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Air Traffic Control Pre-Landing and Post Landing Process (Climatology Analysis and Touch down Aviation)

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Abstract: ***Now days, the most required one for modern airports is advanced landing technology for accident free air traffic. The proposed design focuses on safe landing of aircraft during end of flying state called Touchdown point (TDP). The most frequent air accidents have been recorded during the End of Flying State (EFS), statistical data available and states that more than 90 percent of flight accidents are happening at EFS. Advanced landing technology is the most essential and required for modern airports to reduce time of activities and to improve quality and accident free air traffic. TDP is the most important parameter which determines to take decision on speed deceleration of aircraft by employing various brake methodology during landing. The TDP information must be passed to the Air Traffic Control (ATC) room and must be again communicated to the aircraft to control its actuators to reduce speed in accordance with the metrological conditions of the concerned Airport and TDP. Various technologies were introduced from the beginning and each technology has its own advantages and disadvantages. When application is concerned and various metrological changes, most of the existing technologies don't suits to the most frequent landings in metro-cities.Most of the recent researches are done on safe landing by making some gear system, looking for the convenient parameters. Here we have interfaced both the pre-landing process and the post landing process for the aircraft safe landing and takeoff. This research mainly concentrated on climatology and the touchdown point (TDP).***
Our Proposed design would develop an integrate system, and to provide an economic solution for perfect landing. The art embedded controller technology has been employed to demonstrate the reality of proposed plan. This consists of parameters like temperature, humidity, wind speed, wind direction which should be known before landing. This design helps Air Traffic Services [ATS] for controlling smooth landing of many aircrafts in the airport.
Keywords: Air traffic control(ATC),Touch down point(TDP), End of flying state(EFS), Air traffic service(ATS), Instrument Landing System (ILS), Ground Support Data (GSD)

I. INTRODUCTION

A service provided by ground-based air traffic controllers is aid as Aircraft Control. They direct aircraft on the ground, and can provide advisory services to aircraft in non-controlled airspace. The ATC prevent collisions, controls the flow of air traffic, and gives information to the aircraft and gives support to pilots. The Air Traffic Control helps Aircraft in flying, near the runway (pre-landing), after reaching the runway (post landing)

1) Motivation

There were total of 415 accidents worldwide during the period of 2010-2014.Among 409(99%) of all accidents category are happened during End of Flying State(while landing),five accidents lacked insufficient information for classification and one on mid of air. Per day an average of 400 flights using Chennai airport for takeoff and landing. It is essential to find out touchdown point of an aircraft to avoid accidents and to reduce communication delay during landing. Emerging technology to be incorporated with Non Intrusive Network for safety of aircraft during landing. Even developed countries airports in Europe facing power issues because of grid failures, which is to be taken into account while developing modern airports.

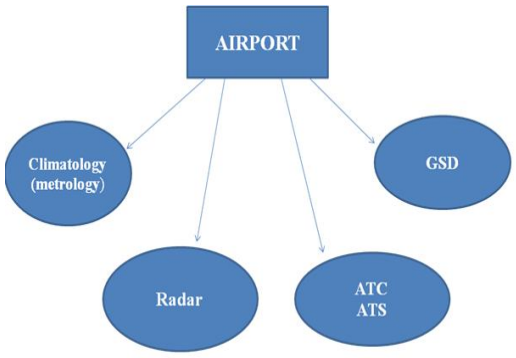

Figure 1: Hierarchy of ATC

2) Need of The Proposed System

To Acquire the point of landing for effective decision making on breaking. To establish fastest data collection and communications between Metrology, Runway, Aircraft Fastest data transmission, between Air Traffic Control(ATC) and Aircraft. The data's will be collected by the Pilot and the Aircraft Control Room simultaneously.

II. SYSTEM ANALYSIS

A. Existing System

In Airports Instrumental Landing System is used for landing Aircrafts on the runway .In ILS there are four departments involved that are the Metrology, Radar, Air Traffic Control (ATC) and Ground Support Data (GSD). Above all departments are located in the different area, these department's gives information about the weather of the airport, Flight position angle in the sky, Airport runway and taxiway information and send data to the ATC control room and air traffic controller analyzes all the data give voice commands to an aircraft in order to land at an airport.

In olden days, manual monitoring system of touch down is employed. Highly skilled employee will be stationed close to the landing pad to communicate through wireless to the air traffic control room till 1995. ATC will have a communication to the pilot regarding the landing point and rest of the breaking behavior for safe movements and halt.

Existing system after 1995 to till date, Camera based system is employed with digital image processing is used to analysis touch down point instead of human like earlier system. Manual monitoring of aircraft movement of the runway is achieved and communicated to the air traffic control room. Human centric system is replaced by automation system due to some impacts like impaired system, transient workload peaks.

B. Limitations of Existing Technology

There are various situations like manual error, breakdown system, communication failure which cause panic when landing. Behavior of the camera differs from day and night, during rainy season camera may not work, and during fog on the runway camera behaves much abnormal. Both the early system used human machine interface which makes slower operation. Zero visibility landing will not be possible but it is essential in mountain landing and fog areas of North and north east India like Jammu - Kashmir, Himachal, Leh, Ladagh, Gauhati and shillong etc .(Camera and manual system will not work here). The existing system finds very complex issue in airports like Lakshadweep airport because of uncertainty in climate causes camera effects.

The recent research was about the pilots has to separate themselves from the external hazards. When such situations happens there might be some solutions to reduce robustness of the airspace. And although these solutions may be promoted or may be enabled by constrained based applications. The underlying goals, strategies used for reducing accidents may play some important roles in such interface

C. Proposed Work

Pre-landing process, ambient parameters like visibility, wind speed, humidity has to be checked while landing. When all the parameters are in correct particular range the aircraft can land. For post landing process, piezo electric crystals are arranged on the runway which is used to monitor the TDP. Piezo crystal accepts the impact energy of an aircraft while landing in runway and generates voltage which is equivalent to the impact. Thus, the virtual image of the flight can be seen by the pilot while landing and according to that appropriate brake should be applied.

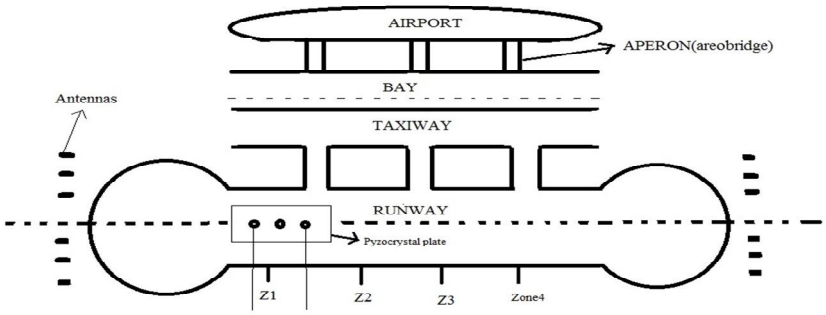

Figure 2: Airport Model

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 and ambient parameters. All the processor and the operations involved are combined together and controlled by the embedded system.

D. Advantage of Proposed System

The Aircraft can be safe while landing by this proposed design. Transferring of Data's will be so accurate between the ATC room and the Aircraft. The vital advantage is that the information's for the safe landing and the parameters outside the aircraft can be received by the pilot and the ATC room simultaneously.

This proposed design may reduce any of crashes while landing, and can make an accident free air traffic in airports. By the software simulation the pilot can make himself very comfortable when pre- landing as well as post landing.

III. SYSTEM ARCHITECTURE

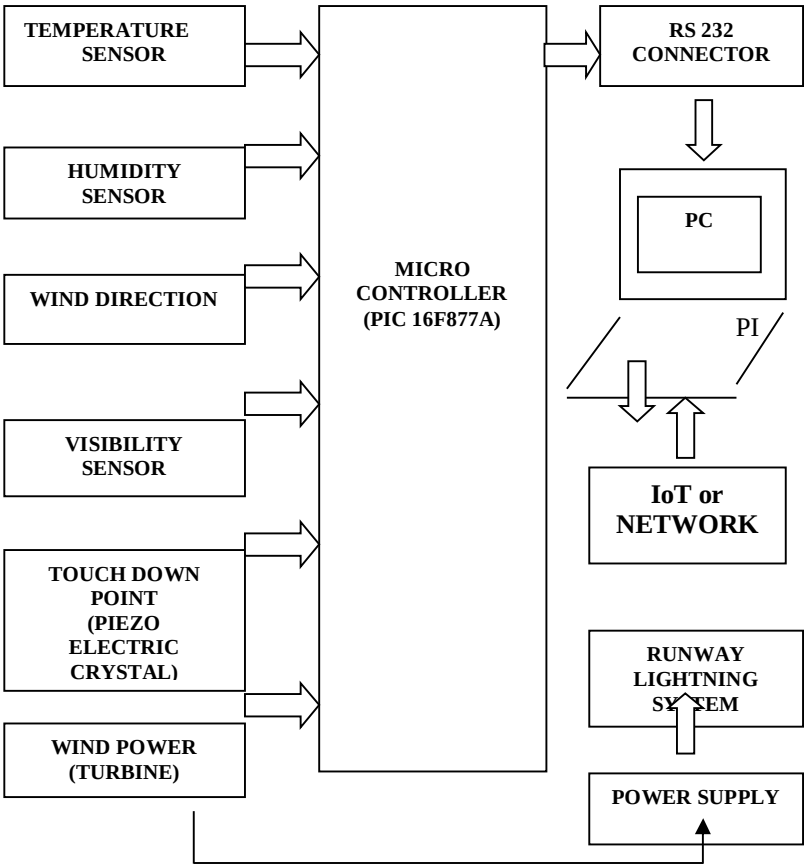

Figure 3: Block diagram

A. Architecture Description

1) *Pic-Microcontroller and Personal Computer:* PIC is an embedded controller. The advantages, like Fast Data acquisition, Compactness, Accuracy over some micro controller. I/O ports are made built in, to connect the peripheral devices like personal computer, ALS kit, etc.
2) *Pin Description:* Embedded Microcontroller is used to design the hardware part of our project .It is used as switch and to control and monitor the device. It is preferred for its industrial advantages as built in ADC, RAM, ROM, Ports.

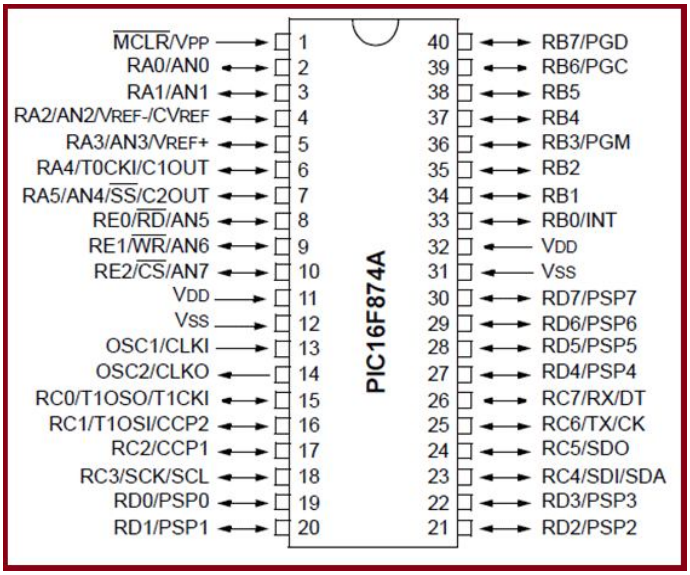

Figure 4: Pin configuration

3) Rs-232 Converter

A serial port connector is used for interfacing both the hardware and software. It can be defined for meaning of signal, physical size of signals. Only by interfacing the results from the hardware can be simulated as software (PIC: 5 volts, PC: 10volts).

B. Pre- Land Parameters (Climatalogy) & Sensors

1) Temperature and Humidity (Sensors): Thermistor sensor is used for finding the atmospheric (room) temperature and humidity. It converts Temperature into Mill volts (mv).Room temperature is converted into ºC by manual calculation with the help of previously obtained values. For Humidity, One thermistor will be put in water and the other thermistor will be kept in room, so that it senses and displays room temperature and water temperature. Humidity= (Thermistor (water) /Thermistor (room)*100
2) Wind Direction: Wind speed is one of vital parameter. Aircraft has to land, opposite to the wind, otherwise the wind will take the aircraft somewhere else. Switches measure the wind direction and fan measures the wind speed.

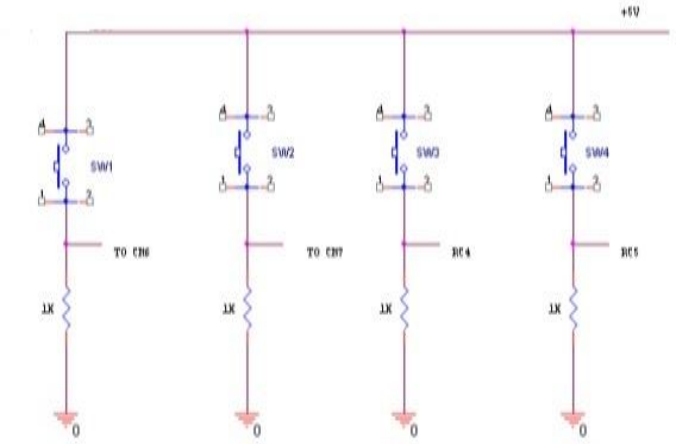

Fig 5: Wind direction (Circuit)

3) Visibility: IR Sensors are used for determining fog. IR Sensors consists of IR Emitter, and IR Detector. IR Emitter conducts the positive voltage, it transmits IR rays continuously. These rays are collected by IR detector. The amount of rays that is collected by Detector will be reduced depends on the obstacle. Present between the Emitter and Detector.

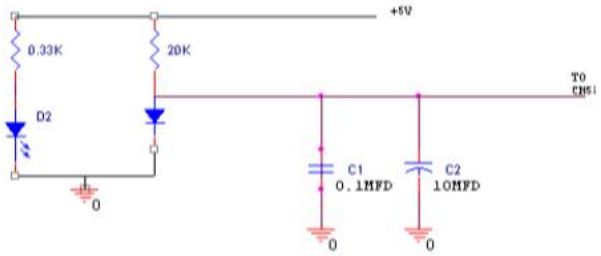

Figure 6: Visibility (Circuit dig)

4) Landing Sensors

Three stages for aircraft has been explained as movement of Upwards, Downwards, and Turn left and Turn right. Therefore, twelve positions and also it has a lever to change the position of flight. While just before take-off and landing aircraft should be in pre-defined position. The accident may occur if it is doesn't defined. For this criterion pull-up-resistors (sensors) has kept at both end in every position (12-Positions).For this RF transmitter and receiver modules are used to change the position.

5) Piezo Electric Crystal

Piezoelectricity is charge of electric that gradually gathers in solid materials where the applied mechanical stress is the response. Piezoelectricity means electricity resulting from physical pressure and heat. By using this mechanism, we can able to point out the landing point of an Aircraft.

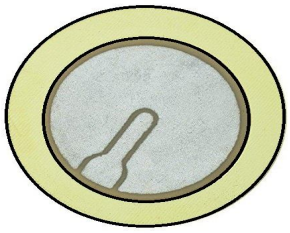

Fig 7: Piezo electric crystal

6) Wind Power (Turbine)

Wind power is the flow of air through the wind turbines which mechanically power generators for electric power. The electric power is used for lighting the runway lights, DC motor is used for power.

C. Post- Land Process

A concept of employing piezo electric crystals are arranged in a format of matrix on the runway which is used to monitor the TDP. Piezo crystal accepts impact energy of an aircraft while landing and generates voltage. This voltage is equivalent to the impact energy. The pilot can able to find the landing point of the Aircraft by himself on the handmade small system which would be kept inside the aircraft .Thus simulation can be done by interfacing IoT, Thus, the virtual image of the aircraft can be seen by the pilot while landing and according to the TDP, brake should be applied appropriately. So that the aircraft can land safely without any crashes.

IV. CONCLUSION

The proposed design helps Air Traffic Control (ATC) for controlling smooth Landing of many aircrafts in the airport. The checking of pre-landing process parameters makes the aircraft to land safely without any crash. The proposed post landing process helps the pilot to identify the aircraft landing point accurately. It doesn't need any special announcement from ATC room. Integration of these monitoring systems avoids confusion while landing and increases the flow of air traffic. By using this project, ATC can monitor and control the air-traffic more efficiently.

V. ACKNOWLEDGEMENT

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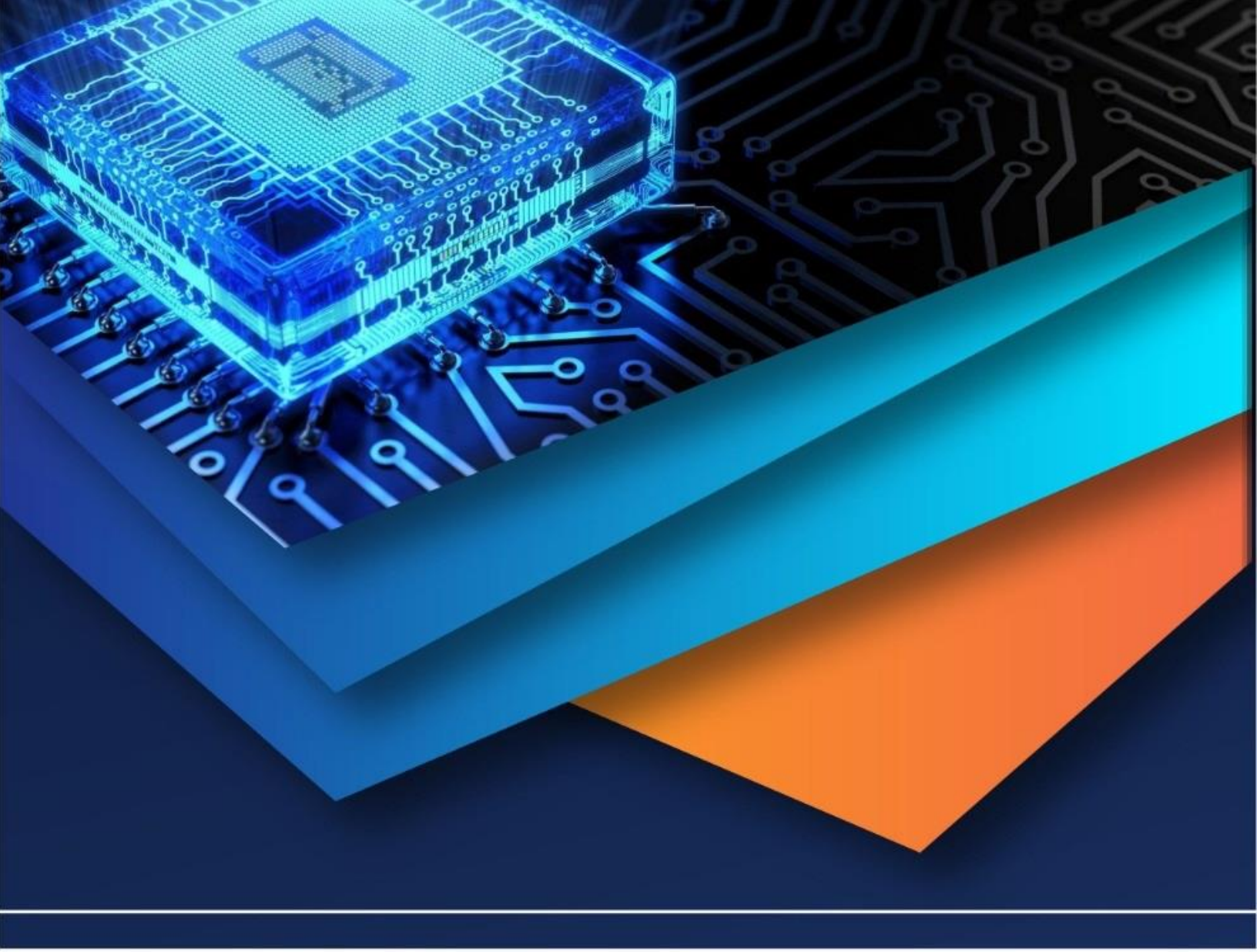

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