# Survey on Arduino and its applications

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***Abstract*- This paper presents the various sensors and their usage with the microcontroller. Few of the sensors that are available in market are wired with microcontroller along with other supporting modules or devices to study their working. Each sensor has a unique way of operation, code (sometimes include library files), connection and area of application. Arduino Uno, a microcontroller board based on ATmega328 is used.**

***Keywords*- Arduino IDE, Arduino Uno, Sensors.**

## I. INTRODUCTION

The number of devices using internet became greater than the number of people using internet in the year 2008. A survey says that more than 50 billion devices will use internet at a time by 2020. The interfacing of real-world with these devices over the internet is said to be Internet of Things (IoT) [2]. The word 'thing' in IoT is combination of smart sensors, microcontrollers, data, network connectivity and actuators. Day by day the complexities of sensors are increasing in order to provide a real time data, without any errors. Sensors are used depending upon the complexity of the application. To process these data a compatible microcontroller is needed. The outcome of the microcontroller is actuated using actuators. The outcome depends on the sensed input data and the predefined instructions given to the microcontroller. Arduino is an open source platform with easy to use hardware and software. Arduino is user-friendly, easy to use for begineers. Many projects and applications can be built using Arduino boards [3][4]. The instructions you need your microcontroller to perform is written using Arduino IDE, open source software.[1]

## II. SENSORS

A sensor is a device used to collect or detect the information continuously from the real-world and send it to the electronic device or a microcontroller. Use of sensors has expanded in every electronic gadget in present time. The use of sensors has become necessary everywhere. For example a touch sensor is used in ATM machines, smart phones and in many other. The various sensors that will be disussed are

A. Temperature and humidity sensor
B. LDR sensor
C. IR sensor
D. Ultrasonic sensor
E. Vibration sensor

Let's see individual sensor by connecting it to Arduino.

### *A. Temperature and Humidity sensor*

The DHT11 is a basic, low-cost digital temperature and humidity sensor. The Dht11 is shown in the Fig 1. It has 4 pins- Vcc, Data, NC, GND. Power supply of 3-5V is given to Vcc and GND terminals. DHT11 gives a digital output. It can measure humidity about 20-90%RH and temperature about 0-50°C [5].

Fig 1. DHT11 Humidity sensor

The DHT11 is connected with arduino as shown is Fig 2. The Data pin of DHT11 is connected to pin 2 of Arduino. 5V Power supply terminal is connected to Data pin of DHT11 via 10K Ω resistor. The Arduino is connected to the Computer via USB port. The libraries are used along with the instructions in Arduino IDE. The code is dumped onto the microcontroller. After successfully uploading the code, open the serial monitor to see the output of the sensor. The output that was given by the DHT11 is given in the Fig 3. As the temperature and humidity vary the sensor detects and sends the signal to the microcontroller.

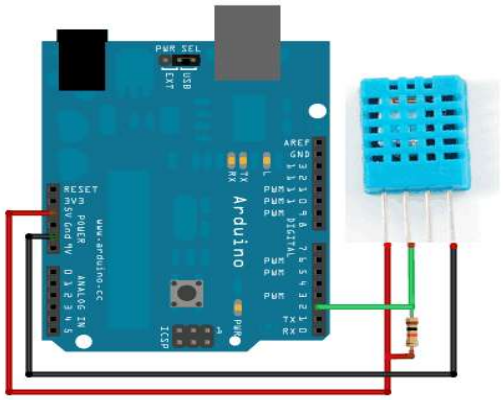

Fig 2. Humidity sensor with arduino

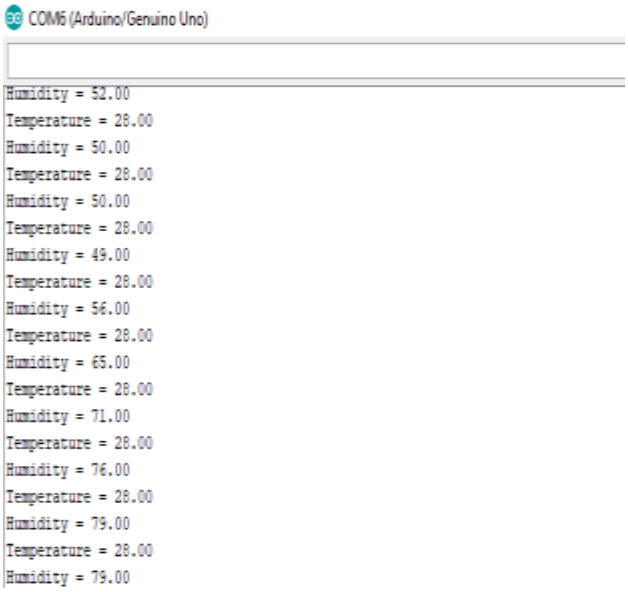


Fig 3. Serial monitor output of DHT11 sensor

*B. LDR sensor*

LDR or Light dependent resistor, shown in Fig 4, is a variable resistor which varies with the intensity of light that falls on it. It has many other names such as photoconductor, photoresistor or a cadmium sulfide (CdS) cell. It works on the principal of photoconductivity. As the intensity of light increases the resistance of LDR also increases. The output of LDR is analog thus the output of LDR is connected to analog pin of arduino. Various applications LDR are Automatic Street Light Circuit, Simple Fire Alarm Circuit, Light Activated Switch Circuit, Automatic LED Emergency Light and Night Security Light.

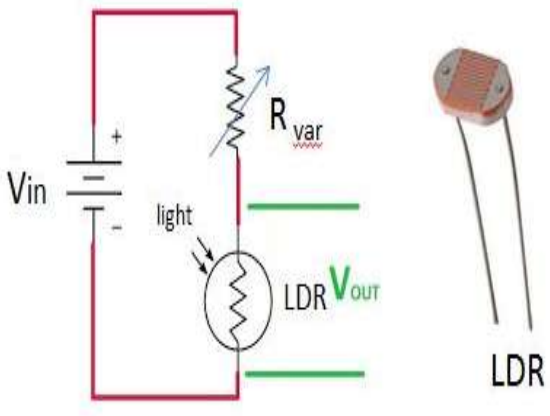


Fig 4. Light Sensor(LDR)

The LDR is connected with Arduino along with LED as shown in Fig 5. As the intensity of light decreases, the LED glows and vice-versa. . The output of LDR is analog thus the output of LDR is connected to analog pin of arduino as shown in Fig. The output on the serial monitor is shown in the Fig 6.

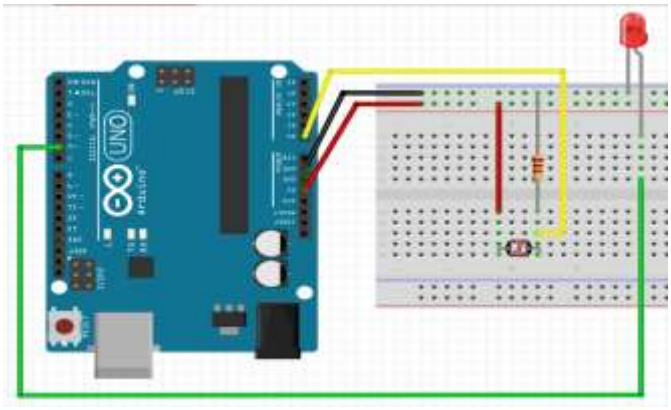

Fig 5.LDR sensor with arduino


Fig 6. Serial monitor output of LDR sensor

*C. IR sensor*

Infrared sensor, shown in Fig 7, is an electronic device that senses infrared rays from structures or aspects present in the surroundings. IR radiations are not invisible to our eyes and can be detected by an infrared sensor. IR LED (Light Emitting Diode) acts as an emitter and an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED acts as a detector. When photodiode detects the IR light, the resistances and the output voltages, change in proportion to the magnitude of the IR light received.

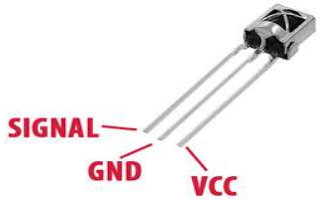


Fig 7. IR sensor

The IR sensor connection with Arduino is shown in Fig 8. The TV remote controller can be used to as IR emitter. The hex codes of each button can be decoded and written in understandable words while writing instructions. When the buttons of remote are pressed the equivalent output is printed on the serial monitor as shown in Fig 9.

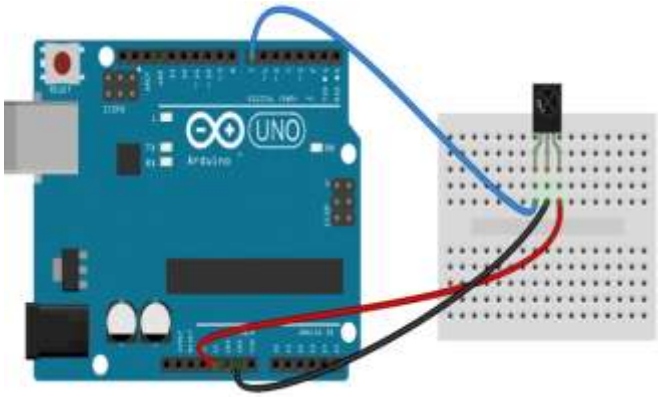

Fig 8.IR sensor with arduino

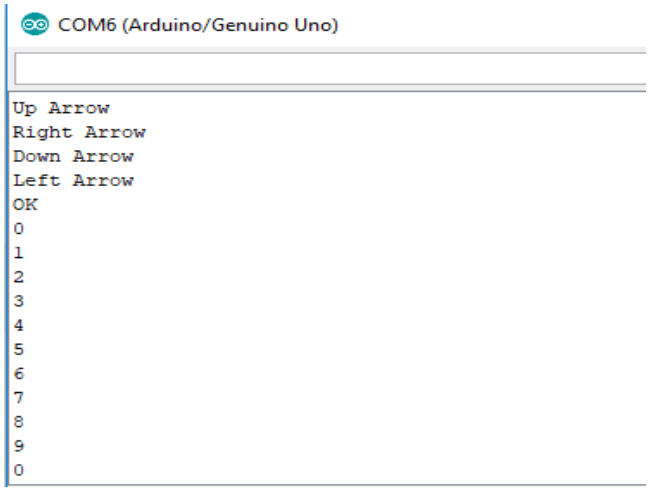


Fig 9. Serial monitor output of LDR sensor

*D. Ultrasonic sensor*

Ultrasonic sensor is an electronic device that measures distance by using ultrasonic waves. The sensor triggers or emits an ultrasonic wave and receives the reflected wave from the target object. The distance of the target object is measured by measuring the time gap between the emission and reception of wave signal. An optical sensor has separate transmitter and receiver, whereas an ultrasonic sensor has a single ultrasonic element for both emission and reception [6].

The Ultrasonic sensor has 4 terminals Vcc, GND, Trigger and Echo as shown in Fig 10. Trigger sends the ultrasonic wave the travels back after getting reflected by the object. The reflected sound is collected by Echo.


Fig 10. Ultrasonic sensor

The distance can be calculated with the following formula: Distance L = 1/2 × T × C, where L is the distance, T is the time between the emission and reception, and C is the sonic speed. (The value is multiplied by 1/2 because T is the time for go-and-return distance).

The connection of Ultrasonic sensor is shown in Fig 11. The obstacle is placed at different positions. The distance measured by the sensor is continuously printed on serial monitor as shown in Fig 12.

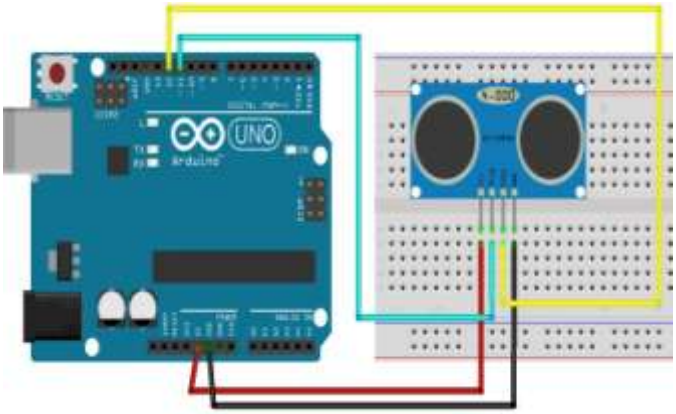

Fig 11. Ultrasonic sensor with arduino

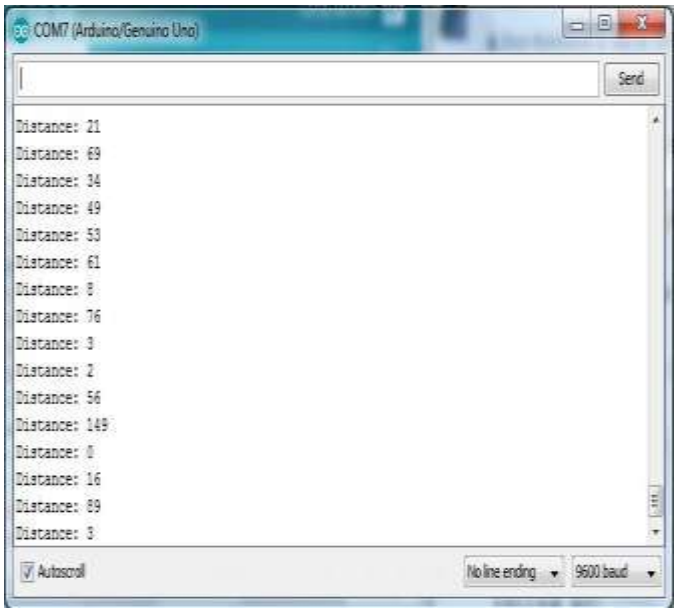


Fig 12. Serial monitor output of Ultrasonic sensor

*E. Vibration sensor*

SW420, vibration sensor, is Single-roller type full induction trigger switch. When there is no vibration, the circuit inside is ON, conducting and is in the steady state. When a vibration or tilt occurs, the switch will be forced to disconnect and the conductive resistance increases. This generates a current pulse signal, thereby triggering circuit [7].

Fig 13. Vibration sensor

The sensor has 3 pins Vcc, GND and D0 (output data pin) as shown in Fig 13. The sensed vibration by the module is sent to the controller via D0. The connection of sensor with Arduino is shown in Fig 14. The output values of the vibrations are displayed on serial monitor as shown in Fig 15.

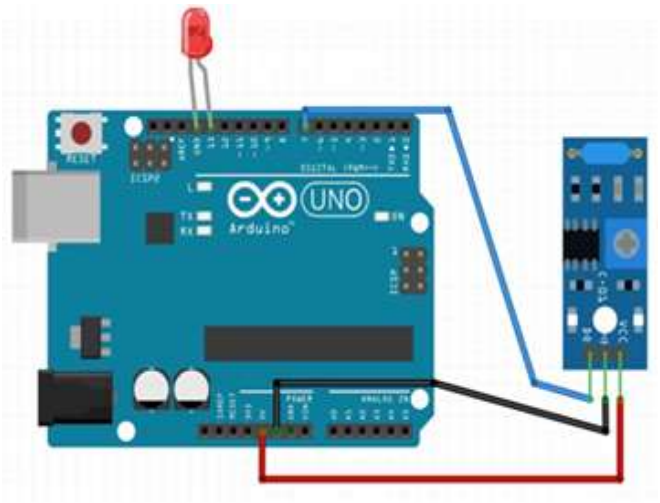


Fig 14.Vibration sensor with arduino

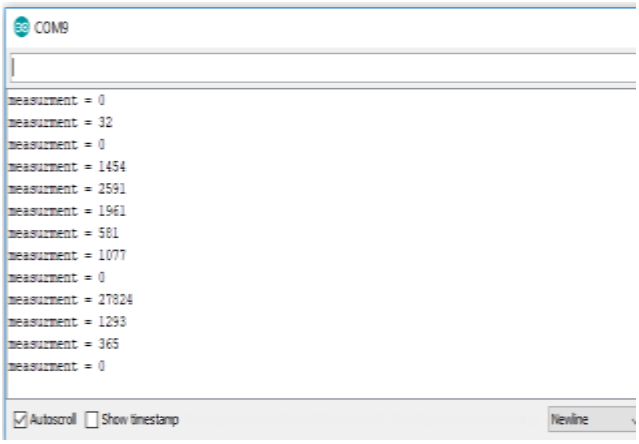


Fig 15. Serial monitor output of Vibration sensor

## III. CONCLUSION

Various sensors were studied and the working of those was understood. The sensors were rigged up as per the circuit diagrams and inputs were provided whenever and wherever necessary. Few sensors required library files for their operation. The observed outputs were recorded. All the above sensors can be interfaced together with the Arduino Uno and a new project/system can be done.

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