IOT BASED HOSPITAL SANITATION SYSTEM

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ABSTRACT

Overflowing bins have always been one of the main reasons behind any epidemic outbreak in developing nations, in particular. The sphere of medical science alongside with its new technology is accelerating in the time when the vision of "The internet of things (IoT)" has turned into reality. IoT can play a vital role in healthcare domain by controlling chronic diseases at one end as well as prevent the spreading of those diseases on the other end. The risk posed by overflowing bins in the hospital itself is quite alarming and plays a major role in the later of the former statement-preventing the spreading of the disease because of the presence of recuperating patients. Hence it is of utmost importance that bins in hospital premises and wards be cleared immediately as and when they get filled. In case of manual checking of bins, it must be done every now and then to ensure that no bin overflows. However the frequent interruptions may cause discomfort to the residing patients. Hence our project ensures that bins get cleaned only when needed and the manpower required will be reduced.

KEYWORDS: RFID, LCD, HOSPITAL, BIN, SIM900.

I. INTRODUCTION:

The IoT (Internet of Things) divided into Industrial IoT and commercial IoT in which technology and applications were discussed with various statics in detail. Using IoT controlling and monitoring of equipment can be done clearly in which sensors [2] will play an important role. With help from sensors like Ultrasonic Sensors, garbage levels are identified and displayed and intimated to the corresponding organization.

Majority of viruses and bacterial infections develop in a polluted environment. The environment we live is polluted with waste and hence using technology resources to protect our environment is now needed more than ever. So, modernization of the hospitals is needed by imparting the smart technology. The amount of waste is determined by two factors: first, the population in any given hospital, and second, its consumption patterns.

The United Nations Population Division, World Population Prospects states the current (as in March 2018) world population is 7.6 billion. With this growth rate, the world population in 2070 is estimated to be around 10.58 billion. A drastic increase in population comes along with a lot of responsibilities in the disposal of waste and sanitation. A lot of frameworks and technologies have been brought forward to manage this issue, but they have not primarily focused on managing the solid waste inside hospitals. The complexity of gathering information of waste in each hospital ward or room is solved by our proposed model. Focusing on sanity in each corner of the hospital will create an overall healthy and hygienic environment thereby preventing the occurrence of any appalling event.

In our proposed paper we give one of the most efficient ways to keep the environment of the hospitals sterile and hygienic. This new model for the hospital dustbins intimates the central server of the hospital for immediate cleaning of the trash in each ward or room. The bins in each room of the hospital collect from fruit peels to medical waste hence it is crucial to clean it on time and at the same time not to disturb the patient often. By this method, the irregular removal of garbage present in the bin is also eradicated.

II. RELATED WORK:

Gaikwad et al [5] used an image processing system as well as a GSM module to collect information. They used a camera at every garbage collection point along with load sensor wherein a threshold level is set which compares the output of the camera and a load sensor.

Zarook M. Shareefdeen [6] paper on an understanding of medical waste management and control techniques magnified on the introductory materials on the definition of medical waste, medical waste management regulatory acts, the risks of exposure, medical waste management procedures and the controlling techniques.

Sunelirani et al [7] study to understand the Knowledge, Attitude and Practices(KAP) of bio-medical waste in a local hospital brought to limelight the illiteracy of staff members at the lower level regarding the biomedical waste rules. By using the previous methodology the waste management systems in hospitals were not properly maintained. The waste garbage is collected randomly by the employees at any hour of the day. If the bin is full, even the employee's also wouldn't know which bin is filled and which one is empty. So, no one could know whether the garbage bin is cleaned or not. Another problem is that the working status of each and every employee cannot be tracked and expenditure towards maintenance and the required manpower is also exceedingly burdening to the concerned hospitals.

FIG 1

III. SANITATION SYSTEM:

In our project, we introduce smart sanitation system in hospitals to effectively dispose of their waste. This system helps the employee to know when and which bin is full and which needs to be cleaned. In this smart system, we are using ARM7 Microcontroller.

The ultrasonic sensor for monitoring the garbage bin. If the bin is filled then the controller passes the message to server [1] and employee through IoT. The employees have individual RFID cards separately. When the employee cleans the bin, the RFID [3] is shown to the RF reader along with the ARM and then the garbage bin is cleaned. Thereafter, "bin cleaned" message is sent to the server.

IV. SYSTEM ARCHITECTURE:

The design part consists of mainly two sections,

- Hardware architecture
- Software architecture

A. HARDWARE ARCHITECTURE

It includes ARM7 microcontroller, gprs module, SIM900 module, RFID reader and tags, ultrasonic sensor.

1) Microcontroller:

ARM series is a microcontroller that has taken us forward in the field of IOT. Some features that make it unique are:

A 16/32 bit ARM7 Architecture , a Memory Accelerator Module to increase the performance of the CPU, Programmable PLL, Timer, UART, RTC, ADC, PWM and other such peripherals.

Dual power supply of 1.65V to 1.95V (CPU) and 3.0V to 3.6V (I/O) is another key factor.Protocols used are SPI,I2C,USB and CAN.

2) Ultrasonic Sensor :

Using an ultrasonic sensor we can measure the distance to any object. We can measure the distance by sending waves of a particular frequency to hit the object and receiving those bounced back sound waves. It is possible to measure the accurate distance in terms of the elapsed time between the transmission and the reception of the waves.

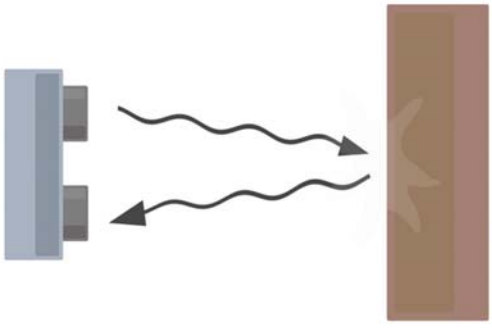

FIG 2

3) GPRS:

The basic purpose of GPRS module is to provide wireless communication between microcontrollers and other instruments/ devices. Wireless connectivity of microcontrollers is a necessity these days.

GPRS is an integrated part of the GSM network that ensures wireless data transfer and communication.Data services originally used circuit switched connection in the GSM Network. In this case, the access time is long and the data charges were based on the connection time. And this type of connection isn't suitable for transmission of multiple bursts of data. By integrating GPRS, a packet switching based data service to the GSM Network, the scenario changes. In GPRS based packet switching networks, the users don't use separate individual resources but from a shared pool of resources.The charges for data are based on the usage and not on the connection time, the access time is shorter and bursts of data can be transmitted efficiently.

4) LCD Display:

An LCD (Liquid Crystal Display) is a flat panel display. They use the liquid crystals property of light modulation. Liquid crystals use backlight or reflector to exhibit the images. These images could be in monochrome or colour. [1].

FIG 3

The general purpose of LCDs is to display arbitrary images or fixed images whose contents can be displayed or hidden such as words, digits, or 7-segment displays similar to a digital clock. The arbitrary images displayed using a large number of pixels while other displayed content have a larger element.

5) RF Reader:

An RFID (Radio Frequency Identification Reader) is a device which is used to track and trace the objects by the information collected through an RFID tag. A technology similar to those in barcodes where radio waves are used to transfer data from the tag to reader is used. The RFID tag must be in the range of 3 to 300 feet in order to be read or in line-of-sight to the RFID reader.

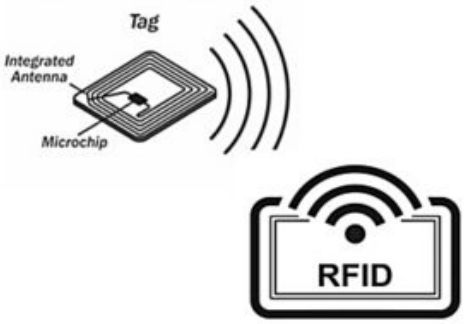

FIG 4

6) SIM900 Module:

SIM900 can be used over to access the Internet as well as for oral communication via. microphone and a speaker. It is used to send SMSs too. The processor manages the phone and data communication through a combined TCP/IP stack. Also through UART and a TTL serial interface where the circuit is interfaced with the mobile.

A SIM card (3 or 1,8 V) obligated by the processor is to be attached to the out wall of the module.

B. SOFTWARE ARCHITECTURE:

It includes embedded C Programming, Keil 4.1 compiler, Mysql 5.0 database.

1) Embedded C Programming:

Embedded C is the heart of mobile phones, washing machines, digital cameras, etc. All the embedded system we use in our daily lives. Each processor is associated with an embedded software and it decides the functioning of the embedded system. Embedded C is the most frequently used language to program the microcontroller. Earlier, many embedded applications were developed using assembly language programming but they did not provide portability. This disadvantage was overcome by the advent of various high-level languages like Pascal, COBOL and C. Since C language is easy to understand and is much reliable, portable and scalable it is widely accepted in the world of embedded systems.

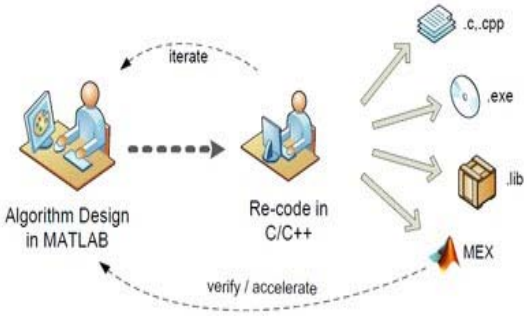

FIG 5

2) Keil 4.0 compiler:

Loading the software and the program that we build in the microcontroller is one of the major parts of building an embedded system. Thus the name, "burning software in the controller." Before that, we must do certain prerequisite operations with the program. This includes the following procedure: writing the program in assembly language or C language in a text editor like notepad, compiling the program in a compiler and finally generating the hex code from the compiled program. Earlier people used different software for all these 3 tasks. The code was initially written in notepad/Wordpad which was then compiled using a software which was solely dedicated to compiling a particular controller. Then the assembly to hex code conversion was done using another software. All these tasks when done separately will involve a lot of time in debugging and revising the source code, hence we use Keil to save time and effort.

3) Mysql 5.0:

MySQL is the most popular open source database. MySQL has proved from time to time as one of the leading database choices for web-applications. Resources trust MySQL for its performance, dependability, authenticity and ease-of-use. MySQL is a Relational Database Management System (RDBMS) that uses Structured Query Language (SQL). It is an open source program.SQL is the most popular language for inserting, accessing and managing content in a database. It is quite popular for its quick processing, proven reliability, ease and flexibility of use.

V. METHODOLOGY:

In this project ARM7 microcontroller is used. It is the 32 bit microcontroller. Here ultrasonic sensor, RF reader and SIM900 these are interface to the microcontroller. The ultrasonic sensors placed over the bins to detect the garbage level and compare it with the garbage bins depth.

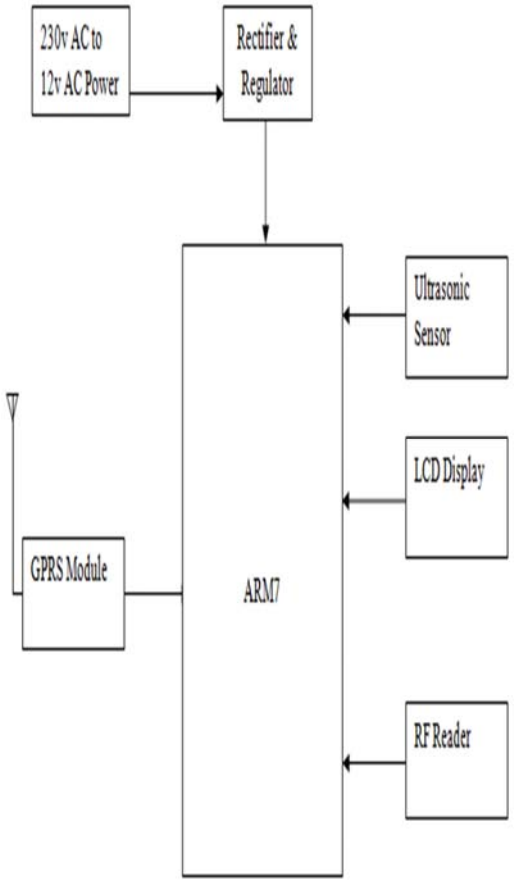

FIG 6

The rectifier is an equipment that converts the alternating current to direct current which means, the current which inverts the direction of direct current to a current flowing in uni-direction. The regulator is used so that it generates a fixed output voltage of present magnitude.

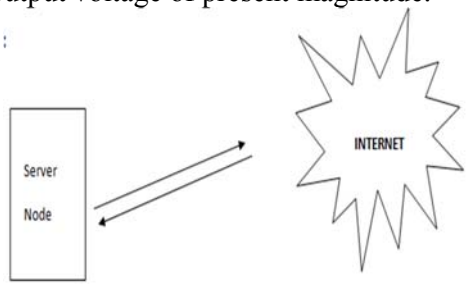

FIG 7 IoT Node

RF Reader used to read the employee's ID before cleaning the garbage bin. After the bin is cleaned it is intimated to the server through IoT. GPRS module is used for sending the information to server (IoT concept). Here the SIM900 gprs module is using. This is the most flexible model. The LCD screen on the outer wall of the bin displays the garbage level collected which can be read by any passerby.

VI. FLOWCHART:

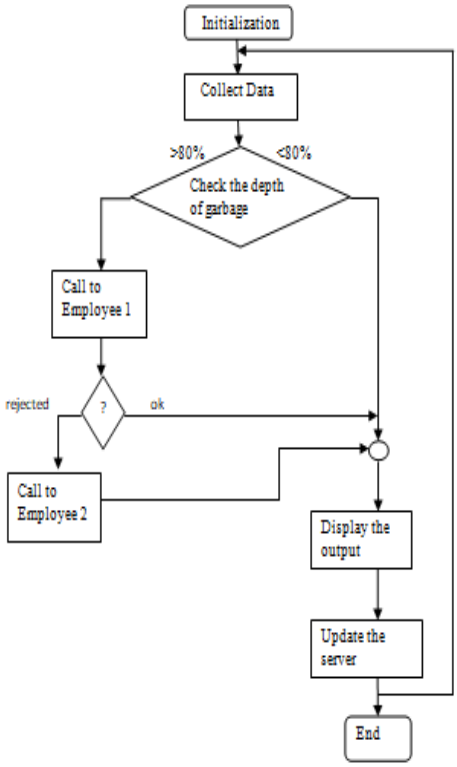

FIG 8 A flowchart to represent the complete working of the sanitation system

VII. RESULTS:

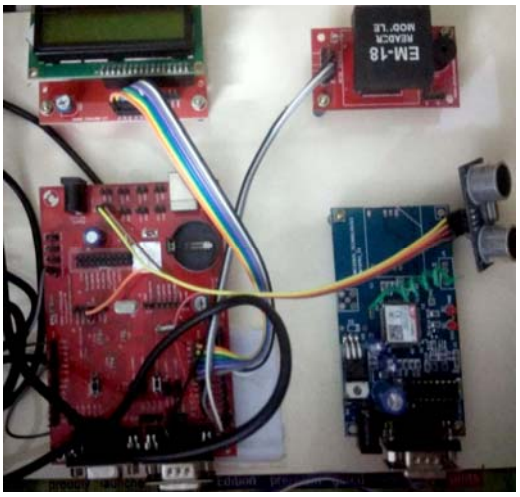

FIG 9 The kit comprising of the sensor, microcontroller and the GPRS module.

A predefined threshold level is set and when the waste in the bins reach this predefined set level, updations are made to the LCD screen and the server, and notifications are sent to the concerned workers.

FIG 10 The message displayed on the LCD screen when the bin gets filled.

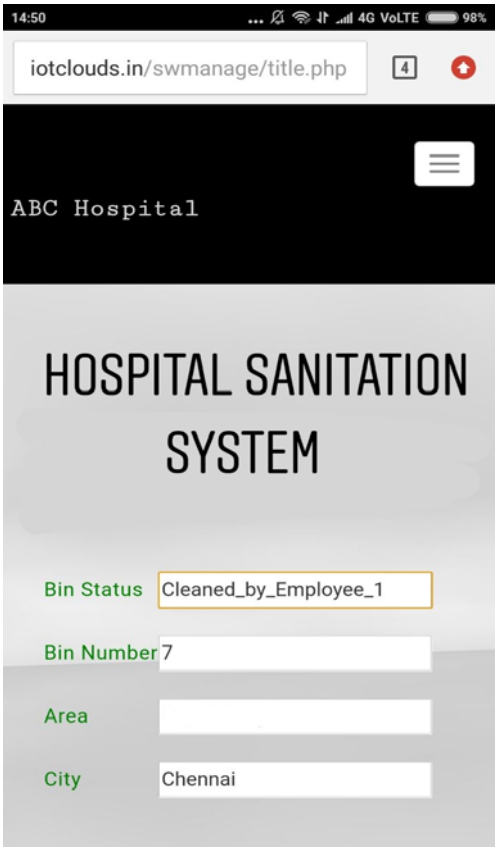

FIG 11 A screenshot of the server page

VIII. ADVANTAGES:

- The exact location of the bin is intimated, in case the threshold level is reached.
- Faster detection can assure the patients of a safe and clean environment.
- Workers needn't unnecessarily check each ward for waste every now and then.
- Incase a worker cant attend to, then immediately another worker is informed.

IX. DISADVANTAGES:

- Malfunctioning sensors may not be able to detect the exact levels.

X. CONCLUSION:

Hospitals are here to ensure that sick people get the proper treatment and to reduce suffering as much as possible. If not properly maintained, it is easy to see how quickly things would spiral out of control. If hospitals are not cleaned properly, they would be doing more harm by introducing individuals who are already sick to a plethora of new diseases.We have proposed a better model to ensure that the hygiene standards are met in hospitals and a clean environment is provided to the residing patients.

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