

# AVR-based parameter monitoring and controlling using fibre optics communication

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**Abstract:** This paper focuses on the use of optical fibre communication for the monitoring and controlling of essential parameters such as temperature and humidity from a distant location. Our proposed system helps in removing the need to man an industry and provides controlling functionality from a distant place in such a way that multiple industries can be controlled by a single operator.

**Keywords—** Baud rate, microcontroller, temperature, humidity, fibre optics, communication, Visual Basic, BASCOM - AVR.

## I. INTRODUCTION

Every industry has some parameters whose value needs to be monitored and controlled. We have considered two parameters viz. temperature and humidity for demonstrating our project. These parameters play an inevitable role in industries where manufacturing processes such as heating, welding, deep freezing etc., are being carried out. Such factors need to be closely monitored as sudden variations or disturbances in their values can damage the instruments or harm the industry workers if timely action is not taken. The processes where heating is required often have temperature value ranges starting from 500° C approximately. Such temperature values cannot be monitored or controlled by a person himself since it involves so much danger. Humidity is another such parameter which can impact the product being manufactured if the set limit is exceeded. For example, if there are five industrial plants located in different remote locations of Maharashtra, these plants can be connected to the main control room located in Mumbai through the use of fibre optics communication. These problems are further worsened if such industries are located in remote locations where telecom or internet networks are hardly present.

## II. LITERATURE SURVEY

Ever since the first fibre optics cable was first commercially utilized for carrying telephone signals in California in 1977, there has been no turning back

for fiber optics communication. The first fibre optic television network in England in 1978 gave the extra boost to the flourishing technology. This period witnessed the beginning of use of fibre optics cable for general use. Robert Maurer of Corning Glass Works is acknowledged for developing a fibre with a loss of 20 dB per km, promoting the commercial use of fibre. The 1980s witnessed the deployment of fibre for telecom networks. Today almost 90 % of the world networks are connected using fibre optics. There are already advanced technologies present in the field of communication but the kind of security and cost effective services these fibre optic communication provide is commendable. Since our focus is providing communication purpose in remote locations where technology is not much developed or electricity is a major concern, fibre optics communication comes to the rescue since the distance they can cover is quite huge. Wireless technology is becoming a rage nowadays but some things need to be wired up for effective communication.

### A. Fibre optic Communication

In the field of communication, fibre optic communication has set a name for itself even in this age of wireless technologies. It constitutes the main part of our project. The following figure shows a typical fibre optics communication system.

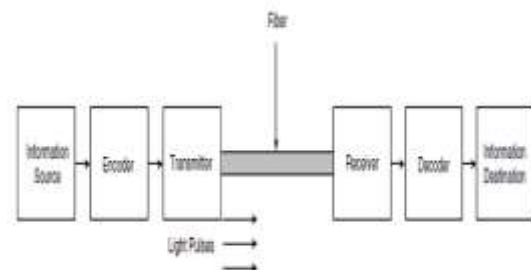


Fig.1: Basic block diagram of fibre optics communication.

Information source can be in the form of voice, video and data or a combination of all. First of all, information from the source is encoded into electrical signals that are used to trigger the transmitter. Transmitter converts these electrical

signals into light pulses which have a very high travelling speed. The fibre acts as an optical waveguide (medium) for the photons as they travel down the optical path toward the receiver. Receiver converts these light pulses back into electrical signals, which are then decoded and are sent to their destination.

### III. PROPOSED SYSTEM MODEL

For our project work, we have used AVR Atmega16 microcontroller. Major components of the proposed project model are AVR microcontroller Atmega16, fibre optic cable, temperature sensor i.e., thermistor, humidity sensor i.e. SY-HS-230, two TTL to USB converter, 16X2 LCD display, two relay, two IR LED and two photo detector.

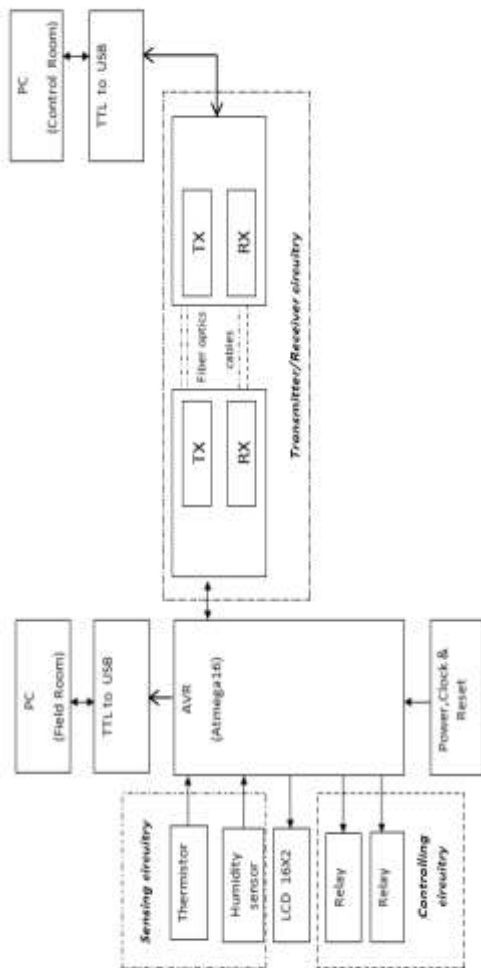


Fig. 2: Block diagram of proposed system

### A. Hardware Description

As you can see from the block diagram, the first block is the sensing circuitry. Since we have considered two parameters i.e. temperature and humidity, we have used NTC thermistor and SY-HS-230 humidity sensor for measuring these parameters. We have connected both the sensors i.e. temperature and humidity sensor to ADC pins of Atmega16 to convert the analog value into digital value. The measured values will be passed towards the field PC through a normal cable as well as towards the control room PC through the fibre optic cable. Now we have to give this digital value to the USB port, so for that purpose, we'll select the baud rate for the data transmission. The transmitter/ receiver circuitry consist of photodiodes, IR LEDs and transistors (for amplifying the weak signal). If the signal is coming from photo diode, it will receive the signal and give it back to the controller and finally controller will display the value on LCD display panel and also control the relay depending on the instruction we provide.

The user sets the maximum limit for the temperature and humidity values. If the set limit is exceeded, the microcontroller provides the controlling actions and turns on the relay and the LED connected with it glows. Also devices such as fan can be connected to the microcontroller which can be manually turned on /off by the operator present in the control room. The field room PC only displays the measured values and the control room PC is used for monitoring as well as controlling purpose. All the controlling action is carried out by the program fed to the microcontroller as well as by the VB6 program. Basically we have been able to achieve device to PC communication in our project.

### B. Software

In our project, we have used Visual Basic 6 for GUI (Graphical User Interface) created for displaying parameter value and control. Visual Basic is a third-generation event-driven programming language and integrated development environment (IDE) from Microsoft for its COM programming model first released in 1991[16] and declared legacy in 2008. For microcontroller program, we have BASCOM-AVR software which is the original Windows BASIC COMPILER for the AVR family. It is designed to run on XP/VISTA/WIN7 and WIN8. It has structured BASIC with labels and structured programming with IF-THEN-ELSE-END IF, DO-LOOP, WHILE-WEND, and SELECT-CASE [15]. It generates fast machine code instead of interpreted code.

### IV. RESULTS

As you can see in the screenshots attached over here, the window created using VB6 displays the parameters' values as well as the controlling commands. Also you can see the graph that updates

itself every one second to plot a time-variant function. There is a COM port select option window where we can select ports from COM1 to COM4 depending on where the USB to TTL logic converter is used. For level converter, we have used Silicon Labs CP210x USB to UART Bridge which creates a virtual serial port in a PC.

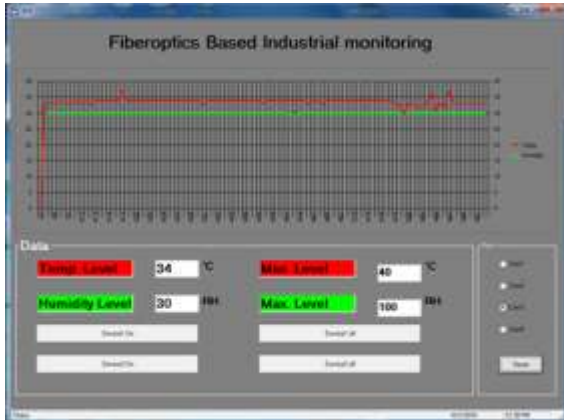


Fig. 3: Visual Basic output (when limit is not exceeded).

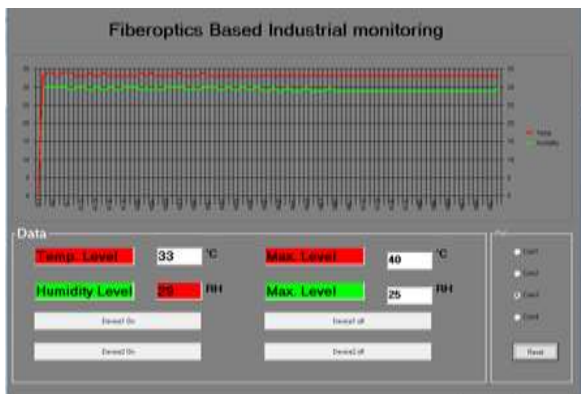


Fig. 4: Visual Basic output (when humidity value is exceeded).

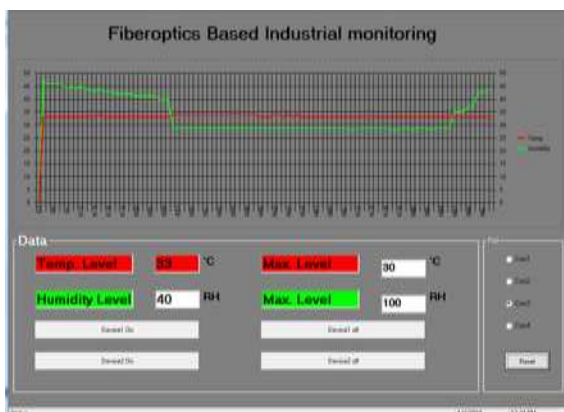


Fig. 5: Visual Basic output (when temperature value is exceeded).

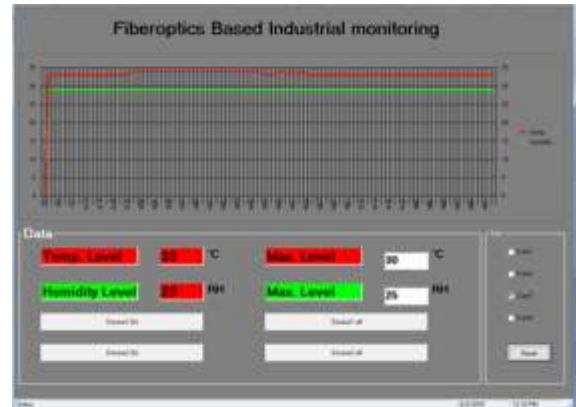


Fig. 6: Visual Basic output (when both temperature and humidity values are exceeded).

This CP210x makes it possible for our project to work on both laptops as well as PCs. The graph starts getting plotted once the port is assigned and the initial value is 0. Once the power supply is turned on, the microcontroller starts working and the temperature and humidity values start getting plotted on screen. If the supply is turned off, slowly the graph will be brought back to its initial position. When the maximum limit is exceeded in either case, the value box goes red as well as the relay turns on and so the LED indicator starts glowing. The “device on/off” can be used to manually control the device attached to the microcontroller circuit. For that purpose, we require additional relays (in this case, we require two relays for device 1 and 2). For example, if the temperature limit is exceeded, we get the signal and depending on that we can switch on the device (assume it is a fan), for bringing down the temperature of the heating element.

## V. ADVANTAGES AND DISADVANTAGES

### A. Advantages:

- 1) Simple and robust.
- 2) Cheaper and flexible.
- 3) Can control temperature, humidity and other parameters (based on our requirements).
- 4) Beneficial for monitoring and controlling operation without much manual efforts.

### B. Disadvantages

- 1) The data transmission rate is slow considering the simplicity of our circuit.
- 2) Thermistor and humidity sensor are very sensitive and are prone to damage.
- 3) There is no storage facility for the measured values.
- 4) The field room PC is not actually required considering the fact it is only used for display purpose.

## VI. CONCLUSION

Information transfer is the requirement of an hour. People are able to utilize the internet for this and yet currently it is a time-consuming process. The

information transfer is implemented including wireless platform and yet it is expensive affair. This is inexpensive than wireless platform and is at in contrast to wireless platform. Fibre optics includes personal benefits, great bandwidth, large speeds etc. In remote places where technology has not still grown where work is done manually and Wi-Fi is a far cry, fibre optics can be used for communication for that whole region. Even though our project has some limitations, it is able to demonstrate the idea that we had in mind. The basic idea of our project is sufficed through the developed prototype.

#### ACKNOWLEDGMENT

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