Special Issue Published in International Journal of Trend in Research and Development (IJTRD), ISSN: 2394-9333, www.ijtrd.com

Microcontroller Based Automatic Control & Smart Protection of Coal Conveyor System

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Abstract - Coal Conveyor is important in any thermal power plant. The fault in the conveyor may lead to reduced efficiency and accidents in the plant. The main reason for the fault is due to increase in temperature and tearing of the belt. Exceeding temperature limit signals from the temperature sensor are send to microcontroller initiating the buzzer and cooling fan. IR sensor senses the motion and detects any tear in the conveyor belt. In this project a second conveyor belt is used in such a way that once the first conveyor stops due to any fault the second conveyor continues the coal handling process.

Keyword - *Conveyor, ATMega328 microcontroller, Temperature sensor, IR sensor, DC Gear Motor, Brushless DC Fan.*

I. INTRODUCTION

A. Coal Handling System (CHS)

Coal is the main component in thermal power station. The effective usage of coal leads to efficient power generation. The amount of coal and Fly ash should be handled properly in such a way that the production is not altered.

B. Conveyor System

For Effective Coal Handling System, the conveyor system should he 100% reliable. The wear and tear of the conveyor belt is accounted and for effective controlling, a microcontroller can be used in conveyor system.

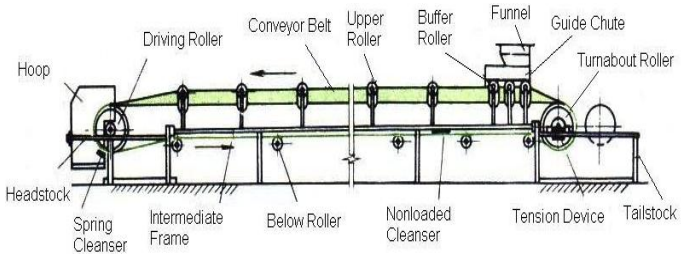

Figure 1: Conveyor Components

II. EXISTING METHOD

For the operation of the conveyor it is needed to set the receiving conveyor system first before starting the feeding conveyor .To stop the conveyor, the operation will be reversed i.e. from upstream towards downstream. So if the conveyor is stopped, the upstream conveyors should stop automatically. This is the conveyor sequential operation. Also it is necessary to stop the conveyor if the rotation of the conveyor becomes slow which is known as zero speed protection. The Existing system will stop the conveyor and additionally it stops the upstream system serially.The conveyor system is operated continuously and it may result in overheating of belt and tear ups. These problems are not monitored automatically in the industry. This can be identified only after the occurrence of the fault. These processes are carried out manually.

III. PROPOSED METHOD

A temperature sensor is used which senses the temperature and if it exceeds the limit a buzzer is triggered and the cooling fan goes to ON condition. IR sensor is used to sense the tear and also the motion of the conveyor belt and it automatically stops the conveyor if the belt is damaged and stops the motor if there is no pay load on the conveyor belt. The operation of second conveyor is initiated when the first conveyor stops due to any fault. All the components are controlled automatically using ATMEL microcontroller.

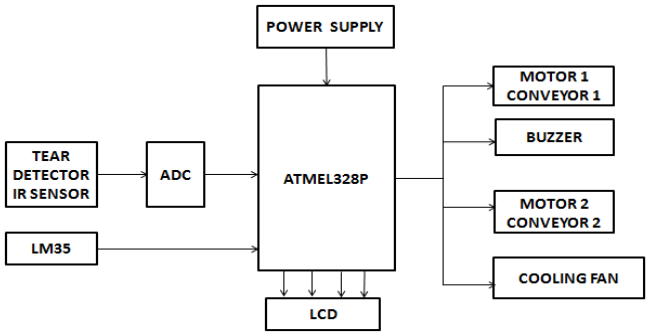

Figure 2: Block diagram

IV. HARDWARE COMPONENTS

A. Power Supply

The supply given is the +5V D.C.The incoming power is 230V A.C, there is a need to convert it into +5V D.C. The input A.C. supply is stepped down from 230V to 9-0-9V. The rectifier consists of diodes D1 and D2 makes the supply D.C. that is, unidirectional waveform.

B. Atmel

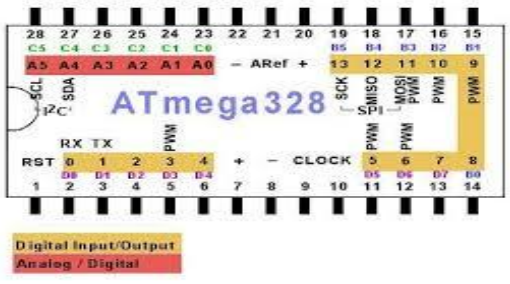

Figure 3: Pin Configuration of ATmega328

Power-on reset and programmable brown-out detection. It has internal calibrated oscillator. External and internal interrupt

sources. Operating voltage : 1.8 to 5.5 v. Temperature range: -40 c to 85 c. High performance and low power consumption. Easy to write and erase the program instructions. Fully static operation. Highly endurance non-volatile memory segments.

C. Temperature Sensor

Operating range -55 c to 150 c. It is used to measure temperature more accurately than thermistor. It generates higher output voltage than thermocouples. It may not required that the output voltage be amplified. Scale factor is .01v/c.

D. IR Sensor

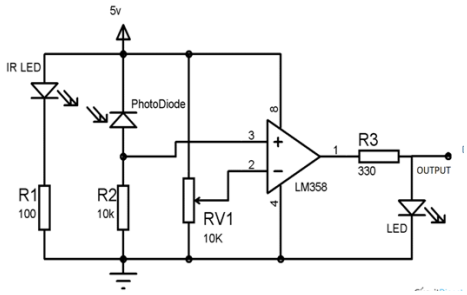

Figure 4: IR Sensor Circuit Diagram

An infrared sensor is an electronic instrument which is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation. Infrared sensors are also capable of measuring the heat being emitted by an object and detecting motion.

E. DC Gear Motor

Operating range: 4v to 12v. Rpm: 30 at 12v.Torque range: 5kg/c. The gear motors are designed to reduce the output speed while increasing its torque. The increasing torque is inversely proportional to reduction in speed.

F. Buzzer

In this we are using piezo electric buzzer. Operating voltage: 1.5 to 12v. It produces sound range from 2 to 4khz. It is used to produce an alarming signal when there is an fault in the process.

G. Brushless DC Fan

If the temperature reaches above the set level the fan will automatically runs. The cooling fan will automatically reduces the temperature and the normal process will goes on. Operating range: 8v -13.8v. Operating temperature range: -10c to +70c. Less required maintenance due to absence of brushes. High output power and low voltage drop across brushes.

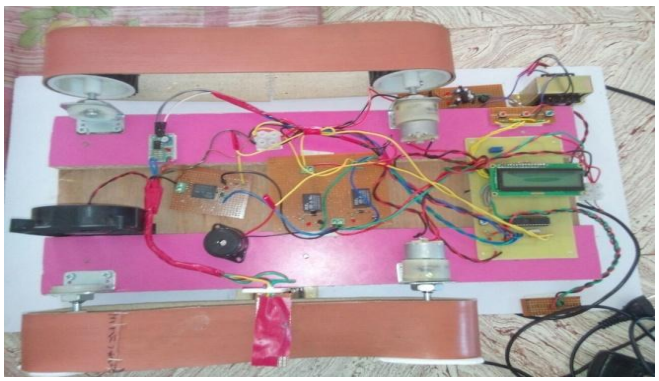

Figure 5: Two Conveyor System

CONCLUSION

ATmega 328 microcontroller effectively controls the movement of the conveyor belt and reduces the risk factors and also the continuous coal handling process is done with the help of second conveyor, which comes to the operating state when the first conveyor belt is damaged. This process effectively achieves the automatic coal handling process. Though it is designed keeping in mind about the need for industry, it can be extended for other purposes such as commercial & research applications. This feature makes this system as the base for future systems.

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