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E-Robot educational System

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Abstract: *the software is 3 dimensional graphical user interface development environment that can translate a multitasking programming sketch into multilayer GUIDE interface. the program has also a node maker wizard that can convert libraries and programming code into a graphical icons we call NODEs. when the user generate the GUI program, the code is automatically generated through the Code IDE and users can view and edit the code. the E-Robot program is associated with an open source microcontroller board series called snowball which is based on Arduino microcontroller which also can be programmed using E-Robot code IDE . the software has a data-lab which is a software that can be directly connected to the MCU to convert the data the sensors sends into gauges and plots. the collected data can be saved in excel sheets for further analysis and data manipulation..*

Keywords: *Education,GUI,Microcontroller, Robotics ,Smart Blocks*

I. Introduction

Open source platform has been welcomed in the field of education in the last few years. It's evolving rapidly due to the large customer satisfaction. The open source movement mainly aims to create a free based environment where individuals from the same interest can easily participate in the development and deployment of the system. The open source platform can be the seed of hundreds of children platforms that can be based on the same design but with deferent characteristics. As for the educational robotic field, we find many open source microcontroller boards such as Arduino, sanguine, FEZ Creb40 and many more.

Thus, the creation of an educational robot platform was a necessity in our region to increase the members the MAKER movement that can part of the world future.

The idea is to create an educational system that teaches the students how to:

1- Use and understand applied STEM (Science- Technology- Engineering- Math)
2- Solve problems
3-creativity and creative solutions
4- Logical and critical thinking
5-Electronics
6- 3D visualization
7- Patience
8- Following rules

The philosophy:

The philosophy of the E-Robot is to build a cheap educational expandable open source easy to use by none programmers prototyping solution. E-robot Educational STEM System empowers you to make unlimited powerful robotics applications for entertainment, prototyping and education. We have created it to be powerful, extendable, friendly, open source and smart.

We are trying to close the technology gap and build an updated generation

II. Hardware

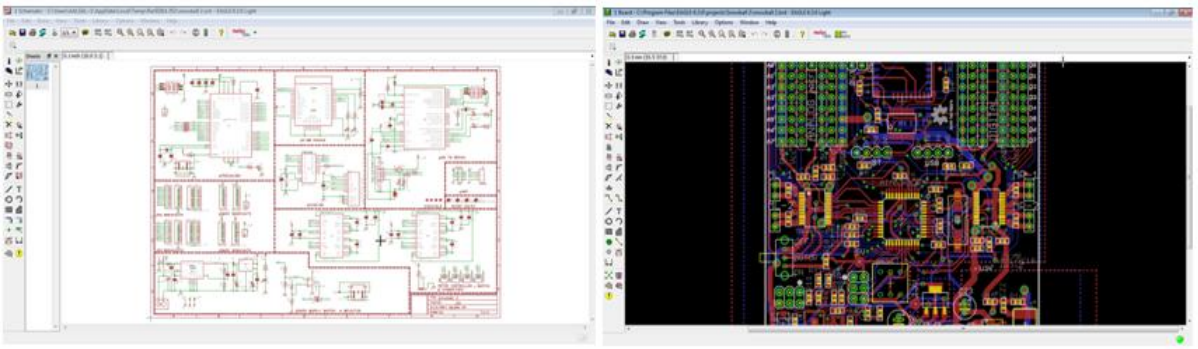
2.1 The Main Unit:

The hardware is ATMEGA1284p chip this 8bit controller AVR device, with Arduino compatible dual boot-loader that have special libraries to run due to the extra features:

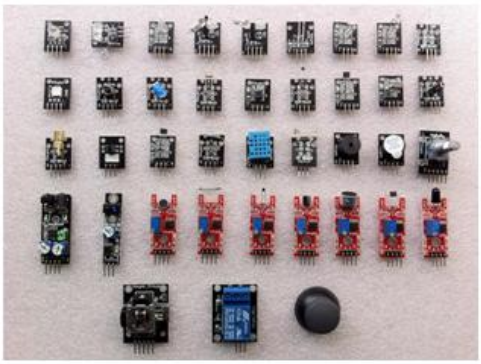
The hardware (snowball):

1- 4 motor ports 3A H-bridge
2- 8 port interrupts which allow the user to have 8 soft serial connections.
3- Bluetooth for controlling and program downloading
4-SD external memory
5-shield adapter for expending the board

6- 16 general purpose IO pins, set initially as 8 inputs and 8 outputs each with 3 header pins and selectable voltage (Vin or regulated 5v).
7- Single UART
8- Single I2C

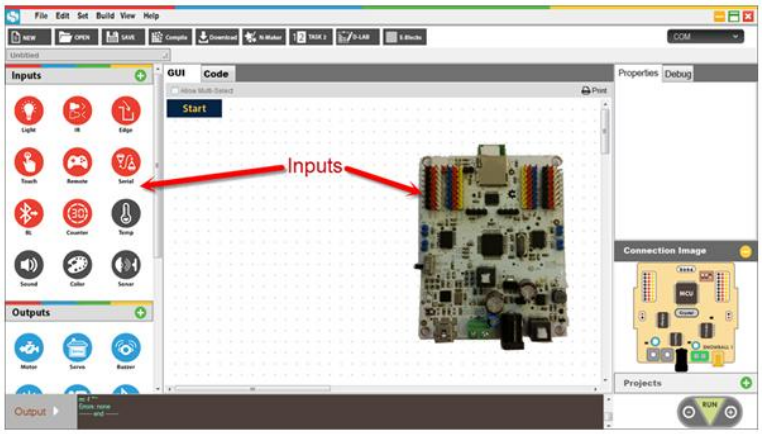


Compatible with all Arduino sensors which is very cheap and educational. All industrial sensors has one of the three most used data transfer methods:
1- The analog to digital conversion (ADC)
2-I2C
3-UART



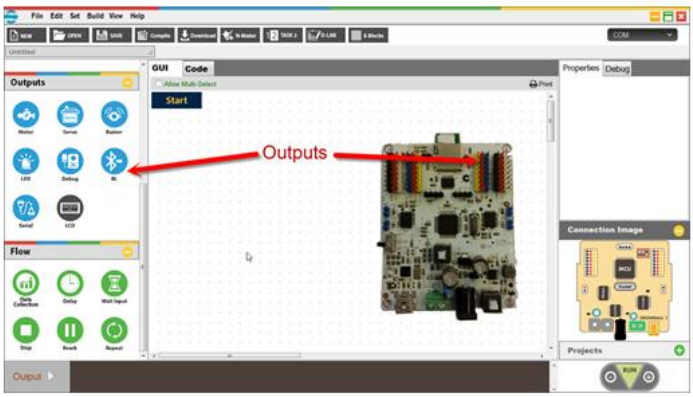
2.1.1The Inputs:

Inputs are devices that senses the environment and sends the readings to the MCU. Examples of the inputs are push buttons, Light sensors CdS, Infra red sensor, sound sensor, color sensor and temperature sensor. Sensors provide an analog signal to the ADC pins of the controller A0..A7 or soft-serial protocol. The pins are colored in red for the supplied voltage, black for the ground and white for the input signal . An extra I2C and UART ports are found in the board for advanced users and electronic prototyping needs. All ports can be used as inputs or outputs according to user preferences.



2.1.2 The outputs:

The board has 8 digital outputs to control servos, lights, sounds starting from D0..D7. The pins are colored in red for the supplied voltage, black for the ground and white for the output signal. all ports has selectable jumper to choose the pin voltage supply either 5 regulated volts or Vin, this enables the users to have larger varieties of sensors and expand the project. All ports can be used as inputs or outputs according to user preferences

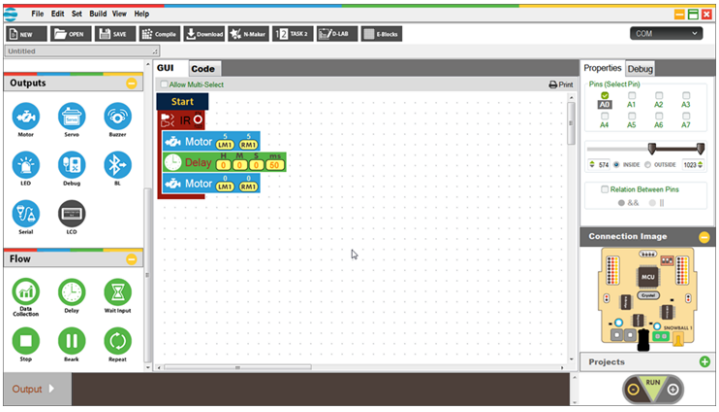


III. Snowball IDE

We have improved the Arduino IDE to fit the educators and professional needs.

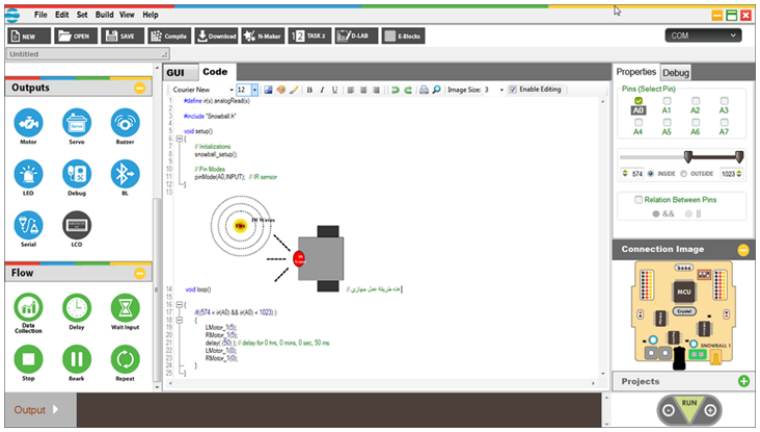
3.1 The GUI interface:

The graphical user interface is drag and drop modulus code generator for snowball hardware. It makes it easy for users to write a complicated programs by following the logical sequence of the program they like to write.



3.2 The Code interface:

As a professional alternative IDE is presented which takes Arduino IDE and adds more to it. The user can see the text editing bar which makes it easy to use the IDE to write a complete report and even adds images.

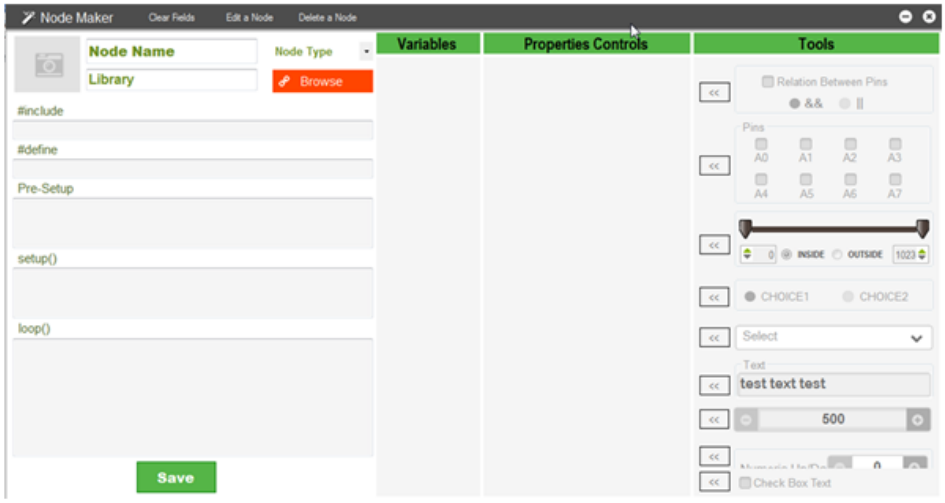


3.3 The Data LAB:

The data lab is a useful tools for scientific researches. Users can observe and log data from a specific sensor. The users can see the changes in values as a gauge or graph. All sensor data is represented in range of 0-1023.

3.4 Node Maker:

The Node maker is one of the most useful tools to expand the software. Each created node represent an algorithm, a shield, a sensor, an output, or any other electronic component the user uses.



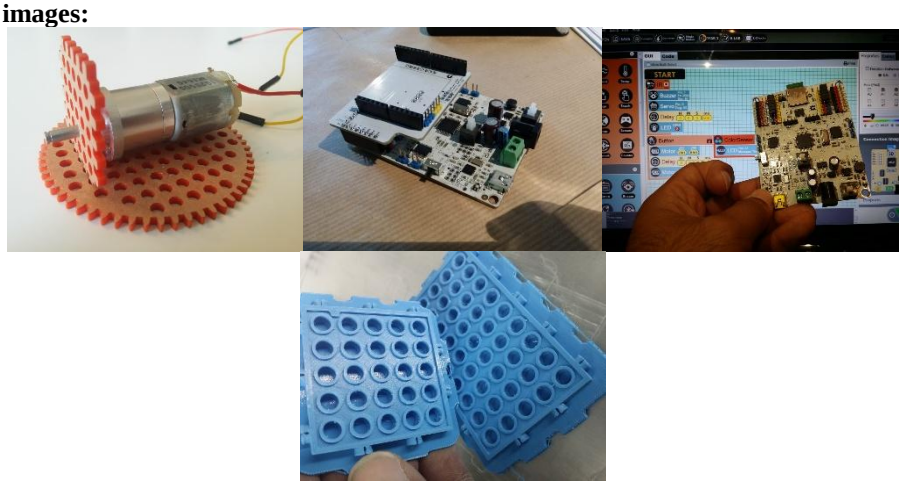
IV. E-Bricks

Mechanical pieces that easily allows you to build your robot, whichever shape you want to make, e.g. fighter, car race, humanoid. The plastic pieces are open source are user can produces them in deferent shapes using the laser cutter or simple workshop tools.

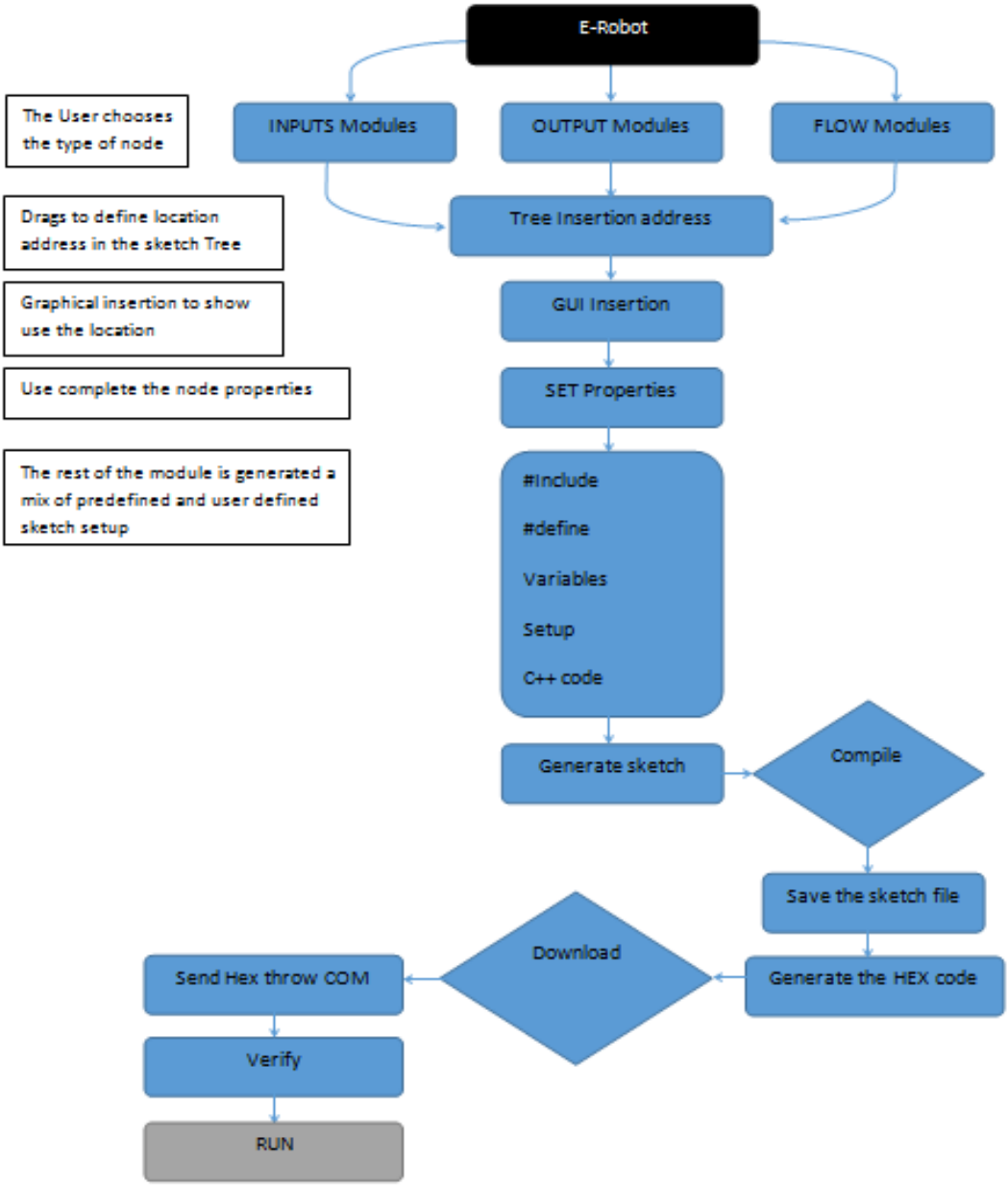
The advantages of E-Bricks are:

1- Easy and fast to use. It takes short time to build a basic structure to prove the concept especially with a limited classroom time.
2- Users can make them or make their own bricks by using any available router of laser cutter.
3- No small pieces that can be considers choking hazard.
4- The coloring system makes it appealing and attractive. It also can be uses to monitor the student build guide in classroom.
5- Users can use 5mm screw and nuts to fix the structure.

Collection of images:



V. The flow chart



VI. Conclusion

The e-robot system that developed by local engineers for better education for STEM concept was applied at Kuwait education system for grade 6,7 and 8 for more than 3 years from now the result comes from teachers and students are more than what we aspect the reasons for that are the simplicity and durability for the system so once it was open source the student was have the no-boundaries to use it with any type of open source sensors and actuators that make students think outside the school activities to explorer how to implemented in their life to solve daily life problems , in this paper I describe the possibilist to make devices to be easy for youth people to deal with it so I think in near future the integration between STEM and embedded system engineer become more and more

References

Patent:

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[2]. Filing dateSep 1, 2015InventorsAhmad A. A. A. Alsaleh, Naser H. N. Jasem