

Internet of Things and Cyber Physical Systems

ECE 510

Project Preproposal

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Topic 1

Problem Statement

The project's goal is to create a smart home automation system that would enable wireless control of different electronic appliances for users. A centralized hub will be used by this system to provide remote control and monitoring. Smart automation with scheduling and triggers, energy-saving suggestions, customization and personalization options, strong security and privacy measures, integration with well-known voice assistants, and expandability for future device additions are some of the key features. Wireless device control via smartphone or web interface is another. With the help of this project, home automation will be made more convenient, energy-efficient, and enable better control over household appliances.

Proposed feature ideas

1. **Wireless Flood Detection System:** To anticipate and reduce flood damage, create a system that measures and monitors environmental variables including temperature, humidity, and water level.
2. **Smart Wheelchair:** Design a wheelchair with sensors integrated into it to gather information about how people sit and how much energy they use. Fall detection and remote monitoring are two uses for this data.
3. **Smart Cradle System:** The goal of the Smart Cradle System is to create a web application that enables parents to watch their child's activity in a cradle, including cry detection and live video surveillance.
4. **Gesture-Controlled Switch:** Construct a switch that offers a distinctive and simple user experience by utilizing gesture recognition to control linked devices in homes or public areas.
5. **IoT-Based Parking System:** Create a system that helps users save time and lessen traffic congestion by utilizing GPS and IoT to locate open parking spaces in congested regions.

Use Cases

1. **Smart Agriculture Monitoring:** IoT sensor deployment in agricultural fields can provide real-time soil moisture, temperature, and humidity monitoring. This is known as "smart agriculture monitoring." Farmers may increase overall agricultural output, monitor crop health, and optimize irrigation with the use of this data. Farmers may make educated decisions about pest management, fertilization, and watering by using the system's warnings and recommendations.
2. **Asset Tracking and Management:** Businesses can track the location, condition, and usage of valuable assets in real-time by affixing IoT tags or sensors to assets like inventory, vehicles, or equipment. This use case facilitates better asset usage, maintenance schedule optimization, theft and loss prevention, and operational streamlining. Applications for it include supply chain management, fleet tracking, and logistics.
3. **Smart Energy Management:** Real-time monitoring and control of energy consumption is possible for businesses and homeowners thanks to IoT-enabled energy management solutions. Users may detect patterns in energy use,

maximize energy efficiency, and lower utility costs by combining smart meters, sensors, and energy analytics. By supporting sustainable behaviors and cost savings, the system may automatically regulate heating, cooling, and lighting based on user preferences, weather, and occupancy.

Topic 2

Problem Statement

The underuse of common domestic doors as a potential energy source is the issue. A scalable and effective system that mounts motors to door hinges and transforms their movement into electrical energy must be created in order to address this. By integrating with a smart home automation system, this technology seeks to minimize energy use and lessen dependency on outside power sources. The project's objective is to build a smart home energy-generating system that makes the most of doors in homes, offering a convincing application for renewable energy production.

Proposed feature ideas

1. **Energy Generation:** The project's goal is to capture and transform the mechanical energy that comes from domestic doors into electrical energy. It is possible to produce electricity from underutilized resources because to this special feature.
2. **Integration with Smart Homes:** A smart home automation system will be smoothly linked with the energy producing system. This integration makes it possible to power multiple appliances and devices in the home while using less energy.
3. **Sustainability:** By harnessing the energy produced by door movement, the project lessens its dependency on outside power sources and cuts down on energy waste.
4. **Scalability:** The system's scalable architecture enables motors to be attached to several doors throughout the house. This feature guarantees that the project can grow to cover more ground and provide more energy.
5. **Unused Potential:** The project's unique selling proposition (USP) is its capacity to convert common household doors into assets that can produce electricity. This creative use case emphasizes the value of making efficient use of already available resources while showcasing the possibility for producing sustainable energy.

Use Cases

1. **Integration with Public Buildings:** Integrating energy-generating systems with revolving doors in public buildings is one creative strategy. People's movement through these doors can be used to generate a large amount of electrical energy. In addition to maximizing energy production, this strategy encourages sustainable habits in places with heavy traffic.
2. **Military Uses:** The energy-generating device can be modified for use in military settings, such as outposts or bases. The device may transform the mechanical energy from gates, obstacles, or even combat equipment into electrical energy by fastening motors to them. This creative solution can lessen the dependency on

fuel-based generators for military operations in distant areas by offering a reliable power source.

3. **Application at a Gym:** Exercise equipment that produces mechanical energy is a common feature in gyms. The energy producing device may transform user exercise energy into electrical energy by connecting with gym equipment like stationary bikes, ellipticals, and treadmills. This strategy encourages users to contribute to energy creation while maintaining their fitness levels in addition to promoting sustainability.

Topic 3

Problem Statement

The objective of this project is to develop a smart plant monitoring system using IoT technology. The system will enable plant owners to remotely monitor and maintain optimal growing conditions for their plants. The project aims to address the challenge of providing plant care even when individuals are away from home or have busy schedules. By leveraging IoT sensors and connectivity, the system will collect real-time data on temperature, humidity, soil moisture, and light intensity, allowing plant owners to make informed decisions about their plants' care. The project will also focus on developing a user-friendly mobile app or web interface that displays the sensor data and enables remote control of the system. The goal is to create a practical and accessible solution that enhances plant care and contributes to the growing field of IoT applications.

Proposed feature ideas

1. **Real Time Monitoring:** Real-time data on temperature, humidity, soil moisture, and light intensity are provided by the system, enabling plant owners to keep an eye on the health of their plants and make knowledgeable decisions regarding their maintenance.
2. **Remote accessibility:** Using a smartphone app or web interface, plant owners can use the system and keep an eye on their plants from any location.
3. **Alarms and notifications:** When specific conditions, like low soil moisture or extremely high temperatures, are identified, the system has the ability to send alarms and messages to the plant owner's mobile device.
4. **Data-driven insights:** By gathering and evaluating sensor data, the system can offer information about the best growing environments for various plant species, assisting plant owners in making the most of their maintenance plans.
5. **Water and energy conservation:** By tracking soil moisture levels and offering watering suggestions based on real-time data, the system assists plant owners in conserving water. Additionally, it optimizes energy use by modifying lighting settings in response to assessments of light intensity.

Use Cases

1. **Smart Agriculture:** To monitor and optimize crop development circumstances, large-scale agriculture can make use of the smart plant monitoring system. Farmers are empowered to make informed decisions that enhance crop productivity while conserving water and energy by having access to real-time data

on temperature, humidity, soil moisture, and light intensity. This may result in higher yields, lower expenses, and more environmentally friendly farming methods.

2. **Urban Gardening:** The concept can be applied in spaces where there is a shortage of space, like communal gardens or rooftop gardens. Urban gardeners can overcome obstacles like restricted access to sunshine and water sources by remotely monitoring and manipulating the plant environment. This can make it possible for people to cultivate their own fresh produce in cities, encouraging self-sufficiency and wholesome eating practices.
3. **Research and Education:** Plant development and environmental factors can be studied in research and educational settings by using the smart plant monitoring system. To better understand plant physiology and enhance experimental settings, scientists and students can gather and examine data from the sensors. In addition to offering beneficial educational opportunities for students interested in agriculture, biology, or environmental sciences, this can further the field of plant science.