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Smart Bird Feeder

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Abstract: *The* ***Smart Bird Feeder*** *is an innovative IoT-based system designed to monitor and assist bird feeding activities while promoting wildlife observation and conservation. This project integrates modern technologies such as sensors, microcontrollers, cameras, and wireless communication to automate bird feeding and data collection. The system identifies bird species using image recognition powered by machine learning algorithms and records visitation data, including time, frequency, and species type. It automatically dispenses food when birds are detected, minimizing waste and ensuring food availability. Additionally, the feeder connects to a mobile or web application, allowing users to monitor activity in real-time, receive notifications, and access data logs.*

Keywords: Microcontroller ATMEGA16A, dht Sensors, LCD

I. INTRODUCTION

In recent years, the integration of smart technology into everyday devices has significantly enhanced our ability to monitor and interact with the environment. One such innovation is the smart bird feeder, which not only provides food for birds but also gathers valuable environmental data. This project presents a Smart Bird Feeder equipped with humidity and temperature sensors, designed to support both birdwatching enthusiasts and environmental researchers.

The primary goal of this system is to create a feeder that not only attracts and nourishes birds but also records ambient temperature and humidity levels in real-time. These environmental metrics are crucial for understanding bird behavior, migration patterns, and habitat preferences. By incorporating sensor technology and, optionally, IoT capabilities, this bird feeder can log and transmit data for further analysis or display it in a user-friendly mobile or web interface.

Such a device contributes to wildlife conservation, citizen science, and eco-friendly living, while also encouraging greater public interest in birdwatching and nature. This project exemplifies how smart solutions can bridge the gap between nature and technology, offering a unique and educational tool for both individuals and communities.

Hardware Requirements

- Pic16f877a Microcontroller
- Lcd 16x2
- Rtc ds1307
- Dht11 temperature and humidity sensor
- 12v geared dc motor
- L298 motor driver
- Relay 5V-5A
- 12v mini exhaust fan
- Pir sensor

II. OVERVIEW OF DESIGN

The basic block diagram of the Smart Bird feeder is shown in the figure below.

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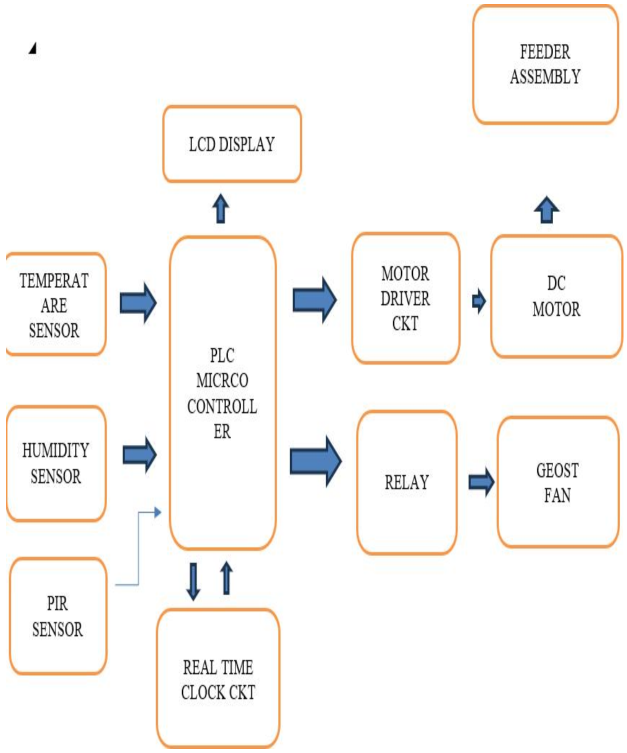

Fig-1 Block Diagram

Power Supply

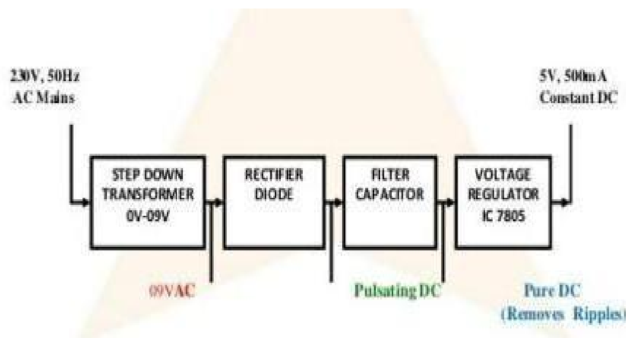

Fig -2: Power Supply

We have used +12V and +5V dc power supply. Step down transformer off 1 Amp, 230V, 50 Hz provides +12V ac supply. It provides required amount of voltage to components. +12V is given to relay driver circuit. µC and LCD require 5V dc supply so to fulfill the requirement we have used regulated IC 7805.

DHT Sensors

The DHT11 is a commonly used Temperature and humidity sensor that comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data.

The DHT11 is a commonly used Temperature and humidity sensor. The sensor comes with a dedicated NTC to measure temperature and an 8-bit microcontroller to output the values of temperature and humidity as serial data. The sensor is also factory calibrated and hence easy to interface with other microcontrollers. The sensor can measure

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temperature from 0°C to 50°C and humidity from 20% to 90% with an accuracy of ±1°C and ±1%. So if you are looking to measure in this range then this sensor might be the right choice for you

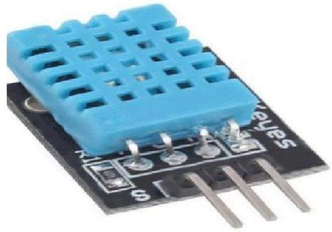

Fig -3: DHT sensor

Microcontroller ATMEGA16A

Microcontroller is a single chip that contains the processor (CPU),ROM, EPROM, EEPROM, RAM, clock and I/O ports. ATMEGA16A is a 8-bit Microcontroller with 16K Bytes In -System Programmable Flash. Its Power Consumption @ 1MHz, 3V, and 25°C– Active: 0.6mA – Idle Mode: 0.2mA– Power -down Mode: < 1µA. The ATmega16A is a low-power 8-bit microcontroller based on the Atmel AVR enhanced RISC architecture. It executes instructions in a single cycle. ATmega16A achieves throughputs approaching 1MIPS per MHz allowing the system design to optimize power consumption versus processing system. XTAL1 gives Input to the inverting Oscillator amplifier and input to the internal clock operating circuit. XTAL2 pin is used for Output from the inverting Oscillator amplifier. Microcontroller is the heart of the circuit. It does the job of room light controller as well as counting number of individuals entering and leaving a room accurately. µC continuously monitors the IR receivers and executes the program stored in its ROM when it receives the signal from the sensors.

Fig -4: Microcontroller ATMEGA16A

LCD 16x2

LCD (Liquid Crystal Display) is used to display number of individuals in a room. It is very thin technology based on combination of liquid and crystal. Liquid state produces an image for display.

Fig -5: LCD Display

Relay Driver Circuit

In relay driver circuit there are transistors, diodes and the relays. Relay driver circuit is used to control the light. This block can drive the various controlled devices. We are using +12V dc relay. As µC cannot drive relay directly so output signal from microcontroller is passed to the base of the transistor, which activates the particular relay so that it can select particular device to operate. Relays can control the charge flowing to the load. Load may be and AC device such as light, fan, Bulb etc.

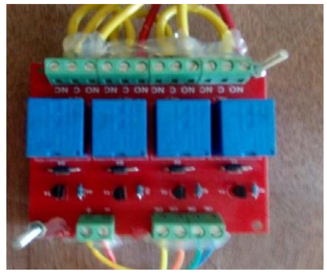

Fig -6: Relay Driver Circuit

Load

Relays control the flow of charge to the load. In this project we have used four bulbs of 10 Watt each as a load. But we can use any electronic object like tubelight, CFL, fans, cooler etc in place of bulbs.

Working

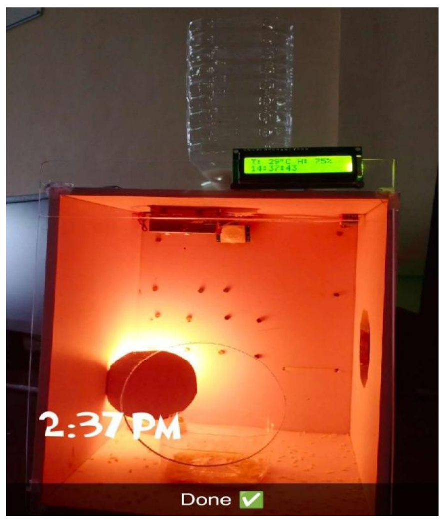

Fig -7: Final Model

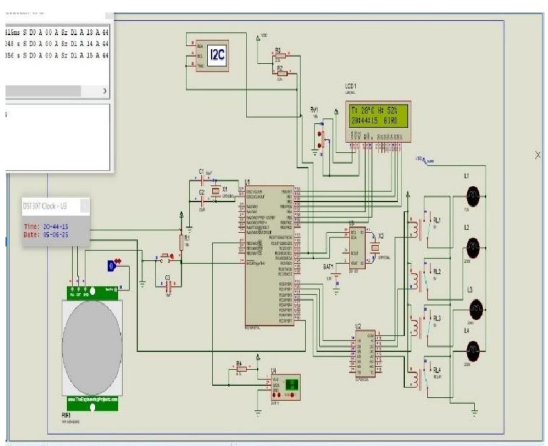

Fig -8: Circuit Diagram

This project is an automated bird feeder and environment control system designed for artificial bird nests. It ensures birds are fed on time and live in a controlled environment with optimal temperature and humidity. The system is based on the PIC16F877A microcontroller, interfaced with multiple sensors and actuators

1. Presence Detection Using PIR Sensor A PIR (Passive Infrared) sensor is placed inside or near.
2. Real-Time Clock (RTC) Based Feeding The system uses a DS1307 RTC module to keep track of real-time clock data even during power loss (with a backup battery). At specific times of the day (e.g., 7:00 AM, 12:00 PM, and 5:00 PM), the microcontroller checks the time from the RTC. If the current time matches the pre-set feeding times and a bird is present, the the entrance of the artificial nest It detects motion or presence of a bird. When a bird is detected, the system becomes active and ready to feed and monitor environmental conditions system: Activates the feeder relay, which energizes a solenoid valve attached to a food container. This releases a small quantity of bird food into the nest for a short duration (e.g., 1 second) After that, the valve closes automatically.
3. Environmental Monitoring with DHT11A DHT11 sensor continuously measures ambient temperature and humidity inside the nest. These readings are processed and displayed on a 16x2 LCD in real-time for monitoring.
4. Temperature Control (Heater Bulb) If the measured temperature falls below a pre-defined threshold (e.g., 20°C), the system: Activates Relay 1 to turn ON a heater bulb .Once the temperature rises above the threshold e.g., 22°C), the heater turns OFF automatically.
5. Humidity Control (Exhaust Fan If the humidity level rises above a set limit (e.g., 70%), the system Activates Relay 2 to turn ON a is small exhaust fan to reduce humidity. When humidity drops below the limit (e.g., 60%), the fan turned OFF.
6. LCD Display A 16x2 character LCD, interfaced in 4-bit mode with PORTB, displays: Current time (HH:MM:SS) Temperature (°C) Humidity (%) Bird is present or not

III. CONCLUSION

The development of a smart bird feeder equipped with humidity and temperature sensors represents an innovative application of embedded systems and environmental monitoring technologies in the field of ecological support and wildlife observation. This project successfully demonstrates how integrating basic environmental sensors with traditional bird feeding systems can create a multifunctional device that serves both biological and scientific purposes.

Through continuous monitoring of temperature and humidity, the system provides valuable insights into the environmental conditions in which different bird species prefer to feed. Such data can be critical for ecological research, helping scientists and bird enthusiasts identify patterns in bird behavior, seasonal migration, and feeding habits in relation to climatic changes.

From a technological perspective, the project showcases the practical use of microcontrollers, sensor interfacing, data acquisition, and potentially wireless data transmission. These components form the backbone of modern IoT systems and underline the importance of interdisciplinary knowledge in developing smart devices. Additionally, the system can be further enhanced with features like real-time data logging, mobile app integration, camera modules for bird identification, and automatic feed dispensing based on sensor input or schedules.

Environmentally, the smart bird feeder contributes to conservation efforts by supporting local bird populations, especially in urban areas where natural food sources may be limited. The device can also serve educational purposes, allowing students and researchers to observe and analyze bird interactions with their environment in a controlled, measurable way.

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