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Hi-Tech Run Way and Air Field Controller System

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Abstract

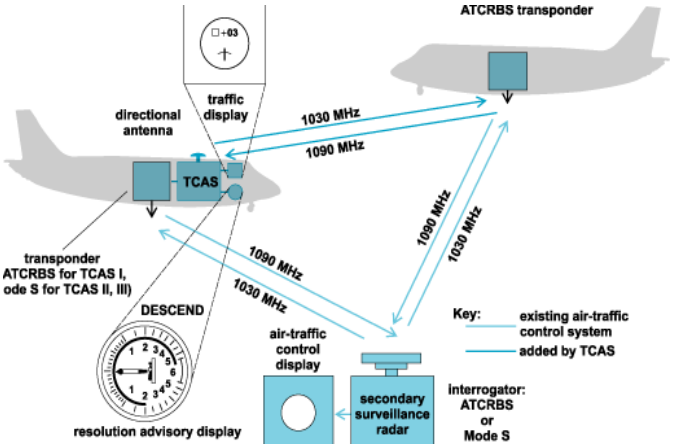
Navigable airspaces are becoming more crowded with increasing air traffic, and the number of accidents caused by human errors is increasing. The main objective of this paper is to decrease the human error in air traffic control (ATC) during high air traffic volume and low visibility operations. The project Hi-tech runway is an implementation of advanced technology in airport and Airspace control systems. As the existing system is manually operated, it is difficult to find solutions for some unexpected problems and Delays in operation. So in order to take protective measures, we introduce an automatic system to detect whether the runway is safe before landing the flight and this system also takes protective measures until the flight completely stops in the Airport. The proposed system is protocol for communication of Airborne vehicle to avoid crashes and Increasing Approaches and Low visibility Operations. Emerging wireless technologies for Aeroplane to Aeroplane communications such as Data Link are promising to dramatically reduce the number of fatal crashes by providing early warnings. One major technical challenge addressed in this project is to achieve low latency in delivering emergency warnings in various ait traffic volume and Low visibility Conditions.

The protocol comprises of following things. Technology that will enable Aircrafts to Talk to Ground controller and Aircrafts to talk to each other, helping to reduce crashes as well as potentially fuel consumption. The idea is that the wireless network and GPS in the aircraft can see the other aircraft connected to the network.

Key Words - ***Aircraft Data Link, ATC ,ARM Microcontroller, GPS, RF Transceiver, IR Sensor***

1.INTRODUCTION

The objectives of the air traffic services shall be to prevent collisions between aircraft, prevent collisions between aircraft on the manoeuvring area and obstructions on that area, expedite and maintain an orderly flow of air traffic, provide advice and information useful for safe and efficient conduct of flights, notify appropriate organizations regarding aircraft in need of search and rescue aid, and assist such organizations as required . In order to achieve this design a intelligent Airfield Controller system in order to avoid collision with the help of Embedded technology, which use ARM Microcontroller, GPS and RF transceiver . With the help of GPS the Runway information is gathered and is sent to other Aircraft through RF transceiver and Microcontroller. The Aircraft which receives the information and replies back its own information. The same communication will he happened between the aircrafts in air space, with this information the aircraft can know the position of aircrafts surrounding it. With help of Lighting System it is easy to land during Low Visibility. With the help of IR sensor it is easy to detect any obstacle on the runway .Smoke sensor will detect the smoke near by the runway to detect the crash conditions and switch on the Water or foam and enable alarm system.



What goes into an Embedded System?

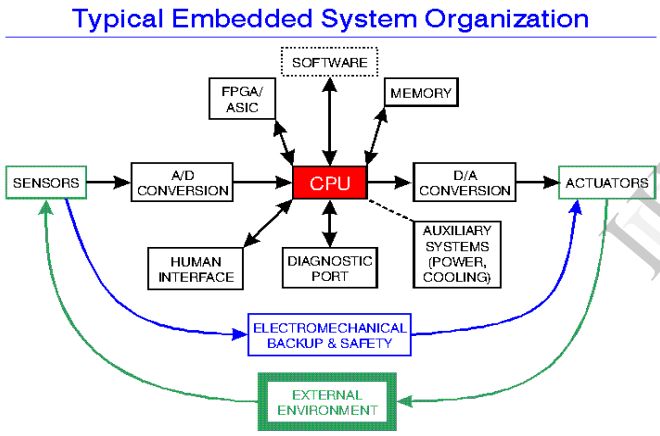
An Embedded system is a device controlled by instructions stored on a chip. These devices are usually controlled by a microprocessor that executes the instructions stored on a Read Only Memory (ROM) chip. One of the most popular

Real Time Operating Systems (RTOS) is in use today is QNX (pronounced `queue nicks'). It is used for everything from medical instrumentation and monitoring nuclear reactors, to traffic lights and industrial process control. In fact, it is so widely used that we use devices having QNX several times a day without being aware of it. QNX makes use of a micro kernel as opposed to OSs such as Windows and UNIX, so system level functions such as device drivers are not part of the system. The kernel contains a minimum number of features for implementing basic system calls. These include message passing along with other interprocess communication,

An embedded system has:

• A digital signal processor,
• A variety of I/O devices connected to
• Sensors and actuators, Controllers and DSP are programmable parts,

–customizable for different application by writing software.



A Microcontroller is a device where CPU and limited associated resources such as memory, I/O are integration on the same single chip. Because of this integrated on a single chip, the reliability of a micro-controller is far superior to an equivalent system designed using CPU, memory, I/O interface chip on a PCB. But it has limitation in terms of program memory, data memory and I/O interfaces. Manufacturers of I/O controllers (Intel, Motorola, Atmel, Scenix, SGS Thomson, Hitachi, Zilogetc). Provide facilities for expansion of resource requirement for memory. But it is always advisable to use the Microcontroller in its single chip mode of operation rather than in the expanded mode. These Microcontrollers are available in sizes of 4 bit, 8 bit, 16 bit and 32 bit from various manufacturers.

II. SYSTEM ANALYSIS

Navigable airspaces are becoming more crowded with increasing air traffic, and the number of accidents caused by human errors is increasing. the air traffic services shall be to prevent collisions between aircraft, prevent collisions between aircraft on the maneuvering area and obstructions on that area, expedite and maintain an orderly flow of air traffic, provide advice and information useful for safe and efficient conduct of flights, notify appropriate organizations regarding aircraft in need of search and rescue aid, and assist such organizations as required .

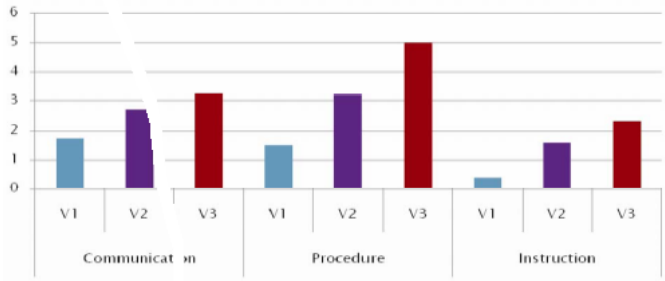


Figure Air traffic volume and frequency of error.

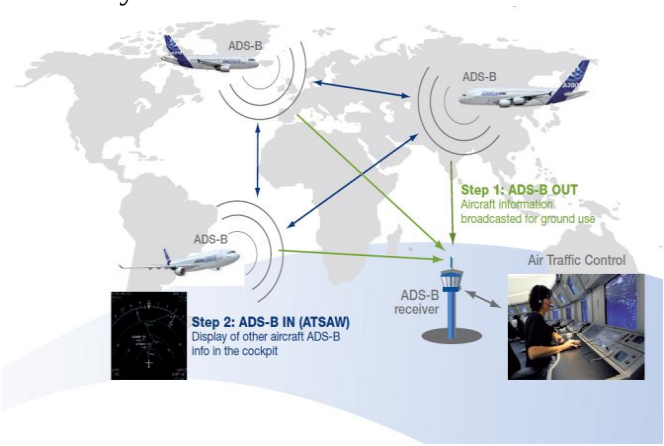
- Line-of-sight limitation in Space & Ground: Typically, Pilot can not see the difference and wing span between the aircrafts. To know the difference and sharing data between aircrafts we have to use Data Link.
- Large processing/forwarding procedure in Airport Traffic Control Operations.

III. PROPOSED SYSTEM

Wireless communication could also lead to a more sustainable next generation Air transportation system. Think of it like this: When there's an accident, it creates congestion. That results in billions of gallons of fuel wasted each year, not to mention the time you're wasting while sitting in traffic. Unlike radar-based safety features, which spot hazards in the driver's line of sight, an advanced Wi-Fi–based radio system allows a full-range, 360-degree detection of potentially dangerous situations, particularly useful when the human error is Observed. Intelligent Systems would talk wirelessly through the Wi-Fi signals, or dedicated short-range communications like RF on a secured channel allocated by the Federal Communications Commission.

Technology that will enable Aircrafts to Talk to Ground controller and Aircrafts to talk to each other. The Ground controller will be monitoring

and controlling the surface traffic management and safety .



IV. ARCHITECTURE OF THESIS

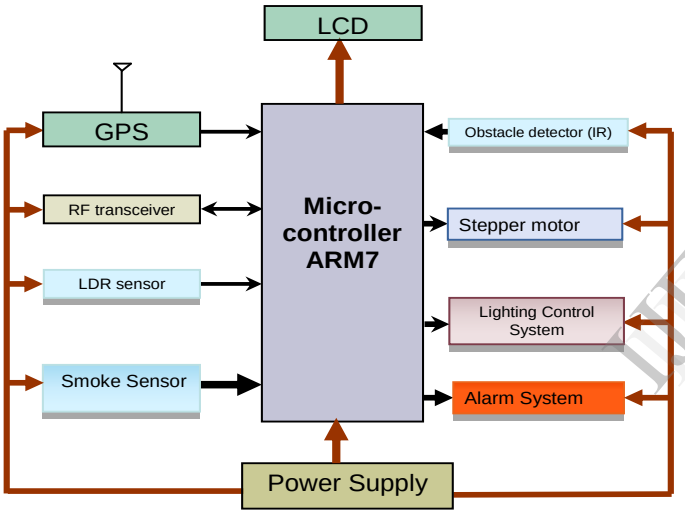


Fig: Air Field Control Module

. ***Design implementation*** focuses on how the solutions were implemented. This section also describes any problems encountered, changes to the original solutions, and discusses alternative designs. Each Runway side, GPS & RF is connected to UART through a relay circuit. LCD is interfaced to **LPC2129** P1.2, 3, 4, 5 are connected for the data pins of 16x2 LCD. Register select and Enable pins of LCD are connected for the ports P1.0, 1. 9v is given to the **LPC2129** board along with RF Transceiver & GPS.

(a) LPC2129 Microcontroller :-The LPC2129 is an 32 bit microcontroller with 256KB ROM and 16k bytes of data RAM. It is of 64 pin IC which supports serial Communication.

(b) GPS :- The Global Positioning System (GPS) is a space-based global navigation satellite system (GNSS) that provides reliable location and time information in all weather and at all times and anywhere on or near the Earth.

(c) IR Sensor :- This sensor has a definite range. If there is no obstruction in line of sight then active low signal is sent by the sensor & if there is any obstruction in line of sight then active high signal is sent by the sensor. This sensor works on the principle of reflection of IR rays.

(d) RF Transceiver:- In this technology the communication between devices is done through radio frequency, transmission & reception. Hence name given RF Transceiver. The RF has a definite range of its operation. Through this we can send string of symbols.

(e) LDR Sensor:- Light Dependent Resistor is a resistor whose resistance decreases with increasing light intensity. Light Dependent Resistor is a resistor whose resistance decreases with increasing

(f)Smoke Sensor:- Used in gas leakage detecting equipments for detecting of LPG, iso-butane, propane, LNG combustible gases. The sensor does not get trigger with the noise of alcohol, cooking fumes and cigarette smoke.

(g)Lighting System:- Here used the different Lighting on the Run way for visibility and identification of safe approach.

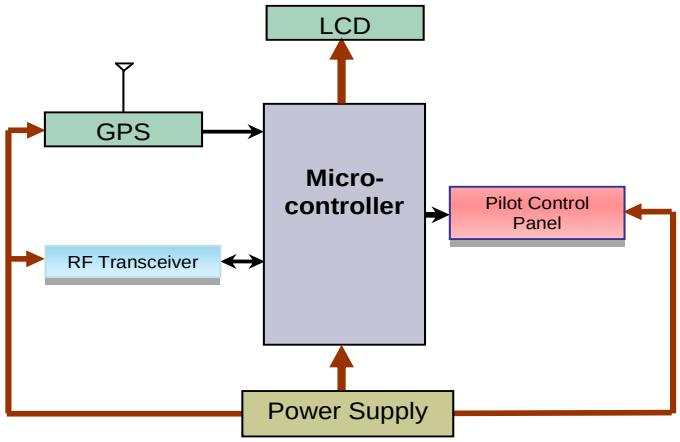


Fig: Aero plane Module

WORKING PRINCIPLE:-

Airfield Controller Module:-

- It has to transmit the GPS,Weather and ATC frequency Data to the Aero plane Module. It will receive the data from the aircraft and it will enable the Monitoring and control systems of respective runway.
- The Second section is Pilot Activated Lighting(PAL) System.
- The third section is the fire and safety system. This system is used to extinguish fire and explosions due to plane crashes in runway. It enables Alarm System.
- The fifth section is arrester barrier system is used to prevent vehicle to the runway which is in use. It will detect the any obstacle in the runway
- It Manages the Airport Surface Traffic .

Aero plane Module:-

- This module will receive the data(GPS) from the Airfield controller module. Then it will display the no of Run ways available in the airfield. It also calculates the distance from the Airport..
- Pilot Control Panel allows the enable the chosen runway and flight phase information to the ground controller.

V. ADVANTAGES

- Improved Approaches and Low Visibility Flight operations.
- Improved surveillance and communications.
- Maximum Runway Utilization.
- Conflict alerts to both controllers and pilots.
- Saving Fuel and Holding Time.
- Reduce CO2 Emission.
- Reduce Delays
- Enhance the capacity and Safety.

VI. CONCLUSION

This Project proposes a Next Generation Air Transportation System. Aircraft Collision Avoidance protocol to improve Flight safety. It also introduce the aircraft data link technology for Air Space Traffic Management ,Automated Air Traffic Controller, It is also demonstrates the Flight operations in Low visibility, Airport surface traffic management and Air port Safety Management.

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