

SMART LIGHTING

by

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INTRODUCTION

Smart lighting is a key component of modern home automation.

- Home automation demand increasing since networking era
- Existing smart lighting systems are costly and complex
- Need for affordable and easy-to-install smart switch
- Smartphone control becoming standard feature

Limitations of conventional lighting systems

- Cannot control lights remotely
- High-voltage lights difficult to interface with controllers
- No systems that learn user lighting patterns
- Energy wasted when lights left ON in empty rooms

PROBLEM STATEMENT

Conventional home lighting systems require manual operation and cannot adapt to user behavior or occupancy. Existing smart lighting solutions are often expensive, complex to install, and do not learn user lighting patterns. As a result, lights are frequently left ON in unoccupied spaces, causing unnecessary energy consumption and inconvenience.

Therefore, there is a need for an affordable, easy-to-install smart lighting switch that can be remotely controlled and intelligently automate lighting based on user habits and room occupancy.

PRIMARY OBJECTIVE

Goal: Develop a smart lighting switch prototype

- Replace conventional wall light switch
- Enable smartphone & manual control
- Detect motion and save energy
- Learn and predict lighting usage patterns

SYSTEM OVERVIEW

Smart switch replacing traditional switch

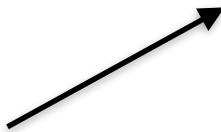
- Controlled via buttons or Android app
- Uses Arduino controller
- Motion sensor detects room occupancy
- Relay circuit controls lights

COSTING AND EXPENSE

S.No	Component	Quantity	Approx. Cost (₹)	Total (₹)
1	Arduino Uno	1	400	400
2	PIR Motion Sensor (HC-SR501)	1	80	80
3	Relay Module (5V, 1-channel)	1	70	70
4	Bluetooth Module (HC-05)	1	250	250
5	Push Buttons	4	10	40
6	Toggle Switches	3	20	60
7	LEDs (Indicator)	5	5	25
8	Resistors Pack	1	30	30
9	Breadboard	1	120	120
10	Jumper Wires	1 set	80	80
11	5V Power Supply / Adapter	1	150	150

Total Estimated Cost ≈ ₹1,305

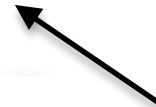
V 0.1



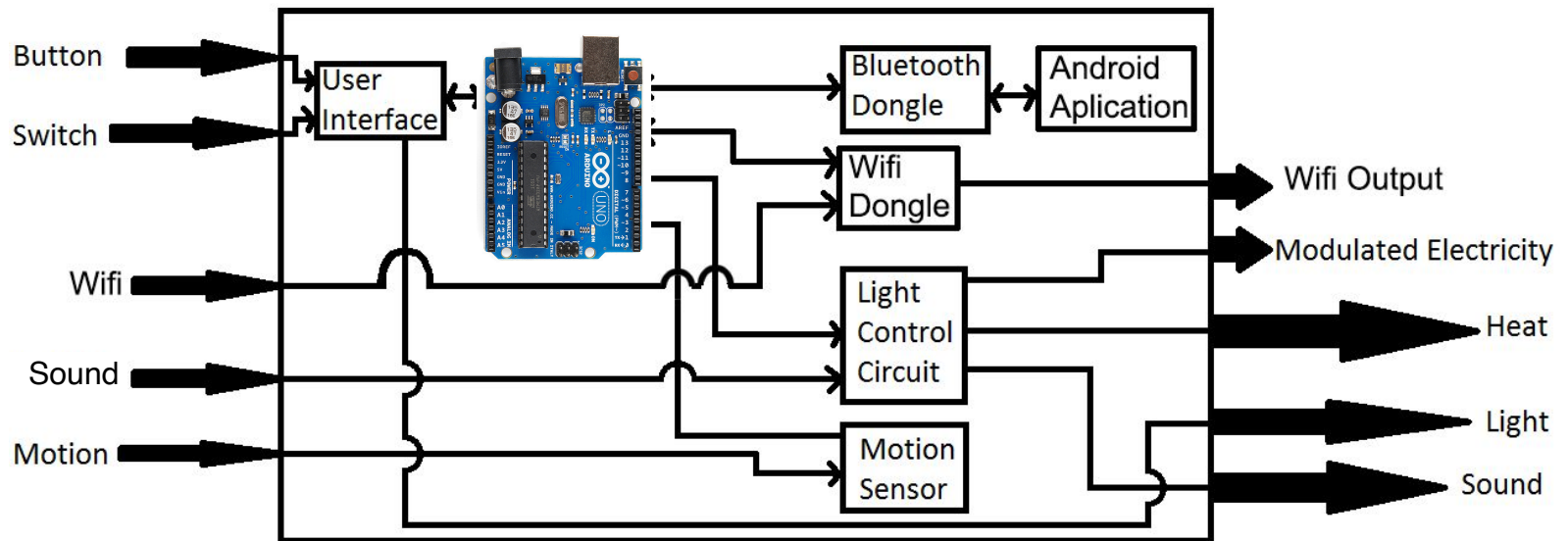
S.No	Component	Quantity	Approx. Cost (₹)	Total (₹)
1	Arduino Nano (compact controller)	1	250	250
2	PIR Motion Sensor (HC-SR501)	1	80	80
3	5V Relay Module (Opto-isolated)	1	120	120
4	Bluetooth Module (HC-05 / HM-10)	1	300	300
5	Custom PCB	1	200	200
6	AC-DC Power Module (220V→5V)	1	180	180
7	Push Buttons (panel mount)	4	20	80
8	Toggle Switches (panel mount)	3	30	90
9	Indicator LEDs (high brightness)	5	8	40
10	Resistors & passive components	1 set	50	50
11	Wall-mount Enclosure / Switch Box	1	250	250
12	Connectors & Terminals	1 set	100	100

Total Estimated Cost ≈ ₹1,740

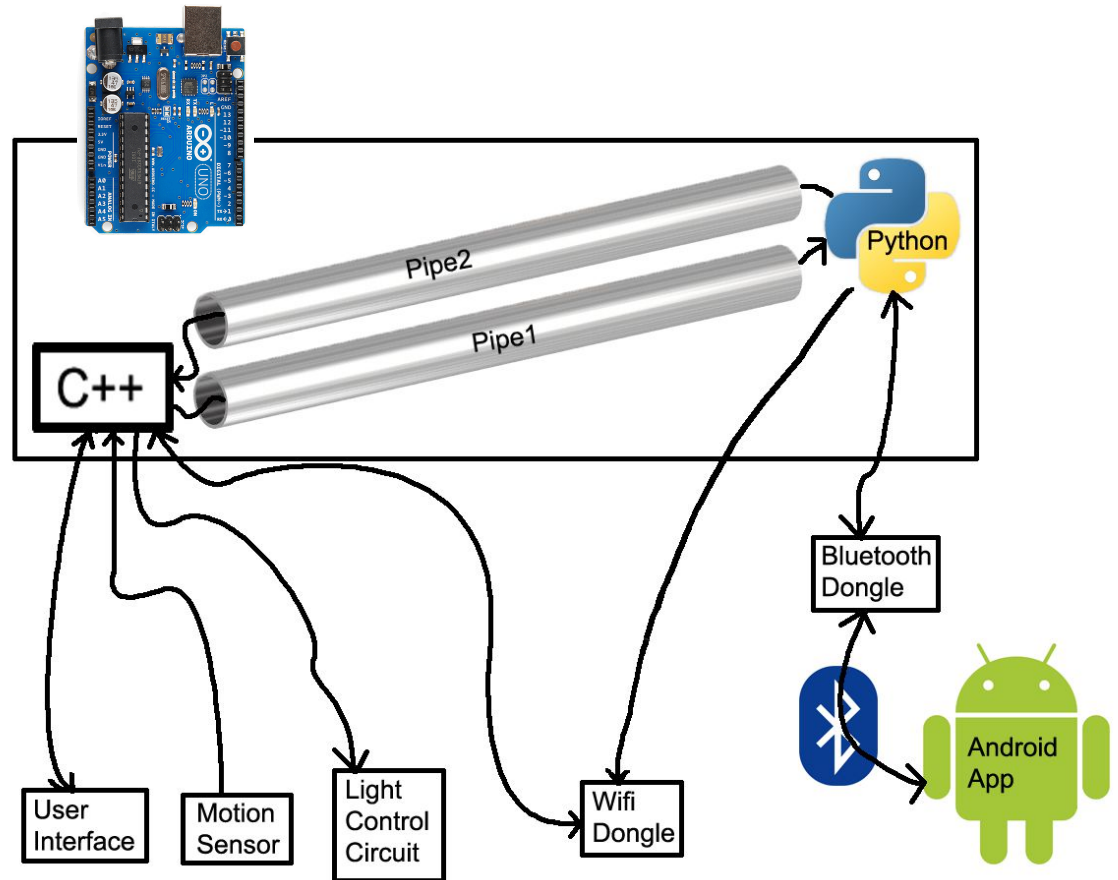
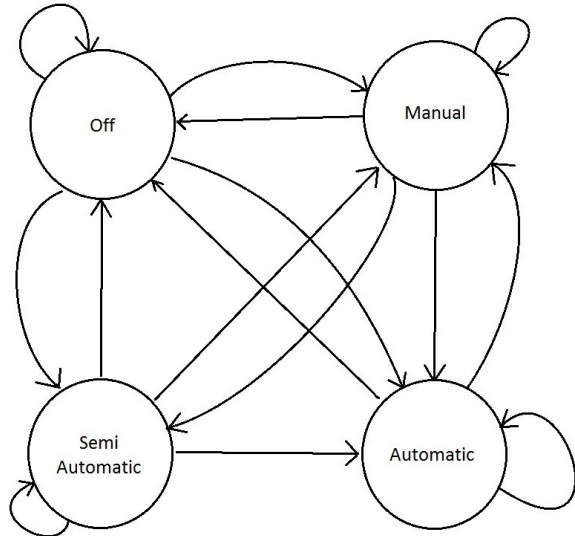
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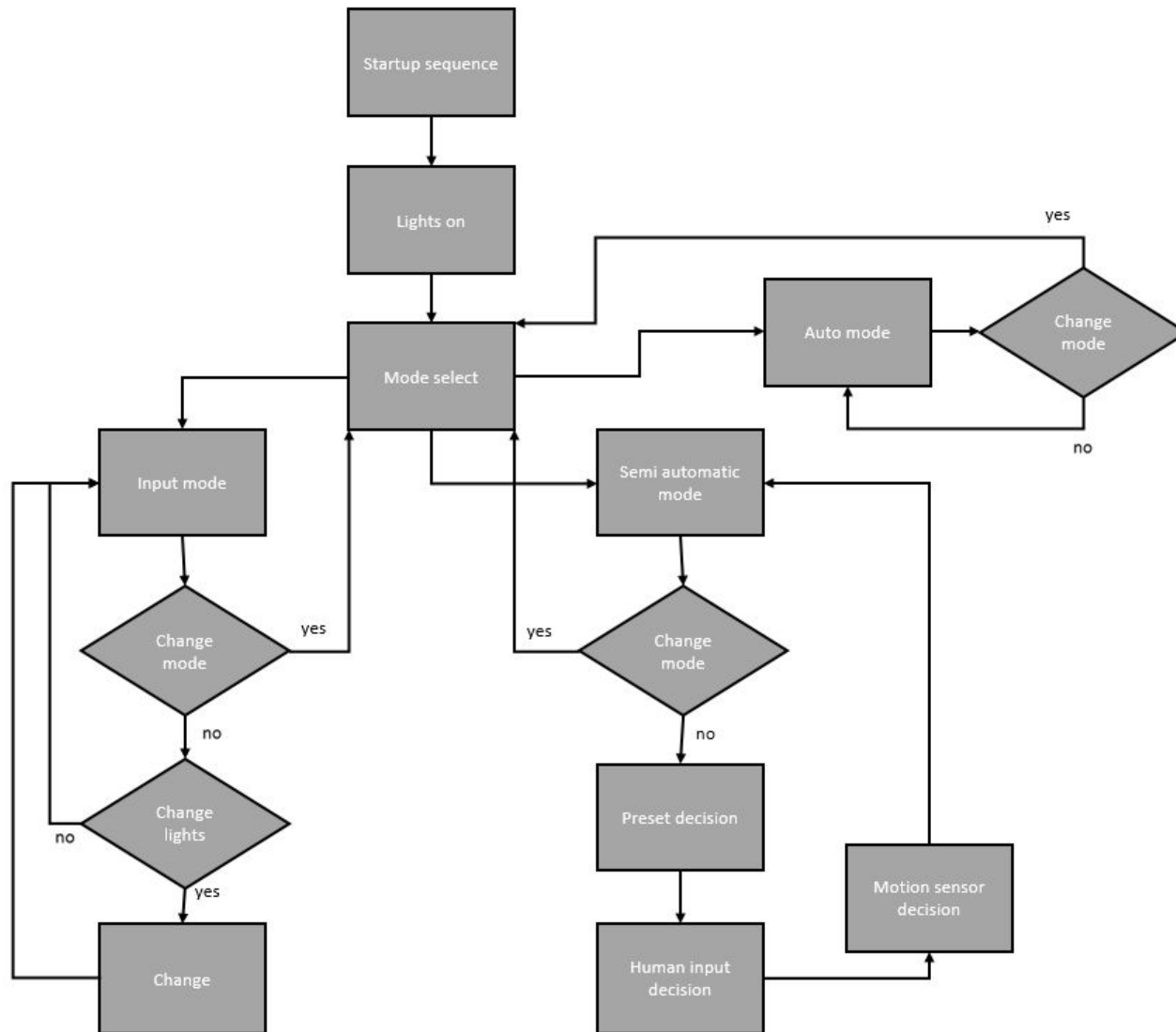
METHODOLOGY



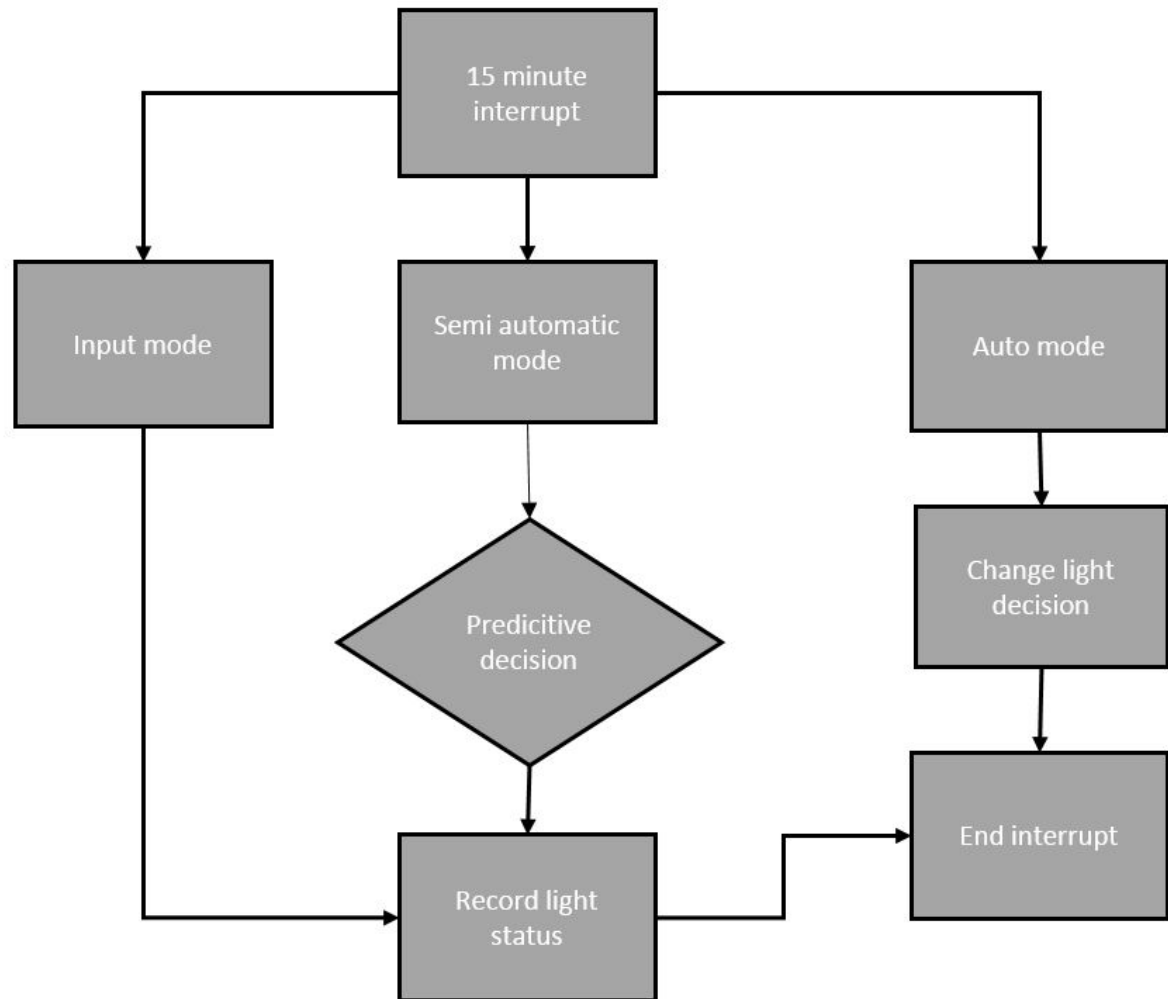
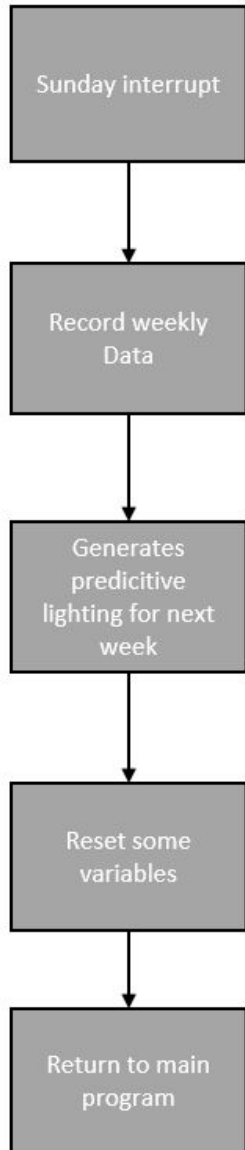
WORKING



WORKFLOW



UPDATE SYSTEM



REFERENCES

- **R. Heukels, “Predicting User Behavior Using Transition Probability,” University of Twente, 2015.**
 - • Provides the mathematical model for predicting user behavior from state transitions.
 - • Used as the basis for the lighting pattern recognition and prediction algorithm in this project.
- **Smart Lighting and Home Automation Literature**
 - • Industry and research sources describing smart lighting architectures and control methods.
 - • Provided background on motion sensing, remote control, and energy-efficient lighting automation concepts.