



Design and Development of IoT Based Solar Powered Water Waste Collector System

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ABSTRACT

Water pollution caused by waste accumulation in water bodies poses a significant threat to ecosystems and public health. Traditional methods of waste collection are often inefficient, labor-intensive, and environmentally taxing. This project presents the design and development of an IoT-based solar-powered water waste collector system that addresses these challenges through automation, sustainability, and efficiency. The system incorporates sensors to detect and collection of waste and IoT technology to monitor waste levels in real-time, enabling automated waste collection mechanisms. Solar panels provide the required energy, making the system self-sufficient and eco-friendly while reducing reliance on non-renewable energy sources. This innovative approach integrates renewable energy and automated technology to provide a cost-effective and sustainable solution for managing water pollution. The proposed system contributes to cleaner water bodies, minimizing human intervention and energy consumption.

Keywords: *Waste detection, Internet of things, solar power.*

I. INTRODUCTION

Water pollution is a significant global issue affecting both human life and the environment. Industrial discharge, improper waste disposal and untreated wastewater contribute to the contamination of water bodies. Water pollution is affecting marine life, ecosystems, and human health hence we need to keep water bodies clean. Cleanliness is the basic need of human society. We need to keep our environment and surroundings clean, but we often focus on keeping our homes and neighborhoods clean, the health of our broader environment especially water bodies demand equal attention. Maximum of the waste is thrown in the water bodies like seas, rivers, lakes, ponds etc. Hence it causes a high amount of water pollution. Water pollution not only harms aquatic life but also poses serious risks to human health. Contaminated water can lead to diseases and diminish the quality of drinking water, impacting communities and ecosystems alike.

The proposed model focuses on the design and development of the water waste collector system. Water waste collector system consists of waste detecting and collecting machine which is operated on IoT. This will eventually help in reducing the deaths of aquatic animals caused by these issues. The IoT based Solar-Powered Water Waste Collector System is an eco-friendly innovation, designed to address water pollution.



The system is built to detect, collect, and store floating waste in water bodies like rivers, lakes, or ponds. Powered by solar energy, the system uses an automated mechanism to navigate, detect waste, and collect it in a designated container. The project is sustainable, reduces dependency on manual labour, and contributes to environmental preservation.

II. PROBLEM DEFINITION

Water bodies such as rivers, lakes, and ponds are often polluted with floating waste like plastic, debris, and organic matter, which poses significant environmental and health hazards. Manual clean-up methods are time-consuming, labour-intensive and often inefficient in tackling widespread waste pollution. The accumulation of waste in water bodies threatens aquatic ecosystems, affecting water quality and marine life and present waste collection methods are slow, inconsistent, and require significant human resources. Our proposed work provides the solution for collection of floating waste from the water bodies and for labour problem.

III. HARDWARE DESIGN

In the proposed model the solar Panel captures solar energy and converts it into electrical energy to charge the battery than the battery stores energy from the solar panel and supplies it to the system. Arduino acts as the central controller of the system. It processes data from the sensors to control the waste collecting vehicle. The obstacle detecting sensor detects any obstacle in the path of collection mechanism. If any obstacle detected, it send signal to Arduino it makes vehicle to move in the other direction where the path is clear. Motor driver receives control signals from the Arduino to operate the motors. It acts as an interface between the Arduino and the motors. Two motors used here provide motion to the waste collecting vehicle. Waste Detecting Sensor detects the presence of floating waste in the water body and this data is sent to the Arduino Nano. Here, Arduino Nano acts as the brain of the system. It receives the signal from the waste detecting sensor, processes the information, and sends commands to relay. The relay is electronic switch is controlled by the arduino Nano. It activates the motor which drive the conveyor belt mechanism for waste collection. Conveyor belt transport the collected waste to the waste collecting bin. The conveyor belt mechanism starts operation only when the waste is detected otherwise, it is in off position. Bin Status Detecting Sensor monitors the status of the waste collection bin (e.g., whether it is full or empty) and sends this information to the Arduino. When the bin is full the bin status detecting sensor sends the signal to Arduino that processes the information and send signal to GSM module through that user get an alert message that 'Bin is Full'. Next the RF module enables wireless communication between the system and remote controller. This allows the user to wirelessly retrieve the waste collecting vehicle to empty the bin. Figure 1 shows the block diagram of the proposed hardware model.

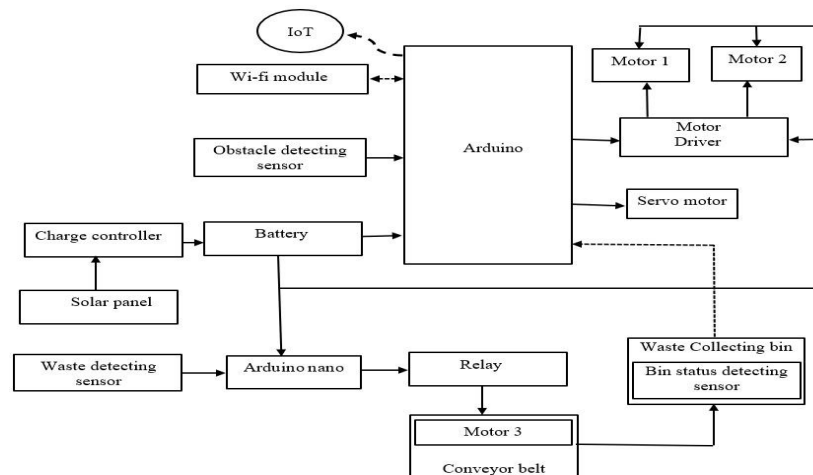


Figure 1. Block diagram

IV. SOFTWARE DESIGN

The software used to program the microcontroller is the Arduino IDE. Arduino is an open- source computer hardware and software company, project and user community that designs and manufactures kits for building digital devices and interactive objects that can sense and control the physical world. These systems provide sets of digital and analog I/O pins that can be interfaced to various extension boards and other circuits. The boards feature serial communications interfaces, including USB on some models, for loading programs from personal computers. For programming the microcontrollers, the Arduino platform provides an integrated development environment (IDE) based on the Processing project, which includes support for C and C++ programming languages. The Arduino board is connected to pc and the program is burnt onto the microcontroller board. The figure below shows the Arduino integrated development environment for compiling and uploading the programs to Arduino board.

Flowchart

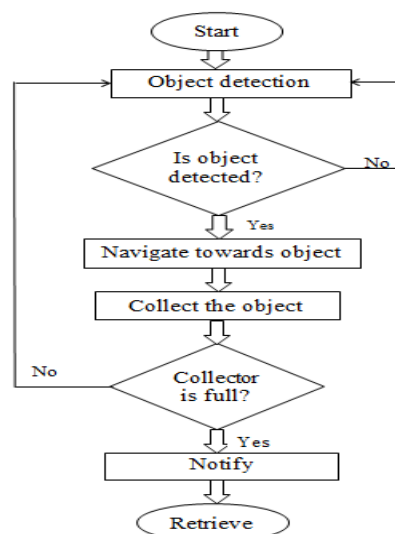


Figure 2. Flow chart

V. RESULT

The below image is a figure of hardware model which effectively detect and collects floating waste from water surface. The main advantages of the proposed project is that it can effectively help to clean the water bodies and the system uses solar power to operate hence eco-friendly. The waste collecting capacity of machine is limited at a time and this machine is capable to collect the waste which is only floating on water surface.

The system is efficiently detecting & collecting the waste automatically & it takes 30s to dump the waste in the bin after collecting it. Once the bin is full, a buzzer is activated and a message indicating that the “BIN IS FULL” is sent to the registered user who retrieves the vehicle to the shore to empty the bin.

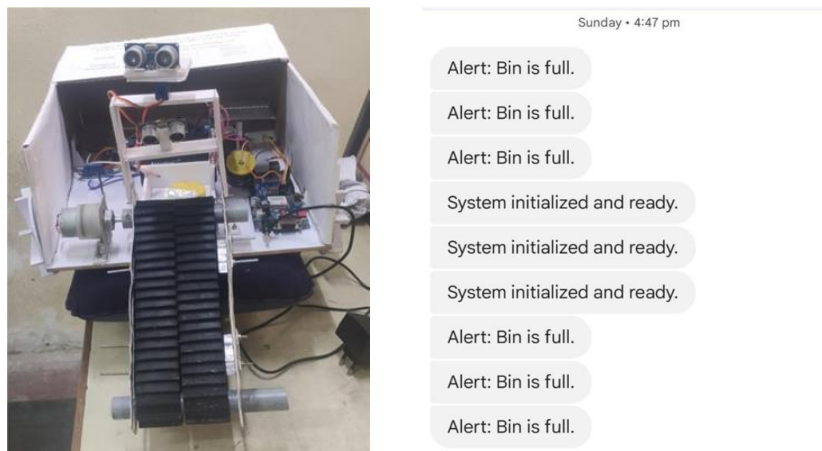


Figure 3. Model, alert message

TABLE1. RESULT

	Distance in meter	Time in seconds	Voltage in Volts	Current in mA
When system is moving in water	1	11	Motor 1 - 7.16	Motor 1 - 20
			Motor 2 - 7.5	Motor 2 - 18
When the system is rotating	-	7	Motor 1 - 7.4	Motor 1 - 18.5
			Motor 2 - 7.5	Motor 2 - 18

VII. CONCLUSION

The IoT-based solar-powered water waste collection system is a practical and eco-friendly solution for addressing water pollution issues. By combining automation, IoT technology, and renewable energy the system helps to keep water bodies clean by detecting and collecting waste, making the environment healthier.

VIII. ACKNOWLEDGMENT

With immense pleasure, we acknowledge a deep sense of gratitude to Dr. S. C. Kamate, Principal, Hirasugar Institute of Technology, Nidasoshi, who has always been an encouraging to all the students in spite of his most busy schedule. We take this opportunity to thank Dr. B. V. Madiggond, HOD of Electrical and Electronics Engineering Department for providing us necessary facilities for carrying out the project work. We extend our



thanks to Prof. S. D. Hirekodi, Project Coordinator for his valuable guidance throughout the project work. We also express a deep sense of gratitude to our Project Guide Dr. B. V. Madiggond and Dr. M. P. Yenagimath, for the inspiration, encouragement and continuous guidance of their full support in achieving this path of success. Last but not the least, We would like to thank all teaching and non-teaching staff of our department, our parents and friends for their valuable guidance, suggestions, continuous encouragement and motivation at every step of this project

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