HARDWARE-ORIENTED MICROPROCESSOR SIMULATOR (HOMS v.1B)

OPEN-SOURCE PROJECT

Quick User Guide

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8/2024

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1. Executing a real program

For performing a program execution, the corresponding byte codes have to be stored in the memory module. When the system starts, the user selects the **Demo** or the **Upload** operation. When the **Demo** option is selected, then the instruction **MOV A,3** is loaded in the memory unit and can be immediately executed. On the other hand, the program can be developed within the GUI environment which is a computer-based application. After the program development, the corresponding byte codes are uploaded to memory unit through a USB connection.

Figure 5.4 shows the computer-based application where the program can be developed. The GUI is organized in sections based on the corresponding functionality.

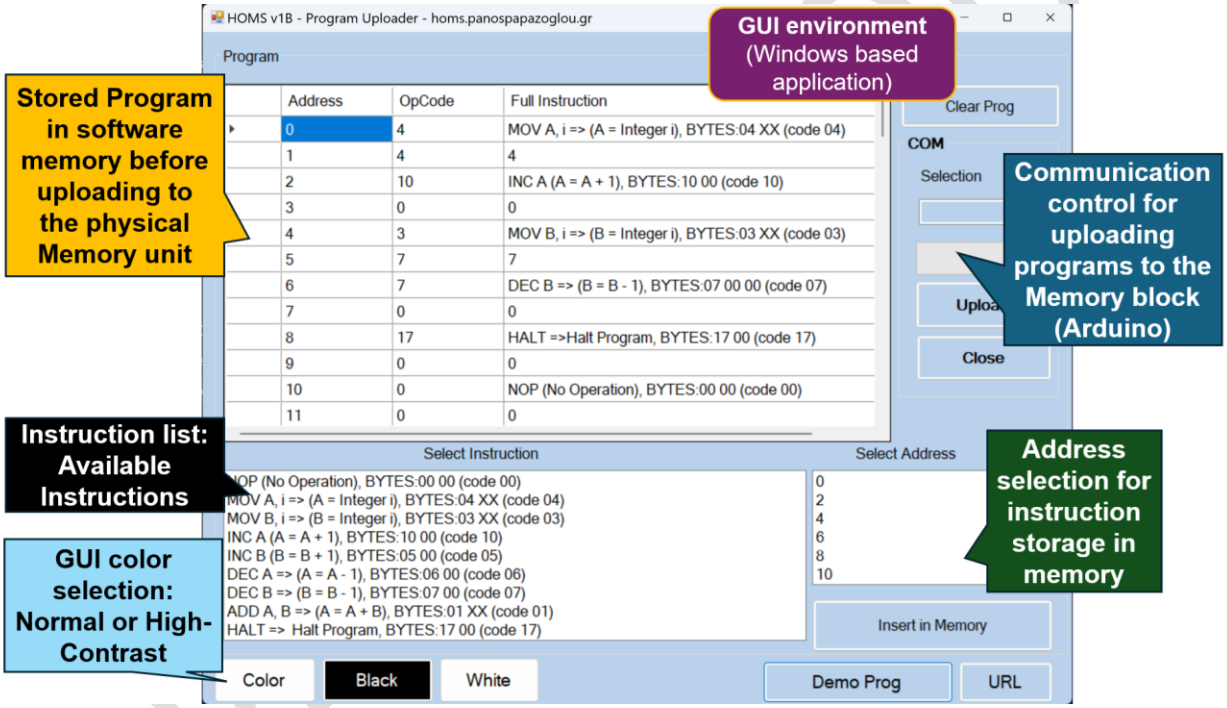

Fig. 5.4 GUI environment for program development

2. Testing the demo instruction

The first thing to do after HOMS activation, is to select the demo execution or the upload from the PC. Fig. 5.5 shows the available options for preparing program execution. The first step for program execution is to load program instruction codes in memory unit.

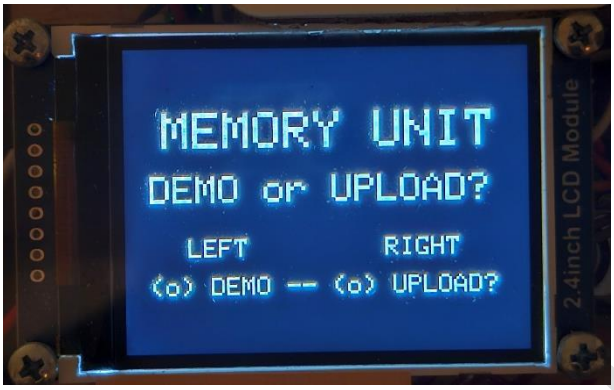

Fig. 5.5 Starting from memory unit

According to fig. 5.6 the user has selected the **Demo** option, where the instruction **MOV A,3** will be loaded in memory.

Fig. 5.6 The instruction MOV A,3 will be loaded in memory

After instruction load, the control unit will be used for starting the execution process (fig. 5.7). The first step is to Reset all the HOMS registers. The initial value for all registers is FF (hexadecimal value) and after Reset, the new content will be zero (fig. 5.8).

Fig. 5.7 Starting the execution process

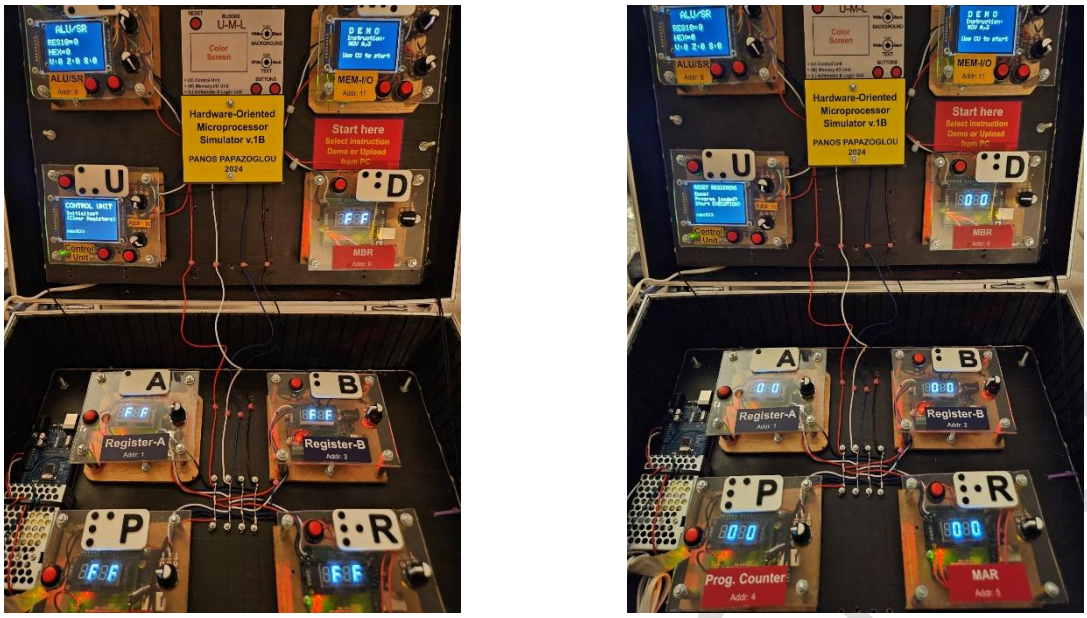

Fig. 5.8 Register Rest

3. Testing a program from PC

For a full demonstration of the HOMS v. 1B tool operation, an assembly program will be developed within the GUI environment and uploaded to the memory module. Table 5.1 shows the demo program (symbolic instruction, byte code and memory contents).

Table 5.1
Demo program

Instruction	Byte code	Address (content) (in decimal)
MOV A, 4	(dec) 04 04, (hex) 04 04	00* (04), 01 (04)
INC A	(dec) 10 00, (hex) 0A 00	02* (10), 03 (00)
MOV B, 7	(dec) 03 07, (hex) 03 07	04* (03), 05 (07)
DEC B	(dec) 07 00, (hex) 07 00	06* (07), 07 (00)
HALT	(dec) 17 00, (hex) 11 00	08* (17), 09 (00)

* Instruction starting address (PC content)

STEP 1 - GUI Application execution

After the PC application execution, the GUI environment will be activated (fig. 5.9).

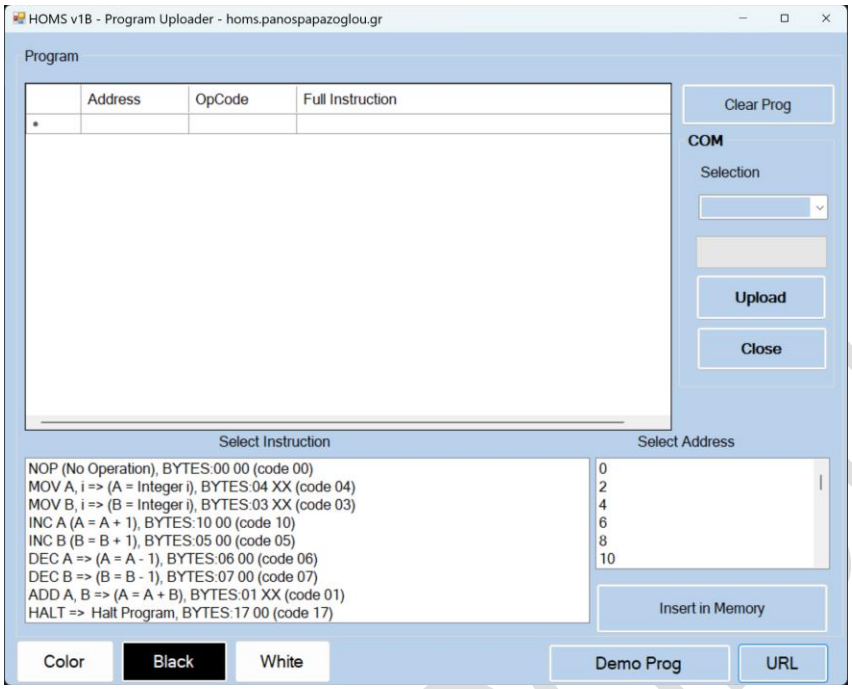

Fig. 5.9 The GUI environment

STEP 2 - Inserting the program

The program can be entered step by step, but we will use the **Demo Prog** option for automatic program insertion. When the button **Demo Prog** is pressed, the program table area is populated with the preinstalled demo program (fig. 5.10).

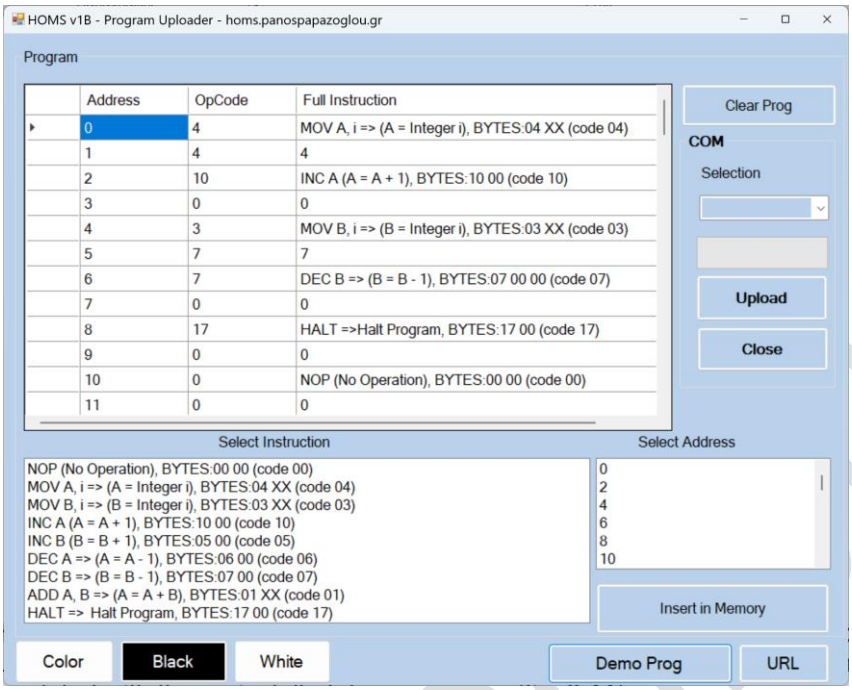

Fig. 5.10 The program is inserted

STEP 3 - Activating HOMS Tool and Upload option

The USB cable is plugged from PC into the memory unit (fig. 5.11) and the option UPLOAD is chosen (fig. 5.12a, 5.12b).

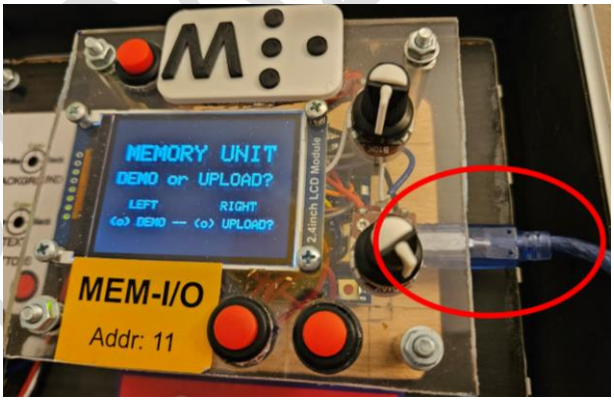

Fig. 5.11 USB connection

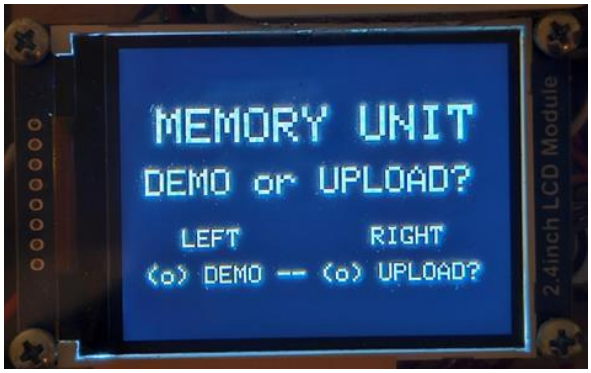

fig. 5.12a Main menu in memory unit

fig. 5.12b Memory unit is waiting to receive from PC

STEP 4 - Uploading from PC

Firstly, we select the COM port where the memory unit (Arduino) is connected (1). The next step is to press the **Upload** button (2). The upload process is confirmed through the green bar (3). Figure 5.13 shows the above steps.

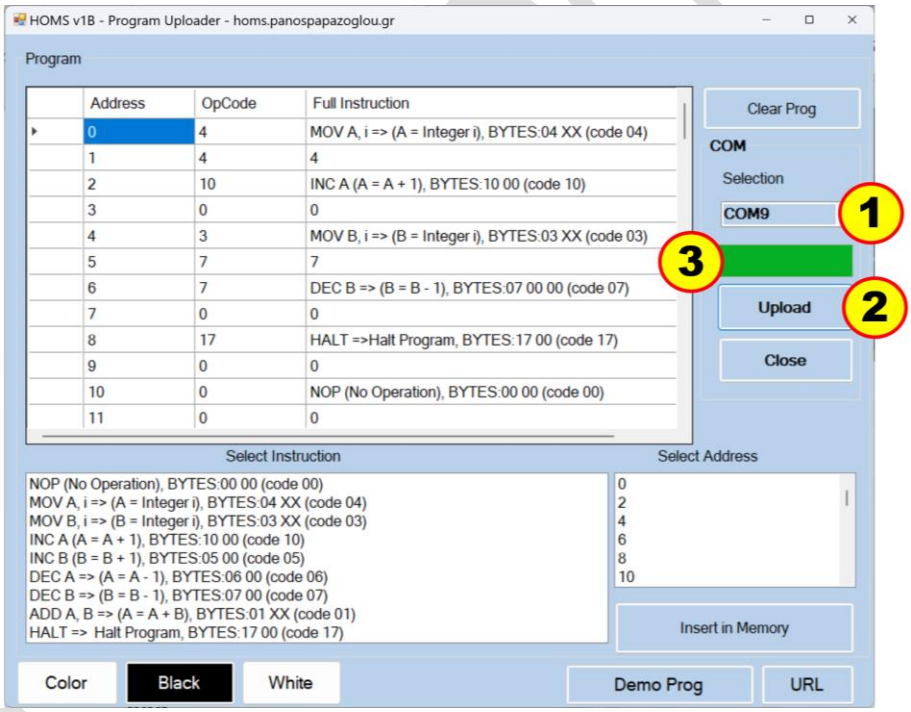

Fig. 5.13 Upload process

If the program upload is successful, then the corresponding bytes will be appeared on the TFT display of the memory unit (fig. 5.14).

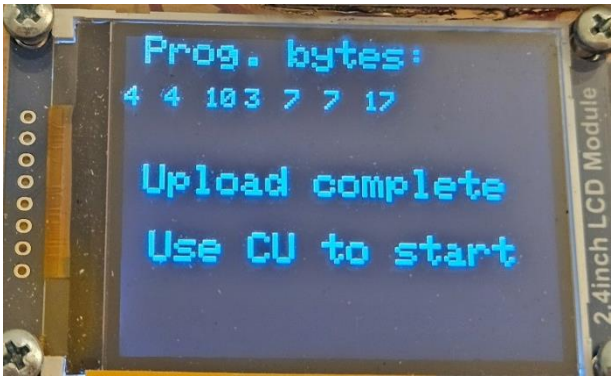

Fig. 5.14 Upload successful

STEP 5 – Program Execution through the Control Unit

Now, the uploaded program can be executed step by step using the on-display instructions at the control unit.

The execution steps inside the HOMS tool are described in the following table.

Table 5.2 shows as an example, how the instruction **MOV A,4** is executed.

Table 5.2
Execution steps for instruction MOV A,4

Register	1	2	3	4	5	6	7
PC	00					DECODE	
MAR		00		01			
MBR			04		04		
A							04

As shown in table 5.2, the instruction *MOV A,4* is executed as follows:

STEP 1: The PC shows the starting address of the instruction to be executed (MOV A,4)
STEP 2: The starting address of the instruction is stored in MAR register
STEP 3: The first instruction byte is fetched and is stored in MBR register
STEP 4: The MAR address is increased by one, in order to point to the next address where the second byte of the instruction is stored (parameter)
STEP 5: The second instruction byte is fetched and is stored in MBR register
STEP 6: The control unit decodes the instruction bytes and starts to execute the instruction
STEP 7: The content of register A is now 04

The above steps can be now confirmed inside the real HOMS tool environment.

***Important note:* please visit the web site of the HOMS project for viewing the corresponding videos.**

Website

https://homs.panospapazoglou.gr/