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DESIGN AND IMPLEMENTATION OF ANIMAL HUSBANDRY HEALTH MONITORING SYSTEM

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Abstract ---
Major issue in rural India is unavailability of good veterinary in the society. And due to this farmers are facing severe problems of their cattle's health monitoring and diagnosis. In this project comparative study about cattle heath is presented and proposed certain solutions to this through cattle health monitoring system. The proposed system is an easy solution for the farmers to monitor the cattle health parameters for farmers. A system is prepared which compares the present health parameters with standard reference parameters. Different types of sensors, Axis sensor, smell sensor, and wireless based platforms are used for experimentation. The proposed monitoring system includes the infrastructure, hardware, software and representative physiological instruments. Many dairies contain large number of cattle's.The main aspect of health monitoring system is to check continuously the health of individual of cattle, easily diagnosis and treatment of sick cattle as early as possible.
This project presents a comprehensive cow health monitoring system utilizing various sensors to track vital parameters and detect potential health issues in cattle. The system monitors parameters such as body temperature, duration of lying down, walking motion, and presence of abnormal smells, all of which are indicative of the cow's health status. Utilizing hardware components such as Nano microcontroller, HC12E sensor for wireless transmission, LCD display, Axis sensor for motion detection, MQ-135 smell sensor, and LM35 for temperature sensing, the system provides real-time monitoring and alerts. The integration of wireless transfer capabilities allows for remote monitoring by cow owners or authorized personnel, enhancing management and early detection of health issues, ultimately contributing to improved cattle welfare and productivity.

INTRODUCTION
Cattle farming is a major industry in many countries, and the health and well-being of cattle is essential to its success. Traditional methods of monitoring cattle health, such as regular physical examinations by veterinarians, can be time consuming and expensive. However, new technologies, such as the wireless transmitter, can be used to monitor cattle health remotely and in real time. The system includes wearable sensors that monitor various vital parameters of the cattle, such as body temperature, smell sensor, and wa. The data collected from the sensors is sent to the authorized personnel. The system also includes that allows farmers to access the data and receive alerts if any abnormalities are detected. The proposed system has several advantages over traditional methods of cattle health monitoring. It allows for continuous monitoring of the cattle's health, which can help detect early signs of illness and prevent the spread of disease.
It also reduces the need for regular physical examinations, which can save farmers time and money. Additionally, the system provides farmers with real-time data on their cattle's health, which can help them make informed decisions about their management practices. In this project, we describe the design and implementation of the cattle health monitoring system using wireless. Also evaluate the performance of the system through a series of experiments and show that it is capable of accurately monitoring the health of cattle in real time. These results, demonstrate the potential of

wireless technology to revolutionize the cattle farming industry and improve the health and well-being of the cattle.

LITERATURE SURVEY

1. Adamczyk K, Cywicka D, Herbut P, Trześniowska E. The application of cluster analysis methods in assessment of daily physical activity of dairy cows milked in the voluntary milking system. Comput. Electron. Agric. 2017;141:65–72. doi: 10.1016/j.compag.2017.07.007. (2017)

A great individual variability of dairy cows and the diversity of conditions of their maintenance make it difficult to unequivocally interpret the animals' behaviour and, consequently, to assess their welfare objectively. Thus, technical support to cattle breeders seems increasingly important in this respect at the stage of data collection, the analysis of data and assessment of rearing conditions. Therefore, the aim of the project was to examine the possibility of using cluster analysis to assess physical activity of dairy cows milked in the Voluntary Milking System while taking into account environmental conditions.

2. Aguilar S, Vidal Ferré R, Gomez C. Opportunistic sensor data collection with bluetooth low energy. *Sensors.* 2017;17:159. doi: 10.3390/s17010159. (2017)

Bluetooth Low Energy (BLE) has gained very high momentum, as witnessed by its widespread presence in smartphones, wearables and other consumer electronics devices. This fact can be leveraged to carry out opportunistic sensor data collection (OSDC) in scenarios where a sensor node cannot communicate with infrastructure nodes. In such cases, a mobile entity (e.g., a pedestrian or a vehicle) equipped with a BLE-enabled device can collect the data obtained by the sensor node when both are within direct communication range.

3. Borchers M, Chang Y, Tsai I, Wadsworth B, Bewley J. A validation of technologies monitoring dairy cow feeding, ruminating, and lying behaviors. J. Dairy Sci. 2016;99(9):7458–7466 doi: 10.3168/jds.2015-10843.

The objective of this study was to evaluate commercially available precision dairy technologies against direct visual observations of feeding, rumination, and lying behaviors. Primiparous (n=24) and multiparous (n = 24) lactating Holstein dairy cattle (mean ± standard deviation; 223.4 ± 117.8 d in milk, producing 29.2 ± 8.2 kg of milk/d) were fitted with 6 different triaxial accelerometer technologies evaluating cow behaviors at or before freshening. The AfiAct Pedometer Plus (Afimilk, Kibbutz Afikim, Israel) was used to monitor lying time. The Cow Manager Sensor (Agis, Harmelen, Netherlands) monitored rumination and feeding time. The HOBO Data Logger (HOBO Pendant G Acceleration Data Logger, Onset Computer Corp., Pocasset, MA) monitored lying time.

4. Caja G, Castro-Costa A, Knight CH. Engineering to support wellbeing of dairy animals. *J. Dairy Res.* 2016;83(2):136–147. doi: 10.1017/S0022029916000261.

Current trends in the global milk market and the recent abolition of milk quotas have accelerated the trend of the European dairy industry towards larger farm sizes and higher-yielding animals. Dairy cows remain in focus, but there is a growing interest in other dairy species, whose milk is often directed to traditional and protected designation of origin and gourmet dairy products. The challenge for dairy farms in general is to achieve the best possible standards of animal health and welfare, together with high lactational performance and minimal environmental impact.

5. Del Campo A, Cintioni L, Spinsante S, Gambi E. Analysis and tools for improved management of connectionless and connection-oriented BLE devices coexistence. Sensors (Switz.) 2017;17(4):792. doi: 10.3390/s17040792.

With the introduction of low-power wireless technologies, like Bluetooth Low Energy (BLE), new applications are approaching the home automation, healthcare, fitness, automotive and consumer electronics markets. BLE devices are designed to maximize the battery life, i.e., to run for long time on a single coin-cell battery. In typical application scenarios of home automation and Ambient Assisted Living (AAL), the sensors that monitor relatively unpredictable and rare events should coexist with other sensors that continuously communicate health or environmental parameter measurements.

6. Dolecheck K, et al. Behavioral and physiological changes around estrus events identified using multiple automated monitoring technologies. J. Dairy Sci. 2015;98(12):8723–8731. doi: 10.3168/jds.2015-9645.

These cows were used to compare differences between the 6 h before and after the first standing event (estrus) and the 2 wk preceding that period (nonestrus) for all technology parameters. Differences between estrus and nonestrus were observed for CowManager SensOor minutes feeding per hour, minutes of high ear activity per hour, and minutes ruminating per hour; twice daily DVM bolus reticulorumen temperature; HR Tag neck activity per 2 h and minutes ruminating per 2 h; IceQube lying bouts per hour, minutes lying per hour, and number of steps per hour; and Track a Cow leg activity per hour and minutes lying per hour.

7. Mirani AA, Memon MS, Rahu MA, Bhatti MN, Shaikh UR. A review of agro-industry in IoT: applications and challenges. *Quest Res. J.* 2019;17(01):28–33.

IoT and WSN, the two emerging fields, introduced efficient and reliable agricultural and livestock monitoring. Researchers are focusing these fields to introduce several new trends and techniques for agricultural automation industry. The automation industry is now seeking new opportunity in the field of agriculture and livestock. The idea of IoT is to embed a particular framework by adding computer software, sensors, and actuators and to establish the connection over internet for the purpose of uploading and processing the data over a cloud.

EXISTING METHOD

In the existing manual process, monitoring the health of dairy cattle relies heavily on visual inspection and occasional manual measurements of basic parameters such as body temperature. This method is labor- intensive, time-consuming, and prone to human error, making it challenging to detect health issues in cattle early and provide timely intervention. Moreover, the lack of continuous monitoring results in missed opportunities for real-time detection of subtle changes in the cow's health status, potentially leading to delayed diagnosis and treatment of illnesses.

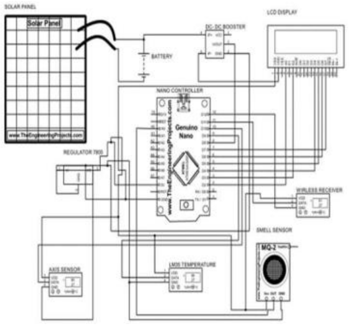
PROPOSED SYSTEM

In rural India, the scarcity of proficient veterinary services poses a significant challenge for farmers, leading to difficulties in monitoring and diagnosing the health of their cattle. To address this issue, a comparative study on cattle health is conducted, proposing solutions through a comprehensive cattle health monitoring system. The system aims to provide farmers with an easy-to-use solution for monitoring cattle health parameters by comparing current health metrics with standard reference values.

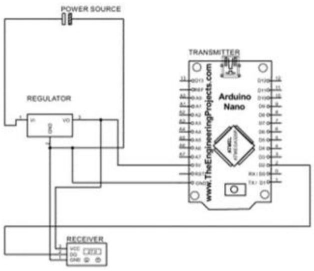
Utilizing a combination of sensors, including Axis sensor for motion detection, MQ-135 smell sensor for odor assessment, and LM35 sensor for temperature monitoring, the proposed system offers real-time monitoring capabilities. Additionally, hardware components such as Nano microcontroller and HC12E sensor enable wireless transmission, facilitating remote monitoring by farmers or authorized personnel. By continuous tracking vital parameters like body temperature, activity level, and presence of abnormal smells, the system enhances early detection of health issues, ultimately contributing to improved cattle welfare and productivity.

DETAILED SYSTEM DESIGN

CIRCUIT DIAGRAM FOR TRANSMITTER SIDE



CIRCUIRT DIAGRAM FOR RECEIVER SIDE



CIRCUIT DESCRIPTION

The Transmitter side core components consist regulator IC7805, Nano controller, solar panel, battery, Dc to DC booster, Liquid Crystal Display, transmitter, smell sensor, lm38 temperature sensor, axis sensor.

The Receiver side core components consist of receiver side (Rx), power supply, Nano controller.

The solar panels will continue to generate voltage, then voltage will be store in battery, then battery connected to dc-dc booster converter that steps up voltage 6v to 12v, then 12v connected to voltage regulator it converting 12v to 5v, 5v supply connected to controller and ground connected to GND.

In Liquid crystal display VCC pin is connected to 5v supply, GND pin is connected to ground remaining data pins are connected to micro controller digital pins.

Smell sensor has 3 pins. VCC pin is connected to 5v supply, GND pin is connected to ground. Output pin is connected to controller analog pin.

Axis sensor has 3 pins. VCC pin is connected to 5V supply, GND pin is connected to ground. Output pin is connected to digital pin.

Transmitter and receiver 3 pins is connected to controller digital pin. RX & TX is connected to TX & RX respectively.

LM35 body temperature monitor sensor has 3 pins. VCC pin is connected to 5V supply, GND pin is connected to ground. Output pin is connected to digital pin.

NANO MICROCONTROLLER

The Nano board is designed in such a way that it is very easy for beginners to get started with microcontrollers. This board especially is breadboard friendly is very easy to handle the connections.

5.1.1 Powering Nano:

There are totally three ways by which one can power Nano.

- **USB Jack:**

Connect the mini USB jack to a phone charger or computer through a cable and it will draw power required for the board to function

- **Vin Pin:**

The Vin pin can be supplied with a unregulated 6-12V to power the board. The on-board voltage regulator regulates it to
+5V

 +5V Pin:
If it has a regulated +5V supply, then it can directly provide this on the +5V pin.
These pins apart from serving their purpose can also be used for special purposes which are discussed below:

- **Serial Pins 0)Rx(and 1)Tx(:** Rx and Tx pins are used to receive and transmit TTL serial data. They are connected with the corresponding USB to TTL serial chip.
- **External Interrupt Pins 2 and 3:** These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- **PWM Pins 3, 5, 6, 9 and 11:** These pins provide an 8-bit PWM output by using analog ***Write*** function.
- **SPI Pins 10)SS(, 11)MOSI(, 12)MISO(and 13)SCK(:** These pins are used for SPI communication.
- **In-built LED Pin 13:** This pin is connected with a built-in LED, when pin 13 is HIGH – LED is on and when 13 pin is LOW, it's off.
- **I²C A4)SDA(and A5)SCA(:** Used for IIC communication using Wire library.
- **AREF:** Used to provide reference voltage for analog inputs with analog ***Reference*** function.
- **Reset Pin:** Making this pin LOW, resets the microcontroller.

Specifications	Arduino Uno	Arduino Nano
Processor	ATmega328P	ATmega328P
Input Voltage	5V / 7-12V	5V / 7-12V
Speed of CPU	16 MHz	16 MHz
Analog I/O	6 / 0	8 / 0
Digital IO/PWM	14 / 6	14 / 6
EEPROM / SRAM [kB]	1 / 2	1 / 2
Flash	32	32
USB	Regular	Mini
USART	1	1

Basic Embedded C Programming Steps Requirement Analysis: Understanding the requirements of the Embedded System to be developed according to the problem| requirement should be done.
Selecting Environment Setup: Selection of proper tools such as choosing Integrated Development Environment (IDE), compiler, debugger and other necessary tools for Embedded C Programming.
Code Development: Writing the Embedded C code based on the system requirements and design specifications must be done in this step. The program should consume less memory space, must be reliable and scalable.
Compilation Process: In this stage the compiler translates the embedded C code into assembly language code or machine level code. The machine level code is in the form of 0's and 1's. Also the preprocessor handles the directives such as #include, #define.
Loading to Target device: Uploading the compiled code onto the target hardware (microcontroller, FGPA) using tools like debugger or flash programmers needs to be done.
Execution and Debugging: Run the embedded system and execution of code is performed. Employing debugging tools to identify and resolve any errors or issues in the code.
Documentation and Maintenance: Creating proper documentation detailing the system architecture, code functionalities and memory usage. Periodically updating and maintaining the codebase to address issues.

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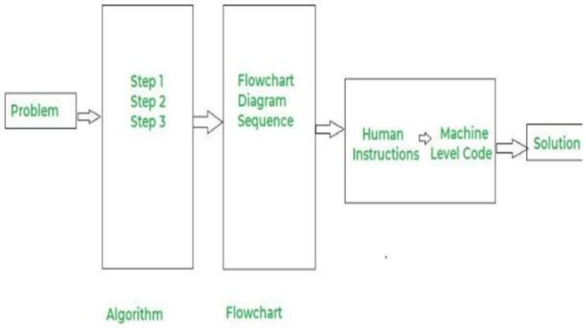
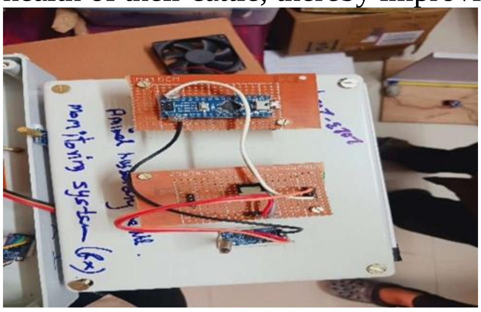
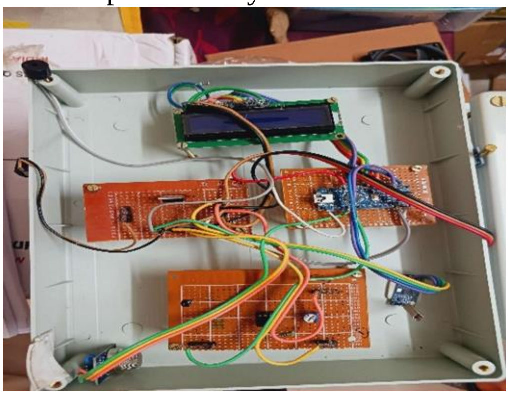


RESULTS

In this project, a comprehensive cow health monitoring system was developed to address the challenges faced by farmers in rural India. Through the utilization of various sensors and wireless transmission capabilities, the system enables real-time monitoring of key health parameters such as body temperature, activity levels, and presence of abnormal smells. The integration of hardware components such as Nano microcontroller, HC12E sensor, LCD display, Axis sensor, MQ- 135 smell sensor, and LM35 for temperature sensing facilitates accurate monitoring and timely alerts. Overall, the implementation of this system offers a practical solution for farmers to monitor and manage the health of their cattle, thereby improving animal welfare and productivity in rural communities.





CONCLUSION

In conclusion, the development of a comprehensive cow health monitoring system represents a significant advancement in farm automation and animal welfare. By leveraging various sensors and wireless transmission capabilities, the system enables real-time monitoring of vital parameters such as body temperature, activity levels, and environmental conditions. This proactive approach allows for early detection of potential health issues in cattle, facilitating prompt diagnosis and treatment. Moreover, the integration of wireless transfer capabilities enables remote monitoring by dairy owners or authorized personnel, alleviating the burden of routine health checks and enhancing overall management efficiency. Ultimately, the implementation of such a monitoring system not only promotes the well- being of individual cattle but also contributes to increased farm productivity and sustainability, aligning with the broader goals of modern agriculture.

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