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An Enhanced A-Guidance System for Managing Ground Services at Airports.

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Abstract

In order to maximize efficiency and decrease delays in air travel, today's airports need automatic advanced landing systems. Improve airport stakeholders' situational awareness by aiding in surface operations including surveillance, control, routing, and guiding. The primary objective is to maintain the stated surface movement rate under all situations of visibility, traffic density, and airport layout without compromising the necessary safety. Transportation and traffic management on the ground, including interactions between drivers and the control room. Since the current technique is widely used at airports today and often results to planes being misdirected, we'd want to include it. We'd want to show how audiovisual networking may improve airports' physical ambient conditions for takeoffs and landings at a reasonable cost. To put our plan into action, we've used cutting-edge Embedded Controller Technology and all the necessary input/output hardware

INTRODUCTION

Modern airports need autonomous sophisticated landing technologies to improve productivity and minimize flight delays. Surveillance, control, routing, and guiding are all surface activities that might benefit from increased situational awareness at airports. Maintaining the specified surface movement pace in all conditions of visibility, traffic density, and airport layout without sacrificing safety is the major aim. Ground-level transportation and traffic management, involving driver communications with a central command center. Given that the prevalent method utilized at airports today often leads to misdirected flights, we'd want to include it. We want to demonstrate that audiovisual networking has the potential to significantly enhance the takeoff and landing environments at airports while keeping costs down. Cutting-edge Embedded Controller Technology and the required input/output hardware have been utilised to implement our concept.

1. AUTOMATIC ADVANCE LANDING SYSTEM DESCRIPTION

Automatic Advanced Landing system follows a client server approach with two main components. One controllers (e.g., ATC, AOO, Airport Authority and Ground Handler Managers) to manage ongoing surface movements, and another corresponding to onboard systems with Functionalities for airport workers (e.g., vehicles drivers) operating at the airside area. The control center provides a geographical information display of the airport layout, traffic situation and labels identifying the position of aircrafts and vehicles on the airside.

The onboard systemincludes a touch screen display with a graphical viewer that triggers alerts whenever drivers cause a safety incursion or infringement. The A-Guidance also provides automated assistance by reducing off-screen distractions through presentation of all required information on one single screen.

2. AUTOMATIC ADVANCELANDING SYSTEM ARCHITECTURE

The present level of technological development enabled the development of a solution for the localization of vehicles ground movements using an IP-based wireless communication network to support datacommunications for location based services. Cooperative vehicles are equipped with aGPS/EGNOS receiver, a Wi-Fi device and an onboard unit that is responsible to compute data and maintain synchronization with the control center.

Information system (GIS) specificallydesigned to represent the airport layout as a set of overlapped map layers, with seamless. The A-Guidance relies on state-of-the art geographical graphical navigationfunctionalities for users to dynamically interactwith the airport map layout. The A-Guidance system was designed to integrate data collected from existing airport systems, including data from the Surface Monitoring Radar (SMR) for non-cooperative mobiles such as aircrafts andto compute positioning data from cooperative objects such as vehicles equipped with a GPS/EGNOS receiver. However, the current version does not enable communication with aircrafts, therefore in this paper interaction with pilots are not considered. Nevertheless ,aircrafts and vehicle movements are clearly identified. As presented in Figure 1, such distinction is obtained through a bidirectional data link established between the A-Guidance and SMR system. The A-Guidance sendsvehicles positioning data to the ATC Systems using ASTERIX CAT21. Based on a data fusing process performed at the Application Server, it is possible to correlate aircrafts data with flight plan data and accurately determine assigned stand at arrivals, provide on/off-blocks time, or identify the takeoff runway. The data fusion process coherently integrates data provided by each cooperative vehicle with data collected from external systems. External systems may have multiple sources and providedata as diverse as data on flights, data on vehicles, data on tasks, and data about workers.the ATC system provides data about aircrafts and vehicles positioning collected from the SMR, the Airport Management System provides detailed data about vehicles, and tasksrelated to airport operators (e.g., surface inspections, bird control, de-icing and snow clearance, follow-me, etc.) and ground handling tasks. The SGO system provides data about flight schedules. Over the last years the architecture has evolved in terms of its hardware infrastructure and on the level of services provided by the Application Server. During 2006 at Porto airport, a middle sizeairport, tests were performed mainly for themanoeuvring area, with more than 15 cooperative vehicles of different categories. The A-Guidance implements three possible configurations for the onboard system to communicate with the control center:

□Magnetic device with a flashlight for surveillance of temporary vehicles entering airside areas. The device provides positioning, speed and direction of movement, but with no interaction with the vehicle driver. Device witha numeric keypad and a LCD. This configuration enables the identification of the driver (though a login procedure) and the possibility to report the start and end of a task.

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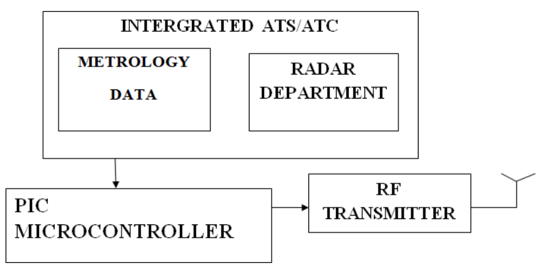
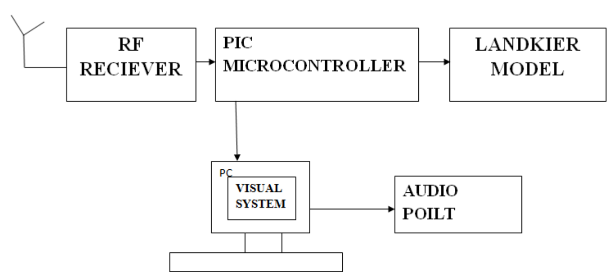
It also enables the reception of alerts in theform of short text messages;

□Device with a touch screen display. This is a more costly solution with all the functionalities and data provided by the two previous devices plus a moving map to guide the drivers within the airside. Safety alerts are presented in a graphical form and functionalities to report surface incidences are also provided. Vehicles equipped with a touch screen display, known as the onboard system includes a PC board with a GPS/EGNOS receiver and a transponder with a wireless network interface. The GPS/EGNOS receiver provides a set of data related to positioningaccuracy, speed, direction of movement, accurate estimate of the err ors, just to mention a few. The GPS/EGNOS receiver gives a more accurate position (within 2 meters) than the oneprovided by GPS alone. After validating and correlating the GPS/EGNOS data with the vehicle ID (call sign) and driver ID (obtained from a login procedure), the data are sent to the backend system using the wireless communicates device .The wireless communication network covers the whole airside area, allowing the exchange of data between vehicle drivers and stakeholders at control centers. Distinct high bit rate network technologies are considered (e.g., Wi-Fi, WI- MAX) for transmitting the data. The systemcan also work, although with a lower quality ofservice, with lower bit-rate communication technologies like CDMA or TETRA. These last two networks are sometimes found in an airport environment and that is the main reasonof their choice as an alternative technology.

Figure: Automatic AdvancedLanding System



a) Automatic integrated data transmittingsystem



b) Automatic data receiving system

VDL-4 or Mode-S may be used for platform-to-aircraft communication in this design. However, if more than one of these technologies is used, a redundant method of communication may be set up. The onboard units' generated data are provided to the Communication Server, which is in charge of handling the diversity of wireless communication networks and providing a unified interface for the application server to use in processing the information it receives. The Communication Server may access these networks wirelessly by connecting to the airport's local area network (LAN) or by utilizing transponders.

use and oversee the airport's private network to facilitate vehicle-to-control-center communication. By connecting to the airport's Wi-Fi, the controller and the drivers may talk to each other. This is especially crucial for maintaining accurate and up-to-date operational data, such as flight records and the duties given to each recorded driver. In reality, the Application Server checks all calculated location data against the airport's safety regulations for each individual transit zone. After being reviewed against safety business rules to verify for any particular safety-related concerns, positioning data and driver and vehicle identity are shown as a point feature on the Ground Human-Machine Interface (GHMI) for every linked client application. Both the controller in the command center and the driver in the car may be alerted to any potential safety issues with a simple color code

2.1 CONTROL CENTER

The control center component of the A- Guidance system was designed to improve airport operations as one integrated support system. Provide surveillance and guiding functionalities with a detailed event resource- usage description to help the airport to be operated more efficiently as a time-ordered system the graphical display provided by the GHMI is managed by a GIS engine, designed specifically to respond to ASMGCS performance requirements, namely to provide ascreen refreshing cycle below one second whenupdating the position of moving objects (i.e., aircrafts and vehicles).

It is possible to visualize the graphical layout of the GHMI with all thematic layers selected (see the Map Feature tab at the left side). Vehicles are represented with a colour code outlining for each hazard situation the severity level. A red label denotes a sever incursion and a yellow label a less sever incursion. A vehicle represented with a green
colour is operating normally and in blue to outline vehicles that stopped for more than 5 seconds. To clearly understand how safety incursion are triggered, we first need to understand the topological proceduresperformed by the Application Server which correlates vehicles/aircrafts positioning against the polygon features of the protections layersor against any other polygon defined for restricted access areas. Protection areas are represented as transparent polygons, any unauthorized incursion into one of these features will automatically trigger a safety incursion alert message at the Alert Viewer

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2.2 SURVEILLANCE AND CONTROLCAPABILITIES

The surveillance service provides location-awareness and identification of all aircrafts and vehicles within the movement area, it is the control service that is responsible for safety risk assessment and diagnosis, triggering alert messages whenever a safety hazard is detected. The A-Guidance provides a collaborative decision support environment to manage real-time events, enabling the surveillance of mobiles to be performed in combination with additional management information, namely:

□ Situational awareness to distinct airport stakeholders(E.g. flights often get blockedduring the taxi-in phase And Aircraft Operatorsand Ground Handlers can see

Exactly where they are).□Operational datasuch as actual landing, on-block, off block and take-off times. Taxi time prediction.

3. DECISION SUPPORT

All the collected physical parameters must be sent to ATS for decision making on ground conditions for safe landing.

3.1 MECHANICAL:

The responsibilities of mechanical dept are rotating the radar at a constant speed of 12.5 rpm (international standard speed) and
collect data's from various aircrafts and their geo position on the air. The collected data's then fed to ATS for decision-making.

4.2 AIR TRAFFIC SERVICES:

This is a decision-making department, but based on the data's collected from the othertwo departments. The responsibilities of ATS are analyzing the aircraft's perfect position and guiding them for safe landing. The wings position, height of the aircraft with respect to the runway are collected automatically using diagonal antennas and advice the aircraft captain to tale right landing path. The above said three departments are located in different areas and they have their own network and theyare exchanging data's manually and automatically. We would like to develop an AD-HOC type system, where the above said three departments will be in one computer. Thesame computer will guide the aircraft for safe landing.

Using of state of art embeddedtechnology and wireless technology and audio- visual system; we will be demonstrating this project perfect implementation.

4.3 TEMPERATURE AND HUMIDITY:

We are used thermistor to findatmospheric (Room) Temperature andHumidity. They Converts Temperature intoMill volts. With these values, we areconverting into ºC (Room Temperature) bymanual calculation. For Humidity,onethermistor is inserted into water, & other Thermistor is kept in room so that to sense &display room temperatureand watertemperature. The formula for Humidity is can be measured by using switches. Windspeed measured by Fan.

4.6 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 collectedby Detector will be reduced depends on theobstacle.

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, theamount of rays collected by Detector will be reduced depends on the obstacle like 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 depends on thedistance of obstacle from IR Emitter. If distance increased, the amount of rayscollected by Detector will be reduced. From this value, we will understand visibility is more(I.e.) visibility increases with decrease in the rays' collection.

4. STEPPER DRIVER LOGIC:

The stepper driver logic consists ofbuffer, op to-coupler, pre-driver and driver.

4.1 OPTO COUPLER:

It consists of Op to- emitter &Phototransistor. An op to coupler is essential to prevent the computer from

4.5 WIND SPEED AND WINDDIRECTION:

In this project wind direction just likethat simulation. Normally the Wind direction 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.

4.1.1 PRE-DRIVER:

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

4.1.2 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.

4.1.3 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.

5. VISUAL BASIC

The Microsoft VB programming systemfor windows is an exciting advance for anyone who is involved in writing window baseapplications. With this event driven programming engine and innovative, easy touse visual design tools, VB lets you take full advantage of the window graphical environment to built powerful application quickly. As more people began to use computers the isotonic and complicated languages used for programming became more of an obstacle. A language called BASIC was developed to counteract this. Its simplicity made it easy for the users to write amazingprograms. Over the years this programming language was enhanced and developed. The demand for faster, simpler, smaller and easy to use software led to the development of Microsoft quick Base. This was in line with the programming language technology of the 1980's but an even bigger change was on the horizon namely, graphical user interface (GUI).With the advent of windows, users are able to work in a graphically rich environment. This made application much easier to learn and use. It also facilitated the use of multiple windows on the screen enabling to run more than one program at a time. Although this environment was like a boon to the user, life was suddenly a lot together for programmers. A simpleprogram to display a message on the screen, which could be written in four lines in MSDOS, now, ran to two or three pages.

5.1 PROGRAMMING FOR WINDOWWITH VB:

The VB programming system packages up the complexity of windows in a truly amazing way. It provides simplicity and ease of use without sacrificing performance or the graphical features that make window such apleasant environment to work in Menus, fonts, dialog, boxes etc are easily designed and these features require no more than a few lines of programming to control. It is one of the first languages to support event driven programming a style of program especially suited to graphical user interface. The aim in modern computer application is to have the user in charge.

Instead of writing a program that plots out every step in precise order, the programmer writes a program that responds the users' action like choosing a command, moving the mouse etc. Instead of writing on large program, the programmer creates an application, which is a collection of co- operating many programs. With VB such an application can be written with unprecedented speed and case. This project has been donewith a virtual view of the traction of the train.It represents the animated view of the moving train with boogies with the multimedia effects etc.

6.1.1 FEATURES:

Improved performance. A data base creationtool. Visual data access with the data control sothat it is possible to create data browsing application without writing code.

A new OLE (object linking and embedding) control that allows in place editing. A collection of common dialog boxes that streamline common user interface tasks. Theability to create pop-up menus anywhere in the application.

6. AUTOMATIC ADVANCE LANDINGSYSTEM REQUIREMENTS

The onboard system offers a good accuracy in locations where there is good visibility of the geo stationary satellites. However, the lack of availability, especially in

Congested areas near or beneath airport terminals, is a Known problem for most of the market EGNOS/GPS Receivers. To overcome this situation ongoing research is being addressed for location- awareness transition using the wireless communication network (e.g., Wi-Max or Wi- Fi signal) together with an electronic gyroscopedevice. Surface guidance includes improvements to visual aids for automated guidance and control along assigned routes. However, for low visibility conditions, airport stakeholders may need additional means, such as a moving map, to monitor progress and compliance with the assigned route. In a future version, the onboard system will include improved

Visual aids for advanced surface movement guidance along assigned routes, such as a moving map to monitor progress and provide additional traffic information.

7. CONCLUSION

Flights taking off and landing at the airport went off without a hitch. Air traffic control issues may be avoided with the use of ambient parameter monitoring. When these monitoring systems are

unified, airport stakeholders benefit from faster air traffic and less stress.
Consider doing a cost-benefit analysis to see whether expanding the monitoring is possible. As part of the continuing investigation, efforts are also being made to improve voice recognition in loud settings.

8. FUTURE WORK

Their location, velocity, and altitude are sent digitally using ADS-B technology. Consider doing a cost-benefit analysis to see whether expanding the monitoring is possible. Now that the land kier model has been automated, radio waves are used to transmit information from the aircraft to the ground. It's simple to disrupt these radio signals. Allocating a new frequency range adds even more complexity. If a satellite is used, however, this difficulty disappears. Neither the certification of surface motions in advance nor the automation of functions are available in the present version of the A- Guidance system. Surface guidance automation features are being tested in conjunction with landing and takeoff procedures. The TMO parameter blend with SMR data allows for the prompt identification of arriving aircrafts. Taxi times up to blocks-on time may be estimated with precision using this data in conjunction with flight records. Increasing efficiency in aircraft turnaround is the primary objective of this strategy. Improvements to the present apron control methods, including those related to routing and control, will be addressed in a later edition. Don't stop monitoring the area around the radar-avoiding item. ADS-B is standard equipment on modern airplanes, and it allows them to transmit their location, velocity, and altitude through a digital data connection to ground control centers. The potential of expanding the surveillance and Control features to include video monitoring is the subject of ongoing investigation. Similarly, abilities

as options for ensuring the device stays operational in indoor settings. The problem of voice recognition in a loud setting is also being investigated.

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