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Solar Trash Can: Hygienic and Inexpensive Solution to Open Bigger Trash Cans

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ABSTRACT

This paper presents a novel way to use the trash can, which is cheap, hygienic, self-sustained and sturdy. Filthy trash cans not only emit bad odour and draw mosquitoes and other insects to them which can be a public health hazard, they also spoil aesthetics of a city's landscape. There are two types of the trash cans, with and without a lid. In this study, a solution has been proposed which contains merit of both the type of cans while skipping any demerits. The lid of the trash can open up intuitively when a user comes closer to it and closes when the user walks away. It uses solar power and is also equipped with a solar tracker, which automatically aligns the solar cells in the direction of the sun to maximize the energy input.

Keywords: Hygiene, Micro-controller, PID, Solar powered devices, Solar Tracker

INTRODUCTION

In today's time, users are aware and particular about the hygiene of their surroundings. Especially in metropolitan cities, people avoid using closed trash can [1] since they fear contracting germs and filth while opening the lid. On the other hand, open lid trash cans also attract house fly, worms and breed mosquitoes and are source of foul odour!

This paper focuses mainly on using modern technology for operating a trash can in a simple way. It intuitively opens when a user comes closer to it and closes when the user walks away.

Use of solar power makes it self-sustained [2] and environment-friendly. Though solar power is sufficiently available in our country, but due to the odd placement of trashcans in public places, a new design for placing solar panel is proposed which analyses the intensity of sunlight and rotates the solar panel in direction of the sun to harness its full potential.

The trash can that we have designed is also equipped with top head LED which glows when a user comes near it and when visibility to the sensors is low. The whole device is controlled using a micro-controller, Generic InfraRed & BH1750 works as inputs and Servo motor & LED works as actuator.

METHODOLOGY

This project uses InfraRed sensors, micro-controller [3], servo motor, DC battery and solar cell [4].

While InfraRed sensors are used to deduce the location of the user relative to the sensor, micro-controller analyses the inputs given by and deduce which action to be performed by Servo Motor.

BH1750[6] is used to deduce the intensity of the light coming to the panels, analyzed by the same micro-controller. This analysis is based on the following:

1) Understanding the direction in which Sun is moving, to maximize the intensity coming to panels. The use of simple solar tracker which rotates 180^{o} in twelve hours can be incorporated, with the use of a servo motor. This is designed to achieve the desired movement for solar panel, the cost of inbuilt tracker will merely enhance the cost of system by 10%. The excess energy is stored in the battery provided, so it can be used during the low sunshine period and night.

2) Understanding when there is no Light (at night), in order to switch on the top head LED lamp when the user comes nearby.

FIG I: IN-HOUSE PROTOTYPE

A control system has been implemented known as proportional–integral–derivative controller to remove the jerking during the mechanical movements as there can be some environmental errors. FIG 1 shows the in-house prototype.

During the day, solar cell powers the circuit as well as charges the battery, and the whole algorithm has been designed to minimize any power wastage as well as ensuring that the battery gets fully charged before the sun sets.

PROTOTYPE

The prototyping of the whole project has been done on a common trash can so that a modular plugin can be built to reduce the overall cost for the consumer. Out prototype includes full functioning trash can, controlled by the movement of the user, a LED lamp has been built separately as it was the top head.

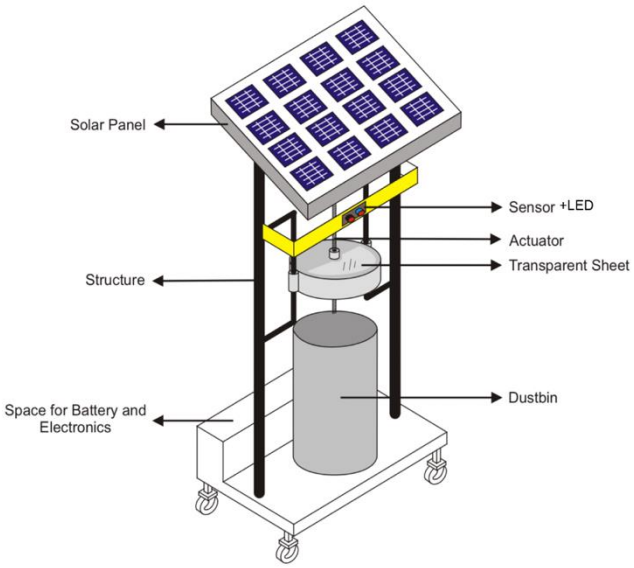

FIG II: DESIGN FOR PROTOTYPE **FIG III: WORKING PROTOTYPE**

The solar panel used was a regular 50 Watt 6 cells connected to a charge controller. A regular solar panel was put for testing along with a 6 volt 3500 mAh battery.

The micro-controller used is 8-bit AVR architecture developed by Atmel and loaded into prototyping PCB by Arduino. Currently we are deploying Arduino Uno as it best suits the electronic configuration and works on very little power requirement. FIG II shows the design of prototype while FIG III shows the working prototype system, wherein the power is derived from the solar panel.

RESULTS

Prototype was developed for the proposed design and has been tested adequately for its efficiency and dependencies.

DISCUSSION

The design of the prototype has been revised several times and its operation is satisfactory. It can further be improved for rigidness and cycles at production level as they have precise control over building the whole model structure. Also, this concept can be used for designing bio-digesters (compactor) too, where organic waste can be selected and used to turn into compost or bio-gas. To summarise, it has the potential to offer triple merits: clean energy, improved hygiene and waste recycling.

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