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GSM based Arial photography using remote flying robot

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ABSTRACT

Development of a suitable lightweight system in which a sensor is airborne for carrying out surveillance. The sensor should remain airborne for a minimum of 2 minutes at a minimum height of 30 meter and above to do imaging of a proportionate area below. Recognizable real time video information should be transmitted to the ground receiver point suitably located in the observation area. Sensor should be able to detect man-sized objects in above-mentioned conditions. Proposed solution should take up design of configuration and identification of suitable options for sensor, data link, ground observation & control points and other support system(s). System configuration details comprising of sensor, data link, observation, data processing mechanism and support system should form part of the design. There are many approaches for motion detection in a continuous video stream. All of them are based on comparing of the current video frame with one from the previous frames or with something that we'll call background. The camera IC will provide high level functionality for all applications. This camera IC is controlled by microcontroller which is connected to it. The camera automatically focuses the object up to 50 m and is controlled by microcontroller.

Introduction

Unmanned Aerial photography (UAPs) are rapidly becoming a key technology in the military domain and offer great promise as a useful technology in many commercial and civil applications in the future. The potential applications are highly diverse and the associated requirements on platform type and payload, in addition to ground control stations and interfaces, must match the constraints of the application in order to make their use both user-friendly and economically feasible. Development of a suitable lightweight system in which a sensor is airborne for carrying out surveillance. The sensor should remain airborne for a minimum of 2 minutes at a minimum height of 30 meter and above to do imaging of a proportionate area below. Recognizable real time video information should be transmitted to the ground receiver point suitably located in the observation area. Sensor should be able to detect man-sized objects in above-mentioned conditions. Proposed solution should take up design of configuration and identification of suitable options for sensor, data link, ground observation & control points and other support system(s). System configuration details comprising of sensor, data link, observation, data processing mechanism and support system should form part of the design.

Hardware Description:

This system involve to Monitoring and controlling the system using four different modules,

1)Flying Robot Control Unit
2)Wireless control Unit
3)Sensing and Control Unit
4) PC and Control unit

Flying Robot Control System Design

The control system which is regarded as the brain of the flying robot is the most important module of the robots. It gathers the robot's internal and external information, receives commands from the remote control system, and executes complex path planning algorithm and so on. The embedded control system structure of the coalmines detect and rescue flying robot as shown in Fig1.

Control system Hardware design

Fig which shows the developed platform which uses single chip microcontroller PIC 18F4520, Light weight Camera, LDRsensor, GAS Sensor, Temperature sensor and communicates through Zigbee.

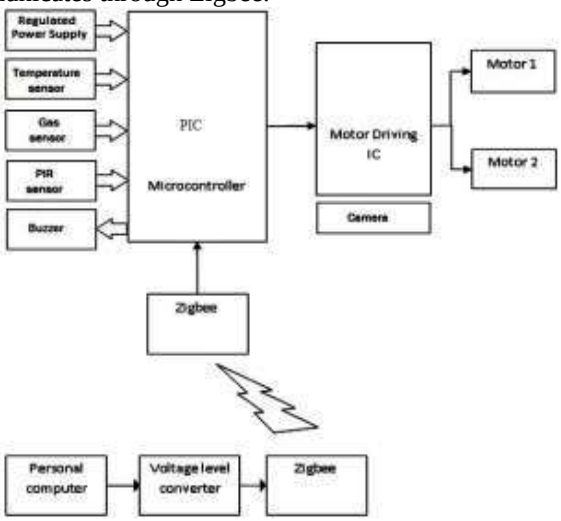

Figure. Control Structure of flying robot

Motion Detection Algorithms

There are many approaches for motion detection in a continuous video stream. All of them are based on comparing of the current video frame with one from the previous frames or with something that we'll call background This application supports the following types of video sources:

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- AVI files (using Video for Windows, interop library is included);
- updating JPEG from internet cameras;
- MJPEG (motion JPEG) streams from different internet cameras; local capture device

Motion alarm:

It is to add motion alarm feature to all these motion detection algorithms. Each algorithm calculates a binary image containing difference between current frame and the background one. So, the only we need is to just calculate the amount of white pixels on this difference image. For some algorithms it could be done even simpler. For example, in blob counting approach we can accumulate not the white pixels count, but the area of each detected object. Then, if the computed amount of changes is greater than a predefined value, we can fire an alarm event.

Aerialphotography

SkyCamUsa is a Professional Aerial Photography & Video Production company creating highly specialized close range aerial media for creative clients in the United States and around the world. New York City based we fly both traditional manned aircraft for marine and high altitude photography and also remote controlled aircraft known as a Drone or Multicopter, light weight and all battery powered they fly like a helicopter with vertical flight, quiet, with six electric or eight motors for aerial photography and video. This flying platform is for a new type of creative aerial media that is cutting edge and catching on fast.

Microcontroller

The microcontroller forms the heart of an embedded system. The AT89S52 is the microcontroller used here which is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable Flash memory. The device is manufactured using Atmel's high-density non-volatile memory technology and is compatible with the industry-standard 80C51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional non-volatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highlyflexible and cost-effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The microcontroller is always in the active mode, if the gas sensor senses a gas and founds a critical situation then the information is sent to the microcontroller. The microcontroller first provokes an alarm to alert the passengers inside the vehicle and also an alert message to the authorised user is sent in the form of SMS through GSM. The microcontroller uses AT+CMGS command to send the SMS where the GSM is connected to the microcontroller through RS232 cable.

GSM Module

A GSM modem is a specialized type of modem which accepts a SIM card, and operates over a subscription to a mobile operator, just like a mobile phone. From the mobile operator perspective, a GSM modem looks just like a mobile phone. A GSM modem exposes an interface that allows applications such as SMS to send and receive messages over the modem interface. The mobile operator charges for this message sending and receiving as if it was performed directly on a mobile phone. To perform these tasks, a GSM modem must support an "extended AT command set" for sending/receiving SMS messages, as defined in the ETSI GSM 07.05 and 3GPP TS 27.005 specifications. Due to some compatibility issues that can exist with mobile phones, using a dedicated GSM modem is usually preferable to a GSM mobile phone. It should also be noted that not all phones support the modem interface for sending and receiving SMS messages. In particular, most smart phones, including Blackberries, iPhone, and Windows Mobile devices, do not support this GSM modem interface for sending and receiving SMS messages at all. Additionally, Nokia phones that use the S60 (Series 60) interface, which is Symbian based, only support sending SMS messages via the modem interface, and do not support receiving SMS via the modem interface. The interfacing between the GSM and the Microcontroller and the developed module is shown in the fig. 7(a) and fig.7(b).

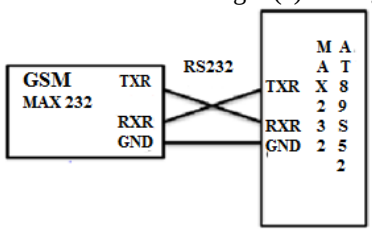


Fig.7(a).Interfacing GSM with AT89S52

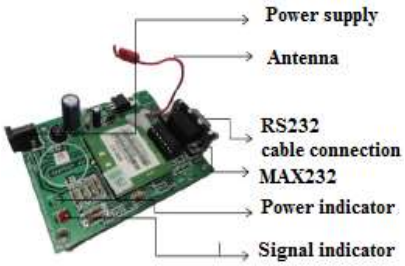
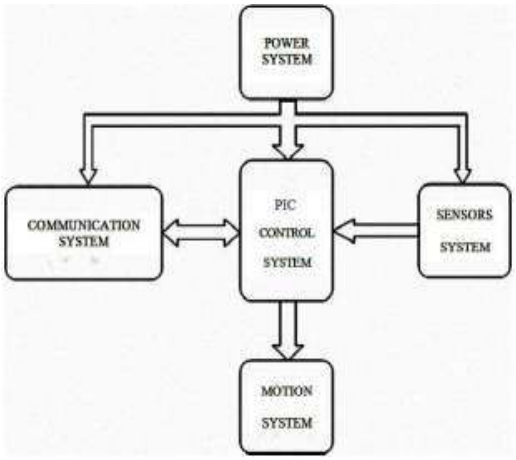


Fig.7(b).The developed GSM module

Flying Robot Structure

The coalmines detect and rescue flying robot is composed of mechanical institution, control system, electronic system, communication system, sensor system and power system. The system structure of the robot is shown in Fig 1. Flying Robot is Two DC motors while two rear arms by another. Front arms are linked by a pole to move together, as well as rear arms. Besides, video image signal can also be send by wireless image transmitter whose working frequency is 1.2GHz and communication distance is l Km in open field.

Robot can communicate with remote control system (RCS) through three ways. The first channel uses radio transceiver through RS232 interface; the second one is the optical fiber communication system which can transmit serial data signals by RS485 interface and cameras' video image at the same time as show in Fig .2.



The last one uses wireless sensor net (WSN) to exchange information while a WSN node is attached to the robot through RS232 interface and robot's RCS connects to the WSN's server. When WSN is used, WSN's nodes should be deployed along the tunnel properly and communication distance can be extended greatly.

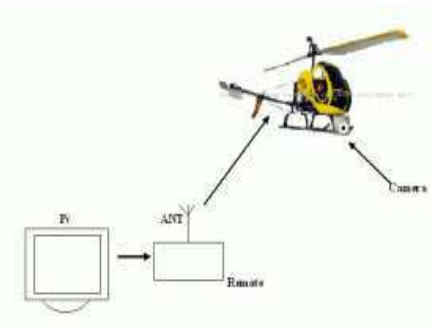


Figure 2. Schematic diagram

Sensors system is composed of camera, gas sensor, temperature sensor and LDR Sensor. Some of these sensors output analog voltage signal sampled by peripheral A/D converter. With these sensors, remote operators can obtain the instantaneous information of the coalmines tunnel and robot can avoid collision when obstacles are laid on robot's path and adjust itself posture in time when it may fall down. The robot is powered by two lithium batteries which output 24V DC voltage. The main tracks driven DC motors and arms DC motors are all supplied by 24V DC converters. Other devices are powered by 12V or 5V DC converters.

Helicopter platform:

Our test platform is based on the E-flite Blade CX2 and Blade CX3 coaxial helicopters. These are cheap, readyto- fly micro helicopters. Each helicopter's rotor diam-eter is 0.36m (with the landing gear in place) – this enables it to fly even in confined spaces. However, its total weight is 227g and allows a payload with a maximum weight of only 70g. We chose the coaxial model because it provides stable flight and is considerably easier to control than its dual rotor counterparts. A Swan EagleEye wireless camera is mounted on-board (Fig. 1 inset) to stream images in real-time to the control algorithm. The camera is small (22 × 24 × 27 mm), light-weight (14g), and has low power consumption (100 mA). It relays back images of 640 x 480 resolution at 30 frames per second. This camera is our only perception source for the helicopter control – we do not even use inertial sensors in our algorithm. A wireless receiver attached to the laptop is used to receive the streaming frames. This enables the helicopter to be controlled via the PC using our control algorithm. We use the Spectrum DX6i 2.4 GHz transmitter, which is capable of translating PPM input to DSM signals that are broadcast to the helicopter.

Implementation

The IR transmitter transmits the IR signals continuously to the maximum level of 3 ft. when the IR signals are reflected back by an object then the signal is received by the IR receiver, thus the module senses the obstacle. Development of a suitable lightweight system in which a sensor is airborne for carrying out surveillance. The sensor should remain airborne for a minimum of 2 minutes at a minimum height of 30 meter and above to do imaging of a proportionate area below. Recognizable real time video information should be transmitted to the ground receiver point suitably located in the observation area.

Conclusion

An embedded system has been developed which observes an object, the system also send an alert message to the authorised user through GSM such that remedy measures could be easily taken.

The embedded control system based on the PIC Microcontroller AT89C51 designed for the flying robot has the features of stable, robust and reliable. Hardware design of the control system has the advantages of scalability, flexibility and low consumption. The PIC microcontroller has advantages of high processing speed, rich chip resources and supporting many different operating systems. Several peripheral devices are extended to enhance more than 10 system performance through interfaces of the development board. As the platform of software development, embedded has the advantages of scalable kernel, multi-user, multi-tasking and strong network function. Various fields experiments prove that the robot based on such embedded control system can basically meet the requirements of coalmines detecting and rescuing after mine disasters occur.

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References

[1] P. Abbeel, A. Coates, M. Quigley, and A. Y. Ng. "An application of reinforcement learning to aerobatic helicopter flight". In Neural Information Processing Systems (NIPS), 2006.

[2] A.Beygelzimer, S. Kakade, and J. Langford. "Cover trees for nearest neighbor." In International Conference on Machine Learning (ICML),2006.

[3]. www. efymag.com

[4]. Kai-Tai Song and Chih-Chieh Yang, of National Chiao Tung University, Taiwan, "Front Vehicle Tracking Using Scene Analysis", Proceedings of the IEEE International Conference on Mechatronics & Automation 2005.

[5]. PadminiKumari j, S.S. Dorle, A.G. KeskarMegha, B. Chakole, "Micro-controlled based Vehicle Safety System Using Dedicated Short Range Communications (DSRC)", Second International Conference on Emerging Trends in Engineering and Technology, ICETET-09.

[6]. Soichi Kubota, Yoshiharu Okamoto, Hideo Oda of National Institute of Information and Communication Technology (NICT), Japan, "Safety Driving Support System Using REID for Prevention of Pedestrian-involved Accidents", 6th International Conference on ITS Telecommunications Proceedings 2006