# Modeling And Simulation of Machine Overheat Detection With Alert System

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***Abstract***- *In industrial machines different alarms are embedded in machines controllers. They make use of sensors and machine states to indicate to end-users various information (e.g. diagnostics or need of maintenance) or to put machines in a specific mode (e.g. shut-down when thermal protection is activated). More specifically, the alarms are often triggered based on comparing sensors data to a threshold defined in the controllers software. In batch production machines, triggering an alarm (e.g. thermal protection) in the middle of a batch production is crucial for the quality of the produced batch and results into a high production loss. This situation can be avoided if the settings of the production machine (e.g. production speed) is adjusted accordingly based on the temperature monitoring. Therefore, predicting a temperature alarm and adjusting the production speed to avoid triggering the alarm seems logical. In this paper we show the effectiveness of Least Squares Support Vector Machines (LS-SVMs) in predicting the evolution of the temperature in a steel production machine and, as a consequence, possible alarms due to overheating. Firstly, in an offline fashion, we develop a micro controller based heat detector model, where a systematic model selection procedure allows to carefully tune the model parameters. Afterwards, the Micro controller model is used online to forecast the future temperature trend. Finally, in this project we are detecting machine overheat by micro controller.*

***Keywords***- embedded systems, PCB, threshold, MicroController.

## I. INTRODUCTION

In recent years, server overheating has become one of the most important concerns in large-scale data centers. Due to the considerations such as real estate and integrated management, data centers continue to increase their computing capabilities by deploying high-density servers (e.g., blade servers). As a result, the increasingly high server and thus power densities can lead to some serious problems. First, the reduced server space may result in a greater probability of thermal failures for various components within the servers, such as processors, hard disks, and memories. Such failures may cause undesired server shutdowns and service disruption. Second, even though some components may not fail immediately, their lifetimes may be significantly reduced due to overheating. It is reported in that the lifetime of an electronic device decreases exponentially with the increase of the operating temperature. Finally, the generated heat dissipation can also lead to negative environmental implications. Therefore, it is important for each server component to run at a temperature below its overheating threshold.

However, in today's data centers, how to precisely detect whether any component in a server is overheating remains an open question. The current practice of detecting and monitoring an over- heating server can be divided into two categories. The first category is a coarse-grained approach that only uses the temperature at a proxy component, e.g., CPU or at a fixed location, e.g., the server inlet, for server overheating monitoring. This is in contrast to the fact that different components in a server may have different over-heating thresholds, which are closely related to their respective thermal failure rates and expected lifetimes. Relying on a single.

## II. LITERATURE REVIEW

Prof. Mukesh Tiwari, Mr. Manish Shrivastava (2013) [2]was published to develop this project is from an machine overheat detection with alert blog known as "heat detector". The article talks about the need of such a project to be and how it would ease the existing industries area that is in place today. In the traditional system, several people are required to monitor a machine lot so as to assess the number of free slots and match it with the capacity of a working machine. If this system is replaced with an automated indicator the number of People employed would reduce. The article talks about this scenario. The need for each component is also elucidated. The heat detector is the heart of this project. The board is controlled using a program that is written on it. The program assessed the number of switches presses where each switch corresponds to a slot and subtracts it from the capacity or the total number of slots present. The literature also describes the common anode display used to display the number of free slots calculated using the program. LED is used to display the number of free slots that are empty. The article also talks about the use of a detection system .

KushagraKumar Choubey, Mousam Sharma (2015) [3] was published that described a design of temperature controller that drives the relays for switching the system ON/OFF for controlling the temperature. In 1959, Some improvements were proposed to a simple temperature controller using a Pt resistance thermometer as one arm of an ac resistance bridge that was published by Wilson and has been operating in many laboratories. Here a transistor preamplifier is used to activate a relay that turns ON/OFF the system. In March 2010 in an IEEE publication, another intelligent temperature control system based on Microcontroller AT89S51 was proposed where the temperature measurement device used consists of the 1- Wire bus digital temperature sensor DS18B20 and the temperature monitoring over a certain range could be achieved. Here in this paper a I2C based Digital Temperature sensor IC is used to measure the temperature that measures with a much higher resolution and accuracy. For the control of temperature with better precision a PWM signal is used to drive a MOSFET that in turn controls the current that drives the heating element.

Prof.P. V. Gawande. (2013) [4] explains the reliability data of fire detection and alarm systems was made resulting to rough estimates of some failure frequencies. No theoretical or technical articles on the structure of reliability models of these installations were found. Inspection records of fire detection and alarm system installations by SPEK were studied, and transferred in electronic data base classifying observed failures in failure modes (59) and severity categories guided by freely written records in the original data. The results of that work are presented without many comments in tabular form in this paper. A small sample of installations was collected, and number of components in them was counted to derive some distributions for determination of national populations of various components based on know total amount of installations. From NPPs (Loviisa, Olkiluoto and Barseb‰ck) failure reports were analysed, and observed failures of fire detection and alarm systems were classified by severity and detection mode. They are presented here in tabular form for the original and new addressable systems. Populations were counted individually, but for all installations needed documents were not available. Therefore, presented failure frequencies are just first estimates, which will be refined later.

Syed Sayeed Ahmed, et.al (2016) [5] was a period of tremendous growth in the popularity of smoke detectors. A growth in research and the general knowledge base regarding the operation of smoke detectors accompanied this. Most of the practical means of estimating the response of smoke detectors were derived from this era and have remained largely unchanged. By itself, this fact is not significant. However, there have been significant advances in detector technology since that time, including more uniform smoke entry characteristics among detector technologies, reduced sensitivity to nuisance (i.e., non-fire) sources, algorithm-based detection and multi-sensor, multi-criteria detection. Research into the current trend toward the development of fire detection algorithms and multi-sensor, multi-criteria fire detectors is prevalent in the literature in the last decade [e.g. 1996; Milke and McAvoy, 1997; Rose-Pehrsson, et al., 2000; Wong, et al., 2000]. However, advancement in the research behind predicting the response of common spot-type ionization and photoelectric detectors has been minimal. More fundamental approaches exist to model the detectors, though these methods have not been advanced sufficiently to prove practically useful for modeling smoke detectors.

## III. MOTIVATION

In traditional system, when the machine working in the industry due to over voltage and some mishap, machine become overheat it cause to damage in industry therefore we need a device that can control this type of happenstance , there we will use the heat detector that reduce the human effort , if some error and any type of any disturbance come in the circuit like over voltage therefore we use heat detector device that give the signal if any paranormal disturbance occur in the circuit.

## IV. OBJECTIVE

The main objective of the project is to design a programmable sequential switching of any load using embedded system based micro controller concept. It uses micro controller from the 8051 family, which is of 8-bit. The development of this application requires the configuration of micro controller architecture - that is, the selection of the machines, and writing debugging of the application program. In this project, the clock plays an important role, wherein it is used in these modes: the set mode, auto mode and manual mode for controlling different machines.

## V. METHODOLOGY

A simple heat detector circuit is shown in the figure that can be used as a heat sensor. In this heat detector circuit diagram, a potential divider circuit is formed with a series connection of thermistor and 100 Ohms resistance. If

(Negative temperature Coefficient) N.T.C type transistor is used, then the resistance of thermistor decreases after heating. Thus, more current flows through the potential divider circuit formed by thermistor and 100 ohms resistances. Hence, more voltage appears at the junction of thermistor and resistor.

### *A. HEAT DETECTOR CIRCUIT*

Let us consider thermistor having 110 Ohms, and after heating its resistance value becomes 90 Ohms. Then, as per potential divider circuit which is pervasive concept namely voltage divider: the voltage across one resistor and the ratio of that resistor's value and the sum of resistances times the voltage across the series combination are equal. The input-output relationship for this heat detector circuit system, takes the form of a ratio of the output voltage to the input voltage which is given by the voltage divider concept in this particular concept.Finally, the output voltage is applied to NPN transistor shown in the circuit through a resistor. A Zener diode is used to maintain emitter voltage at 4.7 volts, which can be used comparatively. If the base voltage is greater than the emitter voltage, then the transistor starts conduction. This is because as the transistor gets more than 4.7V base Voltage and a buzzer are connected to complete the heat detector circuit which is used for producing sound.

### *B. COMPONENT DESCRIPTION*

**8051 series Micro controller**:-A micro controlle**r** is an integrated circuit or a chip with a processor and other support devices like program memory, data memory, I/O ports, serial communication interface etc integrated together. Unlike a microprocessor (**ex: Intel 8085**), a micro controller does not require any external interfacing of support devices. Intel 8051 is the most popular micro controller ever produced in the world market. Now lets talk about 8051 micro controller in detail.

Before going further, it will be interesting for you to understand the difference between a Microprocessor and Microcontroller. We have a detailed article which describes the basic difference between both.There is no need of explaining what each package means, you already know it. So I will skim through mainly used packaging for 8051. See, availability of various packages change from device to device. The most commonly used is Dual Inline Package (40 pins) – known popularly as DIP. 8051 is also available in QFP (Quad Flat Package), TQFP (Thin Quad Flat Package), PQFP (Plastic Quad Flat Package) etc. For explaining the pin diagram, we have used a 40 pin DIP IC as model.

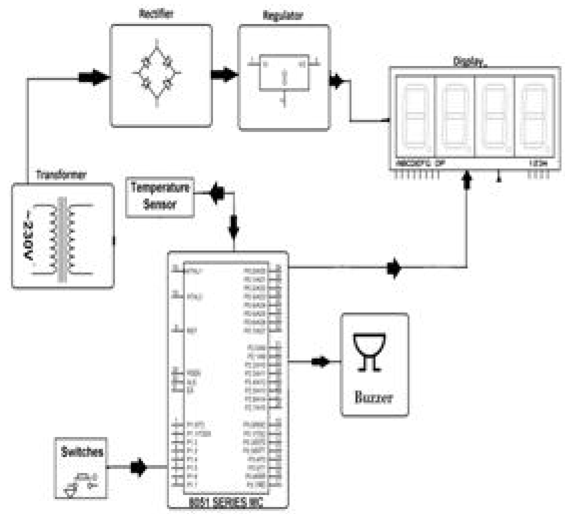



Figure 1. block diagram

**B. LED:-**A light-emitting diode (LED) is a two-lead semiconductor light source. It is a p–n junction diodethat emits light when activated.When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. This effect is called electroluminescence, and the color of the light (corresponding the energy of the photon) is determined by the energy band gap of the semiconductor. LEDs are typically small (less than 1 $mm^2$) and integrated optical components may be used to shape the radiation pattern. as shown in fig .2

Fig 2 Diode [8]

**Seven Segment display**:- It is available in two configurations: common cathode and common anode. All the 8 LED terminals have their one end internally shorted and linked with the middle pins such that it serves as a common terminal (cathode or anode). 7 led are used to form the digits while the 8thone is for the dot which helps in identifying the correct orientation. It is widely used in digital clock, calculator, electronic meters and various other applications where numerical display is required. It can be used in place of dot matrix displays which are more complex than seven segment display. Seven segment displays can also be used to display some alphabets. Seven segment displays is a group of Light emitting diode (LED) arrange in figure of 8 patterns as shown in fig.3

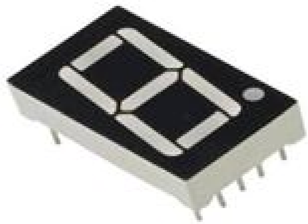


Fig 3 seven segment display[9]

**Voltage Regulator**:-A voltage regulator is designed to automatically maintain a constant voltage level. A voltage regulator may be a simple feed-forward design or may include negative feedback. It may use an electromechanical mechanism, or electronic components. Depending on the design, it may be used to regulate one or more AC or DC voltages. Electronic voltage regulators are found in devices such as computer power supplies where they stabilize the DC voltages used by the processor and other elements. In automobile alternators and central power station generator plants, voltage regulators control the output of the plant. In an electric power distributionsystem, voltage regulators may be installed at a substation or along distribution lines so that all customers receive steady voltage independent of how much power is drawn from the line as shown in fig.4

Fig 4 voltage Regulator[10]

**Transformer**:-A **t**ransformer is an electrical device that transfers electrical energy between two or more circuits through electromagnetic induction. A varying current in one coil of the transformer produces a varying magnetic field, which in turn induces a voltage in a second coil. Power can be transferred between the two coils through the magnetic field, without a metallic connection between the two circuits. Faraday's law of induction discovered in 1831 described this effect. Transformers are used to increase or decrease the alternating voltages in electric power applications.

**Push button**:-A push-button (also spelled pushbutton) or simply button is a simple switch mechanism for controlling some aspect of a machine or a process. Buttons are typically made out of hard material, usually plastic or metal The surface is usually flat or shaped to accommodate the human finger or hand, so as to be easily depressed or pushed. Buttons are most often biased switches, although many un-biased buttons (due to their physical nature) still require a spring to return to their un-pushed state. Different people use different terms for the "pushing" of the button, such as press, depress, mash, hit, and punch. As shown in fig.5

Fig 5 push button[12]

**Temperature Sensor:-**Thermistors are thermally sensitive resistors whose prime function is to exhibit a large, predictable and precise change in electrical resistance when subjected to a corresponding change in body temperature. Negative Temperature Coefficient (NTC) thermistors exhibit a decrease in electrical resistance when subjected to an increase in body temperature and Positive Temperature Coefficient (PTC) thermistors exhibit an increase in electrical resistance when subjected to an increase in body temperature. as shown in fig.6

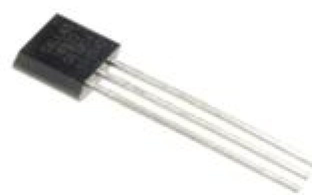


Fig 6 Temperature sensor[13]

**H.Diodes:-**In electronics , a diode is a two-terminal electronic component that conducts primarily in one direction (asymmetric conductance); it has low (ideally zero) resistance to the current in one direction, and high (ideally infinite) resistance in the other. A semiconductor diode, the most common type today, is a crystalline piece of semiconductor material with a p–n junction connected to two electrical terminals A vacuum tube diode has two electrodes, a plate (anode) and a heated cathode. Semiconductor diodes were the first semiconductor electronic devices. The discovery of crystals' rectifying abilities was made by German physicist Ferdinand Braun in 1874. The first semiconductor diodes, called cat's whisker diodes, developed around 1906, were made of mineral crystals such as galena. Today, most diodes are made of silicon, but other semiconductors such as selenium and germanium are sometimes used . As shown in fig.7.

Fig 7 Diodes[14]

**I.Buzzer:-**A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke. As shown in fig.8

Fig 8 Buzzer [15]

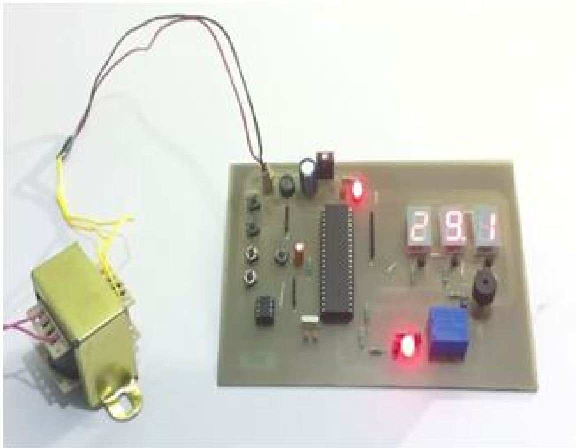
### *C. SOFTWARE PROGRAMMING OF MICRO CONTROLLER*

```
#include LiquidCrystal lcd(12, 11, 5, 4, 3, 2);
const int SPKR_PIN = 6; const int LED_RED_1= 7;
const int LED_RED_2= 8;
const int LED_RED_3= 9;
const int LED_YELLOW= 10;
int tempC_1= 0;
//set initial tempC 0° for all LM35 int tempC_2= 0;
int tempC_3= 0;
const int SensorPin1=A1;
 //input sensor pin const int SensorPin2=A2;
const int SensorPin3=A3;
void setup() { pinMode(SPKR_PIN, OUTPUT);
 lcd.begin(16, 2);
pinMode(SensorPin1,INPUT);
pinMode(SensorPin2,INPUT);
 pinMode(SensorPin3,INPUT);
 pinMode(LED_RED_1, OUTPUT);
pinMode(LED_RED_2, OUTPUT);
 pinMode(LED_RED_3, OUTPUT);
pinMode(LED_YELLOW, OUTPUT);
digitalWrite(LED_RED_2, LOW);
digitalWrite(LED_RED_3, LOW);
 digitalWrite(LED_YELLOW, LOW);
`Page | 48 int tempC_2= analogRead(SensorPin2);
 int tempC_3= analogRead(SensorPin3);
digitalWrite(LED_YELLOW,HIGH);
digitalWrite(LED_RED_2,LOW);
 digitalWrite(LED_RED_3,LOW);
 lcd.setCursor(0, 0); lcd.print("On FIRE: 1 ");
lcd.setCursor(0, 1); lcd.print(" SAFE: 2 3");
 tone(SPKR_PIN, 1047, 500); delay(200); tone(SPKR_PIN,
1109, 300);
delay(200); tone(SPKR_PIN, 1175, 100);
delay(5); } else if(tempC_1 < 50&tempC_2 > 50&tempC_3 <
50) { digitalWrite(LED_RED_2,HIGH);
digitalWrite(LED_YELLOW,HIGH);
 digitalWrite(LED_RED_1,LOW);
 digitalWrite(LED_RED_3,LOW);
tone(SPKR_PIN, 1175, 100); delay(5); } else if(tempC_1 >
50&tempC_2 > 50&tempC_3 > 50) {
digitalWrite(LED_RED_1,HIGH);
 digitalWrite(LED_RED_2,HIGH);
 digitalWrite(LED_RED_3,HIGH);
 digitalWrite(LED_YELLOW,HIGH);
 lcd.setCursor(0, 0);
lcd.print("On FIRE: 1 2 3");
 lcd.setCursor(0, 1);
lcd.print(" SAFE: ");
 tone(SPKR_PIN, 1047, 500);
delay(200); tone(SPKR_PIN, 1109, 300);
delay(200); tone(SPKR_PIN, 1175, 100);
delay(5); } else { digitalWrite(LED_RED_1,LOW);
digitalWrite(LED_RED_2,LOW);
digitalWrite(LED_RED_3,LOW);
digitalWrite(LED_YELLOW,LOW);
lcd.setCursor(0, 0);
 lcd.print("On FIRE: ");
 lcd.setCursor(0, 1);
 lcd.print(" SAFE: 1 2 3");
```

## VI. CONCLUSIONS

The project "modeling and simulation of machine overheating detection with alert" has been successfully designed and tested. It has been developed by integrating features of all the hardware components used and software also in which we have used C language. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced microcontroller and with the help of growing technology the project has been successfully implemented. We conclude that by implementing these systems we can access the live data and control the device interfaced with our system.

**ACTUAL VIEW OF PROJECT**



## VII. ACKNOWLEDGMENT

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**[14]** http://www.newportelec.com/diodes.html
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