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Smart dust bin based on IOT monitoring system

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ABSTRACT

Nowadays, waste management is one of the problems on which millions of dollars are spent worldwide. the key issue in waste management is waste collection and sorting. Also, one of the issues in the waste management is that the garbage bin at public places gets overflowed in advance before the commencement of the next cleaning process. This, in turn, leads to various hazards such as bad odor & ugliness to that place which may be the root cause for the spread of various diseases. To tackle this problem, we propose the IOT enabled dustbins in this paper. these bins, use ultrasonic sensors for quantity measurement and infrared sensor for tracking of the wastes linked with a web-based online system and according to the level of waste added, host server calculates the points and updates in the IOT (Internet of Things). Also, it measures the fullness of the dustbins and updates the status of each dustbin on the municipal server. It notifies them when the dustbin is full and provides alert to empty all the dustbins based on the capacity of the municipal waste loading vehicles. Our system, target two crucial problems, cost efficiency in waste sorting and waste collection processes.

Keywords: Smart Bins, Waste Management, IOT, Ultrasonic Sensor, Infrared Sensor, Dustbins

INTRODUCTION

Today waste is a problem on which huge sums of money is spent each year for its collection and segregation process. India particularly generates approximately 133 760 tons of MSW per day, of which approximately 91 152 tones is collected, and a huge sum of money is spent on collection.

Our proposed system, 'IoT enabled dustbins' can ease these major issues and will have two major functionalities. First, improvising current waste collection system so that the hazards of waste accumulation and cost in collection process are minimized. Second, prevents spilling of the waste all over the roads maintaining cleanliness. Costs related to waste collection are also minimized by routing system based on capacity of municipal trucks and the fullness of the dustbins, in order to get all the waste collected efficiently. Here we have used a microcontroller that acts as the central processing unit. We have used the Atmel microcontroller ATmega8. The sensors such as the ultrasonic sensor, infrared sensor, rain sensor are used. An esp8266 module is connected which accomplishes the task of IOT (Internet Of Things). The ultrasonic sensor is connected in such a way that when the garbage level crosses its sensing area it will give a signal to the microcontroller ATmega8. The infrared sensor is used to detect the overflow of garbage which happens when the bin is full. Upon these parameters the microcontroller ATmega8 will send an alert on the esp8266 module. Based on which the municipality employees will take the necessary action such as changing the bin or removing the waste by trucks. The closing lid of the dustbin is controlled by a motor which also closes automatically during rain. This will prevent decaying of wastes easily in the place.

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LITERATURE SURVEY

Describes on technology like ZigBee, GSM etc. that enables the remote monitoring of solid waste bin in real time and which will inform the authorized person when the garbage bin is about to fill. These technologies are good enough to ensure the practical and perfect for solid waste collection and transportation monitoring and management for greener environment. It doesn't have any user interaction site like websites and android application [1].

Describes the application of our model of "Smart Bin" in Managing the waste collection system of an entire city. The network of sensors enabled smart bins connected through the cellular network generates a large amount of data, which is further analyzed and visualized at efficiency of collecting the garbage is poor in Indian cities compared to other countries. The waste collection process in India is manual solution; NO SMS alert in this system [2].

BLOCK DIAGRAM

Ultrasonic Sensor is used to check the level of the dust bin. It can also update the status of the bin and sends this information to its nearest corporation office. An effective HTML based webpage is used to get the status in the office. It works by sending a sound wave, and it is received back from the other end. By calculating e time of travel of sound wave we can figure out the distance by, Distance = [Speed * Time]; Where Time = Time taken by the sound wave to reach the bin and return back Speed of travel is the Velocity of Sound which is equal to 330m/s. So, Distance = [Total distance travelled i.e.., required distance * 2]. And it can update the status of bin to corporation office by using SPI Ethernet shield through html pages. (The SPI Interface is used as the input output interface for the Arduino. Ethernet module is the additional module attached to the board which is to be used to connect with other computers/servers.

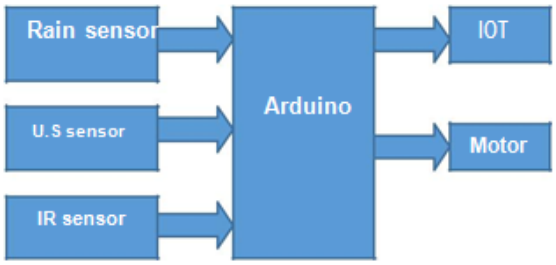


Fig: Block Diagram

EXISTING SYSTEM

In the proposed method, a Sensor node is installed in every Smart-bin with a power supply unit. The Sensor node senses bin fullness, reports readings and Sensor statuses by using Ethernet modern from Arduino UNO. It also has a function to locks the bin door when it is full and also at rain period. The real time to gain insights about the status of waste around the city. This paper also aims at encouraging further research in the topic of waste management. It is difficult to implement in large cities.

It can provide basic LAN based internet connection.) This is provided in recent advanced IOT methods to identify the bin by its ID. Rain Sensors are connected to detect rainfall, to avoid entering of rain water into the bin. It is a group of water Sensors clustered with an AND gate. So, it detects rain by placing three sensors around the bin. IR Sensor is used to detect the nearby objects which are placed closer to the bin (I= 0 or 1). If any object is placed closer to the bin, the buzzer will be turned ON to give an alert to the user and update the status in IOT. Relays and Motors are used to close the door automatically when it

receives bin full indication of ultrasonic Sensor and rain or water detection by rain Sensor [3].

PROPOSED SYSTEM

The proposed method is hardware based solution, here the sensors are placed inside the bin, it senses the garbage level in the bin whether it reached the threshold value or not. If it reached the threshold value, the hardware system directly sends the alert message to the garbage collector. After receiving the message, the garbage collector went to the place and collects the garbage from the bins. IR sensor sense the waste puts outside dustbin its run alarm. And also we can monitor through IOT.

BLOCK DIAGRAM

This system that we have proposed improves the current scenario, by bringing all the data on the internet so that systems operate more efficiently. Primarily, there is level sensor and overflow sensor that will be sending the data.

With the following data, we have a decision taking system that will decide whether to include the dustbin in the list of collection and mark it on the map of the municipal application. This will in fact save a lot of efforts and fuel wasted in collection process as real-time monitoring of bins is done. As well as the parameters of the dustbin is used to notify the user about the status of the dustbin so that user can dump their waste accordingly.

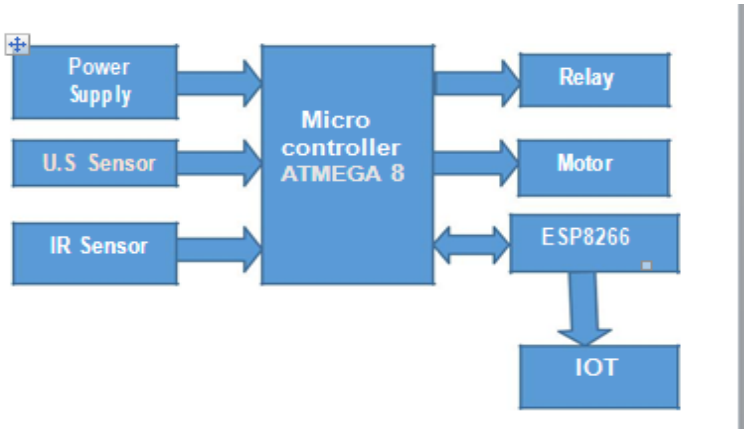


Fig: Block Diagram

For level monitoring we have ultrasonic sensor that updates the level of the bins. The rain sensor is used to detect rain and if it happens the lid of the dustbin is automatically closed. The infrared sensor is used to detect the overflow of wastes around the dustbin. All these parameters are also viewed in the IOT (Internet of Things) [4-9].

IMPLEMENTATION PLATFORM

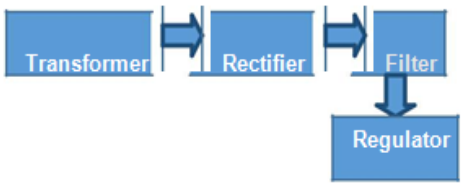
Hardware Requirements

- Power supply unit
- Microcontroller – ATMEGA 8A ESP8266
- Ultrasonic sensor Infrared sensor Rain sensor
- Motor

Software Requirements

- Platform - AVR STUDIO
- In System Programmer - ProgISP 172 Compiler – Win AVR

Power Supply



Transformer

A transformer is an electro-magnetic static device, which transfers electrical energy from one circuit to another, either at the same voltage or at different voltage but at the same frequency.

Rectifier

The function of the rectifier is to convert AC to DC current or voltage. Usually in the rectifier circuit full wave bridge rectifier is used.

Filter

The Filter is used to remove the pulsated AC. A filter circuit uses capacitor and inductor. The function of the capacitor is to block the DC voltage and bypass the AC voltage. The function of the inductor is to block the AC voltage and bypass the DC voltage.

Regulator

Voltage regulator constitutes an indispensable part of the power supply section of any electronic systems. The main advantage of the regulator ICs is that it regulates or maintains the output constant, in spite of the variation in the input supply [10].

Microcontroller-ATMEGA 8

- High-performance, Low-power AVR
- 8-bit Microcontroller
- 130 Powerful Instructions – Most Single-clock Cycle Execution
- 32 x 8 General Purpose Working Registers Fully Static Operation
- Up to 16 MIPS Throughput at 16 MHz

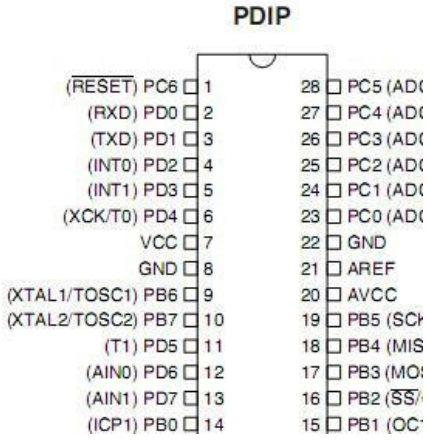


Fig: Pin Diagram

Pin Configuration

VCC: Digital supply voltage

GND: Ground

Port B (PB7…PB0): It is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for Each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins

are tri-stated when a reset condition becomes active, even if the clock is not running.

Port C (PC5…PC0): Port C is a 7-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port C output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tri-stated when a reset condition becomes active, even if the clock is not running.

Port D (PD7…PD0): Port D is a 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low will source current if the pull-up resistors are activated. The Port D pins are tri-stated when a reset condition becomes active, even if the clock is not running.

RESET (Reset input)

A low level on this pin for longer than the minimum pulse length will generate a reset, even if the clock is not running. The Shorter pulses are not guaranteed to generate a reset.

AVCC

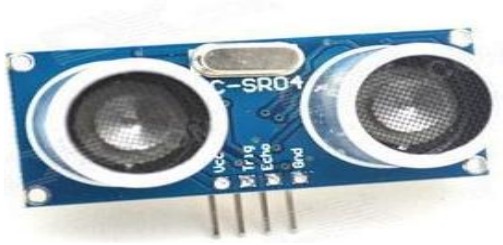
AVCC is the supply voltage pin for the A/D Converter, Port C (3…0), and ADC (7…6). It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter.

AREF

AREF is the analog reference pin for the A/D Converter. These pins are powered from the analog supply and serve as 10-bit ADC channels.

Ultrasonic Sensor

The Ultrasonic Sensor sends out a high-frequency sound pulse and then times how long it takes for the echo of the sound to reflect back. The sensor has 2 openings on its front. One opening transmits ultrasonic waves, (like a tiny speaker), the other receives them, (like a tiny microphone).



The speed of sound is approximately 341 meters (1100 feet) per second in air. The ultrasonic sensor uses this information along with the time difference between sending and receiving the sound pulse to determine the distance to an object. It uses the following mathematical equation: Distance = Time x Speed of Sound divided by 2 D. Infrared Sensor

Infra-red is connected to detect wastes placed around the dustbin. When an object is thrown near the bin, the infra-red sensor detects it and switches ON the buzzer.

Fig: Infrared Sensor

Rain Sensor

Rain sensors shown in Figure are connected to detect rainfall, Rain sensors are a group of water sensors clustered with an AND gate. So, a rain sensor detects rain by placing water sensors on the various sides, and by using the data on all the water sensors, a rain is detected.

Fig: Rain Sensor

ESP8266

The ESP8266 is a low cost micro Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by manufacturer Express if Systems in Shanghai, china. It is a highly integrated chip designed to provide full internet connectivity in a small package.

AVR (Automatic Voltage Regulation)

The AVR is a modified Harvard architecture machine where program and data are stored in separate physical memory systems that appear in Different address spaces, but having the ability to read data items from program memory using special instructions.

Features

- Multifunction, bi-directional general purpose I/O ports with configurable, Multiple internal oscillators, including RC oscillator without external parts
- Optional boot code section with independent lock bits for protection

Workspace of Software

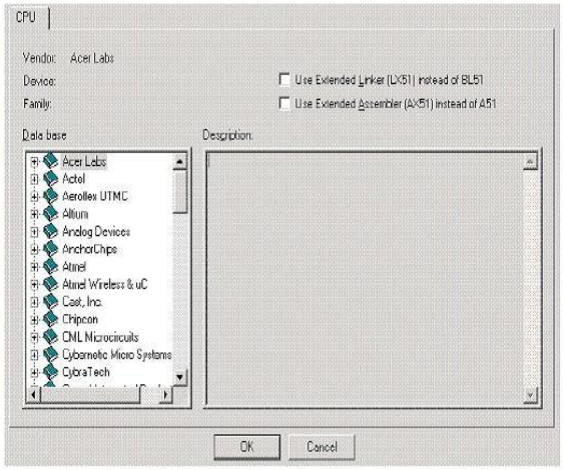


Fig: Window for Choosing target Device Micro Vision must be instructed to generate

A HEX file upon program compilation. A HEX file is a standard file format for storing executable code that is to be loaded onto the microcontroller. In the "Project Workspace" pane at the left, right–click on "Target 1" and select "Options for Target 1". Under the "Output" tab of the resulting options dialog, ensure that both the "Create Executable" and "Create HEX File" options are checked. Then click "OK".

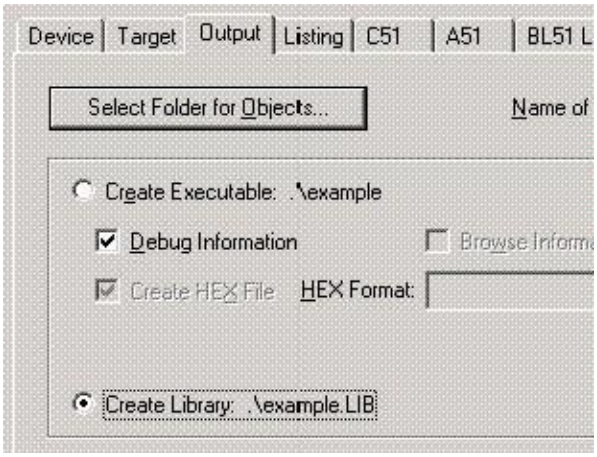


Fig: Project Option Dialog Box

Next, a file must be added to the project that will contain the project code. To do this, expand the "Target 1" heading, right–click on the "Source Group 1" folder, and select "Add files…" Create a new blank file (the file name should end in ".asm"), select it, and click "Add." The new file should now appear in the "Project Workspace" pane under the "Source Group 1" folder. Double-click on the newly created file to open it in the editor.

All code for this lab will go in this file. To compile the program, first save all source files by clicking on the "Save All" button, and then click on the "Rebuild All Target Files" to compile the program as shown in the figure below. If any errors or warnings occur during compilation, they will be displayed in the output window at the bottom of the screen. All errors and warnings will reference the line and column number in which they occur along with a description of the problem so that they can be easily located. Note that only errors indicate that the compilation failed, warnings do not (though it is generally a good idea to look into them anyway).

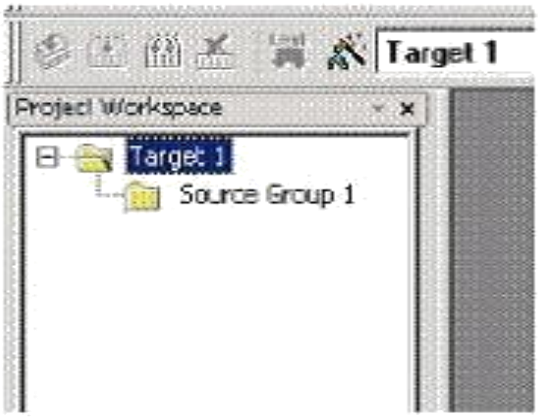


Fig: Project Workspace Panel

At the left side of the debugger window, a table is displayed containing several key parameters about the simulated microcontroller, most notably the elapsed time (circled in the figure below). Just above that, there are several buttons that control code execution.

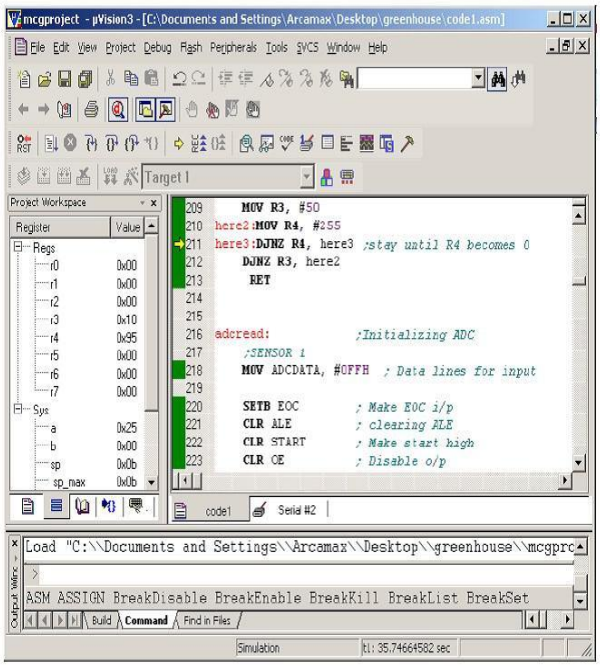


Fig: µVision3 Debugger window

The “Run” button will cause the program to run continuously until a breakpoint is reached, whereas the “Step Into” button will execute the next line of code and then pause (the current position in the program is indicated by a yellow arrow to the left of the code).

CIRCUIT DIAGRAM

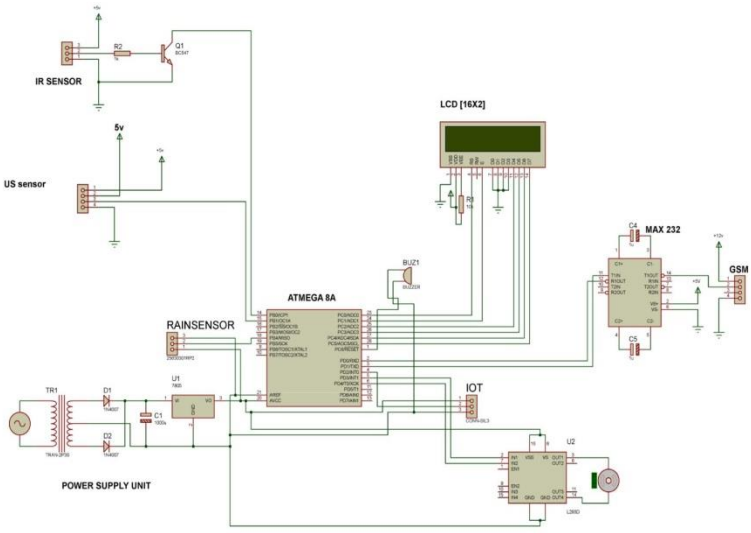


Fig: Circuit Diagram

The microcontroller atmega8 acts as the main console of the system. The infrared sensor is fixed inside dustbin. It is placed in such a way that if the bin reaches its full capacity the sensor is to intimate the microcontroller. On receiving the signal from the sensor, the microcontroller will perform other tasks. Tasks such as collecting the GPS coordinates via the Global System for Mobile communication (GSM) module. Then transmitting the coordinates along with a message notifying that the bin is full [4-9].

RESULT

Fig: Output View

CONCLUSION

In this paper, we have demonstrated a promising approach to manage the waste with increased efficiency so that the huge sums of money involved in the waste collection systems are minimized and the process is eased for both, the citizens and the government. Moreover, the problem related to the spilling of the waste due to overfilling is also solved. The most important part where the huge sums of money is involved is the fuel wastage to physically visit for collection where it is not necessary and check each dustbin if it is full or not. This issue could be solved through implementing such a system. This system could be implemented in developing countries like India, facing such issues for proper waste management and high expenditure on waste collection systems.

FUTURE SCOPE

In future, the problem of waste segregation could be taken into consideration, as it is yet one of the major parts where huge amounts of money are spent and is the problem faced by many countries. Also, the extended version of this paper could include a better approach for waste analysis that has a better approach to monitor the levels of the bins.

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