SRI VENKATESHWARA COLLEGE OF ENGINEERING

NH7, VIDYANAGAR, KEMPEGOWDA INTERNATIONAL AIRPORT ROAD, BENGALURU - 562157

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

(Accredited by NBA)

Internship Presentation on

"REAL TIME FLIGHT DATA MONITORING SYSTEM"

Carried at :

HINDUSTAN AERONAUTICS LIMITED

Presented by

MEGHA D M (1VE16EC055)

Under the Guidance of

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Associate Professor

Dept. of E&CE, SVCE, Bengaluru

For the AY-2019-20

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INTERNSHIP CERTIFICATION

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DESIGN COMPLEX
HINDUSTAN AERONAUTICS LIMITED
Bengaluru - 560 017, India

HAL/DC/RWRDC/HR/PROJ-CERT/221 /2019

3rd August, 2019

CERTIFICATE

This is to certify that Ms. Megha DM (USN: 1VE16EC055) a student of BE(Electronics & Communication Engineering), Sri Venkateshwara College of Engineering, Bangalore, has undergone Internship on No-pay-No-fee basis from 04.07.2019 to 03.08.2019 at Ground Test Centre, Rotary Wing Research & Design Centre, Hindustan Aeronautics Limited, Bangalore.

2. Her Punctuality, Conduct, Behavior & Progress in Training were 'VERY GOOD' as rated by the Department Head during her Internship period with us.

(U SUDHAKAR)
MANAGER (HR)

Ms. Megha DM
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COMPANY PROFILE

- Hindustan Aeronautics Limited (HAL) came into existence on 1st october 1964.The company was formed by merger of Hindustan Aircraft Limited with Aeronautics India Limited and Aircraft Manufacturing Depot, Kanpur.
- **HAL was conferred NAVRATNA status** by the government of India on **22nd June 2007**.
- The company scaled new heights in the financial year 2010-11 with Turnover of Rs.13,116 Crores.
- HAL was established as **Hindustan Aircraft** in Bangalore in 1940, On 23 Dec 1940 Hindustan Aircraft Company was duly incorporated under the Mysore Companies Act as a Private Ltd Company.
- **Hindustan Aeronautics Limited** is an Indian state-owned aerospace and defence company based in Bangalore, Karnataka. It is governed under the management of the Indian Ministry of Defence.
- These include manufacturing and assembly of aircraft, navigation and related communication equipment and airports operation. HAL built the first military aircraft in South Asia.

ABOUT COMPANY

Vision

- “To make HAL, a dynamic, vibrant,value-based learning organization with human resources expectionally skilled, highly motivated and committed to meet the current and future challenges. This will be driven by core values of the company fully embedded in the culture of the organization.

Mission

- To become a globally competitive aerospace industry while working as an instrument for achieving self-reliance in design, manufacture of aerospace defense equipment and diversifying to related areas, managing the business on commercial lines in a climate of growing professional competence.

INTRODUCTION

- **Real Time Flight Data Monitoring** (RTFDM) is a systematic method of accessing, analyzing and acting upon information obtained from flight data to identify and address operational risks before they can lead to incidents and accidents.

Figure 1:Flight data monitoring

- Information from FDM programs is unique since it provides objective data that otherwise is not available. An FDM program is a key component of a Safety Management System (SMS).

FDM Concept :

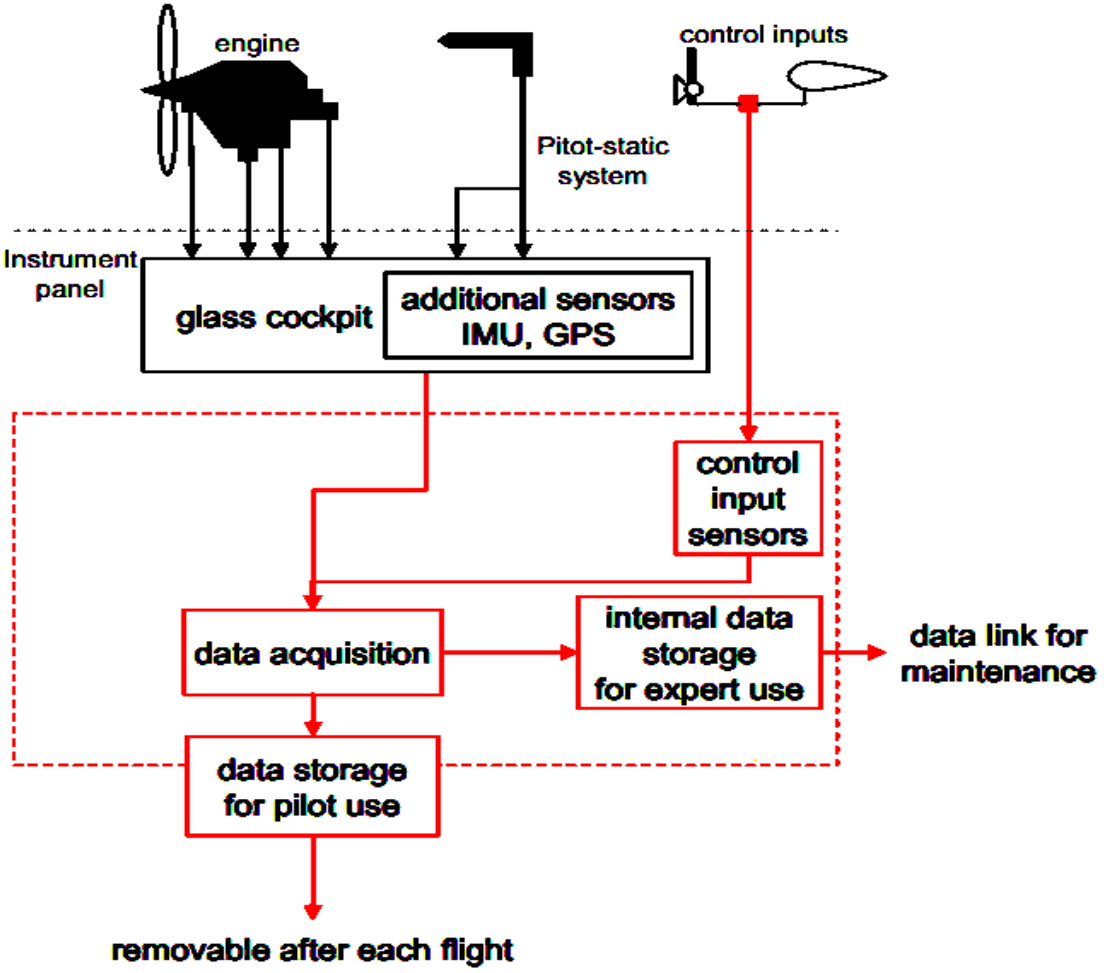


Figure2. FDM System For Helicopter

OBJECTIVES

- To identify and address operational risks before they lead to accidents.
- To reduce operational cost and significantly enhance training effectives and operational maintenance.
- To identify and make adjustments to specific aircraft with usually high fuel burn rates.
- To reduce the need for unscheduled maintenance, resulting in lower maintenance costs and increased aircraft availability.

BLOCK DIAGRAM OF RTFDM

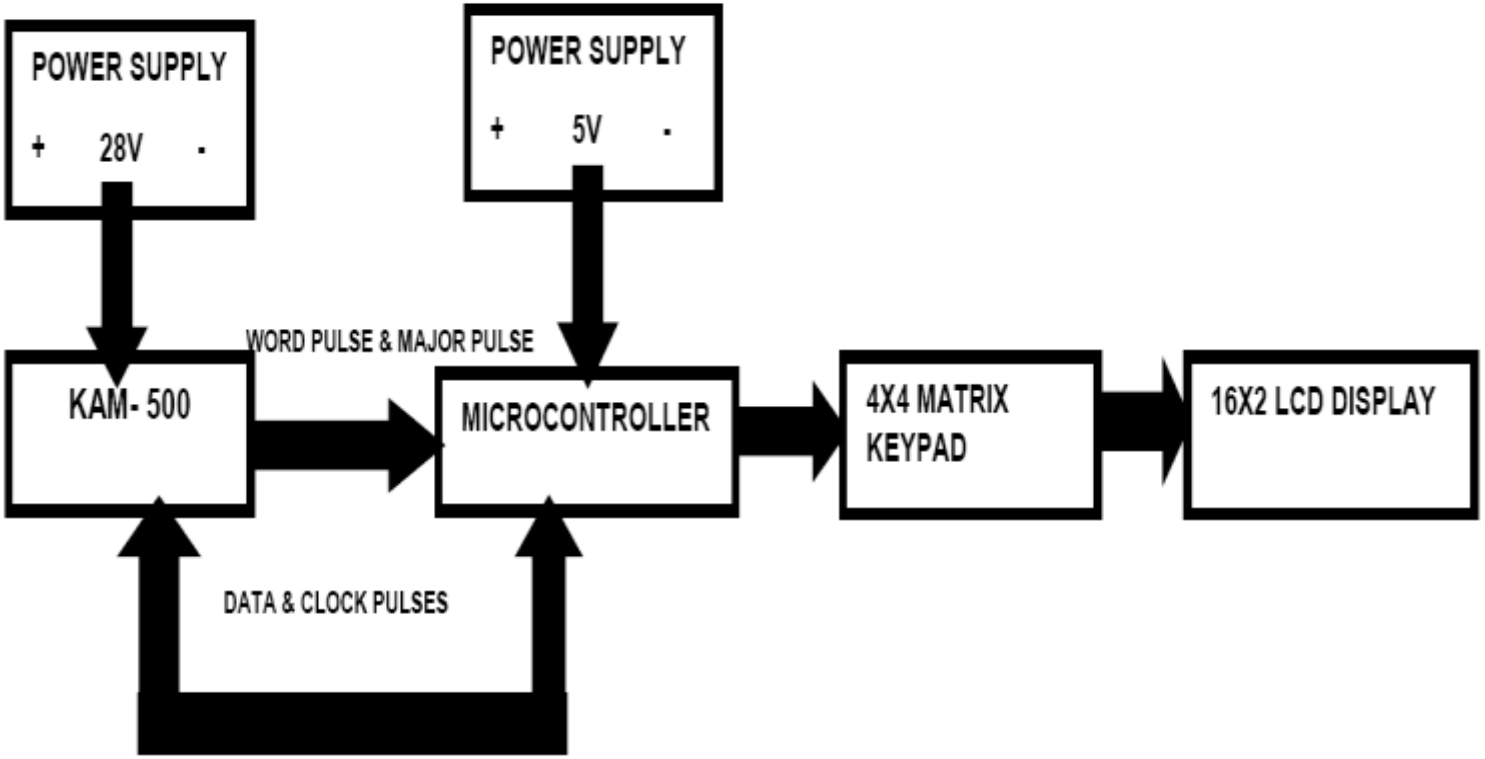


Figure 3: Block diagram of RTFDM

MICRO-CONTROLLER (LPC1768)

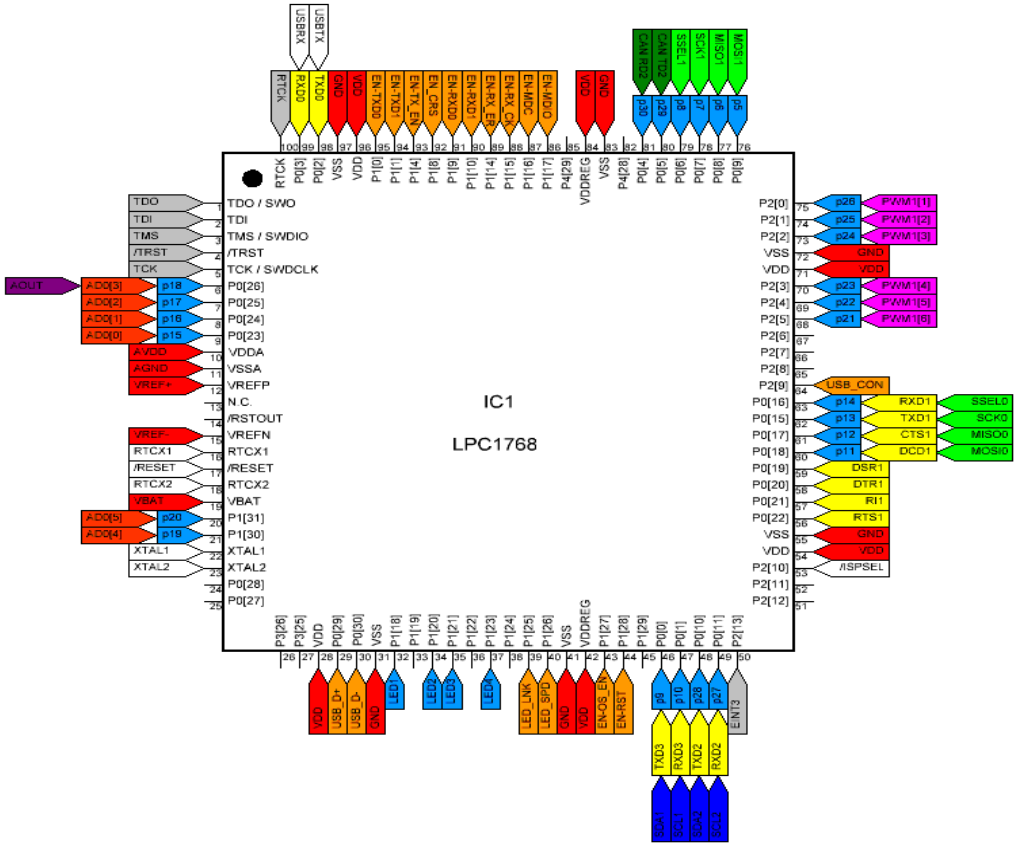


Figure 4. Stamp Module Of LPC1768 IC

SOME FEATURES OF LPC1768 are:

- ARM Cortex-M3 processor, running at frequencies of up to 100 MHz .
- A Memory Protection Unit (MPU) supporting eight regions is included.
- ARM Cortex-M3 is built-in Nested Vectored Interrupt Controller (NVIC).
- Up to 512kB on-chip flash programming memory. Enhanced flash memory accelerator enables high-speed 100 MHz operation with zero wait states.

LCD Interfacing:

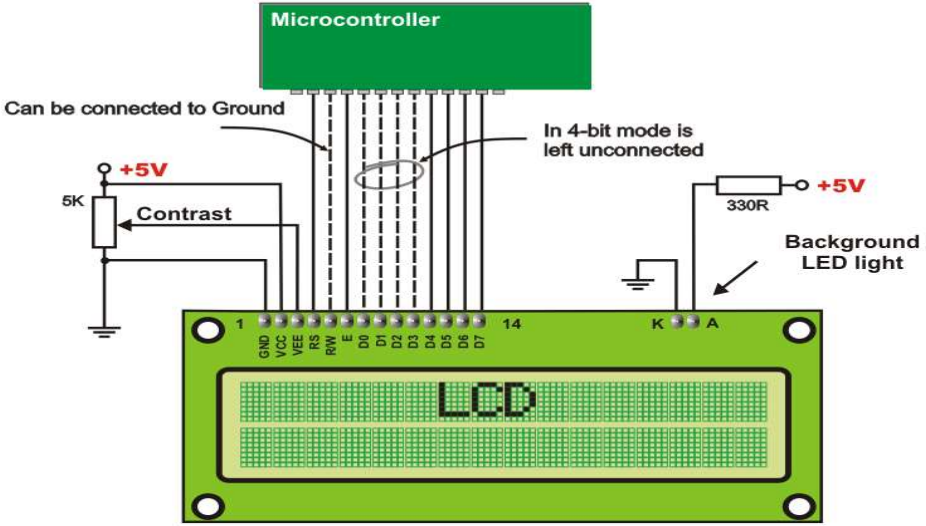


Figure5. LCD Interfacing

Figure6. 4X4 Keypad

To send any command to the LCD, make pin RS=0. For data, make RS=1.Then place a high to low pulse on the E pin to enable the internal latch of the LCD.

KAM 500

Figure 7: KAM 500

The KAM-500 (Koncept Alpha Module-500) system is a general-purpose On-board Data Acquisition System which is a user configurable and programmable system. The system consists of chassis and modules. A black rectangular framework, made up of Aluminium is called chassis which is the main support of the system whereas the Modules are basically PCB cards that can be screwed into the chassis.

WORK CARRIED OUT

Figure8. RTFDM System Image

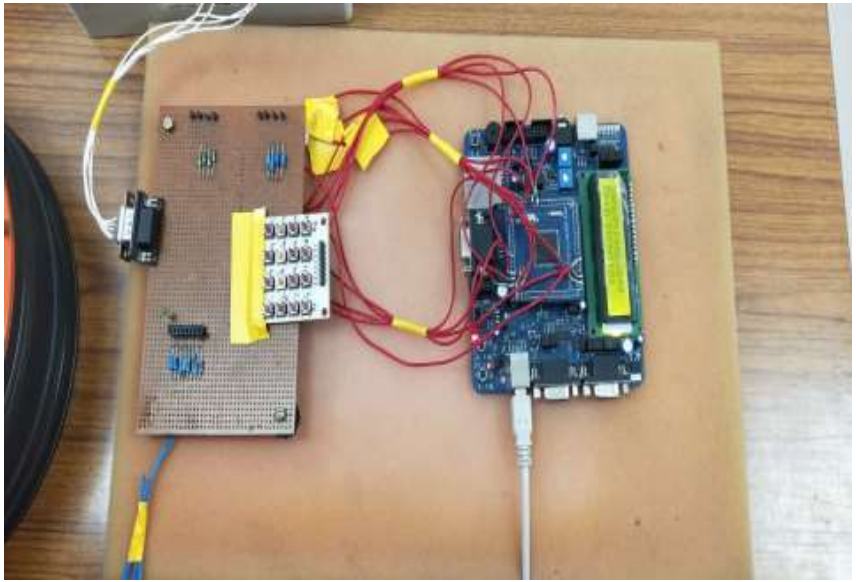


Figure9. RTFDM System Top View

RESULTS OBTAINED

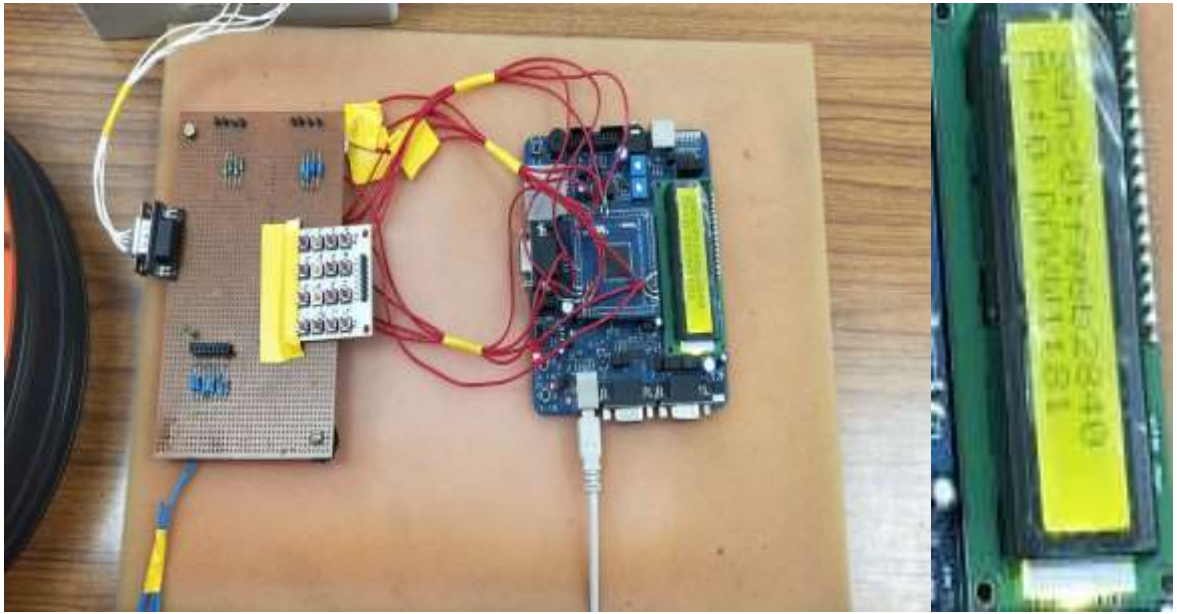


Figure 10. SAMPLE OUTPUT FROM MICROCONTROLLER OF WORD 1(DOY)

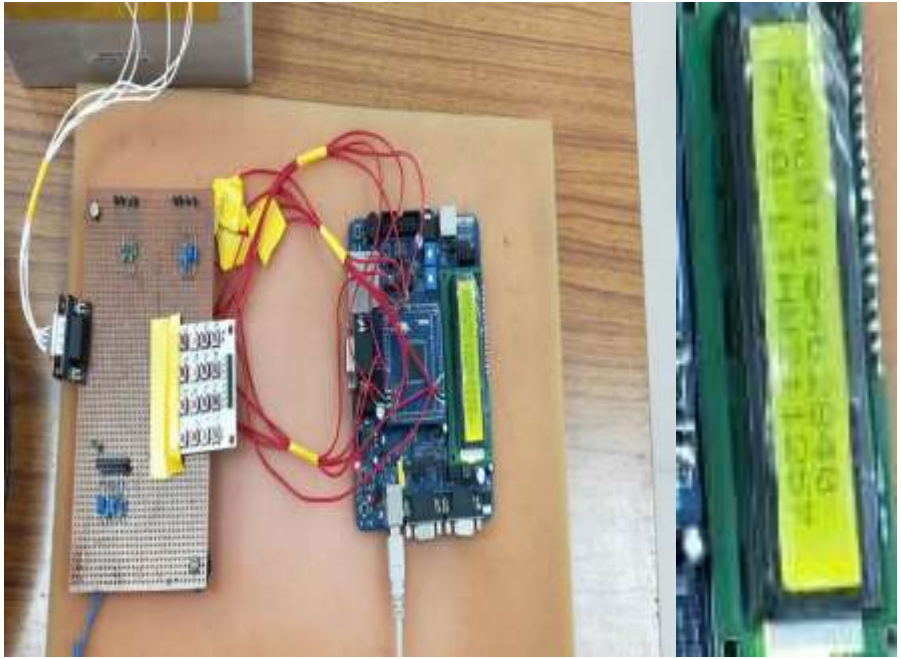


Figure 11. SAMPLE OUTPUT FROM MICROCONTROLLER OF WORD 2(LTH)

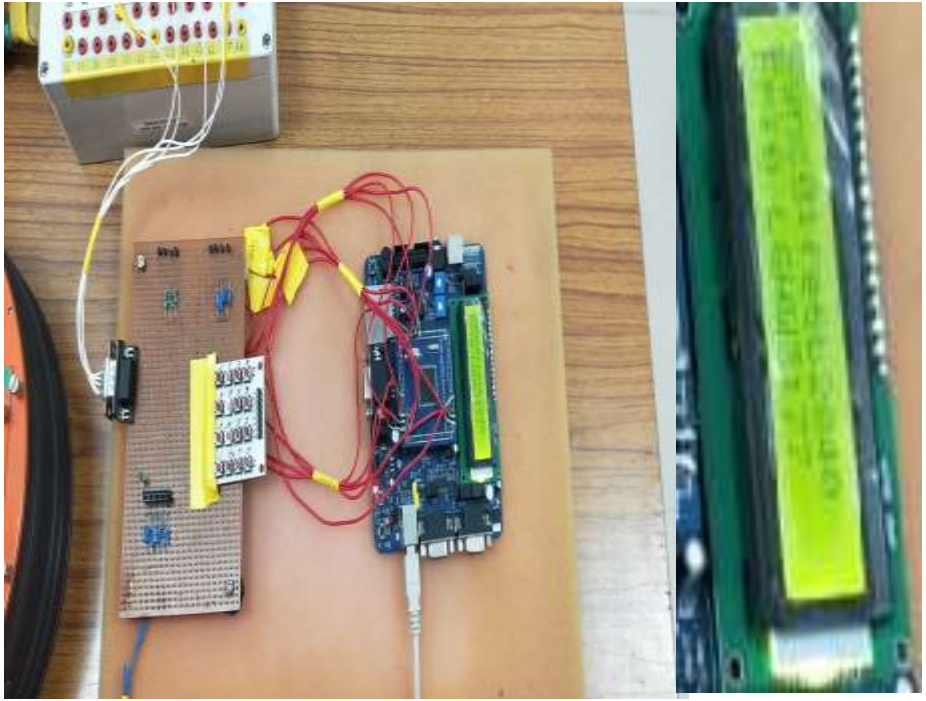


Figure 12. SAMPLE OUTPUT FROM MICROCONTROLLER OF WORD 3(LGH)

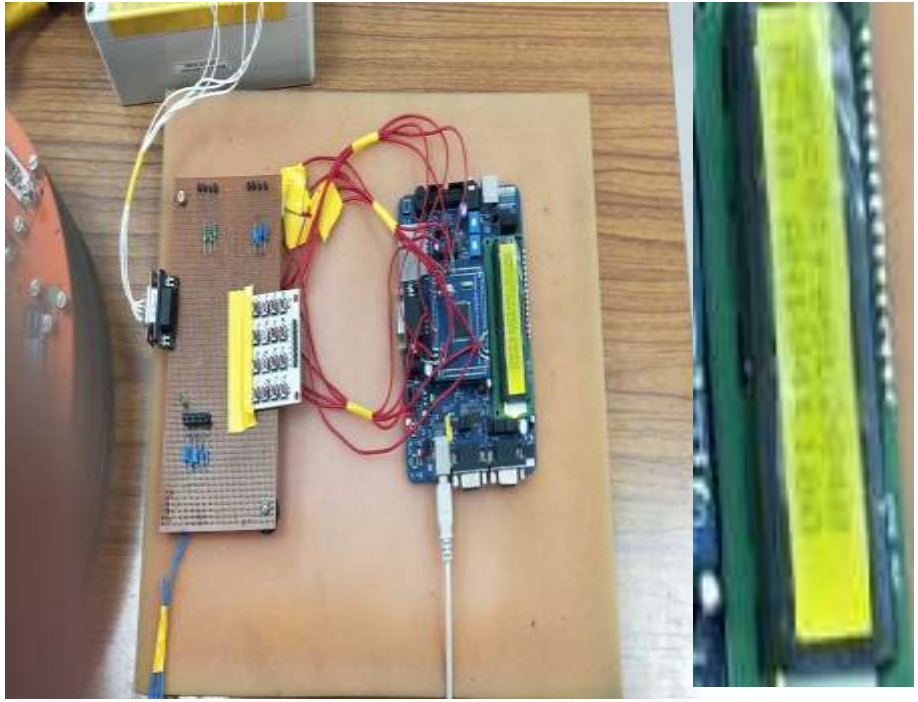
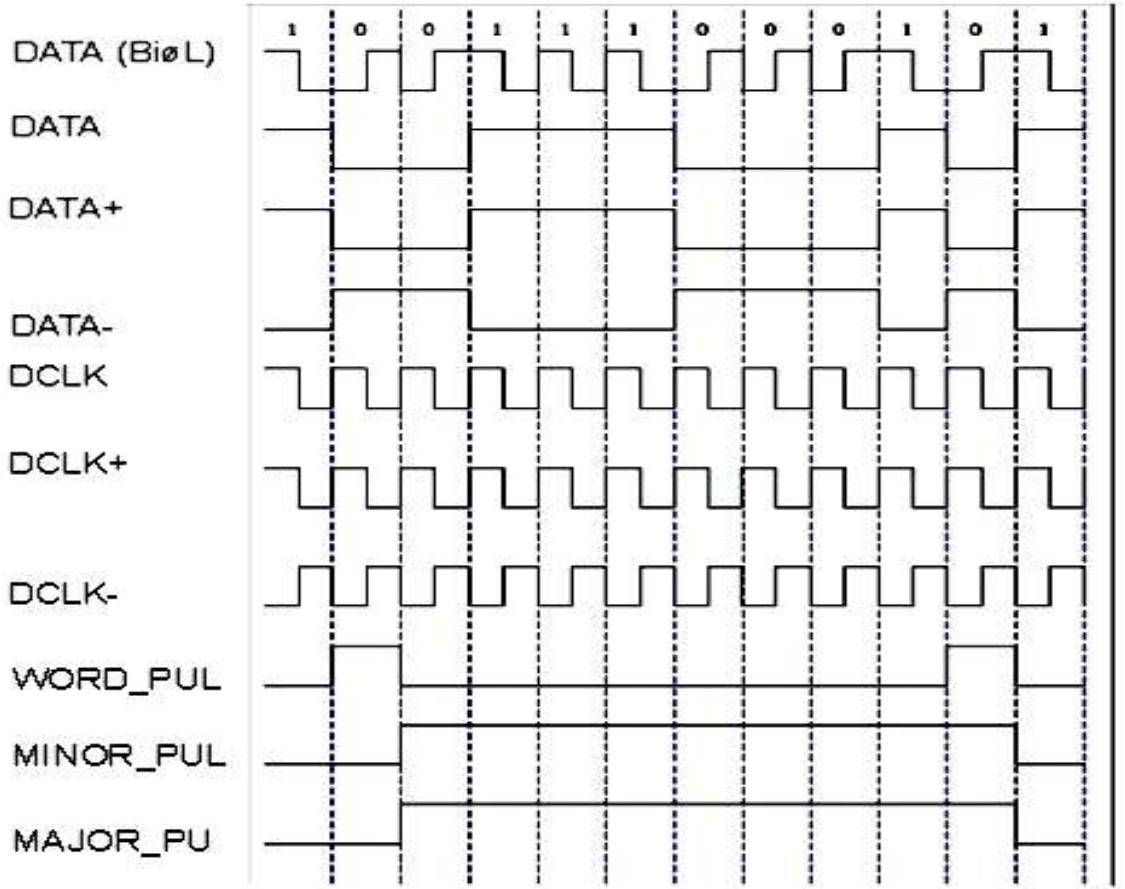


Figure 13. SAMPLE OUTPUT FROM MICROCONTROLLER OF WORD 4(AN1)

INTERNSHIP OUTCOMES



SAFETY OUTCOMES

Identifying causal and contributory factors and accident consequences 7 safety outcomes are taken in order to assess the capabilities of different device types to support an FDM programme for business aviation, it was necessary to firstly, define requirements.

- Loss of control in flight.
- Runway excursion.
- Controlled flight into terrain.
- Runway incursion.
- Airbone conflict.
- Ground handling.
- Airbone and post-crash fire.

BENEFITS

- Providing data to help in the prevention of incidents and accidents.
- Improved operational insight by providing the means to identify potential risks.
- Improved fuel consumption that is FDM provides the ability to identify and make adjustments to company operating procedures or specific aircraft with unusually high fuel burn rates.
- Reduction in unnecessary maintenance and repair.
- Improved ground conditions and airports, in certain cases airlines can use the data captured from their FDM program to support requested changes to air traffic control and airport procedures.

FUTURE SCOPE

- The hardware selected can be used for even military standards and hence suitable for all type of aircrafts.
- The cost effectiveness of the project is an major advantage as it reduces the cost compared to analog indication system.
- Accuracy of the reading provides a major factor for selection of the digital indication system compared to analog ones.
- Real time monitoring of load parameters can be done easily as microcontroller can be reprogrammed to provide any other kind of display on the same LCD.
- In any case related to conversion of same range of sensor output in voltage to digital values it can be implemented easily.

CONCLUSION

- In the internship I understood working principle Real time flight data monitoring system and evaluated the performance of the system. Also got an opportunity to interact with all the team members and found that the critical parameters from sensor's output of the aircraft are acquired and the desired parameter is based on the pilot's choice is displayed and analyzed.
- The data is acquired and analyzed using data acquisition system and the required Configurations are done in kWorkbench software for analysis of parameters. The frame is built in kWorkbench for analyzing the parameters in Quicklook real time and MSO.
- The programme for PCM frame detection is implemented in Keil uVision and is debugged for checking whether the data is synchronized with the system.

REFERENCES

[1]JV Foster, LJ Miller, RC Busan, S Langston “Recent NASA Wind Tunnel Free-Flight Testing Of A Multirotor Unmanned Aircraft System”, in AIAA Scitech, 2020

[2]M. L. McDaniel. “First flights of Advanced Unmanned Aircraft-Fundamentals of Planning and Execution “,in AIAA Aviation and Aeronautics Forum and Exposition,2017.

[3]S.Myschik, M.Heller,F. Holzapfel, and G.Sachs,”Low-cost Wind Measurement System For Small Aircraft”, in AIAA Guidance, Navigation, and Control Conference And Exhibit, 2004

[4]F. Ruffier, N. Franceschini, “Optic flow regulation the key to aircraft automatic guidance”, Robotics and Automation Systems, vol. 50,pp. 177-194,2005.

Online available:

[5] https://maker.pro/arduino/tutorial/how-to-interface-arduino-and-the-mpu-6050-sensor

[6] https://www.grc.nasa.gov/www/k-12/UEET/StudentSite/dynamicsofflight.html

[7] https://www.livescience.com/40102-accelerometers.html

[8] https://howthingsfly.si.edu/flight-dynamics/roll-pitch-and-yaw

[9] https://www.uavnavigation.com/company/blog/uav-navigation-depth-inertial-navigation

THANK YOU