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First Term (Final Project 1)

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HIGH PRESSURE DETECTION REPORT

Creating Linker_Script, Startup.c For a Pressure Monitoring Program & Simulating On Proteus

Contents

Mastering Embedded Systems Online Diploma	1
First Term (Final Project 1)	1
Eng. Alfred Fayez	1
My Profile:	1
HIGH PRESSURE DETECTION REPORT	2
Creating Linker_Script, Startup.c For a Pressure Monitoring Program & Simulating On Proteus	2
Contents	2
Table of Figures	3
1. Case Study	2
2. Assumptions about the System	4
3. Method	4
4. Space Exploration	5
5. Requirements Diagram	5
6. System Analysis	6
1. Case diagram	6
2. Activity diagram	6
3. Sequence diagram	7
7. System Design	
8. State Machine of each block	8
9. Simulation on TTool	
10. Simulating on Proteus	
11. Symbol Table Of The Object Files & The .elf File	
12. Sections In Each File	

Table of Figures

Figure 1 v model	4
Figure 2 Requirements diagram	
Figure 3 case diagram	6
Figure 4 activity diagram	
Figure 5 sequence diagram	7
Figure 6 Sys. Design in TTool	7
Figure 7 Pressure sensor SM	
Figure 8 main algorithm SM	8
Figure 9 alarm monitor SM	
Figure 10 alarm actuator SM	
Figure 11 Verifying on TTool	
Figure 12 proteus simulation case p=25	12
Figure 13 proteus simulation case p=5	
Figure 14 symbole table 1	
Figure 15 symbol tables 2	
Figure 16 symbol table 3	
Figure 17 sections 1	16
Figure 18 sections 2	
Figure 19 sections 3	
Figure 20 sections 4	

1. Case Study

The system is intended to be a component of a pressure control system designed to monitor pressure values in a cabin or closed environment, adhering to the following specifications:

- If the pressure exceeds a specific threshold (20 bar) in the cabin, it will notify the cabin crew.
- The alarm duration is set to 60 seconds.
- The system will consistently track the measured pressure values.

2. Assumptions about the System

- 1. The controller set up and shutdown procedures are not modeled/considered
- 2. The controller maintenance is not modeled
- 3. The pressure sensor never fails
- 4. The alarm never fails
- 5. The controller never faces a power cut

Kindly Note that: Any change in these assumptions will be considered as additional feature in the project.

3. Method

The method used to design and develop the system is the V-model

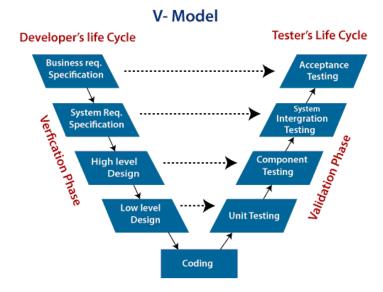


Figure 1 v model

4. Space Exploration

Will be using STM32F103C8T6 MCU (blue pill)

Manufacturer: ST-Microelectronics

Processor: ARM-Cortex-M3

Clock speed: 72MHz

Package: LQFP 48 pins

5. Requirements Diagram

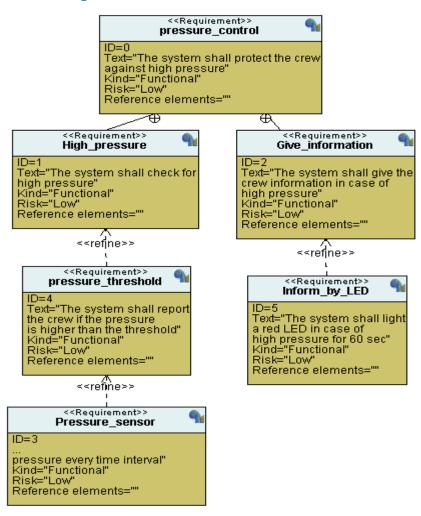


Figure 2 Requirements diagram

6. System Analysis

1. Case diagram

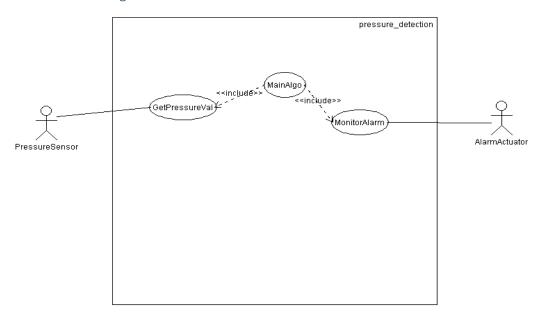


Figure 3 case diagram

2. Activity diagram

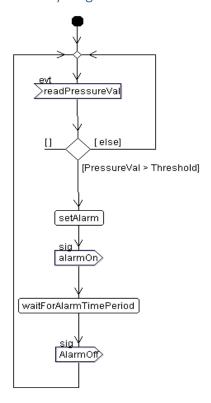


Figure 4 activity diagram

3. Sequence diagram

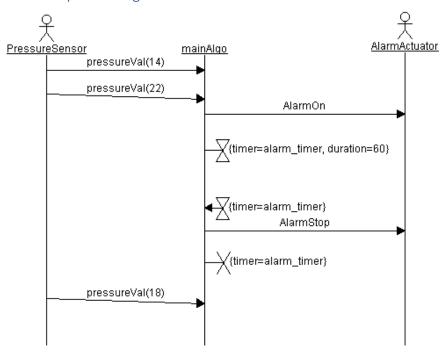


Figure 5 sequence diagram

7. System Design

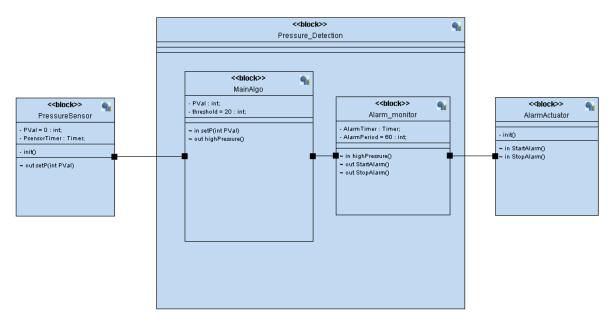


Figure 6 Sys. Design in TTool

8. State Machine of each block

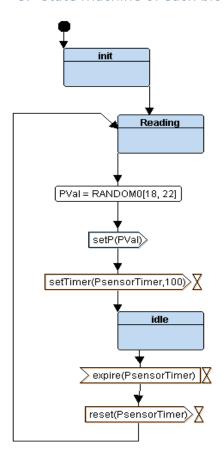


Figure 7 Pressure sensor SM

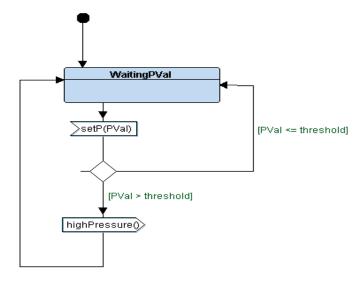


Figure 8 main algorithm SM

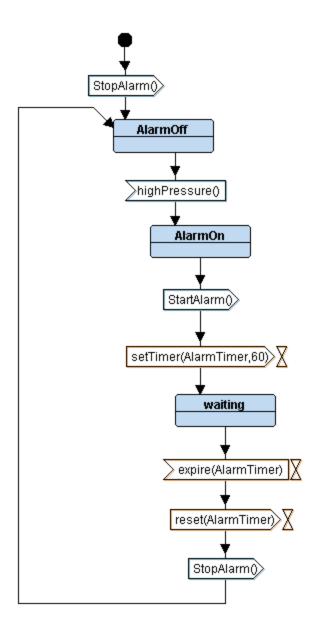


Figure 9 alarm monitor SM

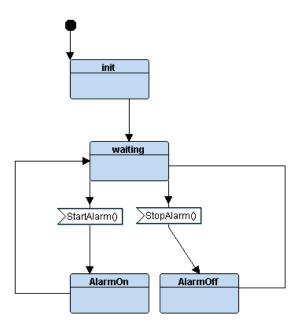


Figure 10 alarm actuator SM

9. Simulation on TTool

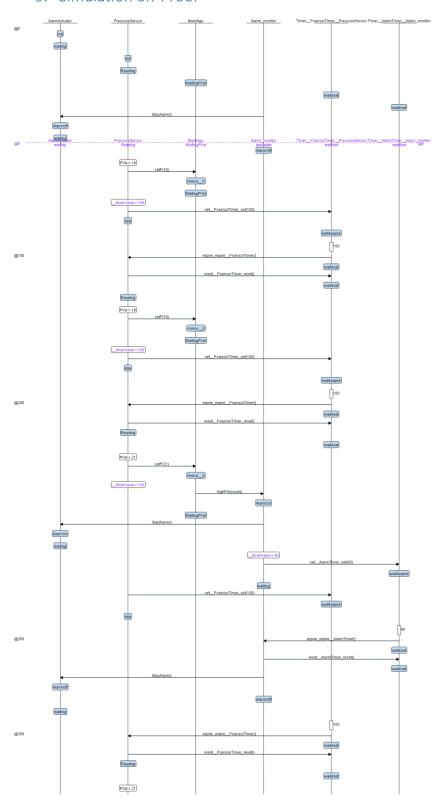


Figure 11 Verifying on TTool

10. Simulating on Proteus

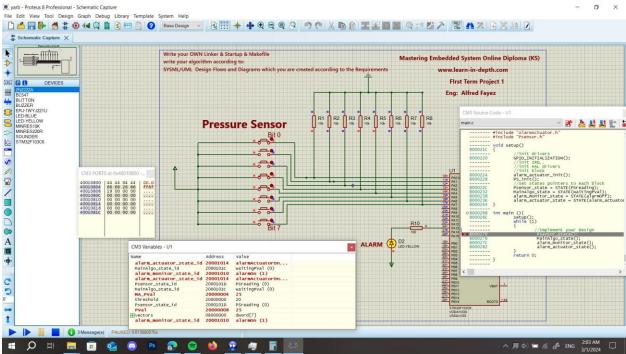


Figure 12 proteus simulation case p=25

The Pressure sensor value is 25 > 20 hence, the LED is on

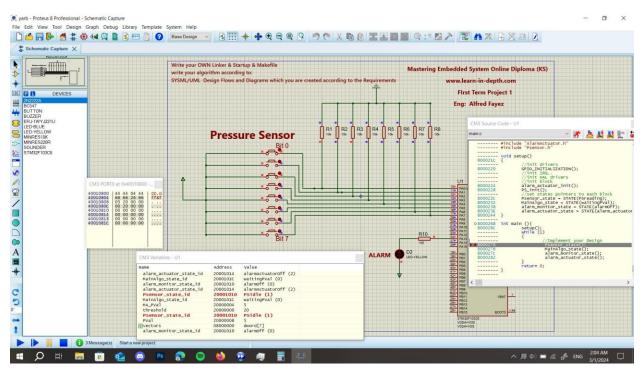


Figure 13 proteus simulation case p=5

The Pressure sensor value is 5 < 20 hence, the LED is off

```
11. Symbol Table Of The Object Files & The .elf File
alarm monitor.o:
00000004 C alarm monitor state
00000001 C alarm monitor state id
         U Delay
00000000 T highPressure
00000070 T ST alarmMonitorWaiting
0000004c T ST alarmOFF
0000001c T ST alarmOn
         U startAlarm
         U stopAlarm
AlarmActuator.o:
00000000 T alarm actuator init
00000004 C alarm actuator state
00000001 C alarm actuator state id
         U Set Alarm actuator
0000005c T ST alarm actuator waiting
0000000c T ST alarmActuatorOff
00000034 T ST alarmActuatorOn
00000074 T startAlarm
00000090 T stopAlarm
driver.o:
00000000 T Delay
00000020 T getPressureVal
00000074 T GPIO INITIALIZATION
00000038 T Set Alarm actuator
main.o:
         U alarm actuator init
         U alarm actuator state
00000001 C alarm actuator state id
         U alarm monitor state
00000001 C alarm monitor state id
         U GPIO INITIALIZATION
0000004c T main
         U MainAlgo state
00000001 C MainAlgo state id
         U PS init
         U Psensor state
00000001 C Psensor state id
```

Figure 14 symbole table 1

```
MainAlgo.o:
         U highPressure
00000000 B MA PVal
00000004 C MainAlgo state
00000001 C MainAlgo state id
00000000 T setP
00000020 T ST waitingPVal
00000000 D threshold
Psensor.o:
         U Delay
         U getPressureVal
00000000 T PS init
00000004 C Psensor state
00000001 C Psensor state id
00000000 B PVal
        U setP
00000058 T ST PSidle
0000001c T ST PSreading
startup.o:
         U _E_bss
         U E DATA
         U E txt
         U S bss
         U _S_DATA
00000000 W Bus fault
00000000 T Default Handler
00000000 R g p fn vectors
00000000 W H fault Handler
        U main
00000000 W MM fault Handler
00000000 W NMI Handler
0000000c T Reset Handler
00000000 b stack top
00000000 W Usage fault Handler
```

Figure 15 symbol tables 2

```
HighPessureDetection.elf:
2000040c B _E_bss
20000004 D E DATA
08000418 R _E_txt
20000004 B _S_bss
20000000 D S DATA
08000094 T alarm actuator init
20000418 B alarm actuator state
20000414 B alarm actuator state id
2000040c B alarm monitor state
20000410 B alarm monitor state id
08000360 W Bus fault
08000360 T Default Handler
08000140 T Delay
080003fc R g p fn vectors
08000160 T getPressureVal
080001b4 T GPIO INITIALIZATION
08000360 W H fault Handler
08000000 T highPressure
20000004 B MA PVal
08000250 T main
20000420 B MainAlgo state
2000041c B MainAlgo state id
08000360 W MM fault Handler
08000360 W NMI Handler
080002dc T PS init
20000424 B Psensor_state
2000041d B Psensor state id
20000008 B PVal
0800036c T Reset Handler
08000178 T Set Alarm actuator
08000284 T setP
08000204 T setup
080000f0 T ST alarm actuator waiting
080000a0 T ST alarmActuatorOff
080000c8 T ST alarmActuatorOn
08000070 T ST alarmMonitorWaiting
0800004c T ST alarmOFF
0800001c T ST alarmOn
08000334 T ST PSidle
080002f8 T ST PSreading
080002a4 T ST_waitingPVal
```

Figure 16 symbol table 3.

12. Sections In Each File

```
alarm_monitor.o: file format elf32-littlearm
Sections:
Idx Name
                 Size
                           VMA
                                     LMA
                                               File off Algn
                 00000090 00000000 00000000 00000034 2**2
 0 .text
                 CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE
                 00000000 00000000 00000000 000000c4 2**0
 1 .data
                 CONTENTS, ALLOC, LOAD, DATA
 2 .bss
                 00000000 00000000 00000000 000000c4 2**0
                 ALLOC
 3 .debug info
                 00000a22 00000000 00000000 000000c4 2**0
                 CONTENTS, RELOC, READONLY, DEBUGGING
 4 .debug_abbrev 000001e1 00000000 00000000 00000ae6 2**0
                 CONTENTS, READONLY, DEBUGGING 00000e0 00000000 00000000 000000cc7 2**0
 5 .debug_loc
                 CONTENTS, READONLY, DEBUGGING
 6 .debug_aranges 00000020 00000000 00000000 00000da7 2**0
                 CONTENTS, RELOC, READONLY, DEBUGGING
 7 .debug_line 00000200 00000000 00000000 00000dc7 2**0
                 CONTENTS, RELOC, READONLY, DEBUGGING
                 0000059e 00000000 00000000 00000fc7 2**0
 8 .debug_str
                 CONTENTS, READONLY, DEBUGGING
 9 .comment
                 0000007c 00000000 00000000 00001565 2**0
CONTENTS, READONLY
10 .debug_frame 00000088 00000000 00000000 000015e4 2**2
                 CONTENTS, RELOC, READONLY, DEBUGGING
11 .ARM.attributes 00000033 00000000 00000000 0000166c 2**0
                 CONTENTS, READONLY
AlarmActuator.o: file format elf32-littlearm
Sections:
Idx Name
                                               File off Algn
                 Size
                           VMA
                                     LMA
                 000000ac 00000000 00000000 00000034 2**2
 0 .text
                 CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE
                 00000000 00000000 00000000 000000e0 2**0
 1 .data
                 CONTENTS, ALLOC, LOAD, DATA
 2 .bss
                 00000000 00000000 00000000 000000e0 2**0
                 ALLOC
 3 .debug_info
                 00000a4b 00000000 00000000 000000e0 2**0
 CONTENTS, RELOC, READONLY, DEBUGGING
4 .debug_abbrev 000001df 00000000 00000000 00000b2b 2**0
                 CONTENTS, READONLY, DEBUGGING
                 00000168 00000000 00000000 00000d0a 2**0
 5 .debug loc
                 CONTENTS, READONLY, DEBUGGING
 6 .debug_aranges 00000020 00000000 00000000 00000e72 2**0
                 CONTENTS, RELOC, READONLY, DEBUGGING
 7 .debug line
                 00000201 00000000 00000000 00000e92 2**0
                 CONTENTS, RELOC, READONLY, DEBUGGING
                 000005e2 00000000 00000000 00001093 2**0
 8 .debug str
                 CONTENTS, READONLY, DEBUGGING
 9 .comment
                 0000007c 00000000 00000000 00001675 2**0
                 CONTENTS, READONLY
10 .debug_frame 000000c8 00000000 00000000 000016f4 2**2
                 CONTENTS, RELOC, READONLY, DEBUGGING
11 .ARM.attributes 00000033 00000000 00000000 000017bc 2**0
                 CONTENTS, READONLY
```

Figure 17 sections 1

```
file format elf32-littlearm
driver.o:
Sections:
Idx Name
                 Size
                         VMA
                                     LMA
                                              File off Algn
 0 .text
                 000000c4 00000000 00000000 00000034 2**2
                 CONTENTS, ALLOC, LOAD, READONLY, CODE
 1 .data
                 00000000 00000000 00000000 000000f8 2**0
                 CONTENTS, ALLOC, LOAD, DATA
 2 .bss
                 00000000 00000000 00000000 000000f8 2**0
                 ALLOC
 3 .debug_info 00000a05 00000000 00000000 000000f8 2**0
                 CONTENTS, RELOC, READONLY, DEBUGGING
 4 .debug_abbrev 000001de 00000000 00000000 00000afd 2**0
                 CONTENTS, READONLY, DEBUGGING
                 00000140 00000000 00000000 00000cdb 2**0
 5 .debug_loc
                 CONTENTS, READONLY, DEBUGGING
 6 .debug_aranges 00000020 00000000 00000000 00000e1b 2**0
                 CONTENTS, RELOC, READONLY, DEBUGGING
 7 .debug_line
                 000002ca 00000000 00000000 00000e3b 2**0
                 CONTENTS, RELOC, READONLY, DEBUGGING
00000563 00000000 00000000 00001105 2**0
 8 .debug_str
                 CONTENTS, READONLY, DEBUGGING
                 0000007c 00000000 00000000 00001668 2**0
 9 .comment
                 CONTENTS, READONLY
10 .debug_frame 000000a0 00000000 00000000 000016e4 2**2
                 CONTENTS, RELOC, READONLY, DEBUGGING
11 .ARM.attributes 00000033 00000000 00000000 00001784 2**0
                 CONTENTS, READONLY
          file format elf32-littlearm
main.o:
Sections:
                 Size
Idx Name
                           VMA
                                     LMA
                                               File off Algn
                 00000080 00000000 00000000 00000034 2**2
 0 .text
                 CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE
 1 .data
                 00000000 00000000 00000000 000000b4 2**0
                 CONTENTS, ALLOC, LOAD, DATA
00000000 00000000 00000000 000000b4 2**0
 2 .bss
                 ALLOC
 3 .debug info
                 00000a9a 00000000 00000000 000000b4 2**0
                 CONTENTS, RELOC, READONLY, DEBUGGING
 4 .debug_abbrev 000001d6 00000000 00000000 00000b4e 2**0
                 CONTENTS, READONLY, DEBUGGING
                 00000058 00000000 00000000 00000d24 2**0
 5 .debug loc
                 CONTENTS, READONLY, DEBUGGING
 6 .debug_aranges 00000020 00000000 00000000 00000d7c 2**0
                 CONTENTS, RELOC, READONLY, DEBUGGING
 7 .debug_line
                00000238 00000000 00000000 00000d9c 2**0
                 CONTENTS, RELOC, READONLY, DEBUGGING
                 00000627 00000000 00000000 00000fd4 2**0
 8 .debug str
                 CONTENTS, READONLY, DEBUGGING
                 0000007c 00000000 00000000 000015fb 2**0
 9 .comment
                 CONTENTS, READONLY
10 .debug frame 00000048 00000000 00000000 00001678 2**2
                 CONTENTS, RELOC, READONLY, DEBUGGING
11 .ARM.attributes 00000033 00000000 00000000 000016c0 2**0
                 CONTENTS, READONLY
```

Figure 18 sections 2

	ions:					
dx	Name	THE DEVELOPE OF	VMA	LMA	File off	1000
0	.text	00000058	00000000	00000000	00000034	2**2
		CONTENTS,	ALLOC, LO	AD, RELOC,	READONLY,	CODE
1	.data		00000000 ALLOC, LO		0000008c	2**2
2	.bss		CONTRACTOR STATE		00000090	2**2
3	.debug_info	00000a62		00000000 ADONLY, DE	00000090 BUGGTNG	2**0
4	.debug_abbrev	0000020e	00000000		00000af2	2**0
5	.debug_loc	00000088	00000000	00000000	00000d00	2**0
6	.debug_arange	s 00000020	00000000		00000d88	2**0
7	.debug_line	000002d8	00000000		00000da8	2**0
8	.debug_str	TO CONTROL OF THE PARTY OF THE	30 80 00 00 00 Table 100	ADONLY, DEI 00000000	BUGGING 00001080	2**0
9	.comment			DEBUGGING	0000160e	2**0
		CONTENTS,	READONLY			
10	.debug_frame		RELOC, REA			2**2
1	.ARM.attribut	es 00000033 CONTENTS,	3 00000000			2**0
	.ARM.attribut	CONTENTS,	READONLY	9000000		9 2**0
er		CONTENTS,	3 00000000 READONLY ≘1f32-litt	0 00000000		3 2**0
er	nsor.o: fi	CONTENTS,	3 00000000 READONLY ≘1f32-litt	0 00000000		
er	nsor.o: fi	CONTENTS, le format d Size	3 00000000 READONLY ≥1f32-litt	0 00000000	0 000016e0	Algn
er	nsor.o: fi ions: Name	CONTENTS, le format of Size 00000080	3 00000000 READONLY ≥1f32-litt: VMA 00000000	0 00000000 learm LMA 00000000	0 000016e0	Algn 2**2
ser ect dx 0	nsor.o: fi ions: Name	CONTENTS, le format of Size 00000080 CONTENTS, 00000000	READONLY =1f32-litt: VMA 00000000 ALLOC, LOG	0 00000000 learm LMA 00000000 AD, RELOC,	0 000016e0	Algn 2**2 CODE
ser ect dx 0	nsor.o: fi cions: Name .text	CONTENTS, le format of the state of the stat	3 0000000 READONLY 21f32-litt: VMA 00000000 ALLOC, LO 00000000 ALLOC, LO	D 000000000000000000000000000000000000	File off 0000034 READONLY,	Algn 2**2 CODE 2**0
ser dx 0	nsor.o: fi ions: Name .text .data	CONTENTS, le format of Size 00000080 CONTENTS, 00000000 CONTENTS, 00000004 ALLOC 00000044e	3 0000000 READONLY elf32-litt: VMA 00000000 ALLOC, LO, 00000000 ALLOC, LO, 00000000	LMA 00000000 AD, RELOC, 0000000 AD, DATA 00000000	File off 00000034 READONLY, 000000b4 000000b4	Algn 2**2 CODE 2**0 2**2
ser dx 0 1 2	nsor.o: fi nsor.o: fi nsor: Name .text .data .bss	CONTENTS, le format of Size 00000080 CONTENTS, 00000000 CONTENTS, 00000004 ALLOC 00000004e CONTENTS, 0000020a	MA 00000000 READONLY ≥1f32-litt: VMA 00000000 ALLOC, LO, 00000000 ALLOC, LO, 00000000 00000000 RELOC, RE, 00000000	LMA 00000000 AD, RELOC, 00000000 AD, DATA 00000000 ADONLY, DEE	File off 0000034 READONLY, 0000004 0000004 0000004 BUGGING 00000002	Algn 2**2 CODE 2**0 2**2 2**0
ser dx 0 1 2	nsor.o: fi ions: Name .text .data .bss .debug_info	Size 00000080 CONTENTS, 00000000 CONTENTS, 00000004 ALLOC 00000044e CONTENTS, 0000020a CONTENTS, 0000009c	MA 00000000 ALLOC, LOV 00000000 ALLOC, LOV 000000000 RELOC, REV 00000000000000000000000000000000000	LMA 00000000 AD, RELOC, 00000000 AD, DATA 00000000 00000000 ADONLY, DEI 00000000 DEBUGGING 00000000	File off 0000034 READONLY, 000000b4 000000b4 000000b4 BUGGING 00000b02	Algn 2**2 CODE 2**0 2**2 2**0 2**0
ser dx 0 1 2 3 4	nsor.o: fi cions: Name .text .data .bss .debug_info .debug_abbrev	Size 00000080 CONTENTS, 00000000 CONTENTS, 00000004 ALLOC 00000044 CONTENTS, 00000020 CONTENTS, 00000020	MA 0000000 READONLY Plf32-litt: VMA 00000000 ALLOC, LO 00000000 ALLOC, RE 00000000 RELOC, RE 00000000 READONLY, 00000000	LMA 00000000 AD, RELOC, 0000000 AD, DATA 0000000 AD, DATA 00000000 DEBUGGING 00000000 DEBUGGING 000000000	File off 0000034 READONLY, 000000b4 000000b4 000000b4 BUGGING 000000b02 00000d0c	Algn 2**2 CODE 2**0 2**2 2**0 2**0 2**0
ser dx 0 1 2 3 4 5	nsor.o: fi cions: Name .text .data .bss .debug_info .debug_abbrev .debug_loc	Size 00000080 CONTENTS, 00000000 CONTENTS, 00000004 ALLOC 00000044 CONTENTS, 0000020a CONTENTS, 0000009c CONTENTS, 5 00000020 CONTENTS,	MA 00000000 READONLY P1f32-litt: VMA 00000000 ALLOC, LOO 00000000 MLLOC, READONLY, 00000000 READONLY, 00000000 READONLY, 000000000 RELOC, READONLY, 0000000000 RELOC, READONLY, 000000000000000000000000000000000000	LMA 00000000 AD, RELOC, 0000000 AD, DATA 0000000 ADONLY, DEI 0000000 DEBUGGING 0000000 ADONLY, DEI 00000000 ADONLY, DEI	File off 0000034 READONLY, 000000b4 000000b4 000000b4 BUGGING 000000b02 00000d0c	Algn 2**2 CODE 2**0 2**2 2**0 2**0 2**0
ser ect dx 0 1 2 3 4 5	nsor.o: file ions: Name .text .data .bss .debug_info .debug_abbrev .debug_loc .debug_arange:	Size 00000080 CONTENTS, 00000000 CONTENTS, 00000004 ALLOC 00000044e CONTENTS, 0000020a CONTENTS, 0000009c CONTENTS, 000000000000000000000000000000000000	MA 0000000 READONLY ≥1f32-litt: VMA 00000000 ALLOC, LO 00000000 ALLOC, EO 00000000 RELOC, RE 00000000 READONLY, 00000000 READONLY, 00000000 RELOC, RE 00000000 RELOC, RE 00000000 RELOC, RE 00000000 RELOC, RE 00000000	LMA 00000000 AD, RELOC, 00000000 AD, DATA 00000000 ADONLY, DEI 00000000 DEBUGGING 0000000 DEBUGGING 0000000 ADONLY, DEI 00000000 ADONLY, DEI 00000000 ADONLY, DEI 00000000 ADONLY, DEI 00000000	File off 00000034 READONLY, 000000b4 000000b4 000000b4 BUGGING 000000000 000000000000000000000000	Algn 2**2 CODE 2**0 2**2 2**0 2**0 2**0 2**0
ser ect dx 0 1 2 3 4 5 6 7	nsor.o: file cions: Name .text .data .bss .debug_info .debug_abbrev .debug_loc .debug_arange: .debug_line .debug_str	Size 00000080 CONTENTS, 00000000 CONTENTS, 00000004 ALLOC 00000044e CONTENTS, 0000020a CONTENTS, 00000020	WMA 00000000 ALLOC, LO 00000000 ALLOC, LO 00000000 ALLOC, RE 00000000 RELOC, RE 00000000 READONLY, 00000000 RELOC, RE 00000000	LMA 00000000 AD, RELOC, 00000000 AD, DATA 00000000 ADONLY, DEI 00000000	File off 00000034 READONLY, 000000b4 000000b4 000000b2 00000d0c 00000da8 BUGGING 00000dc8 BUGGING 00000dc8 BUGGING	Algn 2**2 CODE 2**0 2**2 2**0 2**0 2**0 2**0 2**0
ser ect dx 0 1 2 3 4 5 6 7 8	nsor.o: file cions: Name .text .data .bss .debug_info .debug_abbrev .debug_loc .debug_arange: .debug_line .debug_str	CONTENTS, le format of Size 00000080 CONTENTS, 00000000 CONTENTS, 00000004 ALLOC 00000000000000000000000000000000000	MA 0000000 READONLY 21f32-litt: VMA 00000000 ALLOC, LO 00000000 ALLOC, LO 00000000 RELOC, RE 00000000 READONLY, 00000000 RELOC, RE 00000000 RELOC, RE 00000000 RELOC, RE 00000000 RELOC, RE 00000000 READONLY, 00000000 READONLY, 00000000 READONLY, 000000000 READONLY, 000000000 READONLY, 000000000 READONLY, 000000000 READONLY	LMA 00000000 AD, RELOC, 00000000 AD, DATA 00000000 ADONLY, DEI 00000000 DEBUGGING 0000000 ADONLY, DEI 00000000 ADONLY, DEI 00000000 ADONLY, DEI 00000000 ADONLY, DEI 00000000 ADONLY, DEI 000000000 ADONLY, DEI 000000000	File off 0000034 READONLY, 000000b4 000000b4 000000b2 00000doc 00000da8 BUGGING 00000dc8 BUGGING 00000dc8 BUGGING 000010a3	Algn 2**2 CODE 2**0 2**2 2**0 2**0 2**0 2**0 2**0 2**

Figure 19 sections 3

```
startup.o:
              file format elf32-littlearm
Sections:
                  Size
                            VMA
                                      LMA
                                                 File off Algn
Idx Name
  0 .text
                  00000090 00000000 00000000 00000034 2**2
                  CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE
 1 .data
                  00000000 00000000 00000000 000000c4 2**0
                  CONTENTS, ALLOC, LOAD, DATA
00000000 00000000 00000000 000000c4 2**0
 2 .bss
                  ALLOC
  3 .vectors
                  0000001c 00000000 00000000 000000c4 2**2
                  CONTENTS, ALLOC, LOAD, RELOC, DATA
                  000001c3 00000000 00000000 000000e0 2**0
  4 .debug info
                  CONTENTS, RELOC, READONLY, DEBUGGING
  5 .debug_abbrev 000000d6 00000000 00000000 000002a3 2**0
                  CONTENTS, READONLY, DEBUGGING
  6 .debug loc
                  0000007c 00000000 00000000 00000379 2**0
                  CONTENTS, READONLY, DEBUGGING
  7 .debug_aranges 00000020 00000000 00000000 000003f5 2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  8 .debug line
                  00000207 00000000 00000000 00000415 2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING 000001cd 00000000 00000000 0000061c 2**0
 9 .debug_str
                  CONTENTS, READONLY, DEBUGGING
                  0000007c 00000000 00000000 000007e9 2**0
CONTENTS, READONLY
10 .comment
11 .debug_frame 00000050 00000000 00000000 00000868 2**2
                  CONTENTS, RELOC, READONLY, DEBUGGING
12 .ARM.attributes 00000033 00000000 00000000 000008b8 2**0
                  CONTENTS, READONLY
HighPessureDetection.elf:
                           file format elf32-littlearm
Sections:
                                                 File off Algn
Idx Name
                           VMA
                  Size
                                      LMA
 0 .text
                  00000404 08000000 08000000 00010000 2**2
                  CONTENTS, ALLOC, LOAD, READONLY, CODE
                  00000004 20000000 08000404 00020000 2**2
 1 .data
                  CONTENTS, ALLOC, LOAD, DATA
                  00006da4 00000000 00000000 00020004 2**2
 2 .debug
                  CONTENTS, READONLY, DEBUGGING
                  0000007b 00000000 00000000 00026da8 2**0 CONTENTS, READONLY
 3 .comment
  4 .ARM.attributes 00000033 00000000 00000000 00026e23 2**0
                  CONTENTS, READONLY 00001024 20000004 20000004 00020004 2**2
  5 .bss
                  ALLOC
```

Figure 20 sections 4