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IoT based Powder Coating Process Monitoring

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Abstract - *Powder coating is a process of applying paint in the form of powder spray. The powder spraying is possible due to adhesion property over the surface of metal. The adhesion property of the metal is formed because of the pretreatment process which includes the removing of dust, grease, rust and oil of the metal. So to achieve a good quality powder coating the pretreatment should be done properly.*
1. Part preparation or the pre-treatment
2. The powder application
3. Curing
The whole procedure of powder coating including pretreatment, we have done automation of it by using IOT technology. There are many devices that are used as microcontrollers such as raspberry-pi, esp8266 nodemcu which are Wifi devices. We have used esp8266 nodemcu as it is cheap, reliable and easy to use.

Keywords: Powder coating monitoring, IOT technology, esp8266 nodemcu.

1. INTRODUCTION

The pretreatment for Al and ms includes Degreasing, Water rinse, Derusting, Phosphating, Passivation, Chromatising, more water rinse and drying. For each there is fixed time allotted so that the metal is dipped for a fixed time. Likewise we have 14 tanks which are needed or pretreatment containing degreasing and all. We have made a hardware which senses the metal whenever the metal is dipped and then starts the timer. Further we have covered two parameters:

1. Tank data monitoring.
2. Oven temperature monitoring.

2. BLOCK DIAGRAM

The basic block diagram that shows the inputs and outputs given to our microcontroller esp8266 nodemcu. Here we have used inductive proximity sensor as which senses metal. This sensor is helpful in detecting basket which is dipped in the tank as the basket is made of metal.

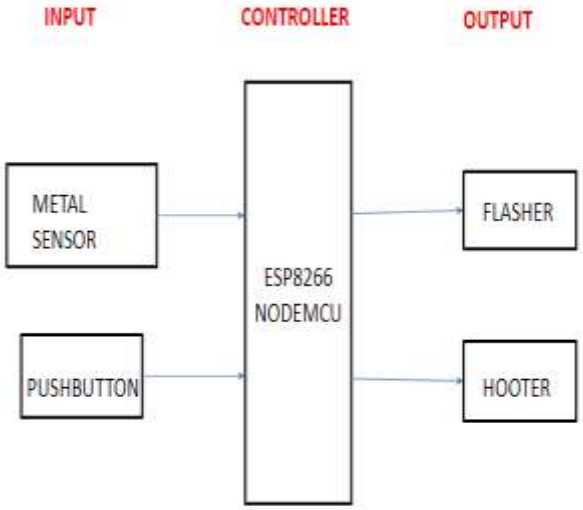


Fig -1: block diagram of hardware

2.1 WORKING

The working is such that whenever the basket containing raw metal is dipped into the tank the proximity sensor detects the basket as the basket is made of metal .When the metal is detected the timer starts in the controller. Every tank has its specified time. If the basket is removed before the time then alarm indications flasher and hooter turns on and off continuously. Again when the basket is dipped into the tank the timer starts from the time where it has previously stopped. After the specified for the tank is over, alarm indications turns continuously on and off indicating the operator to remove basket from the tank.

2.2 OVEN TEMPERATURE MONITORING

Oven is required in powder coating method as it provides perfect adhesion of powder particles on metal. The oven temperature is maintained at 200°C-230 °C. For this we have used microcontroller esp8266 Nodemcu, MAX31865 RTD amplifier, PT100 RTD as our main components. This whole process comes in the curing procedure of powder coating.

Fig -2: Nodemcu

Fig -3: MAX31865 RTD amplifier

Fig -4: PT100 RTD

3. FRONTEND

3.1 FOR TANK MLONITORING

A frontend is made by us such that it shows when the basket has been dipped in the tank and when it has been taken out i.e in time and out time of the basket. The data of all tanks are sent by wifi using Arduino ide. Hence we get all data on our frontend webpage. Next we have also taken oven temperature on our front end page.

Below is the sample data that we get to see for tanks:

Table -1: Sample Table format

Sr_no.	Tank no.	In time	Out time	date
1.	2	12:14:23	12:24:45	7-06-2019
2.	3	12:25:10	12:26:20	7-06-2019
3.	5	12:27:00	12:28:14	7-06-2019
4.	7	12:29:34	12:30:40	7-06-2019
5.	8	12:34:23	12:35:45	7-06-2019
6.	9	12:36:00	12:37:54	7-06-2019
7.	10	12:38:46	12:40:00	7-06-2019

From the above information, we can see that in time and out time of each tank that we can monitor on our webpage. We can calculate the total time for which the basket is dipped in the tank by using formula:

Total time = Out time – In time

Example: For tank no. 2:-

Out time = 12:24:45 & in time = 12:14:23

Therefore, Total time = Out time – in time

= 12:24:45-12:14:23

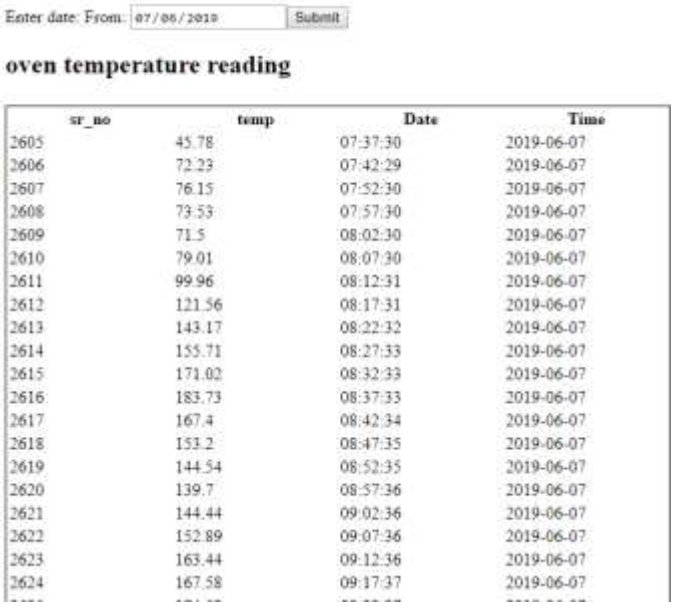
= 00:10:22

Hence, the basket was dipped for 10 minutes and 22 secs.

So likewise, we can calculate all the total time for all tanks.

3.2 FOR OVEN TEMPERATURE

For creating a webpage for showing the temperature of the oven, we have used Wifi router to send temperature from arduino IDE to our database which is in WAMP server. The microcontroller nodemcu made this easy for us as it is a Wifi device. Whatever data we get is stored in our database. We have kept the table in database simple, only collecting the temperature, time and date. We can thus get a daily data for the oven temperature.


Enter date: From: 07/06/2019 Submit

oven temperature reading

sr_no	temp	Date	Time
2605	45.78	07:37:30	2019-06-07
2606	72.23	07:42:29	2019-06-07
2607	76.15	07:52:30	2019-06-07
2608	73.53	07:57:30	2019-06-07
2609	71.5	08:02:30	2019-06-07
2610	79.01	08:07:30	2019-06-07
2611	99.96	08:12:31	2019-06-07
2612	121.56	08:17:31	2019-06-07
2613	143.17	08:22:32	2019-06-07
2614	155.71	08:27:33	2019-06-07
2615	171.02	08:32:33	2019-06-07
2616	183.73	08:37:33	2019-06-07
2617	167.4	08:42:34	2019-06-07
2618	153.2	08:47:35	2019-06-07
2619	144.54	08:52:35	2019-06-07
2620	139.7	08:57:36	2019-06-07
2621	144.44	09:02:36	2019-06-07
2622	152.89	09:07:36	2019-06-07
2623	163.44	09:12:36	2019-06-07
2624	167.58	09:17:37	2019-06-07

Fig -5: Temperature data

4. GRAPHICAL REPRESENTATION

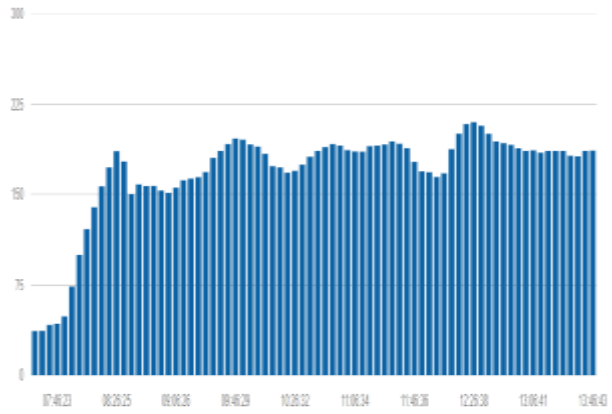


Chart -1: Oven Temperature VS time

Graphical representation makes a complicated thing to view in an easier way so that we can derive conclusions and results from it. We have therefore created a graphical representation using morris.js platform to plot the temperature VS time graph for oven temperature. Chart-1 is the graphical image that shows temperature more meaningfully on webpage.

The morris.js platform of chart made us easy to make this graphical representation which fetches data from database of WAMP server and shows the required graph.

5. CONCLUSION

We can conclude that we can gather all the tank data which contains its in time and out time. From in time and out time we can specify for how much time the basket was dipped in the tank. Thus we can calculate this for all tanks and compare with the actual time for which the basket is dipped in that tanked. Thus we can improve performance of pretreatment by daily monitoring of tanks. Similarly we have monitored oven temperature which is used for curing purpose after when the powder spray is applied on the metal. By monitoring the temperature we can specify whether proper temperature is maintained or not in the oven. Thus, the curing performance can also be improved after the results.

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