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System For the Intelligent Monitoring of Garbage Cans Based on The Iot

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ABSTRACT

Due to its negative effects on the environment, garbage waste monitoring, collection, and management have risen to the forefront of modern concerns. Manually keeping tabs on and collecting trash is an inefficient and costly process that involves a lot of manpower and time. This paper introduces Thingspeak, an open Internet of Things platform, and a garbage monitoring system built on its back. An Arduino microcontroller, a load cell, a Wi-Fi module, and an ultrasonic sensor make up the system. The ultrasonic sensor and load cell send readings to the Arduino microcontroller. A load cell can determine how much trash is in the bin, and an ultrasonic sensor can determine how far the trash has progressed inside the bin. The information is shown on an LCD panel. This information is sent to the web via the Wi-Fi module. The waste system is monitored using Thingspeak, an open IoT platform. The supervisor will have a much easier time keeping track of garbage pickup schedules with this technique. Currently, testing is being done on a prototype. Results have been positive so far. This paper lays forth the specifics.

Keywords:

INTRODUCTION

The effects of trash on the ecosystem are significant . If trash isn't picked up and disposed of properly, vermin like rats and fleas will make a home in it. Trash accumulation may create disease outbreaks with tragic results. The rate of pollution needs to drop as low as feasible if we're going to save the planet. For this reason, a waste management system is required.

The conventional method of keeping tabs on and hauling away trash is time-consuming and labor-intensive, not to mention expensive. The Internet is expanding rapidly and has become an integral part of modern life. The so-called Internet of Things is currently dominating the internet due to its ability to send and receive real-time data as long as the embedded devices are connected to the internet and the data is monitored in real-time over the internet. There is some discussion of MSWM in the Arabian Gulf in . Landfilling, composting, and recycling and reuse methods, as well as their relative merits, are examined.

Since IoT may be used to keep tabs on every aspect of daily life, provides a comprehensive

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examination of the technology, history, and deployment areas of IoT, among other things. Many experts in the field have tried various Internet of Things (IoT) based systems for waste monitoring in recent years. Some authors presented smart collection bins that use a combination of IR sensors and load cell sensors. An Internet of Things (IoT)-based smart dustbin is presented; this system, which employs a GSM modem to alert the appropriate authorities until the trash is collected, can help to significantly lessen environmental pollution.

LITERATURE SURVEY

Nagalingeshwari et al (2017) proposed a fresh approach to trash management systems offered, one that makes use of the Internet of Things and optimises routes. The GSM network acts as a transmission medium for the signal in the remote monitoring system and GPS is used to keep tabs on the trash cans as they fill up. Thanks to this feature, the SMS alerting the registered mobile number that the bins are full will be sent within 10 minutes. To lessen food waste, ***Insung et al (2014)*** proposes an Internet of Things-based smart garbage system (SGS). For one year, the suggested SGS was tested as a pilot project in Korea, where it was found that food waste could be reduced by 33 percent.

For managing trash efficiently, ***Vikrant Bhor et al***.(2015) presented a global positioning system-based smart waste management system . The waste monitoring system was based on IoT and utilised zigbee. Different wireless methods for the Internet of Things were reviewed. Multiple sensing and monitoring systems based on Internet of Things was proposed in ***Pasha et al (2016***). It shows off the functionality of the Thingspeak platform and the Matlab tools that are built right in. ***Nithya et al (2017)*** proposes a solar-powered garbage-monitoring system powered by the Internet of Things. As its primary energy source, it prioritises renewable energy. The garbage can's current status is also shown via an Android app.

we learn that IoT-based Industrial Automation with Raspberry Pi was proposed. Based solely on data obtained from sensors at the industrial site, it monitors and controls the environment. With HTML and CCS, IoT may be realized. An IoT-based garbage-monitoring system is presented in ***Alice et al(2017).*** It keeps tabs on the waste can's weight, gas levels, and fill status online. As proposed by ***Sandeep et al (2107).***A web-based IoT Garbage Monitoring system is shown there. The website provides a graphical representation of the bins, with the waste collected highlighted in colour to indicate the amount of garbage collected and to initiate instructions for cars at the collection facility.

The problems with developing guiding policies for managing municipal solid waste are discussed by ***Viau et al(2020)*** .Substitution modelling in life cycle assessment is the foundation for this approach because of the method's growing prominence around the world. The writers of this piece conduct a thorough analysis of the LCA modelling of substitute materials obtained through municipal solid waste management systems.

METHODOLOLGY

Figure 1 is a block representation of the design process. The trash can has a weight sensor and ultrasonic sensor built in. The microcontroller is linked to these sensors. Sent data from the sensors

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will be shown on the LCD panel and uploaded through Wi-Fi module.

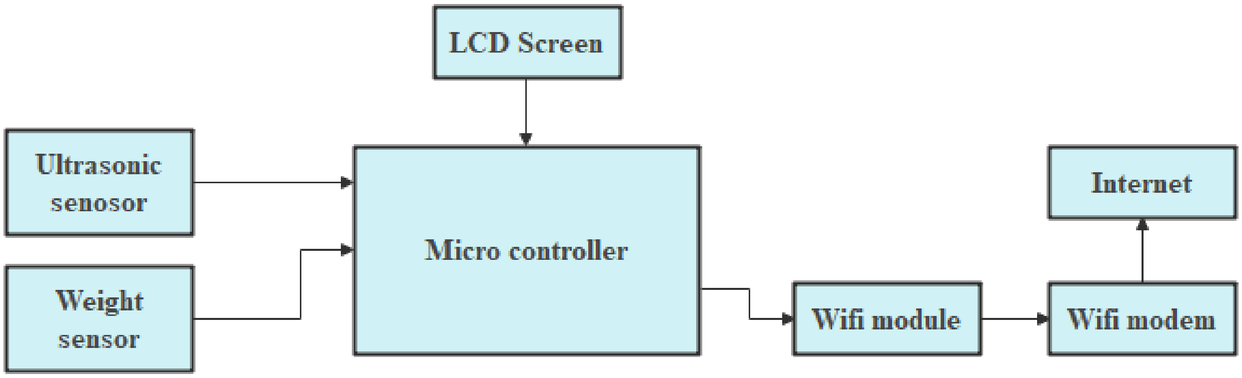

Fig 1: Framework of proposed method

The ultrasonic sensor emits a high-frequency sound wave and detects its reflection off of an obstruction. The time it takes for the wave to go both ways is a measure of the distance. The distance is calculated after receiving the reflected wave and shown on an LCD panel. Simultaneously, the information is transmitted over a Wi-Fi connection from the ESP8266-01 to a website. The garbage can's weight is measured by a load cell sensor and transmitted to an Arduino board. The resultant weight is then shown on an LCD panel. Simultaneously, the information is transmitted to a web page via an ESP8266-01 Wi-Fi connection. Data from the ultrasonic sensor and the load cell is sent to the Thingspeak IoT platform, which then refreshes the channel. An alarm will be sent out via Twitter if there is an excessive amount of data. The ultrasonic sensor and load cell are constantly sending data to the web page through Wi-Fi, allowing the data to be tracked in real time. Twitter notifications allow for more precise planning of waste collection, which in turn provides for a healthier environment in which to live.

The Arduino Mega 2560 board was selected for this project. It's an ATmega2560-based microcontroller board. Both 5V and 3.3V were available from the board to better suit different use cases. The ESP8266 Wi-Fi module requires 3.3V, while the ultrasonic sensor, load cell sensor, and LCD screen all operate on 5V. The garbage monitoring system makes use of an ultrasonic sensor to measure the height of the trash can and a load cell sensor to measure its mass. The load cell sensor's resistance variations are too subtle for the arduino to pick up on. Consequently, the load cell sensor's signal of variations in resistance is amplified by an amplifier module. The schematic is translated into reality by soldering electronic components onto a doughnut board. As indicated in Figure 3, each part snaps into its corresponding socket.

Because of its wide range of useful capabilities, including data gathering, graph plotting, integration with social networks, and compatibility with arduino, the open Thingspeak IoT platform was selected for this project. IoT (Internet of Things) platform is Thingspeak, as seen in Figure 4. Fig.5 depicts the IoT project's communication path. Ultrasonic Sensor and Load Cell Sensor are the titles of two charts that were created. This website will be automatically updated with the latest data as it is received from your Arduino through Wi-Fi. By entering its coordinates, the trash can's current location can be seen.

RESULTS AND DISUCSSIION

Using an ultrasonic sensor, we were able to determine the distance to the trash can as shown in Table 1. A ruler is used to determine the actual distance. The height of the bin is measured from the impediment to the top of the bin, and then the distance is calculated. The process of data collection commences with a clean trash can. A ruler is used to get an initial estimate of the distance, and then an ultrasonic sensor is utilised to get an exact reading. An ultrasonic sensor takes five readings every three seconds. The purpose of this is to track the distance's evolution over a three-second period. The manual (ruler) readings are compared to the average of the five readings. When a garbage can is empty, an ultrasonic sensor may detect its distance with an average of 25.3, which can then be compared with a human reader's reading to determine the bin's accuracy. As a result, you may trust it to within 3% of the time. As the distance between the ultrasonic sensor and the obstruction decreases, the detection accuracy improves. The sensor reading is larger than the manual reading, which is why in some circumstances the percentage is greater than 100. To give just one example, the most recent sensor reading is 4.6, but the corresponding manual reading is 4. Hence, 115% = (4.6/4)*100.

Table 1: The findings of the ultrasonic sensor's distance measurement

Distance measure by ruler(in cm)	Average distance noted by ultrasonic sensor (cm)	Accuracy level (%)
31	25.1	78
25	23.5	84
20	15.9	96
19	13.2	102
8	11.8	106
4	7	115

The 20-cent Malaysian coin's measured weight using a load cell sensor is displayed in Table 2. The weight of a single Malaysian 20 cent coin is about 5.65 grammes. Without exerting any pressure, the LCD panel indicates a weight of 0.7g. You can see the load cell sensor in action in

Initial level error= 0.9			
Original weight	**Measured weight**	**Weight with error**	**Accuracy level**
6.01	58.635	23.5	96
11.2	75.41	95.53	105
45.55	91.28	65.45	105
45.52	54.48	99.89	108

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54.36	75.41	78.54	111
78.23	98.63	58.32	117

Figure 2 displays the findings showing that the discrepancy between the measured and actual weights rises as the weight increases.

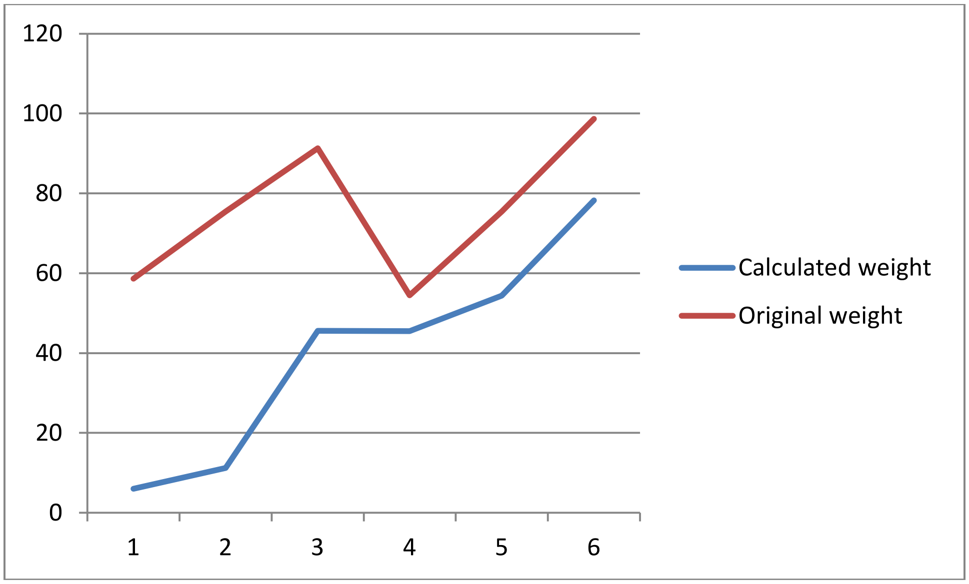

Fig 2: Graph depicting the real weight as well as the measured weight

Thingspeak React Programs will immediately tweet when the trash can reaches its maximum weight or volume. The tweet will include information about the garbage can's location, the ID of the associated channel, the current time, and the amount of garbage it contains. The channel will be updated with its current level and weight on a regular basis.

CONCLUSION

In this work, an Internet of Things (IoT) waste monitoring system built on top of Thingspeak is presented. A prototype has been constructed that uses an ultrasonic sensor to detect the level of rubbish in the bin and a load cell to determine the weight of the garbage bin itself. Both of these sensors were integrated into the prototype. It has been put through its paces, and the results have been deemed satisfactory. Thingspeak, which is a public channel that anybody can access, is utilised in order to keep an eye on the online waste bin. Twitter, a social networking website, is utilised to provide live updates on the status of the rubbish bins on a regular basis at regular intervals. A Twitter status update would be triggered if a garbage can reached its capacity and began to overflow or overload; this would allow authorised staff to respond appropriately. The dissemination of information to the public has the potential to raise public awareness regarding waste management and waste pollution. Because of this system, the administrator is able to more effectively monitor and plan for the pickup of garbage. This method would help to enhance environmental hygiene, make cities cleaner, and contribute to more intelligent waste management.

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