Advanced Landing System

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I. INTRODUCTION:

The principal object of this paper is to emphasize the idea behind our project **"Advanced Landing System"** which is a 3-D model of the proposed Instrument Landing system in the airport. Some essential parts of today's airport are not fully automated.. In India we still use a system called the "Instrument Landing System" for landing of the aircraft. In Europe and America computer-guided landing is done without much manpower. Automatic ***Advanced Landing System*** is most essential for the modern airports to reduce the time of activities and to improve quality air traffic. We would like to integrate the existing system, which consists of three individual departments. We believe that the integration would reduce the number of air accidents.

We present a model of the proposed integrated system which was built using state of art Embedded Controller Technology, Wireless technology and audiovisual networking. In our project we have demonstrated the diagonal antenna function, rotation technique of radars, landing angle of an aircraft, ambient parameters like temperature, humidity, wind Speed, wind direction and much more. For audio, visual effects, multimedia was used along with visual basic software

II. NEED FOR AD-HOC SYSTEM:

As we move on with the technologically driven lives, time becomes important for all of us. Hence air travelling has seen a big boost in the recent ages. As number of air travellers increase , the number of air-crafts increase ,increasing the probability of disastrous accidents along with it. Few of them are listed below

• Name of the aircraft: Air India Express Flight 812

Date: On 22 May 2010
Accident: It overshot the runway 24 on landing at Mangalore International Airport. 158 innocent Passengers lost their lives.

• Name of the aircraft: Air India Flight 855
Date: 1 January 1978
Accident: It 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. All 213 aboard were killed.

We believe that majority of such accidents occur in a scenario in which the pilot is left in dark when it comes to essential data required for landing due to improper communication. We believe that our model can tackle this problem.

III. SYSTEM USED IN THE AIRPORT:

In India, we use conventional ***Instrument Landing System (ILS)*** for all of our airports to land a flight on the runway. In present system , there are three essential departments that work simultaneously so that an aircraft can land safely.
They are
1. Metrological Department
2. Mechanical Department
3. ATS (AIR TRAFFIC SERVICES)

A. Metrological Department:

It measures the following ambient features that are essential for a landing aircraft .They are temperature, humidity, wind speed, Direction of wind, Visibility and Fog. Physical instruments are used in measuring these parameters. The above said parameters are converted to electrical signals using suitable means, which are later conditioned and computed by computer interface. All the collected physical parameters must be sent to ATS for decision making on ground conditions for safe landing of the aircraft.

B. Mechanical:

Mechanical department is involved in rotation of the radar at a constant speed of 12.5 rpm (international standard speed) and it collect data's from various aircrafts and their geographical position on the air. The collected data's then fed to ATS for decision-making process.

*C. **Air Traffic Services:***

This is a decision-making department. It makes its decision based on the data offered by the other two departments. ATS is responsible for analysing the aircraft's perfect position and it guided them during landing. The position of the wings, Aircraft's height with respect to the runway are collected automatically using diagonal antennas which advice the aircraft captain to take right landing path.

The *draw-back* of the mentioned system is
• The landing process is Slow.
• Probability of an error occurring is high.
• The physical parameters are measured by instruments which are reliable but not accurate.

To solve the above, we developed ***an AD-HOC system***, where the above said three departments will be in one computer. The same computer will guide the aircraft for safe landing. ***Embedded technology and wireless technology with audio-visual system*** helped us in this quest.

IV. BLOCK DIAGRAM

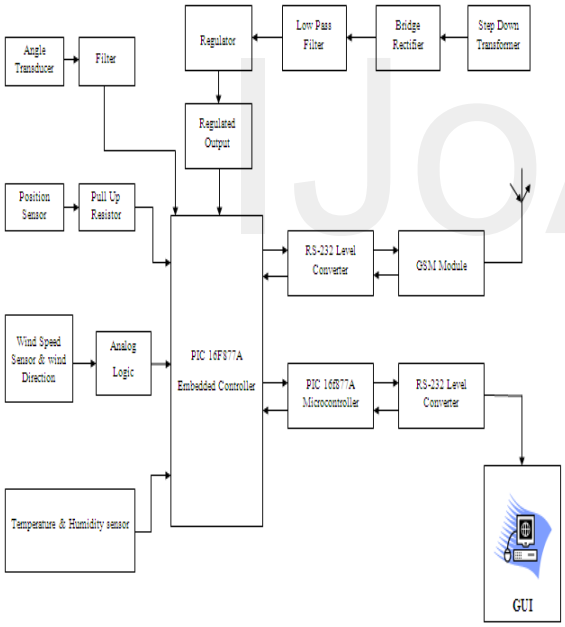

Figure 1. Block diagram

BLOCK DIAGRAM-DESCRIPTION

D. Pic-Microcontroller and Personal Computer:

Peripheral Interface Controller (PIC) is an embedded controller. PIC micro controller has the several advantages over sever other microprocessors and microcontrollers like fast data acquisition, compactness and accuracy. Here PIC used to inter-connect the ALS kit and personal computer using some in-built I/O ports Humidity may be obtained using the following formula available in it. Output of the ALS kit will be given as input to the personal computer and output of personal computer will be given as input to the ALS kit. Personal computer here used for monitor the data which is shown with the help of a simulation done using Visual Basic.

E. Rs-232 Converter:

This is a serial port connector and voltage regulator. RS-232 converter used to make connection between PC and PIC and make voltage regulation between them. (PIC: 5 volts, PC: 10 volts).

F. Landing Sensors (Pull Up Resistors):

Aircraft has three stages for every movement of Upwards, Downwards, and Turn left and Turn right. Totally it has twelve positions which may be changed using a lever. Aircraft should be in pre-defined position before take-off and landing. To find the position of the lever we have used pull-up-resistors (sensors) at both ends in every position (12-Positions). 10kohms resistor is used in series. It is used to verify if the input of pre driver stage is low. When the IR detector is not conducting the collector to emitter is high. Now the input at pre driver (SL 100) may be high or low. To make sure that it is low we use pull down resistor. Whenever a particular sensor senses the lever, the output will go high. This output is given to the monitoring system.

G. Temperature And Humidity:

We have used thermistor to find atmospheric (Room) temperature and humidity. Temperature obtained in millivolts is converted into degree Celsius using manual calculations.

Humidity may be obtained using the following formula:

$$\text{Humidity} = \frac{T_{Water}}{T_{Room}} * 100$$

H. Wind Speed And Wind Direction:

Wind speed and wind direction in our project is shown with the help of simulation only. In real-time wind speed and direction is measured by using switches and fans respectively.

I. Fog And Visibility:

For FOG & Visibility, IR Sensors are used. IR Sensors consists of IR Emitter and IR Detector. Positive Voltage is given to IR Emitter. 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 FOG, IR Emitter & IR Detector is placed face-to-face so that IR Detector collects rays passed by IR Emitter. If there is any obstacle between Emitter & Detector, the amount of rays collected by Detector will be reduced depends on the obstacle (fog).

For VISIBILITY, IR Emitter & IR Detector is placed parallel so that rays passed by IR Emitter are collected by IR Detector. If there is any obstacle between Emitter & Detector, the amount of rays collected by Detector will be reduced. This depends on the distance of obstacle from IR Emitter. If distance increased, the amount of rays collected by Detector will be reduced. From this value, we will understand visibility is more (I.e.) visibility increases with decrease in collection of rays.

J. Stepper Driver Logic:

The stepper driver logic consists of buffer, opto-coupler, pre-driver and driver.

K. Buffer:

Buffer interfaces 8255 with high-level circuits (such as MOS.) for driving high current loads.

L. Opto Coupler:

It consists of Opto-emitter &Phototransistor. An opto coupler is essential to prevent the computer from hazardous conditions like voltage transients, back emf, and high voltage spikes. We use dc Stepper motors for our robotic applications. Normally when we pass dc current to a coil it will get Electro magnetized, when we with draw the dc source & also it won't get demagnetized. If it is not demagnetized, back EMF is produced which can create kick back current to the subsequent devices or associated circuitries.

M. Pre-Driver:

We cannot directly couple the TIP122 (NPN) to the opto-coupler since it requires large current for driving. We use the driver SL100 to boost the current level.

N. Driver:

The main principle of the driver is to amplify the current. It amplifies the 50mA current to2A, which is needed to drive the motor.

O. Control Logic:

It consists of an SL100 and relays. Whenever we need to rotate the stepper motor we input high level through PA7 of PPI to SL100 70msec before. So SL100 produce logic low. Now the coil is energized and the 24v is connected to the coil of the driver by the relay.

V. THE PROJECT:

P. Board 1: Board with sensors:

Twelve pair of IR sensor and detector is used to measure the direction at which the plane is travelling. These inputs are given to the encoder circuit along with the RF module transmits the given information. These are used to create an image of an aircraft which is on the verge of landing.

Q. Board 2: Meteorological part of the project:

Thermistor is used to measure atmospheric temperature. Another thermistor is used to measure humidity simultaneously. Sensors for visibility level and atmospheric fog level are also attached, attached along is a potentiometer that is used to show the angle at which the aircraft should travel. Direction and Speed of the wind are also shown with the help of simulation.

1) *Fog:* Fog means mist and its density. Flight's path isn't clear when there's a fog. To detect the level (amount) of fog in the air oppositely placed IR emitter-IR detector is used.

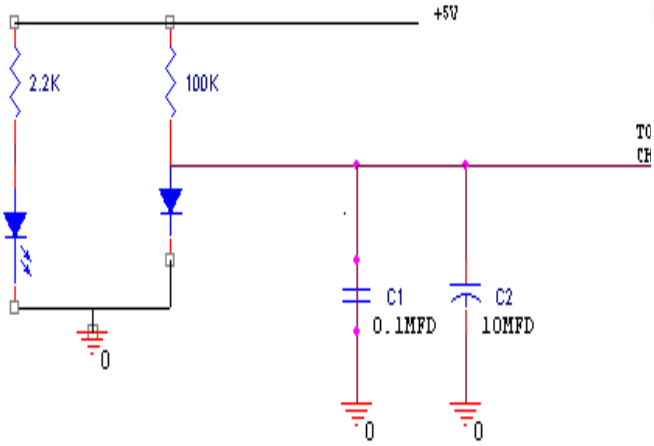

Figure 2. circuit for fog

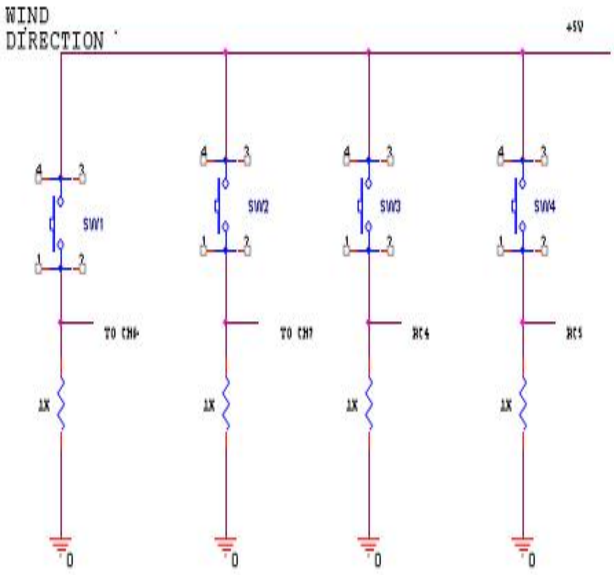

Figure 4. circuit for wind direction

2) *Visibility:* Visibility is an important parameter required by the pilot. This gives information about how far the vision of the pilot or the path of the aircraft is clear. In our project this is measured using parallel (side by side) placed IR emitter-Detector.

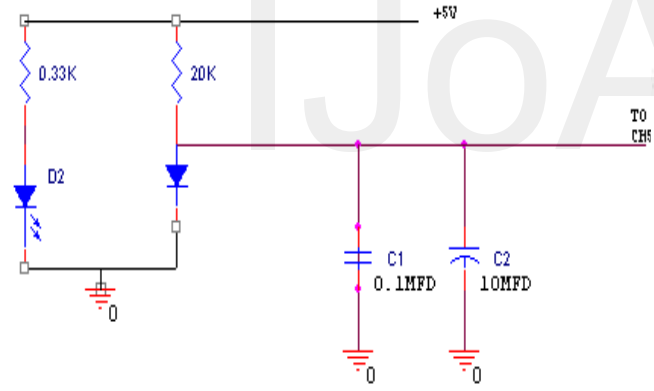

Figure 3. circuit for visibility

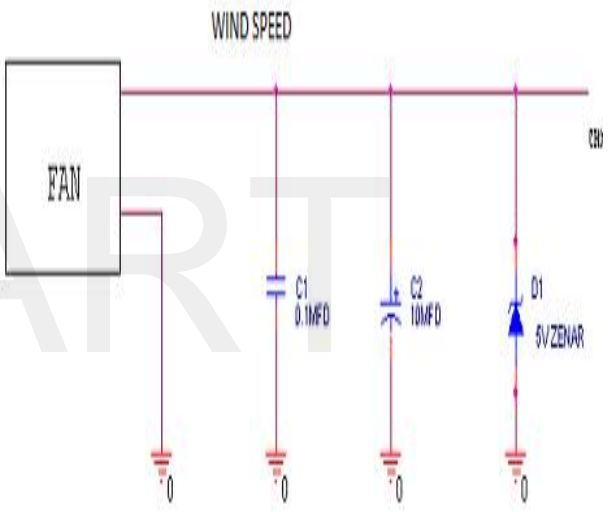

Figure 5. circuit for wind speed

3) Wind Speed & Direction: Wind speed and direction is indicated in the PC with the help of simulation. The Circuit is shown below.

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

5) Embedded Micro-controller Circuit: It covers the work of the Air Traffic Service/Control in the circuit. The input ports of the PIC IC receive the decrypted transmitted message from the Decoder.

According to those received signals, output signals are sent to the RADAR part and the Max 232 board.

6) *RS 232 Board:* This helps in the communication between the computer and ATS model.

7) Radar: Stepper motor does 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)

Figure-6 shows the simulation done using visual basic software.

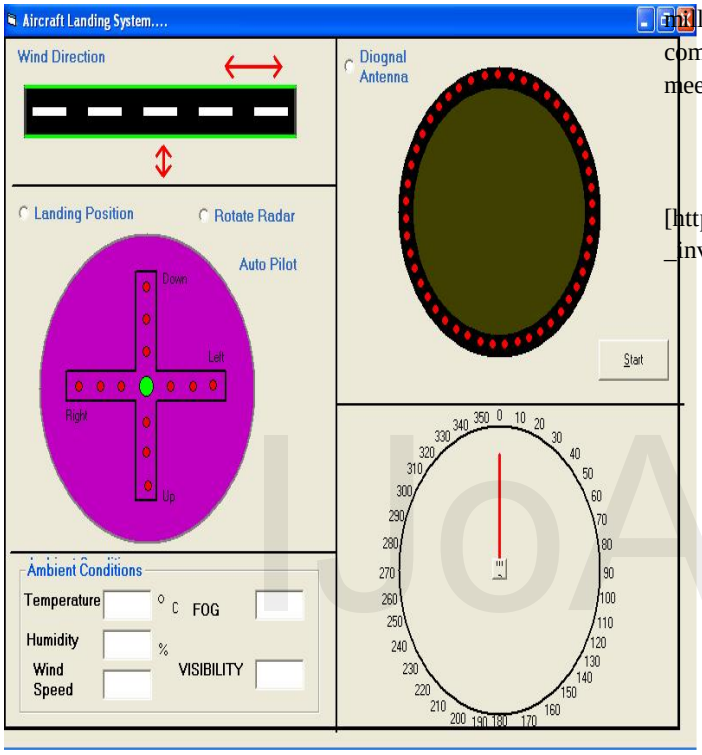

Figure 6.simulaton for aircraft landing system

VI. ADVANTAGES:

Advantages of the proposed model over the existing one:

• All the necessary department are close to one-another.
• Easy to build and re-produce.
• Sensors are accurate and reliable.

Future Scope:

The Aircrafts are to be fitted with GPS systems so that their location at every point in the journey is known. This will avoid accidents due to collisions with other aircrafts. Many such models can be connected to servers which could help in landing of more than two aircrafts simultaneously.

VII. CONCLUSION:

Integration of these monitoring systems reduces time consumption and increases the flow of air traffic. By real-time implementation of this project, **ATS** can monitor and control the air-traffic more efficiently. If such accident proof system were implemented with the helping hand of technology then a safer travel would be possible and such a travel would save millions of lives. Such advancement would lead to healthy competition among the companies in the line of air-travel to meet the growing demand.

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