



# Prototyping and Designing the software for IoT Applications



## What is Prototyping?

It is the process of building IoT hardware and devices enhanced with smart sensors and embedded systems using many off-the-shelf components like sensors, circuit boards, and microcontrollers.

Develop the codes, design and test the embedded devices for IoT and M2M using IDEs and development platform

To develop IoT software five levels are needed.

1. Gather+Consolidate
  2. Connect
  3. Collect+Assemble
  4. Manage and Analyse
  5. Applications and Services.
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# PROTOTYPING EMBEDDED DEVICE SOFTWARE.



- IDE(Integrated development environment) enables development of software at first and second level for embedding into device platform.
- IDE enables development of codes on a computer, and later on downloading of codes on to embedded device, such as Arduino or microcontroller boards.



# Programming Embedded Device Arduino Platform using IDE.



- An Integrated Development Environment (IDE) is software for building applications that combines common developer tools into a single graphical user interface (GUI).
- IDE, or Integrated Development Environment, is a software application that combines all of the features and tools needed by a software developer
- The Arduino Integrated Development Environment (IDE) is the main text editing program used for Arduino programming. Essentially the IDE translates and compiles your sketches into code that Arduino can understand. Once your Arduino code is compiled it's then uploaded to the board's memory.



# Programming for Arduino controlled traffic-lights (TLs) at a road junction.



- Programming for Arduino controlled traffic-control lights (TLs) at a road junction:
- Assume Arduino Uno board as an embedded device platform for the following project: three TLs-Red, Yellow and Green needs to be controlled on each of the four north, east, south and west clockwise pathways.
- Let twelve GPIO pins on Uno connect twelve number externally connected LEDS,  $R_0, Y_0, G_0, R_1, Y_1, G_1, R_2, Y_2, G_2, R_3, Y_3, G_3$ , (four sets of three R, G, Y LEDS each). The port LEDS represents the TLs during the prototype-development and testing-stage.
- How can the port LEDS be On-Off programmed so that north and south pathways directed roads and traffic is switched on and east and west pathways traffic switched off?



First step is declaring the data types, constants coding for setup , variables and functions used.

Second step is

() and loop (). Example of program codes and

Third steps are

*/\*Assume twelve , which embeds onto Uno are as follows:*

*digital 10 ports assigned to external port 14. The ports are programmed according LEDs are port 2 to 12 and Pin 13 to TLS switching ON or OFF./ connects the board LED, and be used for indicating of the developed codes during successful running testing phases.\*/\**

*int internalLED 13;*

*/ Variables are written using a lower case first character \*/*

*int ledRO, ledY0, ledG0, ledR1, ledY1, ledG1, ledR2, ledY2, ledG2,ledR3,ledY3, ledG3;*



Assign the pins to the respectively connected LEDES \*/

ledRO 2; ledYO - 3; ledG4 4; ledR15; ledY16:ledG1 7; ledR2 - 8;  
ledY29; ledG2 = 10; ledR3 11; ledY3 12; ledG3 - 14:

/Declare Functions for sequences of traffic lights ON-OFF as follows: \*/

```
void north_south_Green ()
```

```
{
```

```
digitalWrite LOW); digitalWrite (ledYO, LOW); digitalWrite (ledGo,  
(ledRO,HIGH); digitalWrite(ledY2, LOW); digitalWrite(ledG2, LOW);  
digitalWrite(ledR2,HIGH);
```

```
}; ON for East and West pathways*/
```



/Function Switch RED

```
void east_west_Red() {  
  led, LOW); digitalWrite(led,  
  LOW) a fled), HIGH); digitalWrite(  
  Write  
  LOW)
```

void setup thus assigned port numbers corresponding to 12  
to 12 and 14 are 02, R3, 13, and G3, +/  
/GPIO pins 2 GO, R1, YI, G1, R2, Y2,  
external LEDs, RO. YO,  
Assign mode of each pin as output Canes





Constants are written in Upper

```
pinmode (ledRO, OUTPUT)
```

```
pinmode (ledYO, OUTPUT)) tot is oval babbling cod
```

```
lux no halfoma og of choo
```

```
pinmode (ledY3, OUTPUT);
```

```
led), OUTPUT); be admur bydawd/dawunda only o
```

```
pinmode (
```

Let Pin 13 be used for indicating successful running of the developed codes during testing phases. Initialise internal Port 13 Digital To Pin LED For test./

```
pinmode (internalLED, OUTPUT); o hortwe are own brou zake no
```

```
Initialise start of the Board and Sequences. */
```

```
(internalLED, HIGH);
```

```
/ Display the settings of Digital 19 pins at serial display-monitor on the computer where IDE is setup. /
```





- Let UART mode baud rate – 9600 Serial.begin (9600);
- Serial.println ("Arduino project. Program for controlling Red, Yellow and Green at four pathways three traffic signals- Serial.println"))
- ("Arudino board LED glows when cycle 1lights turning high and turns starts for the sequences of successful completion off for brief interval order the of the cyclein to indicate Serial.println");

("Twelve 12 external R3, Y3, and G3 corresponds LEDS, RO, YO, GO, R1, Y182, Y2. 02.to 12 trarric . 01. four pathways") lights at north, eastwest, south,

- Step: Loop function which

void loop endlessly runs / Assume no 0 4 for right turn from pathways or left turn

- simplicity and for learning from pathways permitted
- Switch Green ON for North the basics. , just Switch RED ON for East and South pathways and West pathways/
- // Run Functions "/



**Thank You**