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Embedded System Based Emergency Evacuation System

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Abstract: ***The complex nature of the internal environment of public buildings make us to think about how to protect people in the break-out of fire and quickly reach the safe area. With the help of Arduino and other components such as fire hydrants, fire extinguishers, safety evacuation symbols in buildings, the migration of the people can be dynamically monitored and controlled. Using Arduino, an intelligent dynamic evacuation path solving model for emergency evacuation system was built for large public buildings. When an emergency situation occurs, the system can help guide people to evacuate from building and reach the safe exit quickly, so as to reduce casualties and economic losses.***

Keywords : Arduino, Embedded system, Evacuation, GSM module.

I. INTRODUCTION

An emergency is a unexpected situation and is usually dangerous crisis that requires prompt attention. In the event of an emergency, the time taken to detect, assess and evacuate people should be lesser than the physical propagation time of the critical event which makes the sensor data obtained in critical time an essential requirement of the evacuation system. Using Arduino, will help optimize the evacuation task. After the occurrence of threatening events there is only a little time to react and therefore it is highly difficult to find a safe zone to evacuate people if it lacks accurate and timely information. In the case of emergency situations the people inside the building are needed to be evacuated to a threat free zone. Thus evacuation system is common in the scenario. The underlying assumption is that there is an evacuation path and this path is safe.

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During a fire and earthquake, uniform evacuation guidance is inadequate because existing emergency guides do not consider the location of the fire and merely direct people to the nearest exit which could be fatal if the fire or a building collapse has occurred at that exit.
The Emergency Evacuation System (EES) aims to achieve an effective evacuation process that ensures safety and minimum casualties. An emergency alert message is immediately sent to the rescuing force. Furthermore, the system guides them to the nearest safest exit route indicating directions through the speakers, based on the data from the sensors. Information about direction of escape is heard via speakers and LEDs which helps people find proper evacuation routes. Thus, the Emergency Evacuation System not only warns but also detects monitors and provides guidance routing to the occupants of the building.

II. LITERATURE REVIEW

Generally speaking, most of the emergency systems in rely on calculation of emergency situation of the section and the path finding is done separately connected to the Arduino sense the temperature, humidity and the vibration values. The rescue teams are provided with the path finding task which takes extra time for the computation of the evacuation path.

Reference [1] proposes a system based upon two different navigators for its functioning. The wireless sensor networks make use of two different nodes such as sensor nodes and decision nodes. The sensor nodes provide information about the particular scenario while the decision nodes are the ones which are responsible for the implementation of the system. Localized emergency navigators (LENs) provide the pathway for evacuees with the localized area. The evacuees are denominated with the path to the localised gateway through the LENs. If high personal is risk is detected, then the system switches over to High Risk Emergency Navigator (HREN). The HREN adjusts the evacuation metrics at the specific DNs and acts to rescue people from the area. Here, the DNs could not handle complex tasks and the HREN overwrites the localized decision by a globally made decision. The evacuation path is provided to the inhabitants through a MATLAB driven simulator.

Reference [2] provides an evacuation system based upon the IOT cloud server. The sensors detect the scenario and send them to the cloud server. The evacuation framework is based upon the mobile devices and Mobile Ad-hoc Network (MANET) for communication between the computational devices. The system makes uses the MANET technology for the communication between the users and the IOT based server app. The application provides a 3D building structure which provides the evacuation path in a clearer picture.

The application explains the dangerous paths through section blocks and threat sign denomination in the app. The user needs to enter his current location in the building and based on the readings from the surroundings the app computes and expresses the safe path.

Reference [5] proposes an emergency evacuation system based upon ant (or) bee colony algorithm. Ant colony algorithm is an artificial intelligence algorithm which computes optimum evacuation path selection with the comparison of building structure to an ant (or) bee colony. The evacuation of the people is done as similar to that of ants escape in a colony during a threat. When a danger is detected, the system is divided into two different nodes based upon the threat points at each section. A node is deemed to be static if there is minimal level of threat (or) the danger in the path is said to be acceptable. Dynamic node is assumed when the emergency situation becomes unbearable and uncontrollable. The users of this system are denominated about the safe paths through a mobile supplication which implies the current emergency situation through a 2 dimensional model. The dynamic nodes are signed with danger symbols (or) denominations. The current location of the user is required for the operation of the system and must be entered manually by the inhabitants of the building. The two dimension structural evacuation path software is enabled through a MATLAB simulator.

III. METHODOLOGY

The system makes us of three sensors namely DHT11, MQ2 & GY521 for temperature, gas level and earthquake sensing respectively. The data from the sensors are set to the Arduino and are compared with pre-entered standard reference values. If the measured values are found to exceed the threshold values, the system begins to operate. The message is sent to emergency rescuing team to intimate them about the emergency occurrence. The system uses speakers and LEDs to provide the information about the right paths during the emergency situation. The safer paths are computed through the data received from the sensors and comparing them with the standard reference values which are being already provided to the Arduino. The evaluation of the emergency paths involves simpler comparison method unlike complex algorithmic methods used by previous emergency evacuation systems. The comparison of danger points in all exit paths is calculated and the safest is one selected for the evacuation purpose. The safe path is being expressed to the inhabitants of the building via speakers and LEDs. The speakers let know the occupants of the evacuation path by the frequent announcements while the LEDs are used for exhibiting the safe paths by their lighting. Green LED glows if the above path is selected as the safe evacuation path while the Red LED glows if the path is deemed to be dangerous (or) unsafe. Thus the safer paths are being denominated to the occupants of the building via the speakers and LEDs and the evacuation of people is done safely.

IV.SYSTEM DESCRIPTION

The emergency evacuation system uses Arduino to read the sensor values and detect the situation of the building. If the threshold value of any of the sensors is exceeded, the system is activated. Values from each sensor are compared with the threshold value and if any of the value exceeds the threshold value, the evacuation system begins to operate. After comparing the values with the threshold values if it does not exceed, the arduino continues the process of reading the signals from all sensors and monitors the sensor data. The sensors connected to the Arduino provide the temperature, humidity and the vibrations along the x, y and z axis. Threshold values for temperature (45C), gas level (500ppm).

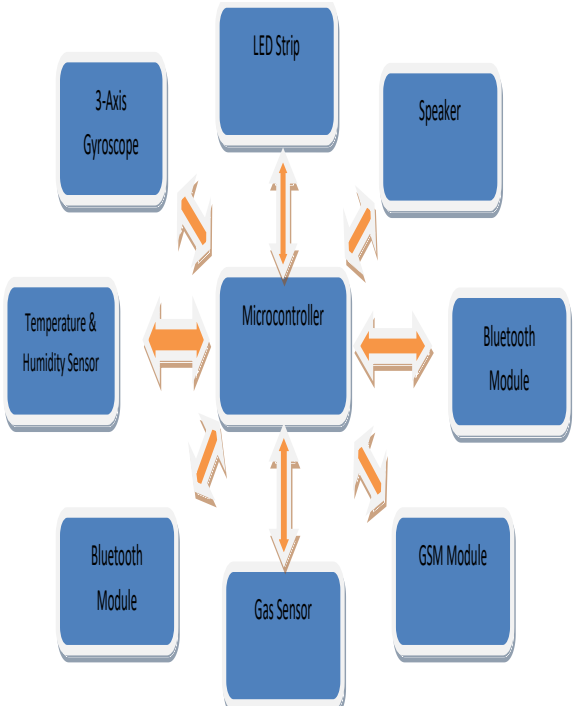

Fig1.Block diagram

V.RESULTS AND DISCUSSION

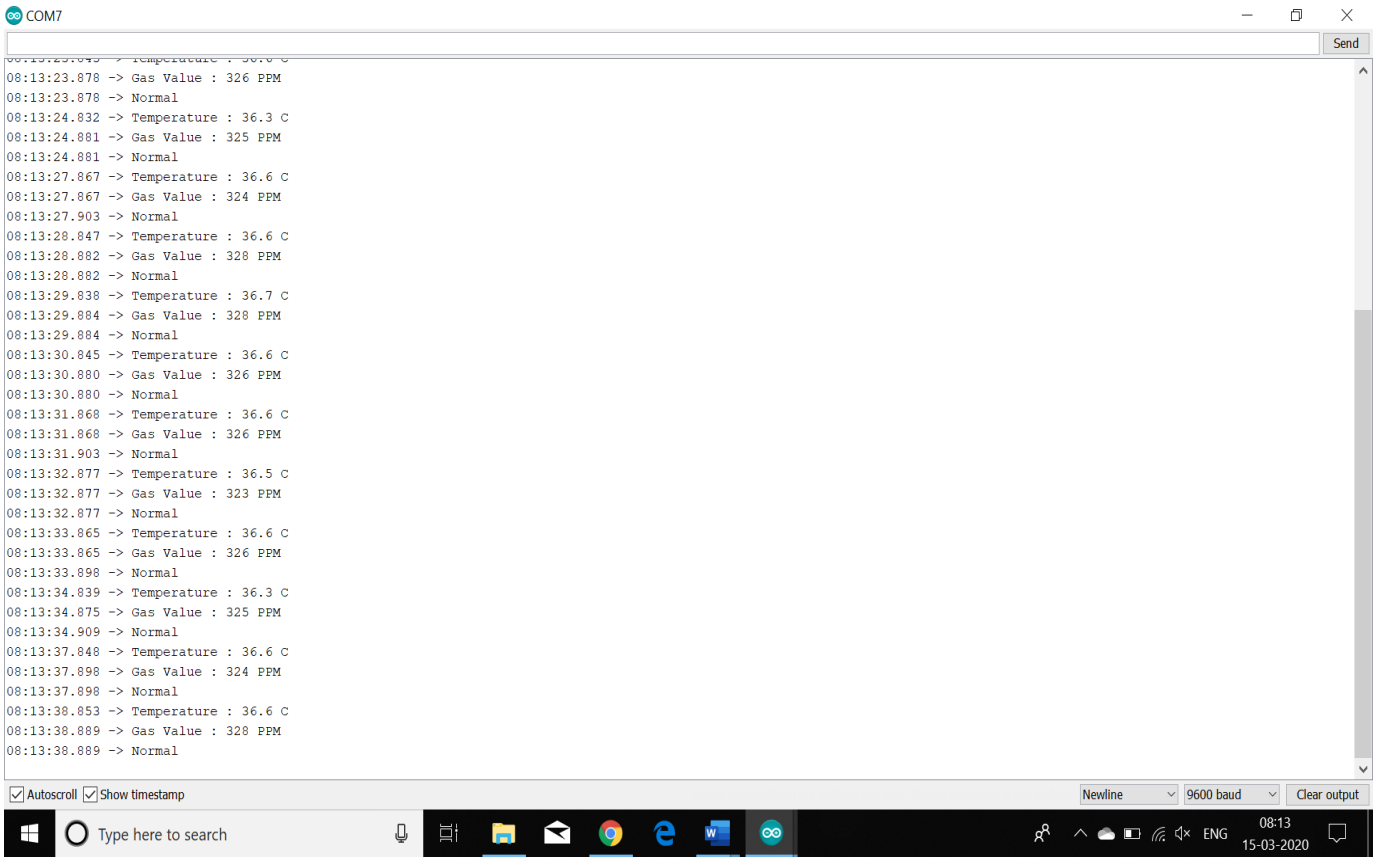

Fig2. Serial Monitor of Arduino IDE under Normal Situation

The Figure 2 Shows the serial monitor of Arduino IDE in normal situation. Here, the message will not be sent to the rescue team.

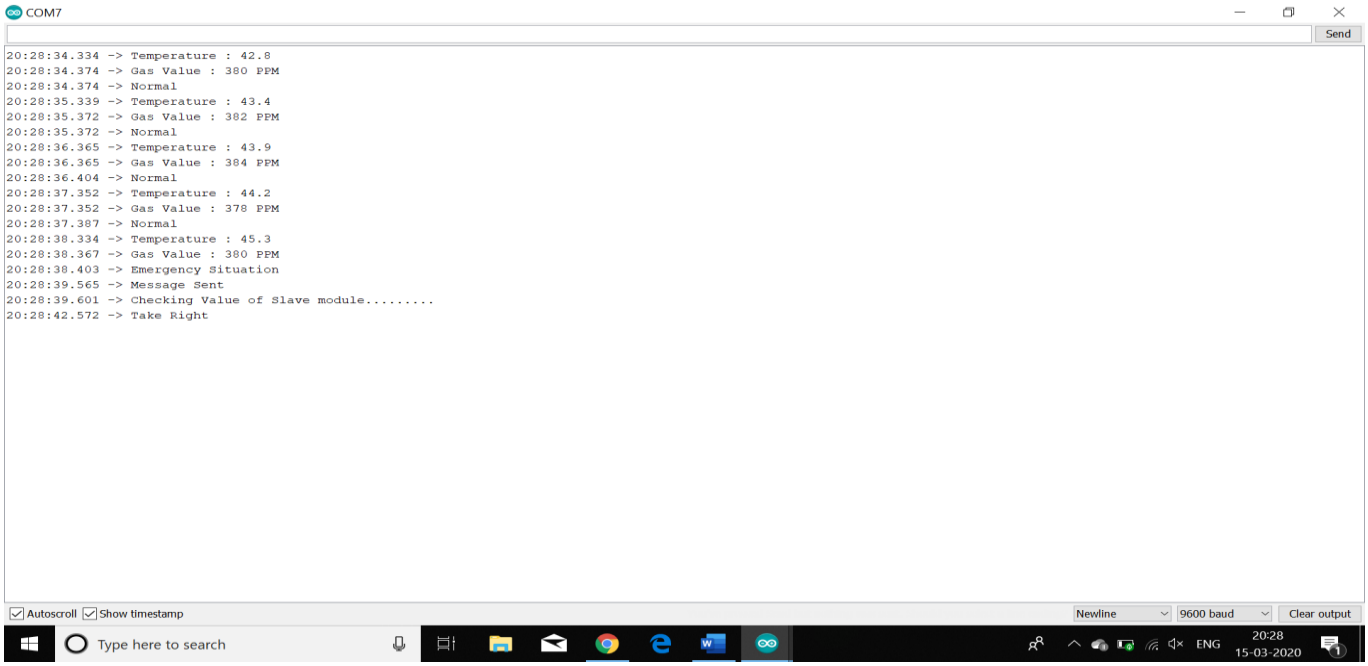

Fig3.Serial Monitor of Arduino IDE under Emergency Situation

The Figure 3 shows the serial monitor of Arduino IDE under emergency situation and the message to the rescue team is sent and then the module search for another module to connect and send the sensor values.

After getting the values, module compares both the values and choose the safest path.

VI. CONCLUSIONS

The evacuation of people in emergency situation in the public buildings must be given with the utmost priority as it would result in huge losses. The system achieves evacuation of the inhabitants in an effective and efficient manner with the help of simple comparison computation. In addition to these features, evacuation based on location of occupants in the building to be taken forward which would enable faster and effective evacuation.

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