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Status Monitoring and Over Current Protection for Textile Machine

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Abstract - *The Present work is dedicated about the system is designed to monitor the environmental status in which the controller boards are installed and current consumed by their drivers. Every parameter is associated with certain values up to which the parameter value can be accepted. Proposed system continuously monitors and compares the sensor values obtained and perform the necessary action to prevent the drastic outcome. The textile machine (Autoconer AC338). In this system current consumed by the drum motor and environmental condition around the controller boards are measured. The parameters that cause the fault for the electronic devices employed in the controller board are Temperature, Humidity, overcurrent etc. If boards are cased within the housing there is no knowledge about burst out condition of board. Smoke sensors are employed to detect it. Proximity sensor is used to detect whether the machine controller board is fixed inside the housing or not. Machine controller board will turn on red light indicator in case of any error in its operation. Light Dependent Resistor will be used to detect the red light indicator status. The system starts to continuously monitor the current and environmental condition. The input parameters are allowed up to certain limit. The design and simulation is done in proteus and labview 18.0*

***Key Words*: Status Monitoring, over current, Textile Machine, Autocorner, labview.,**

1. INTRODUCTION

Electronic components have a wide variety of modes of failure. It is possible to define these in different ways, such as by time or cause. Excess temperature, excess current or voltage, ionising radiation, stress or effects, and many other factors may be responsible for failures. Problems in the product package in semiconductor devices can cause failures due to contamination, mechanical stress of the device, or open or short circuits[1]. Electronic goods are subjected to robust conditions such as temperature, humidity, and moisture in spinning industries. Such prevailing atmospheric conditions increase the rate of failure of components. The failure of electronic devices can lead to dramatic changes in the application system as a whole. The device is designed to constantly track the environmental situation around the goods and warn the consumer about the prevailing condition in order to resolve this result. In critical situations, the system is also designed to take the appropriate action. Geotextiles are also moving into the field of multifunctional intelligence with the introduction of optical fibre sensors into geotextiles[2-3]. When intelligent geotextiles are used to improve the geotechnical structure, health monitoring of the geotechnical structure may also be carried out in order to ensure that the geotechnical structure and its positions with a high risk of failure and harm are detected at an early stage, which is conducive to prevention and maintenance[4-5].

2. PROBLEM FORMULATIONS

Electronic component failure can be caused by some of the environmental factors such as

a) Temperature

Temperature is the environmental factor that most accelerates the degradation of electronics components, among all the environmental factors that may influence the reliability. Since the physical properties of almost all materials are modified by changes in temperature, and the speed of most chemical reactions is also influenced by the temperature of the reactants, temperature changes can cause catastrophic failures due to deterioration of the components. In the following are described the major means by which temperature can affect the robustness of the components.

a) High Temperatures: cause catastrophic failures and chemical degradation of electronic components.

b) Low temperatures: cause mechanical stresses produced by differences in the coefficients of expansion and solidification of the liquid components.

c) Thermal Shock: provide internal mechanical stress in structural elements, particularly when dissimilar materials are encapsulated.

In addition to the static temperature, the correction due to temperature cycle, the temperature raising in the junction of the electronic component and also considers the influence of the temperature when materials of different coefficients of linear expansion are welded on the same board.

b) Humidity and Saline Environment

Moisture is found in nearly all environments and probably it is the chemical factor that causes more deterioration of different materials. The impurities contained in the Humidity causes various chemical problems such as corrosion of many metals. The humidity, when condensed, can be considered a physical agent, since many flexible materials at low temperatures become hard and brittle due to humidity condensation. In addition, most gases readily dissolve in humidity, which may

produce other chemical harms to the reliability of the components. Even though the presence of humidity can cause deterioration, its absence can also cause problems, since the properties of many materials, especially non-metallic, depend on an optimal level of humidity. Humidity and saline environments degrade the performance of the equipment because, in many situations, they promote corrosion and/or electrolysis of the metal components. They may also produce a film of salt in nonmetallic parts, coming to create leak paths and degradation of the insulation and dielectric properties of these materials.

c) Overcurrent

In an electric power system, overcurrent or excess current is a situation where a larger than intended electric current exists through a conductor, leading to excessive generation of heat, and the risk of fire or damage to equipment. Possible causes for overcurrent include short circuits, excessive load, incorrect design, or a ground fault. Overcurrent is any current load in excess of the safety rating of equipment or the capacity of a conductor. Overcurrent may result from an overload, a short circuit, or a ground fault. Overcurrent does not always cause a fire. The magnitude and direction of the overcurrent must be sufficient to heat the wire to a temperature that ignites surrounding combustibles. Sustained overcurrent that can cause damage or fire (called overload). An overcurrent exists when the normal load current for a circuit is exceeded. [14]It can be in the form of an overload or short-circuit. When applied to motor circuits an overload is any current, flowing within the normal circuit path that is higher than the motor's normal full load amperes (F.L.A.). A short-circuit is an overcurrent which greatly exceeds the normal full load current of the circuit. Also, as its name infers a short-circuit leaves the normal current carrying path of the circuit and takes a ―short cut‖ around the load and back to the power source. Motors can be damaged by both types of currents.

3. SIMULATION DESCRIPTION

3.1 LAB VIEW VERSION 18.0

Laboratory Virtual Instrument Engineering Workbench (Lab VIEW) is a system- design platform and development environment for a visual programming language from National Instruments. The graphical language is named "G". Lab VIEW is commonly used for data acquisition, instrument control, and industrial automation on a variety of operating systems (OS) including Microsoft Windows, various versions of Unix, Linux, and macOS.

3.1.1 Graphical Programming Language

The programming paradigm used in LabVIEW is based on data availability. Execution flow is determined by the structure of a graphical block diagram on which the programmer connects different function-nodes by drawing wires. These wires propagate variables and any node can execute as soon as all its input data become available. Since this might be the case for multiple nodes simultaneously, LabVIEW can execute inherently in parallel. Multi-processing and multithreading hardware is exploited automatically by the built-in scheduler, which multiplexes multiple OS threads over the nodes ready for execution. In LabVIEW the programming model is based on Dataflow model. In data flow model represent, the function performed by the VIs only when all required inputs are available at its input section. LabVIEW integrates the creation of user interfaces (termed front panels) into the development cycle. LabVIEW programs- subroutines are termed virtual instruments (VIs). Each VI has three components:

a) Front panel

The front panel is built using controls and indicators. Controls are inputs: they allow a user to supply information to the VI. Indicators are outputs: they indicate, or display, the results based on the inputs given to the VI. Front panel consist of control palette which comprises of the front panel elements in it.

b) Block diagram

The back panel, which is a block diagram, contains the graphical source code. All of the objects placed on the front panel will appear on the back panel as terminals. The back panel also contains structures and functions which perform operations on controls and supply data to indicators. The structures and functions are found on the Functions palette and can be placed on the back panel.

c) Connector panel

To use a VI as a subVI, you need to build a connector pane. Every VI displays a connector pane, shown as follows, next to the VI icon in the upper right corner of the front panel window.

3.2 ASSEMBLING GPIB INSTRUMENT CONTROL SYSTEM

A basic GPIB Instrument Control system consists of following parts:

a) Setting up the PC

PCI-based GPIB controller boards offer a simple, seamless bridge between the PC and the GPIB instrument. Additionally, stand-alone GPIB controllers communicate via serial, USB, or Ethernet/LXI. As a result GPIB instruments can transmit their data across the room or around the world. Additionally, the National Instruments Instrument Driver Network has more than 7000 instrument drivers to choose from, as well as tutorials on how to use them to control your instrument.

b) Configuring the Controller

Depends on the GPIB controller manufacturer, some kind of instrument control software driver will need to be installed before the device will function. National Instruments GPIB controllers come with their own GPIB driver and Measurement & Automation Explorer (MAX). MAX scans for connected

instruments, confirms communication, and creates the necessary handles for programming.

c) Connecting GPIB Controller to Instrument

Once the controller is installed and working properly, the GPIB cable can be connected from the controller to the instrument. In accordance with the IEEE 488.2 standard, with a single controller you can control up to 15 different instruments connected in either a daisy-chain or star topology.

3.3 FRONT PANEL AND CONTROL PALETTE

3.3.1 Front Panel

Front panel is the window which comprises of the set of indicators, controls, connector pane in it shown in Fig 3.3.1. During code execution the input, output, graphical values are displayed here.

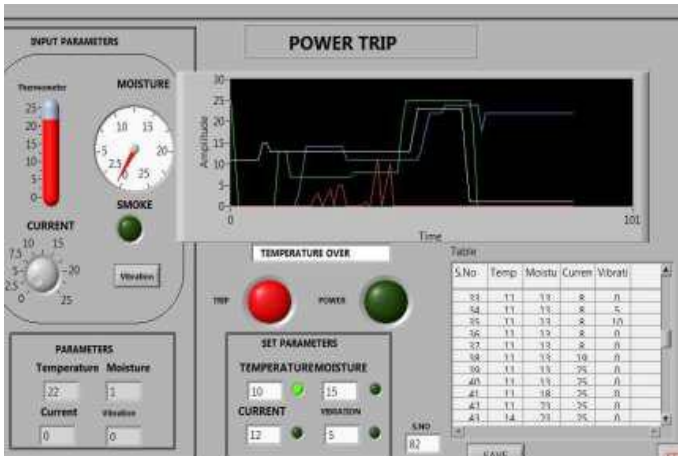


Fig.3.3.1: Front Panel

3.3.2 CONTROL PALETTE

Control palette is found in front panel The Controls palette contains the controls and indicators you use to create the front panel. You access the Controls palette from the front panel window by selecting View » Controls Palette or by right clicking on any empty space in the front panel window. The Controls palette is broken into various categories; you can expose some or all of these categories to suit your needs.

Fig.3.3.2: Controls and Indicators

Back panel is the window where the programming is done in Lab VIEW. Back panel shown in Fig 3.3.3 provides the space for the functions to be picked and placed to create the coding .It is provided with the function palette where the programmer can pick the required function and can create the design.

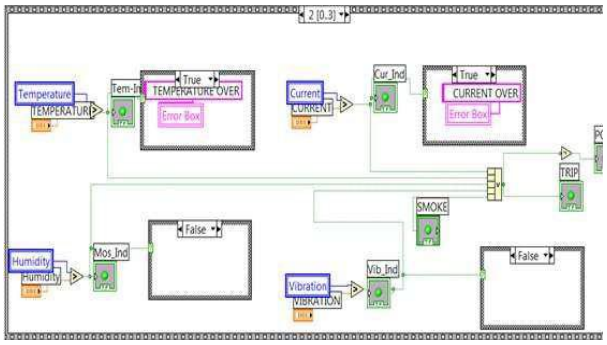


Fig.3.3.3: Block Diagram or Back Panel

The DHT22 is a basic, low-cost digital temperature and humidity sensor. It is used to measure temperature and humidity. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). It's fairly simple to use, but requires careful timing to grab data. The only real downside of this sensor is you can only get new data from it once every 2 seconds.

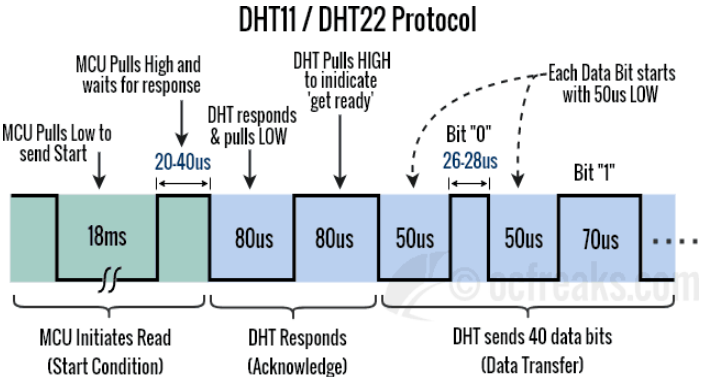


Fig 3.3.4: Communication protocol

4. RESEARCH METHODOLOGY

The system is designed to monitor the environmental status in which the controller boards are installed and current consumed by their drivers. Every parameter is associated with certain values up to which the parameter value can be accepted. Proposed system continuously monitors and compares the sensor values obtained and perform the necessary action to prevent the drastic outcome. The measured sensor values are stored in an excel file for future references

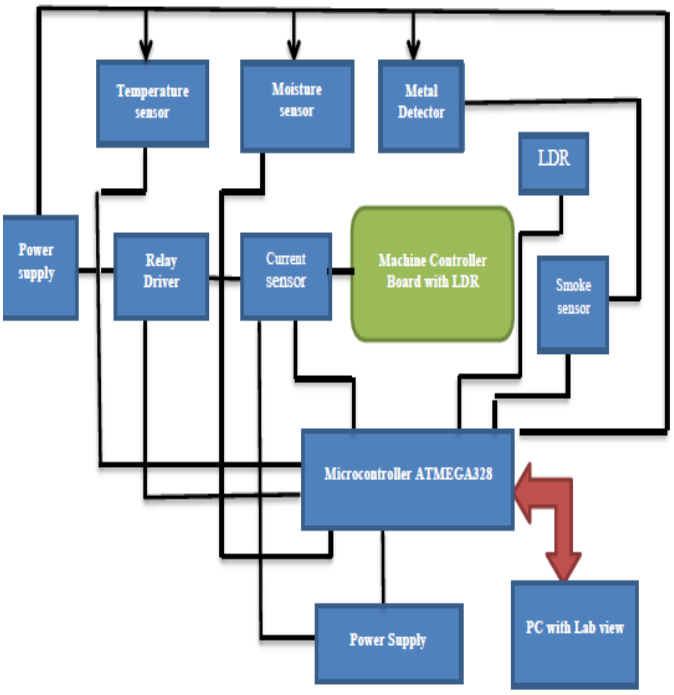


Fig.4.1: Block Diagram of Proposed System

The sensors used in the proposed system are shown above using the block diagram. Each sensor acts as an input for the machine board. The red light indicator is used to indicate the error occurred on the machine board controller. Relay trips the circuit when excessive current passes through it.

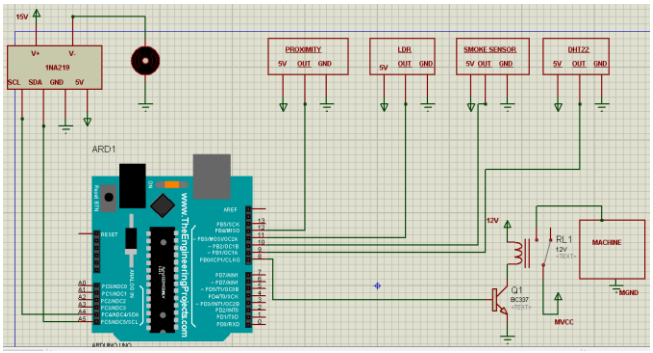


Fig 4.2 shows the schematic of the proposed system.

The technical details of the system are shown in the schematic diagram. The connections are made in such a way to obtain the satisfactory outcome. All the inputs (sensors that read the values) are connected in Arduino UNO pins. The pins connected with input are pin 12, pin 11, pin 10, pin 9. The current sensor is connected in pins A4, A5. The machine is connected to the Arduino UNO through relay (pin 8). The supplied voltage to the proposed system is 15V and the supplied current is 6A. Each sensor activated by 5V supply voltage.

5. RESULTS AND DISCUSSIONS

A. All paramters are in range

When there is no error all the parameters are within range. If all the parameters are within range then there will be no warning messages.

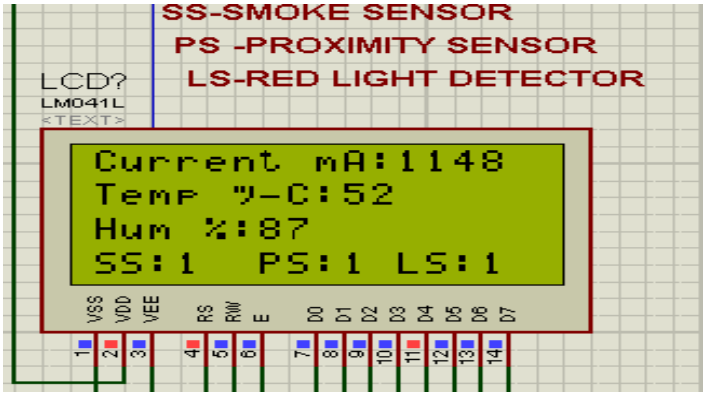
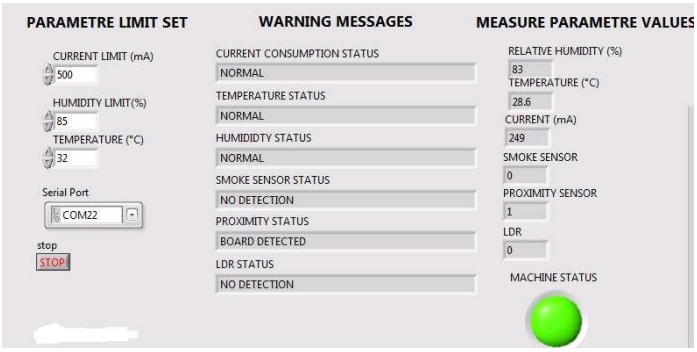
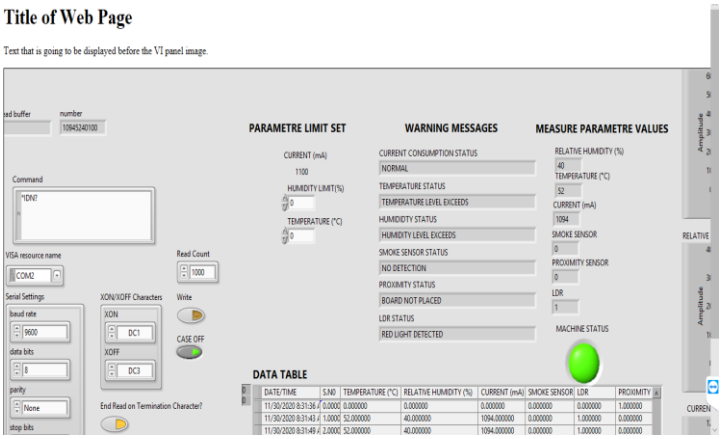


Figure 5.1 Status of parameters (within range) (a) LCD reading



(b) Labview parameters



(c) IOT web page reading

B. Over current

When excessive current consumed by the machine then the warning message "Over current consumption" will be generated then the machine turned off.

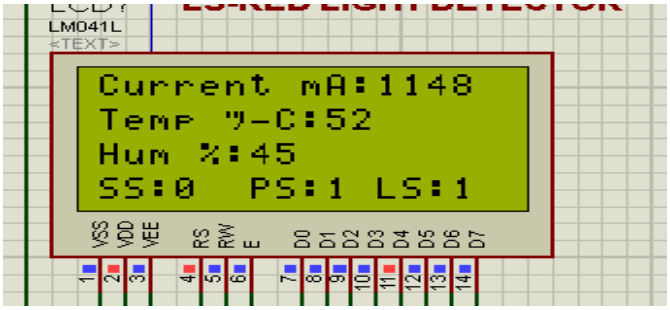
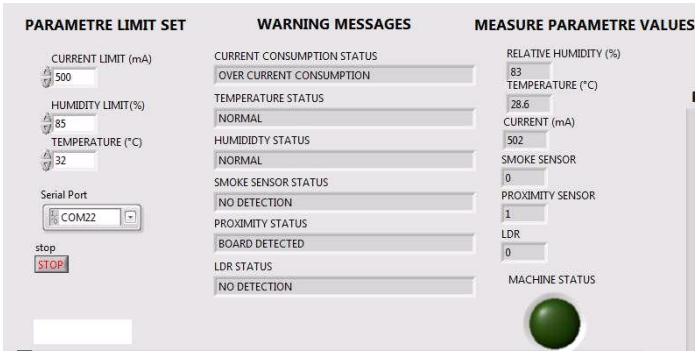
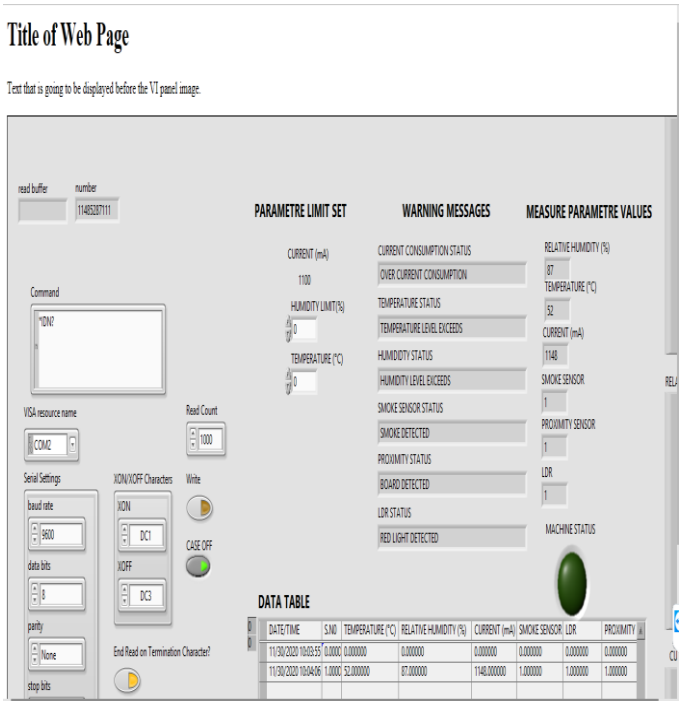


Figure 5.2 Overcurrent (a) LCD readings



(b) Warning due to overcurrent Labview parameters



(c) Over-current IOT webpage

C. Temperature exceeds

When the temperature level is not in range then the warning message "Temperature level exceeds" will be generated.

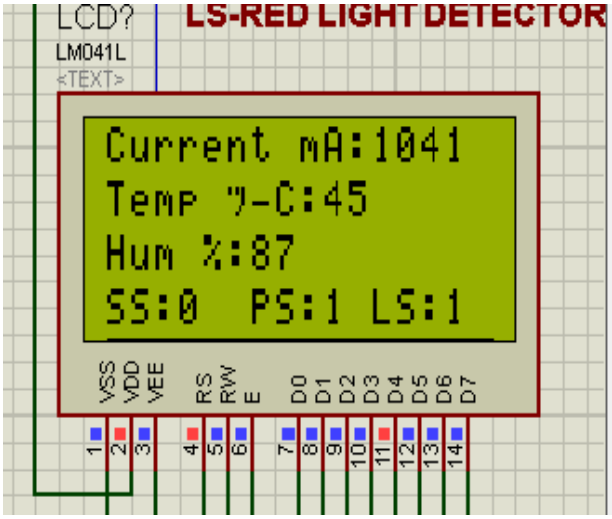
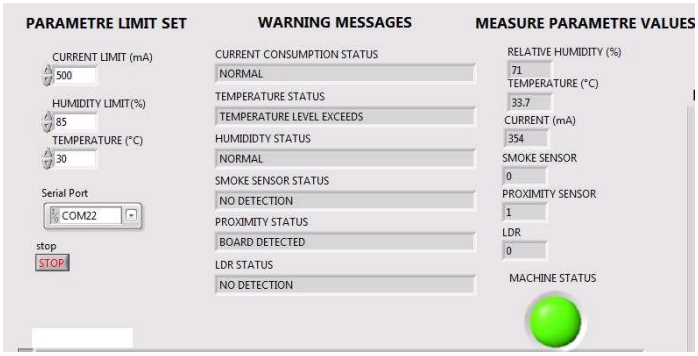
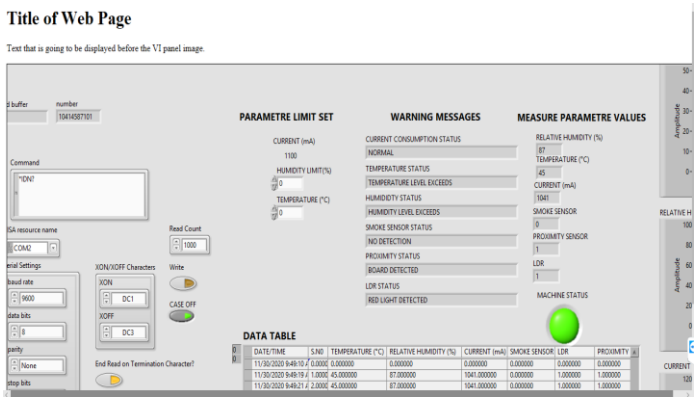


Figure 5.3 Temperature exceeds (a) LCD readings



b) Temperature exceeds



(c) IOT web page parameters

D. Humidity level exceeds

The warning message "Humidity level exceeds" will be generated when the humidity level exceeds the specified range.

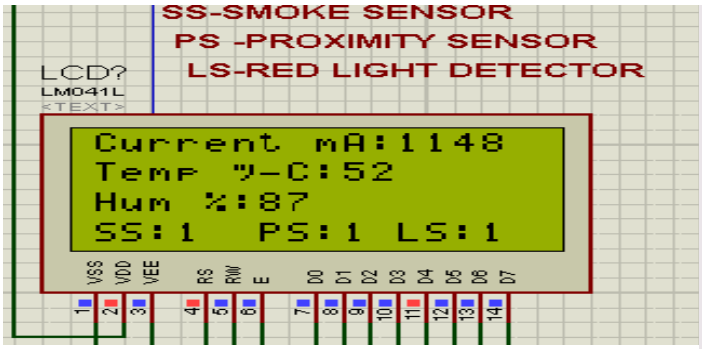


Fig 5.4: Humidity exceeds (a) LCD readings

E. Board not detected

When the board is not connected then thewarning message "Board not placed" will be generated.

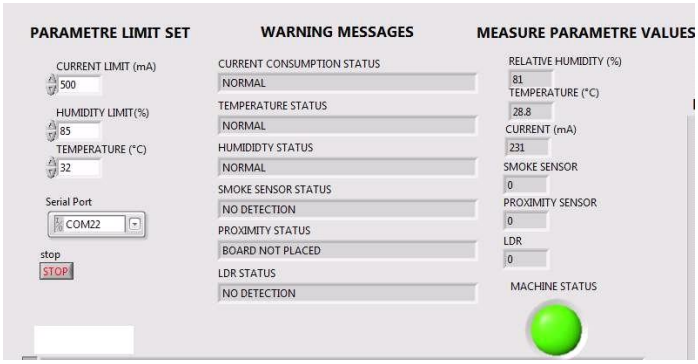


Fig.5.5 Warning message when board not connected

F. Red light detected

When the error exist in the machine controller board function then the warning message "Red light detected" will be generated.

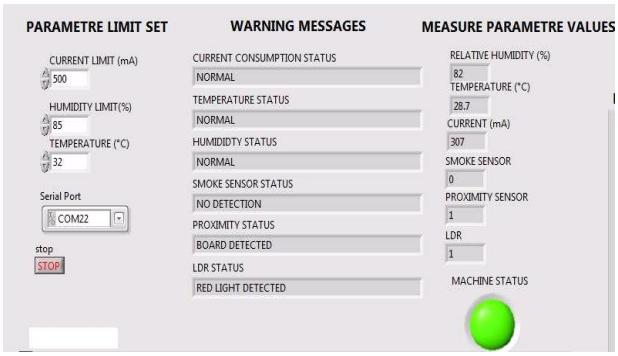


Fig.5.6: Warning message due to error in function

G. Smoke detected

The warning message "Smoke detected" is created when the smoke is detected by the sensor.

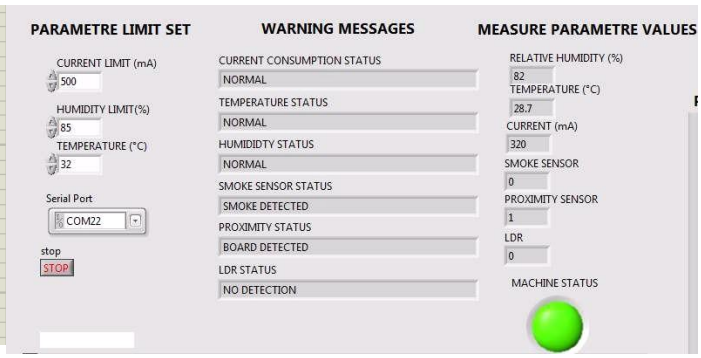
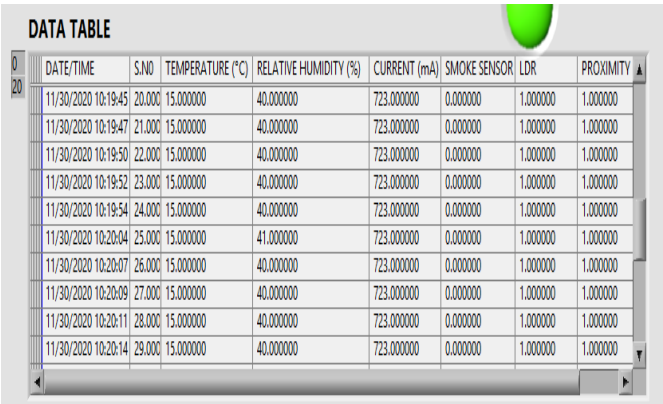


Fig.5.7: Warning message due to smoke

H. Data table

Data table shows the measured parameter value with time stamp. The measured sensor values are stored in the data table is shown below.



DATE/TIME	S.NO	TEMPERATURE (°C)	RELATIVE HUMIDITY (%)	CURRENT (mA)	SMOKE SENSOR	LDR	PROXIMITY
11/30/2020 10:19:45	20.000	15.000000	40.000000	723.000000	0.000000	1.000000	1.000000
11/30/2020 10:19:47	21.000	15.000000	40.000000	723.000000	0.000000	1.000000	1.000000
11/30/2020 10:19:50	22.000	15.000000	40.000000	723.000000	0.000000	1.000000	1.000000
11/30/2020 10:19:52	23.000	15.000000	40.000000	723.000000	0.000000	1.000000	1.000000
11/30/2020 10:19:54	24.000	15.000000	40.000000	723.000000	0.000000	1.000000	1.000000
11/30/2020 10:20:04	25.000	15.000000	41.000000	723.000000	0.000000	1.000000	1.000000
11/30/2020 10:20:07	26.000	15.000000	40.000000	723.000000	0.000000	1.000000	1.000000
11/30/2020 10:20:09	27.000	15.000000	40.000000	723.000000	0.000000	1.000000	1.000000
11/30/2020 10:20:11	28.000	15.000000	40.000000	723.000000	0.000000	1.000000	1.000000
11/30/2020 10:20:14	29.000	15.000000	40.000000	723.000000	0.000000	1.000000	1.000000

I. Graph

The graph is plotted using measured value versus time.

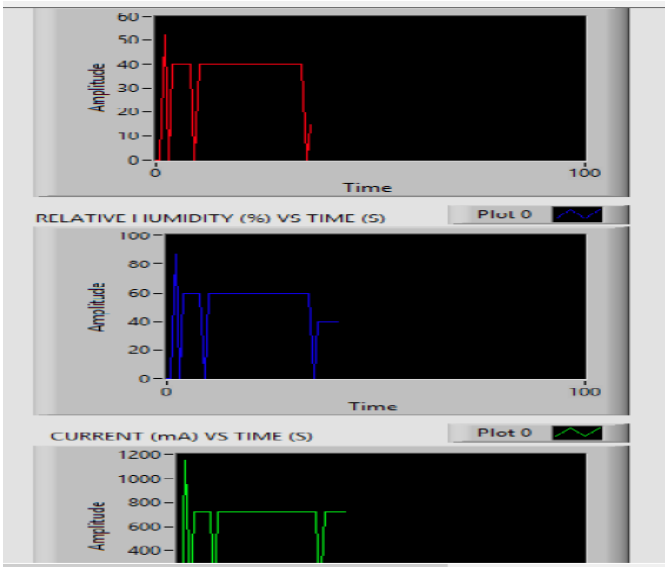


Fig.5.9: Measured parameters versus time plot

6. CONCLUSIONS

Finally the systems intended function is completely designed and simulated using LabVIEW tool. System designed here is tested for various conditions, by varying the parameters using sensors. Each function of the design is tested for wide range of inputs. Result obtained for the various test cases are analyzed and verified. Parameter values obtained are stored and plotted in graph. Every parameter will be continuously measured and necessary action will be taken based on the condition. Whenever the measured values increase over the set limit corresponding warning message is generated with the power trip based on the requirement. The measured values are continuously plotted graphically (measured value versus time) and stored as excel file in PC.

In future, the values measured and then the warning messages will be sent to the user via email. The measured values can be viewed through the Android dashboard and also the Protocol can be updated depends the application and requirement.

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