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Pc Based Child Rescue System from Bore-Well

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Abstract: This paper deals with design to save a child that is struck in a manhole. In recent days, we get some news like a child have struck up in a manhole and it takes more than a day to save it. Here in this paper, a child fallen in a manhole is to be saved using a computer controlled motor with a camera to monitor the position of the child and the action of the arms. In this alternative scenario, there will not be any requirement of digging any hole parallel to the bore-well. The remotely controlled robot will go down the bore-well and perform the action. A lot of other hassles will also be avoided by this alternative technique.The child can be saved within a short period of time without any type of difficulties. Also, the machine is accurate, gas is also detected in manhole and there will not be any damage to the child by the machine.

Keywords: well, Camera, Computer controlled motor, Monitor, Robot,

1. Introduction

Recently, many accident reports of children (and even adults) falling in open bore-wells have appeared in the print and the electronic media. Very few of the victims have been saved in such accidents. In some of these cases the dead body of the subject could not be collected easily. Even if rescued late, most victims were reportedly injured.

To overcome such problems of these rescue operations, we have an alternative (feasible) proposal. We are developing a robot machine that can take out the trapped body in systematic way. It will also perform various life-saving operations for the sufferers such as oxygen supply. A video camera to observe the actual situation closely and continuous interaction with the sufferer could also be attached. It will be a light weight machine that will go down into the bore well pipe and hold the trapped body systematically. This machine assembly will be supported by a cable wire and this will be controlled and supported by a gear assembly. In this alternative scenario, there will be no requirement of digging any whole parallel to the bore-well. The remotely controlled robot will go down the bore well and perform the action. A lot of other hassles will also be avoided by this alternative technique.

The rescue of this trapped children in an uncovered bore-well is not only difficult but also risky. A small delay in the rescue can lost the child his or her life. To lift the child out the narrow confines of the bore wells is also not very easy. The child who has suffered the trauma of the fall and is confined to a small area where, with a passage of time the supply of oxygen is also reduces. Robot for bore well rescue offers a solution to these kinds of situations. It is fast, economical and safe. Moreover, it has the facility to monitor the trapped child, supply oxygen and provide a supporting platform to lift up the child driven by motors. The motor placed at the 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 whole system firmly to the bore-well wall. The 2nd motor placed below the plate turns the bottom shaft by 360 degrees, thereby helping to locate the gap through which the lifting rod passes. This is done with the help of a wireless camera attached to the lifting rod. Once the gap has been located, the 3rd motor adjusts the radial distance of the lifting rod. When the diameter is adjusted, he 4th motor helps the lifting rod to screw its way through the gap towards the bottom of the child. Once the lifting rod reaches a safe position under the child, an air compressor is operated to pump air to the bladder attached to the end of the lifting rod through an air tube that runs downwards inside the lifting rod. The bladder provides a safe seating to the child. When the child is secure, the lifting rod is contracted to its maximum position. The 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.

This machine will be a light weight and easy to operate as compared to other alternative methods, that will go down into the bore well pipe and hold the trapped body systematically. This machine assembly will be supported by a cable wire and this will be controlled and supported by a gear assembly, a stand and all necessary accessories.

2. Literature survey

The major problem faced by the human society was water scarcity is analysed by Bharathi and Suchitha [1]. Due to drought and depletion of underground water more borewells are drilled on the surface of the earth. Due to water scarcity, more borewells are being sunk. In many areas, the borewells are drilled and leaved as it as open without any proper covering. This abandoned borewells have become death pits and started taking many innocent lives especially small children. Now a days falling of children in borewells are increasing due to the carelessness and playful activities of the children. The holes dugged for the borewells are deep around 700 feet. In these cases, the rescue of children from such deepest borewells is quite challenging. Many times, the rescue system for children from borewells may risk the child life.

Children often fall down in the bore well which have been left uncovered and get trapped. The rescue of this trapped children is not only difficult but also risky. A small delay in the rescue can cost the child his or her life. To lift the child out the narrow confines of the bore wells is also not very easy. The child who has suffered the trauma of the fall and is confined to a small area where, with a passage of time the supply of oxygen is also reduces. Robot for bore well rescue offers a solution to these kinds of situations. It is fast, economical and safe.
Palwinder et al [2], it analyzed that, in India for past few days, there have been several accidents of children falling into abandoned borewells which is left uncovered and get trapped. Abandoned borewells seems to be death pits for children. These borewells in turn have started to take many innocent lives. In these cases, normal operation of child rescue is done by using big machines with large manpower involvement. The rescue process to save the child from bore well is a very long and complicated process. It is time taking process and also risky in various ways. So, the aim of the project is to prevent the children from falling in ton the borewell. Our Paper implies a new design which has a sensor kept at top of borewell hole which helps to sense the child if he fell inside.

If the system senses the child the automatic horizontal closure kept at around five feet depth closes and prevents the children from falling beneath it. It is easy to rescue the child from five feet than five hundred feet. This system also alerts by giving siren and messages to rescue team and concern officials with location. Hence this system will help to prevent children from falling in borewell and get trapped.Moreover, it has the facility to monitor the trapped child, supply oxygen and provide a supporting platform to lift up the child driven by motors. The motor placed at the 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 whole system firmly to the bore-well wall. The 2^{nd} motor placed below the plate turns the bottom shaft by 360 degrees, thereby helping to locate the gap through which the lifting rod passes. This is done with the help of a wireless camera attached to the lifting rod. Once the gap has been located, the 3^{rd}motor adjusts the radial distance of the lifting rod. When the diameter is adjusted, he 4^{th} motor helps the lifting rod to screw its way through the gap towards the bottom of the child. Once the lifting rod reaches a safe position under the child, an air compressor is operated to pump air to the bladder attached to the end of the lifting rod through an air tube that runs downwards inside the lifting rod.

Saran et al [3], they have mentioned that, nowadays child often falls down in the borehole which is left uncovered and get trapped. It is difficult and also risky to rescue the trapped children to aid in such rescue we proposed a system of designing robots to the rescue of a child in a borehole. The robot structure consists of power supply, switch pad, gear motors, Oxygen concentrator, camera and Microcontroller. The condition of trapped child is captured with CCTV camera and monitored on a TV. A safety balloon is introduced in order to provide extra safety. Once the lifting rod reaches a safe position under the child, an air compressor is operated to pump air to the bladder attached to the end of the lifting rod through an air tube that runs downwards inside the lifting rod. The bladder provides a safe seating to the child. When the child is secure, the lifting rod is contracted to its maximum position. The motor is then reversely operated so as to unclamp the system. Simultaneously, it is lifted out of the well using a chain or rope. The programming language is Embedded C which is executed by MP lab Integrated Development Environment.

Venmathi et al [4],describes the rescue operations without human intervention. Here the wheeled leg mechanism is design to go inside the pipe and the legs are circumferentially and symmetrically spaced out 1200 apart. The robot can adjust its legs according to the pipeline dimensions. The robot has consisting of power supply, switch pad, and gear motor. The child position is captured from bore well with USB Camera and monitored on PC. The LM35 temperature sensor and 16×2 LCD are interfaced with PIC 16F877A microcontroller to sense and displays on LCD.

3. Working principle and rescue robot details

The rescue robot works mainly on the microcontroller. Here the microcontroller acts as mini-computer for the rescue process. The microcontroller is used to control the operation of all the electrical components as well as mechanical components. The commands will be given to switch on the components based on the requirements.

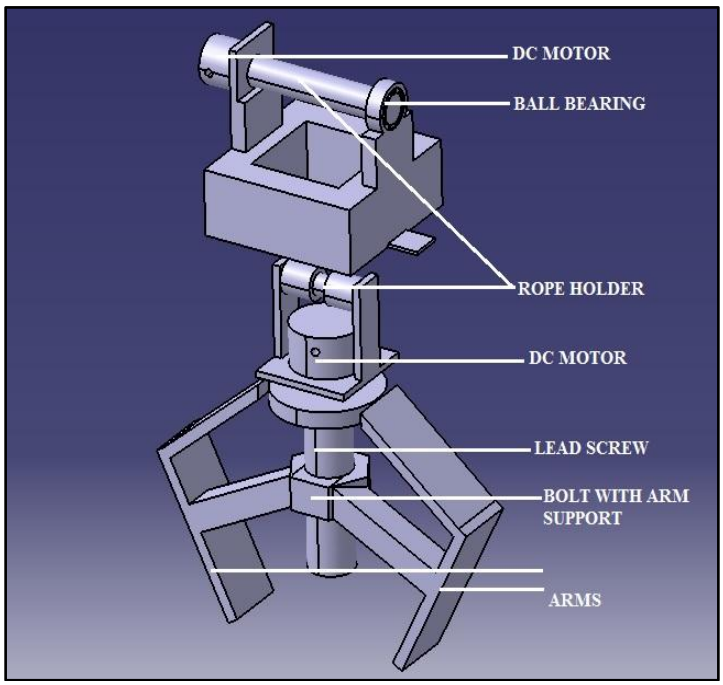

Fig. 1model of rescue system

The child rescue system as shown in Fig. 1 consists of two plates to rescue a child from the manhole. The first plate called holding plate. It is carry the arm of the rod to pick the child. This rotating rod acts as supporting arm for the whole equipment. Then the holding plate which is directly connected with rope and passes through the pulley that is operated by using handle for purpose of lifting and descending. There is a camera fixed to visual it. The camera is used for finding the child inside the manhole. The arm is connected with holding clamp motor runs so the arm moves, it is used to grab the child waist with help of fixed clamp. The rotating plate is connected with holding plate through shaft which carry worm gear connected with motor.

The worm gear is used to reduce the speed of the lead screw, so that the operation can be slow and steady as mentioned by Saran et al [3]. So that the arms can be easily positioned according to the position of the child. The arms can be moved by using the lead screw controlled by microcontroller, for opening and closing. The supporting plate can also be controlled by the microcontroller to provide ascending and descending motion to the arms.

The Fig. 2 shows the block diagram of child rescue system. Here the microcontroller is used to control all the operations by serial communication. The relays are used as switches to control the DC motor. This relay provides the required voltage to the DC motors so that there will be no effect on it.

The gas sensor is used to sense the gas levels in the hole, if there are any poisonous gases in the hole, the level will be displayed on the LED display. The gas sensor senses the signals by analogous form and this will be converted into digital signal by amplifying it and sending it to the ADC (Analog to Digital Converter).

The wireless camera is used to capture the position of the child and to check the rescue operation. The wireless camera is powered by 9volt battery, the transmitter is fitted to the camera so that the signals can be received by the receiver at the top of hole. The receiver is connected to the computer system using TV tuner card, so that the visual display can be seen on the LCD display. The microcontroller has a display which has capability of displaying 2x16 words, all the commands given by the microcontroller will be displayed on the LED display as mentioned.

The transformers are used to step down the voltage levels given to the electrical components. Here two transformers are used to step down the voltage, one is 9volt transformer which is used for some components and the other one is 12Volt transformer to provide required voltage to the DC motors.

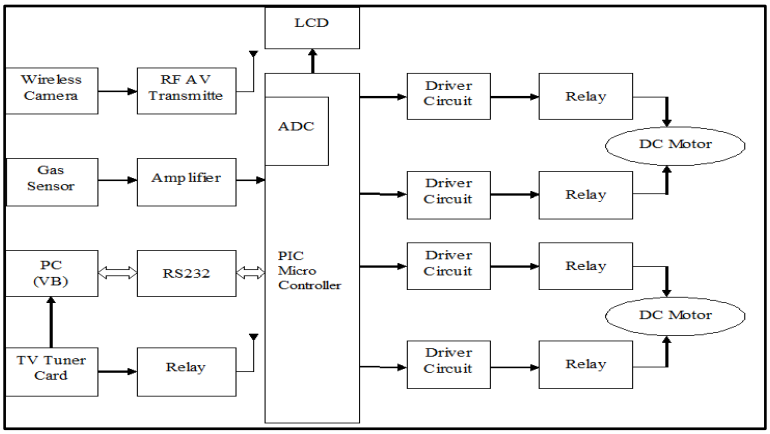

Fig. 2 block diagram of child rescue system

4 Components used in rescue system

The components which are being used in rescue system are

- DC motor
- Wireless camera
- Lead screw
- Worm gear
- Gas sensor
- Microcontroller
- LCD display
- Crystalonics display
- RS232

4.1 DC motor

In any electric motor, operation is based on simple electromagnetism. A current-carrying conductor generates a magnetic field; when this is then placed in an external magnetic field, it will experience a force proportional to the current in the conductor, and to the strength of the external magnetic field. As you are well aware of from playing with magnets as a kid, opposite (North and South) polarities attract, while like polarities (North and North, South and South) repel. The internal configuration of a DC motor is designed to harness the magnetic interaction between a current-carrying conductor and an external magnetic field to generate rotational motion.

4.1.1 DC motor calculation

Specification of a DC motor

Speed : N = 30 RPM
Voltage : V = 12 Volt
Loading Current : I = 300 MA
No Load Current : I = 60 Ma
Power : P = VxI=12x0.3 = 3.6WATT
P = 0.0048HP
Motor Efficiency : E = 36%
Motor Shaft Diameter : D = 6 mm

Good science project does not stop with building a motor. It is very important to measure different electrical and mechanical parameters of your motor and calculate unknown values using the following helpful formulas This formula could be used in many cases. You may calculate the resistance of your motor by measuring the consumed current and applied voltage. For any given resistance (in the motors it is basically the resistance of the coil) this formula explains that the current can be controlled by applied voltage.

Electrical power of the motor is defined by the following formula

Input power : $P_{in} = I \times V$ (1)

Where,

I – current, measured in amperes (A)

V – applied voltage, measured in volts (V)

Motors supposed to do some work and two important values define how powerful the motor is. It is motor speed and torque, the turning force of the motor. Output mechanical power of the motor could be calculated by using the following formula

Output power : $P_{out} = T \times \omega$ (2)

τ – Torque, measured in Newton meters (Nm).

ω – Angular speed, measured in radians per second (rad/s).

Calculation of angular speed if we know rotational speed of the motor in rpm

Angular speed : $\omega = \frac{N \times 2\pi}{60}$ (3)

Where,

π – Mathematical constant pi (3.14).

60 – Number of seconds in a minute.

Efficiency of the motor is calculated as mechanical output power divided by electrical input power:

Efficiency:$E = \frac{Pout}{Pin}$ (4)

Therefore,$P_{out} = P_{in} \times E$

After substituting equation no 1 & 2 in equation no 4, we get

$T \times \omega = I \times V \times E$ (5)

$\frac{T \times N \times 2\pi}{60} = I \times V \times E$ (7)

Connect the motor to the load. Using the motor from generator kit is the best way to do it. Why do you need to connect the motor to the load? Well, if there is no load there is no torque.

Measure current, voltage and rpm. Now you can calculate the torque for this load at this speed assuming that you know efficiency of the motor.

Motor torque changes with the speed. At no load, you have maximum speed and zero torque. Load adds mechanical resistance. The motor starts to consume more current to overcome this resistance and the speed decreases. If you increase the load at some point motor stops (this is called stall).

4.1.2 Torque of the Motor

The formula for calculating torque will be

Torque : $T = \frac{(I \times V \times E \times 60)}{(N \times 2\pi)}$ (8)

Speed : N = 30 RPM

Voltage : V = 12 Volt

Loading Current : I = 300 mA

Torque : $T = (0.3 \times 12 \times 0.36 \times 60)/30 \times 2\pi$

$T = 0.412$ Nm

Torque : T = 4.2 Kgcm

4.2 Wireless camera

A camerais a device used to capture images, either as still photographs or as sequences of moving images (movies or videos). The term comes from the Latin camera obscura for "dark chamber" for an early mechanism of projecting images where an entire room functioned as a real-time imaging system; the modern camera evolved from the camera obscura. Cameras may work with the light of the visible spectrum or with other portions of the electromagnetic spectrum. A camera generally consists of an enclosed hollow with an opening (aperture) at one end for light to enter, and a recording or viewing surface for capturing the light at the other end. Most cameras have a lens positioned in front of the camera's opening to gather the incoming light and focus all or part of the image on the recording surface. The diameter of the aperture is often controlled by a diaphragm mechanism, but some cameras have a fixed-size aperture as mentioned by V Venmathi et al [5].

4.3 Lead screw

A leadscrew (or lead screw), also known as a power screw or translation screw, is a screw designed to translate turningmotion into linearmotion. Common applications are Linearactuators, machine slides, vises, presses, and jacks. Leadscrews are manufactured in the same way as other threadforms. A lead screwcan be used in conjunction with a splitnut. A leadscrew nut and screw mate with rubbing surfaces, and consequently they have a relatively high friction and stiction compared to mechanical parts which mate with rolling surfaces and bearings. Leadscrew efficiency is typically between 25 and 70%, with higher pitch screws tending to be more efficient. A higher performing but more expensive alternative is the ballscrew.

4.3.1 Advantages of Lead Screw

The following are advantages of a leadscrew

- Large load carrying capability
- Compact and simple to design
- Easy to manufacture; no specialized machinery is required
- Large mechanical advantage
- Precise and accurate linear motion
- Smooth, quiet, and low maintenance
- Minimal number of parts
- Most are self-locking

4.4 Worm gear

A worm gear is type of mechanicalgear. Worm gearsare used when large gear reductions are needed. It is common for worm gears to have reductions of 20:1, and even up to 300:1 or greater.Many worm gears have an interesting property that no other gear set has: the worm can easily turn the gear, but the gear cannot turn the worm. This is because the angle on the worm is so shallow that when the gear tries to spin it, the friction between the gear and the worm holds the worm in place. Very interesting usage of worm gears is in the Torsen differential, which is used on some high-performance cars and trucks. A gear consisting of a spirally threaded shaft and a wheel with marginal teeth that meshes into it. The toothed wheel of this gear is called a worm wheel. Compact structure saves mounting space.

4.4.1 Advantages of worm gear

The advantages of worm gear are

- Highly accurate.
- Runs forward and backward.
- High overload capacity and stable transmission with reduced vibration and noise.

4.5 Gas sensor

In current technology scenario, monitoring of gases produced is very important. From home appliances such as air conditioners to electric chimneys and safety systems at industries monitoring of gases is very crucial. Gas sensors are very important part of such systems. Small like a nose, gas sensors spontaneously react to the gas present, thus keeping the system updated about any alterations that occur in the concentration of molecules at gaseous state.

4.6 Microcontroller

Present industry is increasingly shifting towards automation. Two principle components of today's industrial automations are programmable controllers and robots. In order to aid the tedious work and to serve the mankind, today there is a general tendency to develop an intelligent operation.

The proposed system "PC based child rescue system from bore well" is designed and developed to accomplish the various tasks in an adverse environment of an industry. The intelligent using Pic microcontroller, GSM modem. This project is an own to the technical advancement. This prototype system can be applied effectively and efficiently in an expanded dimension to fit for the requirement of industrial, research and commercial applications.

Fig. 3 PIC microcontroller

Microcontroller as shown in Fig.3 is the heart of the device which handles all the sub devices connected across it. We have used as microcontroller. It has flash type reprogrammable memory. It has some peripheral devices to play this project perform. It also provides sufficient power to inbuilt peripheral devices. We need not give individually to all devices. The peripheral devices also activate as low power operation mode as mentioned by Venmathi et al [5].

4.6.1 Advantages of microcontroller:

The advantages of microcontroller are

- Microcontrollers are cheap and very small in size; therefore they can be embedded on any device.
- Programming of Microcontrollers is simple to learn. It's not much complicated.
- We can use simulators on Computers to see the practical results of our program. Thus, we can work on an Embedded project without even buying the required Components and Chips. Thus, we can virtually see the working of our project or program.

4.7 LCD

Liquid crystal displays (LCDs) have materials which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal.

An LCD consists of two glass panels, with the liquid crystal material sand witched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed polymeric layers are present in between the electrodes and the liquid crystal, which makes the liquid crystal molecules to maintain a defined orientation angle

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4.8 Crystalonics Display

Crystalonics dot matrix (alphanumeric) liquid crystal displays are available in TN, STN types, with or without backlight. The use of C-MOS LCD controller and driver ICs result in low power consumption. These modules can be interfaced with a 4-bit or 8-bit microprocessor /Micro controller.

5. Fabrication details

The below Fig.4 shows the 3-D CAD geometry of the project having all required components in it. The 3-D view of the project gives an appropriate idea to fabricate the real model with more idea and less waste material.

This CAD model was designed by using exact dimensions of every components which helped in defining their properties and behavior to the different load conditions while simulation. Fig.4 shows 3-D Model of PC Based Child Rescue System from Bore-Well.

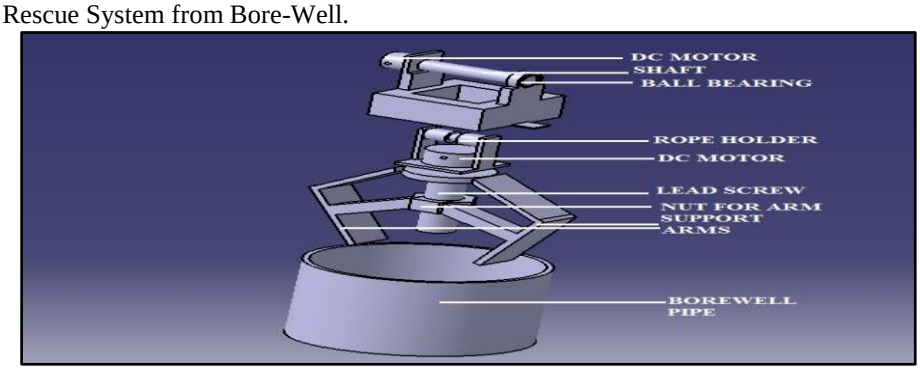

Fig.4 model of PC based child rescue system

5.1 Assembled model

The Fig. 5shows the assembled model of proposed system from different views.

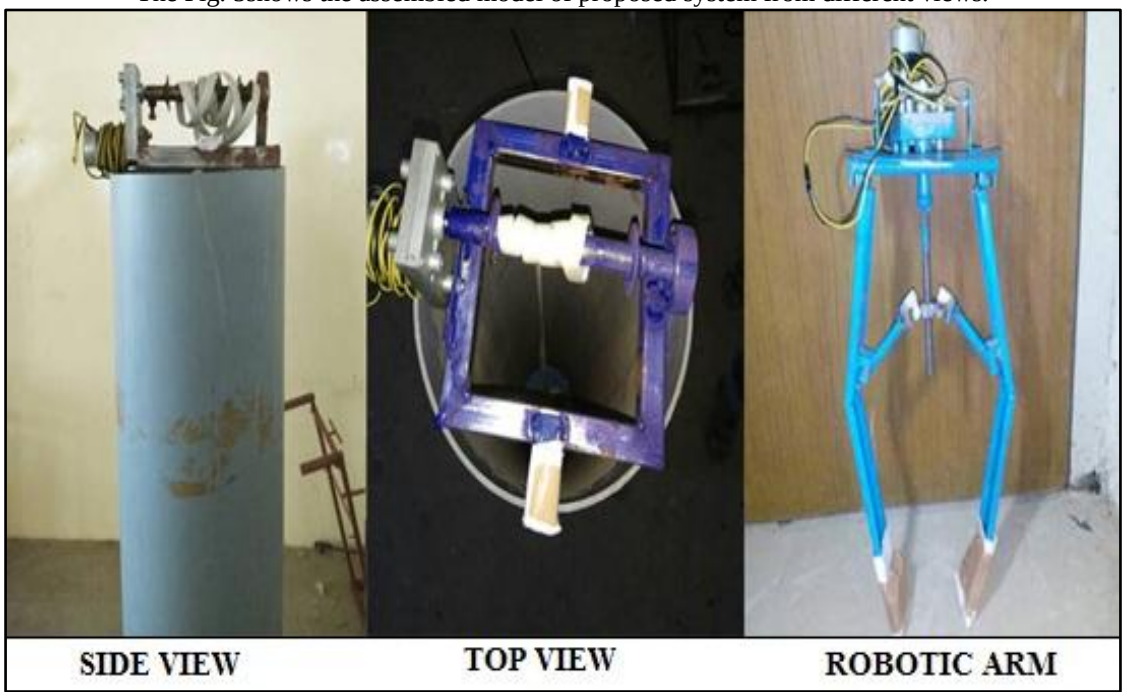

Fig. 5 the different views of assembled model

6. Advantage disadvantage and applications

The advantages, disadvantages, applications and future scope of this proposed model are:

6.1 Advantages

The advantages are as follows:

- Easy to operate and carry.
- Easy to rescue.
- Slow and safety operation.
- Tension free equipment.
- Can observe the position of the child.
- Process cost is minimum.
- Can reduce man power.
- Can reduce operation time.

6.2 Disadvantages

The disadvantages are as follows:

- To need electric power.
- High cost.
- Skilled operator is required.
- Can be dangerous some times.

6.3 Applications

- Can implement for large industries.
- Used in fire service.
- Used in industries for store hazard material under the ground.

7.Conclusion

Human life is precious. Our bore well child recue system is a significant attempt to save the life of the victim of bore well accidents. Besides this, the unique capability of climbing through vertical and inclined pipes

makes wide scope of application for this machine in manufacturing industries and other relevant fields. In the current design of bore well child saver machine has been made to suit every possible situation may occur in rescuing operation. We like to conclude with the help our project, we able to rescue without any damage.

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