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An IoT Based Smart Garbage Monitoring and Disposal System

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Abstract: Today, people all over the world have built a variety of systems applying the principles of the Internet of Things (IoT), which has resulted in a rise in the amount of intelligence that is present in human existence. This growth in intelligence has resulted in an increase in the amount of intelligence that is present in human existence. An essential program known as the Smart Garbage Monitoring and Disposal Support System (SGMDSS) is described in this article as an application that we may utilize in our day-to-day lives. The Smart Garbage Monitoring and Disposal Support System is what its name refers to when written out in full. This apparatus is officially known as the Smart Garbage Monitoring and Disposal Support System to provide its full title. Since the invention of mobile communication and the widespread availability of the internet at any place and at any time, the number of opportunities to control machinery from a distance has significantly increased. This trend is expected to continue in the foreseeable future. Because of this, there are now more chances open for people to take advantage of. The problem of waste that can be physically picked up is currently one of the most significant difficulties that the globe is facing at the moment. This is because incorrect garbage clearance in villages, towns, and cities has an effect on the people who live there and is the final cause for the introduction of new illnesses. This is due to the fact that inappropriate waste clearance has an influence on the people who live there. This is the ultimate factor that contributes to the proliferation of new illnesses. As a consequence of this, one of the most significant difficulties that we face today is effectively managing waste through the implementation of a variety of technologies.

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INTRODUCTION

Garbage collectors may be found just about everywhere these days, including companies, schools, and even hospitals and streets [1]. Their primary responsibility is to remove trash from public spaces. The traditional method of collecting garbage has a basic flaw in that it involves checking waste containers without having a baseline understanding of the information that they hold, which is the amount of rubbish that has been gathered. This is the core problem with the conventional technique. Because of this method, the efficiency with which workers at municipal corporations utilize both fuel and their own time is reduced [2, 4]. Both the efficiency of the collection method and the overall efficacy of operations will be improved when intelligence is added to the process of collecting rubbish [5-7]. In this particular approach, IoT-edged nodes are placed in garbage cans or collected by garbage collectors. These nodes collect information about the quantity of garbage that has been thrown away and upload it to the cloud. In this scenario, the data that is gathered by the nodes is stored and visualized using a cloud platform, which is employed for the purposes of the aforementioned reasons. Each of the workers who are responsible for cleaning will be given the android application that gives them access to all of the data that is saved in the cloud. When the garbage is coming near to being full, the staff receive a notification in the form of an SMS, and the software also suggests the quickest route to

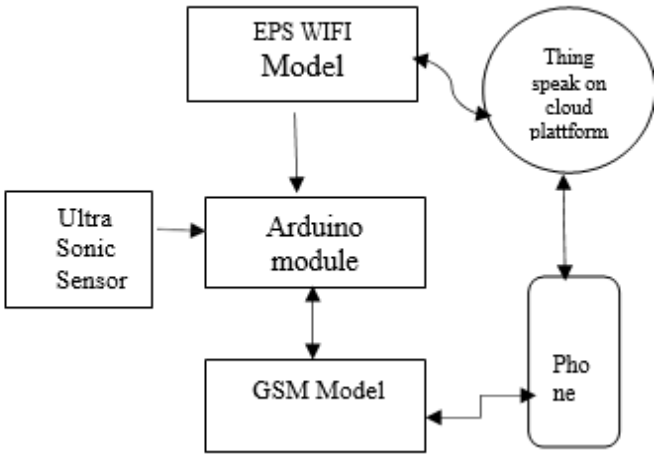
follow in order to collect the rubbish when it becomes essential to do so. There are now other researchers that have constructed systems that are equivalent to this one; nevertheless, this system is unique in that its design makes advantage of the cloud. Because of this, the personnel who are authorized to use this system are now able to access the information that has been obtained regarding the various locations of the bins by using the mobile application. The mobile application for this system possesses a unique characteristic that will, when activated, recommend the quickest path to take in order to reach the garbage can geographical regions that are full to levels that are over the threshold. The appropriate staff members will have access to this information when it is made accessible. With the help of this application for the Internet of Things, it is now feasible to perform monitoring in real time of the amounts of garbage that have accumulated. This will aid in reducing the difficulties that arise as a result of the garbage can being overstuffed. The scope of the system extends to cover every conceivable facet of living. This program may be implemented everywhere or at any time there is a requirement for garbage collection and disposal, including but not limited to homes, apartments, railway stations, organizations, streets, buildings, schools, and so on. A. The Method That Is Currently Used: Because the existing method requires the staff who clean the buildings to walk to each garbage can and check to see if any of the cans are full before emptying them, this procedure results in unnecessary fuel use as well as wasted man-hours. B. The System as It Is Proposed The system as it is proposed includes the procedure in which the people responsible for cleaning go to each garbage can and check to see whether any of the cans are full so that they can empty them. In addition to that, there are times when the personnel let the garbage cans become full to the point where they are overflowing and they do not empty them. B. The proposed organizational structure: In the architecture that has been proposed, the edge nodes of the Internet of Things are placed in garbage cans or on garbage collectors. These nodes collect the data, which is the total amount of garbage that has accumulated in the can, and then they transmit that information to the cloud. In this configuration, the cloud platform for the Internet of Things (IoT) known as "ThingSpeak" is used to store and display the data that is gathered by the nodes [11]. Each of the workers who are responsible for cleaning will be given the android application that gives them access to all of the data that is saved in the cloud. The personnel receive an alarm in a timely manner anytime the waste in any bin is getting close to reaching capacity, and the program also outlines the most efficient way to collect the junk. This occurs anytime any of the bins holding waste are getting close to becoming filled.

EXISTING SYSTEM

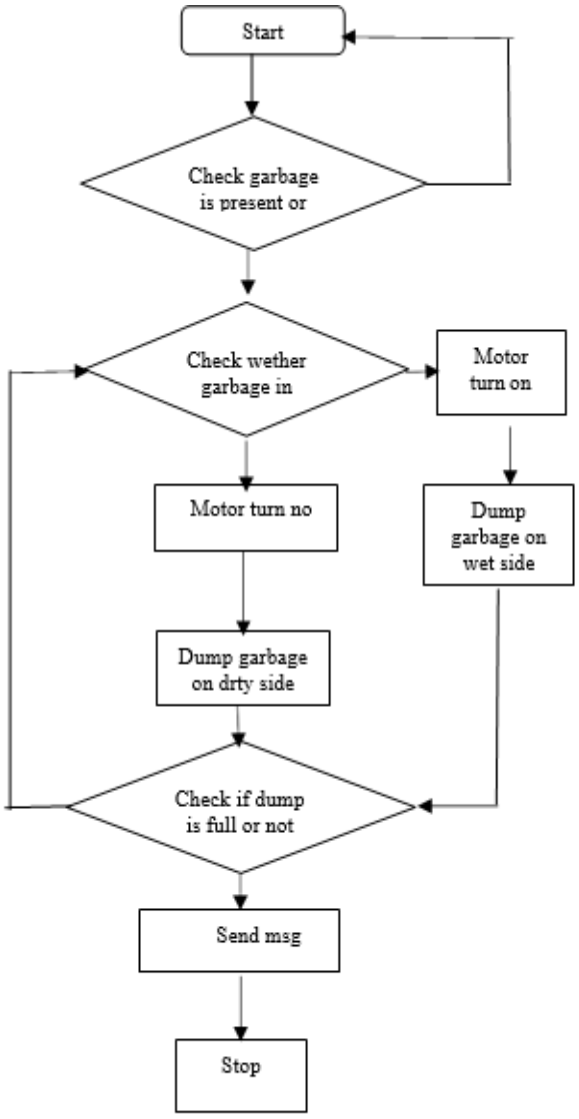
There are many various approaches that may be taken while monitoring the process that deals with garbage. Using an Arduino UNO is the technique that requires the fewest amount of effort and poses the fewest problems. In addition to the usage of Arduino, we also incorporate other types of sensors, such as ultrasonic sensors, rain sensors, infrared sensors, and gas sensors, into our system.

PROPOSED SYSTEM

The expansion of the existing system's capabilities was taken into account when designing the new system that has been suggested. The schematic for the suggested system may be seen further down this page.



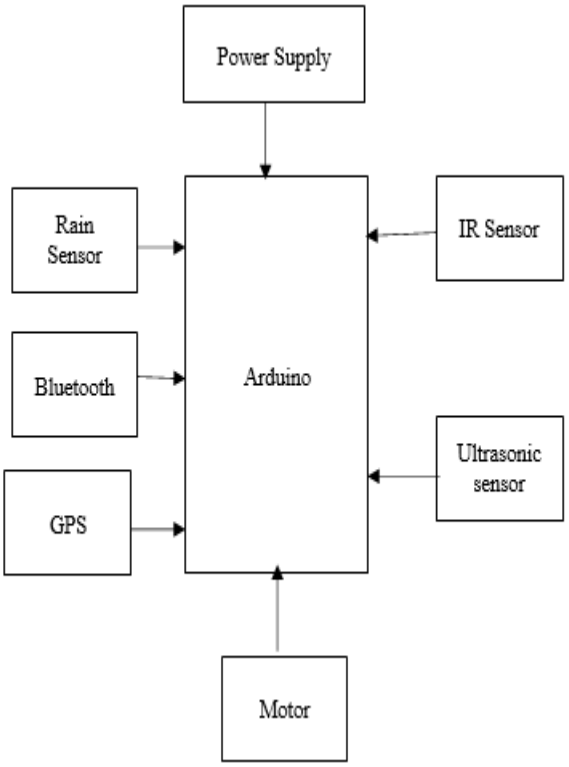
The planned technique will involve checking to see if the wastebasket is already full before moving on to the next step. In the event that the wastebasket is full to the brim, a notification will be delivered to the employees of the municipal corporation, and it will be their responsibility to empty the wastebasket after receiving the notification. In addition to this, the GPS module is employed so that the location of the garbage can may be shown.



BLOCK DIGRAM

DETAILED ARCHITECTURE OF PROPOSED SYSTEM

The Smart Garbage Monitoring and Disposal Support System (SGMDSS) that has been suggested has been split down into its separate blocks, and this section examines those blocks' respective functioning in further detail. In the following, the functionality of the different pieces of hardware that will be used, as well as their incorporation with the cloud and other android application platforms, will be described in order to govern the functioning of the entire system that is being offered. This will be done in order to ensure that the proposed solution is successful. The ultrasonic sensor that is connected to the microcontroller and is included into the smart garbage can is a built-in component of the device. Both the GSM module and the Wi-Fi module are connected to the microcontroller through extra connectors. After being processed by the microcontroller, the information is forwarded to the Thing Speak cloud platform, which is the location where the data is presented in a graphical manner. Access to the same information that is available online can be gained through the use of an Android application on a smart mobile phone.



A. Microcontroller block: An Arduino UNO was used as the microcontroller for this specific project. The Arduino boards have the capacity to take sensor inputs from actual things and, depending on those inputs, either activate functionality or post data online. The embedded microcontroller chip ATmega328 found on the Arduino Uno board is used in a wide range of Internet of Things applications. On the board, this chip is constructed. In addition to having an internal resonator that operates at 16 MHz, it is furnished with a reset button, an In-Circuit System Programming (ICSP) header, a USB connection, and a power connector. General input/output pins, or digital GPIO pins, are another aspect of the device. Six of them are exclusively used for PWM outputs, leaving the other six pins free for analog inputs.

BLOCK DIGRAM

B. ESP 8266 WiFi Module: [3] The ESP8266 is a low-cost (low), Wi-Fi-enabled chip that contains an embedded microcontroller unit (MCU) as well as a full TCP/IP stack. The ESP8266 is designed to be cost-effective. With the assistance of this module, it is possible to create both a Wi-Fi station and an access point, which is necessary for the formation of a hotspot. As a consequence of this, this module is able to rapidly extract the data and upload it to a cloud platform such as Thing Speak, so ensuring the security of IoT connectivity.

GSM Module: The Global System for Mobile Communication (GSM) is a preferred option for many Internets of Things applications since it meets the requirements for mobile communication characteristics. The suggested system makes use of it in order to benefit from the capacity to send SMS alerts.

Ultrasonic Sensor: Since it employs sound waves to calculate the distance between two places, the ultrasonic sensor is one of the most popular types of sensors used when it comes to embedded applications [3,] which makes it one of the most prevalent sorts of sensors. The sound wave that is reflected off of the target is sent out from the sensor head, and the sensor head is also responsible for receiving it back. Using the length of time, it requires for a wave to travel from one site to another, this sensor can calculate the distance between the source and the target. It does this by measuring the time interval.

C. Thing Speak: is a cloud-based open platform for the Internet of Things that finds its primary use in the development of applications for the Internet of Things. It is able to process data in real time and shows the information in a format that is easily accessible by the human eye. Additionally, it is able to perform both of these things simultaneously. It works with any and all application programming interfaces (APIs) and web services without any problems.

PROCESS AND METHODOLOGY

Utilizing an ultrasonic sensor is the way that is engaged in this particular application. The goal of this method is to determine the level of garbage that is contained within a container that is thirty centimeters in height. The ultrasonic sensor has been fastened to the top of the garbage can's lid, and it is arranged in such a way that it is looking down at the bottom surface of the can from the inside. Therefore, the level of garbage that has gathered within the wastebasket is measured continuously with the assistance of a microcontroller from the position of the top lid, and the information that has been processed will be transferred to the ThingSpeak cloud through the use of ESP 8266. The levels used to describe the contents of the bin are "Filled," "Half Filled," and "Empty," in that order. "Empty" refers to the bin when it is completely devoid of any contents. The size of the garbage can decides which of three possible distances there are between each level. These distances can be any one of the three potential distances. The levels labeled "Filled" represent the level as measured between 1 and 10 centimeters, the levels labeled "Half Filled" indicate the level as measured between 11 and 20 centimeters, and the levels labeled "Empty" indicate the level as measured between 21 and 30 centimeters. This line of thought is put into the code, and after that, the code is tested to make sure that it functions correctly in actual use. When the trash can reaches the maximum capacity for any of the levels indicated above, an alert message will be sent on the website, and the level value will be shown in the Android application directly next to the bin number. This will occur when the trash can has reached the maximum capacity for any of the levels described above. When the level of the bin reaches its maximum, also known as the "Filled" level, the person responsible for disposing of waste in that bin will receive an alarm message that specifies the fastest way to go to the bin when the level reaches the maximum. As a consequence of this, the amount of time and fuel that the rubbish collecting vehicles will need to spend working on the task will be reduced. Both a website and a mobile application will be developed for the various municipal development authorities, as well as for the department's staff members who work there. On that website, they are able to monitor the current status of the garbage cans as well as their respective locations, and all of this information can be accessed via the ThingSpeak cloud platform. It is now being developed as an android mobile application that will give the quickest route to travel to the dustbins that are being monitored. Additionally, the status of individual workers who are responsible for collecting dust will be obtained through the program.

IV. EXPERIMENTAL RESULTS AND ANALYSIS
The circuit

Figures 4 and 5 show, respectively, the experimental bin arrangement and a schematic representation of the suggested design. The experiment is carried out using the

built-in apparatus and is done so under the various test circumstances listed in table 1. The results of the tests are summarized in table 2, which is available here, and show how well the system fared in each area of testing. Most of the time, there is a disparity in decimal values between the ultrasonic measured values and the manually measured values (with bar scale). This is due to the accuracy of ultrasonic measurements being higher than manual measures. This is so because manual measurements are made using a bar scale. The information that ThingSpeak keeps precisely and correctly reflects the level of the trashcan as determined by ultrasonic monitoring. The graphical movement of the bin levels is displayed to depict the data in Thingspeak's field chart. The filled levels are shown as RED for "Filled," BLUE for "Half Filled," and GREEN for "Empty." The filled levels are distinguished by color classification and are shown as "Filled," "Half Filled," and "Empty." The user's mobile device is always kept up to date with the most recent information regarding the condition of the bin thanks to the GSM module. All of these details on the various findings from the research are shown in their full in Table 2. Figures 6 and 7 display screenshots of the system, including the website and the Android application, to illustrate the various testing methods that were used. The website and the application are shown in these screenshots.

TABLE 1: DIFFERENT TEST CASES PASSED BY SMARTGARBAGE BIN OF SGMDSS SYSTEM

Test Case	Test case Description	Test data	Expected Result	Actual result	Pass/fail
1	Dust bin failed complexly	1-10 cm	Failed	Failed	PASS
2	Dustbin failed half	11-20 cm	Half Failed	Half Failed	PASS
3	Dustbin empty	21-30 cm	Empty	Empty	PASS
4	Thing speak data collected	% of dust in dustbin	Data in cm	Data in cm	PASS
5	Thing speak indicator	Indicates In re d colour	Red	Red	PASS
6	GSM send msg if dust bin failed	Msg with location	Msg sent	Msg sent	PASS

TABLE 2: EXPERIMENTAL READINGS FOR DIFFERENT

Sr no	Dustbin Actual level measured in cm	Dustbin Level given by Ultrasonics snore	Level reflected denting speak	Colours indications n thing Speak	Level Sent to mobile e	Stat us
1	18.5	18	18	Blue	18	Half Field
2	12.4	12	12	Blue	12	Half/Field
3	4.2	4	4	Red	4	Filled
4	8	8	8	Red	8	Filled
5	22	21	21	Green	21	Empty
6	28	29	29	Green	9	Empty
7	3	3	3	red	3	Filed

CONCLUSIONS AND FUTURE SCOPE

The system that is being suggested is built by fusing a variety of modules together, including a GSM module, an ESP8266 Wi-Fi modem, an ultrasonic sensor, an Arduino board, and more. As a result, a smart garbage collection system is created that is not only affordable but also incredibly cost-effective. The main benefit of this system is that it was created with the use of the cloud-based ThingSpeak database, an open-source for gathering trash levels at each place, and that it seamlessly feeds data back to the mobile application for garbage collection. Another advantage of this approach is that it makes it possible to collect trash right away, which is a regular issue. If this technique is used, the problem of an excessive buildup of rubbish from dustbins in streets, homes, businesses, and other locations that are filled either by hand or with loaders in typical garbage trucks, can be somewhat reduced. The aforementioned dustbins are either manually emptied or loaded with loaders in standard garbage trucks. With the use of sensors, this system can automatically check the amount of garbage present, and it can share that

information with those in charge of cleaning by means of an Android app. Furthermore, it's probable that it will provide the fastest route to the location of the trash can. Above all past systems that are comparable to those that already exist, this represents a breakthrough. For the collection, processing, monitoring, and disposal management of trash in order to provide a better, cleaner, and more environmentally friendly environment for those who live there, the procedure and methodology used in this SGMDSS are more than sufficient to ensure the practical implementation. In the future, it will be possible to enhance the functionality of this system utilizing LoRa technology, which will enable it to cover a big region at an incredibly cheap price.

REFERENCES

Thangavel Bhuvaneswari et.al, (2020), Internet of things (IoT) based Smart Garbage monitoring system, Indonesian Journal of Electrical Engineering and Computer

Science Vol. 20, No.2, November2020, pp. 736~743 ISSN: 2502-4752, DOI: 10.11591/ijeecs. v20.i2. pp736-743

Prof. Dr. Sandeep M et.al, (2017), Smart Garbage Monitoring System using Internet of Things (IOT), IJIREEICE, ISSN (Online) 2321 – 2004, Vol. 5, Issue 1.

T.M.N.Vamsi, G.Kalyan Chakravarthi, T.Pratibha,(2019) An Embedded System Design For Guiding Visually Impaired Personnel, 978-1-5386-9482-4/19©2019 IEEE Explore

N. Sharma, N. Singha, and T. Dutta, "Smart Bin Implementation for Smart Cities,"International Journal of Scientific and Engineering Research, vol. 6, no. 9, pp. 787- 791, 2015.

S. S. Navghane, M. S. Killedar, and V. M. Rohokale, "IoT Based Smart Garbage and Waste Collection Bin," International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE), vol. 5, no. 5, pp. 1576-1578, 2016.

M. K. A, N. Rao, and P. S. B, "Smart Dustbin-An Efficient Garbage Monitoring System," International Journal of Engineering Science and Computing, vol. 6, no. 6, pp. 7113-7116, 2016.