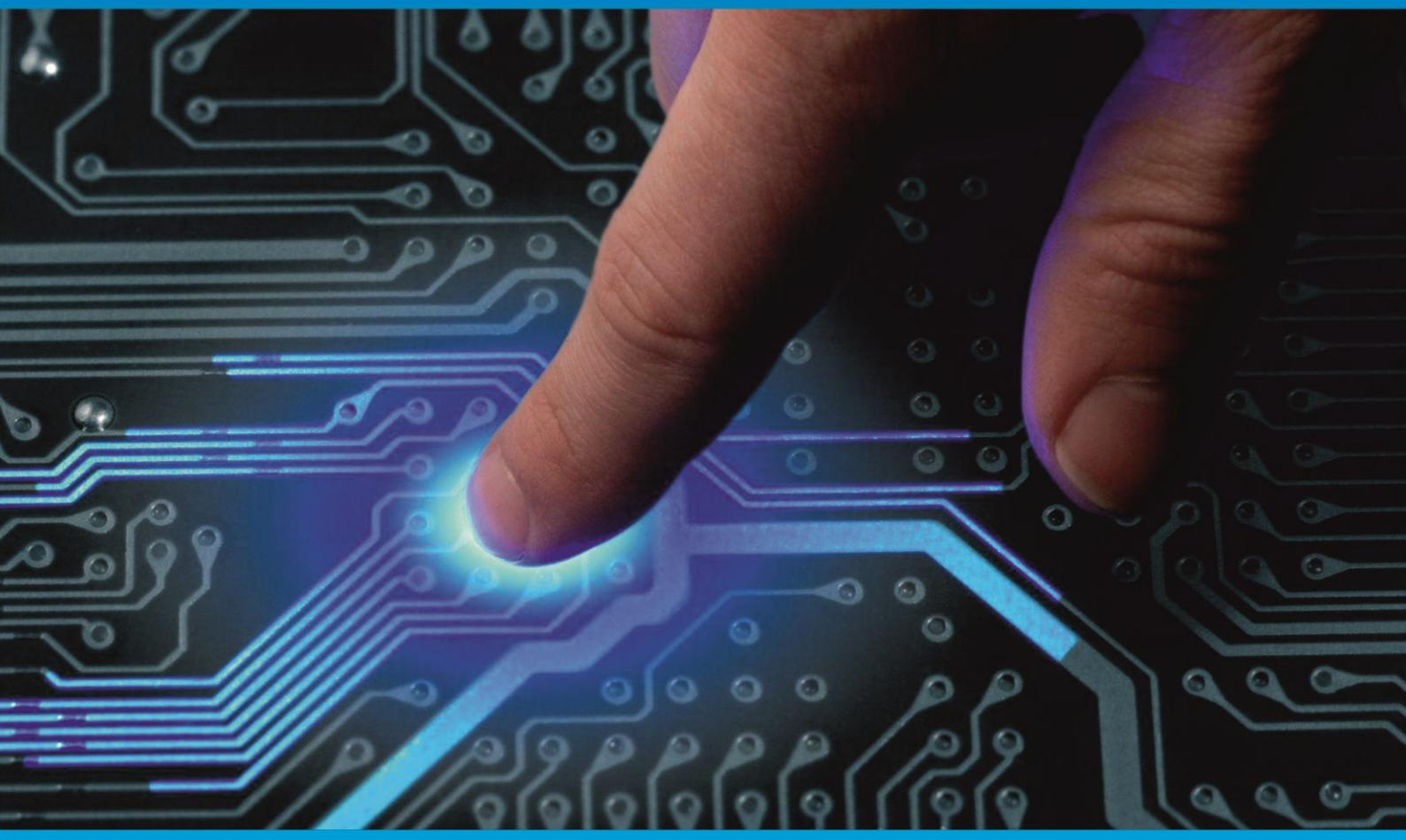
IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 9, Issue 4, April 2021

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.488

International Journal of Innovative Research in Computer and Communication Engineering

| e-ISSN: 2320-9801, p-ISSN: 2320-9798| www.ijircce.com | |Impact Factor: 7.488 |

|| Volume 9, Issue 4, April 2021 ||

| DOI: 10.15680/IJIRCCE.2021. 0904036 |

Building Collapse Detection using IOT

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ABSTRACT: Building collapse detection using IOT is now one of the trending topics in the field of computer science and also construction field. To support the construction works, various technologies are used to increase the quality of buildings and its maintenance. It is very effective to monitor the structural health of a structure. This implementation involves a budgeted, battery-powered based collision avoidance system for use in the building**.** The proposed method is the detection of building collision is where detecting the bend, or any gap in the building**.** If any bend or crack occurred in the building, the flex sensor connected along with the system will detect the bend and the location of the crack or bend will be send as message to the user with the help of GSM module. By this, the user receives the alert message with location and able to find the bend or crack in the building.

KEYWORDS: Internet Of Things, Building collapse, detection of cracks or bend.

I. INTRODUCTION

In day to day life, we came to see many building collapse news, which involves death of many lives and also many property damage. The factors can be natural disasters or man-made fault. The man-made fault is the design in structure and not giving correct load to the structure. The reason behind the collision is the lack of used building materials for the construction of the building and also lack of building maintenance. The major reason for the collapsing of the building is the structural design, cracks, corrosion.

To lack of maintenance, the building gets damaged, the person does not know whether the building is damaged. The small damage in the structure can also be more risk to the structure. The common types of damages are caused by the steel structures are corrosion, cracks, weakness in metal, and failure in the welding of metal. Monitoring the steel structures ultrasonic waves can be used. At present the greater strength than either less quality of concrete and metal structures are designed but fail in the quality of materials . There are many methods for monitoring the structure, the sensors used for detecting and monitoring the structure by ultrasonic waves, vibrations, electrical impedance, acoustic waves, echo sound, and heat-dissipation. These are some best method but the system is expensive and if there is a vibration on the roadside will also alert as an emergency. In our project, the flex sensor

has been used to monitor the bend or gap in the building. Once the gap or bend is detected, then the sensor indicates the system and the system uses GSM module to send message to the user. The system also uses the GPS module to obtain location of the gap or bend in the building, along with location, the system send message with location. By this user can know about the exact location of the gap or bend and proceed further maintenance.

II. EXISTING SYSTEM

The system proposed by author detects the bend or crack from the building, once the crack detected on the building, that is the crack level is more than mentioned level. The information will be sent to the user through communication modules used on the system. The system proposed by author have only send alert message, when the building have more systems in numbers, it is hard to find out which part is exactly affected. Unfortunately, if the building is collapsed, the rescue team may unable to find the exact position of the crack. By this, the rescue system also may trap. Thus the existing system gives limited information about the building.

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III. PROPOSED SYSTEM

The main objectives of this work are to control the structural health monitoring system. Detecting the building collision at an early stage only and altering the building based on the structure. The system consists of Arduino Uno, flex sensor, LED light, Flex sensor, GSM sim 800A board, and GPS Neo-6m.

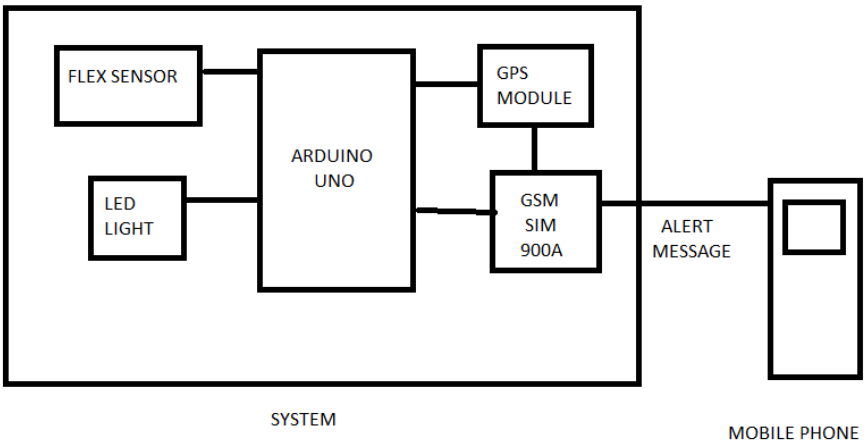

Figure 1: Overall Architecture of Proposed System

On the proposed system, the flex sensor is connected along with the bread board in order to connect with Arduino uno. Once Arduino uno is connected with the flex sensor, then GSM module is connected to the Arduino uno, the module passes information to the system through arduino uno. The GSM module is used to transfer the message to the user as SMS. The GPS module is connected with arduino to pass location of the system. These components are connected all together in the bread board. The bread board act as a bridge between the modules and the arduino uno board. The above architecture explains the connection between the modules and arduino uno. The USB port from arduino uno used to connect the board with computer. Jumper cables are used to connect the modules which are connected in the bread board. The connections on the bread board have to be correct to function correctly.

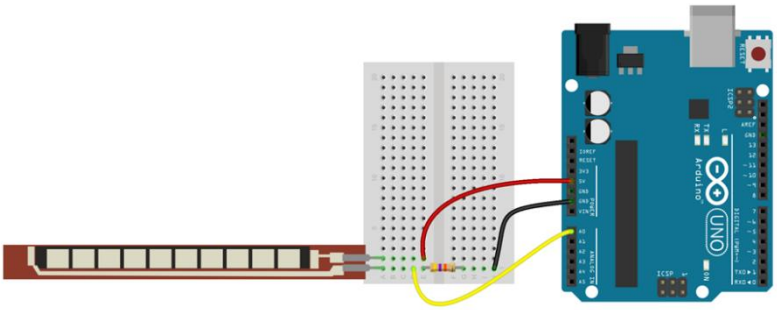

Figure 2: Connection of Arduino with Flex sensor

The deflection in the pillar is more so the flex sensor deflection is also more, so it sends an emergency alert to the owner and rescue team. The sensor is a variable resistance whenever the bend is performed in the pillar the sensor varies its value and alerts the owners at the starting stage.

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IV. HARDWARE DESCRIPTION

The proposed system for monitoring of the primary quality of the structural building depends on Arduino modules.The system consists of arduino uno, flex sensor, bread board, GSM module, and GPS module. Arduino platform depends on the modules, sensors and a
development environment that use the language for processing. Arduino module is equipped with ATmega microcontroller and it interactives with other devices.

Each of the 14 digital pins and 6 analog pins on the Uno can be used as an input or output, under software control(using pinMode(), digitalWrite(), and digitalRead() functions). They operate at 5 volts. A maximum of 40mA must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller. The Uno has 6 analog inputs, labeled A0 through A5; each provides 10 bits of resolution (i.e. 1024 different values). By default, they measure from ground to 5 volts, though it is possible to change the upper end of the range using the AREF pin and the analogReference() function.

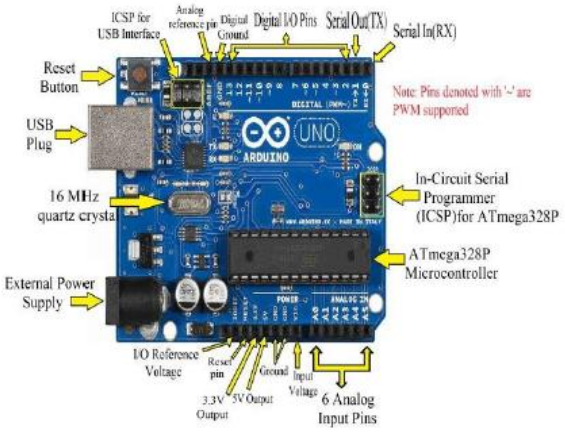

Figure 3: Arduino UNO board

Figure 4: Flex sensor

A flex sensor is a kind of sensor which is used to measure the amount of defection otherwise bending. The designing of this sensor can be done by using materials like plastic and carbon. The carbon surface is arranged on a plastic strip as this strip is turned aside then the sensor's resistance will be changed. Thus, it is also named a bend sensor. As its varying resistance can be directly proportional to the quantity of turn thus it can also be employed like a goniometer. The connection for flex is represented in below figure.

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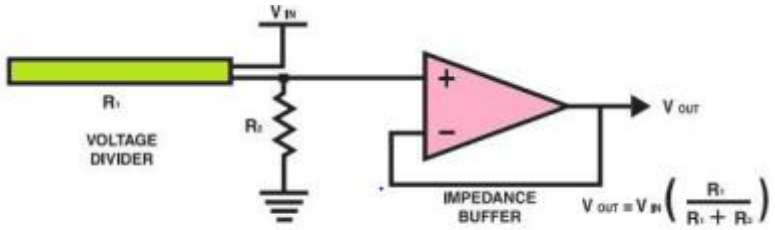

Figure 5: Basic Flex Sensor Circuit

Global System for Mobile communication (GSM) is digital cellular system used for mobile devices. It is an international standard for mobile which is widely used for long distance communication. There are various GSM modules available in market like SIM900, SIM700, SIM800, SIM808, SIM5320 etc. A GSM module or a GPRS module is a chip or circuit that will be used to establish communication between a mobile device or a computing machine and a GSM or GPRS system.These modules consist of a GSM module or GPRS modem powered by a power supply circuit and communication interfaces (like RS-232, USB 2.0, and others) for computer. A GSM modem can be a dedicated modem device with a serial, USB or Bluetooth connection, or it can be a mobile phone that provides GSM modem capabilities.

Figure 6: GSM Module

Global Positioning System (GPS) makes use of signals sent by satellites in space and ground stations on Earth to accurately determine its position on Earth. GPS receiver uses a constellation of satellites and ground stations to calculate accurate location wherever it is located. These GPS satellites transmit information signal over radio frequency (1.1 to 1.5 GHz) to the receiver. With the help of this received information, a ground station or GPS module can compute its position and time.

V. RESULT ANALYSIS

The system with sensors will be connected in the building. So that it can read the values of bend on the building. Once the bend is detected the system will pass the information to the user. The below diagram represents the connections and result obtained from the system.

Once the value is detected and the system uses GSM module to transfer the message to the user. The phone number will be provided to the code, the message will be delivered to the user based on the number they have mentioned on the code. The proposed system thus passes the message to the user. The output of this proposed system is to intimate the user about the crack or bend when it exceeds the level mentioned.

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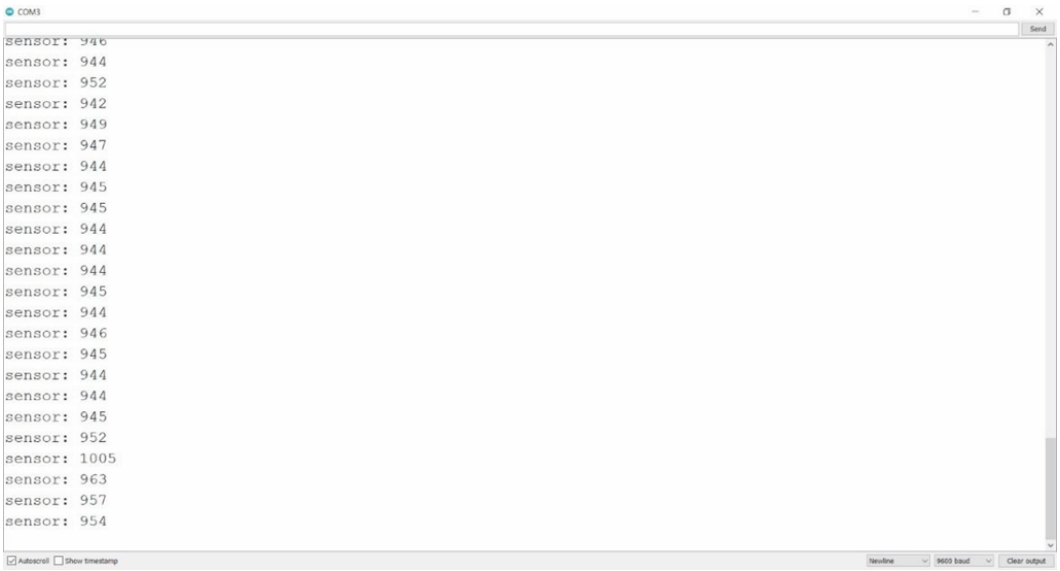

Figure 7: Flex sensor reading

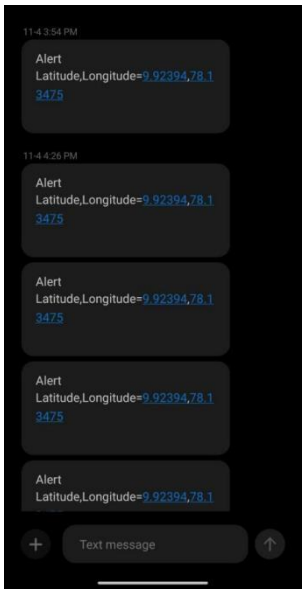

Figure8: Alert message

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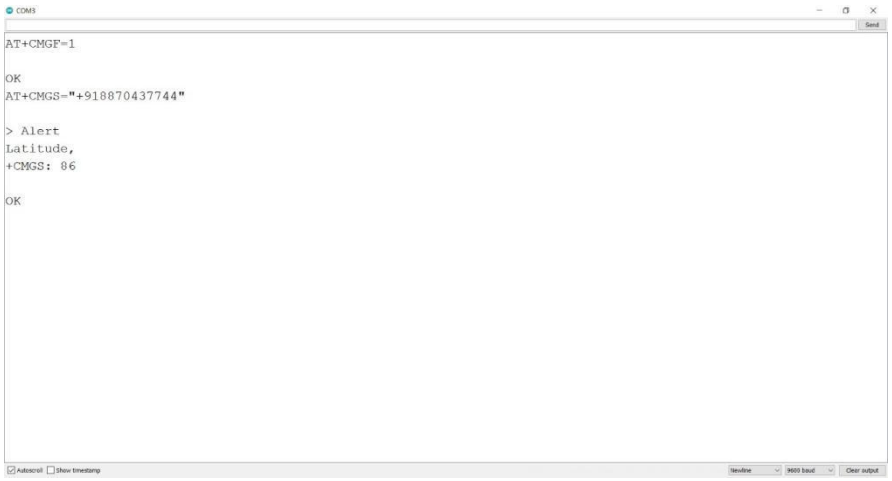

Figure 9: Output from IDE

VI. CONCLUSION AND FUTURE WORK

Building collapse detection using IOT, this proposed system is mainly used to prevent the accidents and to maintain the strength of the buildings and it also improves the lifetime of the buildings. The messages passes by this system improves the chances of saving buildings and lives from the major accidents. The person can be stress -free on the structure because the person will get an alert if anything happens at the starting stage only. The proposed system is implemented in the Arduino board and monitored in the serial monitor. The gsm module is been used for sending an SMS of the system. The flex sensor are been used to monitor the data value of the system. If any value is beyond the calibrated range the alert message will be sent and the system beeps. The system is generated and simulated as per the details. This project can be implemented in any structural buildings. It can be placed to the pillar and the roof of the building. The system has an advantage where it consumes less power,
investment cost low, waterproof can be implemented anywhere including to the dam walls.

VII. FUTURE WORKS

The proposed system extends the system with moisture sensors. The moisture sensors are used to determine the value of humidity in the building. When the moisture content in the building increased it causes the building to bend and it damages the health of the building. The moisture sensor detects the moisture content and report to the user. This prevents the building from getting over moisture in the building.

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7.488

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