IoT based Smart Garbage Collection using IR Sensor

M. Vinodh Kumar¹ V. Priyanga² K. Priadharshini³ P. Priadharshini Jenifer⁴ Dr. M. Kannan⁵

¹,²,³,⁴,⁵Department of Electronics & Communication Engineering
1,²,³,⁴Kathir College of Engineering, Coimbatore, Tamilnadu India

Abstract— In day to day life the proper management of solid waste becomes a greater challenge to the government. In cities many times the garbage bins at the public places are overflowing which creates unhygienic condition for the people and also pollutes the surrounding environment. To avoid such a situation “IOT Based Smart Garbage Collection using IR sensor” is implemented. In this paper, IOT technology has been proposed for garbage clearance. This model consists of Arduino UNO Controller, dustbins loaded with IR sensors and they are continuously monitored through web. This process is aided by interfacing IR sensor with Arduino UNO to check the level of garbage filled in the dustbin and sends the alert message to the web server once if the garbage is filled. Thus the details about the dustbins are accessed with the help of internet and immediate action can be taken to clean the dustbins.

Key words: Arduino UNO, IR Sensor, IOT, Load cell, Wireless LAN, SPI

I. INTRODUCTION

Increasing population levels, economy, rapid urbanization and rise in living standards have greatly accelerated the municipal solid waste. Municipalities usually responsible for waste management in the cities, have the challenge to provide an effective system.

Things that are connected to internet where devices can be controlled through internet is known as Internet of Things. IOT has a special right to communicate around the world. The Internet of Things allows people to be connected anytime, anyplace with anyone. The solid waste takes a huge role in polluting the environment, hence proper management is required for efficient removal of solid waste. In this paper, the smart dustbins are connected to internet which gives the current status of the bins in real time. The bins are provided with IR sensor which is interfaced with Arduino UNO controller. The IR sensor is used to detect the level of waste in dustbins. It also represents the design of cloud system for organization of waste collection process and application for waste truck drivers and managers. The criteria of connecting all the sensor to internet is Internet of Things.

II. EXISTING SYSTEM

In existing system there is no information about collecting time and area. Lack of proper monitoring and the performance of the drivers are not noticed so there is no quick response in urgent cases. Some of the commonly used solutions for waste collections are as follows.

A. GIS Based Solid Waste Disposal

The Geographical Information System is a decision making tool for solid waste management in urban areas. It is divided into two phases, phase one is waste management in areas where it is generated and another phase is this wastes at dumping grounds. GIS system are often so complex and it is difficult to make the programs that both are fast and user friendly. GIS systems require complex command language.

B. RFID Based E-Tracking for MSW

This technology has been widely used in many organizations in some industrial countries. Radio Frequency Identification uses wireless radio communication technology to identify the tagged objects. The chip contains memory which is used to store data and transmit data. RFID systems are typically more expensive for set up. Tag collision may occur if a reader picks up the signals from multiple tags at the same time. RFID also brings up some security issues where unauthorized devices able to read and change the data on tag without the knowledge of person who owns the object.

III. PROPOSED SYSTEM

The main objective of this project is using IOT technology. The proposed system is used for continuously monitoring about the status of bins. The bins are fitted with IR sensor at the top and it can be installed in both lid-based bins and without lid bins. Here Load cell is also introduced to measure the weight of the waste. This system can respond to any abnormal condition and database is provided to check the collection process time and performance.

A. Block Diagram

Fig. 1: Block Diagram

B. Receiving Unit

Fig. 2: Receiving unit

IV. HARDWARE DESCRIPTION

A. Arduino UNO

An Arduino is actually a microcontroller based kit. It is basically used in communications and in controlling or operating many devices. The Arduino UNO is a microcontroller board based on the ATmega328. It has 14 digital input and output pins, 6 analog inputs, 16MHz crystal oscillator, a USB connection, a power jack, an ICSP header and a reset button. It is inexpensive controller which is easy to use for beginners.
B. IR Sensor
An Infrared sensor is an electronic instrument which is used to sense certain characteristics of its surroundings by either emitting or detecting the IR radiation. Since IR radiation is invisible to human eye it can be used in wireless communication. It usually consists of IR transmitter and receiver. A remote control patterns a flash of invisible light which is turned into an instruction and is received by the receiver module.

C. Ethernet Shield
The Arduino Ethernet Shield R3 allows Arduino board to connect to the internet. It is based on the Wiz net W5100 Ethernet chip. The Wiz net W5100 provides a network stack capable of both TCP and UDP. It supports up to four simultaneous socket connections. Use the Ethernet library to write sketches which connect to the internet using Ethernet Shield.

D. Load Cell
A load cell is a sensor or a transducer that converts a load or force acting on it into an electronic signal. This electronic signal can be a voltage change, current change or frequency change depending on the type of load cell and circuitry used. There are 2 different kinds of load cells. They are capacitive and resistive load cells. Resistive load cells work on the principle of Piezo-resistivity. Capacitive load cells work on the principle of change of capacitance which is the ability of a system to hold a certain amount of charge when a voltage is applied to it.

E. SPI
The Serial Peripheral Interface bus is synchronous serial communication interface used for short distance communication. SPI devices communicate in full duplex mode using a master slave architecture with single master. The master devices originates the frame for reading and writing. Multi slave devices are supported through selection with individual slave select lines. SPI is also called as four wire serial bus.

F. Power Supply
Power supply is a reference to a source of an electrical power. A device that supplies an electrical or other type of energy to an output load or group of loads is called a power supply unit. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

V. SOFTWARE DESCRIPTION
A. Arduino Software
The Arduino Software is provided with many functionality, operability which includes with and without limitations. The Open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X and Linux. The environment is written in Java and based on Processing and other open-source Software.

VI. HARDWARE IMPLEMENTATION
The IR Sensor is fitted at the top of the lid which detects the level of waste and the load cell is fitted at the bottom to detect the weight. The Arduino Uno is provided with Ethernet shield where it allows arduino to connect to the internet using Ethernet library. This shield is fully compatible with the former version. To use this shield, it should be mounted on the top of arduino board. To upload the sketches it should be connected to computer using USB cable. Once the sketches are uploaded it can be disconnected from the computer. The shield can be connected to computer or network hub or router using standard Ethernet cable. Here SPI is also used to send the data between the controller. Through this Ethernet shield the information about the bins are sent to the webpage and the webpage contains the information such as location, level, weight and status of the bin. The model of hardware implementation is shown fig.8

VII. SOFTWARE IMPLEMENTATION
A. Embedded C in Arduino
Arduino Uno board and its graphical development environment. It’s a tool that makes it easy to create programs. Stepping away from the default library and the Java IDE and using the compiler directly from the command line. In particular, using C to program the Arduino means usually being able to create smaller programs, and with more fine grained control of what happens. C is adopted worldwide to program for small microprocessors because it gives a good trade-off between development effort and program efficiency, and because of its history there are well-optimized libraries, extensive guides and ways to solve problems. The performance out of the board and the modular approach, shall move to C could be the right choice.

VIII. RESULT
The implementation of hardware and software for smart garbage collection system using sensors, microcontrollers and Ethernet shield module assures the cleaning of dustbins soon when the garbage level reaches its maximum. If the dustbin is not cleaned in specific time, then the record is sent
to the higher authority who can take appropriate action against the concerned contractor. This system also helps to monitor the fake reports and hence can reduce the corruption in the overall management system. This reduce the total number of trips of garbage collection vehicle and hence reduce the overall expenditure associated with the garbage collection. It ultimate helps to keep cleanliness in the society.

IX. FUTURE IMPLEMENTATION

In IOT, there is no standard for tagging and monitoring with sensors and there are several opportunities for failure with several systems. All the data must be encrypted so that data about your financial status. There is a chance that the software can be hacked and your personal information misuse.

In future implementation is using “Raspberry pi” because it is one of the cheapest development boards available with a lot of functionality. This methodology plan will significantly reduce costs, emissions and work hours.

Additionally, a special module can be designed to segregate the hazardous and non-hazardous wastes. So, it can be further recycled for green environment.

X. CONCLUSION

The objective of this project is to develop proper management of waste. With this objective a microcontroller based embedded system is integrated using IOT Technology. It portable and low cost. The overflowing of bins can be avoided in this technology. It can also provide all required information’s such as collection time etc. The technology is robust, cheaper, and easy to use due to low cost of sensor.

REFERENCES


