WIRELESS CONTROLLED HAND GESTURE BASED BORE WELL VICTIMS RESCUE ROBOT WITH VIDEO STREAMING

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ABSTRACT:

Due to drought, more bore wells are drilled on the surface of the earth. When the groundwater gets depleted, the motor and the casing pipe are taken out and the outer cover of the bore is not covered properly in some areas. As a result of this, the children and livestock accidentally fell into it while playing near the bore, which ruined their lives. A little delay in the rescue can cost the child's life. The normal procedure to rescue the victim is to dig a hole beside the bore well. That processtakes more time and also difficult to rescue the trapped victim. Here, a robotic hand system is proposed which is controlled wirelessly with an embedded glove and servo motors for picking up the child. A telecommunication system will also be attached to the robot for communicating with the child. A pair of Zigbee modules are used for wireless communication between the robotic hand and the embedded glove. By using wireless technology, the process of saving the victim can be done without the fear of damaging the wire. A camera and a light are placed, which will relay the information to the device and the light used are for the light requirement inside the pit. Also, there is a path placed to provide oxygen supply to the child. The previous methodology has a mechanical hand that can move to and fro using a remote controller. In this paper, the robotic hand is gesture-controlled and can replicate user's hand movements. This robotic hand system can rescue the trapped victim from the bore well within a lesser time.

Keywords: Bore well, Child rescue, Robotic arm, SSR.
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I. Introduction

The 21st century has been an era of innovation and development. With the advancements of technology, almost every field has been revolutionized. These advancements have made living more luxurious and also has brought imaginable technology to reach. Though the era has seen a lot of development on the other hand, it has also seen a rise in global warming. The scarcity of water has been one of the significant issues in many countries. In India to compensate for this condition, many bore wells are burrowed. When the groundwater gets dried, the motor and the pipes are removed, but sometimes, the bore well is not insulated properly. These dried-out open bore wells have become accident-prone areas. Children while playing, involuntarily fall into the bore well. Usually, due to their small size, children are becoming prey to them. Due to the large depths, the amount of oxygen available and the visibility in the bore well decreases rapidly. Even if people notice a child who has fallen inside the bore well, it takes about twenty to forty hours to rescue them in the already existing method. There is no advanced rescue technique for such accidents. In the already existing method, a parallel hole is burrowed and then a horizontal path is made to reach the child. It takes nearly twenty to thirty hours to dig the parallel pit, by that time the victim would have ceased to exist.

This process takes more time and also the risk factors are high in various ways. Also, it requires lots of manpower and expensive resources which are not easily available everywhere. In most cases, the child rescue operation failed.

In Tamilnadu, Devi, a five-year-old girl, fell into a bore well in farmland near Arani. The dry bore well was covered with a sack, but the baby accidentally stepped on it and slipped in. When they brought her out after 11 hours, she ceased to exist. Similarly, a seven-year-old Muthulakshmi in Karur, a four-year-old Guna in Krishnagiri, a five-year-old Sudharsan in Thirunelveli, and a two-year-old Sujith in Nadukattupatti also lost their lives due to these open bore wells. Several such unfortunate happenings have occurred in other parts of the country as well, including Karnataka and recently as in June this year in Punjab.Thispaper will be most useful in those kinds of farmland areas where more bore wells are burrowed.

In this paper, an alternative method is proposed to overcome such problems of the rescue operations. A wirelessly controlled robotic hand can be developed that can take out the trapped child. An oxygen supply tube is placed in the robotic hand to provide oxygen to the victim. A video camera is placed to visualize the situation inside the bore well. In this proposed method, there is no requirement of digging any hole beside the bore well. A wireless camera is used to provide the vision. The embedded glove controls the robotic hand using wireless communication. The glove is embedded with flex sensors on each finger and an Arduino and azigbee module is attached to it. The robotic hand replicates the actions of the glove. Unlike some mechanical objects, different angles to grip the child can be attained using this robotic hand since it can replicate our actions. The Zigbee modules is used for the wireless communication between the robotic hand and the embedded glove. If the oxygen level is low, oxygen is delivered immediately using a tube. An ultrasonic sensor is used to measure the exact distance between the robotic hand and the child. A speaker can also be attached to communicate with the child. In some cases, even if the child cannot be picked out, the child can be held while a parallel pit is burrowed. As the child is being held, he won't go any deeper into the pit due to the vibrations caused while burrowing a parallel pit.By using this system, the trapped child can be rescued securely within less time.

II. Related works

John Jose Pottery conveyed a paper about bore well rescue in 2009. They depict the workplace to screen the victim, provide oxygen and give a supporting stage to lift the victim. This is done with the help of the lifting rod and motors.Bharathi B,Suchitha Samuel B, dispersed a paper about the Design and advancement of rescue robots and pipeline evaluation using ZigBee in 2013. It portrays a robot for rescuing a victim inside bore well. The robot is managed in PC using ZigBee development. It is an insignificant cost robot that gives an insight view on saving the youngster safely.

Palwinder Kaur, Gurpreet Singh, appropriated a paper about pipeline audit and bore well rescue robot. Here the wheelpart arrangement goes inside the well. The robot can change its legs based on the pipeline angles. The position of the victim is gotten from bore well with the help of USB Camera and minded PC.Manish raj disseminated a paper about rescue robots for bore well conditions in 2014. It depicts as the distance across the drag well is slight for any adult individual and light goes faint inside it, the rescue task those conditions is hard. The computerized structure will join a harness to the young person using pneumatic arms for picking up.

Saran k, Vignesh S., Marlon Jones Louis, appropriated a paper about the Plan and Fabrication of robotics basedbore well rescue method. They have done a human-controlled electronic machine to protect and to hold the child and the security balloons are used under the child to give additional safety. In 2017, Prakash and Devi arranged a robot which has wheels to move along the wall. The wheels of the robot can change according to wall size. A Wireless camera and sensors are used to get the trapped victim's position and temperature inside the well to the PC. The balloon is sent underneath the child.

Kalavathi KS et al is fostered a kid salvage framework against open bore well. The technique is executed through a metal plate is set toward the front of the bore well. IR innovation is utilized to identify the youngster into the bore well. IR sensorsis associated with the comparator. It is connected with the microcontroller. The

microcontroller sends SMS through GSM to ensure the child. The microcontroller activates another DC motor to pull the child from the bore well. LCD will show the working of each unit. This IR sensor detects the information in four directions.Channabasavaraj et al developed a PC-based Child salvage framework from bore well, which is an alternative scenario for burrowing another bore well, robot's component is utilized. Through remote controller, the robot is utilized to play out the activities with the microcontroller. The microcontroller handles the whole sub-devices associated with it. It can show 2x16 words on the display. LED presents the gas levels in the opening and shows some other gases in the opening. The remote camera is utilized to catch the situation of the child. DC motor placed in the top turns the gear system. The arms hold the top of the youngster in the well and the bladder gives a safe setting to the kid.M.Sujatha et al executed a LabView-based bore well kid salvage robot. This robot is based on the Zigbee innovation and remote camera to see both sounds just like the video. This robot has a powerful light source. One finish of the switch is grounded and the opposite end is related to the microcontroller port. The CCTV is used to provide the vision. It is related to the TV tuner to show the baby's position inside the bore well.

III. Dashboards on Child Rescue System against Open Bore Well

This dashboard gives the analytical perspective for the end-users for a better understanding of the statistical analysis from the visualized charts. This data analyses the causes of bore well accidents, state-wise bore well accidents in India, and victims of open bore well.

A) Causes of Bore well Accidents:

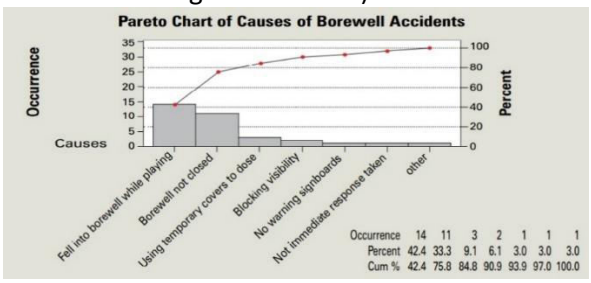

Fig 1. Causes of Bore well accidents

Figure 1 shows the causes for open bore well accidents in the previous years. Most bore well accidents occurred, while the children were playing near the bore well.

B) State-wise analysis of bore well Accidents:

The percentage of state-wise bore well accidents in India is shown in figure 2. In which Tamilnadu has a 15% occurrence of death in India. Among ten states Assam has the least number of deaths in India.

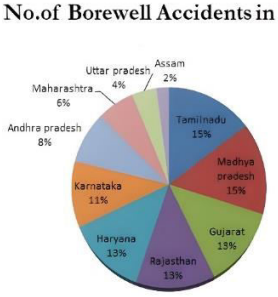

Fig 2. The State-wise percentage of bore well accidents in India

Tamilnadu has a high occurrence of death and Gujarat, Rajasthan, Haryana has the second-highest occurrence of accidents. Assam and Uttar Pradesh have the least deaths.

C) Victims of open bore well accidents:

Table 1. Victims of open bore well accidents

S.NO	Name	Age	Place Of Incident	Alive Or Not	Year
1	Nadeem	1.5	Hisar District	Alive	2021
2	Seema	4	Jodhupur Village	Alive	2019

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3	Fatehveer Singh	2	Bhagwanpura village	Not Alive	2019
4	Sujith Wilson	2	Nadukattupatti	Not Alive	2019
5	R.Madhumitha	3	Villupuram Dist, Tamilnadu	Recovered Alive, but died in hospital	2014
6	Radheshyam	2.5	CharuDist, Jaipur	Not Alive	2014
7	Chotu	9	KarauliDist, Rajastan	Not Alive	2013
8	Tanu	4	Palwal, Haryana	Alive	2013
9	Muthulakshmi	7	Suryapalli Village, Tamilnadu	Not Alive	2013
10	K Ajith	7	Karimnagar. Andhrapradesh	Not Alive	2012
11	Mahi	5	Gurgaon	Not Alive	2012
12	Thirumalesh	1	Mahabubnagar, Andhrapradesh	Not Alive	2011
13	Ankit	4	Raimalpura Village, Kochi	Not Alive	2011
14	Ashmita	1	Rajkot, Gujarat	Not Alive	2011
15	Om Santhosh Devre	1.5	Nashik	Not Alive	2011
16	Dilnaj Kaur	3	Dheera Village, Gurdaspur, PB	Not Alive	2010
17	Ankitma Wada	2.5	Bhopal, M P	Not Alive	2010
18	Pankal	4	Bhilwara, Rajasthan	Not Alive	2010
19	D.Dinesh	2	Hyderabad	Not Alive	2010
20	Darawath Prasad	1.5	Warangal, AP	Not Alive	2010

Table 1 presents the status of some of the bore well victims and their respective places of accidents and the year in which the accident took place.

IV. Proposed Smart and Safe Robot

Due to drought, more bore wells are drilled on the earth. When the groundwater gets depleted, the motor and the pipes aretaken out and the outer surface is not covered properly. Children, while playing near the bore, accidentally fall into it, which ruined their lives. A little delay in the rescue operation can cost the victim's life. To overcome this problem, a smart and safe robot (SSR) is proposed in this paper.In the proposed Smart and Safe Robot (SSR), the embedded glove is the transmitter circuit and the robotic hand is the receiver circuit. The models of the transmitter and receiver circuits are explained below.

In the proposed smart and safe robot, the robotic hand is first sent into the bore well. The robotic hand is wirelessly controlled using an embedded glove. The glove is embedded with flex sensors and accelerometer sensors. The communication between them is done with the help of Zigbee modules and Arduino. The distance and vision inside the bore well are measured using an ultrasonic sensor and a camera module. Oxygen is delivered into the bore well using a tube.Fig 3 explains the embedded glove and the robotic hand.

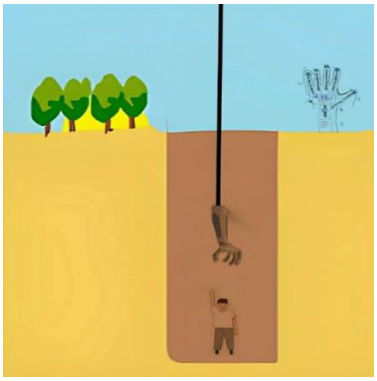

Fig 3. Illustration of Smart and safe robot mechanism

Embedded Glove Of SSR:

Flex sensors and accelerometer sensors embedded in the glove act as the input in this transmitter part. Like the fingers in the embedded glove move, the readings of the resistivity of the flex sensors and accelerometer sensors are transmitted to the receiver part through the Arduino and the Zigbee modules. A speaker is fitted inthe transmitter part to communicate with the child through the receiver part which is the robotic arm. The ultrasonic sensor placed in the robotic hand measures the distance between the victim and the robotic hand and transmits it to the display placed in the embedded glove circuit.

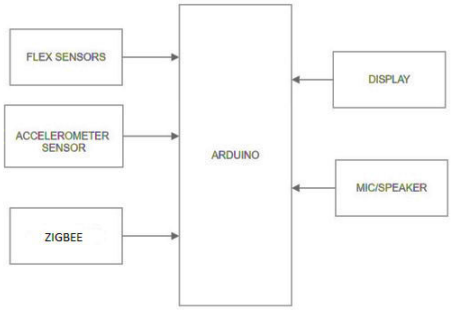

Fig 4. The embedded glove

Robotic Hand Of SSR:

The resistivity readings of the flex sensors and accelerometer sensors are transmitted to the receiver circuit Arduino using the Zigbee modules. The servo motors in the robotic hand are activated using the Arduino code and the readings received from the transmitter circuit.

The ultrasonic sensor measures the distance between the child and the robotic hand and sends it to the transmitter circuit where it will be displayed. The oxygen tube releases oxygen to the child if the oxygen level is low. The speaker and a mic are placed here to communicate with the child.

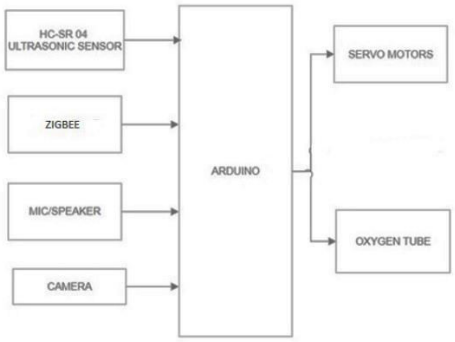

Fig 5. The robotic hand

By wearing the embedded glove, the fingers of the robotic hand can be wirelessly controlled using the Zigbee modules placed. By using this, the trapped child can be held. The vision provided by the camera and the ultrasonic sensor placed will also help in rescuing the victim.

V. Process Flow Of SSR:

The hardware consists of two parts. The first part is the embedded glove and the second part is the robotic hand. Initially, using a strong cable,the robotic hand is sent into the bore well. The robotic hand constantly receives information from the embedded glove and sends those signals to the servo motors in the robotic hand. The robotic arm is crafted similarly to a human arm.

The user wears the embedded glove which is embedded with accelerometer sensors and flex sensors. The embedded glove is the transmitter circuit. The robotic hand consists of servo motors, which are used to hold and release the fingers of the robotic hand. The sensors are embedded in the hand glove and are processed using the Arduino UNO. The user's embedded glove is the transmitter whereas the robotic hand is the receiver. The embedded glove consists of flex sensors, an accelerometer sensor, a Zigbee module, an Arduino, and an LCD display.

A flex sensor is placed on each finger of the glove. When the sensor is bent, the resistance of the sensor increases. The whole process is processed using Arduino and is transmitted to the robotic hand using the Zigbee module. The robotic hand consists of servo motors, an ultrasonic sensor, Arduino, and a camera.

The ultrasonic sensor is placed in the robotic hand, which is used to measure the distance between the robotic hand and the victim stuck inside the bore well. The distance calculated is transmitted to the transmitter section's LCD display using the Zigbee module.

The servo motors placed in the robotic hand constantly receive information from the embedded glove using the Arduino and the Zigbee modules. The servo motors in the robotic hand hold and release, according to the information received from the embedded glove. The servo motor responds in a way, so that the robotic hand replicates the user's embedded glove.

Once the robotic hand reaches the victim and holds the victim is taken out of the bore well.As the camera module would be mounted in front of the robot we can take measures to control the robot and see that no risk is taken. 3D printing technology is used to build the robotic hand. The parts modeled in Solidworks have been 3D printed and assembled. The camera module, Arduino, and sensors are assembled to the prototype and calibrated.

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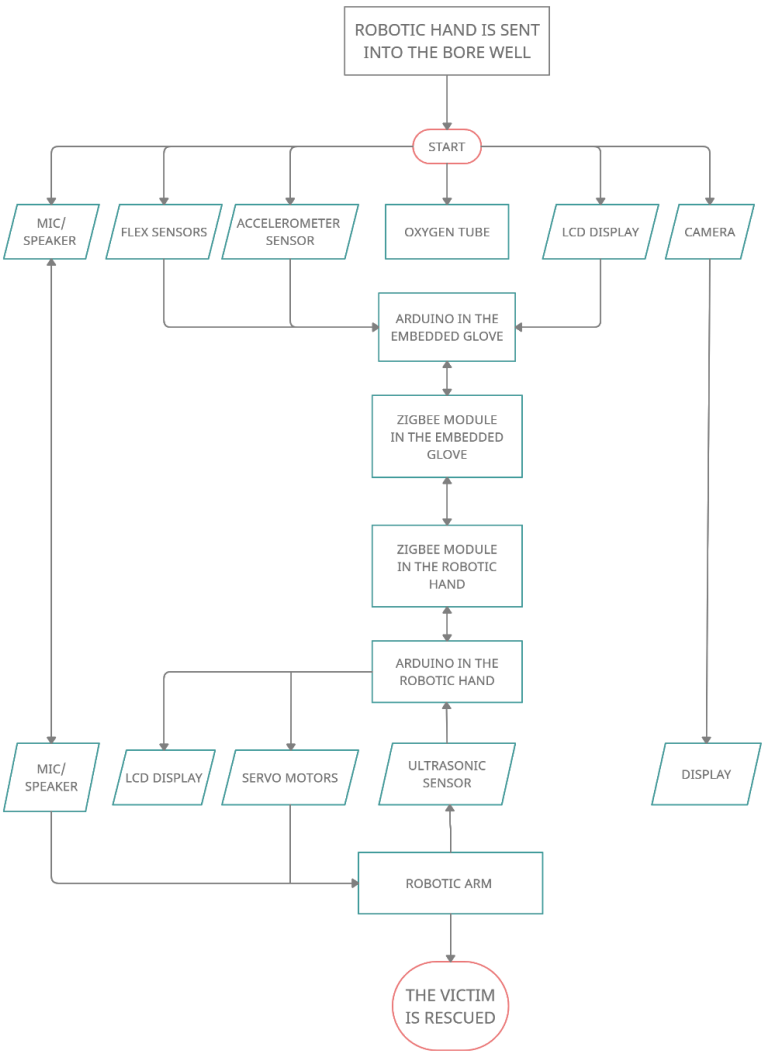

Fig 6. The Process flow diagram of SSR

VI. Results And Discussions

The setup of the robotic arm and the embedded glove is presented in figure 7. The comparison of different factors between the already existing methods and the proposed method has been analyzed.The robotic hand is crafted using 3D printing technology. The process used to craft the robotic hand is Material extrusion.

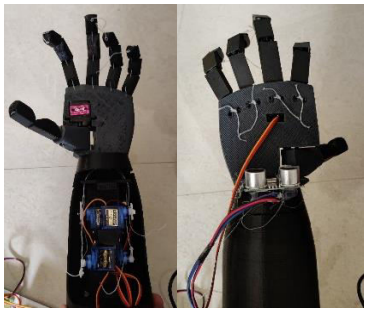

Fig 7. Robotic Hand

Fig 8. Flex sensor embedded in the glove

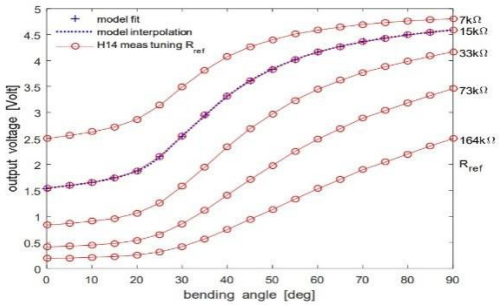

Fig 9. Output voltage vs the bending angle of Flex sensor

The flex sensor changes its resistance when it is bent or any force is applied to it.The resistance of the flex sensor increases as it bends.When the sensor is bent, its resistance increases and this information is transmitted to the servo motors in the robotic hand using the ZigBee modules to which the servo motor responds.

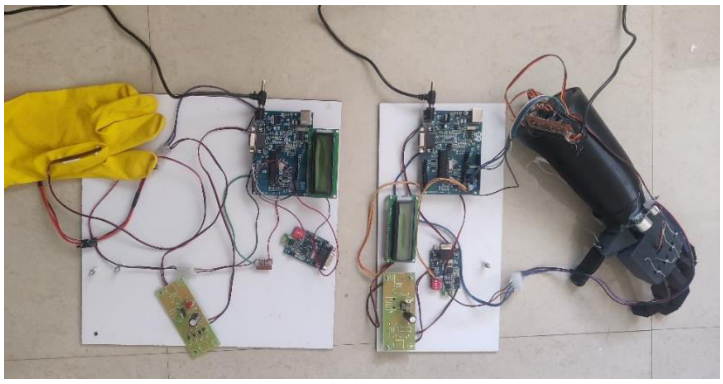

Fig 10. Proposed Smart and Safe robot.

Considering the results, the following parameters can be achieved using the proposed SSR.

Rescue time:

In the already existing method, a parallel hole has to be burrowed and a horizontal path has to be made to reach the trapped child. It will take up to twenty to sixty hours for the rescue of the trapped child. By using this proposed system, we can save the child within three to five hours as it is not necessary to dig a hole.

When a person is under the ground for a long time, the person may become unconscious since the oxygen level is decreased. If the oxygen level is below 19.5 percent, breathing could be difficult.Time is very crucial when a senseless person is not inhaling. After 4 minutes without oxygen Permanent brain damage occurs, anddeath can occur just after 4 to 6 minutes. In the proposed SSR model, oxygen can be delivered using the oxygen tube and so the brain damage can be averted.

Manpower Required:

In the already existing method, more manpower is required as there is a need to dig a hole. More energy is used there as burrowing is a tedious process. The complete rescue operation was manually implemented in the existing method. But in the proposed method, very little manpower is required as the rescue operation here is mostly carried out by wireless automation.

Safety:

In the already existing method, safety is not guaranteed. While burrowing, a lot of vibrations will occur, the sand may get loosened and the child may go deeper into the bore well. The persons carrying out the rescue operation will also be in a dangerous situation. A small error may cause the situation even worse. But in the proposed method, the safety is very much high, as the rescue operation is carried out using automation. As a parallel hole is not burrowed, the child may not go any deeper and no other person can get harmed. The telecommunication system also helps to decrease the psychological effects on the child.

VII. The Conclusion:

A robotic model for rescuing the trapped child from the bore well environment has been proposed here. Observing such circumstances, where innocent children suffered from those open bore wells, the proposed safe and smart robot will be very much useful in saving those innocent lives. It is easy to use as its control is basic. Moreover, this robot can be used in various applications. A minor change of fabrication material would easily hold much more weight. A double arm can be designed to lift the child much easier if the diameter of the hole is larger.

VIII. References

[1] Jayasudha.M,M.Saravanan“Real Time Implementation Of Smart Child Rescue Robot From Bore Well Using Arm And Belt Mechanism”International Journal of Innovative Technology and Exploring Engineering, ISSN: 2278-3075, Volume-8 Issue-12, October 2019

*e*ISSN1303-5150

[2] Manish Raj, P.Chakraborty And G.C.Nandi "Rescue Robotics In Bore Well Environment" https://doi.org/10.48550/arXiv.1406.2134

[3] Venmathi, V., E. Poorniya, And S. Sumathi. "Bore well Rescue Robot." International Journal of Computer Applications (0975 – 8887) Volume 113 – No. 14, March 2015

[4] A. B.A Bakri, R. Adnan And F. A. Ruslan, "Wireless Hand Gesture Controlled Robotic Arm" 2019 IEEE 9th Symposium On Computer Applications &Industrial Electronics, 2019, Pp. 16-22, DoI: 10.1109/ISCAIE.2019.8743772.

[5] Nithin, G., Et Al. "Design And Simulation Of Bore Well Rescue Robot- Advanced." ARPN Journal of Engineering and Applied Sciences, vol. 9, No. 5, PP 608-611, MAY 2014

[7] Channabasavaraj B D , Banu Prakash H R , Amar Y N , Benson P Varghese"Pc Based Child Rescue System From Bore-Well" International Journal of Latest Engineering Research and Applications, Volume – 02, Issue – 05, PP – 104-112, May – 2017

[8] R.Deepa,M.Nivethaa,K.Sibana Parveen,A.Sindhuja,S.Priyadharsini, "Smart And Safe Child Rescue System From An Bore well", International Journal Of Creative Research Thoughts, ISSN:2320-2882, Volume.8, Issue 3, PP.244-247, March 2020

[9] Surya Saravana Pandian, Karthikeyan Sundarsamy,"Multi-Purpose Prosthetic Bore Well Rescue Robot System." (2018),IAETSD Journal For Advanced Research in Applied Sciences Volume 5, Issue 3, Mar 2018

[10] R Chaitra, Monika P, Sanjana M, Shobha Sindhe S R, Manjula G, 2018, Smart Child Borewell Robot Rescue System, International Journal of Engineering Research &Technology – 2018 (Volume 6 – Issue 13)

*e*ISSN1303-5150