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Safe and Secure Flight Using Wireless Technology

B. Vinoth Kumar
U.G Student, Department of ECE, Jay Shriram Group of Institutions, Tirupur, India
J. Jaikumar
U.G Student, Department of ECE, Jay Shriram Group of Institutions, Tirupur, India
E. Kirubasankar
U.G Student, Department of ECE, Jay Shriram Group of Institutions, Tirupur, India
K. Sundaresan
Assistant Professor, Department of ECE, Jay Shriram Group of Institutions, Tirupur, India

Abstract:
An aviation incident is defined as an occurrence, other than an accident, associated with the operation of an aircraft that affects or could affect the safety of operations. With an increasing emphasis on anti hijacking and border security, there is a necessity to develop an indication and security system to reduce or avoid hijacking by unknowingly or unauthorized. In this paper, we have proposed a low cost security system especially for protecting aviation accidents. When they have any problem with hijacking, first it should alerted using an alarm system and according to the navigation auto lending will proceed to further, the special sensor will automatically sense if the flight has hijacked or in trouble and turned on the auto landing using GPS and GSM used to alert the guard so that they can take required action.

1. Introduction

GPS (global positioning system) is increasingly being used for a wide range of applications. It provides reliable positioning, navigation to worldwide users on a continuous basis in all weather, day and night, anywhere on or near the earth. None of the present GPS systems satisfy the requirements for the safety of civilian navigation in the sea as the maritime boundary of a country cannot be marked. The main objective of this paper is to help the flight safety. If the flight reaches some treble's it indicated by an alarm to base station, and the engine of the flight is automatically land in airport by the use of a satellite module interfaced with the system transmits a signal to coast guard base station to take necessary action.

2. Existing System

At present, there are few existing systems which help to identify the current position of the flight using GPS system and view them on an electronic map. No automatic landing (auto pilot mode) has used.

3. Limitations of Existing System

The existing systems just indicate the position of the flight but do not take any control action while hijacked. There may be situations where the monitoring officer may not be viewed when a flight hijacked or met trouble. In such situations the above system goes useless.

4. Proposed Work

In this paper, we propose a system that has an inbuilt sensor to find hijacking problem and other issues then controller to control to fuel supply and other basic setup's if there is a problem in flight it identify the nearby airport and make auto landing and also indicate coastal guard office so that they take further necessary action. The security system used while flight initial checking (before take-off) mode, and also provide necessary security action in mid air region while flight running in sky until the landing the flight. When the flight goes uncontrollable situation, the special sensor or tool provide security by using GPS because it find the location to land the flight while troubled scenario. And also it deals fuel supply to the engine and also if any problem in flight or natural aspects to do this satellite module interfaced with the microcontroller (pic) sends an alert signal to satellite which is directed towards a base station. From the base station an alert signal comprising of latitude and longitude positions of the flight is send as message to the nearby airport and coastal guard office and the officer takes further action. The proposed model block diagram is shown in fig.1

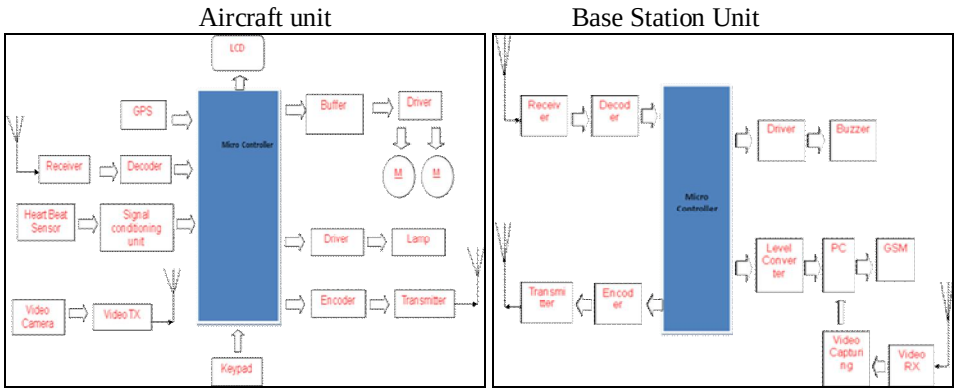

Figure 1: Block Diagram of the Proposed System

5. GPS Module

GPS device needs to be connected to a computer in order to work. This computer can be a home computer, laptop or even a microprocessor/microcontroller. Devices usually are installed with GPS navigation software. Navstar GPS is the newest and most accurate system of radio navigation available. Navstar GPS is a satellite-based open navigation system, which simply means that it is available to anyone equipped with a GPS receiver.

5.1. Navstar GPS

Navstar is an acronym for navigation system with time and ranging, and GPS is an abbreviation of global positioning system. The United States department of defense (dod) developed Navstar to provide continuous, highly precise position, velocity and time information to land, sea, and space based users. In essence, Navstar GPS is a space-based navigation, three-dimensional positioning, and time-distribution system. The intent of the system is to use a combination of ground stations, orbiting satellites, and special receivers to provide navigation capabilities to virtually everyone, at anytime, anywhere in the world, regardless of weather conditions

5.2. Navstar GPS Satellite

The navstar GPS satellite system as shown in figure 2 consists of 24 operational satellites revolving around earth in 6 orbital planes approximately 60^o apart with 4 satellites in each plane. There are 21 working satellites and three satellites reserved as spaces. In the event of a satellite failure, one of the spare satellites can be moved into its place.

Navstar satellites are not geosynchronous. The satellites revolve around earth in an inclined orbit in the angle of elevation at 55^o with respect to the equatorial plane

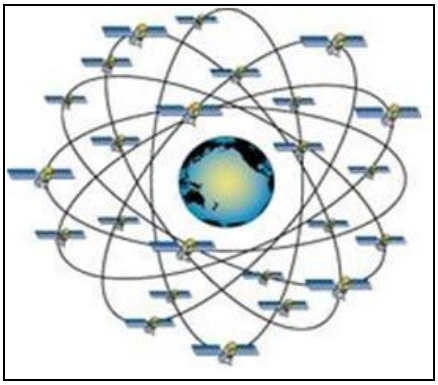

Figure 2: Navstar satellites orbit

5.3. Navstar Satellite Identification

Each satellite has three identifying numbers. The first number is the navstar number that identifies the satellite onboard hardware. The second number is the space vehicle (sv) number, which is assigned according to the order of the vehicle's launch. The third number is the pseudorandom noise (prn) code number. The unique integer number is used to encrypt the signal from that satellite. Some GPS receivers identify the satellite from which they are receiving transmission by sv numbers, others use the prn number.

5.4. Determination of the Position

The GPS system works by determining how long it takes a radio signal transmitted from a satellite to reach a land based receiver and then using that time to calculate the distance between the satellite and the earth station receiver which s given by equation 1,

$d = v * t$ (1)

Where,

d- Distance between satellite and receiver (m)

v -velocity of radio signal ($3*10^8$ m/s)

t- Propagation time (seconds)

Propagation time (delay) is simply determined by comparing the unique prn code transmitted by the satellite with locally generated prn code by the receiver shown in the fig 3.

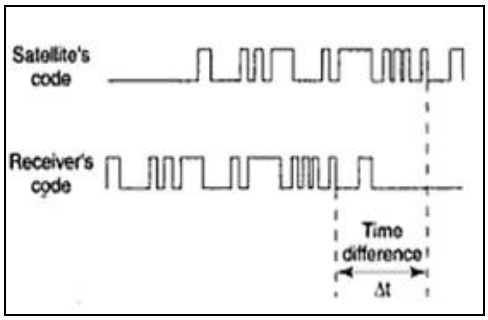

Figure 3: pseudorandom timing code

By using the distance between satellite and receiver we can determine the position of GPS receiver by trilateration method.

If GPS receiver knows the location of a single satellite and the distance from the satellite, then the receiver knows that it must be located somewhere on an imaginary sphere center as the satellite with radius equal to the distance between the satellite and the receiver. If GPS receiver knows the location of three satellites and their distances from the satellite, then receiver knows that it must be located somewhere on the intersection of those three imaginary spheres.

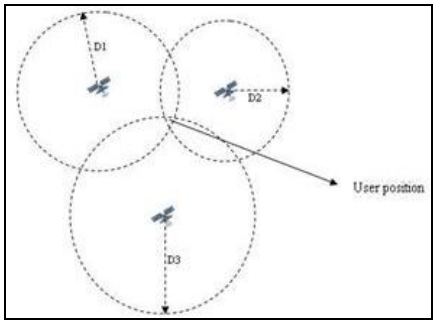

Figure 4: trilateration method

Fig 5 shows there are three unknown position coordinates (x, y, and z). Therefore, three equations from three satellites are required to solve for the three unknown coordinates. A fourth satellite is required to eliminate the clock bias error.

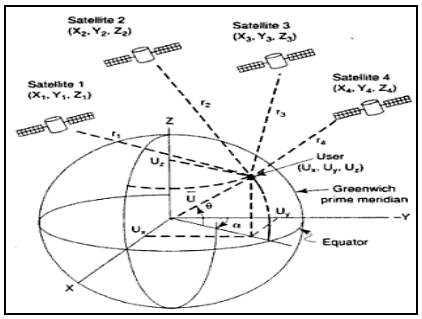

Figure 5: sphere co-ordinate representation

Satellite equations:

$$(X_1 - U_x)^2 + (Y_1 - U_y)^2 + (Z_1 - U_z)^2 = (r_1 - C_b)^2$$

$$(X_2 - U_x)^2 + (Y_2 - U_y)^2 + (Z_2 - U_z)^2 = (r_2 - C_b)^2$$

$$(X_3 - U_x)^2 + (Y_3 - U_y)^2 + (Z_3 - U_z)^2 = (r_3 - C_b)^2$$

$$(X_i - U_x)^2 + (Y_i - U_y)^2 + (Z_i - U_z)^2 = (r_i - C_b)^2$$

$$User's\ latitude = \theta = \cos^{-1}\frac{\sqrt{u_x^2 + u_y^2}}{|U|}$$

$$User's\ longitude = \alpha = \tan^{-1}\frac{U_x}{U_y}$$

6. Microcontroller

This system the microcontroller is added in order to find the location and also to select the control action to be done on the boat. The most widely used microcontroller pic16c87a is used here. According to the programmed microcontroller, when the signal from GPS module the microcontroller compares it with the value which is already stored in the memory. This stored data consists of latitude and longitude data of the border of the country. If the comparing value is same as the stored value in the memory it will set the output logic and will trigger the alarm, when the fisher man reaches within 2 km range of the border. If the fisher man continues to travel after the indication of the alarm then the GPS will provide the signal to the microcontroller, which is compared and the microcontroller sets the output for both the alarm circuit and the CDMA module which will send the message to the coast guard base station. In order to stop the movement of the boat further, the engine of the boat must be stopped.

7. The GSM Network

Global System for Mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is the name of a standardization group

GSM provides recommendations, not requirements. The GSM specifications define the functions and interface requirements in detail but do not address the hardware. The reason for this is to limit the designers as little as possible but still to make it possible for the operators to buy equipment from different suppliers. The GSM network is divided into three major systems: the switching system, the base station system, and the operation and support system (oss).the basic GSM network elements are shown in fig 6.

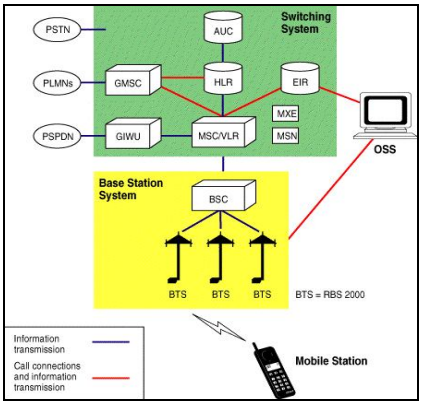

Figure 6: GSM network

7.1. The Operation and Support System

The operations and maintenance center (omc) is connected to all equipment in the switching system and to the bsc. The implementation of omc is called the operation and support system (oss). The oss is the functional entity from which the network operator monitors and controls the system. The purpose of oss is to offer the customer cost-effective support for centralized, regional and local operational and maintenance activities that are required for a GSM network.

7.2. Specifications and Characteristics for GSM

- Frequency band—the frequency range specified for GSM is 1,850 to 1,990 mhz (mobile station to base station).
- Duplex distance—the duplex distance is 80 mhz duplex distance is the distance between the uplink and downlink frequencies. A channel has two frequencies, 80 mhz apart.
- Channel separation—the separation between adjacent carrier frequencies. In GSM, this is 200 khz.
- Modulation—modulation is the process of sending a signal by changing the characteristics of a carrier frequency. This is done in GSM via gaussian minimum shift keying (gmsk).
- Transmission rate—GSM is a digital system with an over-the-air bit rate of 270 kbps.

8. Heart Beat Sensor

A fiber optic sensor for measurement of heart rate in this paper "intelligent ppe system for personnel in high-risk and complex environments". The paper is supported for advanced personal protective equipment (ppe) system that will ensure active protection and information support for personnel operating in high risk and complex environments in fire fighting, chemical and mining rescue operations. The ppe system will be ergonomically designed and fully adapted to end-users' needs as well as to working conditions.

8.1. Sensor Design

The sensor is based on macro bending effects in multi-mode pof and the other sensors are based on single-mode microstructure pof lpg. To increase the sensitivity of the macro bending sensor the cladding of the pof was treated. The fibers were applied on elastic textiles and wrapped around the upper body to measure the circumference changes due to the heart movement. Because of the design of the sensor it is also sensitive to respiratory and body movements. Therefore the heart rate signal is filtered out of sensor signal by signal processing.

The macro bending sensor measures the small elongations of the elastic textile which are caused by the heart movement. The sensor uses polymer optical fiber with a diameter of 500 µm, which is attached to elastic textile in a sinusoidal shape with 3.5 periods. When the bandage is stretched the radii get larger and thus the bending loss decreases.the sensor belt is shown in fig. 1 (left). The main advantage of the macro bending sensor is that its interrogation is quite simple. Only intensity changes are measured, so the main components needed are a led source and a photodiode. Due to this fact a compact design is possible. The components are available for low costs compared to the price of spectrometer needed for interrogation of an mpof lpg. The macro bending sensor monitoring unit is based on a commercial digital fiber sensor from panasonic electric works.

These holes continue through the whole length of the fiber as air channels. Light guidance is made possible with a mechanism Called index guiding.

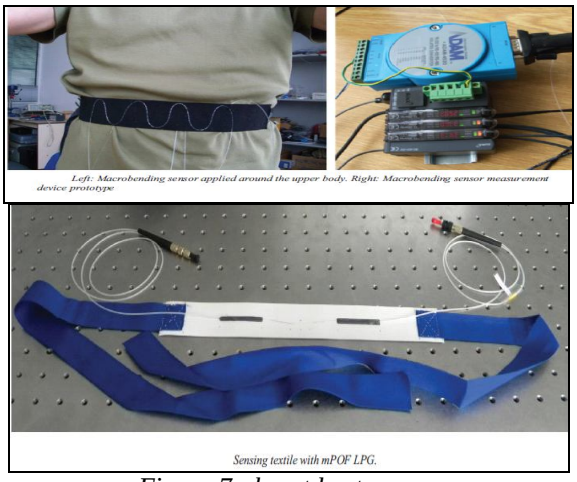

Figure 7: heart beat sensor

9. Conclusion

We proposed a low cost flight security system especially for avoid hi-jacking problems. By implementing this system, a safer navigation especially for auto landing while any problem arises. This system provides more security and also the status of the security signal is informed to the base station which is helps to understand the situation very easily.

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