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REAL TIME IMPLEMENTATION OF BOREWELL RESCUE SYSTEM USING ARDUINO

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Abstract— This paper proposes a system for rescuing victims of bore well accidents. The proposed system is light in weight compared to existing methods, portable easy to handle and requires lesser manpower. The system design comprises of a four leg metal stand which supports the whole mechanical assemble the stand is of low weight therefore it is easy to transport it does not requires any heavy duty cranes. This stand has a round housing which holds the DC gear motor which controls the up and down motion of a robotic arm as the arm is connected to the motors shaft with pulley through a rope or heavy duty steel cable. The robotic arm has four mechanically operated fingers which can be opened or closed using a dc motor placed on the arm itself this motor controls the arm by tightening the cables which runs over the four finger joints just like a human arm. The two motors are controlled by an Arduino based remote control module containing buttons and toggle switch with the help of this module easy control of the system is achieved. In addition to this an ultrasonic sensor and a digital camera was also incorporated to predict the victim's location. In order to determine the feasibility of the system a prototype was designed and fabricated. The prototype consists of all mechanical and electronics setup as discussed above but in a miniature version. The prototype has a control module which consists of LCD display, motor driver IC, arduino microcontroller, control switches, buttons and power supply unit. This is the main electronics unit which controls and coordinates the whole systems operation.

Keywords— bore well, DC motor, arduino, LCD, camera

I. INTRODUCTION

Water is an essential ingredient for life to sustain. In modern times due to climate changes and other environmental problems there has been an scarcity for water for both agricultural and domestic using due to this problem many bore wells are being bored to face our daily needs but some of this wells becomes useless as the ground water level goes below accessible depth so this wells become abandoned and some of them are left open due to ignorance and carelessness. These open wells have become a death trap for children as they fall into these wells accidentally while playing nearby it. These accidents have become common in our country especially in the Sothern states. The emergency response team struggles a lot to rescue the victims of this kind of unexpected accidents and also it takes several hours with huge manpower to rescue the kids. This rescue operation has only 40 percentages as the survival of the kid is uncertain in such harsh environment. In order to overcome these complications, we have designed a child rescue system with advanced equipment's like, an ultrasonic sensor which give the exact depth measurement of the child's location inside the well, and a camera to see what's happening down there. We have deigned our project in such a way that it is compact in size, requires less power, low cost and easy to operate. The whole system can we operated by a single individual and the mechanical child grabbing system can be set to full operation in minutes and it does not require any heavy duty transportation vehicle. Our project mainly consist

of two section an electronic control section and a mechanical section comprising of an mechanical arm and a support structure for lowering the arm into the well the motion of the arm is controlled by the arduino based control panel two dc motor are used for this purpose by turning on the motors in reverse and forward motion the desired motion is achieved this makes it easy to operate. The whole system communicates through wire so there is no risk of loss of communication and malfunction.

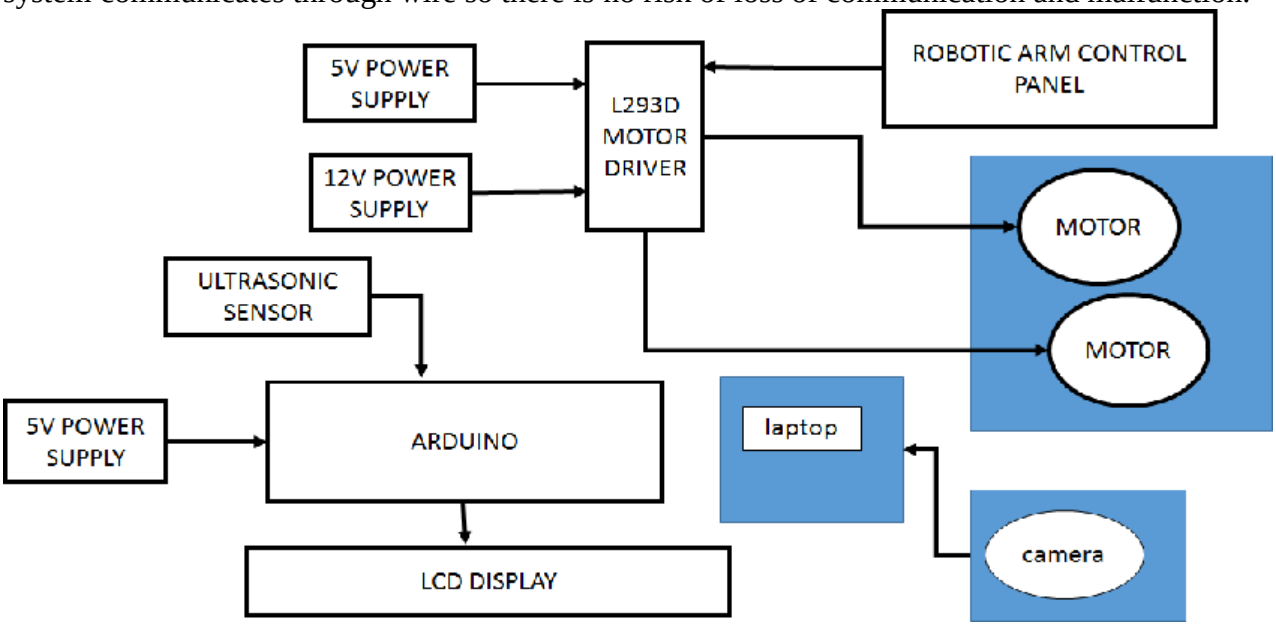

Fig 1 Block diagram for the bore well rescue system

1.1 OBJECTIVE

- To design and fabricate a robotic mechanical arm.
- To implement ultrasonic sensor based distance measurement equipment to measure child location depth.
- Also to implement robotic arm control through motors using Arduino controller

II. HARDWARE IMPLEMENTATION

2.1. POWER SUPPLY

Power supply is very important factor for an electronics based system to operate. Most electronics operates at a voltage of 5 volts DC but the commonly available voltage level is 230V A.C. A power supply circuit consists of various block and they are

- **Step down transformer** – used to reduce the high voltage to low voltage
- **Rectifier circuit** _ used to convert AC to DC
- **Filter Capacitor** _to Get a clean DC output

2.2. DIODE BRIDGE RECTIFIER

A diode bridge rectifier circuit consists of four diodes arranged in a specific manner to allow only positive half cycle of a sine wave. The output is pulsating in nature so in order to smooth it out a smooth capacitor filter is used. A typical rectifier circuit is shown below

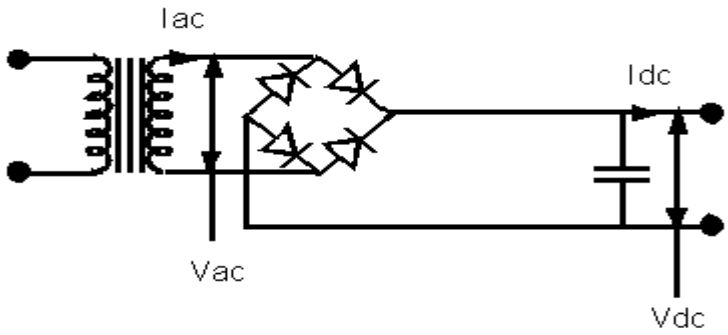

Figure 2 Bridge Rectifier

The output dc voltage is higher than the input because the input voltage is an RMS voltage but the peak of the input is the voltage stored in the capacitor as it can charge quickly and discharge a bit slower.

2.3. ARDUINO CONTROLLER

Arduino is an open-source development board based on Atmel's AT mega 328p microcontroller. Arduino board comes with a free of cost software called the arduino IDE (Integrated Development Environment) this combo aids students and developing engineers to learn embedded programming. Due its small size and easy programmability arduino has gained a huge interest all over the world. And also the arduino does not need any additional hardware or programmer as it has a on board programmer which can be used directly from any PC or laptops through an USB cable which makes a preferable choice among students for developing electronics projects which needs a microcontroller.

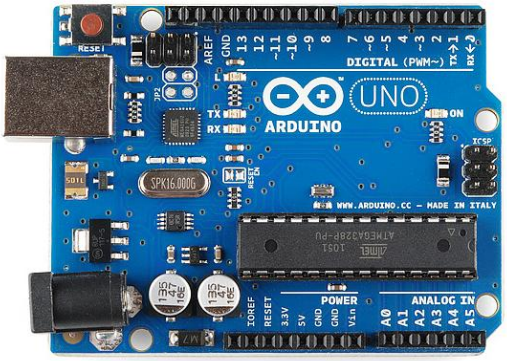

Figure 3 Arduino Uno

Arduino is available in a wide range of variants but the most popular one is the Arduino UNO**.** This board consists of ATmega328p microcontroller which comes in a 28 pin IC package. Arduino Uno has 14 digital I/O pins some of them can also be used as a PWM this pins are denoted by a (~) symbol, 6 analog pins and some power outs.

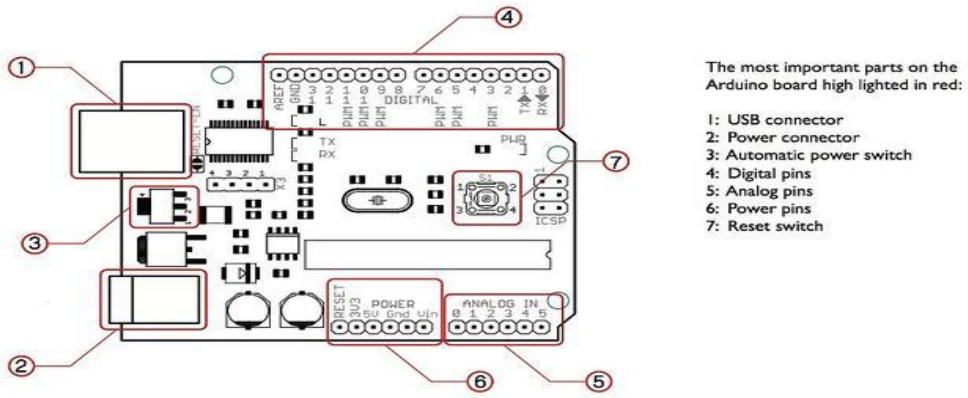

Figure 4 Arduino Pin Diagram

In order to work with arduino it needs to be powered. Arduino can be powered in two ways 1.by using a external power source 2.by using the USB programming port itself.the operating voltage lies in between 7 to 12v DC

2.4. HC-SR04 ULTRASONIC DISTANCE SENSOR

HC-SR04 Ultrasonic Distance Sensor is a popular sensor for non-contact distance measurement it is cheap compared to other modules. This module can be used to measure distances ranging from 4cm to 400cmwith good accuracy. This module consists of an ultrasonic transmitter and receiver along with all necessary circuits.

Figure 5 HC - SR04 Ultrasonic Distance Sensor

HC-SR04 module has 4 pins:

VDD – 5V, +ive of the power supply
TRIG – Trigger Pin
ECHO – Echo Pin
GND – (-) ive of the power supply

TRIG and ECHO pins are the outputs which can be interfaced with any microcontroller especially arduino as it is arduino compatible.

2.5. HC-SR04 ULTRASONIC MODULE WORKING

Ultrasonic sensors uses sound as a parameter to measure distance. By measuring the time taken by the sound wave to return after reflected from an obstacle in proportional to the distance if the speed of sound is known this is the fundamental phenomenon used by an ultrasonic sensor. The HC-SR04 module has four pins namely echo, trigger, power and ground the power and ground pins are used to provide the operating voltage to the module

2.5.1 Mode of operation

- When the trigger pin of the module is pulled high it automatically sends a ultrasonic sound wave at a frequency of 40 kHz.
- The sound wave will travel trough the air if there are any obstacles in its path then the sound wave will get reflected.
- The reflected sound wave is then detected by the receiver this produces pulse output through the echo pin. The width of the pulse corresponds to the time taken for the sound wave to hit obstacle and return back. This time is used for distance measurement

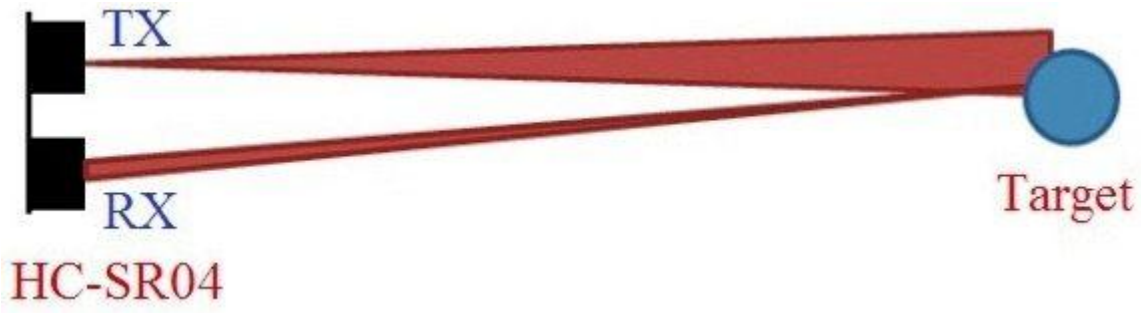

Figure 6 HC-SR04 Ultrasonic Sensor operation

2.6. GEAR MOTOR

"Gear motor" is combination of a motor and a gear train set. The gear assemble in the gear train can be manufactured in such a way that it reduces the speed of the motor but increasing the torque. The gear motor used in this project has a speed ratio of 100:1.this ration can be got by using a set of sequentially arranged gear sets present inside the gear train. In our project we have used a 12 v 30 RPM DC gear motor for the robotic arm operation.

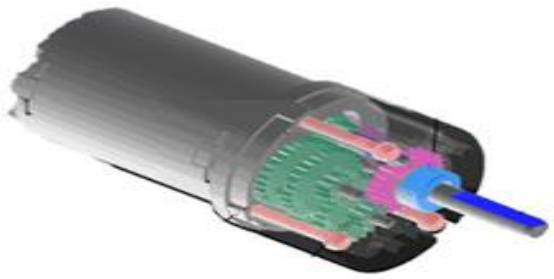

Figure 7 12V DC Gear Motor

Gearing is helpful when a high torque is required mainly for rotor application it can to manage the right balance of speed and torque. They are able to convert a high speed, low torque motor (such as an electric DC motor) into a low speed, high torque output (or vice versa).

2.7. DC MOTOR DRIVER IC

For the up and down motion of the arm and open close motion of the arm fingers we have used a mechanical arrangement that converts the rotation direction of motor in to equivalent motion. For this purpose we have used a motor driver IC named L293D.

L293D is a Motor Driver IC which allows DC motor to drive on either clockwise or antic clock wise direction. L293D comes in 16 pin IC configuration with two sets of on chip H-bridge dc motor controllers this gives it the name Dual H-bridge Motor Driver integrated circuit (IC).

2.8. WORKING OF L293D

It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction. As you know voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction, hence H-bridge IC are ideal for driving a DC motor.

2.8.1. Truth table

Table 1

There are two Enable pins on l293d. Pin 1 and pin 9, for being able to drive the motor, the pin 1 and 9 need to be high. For driving the motor with left H-bridge you need to enable pin 1 to high. And for

Pin no 2	Pin no 7	operation
1	0	Clockwise direction
0	1	Anticlockwise direction
0	0	ideal
1	1	ideal

right H-Bridge you need to make the pin 9 to high. If anyone of the either pin1 or pin9 goes low then the motor in the corresponding section will suspend working. It's like a switch you can simply connect the pin16 VCC (5v) to pin 1 and pin 9 to make them high.

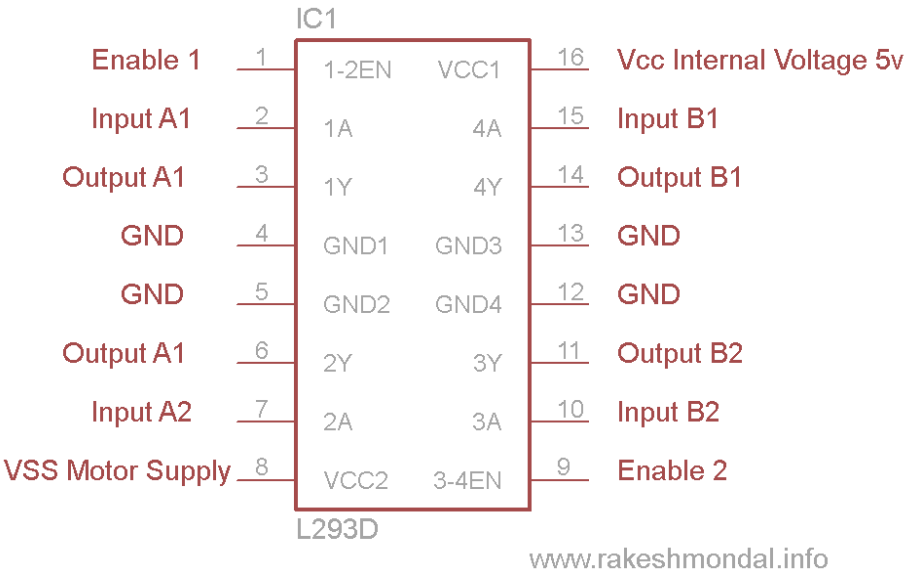

Figure 8 L293D Pin Diagram

There are 4 input pins for l293d, pin 2, 7 on the left and pin 15, 10 on the right as shown on the pin diagram. Left input pins will regulate the rotation of motor connected across left side and right input for motor on the right hand side. The motors are rotated on the basis of the inputs provided across the input pins as LOGIC 0 or LOGIC 1.In simple you need to provide Logic 0 or 1 across the input pins for rotating the motor.

2.9 DIGITAL WEB CAMERA

A webcam is an electronic device which can stream its image in real time to any device through any medium. When sent to a remote location, the video stream may be saved, viewed or on sent there. Unlike an IP camera (which connects using Ethernet or Wi-Fi), a webcam is generally connected by a USB cable, or similar cable, or built into computer hardware, such as laptops.

The term "webcam" (a clipped compound) may also be used in its original sense of a video camera connected to the Web continuously for an indefinite time, rather than for a particular session, generally supplying a view for anyone who visits its web page over the Internet. Some of them, for example, those used as online traffic cameras, are expensive, rugged professional video cameras.

Figure 10 Web camera

2.10. WORKING OF A DIGITAL VIDEO CAMERA

Just like analog video cameras, digital video cameras can be operated with the basic controls record, play, pause, rewind and forward. Most digital video cameras are smaller than analog video cameras which make handling them easier. The fuss of installing film in the video camera has been eliminated. In using a digital video camera, all you need is to power it on and push the record button. You can also preview your captured video images without processing any kind of film or media storage. If you don't like what you see, you can immediately re-capture the video images of your subject again on the spot.

III. METHODOLOGY

The mechanical support structure with four legs in first placed over the bore well opening. This support structure has a motor fixed on it with pulley assembly then the robotic arm setup is tied up to a cable or rope with desired length and is then coupled to the pulley of the up down motion control motor this is the initial step. Now the system is ready for rescue. When the power in turned on the equipment present in the arm turns on along with this a high brightness LED is also placed in it for illumination purpose now the depth of the victims location is displayed on the control panel and the video is seen in a laptop monitor. By operating the appropriate buttons on the control panel the arm is lowered into the well as it move deeper and deeper the depth on the LCD screen decreases and as the arm reaches the victim the value becomes zero indicating that the arm has reached victim. Now the robotic arm which I already in open position is closed in order to grab the victim. We can take decisions based on the video feed. Then arm is slowly pulled up and finally the child gets rescued. And The medical team who are kept in standby will be able to give first aid and to prepare for the treatment depending on the victims medical conditions. When the robot is pulled out, the rope is cut off. The robot is taken outside carefully from the stand. The arms are opened by the control panel and the victim is taken for treatment.

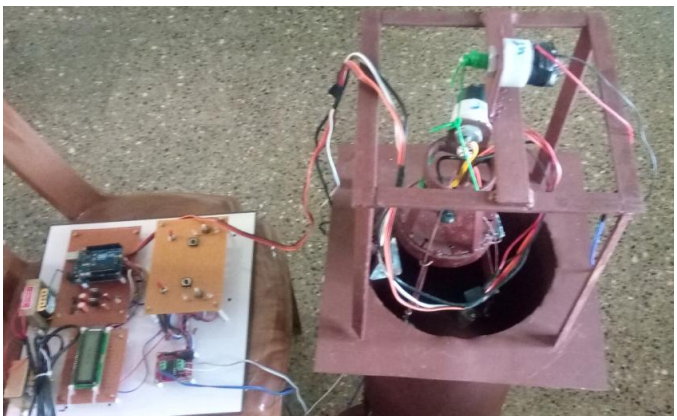

Figure 11. Hardware assembly of the rescue system

IV. CONCLUSION

Thus a bore well recue system was proposed and the prototype of the system was implemented and tested. From the result it is proven that this system can be implemented in this kind of crucial rescue operation. Current design of bore well child rescue system has been made to suit every type of possible situation. The structure is made strong enough to sustain all possible loads, though it is made flexible to wider range of bore diameter. By using the proposed concept the tidies job of bore well child rescue is made little bit easier as this system will take less time than other methods the rescue can be accomplished in few hours. We have further planned to incorporate an oxygen supply system.

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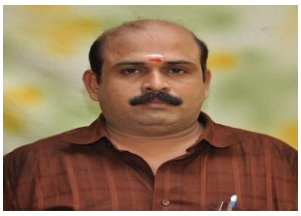

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