OBJECTIVE:

To implement the concepts of Instrumentations and Measurements in constructing a Light Intensity Meter.

COMPONENTS:

The hardware components are as follow:

- NodeMCU (ESP8266)
- BH1750 FVI Chip (Digital Ambient Light Sensor)
- Header Pins (Male Pins)
- DC Battery (9V) with Cap
- Push Button (Switch)
- LED (Red)
- Veroboard
- Connecting Wires
- Soldering Iron
- Soldering Wire

The software part required only one software i.e., Arduino IDE Environment which was used to produce code of the project.

THEORY:

A digital Light Meter is a device which is used to measure the intensity of a source of light. Light meter is one in all devices used for several purposes including photography, occupational health, and illumination engineering and agriculture. Most of the light meter consists of a body, photocell or light sensor, and display. The light that falls on to the photocell or sensor contains energy that's transformed into electric current. Indeed, the measure of current depends on the intensity light that strokes the photocell or light sensor. Light meters read the electrical current calculate the acceptable value and show this value on its display.

EXPLANATION:

ESP8266 is a low power, self-contained SOC with integrated TCP/IP protocol stack WIFI controlled microcontroller. The ESP8266 uses a 32bit processor with 16-bitinstructions. It's Harvard architecture where instruction memory and data memory are completely distinct.

The BH1750 is a light intensity sensor that can be used to adjust the brightness of display in mobiles and LCD displays. It can also be used to turn the headlights of cars on/off based on the outdoor lighting. The sensor uses I2C communication protocol so that makes it super easy to use with microcontrollers. The SCL and SDA pins are for I2C. There is no calculation needed to measure the LUX value because the sensor directly gives the lux value. Actually, it measures the intensity according to the amount of light hitting on it. It operates on voltage range of 2.4V-3.6V and consumes really small current of 0.12mA. The result of the sensor does not depend upon the light source used and the influence of IR radiation is very less. There are very less chances of any error because the variation in measurement is as low as +/-20%.

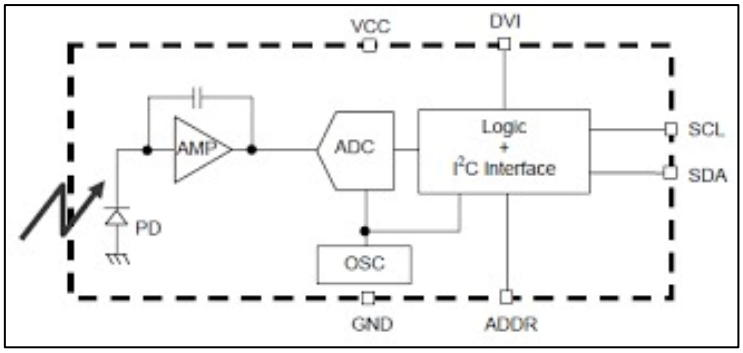

Figure 1: Sensor's Internal Structure

The 9V DC battery is used to provide voltage means here battery is like a dc voltage source that supply voltage to the entire circuit through NodeMCU, the use of switch is to prevent loss of energy where the LED is used for the indication of continuity of the circuit.

CIRCUIT DIAGRAM:

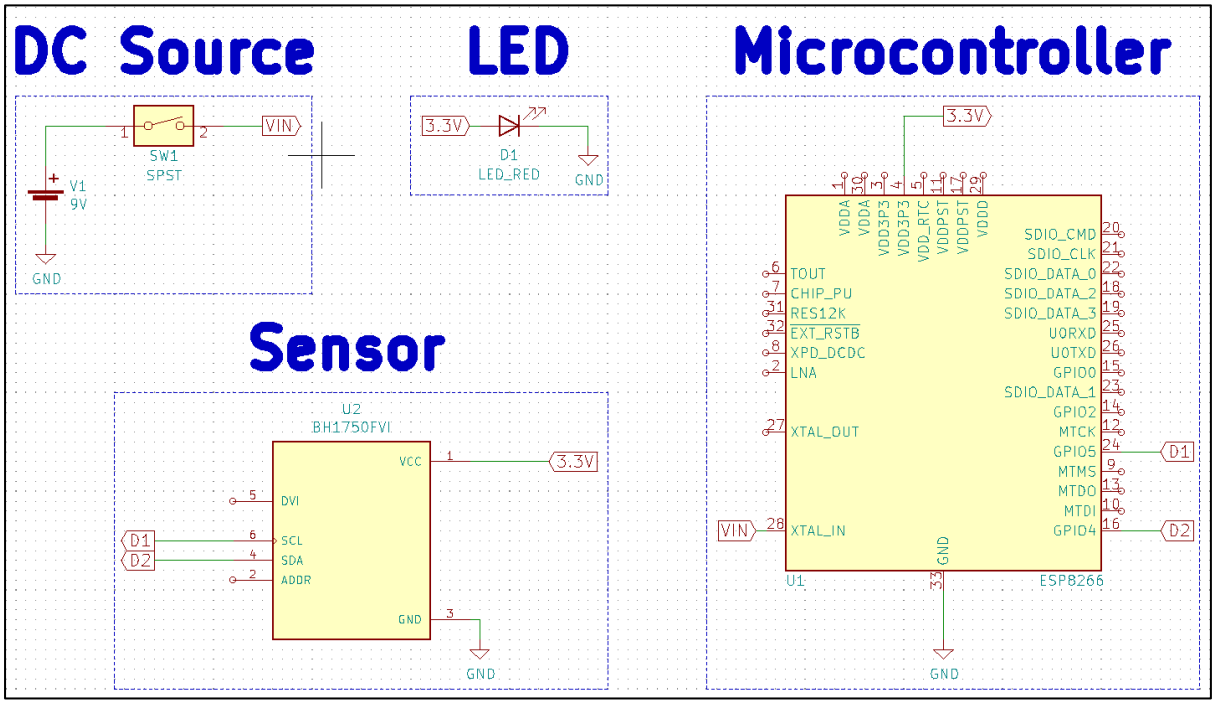

Figure 2: Circuit Diagram of Light Intensity Meter

PROCEDURE:

1. Connect the 9V DC battery cap's positive end with one terminal of switch and negative end with GND of NodeMCU microcontroller.
2. Connect the other terminal of the switch with the VIN of NodeMCU microcontroller.
3. Interface the BH1750 Ambient Light Sensor with NodeMCU ESP8266 Board. The connection is fairly simple. Connect the I2C Pin of BH1750, i.e., SCL & SDA to D1 & D2 of NodeMCU Board Respectively.
4. Connect the 3.3V pin of BH1750 to NodeMCU 3.3V pin & GND to GND.

5. Download and install the Blynk Application from Google Play Store. IOS users can download from the App Store. Once the installation is completed, open the app & sign-up using your Email id and Password.
6. Create your UI (User Interface) by dragging dropping and filling up details along with the virtual pin assignment. Once the UI is created, you can ask for the authentication Token by sending the mail. You will need the Authentication Token for the code.
7. Once the code is uploaded, the NodeMCU Board will connect to the Wi-Fi using the assigned Wi-Fi SSID & Password. Once, the Nodemcu connects to the Wi-Fi, it will start uploading the data to Blynk Server.
8. You can monitor the Light Intensity data on the Blynk Application.

CODE:

```
#include <Wire.h>            // Adds I2C library
#include <BH1750.h>       // Adds BH1750 library file

#define BLYNK_PRINT Serial

// Initializing Template created on Blynk IoT
#define BLYNK_TEMPLATE_ID "TMPLPmISTDdM"

// Initializing Wi-Fi
#include <ESP8266WiFi.h>
#include <BlynkSimpleEsp8266.h>

// Declaring Wi-Fi Connection
char auth[] = "Pwgm23Wmw_6SNHoTAXHIrnUt1ZDtug2v" ;
char ssid[] = "Wi-Fi SSID";
char pass[] = "Wi-Fi Password";

BH1750 lightMeter;

void setup()
{
  Serial.begin(9600);
  Wire.begin();
  Blynk.begin(auth, ssid, pass);
  lightMeter.begin();
}

void loop()
{
  Blynk.run();
  delay(1000);
  float lux = lightMeter.readLightLevel();
  Blynk.virtualWrite(V0, lux);
}
```

APPLICATIONS:

- Sensitive medical equipment
- Checking lamp or fluorescent tube light illumination
- Automatic solar tracking device
- Measurement of sunlight lux in daytime
- Light sampling
- Checking light intensity in the room
- Automatic streetlights intensity controlled

COSTING AND BUDGETING:

Serial #	Components	Unit Price (PKR)	Quantity	Total Price (PKR)
1	NodeMCU (ESP8266)	450.00	1	450.00
2	BH1750 FVI Chip (Light Sensor)	450.00	1	450.00
3	DC Battery (9V)	50.00	1	50.00
4	Battery Cap	10.00	1	10.00
5	Switch	5.00	1	5.00
6	LED	5.00	1	5.00
7	Veroboard	50.00	1	50.00
8	Connecting Wires	30.00	1	30.00
9	IoT Device	0.00	1	0.00
	Overall Cost (PKR)			**1050.00**

GROUP MEMBERS:

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CONCLUSION:

It is concluded that light sensor is a device that is used to detect light. There are many different types of light sensors. The light sensor can be used for measurements of light intensity in a variety of situations. The design and development of an inexpensive and accurate light intensity meter basically using only electronics components. It also provides an opportunity to apply the knowledge of electronics module to design a prototype of a product.