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Air Craft Black Box

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***Abstract*— In the continually growing sport of model aircraft, pilots are challenged with many obstacles. In the division of gliders, One of the biggest difficulty is the loss of model aircraft. Pilots launch their aircraft off mountain tops if air craft crashes below, the pilot must make use of his greatest estimates in order to locate the aircraft. This takes several hours, or the aircraft is never recovered. Pilots are also at lost with regard to actual time data but not limited to battery levels, altitude and speed. Model aircraft competitions are also limited to the most excellent estimate of officials. In this work an effort has been made to design and develop embedded system for model aircraft. In aircraft height, direction, air-pressure, G-force are logged to an memory device for any flight investigation. In existing system these parameters are obtained by GPS installed in aircraft but due to signaling error propagation delay in signal these parameters lags sometimes false parameters get recorded. In this proposed embedded system these parameters are store broadcast digitally in real time .**

Index Terms- Gyroscope, Accelerometer, BMP180, CC2500 trans-receiver,LCD display, PIC18F45.

I. INTRODUCTION

The Black Box was first invented by a young Australian Scientist named Dr. David Warren. When Warren was working at the Aeronautical Research laboratory in Melbourne in mid 1950s he was caught up in an accident investigation surround the mysterious crash of the world's first jet powered commercial aircraft, the comet realising that it have been useful for investigators if there had been a recording of what had happened on the plane just before crash, Warren got to work on a basic Flight Data Recorder[1]. The First demonstration unit was produced in 1957, but it was not until 1960, after an unexplained plane collapse in Queensland, that Australia became the first country in the world to construct the black box compulsory for all commercial aircraft[4]. Any commercial Aeroplane or corporate jet is necessary to be equipped with a cockpit voice recorder and a Flight data recorder. It is these two items of separate equipment which we commonly referred to as Black Box. While they do nothing to help the plane when it is in the air, both these pieces of equipment are vitally important should the plane crash, as they help crash investigators to find what happened just before the crash[2] .Often for example when a plane crash in the sea, as happened with 1985 bombing of Air India flight 182 by Sikh terrorists over the Atlantic Ocean. Cockpit voice recorder: The main purpose of Cockpit voice recorder is unsurprisingly to record what the crew say and monitor any sounds that occur within the cockpit. While researchers are keen to pick upon sounds such as engine noise, emergency pings and pops. Investigators are so expert that they are then able to work out crucial flight information such as the speed the plane was travelling & engine rpm and can at times pin out the cause of crash the CVR is also very necessary for determining the timing of events as it contains information such as communication among the crew ground control other aircraft it is usually located in the tail of a plane[3]. Flight data recorder: This piece of kit is essential to the work of air crash researchers as it records the many speed and direction the plane is heading. But these are just the main function of the recorder. In fact new flight data recorder are able to monitor countless other actions, such as the movement of each flaps on the wings, auto-pilot, fuel gauge. Information stored in the flight data recorder of a plane that has crashed is precious for investigators in their search for determining what cause a specific crash

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II. LITERATURE SURVEY

The entire designed system is valuable for the avoidance of accident.. The Air Craft Crashes Record Office (ACRO) a NGO in Geneva announced that there are about 2436 flight accidents all over the world from 1999-2013 ensuing in a death toll of 18,987 when flights meet disaster in mid air. The reason of the accident is not known instantly. Teams are dispatched in complicated condition to recover the aviation data recorder also called as Black Box. Until the Black box is found the exact reason of the crash cannot be firm. At times it may take years to find the black box. For ex. Air France flight 447 crashed into the Atlantic Ocean on June 1, 2009. The reason of the accident was unidentified mainly because of the black box was missing .It was found after almost two years later in May 2011.

It is vital to note that the delay in finding flight data recorder creates hazard for future flights. If the flight data is transmitted into real time to ground using CC2500 in adding to being saved in the black box the data would be obtainable immediately in case of crash.

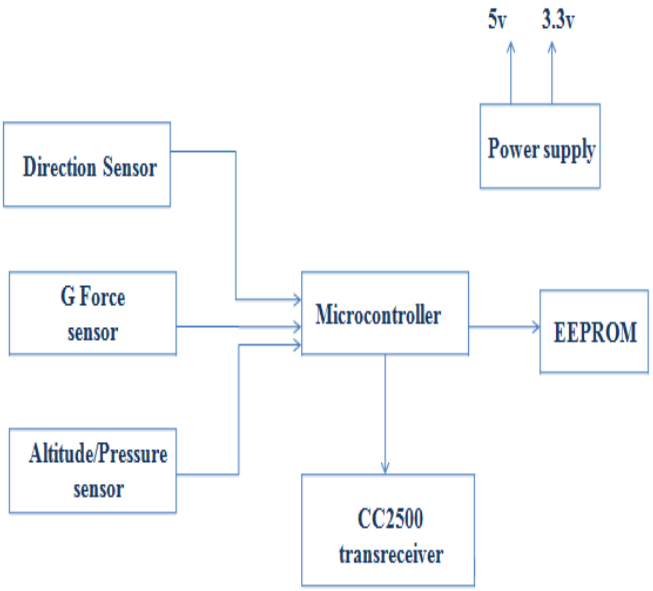
Today's the Black Box is still just as vitally significant in helping piece together the reason of a plane crash , as seen by the innovation of the black box in the Mexico on 4th November, 2008. The first demonstration unit was formed in 1957, but it was not until 1960, after an unsolved plane crashed in Queensland, that Australia became the initial country in the world to construct the black box compulsory for all commercial aircraft

III. METHODOLOGY

Taking into account the current system parameters like Altitude, Pressure, Direction, G-force are obtained by

means of Global Positioning System (GPS) installed in aircraft but due to signalling fault and transmission delay in signal these parameters lags and sometimes fake parameters are recorded so we are developing an embedded system which is independent of Global Positioning System. Methodology used for project is cycle scan method in which working is split into several parts. First microcontrollers calibrate the sensor then gather data from all sensors and process it as per program (ex. Find altitude by measuring pressure). Then this data gets stored in inside EEPROM of microcontroller and show on LCD, then at the end transmitted over 2.4GHz ISM band with the help of CC2500 Trans-Receiver in the direction of the base station. This process is in cycle.

IV. ARCHITECTURE



A. *System architecture.*

The proposed system consists of Direction, G force, Altitude/Pressure sensor, CC2500 trans-receiver,PIC microcontroller, LCD.

B. *Operation*

The block diagram consists of various sensors which are constantly sensing various parameters and providing input to inbuilt ADC of PIC micro-controller. The ADC translate that analog data into the digital data and sends that data to the receiving part. The 16*2 LCD is used to display data constantly and which is also used for indication.

C. *Microcontroller (PIC18F452)*

It is heart of our project. This is used different application such as automatically controlled products, remote controls, printer, office equipment, appliances, toys and other embedded systems. In the early hours models of PIC had read-only memory (ROM) or field programmable EEPROM for program storage, some with provision for erasing memory .All existing models use Flash memory for program storage .Program memory and data memory is separated. It is 8-bit, 16-bit and in newest models, 32-bit wide. Program instructions vary in bit count by family of PIC. PIC18FX52 devices have two times the Flash program memory and data RAM of PIC18F452 device (32 Kbytes and 1536 bytes). The PIC18F458 devices include characteristic that allows the system clock source to be switched from the central oscillator to an alternating low-frequency clock source. Only PIC18F4X8 devices implement the improved CCP module, analog comparators as well as the Parallel Slave Port. It is having a capacity of High current sink/source 25 mA/25mA, There are three external interrupt pins, Low-power, high speed Enhanced Flash technology, There are Four Timer modules (Timer0 to Timer3), 10-bit, up to 13-channel Analog-to-Digital Converter module (A/D) with Programmable Acquisition Time, Two External Clock modes, up to 48 MHz, Programmable Brown-out Reset (BOR) and Wide operating voltage range (2.0V to 5.5V)

D. *CC2500 transceiver*

This RF module can be used for applications that need two way or Multiway wireless data transmission. It features Multi master and Multi slave and reliable transmission, small size and best range in its class protocol is self controlled & entirely transparent to user interface. The unit can be embedded to your current design so that wireless communication can be set up easily for wireless data transmission. It supports adjustable data rate with reliable transmission distance. The CC2500 is a low cost 2.4GHz transceiver designed for very low power wireless applications. The circuit is anticipated for the 2400-2483.5 MHz ISM (Industrial, Scientific and Medical).The Rf transceiver is integrated with a highly configurable modem.

E. *Direction Sensor(GY-273 HMC5883L)*

Gyroscope is spinning wheel or disc wherein the axis of rotation is free to suppose any orientation. When rotating, the orientation of axis is unaffected by tilting or rotation of mounting according to the conservation of angular movement. Because of this, gyroscope are useful for measuring or maintaining orientation. It works on 3v-5v having range from 1.3-8gauss. The middle of gravity of the rotar can be in set position. The rotar simultaneously spins about one axis and is capable of oscillating about the other two axis and thus except for its inherent opposition due to rotar spin, it is free to turn in any direction about the fixed point.

F. *Pressure Sensor (BMP180)*

This module can measure the air pressure and temperature of the current environment, and then you can translate this signal to information of altitude. The BMP180 is the function compatible successor of BMP085. The ultra-low power small voltage electronics, superior performance of the BMP180 is optimized for used in wearable tools mobile

phones, PDAs, GPS map-reading devices and outdoor equipment. The BMP180 offers a pressure measuring range of 300-1100 hPa with an precision down to 0.02hPa in advance resolution mode. The chip only accepts 1.8v to 3.6v input voltage.

G. *Accelerometer (ADXL335)*

The ADXL335 is a small, thin low power, complete-3 axis accelerometer with single conditioned voltage outputs. It works on 1.8v to 3.6v. The product measures acceleration with a minimum full-scale range of +3 or -3g. It can compute the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from movement, shock, or vibration. The user selects the bandwidth of accelerometer using the CX, CY & CZ capacitors at XOUT, YOUT and ZOUT pins. Bandwidth can be selected to suit the application, with a range of 0.5Hz to 1600Hz for the X and Y axis and a range of 0.5Hz to 550Hz for the Z axis.

H. *Power Supply*

The power supply is important for any electronic circuits, which provides the required power to microcontroller and other electronics devices, which provide the required power to the PIC18F452 and other ele ctronics devices. For this system we are using +5v power supply for LCD and all different sensor which are used by us Also we required 3.3 v power supply for ADXL335.

I. *LCD Display*

The term liquid crystal is used to demonstrate a substance in a state between liquid & solid but which exhibit the properties of both. Molecules in liquid crystal tend to arrange themselves until they all point in the same specific direction. It is a 14 pin device working on +5v supply.

V. CONCLUSION

Thus we are developing an embedded system for transmission of data from aircraft black box to control station by using CC2500 wireless transreceiver instead of using GPS to avoid signalling problem. In air craft altitude, direction, air pressure, G-force are logged to an memory device for any flight investigation. In current system these parameters are obtained by GPS installed in aircraft but due to signalling error propagation delay in signal these parameters lags sometimes false parameters get recorded. We are developing an embedded system which measures store broadcast this parameters digitally in real time.

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