Wireless Earthquake Alarm

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Abstract: The project aims at designing an earthquake monitoring and warning system that is capable of detecting earthquakes as well as warning people to take necessary precautions. This system will not only attempt to save human lives, but will also store the data for later use by professionals working at this sector. Existing earthquake systems are moreover designed for aftershock management and they hardly deal with real-time data. However, this system is mainly designed to react as soon as the sensor nodes come across a p-wave. Many life and properties have been lost due to the earthquake. Many countries have implements EEW (Early Earthquake Warning) System to save human lives. In this paper an idea of low cost earthquake alarm system using ATmega32, RF transmitter, RF receiver, relay, buzzer. A large number of earthquakes are felt all over the globe every year. The small ones are unnoticed while the large ones are felt over thousands of kilometers. Earthquakes have damaged and destroyed human lives since time. It is therefore important to design low cost earthquake alarm system which can be used by the people in their home to save their lives at the time of earthquake.
Nowadays thousands of people are dying because of earthquake. Because earthquake strikes without warning. So we would like to implement a system which detect earthquake before occurrence. This project is implemented by detecting the vibrations which occurring under the earth. When the values of vibration create a massive variation signal will be sent to the GSM and a real time graph of the earthquake will be plotted too.

Index Terms **– Earthquake, EEW.**

I. INTRODUCTION

Nowadays thousands of people suffers a lot from earthquake. It is mainly because earthquake strikes without warning and it cause a great damage to human structures such as buildings, roads, rails, factories, dams, bridges etc, and thus cause heavy damage to human property. The impact created by earthquakes particularly in hilly areas and mountains which are tectonically sensitive causes landslides and debris fall on human settlements and transport system on the lower slope segments, inflicting damage to them. Main defect for the earthquake is that it strikes without warning. So we need to been taken care of it as early as possible. Only way is to avoid the disaster. Our authorities are only considering and bothering the situations and crisis after the occurrence of earthquake. So we need to detect the earthquake before its occurrence. By using sensors, vibration sensor and network we can detect the vibrations which occurring under the earth. When the threshold voltage of the system crosses the vibration of the earth the signal will be passing to a central station through GSM.
This system shows the design of low cost earthquake alarm system using ATmega328p and GSM Module which can be used by the people in their home to save their lives at the time of earthquake. If the acceleration of the seismic wave is greater than the predefined value, the system blows the alarm. This system can be used in multi storied building as the alarm is connected wirelessly.
By the theory that the S waves are the first attack wave from the surface and then the P waves attack the surface latter that brings the strongest shake then the S wave. Hence the public is warned earlier in few minutes or seconds before. This shows the design of low cost earthquake alarm system which can be used by the people in their home to save their lives at the time of earthquake. If the acceleration of the seismic wave is greater than the predefined value, the system blows the alarm.
The paper international journal of advance research in science and engineering April 2018 “Wireless Earthquake Alarm Design Based on MEMS Accelerometer” earthquake detector we replaced Bluetooth instead of LCD because LCD cost is high and it is wired system. Bluetooth is wireless technology and it also alerts the person in the control room through mobile. Designing an earthquake alarm to detect the magnitude of the quake and give an alarm. A method is described in the present disclosure which includes detecting a longitudinal wave of a seismic movement by an accelerometer. Determining whether a magnitude of the longitudinal wave exceeds a predetermined threshold, and wirelessly transmitting an alarm notification indicating seismic movement to at least one alarm device. If making many alarm devices, they can form a network and communicate each other.

The paper “earth quake detection using GSM and monitoring” 2017, We implanted GSM technology for the purpose of monitoring live location and for sending message to the mobile. Earthquake early-warning systems detect the first quivering of a major quake, triggering alarm systems in advance of the most violent shaking. The Alert system that has been proposed for all over the world would use a network of digital seismometers deployed around the state to give populated areas up to a minute of advance warning
The paper international journal of science and research 2017 “Earthquake Early Warning System by IOT using Wireless Sensor Networks” we replaced accelerometer with vibration sensor, as accelerometer is also costly and cannot detect sensitive vibrations so we replaced accelerometer with vibration sensor. In the field of wireless sensor networks, those measurements that significantly deviate from the normal pattern of sensed data are considered as outliers. The potential sources of outliers include noise and errors, events, and malicious attacks on the network. Traditional outlier detection techniques are not directly applicable to wireless sensor networks due to the nature of sensor data and specific requirements and limitations of the wireless sensor networks.
From 2016 IEEE paper earth quake early warning system using wireless sensor network we implemented wireless technology as it gave us a base plan of how the wireless system works. This survey provides a comprehensive overview of existing outlier detection techniques specifically developed for the wireless sensor networks. Additionally, it presents a technique-based

taxonomy and a comparative table to be used as a guideline to select a technique suitable for the application at hand based on characteristics such as data type, outlier type, outlier identity, and outlier degree.

From 2016 international journal of innovative research in computer and communication engineering wireless sensor networks for earthquake detection and damage mitigation system we got an idea on how to track and take action and measures on earth quake using wireless system

From international journal of advance engineering and research development 2017 paper. This present research paper proposes the earthquake warning alarm systems detect the first quivering of a major quake, triggering alarm systems in advance of the most violent shaking

The International Journal of Research in Advent Technology 2016 In this paper a simple earthquake indicator using Arduino board and a highly sensitive accelerometer is presented that can sense even minute vibrations Proceedings of the Asia-Pacific Advanced Network 2015 An Efficient Alarm Notification Algorithm for Earthquake Early Warning System In this paper, we propose an efficient alarm notification algorithm for earthquake early warning system in Taiwan.

International Journal of Research in Advent Technology August 2016 "Earthquake Indicator Using Arduino" In this paper a simple earthquake indicator using Arduino board and a highly sensitive accelerometer is presented that can sense even minute vibrations. This product is capable of providing immediate alert enabling us to foresee the disaster and to take preventive measures accordingly.

II. Working and Block diagram

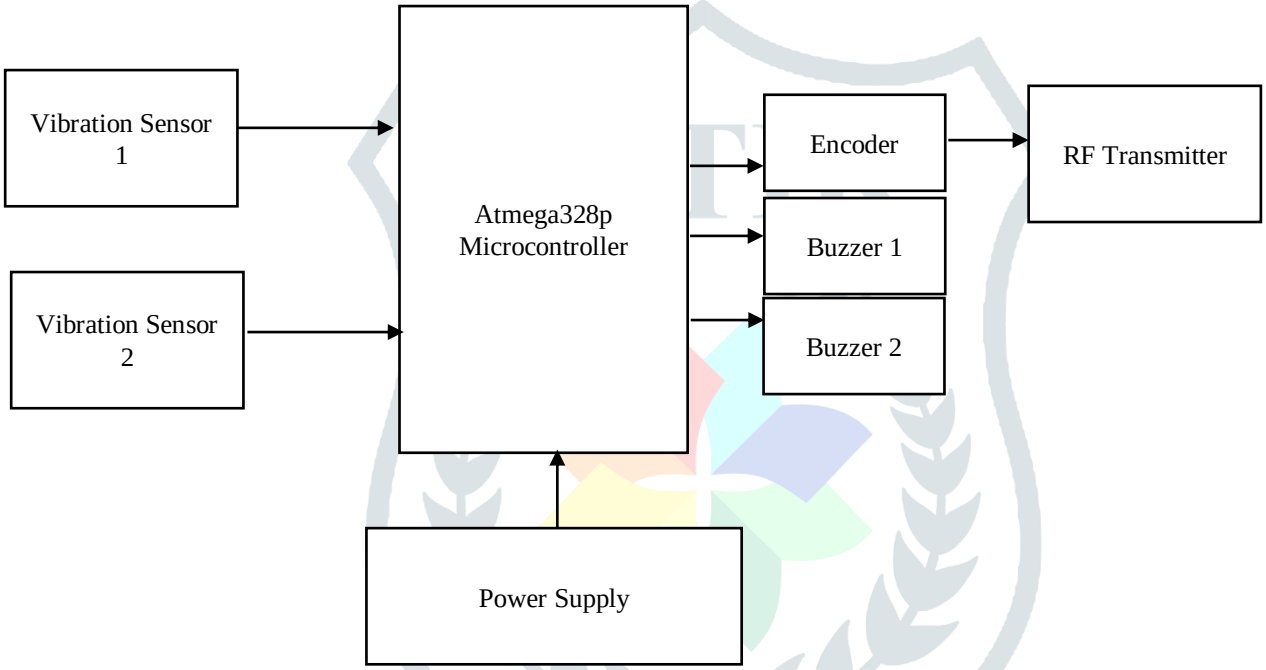


Fig 1.1: Block Diagram Of Detection Circuit With Transmitter

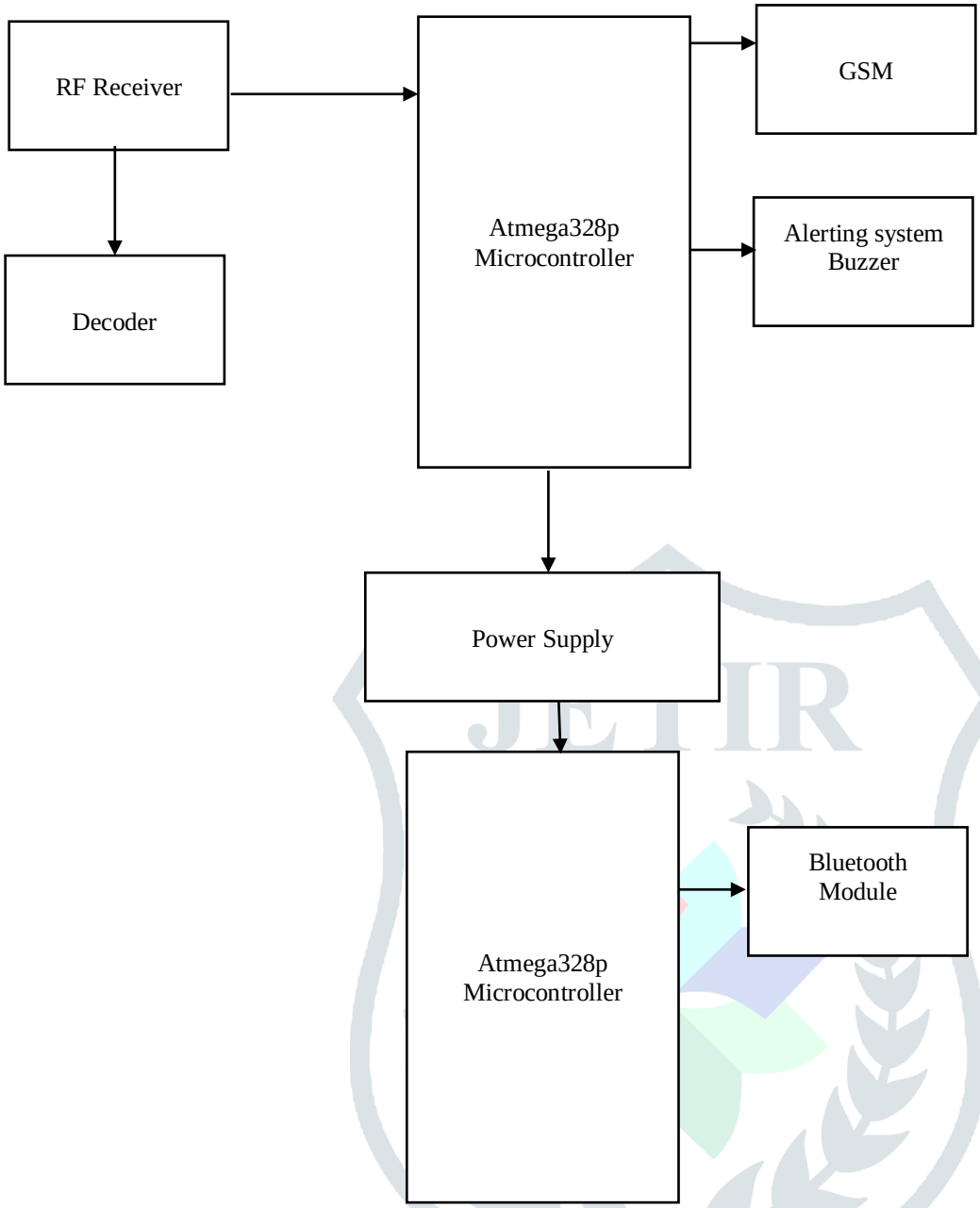


Fig 1.2: Block Diagram Of Alerting System With Receiver

The vibration sensor is used to detect vibrations, two sensors are placed in two different earthquake prone locations in the same area connected to a common transmitting node. When the sensors detect vibration, it will send this signal to the microcontroller which process it and send this distress signal to the Alerting system at the Master Control Centre (Data Centre) using RF communication facilitated by RF transmitter and receiver pair. As a first line of alert system individual Distress alert system represented by a buzzer is placed near the sensors and will turn ON when the sensors detect vibrations.

Upon receiving this signal in the receiver side, the microcontroller processes this data and sends out an alert SMS to the civilians in that particular area from which the vibration sensor data was received and at the same time it activates the alert system by turning on the buzzer and SOS lights in the data centre.

The head of the data centre will have an android app running in their smart phone so no matter where they are within the Master control centre, they need not run towards the alert system to identify where exactly the problem is, as the system sends this information over Bluetooth directly to the smart phone so that the head of the centre knows exactly which area is in trouble and take necessary steps to deploy a emergency response team. Thus, in the proposed project, the conventional wire based localized sensors and converted into a simple an efficient wireless system which not only alerts civilians but also the ERT for immediate actions and advanced IoT based techniques using Bluetooth is used for quick response without any interference in communication.

II.COMPONENTS DESCRIPTION

COMPONENTS USED

1. Atmega328p Microcontroller
2. Vibration Sensor
3. RF Transmitter
4. RF Receiver

5. Relay
6. Buzzer
7. GSM Module
8. Power Supply

Arduino Atmega328p Microcontroller

Arduino Uno is a microcontroller board based on the ATmega328P .It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, 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 a AC-to-DC adapter or battery to get started.

Fig 2.1- Arduino uno ATmega328p

2.1 Pin Configuration

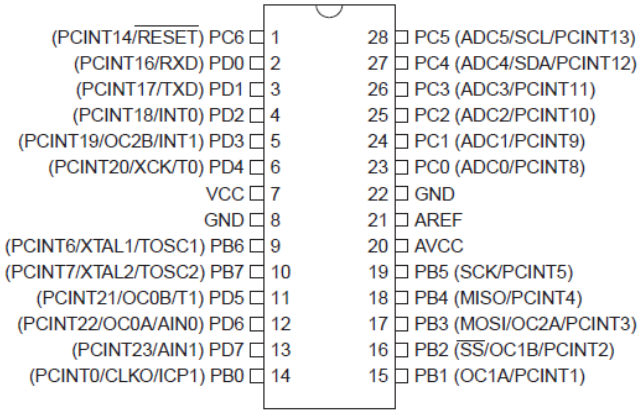


Fig 2.2-The pin configuration of Arduino ATMega328p

VCC
Digital supply voltage.
GND
Ground.
Port B (Pb7:0) Xtal1/Xtal2/Tosc1/Tosc2
Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tristated when a reset condition becomes active, even if the clock is not running. Depending on the clock selection fuse settings, PB6 can be used as input to the inverting Oscillator amplifier and input to the internal clock operating circuit. Depending on the clock selection fuse settings, PB7 can be used as output from the inverting Oscillator amplifier. If the Internal Calibrated RC Oscillator is used as chip clock source, PB7...6 is used as TOSC2...1 input for the Asynchronous Timer/Counter2 if the AS2 bit in ASSR is set.
Port C (PC5:0)
Port C is a 7-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The PC5...0 output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port C pins that are externally pulled low will source current if the pull-up resistors are activated. The Port C pins are tristated when a reset condition becomes active, even if the clock is not running.
PC6/RESET
If the RSTDISBL Fuse is programmed, PC6 is used as an I/O pin. Note that the electrical characteristics of PC6 differ from those of the other pins of Port C. If the RSTDISBL Fuse is un programmed, PC6 is used as a Reset input. A low level on this pin for longer than the minimum pulse length will generate a Reset, even if the clock is not running. The minimum pulse length is given in Table 29-11 on page 305. Shorter pulses are not guaranteed to generate a Reset
Port D (PD7:0)
Port D is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port D output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port D pins that are externally pulled low

will source current if the pull-up resistors are activated. The Port D pins are tristated when a reset condition becomes active, even if the clock is not running.

AVCC

AVCC is the supply voltage pin for the A/D Converter, PC3:0, and ADC7:6. It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter. Note that PC6...4 use digital supply voltage, VCC.

AREF

AREF is the analog reference pin for the A/D Converter.

ADC7:6 (TQFP and QFN/MLF Package Only)

In the TQFP and QFN/MLF package, ADC7:6 serve as analog inputs to the A/D converter. These pins are powered from the analog supply and serve as 10-bit ADC channels.

General Description

The AVR core combines a rich instruction set with 32 general purpose working registers. All the 32 registers are directly connected to the Arithmetic Logic Unit (ALU), allowing two independent registers to be accessed in one single instruction executed in one clock cycle. The resulting architecture is more code efficient while achieving throughputs up to ten times faster than conventional CISC microcontrollers.

The ATmega48A/PA/88A/PA/168A/PA/328/P provides the following features: 4K/8Kbytes of In-System Programmable Flash with Read-While-Write capabilities, 256/512/512/1Kbytes EEPROM, 512/1K/1K/2Kbytes SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible Timer/Counters with compare modes, internal and external interrupts, a serial programmable USART, a byte-oriented 2-wire Serial Interface, an SPI serial port, a 6-channel 10-bit ADC (8 channels in TQFP and QFN/MLF packages), a programmable Watchdog Timer with internal Oscillator, and five software selectable power saving modes. The Idle mode stops the CPU while allowing the SRAM, Timer/Counters, USART, 2-wire Serial Interface, SPI port, and interrupt system to continue functioning. The Power-down mode saves the register contents but freezes the Oscillator, disabling all other chip functions until the next interrupt or hardware reset. In Power-save mode, the asynchronous timer continues to run, allowing the user to maintain a timer base while the rest of the device is sleeping. The ADC Noise Reduction mode stops the CPU and all I/O modules except asynchronous timer and ADC, to minimize switching noise during ADC conversions. In Standby mode, the crystal/resonator Oscillator is running while the rest of the device is sleeping. This allows very fast start-up combined with low power consumption. Atmel® offers the QTouch® library for embedding capacitive touch buttons, sliders and wheels functionality into AVR® microcontrollers. The easy-to-use Q Touch Suite tool chain allows you to explore, develop and debug your own touch applications.

The device is manufactured using Atmel's high density non-volatile memory technology. The On-chip ISP Flash allows the program memory to be reprogrammed In-System through an SPI serial interface, by a conventional non-volatile memory programmer, or by an On-chip Boot program running on the AVR core. The Boot program can use any interface to download the application program in the Application Flash memory. Software in the Boot Flash section will continue to run while the Application Flash section is updated, providing true Read- While-Write operation. By combining an 8-bit RISC CPU with In-System Self-Programmable Flash monolithic chip, the Atmel Atmega48A/PA/88A/PA/168A/PA/328/P is a powerful microcontroller that provides a highly flexible and cost effective solution to many embedded control applications. The Atmega48A/PA/88A/PA/168A/PA/328/P AVR is supported with a full suite of program and system development tools including: C Compilers, Macro Assemblers, Program Debugger/Simulators, In-Circuit Emulators, and Evaluation kits.

Programming

The Arduino Uno can be programmed with the (Arduino Software (IDE)). Select "Arduino/Genuino Uno from the Tools > Board menu (according to the microcontroller on your board)

The ATmega328 on the Arduino Uno comes preprogrammed with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files).

Power

The Arduino Uno board can be powered via the USB connection or with an external power supply. The power source is selected automatically.

External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm center-positive plug into the board's power jack. Leads from a battery can be inserted in the GND and Vin pin headers of the POWER connector.

The board can operate on an external supply from 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may become unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

The power pins are as follows:

- Vin. The input voltage to the Arduino/Genuino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.
- 5V.This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board.
- 3V3. A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.
- GND. Ground pins

Memory

The ATmega328 has 32 KB (with 0.5 KB occupied by the boot loader). It also has 2 KB of SRAM and 1 KB of EEPROM

Input And Output

Each of the 14 digital pins on the Uno can be used as an input or output, using pin Mode (), digital Write (), and digital Read() functions. They operate at 5 volts. Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller.

Communication

Arduino/Genuino Uno has a number of facilities for communicating with a computer, another Arduino/Genuino board, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX). An ATmega16U2 on the board channels this serial communication over USB and appears as a virtual com port to software on the computer. The 16U2 firmware uses the standard USB COM drivers, and no external driver is needed. However, on Windows, a .inf file is required. The Arduino Software (IDE) includes a serial monitor which allows simple textual data to be sent to and from the board. The RX and TX LEDs on the board will flash when data is being transmitted via the USB-to-seriachip and USB connection to the computer (but not for serial communication on pins 0 and 1).

VIBRATION SENSOR

Fig 2.3-Vibration sensor

Specifications

- Working voltage: DC 5-15V
- With signal indicate light
- Output signal: LOW level when vibration is detected
- Interface: PH2.54 3pin

Working Principle Of Vibration Sensor

This is a High sensitivity vibration sensor module. The vibration sensing system of this product composed of the buzzing and the contact spring, which has the characteristics of high sensitivity, high speed and high performance. Piezoelectric ceramic spring hammer structure vibration signals detection, and through the LM358 OP AMP and outputs the control signal, it is low cost, high sensitivity, stable and reliable. Vibration detection can be controlled in a wider range, has been widely applied to automobile, motorcycle anti-theft system, the vehicle alarm is 80% with this kind of sensor. The sensor can also be used with MCU, wireless transmitting module, wired alarm etc. They are widely used in automobile anti-theft and other security products.

RF TRANSMITER

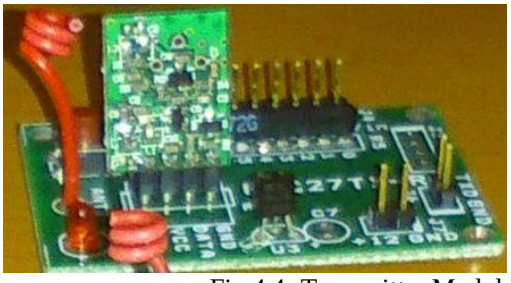


Fig 4.4- Transmitter Module

Fig 2.4: Features

- Frequency Range: 315 / 433.92 MHZ.
- Supply Voltage: 3~12V.
- Output Power: 4~16dBm

GENERAL DESCRIPTION

The ST-TX01-ASK is an ASK Hybrid transmitter module. ST-TX01-ASK is designed by the Saw Resonator, with an effective low cost, small size, and simple-to-use for designing.

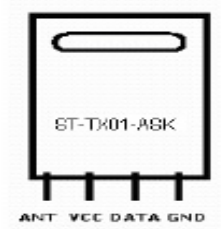


Fig 2.5: Pin description

ANT: 50 ohm antenna output. The antenna port impedance affects output power and harmonic emissions. An L-C low-pass filter may be needed to sufficiently filter harmonic emissions. Antenna can be single core wire of approximately 17cm length or PCB trace antenna

VCC: Operating voltage for the transmitter. VCC should be bypassed with a .01uF ceramic capacitor and filtered with a 4.7uF tantalum capacitor. Noise on the power supply will degrade transmitter noise performance

DATA: Digital data input. This input is CMOS compatible and should be driven with CMOS level inputs.

GND: Transmitter ground. Connect to ground plane.

The STT-433 is ideal for remote control applications where low cost and longer range is required. The transmitter operates from a 1.5-12V supply, making it ideal for battery- powered applications. The transmitter employs a SAW-stabilized oscillator, ensuring accurate frequency control for best range performance. Output power and harmonic emissions are easy to control, making FCC and ETSI compliance easy. The manufacturing-friendly SIP style package and low-cost make the STT-433 suitable for high volume applications.

Features of RF transmitter

1. 433.92 MHz Frequency

2. Low Cost

3. 1.5-12V operation

4. 11mA current consumption at 3V

5. Small size

6. 4 dBm output power at 3V

Specifications of RF transmitter

- Operating Voltage Vcc: 1.5 to 12 Volts DC
- Operating Current: Icc - 11mA @3V, 59mA @5V
- Frequency Accuracy: -75 to 75 KHz
- Center Frequency: 433 Mhz
- RF Output Power: 4 dBM@3V (2 mW), 16 dBM@5V (39 mW)
- Data Rate: 200 to 3K bps
- Temperature:-20 to +60 Deg. C

Theory

OOK (On Off Keying) modulation is a binary form of amplitude modulation. When a logical 0 (data line low) is being sent, the transmitter is off, fully suppressing the carrier. In this state, the transmitter current is very low, less than 1mA. When a logical 1 is being sent, the carrier is fully on. In this state, the module current consumption is at its highest, about 11mA with a 3V power supply.

OOK is the modulation method of choice for remote control applications where power consumption and cost are the primary factors. Because OOK transmitters draw no power when they transmit a 0, they exhibit significantly better power consumption than FSK transmitters.

OOK data rate is limited by the start-up time of the oscillator. High-Q oscillators which have very stable center frequencies take longer to start-up than low-Q oscillators. The start-up time of the oscillator determines the maximum data rate that the transmitter can send.

Data Rate: The oscillator start-up time is on the order of 40uSec, which limits the maximum data rate to 4.8 kbit/sec.

SAW stabilized oscillator: The transmitter is basically a negative resistance LC oscillator whose center frequency is tightly controlled by a SAW resonator. SAW (Surface Acoustic Wave) resonators are fundamental frequency devices that resonate at frequencies much higher than crystals.

Applications

1. Remote Keyless Entry (RKE)

2. Remote Lighting Controls

3. On-Site Paging

4. Asset Tracking

5. Wireless Alarm and Security Systems

6. Long Range RFID

7. Automated Resource Management

8. Wireless security systems

9. Car Alarm systems

RF RECIEVER

Fig: 2.6- Receiver module

Features

1. Low power consumption.

2. Easy for application.

3. Operation temperature range :-20℃ ~ + 70℃

4. Operation voltage: 5 Volts.

5. Available frequency at: 315/434 MHz

The STR-433 is ideal for short-range remote control applications where cost is a primary concern. The receiver module requires no external RF components except for the antenna. It generates
virtually no emissions, making FCC and ETSI approvals easy. The super-regenerative design exhibits exceptional sensitivity at a very low cost. The manufacturing-friendly SIP style package and low-cost make the STR-433 suitable for high volume applications.

Pin Description

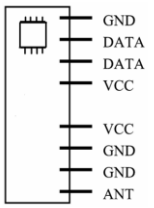


Figure 2.7: Pin Description

ANT: Antenna input.
GND: Receiver Ground. Connect to ground plane.
VCC: (5V) VCC pins are electrically connected and provide operating voltage for the receiver. VCC can be applied to either or both. VCC should be bypassed with a .1µF ceramic capacitor. Noise on the power supply will degrade receiver sensitivity.
DATA: Digital data output. This output is capable of driving one TTL or CMOS load. It is a CMOS compatible output.

Operation

The STR-433 uses a super-regenerative AM detector to demodulate the incoming AM carrier. A super regenerative detector is a gain stage with positive feedback greater than unity so that it oscillates. An RC-time constant is included in the gain stage so that when the gain stage oscillates, the gain will be lowered over time proportional to the RC time constant until the oscillation eventually dies. When the oscillation dies, the current draw of the gain stage decreases, charging the RC circuit, increasing the gain, and ultimately the oscillation starts again. In this way, the oscillation of the gain stage is turned on and off at a rate set by the RC time constant. This rate is chosen to be super-audible but much lower than the main oscillation rate. Detection is accomplished by measuring the emitter current of the gain stage. Any RF input signal at the frequency of the main oscillation will aid the main oscillation in restarting. If the amplitude of the RF input increases, the main oscillation will stay on for a longer period of time, and the emitter current will be higher. Therefore, we can detect the original base-band signal by simply low-pass filtering the emitter current. The average emitter current is not very linear as a function of the RF input level. It exhibits a 1/ln response because of the exponentially rising nature of oscillator start-up. The steep slope of a logarithm near zero results in high sensitivity to small input signals.

Data Slicer: The data slicer converts the base-band analog signal from the super-regenerative detector to a CMOS/TTL compatible output. Because the data slicer is AC coupled to the audio output, there is a minimum data rate. AC coupling also limits the minimum and maximum pulse width. Typically, data is encoded on the transmit side using pulse-width modulation (PWM) or non-return-to-zero (NRZ).

The most common source for NRZ data is from a UART embedded in a micro-controller. Applications that use NRZ data encoding typically involve microcontrollers. The most common source for PWM data is from a remote control IC such as the HC-12E from Holtek or ST14 CODEC from Sunrom Technologies. Data is sent as a constant rate square-wave. The duty cycle of that square wave will generally be either 33% (a zero) or 66% (a one). The data slicer on the STR-433 is optimized for use with PWM encoded data, though it will work with NRZ data if certain encoding rules are followed.

Power Supply: The STR-433 is designed to operate from a 5V power supply. It is crucial that this power supply be very quiet. The power supply should be bypassed using a 0.1uF low-ESR ceramic capacitor and a 4.7uF tantalum capacitor. These capacitors should be placed as close to the power pins as possible. The STR- 433 is designed for continuous duty operation. From the time power is applied, it can take up to 750mSec for the data output to become valid.
Antenna Input: It will support most antenna types, including printed antennas integrated directly onto the PCB and simple single core wire of about 17cm. The performance of the different antennas varies. Any time a trace is longer than 1/8th the wavelength of the frequency it is carrying, it should be a 50 ohm micro strip.

Applications
1. Car security system

2. Sensor reporting

3. Automation system

4. Remote Keyless Entry (RKE)

BUZZER
Basically, the sound source of a piezoelectric sound component is a piezoelectric diaphragm. A piezoelectric diaphragm consists of a piezoelectric ceramic plate which has electrodes on both sides and a metal plate (brass or stainless steel, etc.). A piezoelectric ceramic plate is attached to a metal plate with adhesives. Applying D.C. voltage between electrodes of a piezoelectric diaphragm causes mechanical distortion due to the piezoelectric effect. For a misshaped piezoelectric element, the distortion of the piezoelectric element expands in a radial direction. And the piezoelectric diaphragm bends toward the direction. The metal plate bonded to the piezoelectric element does not expand. Conversely, when the piezoelectric element shrinks, the piezoelectric diaphragm bends in the direction Thus, when AC voltage is applied across electrodes, the bending is repeated, producing sound waves in the air.
To interface a buzzer the standard transistor interfacing circuit is used. Note that if a different power supply is used for the buzzer, the 0V rails of each power supply must be connected to provide a common reference.
If a battery is used as the power supply, it is worth remembering that piezo sounders draw much less current than buzzers. Buzzers also just have one _tone', whereas a piezo sounder is able to create sounds of many different tones.
To switch on buzzer -high 1
To switch off buzzer -low 1
Notice (Handling) In Using Self Drive Method
1) When the piezoelectric buzzer is set to produce intermittent sounds, sound may be heard continuously even when the self drive circuit is turned ON / OFF at the "X" point shown in Fig. 9. This is because of the failure of turning off the feedback voltage.
2) Build a circuit of the piezoelectric sounder exactly as per the recommended circuit shown in the catalog. Life of the transistor and circuit constants is designed to ensure stable oscillation of the piezoelectric sounder.
3) Design switching which ensures direct power switching.
4) The self-drive circuit is already contained in the piezoelectric buzzer. So there is no need to prepare another circuit to drive the piezoelectric buzzer.
5) Rated voltage (3.0 to 20Vdc) must be maintained. Products which can operate with voltage higher than 20Vdc are also available.
6) Do not place resistors in series with the power source, as this may cause abnormal oscillation. If a resistor is essential to adjust sound pressure, place a capacitor (about 1μF) in parallel with the piezo buzzer.
7) Do not close the sound emitting hole on the front side of casing.
8) Carefully install the piezo buzzer so that no obstacle is placed within 15mm from the sound release hole on the front side of the casing.

GSM MODULE

Fig 2.8: GSM Module

The GSM/GPRS Modem is having internal TCP/IP stack to enable you to connect with internet via GPRS. The shield is manufactured with Automatic Pick and place machine to meet the high quality standards. On its own, this shield can't do anything. It requires a microcontroller like an Arduino to drive it! Additionally a SIM Card with cellular connectivity! The shield can be powered either via Arduino or directly over RMC connector.
This is a GSM/GPRS-compatible Quad-band cell phone, which works on a frequency of 850/900/1800/1900MHz and which can be used not only to access the Internet, but also for oral communication (provided that it is connected to a microphone and a small loud speaker) and for SMSs. Externally, it looks like a big package (0.94 inches x 0.94 inches x 0.12 inches) with L-shaped

contacts on four sides so that they can be soldered both on the side and at the bottom. Internally, the module is managed by an AMR926EJ-S processor, which controls phone communication, data communication (through an integrated TCP/IP stack), and (through an UART and a TTL serial interface) the communication with the circuit interfaced with the cell phone itself. The processor is also in charge of a SIM card (3 or 1,8 V) which needs to be attached to the outer wall of the module. In addition, the GSM900 device integrates an analog interface, an A/D converter, an RTC, an SPI bus, an I²C, and a PWM module. The radio section is GSM phase 2/2+ compatible and is either class 4 (2 W) at 850/ 900 MHz or class 1 (1 W) at 1800/1900 MHz. The TTL serial interface is in charge not only of communicating all the data relative to the SMS already received and those that come in during TCP/IP sessions in GPRS (the data-rate is determined by GPRS class 10: max. 85,6 kbps), but also of receiving the circuit commands (in our case, coming from the PIC governing the remote control) that can be either AT standard or AT-enhanced SIM Comtype. The module is supplied with continuous energy (between 3.4 and 4.5 V) and absorbs a maximum of 0.8 A during transmission.

General features

- Quad-Band 850/ 900/ 1800/ 1900 MHz
- GPRS multi-slot class 10/8
- GPRS mobile station class B
- Compliant to GSM phase 2/2+
  - Class 4 (2 W @850/ 900 MHz)
  - Class 1 (1 W @ 1800/1900MHz)
- Dimensions: 24* 24 * 3 mm
- Weight: 3.4g
- Control via AT commands (GSM 07.07 ,07.05 and SIMCOM enhanced AT Commands)
- SIM application toolkit
- Supply voltage range 3.4 ... 4.5 V
- Low power consumption
- Operation temperature: -30 °C to +80 °C

BLUETOOTH MODULE

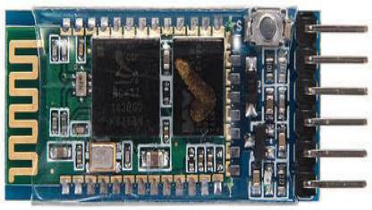


Fig 2.9: Bluetooth module

The Bluetooth Transceiver HC-05 Breakout is the latest Bluetooth wireless serial cable! This version of the popular Bluetooth uses the HC-05/HC-06 module. These modems work as a serial (RX/TX) pipe. Any serial stream from 9600 to 115200bps can be passed seamlessly from your computer to your target.

The remote unit can be powered from 3.3V up to 6V for easy battery attachment. All signal pins on the remote unit are 3V-6V tolerant. No level shifting is required. Do not attach this device directly to a serial port. You will need an RS232 to TTL converter circuit or ArduinoXBee USB Adapter if you need to attach this to a computer. You can either solder a 6-pin header or individual wires. Unit comes without a connector. Please see related male and female pins below. And now, we provide HC-05/06, HC-05 could be setting to Master or Slave by user. HC-06 just be Master or Slave, that could be customized.

POWER SUPPLY

Voltage regulator IC's are available with fixed (typically 5v, 12v and 15v) or variable output voltages. They are also rated by the maximum current they can pass. Negative voltage regulators are available, mainly for use in dual supplies.

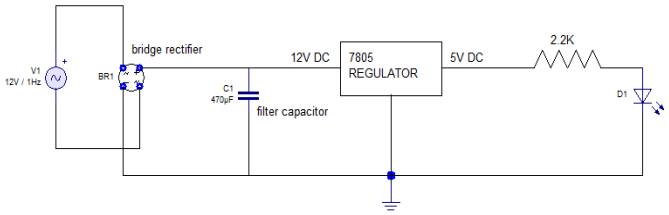


Fig 2.10: -Power supply

Most regulators include some automatic protection from excessive Current (overload protection) and overheating (thermal protection). Most of the fixed voltage regulator IC's has 3 leads and Look like power transistors, such as 7805 +5v 1A regulator. They include a hole for attaching a heat sink if necessary. The Wheel-Chair needs a good power supply that can put out a reasonable amount of current for the DC motors as well as run a microcontroller and sensors. There are many different types of batteries need to be considered as a power source. The factors that we will consider for the batteries include: long duration, high performance, fair cost, size and environmental friendliness. Another important consideration for the battery is its recharge ability. It shouldn't take too much time to recharge. Moreover, using a photocell charger for the batteries shall be a good way to extend the battery life. The solar powered battery charger shall be used to perform this requirement.

LED

A light-emitting diode (LED) is a semiconductor light source. LED's are used as indicator lamps in many devices, and are increasingly used for lighting. Introduced as a practical electronic component in 1962, early LED's emitted low-intensity red light, but modern versions are available across the visible, ultraviolet and infrared wavelengths, with very high brightness. The internal structure and parts of a led are shown in figures 3.4.1 and 3.4.2 respectively.

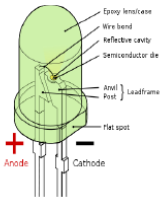


Fig 2.11: Inside a LED & Parts of a LED

Working

The structure of the LED light is completely different than that of the light bulb. Amazingly, the LED has a simple and strong structure. The light-emitting semiconductor material is what determines the LED's color. The LED is based on the semiconductor diode.

When a diode is forward biased (switched on), electrons are able to recombine with holes within the device, releasing energy in the form of photons. This effect is called electroluminescence and the color of the light (corresponding to the energy of the photon) is determined by the energy gap of the semiconductor. An LED is usually small in area (less than 1 mm2), and integrated optical components are used to shape its radiation pattern and assist in reflection. LED's present many advantages over incandescent light sources including lower energy consumption, longer lifetime, improved robustness, smaller size, faster switching, and greater durability and reliability. However, they are relatively expensive and require more precise current and heat management than traditional light sources. Current LED products for general lighting are more expensive to buy than fluorescent lamp sources of comparable output. They also enjoy use in applications as diverse as replacements for traditional light sources in automotive lighting (particularly indicators) and in traffic signals. The compact size of LED's has allowed new text and video displays and sensors to be developed, while their high switching rates are useful in advanced communications technology.

4.10.1 LED lights have a variety of advantages over other light sources

- High-levels of brightness and intensity
- High-efficiency
- Low-voltage and current requirements
- Low radiated heat
- High reliability (resistant to shock and vibration)
- No UV Rays
- Long source life
- Can be easily controlled and programmed

Applications of LED fall into three major categories

- Visual signal application where the light goes more or less directly from the LED to the human eye, to convey a message or meaning.

- Illumination where LED light is reflected from object to give visual response of these objects.
- Generate light for measuring and interacting with processes that do not involve the human visual system.

The methodology section outline the plan and method that how the study is conducted. This includes Universe of the study, sample of the study, Data and Sources of Data, study's variables and analytical framework. The details are as follows;

ALGORITHM FOR EARTH QUAKE DETECTION PROGRAM

1. Start
2. If vibration sensor 1 is ON area 1 buzzer and area 1 LED is ON area 1 TX send input to the GSM
3. GSM is send SMS to the area 1 peoples
4. If vibration sensor 2 is ON area 2 buzzer and area 2 LED is ON area 2 TX send input to the GSM
5. GSM is send SMS to the area 2 peoples
6. Stop

ALGORITHM FOR SENDING A MESSAGE

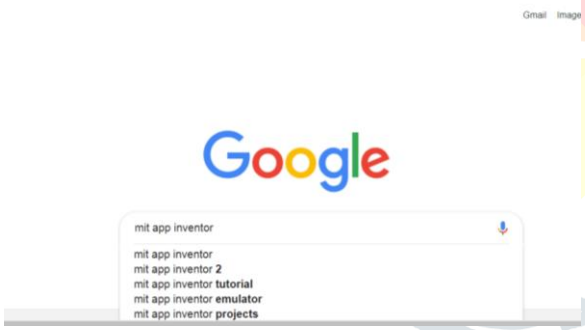
1. Start
2. Declaration of vibration sensor as variable with digital
3. Senses the signal from vibration sensor.
4. Actuates the GSM module using AT set of commands
5. Message received.

ALGORITHM FOR BLUETOOTH PROGRAM

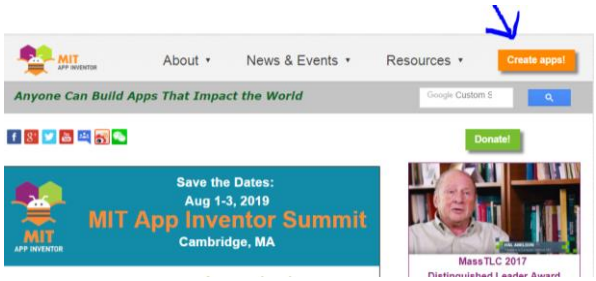
1. Start
2. User phone is connected to Bluetooth
3. Vibration sensor is powered ON
4. When earth quake occurs
5. Sending of location through SMS
6. Stop

DESIGNING OF APPLICATION IN ANDROID SSYSTEM

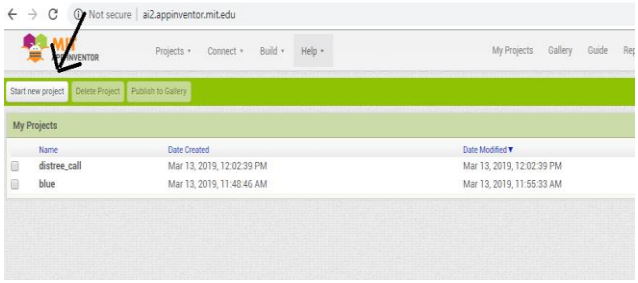
STEP 1: Go To Google And Search "Mit App Inventor" And Enter.



STEP 2: Click On Create Apps

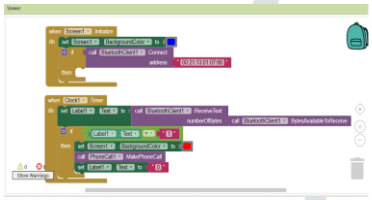


STEP 3: Click On Start New Project And Give A File Name

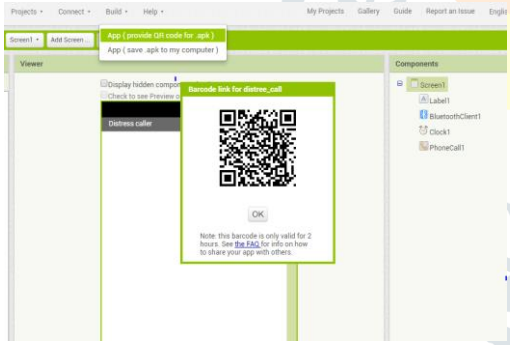


STEP 4: Drag And Drop A Required Component From The User Interface.

STEP 5: Select The Block According To Requirement



STEP 6: Click On Build And Create An Apk Of The App



IV. RESULTS AND DISCUSSION

CASE1:

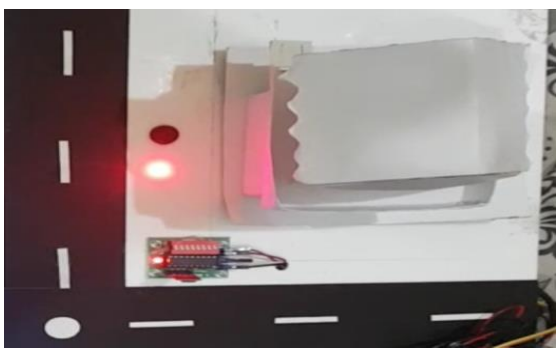


Fig4.1- Area 1 alerting system

FIG 7.1 shows that if the vibration sensor detects the earth quake in area 1 the buzzer and LED will be ON and alerts the people in that area.

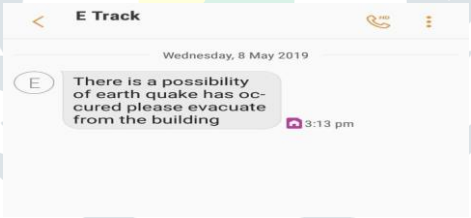
Fig4.2-message showing possibility of earthquake in that area

Fig 4.2 shows that message sent to the people if earthquake happens in that area.

CASE2:

Fig 4.3-area 2 alerting system

shows that if the vibration sensor detects the earth quake in the area 2 the buzzer and LED will be ON and alerts the people in that area.



message showing possibility of earthquake in that area

Fig 4.4 shows that message sent to the people if earthquake happens in that area.

CASE 3

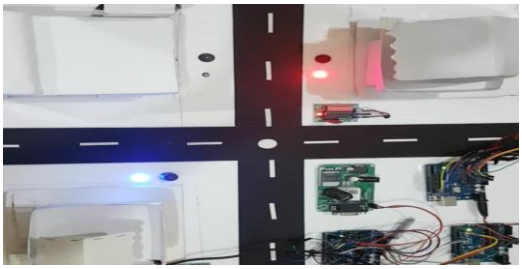


Fig 4.5-office alerting system

Fig 7.5 shows that if any vibration sensor detects the earthquake the buzzer and LED in the geological survey or fire station office turn ON.

Fig 4.6-Display message indicating earthquake in which area

Fig 4.6 shows the display message to the office in which area the earth quake happens.

MODEL

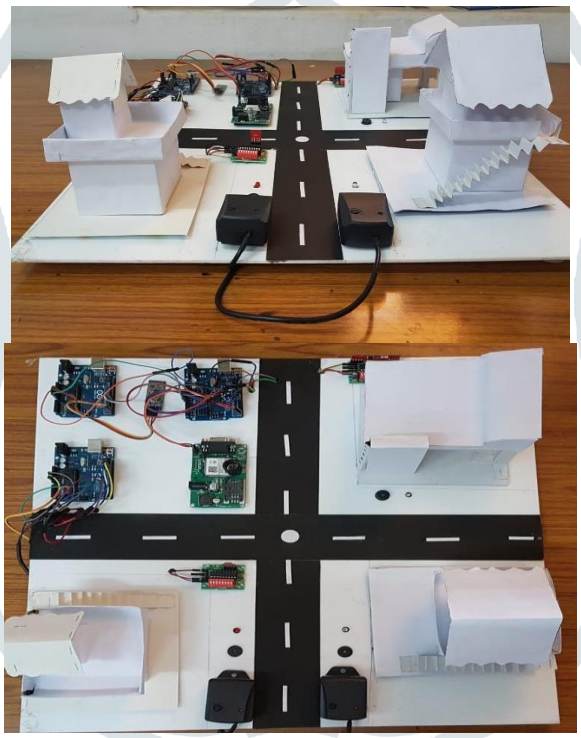


Fig 4.7:-Final model

V. APPLICATIONS, ADVANTAGES AND DISADVANTAGES

Applications

- Earthquake early warning systems in hospital gives early information
- about the earth quake so that early evacuation is possible
- Earthquake early warning systems are used in schools
- Earthquake early warning systems are used in office buildings and apartments
- Earthquake early warning systems are used in airports and helipads

Advantages

- The stability of the system will be increases
- The system will be consumption of power will be more
- Using of advanced processors, the earthquake detection is very simple
- Providing of GSM based system is able to send the quick information to the selected rescue team or local peoples

- The cost will be reduced as compared to the old type of the system is plotting the graph and using of high consumption of power circuits.
- This system has many advantages such as low cost
- low power consumption and
- small in size.

Disadvantages

- It is difficult to separate earthquakes and provide accurate warnings when multiple earthquakes occur almost simultaneously or in close proximity to each other.

VI.CHALLENGES AND FUTURE SCOPE

Though the prototype model worked very efficiently with remarkable outputs, the real life situation is going to be way more challenging and demanding. Few of the challenges and future scope that should be taken into account are listed as follows:

- Usage of vibration sensor to detect earthquake in every area.
- It is difficult to separate earthquakes and provide accurate warnings when multiple earthquakes occur almost simultaneously or in close proximity to each other.
- Higher range RF transmitter and receiver can be used.
- Periodic checking of the accuracy and precision is a must for efficacious operation of this model prototype.
- Safety first it has to be absolutely made sure that no compromise is being made on safety issues.
- We need to implement GPS module in our project
- We need to implement higher range vibration sensor

VII.CONCLUSION

It is concluded that, we have completed earth quake detection and alerting system. And priority is given as early warning in case of earth quake. The design of the device is a representation of an innovative approach in construction of an earthquake warning and alert system. The Earthquake Warning system is one of the useful developments to save human lives. If the acceleration of the seismic wave is greater than the predefined value, the system blows the alarm. This system can be used in multi storied building as the alarm is connected wirelessly. All sensors used are readily available and cheap thus making it a user friendly and affordable product. This system has many advantages such as low cost, low power consumption and small in size.

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