

Novel Crawler for Recovery of Things from Unmanned Pit Using Micro Electro Mechanical System

Associate Prof. Dr. Sheryl Radley, Assistant Prof. N. Mohana Priya, Assistant Prof. B. Vennilapriya, Dinesh Kumar R., Pawaneshwar A., Supratha Devi S.R., Iswariya R.

Meenakshi College of Engineering, Chennai, Tamil Nadu

sherylannie@gmail.com, mohanaamaran22@gmail.com, vennila.pets@gmail.com, kumarsaravanan23041998@gmail.com, Pavaneshwar89@yahoo.com, sudhaselvarajan1798@gmail.com, iswariya099@gmail.com

Abstract- The research is based on the recovery of things/human being that have fallen into deep pit such as the unmanned borewell or an unnoticed deep pit. Due to the drought and depletion of underground water a greater number of bore wells are drilled on the surface of the earth. When the ground water gets dried or polluted by industries, the motor along with casing pipes are removed and the outer surface of the bore is not insulated properly. As the result of this, children who were playing near the bore, accidentally fallen into it, which has drunk their lives. Even some of the things have fallen into it. This aids to monitor the children from the borewell without any danger of the victim. The sensor system is interfaced with the microprocessor. A camera along with an LED light is used to visualize the victims well as it helps to operate the system by control unit. The main aim of the project is to monitor the victim who were playing near the borewell, accidentally fallen into it, by using Micro Electro Mechanical System (MEMS), and the stimulation result are obtained by using Embedded C.

Keywords- Micro Electro Mechanical System (MEMS), Embedded C, Universal asynchronous receiver-transmitter, Integrated development environment, ZigBee.

I. INTRODUCTION

Arduino is an open source, computer hardware and software company, project and user community that designs and manufactures Single-Board micro controllers and micro controller kits for building digital devices and interactive objects that can sense and control objects in the physical world. Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs-light on a sensor, a finger on a button, or a Twitter message-and turn it into an output-activating a motor, turning on an LED publishing something online.

The Arduino Uno board is a micro controller board based on the at mega328(data sheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs) 6 analog inputs, a 16MHs crystal accelator, a USB connection, a power jack, an ICSP header and a reset button. Arduino is an open-source project that created micro controller-based kits for building digital devices and interactive objects that can sense and control physical devices. The project is based on micro controller board designs, produced by several ventures, using various micro controllers. These systems provide sets of digital and analog inputs/outputs(I/O) pins that can interface to various expansion boards (termed shields) and other circuits. The boards future serial communication interfaces, including Universal Serial Bus (USB) on some models for loading programs from personnel computers.

For programming the micro controllers, the Arduino projects provides an integrated development environment (IDE) based on a programming language named processing, which also supports the languages C and C++. Fig.1 shows the ARDUINO UNO Interface with Sensor and Buzzer. Arduino Uno is micro controller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, USB connection, a power jack and ICSP header and a rest button. It contains everything needed to support a micro controller, simply connect it to a computer with a USB cable or power it with an AC to DC adapter. Arduino Uno has member of facilities for communicating with a computer, another Arduino board or other micro controllers.

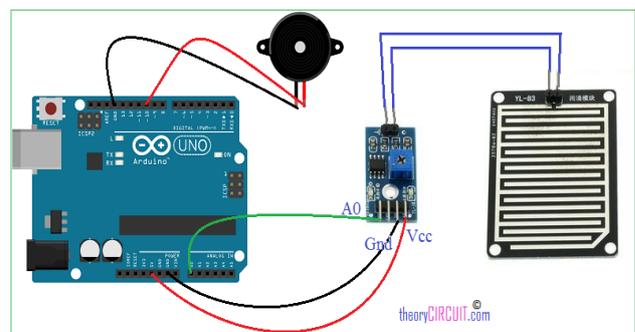


Fig 1. ARDUINO UNO Interface With Sensor and Buzzer.

II. RELATED WORKS

[1] is based on rescuing infants who have fallen into the bore-well. An abundance child death reports have been reported so far. Due to the scantiness of water level, borewell are dig to more depth. The basis of the project is to rescue the infant. The rescue is done by digging a parallel pit, which takes more than a day and even have not found a genuine result. The high point of this project is that the child will be rescued before it reaches the high depth, which is based on communication using Infra-Red Signals. When the IR signal, placed two inches diametrically under the ground surface of the bore-well, breaks due to any obstructing object, a buzzer starts sounding as an alert in mobile phone. After a stake that is kept a few feet lower in the borewell, closes the bore in the order to prevent the infants falling deeper into the well. These accidents are substantial found in agricultural bore-well.

The various risks associated with the rescue of infants can be minimized using this system. [2] based on the recovery of children who fallen into the borewell. Due to the drought and depletion of underground water more bore wells are drilled on the surface of the earth. When the ground water gets dried or polluted nearby industries, the motor along with the casing pipe are removed and the outer surface of the bore is not insulated properly. As a result of this, the children who were playing near the bore, accidentally fallen into it which has drunk their lives. This aid to recover the children from the borewell without any danger of the victim. The sensor systems are interfaced with the ARM8 processor. A camera along with an LED light is used to visualize the victim as well as it helps to operate the system by control unit. The vacuum cup is used to adjust the child position. The arm movement of the robot is controlled by stepper motor. Once the child is perfectly picked by the robot, BLDC motor is used to lift up the child from borewell. The ZigBee plays a vital role of a data transferring between the victim in the borewell and the recovery team in the earth surface. The simulation result is obtained using the software keil C. The hardware output is implemented and the results are shown.

Implementing robotic system for lifesaving measures is one of the important applications, one such implementation needs to be applied for the recovery of child from a constrained environment more specifically borewell. Accidents associate with the borewell is incredibly abundant on the rise, removal of casing pipes once a borewell changing into defunct and abandoning the borehole structure while not which is one in all the most reasons for children slithering into them. Possibilities of convalescent the child once fell into the borewell are terribly slim. The rescue process to recover a child involves digging the hole parallel to that of the borewell where the child fell, this usually fails because rescuers takes several hours to reach the child for providing first-

aid which results in complication of life. To assist in such rescue operations the team tend to propose a robotic system cable of moving underneath the borewell supported with user commands equipped with a robotic arm, high power LED, high-resolution camera, and sensors like ultra sonic, temperature and gas sensor. The device is interfaced with the at Mega 328 controller. Two cameras were placed at different angles so that the entire borewell was captured which are controlled through raspberry pi SOC. Robotic arm is designed uniquely where it operates with 4-point gripping system in which each pair is controlled separately in order to increase the precision of the grip, additionally a fail-safe safety system was designed which provides additional safety in rescue operation. Robotic arm is operated by the rescue team through a specially designed control system software [3]. In India past one decade, there have been several borewell accidents where especially children accidentally fall into open borewell holes.

Many system idleness becomes critical as because of human interacts. The small delay in the rescue can affect the life of the children. The main objective of this survey is to find the various techniques and mechanism which is used in the rescue operation. From this survey the observed that the borewell data can be analyzed by using the sensors fusion and the robotic arm. The borewell using the sensor fusion will helps the rescue operation in short time period. The source of the paper obtained from the various digital libraries. Here the analyzed borewell accidents between the years 2016-2017. Based on criteria 12 articles is reviewed and brief by the various mechanisms where commercially, behind the review 11 papers has been elucidate the system functionality and also solve the criteria-based analysis. From this we wrap up that most of the rescue operation is thrive because of the sensor fusion, robotic arm, wireless technology and IOT Techniques [4].

The crosstalk suppression of multichannel coupled drivelines is studied for high performance integration of micro-electro-mechanical system arrays. By using traditional drivelines, for example, micro strip lines, the distance between adjacent drivelines should be large enough to reduce the multichannel coupling effects. As a result, the size and the area of ultra-low crosstalk and closed-packaged driveline become an issue for design. To address it, we proposed a new scheme of multichannel spoof surface plasmon polaritons (SSPP)-based drivelines. The new drivelines consist of multiple parallel planar corrugated metallic strips. Thanks to the strong field confinement and localization characteristics of the SSPPs, the coupling effects between drivelines in different channels can be significantly suppressed with no need of any other coupling suppression circuits. For demonstration and investigation, both simulation and measurement are carried out up to 20 GHz. The results show that the crosstalk by using the proposed new

drivelines can be reduced by about 10 dB on average. Therefore, the SSPP-based multichannel drivelines would be a good candidate for large-scale advanced integrated devices and systems with requirements of both miniaturization and Band coupling suppression [5]. The paper presents a sense mode closed-loop method for dual-mass micro-electro-mechanical system (MEMS) gyroscope based on the bipole temperature compensation method. A pair of conjugate poles are investigated as the bottle neck of the sense closed-loop system of MEMS gyroscope, and the bipole temperature compensation proportional controller (BTCPC) is employed to realize the closed-loop: a pair of additional conjugate zeros are utilized to generate bipoles with poles. Since poles change with temperature, thermal resistance is utilized in BTCPC to make zeros variable with temperatures.

The BTCPC is designed very carefully to make the system have enough bandwidth and better performance. The overall gyroscope model is established and simulated either in the time domain or the frequency domain, and the results verify that the sense closed-loop works rapidly and steadily. The system is realized on PCBs and is tested on the turntable in temperature oven. The experimental results show that the bias stability, angular random walking, bias temperature coefficient, and the bandwidth values of sense open-loop and closed-loop are $2.168^\circ/\text{h}$, $0.155^\circ/\text{h}$, $9.534^\circ/\text{h}^\circ\text{C}$, 13 Hz, and $2.168^\circ/\text{h}$, $0.140^\circ/\text{h}$ (five tests average value), $5.991^\circ/\text{h}^\circ\text{C}$, 61 Hz, respectively [6].

A common problem experienced by micro-electro-mechanical system (MEMS) initiators is unintentional triggering in a transient high-pulse environment owing to low ignition energy. Herein, therefore, combining the size effect of the Paschen's law with a modified semi-empirical formula of the secondary electron emission coefficient, a theoretical calculation was carried out to improve the electrostatic grooming structures. It was found that the size effect of the Paschen's law is owing to the distance-dependent process dominance of the Thomson discharge process and the field-induced electron emission process. A micro scale breakdown model was, thus, proposed based on field-induced electron emission and the secondary electron emission coefficient. The structural simulations and the optimization of various materials were carried out using the multi physics field simulation software (i.e., COMSOL), and an electrostatic grooming device was subsequently fabricated. During experimental testing, the transient voltage of an electrostatic grooming device with a $1\ \mu\text{m}$ -wide comb gap could be groomed over 130 V. Furthermore, the model was in good agreement with the experimental results in the range of less than $2\ \mu\text{m}$ and more than $9\ \mu\text{m}$. In the optimum range of $2\text{--}9\ \mu\text{m}$, the result of the test differed from the model by less than 15%. The model, therefore, possesses excellent adaptability in this scale range and

can be used to greatly improve the anti-static characteristics of initiators [7].

III. EXISTING SYSTEM

The respiration sensor is used to monitor abdominal or thoracically breathing, in bio feedback application such as stress management and relaxation training. Besides measuring breathing frequency, this sensor also gives us an indication of the relative depth of breathing. The Respiration Sensor for Nexus can be worn over clothing, although for best results we advise that there only be 1 or 2 layers of clothing between the sensor and the skin. The Respiration sensor is usually placed in the abdominal area with the central part of the sensor just above the navel. The sensor should be placed tight enough to prevent loss of tension. First sensor develops and manufactures highly reliable sensors and customized sensor systems as a strategic partner to medical product manufacturers in the area of breathing and respiration. The first step in this process is breathing in air, or inhaling. The taking in of air rich in oxygen into the body is called inhalation and giving out of air rich in carbon dioxide from the body is called exhalation. The second step is gas exchange in the lungs where oxygen is diffused into the blood and the CO_2 diffuses out of the blood. The third process is cellular respiration, which produces the chemical energy that the cells in the body need, and CO_2 . Finally the CO_2 from the cellular respiration is breathed out of body from the lungs.

The ATmega328 is a single-chip microcontroller created by Atmel in the mega AVR family. The Atmel 8-bit AVR RISC-based micro controller combines 32 Kb ISP flash memory with read-while-write capabilities, 1 Kb EEPROM, 2 Kb SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software select-able power saving modes. The device operates between 1.8-5.5 volts. The device achieves throughput approaching 1 MIPS per MHz. Port B (PB7:0) XTAL1/XTAL2/TOSC1/TOSC2: Port B is an 8-bit bi-directional I/O port with internal pull-up resistors (selected for each bit). The Port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, Port B pins that are externally pulled low will source current if the pull-up resistors are activated. The Port B pins are tri-stated when a reset condition becomes active, even if the clock is not running. Depending on the clock selection fuse settings, PB6 can be used as input to the inverting Oscillator amplifier and input to the internal clock operating circuit. Depending on the clock selection fuse settings, PB7 can be used as output from the inverting Oscillator amplifier. If the Internal Calibrated RC

Oscillator is used as chip clock source, PB7..6 is used as TOSC2..1 input for the Asynchronous Timer/Counter2 if the AS2 bit in ASSR is set.

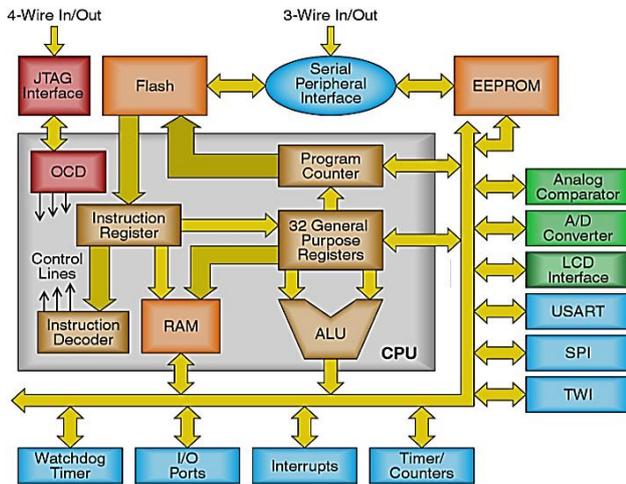


Fig 2. Architectural diagram of ATmega328 IC.

An Ultrasonic sensor is a device that can measure the distance to an object by using sound waves. It measures distance by sending out a sound wave at a specific frequency and listening for that sound wave to bounce back. By recording the elapsed time between the sound wave being generated and the sound wave bouncing back, it is possible to calculate the distance between the sonar sensor and the object. Ultrasonic sensor emit ultrasonic pulses, and by measuring the time of ultrasonic pulse reaches the object and back to the transducer.

The sonic waves emitted by the transducer are reflected by an object and received back in the transducer. After having emitted the sound waves, the ultrasonic sensor will switch to receive mode. The time elapsed between emitting and receiving is proportional to the distance of the object from the sensor. A temperature sensor is a device, typically, a thermocouple or RTD, that provides for temperature measurement through an electrical signal. A thermocouple (T/C) is made from two dissimilar metals that generate electrical voltage in direct proportion to changes in temperature. The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly-proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling.

The LM35 device does not require any external calibration or trimming to provide typical ac-curacies of $\pm 1/4^\circ\text{C}$ at room temperature and $\pm 3/4^\circ\text{C}$ over a full -55°C to 150°C temperature range. The low-output impedance, linear output, and precise inherent calibration of the LM35 device makes interfacing to readout or control circuitry especially easy. LM35 is a precision IC temperature sensor with its output proportional to the

temperature (in $^\circ\text{C}$). The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With LM35, temperature can be measured more accurately than with a thermistor. It also possesses low self-heating and does not cause more than 0.1°C temperature rise in still air.

IV. PROPOSED SYSTEM

ZigBee is a wireless technology developed as an open global standard to address the unique needs of low-cost, low-power wireless M2M networks. The ZigBee standard operates on the IEEE 802.15.4 physical radio specification and operates in unlicensed bands including 2.4 GHz, 900 MHz and 868 MHz. ZigBee is an IEEE 802.15.4-based specification for a suite of high-level communication protocols used for wireless networking. It is a wireless technology developed as an open global standard to address the unique needs of low-cost, low-power wireless M2M networks. ZigBee (CC2500) is a low cost true single chip 2.4 GHz transceiver designed for very low power wireless applications. The RF transceiver is integrated with a highly configurable base band modem. ZigBee devices can transmit data over long distances by passing data through a mesh network of intermediate devices to reach more distant ones. ZigBee is typically used in low data rate applications that require long battery life and secure networking. ZigBee has a defined rate of 250 k bit/s, best suited for intermittent data transmissions from a sensor or input device.

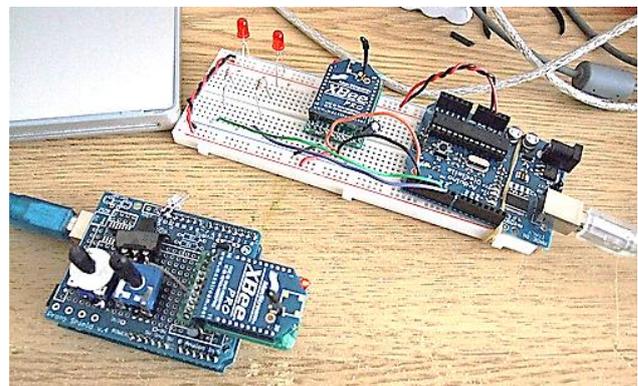


Fig. 3. ZIGBEE Module Interface with ARDUINO.

The series DC motor is an industry workhorse for both high and low power, fixed and variable speed electric drives. Applications range from cheap toys to automotive applications. They are inexpensive to manufacture and are used in variable speed household appliances such as sewing machines and power tools. Gear motors are an all-in-one combination of an electric motor and gears or a gearbox. A gear motor simplifies combining a motor with a gear reducer system. Gears are used with motors to lower the motor's speed while increasing the output torque. A gear motor adds mechanical gears to alter the speed/torque of the motor for an application. Usually such

an addition is to reduce speed and increase torque. A DC motor without gears is useful in many applications. The relationship between torque vs speed and current is linear as shown left; as the load on a motor increases, Speed will decrease. The graph pictured here represents the characteristics of a typical motor. As long as the motor is used in the area of high efficiency (as represented by the shaded area) long life and good performance can be expected. However, using the motor outside this range will result in high temperature rises and deterioration of motor parts. A motor's basic rating point is slightly lower than its maximum efficiency point. Load torque can be determined by measuring the current drawn when the motor is attached to a machine whose actual load value is known.



Fig. 4. DC Gear Motor Interface with Controller.

The two applications are Back-end systems which need to send purchase order data to oracle applications send it to the integration service via a integration server client and SMPS applications.

V. EXPERIMENTAL RESULTS

In the project we use four types of sensor Temperature Sensor, Gas sensor, Ultrasonic Sensor and Respiratory sensor which are connected to the micro controller Arduino Uno. This combination of circuits consists of Dc motor drive and ZigBee connected to the personal computer. These Sensors are capable of sensing the changes in the surrounding parameters. The ZigBee is used to record the movement of the victim. So, any abnormal changes are recorded and visualized in the pc. The image represents the working of novel device connected with PC.

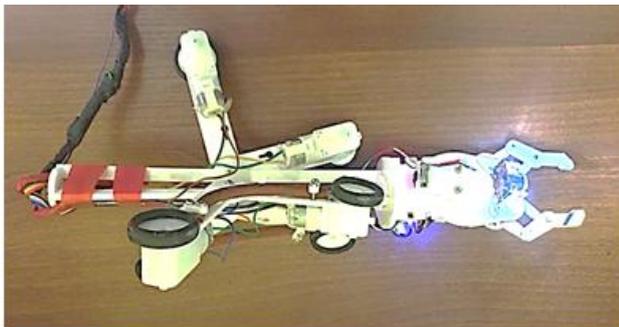


Fig. 5. Connected the Real Image of the Device with PC.

The image represents the connection between the Arduino Uno, Drive module, Dual motor and Battery. The Arduino uno is a micro controller board based on ATmega328. It has 20 digital Input/Output pins of which 6 can be used as PWM outputs and 6 can be used as analog inputs. It consists of programmable circuit board that runs on your computer, where you can write and upload the computer code to the physical board. The drive module can drive DC motors that have voltages between 5 and 35V, with a peak current upto 2A.

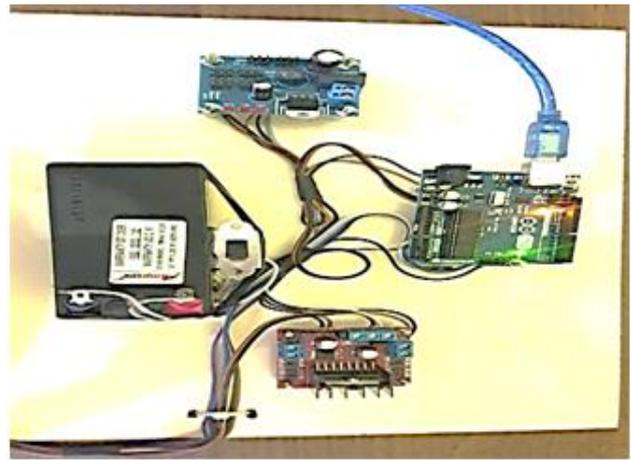


Fig. 6 Connection between the Devices Arduino Uno, Drive Module, Dual Motor and the Battery.

The image represents the motor device is moving to the 5feet water pipe and the movement is recorded by ZigBee connected in the devices.

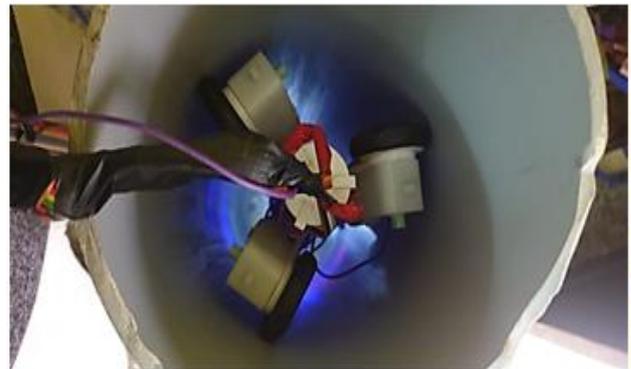


Fig. 7 The Movement of the device in the Water Pipe.

The ZigBee is primarily used for two-way communication between a sensor and a control system. Like Wifi, Bluetooth it is short range communication and offers connectivity upto to 100 meters. The ZigBee network starts its formation as soon as device become active. Using this the device is moved through the water pipe and help us to monitor the movement and the sensor used in it will help us to record the temperature, humidity and types

of gas in the surroundings. The recording will be updates using PC.

Grooming Structure For Initiator Materials. IEEE Access, 7, Pp.93150-93160.

VI. CONCLUSION AND FUTURE SCOPE

In our project, we have successfully made the recovery of things/human being that have fallen into a deep pit such as unmanned borewell or an un noticed deep pit. The sensor system is interfaced with the microprocessor. A Camera along with the LED light is fixed with device which is used to visualize the victim well as it helps to operate the system by control unit. We use the stepper motor for the arm movement of the machine. The data is well transferred between the victim and recovery team. The stimulation result is obtained by using the Embedded C. In future the machine can be made as a commercial device with further integration process and can create a great impact in the Micro Electro Mechanical System. This can help to rescue victim from the bore well and save the life of the victim. Using the advanced integration technique the product will be developed which will create a great impact in the future.

REFERENCE

- [1] Sumit Pandey, Sanjay Kumar Shah, Shreekant Sah, Chandan Kumar Mahto, Dr. A. Sathyanarayananaswamy, 2019. CHILD RESCUE SYSTEM AGAINST OPEN BOREWELL, International Journal Of Science Technology And Management, 8(05), Pp.12-17.
- [2] Gopinath, S., Devika, T., Manivannan, L. And Vanitha, N.S., 2015. Rescue Child From Bore Well Using Embedded System. International Research Journal Of Engineering And Technology (IRJET), 2(03).
- [3] Lawrence Danieal R, Vinolee R, Ruhan Bevi A, 2017. DESIGN OF ROBOTIC SYSTEM TO RESCUE A CHILD UNDER CONSTRAINED ENVIRONMENT. International Journal Of Pure And Applied Mathematics, 116 (5). Pp. 31-36.
- [4] Thangaraj, P. And D. S. Gavaskar, 2018. Borewell Rescue To Child Using IOT Techniques: A Survey. International Journal Of Research In Advent Technology.
- [5] Zhao, S., Zhang, H.C., Liu, L., Zhao, J. And Yang, C., 2019. A Novel Low-Crosstalk Driveline Based On Spoof Surface Plasmon Polaritons. IEEE Access, 7, Pp.30702-30707.
- [6] Cao, H., Liu, Y., Zhang, Y., Shao, X., Gao, J., Huang, K., Shi, Y., Tang, J., Shen, C. And Liu, J., 2019. Design And Experiment Of Dual-Mass MEMS Gyroscope Sense Closed System Based On Bipole Compensation Method. IEEE Access, 7, Pp.49111-49124.
- [7] Feng, H., Lou, W., Zheng, F. And Ding, X., 2019. Design, Processing And Testing Of A MEMS Energy