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Heterogenous Waste Collecting Machine Using PLC

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Abstract: - Solid waste management is the basic essential service provided by municipal authorities in the country to keep the cities clean. The per capita waste generation rate in India has increased from 0.44 kg per day in 2003 to 0.5 kg per day in 2015. This shows that the serious attention is needed to dispose the wastages properly. The proposed idea has 2 objectives namely, to dispose the waste in a proper way regularly and to encourage the people for this activity by rewarding them. This system comprises of PIC microcontroller, PLC, waste collector bins etc., It provides a separate user login id for each house with a unique number which has the link to the server, It takes the user to their personal login through which the details of the household stored in SQL server, can be obtained. Whenever the dusts are dumped, then, it could be sensed through IR sensor. When waste dumping level reaches the already set level, probably 2 kg; automatically the amount will be credited in the user account. The amount credit details are seen as text message in the user mobile. The simulation output of this heterogeneous waste collecting machine is obtained by PROTEUS 8.0 software. The simulated output is verified with the hardware model developed.

Keywords: Solid Waste, Waste Collector Bins, PIC Microcontroller, Genie-Nx PLC, IR sensor.

I. INTRODUCTION

Solid waste is the unwanted solid materials generated from combined residential, industrial and commercial activities in a given area. Based on the characteristics of waste particles, it can be categorized such as organic material, glass, metals and plastic papers. Solid Waste management (SWM) is far from a new phenomenon in India; the Ministry of Food and Agriculture offered loans to ULBs for SWM. Management of solid waste reduces or eliminates the adverse impacts on human health; enhance the quality of human life and a number of processes are involved in effectively managing solid waste from the municipality. The process includes monitoring, collection, transport, processing, recycling and disposal. This prevents greenhouse gas emission, pollutants, conserve resources, save energy and reduce the demand for waste treatment technology and landfill space. Therefore, this method is incorporated and adopted as part of the waste management plan. Even though many schemes are implemented to manage solid wastes, but it does not properly utilized by the workers.

In the current scenario, mostly the Dust bins are placed at public places in the cities to collect the unwanted wastes (biodegradable and non-biodegradable). Those garbage bins are overflowing due to increase in the waste every day. It creates unsanitary condition for the people as well as, all small creatures in the world. This leads in spreading some deadly diseases such as dengue fever, cholera which affects the humans severely. Moreover it affects the environment cleanliness. In order to overcome these problems, a novel heterogeneous waste collecting machine is proposed. The proposed modernized and economically-benefitted machines are placed in the residential, industrial parts of the locality. The main aim of this idea is to make the surroundings more hygienic as well as wastes can be reused in proper manner such as power generation, preparing manures for agriculture etc. The persons who are disposing their wastes in proper manner will be appreciated by crediting the money to their account.

II. LITERATURE SURVEY

Prakash and et al., proposes "IOT Based Waste Management for Smart Cities". In this research paper, entire device setup is divided into two parts Transmitter section and receiver section. In the transmitter section, 8051 microcontroller, RF Transmitter and sensors are attached to the dustbin. Initially IR sensors placed in all dustbins is used to detect the level of solid wastes. Whenever the solid wastes reaches the threshold limit i.e. dustbin is full, IR receiver sends the data to 8051 microcontroller and the same data can be wirelessly transmitted to the Central system (Intel Galileo microcontroller) using RF Transmitter and receiver. Multiple transmitters can send data to Intel Galileo Gen2 Microcontroller which process those data's and it will be transmitted to the client.

Narendra Kumar G and et al., proposes "Efficient Garbage Disposal Management in Metropolitan Cities Using VANETs". In this

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paper, Light sensory circuit is placed at the three fourth distances from the base of each dustbin. The circuit consists of LASER diode and photo detector which is placed on the either side of dust bin. LASER diode always transmits light which is received by photo diode. When the dust bin is being full of waste, photodiode doesn't receive the transmitted light. So it triggers RF transceiver to send signal to the Road Side Units (RSU) indicating that the dustbin is full. Once the message received by Garbage Collecting Vehicle (GCV) from RSU, the van will go to appropriate location to the collect the wastes.

Kanchan mahajan and et al., proposes "Solid Waste Bin Monitoring Using Zig – bee". In this research work, ultrasonic sensors are placed in the garbage collecting bins in all areas and Zig - Bee is also employed in every dust bins. Whenever the solid wastes reaches the maximum position in the bins, the ultrasonic sensor sends information to Zig – Bee that the dust bin is full and it transmits the same information to ARM 2148 microcontroller through Zig – Bee connected to the controller. GSM is interfaced with controller through MS 232 interfacing module and is used to intimate about the status of garbage collecting bins to the user. PC is also interfaced with microcontroller using RS 232 interfacing module.

S. Padmapriya and et al., proposes "E- Tracking System for Municipal Solid Waste Management Using RFID" In this system, RFID tag and IR sensor is placed in all dust bins. RFID reader sends signals to identify RFID tag in its frequency range. Whenever any tag comes to the frequency range of RFID reader it automatically reads data from the RFID tag and the status of the dustbin can also be identified using IR sensor. After completion of this process, reader sends the same information to the controller, then it filters the collected data and arranges it into specific format. After arranging the data's, the controller sends the data to central server through GPRS. After fetching and verifying the data, central server sends the data to web server and also to authorized persons mobile phone.

III. PROPOSED SYSTEM

The main theme of the idea is to reduce the disposal of plastics and domestic waste materials to the environment. The block diagram of proposed system is shown in fig 1. It comprises of major component like PIC Microcontroller, PLC, IR sensor, GSM, Load cell, LCD display and keypad. This system performs five functions namely collecting the municipal wastes, crediting the amount in consumer's account, intimating the current account balance through SMS to the user, monitoring the waste bin's level, sending SMS to corporation when the level of bins is filled.

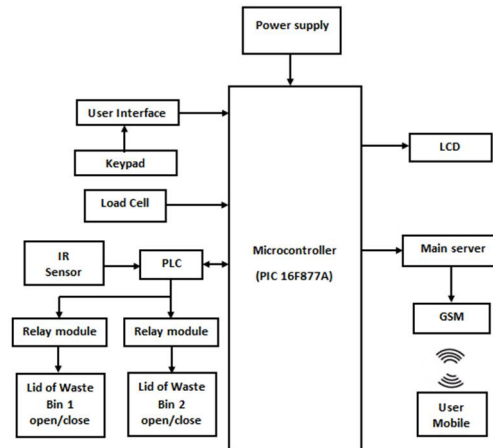


Fig -1: Block Diagram of Proposed System

Initially users have to type their password in the keypad to enable their log-in. User can interact with the GUI and they can choose the type of material to be disposed in the bin. Then the controller reads the command and the required bin can be opened by the motor driver through PLC by which the timing function is included. The bin will be opened for fixed time period during which the users have to put the wastes in corresponding bins. Once the wastes are dumped in bins, weight of the municipal wastes will be automatically calculated with the help of load cell and it will be fed to the microcontroller. The cost/Kg data is already stored in the server calculates the amount to be credited in user's account. In Addition, through the main server also the confirmation SMS will be sent to the respective user mobile number by GSM.

The level of waste-bins is monitored by the IR sensors, when the bins reaches 90% level then the SMS will be sent to truck drivers and if truck driver doesn't respond then SMS reaches to next level of authorities. Any Number of bins can communicate with the

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main server through wireless communication. The user information like user ID, Bank account details, mobile number, etc., can be stored in database. So that the material and account information will be updated automatically and stored in data logger. The major components used in the proposed system are explained below.

A. User Interface

User interface has keypad and display interconnected with microcontroller. Each user can communicate with PIC through keypad and display. This enables the user to login and choose the type of material to be disposed.

B. PIC

PLC plays a major role in the control of peripherals connected to it and it can work coordinately with PLC. The sensor signal will be read by the PLC and it can communicate with the microcontroller. The user interface is connected to the PIC which calibrates the weight of material that is disposed by the respective user.

C. PLC

Programmable logic controllers are used to monitor the level of bins and to control the lid of the bins. Once the user selects the type of material to be dispose, the PLC opens the lid and keeps it in opened position for a fixed duration.

D. Sensors

Level Sensors are fixed at top and bottom of the bin to identify the level of wastes in the bins. This information will be send to the PLC and Microcontroller. The load cell fixed at the bottom of the bin monitors the weights accordingly.

E. Main server

The master computer is located at a particular location which can be connected to the multiple bins which are in remote locations. It comprises of database and data logger. The data base has user information and the data logger can periodically check the bin status and stores the amount of transaction along with user details.

F. GSM

Here the GSM is connected to the main server where the user information is stored. Whenever a user used to dispose their wastages at bins the information will be send to the main server through wireless communication. The database which consists of user mobile number to which GSM can send the information about the amount credited.

IV. RESULTS AND DISCUSSION

A. Simulation output in PROTEUS

Proteus 8 is a single application with many service modules offering different functionality like schematic capture, PCB layout, etc. The wrapper that enables all of the various tools to communicate with each other consists of three main parts. Proteus 8 consists of a single application (PDS.EXE).

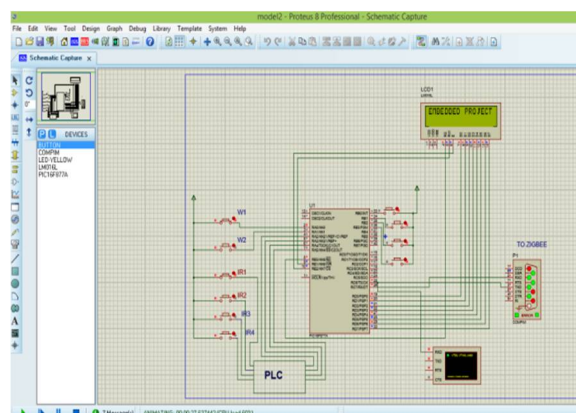


Fig 2. Simulation output in PROTEUS

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The simulated output of proposed system using Proteus software is shown in Fig.2. This depicts the complete operation of sensors and peripheral inputs. Here the PLC is interconnected between sensor input and PIC. The above fig shows wastages weight and level. The output displayed in LCD Screen as well as in GUI of PIC.

- 1) *Visual studio GUI*: Visual studio provides Graphical User Interface (GUI) simulates the output signals that can be represented as animations. This provides the user to understand the concept easily. The animated image is shown in Fig.3 which contains the details of the individual user like person user ID, Weight of wastages, Amount credited and the status of the bin. Here visual studio is mainly used for monitoring the level of bins.

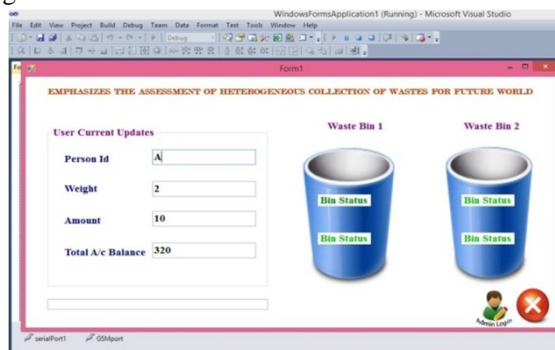


Fig 3 Simulation result in Visual studio

- 2) *Text Alert through GSM (Bank Balance Transaction)*: The PIC can directly connected to the main server and the amount can be transferred to the respective user bank account through official bank transaction. Correspondingly it sends a text message to the user about the balance credited to the bank account. The Fig 4 shows the notification of current account balance.

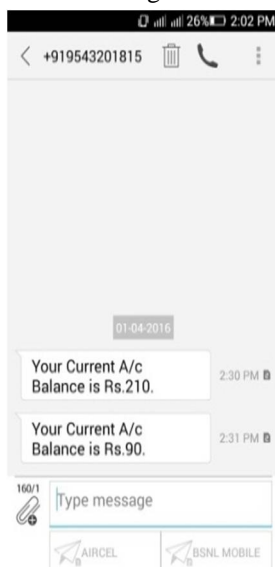


Fig 4 Text message received by the User

- 3) *Hardware Module of proposed System*: Hardware model is developed using PIC and PLC along with sensors and LCD. The system measures the weight of wastages added to the bin, and displays the status about the level wastages in the bin. When bin is completely filled by the wastage, the LCD indicates the status of bin as 100% filled. This is shown in fig .5.

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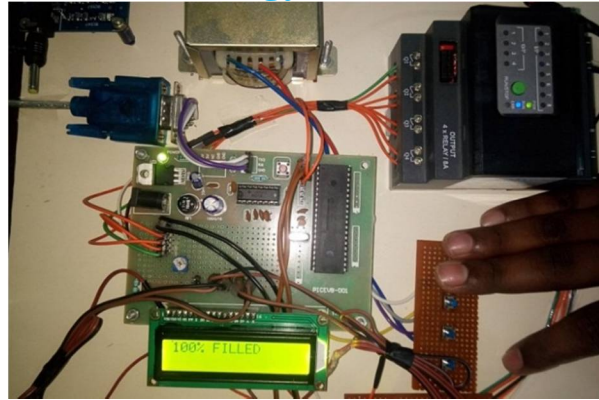


Fig 5 Hardware Module indicating bin status

V. CONCLUSION

In general, solidly waste management is not maintained in proper manner anywhere. Users are throwing their household wastes (bio and non-bio degradable) at any places in streets lines. Due to this, environment gets affected; a lot of diseases are spreading the fertile soil becomes infertile which leads to water pollution. To overcome this problem, the heterogeneous waste collecting machine is proposed with rewards to household who dispose it properly. Proposed system not only gives benefits to the society but also motivates cleanliness of the environment. Furthermore, this system increases the responsibility of every citizen to make the surroundings hygienic. As well, it gives extra financial assistance to public in turn motivates the people to keep the environment clean.

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BIOGRAPHIES



KARTHICK.S is pursuing Bachelor of Engineering in the discipline of Electrical and Electronics Engineering at Knowledge Institute of Technology, Salem, under Anna University, Chennai, India. He has won first prize with cash award of Rs.30, 000 at National Level for the project titled as "Advanced Line Following Robot using Barcode Addressing Techniques" in e-yantra ideas competition 2015 conducted by IIT – Bombay. He received YOUNG SCIENTIST AWARD for his project during the year 2014. He has presented number of technical papers in national level technical symposium. He is acting as a student member of various clubs and forums like Green club, Instrumentation and Control Engineers (ICE) club. He also published an International Journal and presented a paper at National Conference. Presently He is doing minor research works on various fields like Power electronics, Robotics etc.

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VIGNESH.K is pursuing Bachelor of Engineering in the discipline of Electrical and Electronics Engineering at Knowledge Institute of Technology, Salem, under Anna University, Chennai, India. He has presented number of technical papers in symposium. He is acting student member of various clubs and forums like Robotics and Intelligence Machines (RIM) Club, Green club, i-can Club, Instrumentation and Control Engineers (ICE) club. He won prizes for project contest. Presently he is doing minor research works on various fields like Power Electronics, Biomedical Instrumentation and Robotics etc. She got more awards and prizes for her extracurricular activities.



RAGHAVENDRA.S.S is pursuing Bachelor of Engineering in the discipline of Electrical and Electronics Engineering at Knowledge Institute of Technology, Salem, under Anna University, Chennai, India. He participated in Young Scientist Award in the academic year 2014. He is the member of various technical clubs like Robotics and Intelligence Club, Embedded Club of Knowledge Institute of Technology. He has presented number of technical papers at National level. Presently he is doing minor research works on various fields like Power system, Transmission and distribution, etc.



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Ratna Gold Medal Award from Global Economic Progress and Research Association, New Delhi for the individual achievements in the field of Biomedical and Embedded Systems, 2014 and she received cash award of Rs.5,00,000 for guiding the under graduate students project titled "A Novel Design of High Efficient Vertical Axis Wind Turbine" and has won GE Edison Award on par with IIT's at Edison Challenge Contest 2014 conducted by "General Electric, Bangalore" at National level. She organized various Guest lectures, Seminars, Workshops and FDP. She acted as a chair person at National level conferences and symposiums. She has Ph.D supervision for guiding research scholars under Faculty of Electronics and Communication Engineering. She is guiding student's projects at UG and PG level. Her technical field interests include Biomedical Instrumentation, Embedded Systems, Robotics, Power Electronics and Renewable Energy, Digital Signal Processing and Wireless Communication Networks. She is the life member of ISTE and IEEE.

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