MESH NETWORK COMMUNICATION

TEAM MEMBERS

Swathi Thekkuveettil

Reshma Kallungal

Manisha Arora

PROJECT DESCRIPTION

Project title: Mesh Network using NRF24L01

In this project we are planning to make a network with three nodes in which each node can communicate with any of the other nodes in the network and at the same time they can work as both transmitters and receiver. We can further develop the project to make a larger network. The Main requirements of the project are, three NRF24L01 which works as nodes and a microcontroller to make a network, for this project we are planning to use arm controller. A single NRF24L01 can listen up to 6 other modules at the same time. In our project a module consists of NRF24L01, Arm Controller and LCD display, led and a push button. This project is mainly dedicated to the persons with disabilities who have hearing disabilities.so they can make their life easier.

PROBLEM STATEMENT

The stakeholder of our project is Mike Jerabek who is our professor. His main purpose to build the project is to help his co-workers with disabilities. In this project we are preparing a small box which we call a node. When a person need the attention or help from a person inside the cubicle even if it is a student or a coworker they can key in the code and deliver a message for the particular person ,the led attached to the box blinks and the LCD screen displays the message.so they can key in their answer. There are a lot of mesh network available but everything concentrates on the home automation uses the Bluetooth networks but it have some limitation in the range and the number of nodes to be added but in our project we use NRF24L01 which work on radio waves and we can extend the number of nodes as we are using tree topology. Each NRF24l01 can connect to at least 5 other modules and transmits the data.

PROJECT REQUIREMENT

The requirement of this project is to establish a network layer communication between the nodes. As for now we are planning to make a mesh network with three nodes. After the successful completion of this we are planning to provide the end result that is to display the transmitted messages in LCD display and to provide a notification using LED or a buzzer when a message is received.

If we could complete this we would like to advance our project where we can modify each node according to the specifications and requirement from the user end.

TEAM MEMBER ROLES /RESPONSIBILITIES

TEAM LEADER

We selected our Team leader to be Swathi Thekkuveettil. She is supposed to plan the group meetings and the meetings with the sponsor. As for now we planned 3 meeting with the sponsor and 4 group meeting. In the group meetings we assign each person with a task to complete and discuss the tasks assigned in the previous meeting. Swathi is supposed to work on the software part

RECORDER/ANALYST

Recorder of our team is Reshma kallungal Paul. The recorder keeps a record on the information discussed in the meeting for the future reference. Keep records on the assigned tasks and notes the completed tasks and the information to be used for the successful completion. She is also assigned to work as a software analyst for this project

Hardware

Manish arora is assigned to work on the hardware parts for the successful completion of the project

SPECIFIC PROJECT TASKS

May 9, 2019 :- We met Mike after the project topic confirmation to discuss the further details. He gave us an overall idea about the project and shared his expectation about the project. Mike arranged a meeting the very next day so that he can handover the documents and the relevant information's required to complete this project

May 10, 2019 :- We had a meeting with Mike as per the appointment and discuss about the various steps in the development of project. He shared us the related theory modules to get a clearer idea about the project. Mike gave us the source code and the papers from the Nordic semiconductors and the datasheets of NRF24L01, and some references

May 10 to 13 2019:- We learned and searched through several international journals related to mesh communication which helps us to get a more wider idea about the topic. Started the research of the nodal communications. Referred similar project ideas. By completing the datasheets of NRF24L01, started the research about the transmitter and receiver pins. As the

knowledge of all the data provided are inevitable for every team member for the successful completion of project, every team members are assigned to complete a thorough research.

May 14 2019: - we met Mike as per his instruction and he gave us three NRF24l01, which are the nodes to establish a successful network with the help of ARM microcontroller

May 15-22,2019: - Each member is assigned to study through the data sheet of NRF24L01 provided by mike. So we can get a clear understanding about the module along with that we have been going through the data sheets of Arm M4 cortex. Prepared an estimate of hardware required to successfully complete the project. Estimated the cost and prepared a part selection list.

PROJECT TASK TIMELINE

Task	Start Date	End Date
Project Proposal	May 9,2019	N/A
Data Collection	May 10,2019	May 15,2019
Part selection	May 14,2019	May 22, 2019
Data sheet	May 16,2019	May 26,2019
Software creation	May 27,2019	June 15,2019
Hardware Software Interfacing	June 16,2019	July 23,2019
Testing	July23,2019	July 31,2019
Project completion		August 03,2019

Project proposal

To-do-List

- Submitted the three project topics selected from the pitch day
- Confirm the project topic
- Meet sponsor to get the mission and vision of the project
- Analyse the relevance of the project

Project Research

To-do-list

- Collect all the related journals
- Collect the data sheet of the components used
- Find the predecessors of the project

- Look for similar project ideas
- Collect in depth datas about each hardware component
- Assign the team members the topic for research
- Make a follow-up plan to discuss the details

Kick off document

- Assign roles for team members
- Prepare a logo and a name for the project group
- Prepare a rough plan for the project
- Make sure every team member get an overview of the project
- Prepare an agenda for the semester to successfully complete the project

Parts Selection

- Discuss the structure of the project
- Make a rough plan about the end product
- Make a list of hardware required
- Find the availability of the product
- Prepare a part selection list
- Assign jobs to team members
- Prepare the budget for the parts

Detail Design Document

- Assign topics to each team member
- Prepare gantt chart
- Prepare overall timeline for the project
- Prepare a breakdown structure
- Prepare a risk management plan

Initial Software Creation

- Prepare detailed flow chart to start the project
- Detailed analysis of the data sheet of NRF24L01 module

Low level software Working

- Prepare the source code that compiles
- Create a video to make sure that the project is working

Integration

- Interface hardware and software

- Complete the test plan
- Make sur the project works

Project completion

- Prepare the completed project for demo

Please refer the enclosed Gantt chart for the detailed working hours

RISK MANAGEMENT

We called a meeting to discuss about all possible risks and the limitations in our project, the main risk is the power supply to the NRF24L01 module. The power supply should not exceed 3.3 v. we decided to have regular meetings and a created a new group in whatsapp so we can communicate properly without any delays and we decided to update everything in the group.

Conestoga College

Institute of Technology and Advanced Learning

Document   Hardware -Software Test Plan
Project   Embedded STM32F303 Microcontroller Board
Revision   1.0
Date   July 15,2019
Department   School of Engineering and Information Technology
Program   Embedded System Development
Author   Group G
Reviewers   So-Ra Chung, Sandra
Date of Current Spec

Revision	Description of Change	Effective Date

Table of Content

1.Introduction

1.1Objective

To create a testing plan for the Arm M4 cortex microcontroller in a detailed manner for the components used in the project.

1.3 Phase Breakdown:

1. Visual Inspection
    a. Individual component inspection
    b. Solder check
    c. Jumper check
2. Power Supply and Regulator Testing
    a. Input current level verification
    b. Voltage output level verification
    c. Power pin checks
3. Reset and Clock Circuit Testing
    a. Functionality check
    b. Waveform check
    c. Rise/Fall-time check
    d. Oscillator frequency check
4. CPU Interface Testing
    a. Interface timing checks
    b. Interface signal level checks
    c. BDM Testing
5. Software Loading
    a. I/O Testing
    b. RAM/Memory Testing
    c. LCD

        d. NRF24L01

6. System Level Testing
        a. System software loading
        b. Performance testing

A. Individual Component Inspection

Estimate the bill of the project. Checking the component to check the following using the prepared checklist

1. Solder Connection
2. Proper Orientation
3. Correct Values

B. Solder Check

Ensure there are no short or open circuits in the solder joints. Note them below if found any.

C. Jumper Check

Make sure that all jumper wires are in correct location. If found any log them below.

PHASE 2: POWER SUPPLIES AND REGULATORS

A. Current Monitoring

Apply power to the power supply circuitry using a power supply with current limiting capability. Check whether the current drawn exceeds the design calculation

B. Voltage Verification

Make sure that the output voltage level of each power supply/regulator is within the specified accepted tolerance range.

Circuitry	Expected Voltage	Accepted Tolerance	Measured Voltage
+5V (R65_P1)			
5VS (R65_P2)			
NRF24L01			

C. Power Pin Verification

Measure voltage levels at all major power vias.

Location	Expected Voltage	Measured Voltage
NRF24L01 LCD		

PHASE 3: RESET AND CLOCK CIRCUIT

A. Functionality Check

Power the board up and down by resetting the trigger. Check the functionality of the reset pushbutton
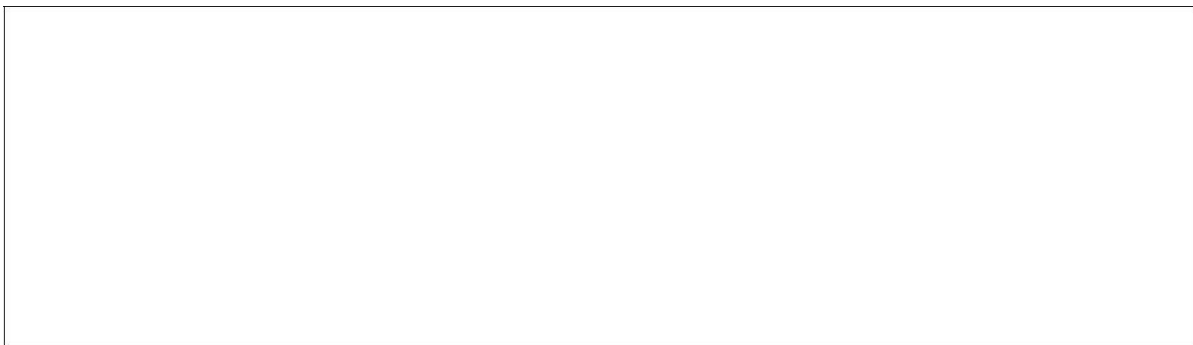
B. Waveform Check

Check whether the reset waveform matches the specification of the device ..

C. Rise/Fall-time Check

Make sure that the rise time and fall times are as expected.

D. Oscillator Frequency Check

Measure Oscillator frequency using oscilloscope and ensure that it is in the accepted range.
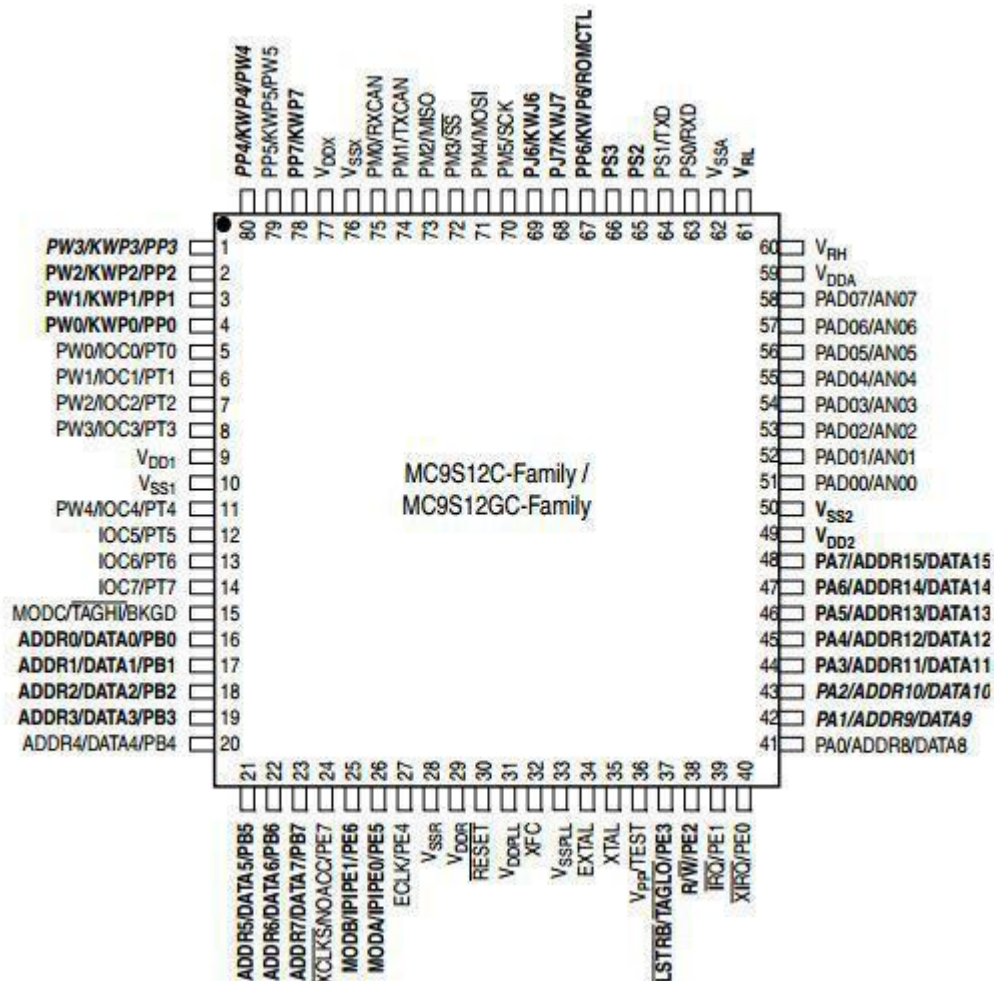
PHASE 4: CPU TESTING

A. Interface Timing Checks

With reference to the datasheet check whether the interfaces are operating within Specified timing range.

B. Interface Signal Level Checks

With reference to the datasheet, check that interfaces are operating at the specified signal levels.

MC9S12C-Family / MC9S12GC-Family

PIN #	PIN NAME	Expected Voltage at Logic 1 (HIGH)	Measured Voltage at Logic 1 (HIGH)	Expected Voltage at Logic 0 (LOW)	Measured Voltage at Logic 0 (LOW)
1	PP3				
2	PP2				
3	PP1				
4	PP0				
5	PT0				
6	PT1				
7	PT2				
8	PT3				
9	VDD1				
10	VSS1				
11	PT4				
12	PT5				
13	PT6				
14	PT7				
15	BKGD/MODC				
19	PB0				
17	PB1				
18	PB2				
19	PB3				
20	PB4				
21	PB5				
22	PB6				
23	PB7				
24	PE7				
25	PE6				
26	PE5				
27	PE4				
28	VSSR				
29	VDDR				

30	**RESET**		
31	**VDDPLL**		
32	**XFC**		
33	**VSSPLL**		
34	**EXTAL**		
35	**XTAL**		
36	**VPP/TEST**		
37	**PE3**		
38	**PE2**		
39	**PE1**		
40	**PE0**		
41	**PA0**		
42	**PA1**		
43	**PA2**		
44	**PA3**		
45	**PA4**		
46	**PA5**		
47	**6**		
48	**7**		
49	**VDD2**		
50	**VSS2**		
51	**PAD00**		
52			
53	**PAD02**		
54	**PAD03**		
55	**PAD04**		
56	**PAD05**		
57	**PAD06**		
58	**PAD07**		
59	**VDDA**		
60	**VRH**		
61	**VRL**		
62	**VSSA**		

63	PS0		

64	PS1	
65	PS2	
66	PS3	
67	PP6	
68	PJ7	
69	PJ6	
70	PM5	
71	PM4	
72	PM3	
73	PM2	
74	PM1	
75	PM0	
76	VSSX	
77	VDDX	
78	PP7	
79	PP5	
80	PP4	

C. BDM Testing

Connect the processor and manually connect the interfaces step by step

PHASE 5: SOFTWARE LOADING

A. I/O Testing

Load the software on the board, run the software in each interface one at a time.Record and note the success of each interface separately
Ensure the integrity of ports. Software should enable to write to all I/O location

B. RAM / Memory Testing

Test RAM, ROM and other memory address. Software allows reading/writing int RAM

PHASE 6: PERIPHERAL CIRCUITS TESTING

A. LCD

- o Ensure each pin have expected signal level.

- o Check all voltage supply vias.

- o Make LCD work using software

B. DAC

- o Ensure each pin have expected signal level.

- o Check all voltage supply vias.

- o Make DAC work using software

C. NRF24L01

- o Ensure each pin have expected signal level.
- o Check all voltage supply vias.
- o Make IR Sensor work using software

PHASE 7: SYSTEM LEVEL TESTING

E. System Level Software

Load the system level software into STM32F303 microcontroller board. Test the interfaces and the components connected to the system using sensors and actuators. Make sure that the peripherals give the expected output

F. Performance Testing

Record the result. Make sure that the board works as per the objective of the project.