 2015



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