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RESEARCH ARTICLE OPEN

Development of Internet of Things Enabled Livestock Monitoring and Controlling Model

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ABSTRACT: The livestock farm control system is based on wireless sensor network. The livestock farm control and monitoring system based on the WSN stores the environmental information received from the livestock farm. The server of the livestock farm control system based on the Data base carries out the analysis for the collected environmental information. This provides information on the environment and the abnormal symptoms of the livestock farm through the text service and the GUI devices.
It could carry out the management of livestock farm by applying the proposed livestock farm control model and could quickly cope with a dangerous situation of the livestock farm by informing it in real time when there is an abnormal symptom. This can be controlled manually and automatically.
The smart animal farm consists of Bio Gas Control System, Feed Control System, Temperature Control System, Fire Detecting System and Water Control System. The data is transmitted through wireless sensor network. The smart animal farm continuously monitors and controls the physical parameters. The design of smart animal farm is suitable for any kind of livestock monitoring system with little modifications.
Keywords: Tinker cad, Microcontroller, Livestock, Sensors.

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I. INTRODUCTION

There has been always a strong relationship between mankind and animals throughout the centuries. We rely on animals for life such as sports, food, cloth and other products. The livestock industry could monitor the animals continuously and intimate the owner about livestock farm conditions. The term Internet of Things is a new paradigm about the ability of connected devices to sense and gather data and then share that data using the Internet facility so that it can be processed and utilized to fulfill common goals.

IoT refers to a technology where different devices will have connectivity and can be accessed from anywhere in the world. There can be many IoT enabled applications such as healthcare, smart cities, building, energy and smart grid, manufacturing industry, weather forecasting and environmental monitoring, logistics and resource management, agriculture, smart shopping, automotive.

Currently, in cattle rearing the environmental conditions within the farm are manually monitored on an irregular basis. This process is largely consistent with the farmer expertise that is time consuming and expensive in terms of workforce. This system should provide feed and water as required, exhaust the excess of biogas which is produced by the animal waste, and detect fire in the farm. Moreover, this intelligent system should also do surveillance of the entire farm.

This kind of smart system can be designed cost effectively by using microcontrollers, water level sensor, gas sensor, temperature sensor and with internet or Intranet connectivity with the devices i.e. smart phones or computer. Using these features, we develop an IoT based smart livestock farm.

II. LITERATURE REVIEW

M. Xu et all [1] in his paper explains on the wireless sensor technology and the basic idea of modern wireless telecommunications to allow interactions among the pervasive presence of a variety of things or objects through unique addressing schemes. Hence, they are able to interact with each other and co-operate with their neighbors to reach common goal.

C. P. Schofield et all [2] in his paper explains the cattle farm automation, essential designs required for implementing the system, interaction between the systems, operating process of the designed system.

B. S. Chowdhry et all [3] in his paper explains IoT enabled smart animal farm. The system was cost effective. It constantly monitors the physical parameters of an animal farm.

H. Yoe et all [4] in his paper proposes a livestock control system based on the distributed platform as a control and integrated management of livestock farm. The domestic livestock industry is expected to be competitive because this system would provide reduction of labour force, production of high-quality livestock and improvement of productivity.

III. OBJECTIVES AND METHODOLOGY

Objectives:

The objectives of project are given below:

1. To study the existing circuit system based on livestock monitoring and its controlling.
2. To arrive at the specification for livestock monitoring and controlling model.
3. To develop the livestock monitoring and controlling model.
4. To test the livestock monitoring and controlling model.

Methodology:

Methodology of objective-1:

- Literature survey will be made to understand the developments made in livestock monitoring and controlling system.

Methodology of objective-2:

- Pre-requisite data for the specifications of livestock monitoring and controlling model will be extracted from the available reference journal publications meeting the desired specifications.
- The designed livestock monitoring and controlling model will be simulated in Tinker cad.

Methodology of objective-3:

- Livestock monitoring and controlling model will be developed by choosing the components to obtain appropriate design.

Methodology of objective-4:

- The programming will be interfaced with the hardware livestock monitoring unit.
- Livestock monitoring and controlling system functioning will be observed and recorded.
- Conclusions will be drawn based upon the validation studies.

IV. EXPERIMENTAL WORK

Figure 1 represents the block diagram of our livestock monitoring and controlling model. It contains all the individual components required for monitoring and controlling temperature, fire detection, gas detection, water level and feed detection systems. The microcontroller used in the circuit monitors the different parameters inside the animal farm. The circuit is designed to control all the specific parameters of livestock monitoring and controlling system.

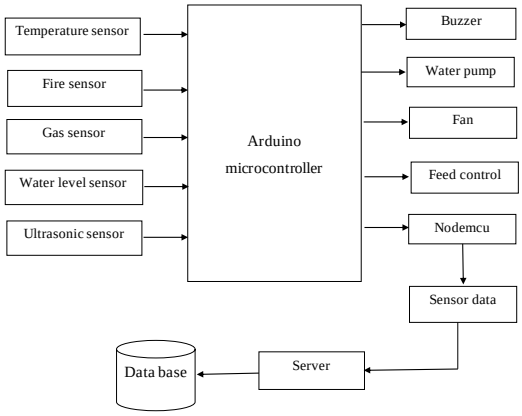

Figure 1: Block diagram

The first phase of the project involved the simulation of the project on Tinker cad Software.

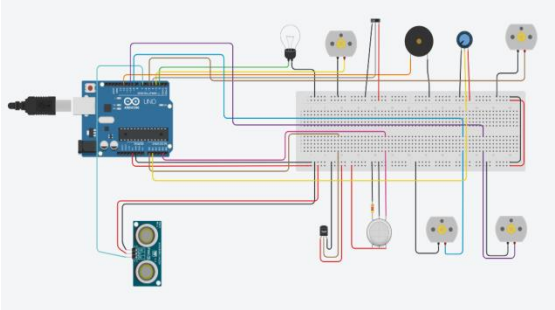

Figure 2: Simulation in Tinker cad

Figure 2 shows the simulation layout which is built in Tinker cad Software.

The designed model mainly consists of two modules, embedded system module and Ethernet communication module. The first module contains Water level sensor, Biogas sensor, temperature and humidity sensor, fire sensor and microcontrollers which are placed in the livestock model to sense the system parameters.

The data is transmitted by Ethernet shield through WI-FI. The embedded system module acquires information of the livestock and maintains the record and performs respective function in real time. It has two modes of operation i.e., automatic mode and manual mode. If the system is in automatic mode, the system operates according to the

programmed threshold values and keeps on giving feedback through GUI on certain IP.

Moreover, if the System is in manual mode, it is controlled manually using switches in GUI. This smart animal farm consists of subsystems which are Biogas Control System, Feed Control System, Fire Detecting System and Water Control System.

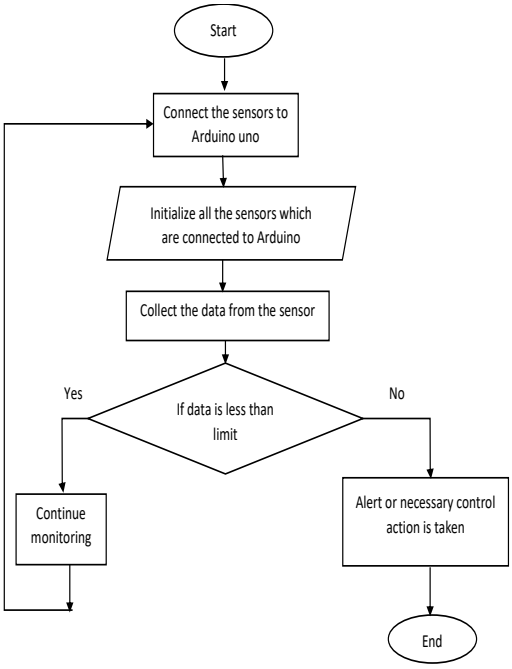

Figure 3: Flowchart

The data flow diagram is shown in Figure 3

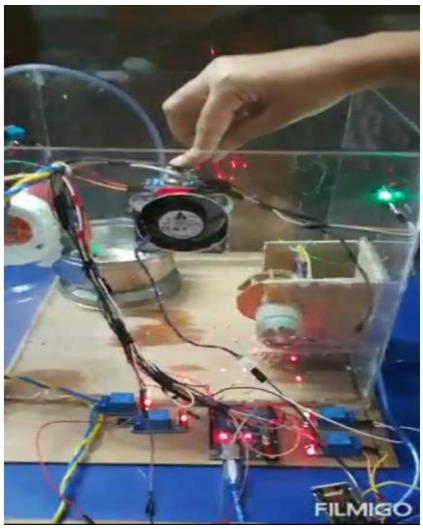

Figure 4: Livestock monitoring and controlling Model

Figure 4 shows the complete Livestock monitoring and controlling model including all the sensors like Water level sensor, Biogas sensor, temperature and humidity sensor along with other components.

Sensor	Condition	Outcome
Gas sensor	<Threshold >Threshold	Buzzer OFF Buzzer ON
Temperature sensor	<Threshold >Threshold	Fan OFF, Bulb ON Fan ON, Bulb OFF
Water level sensor	>Threshold <Threshold	No Water, Motor ON Water present, Motor OFF
Fire sensor	>Threshold <Threshold	Fire Started, Sprinkler ON No Fire, Sprinkler OFF
Feed	<Threshold >Threshold	Food not available, Food belt ON Food available, Food belt OFF

Table 1: Results

The humidity of the system is different throughout the day. The results as in table 1 reveal that it can be maintained using this smart system. The temperature of livestock can be stabilized using heater and fan. The continuous data from the temperature sensor is used to maintain the temperature of the system. 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. If the feed in the container is less than a threshold value or a certain quantity then system turns on the feed valve to maintain up to a specified level. If the fire sensor value goes below the threshold value, system turns on an alarm. Finally, if the water level becomes below the threshold value, the system turns on the water pump.

V. CONCLUSION

Farming plays an important role in today's world and it requires proper environmental and diet care. A smart system is needed to operate and monitor animal farm remotely.

The developed model comprises feed filling system, water filling system, temperature control system, biogas exhaust system, fire detecting system. The data from the system is transmitted and received by a certain IP address and port address using a WIFI router to the GUI of the system. The system can be controlled and monitored using the GUI of the system.

It continuously monitors the physical parameters of the livestock. It can be controlled manually as well as automatically. This design is suitable for any kind of livestock with slight modifications.The design of smart livestock farm requires less human intervention**.**

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