Students Project List 2025-26

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		Mr. Prajwal K. Kamble
		Mr. Surajkumar S. Mahto

VIVEKANAND COLLEGE KOLHAPUR (Empowered Autonomous) ESTD JUNE 1964

(Dr. C. B. Patil)
HEAD
DEPARTMENT OF ELECTRONICS
VIVEKANAND COLLEGE, KOLHAPUR
(EMPOWERED AUTONOMOUS)

PROJECT WORK

Entitled

"Development of an Arduino-Based Automated Colour Detection System"

Submitted to

Department of Electronics

Vivekanand College, Kolhapur

(An Empowered Autonomous Institute)

By

Mr. Vinayak Dattatraya Devekar

Mr. Prajwal Kiran Kamble

Mr. Surajkumar Subhash Mahto

PROJECT GUIDE

Prof. (Dr.) C. B. Patil

Dr. P. R. Bagade

YEAR: **2025-26**

Exam Seat No. : 8453, 8454, 8455

Date:- 11/10/2025

CERTIFICATE

Vivekanand College, Kolhapur

(An Empowered Autonomous Institute)

Department of Electronics

This is to certify that Mr. Vinayak Dattatraya Devekar, Mr. Prajwal Kiran Kamble, and Mr. Surajkumar Subhash Mahto students of B.Sc III (Electronics) class has satisfactorily completed the project entitled " Development of an Arduino-Based Automated Colour Detection System" as a partial fulfilment of Electronics practical examination conducted by the college during the year 2025-26.

Teacher in charge **Examiner** **Head of Department**

(Prof. (Dr.) C. B. Patil)

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By:-

Mr. Vinayak Dattatraya Devekar (8453)

Mr. Prajwal Kiran Kamble (8454)

Mr. Surajkumar Subhash Mahto (8455)

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Chapter:-1

1.1 Introduction

Colour-based Detection of objects is one of the most common tasks encountered in industries such as food processing, pharmaceuticals, agriculture, plastics recycling and packaging. Traditionally, this sorting was performed manually, which is slow, labour-intensive, inconsistent and prone to human error, particularly when items must be sorted continuously at high speed. With advancements in embedded systems and low-cost sensor technology, it has become possible to automate this process using microcontroller-based systems.

The system integrates several hardware modules, an Arduino Uno microcontroller, a TCS3200 colour sensor, and an LED display for status feedback — to build a compact, low-cost and reliable automated Detection mechanism suitable for educational demonstration.

The TCS3200 colour sensor contains an array of photodiodes with different colour filters. It detects the intensity of red, green, and blue components of reflected light from an object. The sensor converts the detected light intensity into a frequency signal, which can be measured by the Arduino. By comparing the measured colour values with predefined ranges, the microcontroller determines the approximate colour of the object.

1.2 Need of Project

In many industries and educational applications, objects need to be separated according to their colour. Manual colour Detection requires continuous human involvement and can become inefficient when a large number of objects must be processed.

An automated colour sorting system provides a simple solution by combining a colour sensor with a microcontroller and an actuator. The system can continuously detect objects and classify them according to their colours. It can improve Detection consistency and reduce human effort.

- To reduce manual effort in colour-based Detection.
- To provide automatic identification of object colours.
- To improve the consistency of Detection operations.
- To demonstrate the practical application of the TCS3200 colour sensor.
- To develop a low-cost embedded automation system.
- To provide a platform for learning Arduino programming and sensor interfacing.

1.3 Objective

The objectives of the Arduino-based automated colour sorting system are as follows:

- **Accurate Detection:** To design a system capable of accurately detecting the colour of an object in real time using the TCS3200 colour sensor.
- **Automatic Sorting:** To automatically actuate a servo mechanism that directs objects into the correct bin according to their detected colour.
- **Cost-Effectiveness:** To build the system using low-cost, easily available components such as the Arduino Uno, TCS3200 sensor and a standard servo motor.
- **Real-Time Feedback**: To provide real-time status information about the detected colour through an LCD display and/or serial monitor.

Chapter 2: System Implementation

2.1 Block Diagram:-

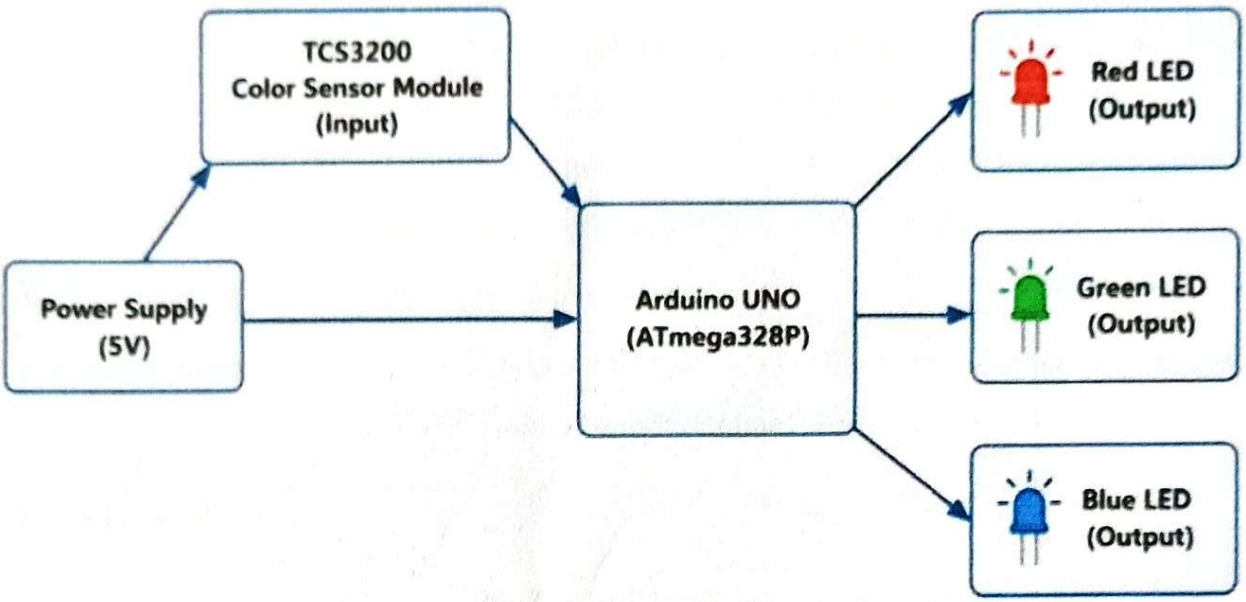

Figure 1: Block Diagram of Arduino-Based Automated Colour Detection System

2.2 Working of system:

The Arduino-Based Automated Colour Sorting System using the TCS3200 Colour Sensor Module works on the principle of detecting the colour of an object and providing a corresponding visual indication through Red, Green, and Blue LEDs. The Arduino UNO (ATmega328P) acts as the main control unit, while the TCS3200 sensor serves as the colour-detection input.

Initially, a regulated 5 V power supply is provided to the Arduino UNO and the TCS3200 colour sensor module. When a coloured object is placed in front of the TCS3200 sensor, light reflected from the surface of the object reaches the photodiode array inside the sensor. The TCS3200 contains photodiodes with red, green, blue, and clear filters. By selecting the appropriate filter, the sensor measures the intensity of the corresponding colour component.

The TCS3200 converts the detected light intensity into a frequency signal. This frequency signal is supplied to the Arduino UNO through its digital input. The Arduino sequentially reads the sensor response corresponding to the red, green, and blue components. The microcontroller then processes and compares these readings with the predefined/calibrated colour values stored in the program.

Based on the comparison, Arduino determines the approximate colour of the object. If the detected colour is red, the Arduino activates the Red LED. Similarly, when a green object is detected, the Green LED is activated, and when a blue object is detected, the Blue LED is activated. Thus, the glowing LED provides a simple visual indication of the detected colour

2.3 Hardware Components Description

The major hardware components required to build this Arduino-based automated colour sorting system are: Arduino Uno, TCS3200 Colour Sensor, Colour LED and connecting wires.

2.3.1 Arduino UNO

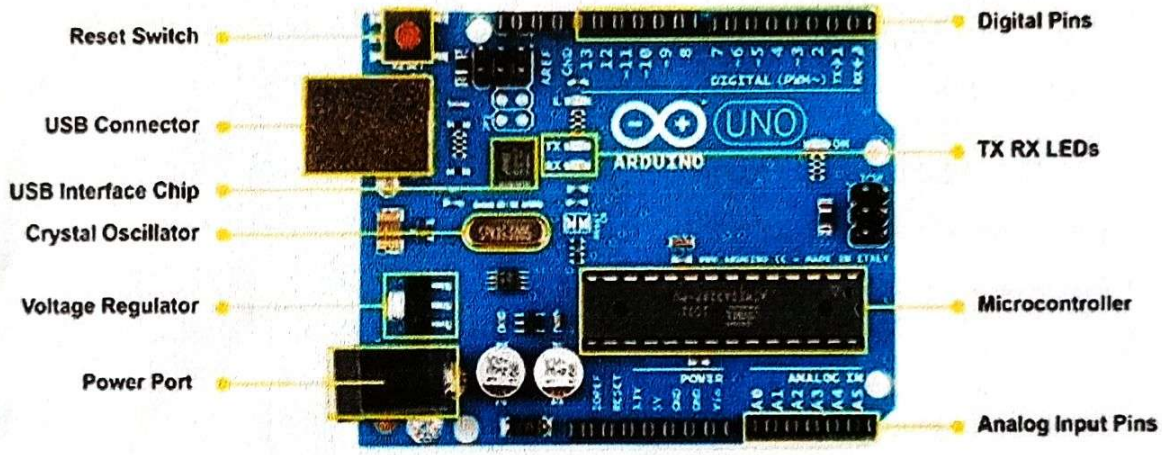

Figure 2: Arduino Uno Board

The Arduino Uno is a widely used microcontroller board based on the ATmega328P chip, and forms the central control unit of this project. Here's some information about it:

Microcontroller: The heart of Arduino Uno is the ATmega328P microcontroller chip, which is clocked at 16 MHz. It has 32 KB of flash memory for storing your programs (of which 0.5 KB is used for the bootloader), 2 KB of SRAM, and 1 KB of EEPROM.

Digital and Analog I/O: The Uno has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP

header, and a reset button. It can be powered either via USB connection or an external power supply.

Power: Can be powered via USB or an external 7-12V DC supply.

Programming: The Uno can be programmed using the Arduino Software (IDE), which is a cross-platform application that runs on Windows, macOS, and Linux. It uses a simplified version of C++ to write programs for interacting with the hardware.

Compatibility: Arduino Uno is widely used and supported in the maker community, with a vast array of libraries and examples available. It's compatible with a wide range of sensors, actuators, shields, and other add-on modules, making it versatile for various projects.

Open Source: Arduino Uno, like other Arduino boards, is open-source hardware. This means the designs of the board are freely available for anyone to examine, modify, and distribute under the terms of the Creative Commons Attribution Share-Alike license.

Community and Resources: There's a large and active community around Arduino, with forums, tutorials, and guides available online. This community support can be helpful for beginners as well as experienced users who may encounter challenges or need inspiration for their projects.

Expansion: One of the significant advantages of Arduino Uno is its compatibility with a wide range of shields – add-on boards that can extend its capabilities. Shields are available for Ethernet, WiFi, Bluetooth, motor control, LCD displays, and more, making it easy to add functionality to your projects without much soldering or wiring.

Arduino Uno is often recommended as an excellent starting point for beginners due to its simplicity, ease of use, and extensive documentation and community support. It's also capable enough to be used in more advanced projects by experienced makers and professionals.

2.3.2 TCS3200 Colour Sensor

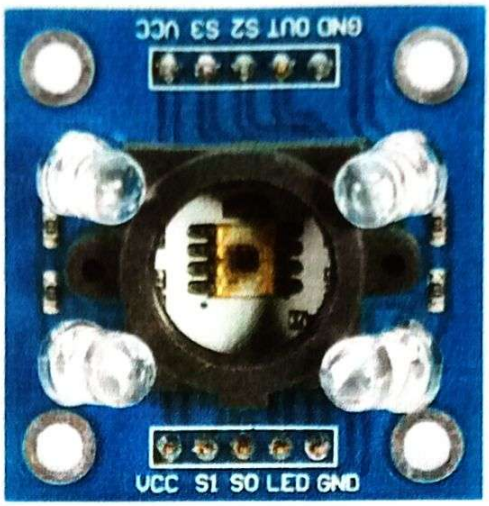

Figure 3: TCS3200 Colour Sensor Module

The TCS3200 is a programmable colour light-to-frequency converter that combines configurable silicon photodiodes and a current-to-frequency converter on a single monolithic CMOS integrated circuit. The output is a square wave (50% duty cycle) whose frequency is proportional to the intensity of the selected colour (red, green, blue or clear).

The sensor's photodiode array consists of 8x8 photodiodes, of which 16 have red filters, 16 have green filters, 16 have blue filters and 16 are clear with no filters. The four types of photodiodes are interdigitated to minimize the effect of non-uniformity of incident irradiance. Two control pins, S2 and S3, are used to select which group of photodiodes (red, green, blue or clear) is active, while S0 and S1 control the output frequency scaling (2%, 20%, 100% or power-down).

Because the TCS3200 provides a digital frequency output rather than an analog voltage, it can be interfaced directly with a microcontroller's digital I/O pins without requiring an analog-to-digital converter, which keeps the interfacing circuit simple and the readings resistant to electrical noise.

2.3.3 5V Power Supply

The 5V power supply provides the required electrical power to the Arduino UNO and the TCS3200 colour sensor module. A regulated 5V supply is preferred because stable voltage is important for reliable sensor operation and consistent colour detection.

2.3.4 Coloured LEDs

- **Red LED**

The **Red LED** is an output indicator used to indicate that the Arduino has detected a **red-coloured object**. When the measured red component satisfies the programmed colour-identification condition, Arduino activates the digital output connected to the red LED.

- **Green LED**

The **Green LED** indicates that the TCS3200 sensor and Arduino have identified a **green-coloured object**. When the green component is identified as dominant according to the programmed algorithm, Arduino turns ON the green LED.

- **Blue LED**

The **Blue LED** is used to indicate detection of a **blue-coloured object**. When Arduino determines that the blue component is dominant, it activates the blue LED.

Chapter 3: Software Design & Implementation

3.1 Flow Chart

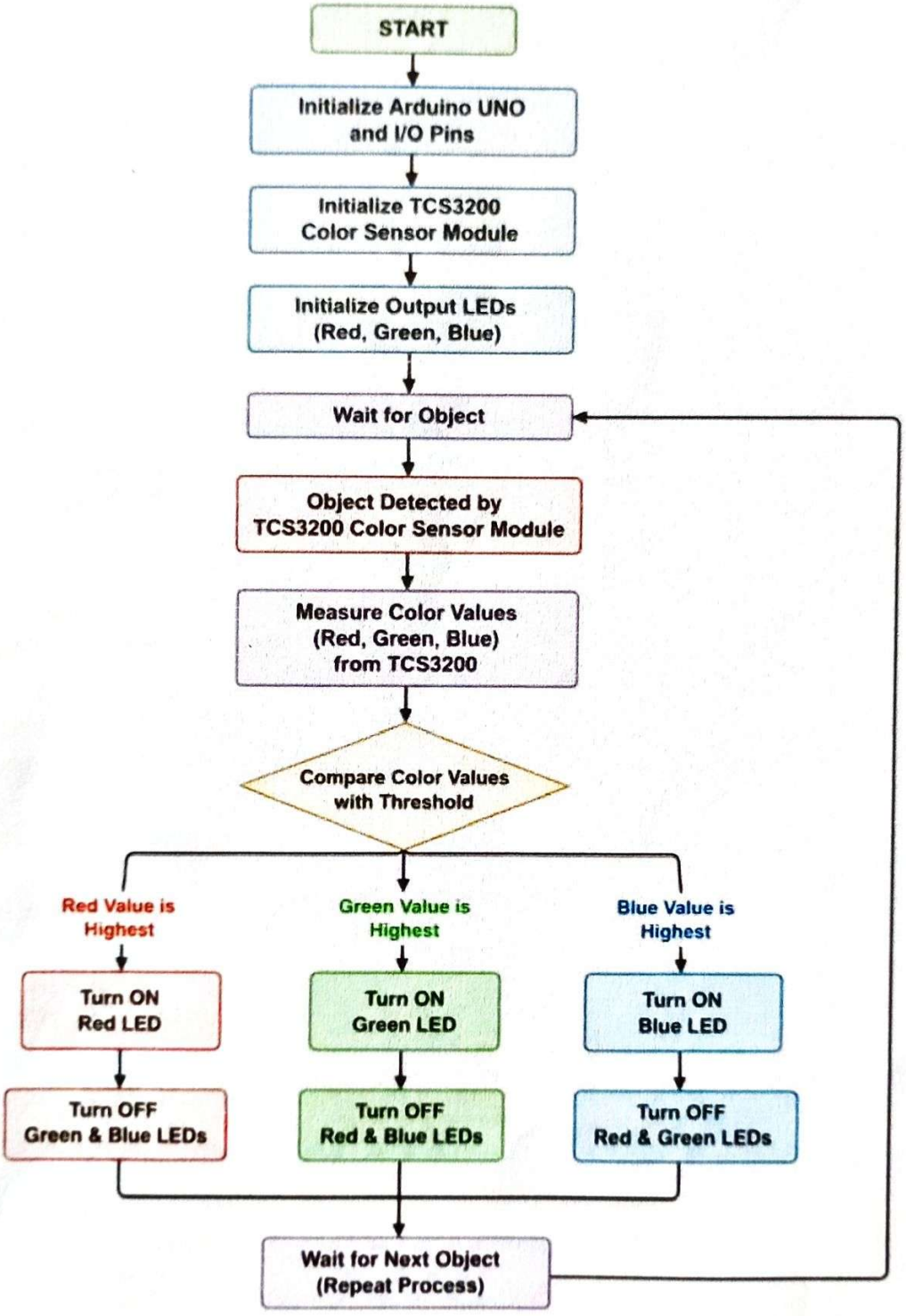

Figure 4: Flowchart of Arduino-Based Automated Colour Detection System

3.2 Programme

```
#define S0 4
#define S1 5
#define S2 6
#define S3 7
#define OUT 8

#define RED 9
#define GREEN 10
#define BLUE 11
long R, G, B;
void setup()
{
  pinMode(S0,OUTPUT); pinMode(S1,OUTPUT);
  pinMode(S2,OUTPUT); pinMode(S3,OUTPUT);
  pinMode(OUT,INPUT);

  pinMode(RED,OUTPUT);
  pinMode(GREEN,OUTPUT);
  pinMode(BLUE,OUTPUT);

  digitalWrite(S0,HIGH);
  digitalWrite(S1,LOW);

  Serial.begin(9600);
}
void loop()
{
  // Read Red
  digitalWrite(S2,LOW);
  digitalWrite(S3,LOW);
  R = pulseIn(OUT,LOW);

  // Read Green
  digitalWrite(S2,HIGH);
  digitalWrite(S3,HIGH);
  G = pulseIn(OUT,LOW);

  // Read Blue
  digitalWrite(S2,LOW);
  digitalWrite(S3,HIGH);
```

```
  B = pulseIn(OUT,LOW);

  Serial.print("R="); Serial.print(R);
  Serial.print(" G="); Serial.print(G);
  Serial.print(" B="); Serial.println(B);

  // Identify colour
  digitalWrite(RED,LOW);
  digitalWrite(GREEN,LOW);
  digitalWrite(BLUE,LOW);

  if(R < G && R < B)
    digitalWrite(RED,HIGH);
  else if(G < R && G < B)
    digitalWrite(GREEN,HIGH);
  else if(B < R && B < G)
    digitalWrite(BLUE,HIGH);

  delay(1000);
}
```

The Arduino-Based Automated Colour Detection System is implemented using an Arduino UNO (ATmega328P) as the central control unit, a TCS3200 Colour Sensor Module as the input sensing device, and Red, Green, and Blue LEDs as the output indicators. A regulated 5 V power supply provides the required operating voltage to the Arduino and sensor module. The system implementation follows the sequence of colour sensing → signal processing → colour identification → LED indication.

Working:-

The working of the system takes place in the following sequence:

Step 1: Power ON

When the system is switched ON, the regulated **5 V supply** powers the Arduino UNO and TCS3200 sensor module. The Arduino initializes the sensor pins and LED output pins.

Step 2: Object Placement

The object whose colour is to be identified is placed in front of the **TCS3200 colour sensor module**.

For reliable operation, the distance between the object and sensor should preferably remain approximately constant and the sensing area should have controlled illumination.

Step 3: Detection of Red Component

Arduino configures the TCS3200 to select the **red-filter photodiodes** using the S2 and S3 control inputs. The sensor detects the intensity of red light reflected from the object and produces a corresponding frequency at its **OUT** pin.

Arduino measures this frequency and stores it as the red-channel reading.

Step 4: Detection of Green Component

Arduino changes the S2 and S3 control signals to select the **green-filter photodiodes**. The TCS3200 generates a frequency corresponding to the detected green-light intensity. Arduino measures and stores this value as the green-channel reading.

Step 5: Detection of Blue Component

Similarly, Arduino selects the **blue-filter photodiodes**. The TCS3200 produces a frequency corresponding to the blue-light intensity, and Arduino stores the resulting measurement as the blue-channel reading.

Chapter 4: Result and Discussion

4.1 Result:

The developed system was tested using a set of red, green and blue colour objects placed one at a time in the sensing zone. The TCS3200 sensor successfully generated distinct frequency signatures for each colour, and the Arduino correctly identified the dominant colour in the large majority of trials. Upon identification of different colour, the respective colour LED trun ON.

The average time taken from object detection to completion of the Detection action was found to be under 2 seconds per object, which is suitable for low-to-medium throughput sorting applications.

4.2 Advantages:

- Provides fast, consistent and automated colour-based sorting without continuous human supervision.
- Low-cost implementation using readily available components.
- Simple to build, program and calibrate.
- Reduces manual labour and associated sorting errors.
- Can be adapted to sort additional colours or integrated with a conveyor system.

4.3 Disadvantages:

- Detection accuracy is sensitive to ambient lighting conditions and requires periodic recalibration.
- Limited to distinguishing a small number of clearly separated colours without more advanced signal processing.

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5.1 Future Scope:

- Increased Colour Range: Enhance the algorithm and calibration to reliably distinguish a larger number of colours and shades.
- IoT Connectivity: Add Wi-Fi/Bluetooth connectivity (e.g., via ESP32/ESP8266) to log sorting data to a cloud dashboard for remote monitoring.
- Machine Learning: Incorporate camera-based image processing and machine learning for more robust colour and shape recognition.

5.2 Conclusion:-

The Arduino-based automated colour sorting system successfully demonstrates how low-cost microcontroller and sensor technology can be combined to automate a task that is traditionally manual and repetitive. By using the TCS3200 colour sensor for accurate colour detection and a LED based indication, the system is able to identify and sort objects by colour quickly, consistently and with minimal human intervention. The project validates the feasibility of building an affordable, compact and reliable colour sorting mechanism suitable for educational purposes and small-scale automation applications, while also highlighting clear directions for future enhancement such as conveyor integration, IoT connectivity and machine-learning-based classification

Chapter: - 6

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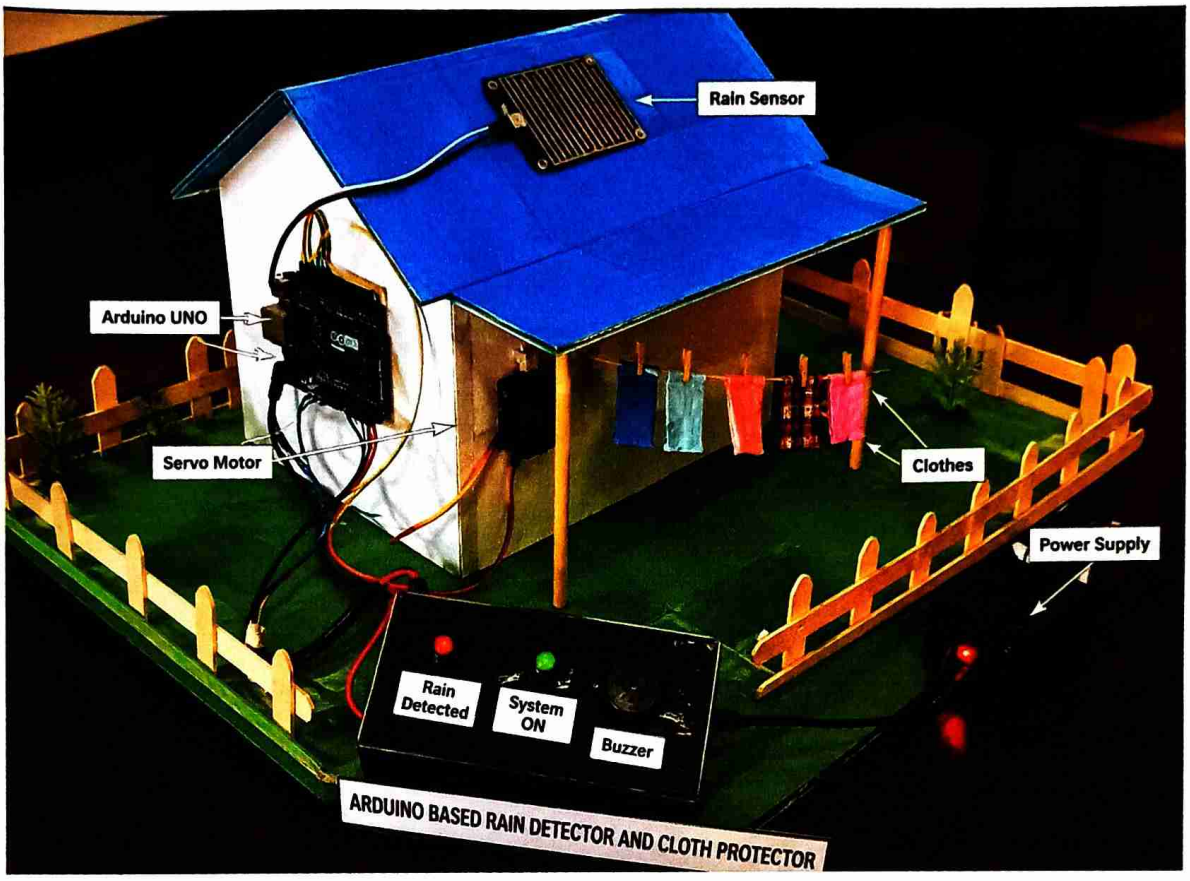
"Arduino-Based Automatic Rain Detection and Clothes Protection System"



PROJECT WORK

Entitled

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Submitted to

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VIVEKANAND COLLEGE, KOLHAPUR

(AN EMPOWERED AUTONOMOUS INSTITUTE)

By

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Mr. Khopkar Pratamesh Babasaheb

Mr. Nigade Rupesh Mohan

PROJECT GUIDE

Dr. Poonam S. Jadhav

Year: 2025-26

Date : 11/10/2025

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CERTIFICATE

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Name of the student	Roll No
Miss. Athane Shreya Deepak	8246
Mr. Khopkar Pratamesh Babasaheb	8247
Mr. Nigade Rupesh Mohan	8452

(Dr. Poonam S. Jadhav)
Teacher in charge

Examiner

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By: Miss. Athane Shreya Deepa

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Mr. Nigade Rupesh Mohan

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Chapter:-1

1.1 Introduction

Rainfall is a natural phenomenon that plays an important role in agriculture, water conservation, and maintaining the ecological balance. However, sudden and unexpected rainfall can create difficulties in daily household activities, particularly when clothes are placed outdoors for drying. People often leave washed clothes on balconies, terraces, clotheslines or open spaces to dry under sunlight. If rainfall occurs suddenly when nobody is available to move the clothes indoors, the clothes may become wet again. This results in additional washing, increased use of water and electricity, wastage of time, and inconvenience to the user. Therefore an automatic system capable of detecting rainfall and protecting clothes from rain can provide a simple and useful solution to this problem.

The Arduino-Based Automatic Rain Detection and Clothes Protection System is designed to automatically detect the presence of rain and take appropriate action to protect clothes from getting wet. The system uses an Arduino as hardware platform and a rain sensor to detect water droplets or rainfall. When the rain sensor detects rain, it sends a signal to the Arduino. The Arduino processes this signal and activates a suitable actuator, such as a servo motor to move the clothesline, protective cover or clothes rack to a safe position. When the rain stops, the system can be designed to return the clothes to their original position or provide an indication to the user, depending on the system configuration.

The proposed system operates automatically with minimum human intervention. Under normal dry conditions, the clothes remain in their designated position for drying. When rainfall is detected, the Arduino immediately receives the sensor signal and activates the motor mechanism. The motor moves the clothes to the safe position away from the rain. An LED and buzzer are incorporated to provide an alert whenever rainfall is detected. After the rain stops and the sensor becomes dry, the Arduino can again control the motor according to the programmed conditions

1.2 Need of Project

The Arduino-Based Automatic Rain Detection and Clothes Protection System is needed to protect clothes from sudden and unexpected rainfall. Manually monitoring clothes during changing weather conditions is inconvenient and time-consuming, especially when the user is away from home. The proposed system automatically detects rain using a rain sensor and activates a motor mechanism to move the clothes to a protected area. Thus, it reduces human effort, saves time, prevents clothes from getting wet and provides a simple, low-cost solution for household automation.

1.3 Objectives

The main objectives of the Arduino-Based Automatic Rain Detection and Clothes Protection System are:

1) **To detect rainfall automatically:**
To design a system that can sense the presence of rain or water droplets using a rain sensor without requiring manual observation.
2) **To interface the rain sensor with Arduino:**
To connect the rain sensor to an Arduino microcontroller and process the sensor output to determine whether the weather is dry or rainy.
3) **To control the motor mechanism:**
To interface a servo motor or DC motor with the Arduino and control its movement according to the rain sensor output.
4) **To reduce human intervention:**
To minimize the need for users to continuously monitor outdoor clothes and manually move them during sudden rainfall.
5) **To prevent clothes from getting wet:**
To provide an early response to rainfall so that clothes can be protected before significant exposure to rain.
6) **To develop a low-cost system**:
To design the project using easily available and economical components such as Arduino, rain sensor, motor, motor driver, LED, and buzzer.

Chapter 2: System Review

2.1 Block Diagram:-

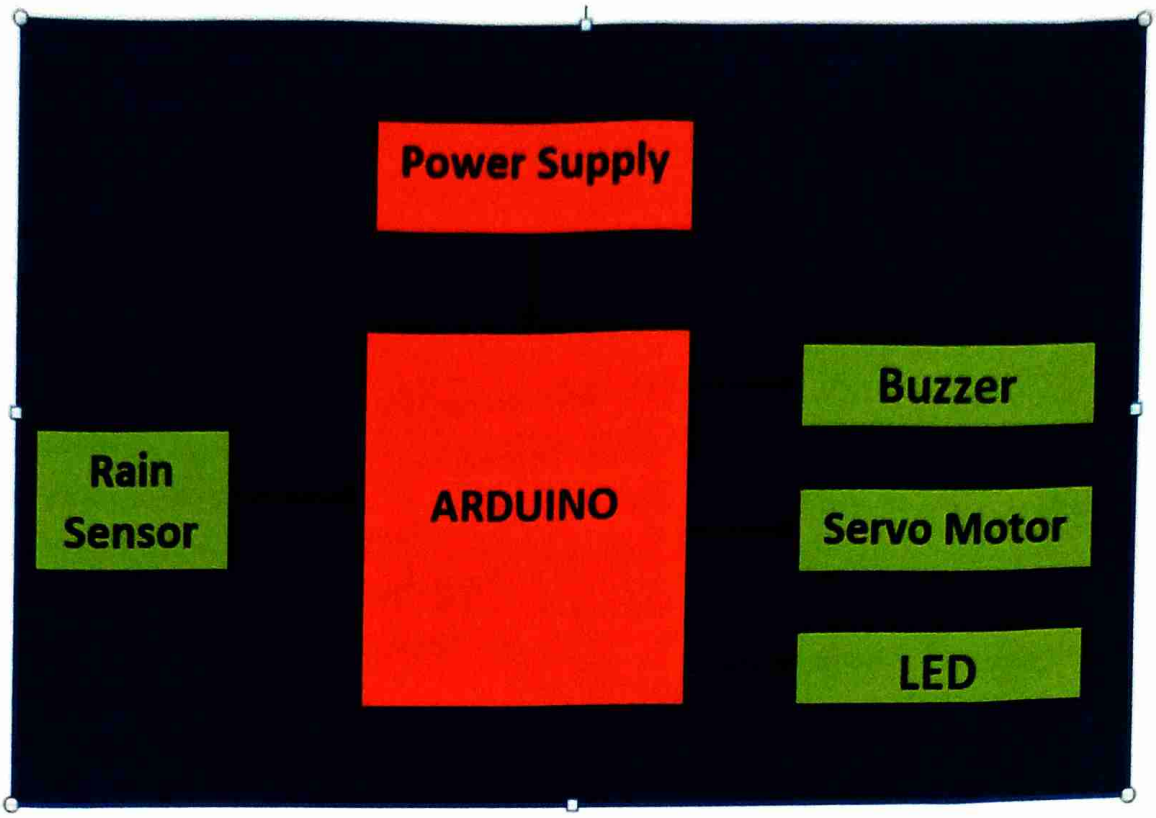


Figure 1: Block Diagram of Arduino-Based Automatic Rain Detection and Clothes Protection System

The block diagram represents an Arduino-Based Automatic Rain Detection and Clothes Protection System consist of Rain Sensor Module, Arduino UNO, Servo Motor ,Buzzer and light emitting diode blocks.

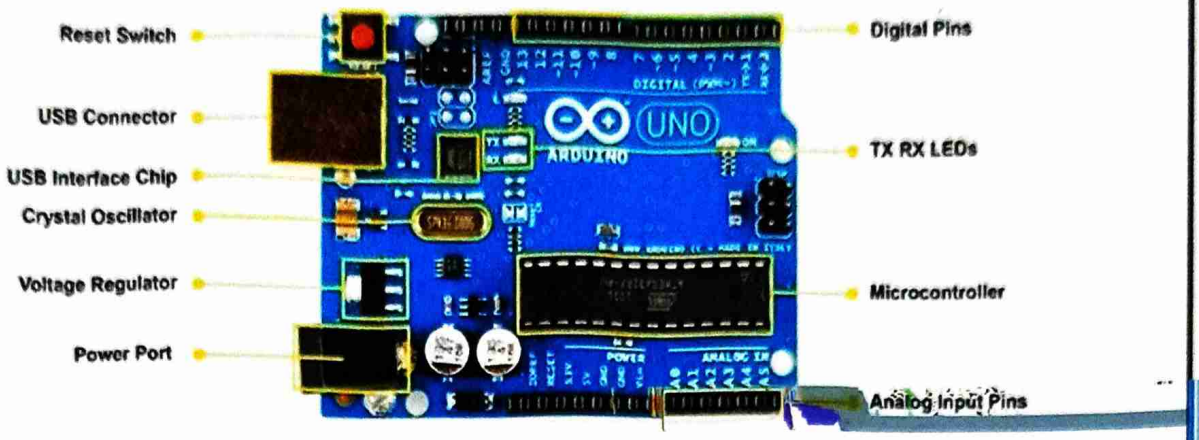
2.2 Block Diagram Description:-

The block diagram represents an Arduino-Based Automatic Rain Detection and Clothes Protection System designed to automatically detect rainfall and protect clothes from getting wet. The Power Supply provides the required electrical power to the Arduino. The Rain Sensor continuously detects the presence of rain or water droplets and sends a corresponding signal to the Arduino, which acts as the main control unit. The Arduino processes the sensor signal according to the programmed instructions and when rain is detected, activates the Servo Motor. The servo motor rotates and moves the clothes or protective mechanism to a covered and safe location. At the same time, the Buzzer produces an audible alert to inform the user about the detected rainfall, while the LED provides a visual indication of the system status. Under normal conditions, the rain sensor continuously monitors the surroundings. When rainfall occurs, the Arduino receives the sensor signal and simultaneously controls the servo motor, buzzer, and LED. Thus, the system provides automatic, timely and efficient protection of clothes from rain with minimum human intervention.

2.3 Hardware Components Description

Required Components to build an Arduino based Saline monitoring system are Arduino Uno, YL-83 Rain Sensor Module, Servo Motor, Buzzer, LED's and connecting wires.

2.3.1 Arduino UNO



Picture 1: Arduino Uno Board

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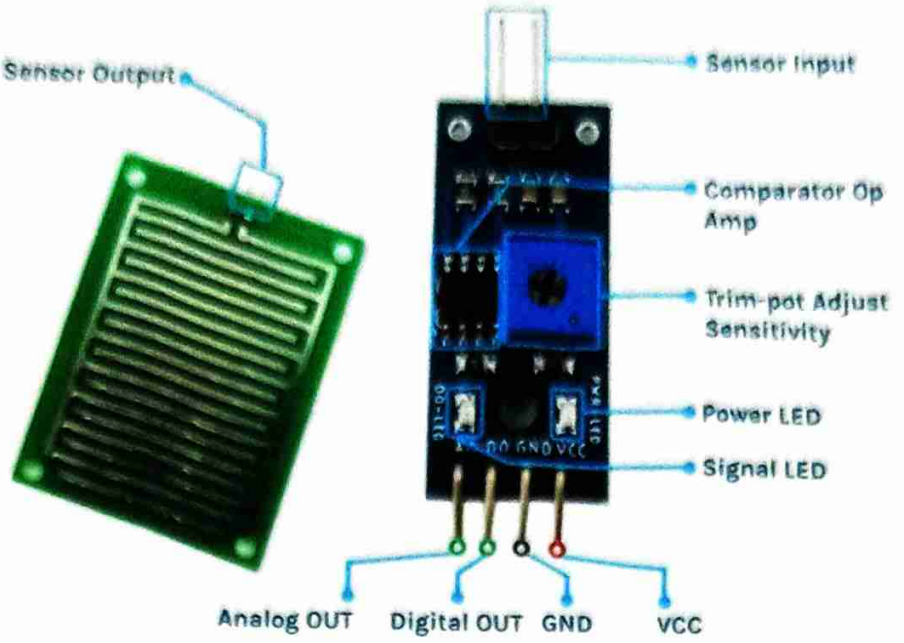
2.3.2 Rain Sensor Module

Core Components of Rain Sensor Module are

Sensing Pad: An exposed board with interleaved copper traces acting as a variable resistor.

Control Board: Houses the LM393 operational amplifier chip, a power LED, a trigger indicator LED, and a sensitivity-adjusting potentiometer.



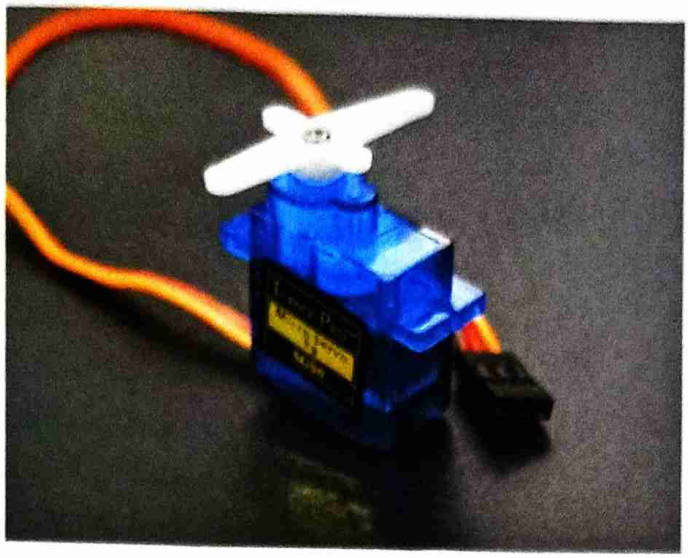
Picture 2: Rain Sensor Module

Dry Condition: With no water on the pad, resistance is very high, yielding a high analog voltage output.

Wet Condition: Raindrops create a conductive parallel path between the copper lines, dropping the resistance and lowering the output voltage

We use a common resistive rain-sensing module (e.g. YL-83 or similar). It consists of a PCB with intergraded copper traces and a comparator (LM393). When water droplets connect the traces, the resistance drops and the digital output goes LOW. A potentiometer on the module sets the sensitivity. The rain sensor module comes with a small potentiometer that lets you customize sensitivity of the sensor is. In practice, when enough water exceeds the threshold, the module's status LED lights and its digital output goes LOW. This binary signal (rain/no rain) is read by the Arduino.

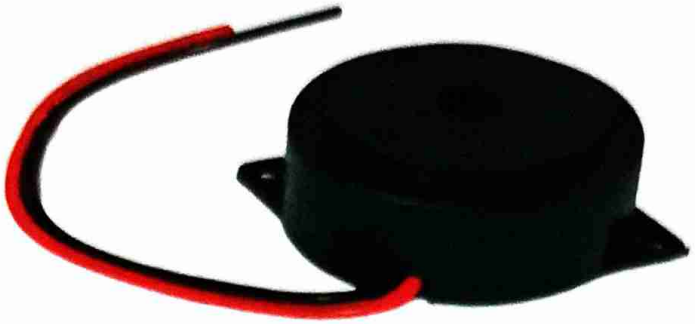
2.3.3 Servo Motor:-



Picture 3: Servo Motor

A servo motor is a motor that rotates to a specific position with high accuracy using a feedback control system. An Arduino or microcontroller sends a PWM (Pulse Width Modulation) signal to the servo motor, where the pulse width determines the required angular position, such as 0°, 90°, or 180°. The internal control circuit receives this signal and controls a small DC motor, while a set of gears reduces the motor speed and increases the output torque. A potentiometer connected to the output shaft continuously detects the actual position and provides feedback to the control circuit. The control circuit compares the desired position with the actual position and, if an error exists, rotates the motor until the desired position is reached. Once the required position is achieved, the motor stops and holds the shaft in that position. If an external force changes the shaft position, the feedback system detects the error and automatically corrects it. Thus, a servo motor provides accurate position control, automatic error correction, and stable position holding, making it suitable for robotics, automatic systems, and Arduino-based applications.

2.3.4 Buzzer:-



Picture 4 : Buzzer

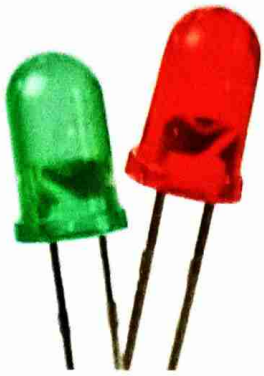
A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, train and confirmation of user input such as a mouse click or keystroke. When a voltage is applied across the two electrodes, the piezoelectric material mechanically deforms due to the applied voltage. This movement of the piezo disk within the buzzer creates sound in a similar manner as the movement of the ferromagnetic disk in a magnetic buzzer or the speaker cone mentioned above. Magnetic buzzers operate at lower voltages and higher currents (1.5~12 V, > 20 mA) compared to piezo buzzers (12~220 V, < 20 mA), while piezo buzzers often have greater maximum sound pressure level (SPL) capability than magnetic buzzers.

The buzzer is a sounding device that can convert audio signals into sound signals. It is usually powered by DC voltage. It is widely used in alarms, computers, printers and other electronic products as sound devices. It is mainly divided into piezoelectric buzzer and electromagnetic buzzer, represented by the letter "H" or "HA" in the circuit. According to different designs and uses, the buzzer can emit various sounds such as music, siren, buzzer, alarm, and electric bell.

The piezoelectric buzzer uses the piezoelectric effect of the piezoelectric ceramics and uses the pulse current to drive the vibration of the metal plate to generate

sound. Piezoelectric buzzer is mainly composed of multi-resonator, piezoelectric plate, impedance matcher, resonance box, housing, etc.

2.3.5: LED's Light Emitting Diode

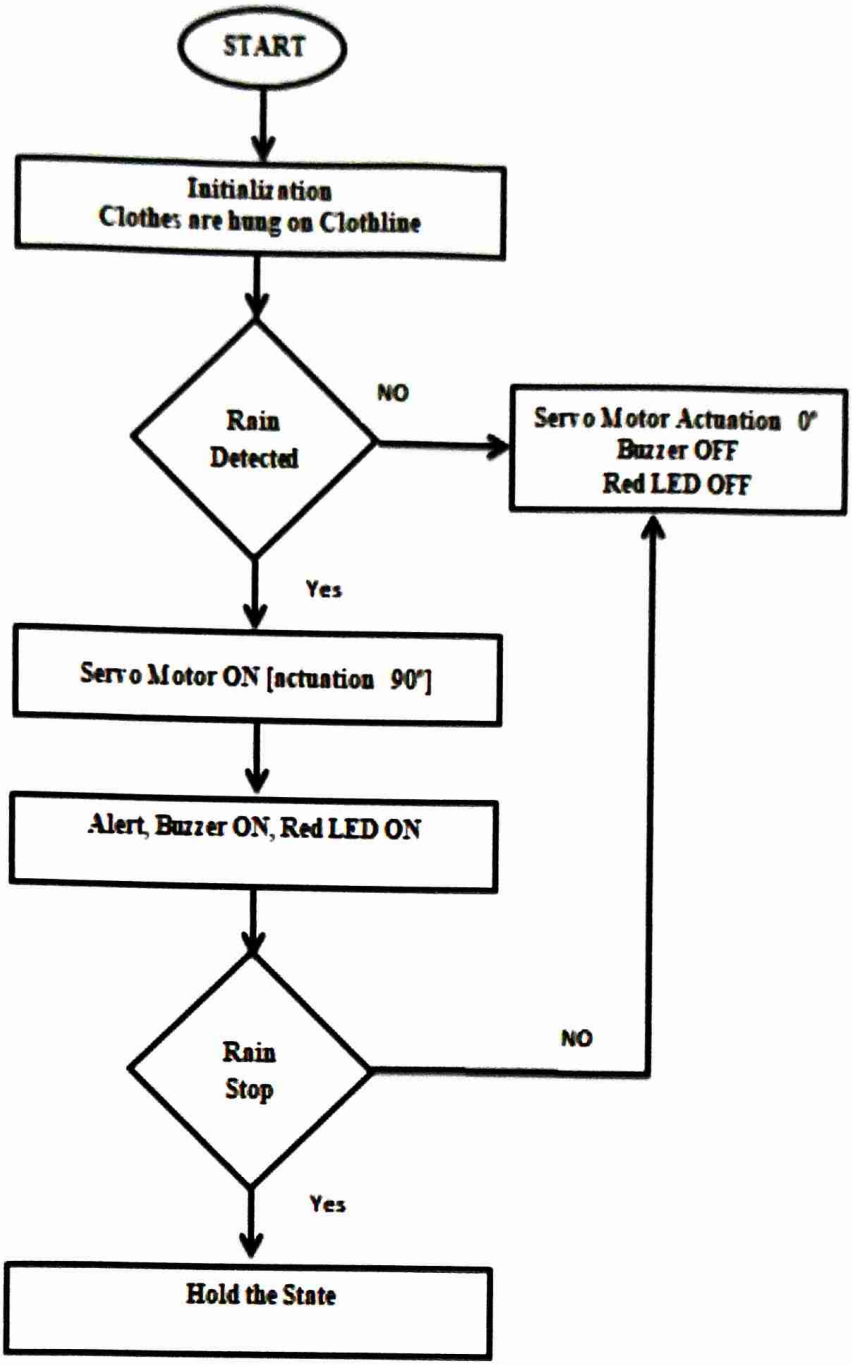


Picture 5 : Light Emmiting Diodes

In the Arduino-Based Automatic Rain Detection and Clothes Protection System, the LED is used as a visual indicator to show the rain status. The green LED indicates the system is ON. The rain sensor detects the presence of water droplets and sends a signal to the Arduino. When rain is detected, the Arduino turns the Red LED **ON**, indicating that rain is present. When the rain stops, the Arduino turns the Red LED **OFF**. Thus, the LED provides a simple visual indication of the rain condition and helps the user know when the clothes need protection.

Chapter 3: Software Design & Implementation

3.1 Flow Chart



3.2 Programme

```
#include <Servo.h>
Servo clothServo;
// Pin definitions
const int rainSensor = 2;
const int buzzer = 8;
const int redLED = 7;
const int greenLED = 6;
const int servoPin = 9;
void setup()
{
 pinMode(rainSensor, INPUT);
 pinMode(buzzer, OUTPUT);
 pinMode(redLED, OUTPUT);
 pinMode(greenLED, OUTPUT);
 clothServo.attach(servoPin);
 // Green LED indicates that the system is ON
 digitalWrite(greenLED, HIGH);
 // Initial condition: no rain
 digitalWrite(redLED, LOW);
 digitalWrite(buzzer, LOW);
 // Clothes in normal position
 clothServo.write(0);
 Serial.begin(9600);
}
void loop()
{
 int rainStatus = digitalRead(rainSensor);
 // Rain detected
 if (rainStatus == LOW)
```

```
{
  Serial.println("Rain Detected!");
  // Red LED ON
  digitalWrite(redLED, HIGH);
  // Buzzer ON
  digitalWrite(buzzer, HIGH);
  // Move clothes to protected position
  clothServo.write(90);
  delay(1000);
}
// No rain
else
{
  Serial.println("No Rain");
  // Red LED OFF
  digitalWrite(redLED, LOW);
  // Buzzer OFF
  digitalWrite(buzzer, LOW);
  // Keep clothes in normal position
  clothServo.write(0);
}
// Green LED remains ON to indicate system is active
digitalWrite(greenLED, HIGH);
delay(500);
}
```

3.3 System Implementation

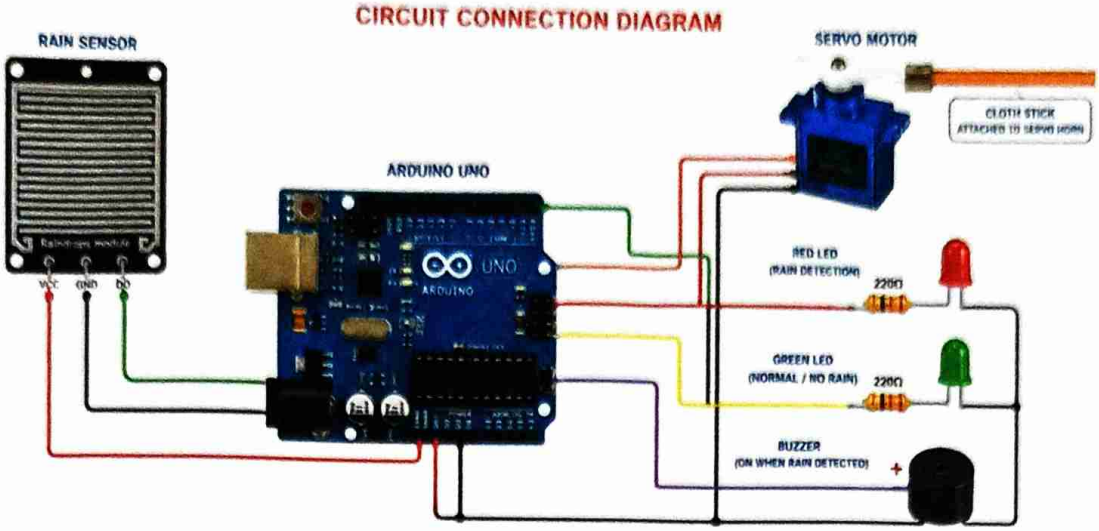


Figure 2: Circuit Connection

```
PIN ASSIGNMENT (AS PER DESCRIPTION)
rainSensor  = 2
buzzer      = 8
redLED      = 7
greenLED    = 6
servoPin    = 9
```

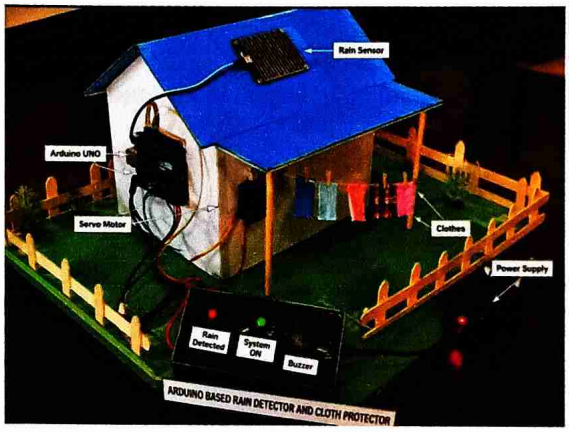
Working:-

The Automatic Rain Detector and Clothes Protector using Arduino is designed to automatically detect rainfall and protect clothes from getting wet without requiring manual intervention. The system uses a rain sensor, Arduino UNO, servo motor, red LED, green LED and buzzer. The rain sensor continuously monitors the surrounding conditions for the presence of water droplets. Its digital output (DO) is connected to Digital Pin D2 of the Arduino UNO. The Arduino acts as the main controller and continuously reads the signal received from the rain sensor. Under normal weather conditions, when no rain is detected, the Arduino keeps the system in its normal state. The green LED connected to D6 remains ON to indicate that there is no rain, while the red LED

and buzzer remain OFF. The servo motor remains at its initial position, keeping the clothes stick in the normal position.

When raindrops fall on the sensing surface of the rain sensor, the sensor detects the presence of water and changes its digital output. This signal is received by the Arduino through D_2. The Arduino immediately processes the signal and activates the rain-protection mechanism. A control signal is sent from D_9 to the servo motor. The servo motor rotates through a predetermined angle, and the clothes stick attached to the servo horn moves along with it. This movement shifts the clothes away from the open area and places them under a suitable protective covering or sheltered position, thereby preventing the clothes from becoming wet due to rain.

At the same time, the Arduino activates the red LED connected to D7, which provides a visual indication that rain has been detected. The buzzer connected to D8 is also switched ON to provide an audible alert to the user. Thus, the combination of the red LED and buzzer immediately informs the user about the rainfall while the servo motor automatically performs the clothes-protection operation. When the rain stops and the rain sensor no longer detects water, the Arduino recognizes the change in sensor output and returns the system to its normal condition. The red LED and buzzer are switched OFF, while the green LED connected to D6 is switched ON to indicate the absence of rain. The servo motor can then be programmed to return to its original position, bringing the clothes stick back to the normal position. Therefore, the complete system provides an automatic, low-cost, and efficient solution for detecting rain and protecting drying clothes, while demonstrating the practical application of Arduino, sensors, servo motors, and output indicators in an embedded system.



Picture 6: Arduino based Automatic Rain Detector and Clothes Protector System

Chapter 4: Result and Discussion

4.1 Result:

The Arduino-Based Automatic Rain Detection and Clothes Protection System was successfully implemented and tested. The rain sensor effectively detected the presence of water droplets and transmitted the signal to the Arduino for processing. When rain was detected, the red LED and buzzer were activated to provide visual and audible indications, while the servo motor automatically moved the clothes to a protected position. When the rain stopped, the system returned to its normal operating condition, with the green LED indicating that the system was active. The experimental results showed that the system responded quickly and reliably to changes in rain conditions and reduced the need for manual intervention. Thus, the developed system provides a simple, low-cost, and efficient solution for protecting clothes from unexpected rainfall.

4.2 Advantages:

- Automatic rain detection
- Protects clothes from rain
- Reduces human effort
- Provides LED and buzzer indication
- Low-cost system
- Easy to operate and maintain
- Fast response to rainfall
- Low power consumption

4.3 Disadvantages:

- Servo motor has limited load capacity
- Electronic components need proper protection when installed outdoors.

Chapter: - 5

5.1 Future Scope:

- IoT Integration: Connect the system to the internet for remote monitoring.
- Mobile Alerts: Send rain notifications to the user's smartphone.
- Weather Forecasting: Use weather data to predict rainfall in advance.
- Solar Power: Use solar energy for eco-friendly operation.
- Improved Motor: Use a stronger motor to handle more clothes.
- Smart Home Integration: Connect the system with other smart home devices.
- Voice Control: Add voice-based control for user convenience.
- Cloud Monitoring: Store and monitor rain and weather data through a cloud platform.

5.2 Conclusion:-

The Arduino-Based Automatic Rain Detection and Clothes Protection System successfully detects rainfall and protects clothes automatically. The rain sensor, Arduino, buzzer, LEDs, and servo motor work together for effective rain detection and clothes protection. The system reduces human effort, saves time, and provides a simple, low-cost, and reliable solution.

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