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IoT Based Toilet Cleaning ROBOT – TOILBOT

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Abstract: -

Background: Public toilets play a vital role in community health and individual well-being. Poor Sanitation facility in public toilets is the reason for the spread of infectious diseases to people using them. On the other hand, one of the main problems faced by manual scavengers is proper maintenance of the public lavatory. **Objective:** To keep the toilets in clean condition to improve hygiene**.**

Methods: In today's developing trends on Robotics and Automation, Toilbot can play a key role in promoting good sanitation facilities to public lavatories.

Findings: Further, the toilbot is cost effective and uses minimum amount of water for cleaning purpose. Also, the robot helps in reliving the workers form manual method of cleaning. The robot can clean public restrooms in a faster way. Thus, the entire cleaning process is made simple for the user.

Novelty: In order to have an efficient cleaning mechanism, Toilbot is introduced. Toilbot is commanded using NodeMCU. NodeMCU is the central part of Toilbot which controls the entire operation. It has arm through which brush and pipes are attached. The BOT pours water into the lavatory and then brushes and cleans the lavatory. Cleaning agent is to be poured at the mentioned time and again water is allowed to pour and cleaning process ends. This is a solution provided for INDIAN type toilets.

Keywords*: Toilbot, NodeMCU, INDIAN type toilets.*

1. Introduction

Knowing the importance of thorough cleaning and disinfecting is especially crucial in light of the potential spread of diseases. In our country the government has introduced a scheme called "Swatch Bharat Abhiyan" which is the motto behind the project. Keeping the toilet clean is the main objective of the system. Understanding various toilet cleaning system and examines the viability of using commercial devices- Giddle and SpinX devices in developing countries' public restroom [1]. Giddle is capable of washing either the toilet bowl or just the toilet seat. SpinX satisfies both standards, however it is too expensive to use in public restrooms. Need of controlling of robot with motor and communication through Bluetooth devices which navigates the movement of cleaning robot provides an idea for using other technologies too for betterment [2]. The technology employed offers 'clean on demand' model to deploy the man power resources efficiently and allows better maintenance and hygiene level of toilets and set high standard of cleanliness of the toilets[3].

Pertaining to smart lavatory automatic flushing in the toilet seat is implemented using Gear motor. This work makes use of money slot system and occupancy detector which have automatic control over the lavatory doors, which addresses the problem of manually cleaning the public toilets [4]. Employing a periodical inspection of surface using ultrasonic sensors and visual cameras in order to prevent contamination in toilets is necessary. To

clean various fields effectively it is needed to investigate the robot which is guided using wireless communication [5].

Given the many problems that need to be tackled in today's society, urban sanitation is of utmost importance. Many fungi, germs, and pathogens are spread widely in public restrooms and cause discomfort while using it. It should be kept clean otherwise it will lead to hazardous disease to human life. Yet, in India, the situation with regard to public restrooms and in trains is still problematic. Effective cleaning of lavatories is an even more crucial thing and is an unpleasant chore as public cleanliness is not given the same level of attention by people [8]. In this technological world, everything is moving towards automation and smart thinking.

2. Design and Development

Driver Circuit, relays, a servo motor, a water pump, a DC motor, an ESP8266MOD, and primarily a 12 V battery are needed for the experimental setup. When designing this bot, cost effectiveness and ease of maintenance were in priorities.The block diagram for the robot that cleans toilets can be seen in Fig. 1.

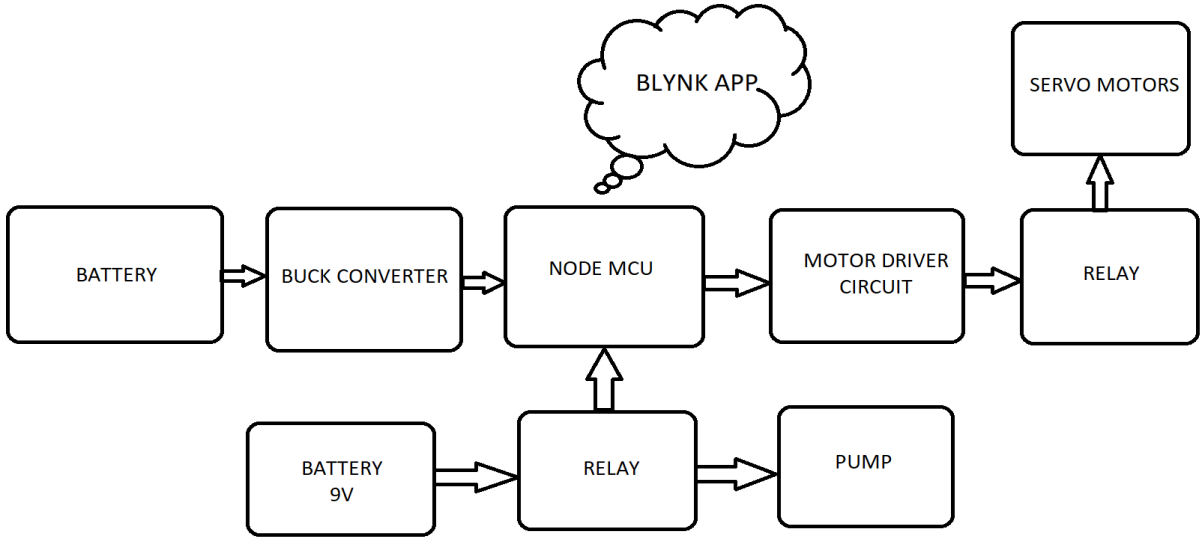

Figure 1: Block Diagram

2.1. Process Flow

The brains of the bot are the NodeMCU-ESP8266. The NodeMCU's instructions are used to carry out every process. An app can be used to control the bot. The bot moves forward when the forward command is given, and it has an arm structure that it uses to clean the restroom. Initially, the arm is raised, the pump is turned on to create a water supply, the brush attached to the end of the arm rotates, and the cleaning process begins. Later, the pump is shut off, the brush stops rotating, and the arm lowers. The process also involves rotating the arm further to the right. Process flow is demonstrated in detail in Fig.2.

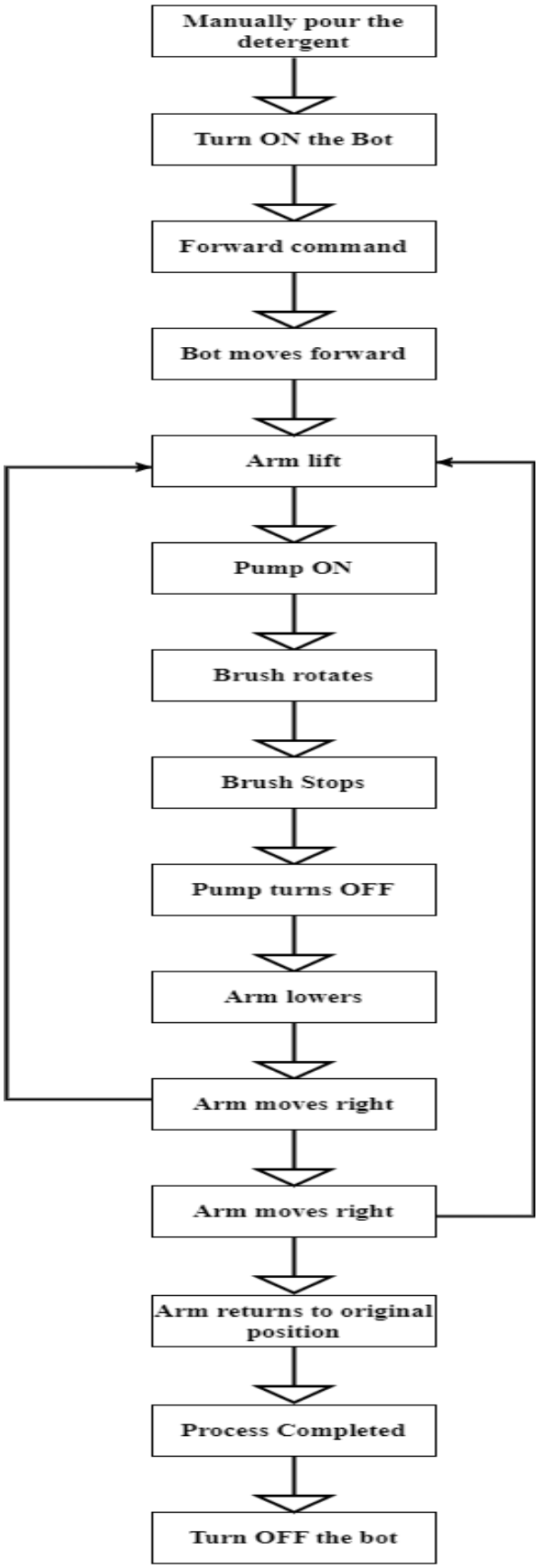

Figure 2: Flow chart

2.2. Design and Fabrication

The model is created and viewed in 3D with the aid of SOLIDWORKS. Fig.3. shows the created simulation. To obtain the model in sturdy plastic material, a dispatch must be made. Constructed and sent for fabrication are the arm structure and the base[7][9]. The constructed model needs to have screws added to it in order to transform it into the desired bot. According to the desired method, as shown in Fig.4, the bot structure was created.

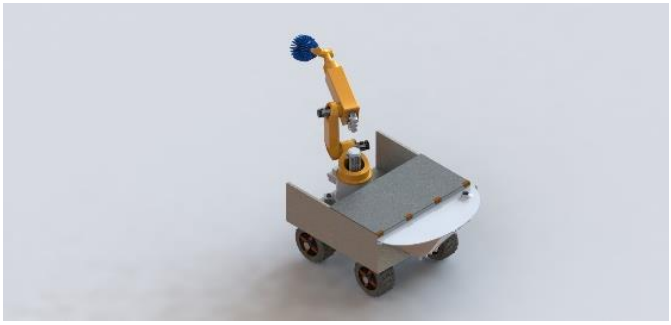

Figure 3: 3-Dimensional Model

2.3. Driver Circuit and Relay Module

A motor driver in the driver circuit model is able to control two sets of motors, or four motors, simultaneously. To allow the bot to move, we have attached 4 DC motors to the 4 wheels at the bottom of the machine. When a forward command is given from the app, NodeMCU instructs the motor driver circuit to cause the motors to rotate in order to move the bot forward. One DC motor, which rotates the brush 360 degrees, is connected to the relay circuit. According to the code, the relay should turn the motor ON and OFF. The water pump is connected to a different relay module so that the water supply can be provided when needed.

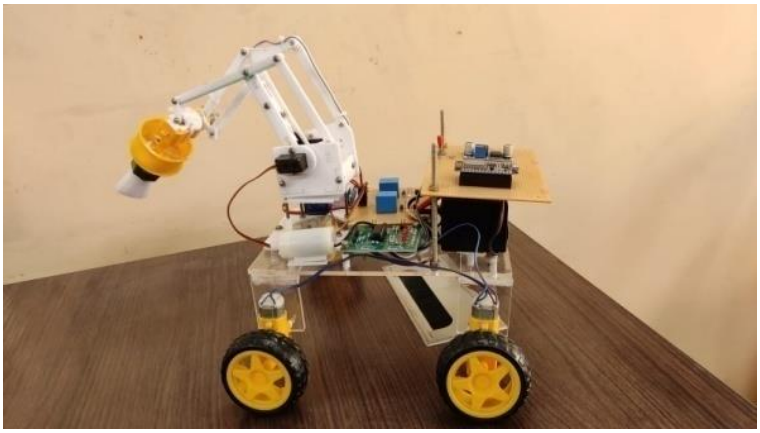

Figure 4: ToilBot Overview

3. Statistical AnalysisandFuture Predictions

Although the SulabhShauchalaya was a first step in providing hygienic sanitation facilities, it fell short of its objectives. The elimination of open defecation was one of the main objectives of the "Swachh Bharat Abhiyan," which the Indian Prime Minister of India launched in October 2014.

The Swachh Bharat Abhiyan altered Indians' perceptions of cleanliness and public areas. Numerous restrooms, both public and private, have been put in place nationwide as part of this mission. The practice of open defecation still prevails, though, in the real world.

Additionally, compared to manual cleaning, our bot has demonstrated a significant reduction in water consumption. In many regions of the world, usable water is already in short supply, which is cause for concern.

Water availability is probably one of the most important issues that humanity will face in the future, as our compilation of facts about water pollution demonstrates.

Designing sustainable systems requires taking into account how people can efficiently conserve and use freshwater. To keep the water cycle's integrity, they must also figure out how to manage the land. Examples include ways to reclaim polluted water and channelling water where it is needed.

When developing systems that effectively conserve water rather than wasting it, we must never lose sight of our limited supply of freshwater.

4. Results and Future Scope

As a result, this BOT is used to clean Indian toilets. Numerous public manual workers will benefit from their inclusion in real time. This BOT also displays the anxiety that people experience when using public restrooms. This BOT can be used in homes when the cost is made affordable because it is primarily designed to clean Indian-style toilets. Manual cleaning and human reluctance to engage in this kind of task leads to the development of robots. Robots assist us in cleaning our homes in the current situation. The idea of using bots has several similarities to technological advancements and they serve a range of purposes. Automatic cleaning of toilets using robots will help to save time and energy. On implementing smart lavatories, cleanliness of the toilet is ensured every time. Lavatory cleaning robot replaces the manual labor and works efficiently. Technical advancement in all fields ensures development of Nation.

Although western-style toilets are increasingly popular, we predict that soon people will switch to Indian-style squat toilets due to the enormous health benefits of these facilities. The main issue with Indian-style toilets is that the bowls have different shapes, which provides an opportunity to broaden our research area and develop a BOT that can handle these different shapes.

5. Conclusion

Due to the unsanitary conditions, the majority of people avoid using public restrooms. The major objective was to make public restrooms more hygienic. It aids in water and electricity conservation. People's perceptions of unhygienic in public restrooms could be changed through the automated cleaning process, allowing them to use these facilities without hesitation. This in turn aids in the promotion of the government of India's Swach Bharat initiative. Every aspect of cleaning the toilet has been automated. Future scope of research can be using special techniques like a smell-based cleaning system and an autonomous sewage system can be added. The restrooms' energy needs are met by solar cells. The power generated by the PV system that could be installed on public restrooms will be stored in the solar cells.

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