

Safety of People through Smart Things

Revathi Lavanya Baggam

MTech, MIAENG

CVR College of Engineering, Hyderabad, India.

Abstract

In India, everyday people are being prone to accidents through many ways, out of which accidents by open bore-well and man-hole count is being increased day to day. Especially kids are dying due to the open man-hole and bore-well which are going unnoticed. In order to prevent the same from happening the idea proposed in this paper would definitely lend a helping hand. Internet of Things (IoT), which introduced many smart things to the society, plays a major role behind this idea of developing smart bore-well and man-hole, which would alarm the concerned team and the neighboring society with continuous alerts. This paper implies a new design which has a sensor kept at top of bore-well hole which helps to sense the child if fell inside. If the system senses the child the automatic horizontal closure kept at around 8 feet depth closes and prevents the children from falling. Since kids who are the future of India should be saved from these dangers.

Index Terms: Sensor system integration, service functions and management, sensor, Wi-Fi, MQTT, cloud, Raspberry Pi.

I. INTRODUCTION

The Internet of things (stylised Internet of Things or IoT) is the internetworking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings and other items—embedded with electronics, software, sensors, actuators, and network connectivity that enable these objects to collect and exchange data. In 2013 the Global Standards Initiative on Internet of Things (IoT-GSI) defined the IoT[1][3] as "the infrastructure of the information society." (A. Laya, V. I. Bratu, and J. Markendahl et al, 2013) The IoT allows objects to be sensed and/or controlled remotely across existing network infrastructure (H. Schaffers, N. Komninos, M.

Pallot, B. Trousse, M. Nilsson, and A. Oliveira et al,2011) creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, smart health ,smart homes, intelligent transportation and smart cities[2][4][5][12][13]. Each thing is uniquely identifiable through its embedded computing system but is able to interoperate within the existing Internet infrastructure.

However, such a heterogeneous field of application makes the identification of solutions capable of satisfying the requirements of all possible application scenarios a formidable challenge. This difficulty has led to the proliferation of different and, sometimes, incompatible proposals for the practical realization of IoT systems. Therefore, from a system perspective, the realization of an IoT network, together with the required backend network services and devices, still lacks an established best practice because of its novelty and complexity. In addition to the technical difficulties, the adoption of the IoT paradigm is also hindered by the lack of a clear and widely accepted business model that can attract investments to promote the deployment of these technologies.

Taking into account the number of people who lost their lives by slipping into man holes especially during floods or raining season when the municipality open up the manholes to shed the excessive water that flows on roads. Along with this the open bore well system is causing equal damage to the lives of the younger ones who unknowingly are slipping into them. The object of the paper is to discuss about the architecture of the smart man hole and bore well systems along with the blue print of the models. The following are the topics which will be covered, section II: Smart Rescue System Concept and Services section III: Smart Rescue System architecture, section IV: Advantages of Smart Rescue System and section V: Conclusion.

II. SMART RESCUE SYSTEM CONCEPT And SERVICES

Smart Rescue System is an application that prevents accidents from happening when a man hole or a bore well is open. This indirectly saving the lives of innocent people.

Smart Rescue System – Bore Well: In India, the municipalities are digging bore wells but at the same time they are not taking 100 percentage safety measures and the bore wells are left open. The Safety Rescue System upon installation at the respective bore well will help to generate a red light with a diameter greater than the bore-well will be glowing at a height of 3 feet with a depth of 1 foot and sends a high alert message to the mobiles within 3 km radius daily twice. The messages will contain a caution text to the people within 3 km radius so that they will be informed about the bore well and

hence would be able to take care of their kids from going to the nearby vicinity of the bore-well. This means people travelling within 3 km radius will also be receiving the high alert message. Along with this when a child slips unfortunately slips into the bore-well then there will be a closure that gets initiated at a depth of 8 feet so that it would prevent the child from falling into the bore well which could be of 1500 feet depth. As soon as the sensor detects a child inside the 8 kms depth closure a high alarm starts blowing, thus by alerting the nearby people about the child slippage into the bore well. At the same time high alert message to the nearby municipalities, fire and police department will be sent along with people living within 10 km of the incident about the accident. It is in fact a much easier task to rescue a child from 8 feet depth instead of 1500 feet depth bore well. People of urban as well as rural areas should be educated on the safety precautions to be taken at first instance and later should be educated on smart applications that needed to be installed to prevent the accidents from happening. As now the they are many changes in the trends in technology, the same should be lending a helping hand to the society with some good applications. In order to experience the helping system a request should be sent to the residents of the city to install the concerned application in their android phones. The below tabular form speaks about the statically measure of accidents caused due to open bore-well:

Table 1: Accidents due to bore well

PLACES	YEAR	AGE
Jodhpur	July, 2016	18 months
Alwar	Oct,2016	6 year
Hyderabad	Feb, 2016	3 year
Karnataka	Aug, 2014	6 year
Bhavnagar	May,2014	3 year
Vellore	April,2015	3 year
Tiruvannamalai	April,2014	18 months

The below pie chart shows the statistics state wise about the number of accidents that have taken place due to open bore-well.

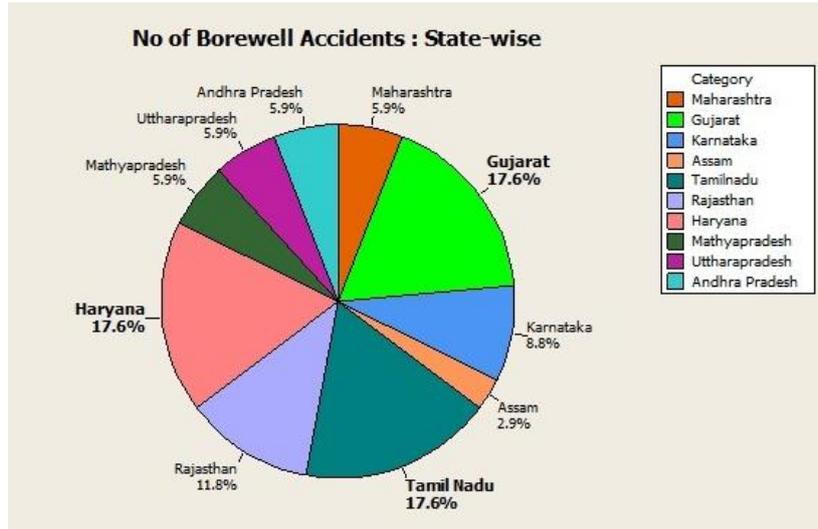


Figure 1: Statistics State wise

The below Pareto chart conveys the causes of bore-well accidents.

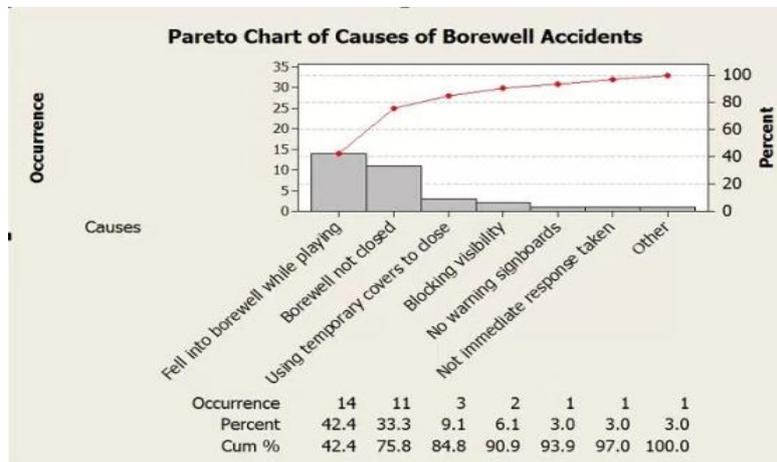


Figure 2: Causes of Bore-Well accidents

Mostly the bore-well accidents are occurring since the bore-well is open and child is playing without noticing the open bore-well, or bore-well is closed with temporary closures which are not preventing the child from slipping, or there are no proper warning signboards, or no immediate response from the concerned department after the incident has taken place.

The above causes can be stopped to a greater extent by using this Smart Rescue System[13][6][7][8], since a closure will be activated as soon as the child slips while playing at a depth of 8 feet. The glowing red light will solve the problems of blocking visibility and absence of signboards, the alert messages to the respective teams will address the problems of response time.

Smart Rescue System – Man-Hole: In India especially during rainy season and during floods the roads get flooded with water, which is when the municipality will leave the man-hole open. People who commute by walk or bike who are unaware of the presence of the man-hole slip into the same, thus losing their lives for someone's irresponsibility. The same can be prevented by two ways:- a) Smart Rescue System, which would alarm and generates a circular red laser light at 4 feet above the man-hole which is left open. At the same time helium rods will pop up around the open man-hole which is of height 4 feet and contains a unique identification number on the rods. A high alert message will be sent to the people who are within 3 km radius, municipality, and police department and to the concerned political leader about the open man-hole along with unique identification number present on the rods. So here each man-hole is being identified with a unique identification number. The alarm gets generated continuously until the man-hole gets closed. The message which is being sent contains a caution text about the open man-hole. The second method to prevent accidents with open man-hole is b) As and when the municipality open up the man-hole a fiber unbreakable sheet automatically covers the man hole which has enough gaps within the sheet for the water to go through with force but at the same time the gaps present on the sheet will avoid anyone from falling into the man hole. But definitely body parts may get stuck. So along with this additional sheet the same procedure followed in the first method can be followed in order to prevent the accidents from happening. Man-hole is a kind of sewage canal which is connected to drainage. So if anyone slips into the same, it's very difficult to trace at least the body. This rescue system will help from preventing any such accidents from happening.

The below images show up the man-holes which are improperly closed even in the absence of rains.



Figure 3: Improperly closed man-hole

The number of accidents occurred due to man-hole can be understood from the tabular forms shown below, with a variation of 10 years.

Table 2: Accident, Deaths caused due to various reasons

Incidence, Share & Rate of Accidental Deaths By Causes Attributable to Nature and Un-Natural Causes During 2005 & 2006

Sl. No.	Cause	2005			2006			% variation of incidence in 2006 over 2005
		No.	% share (w.r.t. All India)	Rate	No.	% share (w.r.t. All India)	Rate	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
A. CAUSES ATTRIBUTABLE TO NATURE:								
1	Avalanche	238	0.1	0.0	18	0.0	0.0	-92.4
2	Cold and Exposure	646	0.2	0.1	694	0.2	0.1	7.4
3	Cyclone/Tornado	1438	0.5	0.1	96	0.0	0.0	-93.3
4	Starvation/Thirst	163	0.1	0.0	174	0.1	0.0	6.7
5	Earthquake	724	0.2	0.1	8	0.0	0.0	-98.9
6	Epidemic	103	0.0	0.0	76	0.0	0.0	-26.2
7	Flood	785	0.3	0.1	1097	0.3	0.1	39.7
8	Heat Stroke	1075	0.4	0.1	754	0.2	0.1	-29.9
9	Landslide	590	0.2	0.1	274	0.1	0.0	-53.6
10	Lightning	2064	0.7	0.2	2387	0.8	0.2	15.6
11	Torrential Rains	557	0.2	0.1	259	0.1	0.0	-53.5
12	Other causes attributable to nature	14032	4.8	1.3	15665	5.0	1.4	11.6
	Total (A)	22415	7.6	2.1	21502	6.8	1.9	-4.1
B. UN-NATURAL CAUSES								
1	Air-Crash	6	0.0	0.0	2	0.0	0.0	-66.7
2	Collapse of Structure:	2718	0.9	0.2	2399	0.8	0.2	-11.7
	(i) House	917	0.3	0.1	933	0.3	0.1	1.7
	(ii) Building	253	0.1	0.0	250	0.1	0.0	-1.2
	(iii) Dam	32	0.0	0.0	34	0.0	0.0	6.3
	(iv) Bridge	234	0.1	0.0	169	0.1	0.0	-27.8
	(v) Others	1282	0.4	0.1	1013	0.3	0.1	-21.0
3	Drowning:	23571	8.0	2.1	25571	8.1	2.3	8.5
	(i) Boat Capsize	759	0.3	0.1	830	0.3	0.1	9.4
	(ii) Other Cases	22812	7.8	2.1	24741	7.9	2.2	8.5
4	Electrocution:	6987	2.4	0.6	7619	2.4	0.7	9.0
5	Explosion:	643	0.2	0.1	824	0.3	0.1	28.1
	(i) Bomb explosion	304	0.1	0.0	486	0.2	0.0	59.9
	(ii) Other explosion (Boilers etc.)	339	0.1	0.0	338	0.1	0.0	-0.3
6	Falls:	9132	3.1	0.8	9821	3.1	0.9	7.5
	(i) Fall from Height	7698	2.6	0.7	8259	2.6	0.7	7.3
	(ii) Fall into Pit/Manhole etc.	1434	0.5	0.1	1562	0.5	0.1	8.9
7	Factory/Machine Accidents	671	0.2	0.1	869	0.3	0.1	29.5
8	Fire:	19093	6.5	1.7	19222	6.1	1.7	0.7
	(i) Fireworks/Crackers	237	0.1	0.0	304	0.1	0.0	28.3
	(ii) Short-Circuit	895	0.3	0.1	962	0.3	0.1	7.5
	(iii) Gas Cylinder/Stove Burst	3439	1.2	0.3	3377	1.1	0.3	-1.8
	(iv) Other Fire Accidents	14522	4.9	1.3	14579	4.6	1.3	0.4
9	Fire-Arms	2254	0.8	0.2	2161	0.7	0.2	-4.1
10	Sudden Deaths:	18519	6.3	1.7	19450	6.2	1.8	5.0
	(i) Heart Attacks	11622	4.0	1.1	12491	4.0	1.1	7.5
	(ii) Epileptic Fits/Giddiness	2838	1.0	0.3	2625	0.8	0.2	-7.5
	(iii) Abortions/Child Birth	696	0.2	0.1	759	0.2	0.1	9.1
	(iv) Influence of Alcohol	3363	1.1	0.3	3575	1.1	0.3	6.3
11	Killed by animals	847	0.3	0.1	864	0.3	0.1	2.0
12	Mines or quarry disaster	456	0.2	0.0	409	0.1	0.0	-10.3

Table 3: Accident, Deaths caused due to various reasons

Number, Share and Rate of Accidental Deaths by Causes Attributable to Nature, Un-natural and Other Causes of Accidents during 2014 & 2015

Sl. No.	Cause	2014			2015			% Variation during 2015 over 2014
		No.	% Share (w.r.t. All India)	Rate	No.	% Share (w.r.t. All India)	Rate	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
A. CAUSES ATTRIBUTABLE TO NATURE								
1	Avalanche	23	0.1	0.0	38	0.4	0.0	65.2
2	Exposure to Cold	913	4.5	0.1	1149	10.9	0.1	25.8
3	Cyclone	62	0.3	0.0	15	0.1	0.0	-75.8
4	Tornado	42	0.2	0.0	13	0.1	0.0	-69.0
5	Tsunami	0	0.0	0.0	0	0.0	0.0	-
6	Starvation Due to Natural Calamity	50	0.2	0.0	30	0.3	0.0	-40.0
7	Earthquake	2	0.0	0.0	92	0.9	0.0	4500.0
8	Epidemic	48	0.2	0.0	218	2.1	0.0	354.2
9	Flood	541	2.7	0.0	846	8.0	0.1	56.4
10	Heat/Sun Stroke	1248	6.2	0.1	1908	18.2	0.2	52.9
11	Landslide	499	2.5	0.0	232	2.2	0.0	-53.5
12	Lightning	2582	12.8	0.2	2641	25.1	0.2	2.3
13	Torrential Rain	156	0.8	0.0	195	1.9	0.0	25.0
14	Forest Fire	11	0.1	0.0	19	0.2	0.0	72.7
15	Other Natural Causes	14024	69.4	1.1	3114	29.6	0.2	-77.8
16	Total (A)	20201	100.0	1.6	10510	100.0	0.8	-48.0
B. UN-NATURAL CAUSES								
1	Air-Crash	15	0.0	0.0	23	0.0	0.0	53.3
2	Ship Accidents	7	0.0	0.0	1	0.0	0.0	-85.7
3	Collapse of Structure	1821	0.6	0.1	1885	0.6	0.1	3.5
4	Drowning	29903	9.4	2.4	29822	8.9	2.4	-0.3
5	Electrocution	9606	3.0	0.8	9986	3.0	0.8	4.0
6	Accidental Explosion	1194	0.4	0.1	831	0.2	0.1	-30.4
7	Falls	15399	4.9	1.2	16759	5.0	1.2	8.8
8	Factory/Machine Accidents	797	0.3	0.1	695	0.2	0.1	-12.8
9	Accidental Fire	19513	6.2	1.6	17700	5.3	1.5	-9.3
10	Firearm	633	0.2	0.1	736	0.2	0.1	16.3
11	Mines or Quarry Disaster	210	0.1	0.0	118	0.0	0.0	-43.8
12	Traffic Accidents	169107	53.4	13.6	177423	52.8	13.4	4.9
13	Stampede	178	0.1	0.0	480	0.1	0.0	169.7
14	Other Un-natural Causes	55482	17.5	4.5	64427	19.2	4.4	16.1
15	Causes Not Known	12963	4.1	1.0	15165	4.5	1.0	17.0
	Total(B)	316828	100.0	25.5	336051	100.0	25.2	6.1

III. SMART RESCUE SYSTEM ARCHITECTURE

Smart Rescue System Bore-Well: The below figure Fig.4 depicts the architecture of the Smart Rescue System. The fall detection is identified by a sensor which would enable the closure at a depth of 8 feet. The Load sensor that is the sensor used to calculate weight of child that has fallen into the bore-well pit. The sensor should send data to the cloud using MQTT over Wi-Fi through Raspberry Pi[1][9][10][11] by using the logic present in the python script through Ethernet medium. The data present in the cloud can be shared through Amazon AWS IoT using Dynamo DB.

This data is further sent to various devices using Android .So the users using the Android phone or devices would get high alert message from sensor via the cloud whenever the sensor senses weight. So this message is sent to the users within 10 km radius about the incident.

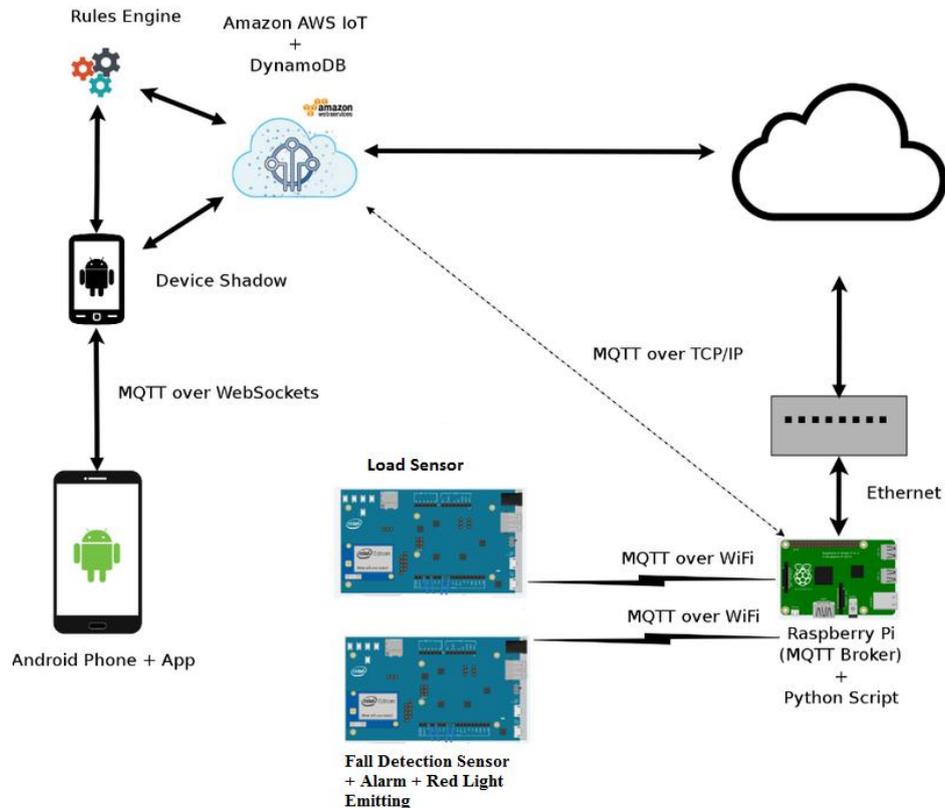


Fig 4: Smart Rescue System Bore-Well Architecture

Smart Rescue System Man-Hole: The below figure Fig.5 depicts the architecture of the Smart Rescue System. The open detection is identified by a sensor which would enable red light to emit, blow alarm and enables the helium rods to pop up. The sensor should send data to the cloud using MQTT over Wi-Fi through Raspberry Pi by using the logic present in the python script through Ethernet medium. The data present in the cloud can be shared through Amazon AWS IoT using Dynamo DB .This data is further sent to various devices using Android .So the users using the Android phone or devices would get high alert message from sensor via the cloud whenever the sensor senses man-hole open. So this message is sent to the users within 3 km radius about the open man-hole.

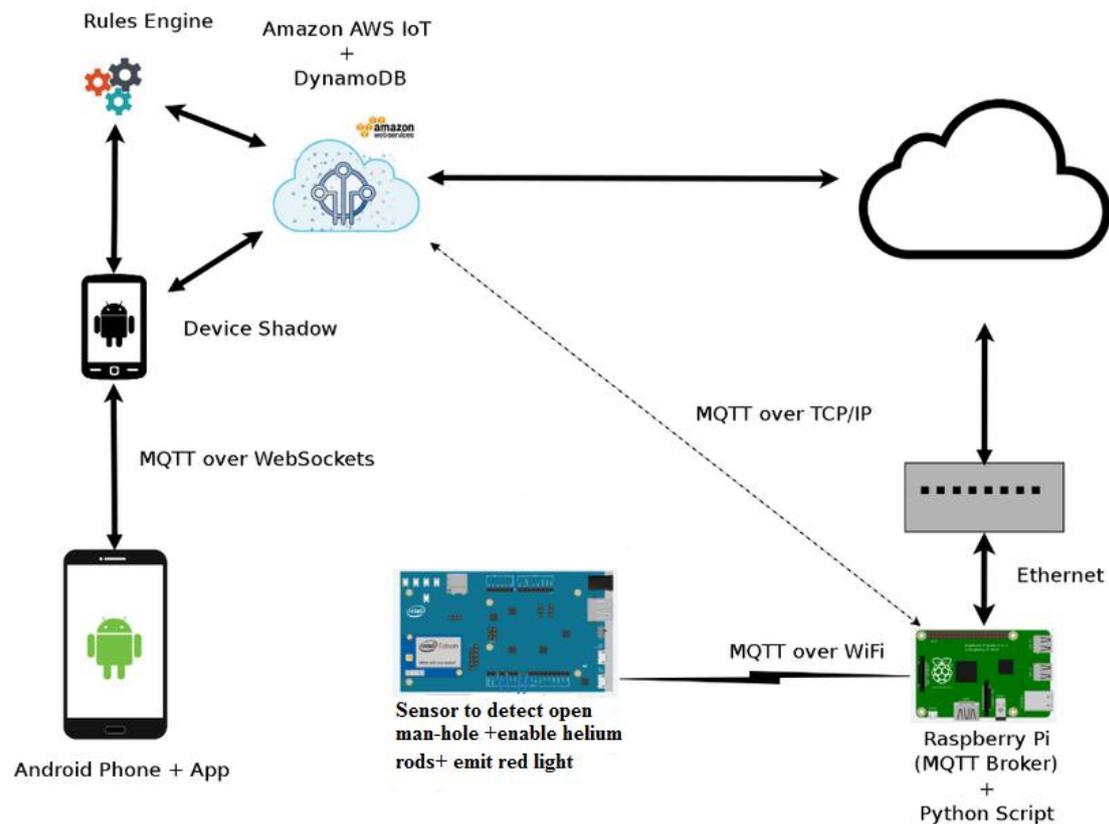


Fig 5: Smart Rescue System Man-Hole Architecture

IV: ADVANTAGES OF SMART RESCUE SYSTEM

This latest IoT app would definitely result in many advantages like:

1. It reduces the death toll rate due to over look of open man-hole and bore-well pits
2. The above point can be controlled by educating the people of society by the alert messages that are being generated whenever a bore-well or man-hole is left open.
3. It eases the work of rescue team, since saving a life from 1500 feet is definitely tough when compared to saving life from a 8 feet depth bore-well pit.
4. The causes of bore-well death reasons can be reduced to a greater extent due to high alert messages being sent to the various groups.
5. The authorities will be more focused and utmost care will be taken care towards the open pits , since they will informed with the alert messages of the open pits.

V: CONCLUSION

This application would definitely lend a helping hand to the society by reducing the death toll rate. The Internet of Things which emerged in this latest advanced technology is definitely making surroundings manage in a smart way. In present scenario of managing both work and life one will always opt for leading a smart life with smart devices which are making the surrounding smarter. The idea present in the paper which was drafted needs to be implemented which would be the future scope of this paper.

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Author Biography:



Revathi Lavanya Baggam, BTech and MTech in Computer Science and Engineering from Jawaharlal Nehru Technological University, worked for Infosys Ltd for 8 years as Team Lead on Core Banking Solutions called Finacle for banks like URALSIB which is a bank in Russia, banks in Cairo, Egypt, SoutAfrica and many Indian banks like SBI,ICICI etc. Currently working as Assistant Professor for CVR College of Engineering, Hyderabad, Telangana, India.

