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Satellite Assisted Flight Tracking And Rescue

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Abstract— The conventional method of tracking an aircraft using RADAR is efficient but the results of crash are unknown. Also the procedure of the Rescue attempt engaged in the accident of an aircraft is not being efficient and timely. Thus, the golden hour is wasted due to the initiation of the mission. Hence, there is a strong need for a system that makes tracking and rescue attempt very fast. All aircrafts cruise at a higher speed which makes the GPS system fail to get a fix on the target.GPS also requires minimum of 3 satellites to get the fix. Thus during a crash, much time is spent in analyzing the aircraft's last known RADAR contact point. This paper provides an alternative way to Global positioning system and RADAR system to locate an aircraft that has crashed.

Keywords—Collision sensor;RADAR;Tracking;Global Positioning System;Personal Handy System;

I. INTRODUCTION

The present Global Positioning System is used to track the vehicles using Low Earth Orbit (LEO) satellites continuously in present scenario. Also, aircrafts use GPS systems to navigate and do not communicate their coordinates with the Air Traffic Control (ATC).GPS lacks accuracy and requires time to get the fix on the target. But if the aircraft moves beyond the network area, it will not be possible to track the aircraft using GPS. Hence, to overcome this problem personal handy system is provided which works even if the vehicle is in not reachable area. The Personal Handy System (PHS) service was launched first in 1995 to respond to the demand of mobile communication in Japan. This system is completely automated and does not require any manual triggering of the operation.

II. EXISTING SYSTEM

The current system employs RADAR to track the position of the aircraft. The Air traffic control (ATC) is equipped with primary RADAR. The primary RADAR came into existence in late 1930s. The approximate distance is measured using the reflected waves from the aircraft. This tracking is done, even if the aircraft wishes not to be tracked.

The secondary RADAR used for tracking requires aircrafts equipped with transponders. Figure 2 shows the secondary RADAR installed at an airport.

Fig1: Primary RADAR [3].

Figure 1 shows the primary RADAR for tracking an aircraft.

Fig 2: Secondary RADAR [4].

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III. PROPOSED SYSTEM

This system is about an alternative technology which is much economical, simple and indigenous in design. There by resulting in an effective system for our own network system of tracking an aircraft that has gone missing from the RADAR.

With help of this system, it is possible to easily track particular aircraft for its geographical locations on display. The operator can get the exact location of the crash location in real time mode. Here the communication network is comparable to the cellular network in operation. As the concept of PHS is implemented, communication link is reliable. Also, the rescue mission can be initiated by a single click.

IV. SYSTEM OVERVIEW

A. The base station

The base station monitors the movement of the aircraft using the PHS system and also is responsible of initiating the rescue mission. When the information of the crash is received by the tower, it sends the co-ordinates information to the nearest rescue unit. It forms the hub of the network. The crash information is obtained from the towers placed. This information is processed and interpreted in a proper format by the base station. Also, the base station has an area under its coverage. The block diagram of base station is as shown in Figure 3.

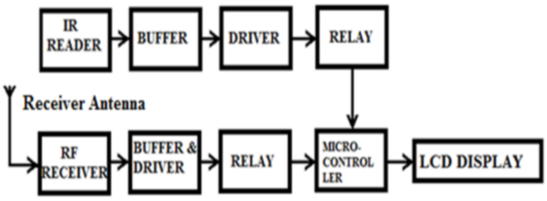

Fig 3: The Base station

B. The Aircraft unit

This unit consists of a collision sensor which activates the circuit on detecting a collision. It activates the IR beacon which in turn sends out random IR signals in all directions similar to a homing beacon. This unit also has a proximity sensor fitted in the avionic system deck in the aircraft which alerts the pilot when an unauthorized entry is detected. This unit forms the major part as accuracy is in great demand for operations to happen without errors.

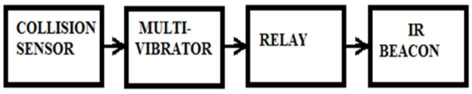

Fig 4: The Aircraft Unit

Figure 4 shows the block diagram of the aircraft unit.

C. The Rescue unit

The Rescue unit is the mobile vehicular system that reaches to the crash location as soon as possible. The Rescue unit will be provided with the co-ordinates of the location, thereby to reach the location in faster time. This unit will be equipped with state-of-art communication devices for reliable communication. The unit is also equipped with communication check mechanisms to ensure that link exists between base station and the unit itself.

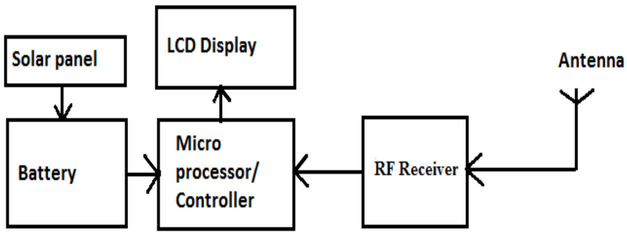

Fig 5: The Rescue unit

D. RF Transmission Towers

The RF transmitter is built around the ASIC and common passive and active components, which are very easy to obtain from the material shelf. The circuit works on Very High Frequency band with wide covering range. The Carrier frequency is 147 MHz and Data frequencies are 17 MHz, 19 MHz, 22 MHz & 25 MHz .

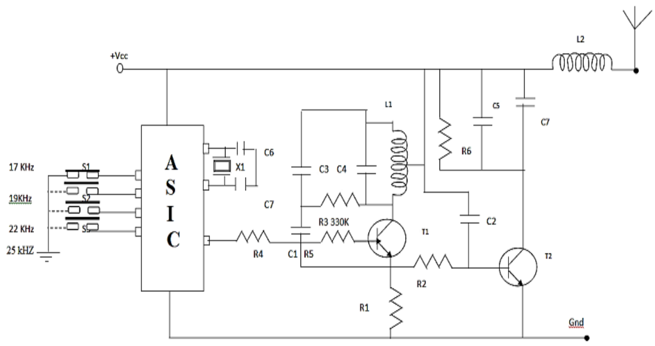

Fig 6: RF transmitter

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The Transmission towers are equipped with IR readers. Whenever the IR signal from the beacon is picked up the reader, the information is sent to the Base station.

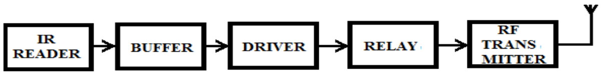

Fig 7: Area B

Figure 7 shows the block diagram of Area B. The information is sent through direct LoS (Line of Sight) transmission link to the base station.

E. PHS Satellite System

The use of PHS system increases range as it includes satellite. The direct transmission restricts the area to the smaller distances. With satellite the communication can be established from anywhere. In this project a prototype of satellite is build to increase the range as shown in Fig 8, whose working is same as that of Area A and Area B.

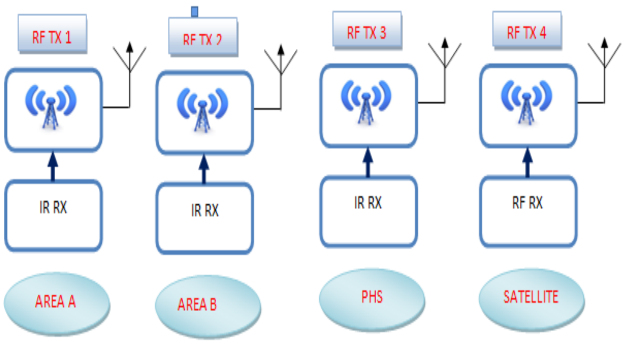

Fig 8: PHS System overview

V. Working Of The System

[i] The aircraft in flight is continuously tracked using the towers placed on land and water. These towers are equipped with IR receivers.

[ii] The aircraft unit is fitted with the collision sensor and IR beacon. When there is an event of a crash, the IR beacon is activated by the collision sensor, and IR radiations are sent out in all directions.

[iii] This IR radiation is sensed by the towers placed nearby and the information is sent to the base station based on the available communication medium, i.e. RF ground link or satellite link.

[iv] If crash has occurred at Area B, the communication is through LOS. The RF signal at 25 MHz is transmitted to the base station.

[v] The information is received by the base station as soon as a crash occurs. This information contains the co-ordinates of the tower placed.

[vi] This is sent to the nearby rescue units through another channel operating at 433 MHz

[vii] Thus, long distance communication is possible between the rescue unit and the base station.

[viii] The rescue unit is also equipped with the communication check system to ensure that it is connected to the base station.

VI. Results

The concepts discussed in the paper were successfully implemented and developed into a working prototype.

Fig 9: Working model

Fig 10: Crash location display at the base station

The base station was implemented using ARM microcontroller.

The IR beacon activation was successfully done using the piezo sensor working as the collision sensor. The IR readers were tested and installed at the towers and the base station. The Towers were placed at proper distances without interference due to cell overlapping. When the crash occurred at Area A, i.e. the base station vicinity itself, the LCD displayed the message “AREA A” as shown in figure 10.

When the crash scenario was created at the vicinity of Area B, the message was sent to the base station from the RF tower at area B. The LCD at the Base station displayed "AREA B".

Similarly, when crash occurred at the PHS tower surveillance area, the information was uplinked to the PHS satellite. The satellite down-links it in corresponding frequency to the base station. The LCD at the base station displayed "PHS AREA".

The Rescue unit was implemented using ATMEGA 328P, a RF receiver, a buzzer, and a GLCD (Graphical Liquid Crystal Display).

To initiate the search mission, switch 1 was pressed at the keypad in the base station; the rescue unit received the message as "PLANE FOUND IN AREA A".

To send the rescue unit to the vicinity of area B, switch 2 was pressed. The GLCD display in the rescue unit displayed "PLANE FOUND IN AREA B".

To send the rescue unit to the vicinity of PHS Area, switch 3 is pressed. The display unit displayed "PLANE FOUND IN PHS AREA".

When no crash is occurred, "ALL SYSTEMS ARE NORMAL" message is displayed.

When transmission link is disrupted, the rescue unit displayed "NO SIGNAL! CHECK TRANSMITTER".

VII. Conclusion

We conclude that we were able to successfully implement the proposed system. The results were meeting the expectations. The aircraft unit could be mounted in the Black box of an aircraft. The existing towers for GSM communication can be added with the RF tower modules to decrease the cost factor. The rescue unit module can be fitted in the rescue vehicle. The existing Radio Base Station (RBS) can be mounted with a IR Reader for coverage. For efficiency, IR concept can be replaced by RF. The system can save lives in a large number by initiating the rescue mission. The first 24 hours after the crash, usually referred as the "Golden day", can be effectively made use of. Also, several systems in the proposed method are reliable. The communication link is maintained intact always. The rescue unit is informed instantly to carry out the rescue operation.

Thus, this system serves as an alternative to track an aircraft using the conventional methods and also can result in the accurate location of the crashed aircraft.

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