

# REVIEW ON OPEN SOURCE ELECTRONIC DESIGN APPROACHES

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**Abstract—** With advancement technology and emerging design methodology, open source electronic design approaches have been adopted in industry. Designer has to compromise with limited availability of resources to design interactive electronic hardware applications. To control and monitor physical world entities, there is a need of such development platform which provide all facilities on a single board. Arduino is open source electronic design board having a microcontroller to write code for different applications. It has capability of physical computing to develop software code for taking object inputs, to drive motors, control sensors and act as a communication interface among different softwares also.

**Keywords—** open source; design; arduino; physical world; computing

## I. INTRODUCTION

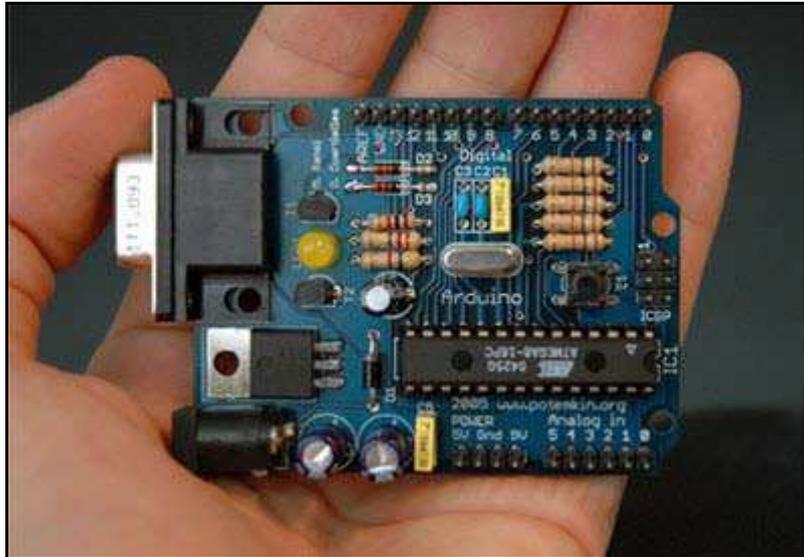


Fig. 1 Arduino Board (image source: [www.arduino.cc](http://www.arduino.cc))

Arduino can help designers interact with the physical world. It is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments. The key is its intention – intended for artists and designers, two groups of people whose backgrounds aren't necessarily technical ones (or if they are, they aren't likely to be deep in embedded computing). There a range of different boards having extensive features. One can choose and play with it. It does not need any high level expertise. Even a school student can work on it. It has a microcontroller along with different interfacing facilities available on its board. There are readymade circuits are available in market indentified as "shields" for it. Its programming language is an implementation of Wiring, a similar physical computing platform, which is based on the processing multimedia programming environment. Fig. 1 shows an image of arduino board.

## II. PROGRAMMING

Arduino board consist a microcontroller, typically atmel microcontroller which can be programmed on IDE platform. It is user friendly which provide ease at programming for newcomers, hobbyist, etc. It has reach library support with example codes.

Unlike assembly language, arduino IDE has user friendly programming techniques. Fig. 2 shows a snapshot it's IDE. It shows a simple blink program for beginners.

```

Blink | Arduino 1.0
File Edit Sketch Tools Help

Blink

/*
Blink
Turns on an LED on for one second, then off for one second, repeats.

This example code is in the public domain.
*/

void setup() {
  // initialize the digital pin as an output.
  // Pin 13 has an LED connected on most Arduino boards:
  pinMode(13, OUTPUT);
}

void loop() {
  digitalWrite(13, HIGH); // set the LED on
  delay(1000); // wait for a second
  digitalWrite(13, LOW); // set the LED off
  delay(1000); // wait for a second
}

1 Arduino Uno on /dev/ttyACM1

```

Fig. 2: A simple blink program on Arduino IDE

IDE is a cross-platform application written in Java, and derives from the IDE for the Processing programming language and the wiring projects. It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and is also capable of compiling and uploading programs to the board with a single click. A program or code written for Arduino is called a "sketch". Most Arduino boards contain an LED and a load resistor connected between the pin 13 and ground, which is a convenient feature for many simple tests. The Arduino IDE uses the GNU toolchain and AVR Libc to compile programs, and uses avrdude to upload programs to the board. As the Arduino platform uses Atmel microcontrollers, Atmel's development environment, AVR Studio or the newer Atmel Studio, may also be used to develop software for the Arduino.

### III. BENEFITS

Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems as listed below:

A. *Inexpensive* - Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than \$50.

*B. Cross-platform* - The Arduino software runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows. Simple, clear programming environment - The Arduino programming environment is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with the look and feel of Arduino.

*C. Open source and extensible software* - The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.

*D. Open source and extensible hardware* - The Arduino is based on Atmel's ATMEGA8 and ATMEGA168 microcontrollers. The plans for the modules are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money.

#### IV. APPLICATIONS

There are seamless applications of arduino. It has a wide range of applications as it is made up for all types of techy people comes from different backgrounds and geographical area. From student to a researcher, arduino is capable for versatile types of application development. Its tiny size and handy tools makes it more optimized. Expansion boards' i.e.shields extends its programming as well design efficiency. It can be used to control sensors from real world, drive motors and its actuators, glow an LED and ON/OFF a power supply as well. It supports Matlab, LabVIEW kind of programming environments. There is support toolkit provided by Matlab for Arduino. I/O pins makes it more modular. It can be used in mobile applicatiios, smart home automation, health monitoring, control and simulation, communication interface, smart wearable electronics, etc. One can make fashionable LED patterns as well can control mechanical assembly by using it. Following images can explain more:



Fig. 3: LED pattern



Fig. 4 Health monitoring

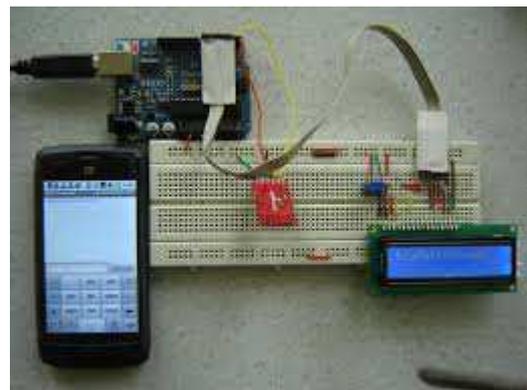


Fig. 5 Mobile apps for control & automation

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