Air Traffic Control

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***Abstract*-With the increasing demand for air transportation, all parties involved in the air transportation system have increased their efforts to make the system more efficient without sacrificing safety. This paper presents a new system based on information integration, the Air Traffic Control Command Monitoring System (ATCCMS), which integrates all kinds of fundamental information such as radar information, flight plans, voice communication, and weather conditions into a comprehensive information platform. In this paper, the context of voice communication is analyzed with speech recognition technology and is correlated with radar data and expert knowledge to determine whether any potential danger will emerge from the controller's instructions. Simulation experiments show that the safety level of air transportation systems will be effectively improved by the use of the information integration technique.**

Keywords—voice communication;radar information;flight plans; weather conditions

I. INTRODUCTION

To provide separation service for civil flights is the primary task of air traffic control. Aviation safety is the basis of expediting air traffic flow and improving the profitability of civil aviation transportation. Along with the rapid increase in air traffic flow in China in recent, air traffic controllers' workloads have been so greatly increased that man-made mistakes that threaten flight safety frequently happen. Although technical innovations in communication, navigation and surveillance have progressed and on-board safety devices,such as the Traffic Alert and Conflict Avoidance System (TCAS), have been gradually perfected, one problem that remains is to develop an efficient auxiliary automated system for air traffic controllers, which will act as an intelligent supervisor with the functions of monitoring daily air traffic control operations, alerting human controllers to possible man-made errors and ultimately ensuring flight safety. As described in [1] and [2], information integration, the driving force of this decade of IT (information technology) spending, is a technological approach that combines core elements from data management systems, content management systems, data warehouses, and other enterprise applications into a Platform. Based on the information integration technique this paper presents a new system for air traffic control, the air traffic command monitoring system (ATCCMS), which can reduce the controller's man-made errors and ensure flight safety. Some key components of ATCCMS are discussed in following discussion.

II.SAFETY PROBLEMS IN AIR TRAFFIC CONTROL (ATC)

During busy aviation activity, the concentration and stress of human controllers are so heavy that their mistakes are an important source of danger to flight safety. Most mistakes are related to the controller's speech. At present, TCAS has become the standard device for current civil aviation aircraft, which can effectively provide the pilot with potential conflicts and advice in order to avoid collision.

III.BLOCK DIAGRAM OF AIR TRAFFIC CONTROL:-

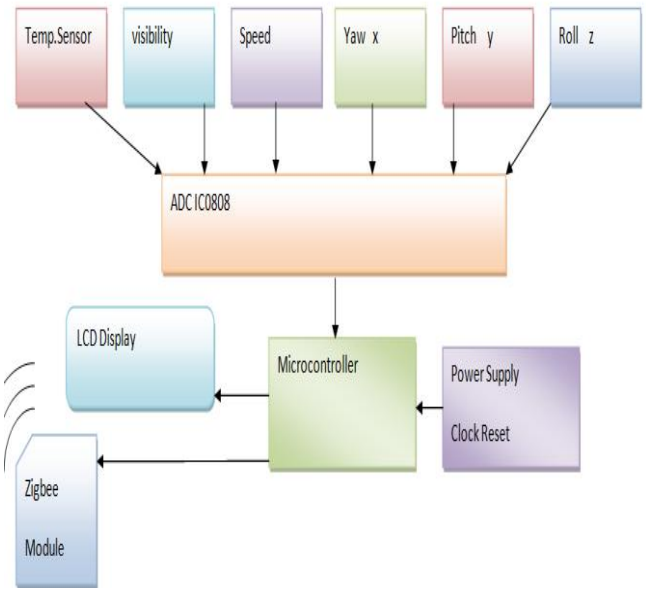

Figure 3.1:-Block diagram of transmitter

BLOCK DIAGRAM EXPLANATION:-

1) It consists of various sensors like temperature sensor, visibility sensor, speed sensor and accelerometer.
2) It gives information about the parameters in analog form and then using ADC IC0808 it is converted in digital.
3) Then the output of ADC goes to the microprocessor

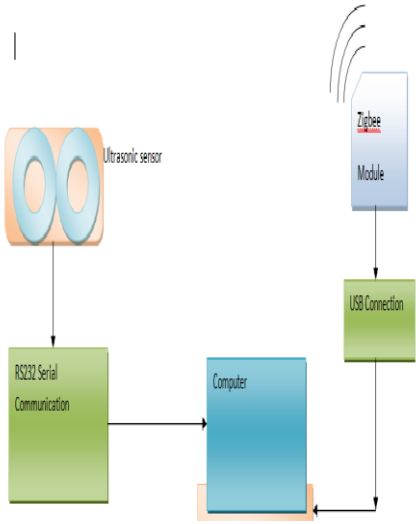

Figure 3.2-Receiver

and the microprocessor is connected to the power supply , clock and reset circuit.

4) Microcontroller output is connected to the LCD in the plane circuit to display parameters to pilot so he or she can find out the fault in which part is taking place.
5) Microprocessor output is also given to Zigbee module which transmits it to the control room.
6) Receiver also has a Zigbee module. It receives signal sent by transmitter and this module is connected to computer through USB connection.
7) This module has ultrasonic sensors which are connected to computer by RS232 serial interface. Ultrasonic sensor is used to detect any obstacle which is present on runway to avoid accidents also the collision of planes.

IV.CIRCUIT EXPLANATION:-

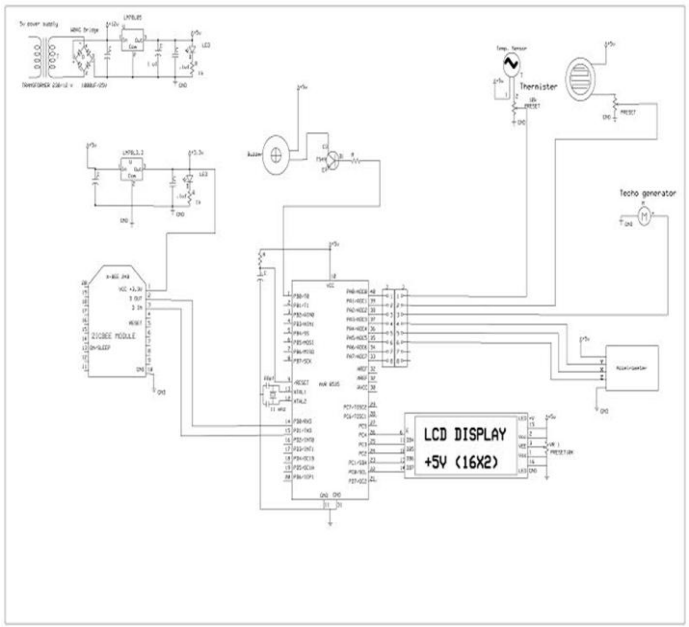

Figure 4.1:-Transmitter Section

1) Accelerometer sensor is a used to measure the distance,height and position of the plane .Five pins of this sensor are used like GND, VCC,X,Y,Z. It gives information in analog form.

2) Second sensor is temperature sensor.This sensor includes thermistor and potential divider. It has negative temperature coefficient. It gives variable voltage. It gives temperature of the plane engine.
3) Third sensor is used to measure the speed of the plane. This is obtained using techno generator. The variable voltage is produced depending upon the shaft position.
4) Fourth sensor used is visibility sensor.It is used to sense the visibility. In this, LED is used with photo diode. When the light on photo diode junction breaks, depending on that transistor is turned ON or OFF.
5) All these output values are in the analog form and then given to the ADC0808 to convert it into digital form and digital values are given to the microprocessor.
6) The ADC output is selected depending upon the select input. Clock to ADC is provided using 7414IC with a frequency 560Khz

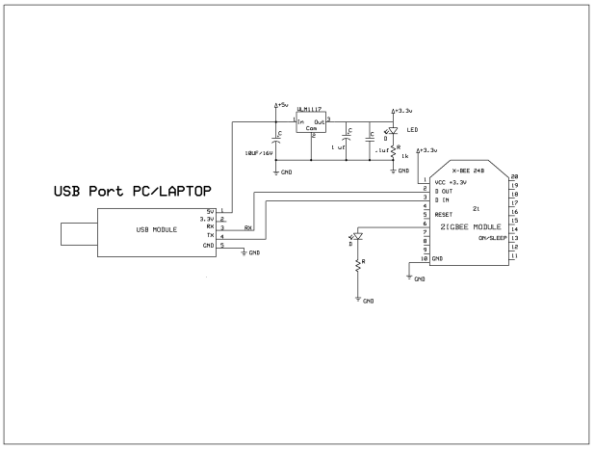

Figure 4.2:-Receiver

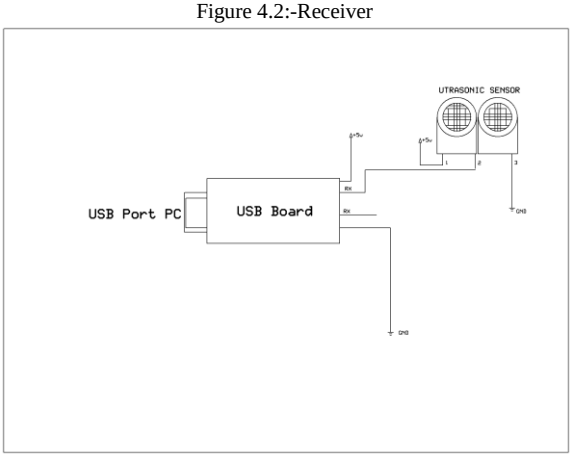

Figure 4.3:- Ultrasonic Sensor

V.ADVANTAGES:-

1) Air traffic control avoids accidents.
2) Air traffic controllers help to direct airplanes in the sky, on runways and at landing and take off to try to ensure the safety of air travel.
3) They warn pilots of weather changes, watch flights on radar and give permission for changes in flight plans. Some work as tower controllers, supervising runways, landings and takeoffs while others work as approach and departure controllers, using radar to guide traffic in and out of the airport.

VI.DISADVANTAGES:-

1) Base station range can be selected hence plane can be controlled within range.
2) Weather also is a problem factor for communication.

VII.APPLICATIONS:-

1) ATC circuit may apply to all planes.
2) This project may help in the future.
3) ATC helps to manage all unexpected accidents.
4) It can be used in aeroplanes.
5) This system can be easily connected to personal computer.
6) ATC is developed with Visual C++ 6.0 which provides GUI to the user, so it is easily understandable by the operator.
7) It integrates radar information, flight plan information, and weather information into a control room.

VIII.CONCLUSION:-

ATCCMS, developed with Visual C++ 6.0, integrates radar information, flight plan information, speech information of control instructions, and weather information into a common platform. Its function architecture and logic architecture were discussed in this paper. It can ensure reliable safety through monitoring the whole process of controller's instruction.In ATCCMS, multi-item unit techniques are used, such as speech recognition and its post-processing, flight conflict detection and alerting, and short-term flow management. These units monitor the different parts of the ATC command process, and support and reinforce each other by information integration. The simulation results show that the information integration technique is more effective than simply improving unit technique, and it can be a new promising method for solving the control and optimization problem of a large, complex system. ATCCMS can present, besides system safety, an information environment for air traffic control automation and the national flow management system of China.

However, the speech recognition component of ATCCMS currently relies on a Verbex voice recognition card, which is only supported by DOS drivers and is not supported by the Windows platform. Verbex also required users to train for up to one hour before using the program. While this ensured higher accuracy rates, the training period was inconvenient and required considerable time and effort in maintaining user's voice profiles. At the same time, the ability to use dynamic call signs and complex multi-instruction messages are strongly desired by air traffic controllers. It became clear that the Verbex system needed to be updated.

The direction for future work is to develop a new speech recognition system that can work well with Windows-based applications and support large complex grammar files. The grammar files could be easily modified to allow for multiple pronunciations of a single word or phrase. Most importantly, for the new system, user's training time should be eliminated and allow users with discrete accents to readily use the application.

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