EKA-PURE

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ABSTRACT

The Eka Pure project is creating a smart washroom cleaning monitoring system that enhances hygiene levels and optimizes maintenance processes. It utilizes a network of IoT-enabled sensors, including infrared detectors, air quality sensors, and Wi-Fi communication units, which are strategically positioned within the washroom environment. These sensors continuously gather data related to environmental conditions and usage patterns, transmitting the information wirelessly to a centralized control platform. The system identifies real-time data when cleaning is necessary and promptly notifies authorities. This approach to maintenance helps prevent hygiene issues and improves the user experience. The platform provides analytical tools for facility managers, enabling them to optimize cleaning routines. The project is to maintain high sanitary standards through real-time data monitoring, automated decision-making.

KEYWORDS: *Washroom hygiene surveillance, Tracking System, IoT-Driven Monitoring, Live Environmental observe, Sensor-Based framework, Sanitation structure, Automated Cleaning Alarming.*

1. Introduction

When indeed public sanitation facilities fail, it turns into a serious problem because one may not maintain it very cleanly. This, in turn, leads to unhealthy conditions, users being dissatisfied, and a higher possibility of transmitting diseases. Old traditional cleaning methods don't consider present-day hygiene levels because they were based on preset schedules. Since urban populations are on the rise and demand for public sanitation is increasing, there are urgent demands for technology-based solutions for updating systems of maintenance and cleanliness.

This paper presents the EKA PURE smart monitoring system addressing these challenges. The system utilizes a suite of sensors—including gas detectors for ammonia and other odors . These sensors collect environmental data, which is processed by a central microcontroller and communicated to maintenance personnel via cloud-based platforms. A key feature of the EKA PURE system is its ability to alerts, staff to perform cleaning tasks based on actual conditions rather than pre -defined. This leads to improved optimized resource usage, and increased efficiency. Additionally, system archives historical data analysis, helping authorities identify high-traffic periods and maintenance activities.

Beyond Hygiene systems promote sustainable urban sanitation by cleaning agents. It also strengthens user satisfaction in public places such as transport hubs, leisure spots, and tourist attractions. It overlaps with broader smart city frameworks and national sustainable Development.

The paper is organized in 4 sections. Section 1 provides an overview of the EKA PURE system, highlighting its purpose. Section 2 lists the surveys existing literature advancements in the field of Sanitation systems. Section 3 gives architecture, including its primary components and technologies. Section 4 explains the implementation and the flow of data within the system. Section 5: results obtained from system and evaluates its overall performance. The conclusions from the study and proposes for future enhancement of public hygiene framework.

2. Literature Review

To ensure cleanliness of public toilets is an element of urban infrastructure tied closely with public health, user comfort, and environmental safety-thereby addressing these limitations-study authors explored a mixed-method approach integrating Internet of Things (IoT) technologies and sensor-based automation into responsive sanitation monitoring capable of real-time alerting.
In addition to gas sensors, detection using PIR sensors via ultrasonic sensors have been widely adopted. These sensors collect real-time usage data and ultrasonic sensors with an Arduino-based controller to assess restroom conditions dynamically. Cloud storage solutions are used to enabling trend analysis and maintenance strategies.
To enhance integrate such as QR-code-based surveys or app framework, enabling report cleanliness concerns directly. This hybrid model—blending automated sensing with human input—has been shown to improve the system and expands upon these technological foundations. By combining sensor, real-time communication, and data analysis, the system aims to provide a, scalable solution for maintaining sanitary conditions.

3. Components & Materials

The Eka Pure solution combines the Internet of Things (IoT) for tracking and managing environmental and sanitary conditions of public washrooms.
The system has the following key components:

1. Sensor Network: Infrared (IR) sensors and air quality sensors detect motion, occupation, and levels of odour and provide real-time information on washroom status.
2. Microcontroller Units: Arduino UNO handles processing of the data from the sensors. Wireless communication is made using the efficient ESP8266 Wi-Fi System-on-Chip (SoC), which has high efficiency and is highly integrated with IoT systems.
3. IoT Platforms: The IoT platforms provide a user-friendly centralized interface for real-time monitoring, control, and configuration purposes, wherein users may visualize data, handle alerts and interact with connected devices.
4. All the information amassed by sensors is recorded in cloud databases, which fundamentally differ from storage that allows using database-type analysis on the stored data to prepare the environment for analyzing the long-term data trend concerning hygiene conditions as well as performance of the system.
5. Web and mobile applications integrate terminal facilities and facilitate real-time updates to control capability empowerment.

The model will be proactive and data-oriented in the maintenance of washrooms; hence hygiene and operation efficiency will be advanced.

4. Methodology

The architecture is outfitted with sensors and modules along with it for the Conditioning of environment to transfer data for Upkeep:
Fig 1: Circuit diagram of EKA PURE sensor is simulate including IR sensors, microcontroller, PIR sensor, Bluetooth module, Wi-fi module, GSM etc for the architecture.
Fig 2: Working model of EKA PURE installation of architecture after simulation of sensor and encrypting modules for the required output, here we present our succeeding foundation of the motto Swasth shauchalaya Swasth Bharat through the naming our project EKA refer to unity in Pali, Pure refer to cleanliness through unity.
Fig 3: Browser page for keep tracking of our motto start with some serious issues faced by us in public toilets like in our college, wave, Railway Station, local markets toilets etc.

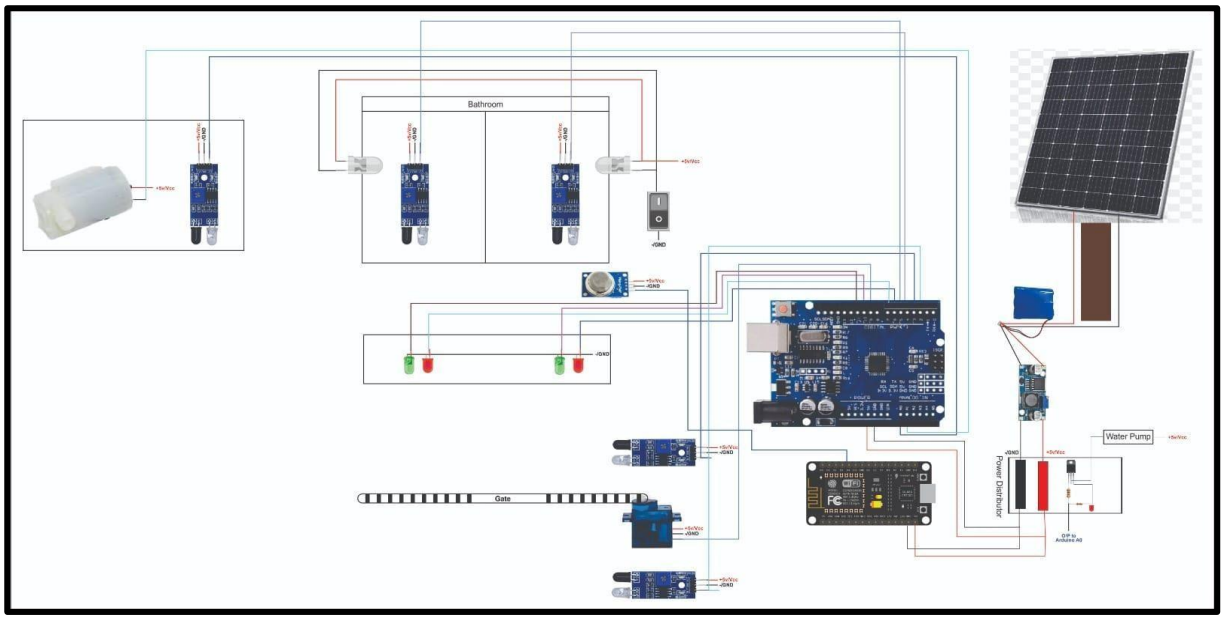

Fig 1: Circuit diagram of EKA PURE working module

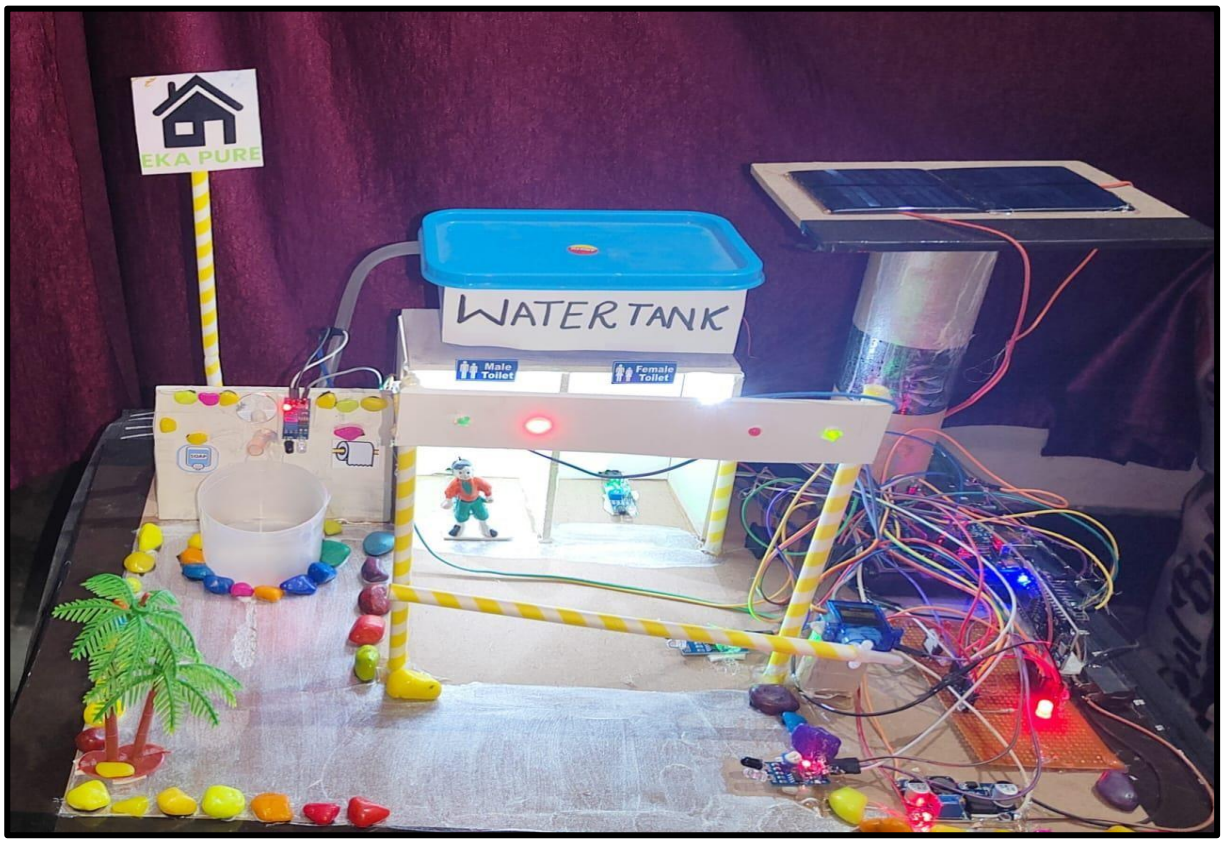

Fig. 2: Working model of EKA PURE

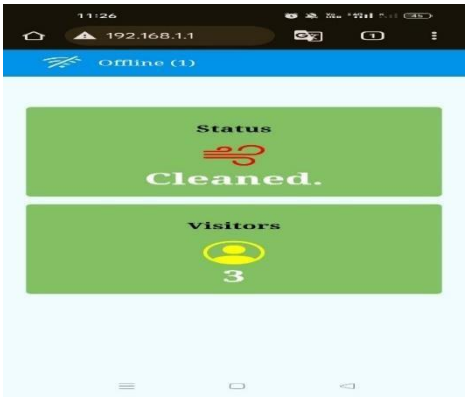

Fig 3: Browser page for monitoring data

5. Results and Discussion

The vision is in line with the national campaign "Swachh Shauchalaya Swasth Bharat", which focuses on sanitation and hygiene in public places. The project has been titled EKA PURE, representing towards keeping public washrooms, hubs, hospitality places, etc., clean. The system employs a Wi-Fi module for data transfer, and the status and can be viewed through a browser by typing the IP address 192.168.1.1, enabling local monitoring through connected devices.

6. Conclusion & Future Work

The EKA PURE system enhances cleanliness through monitoring and cleaning notification of toilets, to improve the toilet environment. Sensors in the system allow for better maintenance and hygienic options. Going forward, other developments could include feedback from users, a maintenance framework using data trends, and possible renewable energy applications for a greener and cleaner system. The model strongly supports wider acceptance in urban sanitation design for socially responsible purposes - keeping cleaner public places.

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