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Cloud-based Disaster Warning System

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A B S T R A C T

A disaster is often defined as a ‘sudden accident or a natural catastrophe that causes great damage or loss of life. Disasters aren’t always predictable and not all kinds of disasters occur everywhere. Disaster management refers to the conservation of lives and property during a disaster. In most cases, the most significant thing for effective disaster management is to get the information at the right time. There have been several instances in the past where disasters such as landslides, forest fires, etc. were reported too late leaving the authorities with no options to mitigate its effects. Though the disasters are being monitored at various levels by the authorities, due to the large geographic area and diverse conditions there have been delays in being informed about the occurrence of a disaster. There are several disaster monitoring centers and also methods including satellite-based/drone-based disaster monitoring systems. But these have many limitations. There is a need for a much more cost-effective system that can do the same in a more efficient way. Here we propose a system that is cost-effective and can be deployed on a large scale. The use of this system that we propose will enable 24x7 monitoring of a large area from a single location.

Keywords: Disaster, Warning System, Cloud, Arduino, Sensor

1. Introduction

A disaster is often defined as a ‘sudden accident or a natural catastrophe that causes great damage or loss of life. Disasters aren’t always predictable and not all kinds of disasters occur everywhere. Disaster management refers to the conservation of lives and property during a disaster. In most cases, the most significant thing for effective disaster management is to get the information at the right time. There have been several instances in the past where disasters such as landslides, forest fires, etc. were reported too late leaving the authorities with no options to mitigate its effects. Though the disasters are being monitored at various levels by the authorities, due to the large geographic area and diverse conditions there have been delays in being informed about the occurrence of a disaster. There are several disaster monitoring centers and also methods including satellite-based/drone-based disaster monitoring systems. But these have many limitations. There is a need for a much more cost-effective system that can do the same in a more efficient way. Here we propose a system that is cost-effective and can be deployed on a large scale. The use of this system that we propose will enable 24x7 monitoring of a large area from a single location.

2. Working

The system mainly monitors earthquakes, landslides, and forest fires. The sensors which are connected to the Arduino UNO will be continuously providing the physical parameters such as vibrations, light intensity, soil moisture content, a flame presence in the form of voltages between 3.3V and 5V. The Arduino reads the analog voltage values which will be sent to the cloud server of RemoteXY which is a free IoT cloud service provider. The users can view the information sent by the remotely placed unit by logging in through the app. The ESP8266 module connects the Arduino UNO to the internet from a nearby Wi-Fi access point. During any seismic activity, a positive graph will be plotted in the user interface, where the data can be analyzed. The information from the vibration sensor will be utilized for this purpose. The unit gives a landslide warning in the user interface when the moisture content of the soil is beyond a threshold level and if there is a chance of a landslide. This will be helpful in moving people to safer locations. The soil moisture will be plotted continuously in the user interface.The flame sensor can be helpful in detecting forest fires. When the flame sensor detects the presence of fire a red indicator is turned on in the user interface. The light intensity level will also be displayed in the user interface which is crucial in planning rescue.

The remote unit can work from any power source which may be solar panels or batteries, it can be selected considering the location of deployment.

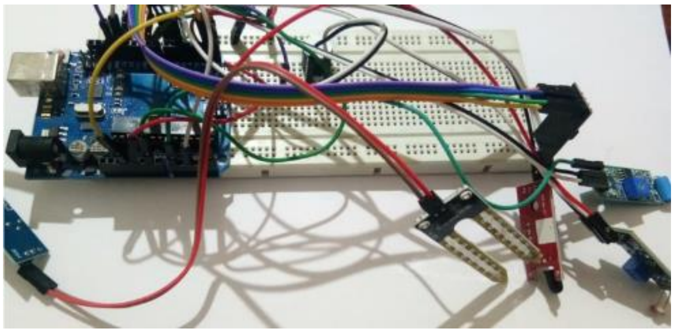


Fig. 1 – Hardware Prototype

3.Block Diagram

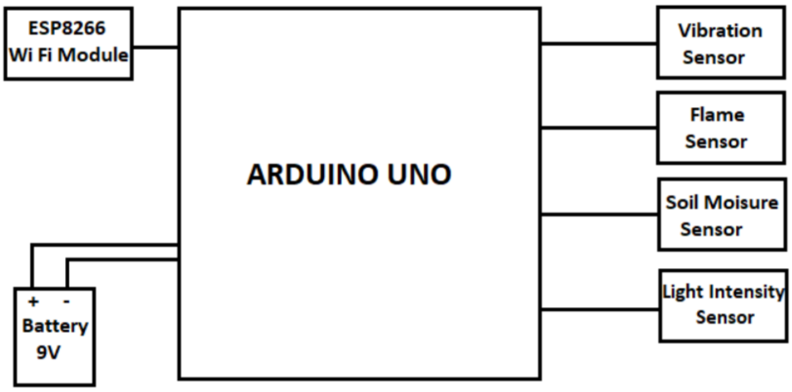


Fig. 2 – Block Diagram

4. Program

```
#define REMOTEXY_MODE__ESP8266_HARDSERIAL_CLOUD

#include <RemoteXY.h>

// RemoteXY connection settings

#define REMOTEXY_SERIAL Serial

#define REMOTEXY_SERIAL_SPEED 9600

#define REMOTEXY_WIFI_SSID "HTP"

#define REMOTEXY_WIFI_PASSWORD "pswrd"

#define REMOTEXY_CLOUD_SERVER "cloud.remotexy.com"

#define REMOTEXY_CLOUD_PORT 6376

#define REMOTEXY_CLOUD_TOKEN "token"

#define REMOTEXY_ACCESS_PASSWORD "sreehari"

// RemoteXY configurate

#pragma pack(push, 1)

uint8_t RemoteXY_CONF[] = // 60 bytes

{ 255,1,0,10,0,53,0,16,8,1,68,17,4,6,54,28,8,36,68,17,

4,43,36,21,8,6,70,16,47,49,9,9,26,50,0,2,1,42,81,15,
```

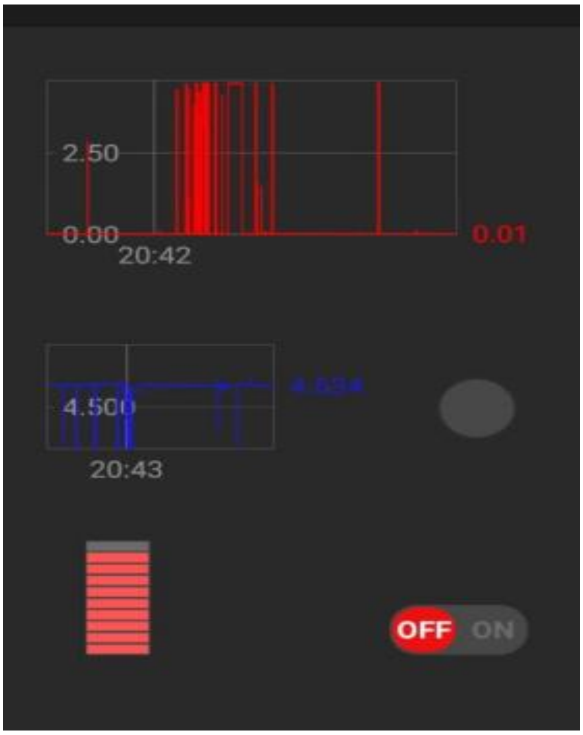
```
7,1,26,31,31,79,78,0,79,70,70,0,66,0,9,72,7,16,1,26 };
// this structure defines all the variables and events of your control interface
struct {
// input variables
uint8_t switch_1; // =1 if switch ON and =0 if OFF
// output variables
float Seismic_Activity;
float Water_Level;
uint8_t led_1; // led state 0 .. 1
int8_t level_1; // =0..100 level position
// other variable
uint8_t connect_flag; // =1 if wire connected, else =0
} RemoteXY;
#pragma pack(pop)

#define PIN_SWITCH_1 13
int x=0;
void setup()
{
RemoteXY_Init ();
pinMode (PIN_SWITCH_1, OUTPUT);
pinMode(5,INPUT);
// TODO you setup code
}
void loop()
{
RemoteXY_Handler ();
digitalWrite(PIN_SWITCH_1, (RemoteXY.switch_1==0)?LOW:HIGH);
RemoteXY.Seismic_Activity = float (analogRead(A0)) / 204.8;
RemoteXY.Water_Level = float (analogRead(A2)) / 204.8;
x=digitalRead(5);
if(x=1){
RemoteXY.led_1 = 255;
}
else{
RemoteXY.led_1 = 0;
}
int adc = analogRead(A5);
RemoteXY.level_1 = (int)(adc / 10.24);
```

}

5. Results

The system performed well. The following figure shows the graphs generated in the user interface based on data collected using the sensors. The software also gave audio alert when the parameters crossed threshold value. The alarm in the remote unit was also tested using the button in the interface.



6. Future Development Scope

Many more sensors can be integrated into the system which can increase its versatility. The communication channel can be replaced and multiple derivatives of the system can be easily developed. The sensor data can be utilized for academic or research purposes also. With a few additional sensors the system can also act as a remote weather station.

7. Conclusion

This system is versatile, scalable, efficient, and can be deployed at multiple locations to monitor the situation in a large geographic area. It also has a good potential to be developed further and will be a cost-effective solution that will help the disaster management authorities and the common people to increase the survivability and also to make a timely response if any of the mentioned disasters occur.

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