AUSTRALIAN JOURNAL OF BASIC AND APPLIED SCIENCES

ISSN:1991-8178 EISSN: 2309-8414
Journal home page: www.ajbasweb.com

Ambience monitoring system for Hatchery Units

[1]A.S.Anakath, [2]R. Kannadasan, [3]N. Prabakaran, [4]A. Krishnamoorthy, [5]K.Naresh, [6]G. Sivashanmugam

[1]*Research Scholar, University College of Engineering, Ariyalur, TN, India, 621704*
[2~6]*Assistant Professor, VIT University, School of Computing Science and Engineering,vellore,TN,India,632014*

Address For Correspondence:
R.Kannadasan, Assistant Professor, School of Computing Science and Engineering, VIT University, Vellore. Tamilnadu, India-632014,
E-mail: desurkannadasanr@gmail.com

ARTICLE INFO

Article history:
Received 04 December 2015
Accepted 22 January 2016
Available online 14 February 2016

Keywords:
Hatcheryunits,egg,microcontroller,cooler

ABSTRACT

Hatchery units are enclosures having controlled temperature, humidity, and ventilation used for hatching fertile eggs. Hatchery units allow the use of artificial conditions where eggs are hatched to enhance food supplies. Temperature and humidity needs to be set at optimum degree, failing which production of the unit will suffer an adverse effect. Through this ambience temperature monitoring device we are creating a system which will ensure that temperature and humidity remains in the optimum range needed for surplus production. Temperature and humidity sensors will be used to observe the temperature and humidity of the hatchery unit. ADC take the analog data from the sensors and convert them to digital values which is easily acceptable to the microcontroller. If the temperature goes above the optimum range the cooler is switched on, if it goes below the heater is turned on and similarly actions are taken to keep the humidity in optimum range.

INTRODUCTION

Hatchery units allow the use of artificial conditions where eggs are hatched to enhance food supplies. Temperature and humidity needs to be set at optimum degree, failing which production of the unit will suffer an adverse effect. Through this ambience monitoring device we are creating a system which will ensure that temperature and humidity remains in the optimum range needed for surplus production. If any abnormalities happen it will take desired actions to ensure smooth functioning. LM235 temperature sensor is used to temperature sensing purpose. PIC16F877 microcontroller is used as the core of the system that holds the monitoring and controlling program and the data obtained is displayed on an LCD screen. If the temperature goes above the optimum range the cooler is switched on, if it goes below the heater is turned on and similarly if the humidity goes above the optimum range the de-humidifier is switched on, if it goes below the boiler is turned on.

Related work:

Sensor and actuator:

DusyantaPande, Jeetender Singh Chauhan and Nitin Parihar have discussed about the Real Time Hardware Design to Automatically Monitor Light and Temperature. In this paper, temperature and light monitoring is done with the help of two sensors and displayed on an LCD screen and the desired values of temperature and light are set with the help of provided keypad. They have used PIC microcontroller and an ADC 0809 for analog to digital conversion for their system. In our system, we also have used PIC 16F877 that features all the components which modern microcontrollers normally have. The PIC16F provides8K bytes of Flash, 368 bytes of RAM, 256 bytes of EPROM, 5 I/O ports, 3 timers., 35 simple word instructions.

To Cite This Article: A.S.Anakath, R. Kannadasan, N. Prabakaran, A. Krishnamoorthy, K.Naresh, G. Sivashanmugam, Ambience monitoring system for Hatchery Units. ***Aust. J. Basic & Appl. Sci.,*** *10(2): 181-185, 2016*

Real time monitoring system:

R. A. Eigenberg, J. A. Nainaber, T. M. BrownBrand and G. L. Hahn have developed a system for Rugged Environmental Monitoring Units for Temperature and Humidity. The system has extra complexity of construction and calibration for some applications which involves stiff environment. The system also does not have any hardware control unit to meet specific conditions.

Interfacing the peripherals:

A. Goswami and K. C. Sarma have proposed an Embedded System for Monitoring and Controlling Temperature and Light. In this system microcontroller AT 89S52 is used which is a 40 pin IC. The temperature measurement and light intensity from the channels of ADC 0809 are taken. The performances of the channels are distinguished on the basis of its accuracy. The accuracy shows how precisely the sensors can measure the actual and the real world parameter.

Hatchery units:

Hatchery units are enclosures having controlled temperature, humidity, and ventilation used for hatching fertile eggs. Hatchery units allow the use of artificial conditions where eggs are hatched. Temperature and humidity needs to be set at optimum degree, failing which production of the unit will suffer an adverse effect.

Poor results are most commonly produced if the temperature or humidity is too high or too low for a sufficient length of time that it interferes with the normal growth and development of the embryo. Minor fluctuations (less than ½ degree) above or below 100 degrees Fahrenheit is acceptable, but do if the temperatures vary more than a total of 1 degree it will have bad effects. Prolonged periods of low or high temperatures will alter the success of hatching. Higher temperatures are especially serious. A hatchery that is too warm will produce early hatches. The one that runs consistently cooler tends to produce late hatches. In both the cases total chicks hatched will be reduced. If the temperature and the humidity is not kept in the given range the whole lot of egg will be wasted. It is necessary to maintain the temperature in the 99-102° F. temperature range. Overheating the embryo is more damaging than under-heating is; overheating speeds up embryo development, causes abnormal embryos, and lowers the percentage of hatchability. Though a short cooling period may not be harmful, but longer periods of low temperature will reduce the rate of embryo development. Extremely low temperatures will kill the embryos. Temperatures outside the 97-103° F. range must be avoided. If the temperature remains beyond either extreme for several days, hatchability may be severely reduced. The moisture level in the incubator should be about 45 to 70 percent humidity. Temperature and humidity sensors will be used to observe the temperature and humidity of the hatchery unit. In built ADC of PIC16f will be used to take the analog data from the sensors and convert them to digital values which are easily acceptable to the microcontroller. If the temperature goes above the optimum range the cooler is switched on, if it goes below the heater is turned on and similarly actions are taken to keep the humidity in optimum rangeAbbreviations and Acronyms Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

Function:

- To constantly monitor the temperature of the Hatchery Unit and display it."
- To switch on the cooler if the temperature crosses the optimum range for smooth functioning of the unit
- To switch on heater if the temperature falls below the optimum range to ensure the smooth functioning of the unit.
- To constantly monitor the humidity of the Hatchery Unit and display it
- To switch on the boiler if the humidity falls below the optimum range for smooth functioning of the unit.
- To activate the de-humidifier if the humidity crosses the optimum range for smooth functioning of the unit

Features:

- Ease of use and simplicity in implementation
- No need of constant human surveillance
- Additional modules can be added without affecting the existing modules. This allows flexibility and easy maintenance of the developed system

Hardware requirements:

Microcontroller:

A Microcontroller contains a powerful CPU with memory, various I/O interfaces like serial port, parallel port timer or counter, interrupt controller, data acquisition interfaces Analog to Digital converter, Digital to Analog converter, integrated on to a single silicon chip. If a system is developed with a microprocessor, we

need to go for external memory like RAM, ROM, EPROM and peripherals. But controller is provided all these facilities on a single chip. PCB size and cost of design can be reduced if we develop using microcontroller. One of the key differences between a Microcontroller and Microprocessor is that a controller deals with bits not bytes in the real world application. The PIC 16F877 is almost completely feasible, with good program security and using flash memory in the place of EEPROM memory for program memory. PIC 16F877 is one of the most advanced microcontroller from Microchip. This controller is widely used for modern applications because of its low price, high quality, and vast range of applications. It is best for applications such as measurement devices, machine control applications and so on.

PDIP:

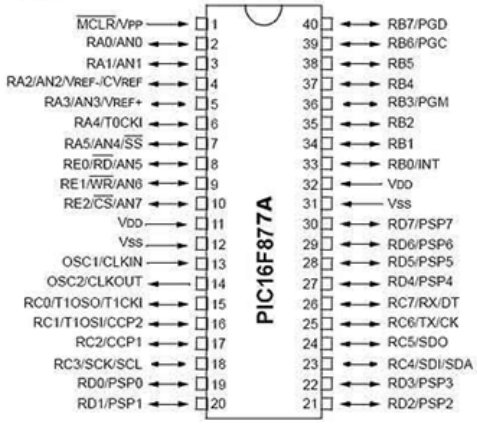

Fig. 1: Pin diagram PIC16F877A

The PIC 16F877 features all the components which modern microcontrollers normally have The PIC16F provides 8K bytes of Flash, 368 bytes of RAM, 256 bytes of EPROM, 5 I/O ports, 3 timers., 35 simple word instructions.

Some other standard features are:

a) Self-programmable under software control
b) 10 bit, up to 8 channel A/D converter
c) Wide operating voltage range (2.0-5.56) volts.
d) High speed –low power EEPROM/CMOS flash
e) High performance RISC CPU

Humidity Sensors:

Employed to provide an indication of the moisture levels in the Hatchery Unit. It will sense the humidity of the unit and send it to the microcontroller to take further actions if needed.

Temperature Sensors:

To sense the temperature of the unit and send it to the microcontroller to take further actions if needed.

Liquid Crystal Display:

LCD is a flat, thin panel which electronically displays information such as images, text, and moving pictures. It is used as monitors for computers, televisions, instrument panels. Among its major features are its portability, its lightweight construction, and its ability to be produced in much larger screen sizes. It is an Alphanumeric Display it means that it can display Numbers Alphabets, as well as special symbols thus LCD is a user friendly Display device which can be used for displaying various messages unlike seven segment display which can display only numbers and some of the alphabets. Its low electrical power consumption enables it to be used in battery powered electronic devices. It is an electronically modulated optical device made up of any number of pixels filled with liquid crystals and arrayed in front of a light source (backlight or reflector) to produce images in color or monochrome

IP122:

A TIP122 is an electrically operated switch. It is used for general-purpose amplifier and low-speed switching applications.

Step-down Transformer:

The Step down Transformer is used to step down the main supply voltage from 220V AC to lower value. This 220 AC voltage could not be used directly, hence it is stepped down. The Transformer has primary and secondary coils. To step down the voltage, the transformer is designed to have less number of turns in the secondary coil. The output from secondary coil is also AC waveform. Thus the conversion from AC to DC is must. It is achieved by using the Rectifier Circuit/Unit.

Power Supply Module:

This module is basically designed to achieve 5V & 12V regulated power supply for the circuit. It mainly consists of a step down transformer which is used to step down the AC voltage; diodes used to form a full wave bridge rectifier to convert AC to DC, capacitor 1000μF used as a filter circuit and regulator ICs to obtain the output of the regulator.

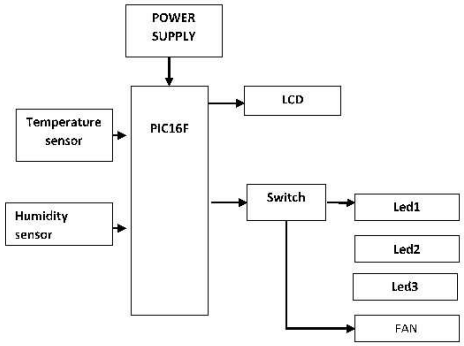

Fig. 2: Ambience Monitoring system for Hatchery

Working principle:

This project uses PIC16F microcontroller for programming and operation. The block diagram of temperature monitoring system consists of temperature sensor, Humidity Sensor, PIC16F microcontroller, and LCD. Temperature and humidity is sensed by respective sensors and sensor output is amplified and given to ADC. As the output of Temperature sensor is in the form of analog signal, ADC (embedded in PIC16F) is used to convert this analog signal to digital. Microcontroller controls these parameters and keeps them at some predefined levels using TIP122 interface. These can be connected to Fan/Heater. For demo purpose we added a 12v DC Fan. At the same time these values of temperature and humidity are sent to the microcontroller through serial port. The output of controller will be displayed on the LCD Display. The output of the transformer is given to the rectifier circuit. The rectifier circuit converts the ac voltage to dc voltage. The voltage converted may consist of ripples or harmonics. To reduce these ripples, the output of the rectifier is connected to filter. The filter thus removes the ripples. This is the exact dc voltage of the given specification. But the microcontroller operates at 5V dc. Thus regulator is required to reduce the voltage. Regulator produces 5V dc. Here the microcontroller gets activated when power supply is given to it. The resultant output will be displayed on the LCD display.

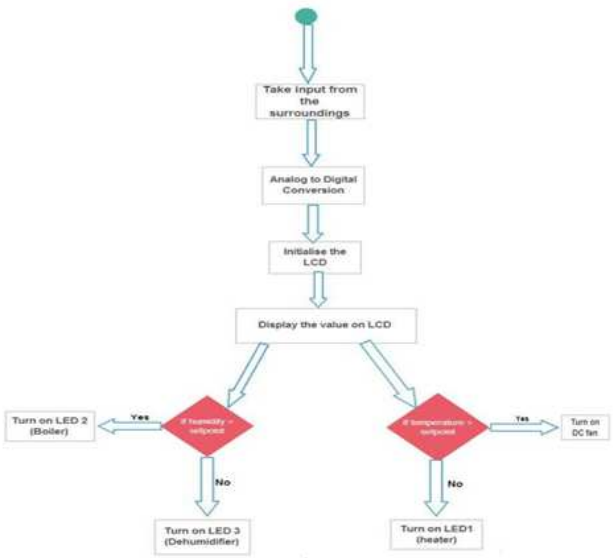

Fig. 3: Ambewnce Monitoring System for Hatchery flow chart

Result:

A step-by-step approach in designing the microcontroller based system for the measurement and control of temperature and humidity is followed. The results obtained from the measurement have shown that the system performance is quite reliable and accurate. This system requires a number of hardware components, properly integrated in accordance with their specifications. The system requires a continuous and reliable power supply provided to them

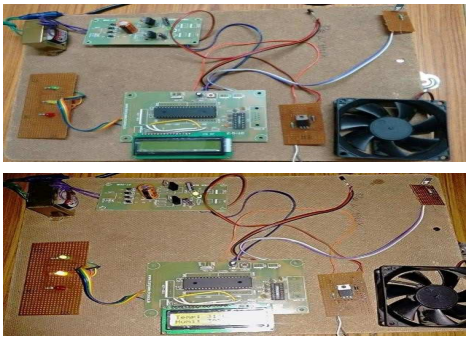

Fig. 4: Hardware microcontroled system

Conclusion:

Through this Ambience monitoring device, we have created a system which will ensure that temperature and humidity remains in the optimum range needed for surplus production of the Hatchery Units. Temperature and humidity sensors are used to observe the temperature and humidity of the hatchery unit. Using PIC16F microcontroller, the device allows keeping the temperature and humidity of the unit in the specified range by taking required actions.

It can be further implemented to monitor more parameters like water content, pH of soil, water level and at the same time control them. It can also be implemented in green houses to monitor proper plant growth. It can also be used in confectioneries for the preservation of sweets. We can send this data to remote locations using mobile or internet by integrating it with GSM module.

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