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A Comprehensive Study of Smart Farm

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ABSTRACT

Agriculture is the important factor development in rise of human civilization, and farming of domestic species which helped in creating food surpluses that nurtured the development of civilization. To produce output with high quality requires a good farm. In today's world, traditional farm alone cannot produce such results. It needs to get upgrade with technology thus enabling farmers to produce previously unseen results. With the advancement in the field of technology, the world around us is shifting towards automation. Automatic systems are being prioritized over manual systems, as they are energy efficient and minimize the need for tedious manual labour.

Keywords: Automation, Wireless Sensor Network, Zigbee, BeagleBone, Router, Access Point

I. INTRODUCTION

This paper aims to raise alternative ways to support farming. Modern farming techniques seek to diminish human involvement, escalate yield, and improve animal health. There are many actors which play a vital role in raising of animals in farm such as economics, quality and consumer safety. The paper attempts to extend automation to the farm level, by using complex and sophisticated home automation techniques, and adjusting them to suit a modern day farm.

Automation makes use of machines, control systems and information technologies to optimize productivity in the production of goods and delivery of services. The Indian farms are slowly beginning to feel the need of the technical advancement to be made in traditional farming methods. Automation in India is advancing at a fast pace, yet agriculture is one area that has seen less technological advancement as compare to the other countries despite having majority of population dependent in this sector. Use of sensor and other devices has made it possible to have technological advancement in almost all the areas. Sensor networks are compact wireless networks of small and low cost sensors, which gather and distributed environmental data. Wireless sensor networks helps in monitoring and controlling of corresponding physical environments from remote area with better efficiency and accuracy. It has applications in a range of fields such as environmental monitoring, climate control, surveillance and many more. Sensor nodes have various energy and computational restrictions because of their reasonable nature and ad-hoc method of implementation. In this paper we have proposed the Wireless sensor network to design the smart environment to monitor and control various climatic parameters contributing to smart farm. Data about livestock and farm can be remotely obtained by

farmer. Various operations such as automatic light control, automatic irrigation control can also be done with the help of system.

II. FEATURES

Features of Smart Farm are as follows

- Automatic lighting Control
- Climate Control System
- Humidity and Moisture Control
- Environment Monitoring System
- Tracking livestock
- Irrigation Control System

A. Automatic light switching system

Counters are used in both the directions to count the number of people entering a room in the farm house. The lights are turned off automatically on reading count zero. The system can also be modified to be timer dependent. In this case, lights will only be switched on when animals are awake and in their enclosures. In the farmhouse, lights will switch off at a preset time. An up-down counter that can change its state in either direction is used to count the number of people entering and exiting the farmhouse rooms. The up mode is counting the number of people entering while the down mode is used to count the number of people leaving the room by decrementing the value of counter. The IR sensor detects motion. When a person exits or enters it detects the interruption and runs the counter in either up or down mode based on selector setting. The count is displayed on a display(LCD). In this circuit, as showed in figure, a pair of infrared (IR) sensor modules is used, for both up and down counting. The pair of IR sensors are horizontally placed at a distance such that, whenever an interruption is observed by the first IR sensor, it increments the counter value. When the count value is more than zero, the lights are switched on. When the value becomes zero, the lights are automatically switched off, thus conserving energy.

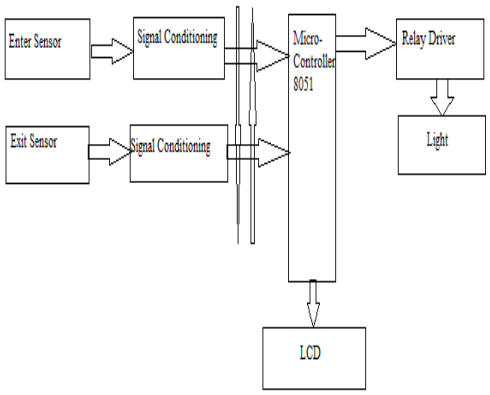

Figure 1. Automatic Light Control

B. Climate control system

An exhaust fan or a heater will get switched on automatically depending on real time readings from a temperature sensor. An 8-bit ADC is sufficient to provide required accuracy for in-house temperature readings. Depending on conditions requirements of cooling down or heating up inside the farm house, the microcontroller decides to switch on the exhaust fan or the heater respectively. It ensures comfortable conditions for livestock without tedious manual monitoring, along with energy conservation. The system can also be used for storage of farm products like milk and eggs, which require ambient temperature conditions to prevent spoilage. In addition, it can also be used in hatcheries to store eggs at required temperature for artificial hatching to ensure quality control. The temperature output can be preset with a keyboard interface to the microcontroller based system. The system has also a

humidity sensor to decide whether increase or decrease humidity.[5]

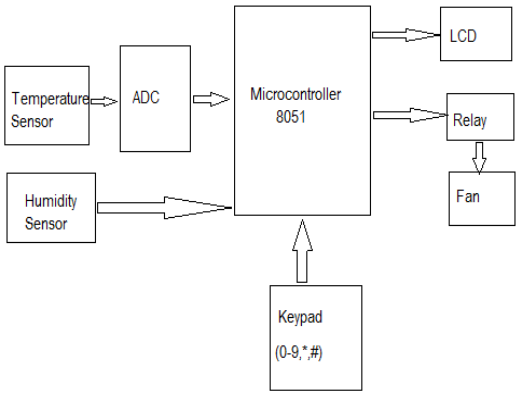

Figure 2. Climate Control System

C. Humidity and moisture control

A humidity sensor circuit is used to detect a change in humidity of the field surrounding and generate an interrupt signal to the microcontroller, which activates the sprinklers with the help of a digital solenoid valve. In the present scenario of water shortage, this system is an efficient and simple way of conserving water used in the farm. Humidity sensor is also used in many places such as hatcheries to maintain ambient temperature for artificial hatching. New born chicks require specific humidity and temperature conditions for their survival and healthier growth. The system has capability to measure different levels of temperature humidity and thus providing the necessary information to the farmers so that early precaution steps can be taken.[4]

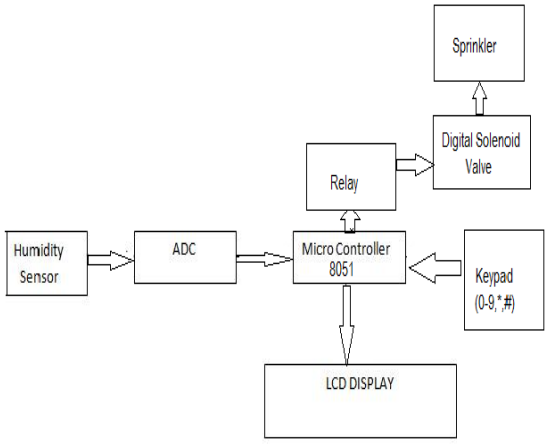

Figure 3. Humidity Control System

D. Environment Monitoring System

There are various problems in the traditional agriculture like weak real-time data acquisition, limitations in monitoring area, excessive manpower etc., The system collects various climatic parameters like temperature, humidity, illumination, voltage etc. from greenhouse and from there it transmits the data to nearest server via GPRS. The system includes a web application which is using Google Maps to show the greenhouse status and provide regular voice and SMS alarm service. Since, it requires lots of power so it is powered by solar and storage batteries. This results that low power system has better scalability and can provide better service.

E. Tracking livestock

The tracking collars are worn on the animal as a collar, and if or when the farmer wants to collect and review that recorded tracking data all they need to do is manually remove the collar and download the stored data, which will allow them to view in retrospect the movements of the livestock.

F. Irrigation Control System

The utilization of proper method for irrigation by drip is very proficient and reasonable. The approach reviews various monitoring system and also proposes an automatic monitoring system model which is using Wireless Sensor Network (WSN) which is useful for the farmers to improve the growth of crops. The system provides proper amount of irrigation to agricultural fields by observing the moisture content of soil. The system automates the process of manually irrigating the fields by switching the pump ON/OFF. It is implemented by using an 8051 series microcontroller, programmed such as to collect input signals that measures moisture content of soil through sensing arrangement.[3]

III. CONCLUSION

This project has proposed to introduce an efficient and advance smart farm system. It has make use of automation into various aspects of the farm. A new system for animal enclosures is put forward to improve the living conditions of livestock, as well as reduce manual labour. It includes an automated light, humidity and sprinkler system. The humidity and moisture control mechanisms make sure the animals are comfortable in the conditions they are kept in, by auto adjusting the settings as per requirement. The system is energy efficient as it helps conserve resources like energy, water and reduces manual labour to a great extent. A GSM module is used to connect all aspects of the modern automated farm. The farm owner has easy access to the system and can control it remotely through his mobile phone. This paper shows that with the use of advance technology to the farm, systems and appliances will be able to communicate in an integrated manner. This will result in convenience, energy efficiency, and quality and safety benefits.[2]

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