

Deep Well Robotics Manipulator

S.Parthasarathy¹, C.F.Theresa Cenate², R. Alarmelumangai³, M.Dhakshina Moorthy⁴

^{1,2,4} New Prince Shri Bhavani College of Engineering and Technology, Chennai, India.

³New Prince Shri Bhavani Arts and Science College, Chennai, India.

E-mail: spsarathy_au@yahoo.co.in

Abstract

The headways in innovation with the advancement of latest highlights in the sensors have converted the field of computerization to get exceptional regarding human solace and wellbeing. The proposed framework is a way to deal with salvage of the youngster caught in the bore well, utilizing the flex sensor and the Micro electromechanical system accelerometer which actually control the mechanical arm as indicated by the hand motions created by the individual engaged with salvage activity. The MEGA Arduino is the regulator part that control the various tasks. To screen the youngster, a TV screen and remote camera is utilized. To monitor the kids, a special LED is utilized. The automated arm alongside the remote camera sending part is made to enter into the bore hole and recognize the situation of the youngster and afterwards salvage him. There is nill man-made brainpower or PC helped saving, yet it is controlled completely by human knowledge to ensure that the salvage activity happens in least measure of time. Reproduction results are likewise appeared in Proteus 7 reenactment programming.

Keywords: Deep well, Robotics Manipulator, Flex sensor, MEMS.

1. Introduction

The fundamental target of the paper is to recover a child which fell into a bore hole which is in open condition. 2 mechanical arms were utilized to grasp the caught kid, where these 2 arms are activated consequently by the developments incorporated by the individual associated with salvage activity, utilizing Flex sensor, Micro electromechanical system through the ARDUINO MEGA. Despite the fact that the model is analogous to that of the various available frameworks [1-5], the effective method of operating the arms is the main component here. The mechanical arms is constrained by the human arm developments with no automated mediation will limit the time taken to play out the salvage activity. Thinking about the cost, the model is intended to function visual observing and carrying activities just, however can be upgraded by including extra highlights like the temperature detector sensor, moistness detector sensors and numerous other valuable detector sensors for observation moreover. The circuit is simulated in Proteus 7 software and the working of the motors in the robotic arm and the motor in the pulley mechanism are shown.

2. Block Diagram Description

The block diagram implemented in this paper is shown in Fig.1.

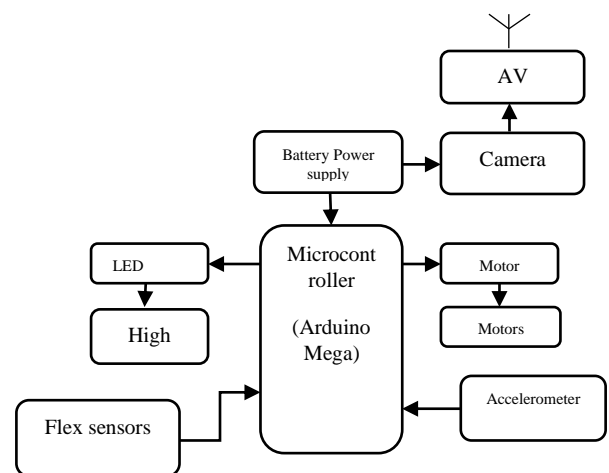


Fig. 1. Lay out of Proposed system

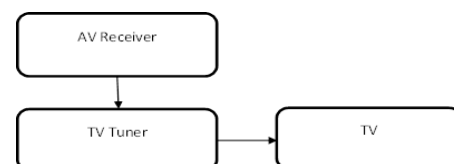


Fig. 2. Lay out of Camera Receiver Unit

The input and output pins of ARDUINO MEGA is 54. There are 2 Micro electromechanical system accelerometers and 2 flex sensors in the framework. These detectable sensors are joined to a couple of gloves. The signs detected by these

detectable sensors are perused by the Analog to digital channels of the ARDUINO. L293D H-connect drivers were utilized to operate the 12 V Direct Current [6] engines in the framework. The remote cameras will catch the situation of the kid in VGA goal and hereby communicate the signs to the beneficiary element. The beneficiary element is associated with a Liquid Crystal Display screen by which the situation of the youngster can be observed and can be saved effectively.

3. Circuit Diagram Description

There are 54 simple I/O pins in the Arduino advancement board. The associations of the info and the yield gadgets to the Arduino MEGA are appeared in the circuit chart. The two flex sensors are associated with the ADC channels 0 and 1 of the ATMEGA 2560 small scale regulator through the simple I/O pins 0 and 1 of the Arduino. The three simple signs from a MEMS accelerometer sensor is perused by the ADC channels 2, 3 and 4 separately through the I/O pins 2, 3 and 4 of the Arduino. Also the other three signs from different MEMS sensor is perused by the ADC channel 5, 6 and 7 through the I/O pins 5, 6 and 7 of the Arduino. The four engines are associated with four successive PWM pins of the Arduino board. A 12V DC power gracefully is associated with the force jack of the Arduino.

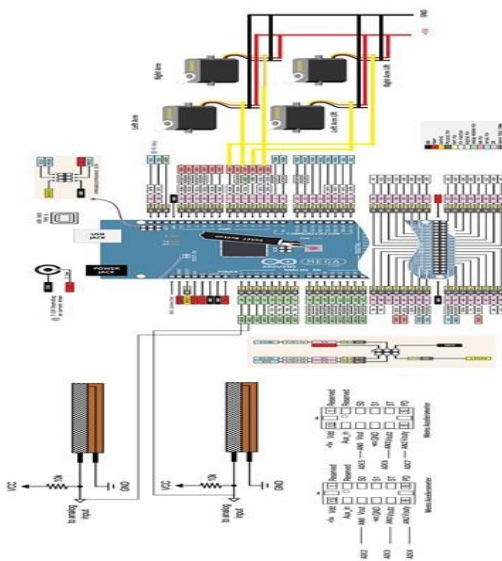


Fig. 3. Circuit Diagram

4. Hardware Description

4.1 Arduino Mega

The microcontroller board, Arduino Mega 2560, has 54 computerized pins, simple data sources of 16, UARTs of 4, a gem oscillator with 16 MHz, a Universal serial bus port, an ICSP header, a reset button and a jack.

4.2 Flex Sensors

Flex sensor is one that adjust in opposition based upon the measure of twisting in the sensor. They make the adjustment in twist converted to electrical opposition. They are

ordinarily as a dainty strip from 1" to 5" long that shift in obstruction. They can be made uni-directional or bidirectional. Flex sensor utilized here is 2.2" flex sensor. Flex are basic resistors. They function as a simple voltage dividers. Inside the flex sensors presents a carbon resistive components with a adaptable substrate. More carbon implies less obstruction. At the point when the substrate is twist the sensor delivers an opposition yield comparative with the twist span.

4.3 Micro electromechanical system Accelerometer

The ADXL345 is somewhat, thin, low power, 3-center point accelerometer with significant standard assessment at up to 16g. It checks the static accelerating of gravity of tilt-identifying applications, similarly as ground-breaking stimulating coming about in view of development or paralyze. Its significant standard (4 mg/LSB) engages assessment of propensity changes under 1.0°. Development and dormancy identifying perceive the proximity or nonattendance of development and if the reviving on any center point outperforms a customer set level.

4.4 DC Gear Motor

An electric motor is a machine which changes over electrical imperativeness into mechanical vitality. Outfitted DC motors can be portrayed as an enlargement of DC motor. An equipped Direct Current Motor[7,8] has a mechanical assembly assembling associated with the motor. The rpm of motor is incorporated similarly as turns of the rotor each second and is named as rpm. The gear get together associates in extending the power and diminishing the speed. Utilising the exact mix of apparatuses in a contraption motor, its rpm can be lessened to any charming figure. This thought where apparatuses reduce the speed of the vehicle yet increase its power is known as mechanical assembly decline.

4.5 Drive IC of Motor

L293D is a common driver of motor which grants to drive DC motor on either heading. L293D, a 16-pin IC which can activate 2 DC motors simultaneously toward any way. It suggests that you can activate 2 DC motor with a single L293D IC. It manages the possibility of H-associate.

4.6 Wireless Camera

Remote camera are circuit TV camera which communicates video sign and sound signs to a remote beneficiary of a radio frequency. Numerous remote cameras require at any rate one wire or link for power. Anyway some remote cameras are battery fueled, making the cameras remote start to finish. The sending part of the remote framework has a camera which encapsulates a communicating. The camera can record sound just as video all the while which are changed over to radio signals and are communicated to the recipient area. The recipient area has a radio collector that will get the signs from the transmitter. The transmitter is then associated with a TV however the sound and the video jack.

4.7 Television

TV is media transmission medium utilized for sending sound and moving pictures in monochrome(black and white) or in shading and in two measurement or three measurement. TV is a mass mechanism for diversion, instruction, news and publicizing. At first the signs were communicated as simple

signs, however then nations began changing to advanced signs. In the proposed frame work a video screen is utilized as a visual showcase unit. So as to get and interpret the signs from the remote camera's recipient, a different TV tuner is used.

4.8 Light emitting diode

A light-emitting diode (LED) is a well-lit source made of semiconductor. When a well-lit releasing pn diode is turned on, electrons re-join with the holes present inside the device, emerging as photo particles. This phenomena is specified as electro-luminescence in which the shadow of the light is forwarded by the property of the semiconductor. LEDs present various central attentions over shining bright bases including less imperativeness use, improved force, higher life, tinier size, and speedier response.

4.9 Robotic Arm

The automated arm utilized in the proposed framework has a 4 level of opportunity (D.O.F). There are four 100 rpm DC gear engines in the automated hand arrangement. Two engines are for controlling the broadening and shutting of the two arms in its lower leg joint, which are constrained by the MEMS sensors. The other two engines are controlling the opening and shutting of the holding part in the mechanical arm, which are constrained by the Flex sensors.

5. Software Description

The Arduino IDE is a Java written cross-stage application which is received from the IDE made for the programming processing language and the adventure wiring. It is de-set apart to familiarize specialists programming and various new coding developers to software improvement. It joins a program director with features, for instance, language structure including, uphold organizing, and customized space and furthermore prepared for requesting and moving tasks through the board with a single shot. There is routinely no convincing motivation to modify or execute programs on the request line. The Arduino IDE goes with, Wiring, which is in C/C++ library, that makes various essential data or yield undertakings much low complex. Arduino programs are entered in C/C++, in other of the way that customers simply need to describe 2 limits in order to make a executable program: `plan ()` the limit execute once close to the beginning of the program which can be used for instating settings, and `circle ()` the limit called reliably until the board is energized. The Arduino IDE uses the GNU mechanical assembly chain and AVR Libc to accumulate activities, and utilizations `avrduide` to move ventures to the board. The language used for programming in the Arduino IDE is introduced C. Proteus is a champion among other generation programming anticipates for various structures with scaled down scale controller. It is basically well known because of openness of for all intents and purposes all little scope controllers in it. So it is useful gadget test programs and embedded structures for electronic master. The program formed for a little scope controller can be re-established in Proteus.

6. Working of Deep Well Robotic Manipulator

Once the child has found to be caught into the bore hole, the people must immediately inform the concerned authorities, instead of trying to solve the problem by themselves and making the conditions even more worse. It is to be noted that when more people gather around the locality, then there will be more chance for sand and stones to slide into the hole and affect the child. So it is always better to keep the surrounding crowd free and silent allow more air to enter into the hole so that child may not suffer from lack of oxygen and over heat. Once the concerned authorities have reached the site, the person who is going to involve in the rescue operation must prepare himself for the task. Meanwhile the equipment is to be placed above the bore hole in a position that would be comfortable for the rescue person. The fundamental target is to protect a kid caught in profound bore wells. The proposed system incorporates an Arduino development board that has the ATMEGA Micro controller, Micro electromechanical system accelerometer, Flex sensors, pulley instrument and Direct current gear motors. Out of the 2 glove is used, one has flex sensor and other one has Micro electromechanical system accelerometer. The proposed structure has four Degree Of Freedom (D.O.F) of the arm. The robotized activated arms are affixed to a packaging, which will grasp the arms in position. The improvement of the mechanical arm is spoken to by the finger cum wrist signals created by the individual holding that gloves. To have the computerized wrist to go into the deep hole and to carry it up with the youth, a Direct Current motor with pulley instrument was used. There presents sixteen basic data sources connection in the MEGA ARDUINO board. Each Micro electromechanical system accelerometer will identify the assortments in three turn, so 3 signs lines will flow from 1 sensor to introductory three consistent Analog to Digital Converter channels of the MEGA Arduino. Basically another 3 signs from various Micro electromechanical system sensor will flow to the following 3 successive Analog to Digital Converter coordinates of the board. Every flex sensor will have 1 sign line that always pass on the sign at whatever point the flex sensor practices a curving control on it. Those signs have to be scrutinized by the Analog to Digital Converter coordinates of the Arduino board, through the data yield ports. At whatever point the individual working the glove turns his wrists, the Micro electromechanical system sensor will distinguish the difference toward the X, Y and the Z center. By and by this difference toward the path will create a modification in voltage of the sensor yield. The Analog to Digital Converter in MEGA ARDUINO has ten piece objective. Hence the recognized voltage of the sensor has to be changed over to cutting edge characteristics. Directly according to the program feeded into the ARDUINO controller, hence will be a looking at difference in the lower leg connection motor of the mechanized arms and will make the arms to expand or to become shut. By then at whatever point the individual turns his hand, the flex sensor will practice a bowing strength and in this manner there will be a difference in its resistance, that will be identified and will

make the gripper in the mechanical arm to either open or close. Right if the flex sensor is contorted, the gripper of the mechanical arm will begin shut, and when the flex sensor straightened, the gripper will maintain the open condition. The whole arm arrangement is made to enter into the borehole through a rolling strategy which is compelled by a Direct current motor worked by a catch framework. Far off cameras having infra red lights and moreover power light emitting diode are joined with the packaging owning the arms, so it will be probable to see the child's location and position evidently. All these incidents are seen by a liquid crystal monitor screen through which the far off camera's beneficiary element is related. At this point where the correct circumstance for the youth has been recognized, by then the individual related with the rescue movement can see it in the screen and a while later can proceed with grasping the child and subsequently raised it up. At the point when the child has been raised successfully, the gathering should not be allowed to make alert again. The crisis vehicle and all clinical guide workplaces should be kept arranged to guarantee that the kid is kept lively till it shows up at the facility and gets authentic medication. The reproduction is finished utilizing the Proteus 7 programming.

7. Result

7.1 Implementation

There are various other models and existing system for the rescue of the child from the bore hole. But the proposed system uses the human aided control of the rescue system, which is controlled by the gestures made by the human arms.

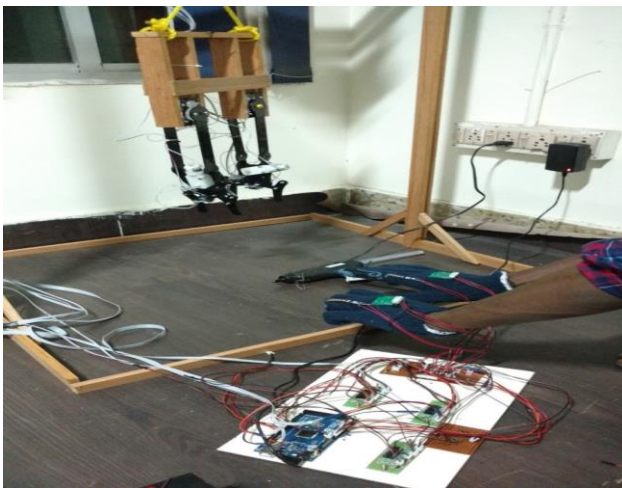


Fig. 4 Demonstration using Prototype

7.2 Simulation Result

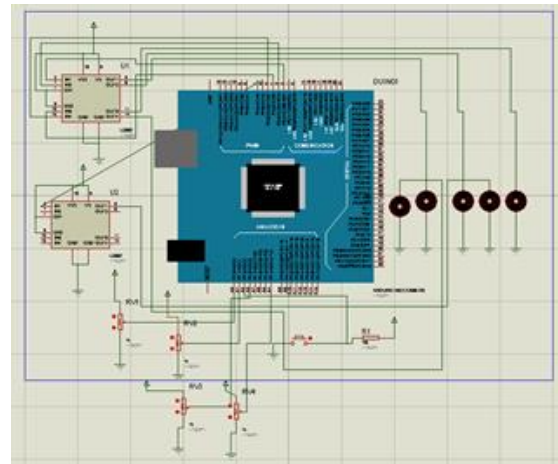


Fig. 5 Simulation Result

The simulation is done using the Proteus 7.0 software. The sensors and the controlling motors are joined to the analog input-output pins of the Arduino MEGA.

8. Conclusion

The developed system has an advanced board of Arduino that has the Micro controller of ATMEGA 2560, Flex sensors, Micro electromechanical system accelerometer, a pair of robotic arms and pulley mechanism. The movement of the robotic arm in the proposed system is controlled by the gestures done by the person having the controlling glove. To go in into the bore well and to raise up with the child, the robotic hand, a direct current motors with rolling mechanism was employed. The robot gripper's opening and closing operation is controlled by the bending and releasing of the flex sensor and the closing and widening of the entire arm set up is individually controlled by the movements made in the MEMS attached to the gloves. Further in future, changes are to be done in the robotic hand model with even more suitable mechanical grippers increased degree of freedom that will grab the child in whatever position it may be.

References

- [1] Sriramireddy K.1, D, Satyanarayana and Ravikumar Mandava, An Investigation on Bore-well Rescue Robot–Present Devices and Techniques, International Journal on Emerging Technologies,2020, 11(1), 358-363.
- [2] Peter Racioppo, Pinhas Ben-Tzv, Design and Control of a Cable-Driven Articulated Modular Snake Robot, IEEE/ASME Transactions On Mechatronics, 2019, 24 (3), 893 – 901.

- [3] Aashvij Shenai, Abhijeet Antin, R Pallvai and Dawnee Soman, Development of In-Pipe Robot for Assisting Borewell Rescue Operations, 3rd International Conference on Circuits, Control, Communication and Computing , 2018, DOI: 10.1109/CIMCA.2018.8739674.
- [4] SinguruRajesh, GaminiSuresh and R.Chandra Mohan, Design and development of multi-purpose prosthetic bore well system- an invincible arm, 2017, Materials-today-proceedings, 4 (8), 8983-8992.
- [5] Shivam Bajpai, Abhinav Singh, Ravi Shankar Rai, Ashwani Sharma and C.K. Jha, Design and Fabrication of Bore Well Rescue Robot, International Journal of Engineering Science and Computing, 2017, 7 (5), 12182.
- [6] S.Parthasarathy, P.Neelamegam and P.Thilakan, Power performance characterization of multi-crystalline silicon solar cells and its module at outdoor exposure 2017 International Journal of Green Energy 14 (1) 9-14.
- [7] S.Parthasarathy, P.Neelamegam and P.Thilakan, Outdoor Performance Characterization Of Multi-crystalline Silicon Solar Module 2012 Journal of Applied Sciences 12 (18) 1953-1959.
- [8] S.Parthasarathy, P.Thilakan, P.Neelamegam and R.N.Srinath, Studies on the assembly induced performance losses in multi-crystalline silicon solar PV module 2011 European journal of scientific research 62 (2) 248-256.
- [9] Dr.G.Suresh, Dr.A.Senthil Kumar, Dr.S.Lekashri, Dr.R.Manikandan. (2021). Efficient Crop Yield Recommendation System Using Machine Learning For Digital Farming. International Journal of Modern Agriculture, 10(01), 906 - 914. Retrieved from <http://www.modern-journals.com/index.php/ijma/article/view/688>
- [10] Dr. R. Manikandan, Dr Senthilkumar A. Dr Lekashri S. Abhay Chaturvedi. "Data Traffic Trust Model for Clustered Wireless Sensor Network." INFORMATION TECHNOLOGY IN INDUSTRY 9.1 (2021): 1225–1229. Print.
- [11] Dr.A.Senthil Kumar, Dr.G.Suresh, Dr.S.Lekashri, Mr.L.Ganesh Babu, Dr. R.Manikandan. (2021). Smart Agriculture System With E – Carbage Using Iot. International Journal of Modern Agriculture, 10(01), 928 - 931. Retrieved from <http://www.modern-journals.com/index.php/ijma/article/view/690>