Animal Waste Management in Dairy Farm Using Internet of Things

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Abstract: Dairy Farming plays an important role in day to day human life. Continuously increasing population has resulted in large demand of dairy products and thus in more & more need of establishing new dairy requirement. This overall scenario resulted in increased pollution of animals and waste caused by them. The proper management of this waste is must form viewpoint of the environment, therefore a smart system is an urgent needed to operate and monitor animal farm waste remotely. Animal Waste Management is one of the key issues to solve the environment problem especially in tier 2 and tier 3 cities which are seriously facing problems due to this issue. The paper proposes an IoT based smart intelligent alert system for proper management of animal waste.

The proposed system uses "Internet of Things" to automate and control the process of collecting waste from all the dairies in the city and helps in appropriate disposal. The system also uses sensors to exhaust the excess of biogas which is produced by the animals waste. This intelligent system will also help in reducing the pollution of rivers as most of the animal waste is flushed in the nearby water-pond or river which also causes water pollution and health hazards to people living in surroundings as well. The proposed intelligent system can be designed cost effectively by using some IOT devices like "Arduino Uno, Raspberry Pi, ESP8266, MQTT, microcontrollers, gas sensor along with Internet or Intranet connectivity with the devices i.e. smart phones or computer.

Index Terms - **Arduino UNO microcontroller, Animal Smart Farm, ESP8266, MQTT Protocol, Raspberry Pi, Ultrasonic Sensor etc.**

I. INTRODUCTION

There has been strong relationship between humans and animals throughout the centuries. Humans depend on animals in various aspects of life such as sports, food, clothes and other product that support and facilitate their living. Therefore, a good care of animals is very important. Even today in many states there is a need of proper disposal of farm waste including dung, urine and other waste such as fodder etc., to improve the farm hygiene and to reduce the odor problems in dairy farms.

The livestock industries could greatly be benefitted from a sophisticated system capable of continuously monitoring the health of animals, aggregating the data and reporting the obtained results to owners. The Internet of Things (IoT) is a recent communication paradigm that envisions near future, in which the objects of everyday life will be equipped with microcontrollers, transceivers for digital communication, and suitable protocol stacks that will make them able to communicate with one another and with the users, becoming an integral part of the Internet [5]. This project which is based on "IOT Garbage Monitoring System" is a very innovative and smart system that will help to keep the cleanliness of the dairies.

II. LITERATURE REVIEW

Smart waste collection mechanism is used in dairy farms. Animal waste causes biogas emission which is harmful for the environment. Therefore, to get rid and/or minimize this ill effect, an exhaust system is designed. There are large pits or bins in dairy where the animal waste is gathered. Sensors are placed over the bins. The system works in two ways (i) whenever the biogas level is detected by the gas sensor, exhaust system is turned on which let the bio gas emit out of the farm.(ii) it avoids the overflow of the bins/pits by sending alerts to the respective Municipal/Government authority person [3].

This is not an original idea, for the implementation of smart garbage pit; the idea has existed for many years, After the IoT field finding its grip in human lives. This is, however an original plan for designing smart garbage bin with weight sensor, gas sensor, IR sensor and Wi-Fi module for transmission of data [4].There have been lot of work for managing garbage in smart cities, the idea of managing animal manure works on similar lines.

The paper [1] proposes waste gathering system dependent on waste level information from trashcans in a metropolitan zone. The information is gathered by sensors and sent over the web to a server where it is entered and prepared. The information is then utilized for checking and improving the day by day determination of trashcans to be gathered, ascertaining the courses likewise. The key feature of this system is that it is designed to learn from experience and to make decisions not only on the day by day waste level status as well as on future state figure, activity blockage, adjusted cost-productivity capacities, and other influencing factors that from the earlier people can't anticipate. The rate at which trashcans are being filled can be examined based on historical data.

In paper [5] Infrared sensor (IR sensor) is utilized which is a multipurpose sensor, which can distinguish the level of trash. IR sensor discharges the light, which is imperceptible to exposed eye however the electronic parts can identify it. It comprises of IR transmitter and IR collector. The yield of IR sensor is gained by The National Instruments myrio1900. It is an information yield

gadget which is compact and reconfigurable. USB goes about as a connector between the NI myrio-1900 and have PC. It has connectors An and B that goes about as a development port and a connector C that go about as a scaled down framework port, they convey the signs and these signs are recognized by various connector names. Sensor detects level of the canister. The GUI gives the yield of what level of waste is filled. Sensor detects level of the container. The graphical portrayal to get to the yield of the sensor is as demonstrated as follows. It gives the yield of what level of waste is filled. At the point when the level in a canister is achieved the edge, the LED put at the area of the receptacle engines flickering. At the point when the squinting LED is clicked, a show opens demonstrating the area of the receptacle, status of the container, information and time when the bin gets filled, versatile number and the content to send to the concerned individual. In any case, this framework does not guarantee whether waste is cleaned or not and transportation cost is another issue.

III. METHODOLOGY

The proposed system will use microcontroller Arduino Uno board, ultrasonic sensor, Biogas sensor, GSM module and MATLAB based GUI [6]. The proposed system can also be implemented for small and medium dairy farms. Depending on the size of the farm the number of dung-pit should be installed. In each dung-pit the Biogas sensor and Ultrasonic sensor will be placed.

Procedural steps:-

i.) Check dung-pit is filled with the waste or not, in particular time interval each dung-pit shares its status to the truck that holds the key. If waste in the dung-pit cross the threshold then the status of each dustbin is sent to the primary truck.

ii.) Primary truck finds the shortest path for all the dung-pit filled with the waste, Identified route and all filled dustbins marked locked, and the key is transferred to the secondary truck now secondary truck able to communicate with the dustbins.

iii.) Then Primary truck collect the waste of all the dustbins and that collected waste is transferred to large truck standing somewhere in the city.

iv.) Now same process is followed by secondary truck and tertiary truck and key regularly rotated from primary truck to secondary truck, secondary truck to tertiary truck then tertiary to primary truck and all the waste is transferred to the large truck.

v.) If dung-pit not filled by the waste for a long time so this system notifies the authorities regarding the status of the dustbin which is empty for a long time.

vi.) If trucks not visited the location of overflow dung-pit on the given time so automatically this system notify the authorities, If the authorities not take any action regarding this complains so this system send the information to the higher authorities.
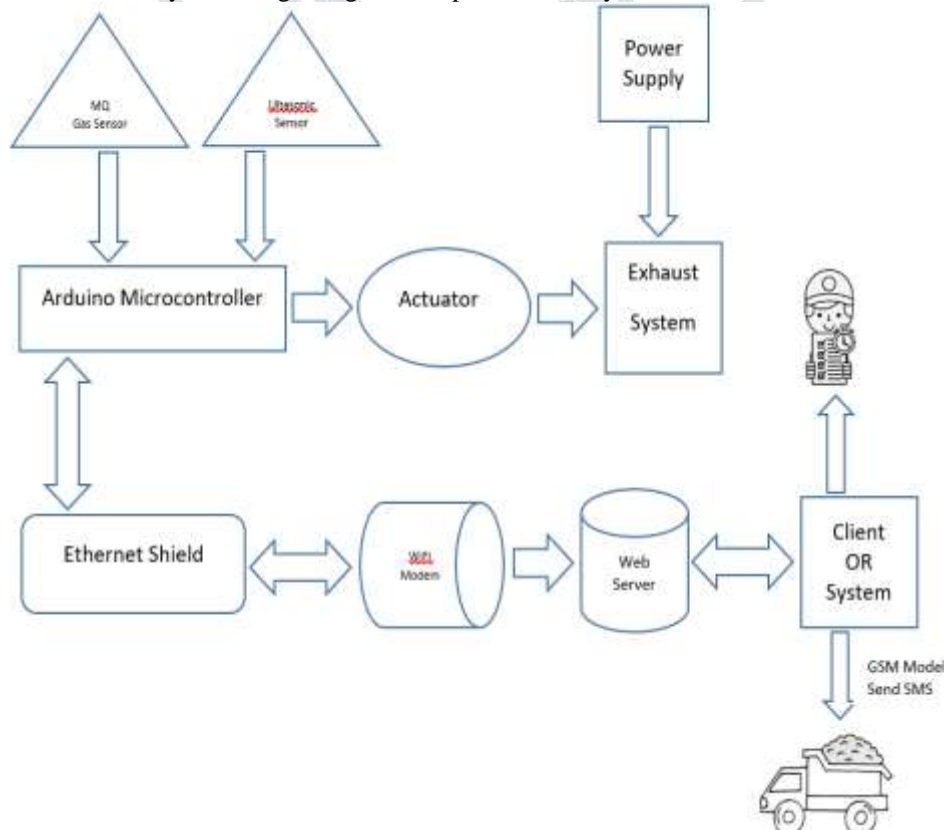

Figure 1 System Architecture

IV. SYSTEM OPERATION

The complete system operation is shown in the flowchart below.

(i) If the biogas indication is less than threshold value it will not turn on exhaust system. If it becomes more than a threshold value it will start an exhaust system.

(ii) When the dung-pit is filled 70% the database of the dustbin is made enabled to people to look in into the application called "Things view" (an android application) & for the municipal corporation of the city, via the mobile communication network, the signals are sent to awe application which can be viewed by waste

management company [7]. This implementation of Smart Garbage collection bin using IoT, IR sensor, microcontroller and GUI. This system assures the cleaning of dustbins soon when the garbage level reaches its maximum. If the dustbin is not cleaned in specific time, the record is sent to the higher authority who can take appropriate action against the concern contractor. Considering the current scenario and the pollution made by dumping dairy waste in the rivers(One of the example is Gaur River in Jabalpur), this solution can be implemented by the existing dairies.The cost of components involved is pretty reasonable so the overall system is very inexpensive and would benefit both the dairy farmers and the residents of the city
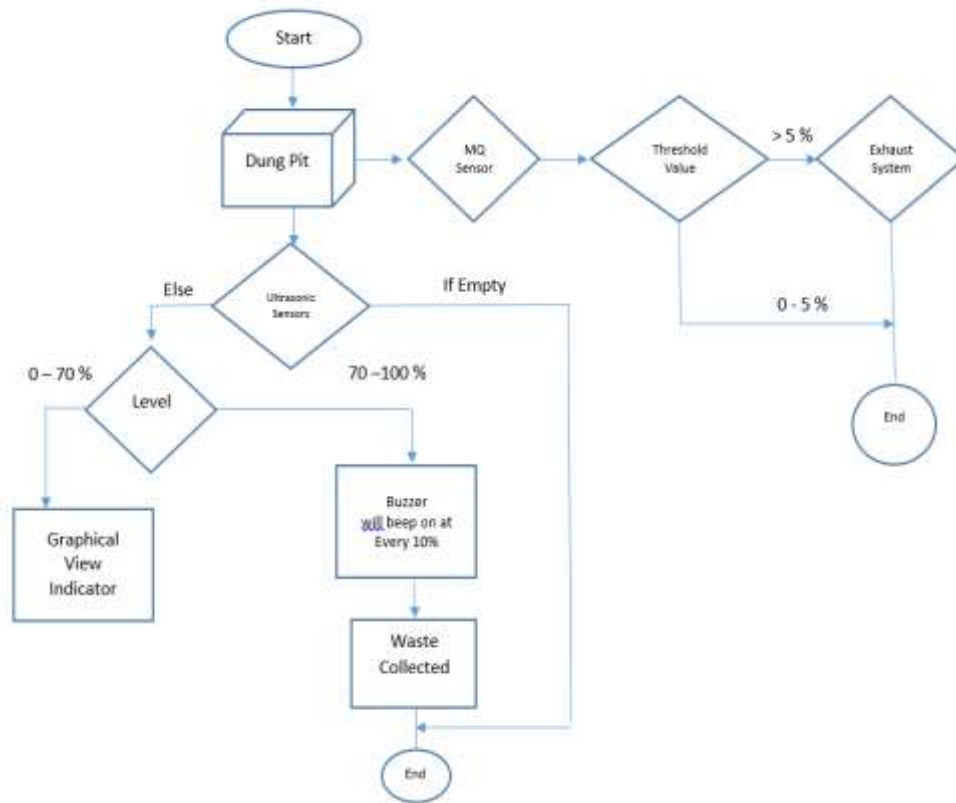

Figure 2 Flow diagram

V. CONCLUSION AND FUTURE SCOPE

In this paper an IoT enabled dairy farm has been designed to find out effective methods which are needed for providing hygienic environment in cities. As the level of waste in the dung-pits crossed the threshold, it will be informed to the corresponding authority; in case no timely action is taken it is automatically escalated to higher authority so a proper monitoring happens continuously to ensure proper hygiene is maintained in the farm.

In future a complete smart dairy can be implemented using IoT which can have Feed Control System, Incubator Control System, Water level control system, Fire detecting system etc.

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