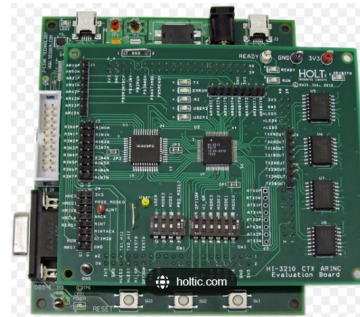# Design SDPG9

By Jared, Riley, Eduardo, Nick, and Nate

Problem Statement

Currently in order to read Arinc 429 data there is a need for a bulky and expensive data receiver and transmitter. We will be altering a size and cost-effective bus reader to meet a variety of requirements so it can be used in the avionics industry and replace the bulky and expensive one.

Design Context - Broader Context

- Exists within specific and proprietary space
- Designing with those working in the avionics field
- Users will be technologically competent and knowledgeable about the data being conveyed
- Only addresses need for efficiency and ease of use when people are doing their jobs

Design Context - Broader Context

Area	Description	Examples
Public health, safety, and welfare	How does your project affect the general well-being of various stakeholder groups? These groups may be direct users or may be indirectly affected (e.g., solution is implemented in their communities)	This method of interacting with the Arinc429 data would allow for a more productive work day by eliminating the time consuming task of connecting to the Arinc429 directly.
Global, cultural, and social	How well does your project reflect the values, practices, and aims of the cultural groups it affects? Groups may include but are not limited to specific communities, nations, professions, workplaces, and ethnic cultures.	Our project directly supports those in the avionics industry and their needs, values, and practices by giving them a long-needed solution to a problem they consistently face
Environmental	What environmental impact might your project have? This can include indirect effects, such as deforestation or unsustainable practices related to materials manufacture or procurement.	Using smaller pieces of equipment lowers the environmental impact of manufacturing and waste from disposal
Economic	What economic impact might your project have? This can include the financial viability of your product within your team or company, cost to consumers, or broader economic effects on communities, markets, nations, and other groups.	Product should be low cost with the use of the ESP32-S3 chip Additionally by increasing the ease with which engineers can use Arinc 429 technology will increase production overall

Design Context - User Needs

Aerospace and systems engineers need a way to easily read and write Arinc 429 data because it is currently very inconvenient.

Design Context - Prior Work/Solutions

- There exist other products to read and write data using Arinc 429
- The existing products are bulky and expensive
- Pros of our target solution: smaller, easier to use, inexpensive
- Cons of our target solution: requires a cellphone and has lower reliability

Design Context - Technical Complexity

- Design consists of multiple components/subsystems
- Each utilize distinct scientific, mathematical, or engineering principles
- Problem scope contains multiple challenging requirements

Design Exploration - Design Decisions

- We decided to use the ESP32-S3 chip as it is a powerful and relatively inexpensive chip
- We decided to use the Flutter framework to develop our mobile application due to its cross platform compatibility and ease of use
- BB830 Circuit Board because of its availability and our familiarity with it

Design Exploration - Ideation

- The client had already completed thorough research on all of our design decisions
- Client made recommendations based off expertise in the industry
- The circuit board was decided by us because we already had it from class and it met our requirements

Design Exploration - Decision Making and Trade-Offs

- Our ideated options were chosen specifically by the client
- ESP32 chip - small, inexpensive, and well-documented
- Flutter application - cross-platform, allowed for us to use the ESP32 and smartphones
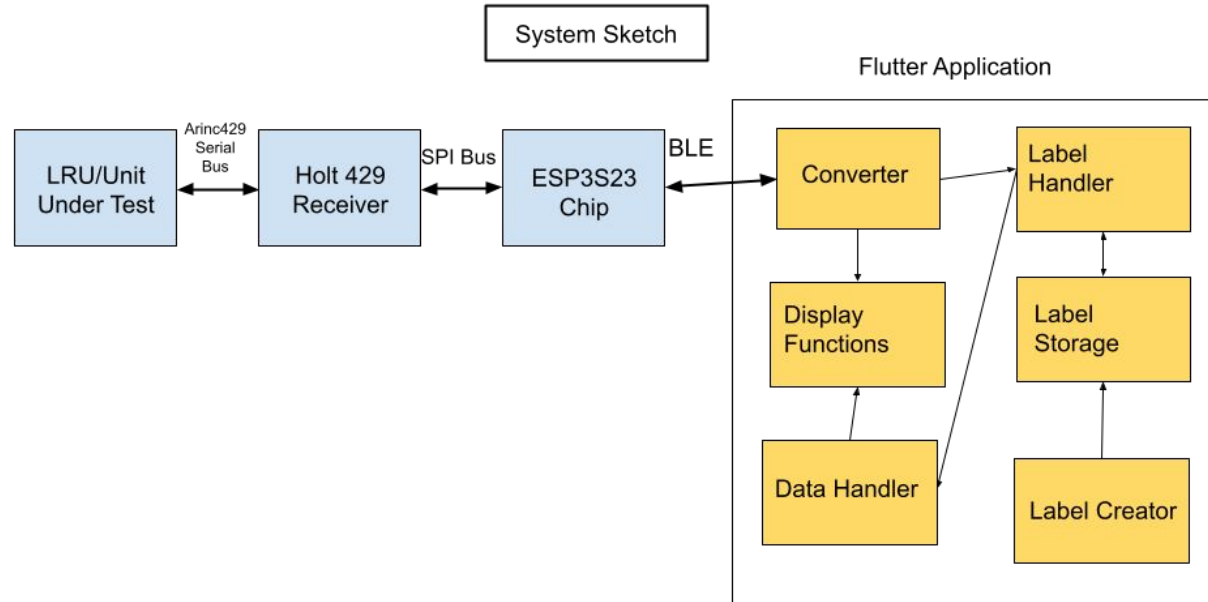- The circuit board - readily available, worked effectively
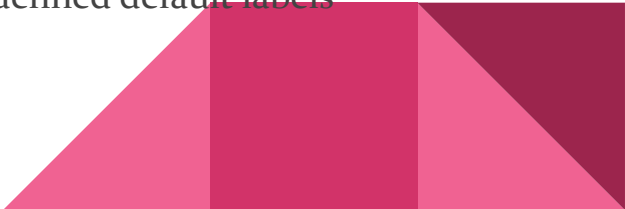
Proposed Design

- Completed research and experimentation
- System sketch (pictured in next slide)

Proposed Design - Design Visual and Description

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- Flutter application - Converter takes in the data over BLE, converts it to a word object
- Label Handler - takes label bits from word object, finds definitions corresponding to label in Label Storage and sends to Data Handler
- Data Handler - takes data definitions from label, data word object converts data bits from word into formats specified by the label definition
- Display Functions - take data word from different sources and display in correct format data name fields and proper values
- Label Creator - define label numbers and data fields' names/formats to be submitted and stored in the Label Storage
- Label Storage - keeps sorted list of user defined labels and previously defined default labels

Proposed Design - Functionality

Proposed Design - Functionality

- First Screen - displays the data coming in over BLE, gives the option to connect/disconnect to a BLE server, to switch between sending and receiving data, and to define a label
- Third Screen - Choose connection to send/receive data with
- If receiving data, it will be being displayed through shown screens
- If sending data, tap on data field and input desired data
- Define Label button pressed - brings user to second screen to define new label
- Able to fully satisfy communication between Arinc429, ESP32-S3, and Flutter application
- Able to leverage BLE communication to transmit Arinc429 data to the Flutter application efficiently and effectively
- Allows us to directly communicate with Arinc429 in an effective manner

Proposed Design - Areas of concern and development

Flutter application:

- Creating an effective cross-platform app layout
- Misinterpretation of the Arinc429 data if the information displayed on the app is out of place/order
- Leveraging Flutter's multi-platform development tools to properly design a cross-platform application