Waste management system for Smart city using Raspberry Pi and Thing speak cloud

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Abstract- The Internet of Things (IoT), as expected infrastructure for the envisioned concept of Smart City, brings new possibilities for the city management. IoT vision introduces promising and economical solutions for massive data collection and its analysis which can be applied in many domains and so make them operate more efficiently. Normally there is one of the most challenging issues - municipal waste-collection within the Smart City. To optimize the logistic procedure of waste collection. The presented solution provides a calculation of more efficient garbage-truck routes. As an output, we provide a set of simulations focused on the mentioned area. If the dustbin it fills we get some alert via the Buzzer also send the SMS to an authorized person in a particular time they didn't response we will intimate to the higher authorized persons.All the data from the sensors is uploaded to the thing speak cloud. And the date from the sensor will saved in the cloud.

Keyword- SMS, THINGSPEAK CLOUD, ULTRASONIC SENSOR

I. INTRODUCTION

The Smart City represents nowadays hot topic in terms of improving living conditions. Considering mainly the situation in European Union, the EU national governments and also private companies are investing every year a significant amount of their budgets to research, development,and implementation of the concept of Smart City. The Internet of Things (IoT) is currently considered as a basic communication infrastructure for smart cities, where machines communicate automatically between each other. The biggest advantage is the cooperation of many different communication technologies and devices within one functional system, where a big amount of information and data are shared and used in a secure and smart way. A smart city is nothing but a vision to integrate several information and communication technology (ICT) along with Internet-of-Things (IoT) in a way so as to manage a city's assets . The city's assets include, among others, the local departments, information systems, libraries, schools, hospitals, waste management systems, transportation systems etc. Currently, Indian cities accommodate nearly 31% of current population and contributes to 63% of GDP (Census 2014) . Urban areas are expected to house 40% of India's population and contribute 75% of India's GDP by 2030. This requires comprehensive development of infrastructures pertaining to social, economical, physical, and institutional fields . All are important in improving the quality of life and attracting people and investment. Development of smart cities is a step in that direction. In this paper, we discuss a smart mechanism for improving the management of wastes in cities. The proposed system is based on the foundation of geographic information systems (GIS), and optimization algorithms. It consists of an IoT based prototype with sensors to measure the waste volume in containers or wastebins, with facility to transmit information over the Internet. The system is simulated in for the city of Pune, using Open Data. The simulation covers a period of one month to model wastebin filling and waste collection. The simulations are done for performing an efficiency comparison of different ways for collection of wastes: Traditional method and dynamic on-demand solution, proposed work (intelligent) for several cases. The effect of this work is an combined system model for smart waste collection system. The rest of the paper is organized into the following sections. Proposed work is covered in section 2. Section 3 covers simulation and results of the proposed system.

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II. EXISTING SYSTEM

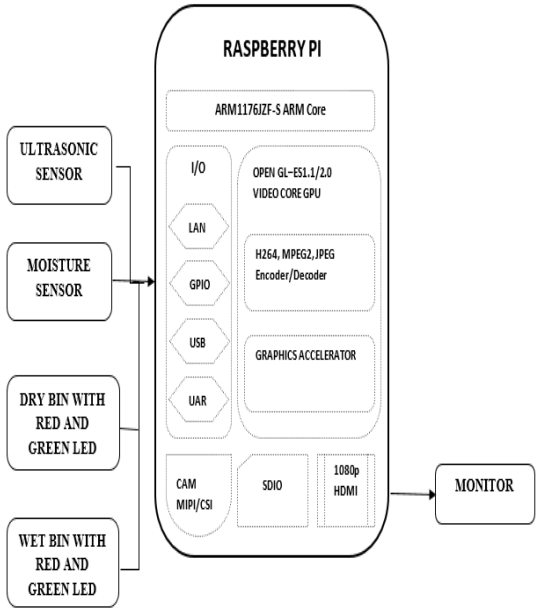
In the existing system, garbage is collected by the corporation by weekly once or by 2 days once. Though the garbage strikes and overflows the garbage bin and spread over the roads and pollutes the environment which produces air pollution causes several diseases.

III. PROPOSED SYSTEM

In this Proposed System consists of a mechanical setup that separates the waste and Manages the waste in a different type

of box by using automation.In this system, we detect the dry and wet waste also and this kind of waste we separate by automatically. By having such a system in multiple places every thing is monitored and controlled by centralized node using IoT technology and using Thingspeak cloud to store the data.

IV. BLOCK DIAGRAM:



V. HARDWARE TOOLS

- Raspberry Pi
- Ultrasonic sensor
- Moisture Sensor

VI. SOFTWARE TOOLS

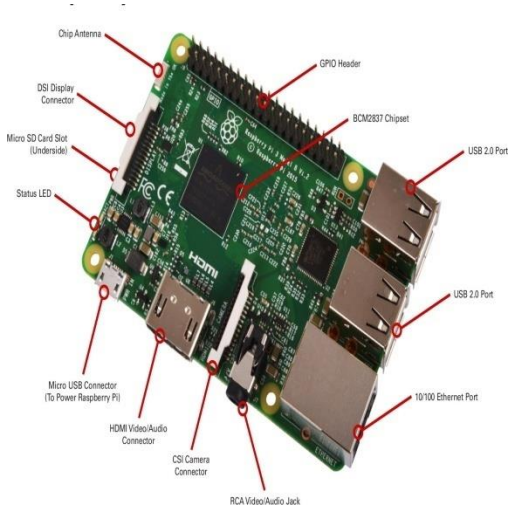
- Raspbian Jessie OS
- Language: Python
- Thingspeak cloud

VII. HARDWARE COMPONENTS

A. RASPBERRY PI

The Raspberry Pi foundation is working on yet another model of the popular Raspberry Pi boards, as the Raspberry Pi 3 model B board. The new board looks very similar to Raspberry Pi 2 model B, but adds on-board WiFi 802.11 b/g/n (2.4GHz only) and Bluetooth 4.0. Let's play "spot the difference" with Raspberry Pi 2 at the top and Raspberry Pi 3 under.We'll find the WiFi/BT chip antenna on the top left corner, and two through holes on the right of the 40-pin connectors, likely the RUN header for reset that can be found on the RPi2 where the chip antenna is now placed on RPi 3. So the through holes are not new, they've just moved it. All connectors have the exact same placement between the two versions. Let's check out the other side of the board.

The wireless module (likely Broadcom based) can be found just above the micro SD slot, and J5 connector is soldered. J5 is the JTAG connector, so it will probably not be soldered with the version that ships. The picture is not very clear but it looks like they've used the same Elpida B8132B4PB-8D-F RAM chip (1GB) as on Raspberry Pi 2. So although we can't be 100% certain right now, the RAM appears to be the same, and the processor is still connected to a similar USB to Ethernet chip, so they've probably kept the same architecture, expect possibly for the CPU core. So the only major changes on Raspberry Pi 3 appears to be built-in Wi-Fi and Bluetooth, and 64-bit ARM cores (likely Cortex A53).



- SoC – Broadcom BCM2837 64bit ARMv8 quad core Cortex A53 processor @ 1.2GHz with dual core VideoCore IV GPU @ 400 MHz supporting OpenGL ES 2.0, hardware-accelerated OpenVG, and 1080p30 H.264 high-profile decode. Capable of 1Gpixel/s, 1.5Gtexel/s or 24GFLOPs with texture filtering and DMA infrastructure
- System Memory – 1GB LPDDR2
- Storage – micro SD slot
- Video & Audio Output – HDMI 1.4 and 4-pole stereo audio and composite video port
- Connectivity – 10/100M Ethernet, WiFi 802.11 b/g/n up to 150Mbps and Bluetooth 4.1 LE (BCM43438 module)
- USB – 4x USB 2.0 host ports (with better power management, allowing higher power peripherals), 1x micro USB port for power
- Expansion
  - 40-pin GPIO header

MIPI DSI for Raspberry Pi touch screen display

B. ULTRASONIC SENSOR

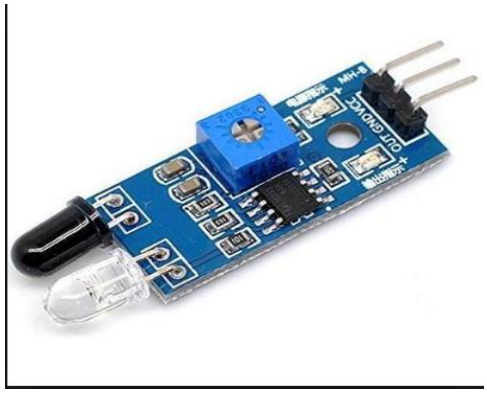
Ultrasonic sensors service the market by providing a cost effective sensing method with unique properties not possessed by other sensing technologies. By using a wide variety of ultrasonic transducers and several different frequency ranges, an ultrasonic sensor can be designed to solve many application problems that are cost prohibitive or simply cannot be solved by other sensors.

Long range detection: In industrial sensing, more and more applications require detection over distance. Ultrasonic sensors detect over long ranges up to forty feet, while limit switches and inductive sensors do not.

Broad area detection: While some photo electric sensors can detect over long distances they lack the ability to detect over a wide area without using a large number of sensors. The advantage of Migatron's ultrasonic sensors is that both wide and narrow areas can be covered. All it takes is the proper ultrasonic transducer selection. **Widest range of target materials:**Only ultrasonic sensors are impervious to target material composition. The target material can be clear, solid, liquid, porous, soft, wood and any color because all can be detected.

Non contact distance measuring: Because sound can be timed from when it leaves the transducer to when it returns, distance measuring is easy and accurate to .05% of range which equates to +or- .002 of an inch at a distance of 4 inches. It is Migatron's continuing goal to provide ultrasonic sensors in industrially hardened packages that are electrically and electronically compatible with standard controls used in today's industrial marketplace.

C. IR SENSOR



IR LED at 900nm-GaAlAs Infrared Light

we decided to use blinking as we wanted the device to be functional for non-vocal or ventilated users (blowing or sucking was another option). Our first idea,and the one we implemented, was to use a led/photodiode pair to reflect light off the eye. We found that Optek Inc. makes a round receiver, consisting of a LED and aphoto transistor mounted on the same unit. This detected a strong increase in signal upon blinking. We were worried about detecting the difference between normal and intentional blinks, but we found that for most users the intentional blinks produced a much stronger signal, and they were always much longer the ~300ms normal blink duration

D. DC MOTOR

DC motors are configured in many types and sizes, including brush less, servo, and gear motor types. A motor consists of a rotor and a permanent magnetic field stator. The magnetic field is maintained using either permanent magnets or electromagnetic windings. DC motors are most commonly used in variable speed and torque. Motion and controls cover a wide range of components that in some way are used to generate and/or control motion. Areas within this category include bearings and bushings, clutches and brakes, controls and drives, drive components, encoders and resolves, Integrated motion control, limit switches, linear actuators, linear and rotary motion components, linear position sensing, motors (both AC and DC motors), orientation position sensing, pneumatics and pneumatic components, positioning stages, slides and guides, power transmission (mechanical), seals, slip rings, solenoids, springs.

Motors are the devices that provide the actual speed and torque in a drive system. This family includes AC motor types (single and multiphase motors, universal, servo motors, induction, synchronous, and gear motor) and DC motors (brush less, servo motor, and gear motor) as well as linear, stepper and air motors, and motor contactors and starters.

E. L293D MOTOR DRIVER

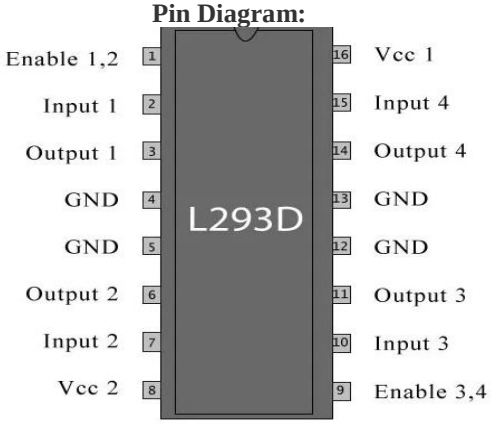
L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors.

L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop

the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively.

Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

Pin Diagram:



F. SOFTWARE TOOLS

This chapter introduces the devices and software which are used in this bachelor's thesis. The chapter also contains short introduction to the Linux operating system which is used in this thesis.

Linux

Linux is a free open source operating system and it belongs to the Unix operating systems. Actually Linux means the kernel itself which is the heart of the operating system and handles the communication between the user and hardware. Normally Linux is used to refer to the whole Linux distribution. (Upton, E. & Halfacree, G. 2012, 28.)

Linux distribution is a collection of software based on the Linux Kernel. It consists of the GNU-project's components and applications. Because Linux is an open source project, anyone can modify and distribute it. That is the reason why there are many variations of Linux distributions. Most popular distributions are Ubuntu, Red Hat Linux, Debian GNU/Linux and SuSe Linux. (Kuutti, W. & Rantala, A. 2007, 2.)

Linux compared to Windows

When comparing Linux and Windows as operating systems, one of the major dif-ferences are that Linux is an open-source project and Windows is a closed-source project. In the closed-source project the users sees only the finished product but do not know how it has been done. In open-source projects everything is made fully visible to the public. (Upton, E. & Halfacree, G. 2012, 13-14.)

In practice this can be seen in Linux's easy customization for different platforms. This process is called porting. There are several distributions ported to the Rasp-berry Pi's BCM2835 chip. One of the distributions is called Raspbian Wheezy. (Up-ton, E. & Halfacree, G. 2012, 14.)

Raspbian Wheezy

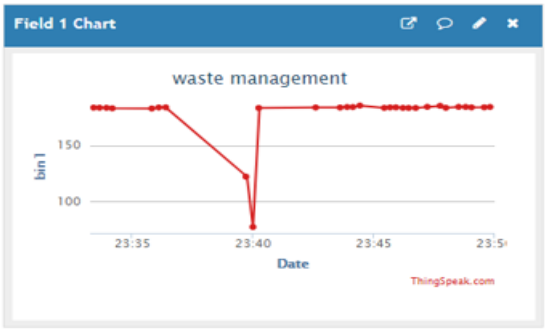
Raspbian Wheezy is a free operating system based on Debian distribution. It is created by a small team of developers who are fans of Raspberry Pi. Raspbian is optimized for the Raspberry Pi's hardware and it comes with over 35 000 packag-es and pre-compiled software. Raspbian is still under active development and it aims to improve the stability and performance of the Debian packages. (Raspbian [Ref. 15.2.2015])

Raspbian is officially recommended for beginners and it includes the graphical desktop environment called LXDE. Raspbian Wheezy is one of the fastest ways to setup and get the RasPi running. (McManus, S. & Cook, M. 2013, 20.)

Programming languages

There are considerable numbers of programming languages which have been adapted for Raspberry Pi. Python programming language is recommended by The Raspberry Pi foundation especially for the beginners. Basically any programming language which can be compiled for ARMv6 can run on the Raspberry Pi. There-fore the users are not restricted to use only the Python. On the Raspberry Pi there are

VIII. RESULTS



IX. CONCLUSION

The article introduced the upcoming IoT infrastructure for smart cities and put it in the context of municipal waste management. Given overview showed that it is not yet enough discussed the possibility of using genetic algorithms as an optimization method for waste collection. This system result is based on the idea of IoT infrastructure, which should provide enough information to handle this Smart City issue more efficiently.

FUTURE SCOPE The authors are continuously working to upgrade the Smart dustbin so as to address a wide number of current shortcomings. The problems of foul odour and manual controlled mobility calls for the future scope which includes the odour control mechanism to get rid of foul smell of organic garbage. Also, realising the requirement of an autonomous dustbin, GPS module can be implemented for path planning combined with ultrasonic sensor for obstacle avoidance.

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