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Development of Testbenches Base on STM32 and CC253X Microcontrollers

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***Abstract*—The purpose of the development is to create a test layout on the STM32 microcontroller and CC253X expansion module. Performing this work had to consider the following steps: analysis of similar devices and expansion modules; develop the spatial structure of the device and its layout; develop the design of the printing module; conduct testing; integrate the test layout and expansion module.**

Keywords—STM32, microcontroller, expansion module, testbench, CC2530, SPI, I2C, GPIO, testing.

I. INTRODUCTION

This template, A test bench or testing workbench is an environment used to verify the correctness or soundness of a design or model [1]. The Wireless sensor networks (WSN) systems have a lot of problems like security, energy consumption, heterogeneity and other disadvantages that need be solved. Therefore, it is quite difficult to design a sensor network node so that it satisfies the necessary criteria for optimality. If such a node is also used for testing and training, then additional requirements for the construction will be propose to, for example, as in articles of designing microprocessor systems [2] or embedded control systems [3]. Energy monitoring [4] is a key factor for the successful prolongation of life times each nodes in wireless sensor network, for examples reducing the power consumption of nodes [5].

STM32 is a family of 32-bit microcontrollers from STMicroelectronics. STM32 chips are grouped in series, each using the same 32-bit ARM core. The CC2530 is a true system-on-chip (SoC) solution for IEEE 802.15.4, Zigbee and RF4CE applications. The CC2538 is the ideal wireless microcontroller System-on-Chip (SoC) for high-performance ZigBee applications.

Performing this work had to consider the following steps: analysis of similar devices and expansion modules; develop the spatial structure of the device and its layout; develop the design of the printing module; conduct testing; integrate the test layout and expansion module.

II. PREPARE YOUR PAPER BEFORE STYLING ANALYSIS OF SIMILAR DEVICES AND EXPANSION MODULES

We analyzed various approaches to the design of such stands - with the presence of a scheme for additional installation (Fig.1) and without it (Fig. 2).

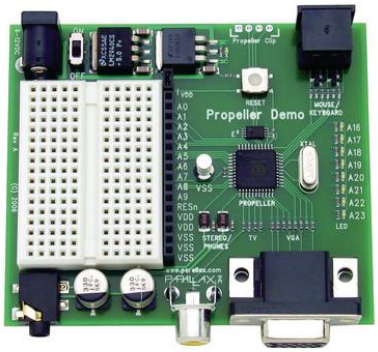

Fig. 1. PCB testbench board with additional installation.

The stand (Fig. 2) the typical implementation of debug bench.

Fig. 2. Typical implementation of debug bench.

We also looked at typical breadboards for modeling - conductive modeling (Fig.3), soldering, (Fig. 4), prepared printed circuit board (Fig. 5).

III. THE USE OF THESE BOARDS FOR TESTBENCH WAS ALSO ANALYZED (FIG. 6).DEVELOPMENT OF THE MODULE BASE ON STM32

As a result of the analysis and design, a printed circuit board was developed and the module was assembled. The Fig. 7 shows the appearance of the text layout and its layout.

The developed expansion module is shown in the (Fig. 8).

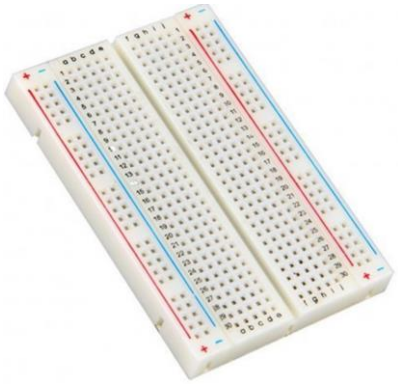

Fig. 3. PCB testbench board with expansion module.

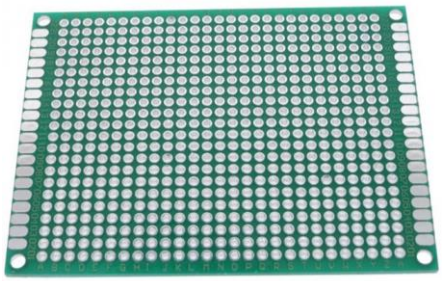

Fig. 4. Testbench board for soldering.

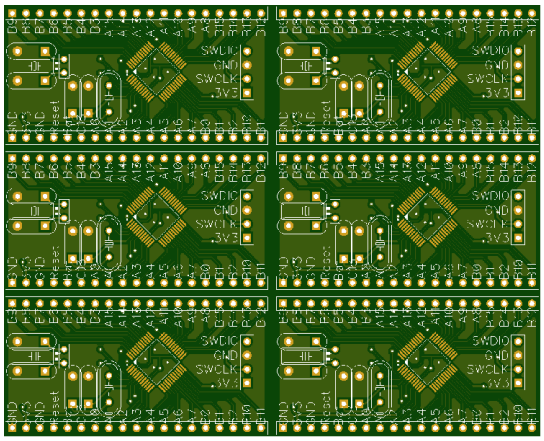

Fig. 5. PCB testbench board .

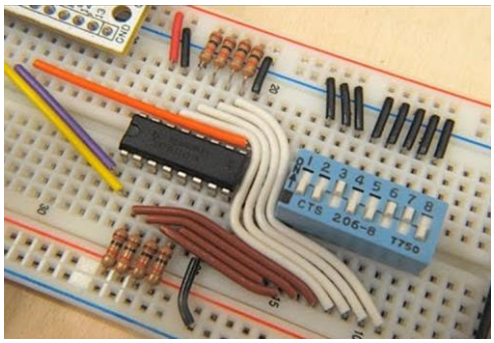

Fig. 6. Testbench board with conductive modeling.

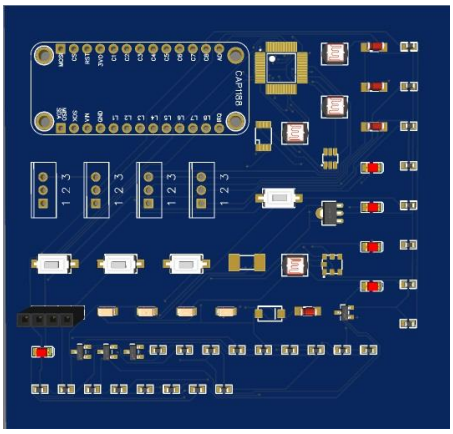

Fig. 7. STM32 testbench base on STM32 microcontroller F103C8 series.

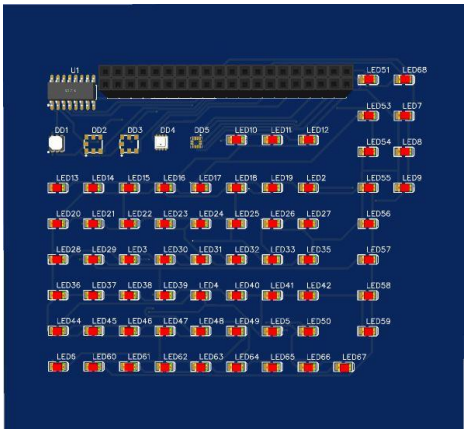

Fig. 8. Developed expansion module.

The proposed model defining defines different levels of system interaction. Each level performs certain functions in such interaction (Fig. 8).

IV. Development of the Module Base on CC2530

There are various modules based on the SoC CC2530 [9], in essence they are a board that hosts the CC2530 itself, an external quartz resonator, several passive components, an antenna connector (or built-in antenna) and outputs for connecting to other devices. The typical node of wireless sensor network can be constructed using a chip CC2530. This transceiver can be ready for prototyping by PCB board-module (Fig. 9).

Developed testbench base on CC2530 shown at the (Fig. 10).

Fig. 9. PCB board-module base on chip CC2530.

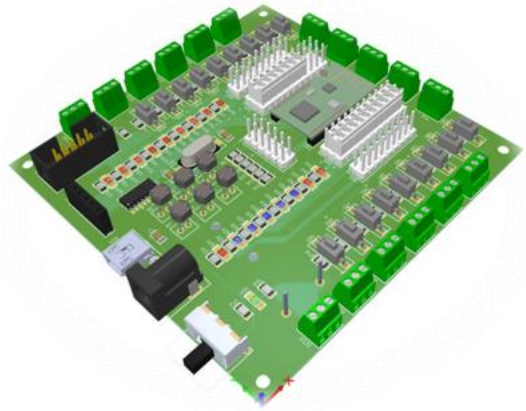

Fig. 10. PCB testbench base on chip CC2530.

V. Development of the Module Base on CC2538

The ZigBee CC2538 module with the CC2592 amplifier is intended for building a ZigBee radio network. The module differs from similar modules in its small size, large programming capabilities and long range. The module consists of a SoC based on SS2538, which has an integrated Cortex M3 processor, RAM 32Kb, Flash 512Kb, several groups of ports for different purposes, ADC, and RFcomm. The second chip is a power amplifier, preamplifier, switches.

As a result of the analysis, the node structures, wireless sensor network modules, CC2538 peripherals were analyzed. A module based on the CC2538 was chosen as the hardware. As elements of the periphery, the following elements were chosen: LEDs; push buttons; temperature, humidity and pressure sensor in the one case; buzzer; hall sensor; lighting sensor; voltage divider with adjustable resistor.

A contact switch is selected to switch between the peripheral elements, and electrical switch for switching between external and internal peripheral (Fig. 11).

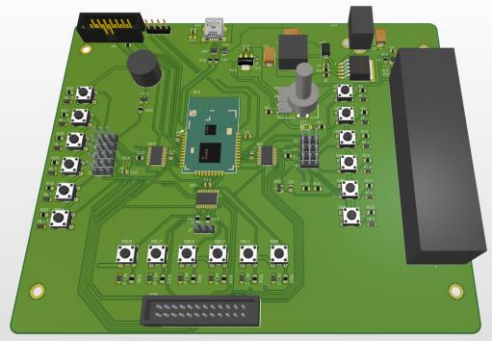

Fig. 11. PCB testbench base on chip CC2538.

Conclusions

Developed of testbenches base on STM3, CC2530, CC2538 microcontrollers. The during of research, it was considered optimize the structure of the node, selection of chip for wireless sensor network node and discussion about peripheral requirements development. Similar constructions and modules are analyzed[1-8]. A test layout based on the STM32 microcontroller has been developed. A test layout based on the CC2530 and CC2538 microcontroller has been developed. Three different models for testing embedded systems have been proposed.

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