MACHINE BREAKDOWN DETECTION SYSTEM

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ABSTRACT

Industrial situation is very critical and is subject to several disturbances, called as real-time events, which can affect output and performance of system. These disturbances are machine breakdown, urgent orders, and cancellations of orders etc. The throughput of manufacturing industry is dependent on these disturbances. Machine breakdown is a significant factor in the throughput of manufacturing industry. Throughput might change, if a breakdown of machine happens in a production system. Throughput is one of the most significant performance measures in a production system. Planned throughput must be achieved by the company. If throughput is decreases, customer requirements cannot be completed and deadlines have to be changed by the production managers. Because of this corporation may lose their customers. Therefore, a manufacture has to meet deadlines with resources which are available with them, in spite of a disturbed environment. The proposed system detects motor current on full load & no load condition .by sensing motor current it detects presence of belt & overloading of motor & by sensing the temperature of particular point by using non-contact temperature sensor if temperature goes beyond range it detects breakdown. if such breakdowns occurs the message regarding breakdown is sent to maintenance engineer & at the same time message is displayed on the LCD at machine

Keyword: - *Breakdown, Uptime, SMS, MTTR*

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1. INTRODUCTION

Machines are important elements for an industries and their breakdown can affects the performance of system. If the breakdowns are unexpected, then it is very difficult for production engineers to achieve target. In the process of production , it is very challenging to guess occurrence a machine breakdown, referred as unplanned machine breakdown . Machine breakdown can cause interruptions in the production process. Due to these interruptions, production is completed later than the planned date. The interruptions in machines affect the whole production and because of this production target is not achieved. Due to situation customer requirements cannot be achieved and production manager has to revise the deadlines. This situation causes corporations to lose their customers, which also means yield loss. Therefore, a production system has to meet deadlines with resources which are available with them, in spite of a disturbed environment

The proposed work design a machine breakdown detection system which detects the breakdowns such as motor overload, different belts in machines, Temperature of motor, direction of motor. Belt broken condition is determined when proximity sensor output is high and motor current is below no load current. Motor overload breakdown occurs when motor current is above full load current. By using non-contact temperature and laser temperature of particular point is detected. To design this system we have used AVR microcontroller, Non-contact temperature sensor, Current sensor, GSM modem, LCD.

2. PROPOSED SYSTEM

The block diagram of the proposed system is shown in fig 1. The proposed system is divided in two sections. The microcontroller section consists of three sensors, potentiometer knob to set temperature, indicator and LCD along with the sim900 module. MLX90614 is the temperature detector, the digital output proximity sensor is the obstacle detector and ACS712 is the motion detector of the system.

The data from the sensors is continually processed by the microcontroller and an alarm is sent to the mobile phone if something is detected or something crosses the limit.

The Sim900 GSM module is present in between the microcontroller section and the mobile phone and is responsible for the communication between them. This module is use to send information from the microcontroller to the mobile phone.

In addition to the microcontroller section, the second section of the system is the mobile a mobile phone. Any mobile phone can be use and it does not require any special feature. The trigger from the microcontroller is received in the form of text.

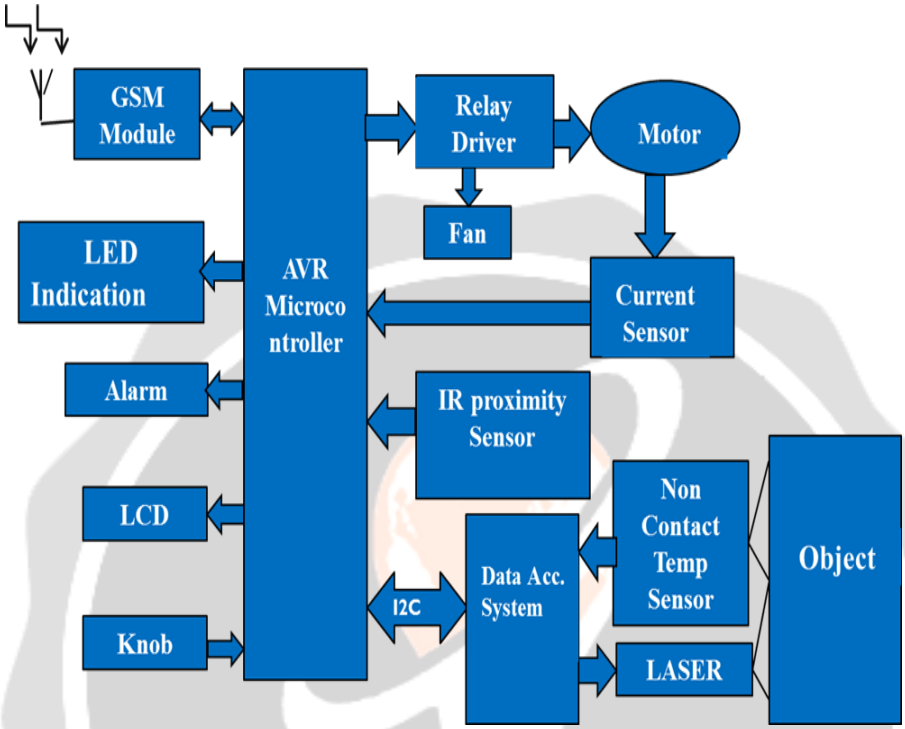

Fig 1: Block diagram of proposed system

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3. DESIGN AND DEVELOPMENT OF PROPOSED SYSTEM

The system is divided in two parts: the mobile phone and the microcontroller unit. The mobile phone is a user interface and it is not a controlling the device. The microcontroller is use to control the devices and to process information collected from the devices. This means that microcontroller is the brain of the system.

3.1.Interfacing Sim900 GSM Module

The Sim900 module is a vital part of the system responsible for communication between the microcontroller and the mobile phone. Interfacing a GSM module to AVR is very simple. It needs only 2 connections between the module and AVR.

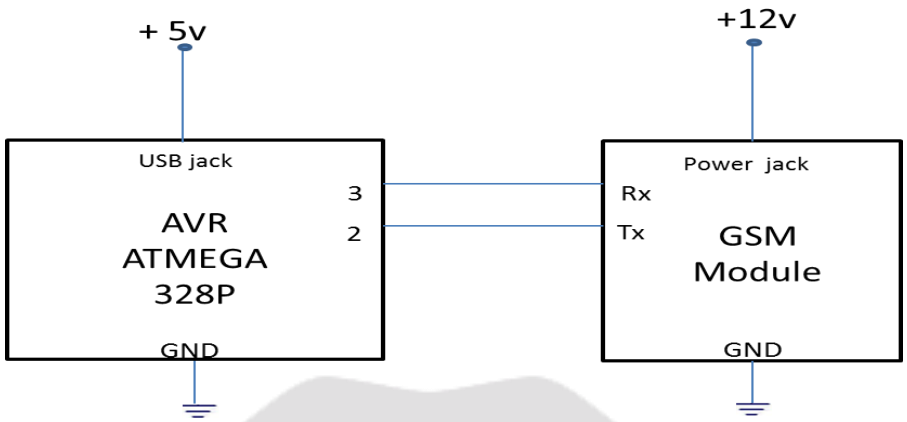

Fig 2: Connection between AVR & GSM Module

3.2 Interfacing and Implementing Sensors

3.2.1Current sensor ACS712

The Allegro ACS712 sensor gives accurate current measurement for both AC and DC signals. Thick copper conductor and signal traces allows for survival of the device up to 5 times overcurrent conditions. Output of ACS712 is an analog voltage signal that changes linearly with current which is sensed by sensor. Analog voltage is send to pin no 23 (i.e. ADC pin) of Atmega's 328P controller and configure microcontroller to read the analog value.

3.2.2Temperature sensor MLX90614

This device can be used to measure temperature from -70 to +380 degree Celsius. Connect four leads of MLX90614 to AVR to get an accurate thermometer with a resolution of 0.01 and accuracy of 0.5 degrees.
AVR microcontroller is using TWI (Two Wire Interface) terms for I2C.I2C is broadly used interface in embedded applications. I2C bus consists of two lines called Serial Data Line (SDA) and Serial Clock Line (SCL). Communication is fast and short distance which is mainly used to communicate between sensors, RTC, EEPROM, and LCD. I2C protocol permits up to 128 devices connected to SDA& SCL lines where each of device has unique address. Master and slave based communication is use in between devices. Master produces clock signal, starts and ends data transfer.
From electrical point of view I2C devices usage open drain (open collector) pins. SDA and SCL lines need pull up resistors to function properly. Usually 4.7kΩ resistors are used.

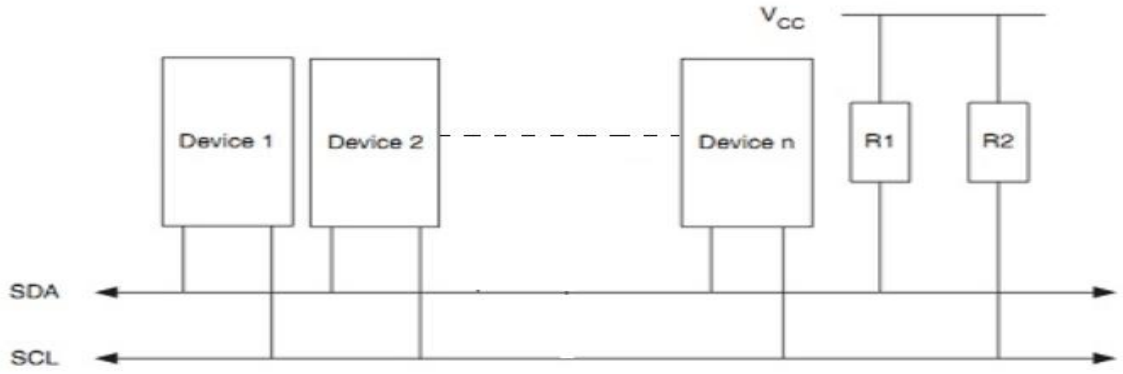

Fig3: I2C Interface

Each communication is started by START signal and finished by STOP. These are always produced by master. START and STOP signals are produced by pulling SDA line low while SCL line is high. In other cases when data is transferred data line must be stable during clock high and can be changed when clock is low:
I2C communication packet comprises of following parts:
START signal;
Address packet – It consists of seven address bits led by data direction bit (read or write) and acknowledge bit;
Data packet – It includes eight data bits and acknowledge bit;
STOP signal.
Acknowledge bit is a ninth bit of every byte transferred. Receiver always has to check proper receive with ACK by pulling SDA low or in case receiver cannot receive data it will keep SDA high (NACK) so master could stop transferring and do other situation if needed.

3.3 Interfacing LCD to AVR microcontroller

The LiquidCrystal library allows controlling of LCD displays.The LCDs have a parallel interface; it means that several interface pins are handle by microcontroller at a time to control the display. The interface comprises 1. A register select (RS) pin selects either the data register or an instruction register. 2. A Read/Write (R/W) pin use to select writing mode or reading mode.3. An Enable pin enables writing to the registers. 4. D0 -D7 are data pins. There is also a display contrast pin (CONRT), power supply pins (+5V and GND) and LED Backlight pins that can be used to power the LCD, control the display contrast, and to turn on and off the LED backlight, respectively.
The controlling of display includes putting the data that form the image of what is to be display into the data registers, then placing instructions in the instruction register. The LiquidCrystal Library simplifies this.
To wire LCD screen to Arduino, connect the following pins:
LCD RS pin to digital pin 13
LCD Enable pin to digital pin 12
LCD D4 pin to digital pin 11
LCD D5 pin to digital pin 10
LCD D6 pin to digital pin 9
LCD D7 pin to digital pin 8
Additionally, connect a 10Kilo-ohm potentiometer between +5V and GND, and connect its output to LCD screens CONTR pin (pin3).

4. RESULTS

The aim of the project was to implement a machine breakdown detection system and the goal was met. The microcontroller unit responds to the input signals from sensors and triggers the alarm upon occurrences of faults.

Current Temp (^{o}c)	Set Temp (^{o}c)	Current	Proximity sensor o/p	Fan	Alarm/ indicator	Motor status	Machine status
23	30	< 0.2A	0	OFF	OFF	ON	Normal
29	30	< 0.2A	1	OFF	ON	OFF	“Belt Broken”
33	30	< 0.2A	0	ON	ON	OFF	“Over Temperature
28	30	> 0.2A	1	OFF	ON	OFF	“Motor Overload”
28	30	Negative	0	OFF	ON	OFF	“Motor Reverse”

4. CONCLUSION

In any manufacturing industry, if machine goes under breakdown, process to report breakdown is very time consuming process i.e. machine operator first informs to production engineer, and then fills the breakdown slip for particular breakdown and search for the maintenance engineer to inform about the breakdown it will take too much time. Because of machine breakdown production stops, this affects the productivity. So in any industry it is desire to have a minimum breakdown time & maximum uptime to increase the productivity. In proposed system we have implemented the breakdown detection system using GSM modem & AVR microcontroller which detects the breakdown of machine & send SMS to authorize person, also indicate the alarm at machine to indicate that the machine is under breakdown. This will reduce the breakdown time of machine (i.e. increase the uptime of machine), send SMS to authorize person, indicate the alarm at machine to indicate that the machine is under breakdown.

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