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BIOMEDICAL WASTE MONITORING SYSTEM AND RECYCLING METHOD FOR HOSPITAL USING IOT

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Abstract: Due to increasing population and COVID-19 pandemic, the biomedical wastes in the hospital are raised. The major goal of this initiative is to treat biomedical related waste properly by disposing, once the waste gets filled in the bins and to classify the biomedical waste for recycling purposes. In hospital there exists the manual detection and clearing of waste is being done once the biomedical waste bins got filled. This system of process has a high risk in contamination once the waste is not disposed at right time or when the waste is stagnant over time. Hence we proposed our project "Biomedical Waste Monitoring System And Recycling Method For Hospital Using IOT" in order to monitor the waste bins continually and alerts the concern scavenge team through automatic triggered SMS and Call facility for that 4 IR sensor, gas sensor, buzzer and GPS module are incorporated with dustbin and interfaced with microcontroller. Our system not only alerts the scavenger team when the bin gets filled, but also it will alerts the scavenger team when the bin high prone to contamination and the stinking smell exists. Using color codes of dustbin to segregate the 10 different categories of medical waste under 4 colors red, black, blue and yellow. The medical waste in blue color bin can be used for recycling it does not contain any harmful wastes and it is send to recycling unit, the waste is shredded into small particles and after sterilizing we can able to make new things.

Keywords: IOT, Medical waste, IR sensor, Microcontroller

I. INTRODUCTION TO BIOMEDICAL WASTE MANAGEMENT IN HOSPITAL

Medical wastes from hospitals are usually classified in to different color codes. The major classifications of biomedical waste are RED, BLUE, YELLOW and BLACK. The RED color waste bin are used for disposing used and disposable plastic items like blood bags, cut plastics, latex gloves, rubber catheters, infectious plastic tubing's, infectious IV sets etc. BLUE color waste bin consists of Infectious Sharp Wastes like glass bottles, glass ampoules, injection vials.

YELLOW waste bin are used to disposing infectious dressing materials like gauze, cotton, Human organs, Body parts and tissues. BLACK waste bins are used to disposing cytotoxic waste, expired medicines and radioactive materials. Thus the above mentioned medical wastes are highly prone to contamination and it forms the major hazard to humans when it is not evacuated properly or not evacuated at right time.

II. EXISTING SYSTEM

At present system, the highly hazardous biomedical wastes are being inspected and wastes are being disposed by the front line workers. Due to this manual inspection of dumpsters for their filled status forms a risk factor for frontline workers and they are exposed to contamination disease. In the other hand the waste bins are filled frequently and the over flow of wastes and spillovers are highly dangerous and create health issues in the case of biomedical wastes spills over and found unnoticed. Due to this the hospital workers and patients are mainly affected.

III. PROPOSED SYSTEM

In the proposed system, we have connected all the waste bins with infra red sensors and hence we can be easily detect the level of each and every dustbins which is about to be filled. Since the yellow coded dustbins will have human organ tissues and blood wastes, it may have foul smell frequently. With the help of our project we can easily identify the foul smell that is present in the waste bins with help of GAS sensor and intimate to the frontline workers through SMS alert

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stating that the yellow coded waste bin has foul smell in it. Thus sending SMS will have unique URL which represents the waste bin color and location linked with Google map where the dumpster has been filled.

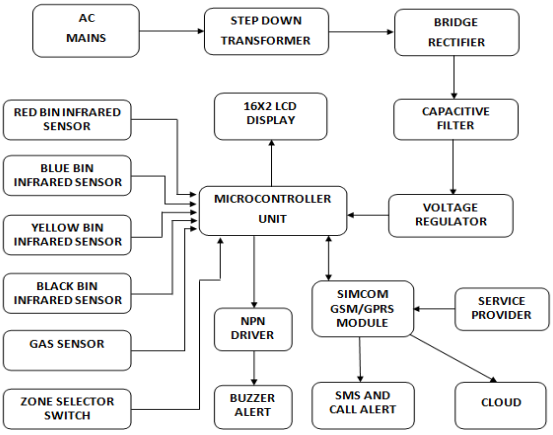

Figure 1: Block Diagram of hardware interface

In the figure 1, the data flow can be clearly seen which is from the sensors towards the microcontroller, thus the microcontroller process the sensor signals and produces the desired output.

IV. DESIGN METHODOLOGY

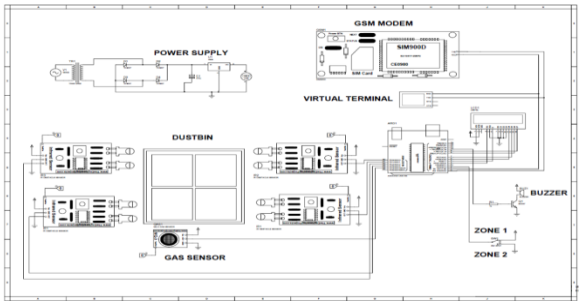

Figure 2: Circuit Diagram

The design describes the entire circuit diagram of this project "BIOMEDICAL WASTE MONITORING SYSTEM AND RECYCLING METHOD FOR HOSPITAL USING IOT" In the above figure 2, the AC line is taken from the EB mains and hence it is processed in to the required DC voltage as the microcontroller requires DC supply for its operation. The AC supply is taken from the EB mains is passed in to the step down transformer's primary coil and as per the transformers rating, the input AC signal is thus reduced to the output AC signal in its amplitude.

Thus acquired lower amplitude AC signal is passed to the Bridge rectifier which is constructed with the help of four 1N4007 diodes in diamond shape circuit which is displayed in the above figure. This process will converts the AC signal to its equivalent rippled DC signal. Since the rippled DC signal cannot be used up by the microcontroller as it requires the stable DC signal, the rippled DC signal is passed to the capacitive filter in the rating of 470uf/25V and the purest form of DC signal is obtained.

Since the acquired DC signal is unregulated DC signal and cannot be used up for the microcontroller due to its in stability, the unregulated DC signal is passed to the linear voltage regulator in order to obtain the regulated constant 5V DC supply for microcontroller operation.

The microcontroller used in our project is ARDUINO microcontroller unit which has powerful ATMEGA 328 chip as a core which is an 8 it microcontroller unit capable of processing 6 analog sensors and has 14 digital pins. This controller is used to process our overall project.

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We have used 16x2 LCD Display in order to display overall project status locally regarding the bin levels and the foul smell present in it. And the foul smell present in the dumpster is detected by MQ02 gas sensor module

Infrared sensor modules are used in our project in order to detect the waste level in the dumpster and the output is obtained in digital form based on the dumpster level in the waste bins.

The SIMCOM SIM800C GSM modem is used in our project to send the triggered SMS alert to the front line workers when the dumpster level is filled. And the alert is produced by piezoelectric buzzer.

V. HARDWARE IMPLEMENTATION

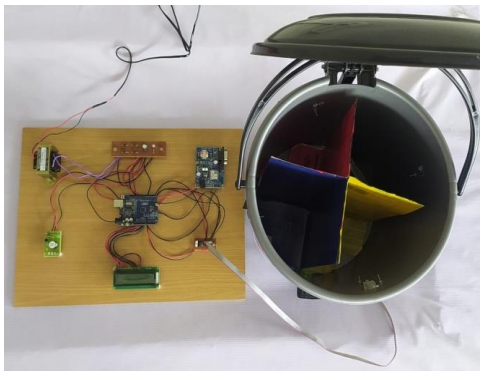

Figure 3: Hardware Implementation

The figure 3 represents the over all Hardware Implementation of our "BIOMEDICAL WASTE MONITORING SYSTEM AND RECYCLING METHOD FOR HOSPITAL USING IOT".

Figure 4: ARDUINO Microcontroller unit

The microcontroller chosen for our project is ATMEGA328 which runs on the ARDUINO platform.

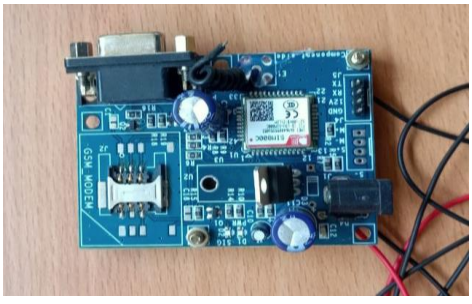

Figure 5: GSM Modem

SIMCOM GSM modem interfaced with microcontroller unit. If waste reaches the threshold level Arduino will trigger the GSM modem to send the message.

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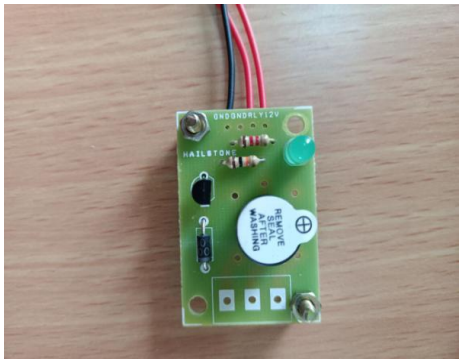

Figure 6: Buzzer Module

As shown in the figure 6, the 12 volt buzzer is connected with microcontroller in order to alert the sanitary workers once the waste reaches the threshold level in the bin.

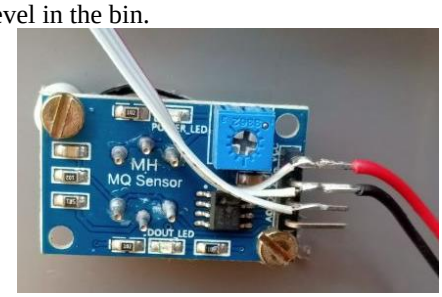

Figure 7: MQ02 gas sensor module

Gas sensor is used in yellow color code bin and interfaced with microcontroller, if any abnormal smell sensed then the gas sensor will send that data to Arduino and it will trigger the SIMCOM GSM modem to send the message.

Figure 8 : IR sensor

IR sensor is used in yellow, red, blue and black color code bins and interfaced with microcontroller, if waste reaches the threshold level data will send to Arduino and it will trigger the SIMCOM GSM modem to send the message.

VI. RESULT AND OUTPUTS

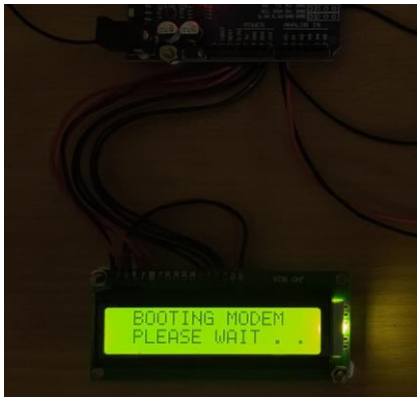

Figure 9: Booting Modem

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The figure 9 represents status of modem as it requires booting time to establish network connectivity.

Figure 10: MODEM READY

The display shows the status of modem when it is ready for its operation

Figure 11: Waste Bin Filled Alert

The figure 11 represents the Alert message in 16x2 LCD Display when the Red color coded waste bin got filled.

Figure 12: SMS ALERT

The figure 12 represents the SMS Alert message when the red color coded waste bin gets filled. Likewise the triggered SMS will be sent to all the color bins

Figure 13: Google Map Integration

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Once the SMS sent to the scavenger team successfully, the link received by the scavenger team is further clicked to view the output where the bin is exactly got filled with Google map Location Integration.

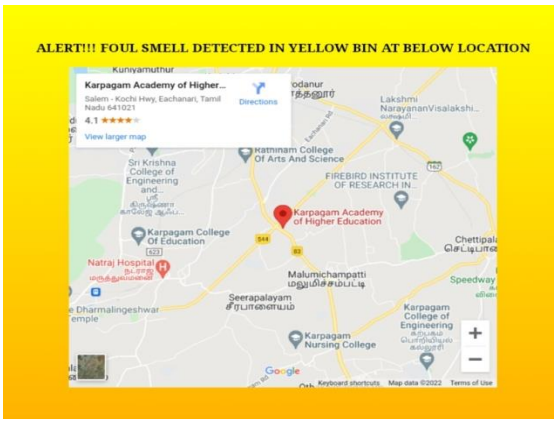

Figure 14: WASTE BIN WITH FOUL SMELL

The figure 14 represents the status of yellow bin that got filled and the foul smell detected in the Google map integration.

VII. CONCLUSION

Thus by implementing this system we can easily track the biomedical waste as soon as the waste has been filled in the color coded waste collection bins through triggered SMS alert without being inspecting wastes frequently. By this system of methodology the spread of contamination disease has been controlled and with the help of location tracking facility we can be easily evacuate the wastes as soon as it has been filled through Goggle map integration.

VIII. FUTURE WORK

Automatic biomedical waste segregator can be added to this system. IR Sensor used for monitoring the level of dustbin, instead of that Ultrasonic sensor and proximity sensor can be used for monitoring the level of dustbin. The system can be connected with monitor in which the status of dustbin waste level can be known or we can create an application for sending and viewing the status of dustbin waste level.

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