Smart Lighting System for Adaptive Brightness, Motion Detection, and Energy Conservation

24CYS333 - Internet of Things Presentation

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Problem Statement

This project focuses on energy conservation through innovative automation. Traditional lighting systems often remain on even when not needed, leading to energy wastage. This smart lighting system dynamically operates by detecting motion and turning on lights accordingly. Motion detection plays a crucial role in optimizing energy usage, enhancing safety, and promoting sustainability.

This project introduces an IoT-based solution that automates monitoring and caring for plants. Sensors and actuators ensure plants receive the optimal amount of water, light, and environmental conditions, making plant care efficient and hassle-free.

Proposed System Architecture

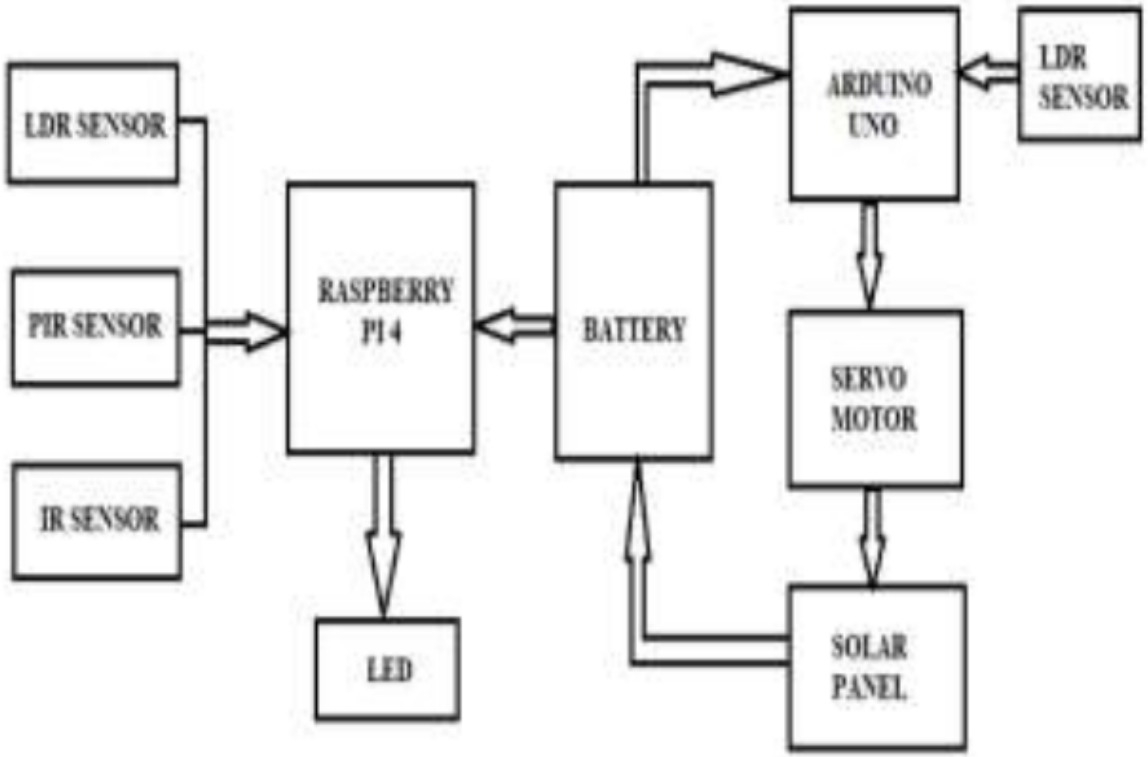

Figure 1: System Architecture Diagram

Use Case 1: Street Lighting Optimization

- Detects pedestrian and vehicle movement using motion sensors.
- Adjusts brightness dynamically based on traffic and ambient light levels.
- Uses IoT-enabled cloud monitoring for real-time control and analytics.
- Reduces energy consumption by dimming or turning off lights when not needed.
- Enhances public safety and lowers operational costs for municipalities.

Use Case 2: Smart Home Energy Management

- Automates home lighting by detecting motion and adjusting brightness based on occupancy.
- Integrates with mobile apps and voice assistants for remote control and scheduling.
- Uses ambient light sensors to reduce energy consumption during daylight hours.
- Provides real-time energy usage analytics to help homeowners optimize electricity consumption.
- Enhances convenience, reduces electricity costs, and promotes sustainability.

Code Implementation (Part 1)

Sample code

```
// PIR Motion Sensor is connected to D2. int PIRInterrupt = 2;
// LDR pin is connected to Analog 0 int LDRPin = A0; // LDR value
is stored on LDR reading int LDRReading; // LDR Threshold value int
LDRThreshold = 300;
// Timer Variables long lastDebounceTime = 0; long debounceDelay = 10000;

void setup()  // Pin for relay module set as output pinMode(relay,
OUTPUT); digitalWrite(relay, HIGH); // PIR motion sensor set as
an input pinMode(PIRInterrupt, INPUT); // Triggers detectMotion
function on rising mode to turn the relay on, if the condition
is met attachInterrupt(digitalPinToInterrupt(PIRInterrupt),
detectMotion, RISING); // Serial communication for debugging purposes
Serial.begin(9600);
```

Code Implementation (Part 2)

Sample code

```
void detectMotion()  Serial.println("Motion"); LDRReading =
analogRead(LDRPin); // LDR Reading value is printed on serial monitor,
useful to get your LDRThreshold //Serial.println(LDRReading); // Only
turns the Relay on if the LDR reading is higher than the LDRThreshold
if(LDRReading > LDRThreshold) if(relayState == LOW) digitalWrite(relay,
LOW);  relayState = HIGH; Serial.println("ON"); lastDebounceTime =
millis();
https://techknowlab.com/smart-street-light-arduino-project/
```

References

Venu, D. N. (2023). IoT-based real-time street lights controlling on motion detection. *European Chemical Bulletin*, **12**(9), 270-287.

TechKnowLab. (2024). Smart Street Light Arduino Project. Retrieved from `https://techknowlab.com/smart-street-light-arduino-project/`