GSM Based Garbage Bin Monitoring System Using ARM7

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Abstract- *Solid waste management is a big challenge in urban areas for most of the countries throughout the world. An efficient waste management for maintain a safe and green environment as there are increasing all kinds of waste disposal.There are many technologies which are used for waste collection as well as for well managed recycling. In this project, we have introduced an integrated system combined with an integrated system of Global System for Mobile Communication (GSM).The sensors would be placed in the common garbage bins placed on the public places. When the garbage reaches the top level of the sensor (ultrasonic distance sensor), then that indication will be given to ARM 7 Controller. The controller will give indication to the driver of garbage collection truck as to which garbage bin is completely filled and needs urgent attention. ARM 7 will give indication by sending SMS using GSM technology.*

Keywords- Ultrasonic sensor, ARM7, GSM.

I. INTRODUCTION

In Day to Day life, we see the pictures of garbage bins being overfull and all the garbage spills out resulting in pollution. This also increases number of diseases as large number of insects and mosquitoes breed on it. Hence our problem statement is to design a System Based on Arm 7 for collecting the garbage from a particular area – the area whose public Garbage Bins are overflowing with prior concern.

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1.1 INTRODUCTION TO EMBEDDED SYSTEMS:

An embedded system can be defined as a computing device that does a specific focused job. Appliances such as the air-conditioner, VCD player, DVD player, printer, fax machine, mobile phone etc. are examples of embedded systems. Each of these appliances will have a processor and special hardware to meet the specific requirement of the application along with the embedded software that is executed by the processor for meeting that specific requirement. The embedded software is also called “firm ware”. The desktop/laptop computer is a general purpose computer.

Embedded systems do a very specific task, they cannot be programmed to do different things. Games, word processing, accounting, software development and so on. In contains Embedded Embedded systems have very limited resources, particularly You can use it for a variety of applications such as playing systems have to work against some deadlines. A specific job has to be completed within a specific time. In some embedded systems, called real-time systems, the deadlines are stringent. Missing a deadline may cause a catastrophe-loss of life or damage to property. Embedded systems are constrained for power. As many embedded systems operate through a battery, the power consumption has to be very low.Some embedded systems have to operate in extreme environmental conditions such as very high temperatures and humidity.

1.2 APPLICATION AREAS:

Nearly 99 per cent of the processors manufactured end up in embedded systems. The embedded system market is one of the highest growth areas as these systems are used in very market segment- consumer electronics, office automation, industrial automation, biomedical engineering, wireless communication, data communication, telecommunications, transportation, military and so on.

Consumer appliances:

At home we use a number of embedded systems which include digital camera, digital diary, DVD player, electronic toys, microwave oven, remote controls for TV and air-conditioner, VCO player, video game consoles, video recorders etc. Today's high-tech car has about 20 embedded systems for transmission control, engine spark control, air-conditioning, navigation etc. Even wristwatches are now becoming embedded systems. The palmtops are powerful embedded systems using which we can carry out many general-purpose tasks such as playing games and word processing.

Office automation:

The office automation products using em embedded systems are copying machine, fax machine, key telephone, modem, printer, scanner etc.

Industrial automation:

Today a lot of industries use embedded systems for process control. These include pharmaceutical, cement, sugar, oil exploration, nuclear energy, electricity generation and transmission. The embedded systems for industrial use are designed to carry out specific tasks such as monitoring the temperature, pressure, humidity, voltage, current etc., and then take appropriate action based on the monitored levels to control other devices or to send information to a centralized monitoring station. In hazardous industrial environment, where human presence has to be avoided, robots are used, which are programmed to do specific jobs. The robots are now becoming very powerful and carry out many interesting and complicated tasks such as hardware assembly.

Medical electronics:

Almost every medical equipment in the hospital is an embedded system. These equipments include diagnostic aids such as ECG, EEG, blood pressure measuring devices, X-ray scanners; equipment used in blood analysis, radiation, colonoscopy, endoscopy etc. Developments in medical electronics have paved way for more accurate diagnosis of diseases.

Computer networking:

Computer networking products such as bridges, routers, Integrated Services Digital Networks (ISDN), Asynchronous Transfer Mode (ATM), X.25 and frame relay switches are embedded systems which implement the necessary data communication protocols. For example, a router interconnects two networks. The two networks may be running different protocol stacks. The router's function is to obtain the data packets from incoming pores, analyze the packets and send them towards the destination after doing necessary protocol conversion. Most networking equipments, other than the end systems (desktop computers) we use to access the networks, are embedded systems.

Telecommunications:

In the field of telecommunications, the embedded systems can be categorized as subscriber terminals and network equipment. The subscriber terminals such as key telephones, ISDN phones, terminal adapters, web cameras are embedded systems. The network equipment includes multiplexers, multiple access systems, Packet Assemblers Dissemblers (PADs), sate11ite modems etc. IP phone, IP gateway, IP gatekeeper etc. are the latest embedded systems that provide very low cost voice communication over the Internet.

Wireless technologies:

Advances in mobile communications are paving way for m way for many interesting applications using embedded systems. The mobile phone is one of the marvels of the last decade of the 20'h century. It is a very powerful embedded system that provides voice communication while we are on the move. The Personal Digital Assistants and the palmtops can now be used to access multimedia services over the Internet. Mobile communication infrastructure such as base station controllers, mobile switching centers are also powerful embedded systems.

Security:

Security of persons and information has always been a major issue. We need to protect our homes and offices; and also the information we transmit and store. Developing embedded systems for security applications is one of the most lucrative businesses nowadays. Security devices at homes, offices, airports etc. for authentication and verification are embedded systems. Encryption devices are nearly 99 per cent of the processors that are manufactured end up in embedded systems. Embedded systems find applications in. every industrial segment consumer electronics, transportation, avionics, biomedical engineering, manufacturing, process control and industrial automation, data communication, telecommunication, defense, security etc. Used to encrypt the data/voice being transmitted on communication links such as telephone lines. Biometric systems using fingerprint and face

recognition are now being extensively used for user authentication in banking applications as well as for access control in high security buildings.

Finance:

Financial dealing through cash and cheques are now slowly paving way for transactions using smart cards and ATM (Automatic Teller Machine, also expanded as Any Time Money) machines. Smart card, of the size of a credit card, has a small micro-controller and memory; and it interacts with the smart card reader! ATM machine and acts as an electronic wallet. Smart card technology has the capability of ushering in a cashless society.

It is no exaggeration to say that eyes wherever you go, you can see, or at least feel, the work of an embedded system.

1.3 OVERVIEW OF EMBEDDED SYSTEM ARCHITECTURE:

Every embedded system consists of custom-built hardware built around a Central Processing Unit (CPU). This hardware also contains memory chips onto which the software is loaded. The software residing on the memory chip is also called the 'firmware'. The embedded system architecture can be represented as a layered architecture as shown in Fig.

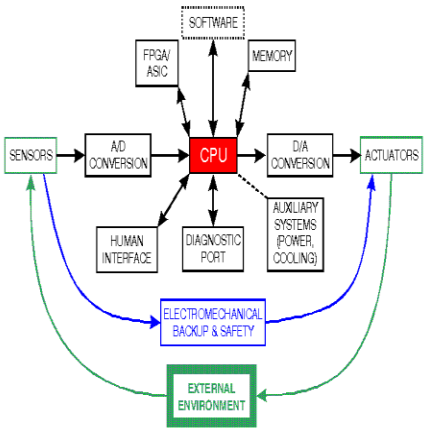

Fig 1.1 Over view Diagram of embedded system

The operating system runs above the hardware, and the application software runs above the operating system. The same architecture is applicable to any computer including a desktop computer. However, there are significant differences. It is not compulsory to have an operating system in every embedded system. For small appliances such as remote control units, air conditioners, toys etc., there is no need *for* an operating system and you can write only the software specific to that application. For applications involving complex processing, it is advisable to have an operating system. In such a case, you need to integrate the application software with the operating system and then transfer the entire software on to the memory chip.

II. HARDWARE IMPLEMENTATION OF THE PROJECT DESIGN

There are many technologies which are used for waste collection as well as for well managed recycling. In this project, we have introduced an integrated system combined with an integrated system of Global System for Mobile Communication (GSM).The sensors would be placed in the common garbage bins placed on the public places. When the garbage reaches the top level of the sensor **(ultrasonic distance sensor),** then that indication will be given to ARM 7 Controller. The controller will give indication to the driver of garbage collection truck as to which garbage bin is completely filled and needs urgent attention. ARM 7 will give indication by sending SMS using GSM technology.

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III. SOFTWARE IMPLEMENTATION

3.1 Software Requirements:

- Embedded 'C'
- KIEL software

3.2 Kiel software:

Kiel compiler is software used where the machine language code is written and compiled. After compilation, the machine source code is converted into hex code which is to be dumped into the microcontroller for further processing. Kiel compiler also supports C language code.

3.3 Steps to write an assembly language program in keil and how to compile it:

1. Install the Kiel Software in the PC in any of the drives.
2. After installation, an icon will be created with the name "Kiel uVision4". Just drag this icon onto the desktop so that it becomes easy whenever you try to write programs in Kiel.
3. Double click on this icon to start the Kiel compiler.
4. A page opens with different options in it showing the project workspace at the leftmost corner side, output window in the bottom and an ash coloured space for the program to be written.
    1. Now to start using the Kiel, click on the option "project".
    2. A small window opens showing the options like new project, import project, open project etc. Click on "New project".
    3. A small window with the title bar "Create new project" opens. The window asks the user to give the project name with which it should be created and the destination location. The project can be created in any of the drives available. You can create a new folder and then a new file or can create directly a new file.
    4. After the file is saved in the given destination location, a window opens where a list of vendors will be displayed and you have to select the device for the target you have created.
    5. The most widely used vendor is ARM. So click on Atmel and now the family of microcontrollers manufactured by ARM opens. You can select any one of the microcontrollers according to the requirement.
    6. When you click on any one of the microcontrollers, the features of that particular microcontroller will be displayed on the right side of the page. The most appropriate microcontroller with which most of the projects can be implemented is the LPC2148. Click on this microcontroller and have a look at its features. Now click on "OK" to select this microcontroller.
7. A small window opens asking whether to copy the startup code into the file you have created just now. Just click on "No" to proceed further.
8. Now you can see the TARGET and SOURCE GROUP created in the project workspace.
9. Now click on "File" and in that "New". A new page opens and you can start writing program in it.
10. After the program is completed, save it with any name but with the .asm extension. Save the program in the file you have created earlier.
11. You can notice that after you save the program, the predefined keywords will be highlighted in bold letters.
12. Now add this file to the target by giving a right click on the source group. A list of options open and in that select "Add files to the source group". Check for this file where you have saved and add it.
13. Right click on the target and select the first option "Options for target". A window opens with different options like device, target, output etc. First click on "target".
14. Since the set frequency of the microcontroller is 11.0592 MHz to interface with the PC, just enter this frequency value in the Xtal (MHz) text area and put a tick on the Use on-chip ROM. This is because the program what we write here in the keil will later be dumped into the microcontroller and will be stored in the inbuilt ROM in the microcontroller.
15. Now click the option "Output" and give any name to the hex file to be created in the "Name of executable" text area and put a tick to the "Create HEX file" option present in the same window. The hex file can be created in any of the drives. You can change the folder by clicking on "Select folder for Objects".
16. Now to check whether the program you have written is errorless or not, click on the icon exactly below the "Open file" icon which is nothing but Build Target icon. You can even use the shortcut key F7 to compile the program written.
17. To check for the output, there are several windows like serial window, memory window, project window etc. Depending on the program you have written, select the appropriate window to see the output by entering into debug mode.
18. The icon with the letter "d" indicates the debug mode.

Click on this icon and now click on the option "View" and select the appropriate window to check for the output.

IV. WORKING PROCEDURE

The input to the sensor module would come from the waste bin which are placed different localities in the public area The sensor is placed in the garbage bin at a max level , if that level is crossed by the garbage in the bin, then sensor will sense that and will communicate to ARM 7 controller through GSM technology.

When the garbage box 1 becomes full, the ultrasonic sensor attached to its lid will detect the level and send a command through GSM. The GSM receiver will receive that command and show the condition of garbage box on Liquid Crystal Display and on the computer .The Message would be that the garbage bin 1 in particular area is filled completely, please collect it".

At the same time a same message will be sent to a driver's mobile that particular garbage bin is completely full through Short Message Service. Same thing will happen when the garbage box 2 becomes full; the ultrasonic sensor will detect the level and send a command through GSM that garbage bin 2 in another area is filled completely , please collect it. At the same time a same message will be sent to a driver's mobile to collect the garbage bins through Short Message Service. By Instance even if both the garbage bin are full at the same time, then also both messages will be displayed on Liquid Crystal Display and. Also Short Message Service will be sent to driver's mobile one by one.

V. RESULT

Fig.5.1: overall view project kit

Fig5.2: Power Generation in Garbage Bin1, When Green LED as Indication of Power Generation

Fig5.3: Power Generation in Garbage Bin2, when white LED as Indication of Power Generation

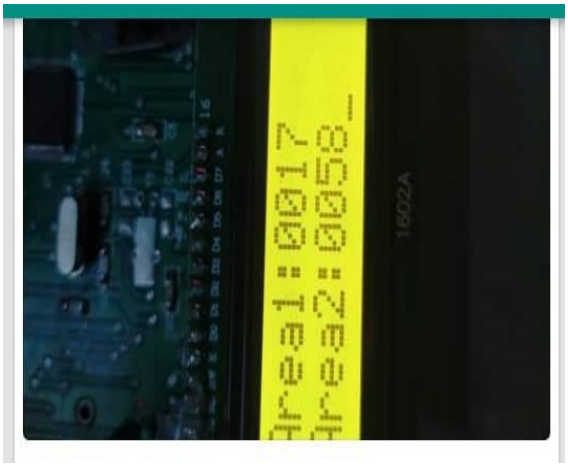

Fig5.4: Area1 Filled the Bin Distance Value Decreased To Low

Fig5.5: Area2 Filled the Bin Distance Value Decreased To Low

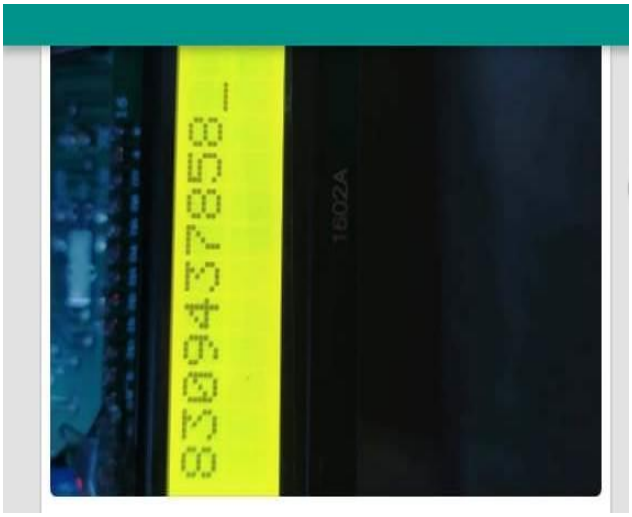

Fig5.6: Mobile Number Received on LCD Display

Fig5.7: Initial Garbage Bins Filling Status

VI. CONCLUSION

Municipal solid waste management (MSWM) is one of the major environmental problems of Indian cities. Improper management of municipal solid waste (MSW) causes hazards to inhabitants. Various studies reveal that about 90% of MSW is disposed of unscientifically in open dumps and landfills, creating problems to public health and the environment.

In the present study, an attempt has been made to provide a comprehensive review of the characteristics, generation, collection and transportation, disposal and treatment technologies of MSW practiced in India. This project solid waste monitoring and management system has been successfully implemented with the integration of communication technologies such as, GSM and for truck monitoring system In this system, truck database has been developed in the way that information of truck ID, driver ID, date and time of waste collection, etc. are compiled and stored for monitoring and management activities.

The proposed system would be able to monitor the solid waste collection process and management the overall collection process. It would provide in time solid waste collection and also overcome the disadvantages such as usage of minimum route, low fuel cost, clean environment and available vehicle. The technologies which are used in the proposed system are good enough to ensure the practical and perfect for solid waste collection process monitoring and management for green environment

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