



AMERICAN INTERENATIONAL UNIVERSITY- BANGLADESH (AIUB)

FACULTY OF ENGINEERING

MICROPROCESSOR AND EMBEDDED SYSTEMS [A]

Lab report on : Familiarization with an STM32, the study of blink test and implementation of a light-controlling system using microcontrollers.

Course Teacher: MD. Ali Noor

GROUP-06

Submitted By: SYED AFTAB UDDIN

ID: 19-41522-3

1	Md. Sumon	20-42556-1	CSC
2	Maimona Rahman Farjana	20-42954-1	CSC
3	MEDHA CHOWDHURY	20-41930-1	CSC
4	ISLAM,MD RASHEDUL	20-43301-1	CSC
5	SYEDA AYNUL KARIM	19-41829-3	CSC

Experiment Title:

Familiarization with an STM32, the study of blink test and implementation of a light-controlling system using microcontrollers.

Introduction:

The objective of this experiment is to get familiarized with STM Microcontroller. In our lab we use STM32-Nucleo-F401RE.

It features the ARM CortexM4 32 bit STM32F401RE microcontroller which is in LQFP64 package. The Board's pinout is similar to Arduino UNO and has many other additional pins to expand performance. This board also comes with an integrated ST-LINK/V2-1 programmer and debugger; hence it is very easy to get started with this board.

Objectives:

The objectives of this experiment are to Familiarize with the STM32CubeIDE and STM32F401RE microcontroller, implement a simple circuit to make an LED light to blink using STM32 and implementation of a light control system using STM32

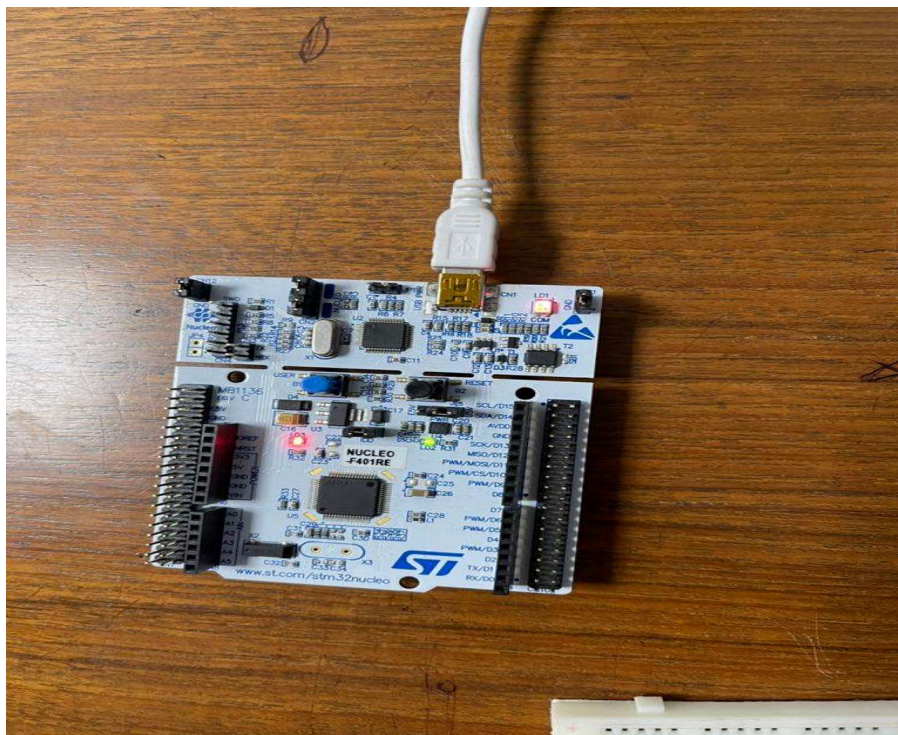
Equipment List:

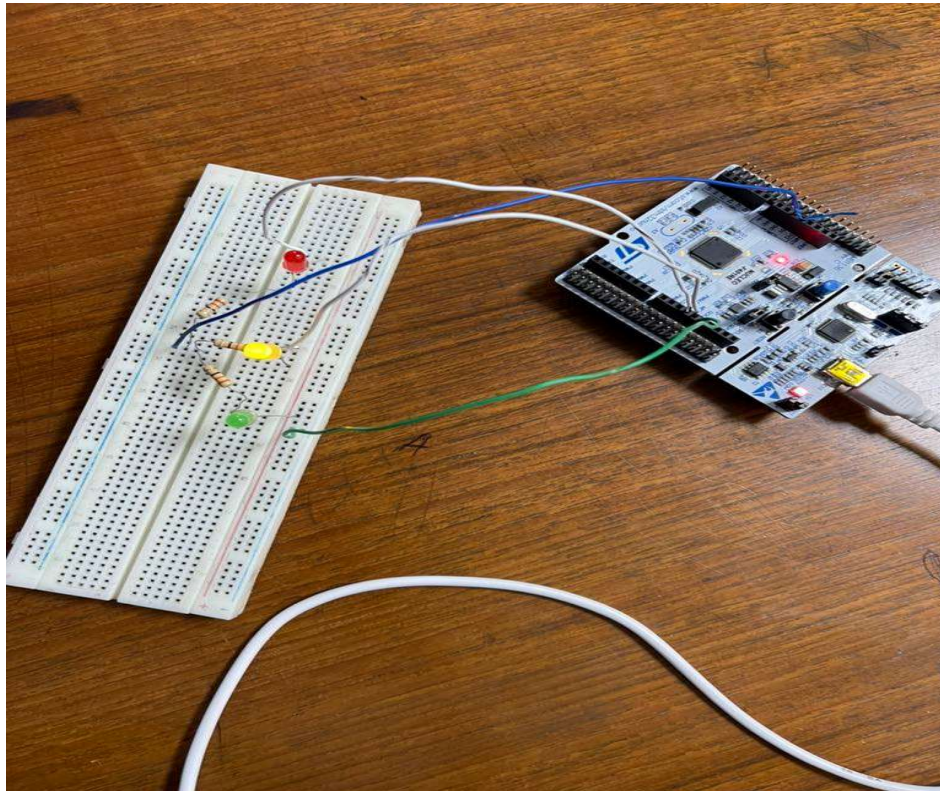
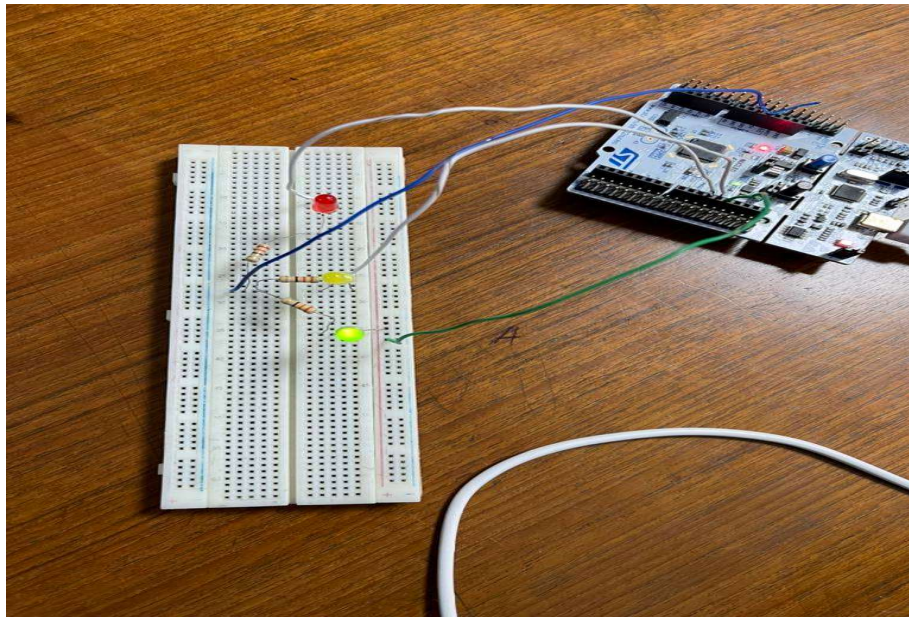
1. STM32F401RE
2. Breadboard
3. LED lights (red, yellow, green)
4. Jumper wires
5. Computer
6. Resistor (Three 100 ohms)

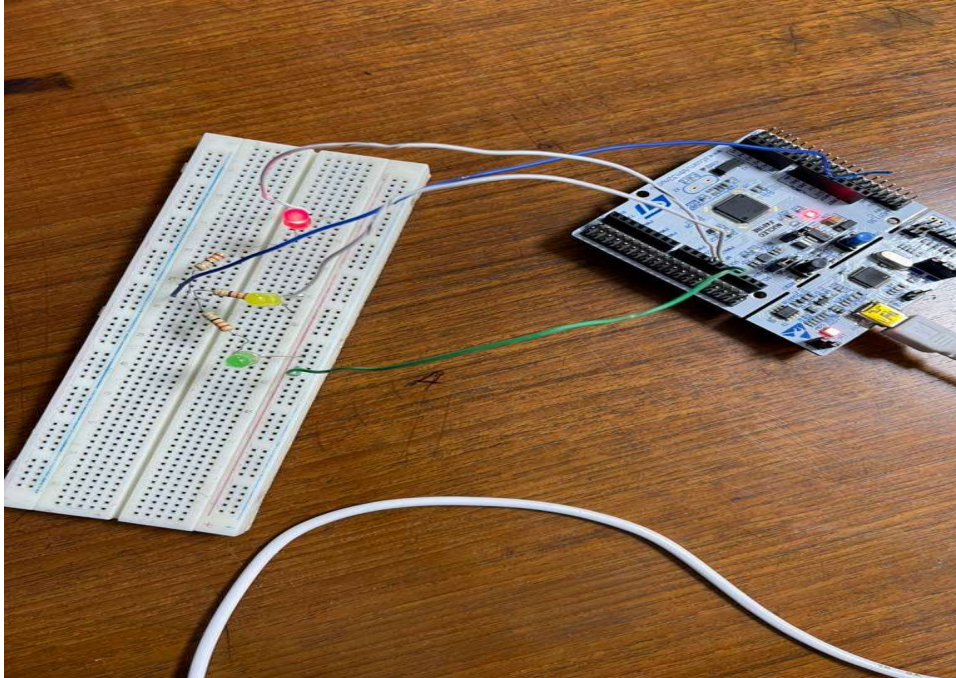
7. STM32Cube IDE (any version)
8. Proteus 8 professional

Overview of STM32 Nucleo-F401RE Board:

Circuit Diagram:







Question answers for report writing:

Code/Program

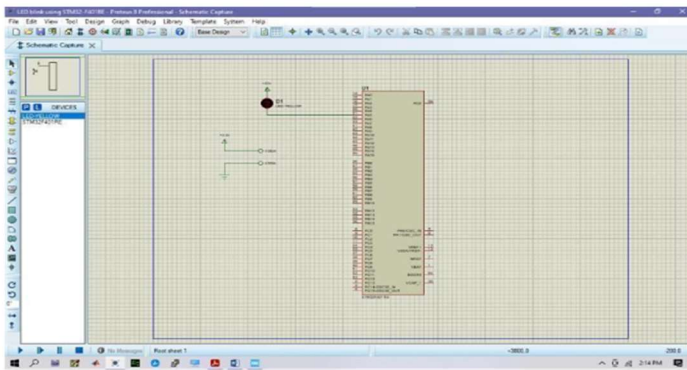
Simulation code for traffic control system:

```
void setup()
{
// pin connections for the LED lights pinMode(5,OUTPUT); pinMode(6,OUTPUT);
pinMode(7,OUTPUT); } void loop() {
HAL_GPIO_WritePin(GPIOA,GPIO_PIN_5,1);
HAL_Delay(500);
HAL_GPIO_WritePin(GPIOA,GPIO_PIN_5,0);
HAL_GPIO_WritePin(GPIOA,GPIO_PIN_6,1);
HAL_Delay(500);
HAL_GPIO_WritePin(GPIOA,GPIO_PIN_6,0);
HAL_GPIO_WritePin(GPIOA,GPIO_PIN_7,1); HAL_Delay(500);
HAL_GPIO_WritePin(GPIOA,GPIO_PIN_7,0);
HAL_Delay(500);
```

```
HAL_GPIO_WritePin(GPIOA,GPIO_PIN_7,1);  
HAL_Delay(500);  
HAL_GPIO_WritePin(GPIOA,GPIO_PIN_7,0);  
HAL_Delay(500);  
HAL_GPIO_WritePin(GPIOA,GPIO_PIN_7,1); HAL_Delay(500);  
HAL_GPIO_WritePin(GPIOA,GPIO_PIN_7,0);  
HAL_Delay(500);  
HAL_GPIO_WritePin(GPIOA,GPIO_PIN_6,1);  
HAL_Delay(500);  
HAL_GPIO_WritePin(GPIOA,GPIO_PIN_6,0);  
}
```

The proteus simulation of the blink program and light control system

Step1



In STM32Cube IDE software we could not the STM32F401RE in target selection. We try to fix and find the exact MCU. After that, we figure out that we did have not a board so stm could not find that. Then read the manual of STM32-F401RE, and we understand that the RETX is the same family. But the proteus directory find the 401RE. STM microcontroller operate +3.3V.

Step 2

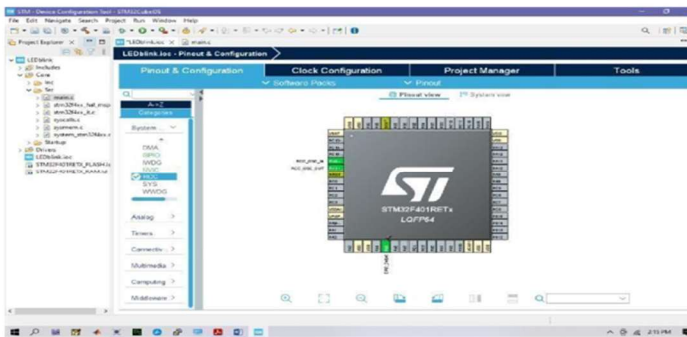
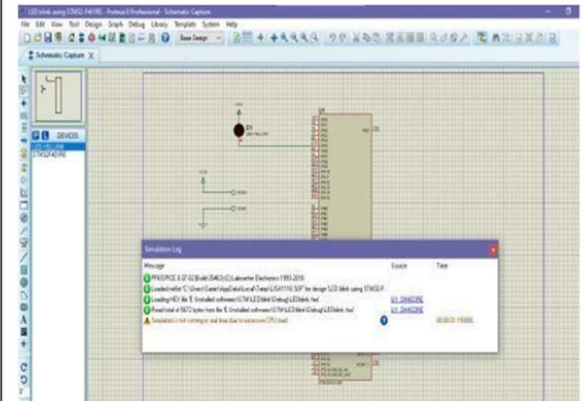
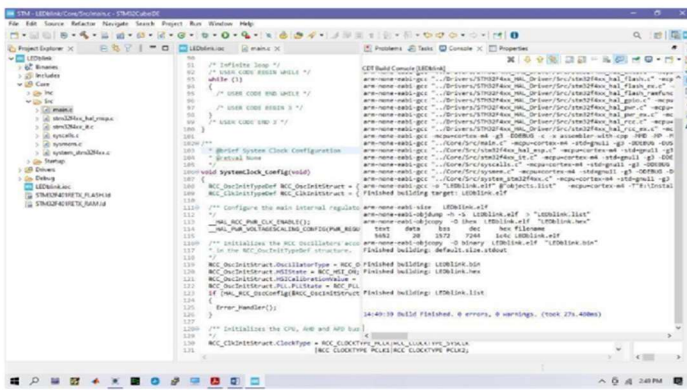


Table 86. Ordering information scheme

Example:	STM32	F	401	E	Y	6	TR
Device family	STM32 = ARM-based 32-bit microcontroller						
Product type	F = General-purpose						
Device subfamily	401 = 401 family						
Pin count							
	C = 48/49 pins						
	R = 64 pins						
	V = 100 pins						
Flash memory size							
	D = 384 Kbytes of Flash memory						
	E = 512 Kbytes of Flash memory						
Package							
	H = LQFP64						
	T = LQFP						
	U = UQFP64						
	Y = WLCSP						
Temperature range							
	G = Industrial temperature range, -40 to 85 °C						
Packing							
	TR = tape and reel						

Step 3



Comment: the LED is not blinking. Because Proteus Library could not find the STM32-F401REtx. proteus library only for the 401 family Re series. For these circumstances, we could not blink the LED simulation. But understand the whole process and gather the knowledge of how to link up the STM IC and proteus Simulink.

Design a simulation for a traffic system using the Proteus simulation toolk and STM32CubeIDE

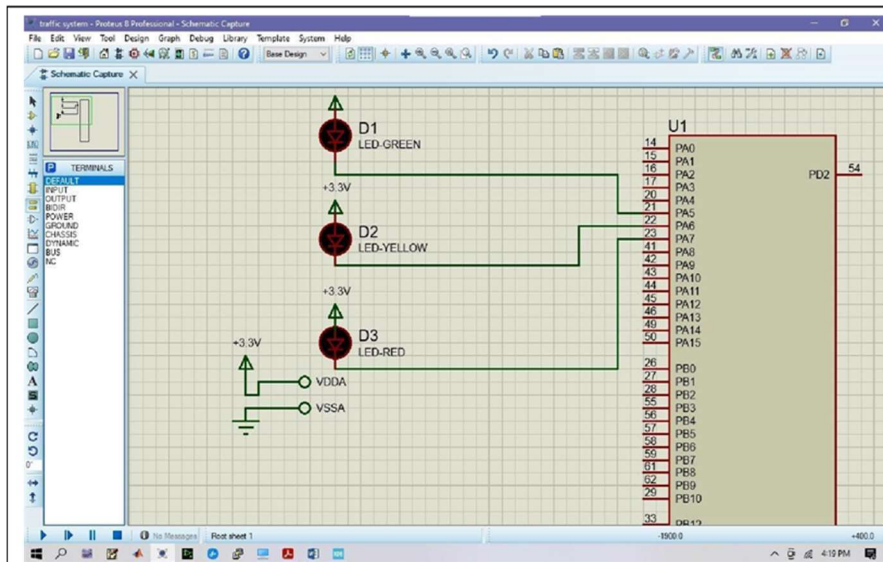


Figure: Step 1 using STM32-F401RE

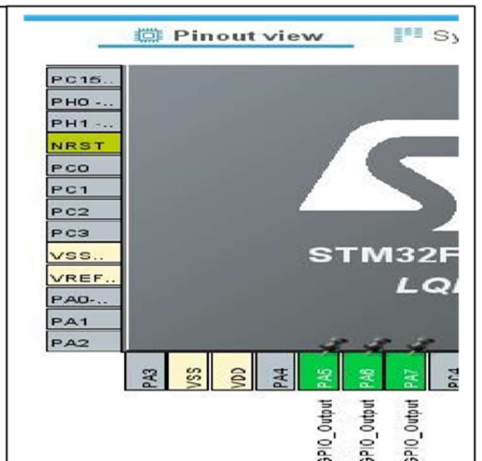


Figure: STM32-F401RET6

Comment: in proteus software, we select STM32-F401RE and take a #LED light (green, red, yellow). Select a power pin then set the Voltage to +3.3v. unfortunately could not be found in STMCubeIDE software the target selector is not traced or located in the STM32-F401RE. because the board is not connected. We try to match the two softs on the same board but it did not work. So, we just proceed with the model and understand the whole process.

Step 2 Code

```

STM - traffic system/Core/Src/main.c - STM32CubeIDE
File Edit Source Refactor Navigate Search Project Run Window Help
Project Explorer traffic system
  traffic system
  Binaries
  Includes
  Core
  Inc
  Src
    main.c
    stm32f4xx_hal_msp.c
    stm32f4xx_it.c
    syscalls.c
    system.c
    system_stm32f4xx.c
  Startup
  Drivers
  Debug
    STM32F401RET6_FLASH.ld
    STM32F401RET6_RAM.ld
    traffic system.ioc
main.c
101 /* Infinite loop */
102 while (1)
103 {
104     HAL_GPIO_WritePin(GPIOA, GPIO_PIN_5, GPIO_PIN_SET);
105     HAL_Delay(4000);
106     HAL_GPIO_WritePin(GPIOA, GPIO_PIN_6, GPIO_PIN_RESET);
107     HAL_Delay(500);
108     HAL_GPIO_WritePin(GPIOA, GPIO_PIN_6, GPIO_PIN_SET);
109     HAL_Delay(2000);
110     HAL_GPIO_WritePin(GPIOA, GPIO_PIN_6, GPIO_PIN_RESET);
111     HAL_Delay(500);
112     HAL_GPIO_WritePin(GPIOA, GPIO_PIN_7, GPIO_PIN_SET);
113     HAL_Delay(2000);
114     HAL_GPIO_WritePin(GPIOA, GPIO_PIN_7, GPIO_PIN_RESET);
115     HAL_Delay(1000);
116     HAL_GPIO_WritePin(GPIOA, GPIO_PIN_7, GPIO_PIN_SET);
117     HAL_Delay(500);
118     HAL_GPIO_WritePin(GPIOA, GPIO_PIN_7, GPIO_PIN_RESET);
119     HAL_Delay(500);
120     HAL_GPIO_WritePin(GPIOA, GPIO_PIN_7, GPIO_PIN_SET);
121     HAL_Delay(500);
122 }
123 /* USER CODE END WHILE */
124 /* USER CODE BEGIN 3 */
125
126
127 void SystemClock_Config(void)
128 {
129     RCC_OscInitTypeDef RCC_OscInitStruct = {0};
130     RCC_ClkInitTypeDef RCC_ClkInitStruct = {0};
131
132     /** Configure the main internal regulator output voltage
133     */
134 }

```

Discussion:

In this experiment, we learned about the STM microcontroller and used this microcontroller to implement three works which are Two LEDblink in LAB, others are proteus simulation with STMCubeIDE. In the lab experiment, we use three resistors with Green, RED, and Yellow LED. After designing along with a breadboard. The resistor has been taken to the ground. After designing the circuit, the code was implemented and LED was blinked using while loop and delay functions were added with the code.

In questions answers 2 and 3 the same process with the proteus simulation. At home, we try to run the process but we could not simulate the LED. Because the STM32CubeIDE has not found the target selection of STM32-F401RE. we try a different method to fix the problem and study the STM official manual and other sources like youtube and browsers.

After all, we set all the processes and try. Design a Traffic System and LED blink, also STMCubeIDE. End of the day we learn first time the STM system and gather a piece of valuable knowledge. In the future, we try our best knowledge to simulate the program, and also try to buy an STM32 module.

Conclusion: ‘

By implementing this experiment we got familiarized with the microcontroller and traffic control system. We also learned about Proteus, STMCubeIDE, and the STM32-F401 family. We how to design and run a circuit in Proteus 8.

Reference(s):

- <https://www.st.com/en/evaluation-tools/nucleo-f401re.html> for STM32F401RE,datasheet • www.st.com
- https://www.st.com/resource/en/user_manual/dm00105879-description-of-stm32f4-hal-and-ll-driversstmicroelectronics.pdf
- www.st.com/en/development-tools/stm32cubeide.html