

UNIFIED SMART UTILITY SYSTEM FOR MONITORING CLIMATIC CONDITIONS

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Abstract: A smart portable and unified utility system for climatic parameter monitoring has been implemented using advanced microcontroller with nano watt technology. Our system aims to design and develop real time monitoring of climatic conditions at a relatively low cost and portability. The System offers the user choice and options according to their requirement. In this paper a system design has been implemented using microcontroller unit to monitor and record the values of essential parameters like temperature, humidity, light intensity and concentration of carbon mono-oxide in air. Microcontroller communicates with various sensors to closely monitor and control the different micro-climatic parameters. Microcontroller then compares the environmental condition, if any corrective action is required, it gives the command to run the actuator circuitry to perform the necessary action as per situation. Alphanumeric display is used for displaying real time data acquired from the various sensors and the status of the various devices that facilitates user to know real time climatic conditions and customize the use to meet the demands in greenhouse, manufacturing industry, food industry, dairy and fisheries, automobile safety, human safety in industry, home automation, weather prediction. Currently available systems offer few parameters for specific purpose while the proposed system can be used for multiple purposes. The system presents versatility, adaptability, multi functionality, portability and cost effectiveness comparing with other weather monitoring systems.

essential need in industry research oriented requirements.[2] Carbon mono-oxide (CO) is a leading cause of chemical poisoning in both the workplace and the home. Greatest single source of this pollutant is the automobile. "The advancement in technology has made small and reliable electronic sensors capable of monitoring environmental parameters more favorable".[3] Temperature, humidity, Illumination, presence of Carbon Mono-oxide (CO) in atmosphere, etc which directly or indirectly govern the plant growth, human health industrial and automobile safety. Greenhouse humidity levels can be reduced by removing the moist around the plants and replacing it with the cooler and drier outside air. The presently available systems suffer from various limitations like complex design, inconvenient repairing and high price. The system is using different sensors and most advanced microcontroller PIC18F4550. Microcontroller unit communicates with the various sensors which monitor and control the climatic parameters, these sensed climatic parameters viz. temperature, and humidity, light intensity, and concentration of CO are monitored. System also employs an alphanumeric display for continuously showing the user about the condition. System Block diagram is as shown in fig. 1. Thus, this system designed is portable an easy to maintain, flexible and low cost solution. The system provides reduced power consumption, maintenance and complexity. Set up can be brought in realization by simply replacing these simulation devices by the actual devices.

Keywords: Sensors, MCU, Relay, CO

Introduction:

The proposed parameter monitoring system is a device with different sensors, like temperature sensor, humidity sensor, LDR, gas sensor. These sensors sense different parameters. The system allow user to choose required parameter as per specific need. Commercial and household items which actively monitor the environmental conditions [1]. In manufacturing process the temperature of boilers, furnace, fisheries, dairy industry has to be controlled and kept constant. Humidity in industries is essential because it may affect the business cost of the product and the health and safety of the personnel. Controlled temperature, light intensity is an

System Implementation:

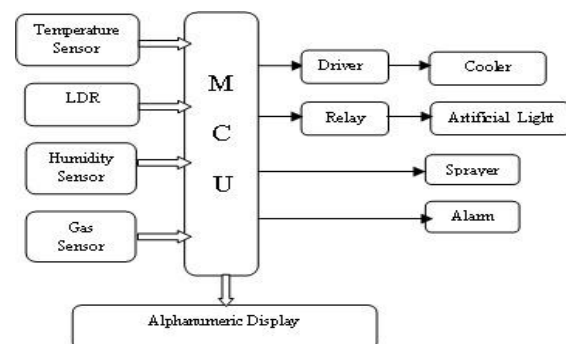


Fig. 1. Block Diagram of Climate Parameter Monitoring System.

Sensors:

LM35 has been used for sensing the temperature. The temperature can be measured more accurately with it than using a thermistor. Electrical output is proportional to the temperature (in o C). Rated for full -55° to +150°C range. Output voltage varies linearly with temperature. SY-HS-220 is used for sensing humidity. Relative humidity is a measure in percentage of the vapor in the air compared to the total amount of vapor that could be held in the air at a given temperature. It works with the rated DC voltage 5V. It operates in the temperature range of 0-60 °C. It works in the condition where relative humidity should be 30%-90%. It delivers an output voltage of 33mv for a rise of one percentage of relative humidity. At ambient room conditions it has an accuracy of about 0-5%. SY-HS-220 gives the output in terms of voltage. It converts relative humidity to voltage. Sensor has good stability with low cost with excellent Chemical Resistance.

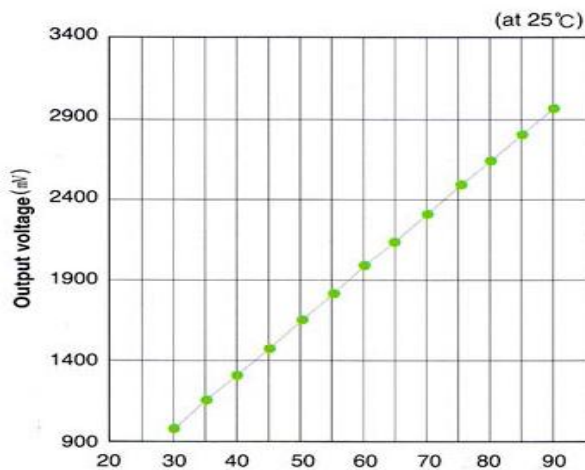


Fig.2 : Characteristics of SY-HS-220

Light Dependent Register: LDR is a device which has a resistance which varies according to the amount of light falling on its surface. Since LDR is extremely sensitive in visible light range. An LDR and a normal resistor are wired in series across a voltage. Depending on which is tied to the 5V and which to 0V, the voltage at the point between them the LDR is the component tied directly to the 5V, the sensor node will increase in voltage with increasing light. The LDR's resistance can reach 10 k ohms in dark conditions and about 100 ohms in full.

MQ-7 is used for sensing the presence of Carbon Monoxide at concentrations from 10 to 10,000 ppm. The surface resistance of the sensor R_s is obtained through effected voltage signal output of the load resistance R_L which series wound. The relationship between them is described in the following equation

$$R_s \backslash R_L = (V_c - V_{RL}) / V_{RL}$$

Carbon mono-oxide produced by certain industrial processes. Carbon monoxide (CO) is a leading chemical pollutant in both the workplace and the home. Compressed carbon mono-oxide can pose extreme health and flammability hazards.

Carbon mono-oxide is inhaled through the lungs and enters the blood stream by combining with hemoglobin. Carbon mono-oxide interferes with the ability of the blood to transport oxygen & Hemoglobin means that it prevents sufficient oxygen from reaching the tissues of the body. Insufficient oxygen can cause DEATH.

Effects of CO	Level of CO	
	CO in air (Parts per million)	CO level in blood (%)
Normal	1-3	0.8-0.7
Time Weighted Average Exposure Value (8 hrs.)	25	5-20
Short-Term Exposure Value (15 mins.) Ten percent COHb is maximum allowable body burden. Frontal headache Shortness of breath	*30-150	50-65
Coma, convulsions	700-1000	Over 70
Unconsciousness and death	Over 2000	

Table 1: CO Level Effects

*http://www.iapa.ca/pdf/carbon_monoxide_feb2003.pdf

Microcontroller:

PIC18F4550 Microcontroller used as interfacing unit to monitor the climatic parameters offers the advantages as high computational performance at an economical price. This microcontroller a logical choice for many high performance, power sensitive applications. This controller incorporate on chip 10 bit ADC. Flash memory of 24 KB.

Power Supply:

The 230 V AC supply is converted to required DC supply using the power supply as shown in fig 3. The first step is to step down the input voltage by using a step down transformer. A bridge rectifier circuit is used to convert the alternating current into unidirectional pulsating current. Then the output of the bridge rectifier circuit is given to the filter where the ripples are filtered to get DC output voltage. IC 7805 is used for regulated supply of +5V output. This is required for sensors, microcontroller and LCD circuitry.

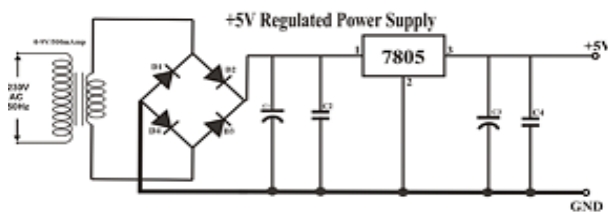


Fig. 3: Circuit Diagram of power supply

Methodology:

The sensed climatic parameters are converted into electric signal in terms of voltages by the sensors. Signals from the sensors are analog in nature. These analog signals are given to the microcontrollers on chip ADC which convert analog signals to digital. The circuit diagram is as shown in fig.5. Microcontroller constantly monitors the digitized parameters of the various sensors and varies them with the predefined threshold values and checks if any corrective action is required to be taken for the condition at that instant of time. In case such a situation arises, it activates the actuators to perform a corrective action. Measured parameters will be displayed on LCD display. Following flow chart shown in fig.4 describes the detail flow of system.

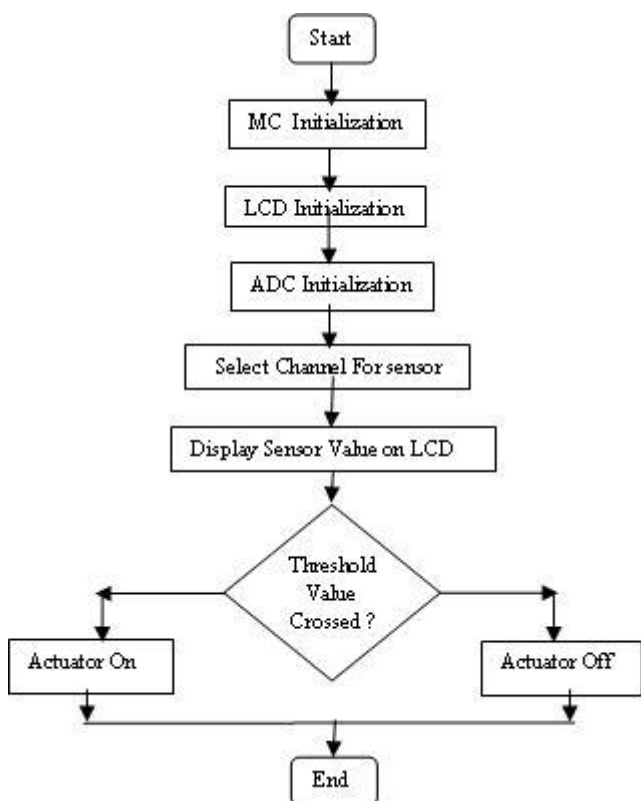


Fig. 4 Flowchart of the system

Result:

The output section consists of (various devices) actuators like cooler simulated as a fan to reduce the temperature.

Artificial Lights to compensate for lack of sunlight inside the greenhouse. Sprayer simulated as a LED to reduce humidity. Alarm as a buzzer to indicate concentration of CO in air. These actuators are controlled by the microcontroller. Alphanumeric display unit will show the values of parameters

- Cooler (simulated as a fan)
- Artificial Light (simulated as bulb)
- Sprayer (simulated as a LED)
- Alarm(Buzzer)

Parameter Monitored	Condition
Temperature	
Below 35 °C	Fan Off
35 °C and above	Fan On
Humidity	
Below 70 %	LED OFF
Above 70 %	LED ON
CO Concentration	
CO below 30 PPM	Buzzer OFF
CO above 30 PPM	Buzzer ON

Table 2: Parameters of climate

If temperature is between 0 to 35 °C fan will turn Off, if it increases above 35 °C fan will turn ON. If the light intensity is high the bulb is switched off, bulb is switched on only when the light intensity is low to save power. If Humidity is between 0 to 70 % RH (Relative Humidity) LED will off. As humidity increases above 70 % RH LED will glow. If concentration of CO in air is increases above 30 PPM (parts per million) buzzer will on else buzzer is off.

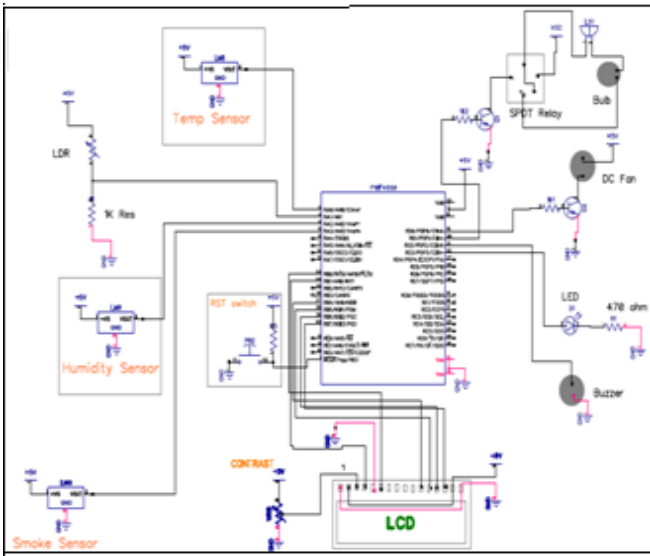


Fig. 5: Circuit diagram of climate parameter monitoring system

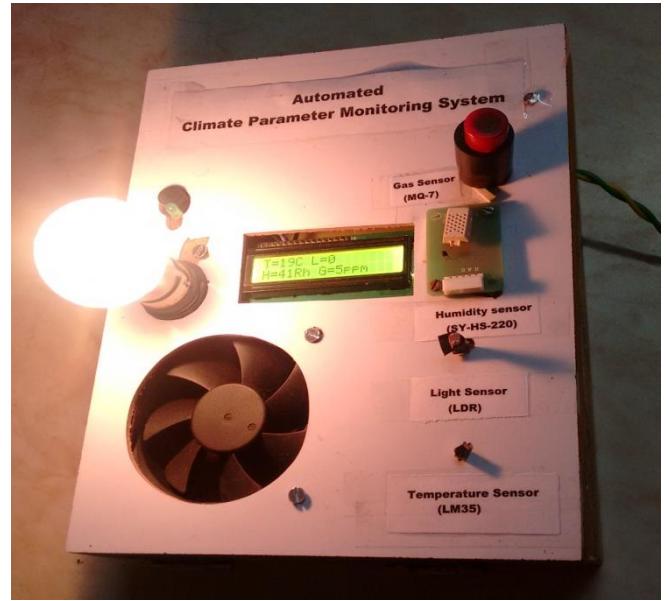
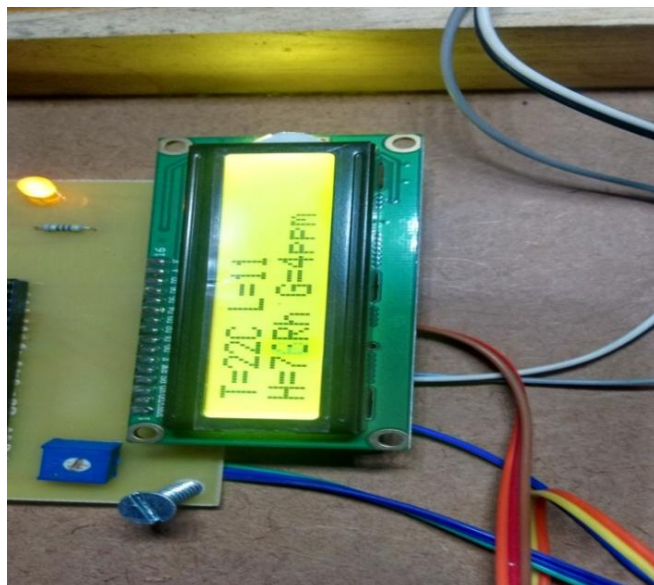
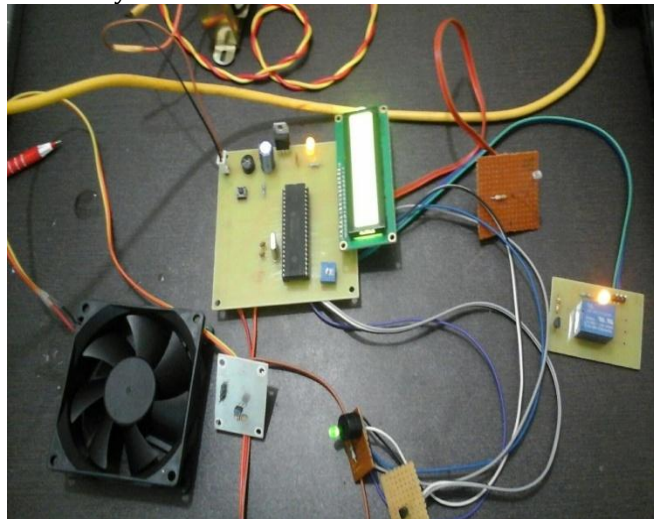


Fig. 6: Prototype of the system



CONCLUSION:

This paper successfully designed and implemented an automatic system for monitoring and controlling climate parameters like temperature, humidity, light Intensity, concentration of CO by using different sensors. These sensed parameters are monitored by giving the command to run the actuator circuitry. LCD will display sensed parameter values. Intension in designing the integrated multidimensional system for monitoring the different parameters has been followed. The results obtained from the measurement have shown that the system performance is quite reliable and accurate. Further improvements will be made by using more precise sensors are developed for use in agricultural and industrial production, home automation, and automobile safety. The system provide various advantages over presently available similar systems reduced power consumption, maintenance and complexity, low cost, on device display and portability, user friendly. Simultaneously providing a flexible and satisfied form of monitoring the climatic parameters.

Future Scope:

The system can be modified with the use of a data logger and a graphical LCD panel showing the measured sensor data over a period of time. A speaking voice alarm could be used instead of the normal buzzer. Proposed system can be advanced using Fuzzy Logic Controller (FLC) for Performance Improvement This system can be connected to, cellular phones or satellite terminal to enable the remote collection of recorded data or alarming of certain parameters.

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BIOGRAPHIES



Ms. Shilpa G. Pabalkar is currently pursuing AMIE (Institution of Engineers India) in Electronics and Telecommunication Engineering, Pune.



Dr. G .S. Mundada is Professor (ECE) and Head T&P Cell at PICT, Pune. He is having teaching experience of 20 years, research of 5 years and the area of interest includes Power Electronics, Wireless Networks, Application of Devices and Circuits. He is recipient of Best Teacher Award of Savitribai Phule Pune University during 2014-15.