Smart Power Consumption Monitoring System

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Project Guide
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Outline of the Presentation

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Problem Definition

Lack of Appliance-Level Insight: which appliances are consuming excessive energy, making it difficult to implement targeted energy-saving measures.

Uncontrolled Energy Costs: Escalating energy costs are a constant concern for both households and businesses.

Inefficient Energy Utilization: In an era of growing energy demands, optimizing energy use is paramount.

Manual Monitoring Hassles: Manual monitoring of appliances for energy consumption is time-consuming and impractical.

Environmental Impact: Reducing energy waste and adopting eco-friendly practices are essential to combat climate change.

Limited Data for Research: The absence of comprehensive, appliance-level consumption data hinders energy research efforts.

Objective

- To create an user-friendly mobile app for detailed energy reports, pinpointing individual appliance usage in buildings.
- To utilize machine learning for personalized energy-saving tips.
- To implement automated controls to reduce energy waste, as well as remote management via Wi-Fi.

Proposed System

Accurate Appliance Tracking: Monitor the power consumption and time period of usage for every device in your building, down to the finest detail.

Intelligent Reports: Our mobile app generates comprehensive energy consumption reports, making it effortless to stay informed.

Tailored Energy Insights: Get personalized suggestions on optimizing energy usage. Discover which devices run excessively or consume the most power, and learn how adjusting their usage can save you money. Our machine learning models ensure continuous improvement in these insights.

Effortless Automation: Motion sensors automatically switch off appliances when rooms are vacant, reducing unnecessary power consumption.

Remote Appliance Control: Use the app to remotely switch the appliances ON/OFF, with the added convenience of a Wi-Fi module.

Scope

1. Residential buildings

- Detailed monitoring and analysis of individual appliance usage
- Customized insights and suggestions for optimizing energy consumption
- High potential for a good social impact

2. Commercial buildings

- Enabling businesses to track and optimize energy usage across various spaces like conference rooms, offices, or common areas
- Quantification of how much energy and hence money can be saved by putting specific devices off use for specified time
- Potential for being sold as a complete energy management system

Potential Beneficiaries

1. House residents
2. Facility managers in commercial buildings
3. Data analysts and researchers
4. Government and regulatory bodies
5. Appliance manufacturers

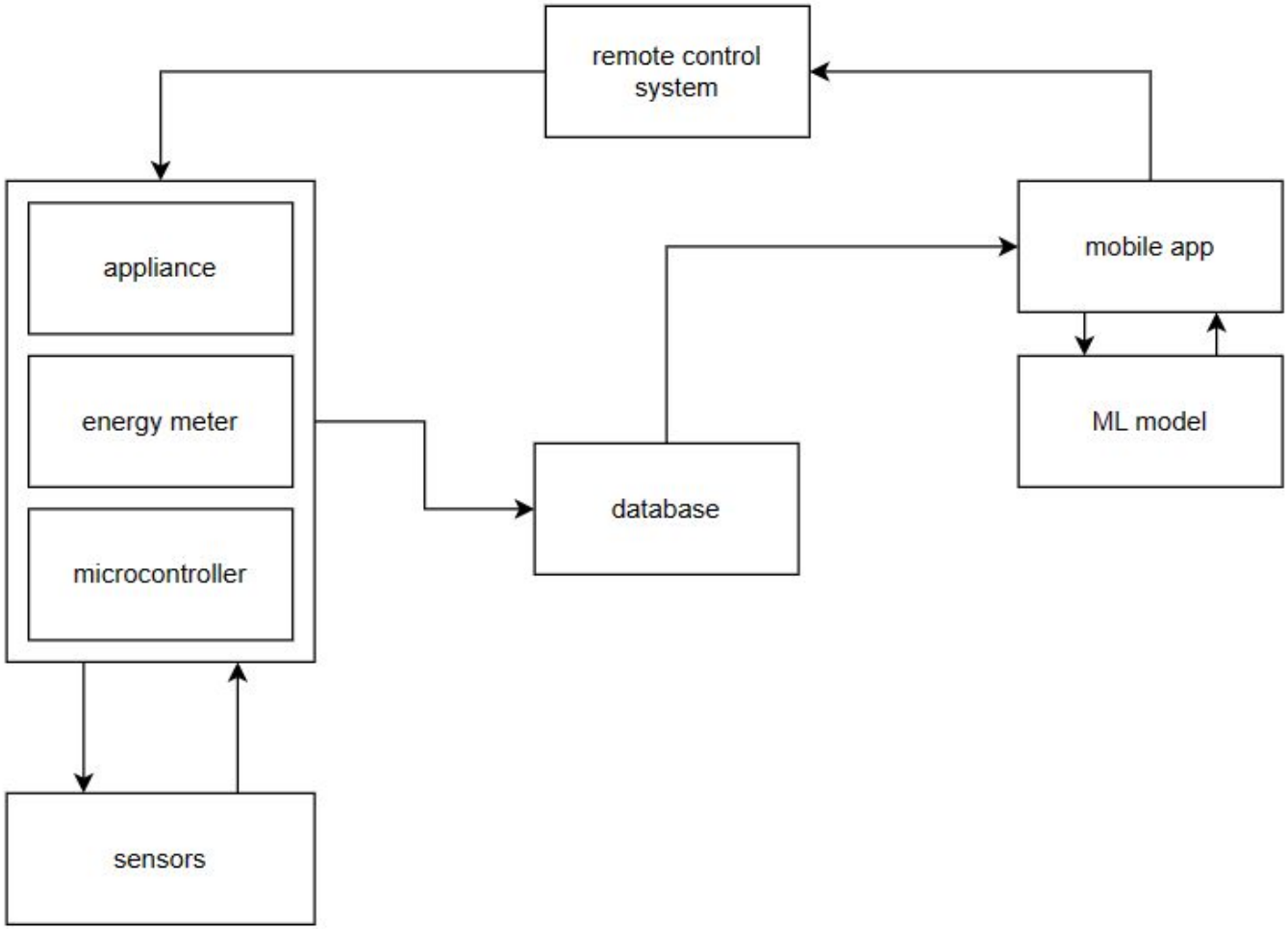
Social Impact

1. Energy conservation
2. Commercial efficiency and cost management
3. Environmental benefits
4. Education and awareness

Plan and Progress

- Install **energy meters**, connect them to **microcontrollers**, and set up **motion sensors**.
- Develop a **database** to collect data on energy consumption and other usage metrics.
- Design and develop a **mobile app** to monitor power consumption, integrate it with the central server, implement user authentication, and create a user-friendly interface.
- Develop machine learning models to **analyze the collected data** and provide insights, create algorithms to identify patterns, anomalies, and areas where energy can be saved, and implement personalized recommendations for users.
- Integrate the system with **smart switches and outlets**, and implement automation rules to turn off appliances when they are not in use.
- Conduct extensive **testing** of the entire system and perform usability testing.

Architecture Diagram



Deliverables

System Architecture and Design Documentation

Working Prototype of the Monitoring System

Mobile Application

Energy Consumption Reports

Timeline

S. No.	Project Phase	Timeline											
1	Establish the foundational hardware infrastructure for power monitoring.												
2	Implement a robust database structure for efficient data storage and retrieval.												
3	Create an intuitive mobile app for users to access detailed energy reports.												
4	Utilize machine learning for insightful energy consumption analysis.												
5	Implement automated control systems based on data-driven insights.												
6	Rigorous testing to ensure system functionality, reliability, and user satisfaction.												
Months		1	2	3	4	5	6	7	8	9	10	11	12

Estimated Budget

S. No.	EQUIPMENT/ SOFTWARE	QUANTITY	AMOUNT (in rupees)
1	E meter	1	2000
2	Tube Light	1	400
3	Table fan	1	1000
4	Arduino UNO	2	800
5	ESP32	2	800
6	Occupancy sensor	1	600
7	Unmanaged switch (tp link SF1005D)	1	1200
8	Smart plug	1	1100
9	Light sensor	1	300
10	Temperature sensor	1	200
11	Router (MI/TP-LINK TL-WR840N)	1	1500
12	Connecting wires	-	200
13	Third Party APIs	-	1000
14	Database hosting by CloudClusters	12 month express plan	6000
15	Miscellaneous	-	2000
	TOTAL	-	**19,100**

Budget Justification

- **Energy Meters:** To measure the power consumption of individual appliances, you'll need energy meters.
- **Arduino UNO:** To run monitoring system and secure data from smart plug
- **WIFI module(ESP32):** Remote monitoring and control
- **Smart Plugs:** These devices can monitor energy usage and transmit data via wifi. helps in controlling flow of current to appliances connected to it.
- **Sensors:** to detect if there are people in a room. This information can be used to automatically switch off appliances when not in use.
- **Router and switch hub:** Local network connectivity and traffic distribution
- **Database hosting:** The database needs to be hosted on a server so the data relating to energy consumption can be stored and accessed from any device.

References

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THANK YOU