# DESIGN AND DEVELOP A CHILD RESCUE ROBOT FROM BOREWELLS

***Project Reference No.:*** *47S_BE_3090*


***College*** *: Acharya Institute of Technology, Bengaluru*
***Branch*** *: Department of Mechatronics Engineering*
***Guide(S)*** *: Dr. Baghirathi V.*
*Dr. Manjunatha K. N.*
***Student(S)*** *: Mr. Shashank T. G.*
*Mr. Pavankumar P. Kadam*
*Mr. Manoj P.*
*Mr. Lokesh Kiran R.*



**Keywords:**

Spur gears, split-hand end effector, crab hand end effector, visual streaming, Tong Mechanism, Belt mechanism lifting, Ballon type rescue system, gripping operation


**Introduction**

India faces the pervasive challenge of water scarcity, exacerbated by escalating resource demands, impacting both rural villages and urban centers. Bore wells, drilled to depths ranging from 100 to 300 feet, are often utilized to address this issue. However, the abandonment of these wells poses a serious hazard, particularly to children, transforming into perilous traps due to their uncapped state. Confined spaces lacking oxygen, elevated temperatures, and darkness characterize these environments, leading to tragic incidents of children falling into them. Over 40 documented cases have occurred in India since 2009, with only 30% resulting in successful rescues. Tragic losses, such as those of Sujith in Tamil Nadu, underscore the urgent need for innovative solutions and rescue initiatives to safeguard innocent lives.

Developed a real-time smart child rescue robot for borewells by Jayasudha.M and M. Saravanan (2019) measuring borewell dimensions ranging from 4.5 to 9 inches. The robot utilizes an arm and belt mechanism, eliminating the need for traditional parallel digging methods and saving time. Equipped with gadgets and guided by visual data from a camera, the robotic arm is lowered into the pit to locate the victim based on captured images. Precautionary measures are implemented simultaneously based on sensor data.

Fig 1.1Belt mechanism lifting

Ballon type rescue system by V. Venmathi's Borewell Rescue Robot is a fully remote-controlled system utilizing a rack and pinion gear mechanism. Structured in a circular shape, it fits within the borewell and features an LED monitor connected to a CCTV camera for monitoring activities inside. As the robot descends, the camera provides visibility of the child's position, while an oxygen pipe supplies oxygen, all displayed on the LED monitor.

Fig 1.2 Ballon type rescue system

Life Saving Machine by Dr. S.M. Mowade et al.'s features a central main axis surrounded by translation elements, forming a base frame with three arms, each housing six wheels. The close proximity of the main axis and translation elements creates a four-bar mechanism, enabling the transmission of compression force from a spring to the wheels. This design allows the vehicle to navigate within vertical tubes effectively.

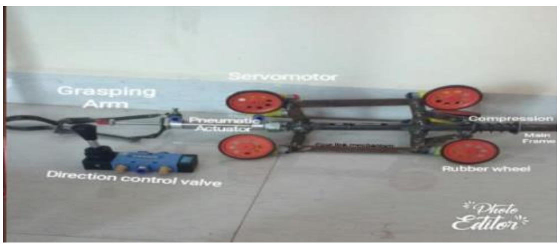



Fig 1.3 Fabrication of Life Saving Machine

Current Rescue technique

Current Rescuing a child from an open borewell presents challenges like darkness, limited visibility, and communication difficulties, with conventional techniques involving lengthy and hazardous digging beside the borewell. This method increases risks, consumes significant time, and may result in the child being trapped for days, requiring utmost caution during excavation. Additionally, there's a risk of land collapse during digging, further endangering the child.

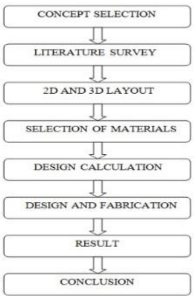

Fig 1.4 Present existing technique

**Objectives**

To address these challenges, we have established specific objectives outlined below:

1. To design and implement a mechanism using end effector ensuring the safety.
2. Implement a surveillances system for viewing the child through-out the rescue operation.
3. To design proper End effector for holding of child with very good grip.

**Methodology:**




**CAD Model of Split Hand Mechanism**

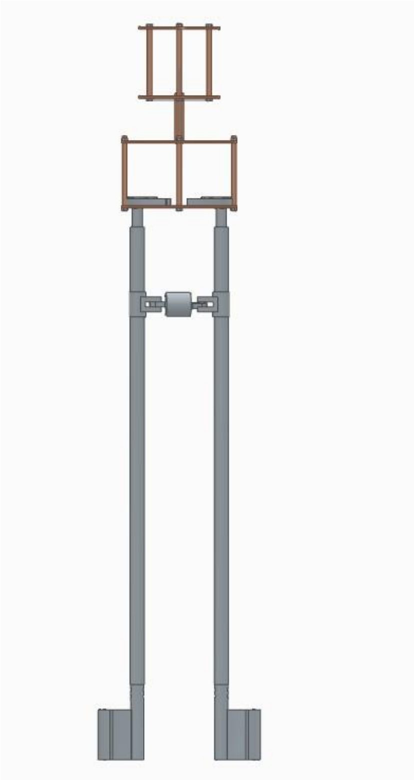


Fig 3.1 Split Hand skeletal view Fig 3.2 Split
Hand skeletal Orthogonal view

**CAD Model of Crab Hand Mechanism**

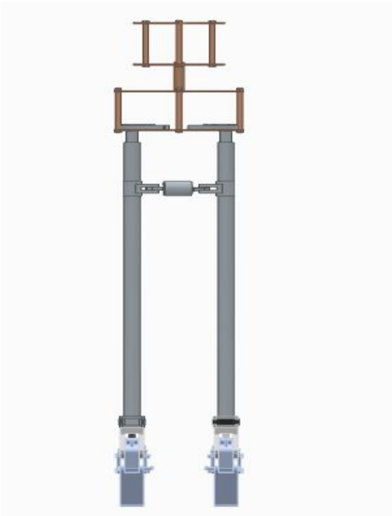


Fig 3.3 Crab Hand skeletal view Fig 3.4 Crab Hand skeletal Orthogonal

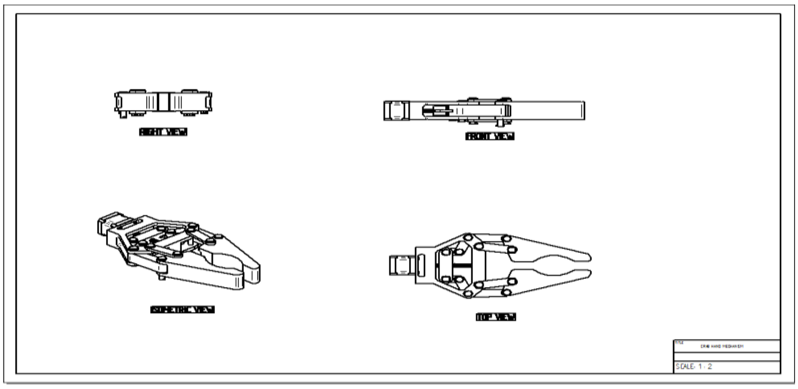



Fig 3.5 Crab Hand Draft view

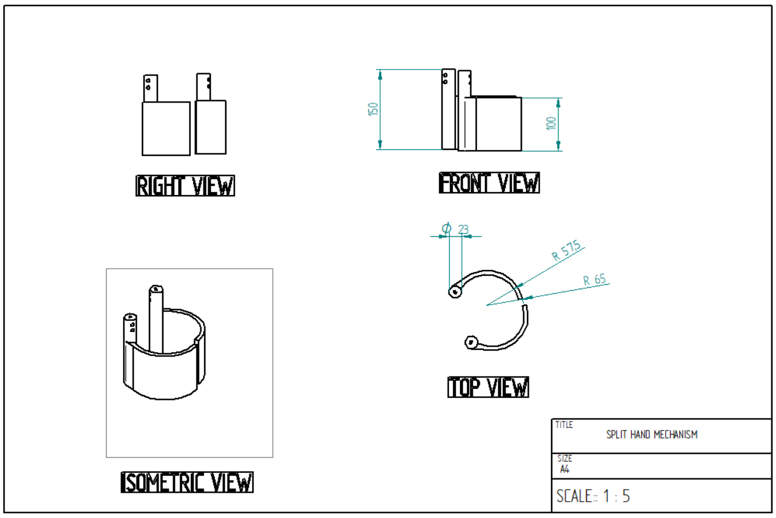



Fig 3.6 Split Hand Draft view

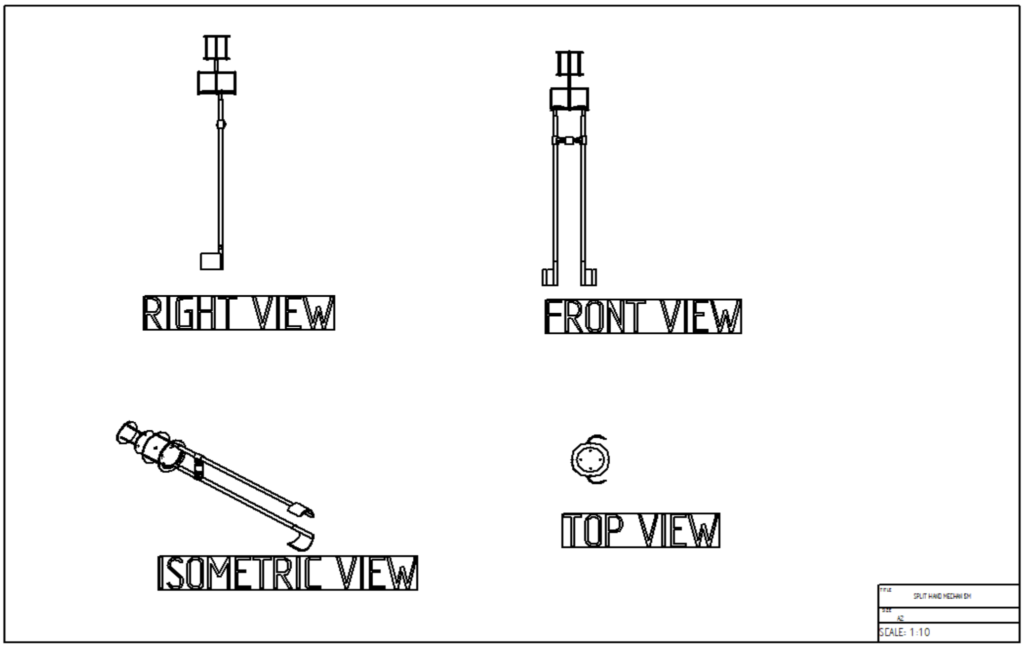



Fig 3.7 Split Hand Assembly Draft view

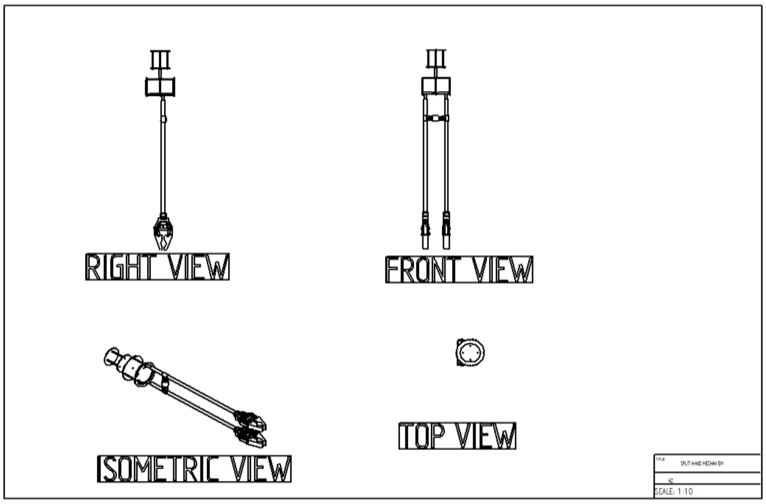



Fig 3.8 Crab Hand Assembly Draft view

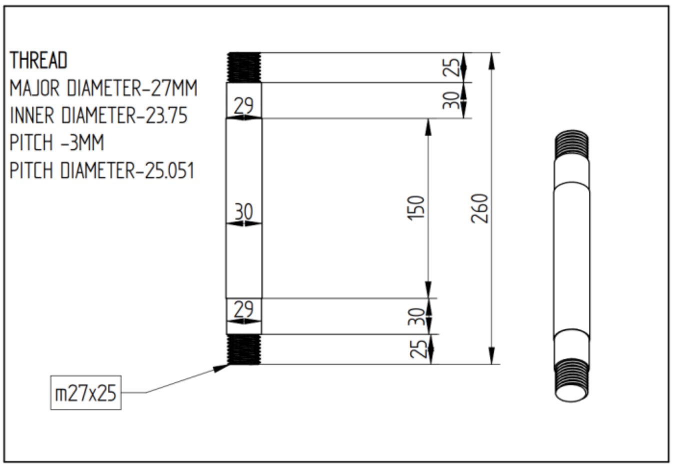



Fig 3.9 Centre Shaft Draft view

Fig 3.10 (A) CNC Laser cutting

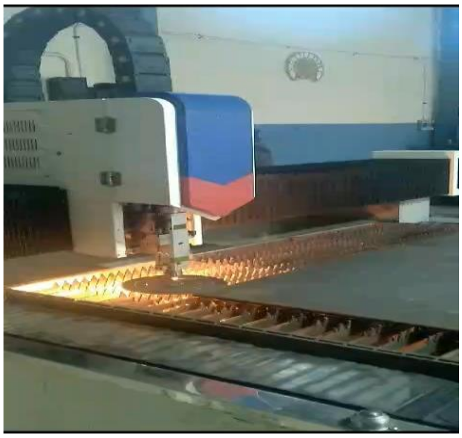


Fig 3.10 (B) CNC Laser cutting

During the prototyping phase, metal plates were precisely cut using a CNC laser cutting machine, ensuring accurate shaping, while the critical shaft was crafted with precision on a lathe for rotational movement. This combination of techniques facilitated the creation of flat and cylindrical components necessary for assembly. CNC laser cutting expedited production, ensuring efficient plate manufacturing with consistent quality, while lathe machining ensured shaft dimensions and surface finish met exact specifications for smooth rotation. Employing CNC laser cutting for plates and lathe machining for the shaft-maintained precision and accuracy in the prototyping process, enhancing the robot's reliability and performance.

**H. Results and Conclusions (about 20 lines with specific reference to work carried out).**

Fig 4.1 (A) Crab Hand

Fig 4.1 (B) Crab Hand

The Work under process and work will be completed in few more days. The provided image represents the partially conclusion of our project, achieving the stated objectives. It captures the culmination of our efforts and the fulfilment of our goals. The picture vividly illustrates how we have met the targets set forth at the beginning of our endeavour. It serves as a visual testament to our dedication and hard work throughout the project timeline. Overall, it encapsulates the successful outcome of our collective efforts.

## Conclusion

In conclusion, our objectives aim to address multifaceted challenges in borewell child rescue operations, prioritizing safety and surveillance. By designing a mechanism with an end effector, we emphasize secure child handling to ensure successful outcomes. Integration of a surveillance system enhances situational awareness throughout the rescue process. Additionally, our commitment to innovation and meticulous design enhances efficiency and effectiveness in retrieval. Emphasis on a strong-grip end effector reflects dedication to addressing unique challenges. Through these objectives, we inspire confidence and strive to set new standards, safeguarding lives with a relentless pursuit of excellence.

### I. What is the innovation in the project?

The innovation part of our project is the split hand mechanism and body rotation. Its designed for a specific scenario.

Fig 6.1 Space Availability

- The robot is equipped with a split-hand mechanism for the rescue scenario.
- Each movement in the rescue mission is meticulously orchestrated to prioritize the safety of the trapped child.
- Robotic arms extend horizontally to accommodate the child's size, while the split-hand end effector approaches with calculated precision, guided by real-time surveillance feedback.
- Surrounding environment is carefully observed to prevent obstacles from impeding the rescue effort, ensuring smooth operation.
- The split hand envelops the armpit region with a firm yet gentle grip, providing stability and support as the child is lifted to safety.

- Each arm can rotate independently by 60 degrees in both clockwise and anti-clockwise directions.
- The entire operation is displayed in real-time on the control box for monitoring and coordination.

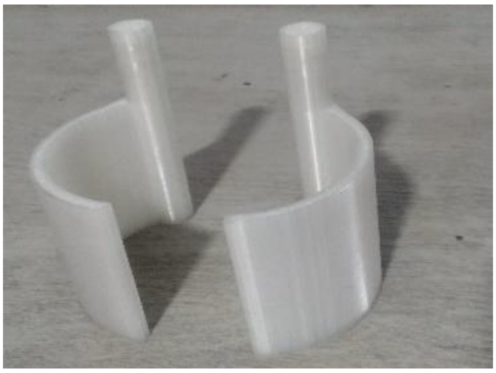


Fig 6.2 Split hand mechanis

space available near the arm pit of the child through the surveillance system. After visualizing the space send the split hand end effector near the arm pit. Rotate the split hand grab the whole arm pit of the child. Slowly pull the robot up, disengage the split hand and rescue mission is completed.

Fig 6.3 (A)

Fig 6.3 (B)

Fig 6.3 (C)

Fig 6.3 (a), (b) and (c) Illustration of split hand mechanism in the robot performing the action.

**Video Demonstration-**

https://drive.google.com/drive/folders/1HUoUmDxpKJdSPdfSgnpyQF-VodDU2-hb

## Scope for future work

- In future not only this robot uses for rescuing children, we design another end effector for pulling old motor fallen inside the bore hole.
- We will upgrade the wire control system to optical fibre control.
- We will make it to sustain more weight load.
- We will add more torque motor for split hand mechanism by designing the motor.
- We will upgrade the gears for split hand mechanism.