Hybrid Based Climatology Lab For Airports

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Abstract-Automatic Advanced Landing System is most essential and required for the most modern airports to reduce down time of activities and to improve quality air traffic. We would like to integrate the existing system, which is widespread in the airports today and leads to misguiding of aircrafts. We would like to present an economic affordable solution for perfect takeoff and Landing System for airports with physical ambient conditions of the airport with audiovisual networking. To have a reality demonstration of our idea, we have employed the state of art Embedded Controller Technology along with associated hardware required for input and output.

We would like to develop angular position of the aircraft from mid of runway, demonstration of 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 will be used along with visual basic software. We would like to develop an auto pilot system during highjack time using communication analysis, delink of communication and reception of communication in other such base station. A real time hand move model will be develop for this project.

Keywords—solar system, wind power, GSM, visual basic, smart grid.

I. INTRODUCTION

Meteorological Stations (AMSs) situated at various national and international airports of the country. The MWOs are catering the needs to flights in their respective flight information region (FIR). Regional Specialized Meteorological Centre (RSMC), IMD New Delhi also serves as one of the ICAO designated Tropical Cyclone Advisory Centers (TCAC) to provide Tropical cyclone advisory to the MWOs in India and neighboring countries for safety of aircraft movement in disaster weather. The technical coordination and overseeing of the functions of the aviation meteorological offices in India is done by Central Aviation Meteorological Division (CAMD) functioning at DGM New Delhi. The web based information dissemination system known as On-line Briefing System (OLBS) of IMD is being maintained by the meteorological offices functioning at MWOs Chennai and New Delhi, through which the registered users can directly download the forecast products as desired. Apart from the primary communication channels of AAI, the department has all advanced communication modes for the dissemination of aviation information.

The aviation industry in India has emerged as one of the fastest growing industries in the country during recent years. New airports are coming up under RCS UDRAN. So Aviation sector has witnessed rapid growth both in terms of density of air traffic and number of airports. This trend is expected to continue in coming years also. In order to meet demands of growing aviation sectors & to discharge quick quality work, the need for a consolidated Standard Operational Procedure (SOP) on aviation meteorological services for ready use by aviation meteorological offices was felt necessary and hence the first edition of SOP on aviation meteorological services in India has been brought out (March 2021). The Areas of SOP are restricted to procedural aspects of Meteorological service to aviation. It is hoped that the information it contains will be very useful to the officials working in operational field.

II.LITRATURE SURVEY

Weather affects aviation activities at various stages of operation. In order to ensure safe operations in all-weather situations, National Meteorological Services throughout the world are obliged by law to make meteorological observations & forecasts, to establish and maintain monitoring and warning systems in their countries.

The objective of Aeronautical Meteorology is to contribute towards the safety, economy, regularity and efficiency of air navigation.

National Meteorological Services throughout the world make meteorological observations and forecasts through establishment of sustained monitoring and warning systems in their respective countries, as per the standards and guidelines provided by World Meteorological Organization (WMO) and International Civil Aviation Organization (ICAO).
World Meteorological Organization (WMO) sets standards and guidelines for meteorological service for aviation through its Standing Committee on Services for Aviation (SC-AVI) earlier known as Commission for Aeronautical Meteorology.
International Civil Aviation Organization (ICAO) which is responsible for civil aviation regulations co-operates closely with WMO in all matters related to meteorology and common regulations are agreed to by both Organization.

III. CLIMATOLOGY INFORMATION

Aeronautical climatological information required for the planning of flight operations shall be prepared in the form of aerodrome climatological tables and aerodrome climatological summaries. Such information shall be supplied to aeronautical users as agreed between the meteorological authority and those users.
Aeronautical climatological information shall normally be based on observations made over a period of at least five years and the period shall be indicated in the information supplied.
Climatological data related to sites for new aerodromes and to additional runways at existing aerodromes shall be collected starting as early as possible before the commissioning of those aerodromes or runways.

IV. METEOROLOGICAL INFORMATION IN SUPPORT OF AVIATION

The Meteorological information for the use of aviation activities are:
1. Current weather observations (METAR/ SPECI, MET REPORT/ SPECIAL).
2. Forecasts (Terminal Aerodrome Forecast (TAF), Area/ Local Forecast, Route Forecast, Take-off and Landing (TREND) Forecast)
3. Warnings (Aerodrome warnings, Warning for Light Aircrafts, Wind shear warnings, SIGMET)
4. Climatology (Climatology of Aerodromes, Climatology Summary, Climatology of upper wind and temperature).
The primary duties of a Tower MET Officer are as follows:
Observation and Recording of Aeronautical Meteorological Phenomena and parameters in accordance with relevant provisions.
Ensure that her/his unit operates efficiently.
Keep continuous watch over the Aerodrome and vicinity for weather phenomenon detrimental for Air Navigation.
Prepare routine, non-routine report and disseminates it to recipients as per the schedule.
Keeps continuous watch over the performance of sensors and instruments.
Check and confirm the quality of meteorological observations before issuance including relevance of content, time of validity and location of phenomena.
Issues TREND Forecasts. Briefs the ATCO, Duty Officer and Operators about the prevailing meteorological Conditions and imminent changes.

V. IMPORTANT PARAMETERS OF METEOROLOGY STATIONS

Surface Wind (Direction and Speed), Visibility, Runway Visual Range (if available), and Present Weather
Cloud amount, cloud type (only for cumulonimbus and towering cumulus clouds) and height of cloud base or where measured, Vertical Visibility, Air Temperature and Dew Point Temperature, Pressure- QNH and, when applicable, QFE (QFE included only in local routine and special reports)This message is identified with the prefix “ADDITIONAL” and supplied on red color paper. However, these are not disseminated outside the aerodrome of origin. These are issued to local ATC units in addition to the local routine reports and local special reports.

VI.SURFACE WIND

1. When the mean surface wind direction has changed by 600m or more from that given in the latest report, the mean wind speed before and/or after the change being 10 knots or more;
2. When the mean surface wind speed has changed by 10 knots or more from that given in the latest report;
3. When the variation from the mean surface wind speed (gusts) has increased by 10 knots or more from that given in the latest report, the mean speed before and/or after the change being 15 knots or more.
Visibility

When the visibility is improving and changes to or passes through one or more of the following values, or when the visibility is deteriorating and passes through one or more of the following values: 800, 1500, 3000 or 5000 meters.

Runway Visual Range (RVR)

When the runway visual range is improving and changes to or passes through one or more of the following values, or when the runway visual range is deteriorating and passes through one or more of the following values: 150, 350, 600 or 800 meters

Present Weather

When the onset, cessation or change in intensity of any of the following weather phenomena occurs:

Freezing precipitation, Moderate or heavy precipitation (including showers thereof), Thunderstorm (with precipitation), Dust Storm, Sandstorm, Funnel cloud (tornado or waterspout)

When the onset or cessation of any of the following weather phenomena occurs:

Ice crystals, Freezing fog, Low drifting dust, sand or snow

Blowing dust, sand or snow, Thunderstorm (without precipitation), Squall

Cloud

When the height of base of the lowest cloud layer of BKN or OVC extent is lifting and changes to or passes through one or more of the following values, or when the height of base of the lowest cloud layer of BKN or OVC extent is lowering and passes through one or more of the following values:

30, 60, 150, 300, or 450 m (100, 200, 500, 1000 or 1500 ft.)

When the amount of a cloud layer below 450 m (1500 ft) changes:

1. From SCT or less to BKN or OVC; or
2. from BKN or OVC to SCT or less.

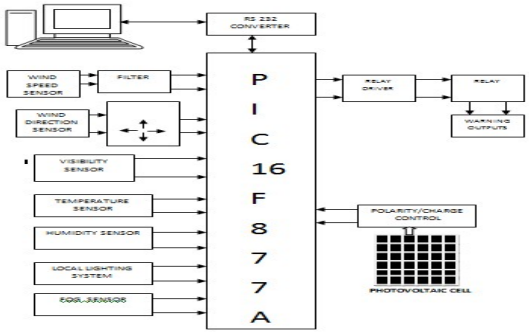
Vertical Visibility

When the sky is obscured and the vertical visibility is improving and changes to or passes through one or more of the following values, or when the vertical visibility is deteriorating and passes through one or more of the following values:

30, 60, 150 or 300 m (100, 200, 300, 1000 ft)

AIR TEMPERATURE

When air temperature has increased by 20 C or more from that given in the latest report.



6. Temperature and Humidity

Temperature Measurement Is Most Important In Aircraft Landing System, because the external Temperature decides internal pressure of the Aircraft which approaches the Runway. When an Aircraft approaching for landing has to come towards gravity, then the internal pressure has to be reduced based on the external temperature to avoid instantaneous Dip/ Rise in altitude, this ensures safe landing of aircrafts.

Humidity plays the vital role in a aircraft landing to identify clear vision, Radio Signal transmission, Mirage and external Ambient. To measure Temperature and Humidity Dry Bulb and Wet Bulb technique is employed in a modern way using Semiconductor based Thermistors which has high Reliability, Repeatability, Sensitivity and Less Cost. Thermistors employed for Temperature and Humidity is a NTC (Negative Temperature Coefficient) i.e., as the temperature increases, its resistance decreases and vice versa made up of Bismuth Oxide ranging from -25oC to +225oC

The formula of Humidity is

(Wet Bulb Value/Dry Bulb Value)X100%

And is modified for thermistor as

Humidity= (Water Temperature/Air Temperature) X100%

Wind Speed and Wind Direction

A wind sock is used to indicate Wind Direction nowadays to Land opposite to the Wind direction for high safety standards, which often get disturbed due to Rain, Long usage Bird hitting. To avoid this we propose a state of art technique below

This Circuit used for wind direction is made up of Four Direction Sliding Bowl Mechanism with appropriate Four Ball Switching methods. The logic of this activity is low to high transition when the ball approaches in a concern Direction, Circuit Delivers Four Digital Output (0001, 0010, 0100, and 1000). Output of this Switch will be Low to High and will be fed to Microcontrollers Digital port for serial conversion to deliver it to PC for Animation and Annunciation

Wind Speed is a Very critical and deciding Parameter of the aircraft landing speed calculation. When the wind Speed is in normal at the runway the flight can land safely once there is a frequent change in the wind speed, must be communicated to the aircraft to increase and decrease the landing speed according to the wind speed.

The landing speed is equal to Landing speed + Wind speed for safe landing .This research we have proposed a sensor made up of DC Generator whose output which corresponds to the wind speed and delivers electrical Output. To avoid generator noises, RFI, EMI and Harmonics a Perfect low pass filter is employed and connected to analog input of the embedded controller for digitization with computer connectivity.

VISIBILITY SENSING

When the visibility is improving and changes to or passes through one or more of the following values, or when the visibility is deteriorating and passes through one or more of the following values:

800, 1500, 3000 or 5000 meters.

RUNWAY VISUAL RANGE (RVR)

When the runway visual range is improving and changes to or passes through one or more of the following values, or when the runway visual range is deteriorating and passes through one or more of the following values:

150, 350, 600 or 800 Meters.

An Infrared system is employed to identify Visibility and fed to an embedded system for computer interface. For Visibility, IR Emitter & IR Detector is placed parallel so that rays passed by IR Emitter is collected by IR Detector. If there is any obstacle between Emitter & Detector, the amount of rays collected by Detector will be reduced 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 the rays' collection.

Analog Output value of the IR detector will be in the form of 5V to 0V which corresponds to Lower visibility to higher visibility as prescribed by the IMD. The output is fed to a microcontroller for analog to Digital conversion and Digital to Serial conversion for computer interface to indicate the true value of the visibility.

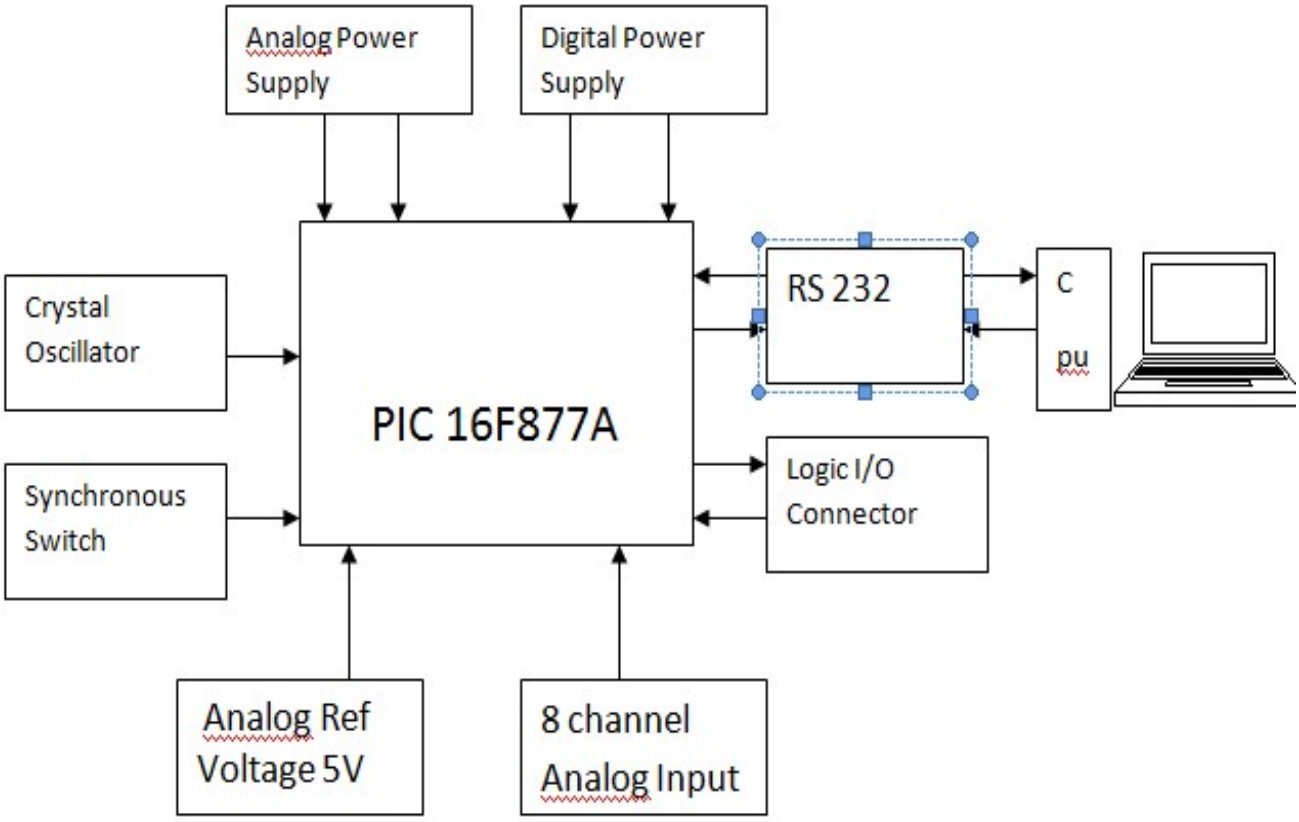
7. FOG SENSING

Fogbound airports are forced to reduce the number of flights taking off and landing every hour. This results in aircraft backed up at the gates and other aircraft going round holding patterns in the air, waiting for their turn to land.

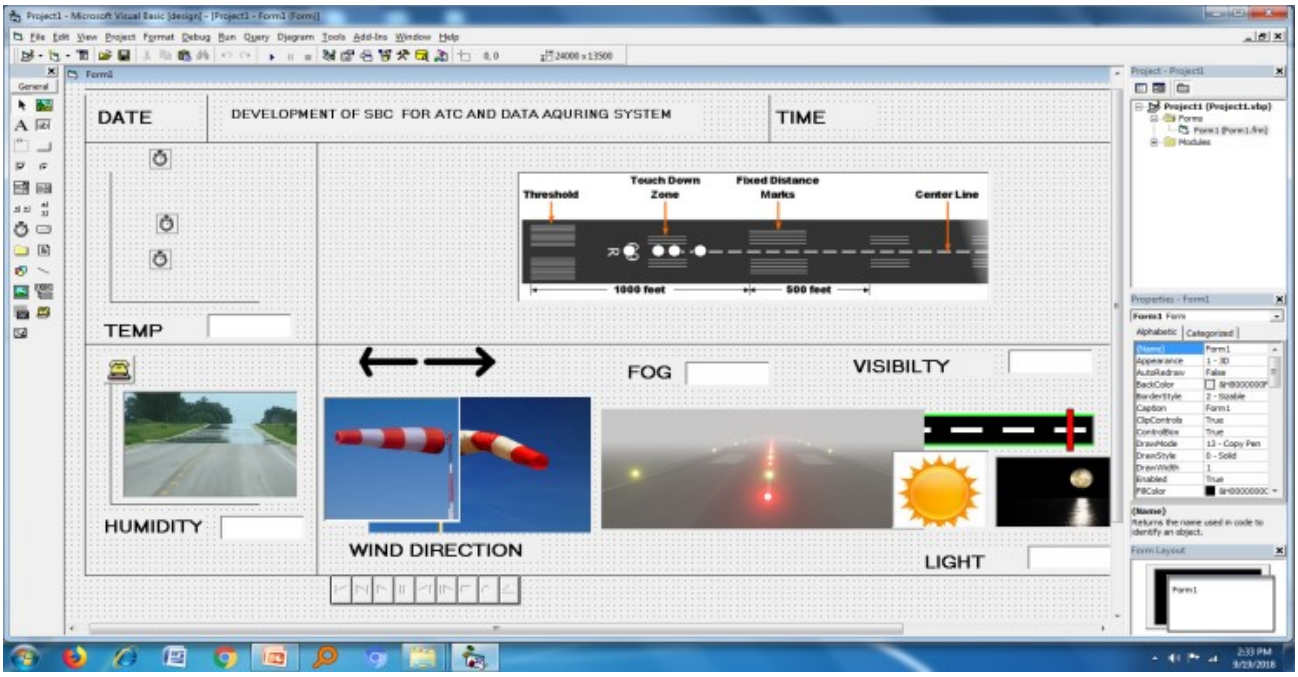
For FOG, IR Emitter & IR Detector is placed face-to-face so that IR Detector collects rays passed by IR Emitter. If there is any obstacle between Emitter & Detector, the amount of rays collected by Detector will be reduced depends on the obstacle like FOG.

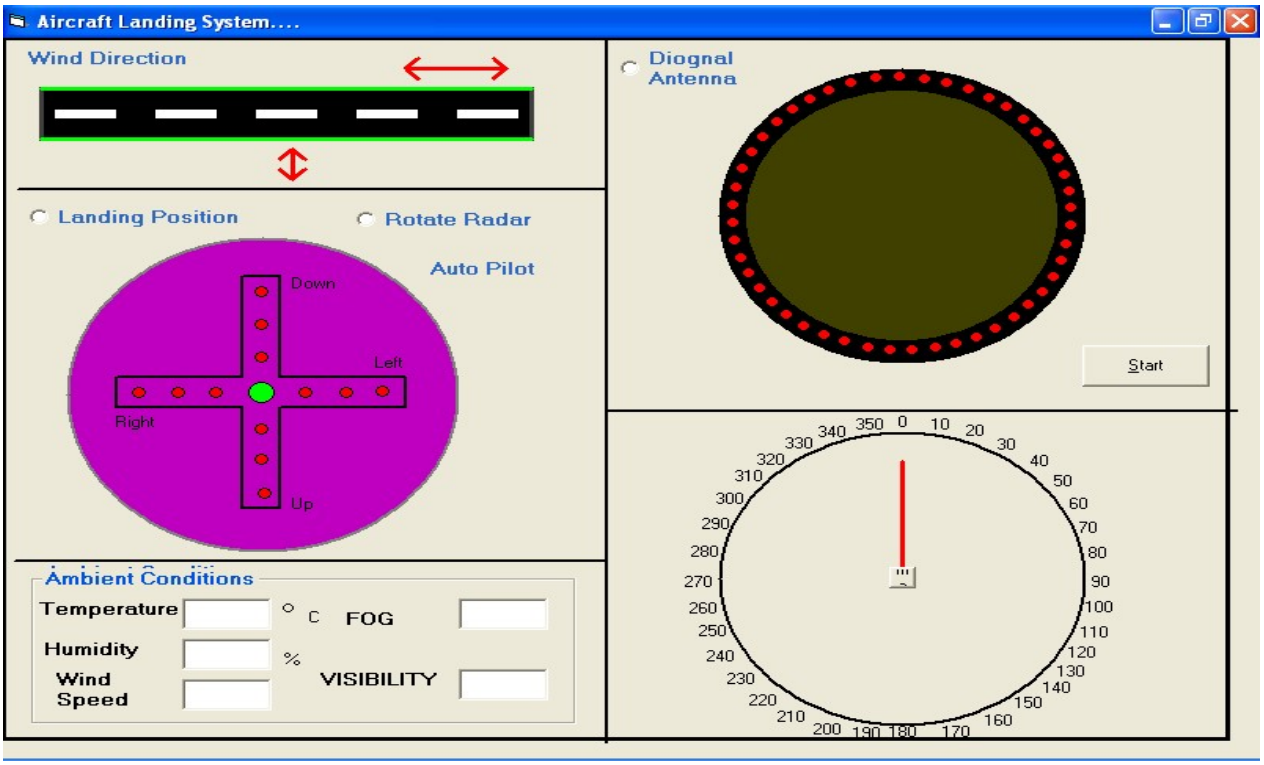
For FOG & Visibility, IR Sensors are used. IR Sensors consists of IR Emitter, and IR Detector. Positive Voltage is given to IR Emitter. Using this voltage, it transmits IR rays continuously & IR Detector collects these rays. If there is any obstacle between emitter & Detector, the amount of rays that is collected by Detector will be reduced depends on the obstacle.

MICRO CONTROLLER BLOCK



VIII. RESULT


DATE
DEVELOPMENT OF SBC FOR ATC AND DATA AQURING SYSTEM
TIME
Threshold
Touch Down Zone
Fixed Distance Marks
Center Line
1000 feet
500 feet
TEMP
FOG
VISIBILTY
HUMIDITY
WIND DIRECTION
LIGHT


Aircraft Landing System....
Wind Direction
Diognal Antenna
Landing Position
Rotate Radar
Auto Pilot
Down
Left
Right
Up
Start
Ambient Conditions
Temperature
C
FOG
Humidity
%
Wind Speed
VISIBILITY

IX. CONCLUSION

The project titled “Advanced landing System“ helps Air Traffic Services [ATS] for controlling smooth Take-off and Landing of many aircrafts in the airport. With the help of monitoring ambient parameters like temperature, humidity, wind speed &its Direction, can avoid confusion in arrival & departure of the aircrafts. There might be a chance of accident due to abnormal position of flight during landing. By checking the position of Lever, the chance of accident (caused by pilot fault) can be reduced. Integration of these monitoring systems reduces time consumption and increases the flow of air traffic. By using this project, ATS can monitor and control the air-traffic more efficiently.

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