KORIŠTENJE LAN I BEŽIČNE TEHNOLOGIJE NA ZRAČNIM LUKAMA

USING LAN AND WIRELESS TECHNOLOGY AT AIRPORTS

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SAŽETAK

Velika brzina prijenosa informacija, bez prostornih ograničenja prijenosa koje osigurava bežična tehnologija omogućuje implementaciju sustava koji značajno poboljšavaju učinkovitost i brzinu na poslovima prihvata i otpreme na zračnoj luci.

Tehnologija prihvata i otpreme provode se na različitim pozicijama (stajanka, putnička zgrada, robni terminal) koje međusobno moraju biti povezane, a službe koje rade na prihvatu i otpremi moraju biti pravovremeno informirane o parametrima vezanim za prihvat i otpremu zrakoplova. Međusobno povezivanje službi koje rade na prihvatu i otpremi optimalno se može riješiti LAN (Local Area Network) i bežičnom tehnologijom prijenosa podataka koja upravo omogućuje protok podataka i komunikaciju između operativnog dijela zračne luke i svih vozila i djelatnika na stajanci.

U radu je dan shematski prikaz idejnog rješenja aplikacije AOC (Airport Operation and Communication Software) koja koristi LAN i bežičnu tehnologiju te je takav ITS sustav prilagođen za rad i implementaciju na zračnim lukama.

KLJUČNE RIJEČI

Zračna luka, prihvat i otprema zrakoplova, bežična komunikacija, LAN, PDA, stajanka, IT rješenja

ABSTRACT

High information transfer rate without area restrictions with wireless technology enables implementation of a system which significantly increases efficiency and speed for ground handling at the airport.

The ground handling technology is performed on different locations (apron, terminal building and cargo terminal) and all the departments and services which are involved in ground handling must be connected and provide safe and easy communication within the community. Interrelation for communication between departments and services involved in ground handling can be provided via LAN and wireless technology. With such technology all the vehicles and service departments can be informed at any position at the airport.

This paper presents the blueprint and design of software application AOC (Airport Operation and Communication Software) which uses LAN and wireless technology, with such an ITS being adapted for the usage at airports.

KEY WORDS

airport, ground handling, wireless communication, LAN, PDA, apron, IT solution for airport

1 INTRODUCTION

At the current level of traffic and the analyses that indicate further growth in air traffic, the airports are facing infrastructure restrictions and a necessity to expand their capacities. In accordance with the expansion there is the problem of communications and interconnections of all the sectors in a high-quality, simple and safe manner.

The development of IT sector is offering a number of new solutions that allow seamless and fast flow of information and thus allow connecting of all the sectors and employees of an airport who are involved in the aircraft handling.

Due to the basic characteristics of air traffic: safety, speed, punctuality, a system has to be implemented that will enable fast and simple coordination and timely communication among all the sectors and employees dealing with the aircraft handling.

The majority of Croatian airports do not use completely automated software for aircraft handling and communication among facilities involved in aircraft handling. Regarding the fact of increasing trend of traffic at the Croatian airports, the management and research departments should consider implementation of new software. This work presents the preliminary solution of an independent system which allows aircraft handling and communication among all the sectors and employees working on aircraft handling that can be easily implemented at the airports.

2 LAN AND WIRELESS TECHNOLOGY

LAN is an acronym for *Local Area Network* or, in other words, local (computer) network which typically covers the area of one office, floor or building. The international IEEE standards encompass the majority of wire line and wireless local networks, and the most common are the standards IEEE 802.3 (Ethernet) and IEEE 802.11 (Wi-Fi).

The combination of LAN and WLAN (Wireless Local Area Network) technology can ideally solve the problem of communication and data transfer in the framework of an airport. In selecting and implementing the system special attention needs to be paid to the characteristics of single technologies and the technological needs of every single sector.

Wireless technology today has become a component of almost every major information system owing to the acceptable price and its comparative advantages over the classical LAN technology:

Flexibility and absence of wires
Simplicity of handling
Transparency of applications
Affordability

The basic comparative drawback of the wireless technology compared to the classical LAN network system are the restrictions related to transmitting of radio-waves and optical visibility among the users.

The system presented in this paper uses LAN and WLAN (Wireless Local Area Network) technology for communication, and the dangers that may result due to the drawbacks of wireless technology have been reduced to a minimum since wireless technology is used exclusively at the apron where the visual space limitations that may cause the system crash are minimal.

3 APPLICATION OF LAN AND WLAN TECHNOLOGY AT AIRPORT

After several years of practical experiences and a number of analyses, a system has been designed which bases the communication on LAN and WLAN technology specific for the implementation at airports. Airport Operation and Communication Software (AOC) system, for the reasons of security and easier technical maintenance has been divided into 2 modules:

- user module, and
- operational module.

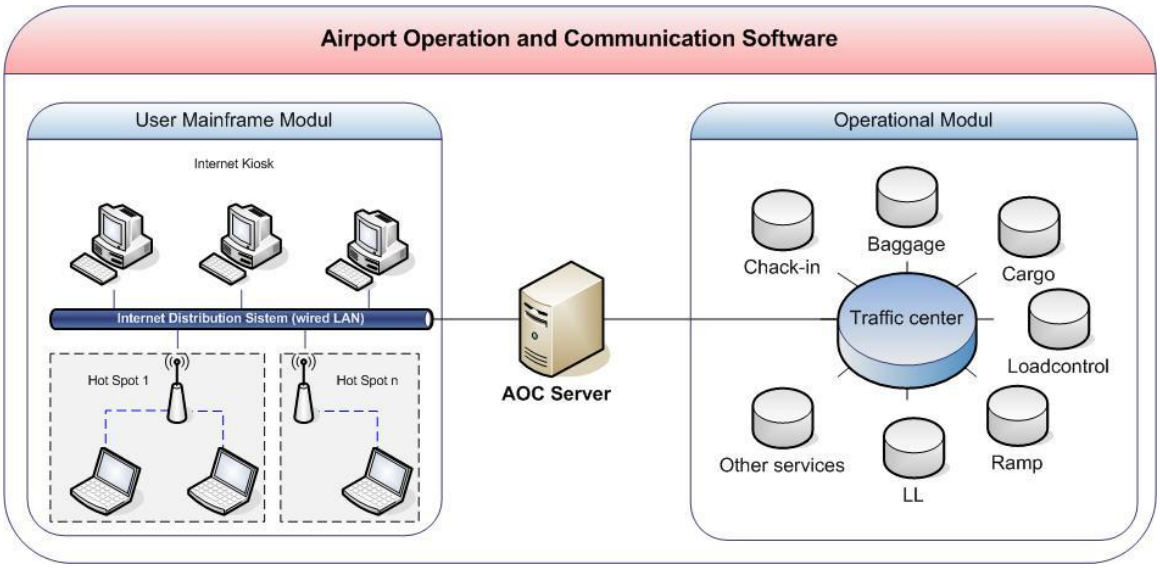

Figure 1: General layout of AOC system

According to the scheme presented in Figure 1, one may notice the simplicity of the implementation of the AOC system to the existing IT infrastructure of the airport by connecting the AOC server to the servers installed at the airport.

The user module of the AOC system follows the latest trends in the world airports that have enabled non-stop Internet service to the passengers waiting at the airport. This enables access to the Internet, which is of extreme importance for the business users.

The operative module of the AOC application has been isolated from the user module for safety reasons and is intended exclusively for the operative purposes of the airport. The applications in the operative module are being developed separately depending on the specific needs of single airport sectors.

4 AIRPORT OPERATION AND COMMUNICATION SOFTWARE

The development of single applications within the operational module is characteristic for each single airport depending on the single sector requirements in accordance with all the safety standards. The current version AOC 0.1 marks the demo version which requires additional development depending on the requirements, but including the basic elements characteristic for every single sector.

4.1 Operational module

4.1.1 Check-in application

The AOC application consists of several modules that run independently, but in the case of a system crash, the module has the possibility of being isolated from the system and of continuing to run locally. According to some examples and analyses from the practice, the aircraft systems are susceptible to longer interferences in operation due to their size and the number of modules, and the connectivity at the global level. The check-in application is designed to act as a system that may operate individually and fully replace the passenger registration module. The entry into the application is simple because of the user-friendly application and in the development itself the difficulties some older and less computer literate persons had in using some previous systems were considered, so that the system has to be based on the simplest form in order to avoid delays and crowds in queuing, and to provide a fast, reliable and simple system for the passenger check-in. The check-in module is directly connected to the loading control office which obtains thus the detailed data about passengers and checked baggage (number of items and weight), the sorting area which is informed about the total number of baggage items and destinations. As mentioned before, in case of identification of a problem in one of the modules, the system is automatically isolated, and if it depends on a certain other module, it continues running with the respective module only.

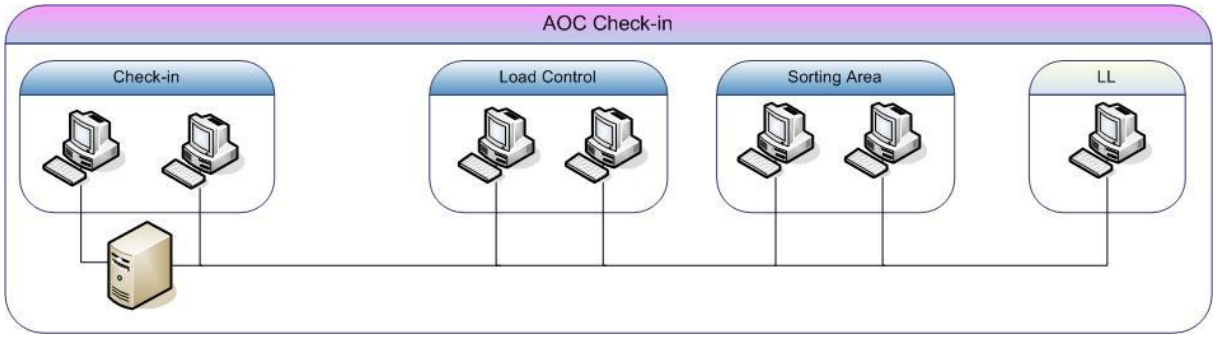

Figure 2: Presentation of AOC Check-in module

4.1.2 Baggage handling application

Baggage handling application is another name for the sorting area module. The module has been developed in order to facilitate scanning and sorting of the baggage items within the sorting area. At big airports the system has been developed that is fully automated. This module is ideal for airports which don't have fully automated system for the sorting of baggage items within their sorting facilities. The module is connected with check-in, and thus receives data on the total baggage, destinations, groups of passengers travelling together and their baggage. By scanning the baggage, all the codes are entered into the system and records are also kept on which trolleys or containers they are located. Such additional information makes it even easier for every sorting area if there are baggage items that for some reason need to be unloaded from the aircraft. This is also great help for tracking baggage items in aircraft with ten or more containers because it provides direct locations. This module is connected to the scales and after weighing the baggage, in a simple manner sends the data on the respective baggage (weight, category of baggage) to all the services that require such information. In this case these services consist of the aircraft load and balance office, and ramp agents. At the aircraft load and balance office, the baggage is directly entered into the balancing system through the module. Using direct connection with the sorting area, the ramp agents receive real-time information and can accurately control loading and baggage status on the aircraft.

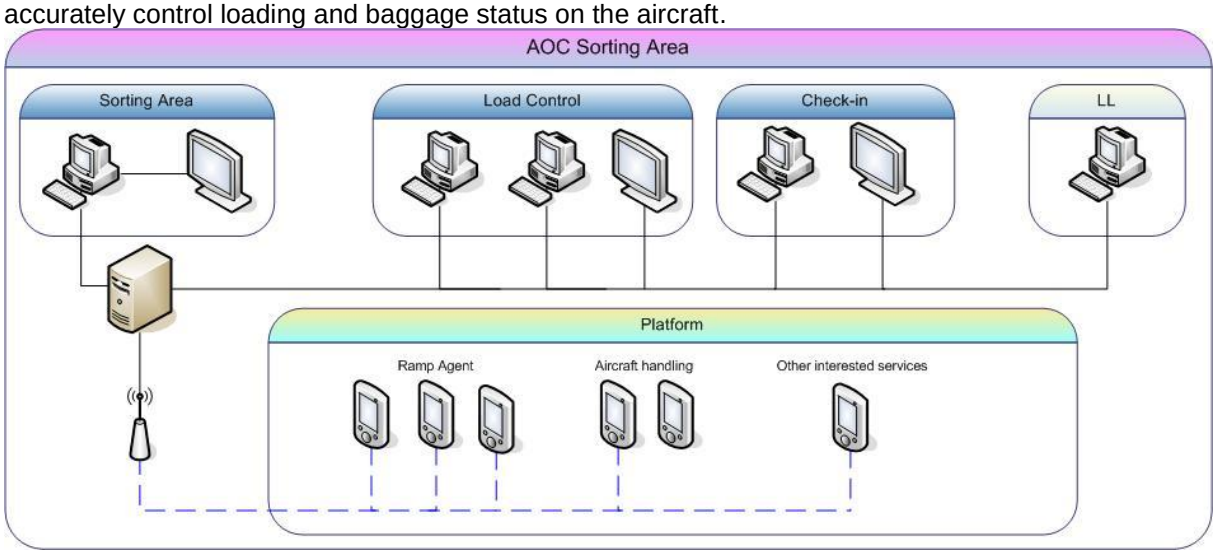

Figure 3: Layout of the AOC sorting area module

4.1.3 Cargo application

Cargo application is interesting from the aspect of cargo acceptance since all the services can have information on cargo on the aircraft in a short time. When cargo is accepted, namely, and the data are entered into the AOC module, it automatically distributes these data to the services that require this. The direct link to the aircraft loading and balance office helps the balancer to react timely in planning the aircraft loading, since the data are received in real time and can be added until agreed deadline. Also, by means of AOC Cargo module, all the services that are related to cargo can be

informed about dangerous and special goods. The module sends the information on special cargo to the aircraft loading office, and together with the entire cargo and mail it is entered directly into the load-control module, and thus provides on the one hand saving in balancer's time, and on the other hand the cargo service directly guarantees the accuracy of the data. The other link connects the aircraft handling service which, over the AOC communication system receives the timely information about the cargo which is intended for the aircraft, and can define within a short period of time the means that will be used for ground handling.

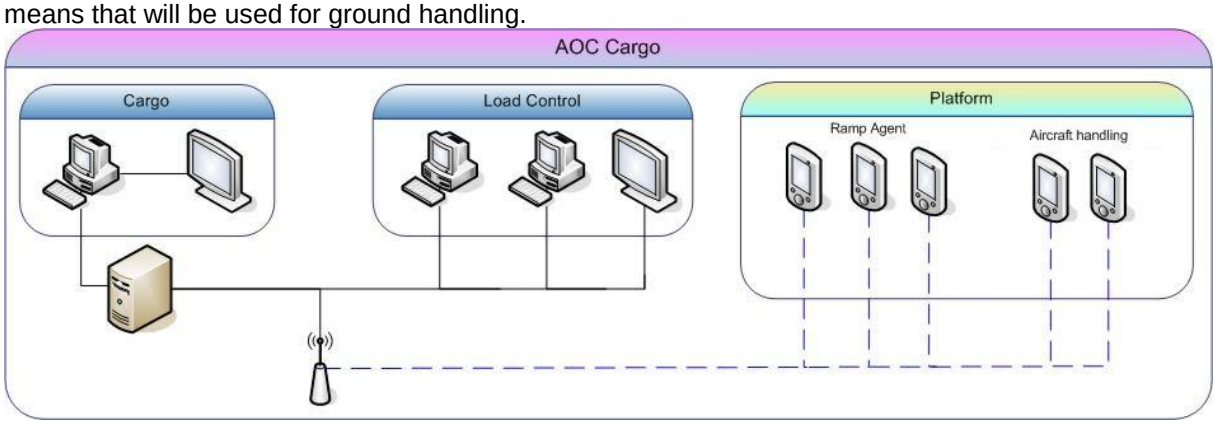

Figure 4: Layout of the AOC cargo module

4.1.4 Load Control application

Load control application is maybe the most demanding within the AOC system since it has to guarantee precision and accuracy of data. Load-control module, however, as was said before, is connected with the cargo service, check-in and sorting area. These three services directly enter the data in this module and provide the balancer with the possibility to perform correct loading. The load-control module consists of three parts. **The first part** is related to the basic information on the flight, destinations, fuel, aircraft weight. **The second part** presents the loading instruction according to the baggage compartments. The AOC system basis is made of a series of necessary information on every aircraft, as well as their cross-section and baggage compartment layout. **The third part** consists of the solutions of all operations that are applied. Thus, for instance, in this area we can see final aircraft weight, weight of each baggage compartment, passenger seating layout according to the aircraft sections and elements that are relevant for the trim-sheet. The module also has an option of helping the balancer perform the ideal loading and guides the balancer to the indicators which baggage compartment may receive more items so that the aircraft balance would be even better. The areas presented under the title "Rješenja" (Solutions) may be distributed over a wireless link directly to the platform, more precisely, to the pocket PC (PDA) which is used by the ramp agent by the aircraft. This is a solution for the communication and information of the ramp agent about the weights, trim and other information about the aircraft itself. The load-control module is presented in Figure 4.

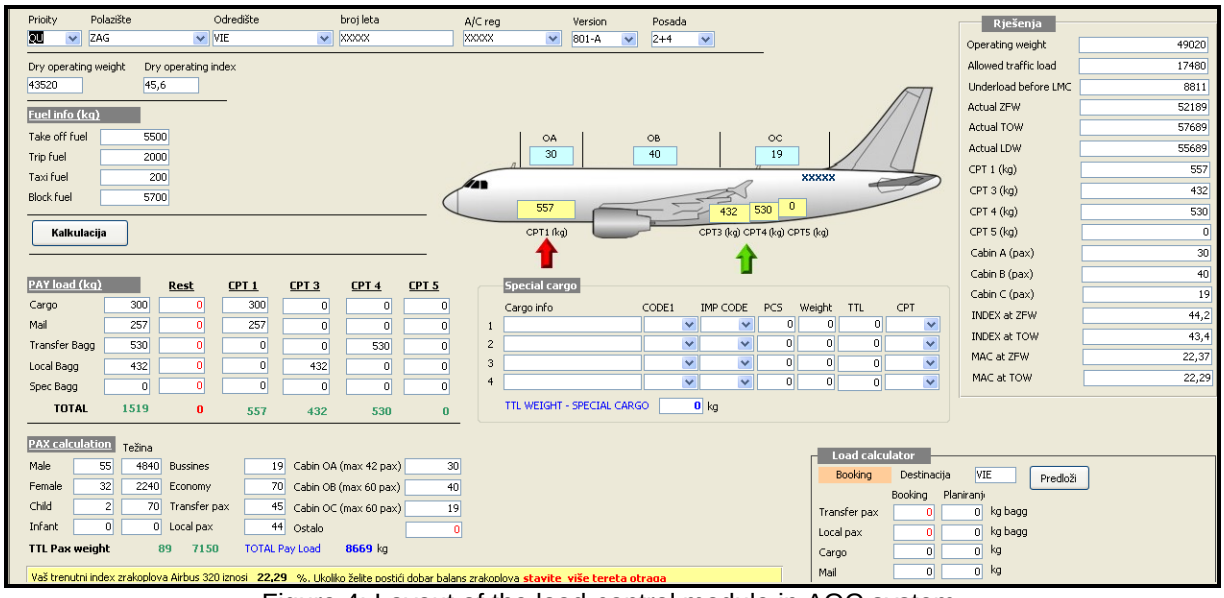

Figure 4: Layout of the load-control module in AOC system

4.1.5 Ramp handling application

Ramp handling module is closely related to load control module since they use all the relevant data about the aircraft. Apart from the technical data, the ramp module consists of link connected with the sorting area, LL, cargo, aircraft handling and the traffic centre. The link towards the sorting area provides information on the current condition, the total and the baggage destinations which arrives to a certain flight. Communication with LL is important because it has been shown in practice that passengers leave their stuff in the aircraft cabin, and it is very important to react as soon as possible in order to find the lost item. By means of this module the ramp agent can also directly communicate with ground handling and using his pocket PC and by clicking a certain icon get the information on anything necessary for aircraft servicing. The pocket PC is connected by the antenna system with the traffic centre that at every moment has insight into all the vehicles that are used on the platform, as well as all the data that are essential for his work.

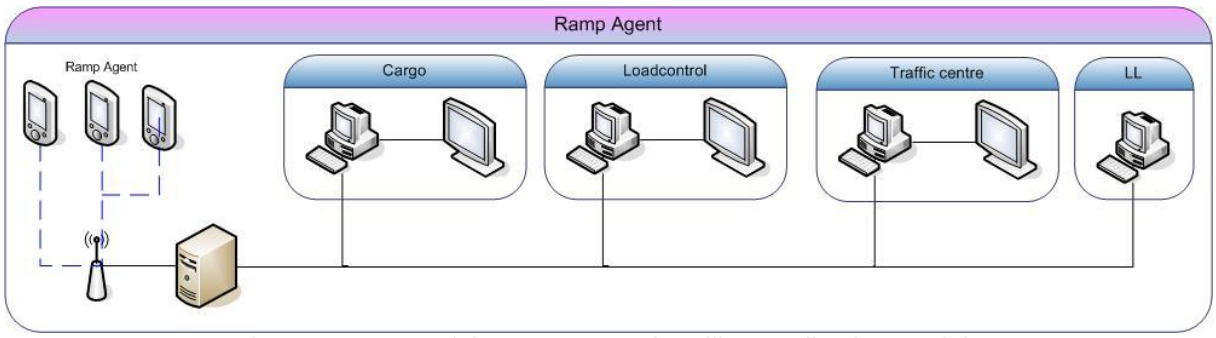

Figure 5: Layout of the AOC Ramp handling application module

4.1.6 Lost luggage application (LL)

LL application has been designed mostly as a communication module between the sorting area service and ramp agents in order to find the lost items from the aircraft as simply and efficiently as possible. The LL module can also directly contact the load control and thus provide information on baggage which is to be sent by aircraft because of baggage delay or baggage loss.

4.1.7 Traffic centre

Traffic centre at the airport represents the central system which supervises the aircraft handling processes at the airport. The traffic centre combines all the information related to aircraft handling and at the same time coordinates the operation of services at the apron, but it also serves as the communication system of other services with the events on the apron. Because of its crucial role in coordinating the services involved in aircraft handling, the Traffic centre represents the base which stores and distributes all the data among the services on the apron and operative services of the airport. Because of this large quantity of data the AOC system managed to solve the problem of data filtering by its communication module, and using the "AOC information filter" method the data distribution has been analyzed. Precisely by timely data distribution among the services it is possible to significantly reduce the handling time. Thus, e.g. it is possible to send the data on the number of inbound passengers via wireless network to the buses on the platform or, should the airport have air-bridges, the exact data on inbound passengers is sent. If ramp agents on the platform need some of the vehicles, fire-fighters, conveying belts can be directly connected to the system and thus avoid congestion at the traffic centre. Such system can be applied at minor airports in which the entire flow of information is through the traffic centre. Also, every aircraft announcement entered by the Traffic centre into their “Traffic Module” distributes the information about the respective aircraft to all the services on time so that these services can get prepared for the aircraft handling. Information about the type of aircraft reaches the main system and is disseminated into several types of information on this aircraft. At the moment of setting the request for aircraft handling, the information on the number of baggage compartments, height of baggage compartment, vehicles primarily required for this aircraft handling, secondary vehicles, need for additional stairs if the aircraft has no stairs of its own, are automatically distributed. The passenger handling service receives information about passengers who require special attention upon disembarkation. “Traffic Module” includes the system for simple monitoring of SITA messages, following of delay codes, and what is most interesting, the apron layout with the displayed positions for aircraft parking. Along with this system, the system for tracking aircraft on ground can also be developed.

4.1.8 Other departments

The demo version AOC 0,1 has additionally set "User Module" which is intended for connecting and direct input of information of every company about their aircraft. Regarding this input it refers to the data on the crew, fuel, slots, aircraft registrations, special data, etc. Such module is directly related to the main system and also filters the data towards the departments. If the company requires it, such a system has the possibility of adding module where the company receives in real time every minute and every event about its aircraft. As a communication system "AOC Airline" can offer also direct connections of airline agents with ramp agents located at the aircraft and will thus provide assistance in aircraft handling. The system may be connected without spatial restrictions so that it provides the possibility of connecting the airline headquarters which are not located at the airport and provides insight into the real situation about their aircraft.

4.2 Communication module

Wireless communication allows data transfer between the AOC server and the portable PDA computers in the possession of the ramp agent. The data transfer between the AOC server through wireless network is enabled by the usage of HTTP protocol.

Further in the text the method of getPage() is presented, which allows loading of the page from AOC server onto the PDA device by using HTTP protocol:

```
private String getPage(String url) throws IOException {
  HttpConnection c = null;
  String result = null;
  try {
    c = (HttpConnection)Connector.open(url);
    DataInputStream dis = c.openDataInputStream();
    byte[] buffer = new byte[(int)c.getLength()];
    dis.readFully(buffer);
```

```
    result = new String(buffer);
  }
  catch (Exception e) {
    Alert alert = new Alert("Error");
    alert.setString(e.toString());
    alert.setTimeout(Alert.FOREVER);
    display.setCurrent(alert, mainForm);
    System.out.println(e.getMessage());
  }
  finally {
    if(c != null)
      c.close();
  }
  return result;
}
```

In order to present the connection of the PDA device, further may be found the class which allows receiving of data on PDA for a certain flight. By simple clicking on the icon "Open" in the application on PDA, a request is sent for the loading of HTML page for the selected flight:

```
private TextArea textArea = null;
private DataInputStream dis = null;

  public HttpNetworking(String title) {
    super(title);
    // zakljucivanje eventa
    addWindowListener(new WindowAdapter() {
      public void windowClosing(WindowEvent e) {
        System.exit(0);
      }
    } );
    setLayout(new FlowLayout(FlowLayout.LEFT, 10, 10));
    Button button = new Button("Open");
    add(button);
    button.addActionListener(this);
    textArea = new TextArea(12,28);
    add(textArea);
  }
```

Clicking on the icon "Open" calls ActionEvent class which implements the actionPerformed() method which allows storage and presentation of data on PDA:

```
public void actionPerformed(ActionEvent evt) {
  String cmd = evt.getActionCommand();
  if (cmd.startsWith("Open")) {
    try {
      URL url = new URL("http://AOCserver.com/base/flight/XXX/HttpNetworking.html");
      HttpURLConnection c =
        (HttpURLConnection)url.openConnection();
      dis = new DataInputStream(c.getInputStream());
      byte[] buffer = new byte[c.getContentLength()];
      dis.readFully(buffer);
      String result = new String(buffer);
      textArea.setText(result);
    }
    catch (Exception e) {
      textArea.setText(e.getMessage());
    }
    finally {
      try {
        if (dis != null) dis.close();
      } catch (IOException e) {}
    }
  }
}
```

The AOC application has used the advantages and the possibilities of Java as object-oriented programming language. Methods such as getPage() have been multiply used for the communication and display of information on the PDA device.

5 CONCLUSION

Airport, as a complex traffic system with developed organization, requires adequate information technology support, in order to raise its services of aircraft handling and other activities to the highest and most acceptable level. Information technology represents today a science of great significance, which can maximally speed up certain activities and realize them in the safest way. The AOC system is an application whose design and further development aims at maximally facilitating and developing the communication system among all the airport departments. The advantage of this system lies in its design which is based on the latest technological achievements and its compatibility with other existing programs at the airport. AOC does not belong to the category of competitive programs but provides instead the communication both of all the departments within the airport and the airports with each other.

6 LITERATURE

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