Automatic Night Light Controller

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MINI LAB PROJECT REPORT

This Report Presented in Partial Fulfillment of the course **CSE224: Digital Logic Design Lab in the Computer Science and Engineering Department**

DAFFODIL INTERNATIONAL UNIVERSITY

Dhaka, Bangladesh

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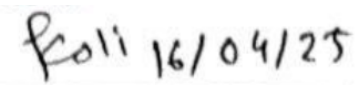
DECLARATION

We hereby declare that this lab project has been done by us under the supervision of **Zannatul Mawa Koli**, **Lecturer**, Department of Computer Science and Engineering, Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere as lab projects.

Submitted To:



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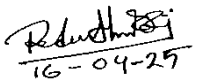

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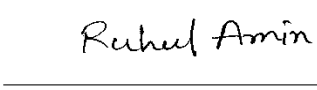

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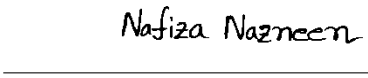

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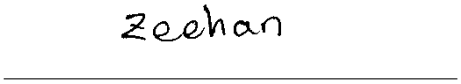

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COURSE & PROGRAM OUTCOME

The following course have course outcomes as following:

Table 1: Course Outcome Statements

CO's	Statements
CO1	**Define** and **Relate** classes, objects, members of the class, and relationships among them needed for solving specific problems
CO2	**Formulate** knowledge of object-oriented programming and Java in problem solving
CO3	**Analyze** Unified Modeling Language (UML) models to **Present** a specific problem
CO4	**Develop** solutions for real-world complex problems **applying** OOP concepts while evaluating their effectiveness based on industry standards.

Table 2: Mapping of CO, PO, Blooms, KP and CEP

CO	PO	Blooms	KP	CEP
CO1	PO1	C1, C2	KP3	EP1, EP3
CO2	PO2	C2	KP3	EP1, EP3
CO3	PO3	C4, A1	KP3	EP1, EP2
CO4	PO3	C3, C6, A3, P3	KP4	EP1, EP3

The mapping justification of this table is provided in section **4.3.1**, **4.3.2** and **4.3.3**.

Table of Contents

Chapter 1

Introduction

1.1 Introduction

The Automatic Night Light Controller is a simple yet effective project that demonstrates the application of digital logic gates in real-world automation. It uses a 7400 NAND gate IC and an LDR (Light Dependent Resistor) to automatically control an LED based on ambient light conditions. This project is designed to provide hands-on experience in digital electronics and logic design.

1.2 Motivation

The motivation behind this project stems from the growing demand for energy-efficient and automated systems. By using basic digital logic components, this project offers a cost-effective solution for automatic lighting, making it an excellent educational tool for students and hobbyists.

1.3 Objectives

- To design and implement an automatic night light system using a NAND gate and LDR.
- To demonstrate the practical application of digital logic gates in automation.
- To create an energy-efficient solution for lighting control.

1.4 Feasibility Study

Similar projects have been implemented using microcontrollers, but this project focuses on using basic logic gates to achieve the same functionality, making it simpler and more accessible for beginners.

1.5 Gap Analysis

Existing solutions often rely on complex microcontrollers. This project fills the gap by providing a simpler, logic gate-based alternative for educational purposes.

1.6 Project Outcome

A functional automatic night light system that turns on in darkness and off in light, demonstrating the practical use of digital logic gates.

Chapter 2

Proposed Methodology/Architecture

2.1 Requirement Analysis & Design Specification

2.1.1 Overview

The system consists of a 7400 NAND gate IC, an LDR, resistors, an LED, and a power supply. The LDR and resistor form a voltage divider, and the NAND gate processes the input to control the LED.

2.1.2 Proposed Methodology/ System Design

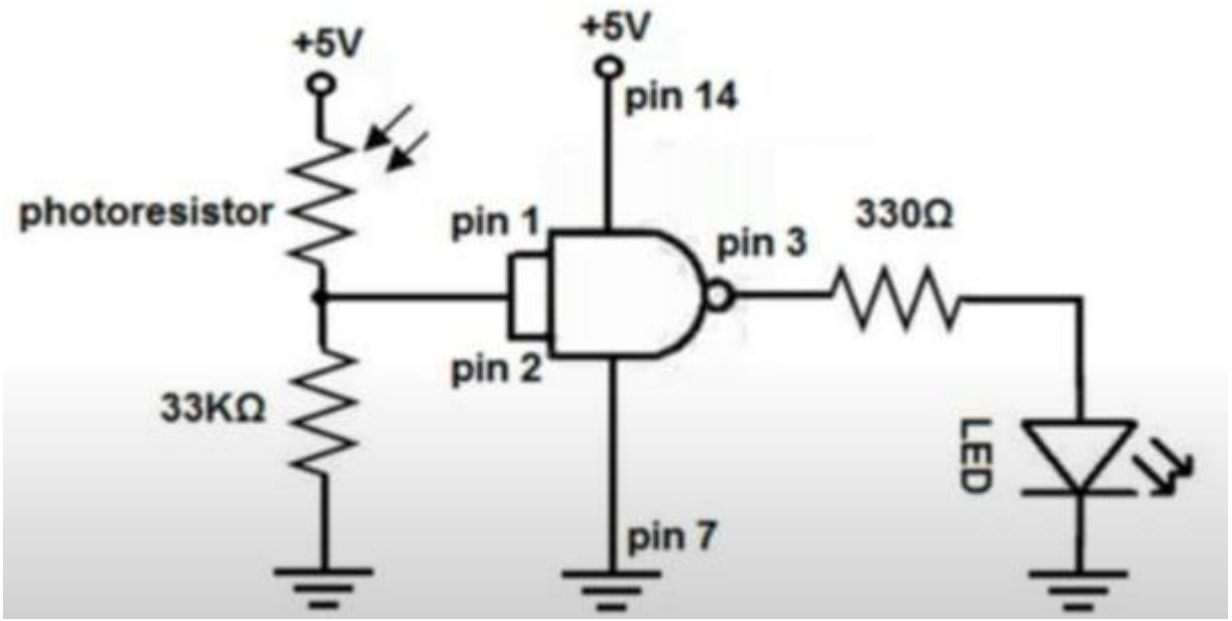

Figure 2.1: Circuit diagram

2.2 Overall Project Plan

The project was completed in phases: component selection, circuit assembly, testing, and documentation.

Chapter 3

Implementation and Results

Implementation

The circuit was assembled on a breadboard using the components listed in Table 1. The LDR and resistor formed a voltage divider, and the NAND gate processed the input to control the LED.

Components Used

S/N	Component	Quantity	Description
1	Breadboard	1	For circuit assembly
2	7400 NAND Gate IC	1	Contains four 2-input NAND gates
3	330 Ohm Resistor	1	Current limiting resistor for LED
4	100 k Ohm Resistor	1	Forms voltage divider with LDR
5	LED	1	Light Emitting Diode for output
6	GL5537 Photoresistor (LDR)	1	Senses light intensity
7	9V Battery	1	Power supply
8	Connecting Wires	-	For circuit connections

Performance Analysis

The circuit was tested under various lighting conditions. The LED turned on in darkness and off in bright light, demonstrating reliable performance.

Results and Discussion

The project successfully achieved its objectives. The use of a NAND gate for automation was demonstrated, and the circuit performed as expected. Limitations include fixed light sensitivity and inability to handle high-power loads.

Chapter 4

Engineering Standards and Mapping

4.1 Impact on Society and Sustainability

- **On Life:** Offers safer lighting at night without manual intervention.
- **On Society & Environment**: Saves electricity, especially in public places.
- **Ethical Aspects:** Built with safety, efficiency, and accessibility in mind.
- **Sustainability:** Designed to use minimal energy and components.

4.2 Complex Engineering Problem

PO	Justification
PO1	Demonstrates logic gate implementation in real applications
PO2	Applies circuit design knowledge to automate lighting
PO3	Solves a real-world problem using basic engineering tools

4.3 Engineering Activities

EA	Justification
EA1	Basic components like NAND gate IC, LDR, and resistors were efficiently used.
EA2	Integrated analog sensing with digital logic.
EA3	Used simple logic gates for automation without microcontrollers.
EA4	Promoted energy saving through automatic light control.
EA5	Applied standard electronics prototyping methods.

Chapter 5
Conclusion

Summary

This project successfully demonstrates how to build an Automatic Night Light using a 7400 NAND gate and an LDR. It blends digital logic and analog sensing to create a simple automation system. It's ideal for students and hobbyists who are learning about basic electronics and automation concepts.

Discussion

The implementation shows how traditional logic gates can be applied in everyday tasks like automatic lighting. Although basic, this circuit forms the foundation for more advanced projects like motion-based lighting or IoT-based smart home devices. It also emphasizes how digital and analog systems can work together effectively.

Future Enhancements

- Add a variable resistor (potentiometer) to adjust light sensitivity
- Use a transistor for driving larger loads (e.g., a bulb)
- Power the circuit with a solar panel and rechargeable battery
- Add a buzzer or other indicator for multi-functionality

References

1. **Digital Electronics**
   - Floyd, T. L. (2014). *Digital Fundamentals* (11th ed.). Pearson.
   - *Covers logic gates (NAND gates), IC 7400, and basic circuit design.*
2. **Light Dependent Resistors (LDRs)**
   - Horowitz, P., & Hill, W. (2015). *The Art of Electronics* (3rd ed.). Cambridge University Press.
   - *Explains LDRs, voltage dividers, and sensor-based circuits.*
3. **Energy-Efficient Automation**
   - Gershenfeld, N. (2000). *The Physics of Information Technology*. Cambridge University Press.
   - *Discusses low-power automation systems and sustainability.*
4. **Practical Electronics for Inventors**
   - Scherz, P., & Monk, S. (2016). *Practical Electronics for Inventors* (4th ed.). McGraw-Hill.
   - *Provides hands-on circuit examples similar to your project.*
5. **Engineering Standards**
   - IEEE Standards Association. (2020). *IEEE Guide for Sustainable Energy Use*. IEEE Std 1888.
   - *Relevant for the sustainability and societal impact sections.*

Contribution

1. **Redwan Ahamed Rafi (232-25-374):**
   Took charge of overall project coordination, circuit design, and documentation. Led the team during testing and ensured timely completion with quality output.

2. **Md. Ruhul Amin (232-15-727):**
   Played a major role in hardware implementation and testing. Actively contributed to circuit troubleshooting, calibration, and improving system accuracy.

3. **Md. Mahfujur Rahman (232-15-324):**
   Provided support in collecting components and actively participated during the circuit building phase by offering suggestions and assisting in the testing process.

4. **Mst. Nafiza Nazneen (232-15-545):**
   Assisted with proofreading and formatting the final report, and helped with arranging the components on the board.

5. **Zeehan Mahmud (232-15-831):**
   Contributed ideas for applications and future improvements. Supported during project demonstration.