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# Design of Robotic Borewell Rescuer Using Raspberry Pi and ATMEGA8 Microcontroller

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**ABSTRACT:** A bore well rescuer is a sophisticated device that can be used to rescue toddlers or any other materials that might have fell inside a bore well. Even though many kinds of such rescue devices exists, none of them provide an overall good performance when it comes to safely rescuing a child that happen to accidently fell into a narrow well. The proposed system is a combination of rescue, life support and communication devices which work seamlessly together to recuing the child. The device can be setup in little to no time and can operate without causing any injury or harm to the child being rescued.

**KEYWORDS:** Borewell rescue, life support, communication device.

## I.INTRODUCTION

**What is a bore well?**

A bore well is a deep, narrow hole drilled into the ground from which water is drawn through a pipe and pump. Bore wells are typically small in diameter — ranging from 4.5 inches (low-capacity bore well) to 12 inches (high-capacity bore well). Bore wells tap into water-bearing soil or rock layers called aquifers, and can go as deep as 1,500 feet into the ground. Bore well technology was first introduced in India in the 1970s as a measure to counter water scarcity. India now has approximately 27 million bore wells, but several of them have been abandoned because they no longer supply water. When a bore well dries up and is no longer in use, its cover, usually made of cast iron, is removed and the PVC pipe pulled out, leaving behind a naked hole. The pipe and the iron cast are removed to show that the well is no longer useful.

**What aren't rescue operations successful?**

According to the National Disaster Response Force (NDRF), over 40 children have died after falling into bore wells since 2009, and rescue operations failed at least 70 per cent of the time [4]. The NDRF data suggests the deadly combination of uncovered, abandoned bore wells and children playing around them are the biggest cause of such fatal accidents. Other reasons include flimsy covering of bore wells and a lack of warning signs. When a child falls in, they fall into a pit from which a pipe has been removed, so the walls of the bore well are not smooth, but rugged. Even if you want to pull the child out, there is hardly any space to do so, and the type of soil surrounding the pit could lead to collapse.

## II. PROPOSED BOREWELL RESCUE DEVICE

a. Inner assembly

The inner assembly of proposed borewell rescue device consists of robotic arm, foldable seat, action camera with depth sensor, mic and speaker with monitoring system, hoist motor with lifting components, gas monitor and the provision for oxygen supply. It consists of transmitting part and receiving part. Transmitting part is controlled by Raspberry pi and the receiving part is controlled by ATmega 8 microcontroller. Robotic arm and foldable arm equally shares the total weight of the subject, so it prevents the chances of further falling down or the malfunctions of anyone. Gas sensor is another important one, because there is a chance of having gases like carbon monoxide etc. so, which helps to detect the poisonous gas present inside the narrow well. The distance sensor is used to calculate the exact distance of the subject. It makes the rescue easier.

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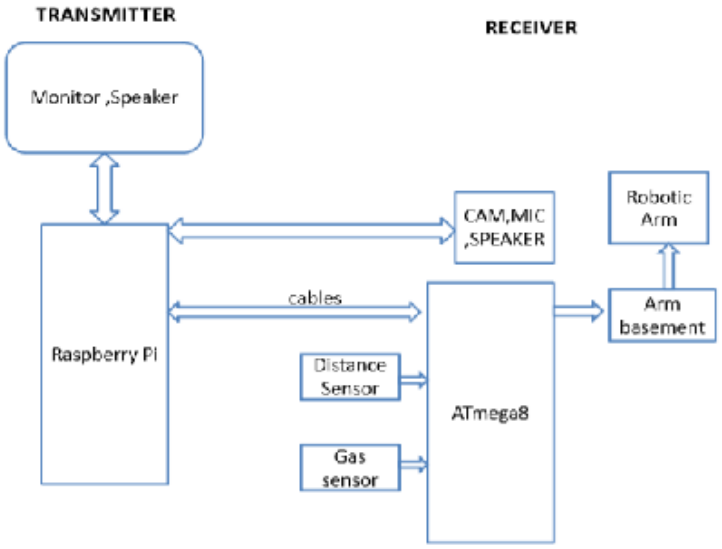


Fig 1**:** Connection diagram of the rescue device

b. Operation

In the event of a toddler falling into a bore well, the proposed rescue device has to be setup around the perimeter of the well. Support structures are placed over the well and the main assembly is attached to it.

After connecting the power supply, communication and control cables, the robotic arm attached to the main assembly is lowered to the well. Real time high definition video and audio playback can be attained through the system over the display and audio setup near the controller. This video feed together with the depth sensor can be used to determine the exact location of the child inside the well. Gas monitor can then show the amount of oxygen and other gases present at that depth. In case the oxygen level is low, controlled oxygen supply can be provided separately (Recommended oxygen levels in confined spaces is between 19.5% to 21.5%).

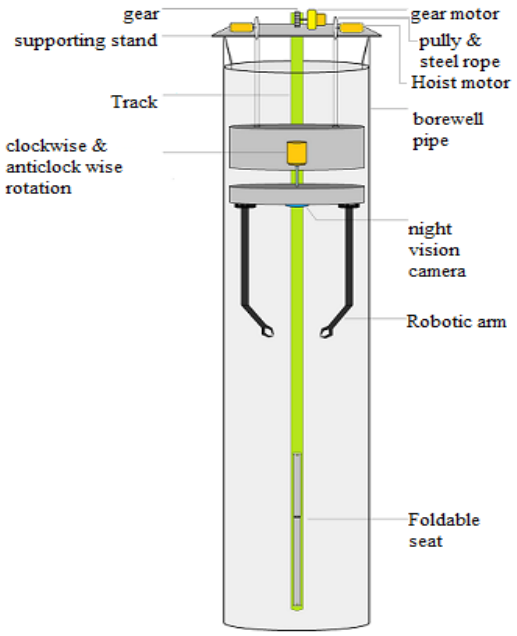


Fig 2: Rescue device setup

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| Components of master assembly |
|---|
| a) Ultrasonic ranging module<br>b) HD camera with night vision<br>c) Lighting system with brightness control<br>d) Servo motor<br>e) Gear motors<br>f) Gas monitors<br>g) AT mega 8 module |

After locating the child and establishing oxygen support, the position of the child and soil condition around the child is determined through the video feed. In majority of the previous cases, children get stuck to the confines of the well before hitting the ground and their hands were put up as a result of the fall [4].

In a similar situation, the robotic arm can lower to the child and attempt to carefully grab the raised hands of the child [1]. This man oeuvre will be aided by the HD camera and the depth sensor. Even if the hands were not found in a raised position, the robotic arm can grab the clothing or the shoulders of the child. The arms are supported on metal wires and depth can be increased as desired.

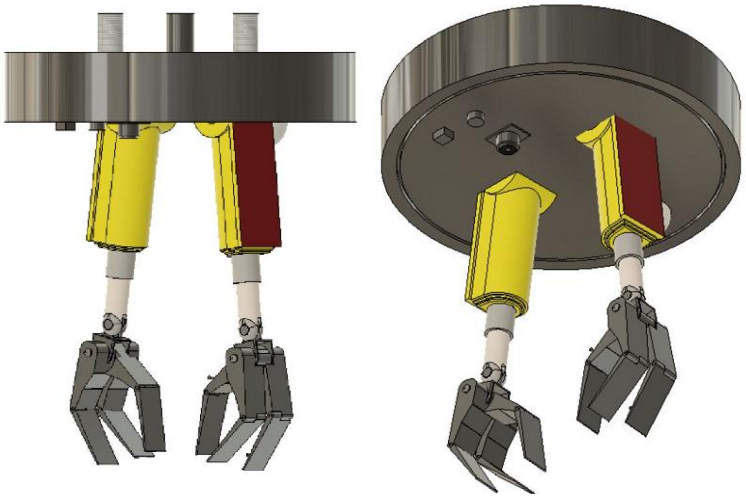

Fig 3: Robotic Arm equipped with HD camera, depth sonsor and gas monitor

The inbuilt communication system allows the child's parents or rescuers to talk to the child to either calm the child down or to ask the kid to behave in a way that aids the rescue process. After carefully and gently holding the child in place, the metal foldable arms are inserted along the sides after carefully examining the side walls and position of the child. This metal arm is slim and can slide alongside the child and the side wall of the well without causing any or little disturbance. The arm will be extended below the child and is then folded to support the child from below. Once the arm is below the child, a metal string running through the insides of the arm is pulled up by a gear motor located in the main assembly causing the arm to fold 90°. This becomes a support for the child from below, thus preventing any chance for the child to fall down even further while pulling the child up or if the robotic arm loses the grip on the child. Once the arm is folded, together with the robotic arm, the whole assembly is pulled up using the help of gear motors and the child is slowly brought to the surface.

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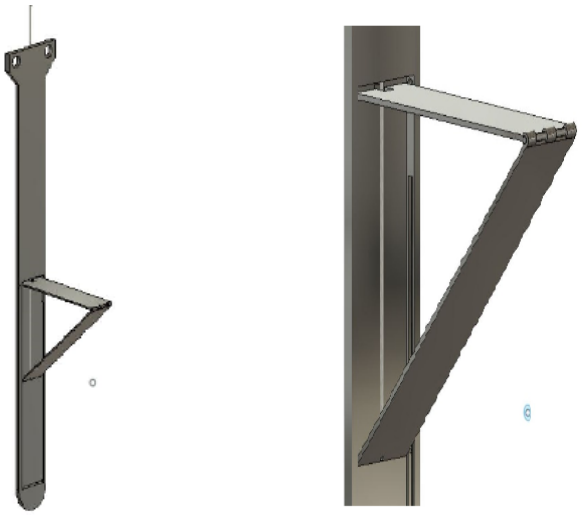

Fig 4: The supporting foldable arm

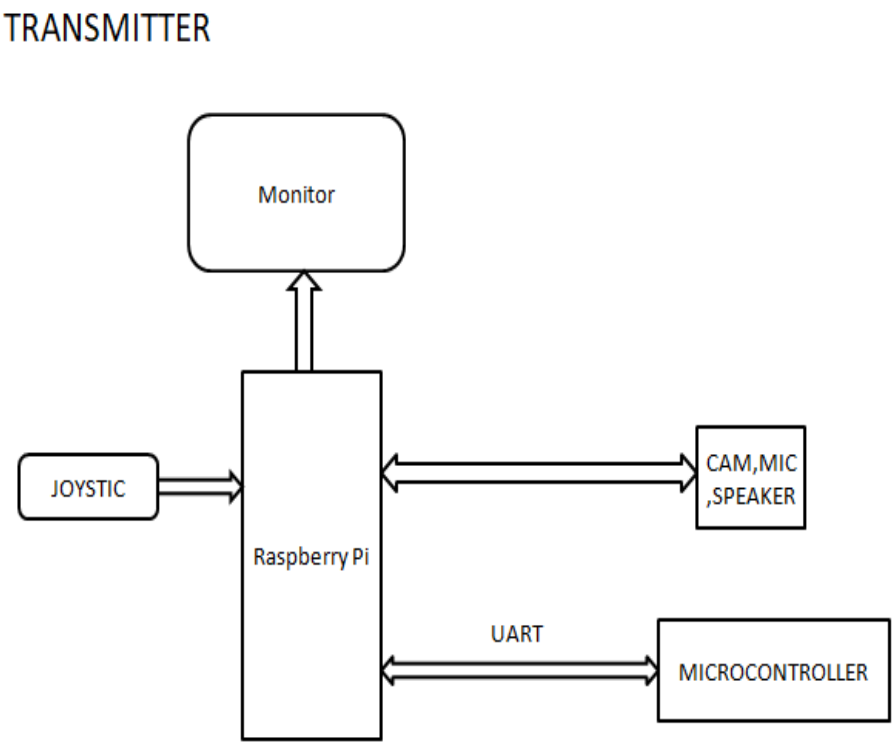


Fig 5: Transmitter module

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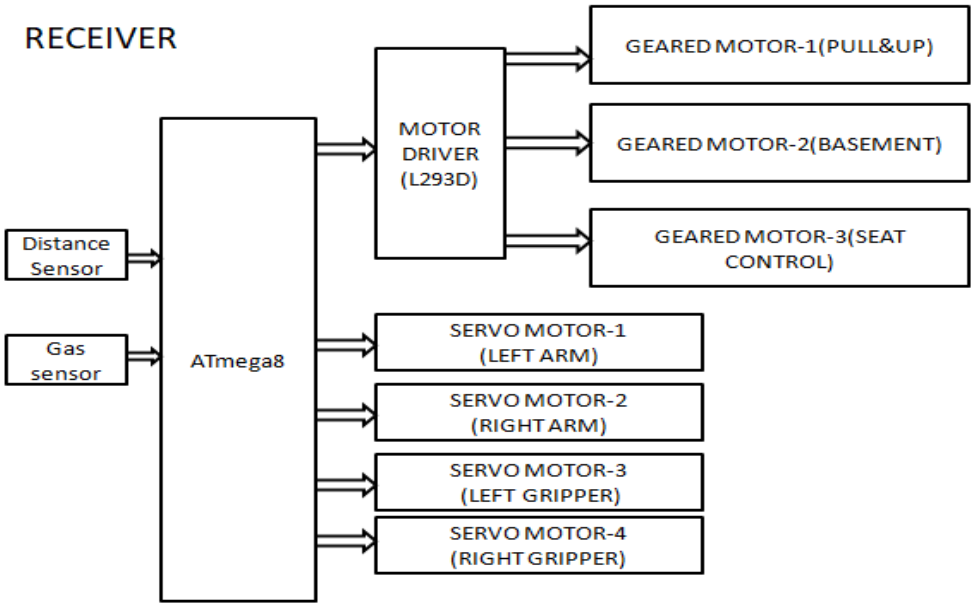
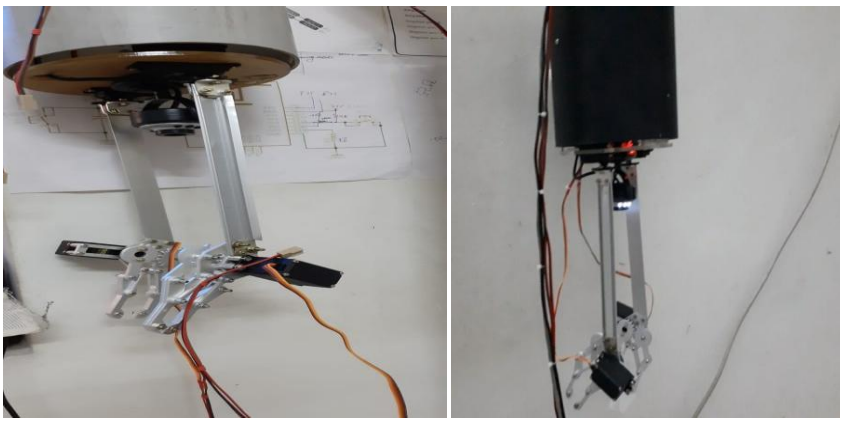



Fig 6: Receiver module

## III. RESULT

The device works efficiently at all climatic condition. Due to the presence of robotic arm and the HD cameras with night vision, a precise operation can be ensured in any lighting situation. In-built communication device can help the parents to communicate with the toddler to calm him down and could help in guiding the child to cooperate with rescue operation. Oxygen supply and gas monitoring systems helps to ensure that the child is safe and breathing normally. Incorporation of both robotic and folding arm to lift the child ensures that any chance of child falling down is negated. Unlike previous methods of drilling parallel wells which will take hours or maybe days to complete, the proposed system can cut short the rescue time significantly. Remote real time monitoring of the child's condition can be achieved through built-in systems. Versatile and can be used on various sizes of bore wells.



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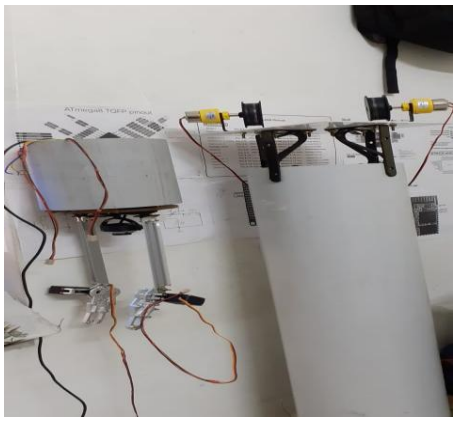

Fig 7: Borewell rescuer

## IV. CONCLUSION

Unused and uncovered bore wells pose a significant threat to toddlers' safety. Due to the carelessness of the adults, kids who are not aware of the dangers of falling in to such wells are getting trapped inside it and thereby risking their life. Almost all the previous bore well rescue devices were having subpar performance when it comes to the safe rescue of children. The proposed system eliminates most of the shortcomings of the previous methods and provides a safe and integrated rescue system while significantly improving on the rescue time. These proposed systems can be a vital part of the fire and rescue departments all over the nation thereby facilitating quicker response and recovery during the event of a toddler falling into a bore well.

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