LABOR, COST & SCHEDULE DOCUMENT
SOFTWARE DEFINED RADIO

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INGRAM SCHOOL OF ENGINEERING

11/1/2018

TEXAS STATE UNIVERSITY

The rising STAR of Texas

Contents

1 Introduction & Summary

In this Project the end goal is an operational software defined radio for educational purposes. It will be a half-duplex device operating in the North American High Frequency Range as allocated by the North American International Telecommunications Union. The radio will be completed by May 1st, 2019. The estimated cost for Labor is $52,016.48 and the estimated cost for Materials is $200.

2 Labor

2.1 Labor Categories

Project Labor Categories	
Labor Category	**Justification**
Design Engineer	Optimization of radio frequency interactions with and between components.
Lawyer specializing in the FCC	Radio communications in the united states are regulated, and many laws apply to their use, it is important to know exactly what all of those are and how to go about designing the radio within legal bounds
Digital Signal Processing Engineer	As much of the fundamental filtering and operation of the radio will be done inside the digital realm of the
Test Engineer	Verifying the design is operating correctly and with in applicable law.
Technical Writer	Create a detailed and user-friendly user manual for device.
Technician	This will be necessary of a build kit goes in to production. A technician will need to be present to keep an eye on the production line.
Fabricator/Assembler	Needed to assemble the prototypes for testing.
Drafting / CAD	Creating clear and concise schematics for the user's manual.
Marketing Analyst	Identifying the best methods to market the radio to those whom would be interested in buying it.
Administrative	Not needed as the device does not have administrative access.
Management / Supervision	Organizing contracts, setting time tables for stages of project, and facilitating funding.

Digital Signal Processing specialist	Need to create and optimize the digital signal processing done inside the device to limit radio latency.
Consulting	Not needed
Contractor	Not needed
Janitorial Services	Keeping a clean work space is very important to productivity, no one wants to work surrounded by filth.

2.2 Labor Rates

I have listed the burdened hourly cost as double the average hourly wage for each of those job titles in the united states as these tasks are not going to take a particularly long time. Meaning each of these jobs will not take an entire year thus hiring by task with a short term contract makes more economic sense then hiring for an entire year.

Labor Categories and Burdened Hourly Costs		
Labor Category	**Burdened Hourly Cost**	**Justification**
Design Engineer	$77.06	On average Radio Frequency design engineers make $80,140 a year, as this device should not take more then a year in development and testing, and the engineer will not be needed for that time it could be a short-term contract. Unfortunately, those type of contracts tend to be more hourly then the annual salary, thus the burdened hourly cost.
Lawyer specializing in the Federal Communications Commission	$114.63	As this radio is being designed for the United states market it is important all laws, rules, and regulations are followed. To do this a lawyer specializing in those things with respect to the FCC is necessary for a legal radio.
Digital Signal Processing Engineer	$82.55	As the fundamental filtering and operation of this device takes place digitally through digital signal processing this job is necessary and vital.
Test Engineer	$63.80	Detailed and extensive testing of radios are necessary to ensure the radio meets federal and state laws and fall within those limits and bounds.

Technical Writer	$70.35	A technical writer is vital whether we are making a build kit or just posting schematics for sale because if few can understand the design, then few will buy or build it. As this is not a project that needs full time employment paying for a contract-based job at the burden rate could be cheaper over all.
Technician	$41.17	This cost will only be necessary if a radio build kit for our design goes in to production, but if it does it is important the production line does not go down, thus the Technician for as long as is needed.
Fabricator / Assembler	$30.77	This person can be brought on as needed for hourly pay or a contract job, This persons duty is to assemble one or a set number of radios for testing, and as that number is variable and the time required may be limited the burdened hourly cost could be manageable.
Drafting / CAD	$52.16	This job is necessary for the creation of schematics for this radio, as the placement of the components will affect the radios harmonics, and internal radio frequency interference this person should work closely with the radio frequency design engineer for placement and many of these schematics will be presented to the user to facilitate assembly. Thus, paying the burdened hourly cost to keep on a qualified and competent Drafter is vital.
Marketing Analyst	$60.15	This job is important as it will provide information as to where to market our radio to attract the intended audience. Having a market analyst is important for the product to even get off the ground.
Administrative	-----	This job is not required as administrative access for this radio does not exist.
Management / Supervision	$64.44	Organizing contracts, setting time tables for stages of the project, and facilitating funding are all things necessary to the completion and distribution of the radio, Thus having one person whom the team can turn to for leadership and consistency is important.
Janitor	$27.71	This is important to keep the work space clean and sanitary.

2.3 Total Cost of Labor

	Radio Freqency Design Engineer	Lawyer specializing in The FCC	Digital Signal Processing Engineer	Test Engineer	Technical Writer	Technician	Fabricator/ Assembler	Drafting /CAD	Marketing Analyst	Management /Supervison	Cleaning/ Janitorial services	Total cost per stage
Burdened Hourly Rate	$77.06	$114.63	$82.55	$63.80	$70.35	$41.17	$30.77	$52.16	$60.15	$64.44	$27.71	
Task	**Hours Required**											
Project Definition	40	40							10	22.5		$9,719.00
Legal documents	4	60							4	17		$8,522.12
Functional Specification	40	4	40		8			10		25.5		$9,570.54
Simulations	10		40	6						14		$5,357.56
Test Plan	20		20	40	8					22		$7,724.68
Prototype Assembly						16	20			9		$1,854.08
Characterization	10			40						12.5		$4,128.10
User Manual		4			10			30	10	13.5		$4,198.26
Cleaning Services											34	$942.14
										Total Burdened Cost =		$52,016.48

3 Materials

3.1 Capital Expenses

CAPITAL EXPENDITURE ESTIMATE		
Task	**Materials**	**Cost**
Project Test	Mixed Signal Oscilloscope	$5,500[1]
	Spectrum Analyzer	$8,000[1]
TOTAL		**$13,500**

[1] Available from Sponsor
[2] Available at Texas State University

3.2 Non-Capital Expenses

NON-CAPITAL EXPENDITURE ESTIMATE		
Task	**Materials**	**Cost**
Project Fabrication	Soldering Station	$150
	Solder kit	$20
	Cables	$100
	IC's	$50
	Perf Board	$40
Project Test	Variable Power Supply (DC)	$200
	Function Generator (DC+AC)	$800
TOTAL		**$1360**

4 Total Project Cost

PROJECT LABOR & MATERIALS COST SUMMARY	
Cost Category	**Estimated Cost**
Labor	$52,016.48
Capital Expenses	$13,500.00
Non-Capital Expenses	$136.00
TOTAL ESTIMATED PROJECT COST	**$65,652.48**

5 Project Schedule

Task	8/8/2018	9/27/2018	11/16/2018	1/5/2019	2/24/2019	4/15/2019	6/4/2019

Statement of Work (Executive Summary)

Watch and take notes on Videos of SDR

Complete Parts List

Setup Arduino Environment and establish understanding the prototype code

Complete Functional Specs

Signed Spec Sheet

Begin RF Amplifier

Begin Power Amp

Begin Bandpass Filter

Labor Cost Schedule

Poster Draft

Test/Benchmark Circuits

Develop Passthrough Tests

Create Quadrature Converter

Test Plan

Configure LCD/Tuner Knob

Implement RF Receive Code

Receive/Tune tests

Transmitting/Tune tests

Final Preparations for Senior design day

Add licensing selection to radio

Raspberry Pi implementation

Custom PCB

Higher Power Amplifier

Alternate Power Sources

Custom Cases

Head phone output jack

6 Approvals

Approver Name	Title	Signature	Date
	Project Manager		
	D2 Project Manager		