DISPLAYING OF COCKPIT INSTRUMENTS USING PROCESSING IDE AND ARDUINO

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Abstract :

Aircraft cockpit consists of analog instruments basically during olden days cockpit was full of analog indicators. Since the era is evolving and everything is in digital there was a new idea of digitalization of analog instruments to digital. So that instead of placing basic six instruments only one LCD is fixed which shows the values of all basic six instruments accurately. Modern aircraft which have been employed to mainly reduce the pilot work load. Research to date on advanced flight instrumentation has primarily focused on mode confusion or pilot misinterpretation of system information. A few studies have also identified pilot workload with a reduction in manual flight skills as a result of regular operation in automated modes. In this study, simple avionics instrument has been designed and implemented for light aviation vehicles. At the moment there are a few commercial products that provide data and vehicle statuses such as altitude, temperature, air speed, etc. However, due to implementation of modern technology for such instruments for such complexity was not affordable. This study presents a new approach such that recent hardware and sensors are utilized to provide critical data to the user accurately. The commercial hardware used in the instrument may easily be available from the electronics market. Devices like these can be used for aviation, automobiles and also sea and land vehicles, providing the user with important data. In this study, design of the device is explained in detail, which may be constructed with basic electronic circuit using Arduino and processing IDE. The instrument that holds security may be fitted for any air vehicle by using the methods in this study.

I. INTRODUCTION

The introduction of digitalization on the modern airliners has contributed to improved range, overall performance, and safety of the aircraft. This digitalization has reduced the physical workload of the pilot and has increased the awareness of the pilot workload, which includes evolution of display system and its programming tools. The Federal Aviation Administration intends to introduce digital data communication as a means of exchanging information between aircraft, ground-based facilities and air-based facilities.

The Arduino UNO is open source software. The board consists of sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards and other circuits, that can be easily programmed to understand and interact, the best parts about Arduino is that the software where the program is free and open source.

Processing IDE is an open source programming language and provides environment to program images, animation, and interactions. It is used by students, artists, designers, researchers for learning, prototyping, and production. It is developed to understand fundamentals of computer programming within a visual context and to serve as a software sketchbook and professional production tool.

Processing was developed to make it easy to create interactive art, it makes programming accessible for the masses. Processing has a close connection to Arduino. The programming language and development environment for the Arduino platform are based on Processing, so data has to be transmitted from software to hardware.

II. METHODOLOGY

2.1 ARDUINO

Arduino is an open source programmable circuit board which can be combined to make a wide variety of different projects. This board contains a microcontroller, which can be programmed to sense and control objects in the physical world. By responding to sensors and inputs, the Arduino is able to interact with the outputs such as LEDs, motors and displays. Because of it's flexibility and low cost, Arduino has become a very popular choice for makers who are looking to create interactive hardware projects. The most commonly used Arduino boards out there is the Arduino Uno. While it was not actually the first board to be released, it remains to be the most actively used for its extreme popularity and most widely documented on the market.

2.2 JUMPER WIRES:

A **jump wire** (also called as jumper wire or jumper) is an electrical wire, or group of them in a cable, with a connector or pin at each end, which is usually used to interconnect the components of a breadboard or test circuit or with other equipment or components, without soldering. Individual jump wires are fitted by connecting their "end connectors" into the slots provided in a breadboard, the header connector of a circuit board, or a piece of test equipment.

2.3 GYRO SENSOR:

MPU6050 sensor module is complete 6-axis Motion Tracking Device. It combines 3-axis Gyroscope, 3-axis Accelerometer and Digital Motion Processor all in small package. Also, it has additional feature of on-chip Temperature sensor. It has I2C bus interface to communicate with the microcontrollers. It has Auxiliary I2C bus to communicate with other sensor devices like 3-axis Magnetometer, Pressure sensor etc. If 3-axis Magnetometer is connected to auxiliary I2C bus, then MPU6050 can provide complete 9-axis Motion Fusion output. Let's see MPU6050 inside sensors.
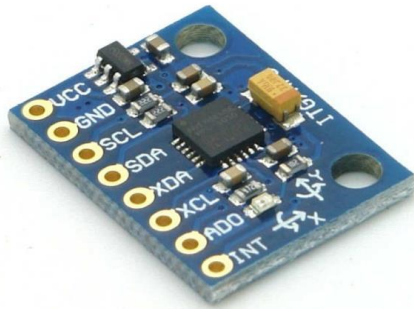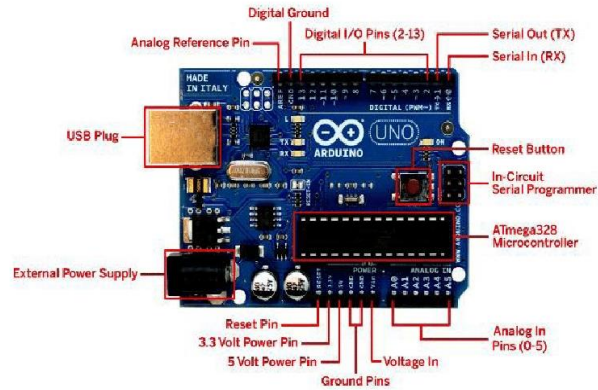
Fig 1 MPU6050 Sensor Module   Fig 2 Arduino Uno

2.4 PROCESSING IDE

Processing connects software concepts to principles of visual form, motion, and interaction. It combines a programming language, development environment, and teaching methodology bring together into a system. It is created to teach fundamentals of computer programming within a visual context, to serve as a software sketchbook, and to be used as a production tool helps for Students, artists, design professionals, and researchers for learning, prototyping, and production.

The Processing language is a text programming language specifically designed to create and modify images. Processing tries hard to achieve a balance between clarity and advanced features. The system provides facilities for learning many computer graphics and interaction techniques including forming drawing, image processing, color models, mouse and keyboard events, network communication, and object-oriented programming. Libraries easily available for processing which has an ability and 3D file formats.

2.5 SOFTWARE:

- A group of instructions about the software medium, the conceptual foundation for Processing and describe decisions related to designing the software and environment.
- Software holds a distinct position because of its ability to produce dynamic forms, process gestures, define behavior, simulate natural systems, and integrate other media including sound, image, and text.
- To process electronic media, it's important to work with electronic materials. Just as each programming language is a distinct material, some are better for drawing than others. Processing is built to act as a software sketchbook, making it easy to explore and perform many different ideas within a short period of time.
- Graphical user interfaces opened up for accessing for millions of people, alternative programming environments will continue to enable new generations for designers to work directly with software. Processing will encourage many artists and designers to address software, which will stimulate interest in other programming environments.
- It is important to understand "secret art of computer programming." Processing attempts to make it possible and advantageous is to learn coding within the visual context, to learn how to build their own tools to become software literate.
- The Processing approach to programming combines with established methods. The core language and additional libraries make use of Java, which also has same element identity to the C programming language. This inheritance allows Processing to make use of existing programming language improvements and makes it understandable to many people who are already familiar with writing software codes. Processing is unique in its importance and in the smart decisions. Processing makes easy to write software for drawing, animation, and reacting to the environment, and programs are easily increased to integrate with additional media types including audio, video, and electronics. Modified versions of the Processing environment have been built to allow programs to run on mobile phones and to program microcontrollers. The practice of programming will reveal its potential as the foundation for a more dynamic media.
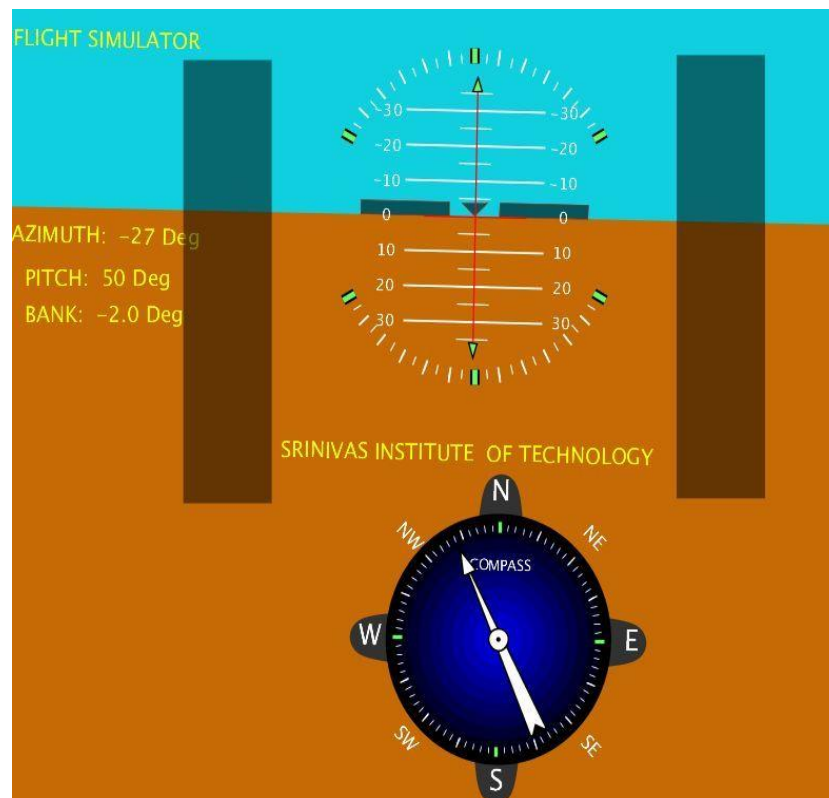
III. RESULTS

Fig 3 Primary Flight Display

The color indicated as blue and brown is sky and a land as sensor moves the roll and the pitch of the flight shows with the values and angles displayed on the left side of the display, which is known as attitude indicator. The transparency in the display indicates the airspeed and the vertical speed indicator. At the bottom of the display there is a compass which shows the direction of the flight. The pointers are used for the indication of parameters. Two reactangles in the horizon indicates the steering which shows the stable condition

IV. CONCLUSION

The designing of the cockpit instruments using processing IDE and interfacing it with ArudinoUNO made it easier to display the basic parameters of the flight through graphics. This way of displaying makes things easier to view and to maintain because everything is displayed in a single display, and to manipulate the display graphics as per the demand and to correct the errors at that instant. Though no more analog indicators are used, there is no fluctuations in the LCD display which gives accurate values and also reduction in the pilot workload.