University of Dar es Salaam

Introduction to Embedded C Programming.

Introduction

- **Programming** is the process of creating a set of instructions that tell a **computer** how to perform a task.
- **Programming** can be done using a variety of computer **programming** languages, such as JavaScript, Python, C and C++.

Embedded C programming

- Embedded C is one of the most popular and most commonly used Programming Languages in the development of Embedded Systems.
- An Embedded System is a system which has both the **hardware** and **software** and is designed to do a specific task.
- Embedded Software or Program allow Hardware to monitor external events (Inputs) and control external devices (Outputs) accordingly.

Embedded C programming cont…

- A software program is written on a special IDE (Integrated Development Environment) on a computer and uploaded to the microcontroller for execution.
- Embedded C is basically an extension to the Standard C Programming Language with additional features.
- It uses the same syntax and semantics of the C Programming Language like **main function**, **declaration of datatypes**, **defining variables**, **loops**, **functions**, **statements**, etc.

Parts of Arduino Program

- Arduino program can be divided in three main parts;
  - values(variables and constants),
  - structure and
  - functions.

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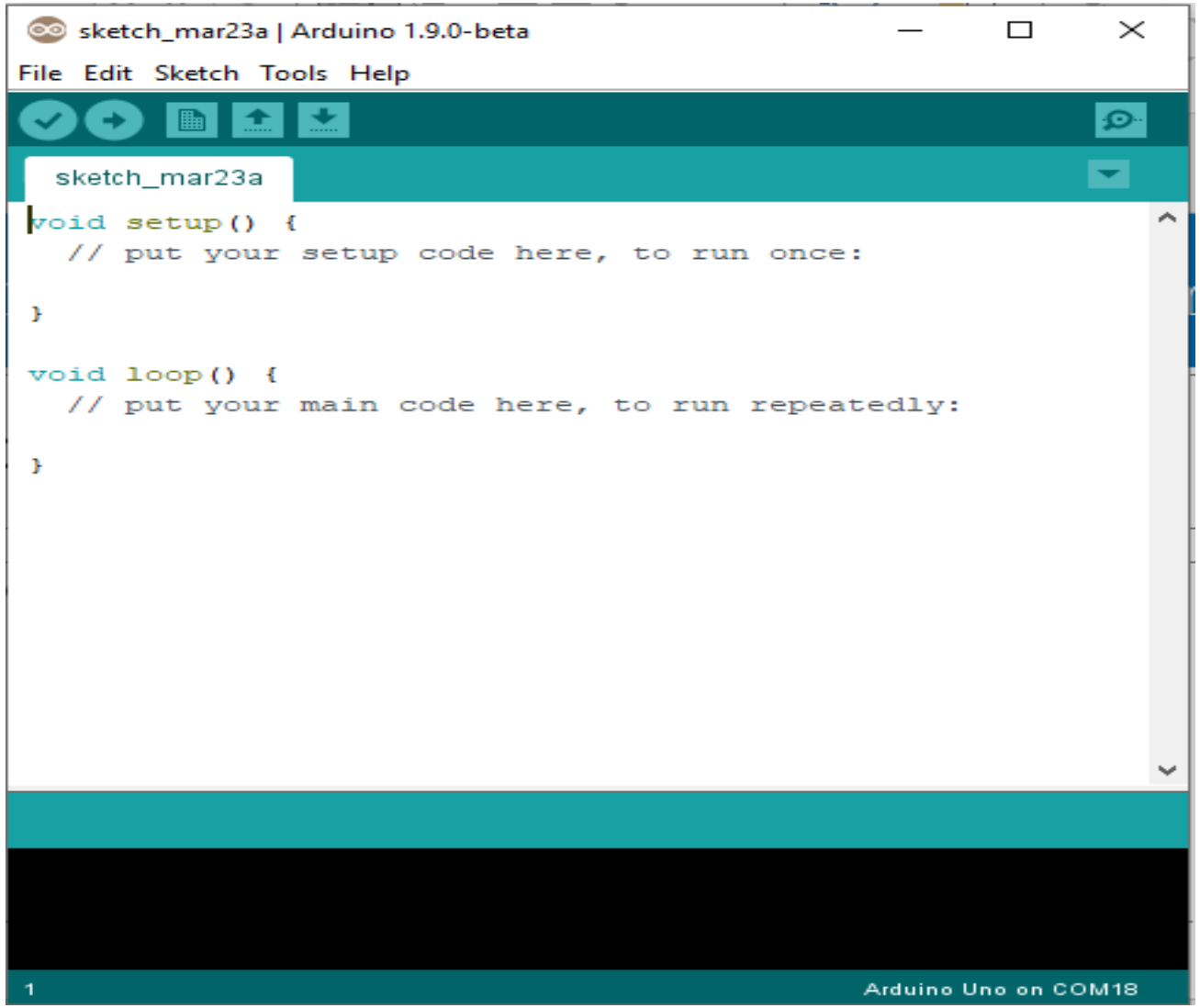


Variables(constants & data types)

❑**Constants**

- HIGH | LOW
- INPUT | OUTPUT
- true | false
- integer constants
- floating point constants, etc.

Data types

Data Type	Size (Bytes)	Range of Values
void	0	null
bool/boolean	1	True/False
char	1	-128 to +127
unsigned char	1	0 to 255
byte	1	0 to 255
int	2	-32,768 to 32,767
unsigned int	2	0 to 65,535
word	2	0 to 65,535
long	4	-2,147,483,648 to 2,147,483,647
unsigned long	4	0 to 4,294,967,295
float	4	-3.4028235E+38 to 3.4028235E+38
double	4	-3.4028235E+38 to 3.4028235E+38
string	-	character array

Some functions in Arduino program

❑**pinMode()**

- It configures the specified pin to behave either as an input or an output. Eg. pinMode (ledPin, OUTPUT);

❑**digitalWrite()**

- Write a HIGH or a LOW value to a digital pin.

  Eg. digitalWrite (ledPin, HIGH);

❑**digitalRead()**

- Reads the value from a specified digital pin, either HIGH or LOW.

  Eg. digitalRead(pin);

Functions in Arduino program cont…

❑**analogRead()**

- Reads the value from the specified analog pin.

  eg. float value=analogRead (inPin);

❑**analogWrite()**

- Writes an analog value (PWM wave) to a pin.

  eg. analogWrite (ledPin, Value/4);

Time functions

❑**delay()**

- Pauses the program for the amount of time (in miliseconds) specified as parameter. (There are 1000 milliseconds in a second.)

  eg. delay(1000);

❑**delayMicrosecods()**

- Pauses the program for the amount of time (in microseconds) specified as parameter. There are million microseconds in a second.

  eg. delayMicroseconds(10000)

❑Other time functions include; **millis()** and **micros()**

Some control structures in Arduino program

- **If**

  if (conditional) and ==, !=, <, > (comparison operators)

- If,is used in conjunction with a comparison operator, tests whether a certain condition has been reached, such as an input being above a certain number.
- Syntax;

```
if (SensorValue<25) {
//do something
 }
```

Control structure cont…

❑**If…else**

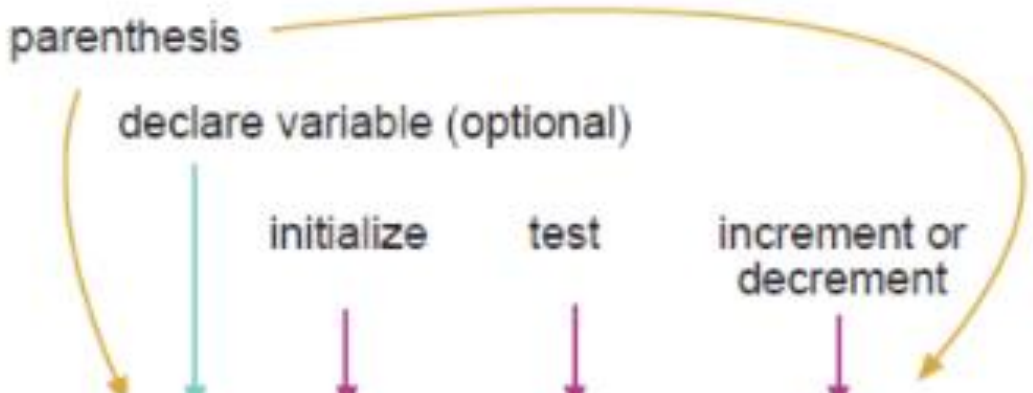
- if/else allows greater control over the flow of code than the basic if statement, by allowing multiple tests to be grouped together.
- Syntax;

```
if (SensorValue<25) {
//Action A
 }
else {
//Action B
}
```

Control structure cont…

❑for statement

- The for statement is used to repeat a block of statements enclosed in curly braces. An increment counter is usually used to increment and terminate the loop.




```
for(int x = 0; x < 100; x++){

   println(x);  // prints 0 to 99
}
```

Control structure cont…

❑while

- while loops will loop continuously, and infinitely, until the expression inside the parenthesis, () becomes false.
- Syntax;

```
while(expression){
//statement(s)
}
```

Other control structures you need to know

- switch case
- do…while
- break
- continue
- return
- goto


Thank you!