Prince Mohammad Bin Fahd University
College of Engineering
Department of Electrical Engineering

Smart Integrated Transceiver Radio System

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Advisor: Mr. Ahmed Abul Hussain

May 17, 2022

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Presentation Outline

- Project Definition
- Project Objectives
- Project Specifications
- Constraints and Eng. Standards
- Project Architecture
- Project Planning
- Background
- Design: Subsystems and Component Selection
- Testing
- Project Management & Team Work
- Impact of Project
- New Skills Acquired and Applied
- Completed and Remaining Work
- Budget Estimate
- References

Project Definition

To design a smart, effective integrated transceiver radio system capable of communicating using receiving and transmitting signals over a distance .

We designed and built a portable, two-way radio transceiver using many components that are mounted on customized PCB boards.

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Project Objectives

01 To design a system that can be easily built and used for communicating.

02 To Increase public awareness about the impact of high signal usage.

03 To replace existing methods of communication with a device that is more effective.

04 To encourage adoption of energy conservation, efficiency and demand control measures.

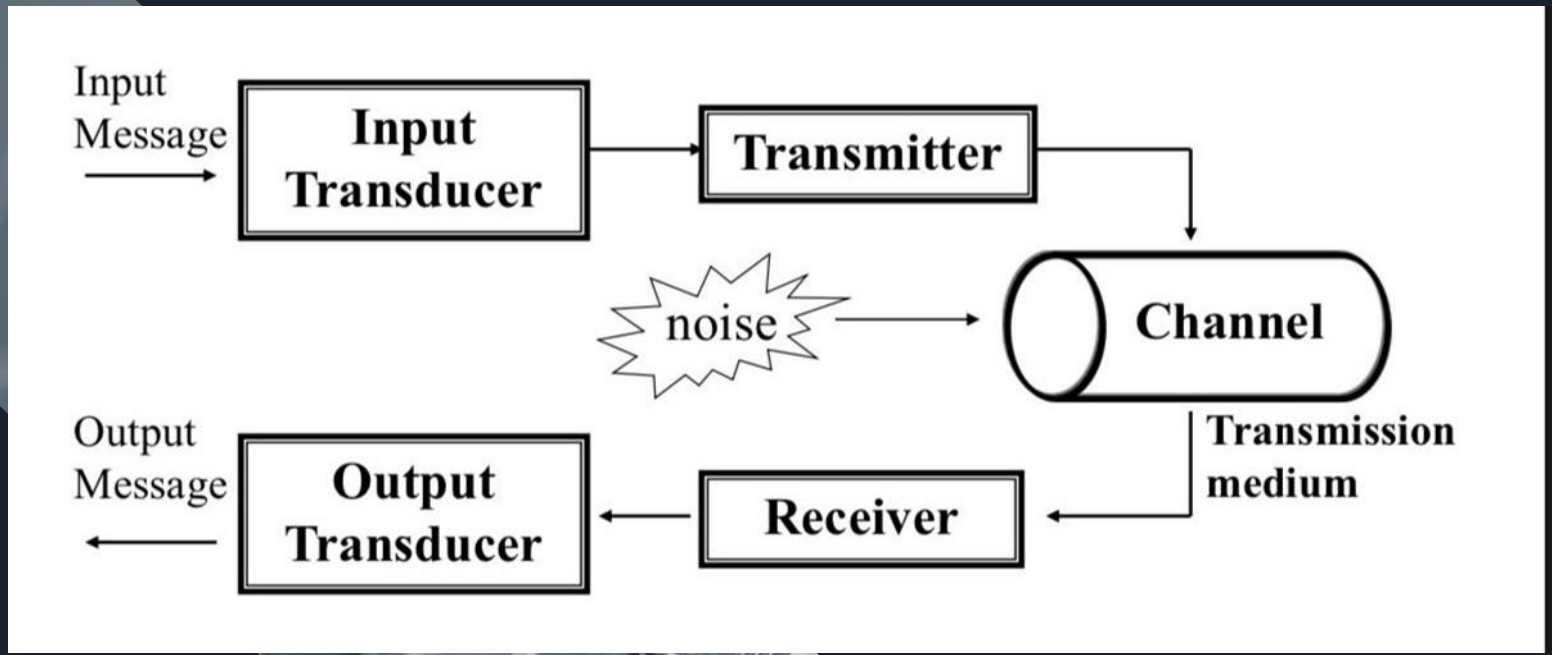
Project Specifications

- Operates on frequency range of 400~470 MHz
- Operates on Supply voltage of 3.3~4.5V
- Works on Tx (transmitter) and Rx (receiver) which is frequency independent; this means our radio system channels can both transmit and receive.
- Presents a high-performance configurable dual-channel system.
- LCD screen for user interface:
  - Display of two channels and selected option
  - Display of 8 volume levels and selected option
  - Display of 8 squelch levels and selected option
  - Display of battery level

Project Constraints & Eng. Standards

1. Environmental
2. Safety and Health
3. Ethical
4. Manufacturability
5. Engineering standards
6. Costing

Project Architecture



Couch, Leon W. II, Digital and Analog Communication Systems, 6th Edition, Prentice-Hall, 2001. ISBN: 0130812234.

Project Planning

1. The project is quite easy to Design and Fabricate.
2. The required components of the project are available locally and outside the kingdom.
3. To get best results of testing the project , we need to use PMU labs and devices.

Background: Problems

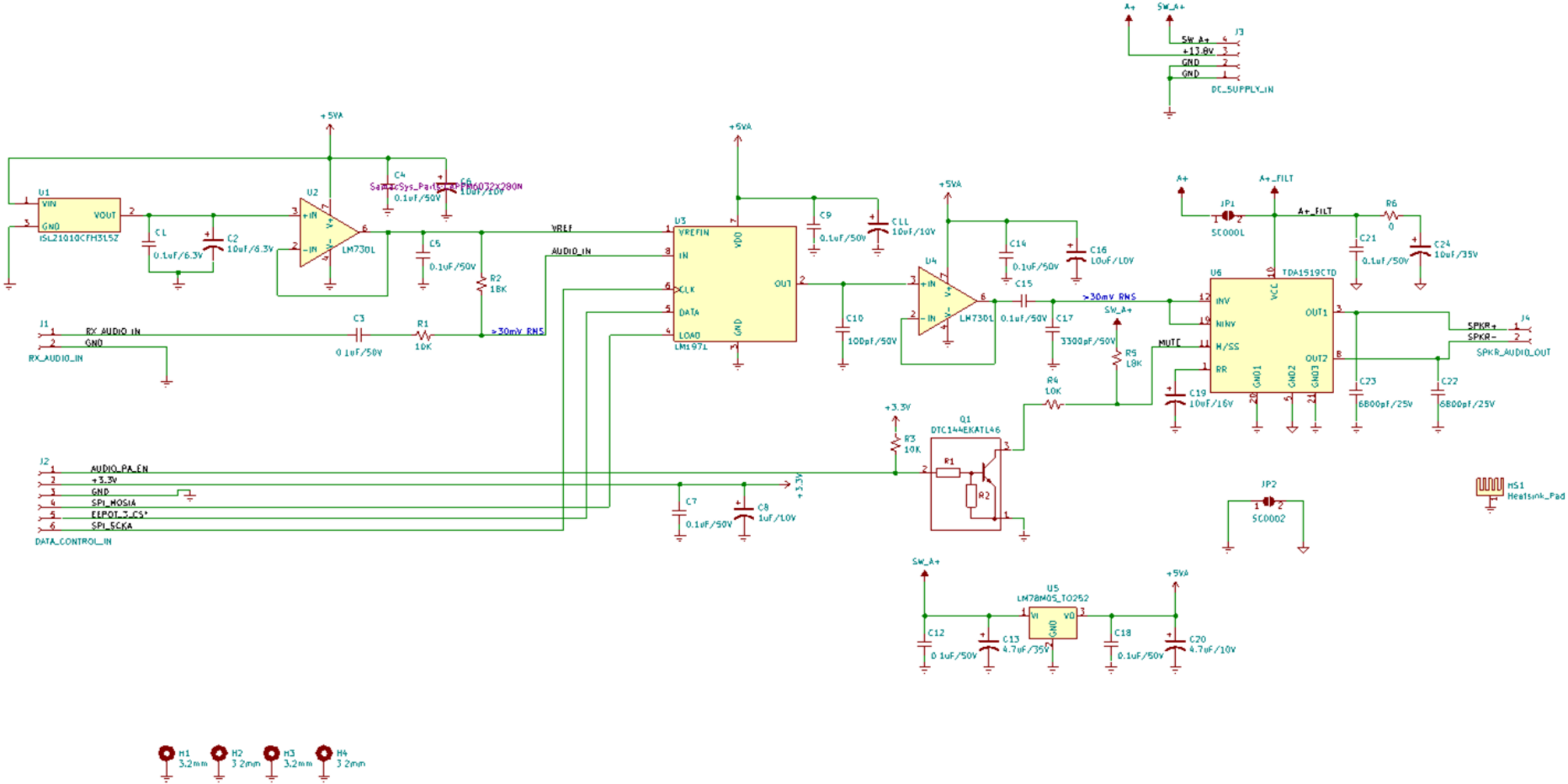
- We would face issues in communication
- Being stranded in an remote area such as camping grounds where there is no cell service.
- Security issue

Background: Solutions

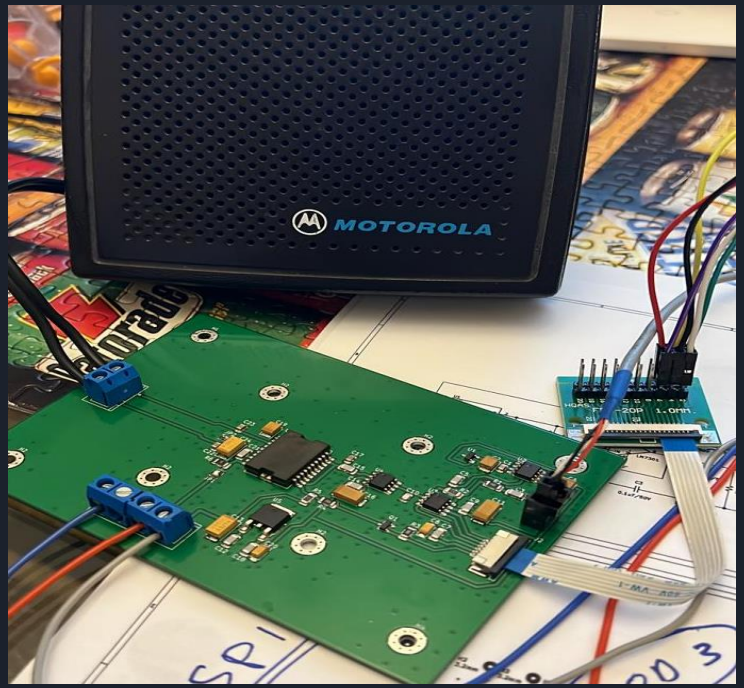
- Changed the dynamic of communication
- Dependability

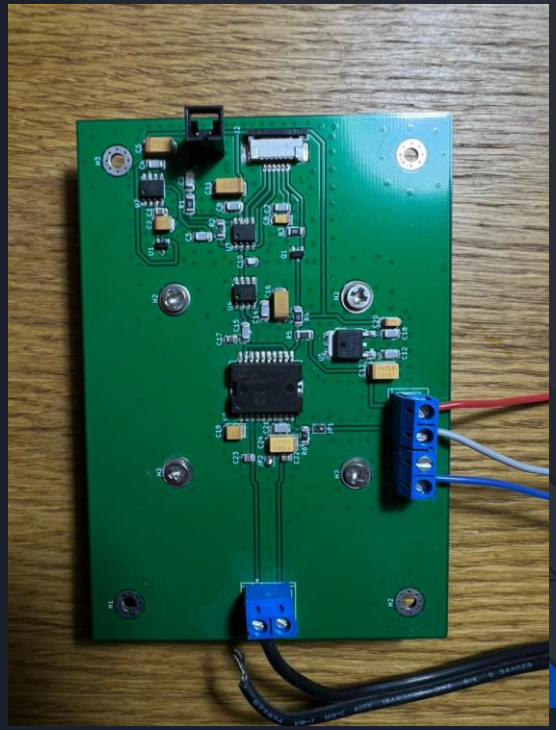
Design: Subsystem 1 (Audio Amplifier)

Design: Subsystem 1



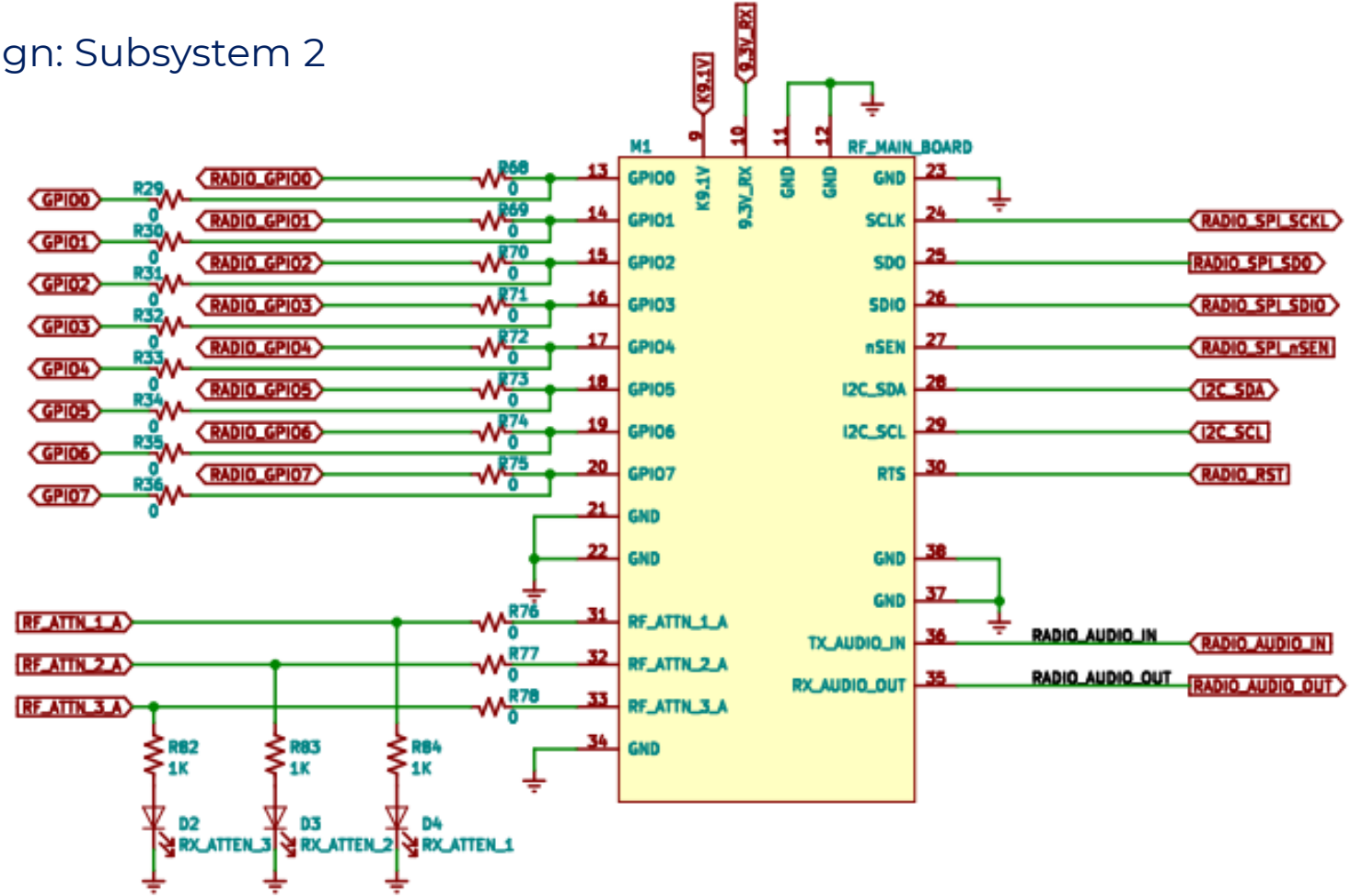
Design: Subsystem 1 (Audio Amplifier)



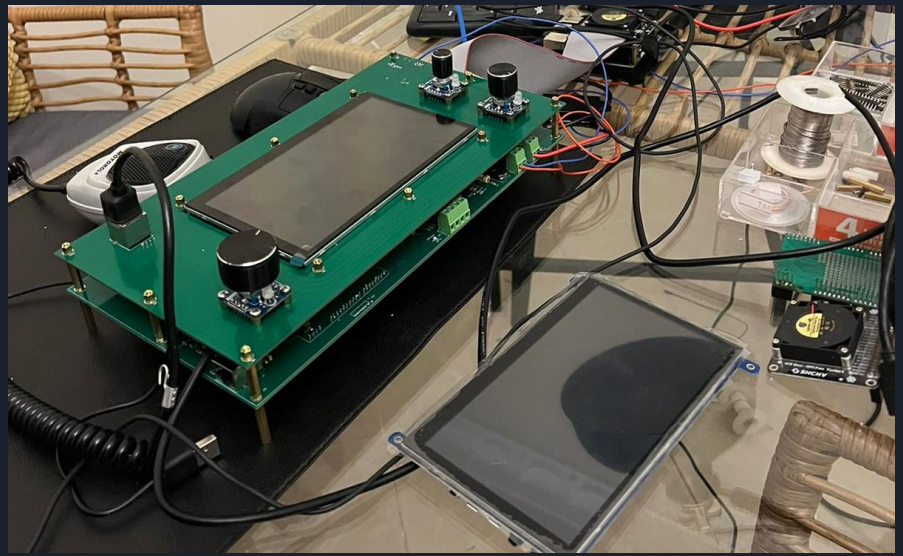


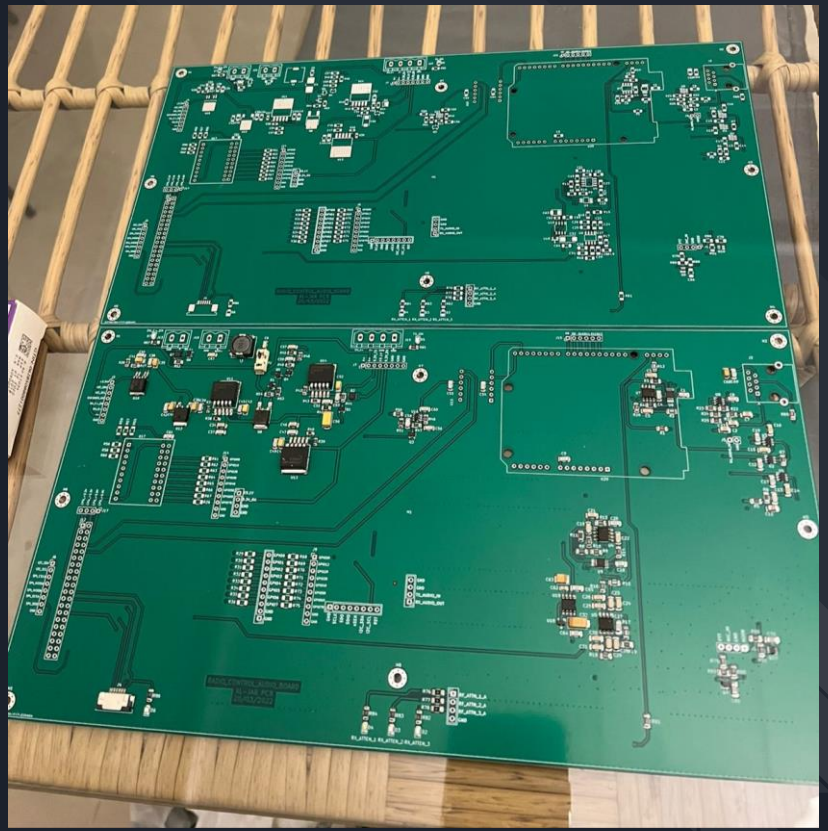
Design:
Subsystem 2
(Main Radio RF Board)

Design: Subsystem 2



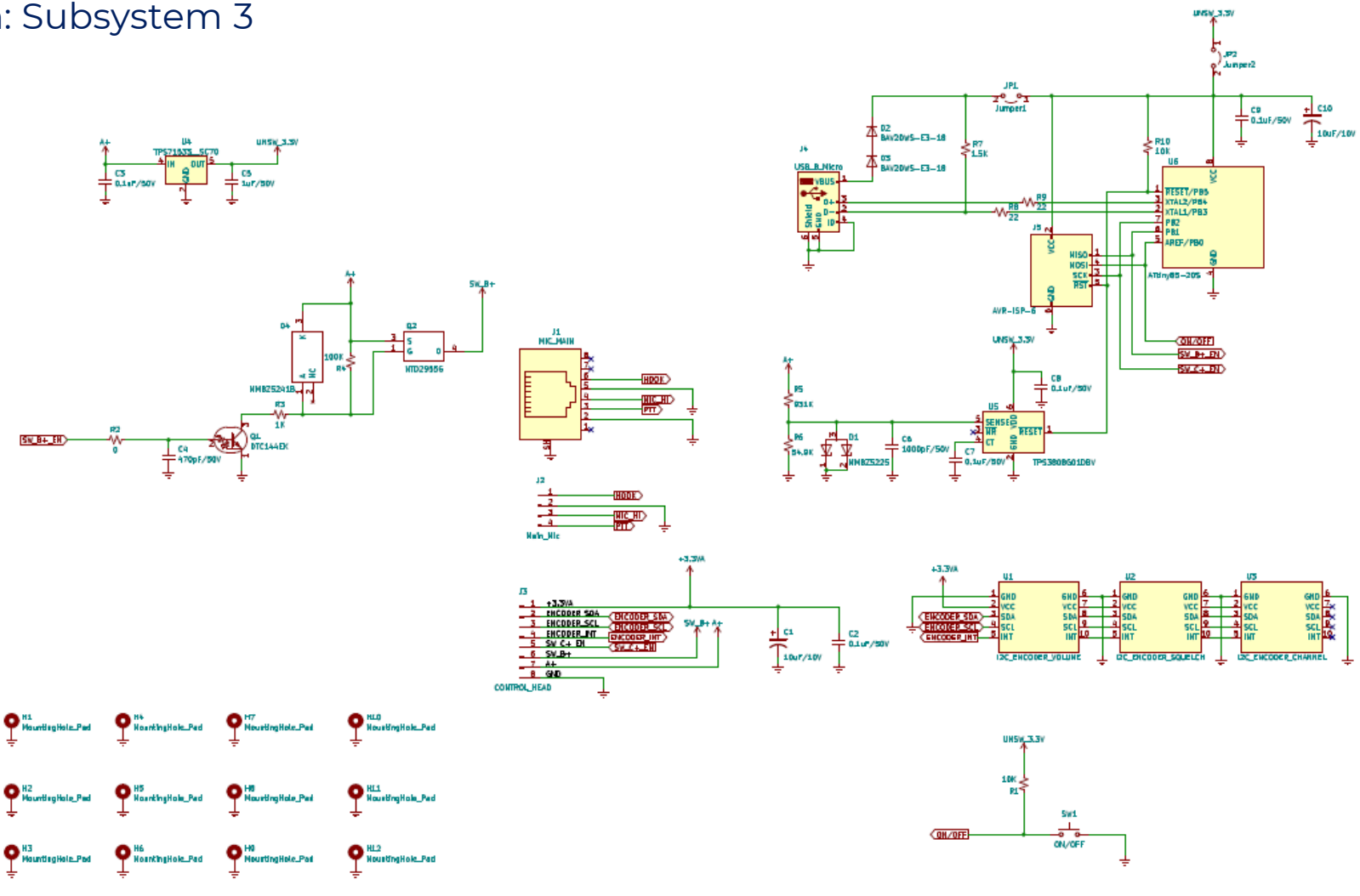
Design: Subsystem 2 (Main Radio RF Board)



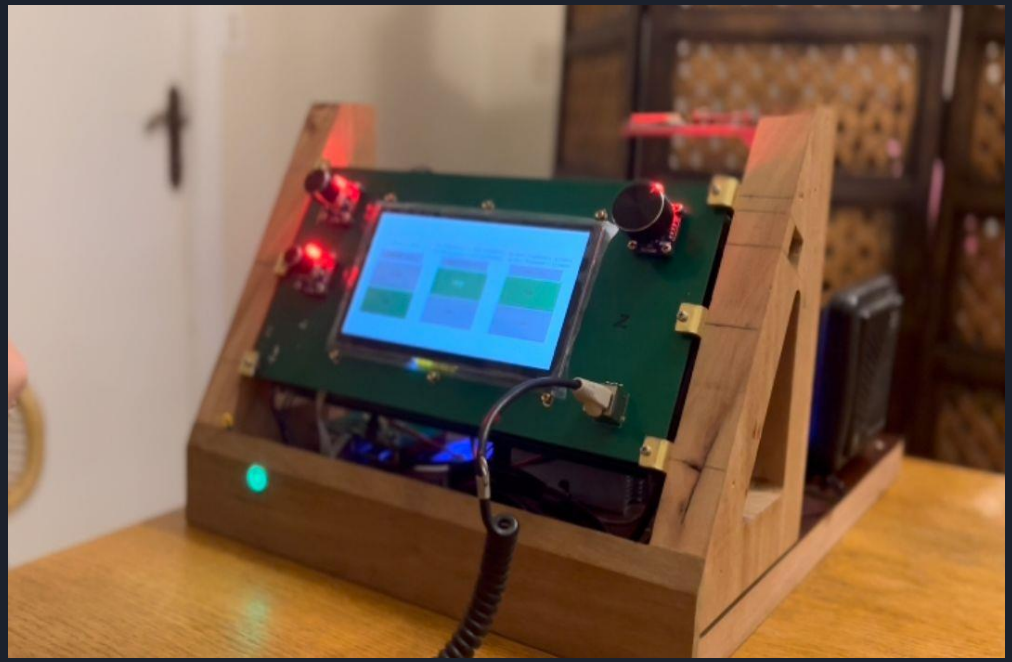


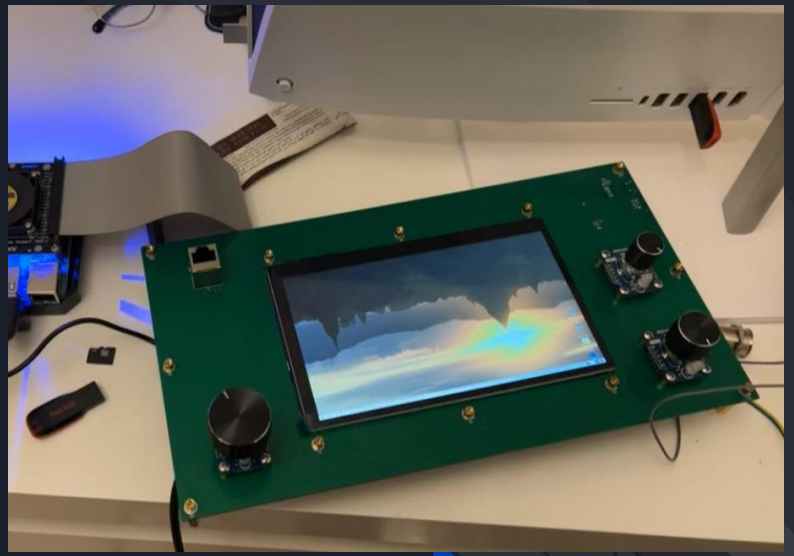
Design: Subsystem 3 (Control Head)

Design: Subsystem 3



Design: Subsystem 3 (Control Head)





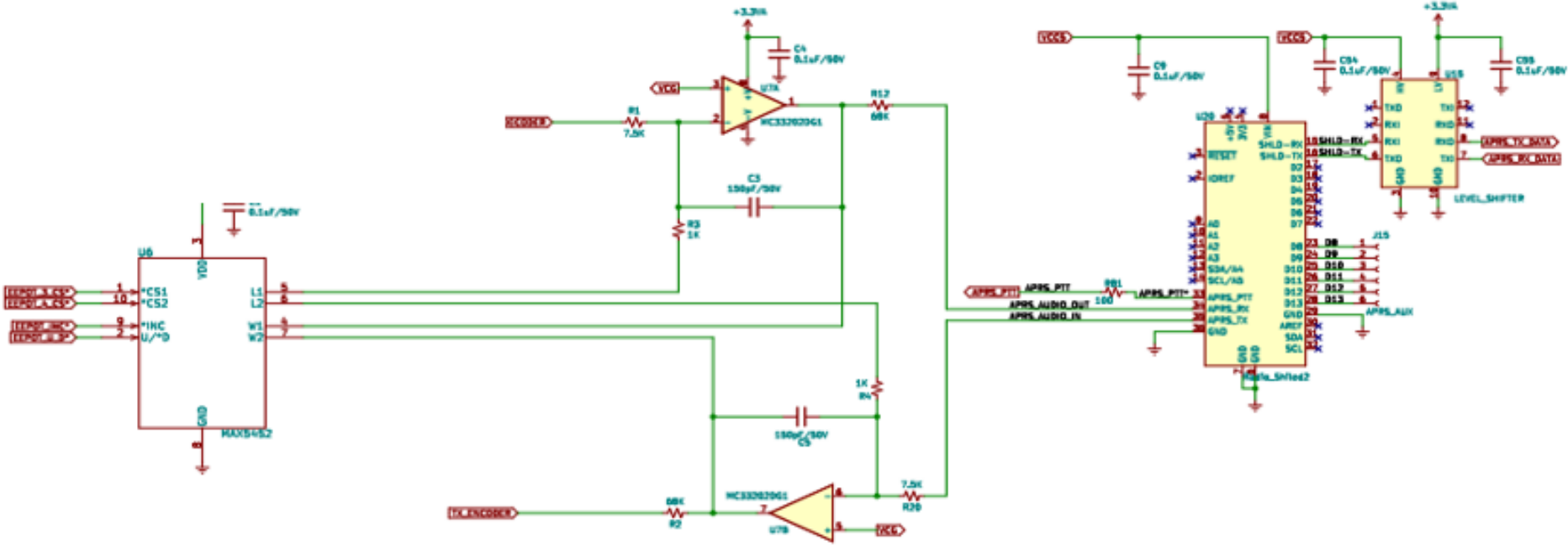
Design: Subsystem 4 (Power Supply)

Design: Subsystem 4 (Power Supply)

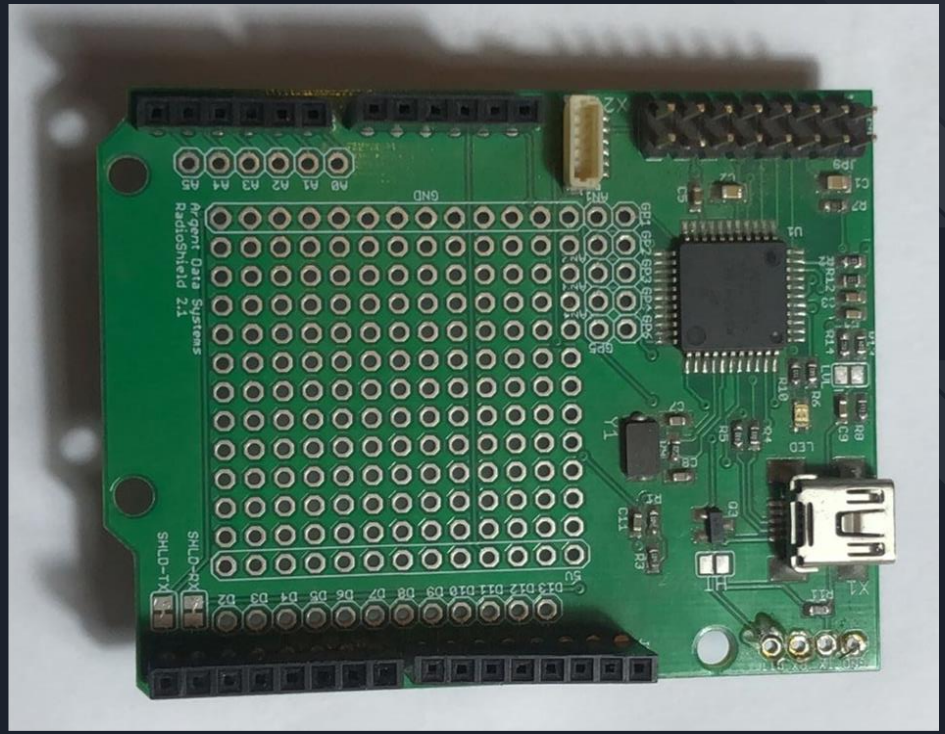
12V 7WATT Battery

Design: Subsystem 5 (APRS Board)

Design: Subsystem 5



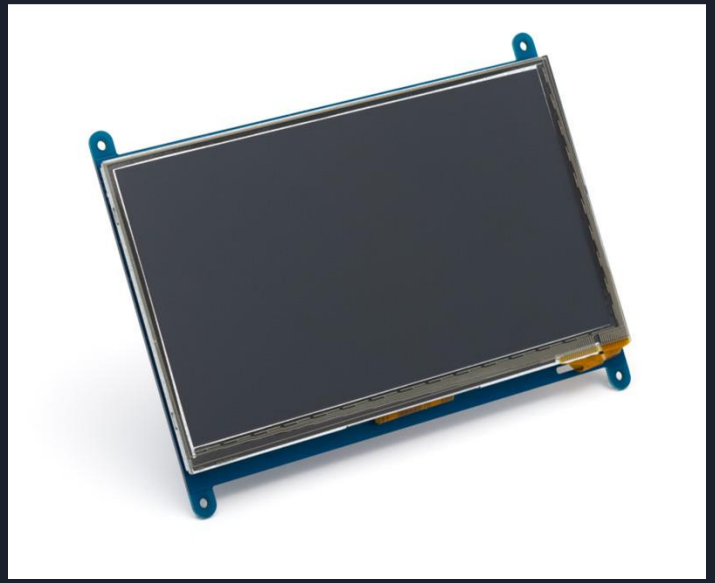
Design: Subsystem 5 (APRS Board)



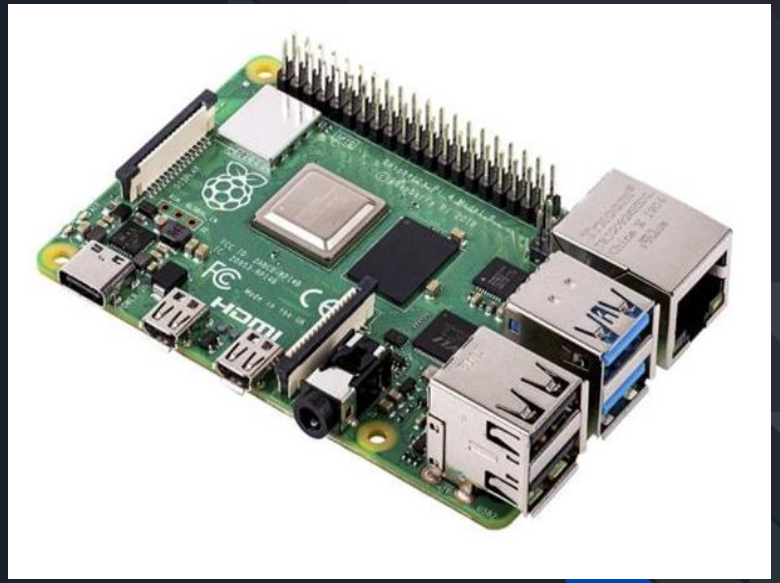
Ready Made APRS Board

Design: Subsystem 6 (Electronic & Software)

Design: Subsystem 6 (Electronic & Software)



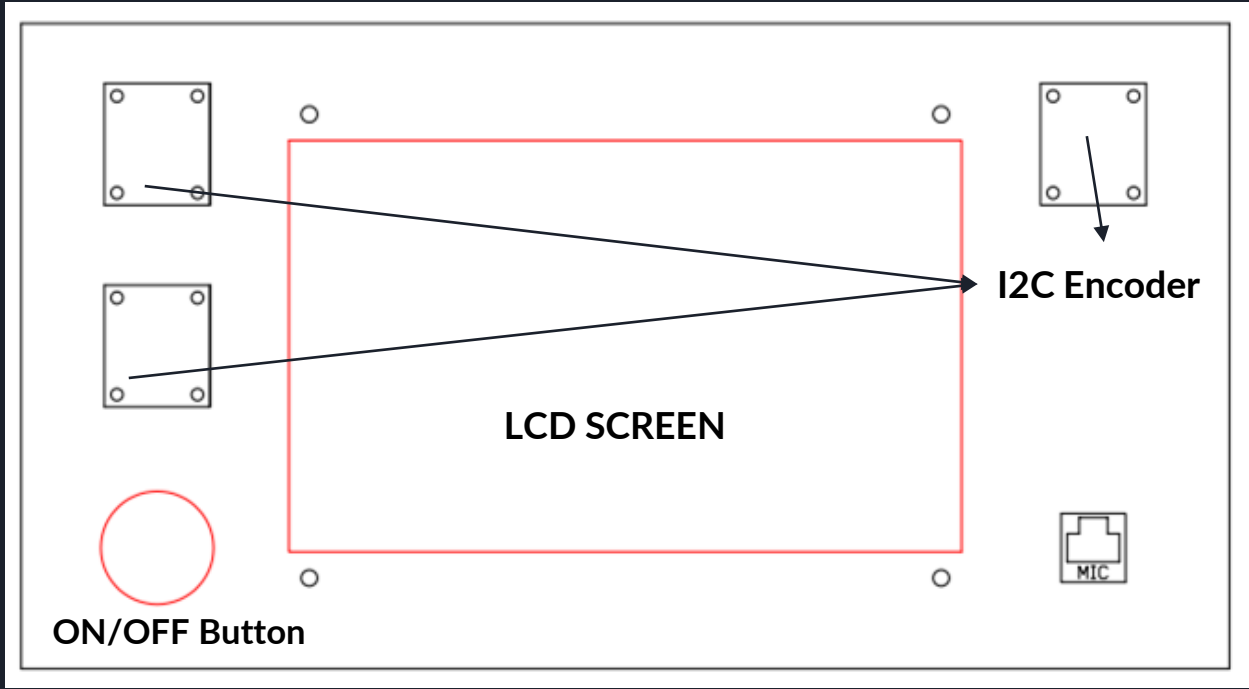
LCD Screen



Raspberry pi 4

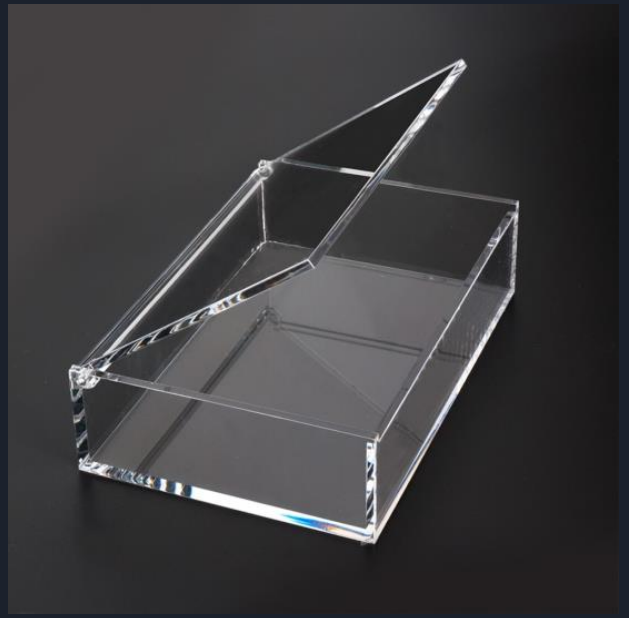
Design: Subsystem 6 (Electronic & Software)

Design: Front Panel Structure



Design: Case Structure

Wood



Acrylic

Design: Completed Work

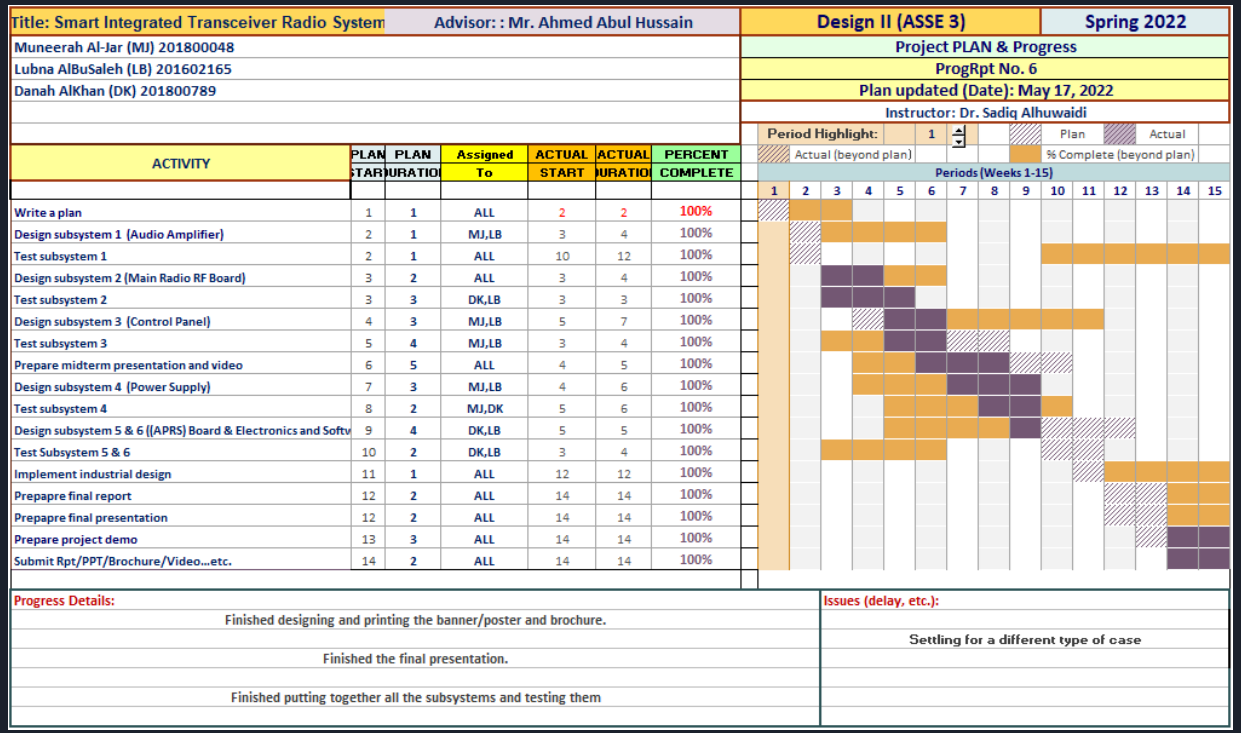
Design subsystem 1 (Audio Amplifier)	100%	Test the system	100%
Design subsystem 2 (Main RF Board)	100%	Test the system	100%
Design subsystem 3 (Power Supply)	100%	Test the system	100%
Design subsystem 4 (Control Panel)	100%	Test the system	100%
Design subsystem 5 (APRS Board)	100%	Test the system	100%
Design subsystem 6 (Electronics & Software)	100%	Test the system	100%

Design: Remaining Work

Design subsystem 1 (Audio Amplifier)	✓	Test the system	✓
Design subsystem 2 (Main RF Board)	✓	Test the system	✓
Design subsystem 3 (Power Supply)	✓	Test the system	✓
Design subsystem 4 (Control Panel)	✓	Test the system	✓
Design subsystem 5 (APRS Board)	✓	Test the system	✓
Design subsystem 6 (Electronics & Software)	✓	Test the system	✓

Project Management & Team Work

Progress Report #6



Title: Smart Integrated Transceiver Radio System | Advisor: : Mr. Ahmed Abul Hussain | Design II (ASSE 3) | Spring 2022

Muneerah Al-Jar (MJ) 201800048
Lubna AlBuSaleh (LB) 201602165
Danah AlKhan (DK) 201800789

Project PLAN & Progress
ProgRpt No. 6
Plan updated (Date): May 17, 2022
Instructor: Dr. Sadiq Alhuwaidi

Period Highlight: 1 | Plan | Actual | Actual (beyond plan) | % Complete (beyond plan)

ACTIVITY	PLAN START	PLAN DURATION	Assigned To	ACTUAL START	ACTUAL DURATION	PERCENT COMPLETE
Write a plan	1	1	ALL	2	2	100%
Design subsystem 1 (Audio Amplifier)	2	1	MJ,LB	3	4	100%
Test subsystem 1	2	1	ALL	10	12	100%
Design subsystem 2 (Main Radio RF Board)	3	2	ALL	3	4	100%
Test subsystem 2	3	3	DK,LB	3	3	100%
Design subsystem 3 (Control Panel)	4	3	MJ,LB	5	7	100%
Test subsystem 3	5	4	MJ,LB	3	4	100%
Prepare midterm presentation and video	6	5	ALL	4	5	100%
Design subsystem 4 (Power Supply)	7	3	MJ,LB	4	6	100%
Test subsystem 4	8	2	MJ,DK	5	6	100%
Design subsystem 5 & 6 ((APRS) Board & Electronics and Softv	9	4	DK,LB	5	5	100%
Test Subsystem 5 & 6	10	2	DK,LB	3	4	100%
Implement industrial design	11	1	ALL	12	12	100%
Prepapre final report	12	2	ALL	14	14	100%
Prepapre final presentation	12	2	ALL	14	14	100%
Prepare project demo	13	3	ALL	14	14	100%
Submit Rpt/PPT/Brochure/Video...etc.	14	2	ALL	14	14	100%

Periods (Weeks 1-15): 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Progress Details:

Finished designing and printing the banner/poster and brochure.

Finished the final presentation.

Finished putting together all the subsystems and testing them

Issues (delay, etc.):

Settling for a different type of case

Risk Management

	Source	Events	Threats	Response
1	Battery Duration	Power Off	Dysfunctional battery	Replace Batteries
2	Team Members	Illness	Development/Test Delay	Sickness is unpredictable and unavoidable

Impact of Project

- To reduce the cost of services in remote areas or road trips
- To reduce the number of death in remote areas or road trips
- Ability to do many functions
- Ability to work everywhere

New Skills Acquired and Applied

- Becoming familiar with using KiCad software for schematics and simulations for the electronic circuit designs and testing.
- Checking all component requirements and choosing the best option.
- Reading materials and searching about the recent technologies used for the same project.
- Learning about risk management of designing and implementing a system.
- Learning about project management, planning, communication and troubleshooting problems.

Budget Estimate

Component	Cost
LCD touch screen	325
I2C ENCODER (3)	6
Speaker	190
TPS71533_SC70	41.25
USB_B_Micro	13.3
TSP3808G01DBV	45
isl21010CFH315Z	42
LM1971	10
LM7805_T0252	5
NLAST4599DTT1G (3)	6
LM2941CS (3)	36
ISL21010CFH315Z	42
MC33202DG1	29
RASPBERRY PI 4	600
DTC144EK	8.36
MMBT2222A (4)	83
SKY12208-478LF	31.5
BFQ67W	32
TRANSISTORS (4)	26.9
1SV229 (4)	180
AT1846S	42
LM78M05_T0252	5
3 knobs	14.6
Main mic port	45
Mic	109
ATiny85-20S	8.5
AVR-ISP-6	22.87
BLUETOOTH MIC	150
12V BATTERY	180
PCB BOARDS (11)	2200
LM7301 (2)	23
TDA1519CTD	18
DCT144EKAT146	27.5
LD2915OPTR	6.5
LM7805_T0252	5
LM7301	12.7
MAX5452AD8591	10
IO EXPANDER	35
AD8591	76.3
LM2941CS_NOPB	64
SHF BMI-S-209-F	7.4
LM7805_T0252	5
SHEILD1 BMIS-207-F	22.5
MCP4725 (2)	60
TOTAL	**4902.18**

Total cost for 2 Units = 9804.36 SAR

*Prices listed above are market values for the basic components.

Used References

Yurackov, D. (2021). *Creating a low-power half-duplex talk station with an FM receiver on the GNU radio.* . IEEEXPLORE. Retrieved March 12, 2022, from https://ieeexplore-ieee-org.library.pmu.edu.sa/document/9396161

Sittakul, V. (2019). *Wireless sensor network for wildfire detection and notification via Walkie-Talkie network.*IEEEXPLORE. Retrieved March 12, 2022, from https://ieeexplore-ieee-org.library.pmu.edu.sa/document/8955180

Bambey, S. (2016). *A cost-efficient transceiver prototype for Arduino-based laser communication*. IEEEXPLORE. Retrieved March 12, 2022, from https://ieeexplore-ieee-org.library.pmu.edu.sa/document/7746087

Silva. (2012). *Building a node for wireless sensor network based on open source platform Arduino.* IEEEXPLORE. Retrieved March 12, 2022, from https://ieeexplore-ieee-org.library.pmu.edu.sa/document/6476081

Project Demo

https://www.youtube.com/watch?v=sgYwe_ge9fo

Thank you!