NSBM Green University

Faculty of Computing

Animal Health Care Collar

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Background - Project background

Humans depend on plant foods and animal foods. Farms raise animals to produce animal feed. Some farms raise many animals. Some farms breed the same type of animals, and some farms breed different types of animals. These animals are very expensive and we as humans get many benefits from these animals. According to the details that we looked at in several farms, we found that the measures that could be taken regarding the health and safety of the animals there were not taken at a significant level. As a result, many animals get sick and die, and because the animals are 100% in good health, the benefits that can be obtained from them cannot be obtained completely. We also found that animals are disappearing in a big way.

Similar Solutions : Various measures for the health and safety of animals have been taken by various farms that measuring the health or health issues that can be taken from various types of devices but our aim is to protect them from environmental changes than been sick. But that doesn't cover all possible steps. In some farms, various measures have been taken to maintain the required temperature for the animals. Also, measures have been taken to maintain their humidity to suit the animals. The health status of those animals is checked almost once a month. Also, in some very limited farms, various types of animals have been fitted with

Problem identification, Problem Justification

Animals on farms are suffering from various diseases and dying in large numbers. Also, due to the animals suffering from diseases, the benefits obtained from them are also limited. It fails to get 100% of their products. Therefore, many economic losses are caused to animals as well as humans. Even though various measures have been taken to get rid of this, they cannot be considered as the best measures. Most of the techniques involve creating environmental conditions suitable for the animals, but they cannot monitor the health conditions of the animals. Animals can develop diseases even in good environmental conditions. Also, on most farms, the health conditions of the animals are checked once a period. But animals can fall victim to sudden diseases at any time. Therefore, the most efficient is to use technology to obtain information so that we can determine the health and safety of the animals every second. Fitting a health band to animals can be considered as the best solution. we checking the environment behavior or changes that affect for health of animal the best solution. we checking the environment behavior or changes that affect for health of animal

Methodology and approach

The aim of our project is to check whether the health level of the animals in the farm is correct and to ensure the health level and safety of the animals by protecting them from illness after examine the environment behavior and gaining a decision.

When we were looking for facts in this connection, we found out that there is currently a shortage of similar devices in Sri Lanka and they are imported from abroad. Therefore, our effort is to make this Health Measure Belt in Sri Lanka at a very low cost and distribute it in Sri Lanka. As well as the priority given to the animals, the separate market for Farm Animals will also come forward but we are mainly focusing on the environment changes using our belt and then doing precaution to protect animals before getting sick.

During our research, we found out that this kind of equipment was implemented in Sri Lanka's most prestigious and famous farm a few months ago. The farm manager said that it was a system they got with animals imported from abroad. We were also able to understand the inconvenience. As a solution to all this, we decided that we should do something by creating a health tracker belt for these farm animals so we are try our best to make a belt or collar that we can detect environmental changes that affect for cows because there are so many project created that are displaying animals data I mean their heart rate , body temperature etc. but there are limited number of collars created that can take environmental data's and protect them before getting sick I think it is best way we can protect animals that examine their conditions.

This belt provides the ability to accurately monitor the temperature, humidity, movements, location and safety of the animals using environmental chamges(cows, goats, horses) raised in the farm. If they are exposed to rain for a long time, they will get sick, so before that happens, the farm owner can get to know about the animals through an alert.)Here, in our Health Tracker Belt, we have created a separate App for the convenience of the farm owner, so that the owner can easily keep an eye on the animals raised in the farm. We have used Firebase for the database for its efficiency and convenience.

And this is different from other similar devices, due to the ability to obtain not only one or two parameters about the animal we are observing, but several at the same time. Our hope is to introduce this new device from the small-scale farms in Sri Lanka to the large scale farms that will further develop these devices. And I think it will be loved by NGO that are working under safety of animals

Solution

- The Health Band can track the health of farm cows and monitor their movements in real-time using accelometer .
- The Band can send alerts to farmers that if their were in unbearable temperature or humidity .
- The band can provide accurate location data of each cow, which can be helpful in managing large herds efficiently.
- The band can monitor the temperature and humidity levels of environment, which can help identify the potential risk of illness or disease.
- Cost savings: By catching potential health issues early after examining by environmental changrs, farmers can save money on veterinary bills and medication.
- Increased efficiency: The use of a health band eliminates the need for manual monitoring of cows, saving farmers time and increasing their efficiency.
- Better animal welfare: By monitoring the cows' activity levels and water intake, farmers can ensure that the animals are well-cared for and comfortable.
- Improved decision-making: The data collected from the health band can help farmers make informed decisions about the management of their herd after examining environmental changes.

It can be challenging to manage and monitor the health of large animal herds, especially in farms where the number of cows can range from a few to hundreds. However, health bands have provided an innovative and practical solution. These bands are designed specifically for cows that are used in milk production farms. The monitoring of the cows' health and activity levels is essential in ensuring optimum milk production. The data collected from the various sensors allows farmers to track the cows' behavior, movement, anphysical conditions after examing environmental change that affect for health of cows.

Data from the DHT11 sensors used to measure temperature can reveal potential health problems such as fever or inflammation. The mpu6050 accelerometer is used to monitor the cow's movements, such as walking and lying down, which can provide insights into the cow's overall activity levels. Furthermore, GPS works to keep track of the cow's location in the farm, permitting farmers to monitor their grazing behavior and customize diet plans to provide nutritious and healthy feed.

The water sensor is also an essential component of the health band, and tracking water intake levels helps farmers manage dehydration and prevent urinary tract infections.

The health band technology has revolutionized the way farmers monitor cow's health in milk production farms. It helps farmers identify potential health issues promptly, reduce disease risks, and increase milk production levels. Overall, this innovative technology is a significant milestone in the agriculture industry; it is not only profitable, but it also ensures animal welfare.

With the advancements made in the field of agriculture, the use of technology has revolutionized the way farmers monitor their livestock. One such technology is the health band, which is now commonly used in the dairy industry. The health band is a wearable device that is placed around the leg of the cow, and it tracks various parameters of the animal's health and activity levels. The information gathered from the health band can be used by farmers to optimize their practices and enhance their milk production. In this paragraph, we will discuss how the implementation of health bands has facilitated improved milk production, cost savings, increased efficiency, better animal welfare, and improved decision-making in the dairy industry.

Improved milk production is perhaps the most significant benefit that farmers can experience using health bands. As the health bands collect data such as activity levels, water intake, and feeding habits, farmers can monitor the cows' health and identify any potential health issues. By doing so, they can take immediate action to address these issues before they escalate and prevent any decrease in milk production.

This proactive approach to health management ensures that the cows remain healthy, comfortable, and productive, resulting in better profitability for the farmers and adequate supply of milk for consumers.

In addition to improved milk production, the use of health bands results in cost savings for farmers. By detecting potential health issues early, farmers can save on veterinary bills and medication. The early detection of health issues ensures early intervention and treatment, avoiding expensive treatment later. Furthermore, the data collected from health bands allows for efficient use of resources, saving farmers both time and money.

The use of health bands also leads to increased efficiency in the dairy industry. The conventional method of manual monitoring of cows is time-consuming, and prone to human error. Health bands eliminate the need for manual monitoring, and farmers can now collect more data and monitor their herd remotely. This timesaving brings about increased efficiency and effective herd management.

Better animal welfare is achieved using health bands. These devices allow for better monitoring of cows' activity levels and water intake, which is an essential indicator of their wellbeing. Farmers can take measures to ensure that cows are well-cared for and comfortable, thereby improving animal welfare.

Finally, the implementation of health bands enhances decision making by allowing farmers to make informed decisions based on accurate data streams. The data collected from the health bands serve as a valuable tool for farming practices, which can be used to optimize milk production, reduce costs and increase efficiency.

In conclusion, the use of health bands in the dairy industry is undoubtedly a groundbreaking technology. The benefits such as improved milk production, cost savings, increased efficiency, better animal welfare, and better decision-making facilitate a paradigm shift in agriculture. With the increasing adoption of technology, the use of health bands is an excellent example of how technology can be harnessed to enhance farming practices and benefit the farming community.

In summary, the health band is a valuable tool for farmers who want to improve the health and milk production of their cows. The use of sensors like DHT11, mpu6050, GPS, and water sensor provides valuable data that can be used to identify potential health issues, improve animal welfare, and increase the efficiency of farm operations. By using a health band, farmers can save money on veterinary bills, improve decision-making, and ensure that their cows are healthy and well-cared for.

Testing and Evaluation

To ensure the device's durability, use, and potential to save lives, the testing and assessment phases of the project are crucial, and a variety of testing procedures are required. These methods involve gathering user input as well as doing functional, usability, performance, compatibility, and field tests. The project may evaluate the device's usability, compatibility, performance, and the accuracy of its sensors, notification system, location accuracy, and battery life to ensure that it meets its goals and functions properly in real-world situations.

Testing of prototype: -

- Verify the sensor's accuracy: Verify that GPS and accelerometers can accurately detect animal sudden movements and changes. Test the device at different times of the animal's destinations to make sure the sensors can detect it.

- Verify the device's durability: Make sure the equipment is reliable and resilient to impact or shock. The equipment should continue to function as intended even after a simulated collision.

- Check the device's battery life: Since the device must operate for a prolonged period, the battery life is crucial. battery power Make sure it can function for a reasonable amount of time under various conditions.

- User testing: Test the device on different users to get their feedback on how easy it is to operate, how easy it is for the animal to wear, and how easy it is to take off in an emergency.

- Check to see if the device is compatible with certain devices:

  Many different operating systems and cellphones should be compatible with the device. Check the device's interoperability with other devices to ensure that it functions properly.

Result discussion & evaluation: -

The suggested testing methods for the prototype crash detection system are rigorous and include important aspects of the device's dependability, performance, and usability.

It is crucial to verify the sensor accuracy for devices to accurately detect unexpected movements and changes in the animal. The crucial step of the process makes sure that the sensors pick up the event by keeping an eye on the animal's trajectory.

It's critical to assess the device's robustness and battery life because it must withstand impact or shock and operate for an extended period of time. These actions can entail putting the item through various stress tests and determining whether the battery life is long enough.

To make sure the device is simple to use, simple to use for the animal, and simple to remove in an emergency, user testing is also crucial. The opinions shared by different users can be used to enhance the user experience and pinpoint potential improvement areas.

For humans to quickly find the animal in case of an emergency, a location's accuracy should be verified. Checking the device's compatibility with various devices is also crucial to ensure that it can function effectively with various mobile phones and operating systems.

Conclusion
Future enhancement and Final conclusion

Good animal health and welfare is critical to dairy farms and sustainable milk production. Unfortunately, as mentioned above, it is challenging to constantly check on the health of animals. Workers sometimes do not have enough time to examine animals and detect early signs of disease, especially on large farms. We believe that the automated, Internet-based monitoring system we have developed will be extremely useful in assessing the health of dairy cows. This function is supported by IOT infrastructure consisting of hardware devices, cloud systems and end user applications.

The main objective of the proposed cow health monitoring system is to prevent cows from contracting diseases. For that, you can know from the points mentioned above that the creation of a neck collar with a counterweight, the monitoring device for collecting locational data, is also convenient for the cow.

We have mentioned above that we will create an app that includes information in a convenient way for future work so that the farmers can also check detailed information about the cow. We can distinguish between cow behavior with great accuracy because of new and creative data measuring approaches, such the Aggregate Behavior Index. The prototype devices that have been shown have been tested in a real environment and are currently being successfully turned into a commercial system.

In the future, some equipment (a magnetometer) for low energy estimates of cow movement and their linkage with the diagnosis of diseases shown by gait alterations are under development. The system can be expanded with new algorithms that can identify the signs of various diseases. It should be noted that measurements obtained from each Hub can be used to roughly determine the location of each Cow Device. When needed (such as for veterinary treatment), this can be used to quickly locate cows, identify cows that are transitioning between breed groups, or provide more details on animal activity and movement to support medical diagnosis. The system can gain more from using BLE v.5.1, which provides Angle-of-Arrival localization, and increases location accuracy even more. Additionally, it is intended to replace a general behavioral stereotype model with unique modeling for each cow.

Appendix

Code of our project that connect of mpu6050 , GPS , water sensor , DHT11 with esp32 and sending data to firebase

```cpp
#include <Wire.h>
#include <FirebaseESP32.h>
#include <DHT.h>
#include <MPU6050_tockn.h>
#include <TinyGPS++.h>

#define FIREBASE_HOST "https://esp-tempareture-default-rtdb.firebaseio.com"
#define FIREBASE_AUTH "AIzaSyBCqnuqJo754o-0TOy9nUYnbo4g_j-GjrE"
#define DHTPIN 23
#define DHTTYPE DHT11
#define WATERPIN 32
#define RX_PIN 16
#define TX_PIN 17

FirebaseData firebaseData;
DHT dht(DHTPIN, DHTTYPE);
MPU6050 mpu6050(Wire);
TinyGPSPlus gps;
int waterLevel;

void setup() {
  Serial.begin(9600);

  Wire.begin();
  mpu6050.begin();
  dht.begin();
  pinMode(WATERPIN, INPUT);

  WiFi.begin("SLT_FIBREDL", "dl2001dl2001dl2001");

  while (WiFi.status() != WL_CONNECTED) {
    delay(1000);
    Serial.println("Connecting to WiFi...");
  }

  Firebase.begin(FIREBASE_HOST, FIREBASE_AUTH);
}
```

```
void loop() {
 float ax, ay, az;
 float gx, gy, gz;
 float temperature, humidity;
 float latitude, longitude;
 unsigned long age;

 while (Serial.available() > 0) {
  if (gps.encode(Serial.read())) {
    latitude = gps.location.lat();
    longitude = gps.location.lng();
    age = gps.location.age();
  }
 }

 mpu6050.update();
 ax = mpu6050.getAccX();
 ay = mpu6050.getAccY();
 az = mpu6050.getAccZ();
 gx = mpu6050.getGyroX();
 gy = mpu6050.getGyroY();
 gz = mpu6050.getGyroZ();

 temperature = dht.readTemperature();
 humidity = dht.readHumidity();

 waterLevel = analogRead(WATERPIN);

 Firebase.setFloat(firebaseData, "/acceleration/x", ax);
 Firebase.setFloat(firebaseData, "/acceleration/y", ay);
 Firebase.setFloat(firebaseData, "/acceleration/z", az);

 Firebase.setFloat(firebaseData, "/gyroscope/x", gx);
 Firebase.setFloat(firebaseData, "/gyroscope/y", gy);
 Firebase.setFloat(firebaseData, "/gyroscope/z", gz);

 Firebase.setFloat(firebaseData, "/temperature", temperature);
 Firebase.setFloat(firebaseData, "/humidity", humidity);
 Firebase.setInt(firebaseData, "/water-level", waterLevel);
 Firebase.setFloat(firebaseData, "/latitude", latitude);
 Firebase.setFloat(firebaseData, "/longitude", longitude);
 Firebase.setInt(firebaseData, "/gps-age", age);

 if (firebaseData.dataAvailable()) {
  Serial.println(firebaseData.stringData());
 }
```
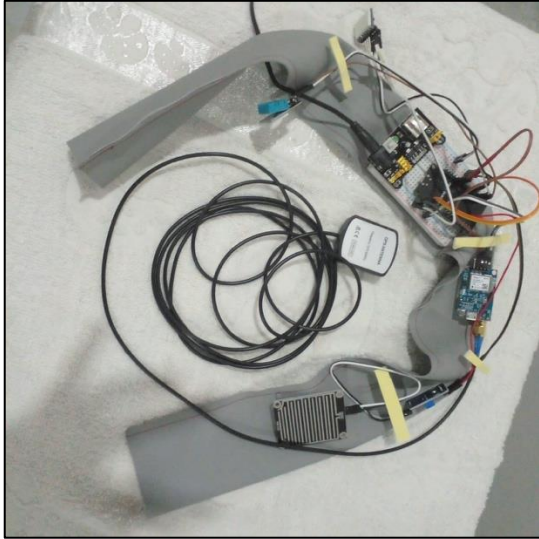
delay(1000); }

➢ We used this antenna because we were inside our home, but it is not used for cows for their location the code itself has ability to detached values from the sensors (without antenna) and show data on firebase.

Testing video:

- ➤ https://drive.google.com/drive/folders/1WzyZDWUnJjzGnM_wkLs_79n NOtVDB_0P?usp=sharing

References

https://www.mdpi.com/2077-0472/10/5/180

https://aws.amazon.com/blogs/industries/the-cow-collar-wearable-how-halter-benefits-from-freertos/

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7302546/

https://www.gea.com/en/products/milking-farming-barn/dairymilk-milking-cluster/cow-sensor/index.jsp

https://www.promptdairytech.com/bovsmart-a-smart-device-to-monitor-cows-activity/

https://www.researchgate.net/publication/339488120_Integrated_Animal_Health_Care_Using_Iot

https://www.researchgate.net/publication/4063442_Wearable_Sensor_System_for_Wireless_State-of-Health_Determination_in_Cattle

https://www.google.com/url?sa=t&source=web&rct=j&url=https://www.ijrti.org/papers/IJRTI1704054.pdf&ved=2ahUKEwia_JuU2sD-AhUATWwGHauxACg4ChAWegQIGRAB&usg=AOvVaw3s43_BseZBdVWyKqIV7GCP

https://www.google.com/url?sa=t&source=web&rct=j&url=https://ijarcce.com/upload/2018/january-18/IJARCCE%252022.pdf&ved=2ahUKEwia_JuU2sD-AhUATWwGHauxACg4ChAWegQIKxAB&usg=AOvVaw3gb-pukRJ3OtE7AdlJ4HOQ