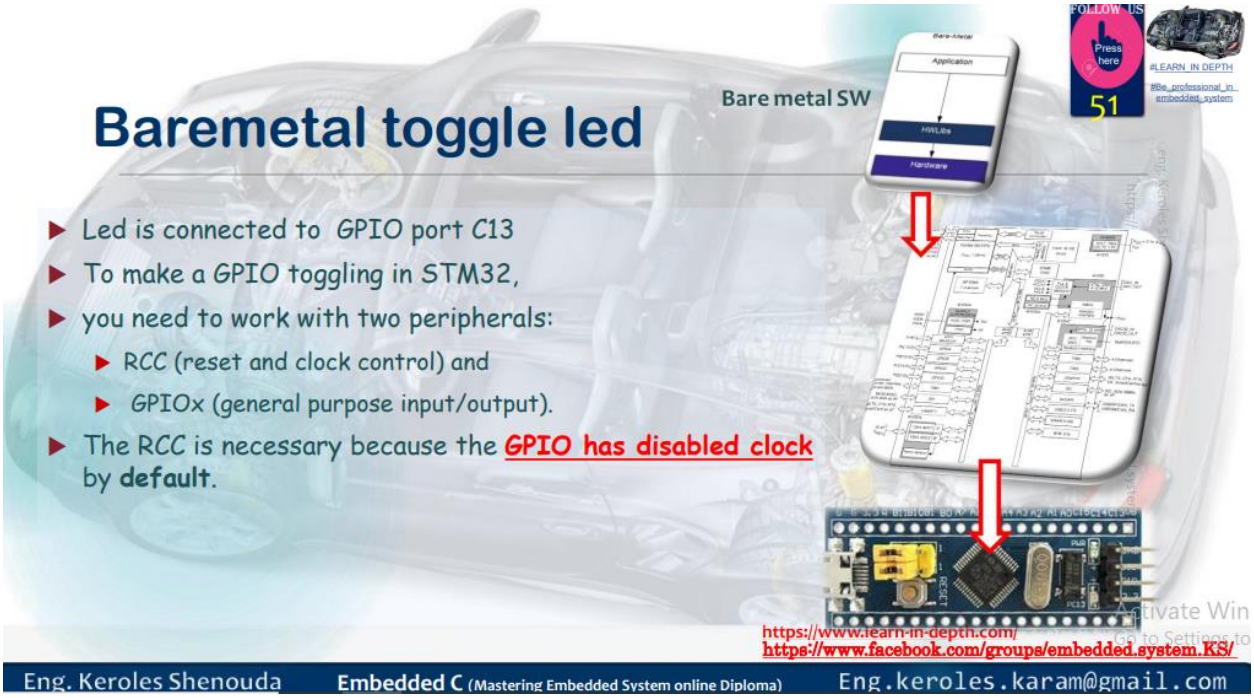
Lab 2

Description:

Create a bare-metal Software to toggle a LED on Stm32f103CX board.



Files Created:

- main.c
- linker_script.ld
- startup.c
- startup.s
- Makefile

Analysis Files:

- main.o
- Map_file.map
- startup.o

Executable Files:

- learn-in-depth_cortex_m3.elf
- learn-in-depth_cortex_m3.bin

Section Headers:

```
El_Amir Tech@DESKTOP-NCOG612 MINGW32 /e/Downloads/Embedded Here We Go Again/Kero
los Shenoda's Diploma/Code/Mastering_Embedded_Systems/Unit3/lesson3 (master)
$ arm-none-eabi-objdump.exe -h main.o

main.o:     file format elf32-littlearm

Sections:
Idx Name          Size      VMA       LMA       File off  Algn
  0 .text         0000007c  00000000  00000000  00000034  2**2
                  CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE
  1 .data         00000007  00000000  00000000  000000b0  2**2
                  CONTENTS, ALLOC, LOAD, DATA
  2 .bss          00000000  00000000  00000000  000000b7  2**0
                  ALLOC
  3 .rodata       00000003  00000000  00000000  000000b8  2**2
                  CONTENTS, ALLOC, LOAD, READONLY, DATA
  4 .debug_info   0000018b  00000000  00000000  000000bb  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  5 .debug_abbrev 000000f8  00000000  00000000  00000246  2**0
                  CONTENTS, READONLY, DEBUGGING
  6 .debug_loc    00000038  00000000  00000000  0000033e  2**0
                  CONTENTS, READONLY, DEBUGGING
  7 .debug_aranges 00000020  00000000  00000000  00000376  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  8 .debug_line   0000012b  00000000  00000000  00000396  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  9 .debug_str    000001cc  00000000  00000000  000004c1  2**0
                  CONTENTS, READONLY, DEBUGGING
 10 .comment      0000007f  00000000  00000000  0000068d  2**0
                  CONTENTS, READONLY
 11 .debug_frame  0000002c  00000000  00000000  0000070c  2**2
                  CONTENTS, RELOC, READONLY, DEBUGGING
 12 .ARM.attributes 00000033  00000000  00000000  00000738  2**0
                  CONTENTS, READONLY
```

Symbols:

```
El_Amir Tech@DESKTOP-NCOG612 MINGW32 /e/Downloads/Embedded Here We Go Again/
$ arm-none-eabi-nm.exe -a learn-in-depth_cortex_m3.elf
00000000 n .ARM.attributes
20000000 b .bss
00000000 n .comment
080000d8 d .data
00000000 N .debug_abbrev
00000000 N .debug_aranges
00000000 N .debug_frame
00000000 N .debug_info
00000000 N .debug_line
00000000 N .debug_loc
00000000 N .debug_str
080000d4 r .rodata
08000000 t .text
080000cc t _reset
20000000 B bss_var
080000d4 R const_varaible
080000dc D g_vaiables
08000050 T main
00000000 a main.c
080000d8 D R_ODR
00000000 a startup.o
080000d2 t Vector_handler
```

main.c | Makefile — lesson3 | Map_file.map

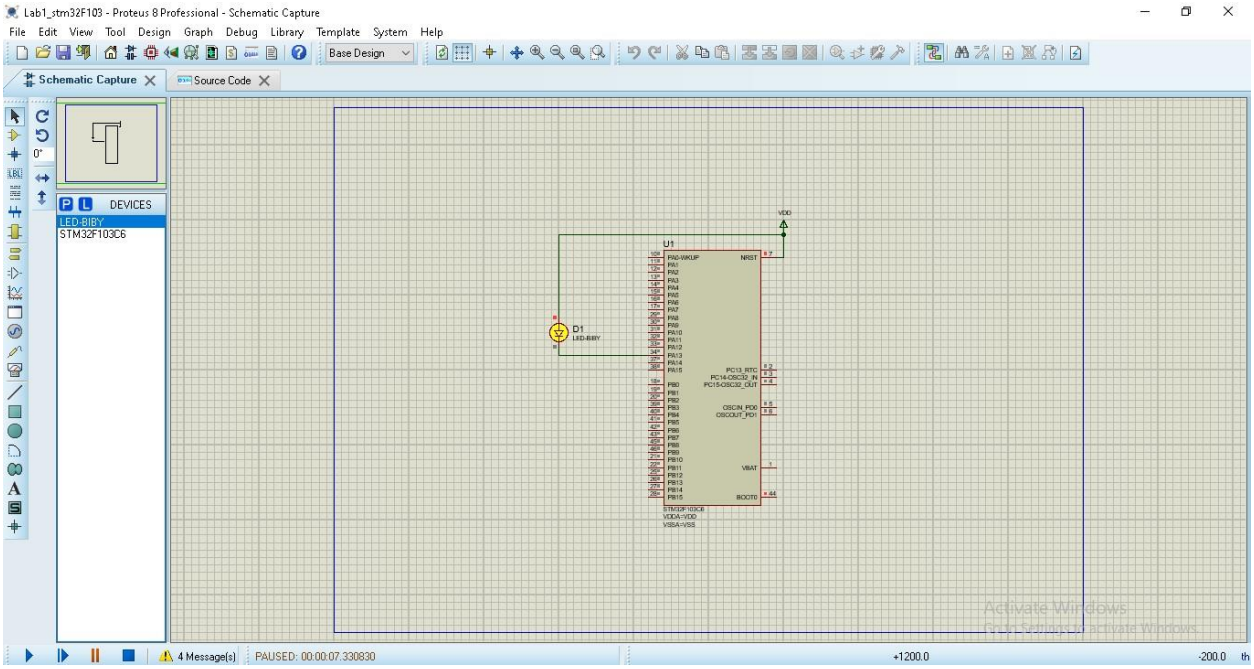
```
Linker script and memory map

.text           0x08000000        0xd4
 *(.vectors*)
 .vectors       0x08000000       0x50 startup.o
 *(.text*)
 .text          0x08000050       0x7c main.o
                0x08000050             main
 .text          0x080000cc        0x8 startup.o

.rodata         0x080000d4        0x3
 .rodata        0x080000d4        0x3 main.o
                0x080000d4             const_varaible

.data           0x080000d8        0x7
 .data          0x080000d8        0x7 main.o
                0x080000d8             R_ODR
                0x080000dc             g_vaiables
 .data          0x080000df        0x0 startup.o

.igot.plt       0x080000e0        0x0
 .igot.plt      0x080000e0        0x0 main.o

.glue_7         0x080000e0        0x0
 .glue_7        0x080000e0        0x0 linker stubs

.glue_7t        0x080000e0        0x0
 .glue_7t       0x080000e0        0x0 linker stubs

.vfp11_veneer   0x080000e0        0x0
 .vfp11_veneer  0x080000e0        0x0 linker stubs

.v4_bx          0x080000e0        0x0
 .v4_bx         0x080000e0        0x0 linker stubs

.iplt           0x080000e0        0x0
 .iplt          0x080000e0        0x0 main.o

.rel.dyn        0x080000e0        0x0
 .rel.iplt      0x080000e0        0x0 main.o

.bss            0x20000000        0x3
 *(.bss*)
 .bss           0x20000000        0x0 main.o
 .bss           0x20000000        0x0 startup.o
 COMMON         0x20000000        0x3 main.o
                0x20000000             bss_var
```

Entry Point:

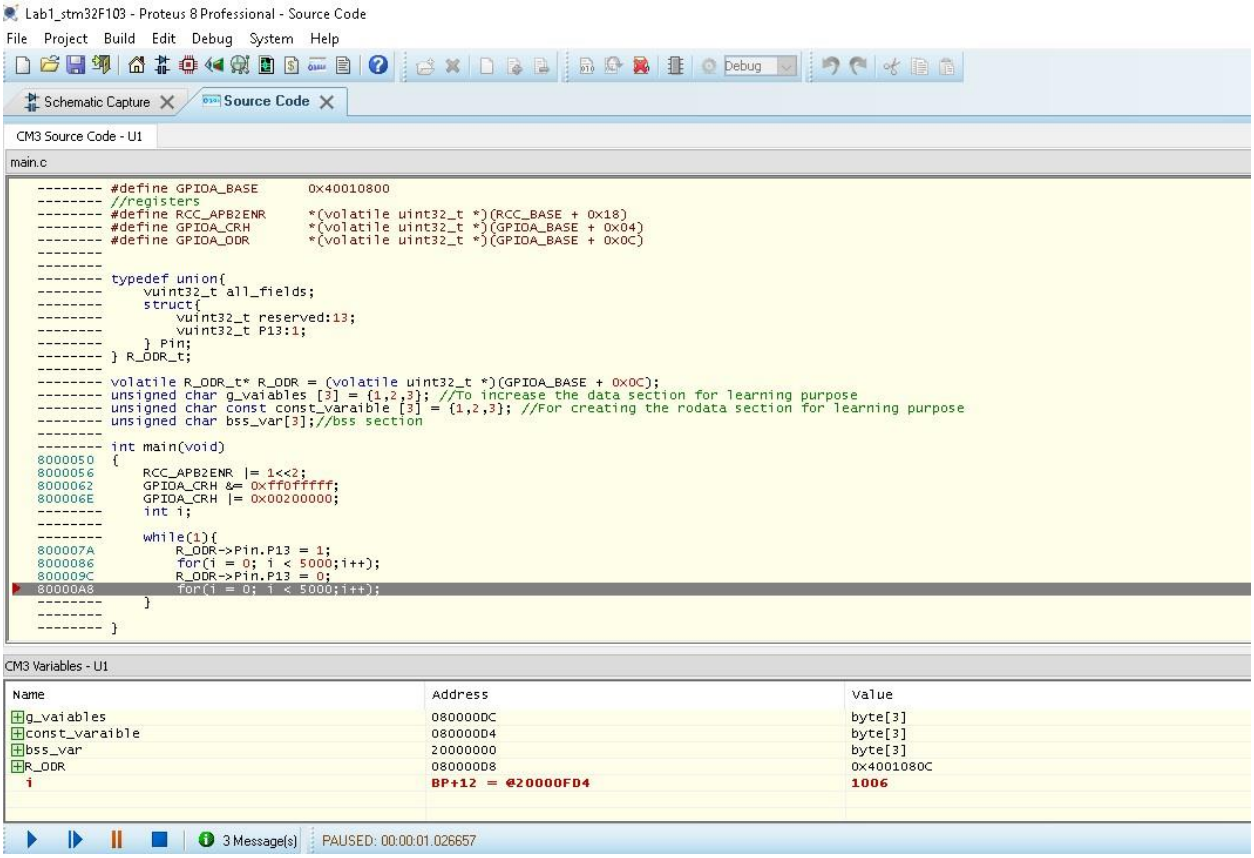
```
Sections:
Idx Name          Size      VMA       LMA       File off  Algn
  0 .text         0000007c  00000000  00000000  00000034  2**2
                  CONTENTS, ALLOC, LOAD, RELOC, READONLY, CODE
  1 .data         00000007  00000000  00000000  000000b0  2**2
                  CONTENTS, ALLOC, LOAD, DATA
  2 .bss          00000000  00000000  00000000  000000b7  2**0
                  ALLOC
  3 .rodata       00000003  00000000  00000000  000000b8  2**2
                  CONTENTS, ALLOC, LOAD, READONLY, DATA
  4 .debug_info   0000018b  00000000  00000000  000000bb  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  5 .debug_abbrev 000000f8  00000000  00000000  00000246  2**0
                  CONTENTS, READONLY, DEBUGGING
  6 .debug_loc    00000038  00000000  00000000  0000033e  2**0
                  CONTENTS, READONLY, DEBUGGING
  7 .debug_aranges 00000020  00000000  00000000  00000376  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  8 .debug_line   0000012b  00000000  00000000  00000396  2**0
                  CONTENTS, RELOC, READONLY, DEBUGGING
  9 .debug_str    000001cc  00000000  00000000  000004c1  2**0
                  CONTENTS, READONLY, DEBUGGING
  Class:                             ELF32
  Data:                              2's complement, little endian
  Version:                           1 (current)
  OS/ABI:                            UNIX - System VNG
  ABI Version:                       0               000738  2**0
  Type:                              EXEC (Executable file)
  Machine:                           ARM
  Version:                           0x1Downloads/Embedded Here We Go Again/Kero
  Entry point address:               0x8000000               lesson3 (master)
  Start of program headers:          52 (bytes into file)
  Start of section headers:          68308 (bytes into file)
  Flags:                             0x5000200, Version5 EABI, soft-float ABI
  Size of this header:               52 (bytes)                              erolos Shenoda's Diploma/Code/
  Size of program headers:           32 (bytes)
  Number of program headers:         2
  Size of section headers:           40 (bytes)00 00 00 00
  Number of section headers:         17
  Section header string table index: 16

Section Headers:
  [Nr] Name              Type            Addr     Off    Size   ES Flg Lk Inf Al
  [ 0]                   NULL            00000000 000000 000000 00      0   0  0
  [ 1] .text             PROGBITS        08000000 010000 0000d4 00  AX  0   0  4
  [ 2] .rodata           PROGBITS        080000d4 0100d4 000003 00   A  0   0  4
  [ 3] .data             PROGBITS        080000d8 0100d8 000007 00  WA  0   0  4
  [ 4] .bss              NOBITS          20000000 020000 000003 00  WA  0   0  4
  [ 5] .debug_info       PROGBITS        00000000 0100df 0001b1 00      0   0  1
  [ 6] .debug_abbrev     PROGBITS        00000000 010290 00010c 00      0   0  1
```

Proteus Simulation

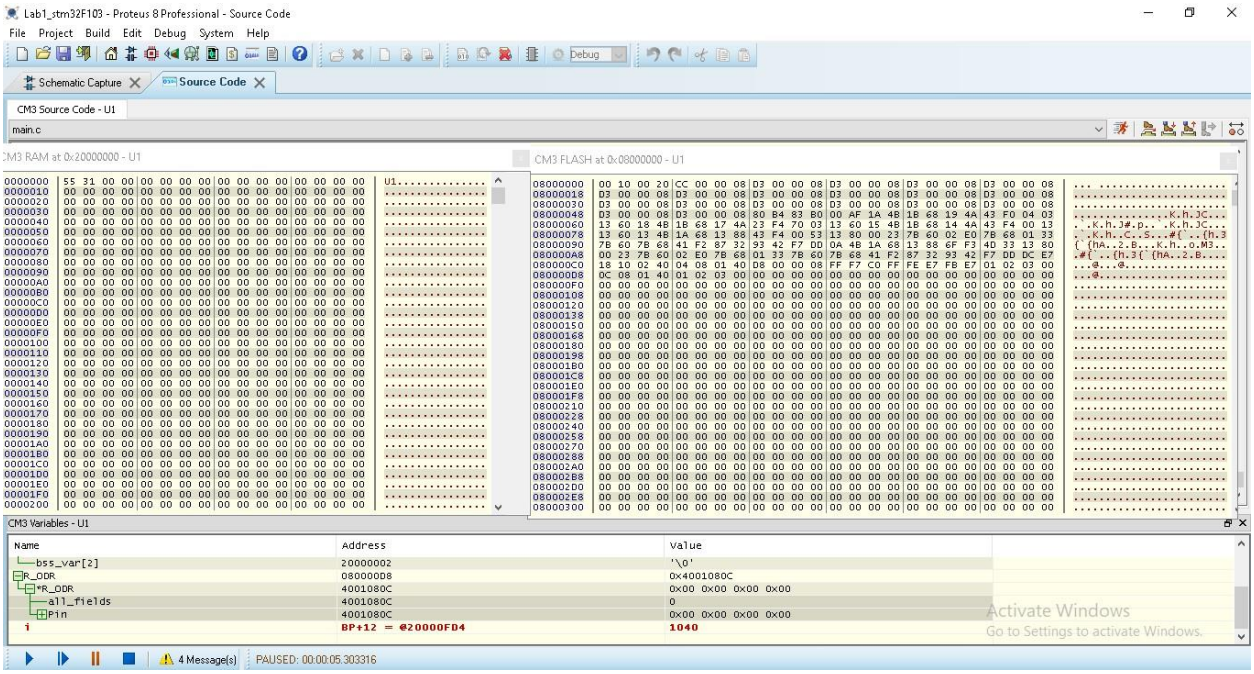
Simulation working:



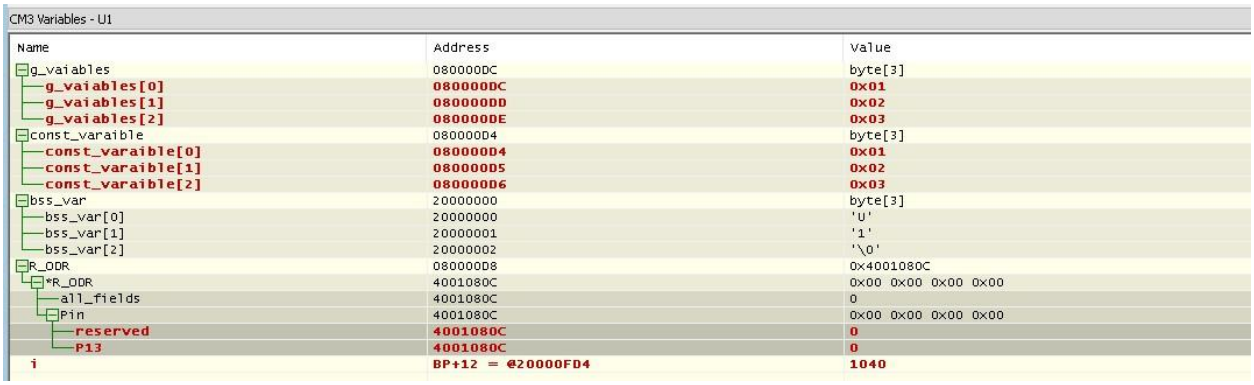
Debug_information:



Ram and Flash Memories:



Variables:



CM3 Variables - U1

Name	Address	Value
g_vaiables	080000DC	byte[3]
g_vaiables[0]	080000DC	0x01
g_vaiables[1]	080000DD	0x02
g_vaiables[2]	080000DE	0x03
const_varaible	080000D4	byte[3]
const_varaible[0]	080000D4	0x01
const_varaible[1]	080000D5	0x02
const_varaible[2]	080000D6	0x03
bss_var	20000000	byte[3]
bss_var[0]	20000000	'U'
bss_var[1]	20000001	'1'
bss_var[2]	20000002	'\0'
R_ODR	080000D8	0x4001080C
*R_ODR	4001080C	0x00 0x00 0x00 0x00
all_fields	4001080C	0
Pin	4001080C	0x00 0x00 0x00 0x00
reserved	4001080C	0
P13	4001080C	0
i	BP+12 = @20000FD4	1040

Registers:

CM3 Registers - U1

PC	080000AE	Privileged	
Pri	FE.FFFFFF01	Mode	Handler
R0	00000000	R7	20000FD0
R1	00000000	R8	00000000
R2	00001387	R9	00000000
R3	00000598	R10	00000000
R4	00000000	R11	00000000
R5	00000000	R12	00000000
R6	00000000	LR	080000D1
MSP*	20000FD0	PSP	00000000
IRQ	3		
APSR	CNQVZ	EPSR	01000000
	01000	iciit	000.00000