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AIRCRAFT CONTROL SYSTEM

[1.]Dr. M. Helda Mercy
Professor and Head of IT Department, Panimalar Engineering College, Chennai – 600123

[2]Divyakriti, [3]Rathi. J, [4]Salai Dhamayamthi. M.S, [5]Samyuktha. R
Students, Department Of IT,Panimalar Engineering College, Chennai – 600123

Abstract: Collision detection and navigation is done by ATC system. ATC uses ground based controllers and traffic separation rules to maintain and expedite the flow in airspace. The airbuses are not provided with collision detection system which can be easily controlled by pilots. As a consequence, to sense the barricades in the surrounding airspace and to capture an alternate path by the pilot this system is put into effect. This is achieved by using ultrasonic sensors to detect any obstacles in the surroundings. A control system is placed inside the cockpit in the view of the pilot that displays obstacles with a warning and alternate route for navigating to avoid impact. The proxy route is also available in the control system.

Keywords: ATC (Air Traffic Control), Collision, Cockpit, Navigation, Ultrasonic sensor.

1. INTRODUCTION

Over the past few decades due to the increase in population of airline customers there has been an increase in airspace traffic. This has led to collision of planes due to improper communication between the pilot and ATC (Air Traffic Control) system. E.g., On December 7, 2016 Pakistan International Airlines Flight 661 crashed at Havelin on its route to Islamabad. This was because the flight flew at a very low altitude leading to crash in the mountains. In one of the country's worst aviation disaster, an Air India Express flight 812 from Dubai to Mangalore crashed while landing at the Mangalore airport at 6:05 am on Saturday. A Boeing 737-800, the aircraft, with 166 people on board, overshot the runway and crashed into the valley before bursting into flames. The crash killed 158 people and left eight survivors. The pilot-in-command, Z Glucia and his co-pilot S S Ahluwalia were experienced pilots. According to sources, the pilots did not report any malfunction to the Airport Traffic Control (ATC), before landing at the Mangalore Airport. After touching down on the 8,033-foot, the plane overran and crashed down the hill at its far end. The final conversations between Air traffic control (ATC) and the pilot prior to the landing showed no indication of distress. This has led for improvements to be done in the aircraft control system.

2. EXISTING WORK

A control system is a collection of mechanical and electronic equipment that allows an aircraft to be flown with exceptional precision and reliability. Control system consists of cockpit control, sensor, actuators and computers.The primary method of controlling the airbuses is through the instructions given by the ATC. In case of emergencies the pilots are prone to listen to the guidance from ATC controller. The pilot isn't aware about any obstacles in the environment and is not free to operate.But when the ATC operators fail to report about the collision that is going to occur, a new concept called Traffic Collision avoidance system (TCAS) has been used in such situations.Once the TCAS comes into effect, pilots are not guided by the ATC system. TCAS starts to work only in the resolution advisory region (i.e.,) 2.1 nautical miles. It instructs the two aircraft to left dip and move forward, so that both the aircraft will not collide with one another. Once the collision has been avoided, pilots can start listening to the instruction provided by the ATC system from the ground.

3. RELATED WORK

[1]Mid- air collision prevention in aircraft using GLARE algorithm.
[2]Attempting to Automate Compliance to Aircraft Collision Avoidance Advisories.
[3]Samplingbased collision avoidance for commercial airliners with intruder aircraft and terrain.
[4]Aircraft collision avoidance using spherical visual predictive control and single point features.
[5]Equity Oriented Aircraft Collision Avoidance Model

4. PROPOSED SYSTEM

The TCAS concept used in existing system may flounder because it intimates the pilot only at the last 25sec before collision. The idea proposed is to place ultrasonic sensors designed to detect obstacles surrounding the aircraft. These sensors provide an alert message to the pilot in the control system present in the cockpit. By this the pilot knows about the hindering objects. It may indicate the pilot about the obstacles before 5 nautical miles. The control system also shows an alternate path from the obstacle in order to avoid collision. The new path is taken by the pilot and thus averts encounter from any hardships while flying. The ultrasonic sensors which emits sound waves to detect any obstacle in its path is used. It is designed in a way to detect any object in the airspace with the help of ultrasonic waves. These sensors are transponders i.e., they have both transmitters and receivers. Transmitter and receiver continuously transmit and receive signals. This way if any obstacle is present it is sensed due to the distortion that takes place in the wave form and thus warned by the control system. Ultrasonic sensors are placed on the plane surface easier to pick reception signals and the alerts are given to the cockpit. Predefined alternate routes are available in the system to help navigation. The new route's climatic conditions are also picked up simultaneously and updated to the pilot. In acquaintance of the navigated path, a message from the control system in the cockpit is given to the nearest ground station.

5. MODULE DESCRIPTION

Collision detection:

The ultrasonic sensors are used to detect obstacles in the airspace. They are transponders that detect any disorientation in the airspace. These sensors provide an alert message to the cockpit by the help of the control system. This helps the pilot to view the location, size and distance of the obstacle. Thus, assisting the pilot in detecting collision.

Collision avoidance:

The collision is detected and the new path is displayed on the control system. By selecting a new path the collision between any object in the surroundings can be avoided.

Navigation:

The paths are shown on the screen and the pilot has to steer according to the new path provided. The new route's climatic conditions and its surroundings are also updated simultaneously.

Monitoring:

After navigating, the plane's altered route is reported to the ATC. When the signal from the ATC is lost, an alert is sent to the nearest ground station from control system in the cockpit.

6. ARCHITECTURE DIAGRAM

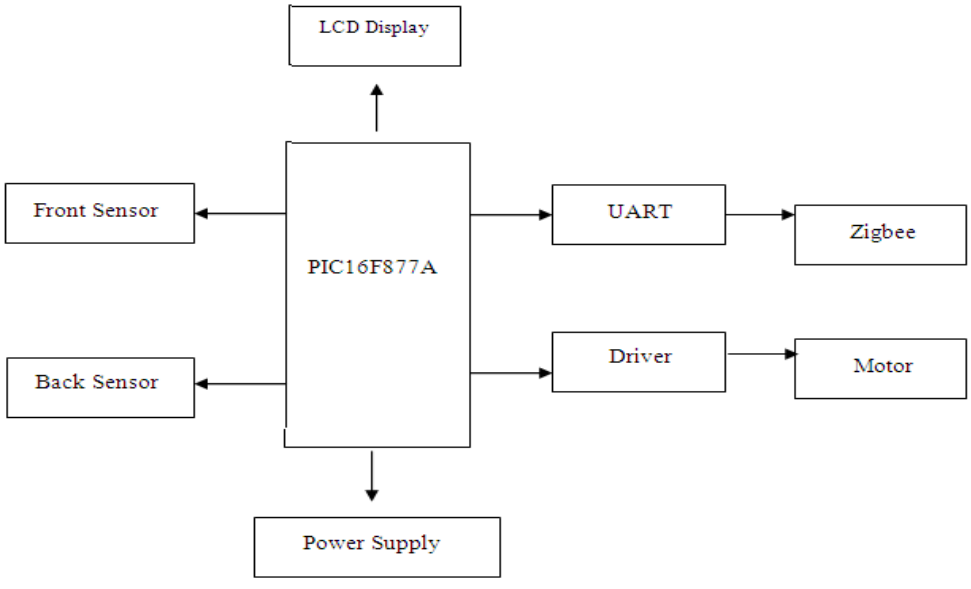

Figure 1. Aircraft 1 control system

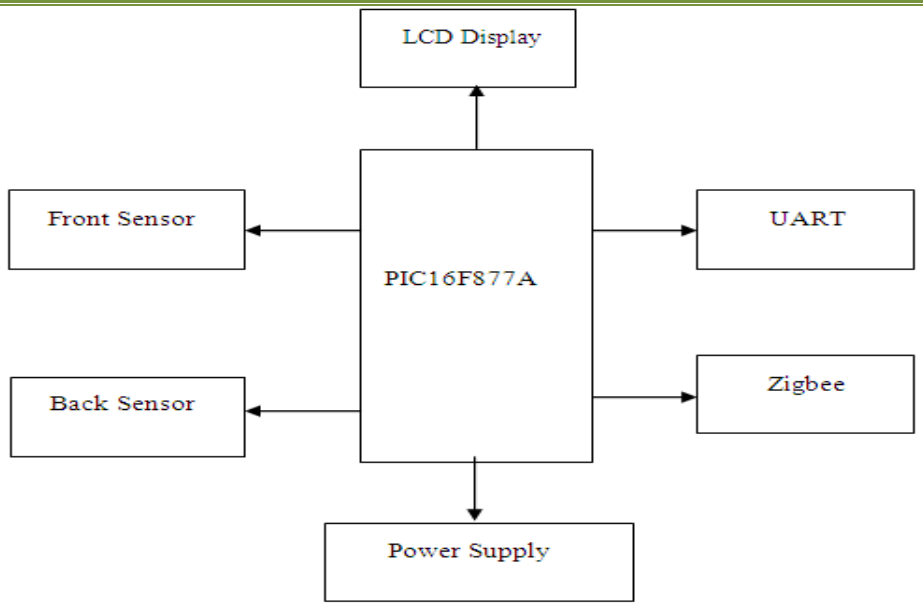

Figure 2. Aircraft 2 control system

7. CONCLUSION

This project will help the pilots in providing safe transportation for the passengers. The Aircraft control system proposed helps avoiding crashes of airplanes in almost every condition giving a protected travel. This system should be placed in every plane for better results. Thus, there is betterment of safety measures in the airspace.Radars can be used instead of ultrasonic sensors as the latter only covers a particular region thus more number of sensors has to be used. But single radar can cover the whole region surrounding the airplane.

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