SMART CITY USING INTERNET OF THINGS

MAJOR PROJECT REPORT

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DECLARATION

We hereby declare that this submission is our own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which has been accepted for the award of any other degree or diploma of the university or other institute of higher learning, except where due acknowledgment has been made in the text.

Place: NOIDA

Date: 16-May-2017

Signature:

Name: Parth Pandey (9913103447)

CERTIFICATE

This is to certify that the work titled “Smart City using Internet Of Things” submitted by “Parth Pandey” in partial fulfilment for the award of degree of B.Tech. of Jaypee Institute of Information Technology University, Noida has been carried out under my supervision. This work has not been submitted partially or wholly to any other University or Institute for the award of this or any other degree or diploma.

Signature of Supervisor ……..

Name of Supervisor Mr. Himanshu Agrawal

Designation ……..

Date 16-May-2017

ACKNOWLEDGEMENT

I would like to place on record my deep sense of gratitude to **Mr. Himanshu Agrawal** Jaypee Institute of Information Technology, Noida for his generous guidance, help and useful suggestions.

I also wish to extend my thanks to **Mr. Himanshu Agrawal** and other classmates for their insightful comments and constructive suggestions to improve the quality of this project work.

Signature(s) of Students

Parth Pandey (9913103447)

Summary

Due to the hazardous nature of the accidents occurring in day to day life, there is a need of a system that can easily call the required response. Thus giving rise to ERS.

ERS is an Emergency Response System that has the capacity to help a victim in the time of emergency. It is a small device that requires a Wi-Fi connection. On activating it sends the uploaded protocol messages to the cloud which in turn alerts the concerned authorities and they can spring in action come to rescue or mitigation process at location of the device.

There are many developed technologies dealing with the emergency response .They help in evacuation and process but are very inadequate in case of mitigation or prevention of the situations thus calling a need to develop a IoT based response system to alert and prevent these disasters and notify users in advance thus in turn helping in evacuation and response.

This technology and thought process has a lot of scope in near future and it can help a lot of authorities and general public in case of emergency.

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List of Acronyms

1. API – Application Programming Interface

2. App – Android Application

3. Iot – Internet of Things

1. Introduction

1.1 General Introduction

The Internet of Things (IoT) is a novel paradigm that is becoming popular with research and industries. The basic idea is that IoT will connect objects around us (electronic, electrical, non electrical) to provide seamless communication and contextual services provided by them. Development of RFID tags, sensors, actuators, mobile phones make it possible to materialize IoT which interact and co-operate each other to make the service better and accessible anytime, from anywhere.

In this project, a mechanism for smart city that would include various aspects of connecting a city via Internet of Things. One of them that we have presented here is an Emergency Fire/Panic Response System which will to contribute towards public safety and reducing reaction time of emergency response system in our smart cities. Various accidents occur due to lack of response or emergency systems. Even though in this era of smart phones we still lack a response system which can be quick and effective.

Take examples of hazard occurring in large scales having high casualty have one thing in common lack of emergency response leading to catastrophic results. From ancient times till today the lives of people is the most important factor considered in any scenario and this project here focuses on saving those most important lives.

1.2 Problem Statement

Out of 100,000 the average rate of road accident casualty is 17.4 where as more than half of the casualties end up as brought dead cases because lack of emergency rescues . Thus the problem here arises how to get help to an injured or a unit to help control fire or any other hazard that might cause loss of people and property.

This casualty rate can easily increase if don't create any set of protocols to contain them. Hence, by using IOT if we build a smart city we will be to cut these casualty rates and save more lives and property.

A smart city project can be identified along six main dimensions:

• A smart economy

• Smart mobility

• A smart environment

• Smart people and safety

• Smart living

• Smart governance

Our focus will be on Smart People and Safety that includes

- Emergency Response System
- Fire-Panic Response System

1.3 Overview of proposed solution approach

ERS is an Emergency Response System used for raising alarm and notifying authorities for further action. An ERS system will be strategically placed by the authorities in places where it will be deemed necessary and potentially hazardous locations.

Upon detecting a fire or a smoke ERS will activate its predefined protocols. The protocol activated will have an instruction to raise the alarm and send the location of the ERS system which in turn will be the location of hazard.

The location sent at the server will be directly sent to the phone having the android application of the ERS system. This application will notify the fire department, hospitals and nearby neighbours of that particular location to evacuate the location and reach safety.

1.4 Approach to Problem

This problem is a complex problem involving more than software but a integration of software and hardware as well. To solve this problem, the approach is should be simple and straight forward.

We firstly, need sensors to detect the external stimuli and constantly keeping a check on them. The sensors can be of any type but for the sole purpose of project there are only two sensors used. First is the temperature sensor detecting a change in temperature. Secondly, the smoke sensor used to detect the smoke. Due to the heat and current environment the temperature will be set for high values and smoke detectors will calculate the percentage of smoke.

After detecting a change these sensors will send data to the wifi module installed and after every thirty second the wifi module will upload data to the Thingspeak server and Instapush server.

Here the software begins. The Thingspeak server and Instapush server are integrated and are sent data via http link because of API integration. Thingspeak will display the data in graphical form and Instapush server will help in push notification and thus will show any change in external stimuli.

1.5 Significance of the Problem

The case of undetected fires is a major issue in recent times. There have been many mishaps that have caused damage to property and lives. For example February 2013 Kolkata, market complex 19 killed and over a dozen injured. September 2012 Tamil Nadu explosion in fireworks factory 54 killed and 78 injured.

The loss of lives is much greater of risk than loss of property .In current era even though our technology is so advance but the implementation of that technology is very weak .We have one of the best defence system , technological knowhow but these implementations in today's world are useless if it doesn't help in day to day needs.

Thus this project aims to increase the awareness of fire hazards which can occur randomly occur and have low detection range or criteria. This project also involves a panic button which can be used to start a alert if the device can't detect the fire or there is an external emergency situation.

1.6 Comparison with Existing Systems

	Emergency Response System	**IoT-based Intelligent for Fire Emergency Response Systems**
Purpose	Notifies the User over internet and alerts the authorities to take action	Exit Route Planning of the current building and showing nearest safest exit
Drawbacks	No route planning	Nearby Alerting Only

Table 1:Comparision Table

2. Background Study

2.1 Literature Survey

2.1.1 Summary of Papers

1. Smart City Implementation Models Based on IoT Technology

IoT (Internet of Things) is the network of physical objects-devices, vehicles, buildings and other items embedded with electronics, software, sensors, and network connectivity-that enables these objects to collect and exchange data. The internet of things allows objects to be sensed and controlled remotely across existing network infrastructure. According to a study, 260 million objects will be connected by year 2020. Several companies and governments have tried to make references with IoT in initial times, but nowadays in manufacturing, retail and SOC (Social Overhead Capital) industries, successful best practices are built recently. In this paper I summarized tangible IoT based service models which are helpful to academic and industrial world to understand IoT business.

2. An Emergency Response System for Intelligent Buildings

Finding the best evacuation path during an emergency situation inside a building is a challenging task, due to the dynamically changing conditions and the strict time constraints. Information systems can benefit the evacuation process by providing directions to the evacuees in an efficient and timely manner. The system provides movement decision support to evacuees by directing them through the less hazardous routes to an exit.

3. IoT-based Intelligent Fire Emergency Response Systems

Taking more than 20 minutes to evacuate from a fire, which is one of the most frequent disasters, greatly reduces survivability. Uniform evacuation guidance such as exit lights are inadequate for guiding evacuees during a fire, which can create poisonous gases, or when buildings are collapsing. Because existing emergency exit guides do not consider the location of the fire and merely direct people to the nearest exit, this may create significant secondary casualties if a fire has occurred at the exit and the evacuees are guided towards it. This paper suggests an IoT-based intelligent fire emergency response system with decentralized control that can intelligently guide evacuees based on the location and time of a fire to minimize the loss of human life

2.2 Research Papers Studied

RESEARCH PAPER	AUTHOR	YEAR OF PUBLICATION
1. Smart City Implementation Models Based on IoT Technology	Jaehak Byun, Sooyeop Kim , Jaehun Sa	2015
2. An Emergency Response System for Intelligent Buildings	Avgoustinos Filippoupolitis , Erol Gelenbe	NA
3. IoT-based Intelligent Fire Emergency Response Systems	Chang-Su Ryu	2015

Table 2:-Related Research Paper

2.3 Empirical Study

2.3.1 Field Survey

The Internet of Things (IoT) is a recent communication paradigm that envisions a near future, in which the objects of everyday life will be equipped with microcontrollers, transceivers for digital communication, and suitable protocol stacks that will make them able to communicate with one another and with the users.

But for that to happen we have to keep in mind the type of field we are working in. The field, in which the project has to be implemented, is in a range of calm to potentially hazardous situations. This includes locations such as buildings, roads, industries and even schools.

This project can find use in every part of a city as there are many vulnerable places that can cause damage or create hazardous situations.

2.3.2 Tool Survey

- **Hardware**

Hardware used:

- Microcontroller ATMEGA328
- LCD Display
- Wi-Fi Module
- Fire Detector(smoke and infra-red detectors)
- Push button
- Frequency crystal
- Capacitors and resistors
- Smoke Detectors

- **Software**

Software used:

- Android Studio
- WinAVR
- Audrino
- Putty

3. Analysis, Design and Modelling

3.1 Overall Description

The project is part of smart disaster mitigation planning and is under emergency response. The idea behind the project is to provide help to every citizen in every possible way in any possible conditions.

Whenever a hazardous condition occurs the sensors of ERS are triggered which then activates some protocols embedded in the system. ERS protocol can also be triggered with the help of a push button in case any sensor fails. This facility allows it to be used anywhere for example schools, offices and industries. Allowing an emergency response.

First protocol is to trigger the alarm or any other sound producing device connected.Second protocol states that ERS should which is readily connected with a Wi-Fi connection should send information to the cloud along with address to be viewed by the authorities and take immediate action.

Upon receiving the alert from the system , the android application connected with the cloud will show notification to the nearby residents of that location and will also send location to the authorities for example the fire department, the police department and the hospital, to send a rescue team on the given location.

This project will address how to build Future Internet based applications and services in the Smart city context from different perspective:

The view of the city (as a unit governed by the public bodies), and main city services suppliers e.g. water suppliers, energy suppliers etc.

The view of the citizens for whom the concept of smart city only makes sense if it implies a better quality of life, sustainability, more possibilities to receive personalized services.

The role(s) of the city as an actor within an increasingly complex value network.

Thus far, there is no commonly accepted definition of what "smart" means in the context of smart cities.

Smart cities will need to adapt the organic and chaotic nature of cities where unexpected things and behaviors will increasingly become the rule rather than an exception. The application and service lifecycle in smart cities is a multi-stakeholder exercise that brings high degrees of uncertainty to all the phases.

The vision of both the city and its citizens are needed and they need to co-exist and complement each other. In this setting, living labs are becoming very popular instruments to shape the applications and services that smart cities will deliver to their citizens supporting the definition of macro and micro-services and application development in the smart city context.

3.2 Requirement Specification

The system is generally in active mode and is shows activity when a card is brought near to it. Then the system validates the card and performs its functions and finally sends the data to other controller to be sent over the internet to the database and after updating finally sends the data to the App and it shows notification to the user.

3.3 Functional Requirements

3.3.1 Software

1. Android Studio
2. Arduino
3. AVR
4. Putty

3.3.2 Hardware

1-Intel core i3 processor.

2- Minimum 4 GB RAM.

3- 250GB internal space.

4- Capacitors

5- Microcontroller

6- 7805 chip

7- LCD display

8- WI-FI Module

9- Resistors

10- LED

11- Switches

12- Wires

13- Breadboard

3.4 Non-Functional Requirements

- Efficiency: The system must be efficient in respect to the services it provides and this chat application is very efficient in terms of providing the emergency response in case of change of external temperature and smoke or press of the panic button. The data should be uploaded in not more than thirty seconds. This is to ensure the authenticity of the system.

- Reliability: The application is very reliable providing very secure and safe service to the user with minimum failure probability. The data is uploaded via http link and Json object creating a secure environment.

- Availability: The system is 24x7 available and operational with high probability of uploading data with no degradation in performance at all.

- Portability: The system is portable and usable anywhere without any requirement of any other external devices. The application can be easily installed and used in any device with minimal requirements

3.5 Use Case diagrams

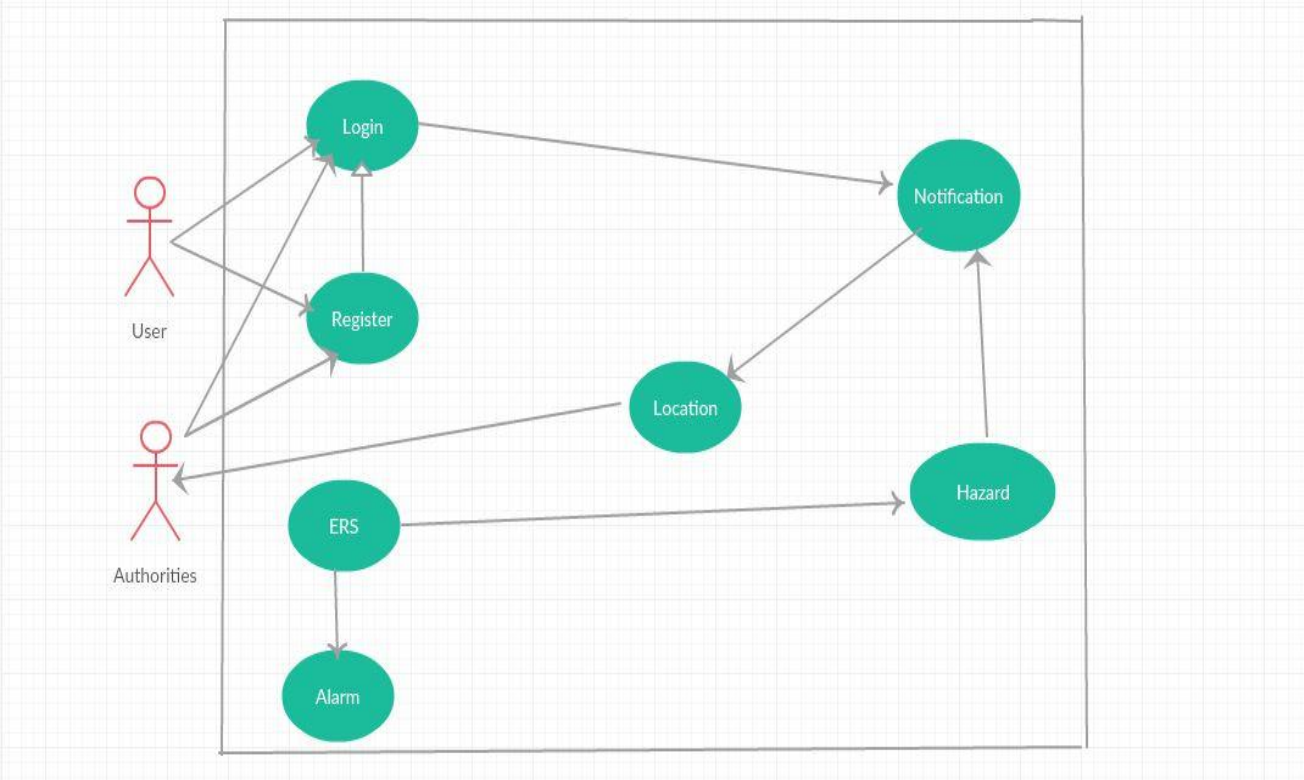


Figure 1: Use Case Diagram of the System

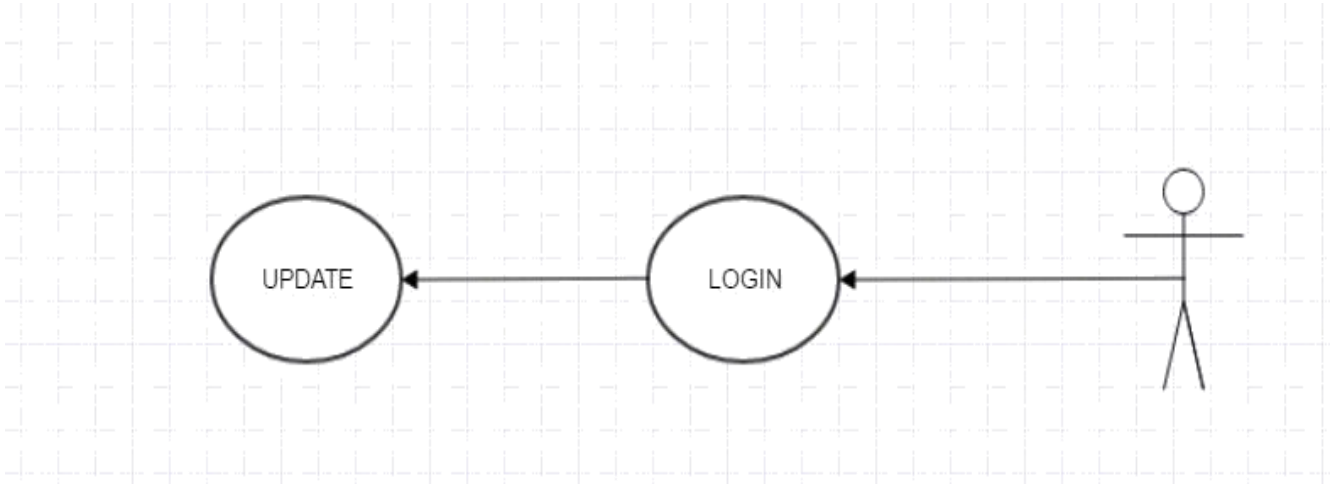


Figure 2: Use Case Diagram for the Admin

3.6 Class Diagram

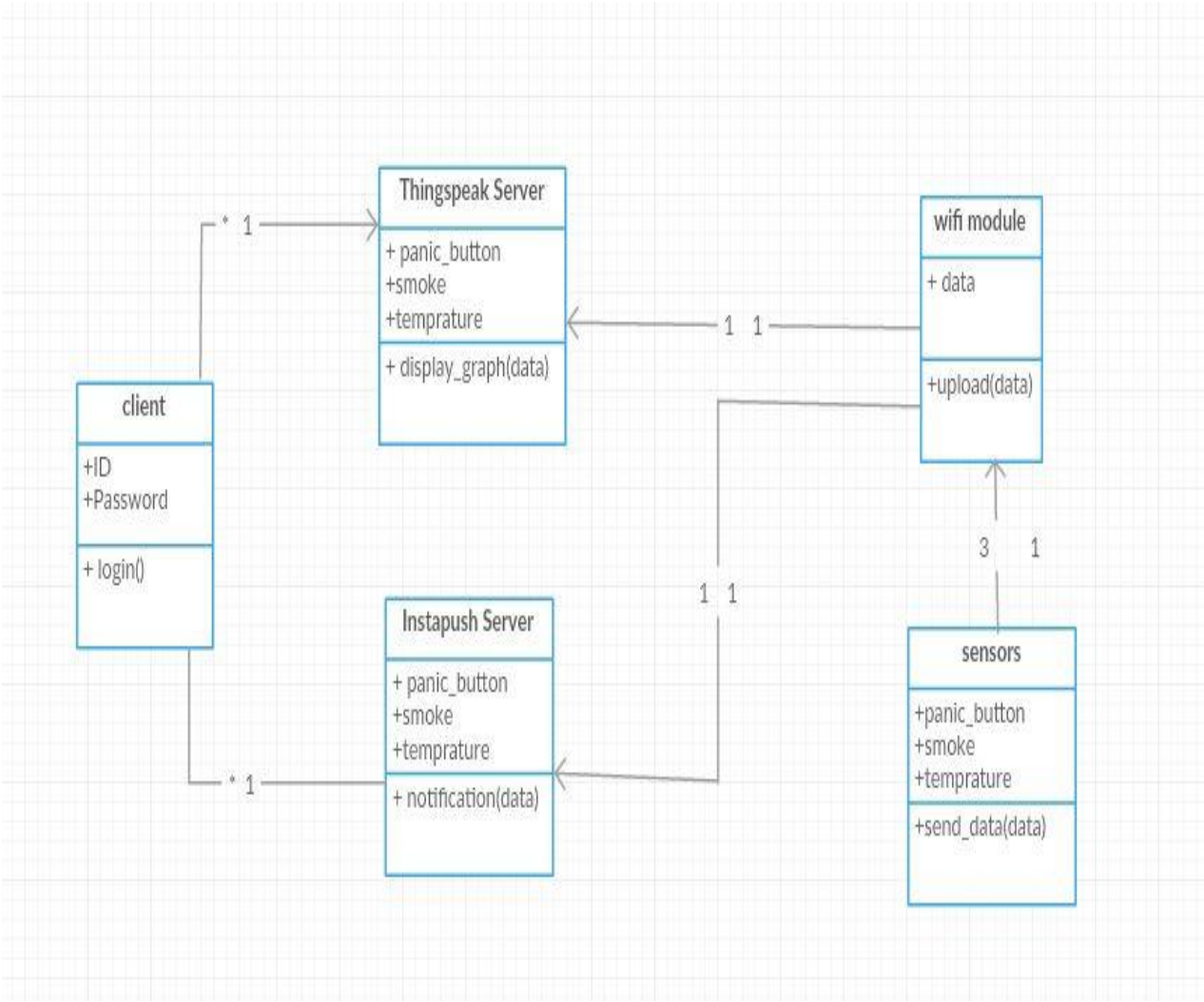


Figure 3: Class Diagram for ERS

3.7 Activity Diagram

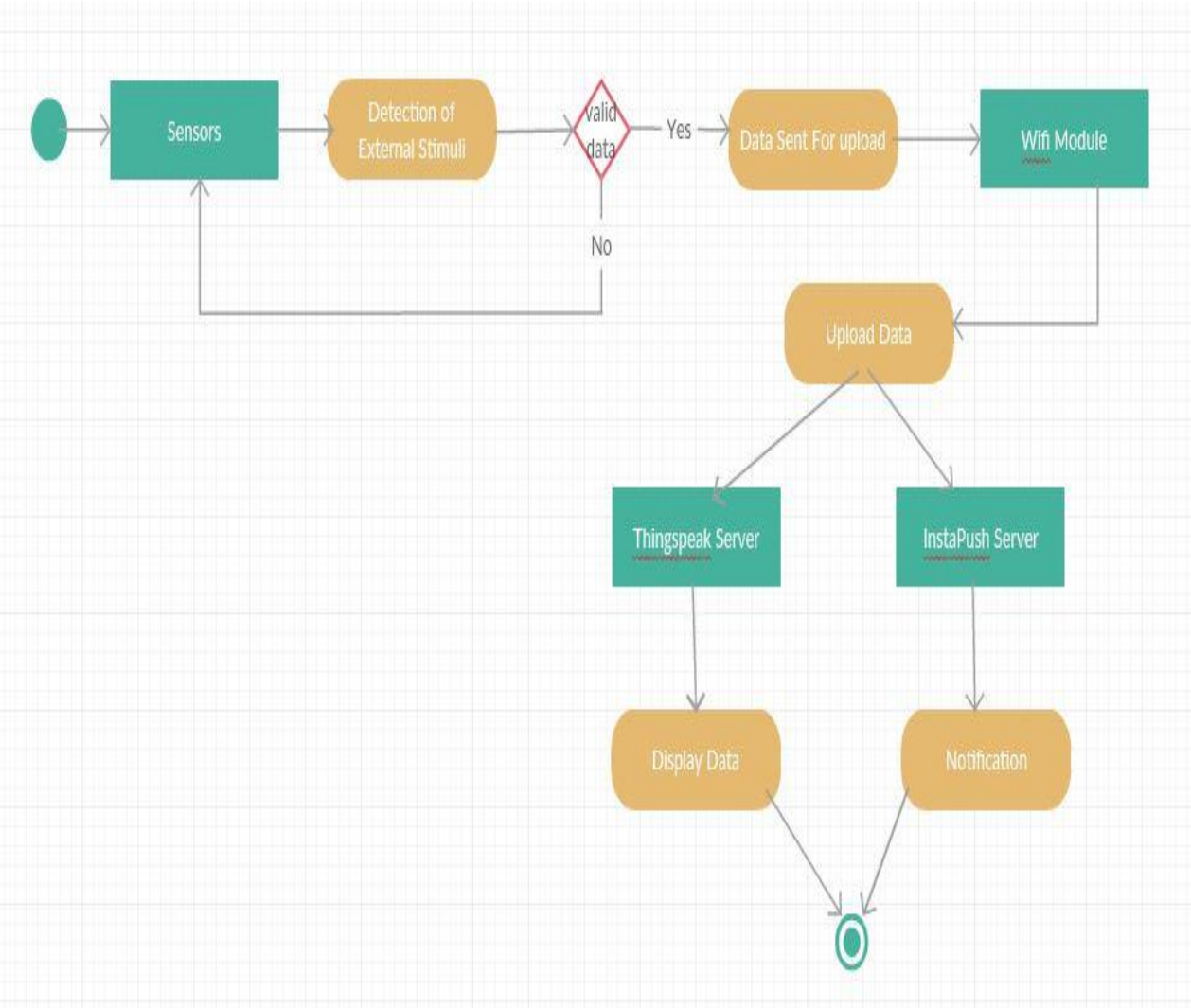


Figure 4: Activity Diagram for ERS

3.8 Circuit Diagram

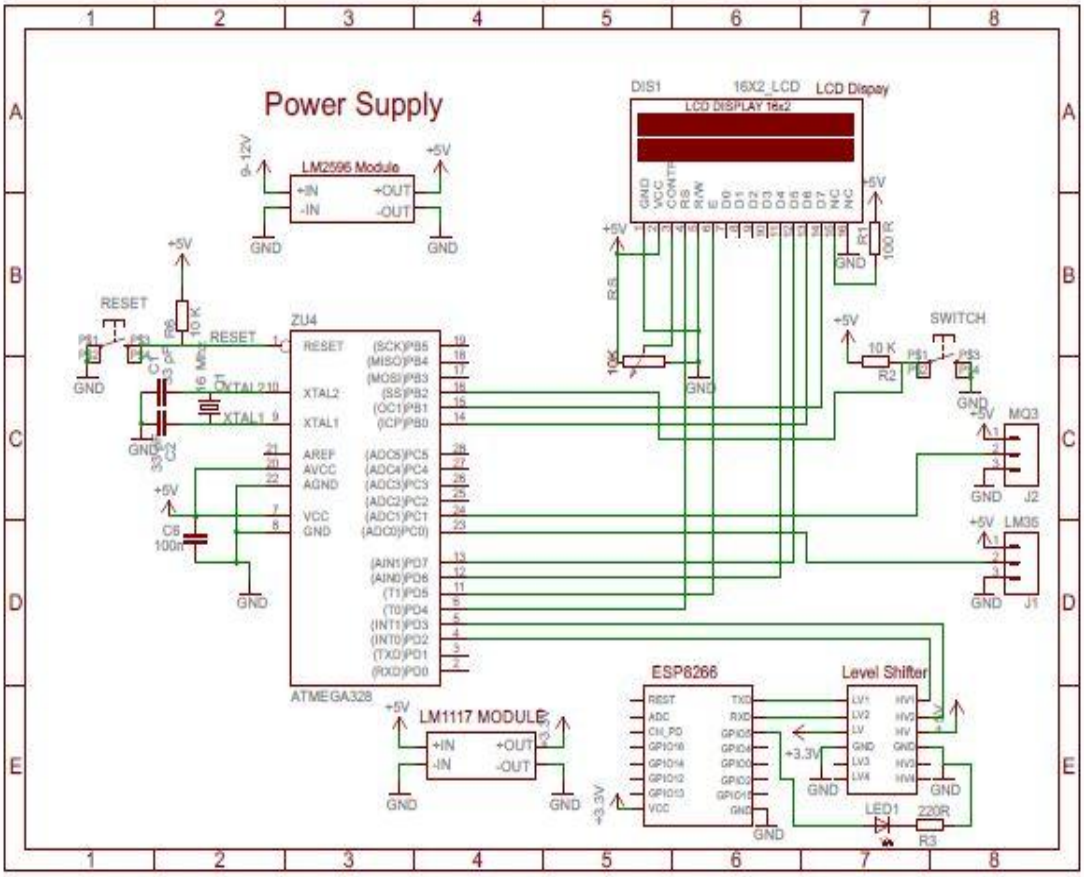


Figure 5: Circuit Diagram of ERS

4 Implementation Details and issues

4.1 Implementation Issues

The project has been partially implemented under highly skeptical conditions and minor issues have risen . Basic login and App work is working fine and the hardware is in working condition .Wiring issues have arisen many time due to shorting of the wires. The main issue was of API integration of the app and Thingspeak server. They tend to fail overtime due to nature of data sent.

4.2 Limitation of the Solution

The project has been studied and implemented with utmost honesty and hard work covering all the shortcomings of previous approaches and algorithms. But still there are some areas that require further considerations.

It includes:

- In case of large datasets the performance degrades.
- The hardware can be easily damaged.
- Continuous Wifi connection needed

4.3 Risk Analysis and Mitigation Plan

Risk Id	Description of Risk	Risk Area	Probability (P)	Impact (I)	RE (P*I)	Risk selected for mitigation	Mitigation Plan
1	Network Failure	Server Related	M	M	M	Yes	Purchase a dedicated server
2	Data Theft	Input data File	M	H	M	Yes	Using the input data in encrypted form.
3	Unauthorized access	Database	L	L	L	Yes	Choosing high level of passwords

Table 3: Risk Analysis and Mitigation

Keywords	Meaning
• L	Low (0 – 25%)
• M	Medium (25% - 75%)
• H	High (75% - 99%)

5 Testing

5.1 Testing Plan

Type Of Test	Will the Test be performed?	Comments	Software/Hardware Components
Requirement Testing	Yes	All the components have to be checked	All the hardware and code was run through.
Unit	Yes	Hardware and software as a unit checked	Fully integrated System
Integration	Yes	Essential for checking hardware and software compatibility	Microcontroller ,LCD, Wi-Fi Module , Arduino Software , API
Performance	Yes	8-10 times data sending and frequency checking	Sensors ,Wi-Fi Module , Thingspeak and Instapush Servers
Security	Yes	All login and hardware interference	Instapush , Thingspeak and Wi-Fi Module
Load	Yes	Load on all sensors was pushed to maximum	Sensors , Wi-Fi Module , Servers

Table 4: Testing Plan

5.2 Testing Team

Role	Name	Comments
Full Testing	Parth Pandey	Full Testing Single Member Team

Table 5: Testing Team

5.3 Component Decomposition and Type of Testing Required

S NO.	Components	Type of Test	Techniques
1	Wi-Fi Module	Unit,Integration,Performance, Load	**White Box**
2	Sensors	Unit,Integration,Performance, Load	**Black Box**
3	LCD	Integration	**White Box**
4	Full System	All	**Direct Running via Full Load**

Table 6: Component Decomposition

5.4 Test Case

S No.	Component	Input	Excepted Output	Status
1	LCD	Hello User	Hello User	Pass(All)
2	Sensor	Fire/ Smoke	Detect Percentage	Pass (4 time) Fail(3 time)
3	Wi-Fi Module	Connection to server	Connection Achieve	Pass (10 time) Fail (6 time)

Table 7: Test Case

5.6 Development Model

Iterative Model

In the iterative model, a simple implementation of the algorithms and function in the modules and the analysis of the modules after the implementation and iteratively the modules are enhanced to integrate the complex algorithms and techniques into the system until the complete system is implemented and then the final analysis of the application is performed after which the application is ready to be deployed.

The iterative model is mostly implemented in such projects which do not have all the requirements and functionalities in details at the starting phase of the project since the implementation can be started in iterative model with or without all the specific requirements.

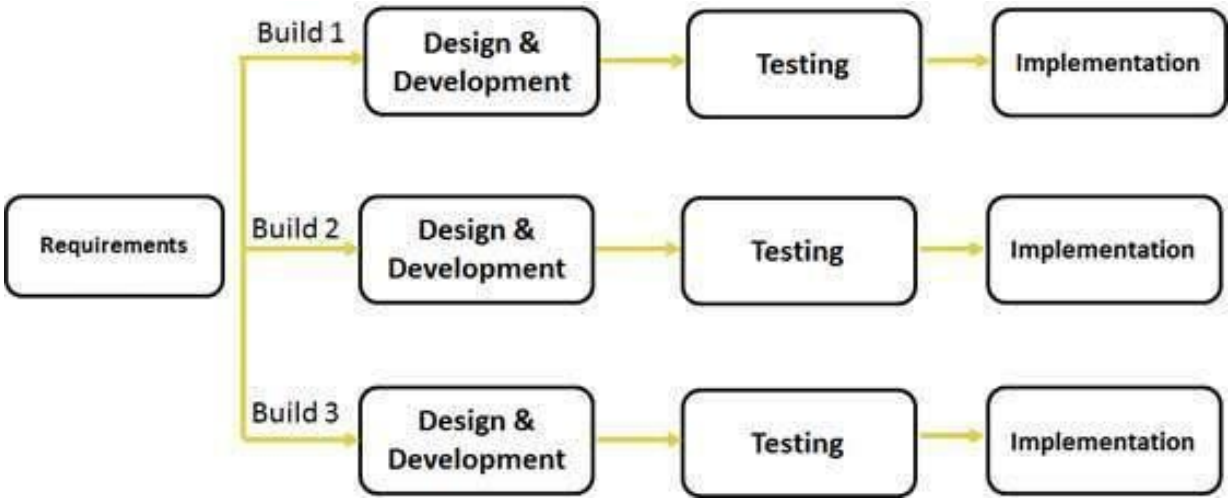


Figure 6: Iterative Model

5.7 Limitation of the Solution

The limitations only occurred while trying to set API for the Thingspeak and Instapush as one takes direct http link while the other demands a json object and had to convert them to it.

The limitations also occur due to wifi connection, it should be stable all the time in order to establish proper connection with the server.

6 Findings and Conclusion

6.1 Findings

The Study of Internet of things has revealed a world of information and a new perspective.

In this project, we analyzed the solutions currently available for the implementation of urban IoT. The discussed technologies are close to being standardized, and industry players are already active in the production of devices that take advantage of these technologies to enable the applications of interest.

In fact, while the range of design options for IoT systems is rather wide, the set of open and standardized protocols is significantly smaller. The enabling technologies, furthermore, have reached a level of maturity that allows for the practical realization of IoT solutions and services, starting from field trials that will hopefully help clear the uncertainty that still prevents a massive adoption of the IoT paradigm.

6.2 Conclusions

ERS is an Emergency Response System used for raising alarm and notifying authorities for further action. The location in the device will be uploaded at the time of mounting the device. This device holds great promise as it can deliver at the time of emergency this classifying into a Real Time System.

Greater things are achieved when you put your goal for the benefit of greater goals.

6.3 Future Scope

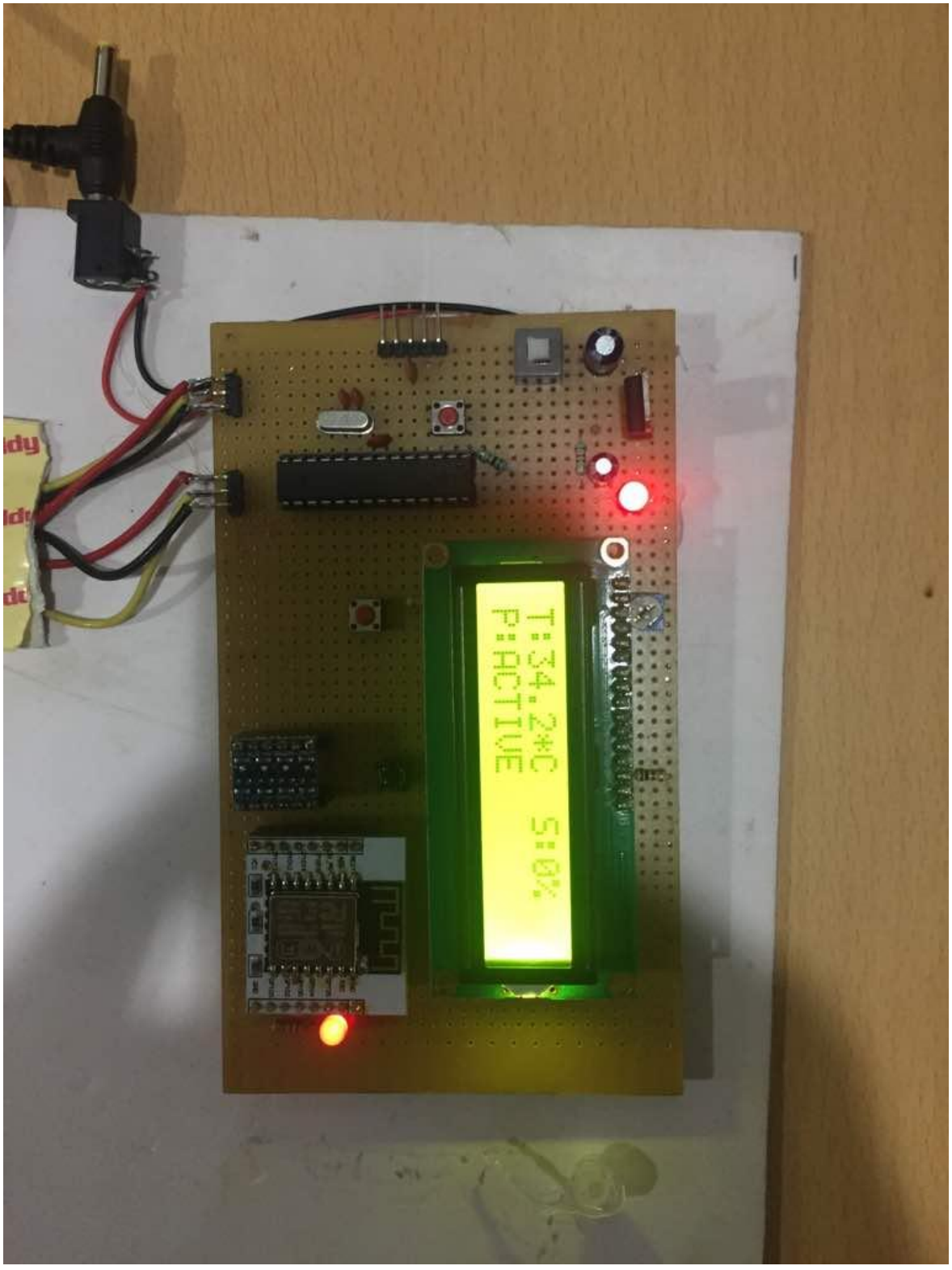
ERS has a lot of future scope due to advancement of future technology and software development .With the application of GPS it can be used in moving and remote location. ERS can find its use in almost any scenario .With the help of different types of sensors new scenarios can be found in which ERS will be useful.

To prevent disasters like Tsunami , Earthquake and storms a high level of software programming is required. With the advent of neural network algorithm it can also learn and store the previous records of disasters and learning from a new one.

The main areas of future application can be:

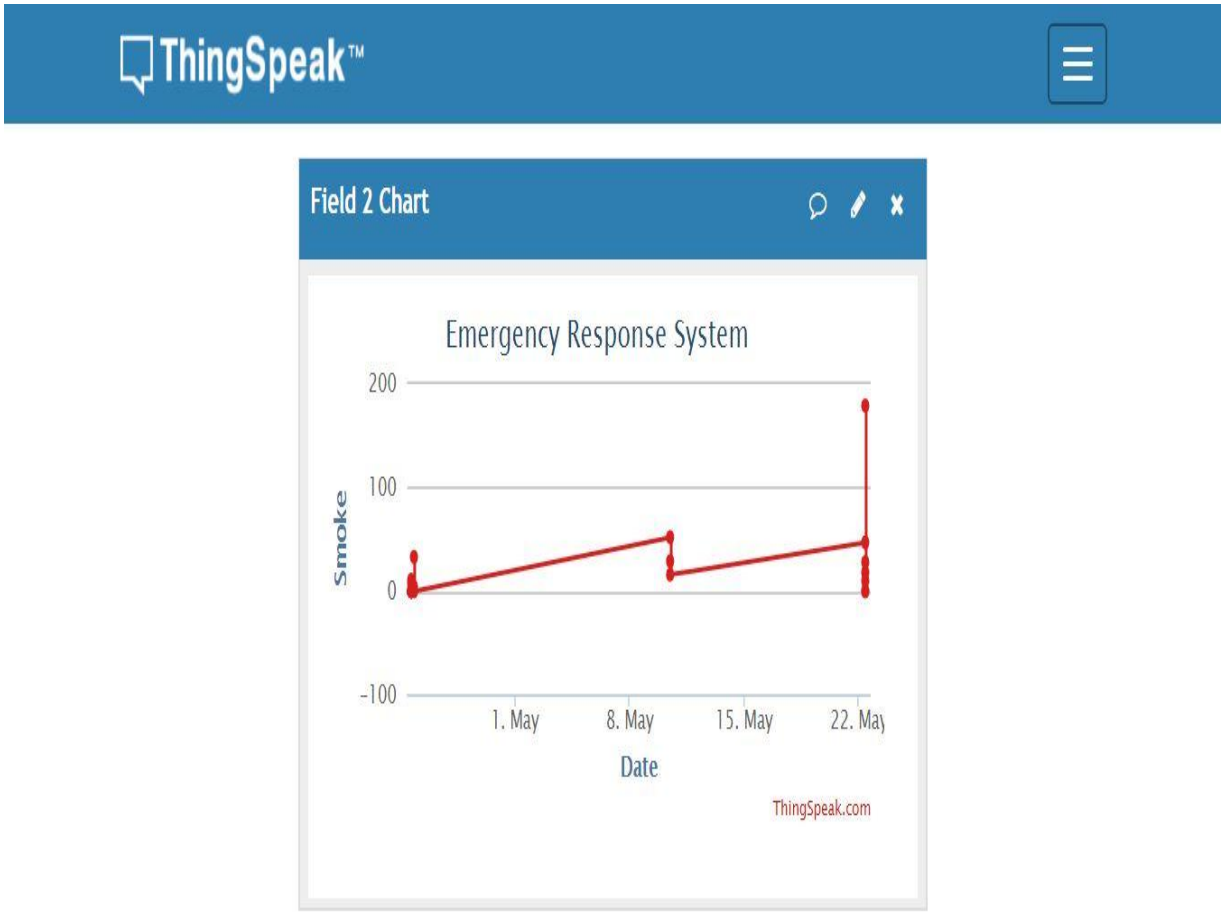
- Schools
- Industries (oil,servers)
- Vehicles
- Disaster Management Systems
- Homes
- Buildings

7 Snapshots




T:28.8*C S:82%
P:INACTIVE


ThingSpeak™
Field 1 Chart
Emergency Response System
100
75
50
25
0
Temp
1. May
8. May
15. May
22. May
Date
ThingSpeak.com


ThingSpeak™
Field 2 Chart
Emergency Response System
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Smoke
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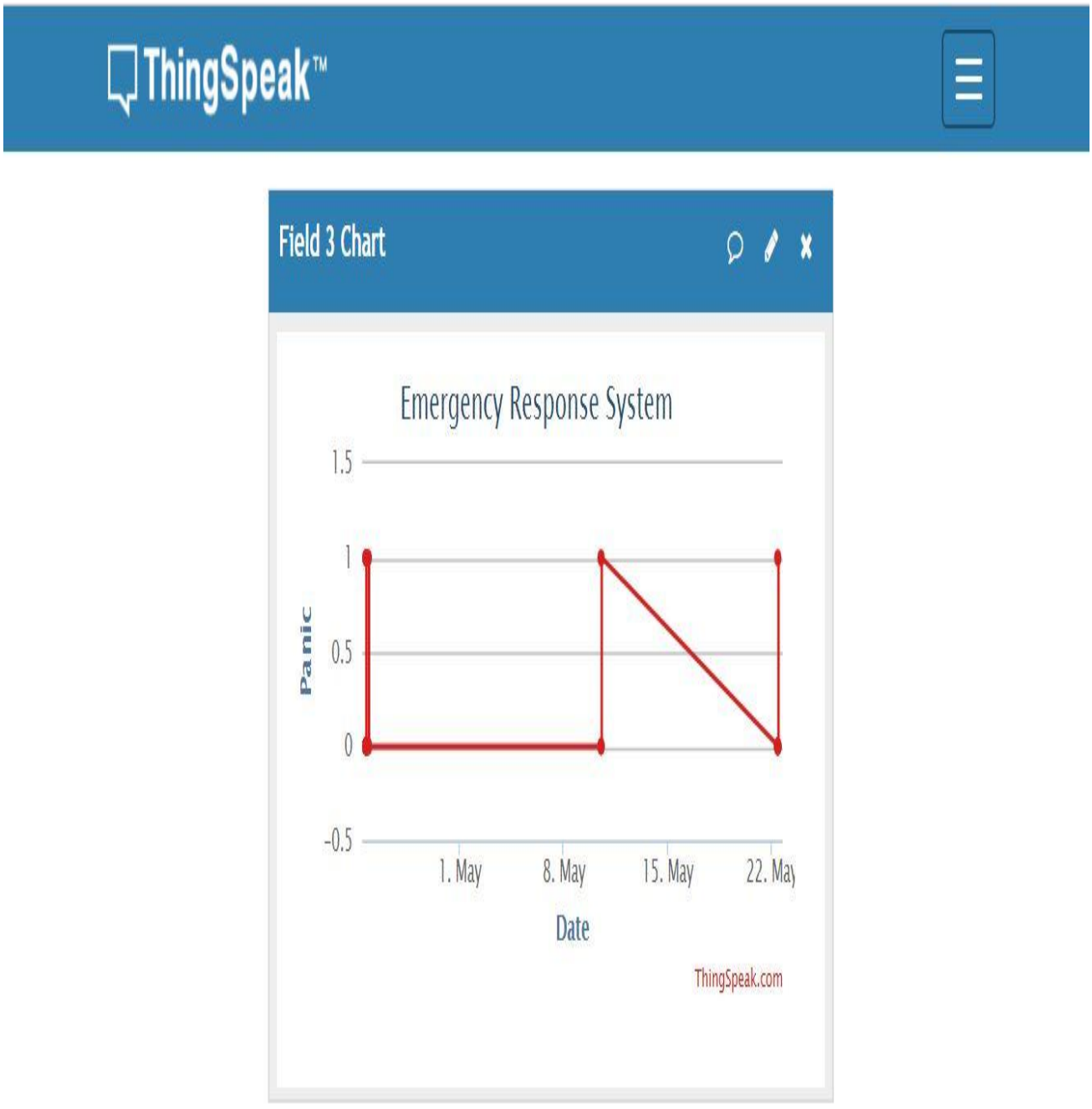
8. May
15. May
22. May
Date
ThingSpeak.com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Field 3 Chart
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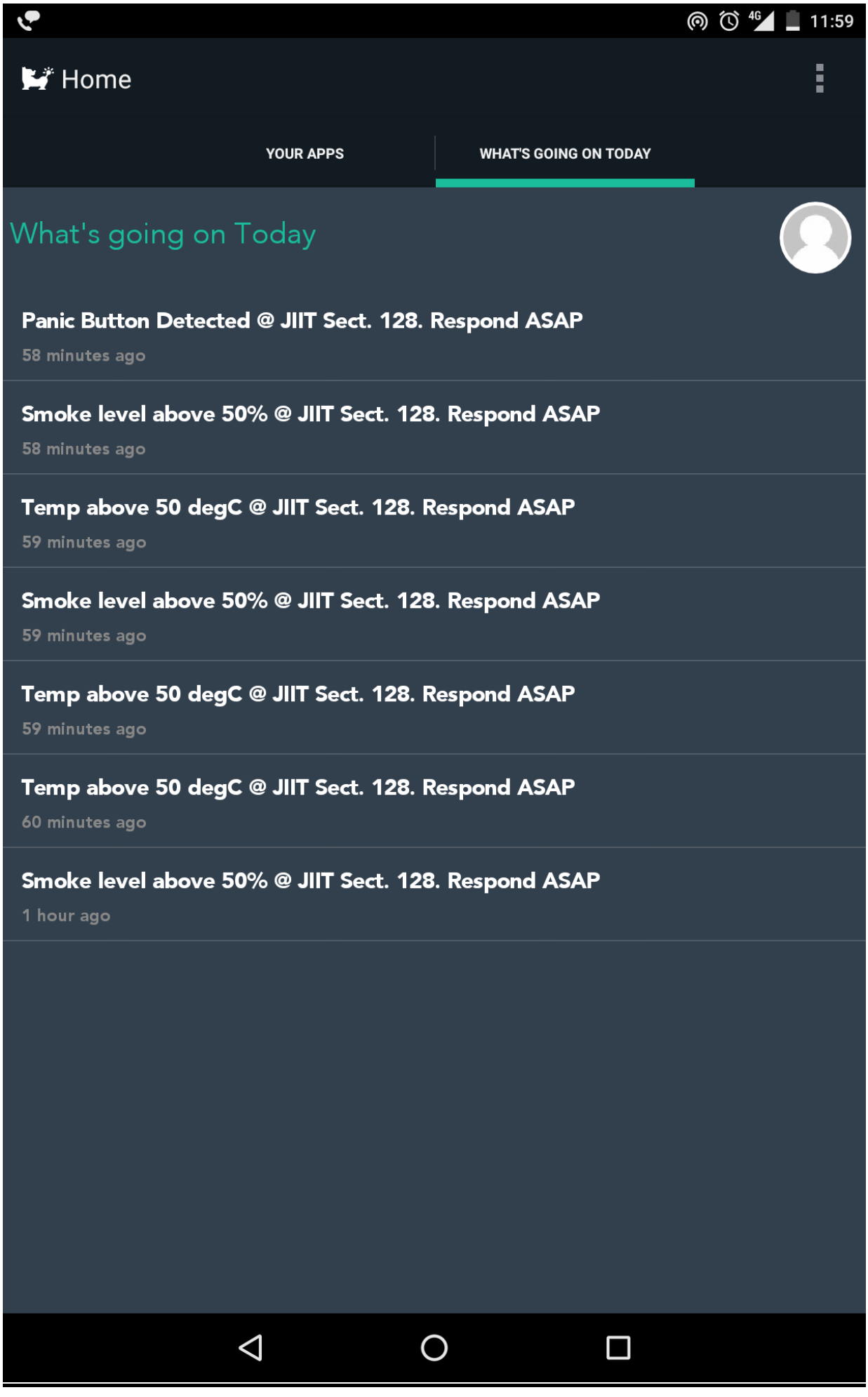
ThingSpeak.com


11:59
Home
YOUR APPS
WHAT'S GOING ON TODAY
What's going on Today
Panic Button Detected @ JIIT Sect. 128. Respond ASAP
58 minutes ago
Smoke level above 50% @ JIIT Sect. 128. Respond ASAP
58 minutes ago
Temp above 50 degC @ JIIT Sect. 128. Respond ASAP
59 minutes ago
Smoke level above 50% @ JIIT Sect. 128. Respond ASAP
59 minutes ago
Temp above 50 degC @ JIIT Sect. 128. Respond ASAP
59 minutes ago
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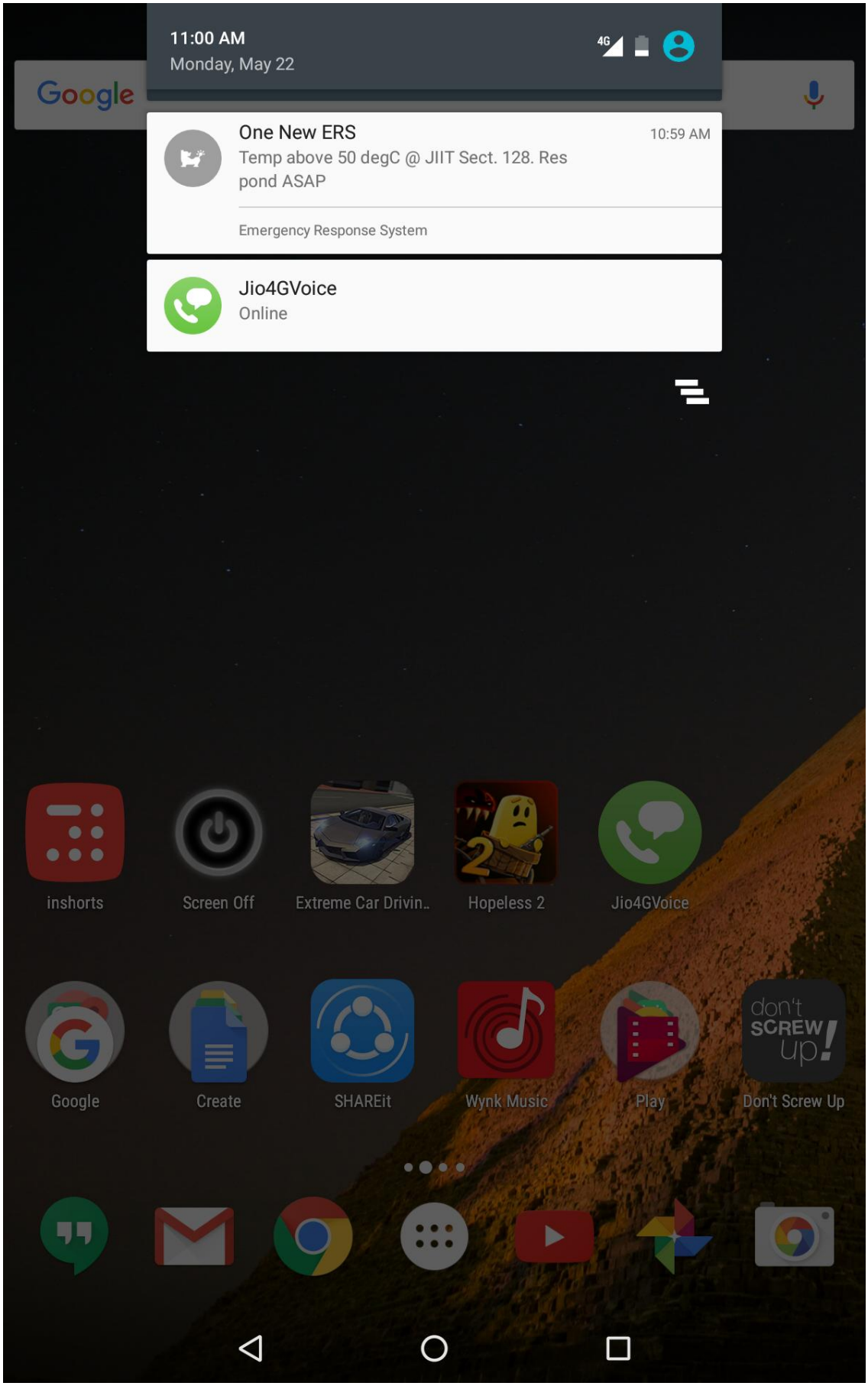
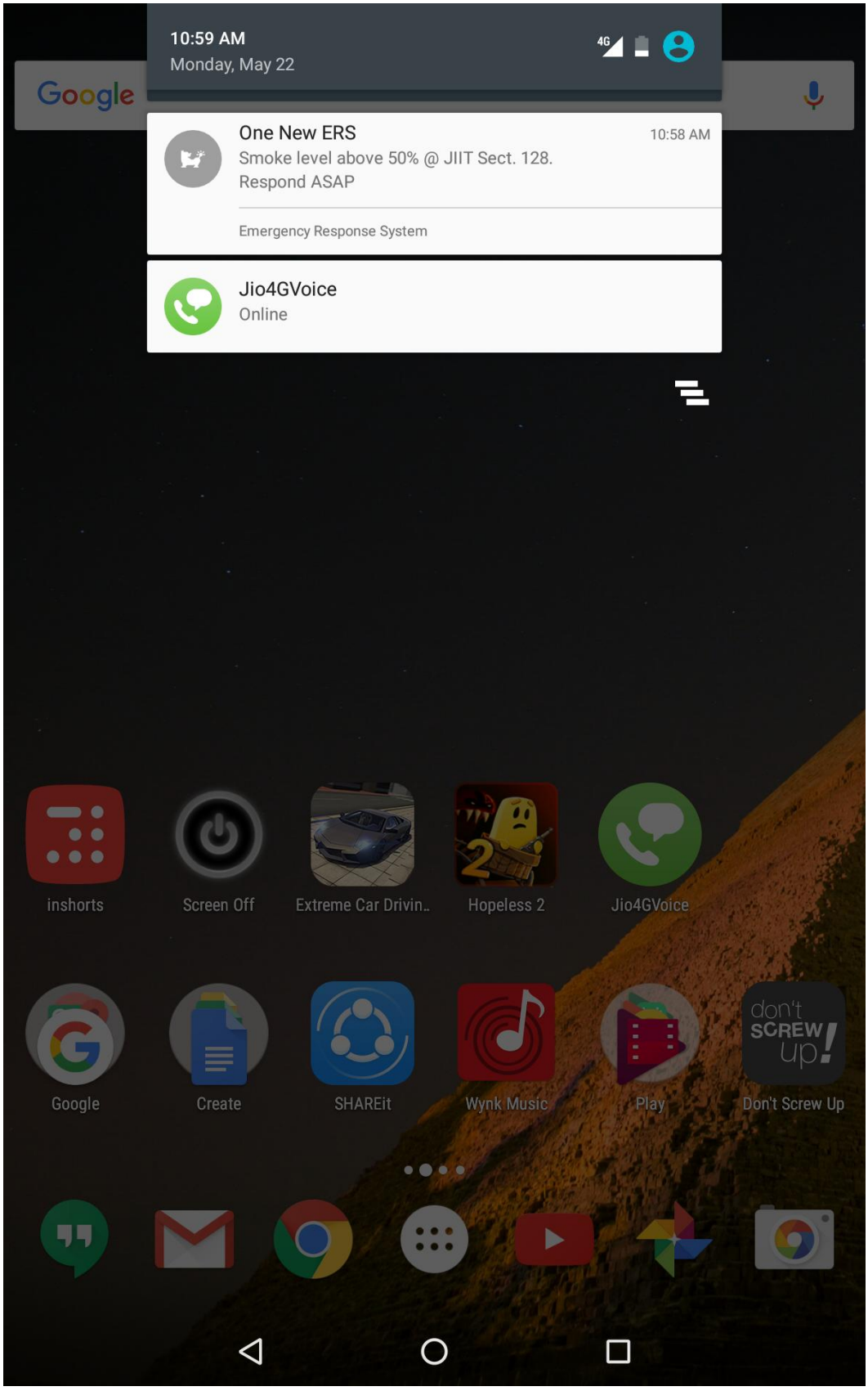
60 minutes ago
Smoke level above 50% @ JIIT Sect. 128. Respond ASAP
1 hour ago


11:00 AM
Monday, May 22
4G
Google
One New ERS
10:59 AM
Temp above 50 degC @ JIIT Sect. 128. Res
pond ASAP
Emergency Response System
Jio4GVoice
Online
inshorts
Screen Off
Extreme Car Drivin..
Hopeless 2
Jio4GVoice
Google
Create
SHAREit
Wynk Music
Play
don't
SCREW
up!
Don't Screw Up


10:59 AM
Monday, May 22
4G
Google
One New ERS
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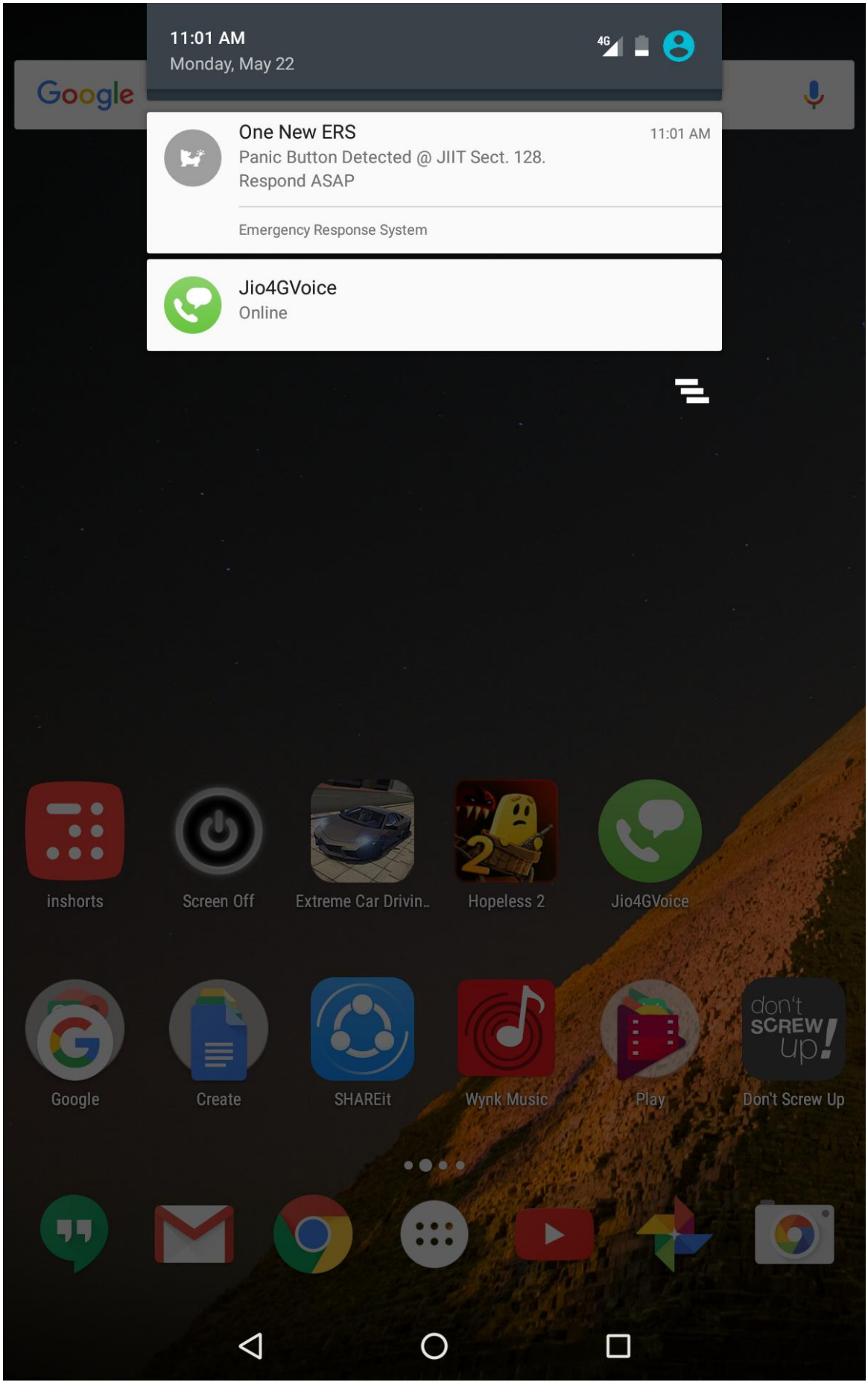
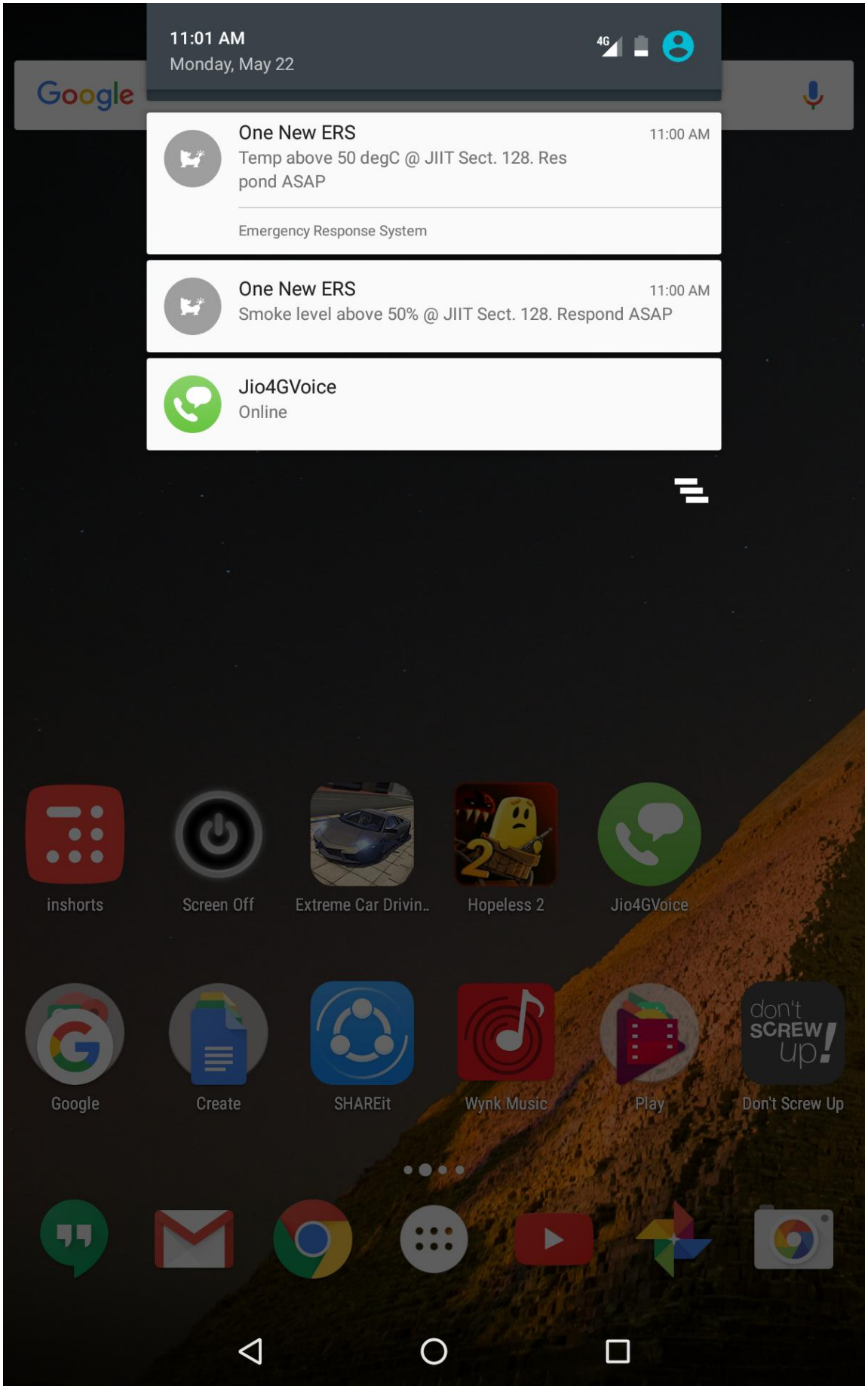
Smoke level above 50% @ JIIT Sect. 128.
Respond ASAP
Emergency Response System
Jio4GVoice
Online
inshorts
Screen Off
Extreme Car Drivin..
Hopeless 2
Jio4GVoice
Google
Create
SHAREit
Wynk Music
Play
Don't Screw Up


11:01 AM
Monday, May 22
Google
One New ERS
11:01 AM
Panic Button Detected @ JIIT Sect. 128.
Respond ASAP
Emergency Response System
Jio4GVoice
Online
inshorts
Screen Off
Extreme Car Drivin..
Hopeless 2
Jio4GVoice
Google
Create
SHAREit
Wynk Music
Play
Don't Screw Up


11:01 AM
Monday, May 22
Google
One New ERS
11:00 AM
Temp above 50 degC @ JIIT Sect. 128. Res
pond ASAP
Emergency Response System
One New ERS
11:00 AM
Smoke level above 50% @ JIIT Sect. 128. Respond ASAP
Jio4GVoice
Online
inshorts
Screen Off
Extreme Car Drivin..
Hopeless 2
Jio4GVoice
Google
Create
SHAREit
Wynk Music
Play
Don't Screw Up

References

1. Jaehak Byun, Sooyeop Kim, Jaehun Sa *"Smart City Implementation Models Based on IoT Technology* ", International Journal of Computer Science Issues (IJCSI 2015).
2. http://illumine.wp.tem-tsp.eu/files/2012/01/13-draft-lee-iot-problem-statement-02.txt
3. http://www.sersc.org/journals/IJSH/vol9_no3_2015/15.pdf
4. https://www.researchgate.net/publication/269222450_GIS_Based_Fire_Emergency_Response_System

PARTH PANDEY

Jaypee Institute Of Information Technology,

NOIDA - 201301

CONTACT: +91 9871900943

parth.pandey13103447@gmail.com

ABOUT PARTH

Hardworking, Dedicated ,Team-Player and Highly Trainable

OBJECTIVE

To work in dynamic, professional and enterprising environment which will provide the potential for increased IT skills and decision making responsibilities.

QUALIFICATIONS

Java Training - B.H.E.L.,Haridawar

C,C++ Language Training - Ducat ,Noida

Core Java Training - Ducat ,Noida

ACADEMIC PROFILE

Period	Degree/Certificate	Institute/School, City	Percentage/GPA
2013-Present	Bachelor of Technology in Computer Science Engineering	Jaypee Institute of Information Technology, Noida	5.9
2012	Senior School Examination (Class XII), C.B.S.E.	Vivekanand Public School, Delhi	80%
2010	Secondary School Examination (Class X), C.B.S.E.	Delhi Public School, Indirapuram	87%

KEY SKILLS , INTERESTS AND EXPERIENCE

Skills: Core JAVA, C/C++, MySQL, Ms office.

Interests: Music , Projects , Games , Movies.

Experience: 6 months as software developer for Pascolan Pvt Ltd.

PROJECTS UNDERTAKEN

TITLE	PROJECT SCOPE	YEAR	TECHNOLOGY USED
Autonomous Asynchronous Robot	This project was aimed at getting best out of Robot. It gives us an intelligent way of managing it using ultrasonic sensors, how to handle Arduino chip.	2014	Arduino Chip and C
Music website and android app (minor project) **www.mp3swagger.esy.es**	The main aim of the project was to provide an easy access to a variety of music and songs to the user with online streaming of songs available on the	2015	HTML,CSS ,PHP and Android

	website and the android application.		
Multiplayer Game	The project aimed at developing a 2D shooting game and a 3D multiplayer car racing game to give the gamer an enjoyable experience of gaming.	2016	UNITY 3D, C SHARP
Smart City using IoT(Autonomous Toll Booth System and Android App)	The project was aimed to provide smooth non-stop commute on toll ways by making them aumtomatic and with centralised server and android app for receipts.		Microcontrollers,C, Android