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ADHOC NETWORK FOR AIRCRAFT LANDING SYSTEM

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***Abstract*— In the most modern airports, to reduce the down time of activities and to improve the air traffic, the automatic aircraft landing system is very important. The main aim of this project is to automate the verbal communication between the pilot and control departments presented on ground. We have majorly three departments on ground such as radar department, meteorological department and air traffic control. These departments are integrated into one by means of a ad-hoc network. The angular positions of the aircraft from the mid of runway, radiation techniques of the radars, demonstration of the diagonal antenna functions, landing angle of the aircraft, ambient parameters like temperature, humidity, wind speed, wind direction and so on.**

***Index Terms*— verbal communication, ad-hoc network, angular positions, diagonal antenna, ambient parameters.**

I. INTRODUCTION

In India, for aircraft landing system, we are using "instrument landing system". To improve the quality air traffic and to reduce the time of activities ad-hoc network for aircraft landing system is required. In order to reduce the number of air accidents, we would integrate the departments which are existed as individual departments.

The model that we are going to present is by using state of art embedded controller technology, wireless technology and audio-visual effects and multimedia was used along with visual basic software. This whole process is executed by means of a ad-hoc network.

A. NEED FOR AN AD-HOC SYSTEM AND NETWORK:

Based on the technologically driven lives, time becomes the most important parameter for all of us. So, the air travelling has seen a big boost in the recent ages. As the number of air travellers increase, the number of aircrafts increase and hence the increase in the probability of disastrous accidents happens.

Let us take an example to explain these accidents. On 22 may 2010, Air India Express 812 overshot the runway 24 on landing at Mangalore International Airport. 158 innocent passengers lost their lives. And one more flight on 1 January 1978, Air India flight 855 crashed off the coast of bandra, Bombay on when the captain became spatially disoriented after the failure of one of the flight instruments in the cockpit. A total of 213 abroad were killed.

We believe that these accidents happened in a scenario in which the pilot is left in dark when it comes into essential data that is required for landing due to improper communication.

II. SYSTEMS USED IN THE AIRPORT:

In India, for all of our airports to land a flight on the run way, we use instrumental landing system(ILS). In the existing system, the three essential departments are working together to safe land the aircraft. They are,

1. Radiation department.
2. Meteorologicaldepartment.
3. ATC(air traffic control)

A. Radiation department:

This radiation department is involved in rotation of the radar at a constant speed of 12.5 rpm(international standard speed) and it collects their geographical position of various aircrafts on the air. Then the data that is collected is fed to the ATS for decision making process

A. Meteorological department:

Meteorological department measures the some of the ambient parameters like temperatures, humidity, wind speed, wind direction, visibility and fog. Sensors are used in order to calculate all these parameters. That means, the physical instruments are used. Then, these parameters are converted into the electrical signals, which are later conditioned and calculated by using computer interface. Then these

collected physical parameters are sent to the ATC for decision making on ground conditions for safe landing the aircrafts.

B. Air traffic control:

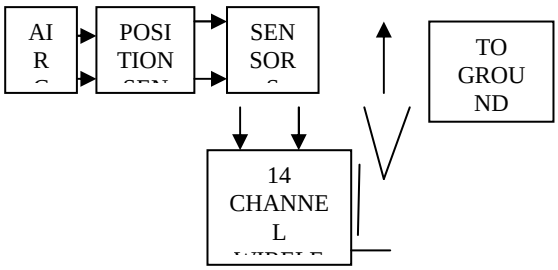
The air traffic control is the decision making department. The information that is sent by the other departments is taken and processed according to that. The responsibility of this department is to analyse the aircrafts perfect position and guides them during landing. The altitude of the aircraft and position of the wings with respect to the runway are collected automatically be means of diagonal antenna. This helps the pilot to right land the aircraft.

The disadvantages of the mentioned system are:

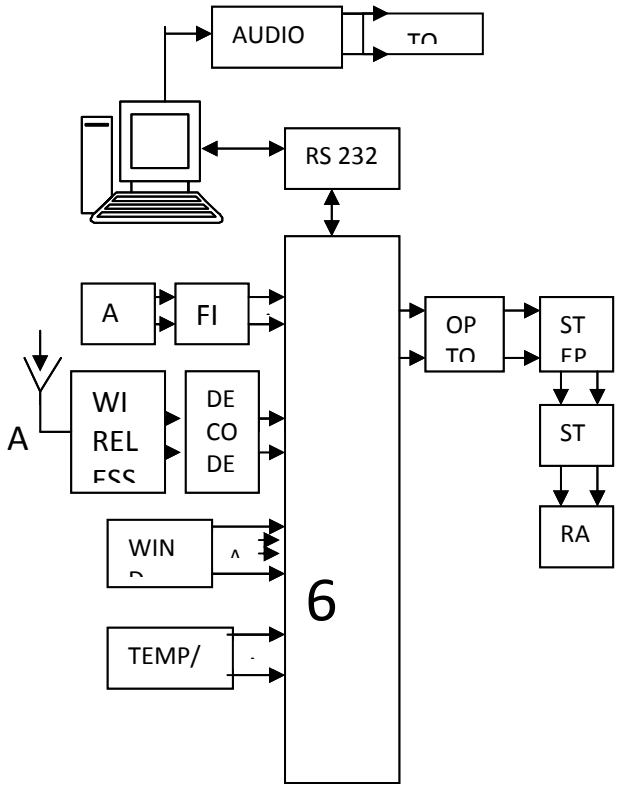
- The landing process and time is slow.
- The error occurring probability is high.
- The physical parameters are not accurate because of using instruments which are reliable.

In order to eliminate the error occurring and reduce the disadvantages, the AD-HOC network is introduced in which above mentioned departments are integrated into one. wireless and embedded technology helped us in this quest.

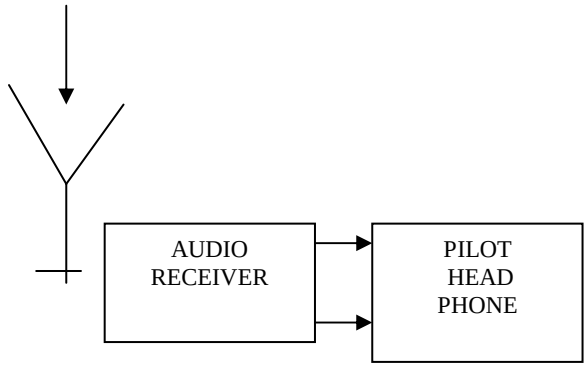
C. Air traffic direction controller:



III. BLOCK DIAGRAM::



A. Aircraft receiver:



Block diagram description:

A. PIC-Microcontroller and PC:

Peripheral interface controller is an embedded controller. This microcontroller has several advantages over different microprocessors and microcontrollers like fast data acquisition, accuracy and compactness. Here, this PIC controller is used to interface the ALS kit and PC using some in-built I/O ports. The output of the ALS kit is give to the PC and the output of PC is given as input to the ALS kit. PC is used to monitor the data which is shown with the help of a simulation using visual basic.

B. RS-232 converter:

This is a voltage regulator and serial port converter. This is used to make the connection between the PIC (peripheral interface controller) and PC(personal computer) and make the voltage regulations between them. (PIC: 5V, PC: 10V).

C. Landing sensors:

Mainly aircraft has three states or stages like downwards, upwards, turn left and turn right. Based on this, a total of twelve positions may be changed during using a lever. The pre-defined position of the aircraft is defined before take-off and landing. In order to find the position of the lever, we have used pull-up-resistors(sensors) at both ends in every position. 10Kohms resistors are used in series. The output will go high whenever the sensor senses the lever. This output will be given to the monitoring system.

D. Temperature and humidity:

Thermistor is used to find the atmospheric temperature (room temperature) and humidity. Temperature is obtained in mill volts and is converted into degree Celsius using some manual calculations.

The formula to calculate the humidity is:

$$\text{Humidity} = \frac{\text{Temperture of water}}{\text{temperature of room}} * 100.$$

B. Wind speed and wind direction:

With the help of simulation only the wind speed and wind direction is shown. By using switches and fans, these parameters are measure in real time.

E. Fog and visibility:

IR sensors are used in order to measure the fog and visibility. These IR sensors consists of IR detector and IF emitter. IR emitter is given by positive voltage. Using this voltage, it transmits IR rays continuously & IR Detector collects these rays. If there is any obstacle between emitter & Detector, the amount of rays that is collected by Detector will be reduced.

For measuring visibility, IR detector and IR emitter are placed parallel so that rays passed by IR emitter is collected by IR detector. If there is any substance or obstacle between emitter and detector, the amount of rays collected by detector is reduced. This depends on the distance of substance from the IR emitter. The amount of rays collected by Detector will be reduced, when the distance increases. Hence, we can understand that visibility increases with decrease in the collection of rays.

For measuring the fog, IR detector and IR emitter is placed face to face so that IR detector collects the rays passed by the IR emitter. If there is any obstacle between Emitter & Detector, the amount of rays collected by Detector will be reduced depends on the obstacle.

C. Stepper driver logic:

Buffer, Opto-coupler, pre-driver and driver are present in stepper driver logic.

D. Buffer:

For driving the high current loads, buffer interfaces 8255 with high level circuits 9such as MOS).

I. Opto coupler:

Opto coupler consists of Opto-emitter and Phototransistor. An opto coupler is essential to prevent the computer from hazardous conditions like back emf's, high voltage spikes and voltage transients. DC stepper motors are used for our robotic applications. When we pass the DC current to a coil it will get Electro magnetized, when we withdraw the DC source and also it won't get demagnetized. If it is not demagnetized, back EMF is produced which can create kick back current to the subsequent devises or associate circuitries.TIP122 (NPN) cannot be directly coupled to the opto coupler since it require large current for driving. Hence, we use the driver SL100 to boost the current level.

N. Driver:

In general, drivers are used to amplify the current. It amplifies the 50ma current to 2A, which is required to run the motor.

O. Control logic:

Control logic consists of SL 100 and relays. When we are required to rotate the motor, we need do input high level through PA7 of PPI to SL100 70mec before. Hence, SL100 produces logic low. Then the coil is energized and the 24V is connected to the coil of the driver by the relay.

IV. THE PROJECT:

P.Board 1: Board with sensors:

Twelve sets of IR sensor and detector is utilized to find the direction at which the plane is voyaging. These information sources are given to the encoder circuit alongside the RF module transmits the given data. These are utilized to make an picture of an aircraft which is very nearly landing.

Q.Board 2: Meteorological piece of the project:

A Couple of Thermistors are used to measure environmental temperature and humidity simultaneously. Sensors for visibility level and environmental haze level are likewise joined, connected along is a potentiometer that is utilized to demonstrate the point at which the flying machine ought to travel. Heading and Speed of the wind are likewise appeared with the assistance of simulation.

1) Fog: Fog refers to mist and its density. Flight's way isn't clear when there's a fog. To recognize the amount of fog in the air oppositely placed IR emitter-IR detector is used.

2) Visibility: It is an important parameter required by the pilot. It provides information about how far the vision ofthe pilot or the path of the aircraft is clear.

In our project thisis measured using parallel placed IR emitter-Detector.

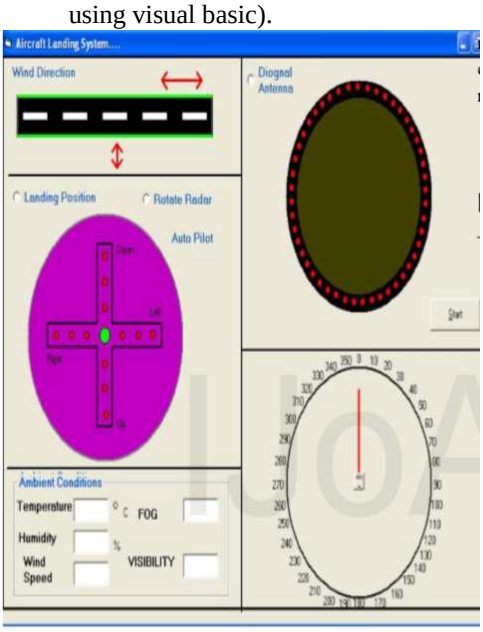
3) Wind Speed & Direction: Wind speed and direction is demonstrated in the PC with the assistance of simulation.

4) ATS: Decoder circuit: The Decoder (HT1D) unravels the data sent by the encoder (HT12E) from the sensor circuit.433.92 RF module helps in getting those sent signals.

5) Embedded Micro-controller Circuit: It does the work ofthe Air Traffic Service/Control in the circuit. The input ports of the PIC controller receive the decrypted transmitted data from the Decoder. According to those received data, output signals are sent to the RADAR part and the Max 232 board.

6) RS 232 Board: This aides in the correspondence betweenthe PC and ATS model.

7) Radar: Stepper motor performs the radar work in the circuit.(The programming for the PIC-microcontroller is done using embedded system and the data is collected and the simulation is done using visual basic).



V. ADVANTAGES:

Advantages of the proposed model over the existing one:

- All the necessary department are close to one-another.
- Simple to fabricate and re-deliver.
- Sensors are precise and solid.

Future Extension: The Airplanes are to be fitted with GPS frameworks so that their area at each point in the excursion is known. This will stay away from mishaps because of impacts with different aircrafts. Numerous such models can be associated with servers which could help inarriving of more than two aircrafts at the same time.

VI. CONCLUSION:

Incorporation of these monitoring systems reduces time utilization and expands the stream of air traffic. By real-timeimplementation of this project, ATS can monitor and controlthe air-traffic more efficiently. If such contingency proof system were implemented with the availing hand of technology then asafer travel would be possible and such a travel would preservemillions of lives. Such advancement would lead to healthycompetition among the companies in the line of air-travel to

meet the growing demand.

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