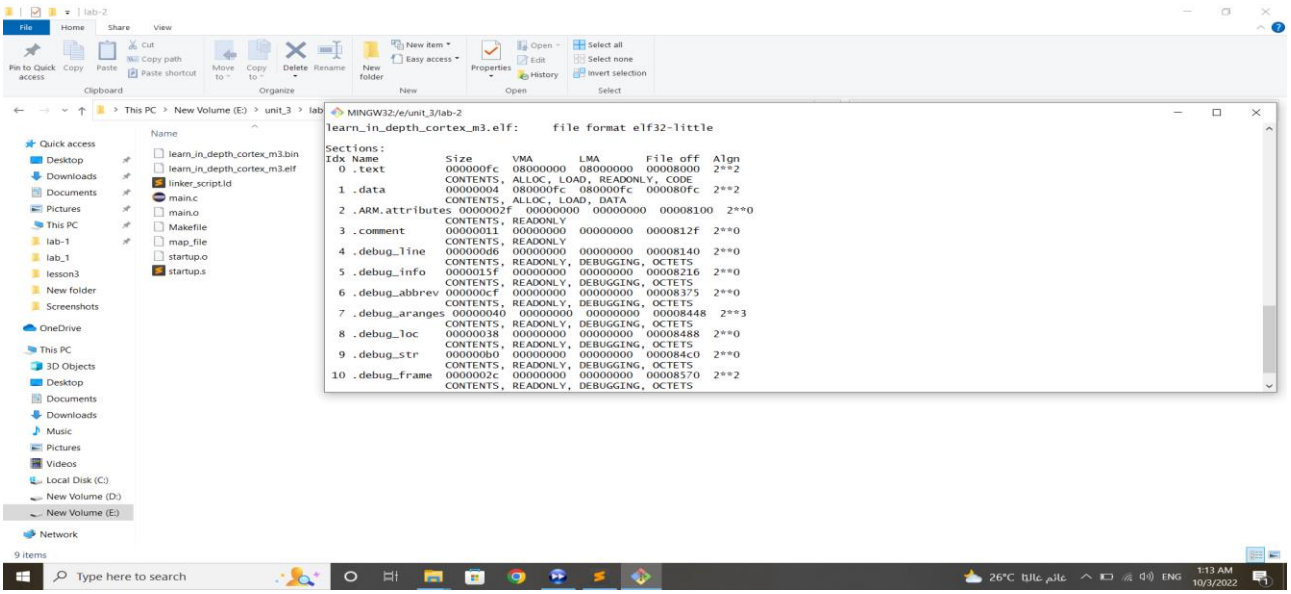
Embedded c lesson 3 lab2

AYMAN_GAMAL

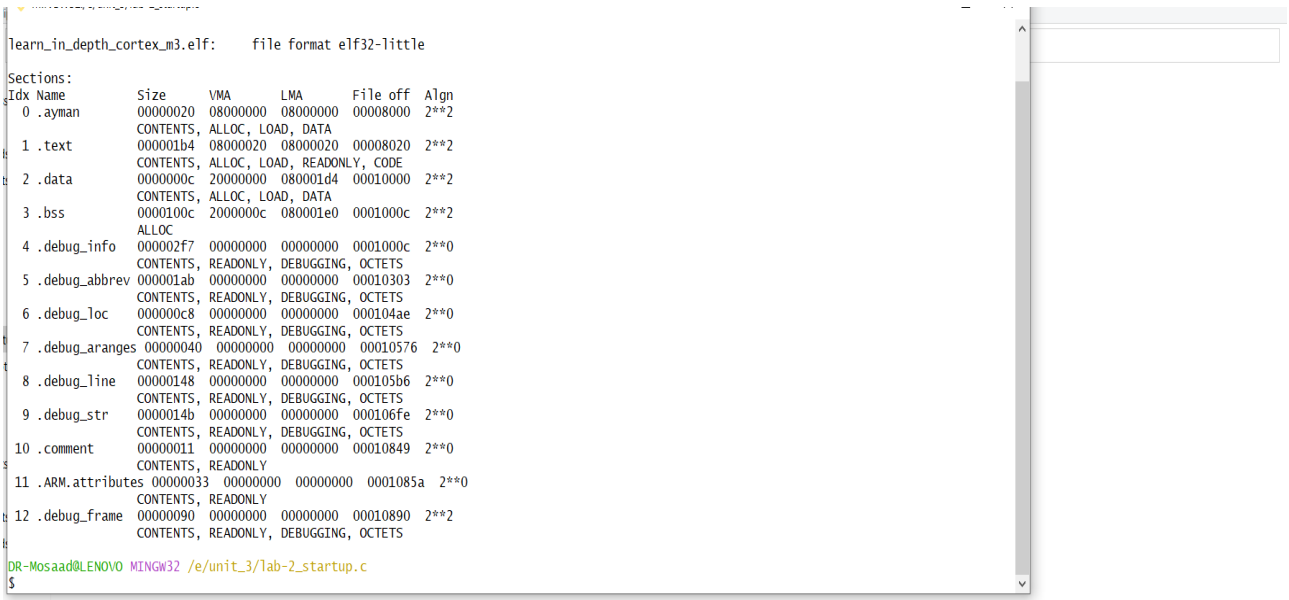
STEPS

- Create main.c (using touch)
- Creat linkerscript.ld and startup.s/.c (using touch)
- creat makefile (to comiple all file in this location with cross toolchain)
- and get learn_in_depth_cortexm3.bin ,app.o,main.o,startup.o l learn_in_depth_cortexm3.elf (from makefile)
    - bass learn_in_depth_cortexm3.bin to our machine
      Hint(I use debug from cross toolchain (-gdwarf-2))

- **sections**



this using startup



symbols

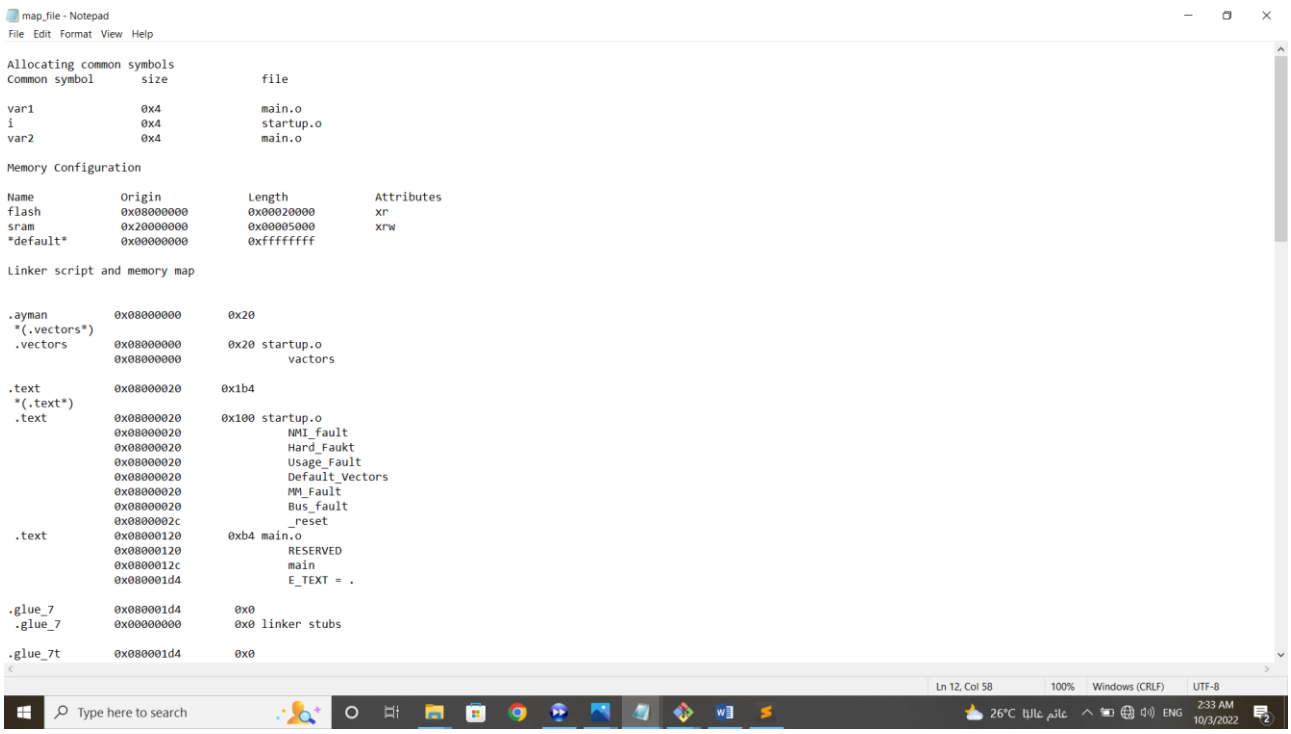
```
MINGW32:/c/Users/DR-Mosaad/Desktop/Master-Embedded-System/Unit 3 (Embedded c)/lesson 3/lab-2_startup.c
DR-Mosaad@LENOVO MINGW32 ~/Desktop/Master-Embedded-System/Unit 3 (Embedded c)/lesson 3/lab-2_startup.c (main)
$ arm-none-eabi-nm.exe learn_in_depth_cortex_m3.elf
080000e0 T _reset
20000004 D array
080000d4 W Bus_fault
080000d4 T Default_Vectors
2000000c B E_BSS
2000000c D E_DATA
080001d4 T E_TEXT
080000d4 W Hard_Faukt
20001014 B i
0800002c T main
080000d4 W MM_Fault
080000d4 W NMI_fault
20000000 D P_ODR
08000020 T RESERVED
2000000c B S_BSS
20000000 D S_DATA
2000100c B stck_top
080000d4 W Usage_Fault
08000000 T vactors
2000100c B var1
20001010 B var2

DR-Mosaad@LENOVO MINGW32 ~/Desktop/Master-Embedded-System/Unit 3 (Embedded c)/lesson 3/lab-2_startup.c (main)
$
```

- ## Mapfile

Old using starrup.s

```
E:\unit_3\lab-2\map_file - Sublime Text (UNREGISTERED)
File Edit Selection Find View Goto Tools Project Preferences Help
map_fileold | startup.s | map_file | linker_script.ld

Name             Origin             Length             Attributes
flash            0x08000000         0x00020000         xr
sram             0x20000000         0x00005000         xrw
*default*        0x00000000         0xffffffff

Linker script and memory map


.ayman          0x08000000       0xfc
 *(.vectors*)
 .vectors       0x08000000       0x4c startup.o
 *(.text*)
 .text          0x0800004c        0x8 startup.o
 .text          0x08000054       0xa8 main.o
                0x08000054             main

.glue_7         0x080000fc        0x0
 .glue_7        0x00000000        0x0 linker stubs

.glue_7t        0x080000fc        0x0
 .glue_7t       0x00000000        0x0 linker stubs

.vfp11_veneer   0x080000fc        0x0
 .vfp11_veneer  0x00000000        0x0 linker stubs

.v4_bx          0x080000fc        0x0
 .v4_bx         0x00000000        0x0 linker stubs

.iplt           0x080000fc        0x0
 .iplt          0x00000000        0x0 startup.o

.rel.dyn        0x080000fc        0x0
 .rel.iplt      0x00000000        0x0 startup.o

.data           0x080000fc        0x4
 *(.data*)
 .data          0x080000fc        0x0 startup.o
 .data          0x080000fc        0x4 main.o

Line 1, Column 1                                                    Spaces: 4  Plain Text
Type here to search   26°C  ENG  2:31 AM 10/3/2022
```

Using Startub.c



```
map_file - Notepad
File  Edit  Format  View  Help

Allocating common symbols
Common symbol       size              file

var1                0x4               main.o
i                   0x4               startup.o
var2                0x4               main.o

Memory Configuration

Name             Origin             Length             Attributes
flash            0x08000000         0x00020000         xr
sram             0x20000000         0x00005000         xrw
*default*        0x00000000         0xffffffff

Linker script and memory map


.ayman          0x08000000       0x20
 *(.vectors*)
 .vectors       0x08000000       0x20 startup.o
                0x08000000                vactors

.text           0x08000020      0x1b4
 *(.text*)
 .text          0x08000020      0x100 startup.o
                0x08000020                NMI_fault
                0x08000020                Hard_Faukt
                0x08000020                Usage_Fault
                0x08000020                Default_Vectors
                0x08000020                MM_Fault
                0x08000020                Bus_fault
                0x0800002c                _reset
 .text          0x08000120       0xb4 main.o
                0x08000120                RESERVED
                0x0800012c                main
                0x080001d4                E_TEXT = .

.glue_7         0x080001d4        0x0
 .glue_7        0x00000000        0x0 linker stubs

.glue_7t        0x080001d4        0x0

                                                  Ln 12, Col 58   100%   Windows (CRLF)   UTF-8
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```
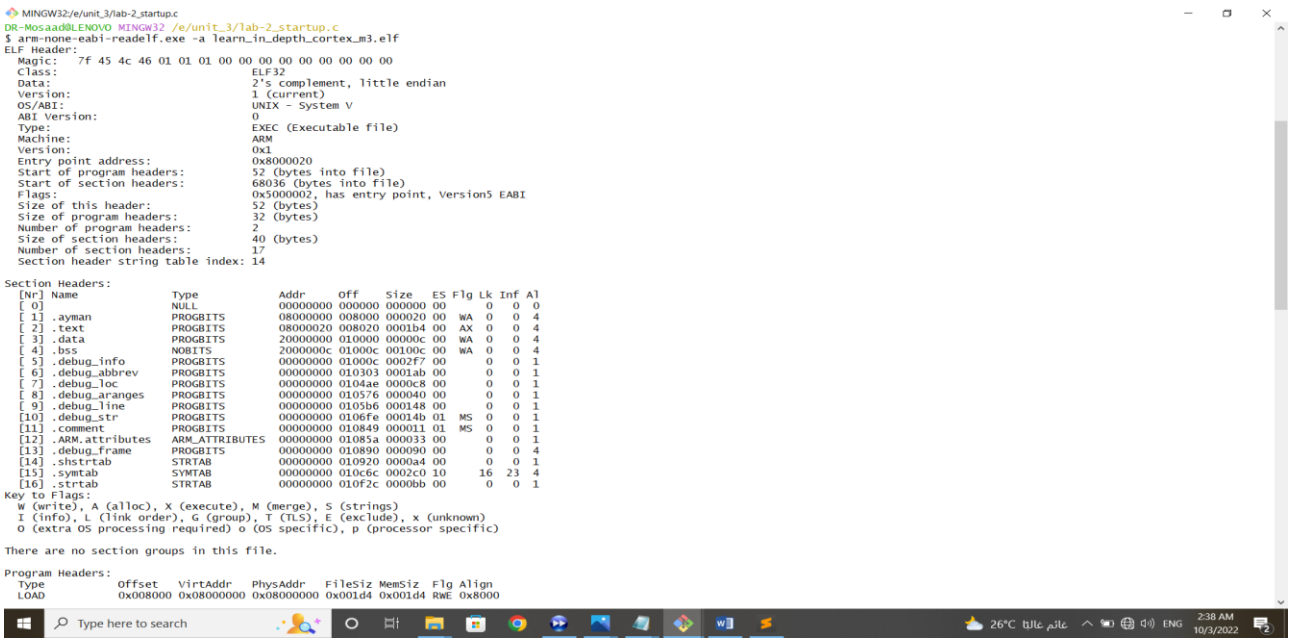

Readelf



```
MINGW32:/e/unit_3/lab-2_startup.c
DR-Mosaad@LENOVO MINGW32 /e/unit_3/lab-2_startup.c
$ arm-none-eabi-readelf.exe -a learn_in_depth_cortex_m3.elf
ELF Header:
  Magic:   7f 45 4c 46 01 01 01 00 00 00 00 00 00 00 00 00
  Class:                             ELF32
  Data:                              2's complement, little endian
  Version:                           1 (current)
  OS/ABI:                            UNIX - System V
  ABI Version:                       0
  Type:                              EXEC (Executable file)
  Machine:                           ARM
  Version:                           0x1
  Entry point address:               0x8000020
  Start of program headers:          52 (bytes into file)
  Start of section headers:          68036 (bytes into file)
  Flags:                             0x5000002, has entry point, Version5 EABI
  Size of this header:               52 (bytes)
  Size of program headers:           32 (bytes)
  Number of program headers:         2
  Size of section headers:           40 (bytes)
  Number of section headers:         17
  Section header string table index: 14

Section Headers:
  [Nr] Name              Type            Addr     Off    Size   ES Flg Lk Inf Al
  [ 0]                   NULL            00000000 000000 000000 00      0   0  0
  [ 1] .ayman            PROGBITS        08000000 008000 000020 00  WA  0   0  4
  [ 2] .text             PROGBITS        08000020 008020 0001b4 00  AX  0   0  4
  [ 3] .data             PROGBITS        20000000 010000 00000c 00  WA  0   0  4
  [ 4] .bss              NOBITS          2000000c 01000c 00100c 00  WA  0   0  4
  [ 5] .debug_info       PROGBITS        00000000 01000c 0002f7 00      0   0  1
  [ 6] .debug_abbrev     PROGBITS        00000000 010303 0001ab 00      0   0  1
  [ 7] .debug_loc        PROGBITS        00000000 0104ae 0000c8 00      0   0  1
  [ 8] .debug_aranges    PROGBITS        00000000 010576 000040 00      0   0  1
  [ 9] .debug_line       PROGBITS        00000000 0105b6 000148 00      0   0  1
  [10] .debug_str        PROGBITS        00000000 0106fe 00014b 01  MS  0   0  1
  [11] .comment          PROGBITS        00000000 010849 000011 01  MS  0   0  1
  [12] .ARM.attributes   ARM_ATTRIBUTES  00000000 01085a 000033 00      0   0  1
  [13] .debug_frame      PROGBITS        00000000 010890 000090 00      0   0  4
  [14] .shstrtab         STRTAB          00000000 010920 0000a4 00      0   0  1
  [15] .symtab           SYMTAB          00000000 010c6c 0002c0 10     16  23  4
  [16] .strtab           STRTAB          00000000 010f2c 0000bb 00      0   0  1
Key to Flags:
  W (write), A (alloc), X (execute), M (merge), S (strings)
  I (info), L (link order), G (group), T (TLS), E (exclude), x (unknown)
  O (extra OS processing required) o (OS specific), p (processor specific)

There are no section groups in this file.

Program Headers:
  Type           Offset   VirtAddr   PhysAddr   FileSiz MemSiz  Flg Align
  LOAD           0x008000 0x08000000 0x08000000 0x001d4 0x001d4 RWE 0x8000
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```
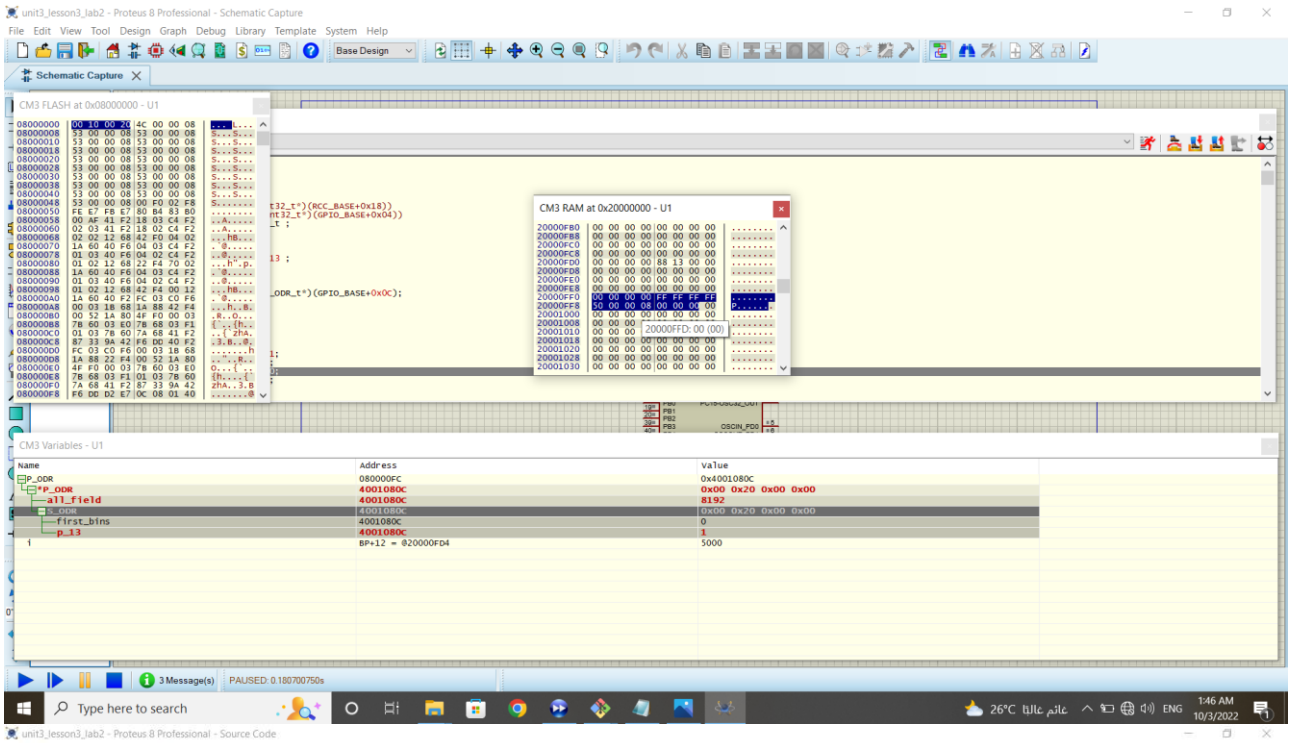
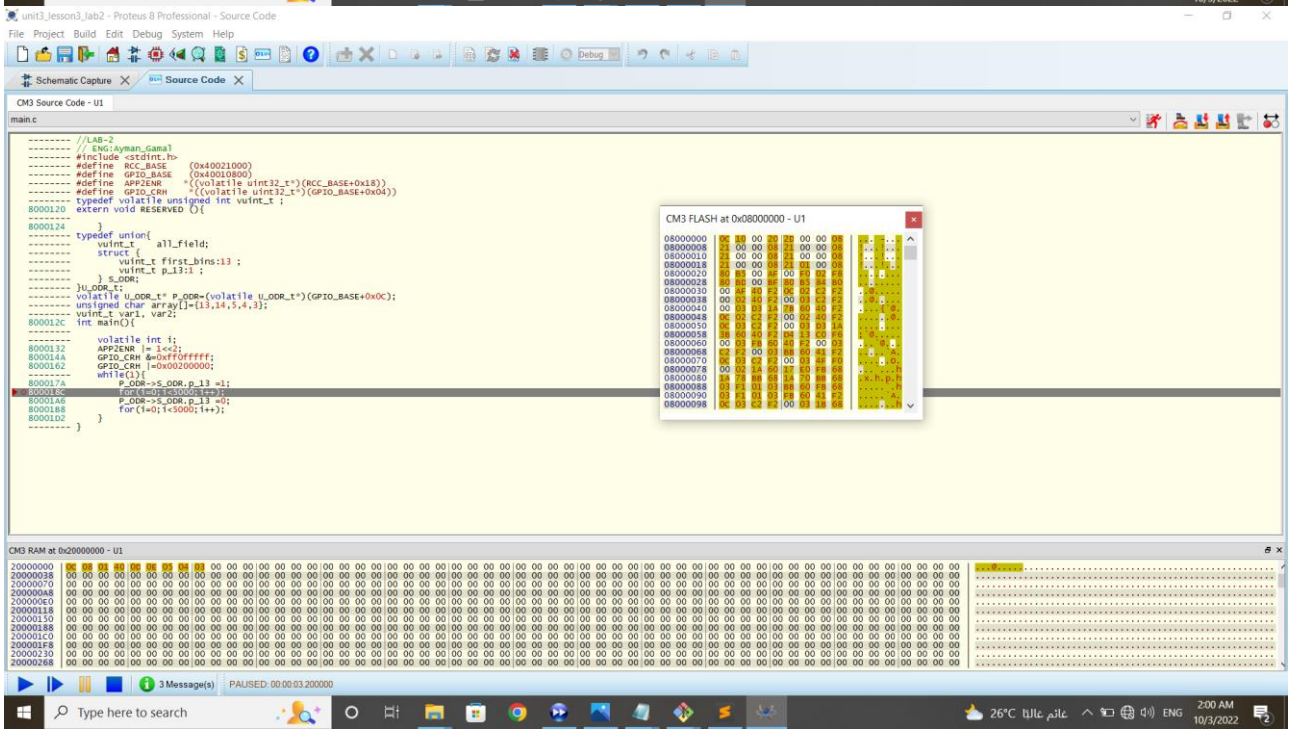
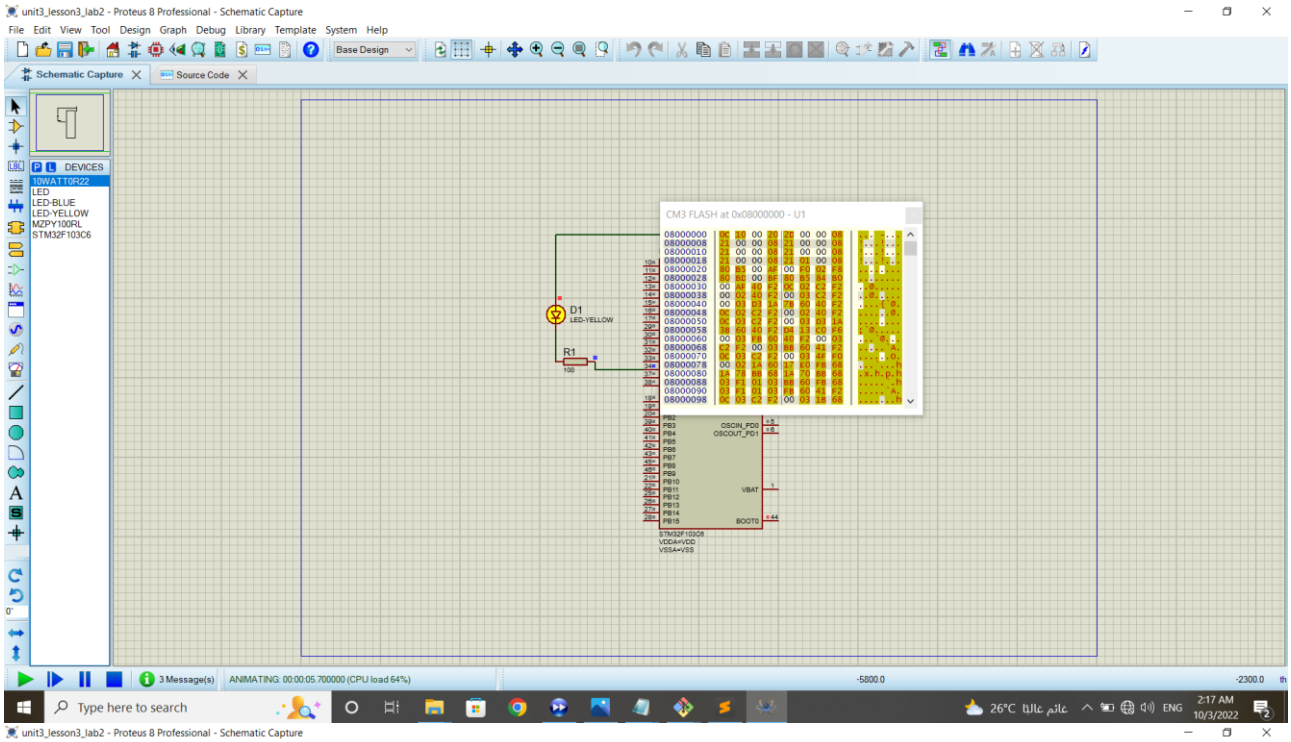
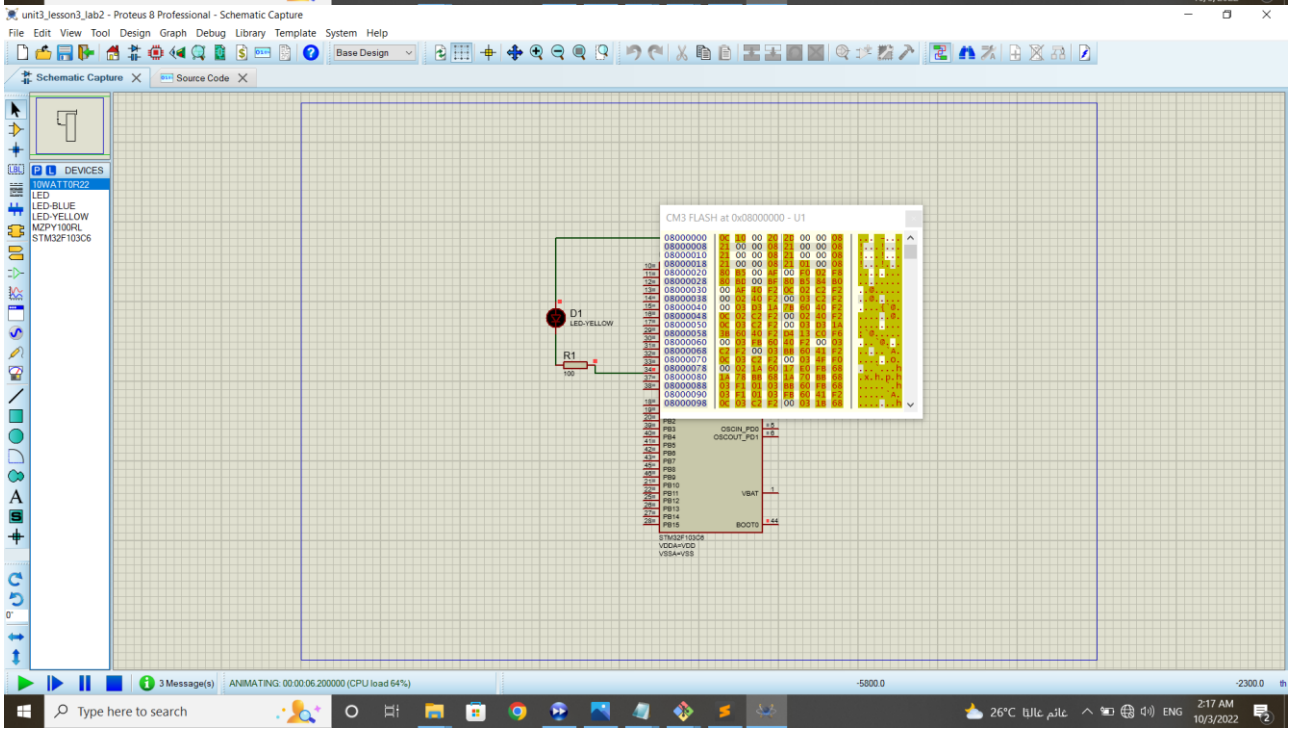
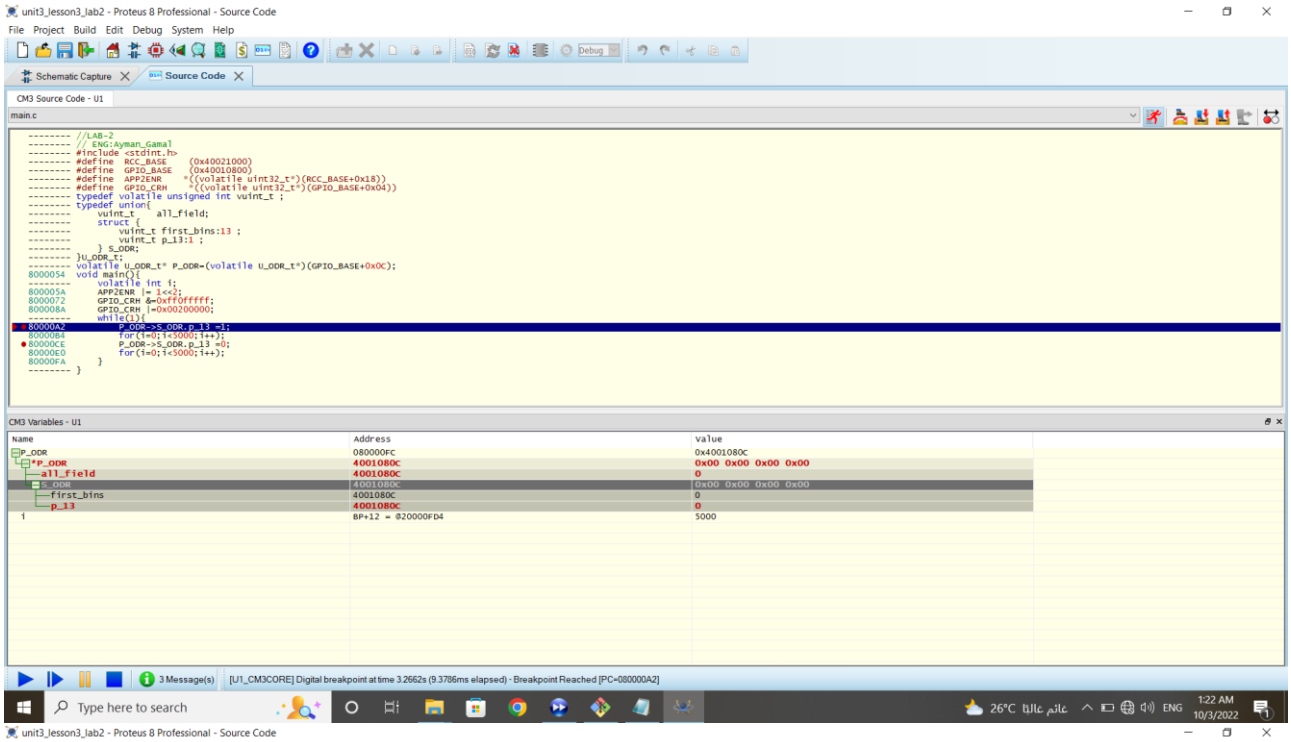

gdb

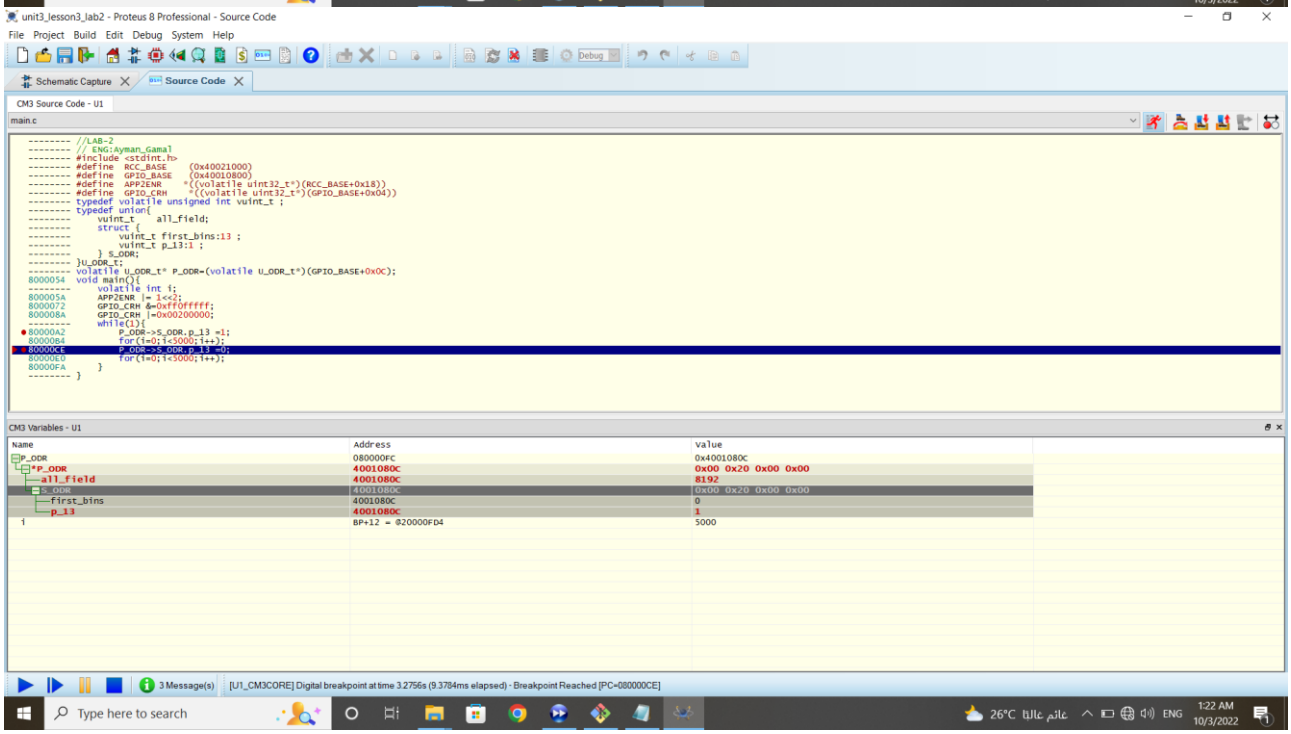

unit3_lesson3_lab2 - Proteus 8 Professional - Schematic Capture
CM3 FLASH at 0x08000000 - U1
CM3 RAM at 0x20000000 - U1
CM3 Variables - U1
Name
Address
Value
P_ODR
080000FC
0x4001080C
*P_ODR
4001080C
0x00 0x20 0x00 0x00
all_field
4001080C
8192
first_bins
4001080C
0
p_13
4001080C
1
BP+12 = @20000FD4
5000
3 Message(s)
PAUSED: 0.180700750s
Type here to search
26°C
ENG
1:46 AM
10/3/2022

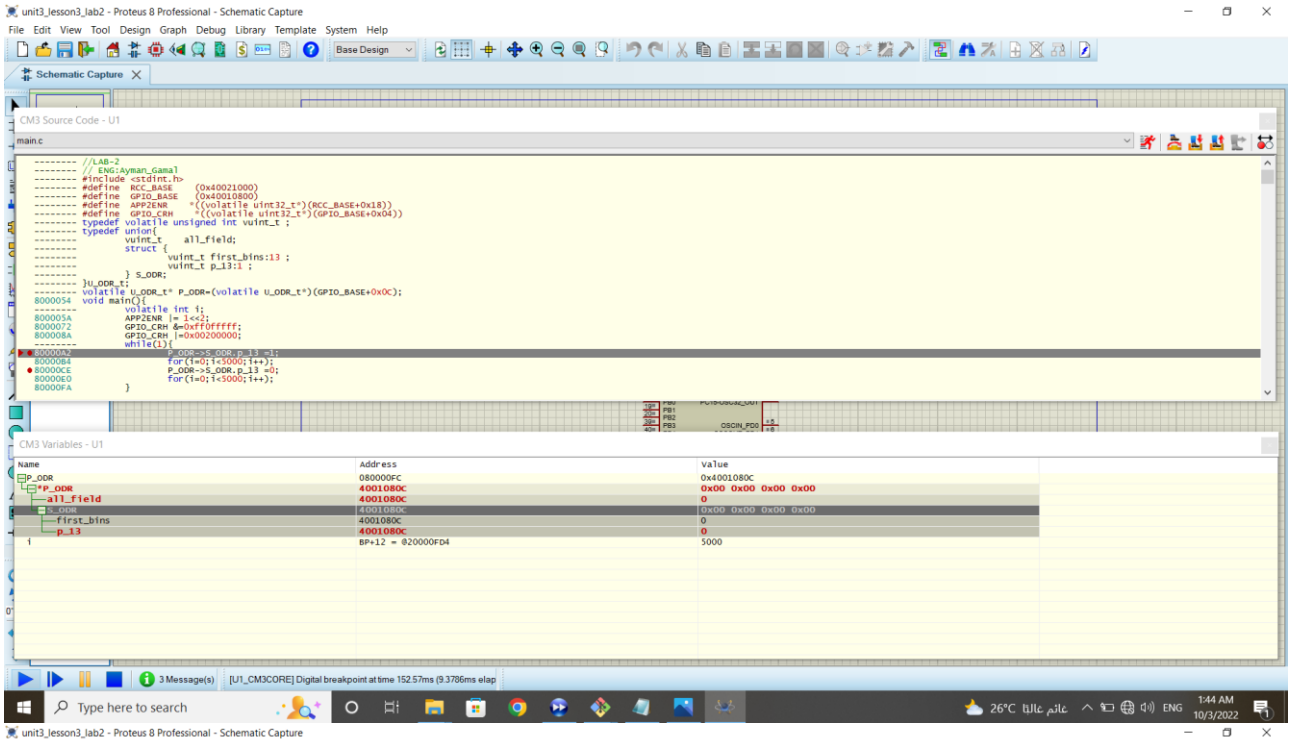

unit3_lesson3_lab2 - Proteus 8 Professional - Source Code
Schematic Capture
Source Code
CM3 Source Code - U1
main.c
CM3 FLASH at 0x08000000 - U1
CM3 RAM at 0x20000000 - U1
3 Message(s)
PAUSED: 00:00:03.200000
Type here to search
26°C
ENG
2:00 AM
10/3/2022

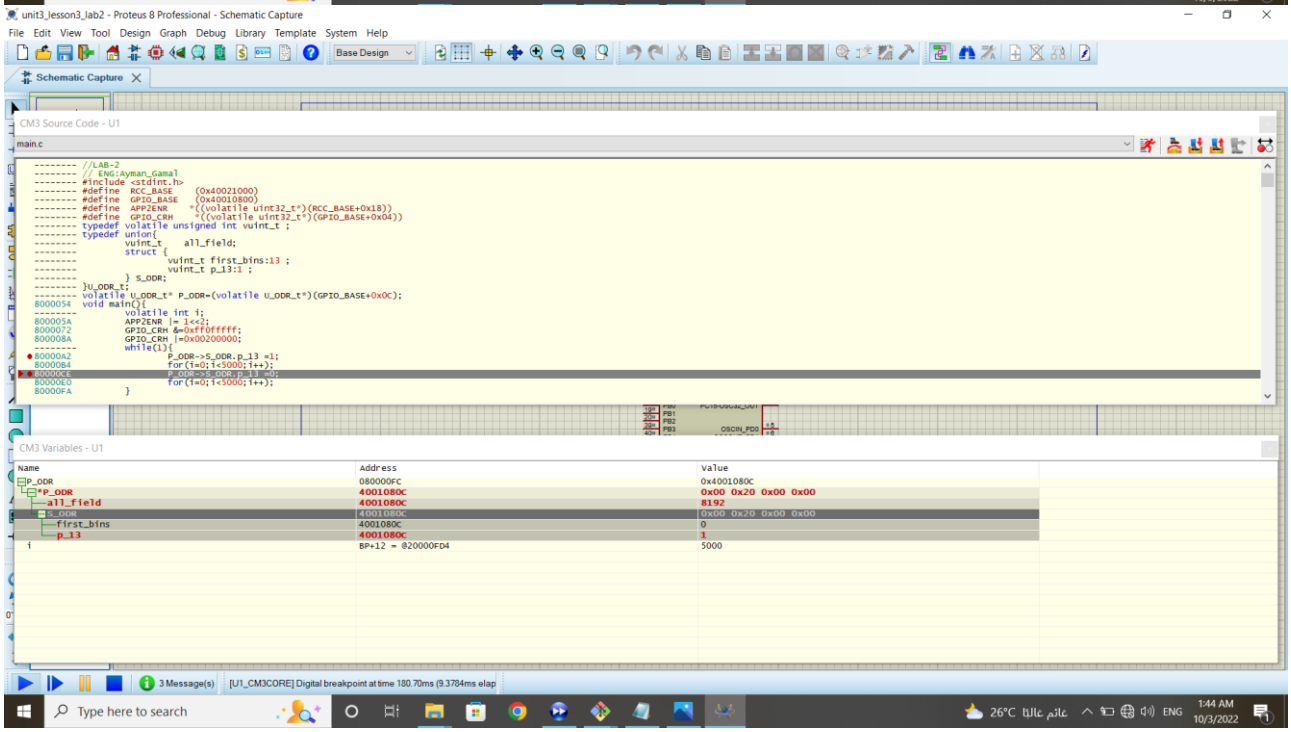

unit3_lesson3_lab2 - Proteus 8 Professional - Schematic Capture
File Edit View Tool Design Graph Debug Library Template System Help
Base Design
Schematic Capture
Source Code
DEVICES
10WATT0R22
LED
LED-BLUE
LED-YELLOW
MZPY100RL
STM32F103C6
CM3 FLASH at 0x08000000 - U1
D1
LED-YELLOW
R1
100
3 Message(s)
ANIMATING: 00:00:05.700000 (CPU load 64%)
-5800.0
-2300.0
Type here to search
26°C
ENG
2:17 AM
10/3/2022

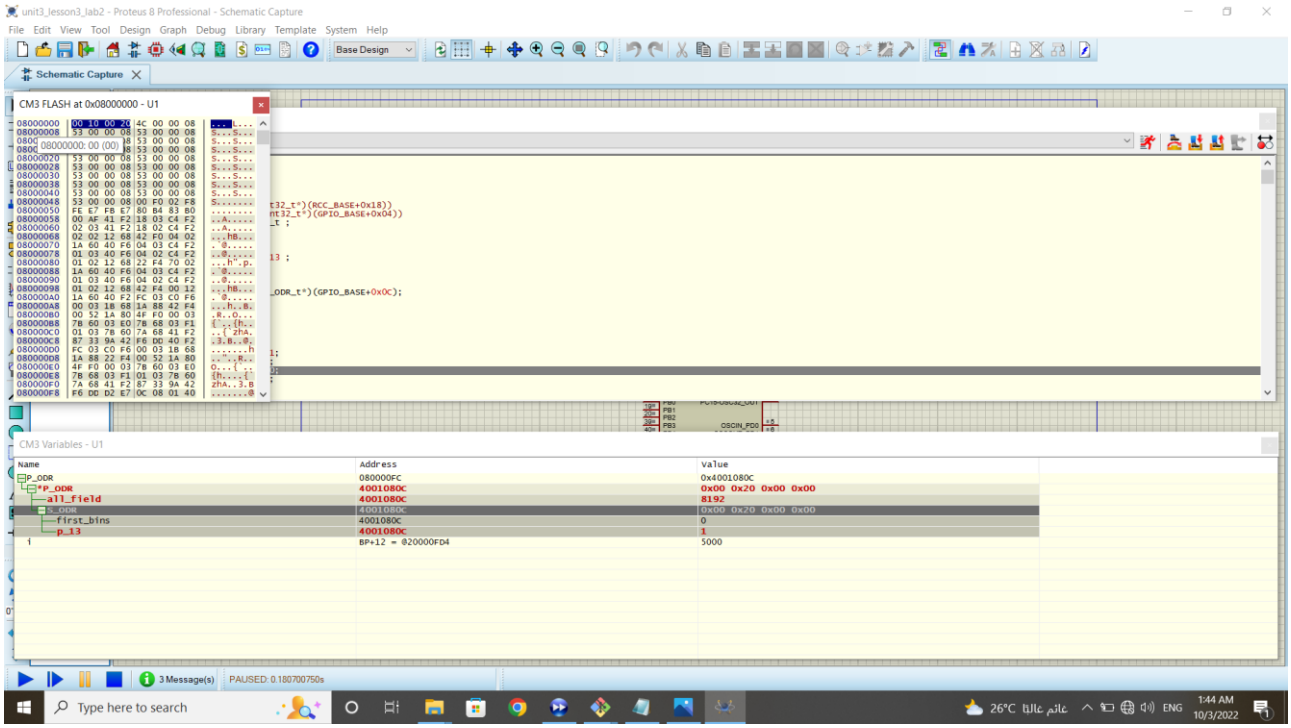

unit3_lesson3_lab2 - Proteus 8 Professional - Schematic Capture
File Edit View Tool Design Graph Debug Library Template System Help
Base Design
Schematic Capture
Source Code
DEVICES
10WATT0R22
LED
LED-BLUE
LED-YELLOW
MZPY100RL
STM32F103C6
CM3 FLASH at 0x08000000 - U1
D1
LED-YELLOW
R1
100
3 Message(s)
ANIMATING: 00:00:06.200000 (CPU load 64%)
-5800.0
-2300.0
Type here to search
26°C
ENG
2:17 AM
10/3/2022


unit3_lesson3_lab2 - Proteus 8 Professional - Source Code
File Project Build Edit Debug System Help
Schematic Capture
Source Code
CM3 Source Code - U1
main.c
//LAB-2
// ENG:Ayman_Gamal
#include <stdint.h>
#define RCC_BASE (0x40021000)
#define GPIO_BASE (0x40010800)
#define APP2ENR *((volatile uint32_t*)(RCC_BASE+0x18))
#define GPIO_CRH *((volatile uint32_t*)(GPIO_BASE+0x04))
typedef volatile unsigned int vuint_t ;
typedef union{
vuint_t all_field;
struct {
vuint_t first_bins:13 ;
vuint_t p_13:1 ;
} S_ODR;
}U_ODR_t;
volatile U_ODR_t* P_ODR=(volatile U_ODR_t*)(GPIO_BASE+0x0C);
void main(){
volatile int i;
APP2ENR |= 1<<2;
GPIO_CRH &=0xff0fffff;
GPIO_CRH |=0x00200000;
while(1){
P_ODR->S_ODR.p_13 =1;
for(i=0;i<3000;i++);
P_ODR->S_ODR.p_13 =0;
for(i=0;i<3000;i++);
}
}
CM3 Variables - U1
Name
Address
Value
P_ODR
080000FC
0x4001080C
*P_ODR
4001080C
0x00 0x00 0x00 0x00
all_field
4001080C
0
S_ODR
4001080C
0x00 0x00 0x00 0x00
first_bins
4001080C
0
p_13
4001080C
0
1
BP+12 = @20000FD4
5000
3 Message(s)
[U1_CM3CORE] Digital breakpoint at time 3.2662s (9.3786ms elapsed) - Breakpoint Reached [PC=080000A2]
Type here to search
26°C
ENG
1:22 AM
10/3/2022


unit3_lesson3_lab2 - Proteus 8 Professional - Source Code
File Project Build Edit Debug System Help
Schematic Capture
Source Code
CM3 Source Code - U1
main.c
//LAB-2
// ENG:Ayman_Gamal
#include <stdint.h>
#define RCC_BASE (0x40021000)
#define GPIO_BASE (0x40010800)
#define APP2ENR *((volatile uint32_t*)(RCC_BASE+0x18))
#define GPIO_CRH *((volatile uint32_t*)(GPIO_BASE+0x04))
typedef volatile unsigned int vuint_t ;
typedef union{
vuint_t all_field;
struct {
vuint_t first_bins:13 ;
vuint_t p_13:1 ;
} S_ODR;
}U_ODR_t;
volatile U_ODR_t* P_ODR=(volatile U_ODR_t*)(GPIO_BASE+0x0C);
void main(){
volatile int i;
APP2ENR |= 1<<2;
GPIO_CRH &=0xff0fffff;
GPIO_CRH |=0x00200000;
while(1){
P_ODR->S_ODR.p_13 =1;
for(i=0;i<3000;i++);
P_ODR->S_ODR.p_13 =0;
for(i=0;i<3000;i++);
}
}
CM3 Variables - U1
Name
Address
Value
P_ODR
080000FC
0x4001080C
*P_ODR
4001080C
0x00 0x20 0x00 0x00
all_field
4001080C
8192
S_ODR
4001080C
0x00 0x20 0x00 0x00
first_bins
4001080C
0
p_13
4001080C
1
1
BP+12 = @20000FD4
5000
3 Message(s)
[U1_CM3CORE] Digital breakpoint at time 3.2756s (9.3784ms elapsed) - Breakpoint Reached [PC=080000CE]
Type here to search
26°C
ENG
1:22 AM
10/3/2022


unit3_lesson3_lab2 - Proteus 8 Professional - Schematic Capture
File Edit View Tool Design Graph Debug Library Template System Help
Schematic Capture
CM3 Source Code - U1
main.c
-------- //LAB-2
-------- // ENG:Ayman_Gamal
-------- #include <stdint.h>
-------- #define RCC_BASE (0x40021000)
-------- #define GPIO_BASE (0x40010800)
-------- #define APP2ENR *((volatile uint32_t*)(RCC_BASE+0x18))
-------- #define GPIO_CRH *((volatile uint32_t*)(GPIO_BASE+0x04))
-------- typedef volatile unsigned int vuint_t ;
-------- typedef union{
-------- vuint_t all_field;
-------- struct {
-------- vuint_t first_bins:13 ;
-------- vuint_t p_13:1 ;
-------- } S_ODR;
-------- }U_ODR_t;
-------- volatile U_ODR_t* P_ODR=(volatile U_ODR_t*)(GPIO_BASE+0x0C);
8000054 void main(){
-------- volatile int i;
800005A APP2ENR |= 1<<2;
8000072 GPIO_CRH &=0xffffffff;
800008A GPIO_CRH |=0x00200000;
-------- while(1){
80000A2 P_ODR->S_ODR.p_13 =1;
80000B4 for(i=0;i<5000;i++);
80000CE P_ODR->S_ODR.p_13 =0;
80000E0 for(i=0;i<5000;i++);
80000FA }
CM3 Variables - U1
Name Address Value
P_ODR 080000FC 0x4001080C
*P_ODR 4001080C 0x00 0x00 0x00 0x00
all_field 4001080C 0
S_ODR 4001080C 0x00 0x00 0x00 0x00
first_bins 4001080C 0
p_13 4001080C 0
1 BP+12 = @20000FD4 5000
3 Message(s)
[U1_CM3CORE] Digital breakpoint at time 152.57ms (9.3786ms elap
Type here to search
26°C
ENG
1:44 AM
10/3/2022


unit3_lesson3_lab2 - Proteus 8 Professional - Schematic Capture
File Edit View Tool Design Graph Debug Library Template System Help
Schematic Capture
CM3 Source Code - U1
main.c
-------- //LAB-2
-------- // ENG:Ayman_Gamal
-------- #include <stdint.h>
-------- #define RCC_BASE (0x40021000)
-------- #define GPIO_BASE (0x40010800)
-------- #define APP2ENR *((volatile uint32_t*)(RCC_BASE+0x18))
-------- #define GPIO_CRH *((volatile uint32_t*)(GPIO_BASE+0x04))
-------- typedef volatile unsigned int vuint_t ;
-------- typedef union{
-------- vuint_t all_field;
-------- struct {
-------- vuint_t first_bins:13 ;
-------- vuint_t p_13:1 ;
-------- } S_ODR;
-------- }U_ODR_t;
-------- volatile U_ODR_t* P_ODR=(volatile U_ODR_t*)(GPIO_BASE+0x0C);
8000054 void main(){
-------- volatile int i;
800005A APP2ENR |= 1<<2;
8000072 GPIO_CRH &=0xffffffff;
800008A GPIO_CRH |=0x00200000;
-------- while(1){
80000A2 P_ODR->S_ODR.p_13 =1;
80000B4 for(i=0;i<5000;i++);
80000CE P_ODR->S_ODR.p_13 =0;
80000E0 for(i=0;i<5000;i++);
80000FA }
CM3 Variables - U1
Name Address Value
P_ODR 080000FC 0x4001080C
*P_ODR 4001080C 0x00 0x20 0x00 0x00
all_field 4001080C 8192
S_ODR 4001080C 0x00 0x20 0x00 0x00
first_bins 4001080C 0
p_13 4001080C 1
1 BP+12 = @20000FD4 5000
3 Message(s)
[U1_CM3CORE] Digital breakpoint at time 180.70ms (9.3784ms elap
Type here to search
26°C
ENG
1:44 AM
10/3/2022


unit3_lesson3_lab2 - Proteus 8 Professional - Schematic Capture
File Edit View Tool Design Graph Debug Library Template System Help
Base Design
Schematic Capture
CM3 FLASH at 0x08000000 - U1
CM3 Variables - U1
Name
Address
Value
P_ODR
080000FC
0x4001080C
*P_ODR
4001080C
0x00 0x20 0x00 0x00
all_field
4001080C
8192
s_ODR
4001080C
0x00 0x20 0x00 0x00
first_bins
4001080C
0
p_13
4001080C
1
1
BP+12 = @20000FD4
5000
3 Message(s)
PAUSED: 0.180700750s
Type here to search
26°C
ENG
1:44 AM
10/3/2022