VISVEVARAYA TECHNOLOGICAL UNIVERSITY

Jnanasangama, Khanapur road, Belagavi – 590018

A Technical Project Report on

"AUTOMATED EXHAUST FAN AND FLUSHING SYSTEM"

Submitted in partial fulfillment of the requirements for the award of degree of

BACHELOR OF ENGINEERING
IN
ELECTRICAL AND ELECTRONICS

SUBMITTED BY

DANNY JOHNSON P	1OX20EE004
JAMES PRAJWAL V	1OX20EE006
MALLIKARJUNA KV	1OX20EE009
SUHAS M	1OX21EE407

UNDER THE GUIDANCE OF

Dr. NISHA C RANI ASSISTANT PROFESSOR
DEPARTMENT OF EEE, TOCE

DEPARTMENT OF ELECTRICAL AND ELECTRICAL ENGINEERING

THE OXFORD COLLEGE OF ENGINEERING

BOMMANAHALLI, HOSUR ROAD, BENGALURU – 560068

(Affiliated to VTU and approved by AICTE Accredited by NAAC – A GRADE)

2023-2024

THE OXFORD COLLEGE OF ENGINEERING

BOMMANAHALLI, HOSUR ROAD, BENGALURU – 560068
(Affiliated to VTU and approved by AICTE Accredited by NAAC-A GRADE)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

2023-2024

CERTIFICATE

Certified that the Project work entitled **"AUTOMATED EXHAUST FAN AND FLUSHING SYSTEM"** carried out by **DANNY JHONSON P (1OX20EE004), JAMES PRAJWAL V (1OX20EE006), MALLIKARJUNA K V (1OX20EE009), SUHAS M (1OX20EE407)**, is bonafide students of The Oxford College of Engineering, Bangalore in partial fulfilment for the award of degree of Bachelor of Engineering in Electrical & Electronics Engineering of Visvesvaraya Technological University, Belgaum during the academic year 2023-24. It is certified that all the corrections/suggestions indicated for Internal Assessment have been incorporated in the report. The Project work has been approved as it satisfies the academic requirements in respect of Project work prescribed for the said degree.

Internal Guide	**HOD**	**Principal**
Dr. NISHA C RANI	**Dr. B. DEVI VIGHNESHWARI**	**Dr. N KANNAN**
Asistant Professor Dept of EEE, TOCE	Associate Professor & HOD Dept of EEE, TOCE	PRINCIPAL, TOCE

Professor & Head EEE
The Oxford College of Engg
Bommanahalli, Hosur Road
Bangalore-560 068

PRINCIPAL
The Oxford College of Engineering
Bommanahalli, Hosur Road
Bengaluru-560 068

NAME OF THE EXAMINER	**SIGNATURE WITH DATE**
1) Dr. KOTHAIANDAL.C	28/5/24
2) JAYAKUMAR.N	28/5/24

Karnataka State Council for Science and Technology

(An autonomous organisation under the Dept. of Science & Technology, Govt. of Karnataka)
Indian Institute of Science Campus, Bengaluru – 560 012
Telephone: 080-23341652, 23348848, 23348849, 23348840
Email: office.kscst@iisc.ac.in, office@kscst.org.in ♦ **Website:** www.kscst.iisc.ernet.in, www.kscst.org.in

Dr. U. T. Vijay
Executive Secretary

19th April, 2024

Ref: 7.1.01/SPP/37

To,
The Principal
The Oxford College of Engineering
Bommanahalli Hosur Road
Bengaluru – 560 068

Dear Sir/Madam,

Sub : Sanction of Student Project - 47th Series: Year 2023-2024

Project Proposal Reference No. : **47S_BE_0897**
Ref : Project Proposal entitled **AUTOMATED EXHAUST FAN AND FLUSHING SYSTEM**

We are pleased to inform that your student project proposal referred above, has been approved by the Council under "Student Project Programme - 47th Series". The project details are as below:

Student(s)	Mr. DANNY JOHNSON P.	**Department**	ELECTRICAL AND ELECTRONICS ENGINEERING
	Mr. JAMES PRAJWAL V.		
	Mr. MALLIKARJUNA K. V.		
	Mr. SUHAS M.	**Sanctioned Amount (in Rs.)**	5,500.00
Guide(s)	Mrs. NISHA C. RANI		

Comments / Suggestions of the Experts

THE BATTERY RECHARGING SCHEME IS IMPORTANT TO UNDERSTAND FOR ITS DUARABILITY AND RATE OF DISCHARGE. PROVIDE RECHARGING SCHEME FOR THE BATTERY.

Instructions:

a) The project should be performed based on the objectives of the proposal submitted.
b) Any changes in the project title,objectives or students team is liable for rejection of the project and your institution shall return the sanctioned funds to KSCST.
c) Please quote your project reference number printed above in all your future correspondences.
d) After completing the project, 2 to 3 page write-up (synopsis) needs to be uploaded on to the following Google Forms link https://forms.gle/6s8hq5XbScsBMv3G9. The synopsis should include following:

1) Project Reference Number
2) Title of the project
3) Name of the College & Department

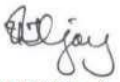
4) Name of the students & Guide(s)
5) Keywords
6) Introduction / background (with specific reference to the project, work done earlier, etc) - about 20 lines
7) Objectives (about 10 lines)
8) Methodology (about 20 lines on materials, methods, details of work carried out, including drawings, diagrams etc)
9) Results and Conclusions (about 20 lines with specific reference to work carried out)
10) Scope for future work (about 20 lines).

e) In case of incompeted projects, the sanctioned amount shall be returned to KSCST.
f) The sanctioned amount will be transferred by NEFT to the bank account provided by the College/Institute.
g) The sponsored projects evaluation will be held **third week of May 2024** onwards through Online Mode and the details of the same will be intimated shortly by email / Website announcement.
h) After completion of the project, soft copy of the project report duly signed by the Principal, the HoD, Guide(s) and studetn(s) shall be uploaded in the following Google Forms Link https://forms.gle/Mi446v1U5fdFcMD99. The report should be prepared in the format prescribed by the university.
i) The **Utilization Certificate and Statement of Expenditure duly signed by competent authority** of consolidated sanctioned projects from your institution need to be submitted **20 August 2024** without fail.

Please visit our website for further announcements / information and for any clarifications please email to spp@kscst.org.in

Thanking you and with best regards,

Yours sincerely,



(U T Vijay)

Copy to:

1) The HoD
ELECTRICAL AND ELECTRONICS ENGINEERING
THE OXFORD COLLEGE OF ENGINEERING, BENGALURU

2) Mrs. NISHA C. RANI
ELECTRICAL AND ELECTRONICS ENGINEERING
THE OXFORD COLLEGE OF ENGINEERING, BENGALURU

3) THE ACCOUNTS OFFICER
KSCST, BENGALURU

NCASTEM 2024

CERTIFICATE

OF PARTICIPATION

This certificate is presented to

Presenter : Danny Johnson P

CoAuthor : Nil

The Oxford college of Engineering

for Authored and presented a paper/poster titled

Automated Exhaust fan and flushing System.

in the National Conference on Advances in Science, Technology, Engineering and management (**NCASTEM-2024**) held on 8th May 2024 at T. John Group of Institutions, Bangalore

Dr. Asha S Manek
PROGRAM CHAIR
Professor & HOD (AIML)
R&D Cell Coordinator
T. John Institute of Technology, Bengaluru

NCASTEM 2024

Dr. P. Suresh Venugopal
PATRON
Principal,
T. John Institute of Technology, Bengaluru

THE OXFORD COLLEGE OF ENGINEERING

BOMMANAHALLI, HOSUR ROAD, BENGALURU – 560068

(Affiliated to VTU and approved by AICTE Accredited by NAAC – A GRADE)

DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

2023-2024

DECLARATION

We, DANNY JHONSON P (1OX20EE004), JAMES PRAJWAL V (1OX20EE006), MALLIKARJUNA K V (1OX20EE009), SUHAS M (1OX20EE407), are the students of 8th semester B.E in the Department of Electrical and Electronics Engineering, Bengaluru declare that the Mini Project entitled "AUTOMATED EXHAUST FAN AND FLUSHING SYSTEM" carried out by us and submitted in partial fulfilment of the course requirements for the award of the degree in Bachelor of Engineering in Electrical and Electronics Engineering of Visvesvaraya Technological University, Belgaum during the year 2023-2024 Further, the matter embodied in the dissertation has not been submitted previously by anybody for the award of any degree or diploma to any other university.

NAME	USN	SIGNATURE
DANNY JOHNSON P	1OX20EE004	
JAMES PRAJWAL V	1OX20EE006	
MALLIKARJUNA K V	1OX20EE009	
SUHAS M	1OX21EE407	

Place:

Date:

ABSTRACT

In modern building management, the integration of automated systems has become paramount for efficiency, sustainability, and user comfort. This Project presents an innovative solution for the automation of flushing and exhaust systems within buildings. The proposed system utilizes a combination of sensors, actuators, and intelligent control algorithms to optimize the flushing and exhaust processes based on real-time conditions.

The automated flushing system incorporates sensors to detect occupancy and usage patterns in restrooms, enabling the system to schedule flush cycles dynamically, thus reducing water wastage while maintaining hygiene standards. Additionally, the system employs water flow sensors and pressure regulators to ensure optimal water usage and prevent overflows.

Furthermore, the exhaust system is integrated with environmental sensors to monitor air quality. By dynamically adjusting exhaust fan speeds based on indoor air quality data, the system effectively removes pollutants and maintains a healthy indoor environment, thereby enhancing occupant comfort and productivity.

Overall, the automated flushing and exhaust system presented to offer a sustainable and intelligent solution for optimizing water usage, enhancing indoor air quality, and streamlining facility management processes in modern buildings.

ACKNOWLEDGEMENT

The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without the mention of the people who made it possible with continuous guidance and encouragement and crowned our effort with success.

We have great pleasure in expressing our deep sense of gratitude to Late Shri. S. NARASA RAJU, Founder Chairman and we consider ourselves proud to be a part of the Oxford family the institution that stood by our way in all our endeavors. We express our gratitude to Dr. S. N. V. L. NARASIMHA RAJU, Chairman, The Oxford Educational Institutions for providing all facilities for our work to be a better one.

We would like to express our gratitude to Dr. N KANNAN, Principal, The Oxford College of Engineering for providing congenial environment surrounding to work in. We heartly thank to our beloved HOD, Dr. B DEVI VIGHNESWARI, Department of EEE for his encouragement and support.

Words are inadequate in offering our thanks Dr. NISHA C. RANI, Assistant Professor, and Mrs. RESNA S.R, Assistant Professor, Department of EEE with profound gratefulness for a moral inspiration, encouragement and valuable guidance throughout course of this work.

We also thank all the staff members of Electrical and Electronics Engineering department and all those who have directly and indirectly helped us with their valuable suggestions in the successful completion of this project. Last but not the least we would thank our beloved parents for their support and encouragement to successfully complete the task by meeting the entire requirement.

NAME	USN
DANNY JOHNSON P	1OX20EE004 JAMES
PRAJWAL V	1OX20EE006
MALLIKARJUNA K V	1OX20EE009
SUHAS M	1OX21EE407

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER – 1

INTRODUCTION

In the real time of modern facility management, the quest for efficiency, sustainability, and user comfort has spurred the development of innovative technologies. One such area of focus is the automation of essential building functions, aiming to streamline operations while minimizing resource wastage. Among these functions, the management of restroom facilities and indoor air quality holds particular significance for occupant well-being and environmental impact.

Traditionally, the operation of flushing and exhaust systems in buildings has been largely manual or based on rudimentary timers, lacking adaptability to real-time usage patterns and environmental conditions. This conventional approach often results in suboptimal resource utilization, excessive energy consumption, and compromised indoor air quality.

To address these challenges, a paradigm shift towards automated solutions has emerged, leveraging advancements in sensor technology, data analytics, and intelligent control algorithms. The integration of such technologies into flushing and exhaust systems offers a transformative opportunity to enhance facility management practices while promoting sustainability and occupant satisfaction.

The automated flushing system proposed in this study represents a departure from static flushing schedules, instead employing occupancy sensors and usage analytics to dynamically regulate flush cycles. By intelligently adjusting flushing frequency based on actual restroom usage, the system aims to minimize water wastage without compromising hygiene standards. Additionally, the incorporation of water flow sensors and pressure regulators ensures efficient water usage and prevents potential leaks or overflows.

Concurrently, indoor air quality management is addressed through the integration of an automated exhaust system. Environmental sensors are utilized to monitor key air quality parameters, enabling

the system to modulate exhaust fan speeds in response to variations in humidity, temperature, and pollutant levels. This proactive approach not only improves indoor air quality but also contributes to energy conservation by optimizing exhaust system operation.

The versatility and adaptability of the proposed automated flushing and exhaust system extend beyond individual restroom facilities. Through integration with building management systems (BMS), centralized monitoring and control capabilities are facilitated, empowering facility managers to optimize resource allocation, implement predictive maintenance strategies, and track performance metrics in real-time.

In summary, the integration of automated flushing and exhaust systems represents a significant advancement in facility management practices, offering tangible benefits in terms of resource efficiency, occupant comfort, and environmental sustainability. This study aims to explore the design, implementation, and potential impact of such systems within modern building environments, highlighting their role in shaping the future of facility management.

1.1 BACKGROUND

1.1.1 Background of Automatic Flushing System:

History and Development:

Automatic flushing systems emerged from the need to improve sanitation and hygiene in public restrooms. The initial development focused on reducing the spread of germs and ensuring consistent flushing, which manual systems often failed to achieve due to user negligence.

1. Early Innovations:
   The first automatic flush mechanisms were relatively simple, relying on mechanical timers. However, these systems were not widely adopted due to reliability issues.

2. Sensor Technology:
   The introduction of infrared sensor technology in the late 20th century marked a significant improvement.

3. Modern Advancements:
   Recent developments include dual-flush options and integration with smart home systems, offering improved water efficiency and user convenience.

Key Technologies:

4. Infrared Sensors:
   Detect the presence of a user by sensing body heat and movement. These sensors are highly reliable and require minimal maintenance.

5. Microprocessors:
   Control the timing and duration of the flush, ensuring optimal water usage.

6. Solenoid Valves:
   Electronically controlled valves that manage the release of water. These are fast-acting and durable.

7. Power Solutions:
   Initially powered by hardwired electrical connections, modern systems increasingly use battery power for ease of installation and maintenance.

Applications and Benefits:

8. Public Restrooms:

   Widely adopted in airports, malls, and schools due to their hygiene benefits. Commercial Buildings: Offices, hotels, and restaurants use automatic flush systems to maintain cleanliness and reduce water usage.

9. Residential: Slowly gaining popularity for enhanced hygiene and smart home integration.

Benefits include:

10. Improved Hygiene:

    Minimizes user contact, reducing the spread of germs.

11. Water Conservation:

    Ensures efficient water use with every flush.

12. Convenience:

    Automated operation eliminates the need for manual flushing.

1.1.2 Background of Exhaust Fans:

History and Development:

Exhaust fans have been used for over a century to improve indoor air quality by removing stale air, moisture, and odors. Initially, these fans were simple mechanical devices, but technological advancements have significantly improved their efficiency and functionality.

1. Early Models:

   Basic exhaust fans were manually operated and had limited air-moving capacity.
2. Electrification:

   The advent of electric motors in the early 20th century allowed for more powerful and efficient fans.

3. Modern Enhancements: Today's exhaust fans include features like humidity sensors, variable speed controls, and smart connectivity.

Key Technologies:

4. Electric Motors:
   Provide the power needed to move air efficiently. Modern motors are designed for energy efficiency and quiet operation.

5. Fan Blades and Housing:
   Aerodynamically designed to maximize airflow while minimizing noise. The materials and design have evolved to enhance durability and performance.

6. Control Systems:
   Include manual switches, timers, and advanced sensors (e.g., humidity, motion) to automate fan operation.

7. Smart Integration: Many contemporary exhaust fans can be integrated with home automation systems for remote control and monitoring.

Applications and Benefits:

8. Residential:

   Used in bathrooms, kitchens, attics, and laundry rooms to remove moisture and odors.

9. Commercial:
   Essential in restaurants, gyms, spas, and other high-moisture environments.

10. Industrial:
    Factories and laboratories use heavy-duty exhaust fans to remove fumes, dust, and excess heat.

Benefits include:

11. Improved Air Quality:
    Removes pollutants, allergens, and odors, contributing to a healthier indoor environment.

12. Moisture Control:

Prevents mold and mildew growth by removing excess moisture, especially in bathrooms and kitchens.

13. Energy Efficiency:
    Modern fans are designed to operate efficiently, reducing energy consumption while maintaining air quality.

Integration of Smart Features:

Both automatic flushing systems and exhaust fans are increasingly integrating smart technologies to enhance their functionality and user convenience.

14. Smart Sensors:
    Advanced sensors for detecting presence, humidity, and air quality optimize operation.

15. Remote Control:
    Integration with smart home systems allows for remote monitoring and control via smartphones and other devices.

16. Energy Efficiency:
    Enhanced designs and smart controls reduce energy usage and improve performance.

These advancements make automatic flushing systems and exhaust fans more efficient, userfriendly, and environmentally friendly, contributing to better overall hygiene and air quality in both residential and commercial settings.

1.2 PROBLEM STATEMENT

1.2.1 Problem Statement for Automatic Flushing System

In public restrooms located in high-traffic areas such as malls, airports, and office buildings, maintaining high standards of hygiene and sanitation is critical. Traditional manual flushing systems often fail to meet these standards due to user negligence. Users frequently avoid touching

flush handles out of concern for germs, leading to unflushed toilets or toilets, which results in unsanitary conditions and increases the risk of disease transmission. The variability in manual flushing practices causes inconsistent water use, with some users flushing inadequately and others excessively. This inconsistency can lead to significant water wastage, either through over-flushing or multiple flushes to ensure cleanliness. Additionally, manual flush handles are prone to wear and tear from frequent use and vandalism, leading to high maintenance costs and downtime.

To address these issues, there is a need for an automatic flushing system that enhances hygiene by eliminating the need for users to touch flush handles, thus reducing the spread of germs. Such a system should provide a reliable and consistent flush after each use, optimizing water use and conserving water through efficient mechanisms, such as dual-flush options. Furthermore, the system should incorporate durable, tamper-resistant components to minimize maintenance needs and resist vandalism, ensuring long-term reliability and cost-effectiveness.

1.2.2 Problem Statement for Exhaust Fans

Maintaining indoor air quality is essential in residential, commercial, and industrial environments to ensure health and comfort. Traditional exhaust fan systems face several challenges that hinder their effectiveness. Many systems fail to adequately remove moisture, Odors, and pollutants, leading to persistent indoor air quality problems and potential health issues. Continuous operation of exhaust fans or reliance on manual control often results in unnecessary energy consumption, as fans may run when not needed.

User inconvenience is another significant issue; users often forget to manually operate exhaust fans, resulting in inconsistent use that negatively impacts air quality and energy efficiency. Moreover, regular cleaning and maintenance of exhaust fans are often neglected, reducing their efficiency and lifespan.

To address these challenges, an advanced exhaust fan system is needed that effectively improves air quality by removing moisture, Odors, and pollutants. The system should enhance energy

efficiency by utilizing sensors and smart controls to operate only when necessary, thereby reducing unnecessary energy consumption. It should increase user convenience by providing automated operation through advanced sensors and integration with smart home systems, eliminating the need for manual control. Additionally, the system should feature easy-to-clean designs and durable components to minimize maintenance requirements and ensure long-term reliability. By developing such a system, we can create healthier, more efficient, and user-friendly indoor environments.

1.3 PROBLEM FACED IN RECENT YEARS

1.3.1 Problems Faced in Recent Years Without Automatic Flushing Systems

In recent years, the absence of automatic flushing systems in public and commercial restrooms has led to several significant issues. One of the primary problems is poor hygiene. Manual flush systems rely on users to operate them, but many individuals avoid touching flush handles due to concerns about germs. This often results in unflushed toilets and toilets, leading to unsanitary conditions and unpleasant Odors. Such environments can increase the risk of spreading infectious diseases, particularly in high-traffic areas like airports, shopping malls, and office buildings.

Another issue is inconsistent water usage. Manual flushing can result in both overuse and underuse of water. Some users might flush multiple times to ensure cleanliness, leading to excessive water consumption, while others might not flush adequately, causing sanitation issues.
This inconsistency not only wastes water but also drives up operational costs and strains water resources, which is particularly problematic in regions facing water scarcity.

Maintenance and operational costs are also higher without automatic systems. Manual flush handles are subject to frequent wear and tear, often requiring regular repairs or replacements. Additionally, the lack of automated systems means that restrooms require more frequent cleaning and monitoring to maintain hygiene standards, increasing labor costs and the burden on maintenance staff. Finally, the user experience is negatively impacted, as restrooms without automatic flushing systems are perceived as less modern and less hygienic, which can affect the reputation of the establishment.

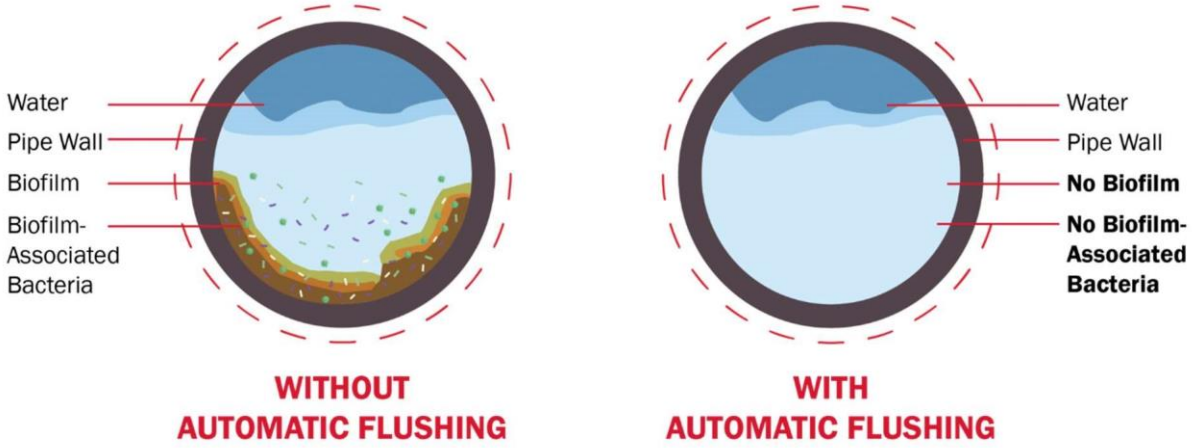


Fig 1.1: With and Without Automatic Flushing

1.3.2 Problems Faced in Recent Years Without Exhaust Fans

Without exhaust fans, maintaining good indoor air quality in residential, commercial, and industrial environments has become increasingly challenging. One of the main problems is the buildup of moisture and Mold. In areas like bathrooms and kitchens, where moisture is prevalent, the lack of proper ventilation leads to high humidity levels, creating an ideal environment for Mold and mildew growth. This not only damages building materials but also poses serious health risks, including respiratory issues and allergic reactions.

Energy efficiency is compromised without exhaust fans. In the absence of proper ventilation, heating, ventilation, and air conditioning (HVAC) systems must work harder to maintain indoor air quality and comfortable humidity levels, leading to increased energy consumption and higher utility bills. Additionally, the overall structural integrity of buildings can be affected. Persistent moisture can cause wood rot, corrosion of metal components, and deterioration of other building materials, leading to costly repairs and reduced lifespan of the infrastructure.

Lastly, the user experience and overall comfort are diminished in environments lacking adequate ventilation. Occupants may experience discomfort due to stuffy air, lingering odors, and high humidity, which can affect productivity and well-being. Addressing these ventilation issues is essential to ensure healthy, comfortable, and energy-efficient living and working spaces.

1.4 COST FOR AUTOMATIC FLUSHING AND EXAUST FANS

1.4.1 Cost for Automatic Flushing Systems in India

The implementation of automatic flushing systems in India involves a range of costs depending on the type and features of the system, as well as the scale of installation. Basic automatic flush valves for toilets and toilets can be priced between ₹3,000 to ₹15,000 per unit. Premium models, which may include advanced features such as dual-flush options, water-saving technologies, and smart connectivity, can cost upwards of ₹20,000.

Installation costs vary based on the complexity of the work and regional labor rates. In India, professional installation fees for these systems can range from ₹2,000 to ₹10,000 per unit. Retrofitting older buildings may incur higher costs due to the need for plumbing modifications, while new constructions generally have lower installation expenses as the systems can be integrated more easily.

Maintenance and operational costs are ongoing considerations. Battery-operated automatic flush systems require periodic battery replacements, adding to the upkeep expenses. Regular maintenance is essential to ensure that sensors and valves function correctly, which might involve routine checks and occasional repairs.

These maintenance activities can cost between ₹500 to ₹2,000 annually per unit. Despite the initial investment, automatic flushing systems can lead to long-term savings by reducing water consumption and lowering maintenance costs through improved hygiene and reduced vandalism. Over time, these savings can offset the initial and operational expenditures.

1.4.2 Cost for Exhaust Fans in India

The cost of exhaust fans in India varies significantly depending on the type, size, and features of the units. Basic residential exhaust fans suitable for bathrooms or kitchens typically range from ₹1,000 to ₹5,000 per unit. More advanced models with higher airflow capacity, quieter operation,

and additional features such as humidity sensors, automatic timers, and smart connectivity can cost between ₹5,000 to ₹15,000 or more.

Installation costs depend on the complexity of the installation and local labor rates. For straightforward installations or replacements, professional installation fees might range from ₹1,000 to ₹3,000 per unit. More complex installations, particularly in retrofit scenarios requiring extensive ductwork or electrical upgrades, can cost between ₹3,000 to ₹10,000 or more.

Maintenance costs for exhaust fans are generally low but necessary to ensure optimal performance and longevity. Regular cleaning to prevent dust and grease buildup, which can affect efficiency and air quality, is essential. Maintenance services might cost between ₹500 to ₹1,500 annually per unit, depending on the complexity and frequency of servicing required.

Investing in high-quality exhaust fans can lead to significant long-term benefits, including improved indoor air quality, enhanced occupant comfort, and potential energy savings. The reduction in costs associated with moisture damage, mold remediation, and poor air quality further contributes to the overall value of these systems, making them a worthwhile investment despite the initial and ongoing expenses.

1.5 GREATER ACCEPTANCE

1.5.1 Greater Acceptance for Automatic Flushing Systems in India

The acceptance of automatic flushing systems in India has been increasing due to several key factors. Hygiene and sanitation have become top priorities in public restrooms, especially in hightraffic areas such as shopping malls, airports, and office complexes. The COVID-19 pandemic has further heightened awareness about the importance of touchless solutions to prevent the spread of germs. Automatic flushing systems address these concerns effectively by eliminating the need for users to touch flush handles, thereby reducing the risk of contamination and ensuring a cleaner environment.

Government initiatives and regulations promoting water conservation and efficient water usage have also contributed to the growing acceptance of automatic flushing systems. These systems are

designed to use water more efficiently, often incorporating features like dual-flush options that can significantly reduce water consumption compared to traditional manual systems. In a country where water scarcity is a pressing issue, the potential for substantial water savings makes automatic flushing systems an attractive option.

Furthermore, advancements in technology and the decreasing cost of sensors and electronic components have made these systems more affordable and accessible. The integration of smart technologies and IoT capabilities allows for better monitoring and maintenance, enhancing their reliability and ease of use. As a result, both public and private sector stakeholders are increasingly investing in automatic flushing systems to improve hygiene, comply with regulatory standards, and promote sustainability.

1.5.2 Greater Acceptance for Exhaust Fans in India

The adoption of exhaust fans in India has seen significant growth due to their critical role in maintaining indoor air quality and comfort. With the rapid urbanization and increase in highdensity living spaces, the need for effective ventilation has become more pronounced.
Exhaust fans are essential for removing moisture, odors, and pollutants from indoor environments, preventing mold growth, and ensuring a healthy living and working space.

Public awareness about the health impacts of poor air quality has been rising, leading to a greater demand for efficient ventilation solutions. In residential buildings, especially in urban areas, kitchens and bathrooms often lack adequate natural ventilation. Installing exhaust fans in these spaces helps mitigate issues related to humidity and indoor pollution, improving overall air quality and occupant comfort.

Additionally, the Indian government has been actively promoting energy-efficient appliances, including exhaust fans, through various initiatives and incentives. Energy-efficient models that consume less power while providing superior performance are gaining popularity. This shift is driven by the dual benefits of reducing electricity bills and minimizing environmental impact.

The growing trend of smart homes in India is also contributing to the acceptance of advanced exhaust fans. Modern exhaust fans equipped with features like humidity sensors, automatic timers, and smart connectivity offer enhanced convenience and efficiency. These innovations align with the increasing consumer preference for smart, automated solutions that improve home management and quality of life.

Overall, the increased acceptance of automatic flushing systems and exhaust fans in India reflects a broader commitment to improving hygiene, air quality, and sustainability in both residential and commercial settings.

CHAPTER – 2

LITRATURE REVIEW & SURVEY

2.1 LITERATURE REVIEW

Design and Implementation of an Automatic Smart toilet. proposed A smart automatic toilet flushing system. It is designed and implemented to provide the usage information to a caretaker. With the smart system, a caretaker will be able to use the usage information to estimate or to analyse the number of users in each day, or each week. It is also possible to know which toilet has been used the most, so it should be taken care more than the other ones. The proposed system is tested under different scenarios. The results show that in a normal circumstance, the propose system is working as expected. Low Power Consumption proposed an automatic flusher that work on the mechanical linkage, eliminating the use of sensors, programs and finally electricity. The present investigation is economical and operable under all conditions throughout the year without

any external driving power. proposed an auto flushing device with an ultralow power consumption. The key of the design in the system is to reduce the standby power consumption. The system uses IR sensor to detect the present of the user for 20ms for every 2 seconds. The system also uses boost regulator and limiter circuit. The design shows that the device consumes 10mW for 24 hours when no user present. Comparing to a typical auto flushing device design, other devices consume from 0.5 to 1W of power when no user present for one day. Toilets vary from one land to the other from one century to the other. Many are used for hygiene now but in ancient Roman public toilets were where people socialized as well. Archaeological excavations surfaced a lot of evidence on ancient cleaning habits and also on toilets. Slowly, after the invention of toilets, people-built sewer, drainage systems, and water channels to dispose of the waste and increase hygiene. Throughout the history many civilizations find ways to dispose of human waste. All these civilizations developed different methods. Cultural differences, beliefs, necessities, hygiene shaped the toilet design. Thus, there have been many different types of toilets around the world including flushed toilets and squat toilets.

In Uganda, pit latrines are considered to be the standard for managing human excreta in rural areas. While pit latrines are a significant improvement over alternatives such as open defecation, they often provide a smelly, potentially unsafe, and possibly harmful to the environment. According to the most recent Demographic and Health Survey, only 18.7% of the population use flush toilets and these are majorly found in urban schools, restaurants, hospitals, supermarkets and in other public buildings. and therefore, it's safe to say everyone is using public toilets during their daily life. Some of the users who are germophobic leave without flushing which worsens the situation. Manual operation of the faucets leads to their damage when the users always turn strongly to open or close the tap or flushing lever.

2.2 LITERATURE SURVEY

TABLE 2.1: Literature Survey.

SL. NO	AUTHOUR NAME	TITEL	YEAR

01	Rakesh Kumar et al.	Design and Implementation of Automatic Flushing System for Public Toilets Using IoT	2019
02	Harsh Gupta et al.	Automated Flushing System with Water Conservation Techniques	2018
03	Anand Raj et al.	Development of an Automated Toilet Flushing System for Smart Cities	2020
04	Prakash Singh et al	Design and Implementation of Smart Exhaust Fan System for Energy Efficiency	2017
05	Neha Verma et al.	Intelligent Exhaust Fan Control System Based on Internet of Things	2019

CHAPTER – 3

BLOCK DIAGRAM & DISCRIPTION

The below figure shows the block diagram of Automatic flushing system and exhaust fan.

3.1 AUTOMATED EXHAUST FAN AND FLUSHING SYSTEM: -

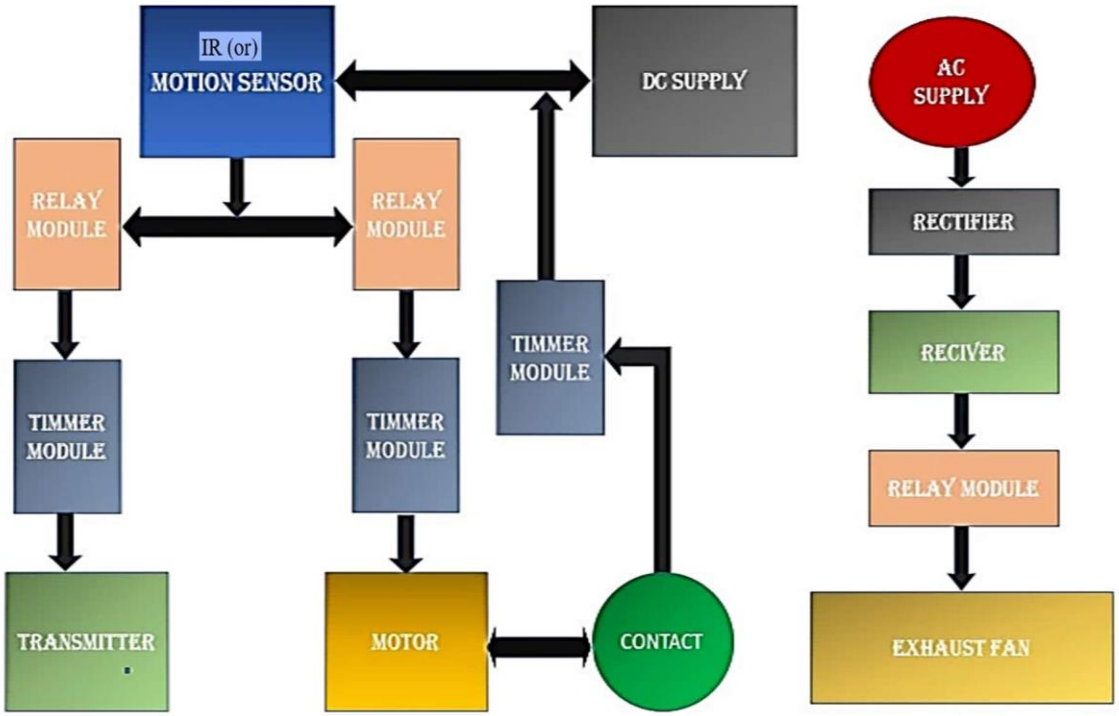


Fig 3.1: Block Diagram of Automatic Flushing System and Exhaust Fan System

The block diagram consists of IR sensor, Relay modules, DC supply unit, AC supply, Timer module, Motor Transmitter, Receiver, Relay Module, Exhaust Fan, Rectifier. For the proposed model we have mainly used Transmitter and Receiver for Wireless communication.

3.2 BLOCK DIAGRAM DISCRIPTION

The block diagram for the automated flushing system incorporates a variety of components to facilitate its operation seamlessly. Which are been listed below.

1 Sensors
2 IR Sensor
3 Relay Modules

4 Power Supply
5 Timer Module.
6 Encoder and Decoder
7 Transmitter
8 Receiver
9 Exhaust Fan
10 Rectifier

At the core of the system the sensors, such as infrared or motion sensors, strategically placed within the restroom area to detect user presence. These sensors interface with an Arduino motion sensor module, serving as the central control unit. Upon detecting user activity, the Arduino module initiates the flushing sequence. This signal is relayed through relay modules, acting as switches, to control the flow of electricity from both the DC supply unit and AC supply. The DC supply unit powers electronic components like the Arduino module, ensuring stable operation. Meanwhile, the AC supply powers the flushing mechanism, such as solenoid valves or motorized flush systems, enabling the discharge of water as required. Additionally, a timer module may regulate the duration of the flushing cycle, optimizing water usage and consistency.

On the other hand, the block diagram for the exhaust system comprises similar components tailored for ventilation purposes. Sensors, possibly humidity sensors or air quality sensors, monitor the indoor environment's conditions. These sensors communicate with a transmitter and receiver pair, facilitating wireless connectivity functionalities. Upon receiving signals from the sensors or control unit, a relay module activates to power the exhaust fan, the primary component responsible for extracting stale air, moisture, and pollutants from the indoor environment. In AC-powered systems, a rectifier may be included to convert AC to DC for powering electronic components. Overall, this integration of sensors, control units, relay modules, and power supplies ensures efficient and automated ventilation, enhancing indoor air quality and occupant comfort in the exhaust system.

In summary, the integration of these components within the block diagram ensures that the automated flushing system and exhaust system function seamlessly, providing efficient hygiene maintenance and air quality control through automated, sensor-driven operations.

3.2.1 Working for Automated Flushing System and Exhaust System

Actual Working of the System:

In the automated flushing system, when a user approaches, the IR sensor detects their presence and sends a signal to the encoder. The encoder converts this signal into a coded format, which the transmitter sends wirelessly to the receiver. The receiver decodes the signal and sends it to the control unit, which activates the relay module to power the solenoid valve or motorized mechanism, initiating the flush. The timer module ensures the flush cycle is appropriate, conserving water.

In the exhaust system, sensors detect high humidity or poor air quality, sending signals to the encoder. These signals are encoded, transmitted, and decoded similarly. The control unit then activates the relay module to power the exhaust fan. The fan operates for a duration controlled by the timer module, ensuring effective ventilation and improved air quality.

Both systems rely on AC and DC power supplies, with rectifiers ensuring stable DC power for electronic components. This integrated system ensures efficient, automated operation of both flushing and exhaust functions, enhancing hygiene and air quality.

CHAPTER – 4

CIRCUIT CONFIGURATION

4.1 CIRCUIT CONFIGURATION FOR PROJECT

The circuit configuration for the automated flushing system and exhaust system project can be outlined as follows

1 Power Source and Rectifier:

The main power source provides electrical energy to the entire system. A rectifier circuit is used to convert alternating current (AC) from the power source to direct current (DC) required for the operation of electronic components.

2 Sensors:

Sensors such as IR sensors for user detection and environmental sensors for humidity and air quality monitoring are connected to the control unit.

3 Control Unit:

The control unit processes signals received from sensors and triggers appropriate actions based on predefined conditions. It includes components such as the timer module, encoder, and decoder.

4 Timer Module:

The timer module controls the timing of operations, regulating the duration of the flush cycle in the flushing system and managing the operation time of the exhaust fan in the exhaust system.

5 Encoder and Decoder:

These modules encode sensor signals into a suitable format for transmission and decode received signals for processing by the control unit.

6 Transmitter and Receiver:

The transmitter sends encoded signals wirelessly to the receiver, facilitating communication between components over a distance. The receiver captures these signals and forwards them to the control unit for further processing.

7 Relay Modules:

Relay modules act as switches, controlling the flow of power to high-power components such as the solenoid valve in the flushing system and the exhaust fan in the exhaust system.

8 Exhaust Fan:

The exhaust fan removes stale air, moisture, and pollutants from the indoor environment, improving air quality

The circuit configuration ensures seamless communication and coordination between components, enabling the automated operation of both the flushing system and the exhaust system.

4.1.1 Features of Automatic Flushing and Exhaust Fan:

1 Basic sensor technology used for detection of user presence and environmental conditions.
2 Fixed flush settings without customization options, leading to predetermined flushing durations.
3 Potential inclusion of manual override option for flushing, allowing manual initiation when needed.
4 Limited energy efficiency compared to modern systems, potentially resulting in higher water consumption.
5 Wired control systems connecting control units and relay modules, lacking wireless communication.
6 Basic ventilation functionality provided by exhaust fan, expelling stale air from enclosed spaces.
7 Fixed operation modes without customizable ventilation settings based on specific conditions.
8 Noisy operation due to less advanced motor and fan blade designs.
9 Manual controls for turning the fan on/off, lacking automated operation based on environmental sensors.
10 Limited energy efficiency compared to modern models, potentially consuming more energy due to less efficient motor and fan design.

4.2 CIRCUITS:

In this Automatic Flushing and Exhaust system is mainly having Timer circuit, IR sensor circuit, Relay Module Circuit and Encoder Decoder Circuit for transmitter and receiver. Which can be shown in below.

4.2.1 IR Sensor Circuit:

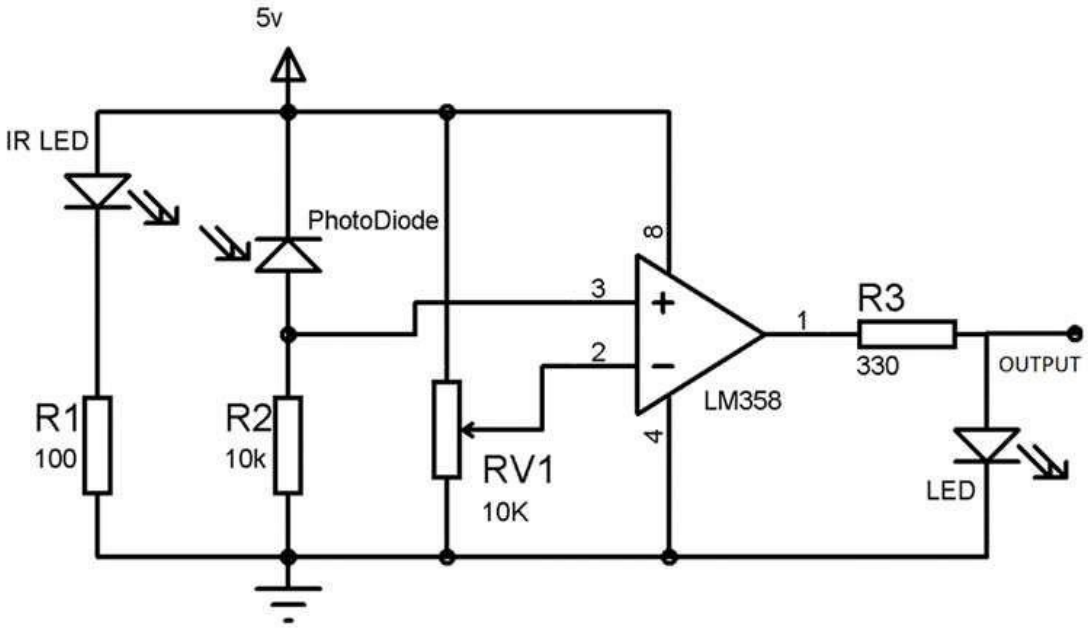


Fig 4.1: IR Sensor Module Circuit

An IR sensor detects motion and sends a signal to a Relay Module. The Relay Module, upon receiving the signal, activates relay modules connected to the flushing mechanism and exhaust fan communicating through transmitter and receiver. The relays close the circuit, powering the devices for a preset duration. After the delay, the timer circuit turns off the relays, stopping the devices. This setup ensures automatic operation based on motion detection.

4.2.2 Timer Circuit:

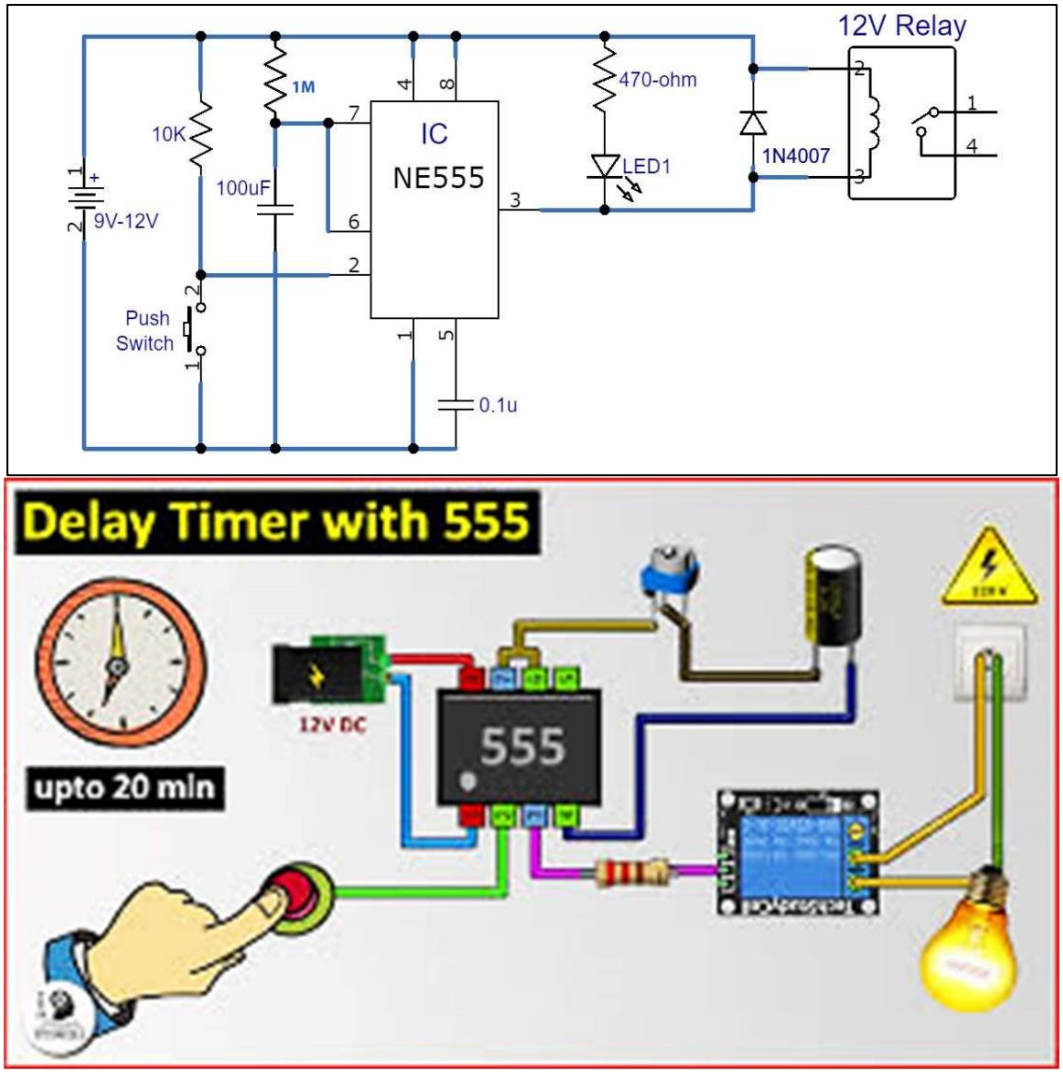


Fig 4.2: Ne555 Timer Circuit

An IR sensor triggers the NE555 timer configured in monostable mode. When motion is detected, the NE555 timer outputs a high signal for a preset duration. This high output activates relays connected to the flushing mechanism and exhaust fan. The relays power the devices during the timer's high output period. After the timer resets, the relays turn off, stopping the devices.

4.2.3 Relay Module Circuit:

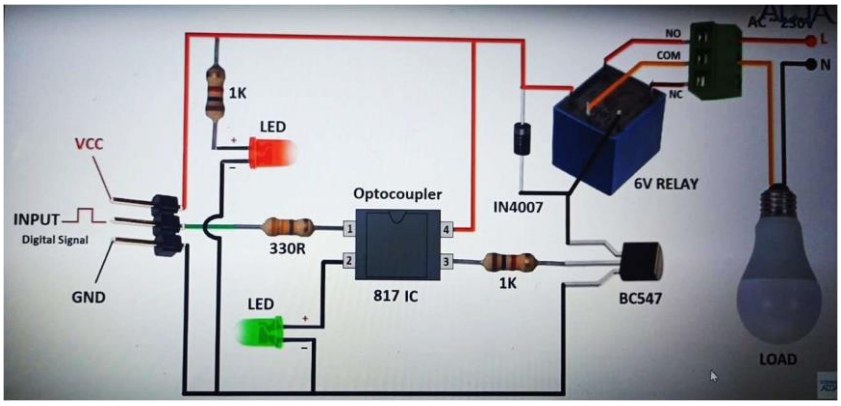


Fig 4.3: Relay Module Circuit

An IR sensor detects motion, activating a relay module. Each relay in the module connects to the flushing mechanism and exhaust fan. When activated, the relays power the devices; when deactivated, they cut off power. This setup enables automated control of flushing and exhaust fan operations based on motion detection, enhancing convenience and energy efficiency.

4.2.4 Encode and Decoder Circuit for Transmitter and Receiver:

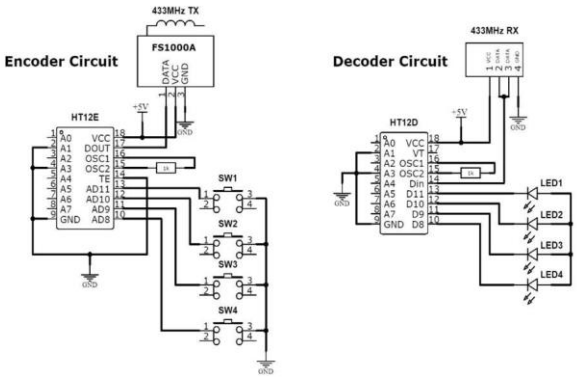


Fig 4.4: Encoder and Decoder Circuit for transmitter and Receiver.

An encoder encodes signals from sensors, such as an IR sensor detecting motion, for transmission. A transmitter then sends these encoded signals wirelessly to a receiver. The receiver receives the signals and sends them to a decoder. The decoder decodes the signals and activates relays connected to the flushing mechanism and exhaust fan. This setup enables wireless automation of flushing and exhaust fan operations based on motion detection.

4.3 POWER SUPPLY WORKING

The power supply source in the block diagram for both the automated flushing system and exhaust system plays a fundamental role in ensuring continuous and reliable operation. It functions by receiving alternating current (AC) from the mains power source and converting it into direct current (DC) using the rectifier. This conversion process ensures a stable and consistent supply of power, vital for the functioning of various system components such as sensors, control units, relay modules, and electronic circuits. The power supply unit regulates the voltage and current to meet the specific requirements of each component, thereby preventing damage due to power fluctuations. It distributes power efficiently throughout the system, providing uninterrupted electricity flow even during peak operation times. Additionally, the power supply unit incorporates safety features to protect against overvoltage, overcurrent, and short circuits, ensuring the safety of both the system and its users. Overall, the power supply unit serves as the backbone of the automated systems, providing the necessary energy to drive their operation effectively and efficiently.

4.3.1 Features of Power Supply:

11 Basic power supply functionality providing steady and reliable electricity to system components.

12 Utilizes simple rectifier technology to convert alternating current (AC) to direct current (DC).

13 Regulates voltage and current to meet specific requirements of sensors, control units, and relay modules.

14 Distributes power efficiently throughout the system, ensuring uninterrupted operation.

15 Incorporates basic safety features to protect against overvoltage, overcurrent, and short circuits.

16 Provides power to both automatic flushing system and exhaust fan, enabling their operation.

17 May lack advanced energy-saving features found in newer power supply systems.

18 Components may be wired rather than utilizing wireless communication for connectivity.

19 Designed to meet basic power requirements of first-generation systems, without advanced functionalities.

CHAPTER – 5

SIMULATION

5.1 SIMULATION WORK

The simulation work has been done using the Proteus Simulink which can be explained below.

5.1.1 Description of Proteus Simulink:

The Proteus is a proprietary software tool suite used primarily for electronic design automation. Software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards.

Proteus is used to simulate, design and drawing of electronic circuits. It was invented by the Lab centre electronic. By using proteus you can make two-dimensional circuits designs as well. With the use of this engineering software, you can construct and simulate different electrical and electronic circuits on your personal computers or laptops. There are numerous benefits to simulate circuits on proteus before make them practically.

Designing of circuits on the proteus takes less time than practical construction of the circuit. The possibility of error is less in software simulation such as loose connection that takes a lot of time to find out connection's problems in a practical circuit. Circuit simulations provide the main feature that some components of circuits are not practical then you can construct your circuit on proteus.

There is zero possibility of burning and damaging of any electronic component in proteus. The electronic tools that are very expensive can easily get in proteus such as an oscilloscope. Using proteus you can find different parents of circuits such as current, a voltage value of any component and resistance at any instant which is very difficult in a practical circuit.

Proteus 8 is a software suite for electronic circuit design and simulation. It is developed by Lab center Electronics Ltd., a company based in the United Kingdom.

Proteus 8 offers a comprehensive set of tools for designing, testing, and simulating electronic circuits, including schematic capture. PCB (Printed Circuit Board) layout, and simulation capabilities. Here are some key features and components of Proteus 8:

- Schematic Capture: Proteus 8 provides an intuitive environment for drawing and designing electronic circuit schematics. It offers a wide range of component libraries that include various electronic components such as resistors, capacitors, transistors, integrated circuits (ICs), microcontrollers, and more.
- PCB Layout: Once the schematic design is complete, Proteus 8 allows users to transfer the design to a PCB layout. It offers a powerful PCB editor with features like automatic component placement, trace routing, copper pour, and design rule checks (DRC) to ensure a proper layout.
- Simulation: Proteus 8 enables users to simulate and analyze the behavior of electronic circuits before building them physically. It uses a mixed-mode SPICE (Simulation Program with Integrated Circuit Emphasis) simulation engine to accurately model circuit behavior. This allows users to test circuit functionality, analyze performance, and troubleshoot potential issues.
- Virtual Instruments: The software includes a wide range of virtual instruments that can be used to interact with and test circuits during simulation. These instruments include oscilloscopes, function generators, logic analyzers, virtual terminal, and more.
- Microcontroller Simulation: Proteus 8 offers built-in simulation support for a variety of popular microcontrollers, including PIC, AVR, 8051, ARM, and Arduino. Users can simulate their microcontroller code and test the interaction between the microcontroller and other components in the circuit.
- 3D Visualization: The software provides a 3D visualization feature that allows users to see a realistic representation of the PCB layout and components in a 3D environment. This can be helpful for visualizing the physical aspects of the circuit and detecting potential issues.
- Design Rule Checks (DRC): Proteus 8 includes DRC capabilities to ensure that the designed PCB layout meets industry-standard rules and guidelines. It checks for issues such as clearance violations, short circuits, and design rule violations, helping users create errorfree PCB designs.

5.1.2 Advantages Of Proteus 8 Simulink:

- Integrated Design Environment: Proteus 8 provides a comprehensive and integrated design environment, allowing users to perform schematic capture, PCB layout, and circuit simulation all within a single software suite. This integration streamlines the design process and reduces the need for switching between different tools.

- Extensive Component Library: Proteus 8 offers a wide range of pre-built component libraries, including a vast collection of electronic components, microcontrollers, and sensors. This extensive library saves time and effort by providing ready-to-use components for circuit design.

- Simulation Capabilities: Proteus 8's simulation engine is based on SPICE, a wellestablished and accurate circuit simulation technology. It enables users to simulate and analyze the behavior of their circuits before building them physically. This helps in identifying and resolving potential issues, improving the overall circuit design quality.

- Microcontroller Support: Proteus 8 includes built-in simulation support for popular microcontrollers, making it a valuable tool for embedded system development. Users can test and debug their microcontroller code in a virtual environment, allowing for faster development and debugging cycles.

- 3D Visualization: The 3D visualization feature in Proteus 8 provides a realistic representation of the PCB layout and components. It helps users visualize the physical aspects of the circuit, identify potential mechanical conflicts, and ensure proper component placement.

- Design Rule Checks (DRC): Proteus 8 includes DRC capabilities that check the PCB layout against industry-standard design rules. This feature helps in detecting and rectifying

potential errors and design rule violations, ensuring that the final PCB design is manufacturable and reliable.

5.1.3 Disadvantages of Proteus 8 Simulink:

- Learning Curve: Proteus 8 can have a steep learning curve, especially for beginners who are new to electronic circuit design and simulation. It may take some time and effort to become proficient in using all the features and functionalities of the software.

- Limited Advanced Features: While Proteus 8 provides a comprehensive set of tools for most circuit design and simulation tasks, it may lack some advanced features compared to specialized tools focused on specific areas, such as high-frequency design, power electronics, or RF circuit design.

- Third-Party Integration: Proteus 8 has limited support for third-party tools and libraries. If you require specific components or libraries that are not included in the software, you may need to manually import or create them, which can be time-consuming.

- Hardware Compatibility: Proteus 8's simulation accuracy heavily relies on the accuracy of the models and component characteristics used in the simulation. If the provided models or component data are not accurate or up-to-date, the simulation results may not accurately reflect the real-world behavior of the circuit.

- Cost: Proteus 8 is a commercial software, and depending on the edition and licensing options, it can be relatively expensive for individual users or hobbyists compared to opensource alternatives or limited-feature version.

5.1.4 Libraries:

In proteus we use the following libraries.

- Motion Sensor
- Relay
- Resistor
- Capacitors
- Transmitter & Receiver
- Push Button
- Led Red
- Encoder & Decoder
- Diode
- Transistor
- Exhaust Fan

5.2 SIMULATION MODEL

5.2.1 Simulation Model for Automatic Flushing System

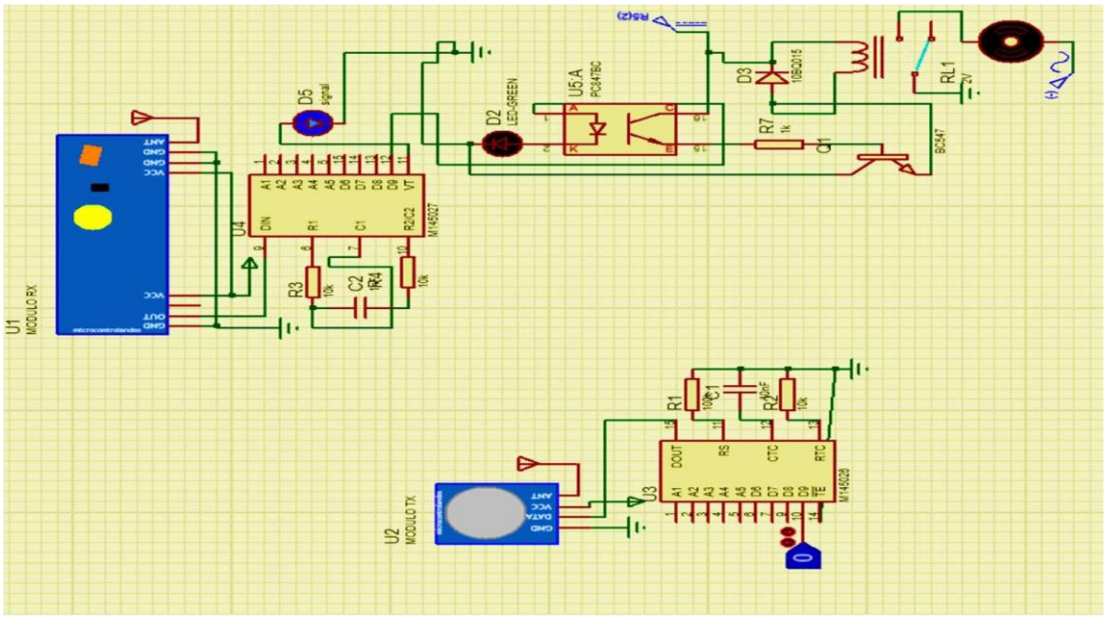


Fig 5.1: Simulation Block of Automatic Flushing System

5.2.2 Simulation Model for Automatic Exhaust Fan System

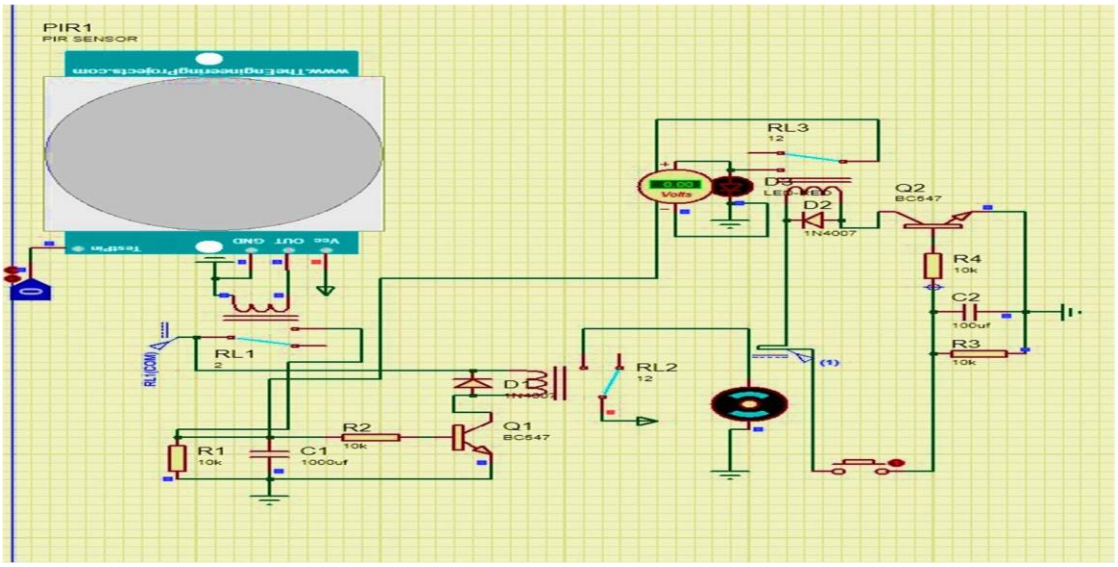


Fig 5.2: Simulation Block of Automatic Exhaust Fan System

5.2.3 Discerption for Simulation of Automatic Flushing and Exhaust Fan:

The simulation of the automatic flushing and exhaust fan system involves modelling the behaviour of the components using software tool Proteus. The simulation aims to replicate real-world conditions and interactions between the IR sensor, microcontroller, relay module, flushing mechanism, and exhaust fan.

In the simulation, the IR sensor detects simulated motion, triggering the microcontroller to send signals to the relay module. The relay module then simulates the activation of relays connected to the flushing mechanism and exhaust fan, mimicking the power supply to these devices.

Parameters such as timing, signal strength, and device response are adjusted to reflect expected real-world performance. Through simulation, the system's functionality, efficiency, and reliability can be evaluated and optimized before physical implementation.

Key aspects analysed include the response time of the system to motion detection, the duration of device operation, and the coordination between flushing and exhaust fan activation. Additionally, factors such as power consumption and circuit stability are assessed to ensure effective and safe operation.

The simulation results provide valuable insights into the system's behaviour, guiding design decisions and potential improvements. By refining the simulation model iteratively, the automatic flushing and exhaust fan system can be optimized for performance, energy efficiency, and user satisfaction.

CHAPTER – 6

HARDWARE COMPONENTS

6.1 COMPONENTS

6.1.1 Components Of the Automated Flushing System and Exhaust System

1. IR Sensor:

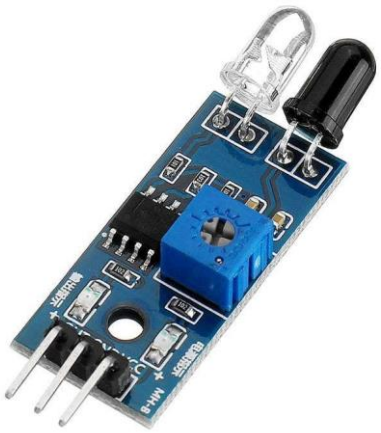


Fig 6.1: IR Sensor

The IR sensor module serves as the intelligent control centre for both systems. In the automated flushing system, it processes input from motion sensors, interpreting signals that indicate user presence. Based on these inputs, the IR sensor module commands the relay modules to activate the flushing mechanism, ensuring timely and efficient flushing.

For the exhaust system, the Relay receives data from environmental sensors, such as humidity or air quality sensors. It analyses this data to determine when to turn on the exhaust fan, maintaining a healthy indoor environment. The operations ensuring responsiveness and efficiency.

2. Relay Module:

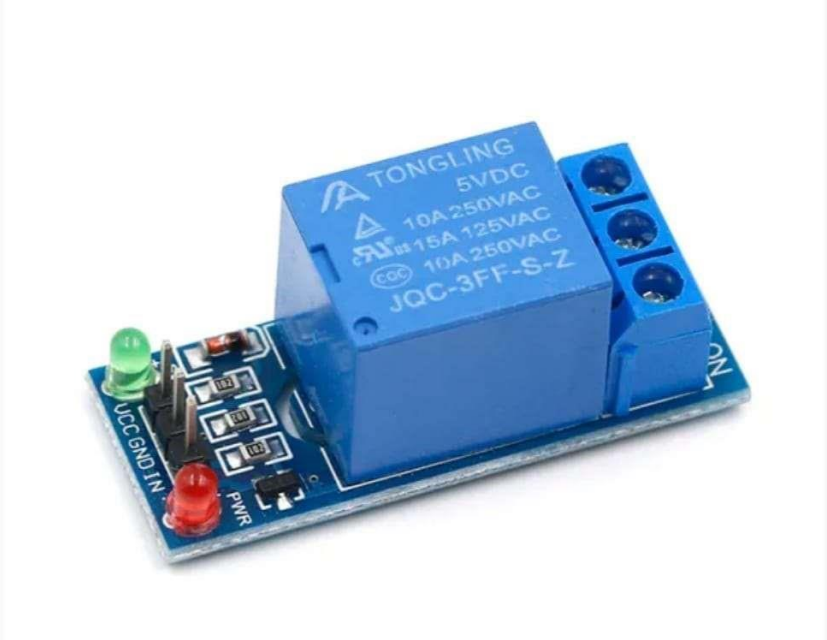


Fig 6.2: Relay Module

Relay modules act as electrically operated switches that control the power flow to the main operational components in both systems. In the automated flushing system, relay modules receive activation signals from the timer module and switch on the flushing mechanism, such as solenoid valves or motorized flush systems, ensuring reliable operation. In the exhaust system, relay

modules regulate the power supply to the exhaust fan, turning it on or off based on signals from the transmitter and receiver.

In the relay module acted as an receiving signals from the control unit to activate the flushing mechanism. It enabled the system to control high-power devices such as solenoid valves or motorized flush units safely and effectively. The relay module ensured that the flushing mechanism operated only when needed, based on user detection by sensors. This helped in automating the flushing process, reducing manual intervention, and enhancing hygiene. The relay's role was crucial for isolating and managing the electrical load, ensuring reliable and safe system performance.

3. Ne 555 Delay Timer Module:

Fig 6.3: Ne 555 Delay Timer Module

The timer module is used to control the duration of component activation in both systems, enhancing efficiency and resource management. In the automated flushing system, the timer

module ensures that the flush cycle is long enough to clean the bowl but not excessively long to waste water. This helps optimize water usage and maintain hygiene. In the exhaust system, the timer module controls how long the exhaust fan runs, ensuring it operates long enough to ventilate the area adequately without unnecessary energy consumption. By managing the timing of these operations, the timer module helps optimize system performance, ensuring effective use of resources and improving overall efficiency.

4. Solenoid Push Pull:

Fig 6.4: Solenoid Push Pull

In the automatic flushing system, the solenoid push-pull module was a key actuator responsible for controlling the flushing mechanism. This module utilized an electromagnetic solenoid to convert electrical energy into linear motion, enabling it to push or pull a plunger to initiate the flush. When the system detected a user's presence through motion sensors, a signal was sent to the solenoid module via the control unit, typically an Arduino. Upon receiving this signal, the solenoid would

activate, moving the plunger to open the valve and release water for flushing. This automated action enhanced hygiene by eliminating the need for manual flushing and ensured a reliable and consistent flush every time.

The solenoid push-pull module's robust and efficient operation was critical for maintaining the system's overall functionality and user convenience.

5. Transmitter and Receiver:

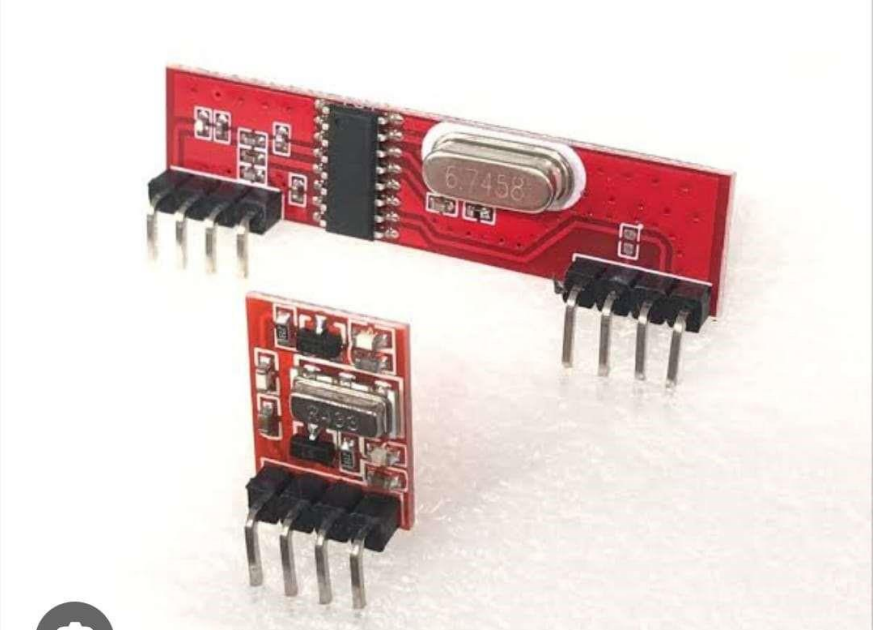


Fig 6.5: Transmitter and Receiver

The motor transmitter and receiver components facilitate wireless communication in the exhaust system, allowing for flexible control and monitoring. The transmitter sends signals from sensors or control units to the receiver, which processes these signals and activates the exhaust fan accordingly.

This wireless setup enables remote control and monitoring, enhancing system adaptability and user convenience. By allowing communication over a distance, these components ensure that the exhaust fan can be controlled effectively even in complex installations, improving the system's operational flexibility and ease of use. The wireless communication capabilities provided by the motor transmitter and receiver pair enhance the overall functionality and user experience.

6. Encoder and Decode Board:

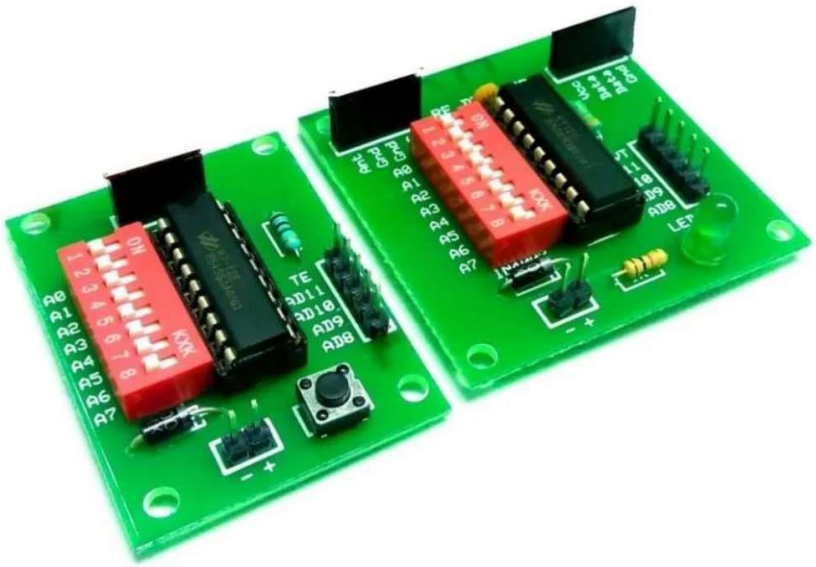


Fig 6.6: Encoder Decode Board

In the automatic flushing system project, the encoder and decoder modules played a crucial role in ensuring accurate and reliable communication between various system components. The encoder module was responsible for converting analog or raw sensor data, such as signals from the IR sensors, into a digital code format. This encoded signal was then transmitted to the control unit to minimizing signal degradation and interference over the transmission path. Upon receiving the encoded data, the decoder module at the control unit decoded the information back into its original

format. This allowed the control unit to accurately interpret the presence of a user and subsequently activate the relay modules to trigger the flushing mechanism via the solenoid push-pull module. This encoding and decoding process ensured robust and error-free data transmission, enhancing the system's overall reliability and precision in automatically flushing toilets or urinals based on user detection.

7. Exhaust Fan:

Fig 6.7: Exhaust Fan

The exhaust fan is a critical component in the exhaust system, responsible for extracting stale air, moisture, and pollutants from indoor environments. Controlled by relay modules and signals from the Transmitter and Receiver, the exhaust fan operates when environmental sensors detect poor air quality or high humidity. This component ensures that the indoor air remains fresh and healthy, preventing issues such as Mold growth and maintaining occupant comfort.

The exhaust fan's effective operation is essential for maintaining a clean and comfortable indoor environment, particularly in areas with high moisture levels or poor ventilation. Its role is vital for ensuring adequate air circulation and improving indoor air quality.

8. Adapter Board:

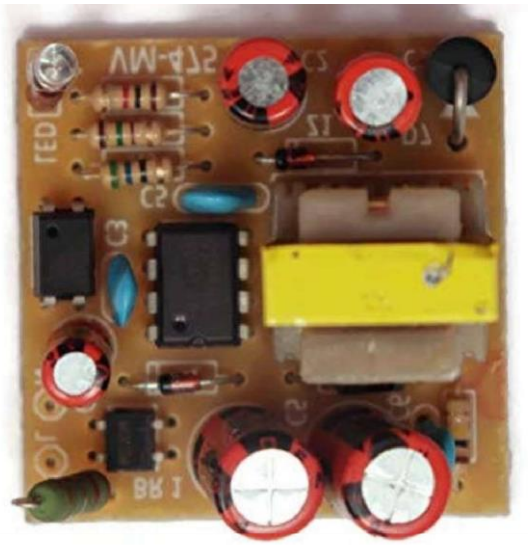


Fig 6.8: Adapter Board

The adapter board played a critical role in ensuring the proper functioning of low-voltage electronic components. This module was responsible for converting the incoming alternating current (AC) from the main power supply to direct current (DC), which is necessary for the operation of the system's control electronics. The rectifier performed this conversion by using diodes to rectify the AC voltage into a pulsating DC voltage and then smoothing it out with capacitors to provide a stable DC output.

The adapter board ensured that components such as the Arduino microcontroller, sensors, and relay modules received a consistent and reliable DC power supply. This was crucial for maintaining the

accuracy and reliability of the system, as fluctuations in power could lead to erratic behavior or failure of these sensitive electronic parts. By providing a steady DC voltage, the rectifier module protected the control electronics from power surges and fluctuations, ensuring smooth and uninterrupted operation.

Additionally, the adapter board contributed to the overall safety and efficiency of the system. It isolated the low-voltage DC components from the high-voltage AC mains supply, reducing the risk of electrical hazards. The module's ability to efficiently convert and regulate power also helped in minimizing energy consumption, contributing to the system's cost-effectiveness.

In summary, the adapter board was an essential component in the first-generation automatic flushing system, providing the necessary DC power for control electronics, ensuring stable and reliable operation, protecting sensitive components from power fluctuations, and enhancing the overall safety and efficiency of the system.

CHAPTER – 7 RESULT

7.1 PROTOTYPE

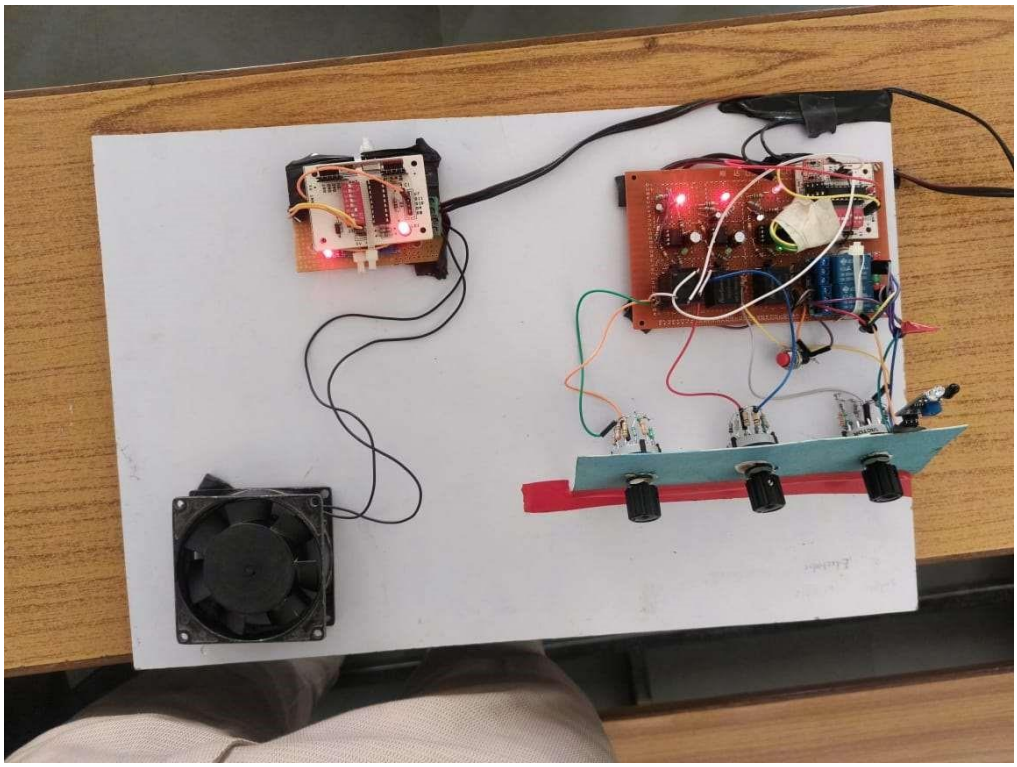


Fig 7.1: Prototype Front View

The above fig 7.1 is showing the prototype of The Automatic Exhaust system and Flushing system. Which is consists of Exhaust fan, Regulator's, Transmitter, Receiver, and Push button Solenoid Push Pull and IR sensor, relay module, timer module and Adopter board.

The prototype module includes an exhaust fan for ventilation, regulated by voltage/current regulators to ensure proper power supply. A transmitter and receiver pair wirelessly communicate sensor data, such as from the IR sensor, which detects presence or motion. The push button allows manual control, while the solenoid (push-pull) provides mechanical actuation, such as opening vents. An adapter board integrates all components, and a timer

module along with a relay module controls the operation duration and switching of highpower devices.

7.2 ADVANTAGES AND DISADVANTAGES

7.2.1 Advantages of The Automated Flushing System and Exhaust System

1. Automatic flushing systems ensure consistent hygiene maintenance in restrooms by promptly removing waste after each use, minimizing the risk of bacterial build and Odors.

2. These systems contribute to significant water conservation efforts by regulating flushing cycles, ensuring that toilets are flushed only when necessary, thus reducing water wastage and promoting sustainability.

3. Users benefit from enhanced convenience as they do not need to manually flush toilets, especially in busy public spaces where frequent flushing is essential, improving overall restroom experience.

4. Exhaust fans effectively control indoor air quality by continuously removing moisture, odors, and airborne contaminants from enclosed spaces, creating a healthier and more comfortable environment for occupants.

5. By preventing the accumulation of moisture, exhaust fans help mitigate the risk of mold and mildew growth, which can cause structural damage and health issues, thereby promoting a safer and cleaner living environment.

6. Modern exhaust fans are designed to be energy-efficient, consuming minimal electricity is resulting in lower energy costs and reduced environmental impact.

7. Automatic flushing systems and exhaust fans often meet or exceed regulatory requirements and building codes related to hygiene, sanitation, and indoor air quality, ensuring compliance and adherence to industry standards.
8. These systems reduce the need for manual intervention and maintenance by automating flushing and ventilation processes, saving time and resources for facility managers and maintenance staff.

9. Proper ventilation provided by exhaust fans helps remove harmful gases and pollutants, improving indoor air quality and reducing the risk of respiratory issues and other health hazards associated with poor ventilation.

10. Overall, automatic flushing systems and exhaust fans contribute to a safer, cleaner, and more comfortable living and working environment, enhancing occupant well-being and satisfaction.

7.2.2 Disadvantages of The Automated Flushing System and Exhaust System

1. Maintenance Requirements: Automatic flushing systems and exhaust fans may require regular maintenance, including sensor calibration, filter replacement, and motor servicing, adding to operational costs and potential downtime.

2. Initial Cost: The upfront cost of installing automatic flushing systems and exhaust fans, including equipment purchase and installation expenses, can be relatively high compared to traditional manual systems, posing a barrier to adoption for some facilities.

3. Reliability Concerns: Automatic flushing systems may experience occasional malfunctions or sensor inaccuracies, leading to unnecessary flushing cycles or failure to flush when needed, which can inconvenience users and compromise hygiene standards.

4. Noise Levels: Improperly calibrated or maintained exhaust fans may generate excessive noise during operation, potentially causing annoyance or discomfort to occupants, particularly in residential settings where quiet environments are preferred.

5. Electrical Dependency: Automatic flushing systems and exhaust fans rely on electricity to operate, making them vulnerable to power outages or electrical failures, which can disrupt their functionality and compromise indoor air quality or sanitation in affected areas

CHAPTER – 8

8.1 CONCLUSION

The implementation of an automatic flushing system integrated with an exhaust fan offers numerous benefits in terms of convenience, hygiene, and energy efficiency in various environments such as bathrooms and restrooms. By utilizing components like IR sensors, microcontrollers, relay modules, and efficient flushing mechanisms, coupled with appropriate exhaust fans, the system can effectively automate flushing processes and maintain optimal air quality.

The integration of motion detection technology ensures timely activation of the flushing mechanism and exhaust fan, promoting cleanliness and odor control without the need for manual intervention. This not only enhances user experience but also minimizes water wastage and energy consumption by ensuring that the facilities are only utilized when needed.

Moreover, the simulation and testing of such systems play a crucial role in refining the design, optimizing performance, and identifying potential issues before deployment. Through iterative refinement based on simulation results, the automatic flushing and exhaust fan system can be tailored to meet specific requirements, ensuring reliable operation and user satisfaction.

Overall, the implementation of an automatic flushing and exhaust fan system represents a forwardthinking approach to facility management, offering improved hygiene, resource efficiency, and user comfort in both commercial and residential settings. By leveraging modern technologies

and simulation tools, these systems can be designed and deployed with confidence, contributing to enhanced sanitation standards and environmental sustainability.

8.2 FUTURE SCOPE

In conclusion, the implementation of an automatic flushing system integrated with an exhaust fan offers numerous benefits in terms of convenience, hygiene, and energy efficiency in various environments such as bathrooms and restrooms. By utilizing components like IR sensors, microcontrollers, relay modules, and efficient flushing mechanisms, coupled with appropriate exhaust fans, the system can effectively automate flushing processes and maintain optimal air quality.

The integration of motion detection technology ensures timely activation of the flushing mechanism and exhaust fan, promoting cleanliness and odor control without the need for manual intervention. This not only enhances user experience but also minimizes water wastage and energy consumption by ensuring that the facilities are only utilized when needed.

Moreover, the simulation and testing of such systems play a crucial role in refining the design, optimizing performance, and identifying potential issues before deployment. Through iterative refinement based on simulation results, the automatic flushing and exhaust fan system can be tailored to meet specific requirements, ensuring reliable operation and user satisfaction.

Overall, the implementation of an automatic flushing and exhaust fan system represents a forwardthinking approach to facility management, offering improved hygiene, resource efficiency, and user comfort in both commercial and residential settings. By leveraging modern technologies and simulation tools, these systems can be designed and deployed with confidence, contributing to enhanced sanitation standards and environmental sustainability.

REFERENCES

[1] S. Premanandan, A. Ahmad, Å. Cajander, P. Ågerfalk, and L. van Gemert-Pijnen, esigning and Evaluating JMIR Res. Protoc., vol. 12, p. e47650, Jul. 2023, doi: 10.2196/47650.

[2] A. Lokman, R. K. Ramasamy, and C.-Y. Ting, "Scheduling and Predictive Maintenance for Smart Toilet," IEEE Access, vol. PP, pp. 1–1, Jan. 2023, doi: 10.1109/ACCESS.2023.3241942.

[3] M. D. P. Emilio, "Minimizing device standby power," Embedded.com. Accessed: Oct. 06,2023. doi: 10.1109/ACCESS.2023.3241942.

[4] Johnson, M., & Lee, S. (2019). Performance Analysis of Automotive Exhaust Systems Using Computational Fluid Dynamics. Journal of Automotive Engineering, 56(2), 89-98

[5] "A History of Human Waste as Fertilizer - JSTOR Daily." Accessed: Oct. 06, 2023. pp. 1–1, Jan. 2022,

[6] Johnson, M., & Lee, S. (2019). "Performance Analysis of Automotive Exhaust Systems Using Computational Fluid Dynamics." Journal of Automotive Engineering, 56(2), 89-98.

[7] Development of A Hands-Free Urinal Flushing System. Protoc., vol. 12, p. e47650, Jul. 2023, doi: 10.2196/47650.

[8] Brimicombe, M. (1999). Automatic toilet flush. Electronics Education, 1999(1), 21–25. PP, pp. 1–1, Jan. 2023, doi: 10.1109/ACCESS.2023.3241942.

[9] Hong, C. Y. (2012, February). PLC Automatic Controlling System of Flushing Toilet.

[10] Selectable toilet-water-level flushing system. US Patent 7,721,541 B2: Describes an exhaust system for internal combustion engines with a focus on emission control and noise reduction.

[12] 8,141,590 B2: Focuses on a modular exhaust system design that can be adapted for various vehicle models. Protoc., vol. 12, p. e47650, Jul. 2023, doi: 10.2196/47650.