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IOT BASED FOREST FIRE AND SMUGGLING DETECTION

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Abstract: In the present arena, wildlife and forest departments face the matter of movement of animals from forest area to residential district. The number of trees has reduced drastically from the forest that makes an unhealthy environment for animals to survive within the forest. It has been found in a survey that 80% losses are caused due to fire and another big problem is smuggling. This could have been avoided if these activities was detected in the early stages. This project proposes a system for tracking and alerting the personnel for the protection of trees against forest fires and smuggling. Nowadays IOT (Internet of Things) devices and sensors allow the monitoring of different environmental variables, such as temperature, humidity, motion etc. Arduino platform based IOT enabled fire and smuggling detector and monitoring system is that the solution to the present problem. In this project we have built fire detector using Arduino NANO which is interfaced with a flame, temperature, tilt and vibration sensor and a buzzer. In order to implement this project, we will be using GSM which is used to provide the final SMS to the user through the given number in the simulation program, flame sensor which is used to denote fire that will be displayed in the LCD Display, tilt and vibration sensor which is used to denote the smuggling movement and will be detected in the LCD display. This will be initiated only when the obtained values exceeds the pre-defined value. Whenever a fire occurs, the system automatically senses and alerts the user by sending an SMS to the user and that location can be seen using google maps application.

Keywords: IoT, GSM, LCD, Arduino, Sensors

INTRODUCTION:

Forest fire also referred to as bush fire or hill fire is an uncontrolled fire occurring wild or forest areas. It is vital to detect these sorts of fires as early as possible so on prevent the damage from it to ecological system. Every year many acres of forest are burnt down. Some of the main causes are erratic climatic change, prolonged dry season, low winter rainfall etc. Traditional manual system does not ensure 24/7 monitoring from fire protection. The reaction time of emergency corps greatly affects the results and losses caused by them, therefore the enhancement of fire prevention and detection systems are often considered a main goal for conserving the environment. The main goal of the proposal here described is to estimate in short-term the existence of fire risks and to detect the recent occurrence of fire outbreaks over different forest areas. For ages we have been hearing about illegal activities like smuggling of Precious and commercial trees such as Teakwood, Sandalwood, etc., from the protected Forest areas. These trees are very expensive and have tons of economic demand within the world market. The trees were usually protected by marking them some tags manually. This will not be useful and reliable since anyone can change it. Also during Natural calamities some trees may get damaged. Hence our proposed system is the perfect solution for both the issues.

LITERATURE SURVEY:

A. LOW ENERGY ADAPTIVE CLUSTERING HIERARCHY

In this paper author shows an assertion based system for disaster the board by utilizing remote sensor

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mapped out, which sense the standard change and subject theoretical expire between the middle core interests. For the correspondence reason, Low Energy Adaptive Clustering Hierarchy (LEACH) figuring has been used. The LEACH figuring is dynamic in nature and intrinsically, helps keep up relationship among the middle centers, which prompts convincing correspondence. Catastrophe is an activity, which may happen at whatever point and wherever without prior information, which impacts the entire mankind, human, animal and their thriving. Since, debacle may be a trademark development, it's doubtful for anyone to prevent it, at any rate a structure are often passed on to alert the exhaustive system before the occasion, with the target that diverse lives are often saved. Inside is towards utilizing the sensor framework and LEACH estimation for the development of a prepared structure, which handles the temperature. A farthest point based part is employed to save lots of the essentialness that's the structure works unequivocally when the temperature degrees to its edge regard for the foremost part don't mishandle the centrality by arranging the info enterprisingly.

B. ANTI SMUGGLING SYSTEM

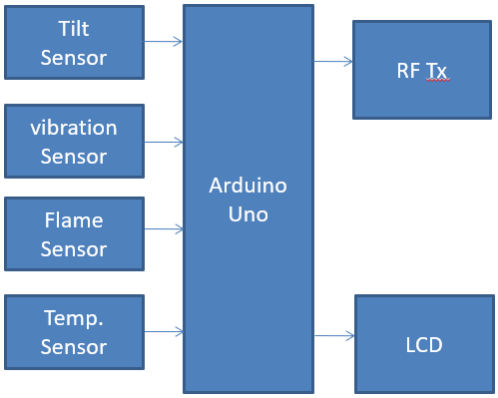
The ideas are clearly defined in Anti-Smuggling System for Trees in Forest using Flex Sensor and Zigbee Volume 3, Issue 9, September 2014. This paper explains on the way to restrict the smuggling activities and to save lots of the forest-areas on Earth using some preventive measures. The system that was developed employing a mini Sensor network using zig-bee module, Flex sensor , GSM Module and GPS using the platform of Visual Basic.

C. FOREST FIRE DETECTION SYSTEM

Another technique is that the utilization of satellite framework to differentiate the wild fire. the first segments of the framework are satellite and therefore the base station that gathers the knowledge send by the satellite and runs the dissecting calculation. The crude information from the satellite is handled and then Best in school High Determination Radiometer instrument is employed to acknowledge nearness of Problem areas. However the mists enormously influence the framework. Wild Fire Reconnaissance Framework which comprises of WSN was likewise proposed for identification of untamed fires in South Korea. The WSN decides the temperature and dampness after which middleware program and web application examines the gathered information. However during this approach of discovery of untamed fire there was some loss of data amid correspondence.

BLOCK DIAGRAM OF THE PROPOSED SYSTEM:

Transmitter unit



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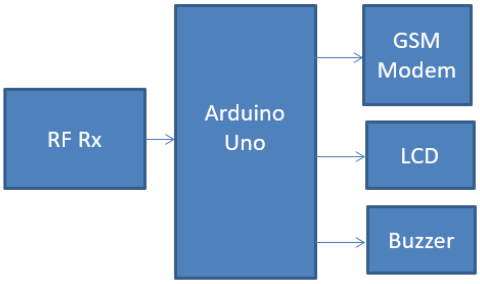
Receiver unit



METHODOLOGY:

A wireless sensor network system includes sensor nodes, gateways (routers) and a monitoring host computer. To minimize the loss of energy and data packets, a multiple sensor network topology structure is applied in this design. The work is also capable of predicting the fire hazard going to happen in the region of interest, this is made with a group of sensors including temperature sensor and flame sensor. And also to detect the smuggling activity in the forest tilt and vibration sensor. Detection methods that use optical sensors and motion sensors combine features that are associated with the physical properties of flame and smoke, like colour, motion, spectral, spatial, temporal, and texture characteristics. Once the activity is detected the information is sent to the control system through transmitter which is connected to the Arduino sensor circuit. Control system processes the data and send a SMS note to the registered mobile number using GSM module. This location can be seen in the google maps application with the mobile. Other researchers where looking on the flickering effect of fire. This is observed in flame contours at a frequency of around 10 Hz, independently of the burning material and therefore the burner. The algorithm was applied to a video dataset consisting of various daytime and night time environments; however, at night, colour analysis is a smaller amount useful and night smoke is a smaller amount visible.

HARDWARE COMPONENTS:

ARDUINO

Arduino is an open-source framework that can be used to create electronic projects. Arduino is made up of a physical programmable circuit board and an IDE (integrated development environment) that runs on your device and is used to write and upload computer code to the board. Based on the ATmega328P released in 2008, the Arduino Nano is a lightweight, full, and breadboard-friendly board. It has the same connectivity and specifications as the Arduino Uno board, but in a smaller package. The Arduino Nano has 30 male I/O headers in a dip-30 configuration that can be configured using the Arduino Software integrated development environment (IDE), which is similar to all Arduino boards and can be used both online and offline. A type-b micro-USB cable or a 9V battery can be used to power the board.

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LCD

- 2X16 alphanumeric display
- Two rows each with 16 column spaces
- 8 pins for data
- 3 pins for control (RS, RW and EN)
- Contrast and Brightness Adjustable Backlight ON/OFF functionality for energy conservation. Every indication requirement in the system will be matched by these displays only.

BUZZER

A buzzer or beeper is a mechanical, electromechanical, or piezoelectric audio signalling device. Alarm clocks, timers, and confirmation of user input such as a mouse click or keystroke are all common uses for buzzers and beepers. The first devices used an electromechanical system similar to that of an electric bell, but without the metal gong. A relay, for example, could be wired to interrupt its own actuating current, causing the contacts to buzz. These units were frequently anchored to a wall or ceiling in order to serve as a sounding board. The rasping noise made by electromechanical buzzers gave rise to the term "buzzer."

RF TRANSMITTER AND RECEIVER

The RF Module is a low-cost wireless communication module that can be used in a variety of applications. A radio frequency module consists of a transmitter and a receiver that operate at the same time. Typically, these modules will communicate at a frequency of 315 MHz or 434 MHz. TWS 434 – RF transmitter At 433.92 MHz, the transmitter output is up to 8 mW, with a range of 400 feet outdoors and 200 feet indoors. It can operate between 1.5 and 12Vdc and accepts both linear and digital inputs. The HT 12E IC is a four-bit RF encoder. RWS 434 – RF receiver. It accept both linear and digital inputs can operate from 4.5 to 5.5 Vdc.HT 12D IC it is a 4bit RF remote control system.

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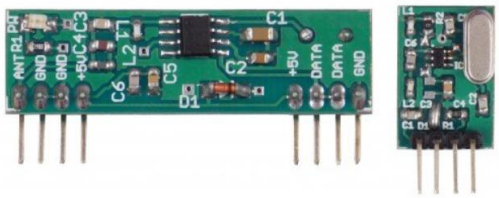


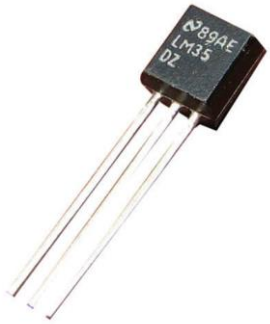
SENSORS

Vibration Sensor

The piezoelectric accelerometer is a transducer that is now almost universally used for vibration measurements. It outperforms all other types of vibration transducers in terms of overall performance. It has a broad frequency and dynamic range, as well as strong linearity across those ranges. Its characteristics are relatively stable over time because it is relatively durable and reliable. Furthermore, since the piezoelectric accelerometer is self-generating, it does not require a power supply. There are no moving parts to wear out, and its acceleration proportional output can be combined with velocity and displacement proportional signals to produce velocity and displacement proportional signals.

Temperature Sensor

The LM35 is an integrated circuit temperature sensor with a proportional output (in C). The LM35 has three sticks. Vcc, production, and GND are the three. The temperature range for operation is -55°C to 150°C.The output voltage changes by 10mV for every °C change in ambient temperature, resulting in a scale factor of 0.01V/°C. Electrical temperature sensors are notoriously difficult to use. Thermocouples, for example, have poor performance levels and must be compensated for cold junctions.
Thermistors are a form of nonlinear device. Furthermore, the outputs of these sensors are not proportional to any temperature scale in a linear manner. Many of these issues were overcome by early monolithic sensors like the LM3911, LM134, and LM135, but their outputs were compared to the Kelvin temperature scale rather than the more common Celsius and Fahrenheit scales.



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Flame Sensor

Flame detectors with a length of 30 x 30 cm (1 x 1-foot) Flame detection is the process of using a flame detector to detect flames. Flame detectors are optical devices that detect fire-related flame phenomena. Flame detection can be divided into two types: In a fire alarm device, a flame detector is used to detect a fire. A flame scanner is used to keep track of the state of a flame in a burner. The previously mentioned de-sensitizing effects of sunlight, water, fog, steam, and blackbody radiation can affect this range.

Tilt sensor

MEMS tilt sensors allow simultaneous 2-axis high accuracy (typically 0.001°) and broad angle measuring range (e.g., 30.000°) in 2-axis tilt sensors/inclinometers. Traditional single-axis tilt sensors are unable to calculate simultaneous 2D (X-Y plane) tilt angles, but 2-axis tilt sensor technology can. In many precision industry applications, such as levelling, angle measurement/alignment, and surface flatness profiling, two-dimensional planes are used instead of single-axis.

GSM MODULE

Messages from remote mobiles can be received via GSM modem, and messages created by the microcontroller can also be sent to remote mobiles via GSM modem. The SIM 900A is a quad-band GSM/GPRS phone that operates at frequencies of 850/900/1800/1900MHz.
Not only can the SIM 900 be used to access the Internet, but it can also be used for oral communication. The module is controlled by an AMR926EJ-S processor, which controls phone communication, data communication (via an integrated TCP/IP stack), and communication with the circuit interfaced with the mobile phone itself (via a UART and a TTL serial interface).

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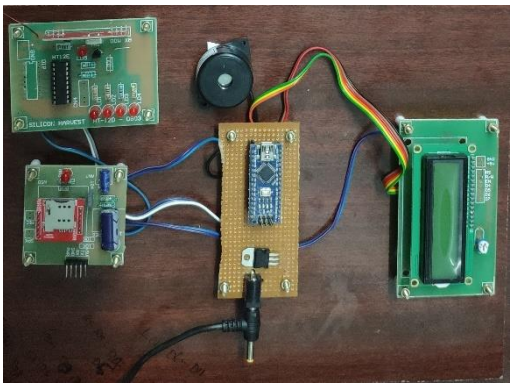
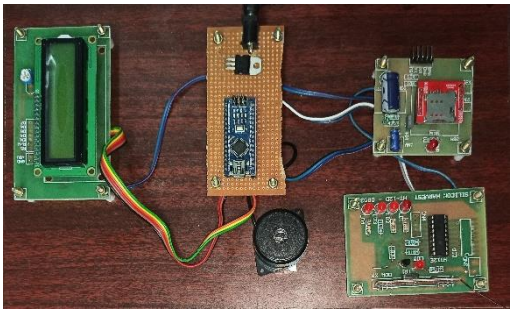
RESULT AND DISCUSSION:

Temperatures can fluctuate widely around the world. We won't be able to solve it in a general way in the forest, so we'll rely on technology and sensors. The LCD will easily alert you of the current temperature situation if the temperature rises. A buzzer will automatically warn the local authority and a message will be sent to the registered mobile number if it is raised and the range is exceeded. Also whenever there is more movements or cutting of trees in the forest region then again an alert message for cutting of trees will be sent to the same number.

HARDWARE KIT:



Image(i) Hardware (Receiver end)



Image(ii) Hardware (transmitter end)

FUTURE SCOPE:

When a fire breaks out, an additional pump may be installed to automatically send water. Industrial sensors may also be used to improve range and precision. Despite the fact that a Smart module has been built to protect trees, future improvements are needed to make the device more durable. Rugged units, hardware, and sensors are needed. A suitable enclosure must be built. The Module should be mounted in an untraceable location on trees, away from tree-destructors. Solar or some other renewable energy source must be used to automate power supply. Forest officials must be properly trained.

CONCLUSION:

The project "Forest Fire and Smuggling Detection System" was successfully completed, and the production results have been tested. The outcomes are in line with what was predicted. Both software and hardware testing tools were used to examine the project. The following components are used in this project: LCD, Microcontroller, temperature sensor, flame sensor, tilt sensor, and vibration sensor and are proved to be more appropriate for the intended application. The project has a lot of potential for improvement in the

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future. The project is a working prototype that meets all of the logical specifications. With minor tweaks, the project can be directly applied to real-time applications. As a result, the project makes a major contribution to the area of "EMBEDDED SYSTEM" and paves the way for faster advances in the same field. The project is also adaptable to ongoing commercial and industrial applications.

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