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IoT BASED SMART FOREST SPECIES MONITORING

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ABSTRACT :

Lives of creatures are precious. As global citizens, we must work to insure the survival and development of creatures in order to maintain the ecosystem's balance and stability.

Wildlife monitoring collects data on wildlife species, figures,habits,quality of life and niche conditions to prop experiments in understanding the status and dynamics of wildlife coffers and to serve as a foundation for effective wildlife resource protection, sustainable use, and scientific operation.

Computers are now an essential part of people's lives, as they're used to negotiate all of mortal job with lesser delicacy and effectiveness.

Object discovery is a branch of computer vision an image processing concerned with detecting particulars of colorful classes(creatures, humans, and motorcars) in prints and pictures

Introduction :

Beast niche application, population, democracy, codding circumstances, and migration patterns all bear wildlife monitoring.
Timbers cover a significant portion of the earth's land face and give multitudinous environmental, profitable, and social benefits. To ensure their sustainable operation, it is essential to gather information about timber coffers, their health, and the factors that affect them.
Timber checks involve the methodical collection of data about colorful aspects of timbers, including their extent, composition, structure, and dynamics. These checks help in assessing the current state of timbers, relating changes over time, and prognosticating unborn trends. They're generally conducted at different spatial scales, ranging from original timber stands to indigenous or public situations.
Stir-sensitive camera traps, radio shadowing, wireless detector network shadowing and satellite shadowing have all been introduced to cover wild creatures.
Presently, beast identification and recognition remain a delicate task, and there's no single system that can give a study and effective answer in all cases.
Every time, million acres of timbers are burnt down. These timber fires have an important impact on the destruction og foliage, on atmospheric pollution, lives.
In numerous cases, the authorities don't have any firepre-warning system nor an alert system to shoot and admit the warning dispatches.
Thus the cautions to the population and to the deliverance forces frequently come too late. Therefore, the ideal of this design is to make a fire alert system that provides further features in the supervision and the discovery of timber fire.
Timber regulating temperature was one of aspects of timber ecosystem services. The land face temperature(LST) and regularized difference foliage indicator(NDVI) were the important parameter of timbers regulating temperature.
The global warming report 2008 mentions timber fires as one of the major reasons behind the increase in global warming due to the quantities of hothouse feasts being released into the terrain.

II. LITERATURE REVIEW :

Svetlana larionova etal., give information on how to use the being library and work with the handed conditions that are applicable to the circumstances." Microsoft's camera traps design is the result of the quests. Mega sensor, a pretrained model for detecting whether an beast oe person is present in an image, was released as a consequence od data collected from colorful wildlife cameras across the world.
Jasko demonstrated a system that can descry a variety of large wild creatures in business scripts . A camera with monocular colour vision was used to collect visual data. The thing was to estimate the business scene image, descry the regions of interest, and meetly classify them in order to find creatures on the road who could beget an accident. Using intensity, colour, and exposure data, a saliency chart was created from the business scene image. The chart's prominent areas were allowed to be areas of interest. A database was created using a vast number of prints of different four-lawful wild brutes.

"Remote sensing of environment" by Jensen,J.R.(2015) This comprehensive book covers the principles and operations of remote seeing ways for timber check and monotoring. It explores colorful detetors, data accession styles, and analysis ways for timber mapping and change discovery

"Timber monitoring styles for terrestrial examinations in europe with an overview of north america and asia" edited by Marchetti, M.etal.(2013) This book provides an overview of timber monitoring styles, including ground-grounded and remote seeing approaches. It covers motifs similar as timber force, biodiversity assessment, and monitoring of timber disturbance.

"Forest monitoring and remote seeing A study on ways and styles for mapping and monitoring timbers" by viana,H.etal(2016) This exploration paper focuses on remote seeing ways for timber monotoring, including the use of upstanding and satellite imagery, Lidar, and radar data. It discusses the advantages and limitations of each fashion and provides case studies.

"Testing ways for timber supplies" by Gregoire,T.G.etal(2006) This book presents colourful slice ways used in timber supplies for estimating timber attributes similar as tree viscosity, biomass, and speceis composition,. It covers design-grounded and model-grounded slice styles, along with their operations in timber monitoring.

"Forest inventory methodology and applications" by Sa Borowski,J.(2029) This book provides an overview of timber force methodologies, including field data collection ways, statistical analysis, and modelling approaches. It also discusses the operation of timber force data foe sustainable timber operation and monitoring.

III. Proposed Method :

Arduino UNO is a microcontroller board based on the ATmega328P microcontroller. It is one of the most popular boards in the Arduino family, and it is commonly used in various electronics projects.

There are many exciting systems of survey and monitoring of forests that are being used today. Here are a few examples:

- **LiDAR (Light Detection and Ranging)** - This is a remote sensing technology that uses lasers to measure the distance between the sensor and the objects in the forest.
- **Drones** - Drones are being used to survey and monitor forests from the air. They can be equipped with cameras and sensors that can capture detailed images and data about the forest.
- **Satellite Imagery** - High-resolution satellite imagery is being used to monitor forests on a global scale. This technology can detect changes in forest cover and help identify areas where deforestation is occurring.
- **Sensor Networks** - Sensor networks can be used to monitor forests in real-time. These networks can be set up to measure things like temperature, humidity, and soil moisture, which can help scientists understand how the forest is responding to changes in the environment.
- **Citizen Science** - Citizen science projects are a great way to involve the public in forest monitoring. These projects can be set up to collect data on things like tree growth, bird populations, and soil quality.

Block diagram

Here is a methodology that combines these components:

1. Hardware Setup:

- Connect the Arduino board to the GSM shield, load cell, temperature and humidity sensor, Web camera, buzzer, and LCD display.
- Ensure proper wiring and connections between the components and the Arduino board.

2. Forest Monitoring Parameters:

- Determine the specific parameters you want to monitor in the forest. For example, you may want to measure tree biomass using the load cell, monitor temperature and humidity levels, and detect any abnormal conditions using the buzzer and LCD display.

3. Data Acquisition:

- Use appropriate code on the Arduino to read data from the load cell, temperature and humidity sensor, and other sensors connected.
- Implement necessary calibration or conversion functions to obtain accurate measurements from the sensors.

4. Data Processing:

- Process the acquired data to obtain meaningful information. For example, you can calculate biomass based on load cell readings or analyse temperature and humidity trends over time.
- Implement any necessary algorithms or calculations specific to your monitoring objectives.

5. Communication and Alert System:

- Utilize the GSM shield to establish a communication link between the Arduino and a remote server or a designated mobile number.
- Set up a mechanism to send data and alerts via SMS or GPRS to the designated recipient or server whenever certain conditions are met, such as abnormal temperature or humidity levels.

6. Display and Visualization:

- Use the LCD display to show real-time data, such as temperature, humidity, or other relevant parameters.
- Implement a user-friendly interface on the LCD display to navigate through different options or modes.

7. Power Supply and Enclosure:

- Ensure a reliable power supply for the Arduino and its components, considering the monitoring duration and the availability of power sources in the forest.
- Consider using appropriate enclosures or protective measures to safeguard the system from environmental conditions.

8. Field Deployment and Testing:

- Install the monitoring system in the target forest area. - Conduct thorough testing to ensure the accuracy and reliability of the sensor readings, communication, and alert system.

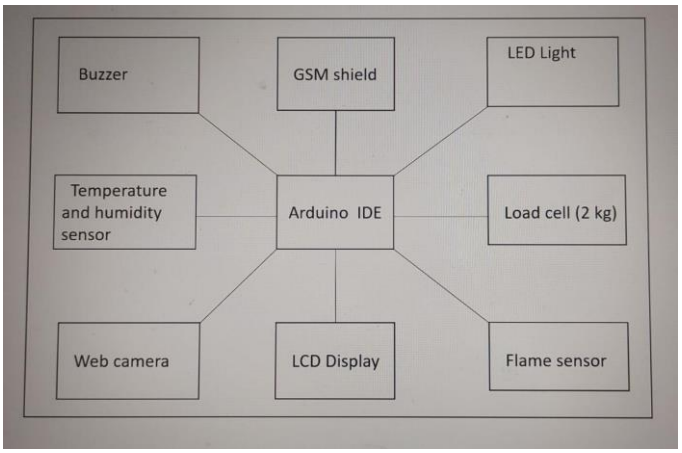

Fig. 1. Block diagram of proposed system.

Hardware Components and Equipment

The required components and equipments used to implement the survey and monitoring of forest is presented in Table 1

Fig. 3. Components and Equipments Utilized.

Device	**Device**	**Device**
Specifications	**Specifications**	**Specifications**
Quantity	**Quantity**	**Quantity**
Arduino UNO	Arduino UNO	Arduino UNO
ATmega328P	ATmega328P	ATmega328P
1	1	1
Temperature sensor	Temperature sensor	Temperature sensor
DHT-11	DHT-11	DHT-11
1	1	1
Humidity sensor	Humidity sensor	Humidity sensor
DTH-22	DTH-22	DTH-22

Table: Equipment and Component List

IV. Results And Discussion :

Forest inventory: The inventory of a forest provides information about the species composition, tree density, age structure, and biomass of the forest. This information can be used to plan forest management activities such as timber harvesting, reforestation, and conservation.

• **Forest health:** Monitoring the health of a forest involves observing and recording the presence and severity of pests, diseases, and other factors that can impact the growth and survival of trees. This information can be used to develop strategies to prevent or mitigate the impact of these factors.

• **Carbon storage:** Forests are important for sequestering carbon and mitigating climate change. Monitoring the carbon storage capacity of a forest can provide important information about its contribution to global carbon cycles.

• **Biodiversity:** Forests are home to a variety of plant and animal species and monitoring the biodiversity of a forest can provide insights into the health and functioning of the ecosystem. This information can be used to identify areas of the forest that are in need of protection or restoration.

1• **Water quality:** Forests play an important role in regulating the water cycle and maintaining water quality. Monitoring the water quality of a forest can provide information about the health of rivers and streams that flow through the forest and the potential impacts of land use activities on water quality.

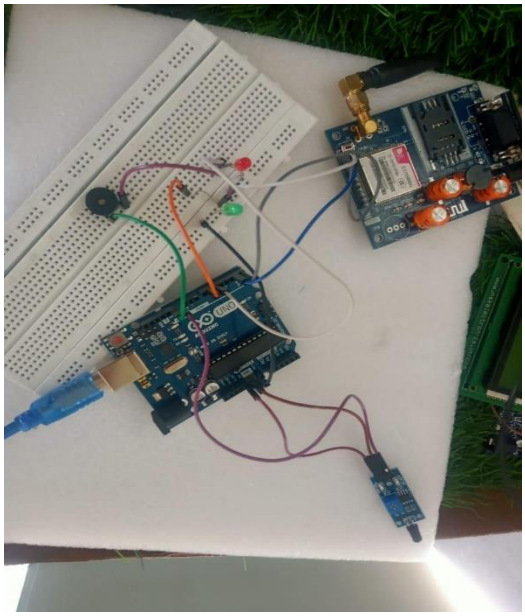

Fig. working module

V. Conclusion :

Surveying involves the collection of data on the physical and biological characteristics of the forest, while monitoring involves the ongoing observation and measurement of specific indicators of forest health and ecosystem function.

- Forest surveying and monitoring can be achieved using a variety of techniques and tools, including remote sensing, GIS, GPS, and field-based measurements.
- These techniques and tools help to generate accurate and reliable data, which can be used to make informed decisions regarding forest management and conservation.Through the use of surveying and monitoring, forest managers can identify changes in forest health and ecosystem function, such as changes in tree growth rates, biodiversity, and soil quality.
- This information can be used to develop management plans that promote sustainable forest practices and protect forest ecosystems for future generations

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