

Review of Arduino Microcontroller

Mayank Singh and Shalli Goel

ABSTRACT: As the computer science field has grown to be ubiquitous part of human's life, the need for making software and hardware support to fit the needs of the users is consistently increasing this lead's to creation of microcontroller arduino In 2005, in Ivera , italy, a project was initiated to make a device for controlling student-built interactive design projects that was less expensive than other prototyping systems available at the time. Founders Massimo Banzi and David Cuartielles teacher of physical computing and interaction desing named the project after arduin of ivera , the main historical character of the town, and began producing boards in a small factory located in the same region as the computer company ollivt. arduino is open source prototyping plateform based on flexibale easy to use software and hard ware . it is intended for artirstic ,desingner, hobbistic and anyone intrested in creating interactive objects or environment .

INTRODUCTION

Microcontrollers are small computational devices embedded on integrated circuit containing processor, memory and other peripheral I/O pins Aurdino is also an micro controller which provides open source computing on simple board and provides environment for software development . The Arduino board consists of a micro controller which enables to receive inputs from the sensors and thereby can be used to drive motors, LEDs, sensors and other components which Is known as physical computing and this was not possible with the other microcontrollers present in market .As, . The figure below illustrates one of the Arduino Diecimila, one of the microcontroller board based on the ATmega168 . The microcontrollers have existed from decades, However Arduino microcontroller is explicitly designed for artists and designers . The main advantage for the artists and the designers is to execute without knowing the internal functioning of either hardware or software of the Arduino . The Arduino was aimed to be used by non technical users.

The Arduino was made apart from other microcontrollers by providing four major features they are inexpensive, providing an IDE for code development, programming via USB and community support for Arduino . Aurdino provides with an interaction desing which is concerned with the creation of meaningful experiences between us (humans) and objects. It is a good way to explore the creation of beautiful—and maybe even controversial—experiences between us and technology. Interaction Design encourages design through an iterative process based on prototypes.of ever-increasing fidelity. This approach—also part of some types of “conventional” design—can be extended to include prototyping with technology; in particular, prototyping with electronics. The specific field of Interaction Design involved Arduino is know as Physical Computing (or Physical Interaction



Desing).

what is physical computing ?

Physical Computing uses electronics to prototype new materials for designers and artists.It involves the design of interactive objects that can communicate with humans using sensors and actuators controlled by a behaviour implemented as software running inside a microcontroller (a small computer on a single chip). In the past, using electronics meant having to deal with engineers all the time, and building circuits one small component at the time; these issues kept creative people from playing around with the medium directly. Most of the tools were meant for engineers and required extensive knowledge.In recent years, microcontrollers have become cheaper and easier to use,allowing the creation of better tools.

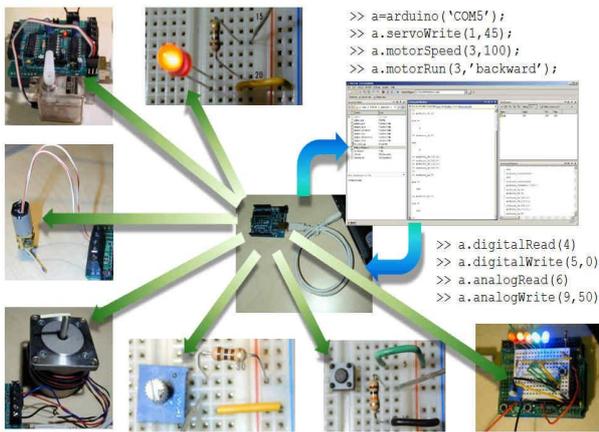


Fig 2 : physical computing

DISCRIPTION OF AURDINO BOARD

Arduino is a multiple pin device consists of 14 digital pin s on which we can provid input as well as we can take output from them and 12 analog pins in which 6 are for input and 6 are for output .The basic pin configuration is shown below :

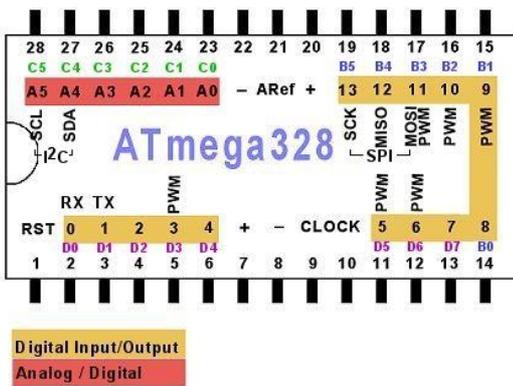


Fig 3. Pin configuration of arduino

Arduino board (fig3) consist of 16 pins upper side and 12 pins at lower side , fuction of these pins is described as below ;

- 1) 14 Digital IO pins (pins 0–13):
These can be inputs or outputs, which is specified by the sketch you create in the IDE.
- 2) 6 Analogue In pins (pins 0–5):
These dedicated analogue input pins take analogue values (i.e., voltage readings from a sensor) and convert them into a number between 0 and 1023.
- 3) 6 Analogue Out pins (pins 3, 5, 6, 9, 10, and 11):
These are actually six of the digital pins that can be reprogrammed for analogue output using the sketch you create in the IDE.

The board can be powered from your computer’s USB port, most USB chargers, or an AC adapter (9 volts recommended, 2.1mm barrel tip,center positive). If there is no power supply plugged into the powersocket, the power

will come from the USB board, but as soon as you plug a power supply, the board will automatically use it.

THE SOFTWARE :

The IDE (Integrated Development Environment) is a special program running on your computer that allows you to write sketches for the Arduino board in a simple language modeled after the Processing language. The magic happens when you press the button that uploads the sketch to the board: the code that you have written is translated into the C language (which is generally quite hard for a beginner to use), and is passed to the avr-gcc compiler, an important piece of open source software that makes the final translation into the language understood by the microcontroller. This last step is quite important, because it’s where Arduino makes your life simple by hiding away as much as possible of the complexities of programming microcontrollers.

Arduino programs are written in C or C++. The Arduino IDE comes with a soft ware library called "Wiring" from the original Wiring project, which makes many common input/output operations much easier. Users only need define two functions to make a runnable cyclic executive program:

- setup(): a function run once at the start of a program that can initialize settings
- loop(): a function called repeatedly until the board powers off

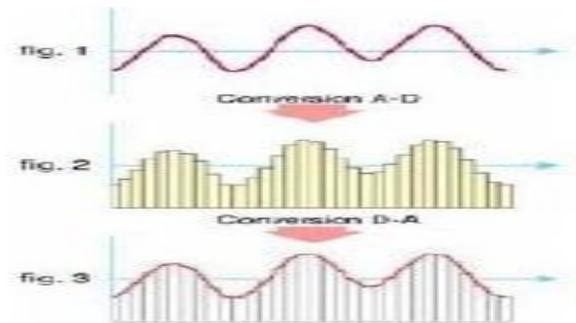
A typical first program for a microcontroller simply blinks a LED on and off. In the Arduino environment, the user might write a program like this.

It is a feature of most Arduino boards that they have an LED and load resistor connected between pin 13 and ground, a convenient feature for many simple tests. The previous code would not be seen by a standard C++ compiler as a valid program, so when the user clicks the "Upload to I/O board" button in the IDE, a copy of the code is written to a temporary file with an extra include header at the top and a very simple main() function at the bottom, to make it a valid C++ program

WHY ARDUINO BECOME SO POPULAR?

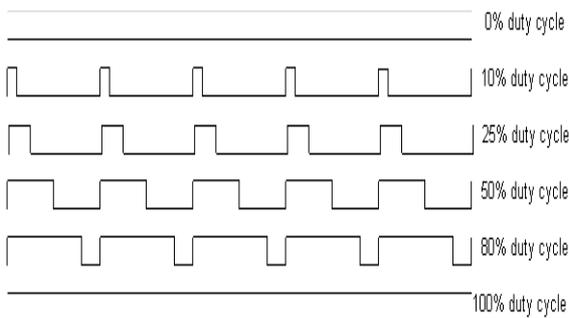
There are some shortcoming in the other microcontrollers present in market which are replaced in Arduino and some additional characteristics are also added which results in growth of demand of Aurduino and these additional characteristics are stated below:

- 1) Many of the DEV boards are historically enormously complex with lot of added parts like LCD, buttons ,LED,7-segment etc.showing everything it can do but arduino has bare minimum i.e there are hundereds of shields from LCD to wi-fi .
- 2) Analog to Digital converter
Arduino can eassily convert small analog signal into digital signals which is not possible with some of other microcontrollers present in market .The process of Analog to digital conversion is shown in figure.



3) PULSE WIDTH MODULATION (PWM)

Arduino has 8 bit of resolution when the outputting a signal using PWM. The outputting voltage varies from 0 to 5 volts which can be depicted as below



With help of this variation in voltage we can perform a number of operations like controlling speed of motor,

controlling intensity of LED, can generate audio signal and many more.

4) open source :

As Arduino is an open source and commercial use is allowed if you make a clone. It's an open source hardware so a company or school can use it without any pre-seat licensing.

5) Cost and Durability:

At \$30 a piece, an Arduino is an inexpensive investment for someone who wants to try it out. Compare that to the BeagleBoard-xM, which costs \$180. One reason why the Arduino is so cheap is because it is easy to clone.

6) Program could be easily loaded on board :

Once the program is made then it could be loaded on the Arduino board easily with connecting it directly to the laptop with help of connecting it with USB cable.

7) IDE software can run with Macs, Linux and Windows

One of the most interesting properties of IDE software is that it is compatible with Macs, Linux, and Windows, which are among the most common operating systems available in the market.

DISADVANTAGES :

There are few disadvantages also with arduino

1)Limited by DAC :

Which means that it can easily convert analog signal to digital signal but it cannot convert digital to analog signal .

2)limited processing power :

The processing power provided which is about 16Mhz is also limited .

3)SMALL MEMORY SPACE ;

As arduino is a small computer only therefore it is also provided with a memory 16kb flash memory ,1KB SRAM ,512 bytes EEPROM (for ATmega168) which is just enough to write single program on the board and make it execute but once you load another program on board the previous one would get erased .

As , arduino is new in market due to which there are less number of shortcomings in it .

APPLICATIONS :

Arduino was basically designed to make the process of using electronics in multi-disciplinary projects more accessible. It is intended for artists, designers, hobbyists, and anyone interested in creating interactive objects or environments. Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. Because of these features, arduino finds extensive application in various fields. Arduino projects can be stand-alone or they can communicate with software running on a computer. Arduino is used by all class of people in a different way. Some students use it in their projects, some using arduino for fun, some went out to become entrepreneurs. This only shows useful is this tiny device. Thousands of projects have been done worldwide using this tiny little device. Some of which are:

- ✎ Simple room temperature readout
- ✎ Interactive real-time auditory feedback system
- ✎ GPS receiver Module
- ✎ Ultrasonic Sensor
- ✎ Infrared detectors
- ✎ SONAR
- ✎ Various sensor projects like
- ✎ Keypad security code
- ✎ Sensor tube for heart monitor
- ✎ Pulse rate monitor
- ✎ Various light projects like

- ✎ Multicolor light display
- ✎ Seven-segment LED display
- ✎ Double seven-segment LED dice
- ✎ LED array
- ✎ LCD module

CONCLUSION:

Arduino is becoming very popular and it is also very useful and effective tool in many projects . so my aim is to make people familiar with this upcoming technology and encourage them to show their active participation in electronics projects .arduino is not only for engineers or technical persons but it could be used by hobbyists also as its usage is quite simple and language used in programming is also very easy .

REFERENCES :

- [1]. <http://www.arduino.cc> -Arduino Official webpage
- [2]. <http://en.wikipedia.org/wiki/Arduino> -wikipedia
- [3]. Jonathan Oxer,Hugh Blemings —Practical Arduino
- [4]. Arduino tool:for interactive artwork Installations.by-Murtaza Hussain Shaikh ,department of computer and information science (IDI) , Norwegian university of science and Technology (NTNU) ,IEEE- paper
- [5]. <http://www.arduino.cc/playground/Projects/ArduinoUsers>
- [6]. <http://www.arduinodocumentary.org>
- [7]. <http://www.google.com>