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An Automated Garbage Collection for Smart City (An Innovative Approach)

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Abstract- *Automatic garbage level indication and alarming feature of our proposed system is an acute step towards an up market and cleaner environment. In this paper, we focus on regular alarming of level indication for various garbage bins present or established in the support of Smart City vision and proper disposal of these garbage bins for a healthy surrounding. Digital Image Processing technique is used as the major tool for monitoring and automatic alarming of level of garbage present in all the public dustbins taken into consideration.*

Keywords- *Image Processing Unit (IPU), Highest Boundary value (HBV), Lowest Boundary Value (LBV)*

1. INTRODUCTION

Today, in every part of our country the government is taking various steps and measures for technological advancement in every city to make it a smart city. But as we all know, the problems faced by us are much more than just advancement in technology. The biggest concern that puts us behind other

nations is their approach towards cleanliness and the management of waste and garbage being poor causes large number of hazardous effect on our environment, our surrounding as well as the development and our health.

We aim at making our city smart, but can we even possibly think of smart city without considering the cleanliness and hygiene. The answer to this question is definitely a No.

The SWACHH BHARAT ABHIYAN has started great deal of work towards this direction. But there are various problems i.e. we have surely established public dustbins for the garbage disposal, but they are not cleaned effectively time to time causing the garbage bins to explode around the area increasing the dirt. This is because the cleaning department does not come to know after how much time the garbage bins get filled completely and due to that regular cleaning is not insured.

To solve this problem we have proposed our model for cleaning and maintaining cleanliness on regular basis. The prototype of our proposed model contains the image processing technique. In this, every garbage bin situated in our city will be kept under surveillance under CCTV cameras that take and record the images of the level of garbage in the garbage bins.

These images are then automatic processed in the IPU and various results are established on the basis of the output.

Figure 1: Actual Condition of Garbage bins of our City

The figure 1 shows the actual condition of our garbage bins. It is evitable from the image what the condition of our city is.

2. PROPOSED WORK

In this section, we describe our approach towards keeping our surrounding clean and thus taking one step closer towards a smart city. The technique that we have in-cooperated in our proposed model uses image processing system. The physical architecture of the model contains various components are described as

Storage Unit

In this unit, the surveillance cameras that are installed at every location where the public dustbins are situated take the images of the garbage bin dustbin after fixed interval of time. The images indicate the level till which the garbage bin has been filled. These images are then passed from the camera to this unit.

Nowadays, we have Wi-Fi cameras that directly send the taken images immediately to the system or the mobile which is made as the main unit. Here this unit is the storage unit.

Figure 2a. Camera Taking Image for Empty & 2b Camera Taking Image for Full Bin

Figure 2a. Shows Camera Taking Image for Empty & Figure 2b Shows camera taking image of full bin Both used for differentiation as well as identification of level of garbage**.**

Image Processing Unit

This is the core unit of our model. The images stored in the storage unit above are received as an input in this unit. This unit then

processes the images by using various image processing techniques and draws conclusion indicating the level of the garbage bin.

We have combined two methods of image processing to obtain the desired work domain.

1. Area image processing
2. Colour domain image processing

Area Image Processing

measures the number of pixels present in a particular area within any image. The boundary of the required area in the image must be defined. In this algorithm we can estimate the lowest boundary value (LBV) of the dustbin and the highest boundary value (HBV) of the dustbin i.e. when it gets approximately full. Algorithm:

The algorithm accepts an image structure pointer. The coordinates of the region containing the object (x1, x2, y1, y2). The area is computed by counting the number of pixels in the area.

By using this algorithm the lowest and the highest coordinates of the dustbin level is identified. These values are stored in the variable. Then the function can be used to return the area, lowest level of the dustbin or the highest level of the dustbin as required.

Figure 3. Indicating Highest and Lowest Level of Bin

Colour Image processing technique is the approach in which the object is distinguished by its colour and a dotted graph is developed which shows the various dots i.e. the colours within the object.

By using the algorithm below, when the dustbin is filled:

- The coloured garbage is identified and dots are graphed.
- The dots in the graph are then used to make a distinct height based database these dots.
- If any dot height is equal to the HBV of dustbin then alarm is generated.

Figure 4. Original Scenario of a Garbage Bin

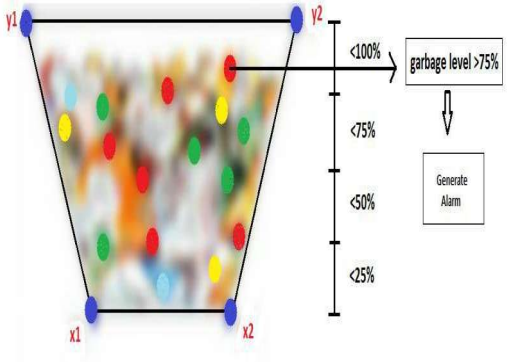

Figure 5 : Colour Processed Image

3. ORIGINAL SCENARIO

Algorithm:

1. Divide the image into pixels
2. Identify different coloured dots

3. Find the height of the first dot where the first dot can be any dot
4. Set Max and h1 to height of first coloured dot.
5. For each coloured dot, find height of the dot and assign it to hd, Compare hd to Max, If hd is greater, Set Max to hd.
6. Set LBV to x1.
7. Calculate HBV.
8. Calculate percentage of garbage in bin, Set Max_per to (max/HDV)*100.
9. **If** Max_per is less than or equal to 25% of HBV **then** assign G to Max_per
10. **If** Max_per is greater than 25% of HBV AND less than or equal to 50% of HBV **then** assign G to Max_per
11. **If** Max_per is greater than 50% of HBV AND less than or equal to 75% of HBV **then** Assign G to Max_per
12. **If** Max_per is greater than 75% of HBV **then** assign G to Max_per and generate alarm
13. Return G to database to keep record of total garbage

Colour Processed Image

Objective of the Processing System:

1. To determine the LBV for the system (dustbins in our case).
2. To obtain continuous status detection of the required area domain.
3. To provide proper alarming and alert generation when the maximum value reaches the Pres specified value.
4. Reset the value to LBV once the dustbins are emptied.

Table 1. Shows Processing Output

Garbage Level %	Processing Output
0-25	Store Level (G)
25-50	Store Level (G)
50-75	Store Level (G)
75-100	Store Level (G) & Generate Alarm

Alarm Unit

When the images are processed and the conclusion is drawn from a particular image a signal is sent to the alarm unit. This alarm unit checks whether the particular garbage bin is full or not. As shown in figure the alarm unit checks if the dustbin is full.

- If the condition is Yes, an alarm is invoked which informs the operator the location of the bin which requires immediate cleaning.
- If the condition is No then in this case the loop goes back to the image processing unit and then the image processing unit keeps processing images until it gets a Yes condition.

Once the cleaning is done, a reset command is sent to the system to mark the particular garbage bin as empty. In this way there is no ambiguity in the level of garbage in the garbage bin preventing false alarms and thus making the system more efficient.

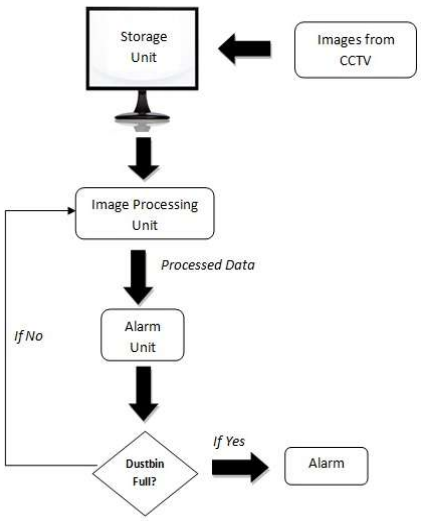

Figure 6. Automated Garbage Collector's Framework

3. CONCLUSION & FUTURE WORK

In the above proposed model, technical approach to develop a garbage cleaning and disposal system is presented. Complete and continuous monitoring for various public garbage disposal areas is performed. How well does the cleaning authority manage and co-operate with this system will be the question of value until the whole system is implemented practically. Future studies on the proposed idea include the methods for fast and accurate real time picture processing techniques.

Also the monitoring system and storage unit establishment and maintained must be taken in proper consideration. The garbage level obtained is an approximate value, however in our future work we will work in obtaining the exact value of the garbage level.

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