DRONACHARYA
College of Engineering

LABORATORY MANUAL

B.Tech. Semester- VI

SENSORS AND ACTUATORS LAB
Subject code: LC-IOT-326G

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DEPARTMENT OF CSE/CSIT/IT/IOT
DRONACHARYA COLLEGE OF ENGINEERING
KHENTAWAS, FARRUKH NAGAR, GURUGRAM (HARYANA)

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Vision and Mission of the Institute

Vision:

"Empowering human values and advanced technical education to navigate and address global challenges with excellence."

Mission:

- **M1:** Seamlessly integrate human values with advanced technical education.
- **M2:** Supporting the cultivation of a new generation of innovators who are not only skilled but also ethically responsible.
- **M3:** Inspire global citizens who are equipped to create positive and sustainable impact, driving progress towards a more inclusive and harmonious world.

Vision and Mission of the Department

Vision:

"Steering the future of computer science through innovative advancements, fostering ethical values and principles through technical education."

Mission:

M1: Directing future innovations in computer science through revolutionary progress.

M2: Instilling a foundation of ethical values and principles in every technologist.

M3: Offering a comprehensive technical education to equip individuals for a meaningful and influential future.

Programme Educational Objectives (PEOs)

PEO1: Apply the technical competence in Computer Science and Engineering for solving problems in the real world.

PEO2: Carry out research and develop solutions on problems of social applications.

PEO3: Work in a corporate environment, demonstrating team skills, work morals, flexibility and lifelong learning.

Programme Outcomes (POs)

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and software tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSOs)

PSO1: Exhibit design and programming skills to develop and mechanize business solutions using revolutionary technologies.

PSO2: Learn strong theoretical foundation leading to brilliance and enthusiasm towards research, to provide well-designed solutions to complicated problems.

PSO3: Work effectively with diverse Engineering fields as a team to design, build and develop system applications.

University Syllabus

1. To sense the Available Networks Using Arduino.
2. Measure the Distance Using Ultrasonic Sensor and Make Led Blink Using Arduino.
3. To detect the Vibration of an Object Using Arduino.
4. Connect with the Available Wi-Fi Using Arduino.
5. Sense a Finger When it is Placed on Board Using Arduino.
6. Temperature Notification Using Arduino.
7. LDR to Vary the Light Intensity of LED Using Arduino.
8. MySQL Database Installation in Raspberry Pi.
9. SQL Queries by Fetching Data from Database in Raspberry Pi.
10. Switch Light On and Off Based on the Input of user using Raspberry Pi.

Course Outcomes (COs)

Upon successful completion of the course, the student will be able to:

CO1: Able to understand the types, working and characteristics of different sensors, actuators and Transducers.

CO2: Able to perform different sensors and Actuators on Arduino-UNO board

CO3: Able to perform different sensors and Actuators on Raspberry-Pi

.

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	3	2				1	1	2	2
CO2	2	2	3	3	2				1	1	3	2
CO3	2	1	2	2	3				1	2	2	3
Average	**2.3**	**1.7**	**2.3**	**2.7**	**2.3**				**1**	**1.3**	**2.3**	**2.3**

CO-PSO Mapping

	PSO1	PSO2	PSO3
CO1	3	2	2
CO2	2	3	1
CO3	2	3	2
Average	**2.3**	**2.7**	**1.7**

Course Overview

This is the fundamental course for the Internet of Things program. It introduces the basic working principle and operation of different types of sensors and actuators and their real time applications. It provides the various characteristics of different sensors and actuators.

It equips students with the practical knowledge required to understand and utilize the latest technologies and the Internet of Things. In this course the different sensors are discussed. It gives the information of Resistive, Capacitive and Inductive sensors and actuators. It gives their types and industrial applications. It also gives the information of many type of force/torque sensors, the strain gage dynamometers and piezoelectric type are most common. Both are available to measure force and/or torque either in one axis or multiple axes. The dynamometers make use of mechanical members that experiences elastic deflection when loaded. It gives the characteristics performance of mechanical sensors like- high stiffness, high resolution over a wide measurement range etc.

It also deals with Temperature Sensors and Thermal Actuators and their types: thermocouple , RTD, PTC, NTC, Thermistors etc. It also gives the information of optical–thermal sensors and actuators. It gives almost all the real time/ industrial sensors like- chemical, hydraulic, pneumatic, smart sensor and micro sensors. It gives the information about the interfacing of sensors /actuators with Arduino and raspberry-Pi.

Finally this subject gives the information of different industrial sensors and actuators and their real time applications with Arduino and Raspberry-Pi.

List of Experiments mapped with COs

S. No.	Name of the Experiments	Course Outcome
1	To sense the Available Networks Using Arduino.	CO2
2	Measure the Distance Using Ultrasonic Sensor and Make Led Blink Using Arduino.	CO2,CO1
3	To detect the Vibration of an Object Using Arduino	CO2
4	Connect with the Available Wi-Fi Using Arduino.	CO2
5	Sense a Finger When it is Placed on Board Using Arduino.	CO1, CO2
6	Temperature Notification Using Arduino-Uno.	CO2
7	LDR to Vary the Light Intensity of LED Using Arduino.	CO1,CO2
8	MySQL Database Installation in Raspberry Pi.	CO3
9	SQL Queries by Fetching Data from Database in Raspberry-Pi	CO3
10	Switch Light On and Off Based on the Input of user using Raspberry Pi.	CO3

Dos and DONT's

Dos

1. Students should maintain discipline all the time and obey the instructions.
2. Students should be punctual and regular to the laboratory.
3. Students should carry observation and record completed in all aspects.
4. Students should be at their concerned experiment table, unnecessary moment is restricted.
5. Students should follow the indent procedure to receive and deposit the components from lab assistant.
6. While doing the experiments any failure/malfunction must be reported to the faculty.
7. Students should check the connections of circuit properly before switch ON the power supply.
8. Students should verify the reading with the help of the lab instructor after completion of experiment.
9. Students must endure that all switches are in the lab OFF position, all the connections are removed.
10. At the end of practical class the components should be returned to the lab assistant.
11. After completing your lab session SHUTDOWN the systems, TURNOFF the power switches and arranges the chairs properly.
12. Each experiment should be written in the record note book only after getting signature from the lab in charge.
13. The final output waveforms should be traced by students from the system and paste on practical notebook.

DON'Ts

1. Don't bring mobiles into laboratory.
2. Don't turn ON the circuit unless it is completed.
3. Avoid making loose connections.
4. Don't leave the lab without permission.
5. Do not open any irrelevant sites on computer.
6. Don't use a flash drive on computers.

General Safety PRECAUTIONS

PRECAUTIONS (In case of Injury or Electric Shock)

1. To break the victim with live electric source, use an insulator such as fire wood or plastic to break the contact. Do not touch the victim with bare hands to avoid the risk of electrifying yourself.

2. Unplug the risk of faulty equipment. If main circuit breaker is accessible, turn the circuit off.

3. If the victim is unconscious, start resuscitation immediately, use your hands to press the chest in and out to continue breathing function. Use mouth-to-mouth resuscitation if necessary.

4. Immediately call medical emergency and security. Remember! Time is critical; be best.

PRECAUTIONS (In case of Fire)

1. Turn the equipment off. If power switch is not immediately accessible, take plug off.

2. If fire continues, try to curb the fire, if possible, by using the fire extinguisher or by covering it with a heavy cloth if possible isolate the burning equipment from the other surrounding equipment.

3. Sound the fire alarm by activating the nearest alarm switch located in the hallway.

4. Call security and emergency department immediately:

Emergency: Reception

Security : Main Gate

Guidelines to students for report preparation

All students are required to maintain a record of the experiments conducted by them. Guidelines for its preparation are as follows: -

1) All files must contain a title page followed by an index page. The files will not be signed by the faculty without an entry in the index page (with date).

2) Student's Name, Roll number and date of conduction of experiment must be written on all pages.

3) For each experiment, the record must contain the following

(i) Aim/Objective of the experiment

(ii) Apparatus required with specification and Name plate details

(iii) Brief theory,Circuit diagrams, procedures, observations, PRECAUTIONS and calculations

(v) Results/ output/Waveforms

Note:

1. Students must bring their lab file along with them whenever they come for the lab.

2. Students must ensure that their lab file is regularly evaluated.

Lab Assessment Criteria

An estimated 10 lab classes are conducted in a semester for each lab course. These lab classes are assessed continuously. Each lab experiment is evaluated based on 5 assessment criteria as shown in following table. Assessed performance in each experiment is used to compute CO attainment as well as internal marks in the lab course.

Grading Criteria	Exemplary (4)	Competent (3)	Needs Improvement (2)	Poor (1)
AC1: Circuit Diagram / Connection	Circuit diagram must be properly connected and software is installed properly.	Circuit diagram drawn and connection given	Circuit diagram and connection to be given as per directions.	No knowledge og circuit connection.
AC2: Interfacing of circuit diagram with system nd note down the reading	Able to identify the errors (connection error or syntax error) and note down the reading accurately by varying all the related parameters	Able to identify the error while running the machine and note down the reading by varying the parameters	Interface the circuit with computer but unable to remove error.	Unable to interface the system with circuit diagram
AC3: Theoretical knowledge (viva-voce)	Complete knowledge about all components used in experiment.	Know the concept of experiment but less knowledge of components used in circuit.	Not able to write concept and procedure	Purpose and result of experiment is not known
AC4: Lab Record Assessment	All the readings are properly recorded at different values and their corresponding results are mentioned properly.	Only readings are written but their consequences are not mentioned	Readings are noted down but not in prescribed table format.	Incomplete

LAB EXPERIMENTS

LAB EXPERIMENT-1

AIM: To sense the Available Networks Using Arduino.

Apparatus:

Arduino- UNO Board

Universal Board

12V Power supply

Jumper Wires

USB cable

LEDs

Hardware Procedure:

1. LED pin is Connected to Arduino Uno pin of 11 & 12.
2. POT pin is connected to the Arduino pin A1.
3. IR Sensor Pin is connected to the Arduino Pin 4.
4. Power jack is connected to the Arduino.
5. USB connector is connected to Arduino Uno to monitor.
6. Connect the 12V power supply to development board.
7. Check the output from the development board.

Software Procedure:

1. Click on Arduino IDE
2. Click on file
3. Click on New
4. Write a Program as per circuit Pin connections
5. Click on Save
6. Click on Verify
7. Click on Upload the code into Arduino Uno by using USB cable.

Program:

```
#include <SPI.h>
#include <WiFi.h>
void setup() {
  //Initialize serial and wait for port to open:
  Serial.begin(9600);
  while (!Serial) {
    ; // wait for serial port to connect. Needed for native USB port only
  }

  // check for the presence of the shield:
  if (WiFi.status() == WL_NO_SHIELD) {
    Serial.println("WiFi shield not present");
    // don't continue:
    while (true);
  }

  String fv = WiFi.firmwareVersion();
  if (fv != "1.1.0") {
    Serial.println("Please upgrade the firmware");
  }

  // Print WiFi MAC address:
  printMacAddress();
}
```

```
void loop() {
  // scan for existing networks:
  Serial.println("Scanning available networks...");
  listNetworks();
  delay(10000);
}
```

PRECAUTIONS:

1. Take care about given power supply (12V).
2. Jumper wires given carefully whenever given circuit connection.

VIVA QUESTIONS:

Q1. What is GSM ntwork?

Q2. What are the different IEEE802.11 standards

LAB EXPERIMENT 2-A

AIM: Measure the Distance Using Ultrasonic Sensor Using Arduino.

Apparatus:

Arduino- UNO Board

Universal Board

12V Power supply

Jumper Wires

USB cable

Ultra Sonic HC-SR04

Hardware Procedure:

1. Ultrasonic sensor module's "trigger" and "echo" pins are directly connected to pin 18(A4) and 19(A5) of Arduino.
2. A 16x2 LCD is connected with Arduino in 4-bit mode.
3. Control pin RS, RW and En are directly connected to Arduino pin 2, GND and 3.
4. Data pin D4-D7 is connected to 4, 5, 6 and 7 of Arduino

Software Procedure:

1. Click on Arduino IDE
2. Click on file
3. Click on New
4. Write a Program as per circuit Pin connections
5. Click on Save
6. Click on Verify
7. Click on Upload the code into Arduino Uno by using USB cable.

Program:

```
const int pingPin = 7; // Trigger Pin of Ultrasonic Sensor
const int echoPin = 6; // Echo Pin of Ultrasonic Sensor
void setup() {
  Serial.begin(9600); // Starting Serial Terminal
}
void loop() {
  long duration, inches, cm;
  pinMode(pingPin, OUTPUT);
  digitalWrite(pingPin, LOW);
  delayMicroseconds(2);
  digitalWrite(pingPin, HIGH);
  delayMicroseconds(10);
  digitalWrite(pingPin, LOW);
  pinMode(echoPin, INPUT);
  duration = pulseIn(echoPin, HIGH);
  inches = microsecondsToInches(duration);
  cm = microsecondsToCentimeters(duration);
  Serial.print(inches);
  Serial.print("in, ");
  Serial.print(cm);
  Serial.print("cm");
  Serial.println();
  delay(100);
}
```

```
long microsecondsToInches(long microseconds)
 {
   return microseconds / 74 / 2;
}
long microsecondsToCentimeters(long microseconds)
 {
   return microseconds / 29 / 2;
}
```

RESULT: Distance is measured in centimeters.

PRECAUTIONS:

1. Take care about given power supply (12V).
2. Jumper wires given carefully whenever given circuit connection.

VIVA QUESTIONS:

Q1. What is the Ultrsonic sensor?
Q2. What are the connections required or serial interface with ultrasonic sensor?

LAB EXPERIMENT 2- B

AIM: To demonstrates the function of blinking an LED using Arduino Uno.

Apparatus:

Arduino- UNO Board

Universal Board

12V Power supply

Jumper Wires

USB cable

LEDs

Hardware Procedure:

• LED pin is Connected to Arduino Uno pin of 2.

• Power jack is connected to the Arduino Uno.

• USB connector is connected to Arduino Uno to monitor.

• Connect the 12V power supply to development board.

• Check the output from the development board.

Software Procedure:

1. Click on Arduino IDE

2. Click on file

3. Click on New

4. Write a Program as per circuit Pin connections

5. Click on Save

6. Click on Verify

7. Click on Upload the code into Arduino Uno by using USB cable.

Program:

```
const int led = 2;
```

```
void setup() {
pinMode(led, OUTPUT);
}
void loop()
 {
digitalWrite(led, HIGH);
delay(1000);
digitalWrite(led, LOW);
delay(1000);
digitalWrite(led, HIGH);
delay(1000);
digitalWrite(led, LOW);
delay(1000);
}
```

RESULT: LED is successfully controlled by Arduino microcontroller Board.

PRECAUTIONS:

- Take care about given power supply (12V).
- Jumper wires given carefully whenever given circuit connection.

VIVA QUESTIONS:

Q1. What is the delay time of LED?
Q2. What is the value of current limiting resistor used with LED?
Q3. What are the steps to interface optical sensor with Arduino?

LAB EXPERIMENT 3

AIM: To detect the vibrations of an object using Arduino.

Apparatus:

Arduino- UNO Board

SW-420 Vibration Sensor Module

Universal Board

12V Power supply

Jumper Wires

USB cable

LEDs

Hardware Procedure:

• LED pin is Connected to Arduino Uno pin of 5.

• Power jack is connected to the Arduino Uno.

• USB connector is connected to Arduino Uno to monitor.

• Connect the 12V power supply to development board.

• Check the output from the development board.

Software Procedure:

1. Click on Arduino IDE
2. Click on file
3. Click on New
4. Write a Program as per circuit Pin connections
5. Click on Save
6. Click on Verify
7. Click on Upload the code into Arduino Uno by using USB cable.

Program:

```
int vibration_Sensor = A5;
int LED = 13;
 int present_condition = 0;
int previous_condition = 0;
* Pin mode setup */
void setup() {
        pinMode(vibration_Sensor, INPUT);
        pinMode(LED, OUTPUT);
}
void led_blink(void) {
        digitalWrite(LED, ON);
        delay(250);
        digitalWrite(LED, OFF);
        delay(250);
        digitalWrite(LED, ON);
        delay(250);
        digitalWrite(LED, OFF);
        delay(250);
}
void loop() {
        previous_condition = present_condition;
        present_condition = digitalRead(A5); // Reading digital data from the A5 Pin of the
```

Arduino.

```
if (previous_condition != present_condition) {
        led_blink();


} else {
        digitalWrite(LED, OFF);
}
```

RESULT: Vibration sensor is successfully operated by Arduino microcontroller Board.

PRECAUTIONS:

- Take care about given power supply (12V).
- Jumper wires given carefully whenever given circuit connection.

VIVA QUESTIONS:

Q1. What is the delay time Vibration Sensor?
Q2. What is the maximum distance that detects by the vibration sensor?

LAB EXPERIMENT 4

AIM: Connect With The Available Wi-Fi Using Arduino

Apparatus:

Arduino- UNO Board

ESP 8266 module or Wi-Fi module

Universal Board

12V Power supply

Jumper Wires

USB cable

LEDs

Hardware Procedure:

STEP1: Start the process.

STEP2: Start→Arduino IDE 1.8.8.

STEP3: Include the file directory ESP 8266 in Arduino.

STEP4: Then enter the coding to Wi-Fi module or ESP 8266 module. STEP5: Then enter the coding in Arduino software.

STEP6: Connect the USB cable to the Wi-Fi module and the Arduino connected system with available network.

STEP7: Select tools→Select board→Node MCU 0.9C ESP-12 module and then Select→Port.

STEP8: Upload the coding to ESP 8266 module and open serial monitor to View the available network connects IP address.

STEP9: Stop the process.

. **Software Procedure:**

1. Click on Arduino IDE

2. Click on file

3. Click on New

4. Write a Program as per circuit Pin connections

5. Click on Save

6. Click on Verify

7. Click on Upload the code into Arduino Uno by using USB cable.

Program:

```
#include <ESP8266WiFi.h> // Include the Wi-Fi library
const char* ssid = "Error"; // The SSID (name) of the Wi-Fi network you want to connect to
const char* password = "networkerror"; // The password of the Wi-Fi network
void setup() {
Serial.begin(115200); // Start the Serial communication to send messages to the computer
delay(10); Serial.println('\n');
WiFi.begin(ssid, password); // Connect to the network
Serial.print("Connecting to ");
Serial.print(ssid); Serial.print("...") int i = 0;
while (WiFi.status() != WL_CONNECTED) { // Wait for the Wi-Fi to connect
delay(1000);
Serial.print(++i); Serial.print(' '); }
void loop() { Serial.println('\n');
Serial.println("Connection established!"); Serial.print("IP address:\t");
Serial.println(WiFi.localIP()); // Send the IP address of the ESP8266 to the computer
} }
```

RESULT:_Thus the output for connecting with the available Wi-Fi using Arduino has been successfully executed.

PRECAUTIONS:

- Take care about given power supply (12V).
- Jumper wires given carefully whenever given circuit connection.

VIVA QUESTIONS

Q1. What is the use of Wi-Fi in Arduino Uno?

Q2. What is the range of Wi-Fi module in Arduino?

Q3. How to control Arduino with WiFi module?

Q4. What is the size of WIFI module?

LAB EXPERIMENT 5

AIM: Sense a finger when it is placed on board using Arduino.

Apparatus:

Arduino- UNO Board
Touch Sensor Module
Universal Board
5V Power supply
Jumper Wires
USB cable
LEDs

Hardware Procedure:

• DIG pin is Connected to Arduino Uno pin D1.

• Power jack is connected to the Arduino Uno.

• USB connector is connected to Arduino Uno to monitor.

• Connect the 5V power supply to development board.

• Check the output from the development board.

Software Procedure:

1. Click on Arduino IDE

2. Click on file

3. Click on New

4. Write a Program as per circuit Pin connections

5. Click on Save

6. Click on Verify

7. Click on Upload the code into Arduino Uno by using USB cable.

Program:

```
int Led = 13 ; // define LED Interface

int buttonpin = 7; // define Metal Touch Sensor Interface
int val ; //
define numeric variables val
void setup ()
 {
Serial.begin(9600);
pinMode (Led, OUTPUT) ; // define LED as output interface
 pinMode (buttonpin, INPUT) ; // define metal touch sensor output interface
}
void loop ()
 {
val = digitalRead (buttonpin) ;
//Serial.println(val);
if (val == 1) // When the metal touch sensor detects a signal,
LED flashes
{
digitalWrite (Led, HIGH);
Serial.println(val); delay(1000);
}
 else
 {
digitalWrite(Led,LOW);
Serial.println(val);
delay(1000);
                }
                }
```

RESULT: Thus the output for sensing a finger when it is placed in board Arduino has been successfully executed.

PRECAUTIONS:

- Take care about given power supply (5/12V).
- Jumper wires given carefully whenever given circuit connection.

VIVA QUESTIONS

Q1. How many types of touch sensors are present?

Q2. Which sensor can detect nearby objects?

Q3. Which sensor is used for touch?

Q4. What is the aim of touch sensor?

LAB EXPERIMENT 6

AIM: Temperature Notification Using Arduino.

Apparatus:

Arduino- UNO Board

Temperature Sensor LM35 series

Universal Board

5V/12V Power supply

Jumper Wires

USB cable

LEDs

Hardware Procedure:

• LM35 sensor has three terminals - V_s, V_{out} and GND.

- Connect the $+V_s$ to +5v on your Arduino board.
- Connect V_{out} to Analog0 or A0 on Arduino board.
- Connect GND with GND on Arduino.

. **Software Procedure:**

1. Click on Arduino IDE

2. Click on file

3. Click on New

4. Write a Program as per circuit Pin connections

5. Click on Save

6. Click on Verify

7. Click on Upload the code into Arduino Uno by using USB cable.

Program:

```
float temp;

int tempPin = 0;
```

```
void setup() {
  Serial.begin(9600);
}
void loop() {
  temp = analogRead(tempPin);
  // read analog volt from sensor and save to variable temp
  temp = temp * 0.48828125;
  // convert the analog volt to its temperature equivalent
  Serial.print("TEMPERATURE = ");
  Serial.print(temp); // display temperature value
  Serial.print("*C");
  Serial.println();
  delay(1000); // update sensor reading each one second
}
```

RESULT : The temperature display on the serial port monitor which is updated every second.

PRECAUTIONS:

- Take care about given power supply (12V).
- Jumper wires given carefully whenever given circuit connection.

VIVA QUESTIONS

Q1. What are the different types of temperature sensors?

Q2. What is the difference between PTC and NTC?

Q3. Give any real time application of RTD.

LAB EXPERIMENT 7

AIM: LDR to vary the light intensity of LED using Arduino.

Apparatus:

Arduino- UNO Board

SW-420 Vibration Sensor Module

Universal Board

12V Power supply

Jumper Wires

USB cable

LEDs

Hardware Procedure:

• LED pin is Connected to Arduino Uno pin of 5.

• Power jack is connected to the Arduino Uno.

• USB connector is connected to Arduino Uno to monitor.

• Connect the 12V power supply to development board.

• Check the output from the development board.

Software Procedure:

1. Click on Arduino IDE

2. Click on file

3. Click on New

4. Write a Program as per circuit Pin connections

5. Click on Save

6. Click on Verify

7. Click on Upload the code into Arduino Uno by using USB cable.

Program:

```
const int ldr_pin = 3;
const int  led_pin  =  2;
void setup( )
{
pinMode(ldr_pin, INPUT);
pinMode(led_pin, OUTPUT);
Serial.begin(9600);
}
void loop() {
if ( digitalRead( ldr_pin ) == 1)
{
digitalWrite(led_pin, HIGH);
}
else
{
digitalWrite(led_pin , LOW); }
Serial.println(digitalRead( ldr_pin ));
delay(100);
}
```

RESULT: Thus the output for LDR to vary the light intensity of LED using Arduino has successfully executed.

PRECAUTIONS:

- Take care about given power supply (5V).
- Jumper wires given carefully whenever given circuit connection.

VIVA QUESTIONS

Q1. What is the difference between LDR and LED?

Q2. What are the voltage range for LDR and LED?

Q3.Which is the best optical sensor LDR or LED?

LAB EXPERIMENT 8

AIM: MySQL Database installation in Raspberry-Pi.

Apparatus:

Raspberry-Pi

HDMI

Micro USB Power cable

Hardware / Software Procedure:

1. Download the SQL Server ODBC driver for Raspberry Pi.
2. Install and license the SQL Server ODBC driver on the Raspberry Pi machine.
3. Create an ODBC data source in /etc/odbc.ini that connects to the SQL Server database you want to access from Python.
4. Use isql to test the new data source.

Program:

```
sudo apt-get install mysql-server sudo apt
update
sudo apt upgrade
sudo apt install mariadb-server
sudomysql_secure_installation sudomysql -u
root –p
```

RESULT: Thus the output to install MySQL database in Raspberry pi has successfully executed.

PRECAUTIONS

- Place the product on a stable, flat, non-conductive surface while in use and do not let it contact conductive items.
- Avoid mechanical or electrical damage to the printed circuit board and connectors.
- Avoid handling the product while it is powered on.

VIVA QUESTIONS

Q1. Which SQL database is most used?

Q2. What is the difference between MySQL and SQLite?

Q3. How data is stored in Raspberry Pi?

Q4. Can a Raspberry Pi run SQL?

LAB EXPERIMENT 9

AIM: SQL Queries by fetching. data from database in Raspberry-Pi

Apparatus:

Raspberry-Pi

HDMI

Micro USB Power cable

Hardware / Software Procedure:

1. Install MySQL on Raspberry Pi.
2. Install Mariadb On Raspberry Pi.
3. Allow remote connection to Mariadb On Raspberry Pi.
4. Login to Mariadb on Raspberry Pi from Windows Computer.

Program:

```
sudomysql -u root –p
CREATE DATABASE exampledb;
CREATE USER 'exampleuser'@'localhost' IDENTIFIED BY
'pimylifeup';
CREATE TABLE Books(Id INTEGER PRIMARY KEY, Title
VARCHAR(100),
Author VARCHAR(60));

INSERT INTO Books(Title, Author) VALUES (1,8War and Peace9,

8Leo Tolstoy9);
SELECT * FROM Books;

UPDATE Books SET Author='Lev Nikolayevich Tolstoy'WHERE
Id=1;

DELETE FROM Books2 WHERE Id=1;
```

RESULT: The output to fetch data from database using SQL queries in Raspberry pi has successfully executed

PRECAUTIONS

- Place the product on a stable, flat, non-conductive surface while in use and do not let it contact conductive items.
- Avoid mechanical or electrical damage to the printed circuit board and connectors.
- Avoid handling the product while it is powered on.

VIVA QUESTIONS

Q1. Why MySQL is used?

Q2. Which SQL database is best for Raspberry Pi?

Q3. How to connect Raspberry Pi to MySQL database?

LAB EXPERIMENT 10

AIM: switch light ON and OFF based on the input of user using Raspberry-Pi.

Apparatus:

Raspberry-Pi

HDMI

Micro USB Power cable

LED

Resistor

Hardware and software Procedure

STEP1: Start the process.
STEP2: Connect micro USB power input to Raspberry pi
STEP3: Connect HDMI to the system to act as monitor for Raspberry pi.
STEP4: Connect USB port 2.0 to mouse and keyboard.
STEP5: Enter the coding in the terminal for installing python and GPTO.
STEP6: Open notepa →enter coding →save as →file extension python or py.
STEP7: Copy file location → open terminal → paste file location in terminal → press enter.
STEP8: In the terminal window to get output enter 0 or 1, to switch light ON when the input is 1 and switch light OFF when the input is 0 in breadboard using Raspberry pi.
STEP9: Stop the process

Program:

```
sudo apt-get install python-pip
sudo apt-get install python-dev
sudo pip install RPi.GPIO

sudo -i #python
importRPi.GPIO as GPIO import time
GPIO.setmode(GPIO.BCM)
GPIO.setwarnings(False)
```

```
GPIO.setup(18,GPIO.OUT)
ip=int(input("enter the value: ")) ifip==1:
print "LED on"
GPIO.output(18,GPIO.HIGH) time.sleep(1)
elifip==0:
print "LED off"
GPIO.output(18,GPIO.LOW)
time.sleep(1)
```

RESULT: The output to switch light ON/OFF using Raspberry-Pi has been executed successfully.

PRECAUTIONS:

- Place the product on a stable, flat, non-conductive surface while in use and do not let it contact conductive items.
- Avoid mechanical or electrical damage to the printed circuit board and connectors.
- Avoid handling the product while it is powered on.

VIVA QUESTIONS

Q1. What is the use of LED in Raspberry Pi?

Q2. What voltage is Raspberry Pi LED?

Q3. How LED is controlled with Raspberry Pi?

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