

# Implementation of a Controller Unit for an Intelligent Ventilation System (IVS) for a BTS Room

Sadeque Reza Khan  
Lecturer, Dept. of EEE  
Prime University  
Dhaka, Bangladesh

Ahmed Al Mansur  
Lecturer, Dept. of EEE  
Prime University  
Dhaka, Bangladesh

S.M. Ferdous  
Lecturer, Dept. of EEE  
American International  
University-Bangladesh, Dhaka

## ABSTRACT

Bangladesh is currently facing 1500 MW of power shortage causing serious dislocation in all spheres of life including production in fields and factories as well as in the section of cellular communication. As a result of giving support to the increasing customers the operators are improving their network by building new BTS all over the country which requires a great deal of electricity support. So to save the electricity and make the use of air conditioner less a system called Intelligent Ventilation System (IVS) is developed. An IVS is an electronic instrument that records data from the environment condition and take decision how the room temperature should be controlled. This research work deals with the design and construction of a ventilation system using the PIC16F877A which includes 10 bit Analog to Digital Converter (ADC) for data conditioning and a 256 byte EEPROM for data storing. Here we use a 4X20 line Liquid Cristal Display (LCD) for display section as well.

## General Terms

ADC, Air Conditioner, BTS, Fan, LCD, Microcontroller.

## Keywords

HSM20G, Intelligent Ventilation System, LM35DZ.

## 1. INTRODUCTION

Bangladesh has been facing electricity shortage for many years. In last few years this problem has exceeded the common people's patient [1]. People are facing heavy load shading problem. In this hot summer people have to stay ten to twelve hours without electricity. If the authority keeps run for one hour another one hour they have to stay without electricity. One of the major steps that our Government has taken to solve this electricity problem is that they will not provide any power from the grid to any new BTS rooms of any Celluler operator companies like Grammen Phone, Robi, Airtel etc. They have to develop their own power station either by using generator or by developing solar plants. Now a days most of the BTS room that the celluler operators are installing with a generator and 48 volt battery backup. So they alternate the source like they use generator for 6 hours and battery for next 6 hours to fullfil their power requirements. But it is not possible to operate an Air Conditioner (AC) by using a generator or battery for a long term. But AC is the most important part of a BTS room as the BTS room has to maintain a quite vaccum condition to keep it dust free and this creats heat like 50 to 60 degree celcius. This temperature is harmful for the equipments of a BTS room as those are very sophisticated and the room temperature must be maintained less than 40 degree celcius[2]. So to solve this problem and make the use of AC less, "ROBI" one of the leading celluler

operator of Bangladesh has designed a system called "Intelligent Ventilation System" or IVS [3][4]. Basically, IVS is a Microcontroller based electronics device that maintains the overall environment of a BTS room by controlling a Fan unit, a Filter unit and an AC by observing the room temperature, room humidity and battery voltage level of a BTS room.

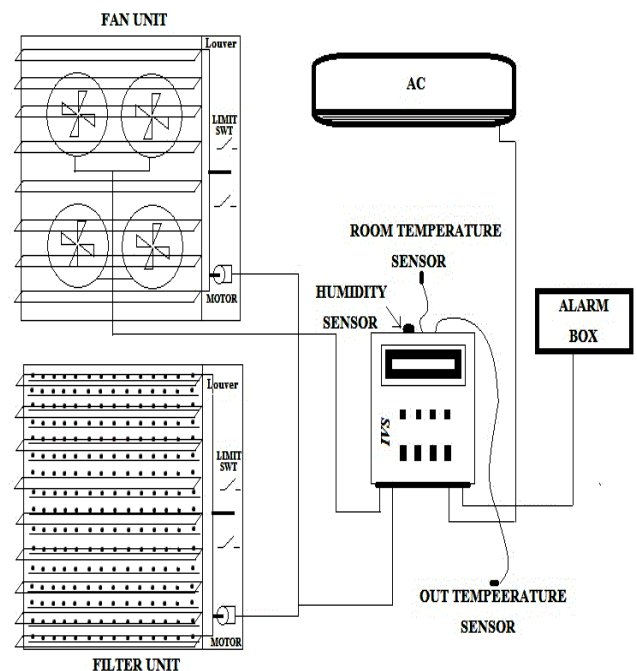


Fig 1: Total Intelligent Ventilation System Proposed by Robi

## 2. PROPOSED SYSTEM

The Intelligent Ventilation System is made up of the following major components, control unit, fan unit, filter unit, and air conditioner. Figure 1 shows the proposed Intelligent Ventilation System.

### 2.1 Control unit

This equipment controls every other component within the system. The controller unit controls Fan unit, Filter unit and AC according to the condition of the BTS room. This controller is also integrated with alarm box of the BTS room.



### 3.7 Fan Driving Section

This section is used to provide 48 volt DC voltage to the Fan unit of IVS. Here we design to give 48 volt individually to all 4 fans. Figure 6 shows the fan driving section.

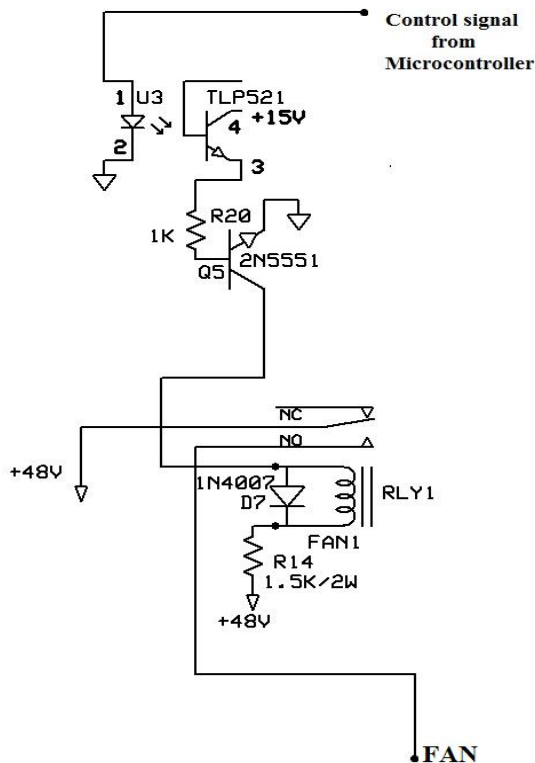


Fig 6: Fan driving Section

### 3.8 AC Driving Section

To drive AC a Solid State Relay is used which can drive upto 80 amperes of starting current. A solid state relay (SSR) is an electronic switching device in which a small control signal controls a larger load current or voltage [11]. Figure 7 shows a Solid State Relay.



Fig 7: Solid State Relay

### 3.9 Alarm Section

There can be three fault generated from the system. They are Fan Fault, Louver Fault and Low Battery voltage. For these three fault only one alarm that is "IVS Fault" must be given by the main controller to the alarm box of the BTS room through a relay contact. Figure 8 shows a alarm section.

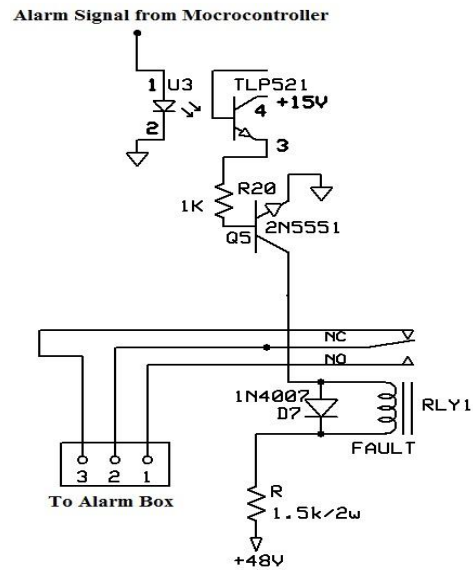


Fig 8: Alarm Section

### 3.10 Motor Driving Section

To open the hood of the louver a 12 Volt DC motor of atleast 10 RPM is used and this motor is driven by the main controller. Figure 9 shows the motor driving section.

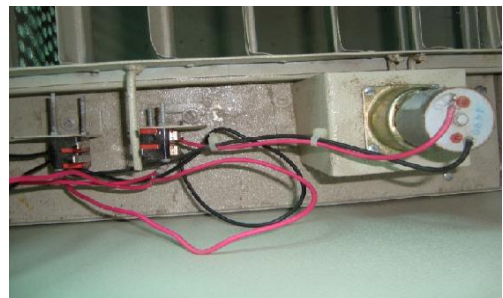


Fig 9: Motor Driving Section

## 4. OVERALL SYSTEM

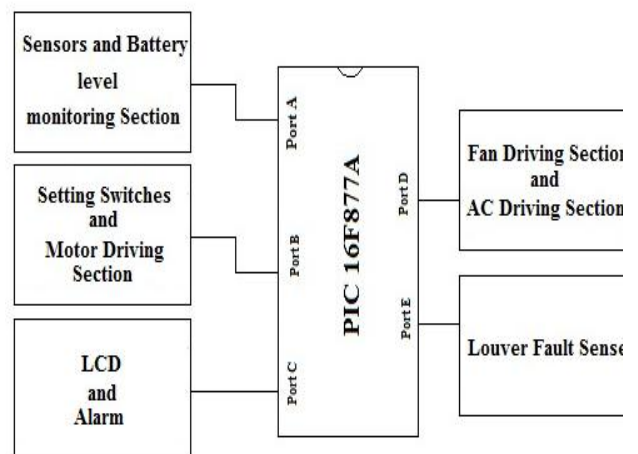


Fig 10: Overall Connection Diagram of IVS



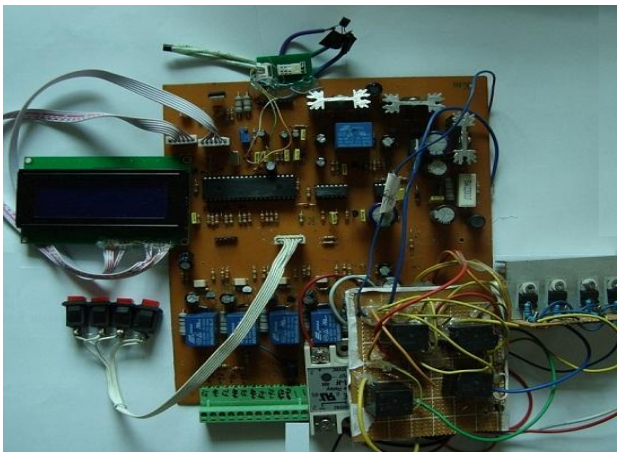
In IVS Controller the Sensors and other ADC components are connected in Port A of the Microcontroller PIC 16f877A[12], [13]. Setting switches and motor driving sections are connected in Port B. Display and alarm sections are connected in Port C. Fan and AC driving sections are connected in Port D. Louver fault sensing section is connected in Port E of controller IC. Figure 11 shows the overall connection diagram of IVS.

### 5. RESULT

The complete hardware of the intelligent ventilation system is shown in fig 11. The fan unit of an IVS, louver of fan and filter unit is shown in fig 12 and fig 13 respectively. Finally the different display outputs are shown in fig 14.



**Fig 13: Louver of Fan and Filter Unit**



**Fig 11: Complete Hardware of IVS Controller**



**Fig 14: Different LCD Output**



**Fig 12: Fan Unit of a IVS**

## 6. FLOW CHART

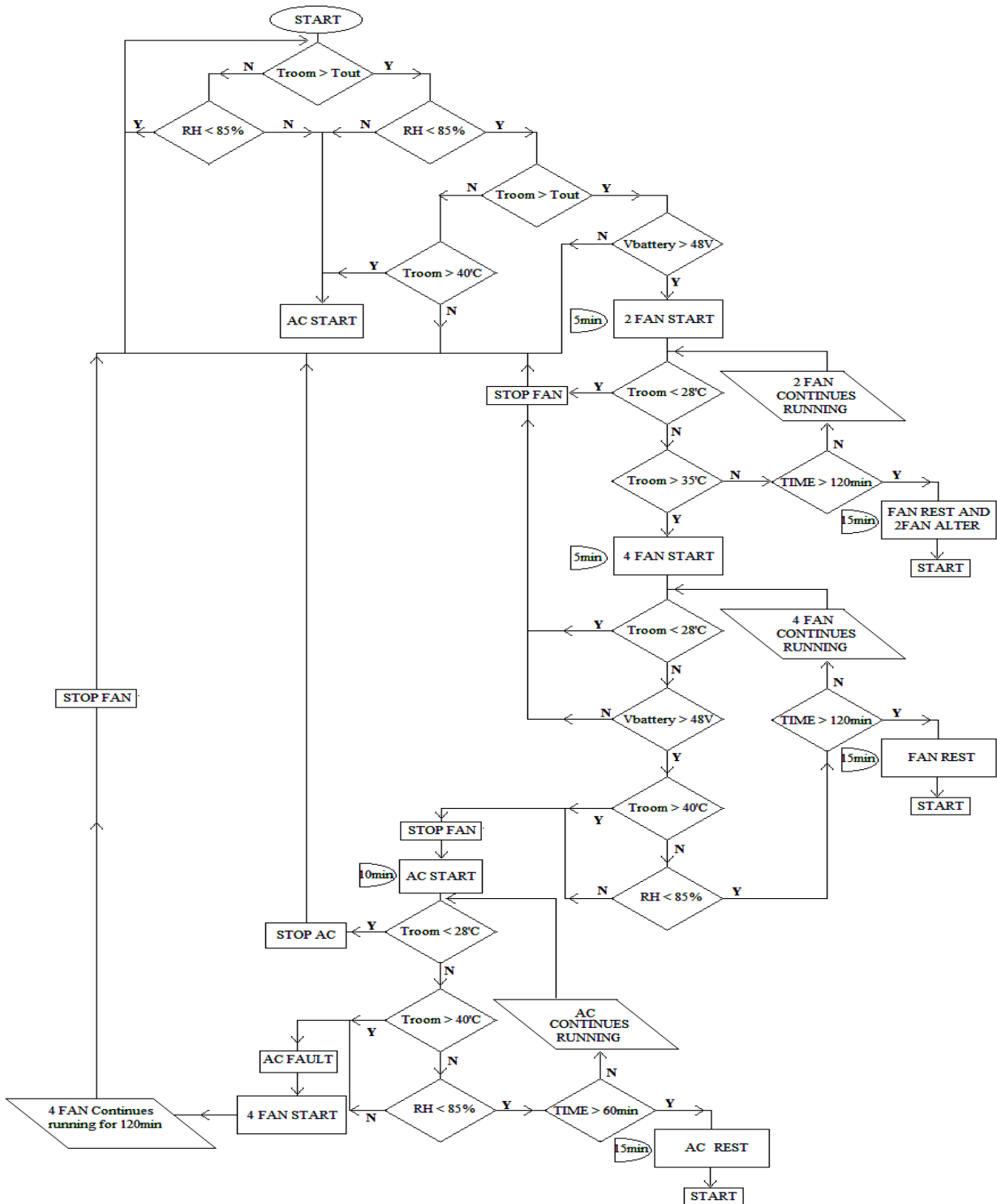


Fig 15: Conceptual logic diagram of IVS

The flow chart represents the complete logic of Intelligent Ventilation System (IVS) controller shown in fig 15. The controller responds with the change of temperature and humidity of a BTS room and it runs two fans or four fans following a louver open signal according to the logical sequence. If it fails to maintain the BTS temperature and

humidity then it gives charge to an Air Conditioner (AC) to control the situation.

## 7. CONCLUSION

The target of this work is to develop a ventilation system for BTS room cost efficiently and accurately. From the results of

the performance study, we can say that the developed system works properly and can provide economic benefits. One target of the system is to watch the condition of a BTS room and take some decision automatically. A microcontroller chip 16F877A is used in the controller and it has a 10 bit ADC module also. So, the system can read the necessary data from the environment accurately. The LCD used in this system can display the ADC data at different environmental conditions. It also display the applied modes by the controller. The other target of the system is to provide economic benefit to its users. Cheap and available instruments are used to design the system. And it is also playing an important role to save some electricity for a country. So, it is affordable for developing country like Bangladesh. The efficiency of the system is satisfactory. The A/D converter module has a high resolution, so accuracy of the system is nearly perfect. The overall performance of the system is satisfactory and successful.

## 8. REFERENCES

- [1] Electricity shortage is a serious problem in Bangladesh [Online]. Available: <http://www.hotneus.com>
- [2] MOBILECOOL/FCB, Available at: [http://www.advancedcoolingtech.com/products/FCB-EN\\_US.pdf](http://www.advancedcoolingtech.com/products/FCB-EN_US.pdf)
- [3] Roby of Bangladesh reduces CO2 emission by 30 percent in 2010, by Michael Kuehner. <http://telecomlead.com/blog-main.php?id=34&blgid=8>
- [4] Green Telecom, available at: <http://www.ekantipur.com/the-kathmandu-post/2011/03/26/money/green-telecom/219899.html>
- [5] SMPS, 15 December 2011 [Online]. Available: <http://en.wikipedia.org/wiki/SMPS>
- [6] PIC16F87XA Data Sheet: 28/40/44-Pin Enhanced Flash Microcontrollers, © 2003, Microchip Technology Incorporated.
- [7] PIC Tutorial Hardware- PIC Vietnam [Online]. Available: <http://www.picvietnam.com/download/Nigel%20tutorial.pdf>
- [8] LM35DZ Available: <http://www.alldatasheet.net/datasheet-pdf/pdf/8875/NSC/LM35DZ.html>
- [9] HSM-20R Humidity Sensor Module, Available: <http://www.justmystage.com/home/bellseki/HSM-20G.pdf>
- [10] Matrix multimedia E-Blocks, 2011 Available: [http://www.matrixmultimedia.com/E-Blocks\\_hardware.php](http://www.matrixmultimedia.com/E-Blocks_hardware.php)
- [11] Solid State Relay, December 2011 [Online]. Available: [http://en.wikipedia.org/wiki/Solid\\_state\\_relay](http://en.wikipedia.org/wiki/Solid_state_relay)
- [12] PIC Flowcode, [Online]. Available: <http://www.matrix-multimedia.com/flowcode3a-x.php>.
- [13] Bart Huysken, “An Introduction to Microcontroller Programming V1.0”, 3 April 2011.