Calibration and Volumetric Measurement of Fuel Gauge for Aviation and Watercraft

[1]Harsha K, [2] Kehkesshan Jalall S, [3]Rashmi Rani S, [4]Khamer Fathima

[1] Asst.Professor, [2]Asst.Professor, [3]Asst.Professor, [4]Asst.Professor

[1] Department of Electronics Communication Engg.

[1] HKBK College of Engineering, Bangalore, India.

Abstract : The main idea behind this project is to provide the real-time alerts to the pilot on flight regarding the fuel quantity, tank status and the sensor failure. In the ancient time, the system used was not much updated. It did not have provision for the switching, error message display on LCD and if the system is unstable there might be tilt in the system. The olden days system used to vary the fuel calibration with the variation in the system, but in the current system even if the system is unstable the fuel will be displayed with precision. When the main tank used to be empty the was no feature of taking the fuel from auxiliary tanks automatically. In the present system proposed in this report when the fuel in the main tank reaches a minimal level then the fuel will be automatically transferred to the main tank from the auxiliary tank 1 and 2 respectively. When there arises a problem in the module it's difficult to find error in a particular tank or sensor, but this problem can be easily determined in the current scenario of the module because it will display an error message for a particular tank or sensor. Thus error detection becomes easier

IndexTerm: ***Fuel display, LCD, ARM7LPC2148, calibration***.

I. INTRODUCTION

An aircraft fuel system allows the crew to pump, manage, and deliver aviation or jet fuel to the propulsion system and Auxiliary Power Unit (APU) of an aircraft. Fuel systems differ greatly due to different performance of the aircraft in which they are installed. Aircraft fuel tanks are a major component of aircraft fuel systems. They can be classified into internal or external tanks and further classified by method of construction or intended use.

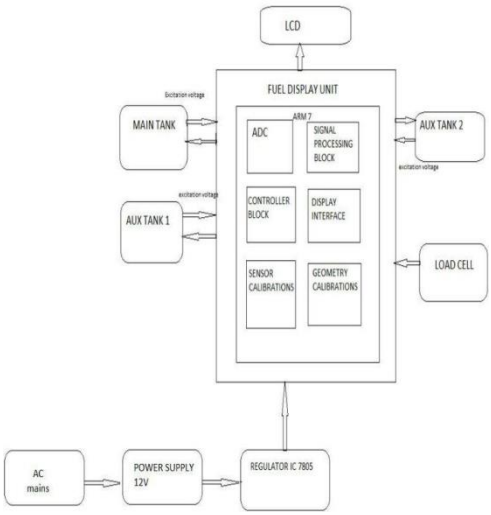
II. WORKING

. Given quantity of fuel, the fuel level height varies when the fuel tank is tilted. This produces wrong fuel indications when the vehicle is tilted. This project describes how a load sensor can be used to determine accurate fuel levels. The ARM processor is used to interfaces all other components.

The ARM works on 3.3V which is obtained on the board. Connecting all the components directly on board may increase heat dissipation and leads to damage, voltage regulator IC- is used to avoid that damage and also produce 5v output. The tanks that are fixed with the load sensors which will give the fuel quantity information. Load cell along with the help of level indicator is used to monitor the fuel quantity variation in real time and display it on the LCD. Each tank has a minimum value to be maintained (like main tank must have 140mg and auxiliary tanks must have 56mg) below which it is indicated to be empty.

The switching provision is provided to the main tank when its fuel level is lower than 140mg. This is achieved with the help of motors in each auxiliary tank which are monitored by the relay. Whenever the main tank level falls below the defined level it is programmed in such a way that, initially the auxiliary tank 1 is checked if it's above the defined level if so switching will occur through aux 1 tank if not it then checks for aux 2 tank and switching occurs if it has more than defined level. If both the auxiliary tanks have less than the defined levels it is displayed as empty. The two motors are monitored by the 2 channel relay. The error message displayed on the LCD will have '*' in the message indicating the sensor failure.

III. FLOW CHART



IV. MERITS

I. ***Switching***: In old systems there was no provision of switching provided. In this module when the level of a fuel is decreased up to a certain amount the fuel will be provided by auxiliary tank 1 and 2 respectively

II. ***Tilt***: When the system is unstable there might be distortion in fuel level. This module shows the precise display of the fuel even when system is unstable**.**

III.*Error message*: When the sensor in the system stops working, then an error message will be displayed on the LCD.

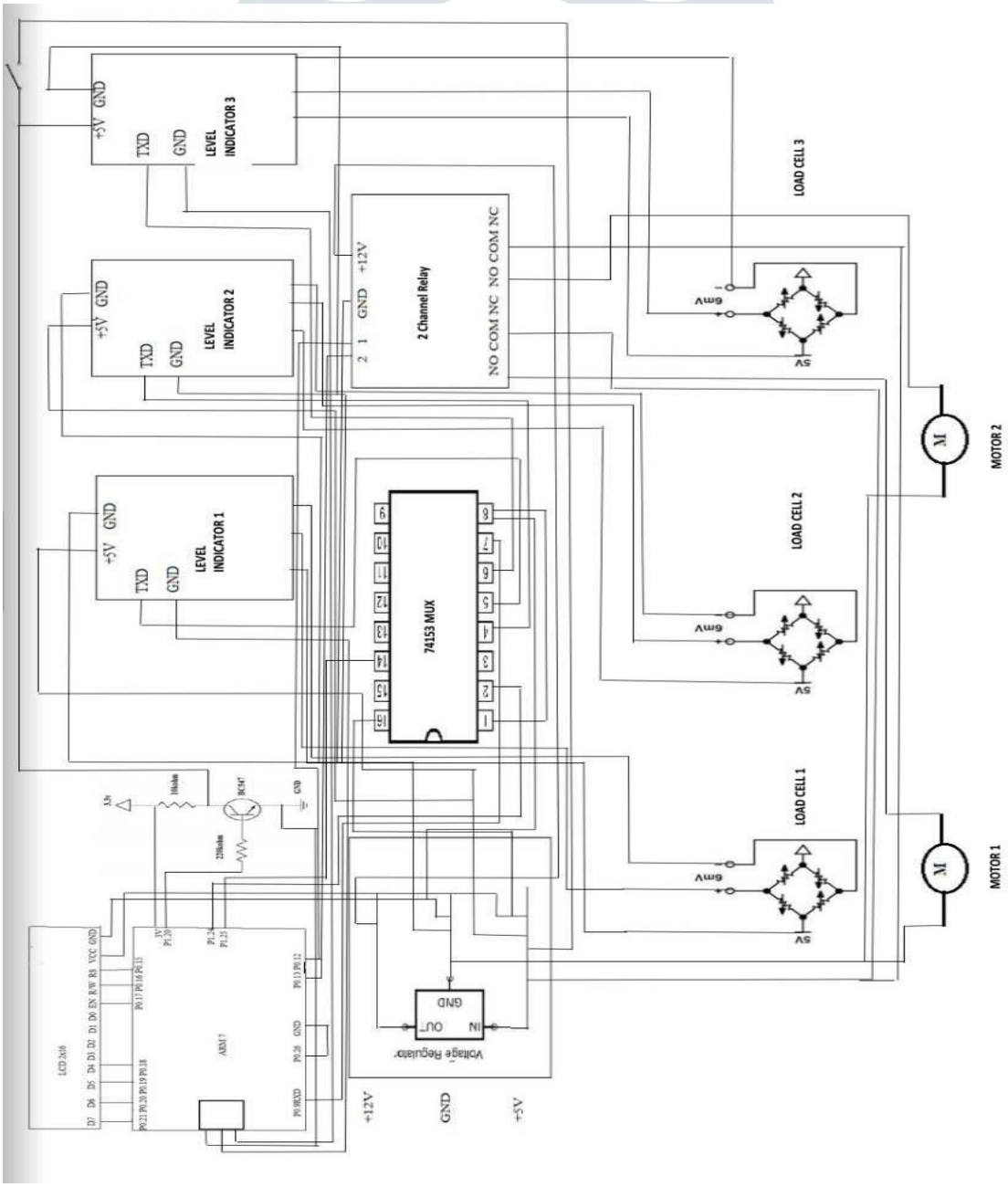
This system has easy error detection capability.

V. DEMERITS

I. ***Cost:*** As the number of tanks in the system increases the cost of the hardware will increase. This module will display the fuel status of all tanks on the same LCD leading to difficulty in analysis

II. ***Delays:*** This system will include delays for displaying fuel status on LCD and hence the total time will be increased

VI. CIRCUIT SCHEMATIC



VII. RESULTS

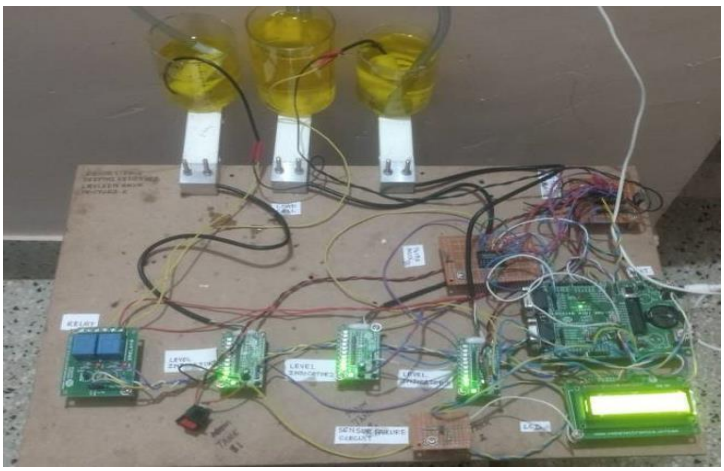


Fig 3: Fuel Display Unit module

Fig 5: Switching action

Fig 6: Message displaying the motor of tank2 is ON for switching

Fig 7: Error message displayed indicating sensor failure

4.1 Results and Conclusion

The fuel display unit basically displays fuel quantities of three tanks with one of them being the main tanks and the remaining two being the auxiliary tank for supplying fuel to the main tank. Each fuel tank contains a fuel sensor for measuring the quantity of the fuel at each cm. There is also a provision provided to display the error message on failure of any of the fuel sensors as a precautionary measure the switching between tanks occur when the main tank level goes below certain predefined level. Here Fuel Display unit that is being designed displays fuel quantities of three tanks with one of them being the main tanks and the remaining two being the auxiliary tank for supplying fuel to the main tank. Each fuel tank contains a fuel sensor for measuring the quantity of the fuel at each cm. It also display the error message on failure of any of the fuel sensors as a precautionary measure the switching between tanks occur when the main tank level goes below certain predefined level. Here a arm7 lpc2148 is used to interface these tanks status to the display and it also interfaces the sensors which is used for measurement.

VIII. ACKNOWLEDGMENT

We would like to express our sincere gratitude to our colleagues for providing their invaluable guidance, comments and suggestions throughout the course of the work. We would specially thank Prof. Hussain Ahmed, HOD, Department of Electronics & Communication Engineering, HKBK College of Engineering for constantly motivating us to work harder to compete this paper.

Also I would like to thank the management of HKBK College of Engineering for providing us with the necessary infrastructure to complete this project successfully.

REFERENCES

[1] https://www.engineersgarage.com/arm- projects/introduction to-arm-microcontroller-lpc2148
[2] http://binaryupdates.com/introduction-to-arm7-lpc2148-microcontroller/ARM7
[3] http://www.firmcodes.com/microcontrollers/arm/introduc tion-of-arm-lpc21xx/
[4] https://www.arm.com/products/processors/classic/arm7/i ndex.php
[5] http://www.datasheetarchive.com/ARM7+SPECIFICATI ONS datasheet.html?p=2
[6] http://techtidda.com/arm7-lpc2148-pin-diagram.html
[7] https://www.engineersgarage.com/electronic- components/16x2-lcd-module-datasheet
[8] https://circuitdigest.com/article/16x2-lcd-display- module-pinout-datasheet
[9] http://www.microcontroller-project.com/16x2-lcd- working.html
[10] https://www.sparkfun.com/datasheets/LCD/ADM1602 K-NSW-FBS-3.3
[11] http://elprojects.blogspot.in/2010/03/lcd-pin- description-for-interfacing.html lcd pin description
[12] https://www.elprocus.com/ever-wondered-lcd-works/ Construction and Working Principle of LCD Display
[13] http://www.geneseo.edu/~mclean/Digital/Handout/MU Xx2x2.pdf Multiplexer Quadrupling Using the 74153 MUX to Generate a 16 row Truth Table.
[14] http://www.electronicshub.org/multiplexerandmultiplex ing/ Multiplexer(MUX) and Multiplexing
[15] https://www.engineersgarage.com/electronic- components/7805-voltage-regulator-ic
[16] https://www.electrical4u.com/voltage-regulator-7805/
[17] https://www.sparkfun.com/datasheets/Components/LM 7805.pdfA7800SERIES POSITIVE-VOLTAGE REGULATORS-SLVS056J –