AUTOMATIC PORTABLE WASHROOM

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Introduction:

1. Portable sanitation systems are widely used in areas such as construction sites, rural locations, disaster zones, and large public gatherings. However, conventional portable washrooms often lack efficient energy usage, proper waste handling, and hygienic operation. These limitations not only lead to resource wastage but also create environmental and health concerns.
2. This project aims to address these challenges by developing an automatic portable washroom system that integrates energy-efficient components with smart control mechanisms. By incorporating timer-based operations, sensors, and automated control of water flow, lighting, and ventilation, the system reduces unnecessary energy consumption and ensures optimal utilization of available resources.
3. The inclusion of water level monitoring and controlled flushing systems contributes to effective water management, which is a critical aspect of waste reduction. Additionally, contact-less operation using IR sensors enhances hygiene while reducing human intervention. The use of solenoid valves and controlled cleaning mechanisms ensures minimal wastage of water and energy during operation.
4. This project aligns with the principles of sustainable development by promoting efficient energy usage, improved sanitation, and responsible waste management. It demonstrates how engineering solutions can be applied to create eco-friendly and user-friendly systems. Overall, the proposed system contributes to building smarter infrastructure that supports both environmental sustainability and public health.

Methodology:

To start the system, a push button is used. After the push button is pressed, the ON signal is sent to a water level switch that ensures enough water is available for the system to operate. Once enough water is supplied, the water level switch sends a signal to a digital timer that controls all timing of functions, including lights, and cleaning. After the digital timer has set all function's timers, power is sent to two different modules:

1) A timer and solenoid valve operate the floor cleaning system by regulating water flow.

2) Another timer is connected to the automatic-flushing mechanism.

3) An IR sensor is connected to a relay module and to the solenoid valve for the user to activate and deactivate water and/or flush without touching anything.

4) An exhaust fan in the washroom that gives the washroom proper ventilation and air circulation.

Every component works together so that the complete portable washroom will automatically, hygienically, and efficiently perform all necessary functions without any manual effort.

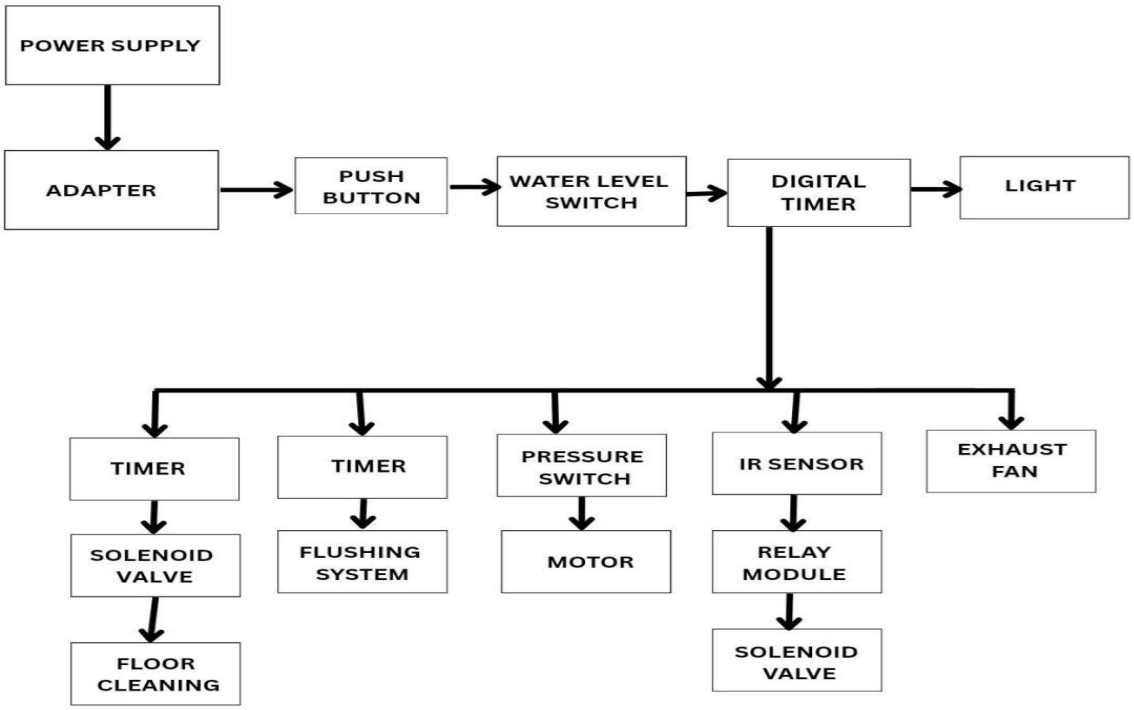

Figure 1: Block Diagram of Automatic Portable Washroom

Result and Conclusion:

1. The system demonstrated reliable operation of all automated functions, including flushing, floor cleaning, lighting, and ventilation, through the integration of timers, sensors, and control units.
2. The use of IR sensors enabled effective contact-less operation, significantly improving hygiene by reducing physical interaction with surfaces. The water level switch ensured continuous monitoring of water availability, preventing system failure due to insufficient water supply. Additionally, the solenoid valve-based control system regulated water flow efficiently, minimizing unnecessary wastage.
3. Observations indicated that the timer-based control mechanism contributed to optimal energy utilization by activating components only when required. The exhaust fan provided proper ventilation, maintaining a clean and odor-free environment inside the washroom. The coordinated functioning of all modules resulted in smooth and efficient system performance.
4. The results also highlighted a noticeable reduction in water consumption compared to conventional systems, supporting the objective of sustainable resource management. The automated cleaning system maintained better hygiene standards with minimal manual effort.

5. From the obtained results, it can be concluded that the proposed system is an effective solution for improving sanitation, energy efficiency, and waste management in portable washrooms. The project successfully demonstrates the application of energy engineering principles in developing a sustainable and user-friendly system.

Figure 2: Final working prototype of Automatic portable washroom

References:

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Future Scope:

The future scope of this project includes:

1. Integration of IoT technology for real-time monitoring of water levels, usage, and maintenance through mobile applications.
2. Implementation of renewable energy sources such as solar panels for energy-efficient and off-grid operation.
3. Addition of advanced sensors for water quality monitoring and improved waste management.
4. Enhancement using microcontrollers or AI-based systems for smarter and adaptive automation.