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Design and Development of Child rescue Mechanism from open bore well

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Abstract – *In the past few years, there have been several accidents of children falling into abandoned bore wells in India. Abandoned bore wells that have turned into death pits for children. The problem is all over India. Rescue team spend hours and sometimes days to save child. A lot of money is also spent in these missions. In most cases they are unable to save the kids. A small delay in the rescue can cost the child's life. The rescue team tries to approach the victim from a parallel well that take hours to dig making the process complicated. Very few of the victims have been saved in such accidents. The objective of the current research is to design and fabricate a child rescue mechanism from open bore well and to supply oxygen to the child trapped inside the bore well at minimum cost. The equipment is designed to operate off the 12volt battery and the light weight DC Johnson motor. This mechanism assembly will be supported by a rope pulley drive and a stand. A camera was placed to find the child position, which will be displayed on the monitor screen.*

***Key Words*: Bore well, child, rescue, Battery, Motor, camera**

1. INTRODUCTION

Today's major problem faced by human society is water scarcity, which leads to a large number of bore wells being sunk. These bore wells in turn have started to take many innocent lives [1]. Bores which yielded water and subsequently got depleted are left uncovered. Small children without noticing the hole dug for the bore well slip in and get trapped. There were so many child deaths due to the open bore wells. There is no proper technique to rescue victims of such accidents. When the make shift local arrangements do not work, army is called in. In most cases reported so far, a parallel hole is dug up and then a horizontal path is made to reach to the subject's body. It is not only a time taking process, but also risky in various ways. Moreover it involves a lot of energy and expensive resources which are not easily available everywhere and in this process we always need big space around the trapped bore that we can dig a parallel bore. In India there were frequent bore-well deaths.

Table-1.1: State wise bore well deaths in India

SL.NO	STATE	NO. OF BOREWELL ACCIDENTS IN INDIA (2006-2017)
1	Karnataka	5
2	Maharashtra	3
3	Gujarat	6
4	Assam	1
5	Tamilnadu	7
6	Rajasthan	6
7	Haryana	6
8	Uttar Pradesh	2
9	Madhya Pradesh	7
10	Andhra Pradesh	4
TOTAL		**47**

Fig-1.1: Traditional rescue method of child from bore wells

Fig-1.2: Digging of parallel well for rescue

1.1 Literature Review

B. Bharathi1, B et. al [1] described the designing a robot for rescue a child from inside bore well, which was capable of moving inside the bore well, according to the human comment by PC and also pick and placing based on arm design. The robot was operated through PC using wireless Zig-bee technology and using wireless camera could view both audio and video on the TV. This robot had a high power LED which acted as a light source when light intensity inside the pipe is low.

Palwinder Kaur et. Al [2] described the rescue operations without human intervention. Here the wheeled leg mechanism was designed to go inside the pipe and the legs are circumferentially and symmetrically spaced out apart. The robot could adjust its legs according to the pipeline dimensions. The robot consisted of power supply, switch pad, and gear motor. The child position was captured from bore well with USB Camera and monitored on PC. The temperature sensor and LCD were interfaced with microcontroller to sense and displayed on monitor.

John Jose Pattery et. al [3] described the facility to monitor the trapped child, supply oxygen and provide a supporting platform to lift up the child. The 1st motor placed at top turns a gear mechanism which, in turn, pushes 3 blocks arranged at 120 degrees from each other towards the side of the bore well. The 2nd motor placed below the plate turns the bottom shaft by 360 degrees, the helping to locate the gap through which the lifting rod passes. This was done with the help of a wireless camera attached to the lifting rod. The 3rd motor adjusts the radial distance of the lifting rod. When the diameter was adjusted, the 4th motor helps the lifting rod to screw its way through the gap towards the bottom of the child. Once the lifting the rod reaches a safe position under, an air compressor is operated to pump air to the bladder attached to the end of lifting rod through an air tube that runs downwards inside the lifting rod. The bladder provides a safe seating to the child. Then 1st motor is then reversely operated so as to unclamp the system. Simultaneously it is lifted out of the well using a chain or rope.

Manish Raj et.al [4] developed a robotic system which would attach a harness to the child using pneumatic arms for picking up. A teleconferencing system would also attach to the robot for communicating with the child thereby aiding in the rescue.

Based on these literature review, the main shortfalls in the current designs were identified which included more time requirement and high cost. The main objective of the current research was to rescue the trapped child from open bore well using a simplified mechanism at the lowest cost and time.

1.2 Conceptual Design

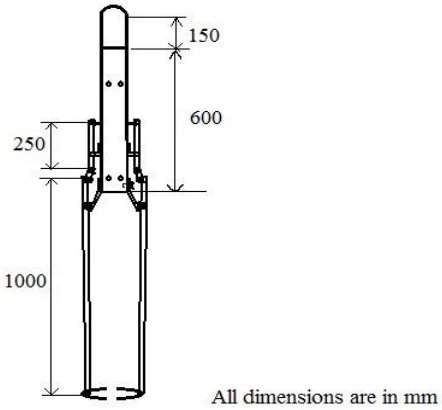

Fig-1.3: 2D Assembled model of rescue mechanism

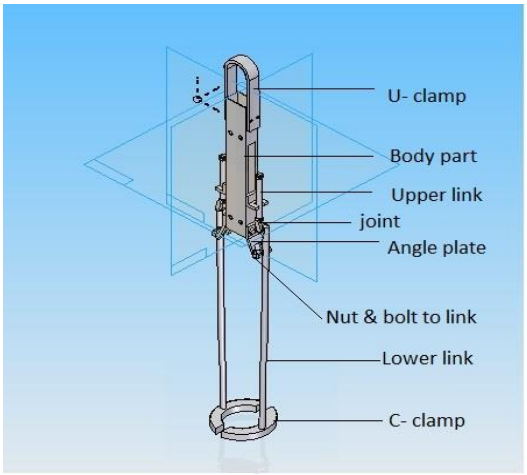

Fig-1.4: 3D Assembled model of rescue mechanism

This mechanism is designed in such a way that it is light in weight that goes down into the bore well pipe and holds the trapped child systematically. This mechanism assembly is supported by a cable wire, controlled and supported by a motor & screw mechanism assembly with all necessary accessories. In this alternative scenario, there will be no

requirement of digging any hole parallel to the bore-well. This mechanism is controlled by rope and pulley which goes down the bore well and perform the rescue operation. A lot of other hassles will also be avoided by this technology.

Table-1.2: Dimensional details of rescue mechanism

Sl. No.	Name of the Part	Dimensions (mm)	Material used
1	Body	600*100*50	Galvanized iron
2	Lower link	1000*ϕ12	Stainless steel
3	Upper link	250* ϕ10	Stainless steel
4	U clamp	200*50*5	Mild steel
5	Threaded shaft	450* ϕ 20	Mild steel
6	Joint	40*3	Aluminum

2. Development of child rescue mechanism

The fabricated mechanism is as shown below. It consists of threaded shaft with a nut. The threaded shaft is connected to the motor from the upper end. The motor is connected to 12 V DC battery which when operated causes the threaded shaft to rotate. When the motor rotates, the nut moves upwards and downwards depending on the direction of rotation which in turn causes the lower link to extend and retract.

Fig-2.1: Fabricated child rescue mechanism

Table-2.1: Bill of Materials

Parts	Quantity	Cost (Rs)
Metal Body	1	150
Bearing	2	200
Links	4	450
Nut & Bolts, Washers	44	380
Threaded shaft	1	300
12v DC Battery	1	450
Motor with wire	1	400
Rope	1	200
Camera	1	500
Other charges (Fabrication cost)	-	1500
TOTAL	**56**	**4530**

The rescue mechanism was tested under different load conditions of the child to check the strength of the overall mechanism keeping the bore diameter constant.

Table-2.2: Testing of Mechanism under varying loads

Sl. No.	Weight lifted (kg)	Diameter of Bore well (inches)
1	5	9
2	10	9
3	15	9
4	20	9

3. CONCLUSIONS

The current research overcomes the limitations of rescue mechanisms of child from open bore well. The research includes the successful design and fabrication of child rescue mechanism from open bore well at low cost which will benefit thousands of people in such scenarios without digging a parallel well. The current design of bore-well child rescue mechanism is made to suit every possible situation of rescuing the child at limited cost and time without the use of robots mentioned in earlier literatures. The mechanism is made strong and light weight to sustain all possible loads, though it is made flexible at the same time to adjust wide range of bore diameter. The camera fitted into the device aids visually during the rescue operation.

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