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PRE-WARNING SYSTEM FOR WEAK HOUSES AND BRIDES USING IOT

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ABSTRACT:
In this project, the alert is made about weak bridges and houses that may destroy and having a risk of collapsing. The main aim of the project is to avoid hazards. Early warning systems are the systems by which people receive relevant and timely information in systematic way. Early action can often prevent a hazard turning into a human disaster by preventing loss of life and reducing the economic and material impacts. In this bridge or House monitoring system is significant to be health monitoring of both old/new bridges and flyovers an infrastructure daily used by citizens of their respective countries. In this system, we use MEMS-Micro Electro Mechanical sensor for dislocation or uneven movement of the bridge or house, flex sensor is used to crack detection, and a Atmega328 micro controller is used for processing the data and to react according to the instructions and alert the system whenever there is an uneven conduction occurred.

Key Words: Arduino Uno, MEMS sensor, Flex sensor, Buzzer, red LED, Green LED.

INTRODUCTION:

Human beings need shelter to live, so they have started building houses and buildings. A Bridge is a structure which connects two places. A bridge is a structure built to span a physical obstacle, such as a body of water, valley, or road, without closing the way underneath. It is constructed for the purpose of providing passage over the obstacle, usually something that is otherwise difficult or impossible to cross. Two things should be considered when you are building the foundations - the solidarity of the soil and the heaviness of the building and its contents. The causes of weak building or houses may be weak foundations, poor soil condition, poor materials - Materials that just aren't strong enough to withhold the load used in construction,

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unskilled or semi-skilled workers - Even when workers are given the right materials to make the concrete, they mix them incorrectly. This results in concrete, which is not of the sufficient strength to hold the load, the load is heavier than expected, the strength isn't tested and to cover a water body such as well, lake etc. and build a house or a bridge. . In this system, we use MEMS sensor for dislocation or uneven movement of the bridge or house, flex sensor is used to crack detection, and a Atmega328 micro controller is used for processing the data and to react according the instructions and alert the system whenever there is an uneven conduction control.

Objective:

The aim of the project is to avoid hazards. The alert is made about weak bridges and houses that may destroy or have a risk of collapsing. Early action can prevent a hazard turning into a human disaster by preventing loss of life and producing the economic and material impacts

Block Diagram:

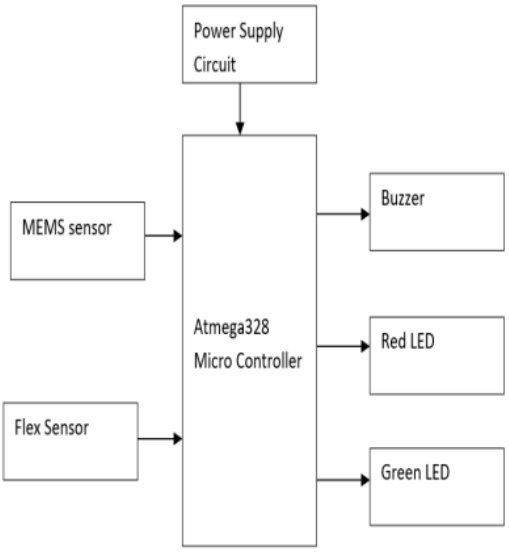

Fig1 : Block diagram of pre-warning system for weak houses and bridges.

Components used: Arduino Uno: The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega16U2 (Atmega8U2 up to version R2)

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programmed as a USB-to-serial converter

Fig 2: Arduino (TM) UNO Rev 3 Board.

Specifications:

Microcontroller Atmega328 Operating Voltage 5V

Input Voltage 7-12V(recommended) Input Voltage(limits) 6-20V Digital I/O Pins 14(of which 6 provide PWM output Analog

Input Pins 6

DC Current per I\O Pin 40mA

DC Current for 3.3V 50mA

Flash Memory 32 KB (Atmega328) of which 0.5 KB

used by bootloader

SRAM 2KB (Atmega328)

EPROM1 KB (Atmega328)

Clock Speed 16 MHz

MEMS Sensor: MEMS is a Micro-Electro Mechanical system, all accelerometers work on the principle of a mass on a spring, when the thing they are attached to accelerates then the mass wants to remain stationary due to its inertia and therefore the spring is stretched or compressed, creating a force which is detected and corresponds to the applied acceleration.

When the sensor is subjected to a linear acceleration along its sensitive axis the proof mass tends to resist motion due to its own inertia, therefore the mass and its fingers become displaced with respect to the fixed electrode fingers. Gas between the fingers provides a damping effect. This displacement induces a differential capacitance between the moving and fixed silicon fingers which is proportional to the applied acceleration.

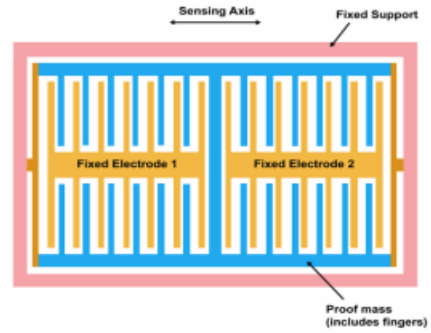

Fig 3: MEMS Accelerometers.

It can measure in 2-dimensional coordinate system - x, y. It has 10 pins.

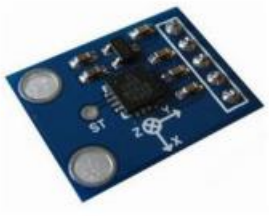

Fig 4: MEMS Sensor (the ADXL202E).

Specifications:

Power Supply: 3-5v

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Axis: X, Y, Z output

Output: Analog

Operating Voltage: 3V to 6V DC

Operating Current: 350μA

Sensing Range: ±3g

3-axis sensing

High Sensitivity for small movements

Needs no external components

Easy to use with Microcontrollers or even with normal

Digital/Analog IC

Small, cheap and easily available.

Pin Name	Description
VCC	The Vcc pin powers the module, typically with +5V
GND	Power Supply Ground
X	X-axis Analog Output Pin
Y	Y-axis Analog Output Pin
Z	Z-axis Analog Output Pin
ST	Self-Test Pin. This pin controls the Self-Test feature.

Table no.1: MEMS Sensor pins description.

Flex Sensor: Flex Sensor can detect flexing or bending or cracking in one direction. Flex Sensor is basically a variable resistor whose terminal resistance increases when the sensor is bent.

Flex Sensor is basically a variable resistor whose terminal resistance increases when the sensor is bent. So, this sensor resistance increases depends on surface linearity. So, it is usually used to sense the changes in linearity.

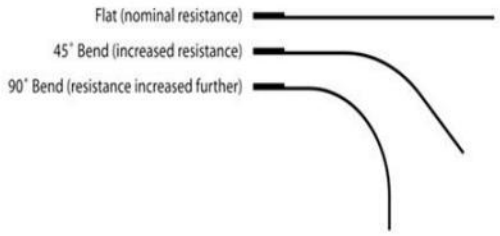

Fig 5: change in resistance when the sensor is bend.

When the surface of flex sensor is completely linear, it will be having its nominal resistance. When it is bent 45º angle, the flex sensor resistance increases to twice as before. And when the bent is 90º, the resistance could go as high as four times the nominal resistance. So, the resistance across the terminals rises linearly with bent angle. So, in a sense the flex sensor converts flex angle to resistance parameter.

Fig 6: Flex sensor.

Operating voltage: 0-5V.

Can operate on LOW voltages.

Power rating: 0.5W(continuous), 1Watt(peak).

Life: 1 million. Operating temperature: -45ºC to +80ºC.

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Flat resistance: 25K Ω.

Resistance Tolerance: ±30%

Bend Resistance Range: 45K to 125K Ohms (depending on bending).

Working:

Initially we supply input of 230V AC (alternating current) to the step-down transformer. Usually, step-down transformer converts high voltage and low current from the primary side of the transformer to the low voltage and high current on the secondary side of the transformer. So, at the output we get 9V to 12V of AC. This 12V of output is given as input to the Bridge rectifier. A bridge rectifier is a type of full wave rectifier which uses four or more diodes in a bridge circuit configuration to efficiently convert the Alternating Current (AC) into Direct Current (DC). A bridge rectifier circuit is a common part of the electronic power supplies. Many electronic circuits require rectified DC power supply for powering the various electronic basic components from available AC mains supply. The 9V or 12V DC is given to filter to get desired output. Filter is a circuit which can be designed to modify, reshape or reject all the undesired frequencies of an electrical signal and pass only the desired signals. The output of filter is given to voltage regulator then we get required 5V. The function of a voltage regulator is to maintain a constant DC voltage at the output irrespective of voltage fluctuations at the input and (or) variations in the load current. The output of regulator is given to the power supply pin of Arduino Uno. The connections are made according to the circuit diagram. The program written in Arduino is uploaded to Arduino Uno board. According to the conditions written in the program, the output is generated. If there is any dislocation or uneven movement then through sensors it detects and a red LED glows and the buzzer makes sound. Otherwise, the green LED glows which indicates that the building or bridge is safe.

RESULTS :

OUTPUT SCREENS:

If any one of the conditions satisfy, then the red LED and the buzzer are ON, indicating that the bridge or the house is in danger. If the conditions don't satisfy, then the green LED glows and the buzzer is OFF, indicating that the house or bridge is safe.

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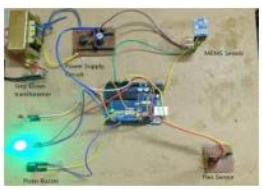

Fig 7: Safe condition.

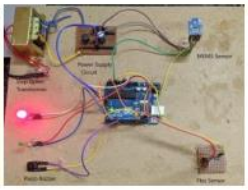

Fig 8: Danger condition.

CONCLUSION :

The bridge health and house health system used several sensors to detect the behavior of a bridge and house such as bridge deformation and damage. The sensors connected to the data logger and subsequently sent the information data such as coordinates and crack to the microcontroller. The data is used as input by microcontroller within the system and gives as a command to the alerting unit.

FUTURE SCOPE:

We can interface the wireless communication system to this system so that it can send the information to the control station or the emergency control organization.

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