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Automation System to Control the Movement of the Inlet Conveyor to the Boiler Furnace and the Exhaust Draft

[1]Pulluri Harish, [2]V.Goutham, M.Nagaraju
[1,2]Student, M.Tech, [3]Associate Professor,
Department of Power Plant Engineering and Energy Management
Turbo Machinery Institute of Science and Technology

ABSTRACT

Records the particular commercial parameter similar to temp, wetness, and communicates the idea in order to pc, in the event that any kind of these valuations will not be throughout restriction next pc communicates wireless demand to be able to management the idea. Industrial Control Systems are typically used in industries such as electrical, water, oil, gas and data. Based on information received from remote stations, automated or operator-driven supervisory commands can be pushed to remote station control devices, which are often referred to as field devices. Field devices control local operations such as opening and closing valves and breakers, collecting data from sensor systems, and monitoring the local environment for alarm conditions. In this project we made a prototype of such system. We use this automated system to manage the furl inlet of the thermal station and also the exhaust system to avoid material wastage.

KEYWORDS- automation, material wastage, wireless demand.

INTRODUCTION

A **thermal power station** is actually driven by steam where water is heated and steam is producing which spin the turbine to produce electricity. After the steam passes through the turbine, the steam is condensed in a condenser and recycled to where it was heated; this is known as a Rankine cycle. The greatest variation in the design of thermal power stations is due to the different fossil fuel resources generally used to heat the water. Some prefer to use the term *energy center* because such facilities convert forms of heat energy into electrical energy. Certain thermal power plants also are designed to produce heat energy for industrial purposes of district, or desalination of water, in addition to generating electrical power. Globally, fossil fueled thermal power plants produce a large part of man-made CO_2 emissions to the atmosphere, and efforts to reduce these are varied and widespread.

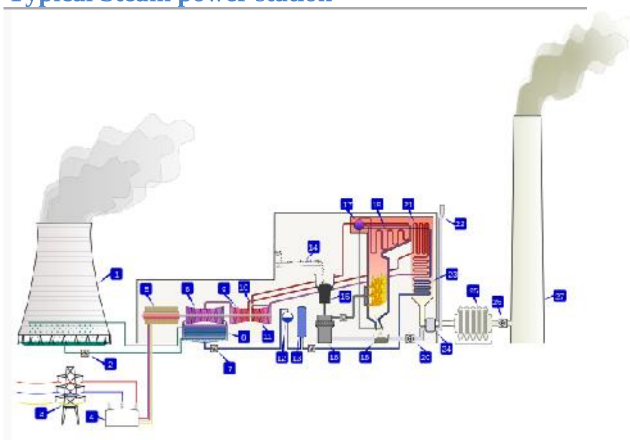
Overview

Coal, nuclear, geothermal, solar thermal electric and waste incineration plants, as well as many natural gas power plants are thermal. Natural gas is frequently combusted in gas turbines as well as boilers. The waste heat from a gas turbine can be used to raise steam, in a combined cycle plant that improves overall efficiency. Power plants burning coal, fuel oil, or natural gas are often called fossil. Some biomass-fueled thermal power plants have appeared also. Non-nuclear thermal power plants, particularly fossil-fueled plants, which do not use co-generation are sometimes referred to as *conventional power plants*.

Commercial electric utility power stations are usually constructed on a large scale and designed for continuous operation. Electric power plants typically use three electrical generators to produce alternating current (AC) electric power at a frequency of 50 Hz or 60 Hz. Large companies or institutions may have their own power plants to supply heating or electricity to their facilities, especially if steam is created anyway for other purposes. Steam-driven power plants have been used in various large ships, but are now usually used in large naval ships. Shipboard power plants usually directly couple the turbine to the ship's propellers through gearboxes. Power plants in such ships also provide steam to smaller turbines driving electric generators to supply electricity. Shipboard steam power plants can be either fossil fuel or nuclear. Nuclear marine propulsion is, with few exceptions, used only in naval vessels. There have been perhaps about a dozen turbo-electric ships in which a steam-driven turbine drives an electric generator which powers an electric motor for propulsion.

Combined heat and power plants (CH&P plants), often called *co-generation plants*, produce both electric power and heat for process heat or space heating. Steam and hot water lose energy when piped over substantial distance, so carrying heat energy by steam or hot water is often only worthwhile within a local area, such as a ship, industrial plant, or district heating of nearby buildings.

Typical Steam power station



Typical diagram of steam power station

Boiler structural:

The boiler structural is divided into two parts.

- Supporting Structure
- Galleries and stair ways

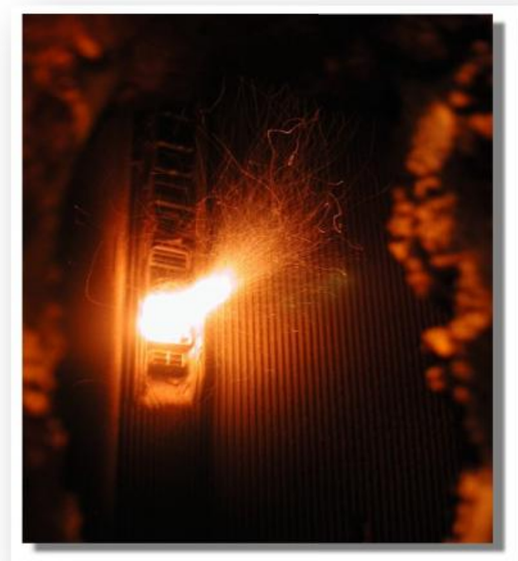
SupportingStructures: Boilers supporting structure consists of a systematic arrangement of columns stiffened with horizontal beams and vertical diagonal bracings and comprise of low carbon steel material. It is composed of 18 main columns and 12 auxiliary columns. The main columns support the main boiler components viz. drum, water wall membrane, panels, super heaters, reheaters, economisers, air preheater, burners and galleries at various levels. The auxiliary columns, supports the boiler platforms and other ducts coming in that region.

The total weight of supporting structures is about 970 M.T.

Galleries and stairways: Galleries and stairways around the combustion and heat recovery areas are provided for proper approach to the boiler. Stairways on both the side of boiler are provided. All the floors are covered with floor gratings of required depth for walkway and are tig welded to the structure. The total weight of Galleries and stairway are 900 M.T.

Furnace

A boiler furnace is that space under or adjacent to a boiler in which fuel is burned and from which the combustion products pass into the boiler proper. It provides a chamber in which the combustion reaction can be isolated and confined so that the reaction remains a controlled force. In addition it provides support or enclosure for the firing equipment



High energy Arc type Igniter

High Energy Arc type electrical igniters are provided which can directly ignite the heavy fuel oil. The main features of this system are:

- An exciter unit which stores up the electrical energy and releases the energy at a high voltage and short duration.
- A spark rod tip which is designed to convert the electrical energy into an intensive spark.
- A pneumatically operated retract mechanism which is used to position the spark rod in the firing position and retract to the non-firing position. Each discrete spark provides a large burst of ignition energy as the current reaches 2 peak value of the order of 2000 amps. These sparks are effective in lighting

of a well atomised oil spray and also capable of blasting off any coke particle or oil muck on the surface of the spark rod.

- For a reliable ignition of oil spray by the HEA igniter, it is very much necessary to maintain the following conditions:

a) The atomisation is maintained at an optimum level. All the atomising parameters suchas oil temperature, steam pressure, clean oil gun tips etc., are maintained without fail.
b) The atomising steam shall be with a minimum of 20 degree superheat. The cold legs must be avoided or maintained to a minimum level.
c) The burner fittings are well traced and insulated. Thesparkrod tip is locatedcorrectly at the optimum location.
d) The oil gun location with respect to the diffuser and the diffuser location with respect tothe air nozzleare maintained properly.
e) The control system is properly tuned with igniter operation. The time of commencing ofall the operational sequences is properly matched.It may become necessary to close the air behind the igniters, during the light off periodfor reliable ignition. This must be established during the commissioning of theequipment and proper sequences must be followed.

- The following facts must be born in mind to understand the igniters and the systemclearly :
  The spark rod life will be drastically reduced if left for long duration in the advanced condition when the furnace is hot.
  Too much retraction of spark rod inside the guide tube will interfere with nozzle tilts and may spoil the guide tube.
  A minimum discharge of 300 Kg/hr of oil is essential for a reliable ignition. A plugged oil
  gun tip may result in an unsuccessful start.
  A cold oil gun and hoses cause quenching of oil temperature and may lead to an unsuccessful start. In such cases, warming up by scavenging prior to start is necessary.

FUEL FIRING AND FEEDING SYSTEM

Most coal fired power station boilers use pulverised coal, and many of the larger industrial water tube boilers also use this pulverised fuel. This technology is well developed, and there are thousands of units around the world, accounting for well over 90% of coal fired capacity.

- The coal is pulverised to a fine powder, so that less than 2% is +300 micro meter (μm) and 70-75 % is below 75 microns, for a bituminous coal. It should be noted that too fine a powder is wasteful of grinding mill power. On the other hand, too coarse a powder does not burn completely in the combustion chamber and results in higher unburnt losses.

- The pulverised coal is blown with part of the combustion air into the secondary boiler plant through 2 series of burner nozzles. Secondary and tertiary air may also be added. Combustion takes place at temperatures from 1300-1700ºC, depending largely on the coal grade. Particle residence time in the boiler is typically a to 5 seconds, and the particles must be small enoughfor complete combustion to have taken place during this time.

- This system has many advantages such as ability to fire varying quality of coal, quick responses to changes in load, use of high pre-heat air temperatures etc.

- One of the most popular systems for firing pulverised coal is the tangential firing using four burners corner to corner to create a fireball at the center of the furnace.

BASIC WORKING OF OUR CONVEYOR SENSOR MECHANISM

This project is mainly used to control the speed of a conveyer belt by taking inputs from a temperature sensor. The speed of the motor will be inversely proportional with the temperature with the maximum and the minimum limits being 20 degrees Celsius and 60 degree Celsius. The speed of the motor will be maximum at 20° and Zero at 60°.

Components used:

1. Arduino.
2. UNL2803.
3. 7805 voltage Regulator.
4. Adapter 12v 1000mAh.
5. High torque Gear Head Motor.
6. LM35 Temperature sensor.

Concepts used:

1. Pulse Width Modulation
2. Analog to Digital Conversion

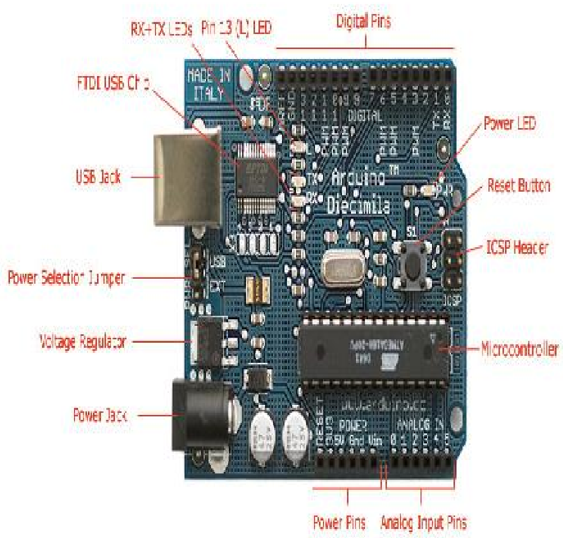
Here is an explanation and working of each component:

Arduino:

This is an open source development platform for embedded applications. Housing an AtMega328 micro controller, this board can be use to solve a wide variety of complex tasks. It has on board Analog to digital conversion and Pulse Width Modulation channels. This board can be programmed using a software provided by Arduino. It can be downloaded here.

http://arduino.cc/

This image explains the features of this board.



Photograph by SparkFun Electronics. Used under the Creative Commons Attribution Share-Alike 3.0 license.

The sensor we are using gives out an analog output which is proportional to the temperature. So it is connected to an Analog pin of this board. Whereas the UNL2308 IC which is used to drive the motor is a Digital IC. So it is connected to a digital PWM pin of this board.

UNL2803:

This is a Darlington pair IC that is used for driving higher loads like Relays, Motors etc.. Since the output pin of a micro controller does not provide enough power to directly drive a motor we use this as an intermediate.

Whenever the PWM pin is logically high the motor starts turning and whenever the pin is low the motor stops turning.

7805 Voltage regulator:

The controller in the board requires 5 Volts to function properly. But we are giving a supply of 12 volts. This voltage is dropped to 5 volts using 7805 IC. The rest is converted to heat. That's the reason you find a small heat sink attached to the IC.

The Input to this IC will can be between 7V and 25V where as the output will be 5 Volts.

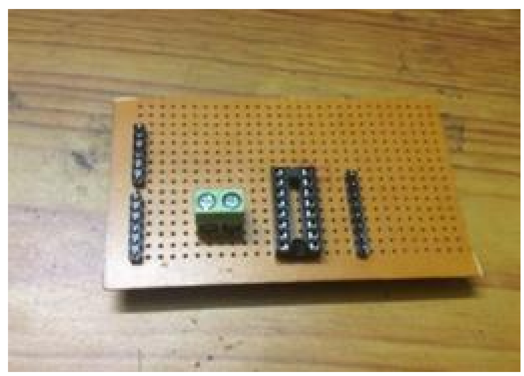
Datasheet:

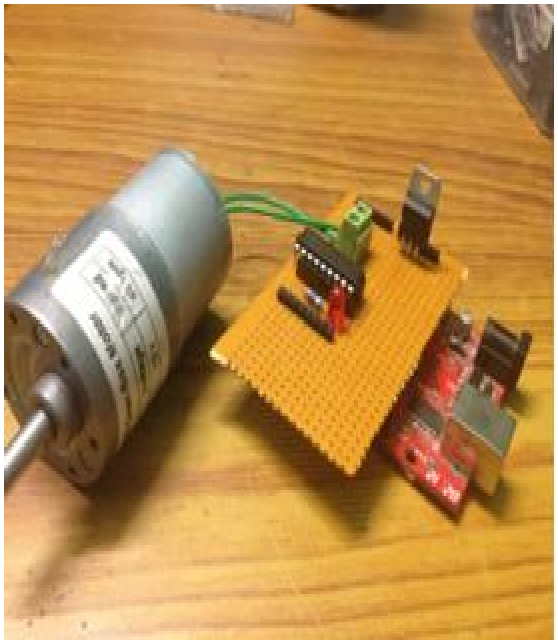
Adapter:

The adapter we are using is of 12Volts and 1000mAh current. This is connected to a DC jack provided on the Arduino Board.

High Torque Gear Head Motor:

Since conveyer belt adds up to the load we had to use a 25Kg-cm torque DC motor which runs at a speed of 30RPM. The gear system used in this motor is Spur type.



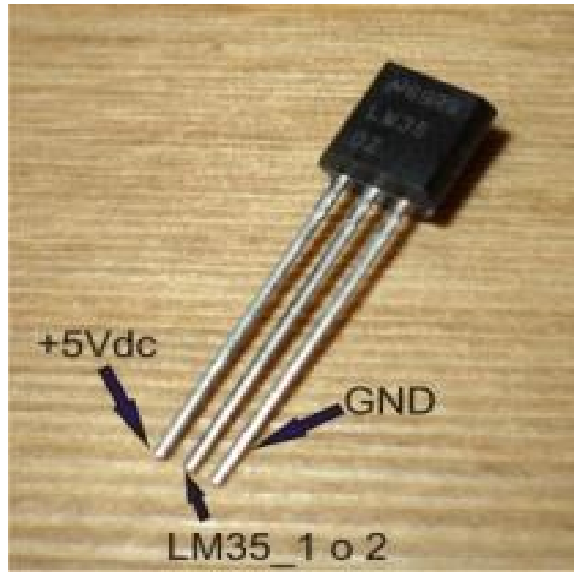


Advantages

The advantages of sensor include:

- High accuracy
- Low drift
- Wide operating range
- Suitability for precision applications.]

LM35 Temperature Sensor:

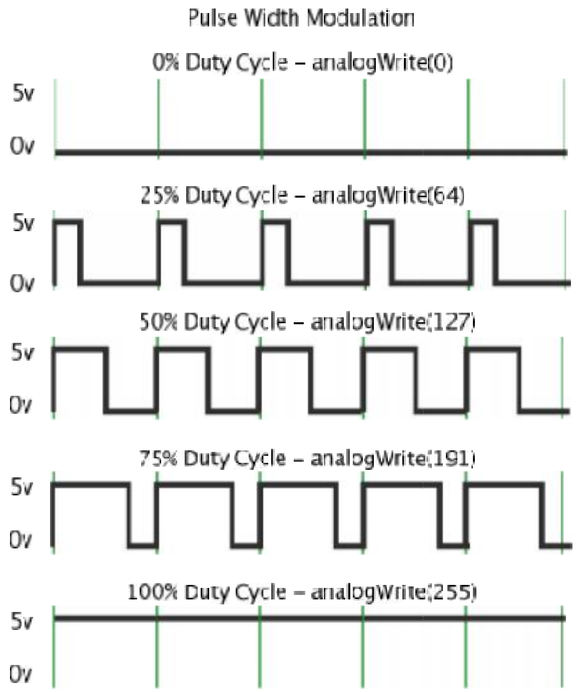


This is a 3 pin precision centigrade temperature sensor that gives out readings in voltage based on the temperature. Higher the temperature, greater will the voltage be.

Pulse Width Modulation

This is a technique mainly used to control the speed of a DC motor or vary the intensity of an LED. All that is done in this is toggling a pin. Making it high and low at quiet a fast rate. In this case we are toggling the PWM pin 500 times a second.

In one high and low cycle the time for which the pin stays high is called high time and the rest is called as low time. Now the percentage of the high time over the low time decides the speed of the DC motor.



If high time is 100% and low time is 0% the speed will be 100%
If high time is 50% and low time is 50% the speed will be 50%
If high time is 0% and low time is 100% the speed will be 0%
This PWM is set by a function analog Write(); in Arduino.

CONCLUSION

Hence we have developed a mechanism which looks over the optimal use of coal fuel wherever its feed is done by a conveyor belt.
For the optimal usage of the fuel used here i.e. coal we have connected the functioning of the conveyor to the temperature in the furnace. The furnace temperature once on reaching the required level must be maintained at that and we cannot waste coal by maintaining the same feed. To solve this problem we have linked the driving motor of the conveyor to the temperature sensor which has been embedded on the furnace wall.

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Pulluri Harish his perusing (M.Tech) from Turbo Machinery Institute of Science and Technology. His current research on Power Plant Engineering and Energy Management

V.Goutham he is perusing mtech from Turbo Machinery Institute of Science and Technology. His current research on Power Plant Engineering and Energy Management

M.Nagaraju he is working as Associate Professor in Turbo Machinery Institute of Science and Technology Hyderabad