Rover Publications
United International Journal of Engineering and Sciences (UIJES)
An International Peer-Reviewed (Refereed) Engineering and Science Journal
Impact Factor:7.984(SJIF) Volume-4, Special Issue-3; ISSN: :2582-5887

Waste Management Improvement in Cities using IOT

Yamini changati, Swapna koppula, Narayana Telugu.
Dept of Electronics & Communication Engineering
RK College of Engineering
Vijayawada, India.
cyamini709@gmail.com, swapnakoppula678@gmail.com, narayanatelugu417@gmail.com
DOI:10.53414/UIJES:2024.43.241

***Abstract* – The problem of overflowing garbage bins in public places and proposes a solution called "IoT Based Waste Management for Smart Cities." The proposed system involves placing dustbins equipped with low-cost embedded devices throughout the city or campus. These devices track the level of garbage in the bins and transmit the information, along with a unique ID for each bin, when the level reaches a threshold. Authorities can access this information remotely via the internet and take immediate action to clean the bins, thus addressing the issue of unhygienic conditions and the spread of diseases caused by overflowing garbage bins.**

***Keywords* – 8051 Microcontroller, RF Module, IR Sensor, RF Transmitter, Intel Galileo Gen2, RF Receiver.**

I. INTRODUCTION

Things (Embedded devices) that are connected to Internet and sometimes these devices can be controlled from the internet is commonly called as Internet of Things. In our system, the Smart dust bins are connected to the internet to get the real time information of the smart dust bins. In the recent years, there was a rapid growth in population which leads to more waste disposal. so a proper waste management system is necessary to avoid spreading some deadly diseases. Managing the smart bins by monitoring the status of it and accordingly taking the decision. There are multiple dustbins are located throughout the city or the Campus (Educational Institutions, Companies, Hospitals etc). These dustbins are interfaced with micro controller based system with IR Sensors and RF modules. Where the IR sensor detects the level of the dust in dustbin and sends the signals to micro controller the same signal are encoded and send through RF Transmitter and it is received and decoded by RF receiver at the Central System (Intel Galileo) and an Internet connection is enabled through a LAN cable from the modem. The data has been received, analyzed and processed in the cloud, which displays the status of the Garbage in the dustbin on the GUI on the web browser.

II.RELATED WORK

In an integrated system employing ZigBee, GSM, and ARM7 is utilized to remotely monitor waste bins, with sensors installed in public garbage bins. When garbage reaches sensor levels, the ARM7 Controller notifies garbage collection truck drivers via SMS, facilitating prompt attention to filled bins. underscores societal concerns regarding escalating resource consumption and waste production, prompting policy makers to advocate recycling and reuse strategies to mitigate raw material demand and reduce landfill waste. proposes an integrated system incorporating Radio Frequency Identification, Global Position System, General Packet Radio Service, Geographic Information System, and web cameras to address solid waste issues. The study also assesses the system's actual performance. Aims to characterize waste and assess the current municipal solid waste management (MSWM) system of Thoubal Municipality. The paper concludes with recommendations to enhance existing management systems for improved efficiency. In the proposed system employs sensor systems to detect garbage levels in dustbins, communicating this data via GSM to an authorized control room. A microcontroller facilitates interface between sensor and GSM systems, while a GUI provides monitoring capabilities for various garbage-related information at selected.

III. PROBLEM DEFINITION

As we have seen number of times the dustbins are getting overflown and concern person don't get the information within a time and due to which unsanitary condition formed in the surroundings, at the same time bad smell spread out due to waste, bad look of the city which paves the way for air pollution and to some harmful diseases around the locality which is easily spreadable.

Disadvantages of the existing system

a. Time consuming and less effective: trucks go and empty containers whether they are full or not.
b. High costs.
c. Unhygienic Environment and look of the city.
d. Bad smell spreads and may cause illness to human beings.
e. More traffic and Noise.

Advantages of the proposed system

- Real time information on the fill level of the dustbin.
- Deployment of dustbin based on the actual needs.
- Cost Reduction and resource optimization.
- Improves Environment quality
    - ♦ Fewer smells
    - ♦ Cleaner cities
- Intelligent management of the services in the city.
- Effective usage of dustbins

IV. METHODOLOGY

Keil µVision IDE: During the implementation of our project we have utilized certain software. The source code for the ARM microcontroller was written in programming language C. The IDE used was Keil µ Vision. The µVision IDE from Keil combines project management, make facilities, source code editing, program debugging, and complete simulation in one powerful environment. The µVision development platform is easy-to-use and helps you quickly create embedded programs that work. The µVision editor and debugger are integrated in a single application that provides a seamless embedded project development environment.

Ardunio IDE: The ArduinoSoftware (IDE) is an opensource software and it makes easy to the code and upload it to the board. I t runs on the different plant from Windows, MAC OS, Linux. The environment is written in Java and before running the IDE Java software to be installed on the machine this software can be used with any Arduino board.

V. MATERIAL

8051 Microcontroller: Here the 8051 microcontroller used to reads the data from the sensor and process the data received from Sensor and the same data wirelessly transmitted to the Central system (Intel Galileo microcontroller) using RF Transmitter.

- Made by Intel in 1981
- An 8-bit, single-chip microcontroller optimized for control applications
- 128 bytes RAM, 4096 bytes (4KB) ROM, 2 timers, 1 serial port, 4 I/O ports
- 40 pins in a dual in-line package (DIP) layout.

IR Sensor: An Infrared (IR) sensor is used to detect level in the dustbin whether the dustbin is full or not. An IR sensor consists of an emitter, detector and associated circuitry. The circuit required to make an IR sensor consists of two parts; the emitter circuit and receiver circuit.

Emitter is simply an IR LED (Light Emitting Diode) and the detector is simply an IR photodiode which is sensitive to IR light of the same wavelength as that emitted by the IR LED. When IR light falls on the photodiode, its resistance and correspondingly, its output voltage, change in proportion to the magnitude of the IR light received. This is the underlying principle of working of the IR sensor.

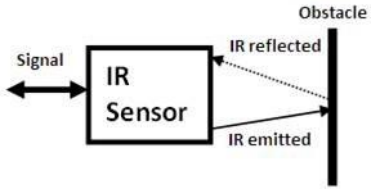

Fig. 1. IR Sensor working

RF Module: This radio frequency (RF) transmission system employs Amplitude Shift Keying (ASK) with transmitter/receiver (Tx/Rx) pair operating at 434 MHzThe transmitter module takes serial input and transmits these signals through RF. The transmitted signals are received by the receiver module placed away from the source of transmission. The system allows one way communication between two nodes, namely, transmission and reception. The encoder converts the parallel inputs (from the remote switches) into serial set of signals. These signals are serially transferred through RF to the reception point. The decoder is used after the RF receiver to decode the serial format and retrieve the original signals as outputs. These outputs can be observed on corresponding LEDs.

Intel Galileo Gen2: Intel is committed to providing the ultimate processors, boards, and tools to its community. The first initiative by Intel is the introduction of Intel Galileo and Intel Galileo Gen 2 boards, which are compatible with the Arduino headers and reference APIs. Intel Galileo boards are open source and open hardware; in other words, all the source code and hardware schematics are available online, which you can download, use, and modify.

The Intel Quark X1000 SoC was preserved on Intel Galileo Gen 2 as the memory's capacity. It also has the same clock frequency, the same analog and power headers (except for a small improvement in the digital header to allow redirection of UART1 to the pins IO2 and IO3), and the same I2C and SPI speeds. The next section discusses the new changes and improvements in details. In terms of Arduino headers, Intel Galileo Gen 2 provides the same set with major improvements, such as PWM. Figure shows its major components.

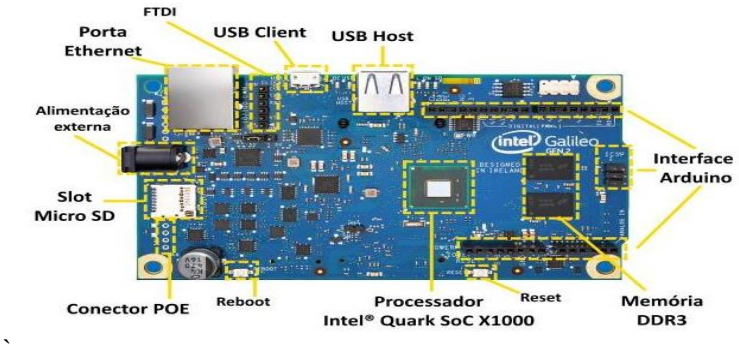

Fig. 2. Intel Galileo Gen2

VI. WORKING PRINCIPLE

The Block diagram shows the different component used in the Smart Dust bin System.IR Sensor, 8051 microcontroller, Power Supply, RF Transmitter, RF Receiver, Intel Galileo microcontroller and the web browser. The project module is divided into two parts Transmitter section and receiver section. Here in the transmitter section we are using 8051 microcontroller, RF Transmitter and sensors these are attached to the dustbin. Sensors detect dustbin fill levels, transmitting data to a powered 8051 microcontroller. The microcontroller processes this data, powered by a +9V battery, and wirelessly transmits it to a central Intel Galileo microcontroller via RF transmission. This facilitates remote monitoring and management of dustbin status.

The RF Transmitter sends signals from the 8051 microcontroller to the Intel Galileo microcontroller. In the receiver section, an RF Receiver, Intel Galileo, and Web Browser are utilized. The RF Receiver captures data transmitted by the RF transmitter to the Intel Galileo microcontroller. The Intel Galileo Gen2 Microcontroller receives data from multiple transmitters, processes it, and transmits it to the client's web browser for viewing.

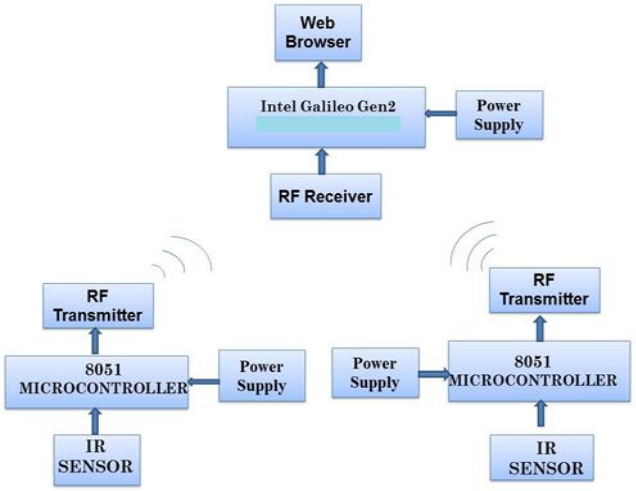

Fig. 3. Smart Dust bin Block diagram

The flowchart outlines the process of the transmitter and receiver sections of a smart dustbin system. In the transmitter section, sensors detect dustbin levels and transmit signals to a microcontroller. The microcontroller assesses the dustbin status and sends signals to the central system via RF. Conversely, in the receiver section, the central system receives

signals from the transmitter via an RF receiver. It then evaluates the status of all dustbins and displays this information on a browser interface.

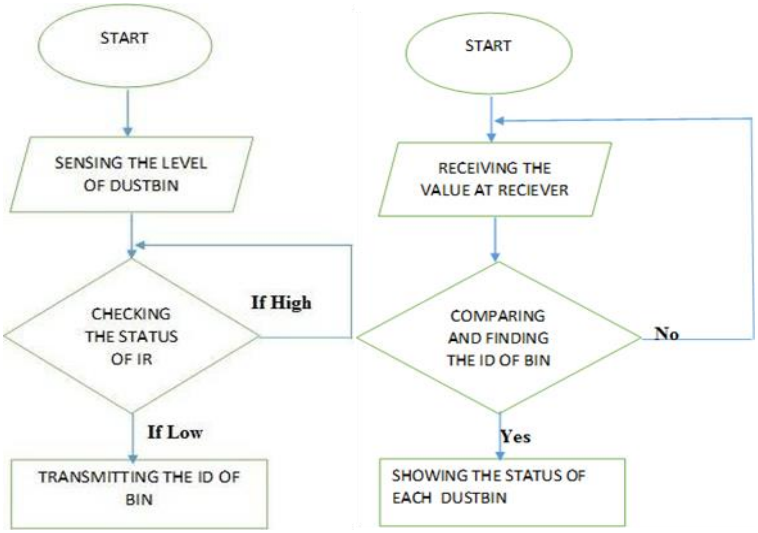

Fig. 4 Flow chart of Transmitting and Receiver Section

.

VII. RESULTS AND DISCUSSION

The outcomes of this project include:
1. Detection of waste levels within the dustbin.
2. Wireless transmission of this information to relevant parties.
3. Accessibility of data from anywhere and at any time.
4. Real-time transmission and access to data.
5. Prevention of dustbin overflows, enhancing efficiency and cleanliness in waste management.

The IoT-based waste management system offers significant benefits for smart cities. It addresses the problem of overflowing dustbins by providing real-time information about dustbin status across various city areas. This enables concerned authorities to access details anytime and from anywhere, facilitating prompt decision-making and proactive management of waste disposal issues.

Fig 5. Smart Dust Bin

The smart dustbin employs an IR sensor to detect dust levels within. A 8051 microcontroller is utilized to read data from the IR sensor. Additionally, an RF transmitter module is integrated to wirelessly transmit dustbin level information to the central system.

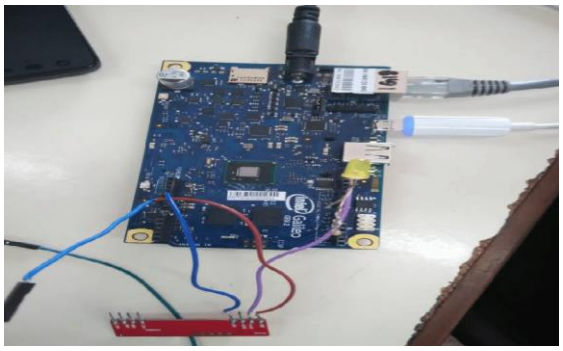

Fig. 7 Central Server System (Intel Galileo)

The central server system, powered by an Intel Galileo Gen2, hosts a web server responsible for processing information received from the smart dustbins. Additionally, it incorporates an RF Receiver module to receive data transmitted by the smart dustbins.

VII. CONCLUSION AND FUTURE WORK

The real-time waste management system utilizes smart dustbins to monitor fill levels, ensuring efficient use of resources. Accessible remotely, the system allows concerned individuals to make informed decisions based on current data. Implementation leads to cost reduction, resource optimization, and effective utilization of smart dustbins, indirectly reducing city traffic. Rather than adhering to fixed collection schedules, the system informs authorities of dustbin status in real-time, enabling optimized collection routes and minimizing unnecessary trips.

For future work, integrating a timestamp feature into the system would enhance its functionality. This addition would provide real-time clock information to the concerned individuals, indicating when each dustbin reaches full capacity and when waste is collected. This timestamp feature adds transparency and accountability to the waste management process, allowing for better monitoring and optimization of collection schedules.

REFERENCES

[1] Kanchan Mahajan, "Waste Bin Monitoring System Using Integrated Technologies", International Journal of Innovative Research in Science, Engineering and Technology, Issue 3, Issue 7, July 2014.
[2] M. Al- Maaded, N. K. Madi, Ramazan Kahraman, A. Hodzic, N. G. Ozerkan, An Overview of Solid Waste Management and Plastic Recycling in Qatar, Springer Journal of Polymers and the Environment, March 2012, Volume 20, Issue 1, pp 186-194.
[3] Islam, M.S. Arebey, M.; Hannan, M.A.; Basri, H, "Overview for solid waste bin monitoring and collection system" Innovation Managementand Technology Research (ICIMTR), 2012 International Conference, Malacca, 258 – 262
[4] Raghumani Singh, C. Dey, M. Solid waste management of Thoubal Municipality, Manipur- a case study Green Technology and Environmental Conservation (GTEC 2011), 2011 International Conference Chennai 21 – 24
[5] Narayan Sharma, "Smart Bin Implemented for Smart City", International Journal of Scientific & Engineering Research, Volume 6, Issue 9, September-2015