A Novel Hybrid Programmable Architecture For Flight Termination System

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ABSTRACT: This is purely new kind of implementation of FTS in SDR platform. The applied design procedure replaces a multiple platform based with a single platform. This paper proposes a SDR BASED FTS IMPLEMENTED ON FIELD PROGRAMMABLE GATE ARRAY (FPGA).Real time flight termination operation demands a very highly reliable and ruggedized platform. RF transceiver is used.

Index Terms: FPGA, SDR, RF transceiver, control switch, landing model.

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I. INTRODUCTION

When landing the flight vehicle there square measure ton of uncertainties concerning flight performance. To secure human life we tend to square measure utilizing flight terminating system.FTS essentially involves in generation and transmission of signals to the air borne flight vehicle to execute some operations within the vehicle as needed. A flight termination system (FTS) is employed to secure the human life and property. Flight vehicle (FV)needs rigorous testing to satisfy all expected performance the look of FTS involves period of time signal generation, transmission and analysis of the transmitted signal. An appropriate package designed radio (SDR) platform has established itself to be terribly economical platform for implementing such versatile and reconfigurable system.SDR in recent trend could be a common term, which Has been used for fast prototyping of various sorts. Flight termination operations square measure powerfully desired. High degree of skillfulness and reconfigurable design with period of time response is accomplishable through the mixture of extremely reliable package with wide selection of capabilities and appropriate for FPGA. It is necessary to possess system that is versatile, reconfigurable and dynamic to the setting things and hardware modifications.SDR supported FPGA system can be a decent choice for planning intelligent and reconfigurable CTS for operations on one platform, as compared to the antecedently used large CTS. Different hardware based mostly CTS systems were used for check of various flight vehicles. The recently developed SDR based mostly FTS system successfully, solves the matter of frequent hardware replacements and price of style as in SDR based mostly system. The FPGAs square measure generally used now-a-days for several industrial management application. Analog to digital device (ADC) and Universal asynchronous receiver/transmitter (UART) square measure enforced in FPGA.ADC could be a device that converts a continual physical amount to a digital range that represents the quantities amplitude. An ADC is outlined by its information measure and its signal to noise quantitative relation. An ADC might also offer associate degree isolated measuring like associate degree device that convert s associate degree input analog voltage or current to a digital range proportional to the magnitude of voltage or current. UART could be a hardware that interprets knowledge between parallel and serial forms. UARTs square measure unremarkably utilized in conjunction with communication standards like RS-232,RS-422 Or RS-485.A UART is typically a private microcircuit used for serial communication over a pc or electronic equipment port. UARTs square measure currently unremarkably enclosed in microcontrollers. A twin UART or DUART combines 2 UARTs into single chip

2. PROPOSED METHODOLOGY

In existing system software package designed radio (SDR) that are generally enforced in hardware. Multiple parts (i.e., FPGA, Antennas) area unit used for analyzing and implementing flight terminating system (FTS).It will solely executes single task at a time. Antennas area unit used for sending and receiving the signal. Fading occurred thanks to antennas. Software package designed radio (SDR) based mostly FTS algorithmic program that contains mathematical formulations were Binary frequency shift keying (BFSK) modulated signals area unit used that ends up in quality. Signal process is incredibly low. Lab VIEW FLEXRIO software package communication is employed. To avoid such issues within the projected system we have a tendency to area unit implementing software package designed radio (SDR) parts by suggests that of software package on a private laptop. RF transceiver is employed that is bi-directionally connected to FPGA. The transmitter includes management switch and RF transmitter. The transmitter transmits the RF signal. The sending aspect is within the air borne flight. The RF transceiver provides an awfully reliable and quick communication between the remote unit and FTS transceiver system. Receiver includes the RF transceiver ,FPGA Spartan 3E kit, LCD and landing model system. FPGA method sends corresponding info to the landing model system.LCD is employed for user reference. VLSI has been enforced that reduces the multiple parts with higher potency. FPGA is employed for multi process. Output is reliable. The hardware needs used area unit FPGA it's Associate in Nursing IC organized specially for FTS system. RF transmitter transmits at oftenest vary varies between 30KHZ and 300KHZ.RF transmitter receives serial knowledge and transmits it wirelessly through RF. The RF receiver receives the RF signal from RF transmitter and demodulates it for any process. PC is employed for software package designed radio (SDR).Landing model is that the basic model used for supporting the landing method. Set of motors (stepper or dc motor) area unit used for adjusting the direction. liquid show is for user reference. The software package needs used area unit XILINX ISE and visual basic (VB) creating set of frequency command through system.
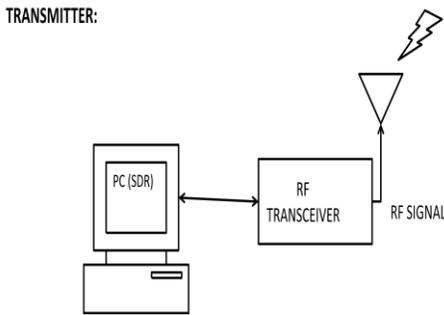
TRANSMITTER:

Figure 1: The block diagram of transmitter

2.1 Software defined radio

SDR is a radio communication system wherever parts that unit of measurement generally enforced hardware (e.g. mixers, filters, amplifiers, modulators, detectors, etc..) is instead enforced by means that of a code on a private laptop pc or embedded system. Traditional radio chips are hard-wired to speak pattern one specific protocol. as an example, a typical movable has many entirely utterly completely different chips to handle a range of radio communications: one to speak to movable towers, another to contact wireless native area network base stations, a 3rd to receive GPS signals, and a fourth to speak with Bluetooth devices. In distinction, software-defined radio hardware works with raw attraction signals, attempting forward to code to implement specific applications. This makes SDR devices enormously versatile. With the correct code, one software-defined radio chip may perform the functions of all of these special-purpose radio chips in your movable and lots of others besides. It might record FM radio and digital TV signals, scan RFID chips, track ship locations, or do natural philosophy. Software-defined radio hardware together permits speedy prototyping of recent communications protocols. Software-defined radio can turn out it realizable to use the spectrum in primarily new ways that during which. Most radio standards recently are designed to use a tricky and fast, slender band. In distinction, software-defined radio devices will tune into many various frequencies at an analogous time, creating realizable communications schemes that may not be come-at-able with commonplace radio gear.
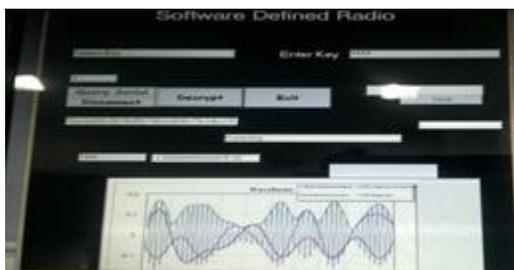

Figure 2: Software designed radio in pc

2.3 RF transceiver

An RF module (radio frequency module) could be a (usually) tiny device accustomed transmit and/or receive radio signals between 2 devices. In Associate in nursing embedded system it's typically fascinating to speak with another device wirelessly. This wireless communication

could also be accomplished through optical communication or through often (RF) communication. For several applications the medium of selection is RF since it doesn't need line of sight. RF communications incorporate a transmitter and/or receiver. RF modules could fit an outlined protocol for RF communications like Zigbee, Bluetooth low energy, or Wi-Fi, or they'll implement a proprietary protocol. Associate in nursing so module is that the same as a transceiver module, however it's typically created with Associate in Nursing aboard microcontroller. The microcontroller is often accustomed handle radio information packetization or managing a protocol like Associate in Nursing IEEE 802.15.4 compliant module. This kind of module is often used for styles that need further process for compliance with a protocol once the designer doesn't would like to include this process into the host microcontroller. Easy Bee is Associate in Nursing IEEE 802.15.4 compliant RF Zigbee transceiver. It permits designers to simply add ZigBee / IEEE 802.15.4 wireless capability to their product while not the necessity for RF or antenna style experience. The module contains all RF electronic equipment, as well as integral antenna and controller during a simple-to-use, plug-in or surface mount module. Easy Bee could be a totally capable device and a ZigBee networking layer isn't needed for point-to-point communication.
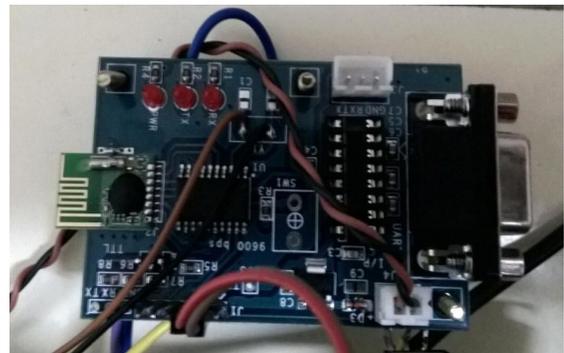

Figure 3: Transmitter
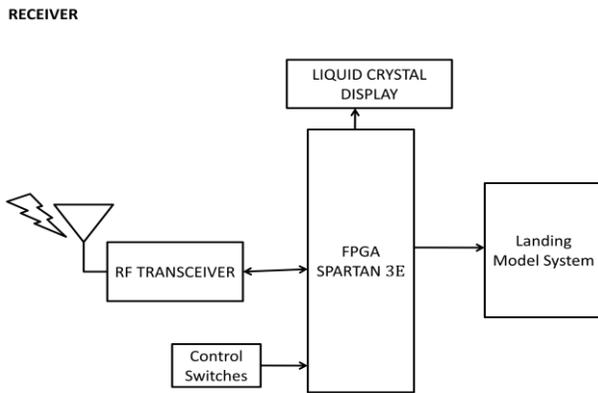

Figure 4: Receiver

RECEIVER

Figure 5: The block diagram of receiver

2.4 Receiver
Field programmable gate array (FPGA) is associate microcircuit designed to be organized by a client .The FPGA configuration is mostly such employing a hardware description language. similar to that used for associate application specific microcircuit (ASIC).FPGA contain associate array of programmable logic blocks, and a hierarchy of reconfigurable interconnects that enable the blocks to be wired along like several logic gates which will be inter-wired in numerous affiliation. Logic blocks may be organized to perform advanced combinatory functions or just straightforward logic gates like AND, XOR square measure most FPGAs,logic blocks conjointly embody memory parts, which may be straightforward flip-flop or complete blocks of memory. Specific applications of FPGAs embody digital signal process, software-defined radio, ASIC prototyping, medical imaging, pc vision, speech recognition, cryptography, bioinformatics, hardware emulation, uranology; metal detection and a growing vary of alternative areas.

2.5 Analog to digital converter
ADC is a device that converts physical amount (usually voltage) to a digital range that represents the quantity's amplitude. An ADC is outlined by its information measure and its signal to noise quantitative relation. The actual information measure of associate ADC is characterized primarily by its rate and to a lesser extent by however it handles errors like aliasing.
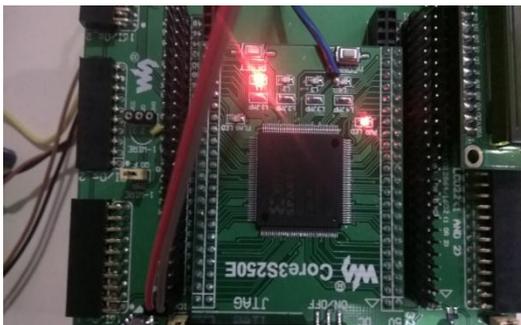

Figure 6: FPGA Spartan 3E

The dynamic vary of associate ADC is influenced by several factors, together with the resolution, dimensionality and accuracy and. The dynamic vary of associate ADC is

usually summarized in terms of its effective range of bits (ENOB), the quantity of bits of every live it returns that area unit on the average not noise. a perfect ADC has associate ENOB capable its resolution. ADCs area unit chosen to match the information measure and needed signal to noise quantitative relation of the signal to be measure. If associate ADC operates at a rate bigger than double the information measure of the signal, then good reconstruction is feasible given a perfect ADC and neglecting division.

2.6 Universal asynchronous receiver/transmitter (UART)
A UART is that the semiconductor device with programming that controls a computer's interface to its hooked up serial devices. Specifically, it provides the pc with the RS-232C knowledge Terminal instrumentation interface in order that it will "talk" to and exchange knowledge with modems and alternative serial devices. Converts the bytes it receives from the pc on parallel circuits into a single serial bit stream for outward transmission on incoming transmission, converts the serial bit stream into the bytes that the pc handles. Adds a check bit on outward transmissions and checks the parity of incoming bytes and discards the check bit. Ads Handles interrupt s from the keyboard and mouse. May handle other forms of interrupt and device management that need coordinating the computer's speed of operation with device speeds.

2.7 Liquid crystal display
A LCD could be a flat-panel show or different electronic visual show that uses the light-modulating properties of liquid crystals. Liquid crystals emit light-weight directly. LCDs are obtainable to show whimsical pictures or mounted pictures with low data content, which might be displayed or hidden, like predetermined words, digits, and 7-segment displays as during a digital clock. They use constant basic technology; except that whimsical pictures are created from an oversized range of little pixels, whereas different displays have larger components. LCDs are utilized in a large vary of applications as well as pc monitors, televisions, instrument panels, craft cockpit displays, and accumulation. They're common in shopper devices like optical disk players, vice devices, clocks, watches, calculators, and telephones, and have replaced electron beam tube (CRT) displays in nearly all applications. They're obtainable during a wider vary of screen sizes than cathode-ray tube and plasma displays, and since they are doing not use phosphors, they are doing not suffer image burn-in. LCDs are, however, vulnerable to image persistence. The liquid crystal display screen is additional energy-efficient and might be disposed of additional safely than a cathode-ray

Figure 7: LCD display

1703

2.8 Landing model system

Landing model system corporate Stepper or dc motor. A stepper motor or step motor or stepper might even be a brushless DC motor that divides a full rotation into equal steps. The motor's position can then be commanded to maneuver and hold at one altogether these steps with none feedback detector, as long as results of the motor is strictly sized to the appliance in connection, distortion and speed. Stepper motors effectively have multiple electromagnets organized around a piece of iron. The electromagnets are energized by associate external driver circuit or a microcontroller. To create the motor shaft flip, first, one magnet is given power that magnetically attracts the gear's teeth. Once the gear's teeth area unit aligned to the first magnet, they are slightly offset from consecutive magnet. This implies that once consecutive magnet is turned on then the initial is turned off, the gear rotates slightly to align with consecutive one. From there the strategy is perennial. Vary of steps making a full rotation. During this approach, the motor is turned by a particular angle. ADC motor is any of a class of electrical machines that converts DC power into mechanical power. The foremost common types trust the forces created by magnetic fields. Nearly all kinds of DC motors have some internal mechanism, either mechanism or electronic, to periodically modification the direction of current flow part of the motor. Most types manufacture rotary motion; a linear motor directly produces force and motion in degree passing lined DC motors were the first kind wide used, since they could be powered from existing direct-current lighting power distribution systems.

Figure 8: Landing model

3. RESULT AND DISCUSSION

The signals square measure transmitted from the flight to the SDR through RF transmitter.SDR is enforced in laptop computer. Personal computer (PC)is placed within the base station.SDR analyses the frequency vary of the flight once it's nearer to base station. PC analyses the signals that square measure transmitted by the flight. Analyzed signals square measure received by RF receiver and is given to FPGA SPARTAN 3E kit. FPGA contains analog to digital convertor and universal asynchronous receiver or transmitter. Codlings square measure given to ADC and UART. By victimization VLSI technology syntax has been checked in XILINX code. It is a code tool made by XILINX for synthesis and analysis of HDL styles. The programming is drop into FPGA hardware kit. FPGA analyses the frequency i.e. kept at the flight air borne aspect. The received frequency is displayed in liquid display (LCD).In the given frequency vary the flight is landed safely in order to avoid accidents. RF transceiver has low noise thus it'll transmit and receive the signals with none distortion.
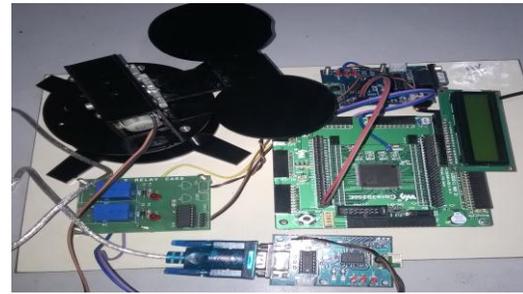

Figure 9: Hardware overall kit

4. CONCLUSION

In this paper SDR based FTS is implemented. The system has been implemented using VLSI technology. The performance of the system is analyzed using RF transceiver that produces fast communication between remote control system and FTS transceiver system. Comparing with embedded systems VLSI reduces the complexity of the hardware system. FPGA is used for multiple processing. Output is reliable. Cost is reduced. Signal processing is very high.

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