IOT BASED AUTOMATED GARBAGE MONITORING AND STREET LIGHT FAULT DETECTION REPORTING SYSTEM FOR MUNICIPALS

[1]Namana.Murali Krishna, [2]Sujeeth T
[1]Professor, Dept of CSE, AVN Institute of Engineering and Technology Hyderabad – 501510.
[2]Assistant Professor, Dept of CSE, Siddhartha Educational Academy Group of Institutions, Tirupati - 517501.
[1]muralinamana@gmail.com , [2]sujeeth.2304@gmail.com

ABSTRACT— *The idea is to create a system based on Smart City. In the present-day scenario, many times we see that the garbage bins or dust bins placed at public places in the cities are overflowing due to increase in waste every day. It creates unhygienic condition for the people and creates bad smell around the surroundings. This leads I n spreading some deadly diseases & human illness, to avoid such a situation we are planning to design an IoT Based Garbage Monitoring System for Cities. In this proposed System there are multiple dustbins located throughout the city. They are fitted with a special type of sensors known as Loadcell which is used to detect the level of garbage in these dustbins. This data is then sent to the Arduino microcontroller, which receives this data. This is sent to the IoT board via a level converter. The IoT board uses a sim card for transfer of data to the cloud. The garbage values are continuously updated in the web page. A unique ID will be provided for every dustbin in the city so that garbage level can be monitored. These details can be accessed by the concerned authorities from their place with the help of Internet and an immediate action can be made to clean the dustbin. When the dustbin is full a message is also sent via IoT to the concerned authorities. Along with this we incorporate the concept of Street Light Control. The street lights will be automated for switching ON and switching OFF based on intensity of sunlight using LDR. It helps to automatically turn on the street light when it is dark and automatically turn it OFF when there is light. In case of any fault in a street light concerned authority will get the notification. This system of street light control uses a driver circuit to drive the low power from Arduino microcontroller to regulate the current flow. Here additionally a relay is used to control the turning ON and OFF of the streetlight.*

Keywords: *Internet of Things, Loadcell, LDR, IoT*

I. INTRODUCTION

Technology makes life easy. There might be arguments regarding this statement but this project makes a sense that this idea modelling of a smart waste collection is way to healthy and hygienic life style. This environment friendly innovation makes sense also to the people of old school of thought as there is only benefit and benefit by usage of this system which will surely help resolving the ongoing hygienic problems being faced by our global community which is growing every day this is without a doubt a way to the green zone. this system is based to be used by municipal based governing bodies which would be able to hold records and manage them using the app of SWC to monitor the working body where this app will make life easier to the waste management labour and workforce managing their time and work overall this system makes the work to be done more efficiently and sophisticatedly.

Food management is always a difficult task for the management as it involves a lot of labour work and continuous analysis of food wastage by every individual. This tedious process can be aided using the Internet of Things (IOT) [1]. It is an important application which has the potential to deliver amazing services. Food wastage not only affects the environment but also creates a negative impact on the economy of a nation and creates great demand for food products. In places like hostels, college canteens, office cafeteria the amount of food waste is extremely high because of the carelessness of the employees and students. In fact, that amount of food can feed a lot of people who could not afford their food. If food wastage is monitored individually and

providing them with rewards, there is a high chance of reducing the amount of food wastage in those public areas. The solution for this problem can be achieved by using the Internet of Things, Cloud Computing [2]. Security has become the most important issue with the development of the Internet of Things. The waste management objects and objects are combined to the Internet of Things (IOT) date verification system with high productive information's, and this information requires to be moved over the main server machine. The collected information in the main server is has been analyzed and processed according to the need of the user. In this system uses the cloud computing virtual network to store all the real time information's and analysis of data instantly. The report is generated immediately and effectively of each product in every individual for future reference [3].

In the above surveys we have come across various drawbacks depending on t he timeliness of the system,cost,ease of access and also complicated hardware and algorithm usage.So our objective is to to create a project to support the government's SwachhBharathAbhiyan campaign and the concept of Smart city by providing such a system which will be both cost effective and easy to implement.Hence our problem statement is to design a system based on any microcontroller for collecting the garbage from particular area whose public garbage bins are overflowing with prior concern.So, continuous monitoring of garbage bins will help to keep the environment clean and safe.We are also aiming at creating a street light which automatically turns ON and OFF according to lighting conditions and which can also be controlled using a web page from any place.

II. LITERATURE SURVEY

Considering the advantages of IoT technologies, many researchers have investigated and developed new applications for smart cities, especially for waste management. To save power consumption and maximize operational time, a simple system that identifies the fullness of trash bins was presented, which collected data and delivered it through a wireless mesh network [5]. However, the idea has still some ambiguous problems in the system. To improve waste management, platform software for smart cities has been introduced in [14]; however, they only concentrated on the collection of data, and their platforms were comprised of technologies from other companies.

III. EXISTING SYSTEM

The existing system has the capability only to measure the food wastage of a whole organization or a particular bin for a day but not for each and every individual person [9]. With that data only few measures that can be taken by the organization to reduce the food wastage. The existing system is a semi-automated process where the report should be verified manually, and rewards selection should be done manually. As mentioned early the existing system will calculate only the food wastage of a whole organization [10]. This leads to very limited applications of data which is collected by the organization. Even with the collected data there would be less effect in creating any awareness or taking measures among the people in the organization. The existing system lacks in the data collection part and the applications with the data collected are limited. So, the existing system has limited uses.

IV. SYSTEM ARCHITECTURE

Our project comes up with a solution to monitor the food wastage of each and every individual. With that data of every individual's food wastage, the organization can come up with some new schemes to reduce the food wastage. Mobile devices, smart devices and sensors have created great waves in the field of food processing all around the world. Food Industries have many advantages by the development of Internet of Things technologies [12]. Figure 1 gives the overview of the proposed

method . Each user has to scan their RFID to open the bin to pour the food waste inside the bin, RFID is used to monitor the food wastage of every individual as every RFID has its unique number. Load cell measures the amount of food wastage of each and every individual in the office premise and is displayed immediately on the screen fixed outside the bin for every time and then the amount of wastage is fed into the database. In the database all the records of every individual are gathered, and an analysis report is generated and the final report is shared to the display of the management website. Then finally management can take necessary measures based on the reports generated by the system. Figure 2 shows the data flow diagram of the proposed method which gains power supply and the arduino controls the entire hardware components like motor, load cell, RFID sensor, LCD display, WIFI module and the motor driver. Then the WIFI module connected to the arduino sends the data gained to the server [11].

Figure-1: Overview of the proposed method

In developing the leftovers are a worrying concern. School hostels, college hostels, canteens, workplace cafeterias and ceremonies give rise to a huge amount of food wastage [7]. This wasted food causes pollution to the environment and causes many economic distresses. Modern reports show that nearly half of the food is wasted globally there is a greater number of volumes in food excess is about tones and is anticipated to keep on increasing in the upcoming years and cause harmful issues. In many developing countries the government is in combat to dispose of the food wastage in a proper way not creating any harm to the society by implementing innovative ideas and projects using advanced technologies. This food wastage is not only an issue in developing countries, but many developed countries are also affected by the issue. In many developed countries the leftover food is dumped in the open areas, which affects the environment. Also, the people in the society should be aware of the effects of wasting food and try not to waste their food each time they are taking a meal and request others to follow the same [8].

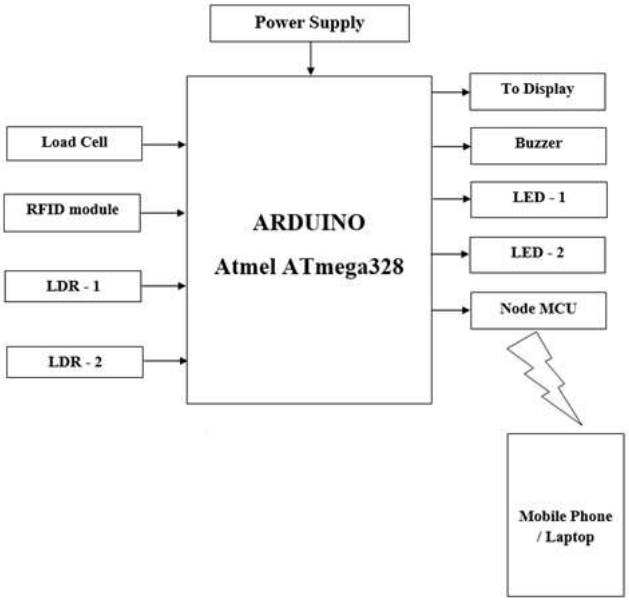

Figure-2: Proposed Block Diagram

a) User Interface

It consists of RFID and LED displays. A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity, and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration [13]. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. User interacts with the product using an RFID scanner fixed to the bin with the RFID provided to them by the management to open the bin[3]. Once the user scans the RFID card in the scanner, the LCD display shows the student or employee ID of the particular card. Then the LCD display shows the information to the user to dump the waste into the bin. After the bin gets opened and the user has to pour the waste inside the bin. LCD displays show the amount of waste that is thrown in the bin by the particular user at that particular time.

b) Weight Management

This module consists of a load cell. A load cell is a force transducer. It converts a force such as tension, compression, pressure, or torque into an electrical signal that can be measured and standardized. As the force applied to the load cell increases, the electrical signal changes proportionally. Load Cell acts as a weight sensor which will sense the weight of food wastage poured inside the bin by the user and send the weight to the arduino board so the LED can display the weight that is thrown in the bin by the user at that particular time. The weight measured is sent to the server using the wifi module installed and stored in the database.

c) Hardware Management

This module consists of a motor driver, motor, and arduino. A servomotor is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration. It consists of a suitable motor coupled to a sensor for position feedback. It also requires a relatively sophisticated controller, often a dedicated module designed specifically for use with servomotors. In this the motor driver is used to control the

rotation direction and speed of the motor. The arduino controls the functions of all the hardware in the product. The motor is responsible for the open and close functions of the bin when the user scans their RFID.

d) Database Management

This module consists of a GSM or WIFI module that sends the data captured by the sensors and the record of the users to the server for further tasks [4]. The GSM or WIFI module is used to upload the weight of the waste to the server which has the database [7].We are using MySQL for the database. HTML can embed programs written in a scripting language such as JavaScript, which affects the behavior and content of web pages. Inclusion of CSS defines the look and layout of content.

e) Record Maintenance

It consists of a Wi-Fi module and the record of the users. , The Wi-Fi module is used to upload the weight of the waste to the server which has the database. This module consists of user login. The user can login and review their record. The admin can login and view the record of each user.

V. HARDWARE COMPONENTS

The design of any system consists of Hardware requirements and Software development. Hardware requirement is focused on the components which are used for designing the project and Software development is focused on the coding which is loaded into the hardware.

a) Arduino Uno

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board.

The Atmega328 has 32 KB of flash memory for storing code (of which 0,5 KB is used for the bootloader); Ithas also 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

Figure-3: Arduino Uno

Table-1: Arduino Specifications

FEATURE	SPECIFICATION
Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 3.3V Pin	50 mA
Flash Memory	32 KB (ATmega328) of which 0.5 KB used by boot loader
SRAM	2 KB (ATmega328)
EEPROM	1 KB (ATmega328)
Clock Speed	16 MHz

b) Liquid Crystal Display

LCD screen consists of two lines with 16 characters each. Each character consists of 5x7 dot matrix. Contrast on display depends on the power supply voltage and whether messages are displayed in one or two lines. For that reason, variable voltage 0-Vdd is applied on pin marked as Vee. Trimmer potentiometer is usually used for that purpose. Some versions of displays have built in backlight (blue or green diodes). When used during operating, a resistor for current limitation should be used (like with any LE diode).

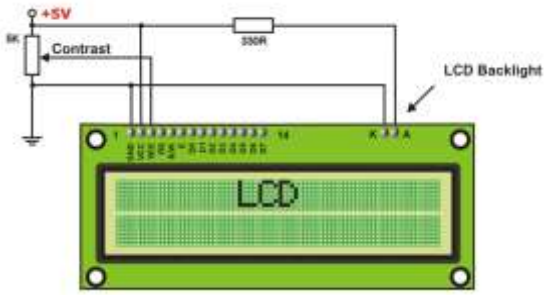

Figure-4: LCD Display

c) Dc Motor

A DC motor is designed to run on DC electric power. Two examples of pure DC designs are Michael Faraday's homopolar motor (which is uncommon), and the ball bearin motor, which is (so far) a novelty. By far the most common DC motor types are the brushed and brushless types, which use internal and external commutation respectively to create an oscillating AC current from the DC source -- so they are not purely DC machines in a strict sense.

Figure-5: DC Motor

d) ULN Driver

The ULN2003 internally employs high voltage, high current darlington arrays each containing seven open collector darlington pairs with common emitters. Each channel rated at 500mA and can withstand peak currents of 600mA. Suppression diodes are included for inductive load driving and the inputs are pinned opposite the outputs to simplify board layout. ULN2003A is of 5V TTL, CMOS. These versatile devices are useful for driving a wide range of loads including solenoids, relays DC motors, LED displays filament lamps, thermal printheads and high power buffers. The ULN2003A are supplied in 16 pin plastic DIP packages with a copper leadframe to reduce thermal resistance [15].

Figure-6: ULN Driver

e) RFID

Figure-7: RFID Tags

Active tags require a power source i.e., they are either connected to a powered infrastructure or use energy stored in an integrated battery. In the latter case, a tag's lifetime is limited by the stored energy, balanced against the number of read operations the device must undergo. However, batteries make the cost, size, and lifetime of active tags impractical for the retail trade.

Passive RFID is of interest because the tags don't require batteries or maintenance. The tags also have an indefinite operational life and are small enough to fit into a practical adhesive label. A passive tag consists of three parts: an antenna, a semiconductor chip attached to the antenna and some form of encapsulation. The tag reader is responsible for powering and communicating with a tag. The tag antenna captures energy and transfers the tag's ID (the tag's chip coordinates this process). The encapsulation maintains the tag's integrity and protects the antenna and chip from environmental conditions or reagents.

f) Load Cell

A load cell is a force transducer. It converts a force such as tension, compression, pressure, or torque into an electrical signal that can be measured and standardized. As the force applied to the load cell increases, the electrical signal changes proportionally.

A load cell works by converting mechanical force into digital values that the user can read and record. The inner working of a load cell differs based on the load cell that you choose. There are hydraulic load cells, pneumatic load cells, and strain gauge load cells. Strain gauge load sensors are the most commonly used among the three. Strain gauge load cells contain strain gauges within them that send up voltage irregularities when under load. The degree of voltage change is covered to digital reading as weight.

A load cell measures mechanical force, mainly the weight of objects. Today, almost all electronic weighing scales use load cells for the measurement of weight. They are widely used because of the accuracy with which they can measure the weight. Load cells find their application in a variety of fields that demand accuracy and precision. There are different classes to load cells, class A, class B, class C & Class D, and with each class, there is a change in both accuracy and capacity.

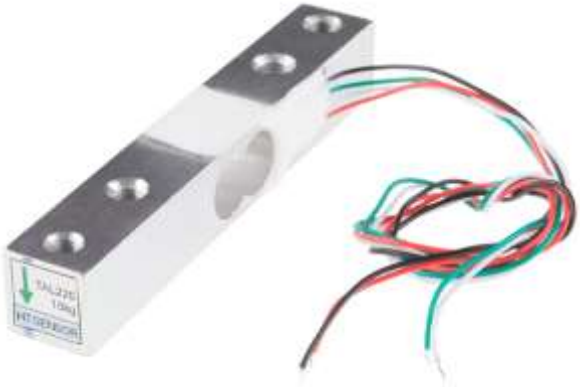

Figure-8: Load Cell

g) Light Dependent Resistor

Light Dependent Resistors are astoundingly significant especially in light/dull sensor circuits. Typically the protection of a LDR is high, once in a while as high as 1,000,000 ohms, however when they are lit up with light, the protection drops significantly. . Along these lines in this endeavor, LDR expect a basic part in trading on the lights in light of the power of light i.e., if the power of light is all the more (amid daytime) the lights will be in off condition. What's more, if the power of light is less (amid evenings), the lights will be exchanged on.

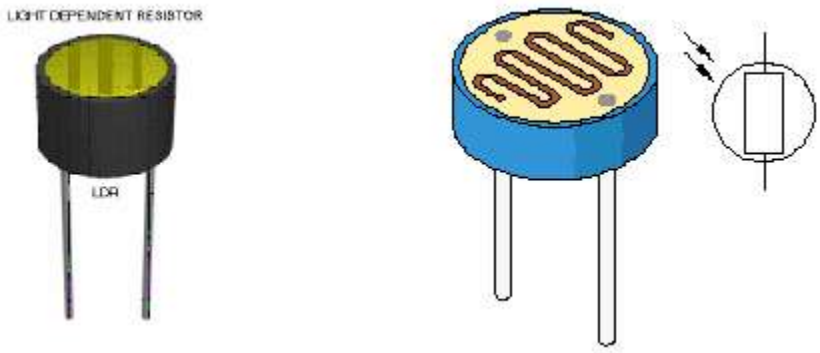

Figure-9: Light Dependent Resistor

The yield of the LDR is given to ADC which changes over the simple power an incentive into relating advanced information and presents this information as the contribution to the microcontroller.

VI. RESULTS

Assemble the circuit on the bread board and general board. After assembling the circuits on the boards check it for proper connections before switching on the power supply. The implementation of "**Iot Based Automated Garbage Monitoring And Street Light Fault Detection Reporting System For Municipals**" is done successfully. The communication is properly done without any interference between different modules in the design. Design is done to meet all the specifications and requirements. It can be concluded that the design implemented in the present work provide portability, flexibility and the data transmission is also done with low power consumption.

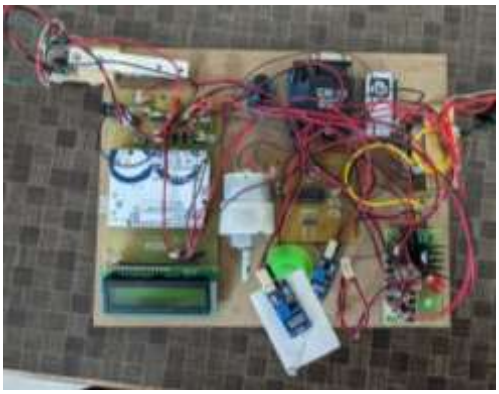

Figure-10: Hardware Prototype

CONCLUSION

In this paper, we can encourage people to take necessary amounts of food so that the wastage of food can be reduced. In our proposal, with the help of cloud computing and IOT sensors we are implementing only in premises where an RFID card is provided, this will help us in saving the cost as well as the for creating the individual records of the management, and this will create a larger impact on the individual food excess at the working surroundings, In our proposed upcoming enhancements, it will cover more areas like restaurants hotels, schools, colleges, tech parks, party spaces etc…

The project was a successful effort in fulfilling the purpose when I started it, that is to research and catch up with current technologies in this field of energy exploitation. It is a useful reference for those who need to develop similar systems. The knowledge and information from this project can also become the starting point for future development of several of applications.

REFERENCES

[1] B. N. Silva, M. Khan, and K. Han, "Towards sustainable smart cities: a review of trends, architectures, components, and open challenges in smart cities," Sustainable Cities and Society, vol. 38, pp. 697–713, 2018.

[2] M. Alvarez-Campana, G. Lopez, E. V ´ azquez, A. Villagr ´ a, and ´ J. Berrocal, "Smart CEI Moncloa: an IoT-based platform for people flow and environmental monitoring on a Smart University Campus," Sensors, vol. 17, no. 12, p. 2586, 2017.

[3] A. Bagula, L. Castelli, and M. Zennaro, "On the design of smart parking networks in the smart cities: an optimal sensor placement model," Sensors, vol. 15, no. 7, pp. 15443–15467, 2015.

[4] E. Vinagre, F. De Paz, T. Pinto, Z. Vale, M. Corchado, and O. Garcia, "Intelligent energy forecasting based on the correlation between solar radiation and consumption patterns," in Proceedings of the 2016 IEEE Symposium Series on Computational Intelligence (SSCI), IEEE, Athens, Greece, December 2016.

[5] F. Folianto, Y. Low, and W. Yeow, "Smart waste management system," in Proceedings of the IEEE 10th International Conference on Intelligent Sensors, Sensor Networks and Information Processing (ISSNIP), Singapore, April 2015.

[6] T. Dinh, Y. Kim, and W. Yeow, "A comprehensive system for a novel location-centric IoT-cloud based on-street car parking violation management system in smart cities," Sensors, vol. 16, pp. 1–23, 2016.

[7] R. Sukjaimuk, Q. N. Nguyen, and T. Sato, "A smart congestion control mechanism for the green IoT sensor-enabled information-centric networking," Sensors, vol. 18, no. 9, p. 2889, 2018.

[8] S. Ahn and J. Choi, "Internet of vehicles and cost-effective traffic signal control," Sensors, vol. 19, no. 6, p. 1275, 2019.

[9] M. S. Munir, I. S. Bajwa, M. A. Naeem, and B. Ramzan, "Design and implementation of an IoT system for smart energy consumption and smart irrigation in tunnel farming," Energies, vol. 11, no. 12, p. 3427, 2018.

[10] D. BanCur, B. Jakˇsic, M. Ban ´ Cur, and S. Jovic, "An analysis of ´ energy efficiency in wireless sensor networks (WSNs) applied in smart agriculture," Computers and Electronics in Agriculture, vol. 156, pp. 500–507, 2019.

[11] J. Muangprathub, N. Boonnam, S. Kajornkasirat, N. Lekbangpong, A. Wanichsombat, and P. Nillaor, "IoT and agriculture data analysis for smart farm," Computers and Electronics in Agriculture, vol. 156, pp. 467–474, 2019.

[12] A. Goap, D. Sharma, A. Shukla, and C. Krishna, "An IoT based smart irrigation management system using machine learning and open source technologies," Computers and Electronics in Agriculture, vol. 155, pp. 41–49, 2018.

[13] T. Anh Khoa, M. M. Man, T.-Y. Nguyen, V. Nguyen, and N. Hoang Nam, "Smart agriculture using IoT multi-sensor: a novel watering management system," Journal of Sensor and Actuator Networks, vol. 8, no. 3, p. 45, 2019.

[14] K. Pardini, J. Rodrigues, S. A. Kozlov, N. Kumar, and V. Furtado, "IoT-based solid waste management solutions: a survey," Journal of Sensor and Actuator Networks, vol. 8, no. 1, p. 5, 2019.

[15] M.-V. Bueno-Delgado, J.-L. Romero-Gazquez, P. Jim ´ enez, ´ and P. Pavon-Mariño, "Optimal path planning for selective ´ waste collection in smart cities," Sensors, vol. 19, no. 9, p. 1973, 2019.

[16] L. Alvaro, J. Caridad, J. De Paz, G. V. Gonz ´ alez, and J. Bajo, ´ "Smart waste collection system with low consumption LoRaWAN nodes and route optimization," Sensors, vol. 18, no. 5, pp. 1804–1282, 2018.