

Waste Monitoring System for Smart Cities through SMS and IoT

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ABSTRACT: In the recent decades, Urbanization has increased tremendously. At the same phase there is an increase in waste production. Waste management has been a crucial issue to be considered. In this paper, smart bin is built on a microcontroller based platform Arduino Uno board which is interfaced with GSM modem and Ultrasonic sensor. Ultrasonic sensor is placed at the top of the dustbin which will measure the status of the dustbin. Arduino will be programmed in such a way that when the dustbin is being filled, the remaining height from the threshold height will be displayed. Once the garbage reaches the threshold level ultrasonic sensor will trigger the GSM modem which will continuously alert the required authority until the garbage in the dustbin is squashed. At regular intervals dustbin will be squashed. Once these smart bins are implemented on a large scale, by replacing our traditional bins, waste can be managed efficiently with the help of the smart dustbin. The unnecessary linkages may lead to the spread of the disease in the place where disease are meant to be cured.

Index Terms : Arduino Uno, GSM Modem, Ultrasonic Sensors, GPS .

1. INTRODUCTION

Nowadays, there are tons of flats and apartments which have been built in the rapid urbanization area. This is due to high housing demands which have been drastically risen as a result of migration

from villages to cities to find works. In order to accommodate the growing population in the urban area, the government has built flats, apartments or condominiums, to provide shelter for them. Besides, flats become popular mainly in the United State, Europe and other developing countries.

There are several issues faced by the inhabitants of the flats. One of them is the issue of the domestic solid waste disposal, which cause pollutions. Unlike landed houses, the flats' waste disposal bins are shared among all residents which live in the same building, and thus, the bins tend to be filled very quickly. Thus, an unsystematic and inefficient disposal waste management may cause the bins to be always full with of garbage, and further littering from the residents will cause the garbage piles to be scattered outside the bins. Therefore, there will be a question of sanitary as those garbage piles may become the root cause of illness and diseases like dengue, diarrhoea, and cholera. Besides, there are also problems regarding the attitudes of each inhabitant of the flats. There are cases where some irresponsible residents, who normally live at the higher levels of the building, littered or simply threw their domestic waste directly from the floor which they live into the bins. This may cause pollutions if the garbage thrown fell outside the bins or injuries to innocent people downstairs if they fell onto them.

The waste disposal can be managed more properly and efficiently by constantly

monitoring the bin status and the garbage level . In addition, the municipality can be alerted when the bin is full or almost full, thus promoting dynamic scheduling and routing of the garbage collection. By comparing to the conventional static scheduling and routing, this dynamic scheduling and routing are said to allow operational cost reduction, by reducing the number of trucks, the manual labour cost and the transport mileage savings.

This paper presents an alternative in managing domestic waste especially in flat areas via a smart garbage monitoring system, which is developed based on Arduino Uno. This system will automatically monitor the garbage level at each bin and will alert the municipality in the case where the bins are almost full.

2. LITERATURE REVIEW

Many researchers in their various works elaborated significantly the problem of implementing reliable Smart Waste Management System, b The existing works can be broadly categorized in two areas, Wireless sensor network- based systems and Camera-based systems. R.E. Barone,T.Giuffrè, S.M.Siniscalchi, M.

A.Morgano, and G.Tesoriere in their research “Architecture for Smart Waste management in smart cities”. They proposed intelligent Garbage Monitoring (IGA) architecture with the aim of providing public management solutions. This architecture provides Authorities information regarding on street Garbage level availability and allows them to reserve the most fast action taking at the Garbage Bins just before their spilling Out on to Roads.“An Internet of Things and mobile communications platform for waste management," described a smart waste collection monitoring system-based on the internet of things technology. Zigbeewireless sensor network were used in this architecture as well as internet of things middle layer and front-end layer as the final user interface which provides data reporting to the user. However, some disadvantages are there such as not using suitable application protocol, system performance isn't there as well as mathematical model for the system evaluation. Shen-En Shih and Wen-Hsiang Tsai, Senior Member, IEEE proposed SPS,“A Convenient Vision-Based System for Automatic Smart Garbage System For Waste Management in smart cities Lots Using Wide-Angle Cameras”

with a number of advantages including that the system can be set up easily by a common user with no technical background.

3.PROPOSED METHOD

This project ensures that the Authorities can easily Monitoring of the Waste Management in Smart Cities.

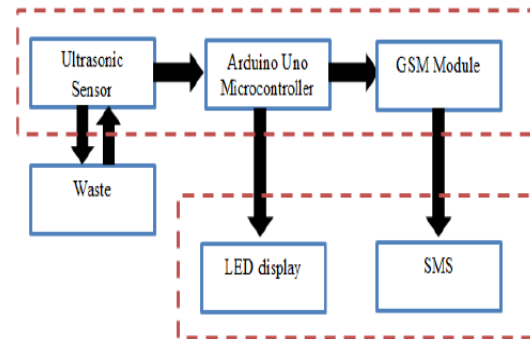


Fig 3.1 block diagram

The ultrasonic sensors are used to detect the level of garbage in each bin, and it will send this information to the Arduino Uno, which acts as the system controller. In the case where the bins are already full or almost full, then it will generate a warning message which will be sent to the municipality via SMS, by using the GSM module. Moreover, this system is also connected to several LEDs, in green or red colours, in order to alert all the residents regarding the bin status.

At first, the level or the height of the garbage in each bin is measured by using the ultrasonic sensor. This information is then received and processed by the Arduino Uno. It will determine whether the garbage level has been surpassing the threshold level or not. For this research purpose, there are two threshold levels sets: the first threshold is at 70% of the bin height, and the second threshold is set at 90% of the bin height. If the garbage level in the bin is crossing the first threshold level, then the first warning message is generated and sent to the municipality. Besides, the green LEDs will be turned ON in order to alert all the residents at every floor. Next, if the garbage level in the bin is crossing the second threshold level, then the second warning message is generated and sent to the municipality. In this case, all the residents will be alerted when the red LEDs are turned ON.

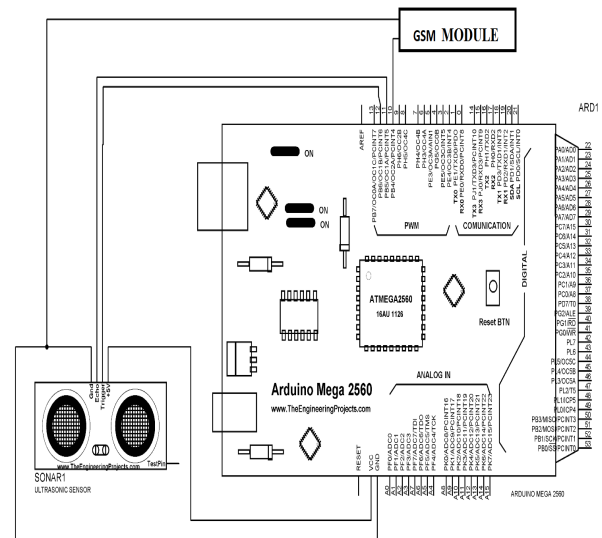


Fig 3.2 circuit diagram

4. SIMULATION RESULTS

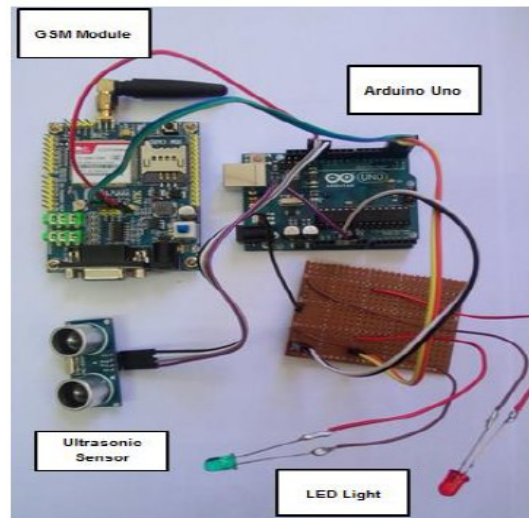


Fig. 4.1. All connection component of hardware in this system

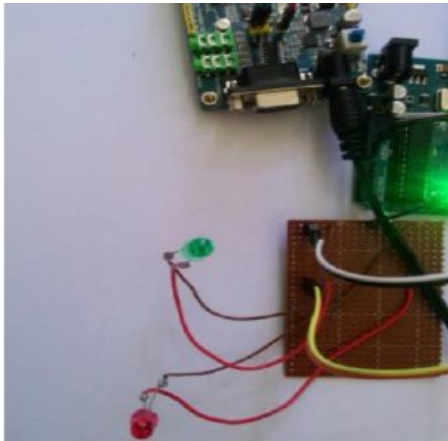


Fig. 4.2. Both LEDs are turned OFF.



Fig. 4.3 GREEN LED is turned ON once the waste reaches the level of 70% full.

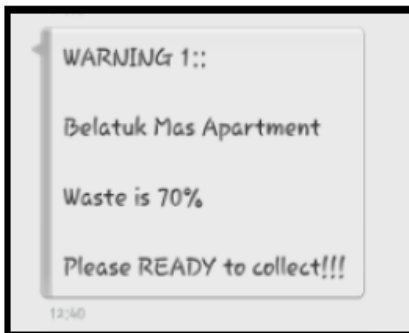


Fig. 4.4 The first notification SMS sent by the system, once the waste reaches the level of 70% full.



Fig. 4.5 Red LED is turned ON once the waste reaches the level of 70% full.



Fig. 4.6. The second notification SMS sent by the system, indicating that bin is at least 90% full and the garbage needs to be collected immediately

CONCLUSION

This paper has described the development of a smart garbage monitoring system, which is based on Arduino Uno microcontroller. It is very useful in improving the efficiency of solid waste disposal management especially in the flat residential areas, where the garbage piles at the bins are one of the residents' major concerns owing to its ability to continuously measure the garbage level in the bin and alerting the municipality for immediate collection. The outputs from the conducted tests show that all the functionality of the system has performed correctly. The proposed system is suitable to be implemented in all flat residential areas, due to its practicality, reliability and reasonable cost.

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