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Land Perforate Rescue by Animatronic Projection

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ABSTRACT

The National Disaster Response Force, have reported that more than 40 children have fallen into borewells, and on an average, 70 percent of the rescue operations fail, since 2009. These borewells are dug due to the increased scarcity of water, but the borewells which are left uncovered become dangerous for the innocent children [1, 5]. Most of the victims are under the age of 10 [8]. The government has adopted various methods to rescue those children but in those rescue operations some children were saved but some, unfortunately, lost their lives. Usually these rescue operations are very lengthy, complicated and very time taking processes [13]. So, we came up with a project to rescue the child from the borewell. This animatronic hand moves according to the movement of a human wearable glove. It works from the information that is received from the glove. The animatronic hand is controlled by an arduino. The movement of the glove is sensed with the help of five flex sensors, and the output of the flex sensors is sent to the servo motors in the animatronic hand by the arduinos. RF module is used for communication between the transmitting side and the receiving side. Using this system, the child can be rescued quickly and also without any major injuries.

Keywords - Borewell rescue, Child rescue, animatronic arm, wireless system , flex sensor, servo motor , Arduino Uno, Embedded System.

I. INTRODUCTION

Due to drought and depletion of underground water, more bore wells are drilled on the surface of the earth [19]. But due to the carelessness of people the borewells are left open and these borewells will become a death pit for the small children. They unknowingly fall into the borewell, and due to the delay and complexity in the rescue operation, it leads to the death of the child. The government has taken several measures to rescue the children. The children are usually rescued by digging a narrow pit parallel to the borewell and then from there digging sideways to reach the child [18,19]. But this process is risky and it takes a lot of time to reach and rescue the child. Also, if the distance is long the process becomes even more risky. So, as a solution to this problem we have designed an animatronic hand to rescue the child [7]. This animatronic hand moves according to the

movement of a human wearable glove. It works from the information that is received from the glove. The animatronic hand is controlled by an arduino. The movement of the glove is sensed with the help of five flex sensors. The output of the flex sensors is sent to the servo motors in the animatronic hand by the arduinos. The hand is controlled by servo motors [15]. For wireless communication between the transmitter and receiver RF module is used [6]. The child is held by the animatronic hand and is then lifted up. This method will be a good alternative for most of the existing methods.

II. EXISTING METHODS

There are many techniques used to rescue children from borewells. Parallel pit rescue method is the most common method adapted to rescue children from borewells [1,16]. This will cause very high vibration inside the bore well [18], so it may be unsafe sometimes. Another method is using a robotic arm whose diameter can be adjusted, to rescue the child from the borewell [2]. The distance to the child is also found using infrared sensors [2,3]. A robotic system which will attach a harness to the child using pneumatic arms is another method. Then the child is picked up . Teleconferencing is also used to communicate with the child [4]. Another system uses a clipper to pick the child [14], and video surveillance monitors the status of the child [14,15].

III. SYSTEM DESIGN

The proposed methodology can be used to rescue children who fell into the borewell. This prototype is capable of lifting upto to a weight of 75kg and the rescue can be done in a short period of time. The topics discussed below include block diagram and its system design.

A. Block diagram

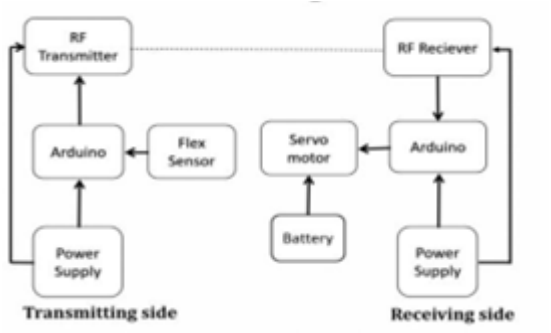

Fig.1. Block Diagram

As shown in Fig.1, the system consists of two units. They are the transmitting unit and the receiving unit. The transmitting unit contains an arduino board to control the transmitting side, five flex sensors and a RF transmitter to transmit the information to the receiving unit. On the receiving side the RF receiver receives the information. Again, the receiving side is controlled by an arduino UNO microcontroller. Five servo motors are connected to an animatronic arm on the receiving side. The servo motors are powered by batteries.

Arduino UNO is a microcontroller board based on the ATmega328P [20]. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a

power jack, an ICSP header and a reset button [5]. The versatility of the pinout provides many different options such as driving motors, LEDs, reading sensors and more. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

Arduino can be powered either from the pc through a USB or through external source like adaptor or a battery. The external power supplies mainly include AC to DC adapter otherwise a battery. The adapter can be connected to the Arduino Uno by plugging into the power jack of the Arduino board. Similarly, the battery leads can be connected to the Vin pin and the GND pin of the POWER connector. The suggested voltage range will be 7 volts to 12 volts.

A transceiver is a blend of a transmitter and a receiver in a single package. An RF module is a small size electronic device that is used to transmit or receive radio signals between two devices. The main application of the RF module in an embedded system is to communicate with another device wirelessly. This communication may be accomplished through radio frequency communication and it does not need a line of sight. The nRF24L01+ transceiver module transmits and receives data on a certain frequency called Channel. Also in order for two or more transceiver modules to communicate with each other, they need to be on the same channel. This channel could be any frequency in the 2.4 GHz ISM [16] band or to be more precise, it could be between 2.400 to 2.525 GHz. Each channel occupies a bandwidth of less than 1MHz. This gives us 125 possible channels with 1MHz spacing. So, the module can use 125 different channels which give a possibility to have a network of 125 independently working modems in one place.

Servomotor is used for controlling the robot arms [12]. It is a rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration [5]. It consists of a suitable motor coupled to a sensor for position feedback.

The servo motor is the MG995 servo motor. MG995 Servo Motor [20] is a heavy-duty reliable servo motor. It is a low-power, cost-effective motor. The MG995 is a dual shock-proof ball-bearing servo design with metal gear making it quite feasible for industrial production. The motor has a quick response and rotates at high speed. It comes with great holding power and a stable constant torque range. MG995 servo motor is a popular servo motor mainly used in robotics and drones applications. MG995 provides precise rotation over 180º range and comes with metal geared, and shock proof double ball bearing design, so suited for designing robotic arm in which wear and tear of motor is high.

The flex sensor measures the amount of bending. When the senor bends its resistance changes. The resistance is directly proportional to the amount of bend. The resistance can be measured using any controller. This is also called a flexible potentiometer. This sensor is used wherever you need to measure the bent, flex, otherwise, change of an angle for any device otherwise any instrument. The internal resistance of this sensor alters approximately linear with the angle of its flex. Thus by connecting the sensor to the device, we can have the flex angle within resistances of electrical parameters.

The lead–acid battery [11] is a type of rechargeable battery first invented in 1859 by French physicist Gaston Planté. It is the first type of rechargeable battery ever created. Compared to modern rechargeable batteries, lead–acid batteries have relatively low energy density. Despite this, their ability to supply high surge currents

means that the cells have a relatively large power-to-weight ratio. These features, along with their low cost, make them attractive for use in motor vehicles to provide the high current required by starter motors.

IV. METHODOLOGY

The system is divided into two separate units, they are the Transmitting (controller) and Receiving units (Animatronic hand)[17,19]. This system works using wireless technology, but it can also be wired if necessary. It consists of flex sensors, arduino UNO microcontroller[11], RF transceiver modules, servo motors, an animatronic hand and five batteries to power the servo motors. The microcontrollers on both the sides are programmed using Embedded C language[9]. Arduino IDE is the software platform used for programming. The flex sensors are used here to get the glove movement from the transmitting side. It is attached to each finger on a glove and the data from the flex sensors is sent to the arduino board. The data is sent to the receiving end using an RF transmitter.

On the receiving side the data is received using RF receiver [10], then the data which is received is sent to the five servo motors by the arduino. The arduino is attached to the RF receiver module. The five servo motors are attached to each finger of an animatronic hand. The fingers of the animatronic hand are moved by the five servo motors. So, the animatronic hand mimics the movement of the glove. So this system can be used to rescue the children who fell into the borewell and the rescue operation is less risky.

V. PROTOTYPE DESIGN

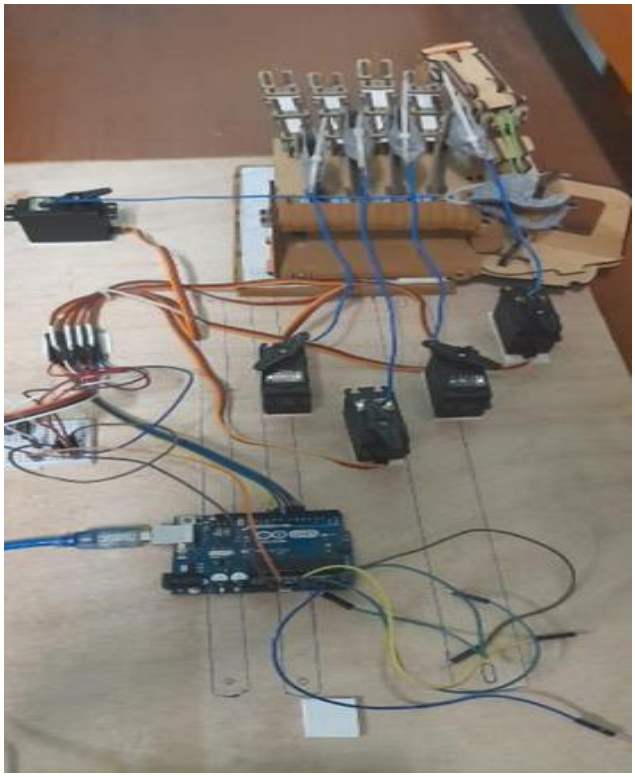

Fig.6. Prototype

VI. CONCLUSION

Thus, this animatronic hand can be used to rescue children who fell into the borewell. The prototype is shown in fig.6. This prototype is capable of lifting upto to a weight of 75kg. This animatronic arm has a human hand-like behaviour and can pick up the victim without causing issues. If we adopt this system the life of the child can be rescued within a short period of time. The lives of many children can be saved.

VII. FUTURE SCOPE

In the future different types of sensors can also be attached with this system to monitor the status of the child.Also AI can also be used in the arm for more accurate and better results. This system can also be used for purposes other than borewell rescue.

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