Borewell Rescue Operations

[1]G.SHIVA PRASAD REDDY, [2]M.SAI CHARITHA, [3]I.HARIKA

STUDENT, STUDENT, ASSISTANT PROFESSOR
ELECTRONICS AND COMMUNICATION ENGINEERING
SREENIDHI INSTITUTE OF SCIENCE AND TECHNOLOGY, HYDERABAD,TELANGANA,INDIA

ABSTRACT: The project is aimed at developing hardware automation prototype for managing borewell rescue operations. A borewell is a deep, narrow hole drilled into the ground from which water is drawn through a pipe and pump. Borewells are typically small in diameter — ranging from 4.5 inches (low-capacity borewell) to 12 inches (high-capacity borewell). Borewells tap into water-bearing soil or rock layers called aquifers and can go as deep as 1,500 feet into the ground. There is a tendency in the rural areas, where these Borewells are left unattended and uncovered, due to which mostly little children fall into these and thus NDRF is requisitioned for the rescue. It is of utmost importance to design an indigenous compact system which may include all the hardware and software and thus help in saving the lives. NDRF doesn't have any specialized equipment for the rescue operations and the methodology adopted is as per the situation. NDRF is presently a combination of tools/equipment for Borewell rescue, which involves J-Hook, Cloth Bucket, Magic Ball, Pendant Jhulan and Umbrella Tool. All these tools are improvised in nature and have been tested in different scenarios. This project contains live monitoring of the surging path inside the borewell and uses controllable arm to pick the victim inside the well. It will help in effectively handling the Borewell Rescue operations. It will minimize the time spent in planning and executing the plan. Lesser time will increase the success percentage.

INTRODUCTION

1.1 MOTIVATION

In recent years, there has been an increase in the bore well mishaps where in children fall into open bore wells. There were so many child deaths due to the open bore-wells. The children fell into the open bore-wells and the rescue operation was almost end with failure. In the present what we do is dig a new well of the same depth next to the bore well and then make a tunnel connecting the two. This is a time consuming and costly process. It may take hours or even days to dig new well. In India there were frequent bore-well deaths. Approximately 20 children were felt in the bore-well and only 2 were alive.

1.2 EXISTING PROBLEM

The Common method used to find the depth of a child is with the help of a rope. In normal rescue operation carried out by the Army and National Disaster Rescue Force Teams, a pit is dug parallel to the borewell close to the depth of the child. Then a horizontal path is created to connect the location of the child is caved through. A small delay in the accumulation of different resources for the rescue operation in the existing method will cost the life of an infant. If the area beside the borehole contains rocks below a certain depth, in such cases the chance of saving the child alive is very low. Lack of oxygen inside the bore well and lack of light sources causes the major difficulty during the rescue operation.

There is no special equipment for rescuing the child trapped inside the bore well. Not even a proper technique to rescue victims of such accidents. The time taken for the operation is more than 72 hours in most of the cases. Following are some of the details of the bore well mishaps in recent years in India. In most of the cases, rescue operations did not yield satisfactory results. Due to very long rescue operations and traditional techniques followed, infants could not be saved.

The following is a list of Bore Well Mishaps occurred in the recent years in different states of the country. Most of the rescue operations did not give fruitful results.

1.3 PROPOSED METHODOLOGY

The main purpose of this project is to save the life, child trapped inside the borewell safely. The problems in current existing methods are It takes up to 30 hours to dig the parallel pit 110ft, by the time the child would have died. Lack of oxygen inside the borewell. Lack of visualization causes the major difficulty during the rescue operation. There is no such equipment for rescuing the child which had fallen into the bore well. There is no interaction of child inside borewell and the parents. Children fall in the Borewell due to the carelessness nature of the people in society. The currently available systems are less effective and costly too.In most cases reported so far, a parallel hole is dug and then horizontal path is made to reach the child. It is not only a time taking process, but also risky in various ways. To overcome these lapses, we have designed and implemented a "***Borewell rescue operations***" as our B.Tech. project.

Which has following advantages: -

1. System is capable to get inside the same borewell the child's fall.
2. There is no need to dug a parallel hole.
3. It saves time with this system to rescue the child.
4. The child can be taken out of borewell safely.

1.4 OBJECTIVES

The objective of our B.Tech. final year project work entitled "*Borewell Rescue Operations*" are as follows:

1. Manually monitoring the child with the help of camera and controlling unit of system.
2. Communicating with the system by sending appropriate commands to it and activate the suitable motors.

3. Once the system has reached proximity of child, it is stopped immediately and is given the commands by the controlling device to perform the closing of the systemic arms.
4. Controlling a system to takeoff the child inside the bore well, which is controlled by sthe person from outside.

LITERATURE SURVEY

2.1 DESIGN AND FABRICATION OF PNEUMATIC BOREWELL CHILD RESCUE SYSTEM

In this paper, a safety balloon is used. The safety balloon ensures the victim will not go deeper any further. The balloon is initially in a deflated condition. Compressed air is passed through the balloon. It takes more time as the balloon is deep inside and should be inflated that it will be able to carry the victim out of the bore well. The main disadvantage in this method is that the chances of balloon bursting is more which may lead the child fall deeper. The diagram for pneumatic bore well child rescue system

2.2 OPEN BOREWELL RESCUE SYSTEM

This paper consists of a three wheeled robot which uses motors to move upward and downward inside the bore well. Zigbee module is used to control the motion. The device includes a personal computer which uses the Zig bee technology to control the robot. The basic ideology behind the work is a pick and place robot along with the live audio and video of the child's status inside the bore well.

2.3 COMPARISION OF DIFFERENT BOREWELL RESCUSING OPERATION

It explains the comparison between the three methods- Manual pulling method, Parallel pit digging method, Pneumatic balloon pulling method. It discusses about the advantages and disadvantages of the rescuing methods. It finally concluded that none of the method can save 100% so better device must be innovated. The manual pulling method.

2.4 ARDUINO BASED CHILD RESCUE SYSTEM FOR BOREWELL

The system uses cable wire to control the machine assembly, gear assembly and other equipment. When the required input is given, the system starts working as a self-operating robot to rescue the child. The distance of the child inside the bore well from the surface can be measured by using an Infrared sensor which is placed at the bottom. A special pipeline which is placed along with the robot can be used to supply the oxygen.

The Arduino is used to control the position of the robot to rescue the child and also to supply the required amount of oxygen to the child.

2.5 SMART CHILD RESCUE SYSTEM FROM BOREWELL

A new design is implied in this paper which consists of a sensor to detect the falling of the victim inside the bore well. If the child is sensed by the system, the horizontal closure which is placed at 5feet depth automatically closes the bore well prevents the child from falling further deeper. Quick siren and messages are given to the rescue team and concern officials along with the location.

2.6 PIPELINE INSPECTION AND BORE WELL RESCUR ROBOT

An autonomous robot which has self-moving and self- sustaining capacity is used in this paper to rescue the victim. To move further inside the pipe, a wheeled leg mechanism is employed in this design. The PIC 16F877A microcontroller is interfaced with the temperature sensor and LCD display to detect and display the temperature.

COMPONENTS DETAILS

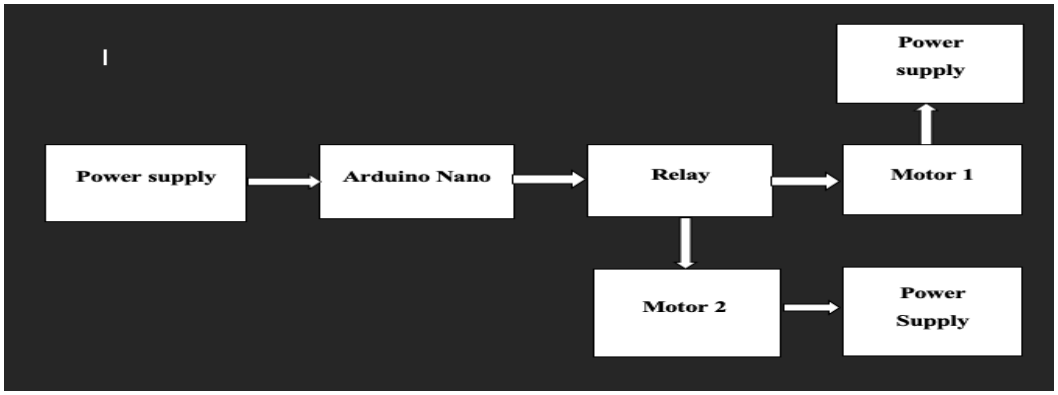
3.1 BLOCK DIAGRAM DETAIILS

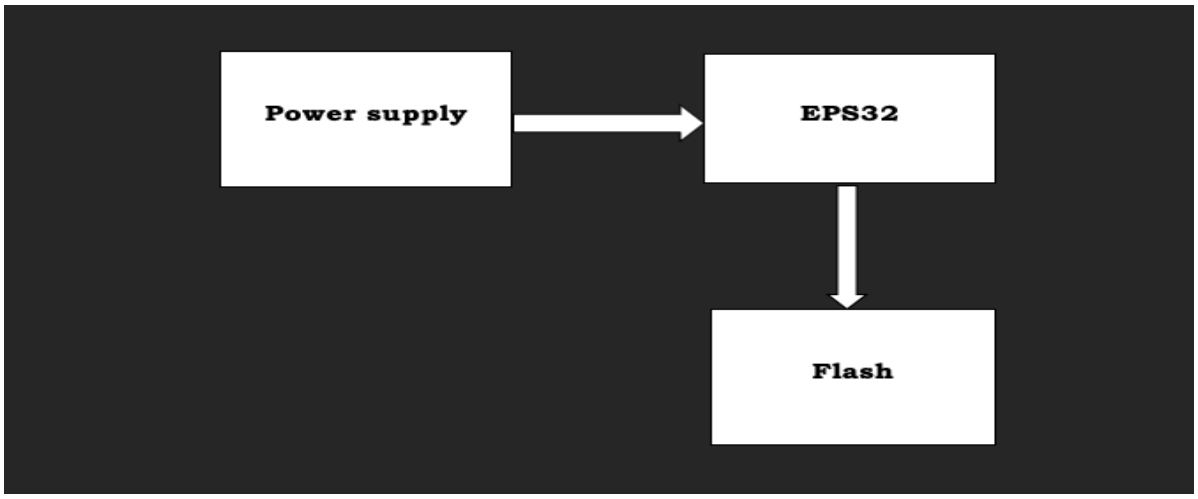
As per the block & circuit diagrams shown in the next chapter is explained in this chapter. The description begins with Arduino which is the heart of the project that controls the system .The robotic arm is used to hold and the victim which is operated using the bluetooth module.ESP32 consists of the camera module which is used to observe the victim inside the borewell. The following is the description.

All the parts of the system are controlled manually outside the borewell using 2 DPDT Switches

1. for rotating DC motor clockwise and anticlockwise,
2. for the opening and closing of the claws).
3. System is taken inside the borewell using pulley and rope mechanism to reach up to the child by visualizing through camera A/V output.
4. Child live position is captured through camera and communication is done with the child with the help of mic and an operational amplifier 7805.
5. The harness of the system used in two arms is very soft so that it do not hurt the child while gripping.
6. The system is rotated using DC motor according to the child position.
7. The child is gripped from suitable position and then the system is taken out from the borewell by pulling the rope.

FIG 3.1 BLOCKDIAGRAM





3.2 ARDUINO NANO

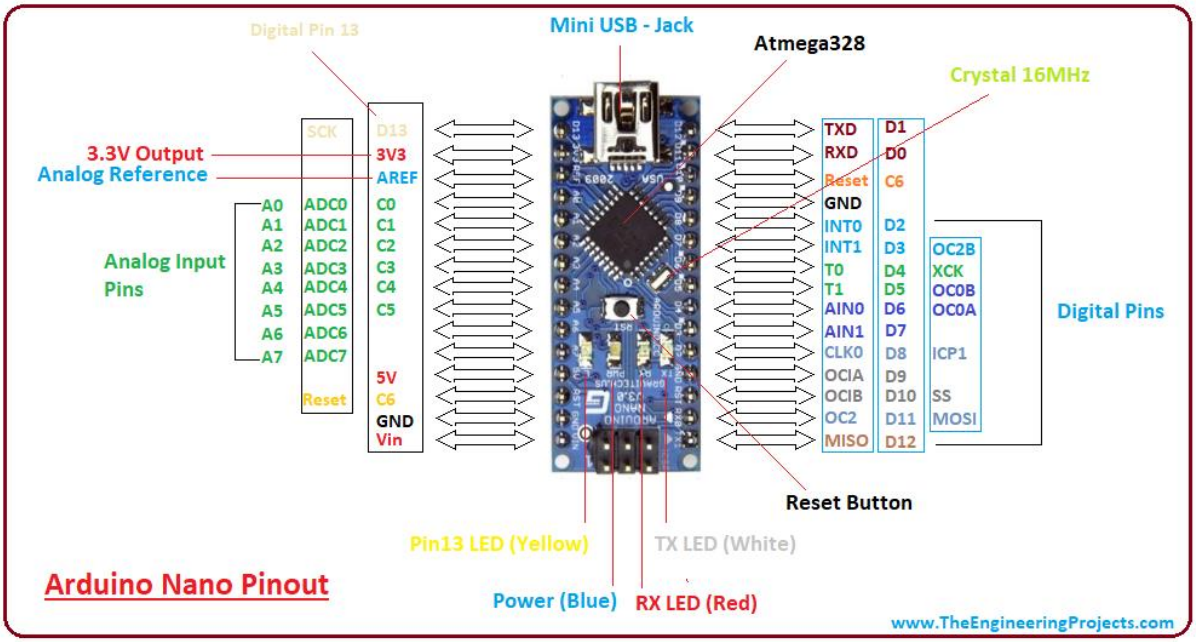
The Arduino Nano is equipped with 30 male I/O headers, in a DIP-30-like configuration,which can be programmed using the Arduino Software integrated development environment (IDE), which is common to all Arduino boards and running both online and offline. The board can be powered through a type-B mini-USB cable or from a 9 V battery.

The Arduino Nano was released in 2008. In 2019, Arduino released the **Arduino Nano Every**, a pin-equivalent evolution of the Nano. It features a more powerful ATmega4809 processor and twice the RAM. The Arduino Nano has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The ATmega328 provides UART TTL (5V) serial communication, which is available on digital pins 0 (RX) and 1 (TX).

An FTDI FT232RL on the board channels this serial communication over USB and the FTDI drivers (included with the Arduino firmware) provide a virtual com port to software on the computer. The Arduino software includes a serial monitor which allows simple textual data to be sent to and from the Arduino board. The RX and TX LEDs on the board flash when data is being transmitted via the FTDI chip and the USB connection to the computer (but not for serial communication on pins 0 and 1). A SoftwareSerial library allows for serial communication on any of the Nano's digital pins. The ATmega328 also supports I2C and SPI communication. The Arduino software includes the Wire library to simplify use of the I2C bus.

Rather than requiring a physical press of the reset button before an upload, the Arduino Nano is designed in a way that allows it to be reset by software running on a connected computer. One of the hardware flow control lines (DTR) of the FT232RL is connected to the reset line of the ATmega328 via a 100 nanofarad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip.

This setup has other implications. When the Nano is connected to a computer running Mac OS X or Linux, it resets each time a connection is made to it from software (via USB). For the following half-second or so, the bootloader is running on the Nano. While it is programmed to ignore malformed data (i.e. anything besides an upload of new code), it will intercept the first few bytes of data sent to the board after a connection is opened.



3.3 ATmega328 P

ATmega328P is one of the high performances AVR technology microcontroller with a large number of pins and features. It is designed by 8-bit CMOS technology and RSIC CPU which enhance its performance and its power efficiency get improved by auto sleeps and internal temperature sensor. This **ATmega328P** IC comes with internal protections and multiple programming methods which helps the engineers to priorities this controller for different situations. The IC allows multiple modern era communications methods for other modules and microcontrollers itself, which is why the microcontroller ATmega328P usage has been increasing every day.

The Atmel 8-bit AVR RISC-based microcontroller 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, 3 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 5 software-selectable power-saving modes. The device operates between 1.8 and 5.5 volts. The device achieves throughput approaching 1 MIPS/MHz.

Atmega328P is same like any other microcontrollers, it is also required to be programmed before use. There are multiple programmers softwares are available to program the chip, one of the easy and more common way to program the chip is by using arduino board and the arduino software named Arduino IDE. The other programmer is the IDP program made for AVR controllers named "Atmel Studio" that can be downloaded free from Atmel and Microchip Technology websites. After installing the desired IDE or IDP software the user has to write the functions / program codes in the IDE or IDP programmer. There are several guides and tutorials are available online from where one can learn how to program the microcontroller to get the desired task from the chip.

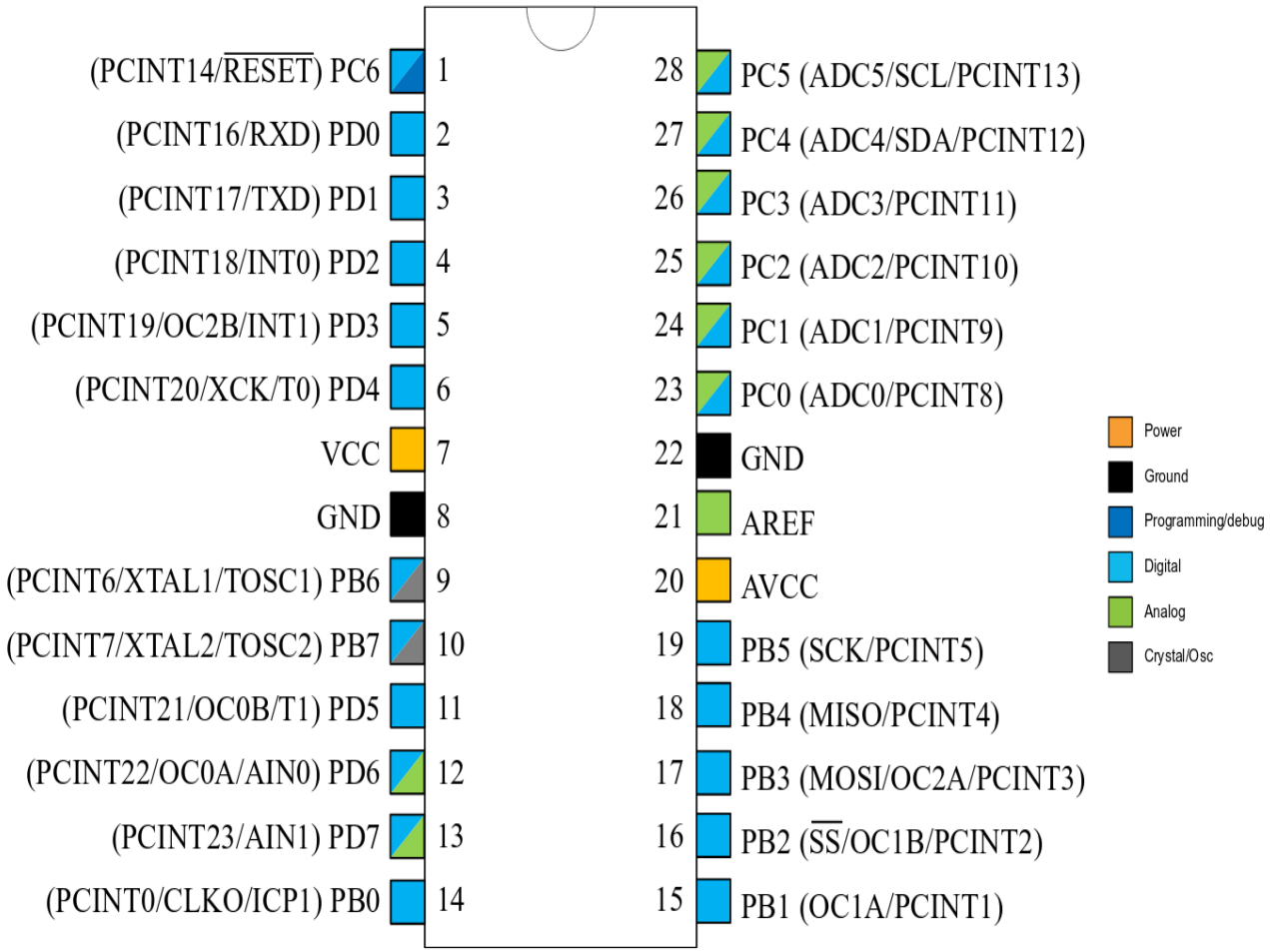


FIG 3.3 ATmega 328P

ATmega328P Features / Technical Specifications:

- High performance design
- Low power consumption
- Total number of Analog Input pins are 6
- Contains 32 kilobytes of flash memory
- Contains 2 kilobytes of SRAM
- Contains 1 kilobytes of EEPROM
- 16 megahertz clock speed
- Minimum & maximum temperature -40 degree centigrade to 105 degree centigrade
- Total number of Digital I/O pins are 14
- Advance RISC
- Lock program functionality for programming code security

- Contains total three timers two 8-bit and one 16 bit
- Total number of I/O pins are 23
- Total number of PWM channels are 6
- Minimum and maximum operating voltage from 1.8V DC to 5.5V DC

3.4 POWER SUPPLY UNIT

The power supply is a Primary requirement for the project work. Before designing a power supply, first we must calculate how much current is required to drive entire circuit. In order to meet the required power levels for the entire circuit to be functioning that requires DC power supply and this is derived from the mains supply. Therefore a transformer of rating 12v and 1000 milliamps at secondary is to be used for safe side.

Since the required DC power supply for the total circuitry to be derived from the single-phase mains, a step down transformer with center-tapped secondary of 12V-0-12V transformer is considered for the purpose. The secondary is rectified with two diodes to convert the AC in to DC, for this purpose higher current rating diodes of 4007 are selected. Now a large capacitor of 1000 microfarad is connected across the DC source for eliminating the AC ripple, there by smooth DC is availed from the power supply unit.

The DC voltage derived from the supply is un-regulated, initially around 18V DC is available at no load, when load is connected, this voltage will be falling down to nearly 12V, which is sufficient drive the entire circuit. The main draw back of this un-regulated supply is, it varies according to the line voltage, where as for micro controller a stable supply of +5V is essential, therefore with the help of a positive voltage regulator, a constant voltage source of +5V is derived, for this purpose 7805, a 3Pin Voltage regulator is used so that, though the mains supply varies from 170V to 250V, the output DC level remains constant. The 7805 used in this project work can deliver a maximum current of 500 milliamps, this device is having thermal shut-down internally, whenever the device body temperature rises more then 100 degree centigrade, automatically output become zero and protects the regulator burning due to the over temperature. A suitable Aluminum heat sink coupled to the regulator body is essential when maximum current is drawn.

A diode can be used as rectifier. There are various types of diodes. But, semiconductor diodes are very popularly used as rectifiers. A semiconductor diode is a solid-state device consisting of two elements is being an electron emitter or cathode, the other an electron collector or anode. Since electrons in a semiconductor diode can flow in one direction only-form emitter to collector- the diode provides the unilateral conduction necessary for rectification.

The rectified Output is filtered for smoothening the DC, for this purpose suitable capacitor is to be selected depending up on the current rating, generally for 500 milli Amp rating power supply 1000 Micro-farad capacitor is used in the filter circuit, hear the supply rating is more, so that heavy capacitor is used. The filter capacitors are usually connected in parallel with the rectifier output and the load. The AC can pass through a capacitor but DC cannot, the ripples are thus limited and the output becomes smoothed. When the voltage across the capacitor plates tends to rise, it stores up energy back into voltage and current. Thus the fluctuation in the output voltage is reduced considerable

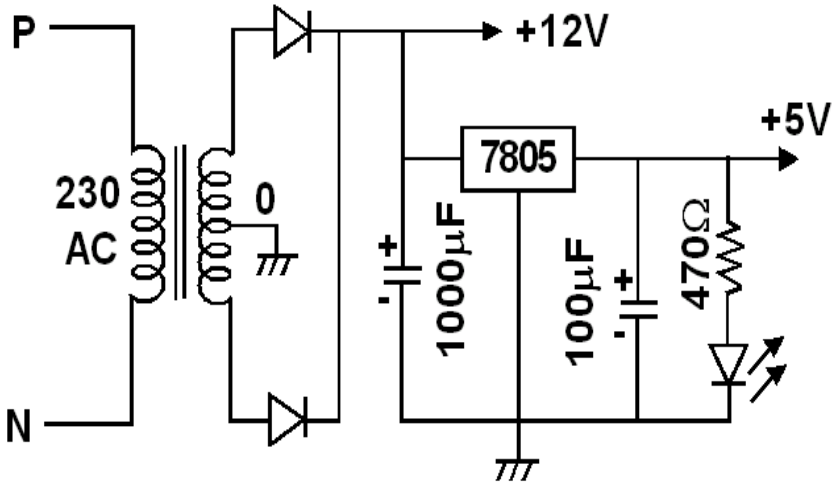


FIG 3.4 Internal structure of power supply unit

3.5 RELAY MODULE

The relay is the device that open or closes the contacts to cause the operation of the other electric control. It detects the undesirable condition with an assigned area and gives the commands to the circuit breaker to disconnect the affected area through ON or OFF.

Every

1.Electromagnet

3.Mechanicallymovablecontact

3.Switchingpoints

4. Spring

COM: common pin

NO: Normally open – there is no contact between the common pin and the normally open pin. So, when you trigger the relay, it connects to the COM pin and power is provided to the load.

NC: Normally closed – there is contact between the common pin and the normally closed pin. There is always

connection between the COM and NC pins, even when the relay is turned off. When you trigger the relay, the circuit is opened and there is no supply provided to the load.

WORKING PRINCIPLE OF RELAY:

It works on the principle of an electromagnetic attraction. When the circuit of the relay senses the fault current, it energises the electromagnetic field which produces the temporary magnetic field.This magnetic field moves the relay armature for opening or closing the connections. The small power relay has only one contacts, and the high power relay has two contacts for opening the switch.The inner section of the relay is shown in the figure below. It has an iron core which is wound by a control coil. The power supply is given to the coil through the contacts of the load and the control switch. The current flows through the coil produces the magnetic field around it.

Due to this magnetic field, the upper arm of the magnet attracts the lower arm. Hence close the circuit, which makes the current flow through the load. If the contact is already closed, then it moves oppositely and hence open the contacts.

Types of Relay Based on the principle of operation

1.Electrothermalrelay:

2.Electromechanicalrelay:

3.SolidStaterelay:

4. Hybrid relay:

APPLICATIONS OF RELAY:

A. They can be used for both ac and dc systems for protection of ac and dc equipment's

B. Electromagnetic relays operating speeds which has the ability to operate in milli seconds are also can be possible

C. They have the properties such as simple, robust, compact and most reliable

D. These relays are almost instantaneous. Though instantaneous the operating time of the relay varies with the current. With extra arrangements like dashpot, copper rings.

E. Electromagnetic relays have fast operation and fast reset

DISADVANTAGES:

a. High burden level instrument transformers are required (CTs and PTs of high burden is required for operating the electromagnetic relays compared to

b. The directional feature is absent in electromagnetic relays

c. Requires periodic maintenance and testing unlike static relays

d. Relay operation can be affected due to ageing of the components and dust, pollution resulting in spurious trips

e. Operation speed for an electromagnetic relays is limited by the mechanical inertia of the component.

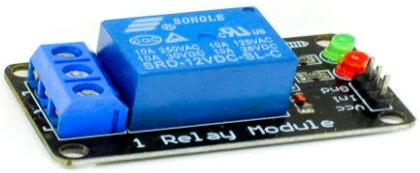


FIG 3.5 Relay module

3.6 ESP32

ESP32 is a series of low-cost, low-power system on a chip microcontrollers with integrated Wi-Fi and dual-mode Bluetooth. The ESP32 series employs either a Tensilica Xtensa LX6 microprocessor in both dual-core and single-core variations, Xtensa LX7 dual-core microprocessor or a single-core RISC-V microprocessor and includes built-in antenna switches, RF balun, power amplifier, low-noise receive amplifier, filters, and power-management modules. ESP32 is created and developed by Espressif Systems, a Shanghai-based Chinese company, and is manufactured by TSMC using their 40 nm process. It is a successor to the ESP8266 microcontroller

Features of the ESP32 include the following:

- Processors:
  - CPU: Xtensa dual-core (or single-core) 32-bit LX6 microprocessor, operating at 160 or 240 MHz and performing at up to 600 DMIPS
  - Ultra low power (ULP) co-processor
- Memory: 320 KiB RAM, 448 KiB ROM
- Wireless connectivity:

- Wi-Fi: 802.11 b/g/n
- Bluetooth: v4.2 BR/EDR and BLE (shares the radio with Wi-Fi)
- Peripheral interfaces:
- 34 × programmable GPIOs
- 12-bit SAR ADC up to 18 channels
- 2 × 8-bit DACs
- 10 × touch sensors (capacitive sensing GPIOs)
- 4 × SPI
- 2 × I²S interfaces
- 2 × I²C interfaces
- 3 × UART
- SD/SDIO/CE-ATA/MMC/eMMC host controller
- SDIO/SPI slave controller
- Ethernet MAC interface with dedicated DMA and planned IEEE 1588 Precision Time Protocol support[4]
- CAN bus 2.0
- Infrared remote controller (TX/RX, up to 8 channels)
- Pulse counter (capable of full quadrature decoding)
- Motor PWM
- LED PWM (up to 16 channels)
- Hall effect sensor
- Ultra low power analog pre-amplifier
- Security:
- IEEE 802.11 standard security features all supported, including WPA, WPA2, WPA3 (depending on version)[5] and WLAN Authentication and Privacy Infrastructure (WAPI)
- Secure boot
- Flash encryption
- 1024-bit OTP, up to 768-bit for customers
- Cryptographic hardware acceleration: AES, SHA-2, RSA, elliptic curve cryptography (ECC), random number generator (RNG)
- Power management:
- Internal low-dropout regulator
- Individual power domain for RTC
- 5 µA deep sleep current
- Wake up from GPIO interrupt, timer, ADC measurements, capacitive touch sensor interrupt.

Programming of ESP32

Programming languages, frameworks, platforms, and environments used for ESP32 programming:

- Arduino IDE with the ESP32 Arduino Core
- Espruino – JavaScript SDK and firmware closely emulating Node.js
- MicroPython (and CircuitPython) – lean implementation of Python 3 for microcontrollers
- Lua Network/IoT toolkit for ESP32-Wrover
- Mongoose OS – an operating system for connected products on microcontrollers; programmable with JavaScript or C. A recommended platform by Espressif Systems, AWS IoT, and Google Cloud IoT.
- mruby for the ESP32
- NodeMCU – Lua-based firmware
- PlatformIO
- Visual Studio Code with the officially supported Espressif Integrated Development Framework (ESP-IDF) Extension
- Zerynth – Python for IoT and microcontrollers, including the ESP32

Use in commercial devices

- Alibaba Group's IoT LED wristband, used by participants at the group's 2017 annual gathering. Each wristband operated as a "pixel", receiving commands for coordinated LED light control, allowing formation of a "live and wireless screen".
- DingTalk's M1, a biometric attendance-tracking system.
- LIFX Mini, a series of remotely controllable, LED based light bulbs.
- Pium, a home fragrance and aromatherapy device.
- HardKernel's Odroid Go, an ESP32 based handheld gaming device kit made to commemorate Odroid's 10th anniversary.
- Playdate, a handheld video game console jointly developed by Panic Inc. and Teenage Engineering.

Use in industrial devices

- TECHBASE's Moduino X series X1 and X2 modules are ESP32-WROVER / ESP32-WROVER-B based computers for industrial automation and monitoring, supporting digital inputs/outputs, analog inputs, and various computer networking interfaces.

- NORVI IIOT Industrial Devices with ESP32-WROVER / ESP32-WROVER-B SOC for industrial automation and monitoring with digital inputs, analog inputs, relay outputs and multiple communications interfaces. Supports LoRa and Nb-IoT as expansion modules.

FIG 3.6 ESP32

3.7 RECHARGABLE BATTERY

A **rechargeable battery**, **storage battery**, or **secondary cell** (formally a type of energy accumulator), is a type of electrical battery which can be charged, discharged into a load, and recharged many times, as opposed to a disposable or primary battery, which is supplied fully charged and discarded after use. It is composed of one or more electrochemical cells. The term "accumulator" is used as it accumulates and stores energy through a reversible electrochemical reaction. Rechargeable batteries are produced in many different shapes and sizes, ranging from button cells to megawatt systems connected to stabilize an electrical distribution network. Several different combinations of electrode materials and electrolytes are used, including lead–acid, zinc–air, nickel–cadmium (NiCd), nickel–metal hydride (NiMH), lithium-ion (Li-ion), lithium iron phosphate (LiFePO4), and lithium-ion polymer (Li-ion polymer).

Rechargeable batteries typically initially cost more than disposable batteries, but have a much lower total cost of ownership and environmental impact, as they can be recharged inexpensively many times before they need replacing. Some rechargeable battery types are available in the same sizes and voltages as disposable types, and can be used interchangeably with them.

Billions of dollars in research are being invested around the world for improving batteries and industry also focuses on building better batteries.

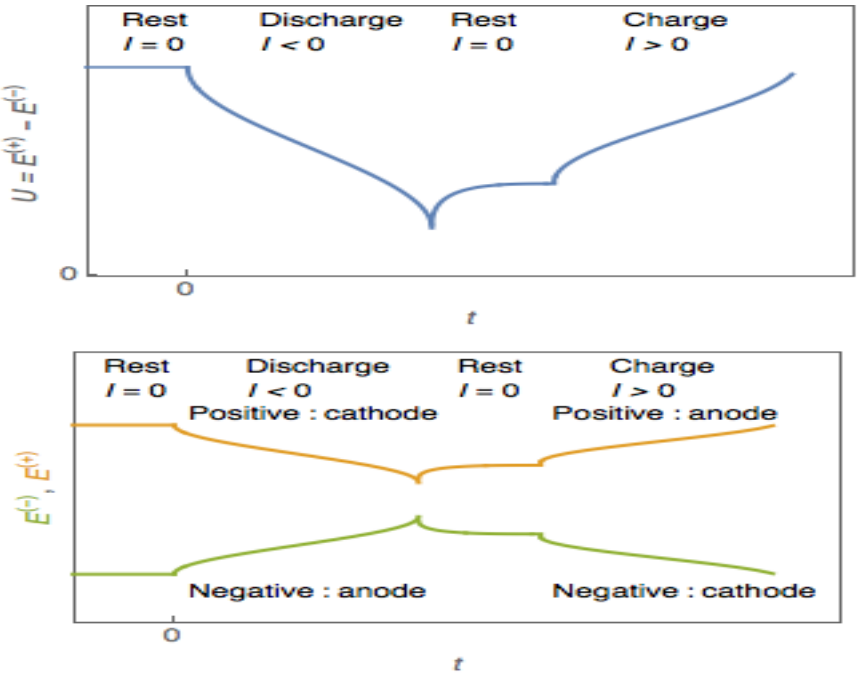
CHARGING AND DISCHARGING

During charging, the positive active material is oxidized, producing electrons, and the negative material is reduced, consuming electrons. These electrons constitute the current flow in the external circuit. The electrolytemay serve as a simple buffer for internal ion flow between the electrodes, as in lithium-ion and nickel-cadmiumcells, or it may be an active participant in the electrochemical reaction, as in lead–acid cells.

The energy used to charge rechargeable batteries usually comes from a battery charger using AC mains electricity, although some are equipped to use a vehicle's 12-volt DC power outlet. The voltage of the source must be higher than that of the battery to force current to flow into it, but not too much higher or the battery may be damaged.

Chargers take from a few minutes to several hours to charge a battery. Slow "dumb" chargers without voltage or temperature-sensing capabilities will charge at a low rate, typically taking 14 hours or more to reach a full charge. Rapid chargers can typically charge cells in two to five hours, depending on the model, with the fastest taking as little as fifteen minutes. Fast chargers must have multiple ways of detecting when a cell reaches full charge (change in terminal voltage, temperature, etc.) to stop charging before harmful overcharging or overheating occurs. The fastest chargers often incorporate cooling fans to keep the cells from overheating. Battery packs intended for rapid charging may include a temperature sensor that the charger uses to protect the pack; the sensor will have one or more additional electrical contacts.

Different battery chemistries require different charging schemes. For example, some battery types can be safely recharged from a constant voltage source. Other types need to be charged with a regulated current source that tapers as the battery reaches fully charged voltage. Charging a battery incorrectly can damage a battery; in extreme cases, batteries can overheat, catch fire, or explosively vent their contents.



APPLICATIONS

Devices which use rechargeable batteries include automobile starters, portable consumer devices, light vehicles (such as motorized wheelchairs, golf carts, electric bicycles, and electric forklifts), road vehicles (cars, vans, trucks, motorbikes), trains, small airplanes, tools, uninterruptible power supplies, and battery storage power stations. Emerging applications in hybrid internal combustion-battery and electric vehicles drive the technology to reduce cost, weight, and size, and increase lifetime.

FIG 3.7 RECHARGABLE BATTERIES

3.8 MOTOR

An **electricmotor** is an electrical machine that converts electrical energy into mechanical energy. Most electric motors operate through the interaction between the motor's magnetic field and electric current in a wire windingto generate force in the form of torque applied on the motor's shaft. An electric generator is mechanically identical to an electric motor, but operates with a reversed flow of power, converting mechanical energy into electrical energy.

Electric motors can be powered by direct current (DC) sources, such as from batteries, or rectifiers, or by alternating current (AC) sources, such as a power grid, inverters or electrical generators.

Electric motors may be classified by considerations such as power source type, construction, application and type of motion output. They can be powered by AC or DC, be brushed or brushless, single-phase, two-phase, or three-phase, axial or radial flux, and may be air-cooled or liquid-cooled.

Standardized motors provide convenient mechanical power for industrial use. The largest are used for ship propulsion, pipeline compression and pumped-storage applications with output exceeding 100 megawatts.

Applications include industrial fans, blowers and pumps, machine tools, household appliances, power tools, vehicles, and disk drives. Small motors may be found in electric watches. In certain applications, such as in regenerative braking with traction motors, electric motors can be used in reverse as generators to recover energy that might otherwise be lost as heat and friction.

Electric motors produce linear or rotary force (torque) intended to propel some external mechanism, such as a fan or an elevator. An electric motor is generally designed for continuous rotation, or for linear movement over a significant distance compared to its size. Magnetic solenoids are also transducers that convert electrical power to mechanical motion, but can produce motion over only a limited distance.

A series DC motor connects the armature and field windings in series with a common D.C. power source. The motor speed varies as a non-linear function of load torque and armature current; current is common to both the stator and rotor yielding current squared (I^2) behavior·A series motor has very high starting torque and is commonly used for starting high inertia loads, such as trains,

elevators or hoists.[2] This speed/torque characteristic is useful in applications such as dragline excavators, where the digging tool moves rapidly when unloaded but slowly when carrying a heavy load.
A series motor should never be started at no load. With no mechanical load on the series motor, the current is low, the counter-Electro motive force produced by the field winding is weak, and so the armature must turn faster to produce sufficient counter-EMF to balance the supply voltage. The motor can be damaged by overspeed. This is called a runaway condition.
Series motors called universal motors can be used on alternating current. Since the armature voltage and the field direction reverse at the same time, torque continues to be produced in the same direction. However they run at a lower speed with lower torque on AC supply when compared to DC due to reactance voltage drop in AC which is not present in DC.[3] Since the speed is not related to the line frequency, universal motors can develop higher-than-synchronous speeds, making them lighter than induction motors of the same rated mechanical output. This is a valuable characteristic for hand-held power tools. Universal motors for commercial utility are usually of small capacity, not more than about 1 kW output. However, much larger universal motors were used for electric locomotives, fed by special low-frequency traction power networks to avoid problems with commutation under heavy and varying loads.

FIG 3.8 MOTOR

3.9 ROBOTIC ARM

A **robotic arm** is a type of mechanical arm, usually programmable, with similar functions to a human arm; the arm may be the sum total of the mechanism or may be part of a more complex robot. The links of such a manipulator are connected by joints allowing either rotational motion (such as in an articulated robot) or translational (linear) displacement. The links of the manipulator can be considered to form a kinematic chain. The terminus of the kinematic chain of the manipulator is called the end effector and it is analogous to the human hand. However, the term "robotic hand" as a synonym of the robotic arm is often proscribed.

Types:

- Cartesian robot / Gantry robot: Used for pick and place work, application of sealant, assembly operations, handling machine tools and arc welding. It is a robot whose arm has three prismatic joints, whose axes are coincident with a Cartesian coordinator.
- collaborative robot / Cobot: Cobot applications contrast with traditional industrial robot applications in which robots are isolated from human contact. Cobot has a large variety of applications such as: Commercial Application, Robotic Research, Dispensing, Material Handling, Assembly, Finishing, Quality Inspection. Cobot safety may rely on lightweight construction materials, rounded edges, and the inherent limitation of speed and force, or on sensors and software that ensures safe behavior.
- Cylindrical robot: Used for assembly operations, handling at machine tools, spot welding, and handling at die casting machines. It is a robot whose axes form a cylindrical coordinate system.
- Spherical robot / Polar robot: Used for handling machine tools, spot welding, die casting, fettling machines, gas welding and arc welding. It is a robot whose axes form a polar coordinate system.
- SCARA robot: Used for pick and place work, application of sealant, assembly operations and handling machine tools. This robot features two parallel rotary joints to provide compliance in a plane.
- Articulated robot: Used for assembly operations, diecasting, fettling machines, gas welding, arc welding and spray-painting. It is a robot whose arm has at least three rotary joints.
- Parallel robot: One use is a mobile platform handling cockpit flight simulators. It is a robot whose arms have concurrent prismatic or rotary joints.
- Anthropomorphic robot: It is shaped in a way that resembles a human hand, i.e. with independent fingers and thumbs.

FIG 3.9 ROBOTIC ARM

DESCRIPTION OF BLUETOOTH MODULE

INTRODUCTION

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module,designed for transparent wireless serial connection setup.The HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication.This serial port bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It uses CSR Bluecore 04-External single chip Rluetooth system with CMOS technology and with AFH (Adaptive Frequency Hopping Feature).

- It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard and many more consumer applications.
- It has range up to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions.
- It is IEEE 802.15.1 standardized protocol, through which one can build wireless Personal Area Network (PAN). It uses frequency-hopping spread spectrum (FHSS) radio technology to send data over air.
- It uses serial communication to communicate with devices. It communicates with microcontroller using serial port (USART).

4.1FEATURES OF BLUETOOTH:

The Bluetooth module HC-05 is a MASTER/SLAVE module.By default the factory setting is SLAVE.The Role of the module (Master or Slave) can be configured only by AT COMMANDS.The slave modules cannot initiate a connection to another Bluetooth device, but can accept connections.Master module can initiate a connection to other devices.The user can use it simply for a serial port replacement to establish connection between MCU and GPS, PC to your embedded project, etc.Just go through the datasheet for more details.

Hardware Features

- Typical -80dBm sensitivity.
- Up to +4dBm RF transmit power.
- 3.3 to 5 V I/O.
- PIO(Programmable Input/Output) control.
- UART interface with programmable baud rate.
- With integrated antenna.
- With edge connector.

Software Features

- Slave default Baud rate: 9600, Data bits:8, Stop bit:1,Parity:No parity.
- Auto-connect to the last device on power as default.
- Permit pairing device to connect as default.
- Auto-pairing PINCODE:"1234" as default.

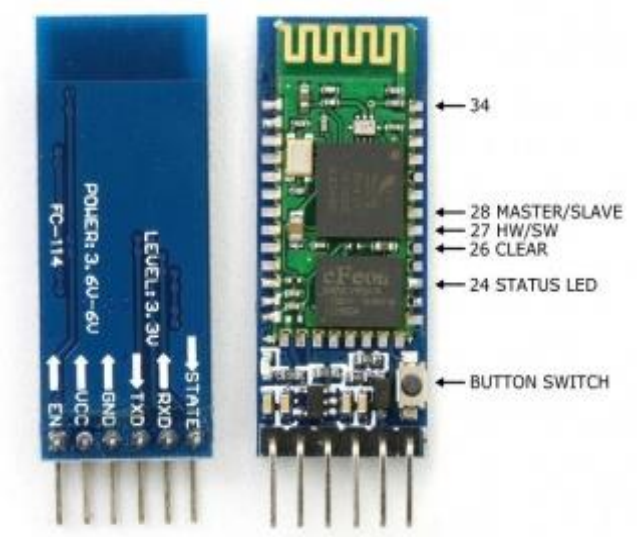


FIG 4.1 BLUETOOTH MODULE

4.2 PIN DESCRIPTION IN BLUETOOTH :

The HC-05 Module supports for UART, USB as well as SPI communication and depending on the application, necessary pins can be used. In my case, the board uses the UART communication.

Coming to the pins of the Bluetooth Module, generally, four pins are sufficient for successfully enabling a wireless communication link but the modules produced now-a-days come with six pins namely: VCC, GND, TX, RX, EN and STATE.

Pin Description

- **EN:** It is the enable pin. When this pin is floating or connected to 3.3V, the module is enabled. If this pin is connected to GND, the module is disabled.
- **+5V:** This is the supply pin for connecting +5V. As the Module has on-board 3.3V regulator, you can provide +5V supply.

- **GND:** It is the ground pin.
- **TX:** It is the Transmitter pin of the UART Communication.
- **RX:** It is the Receive Pin of UART.
- **STATE:** This is a status indicator pin. This pin goes LOW when the module is not connected to any device. When the module is paired with any device, this pin goes HIGH.

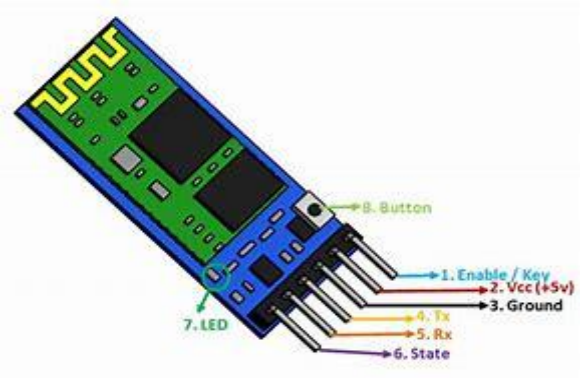


FIG 4.2 PIN DESCRIPTION OF BLUETOOTH

Modes of Operation

The HC-05 Bluetooth Module can be configured in two modes of operation: Command Mode and Data Mode.

In Command Mode, you can communicate with the Bluetooth module through AT Commands for configuring various settings and parameters of the Module like get the firmware information, change UART Baud Rate, change module name, set it as either Master or slave etc.

An important point about HC-05 Module is that it can be configured as Master or Slave in a communication pair. In order to select either of the modes, you need to activate the Command Mode and sent appropriate AT Commands.

Coming to the Data Mode, in this mode, the module is used for communicating with other Bluetooth device i.e. data transfer happens in this mode.

4.3 PROGRAMMING OF HC05:

The program given below is the HC-05 bluetooth module program.This process is quite different from others since we are going to use android mobile to control and communicate with arduino.Here the bluetooth module acts as an interface between our mobile and Arduino board.Before getting into the execution process,follow the given procedure:

- First of all,the user should install an application called **Bluetooth SPP PRO** from the playstore which is a free application.
- After installation,pair the bluetooth module to your mobile as like connecting one device to other using bluetooth.The default pairing code is **1234**.
- Upload the given program to the Arduino Uno board.After uploading the code,unplug the USB from the arduino.
- Now use external power adapter to power the Uno board.
- The Bluetooth SPP PRO has three types of communication mode.Here Byte stream mode is used to communicate.So select that mode and give the input as **1**,as soon as the input has given the arm will open the clamp and for **2** will close the clamp.

4.4 CONNECTION OF BLUETOOTH HC05 TO ARDUINO UNO :

Hardware and Software Required

- HC-05 Bluetooth Module
- Arduino Uno
- Arduino IDE (1.0.6V)

Hardware Connections

As we know that Vcc and Gnd of the module goes to Vcc and Gnd of Arduino.The TXD pin goes to RXD pin of Arduino and RXD pin goes to TXD pin of Arduino i.e(digital pin 0 and 1).The user can use the on board Led.But here,Led is connected to digital pin 12 externally for betterment of the process.

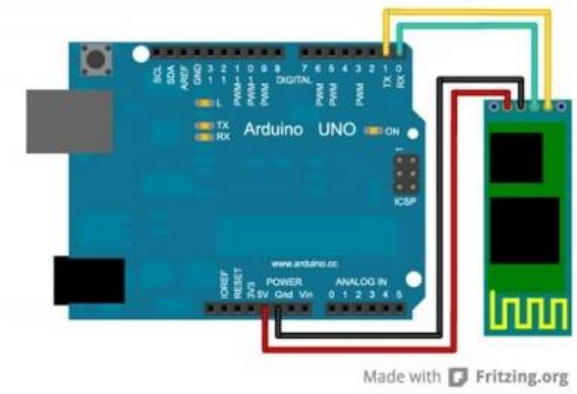


FIG 4.4 CONNECTION OF HC05 TO ARDUINO

DESCRIPTION OF THE CODE

```
#include "esp_camera.h"
#include <WiFi.h>
#define CAMERA_MODEL_WROVER_KIT
#define CAMERA_MODEL_M5STACK_PSRAM
#define CAMERA_MODEL_AI_THINKER
const char* ssid = "New";   //Enter SSID WIFI Name
const char* password = "12345678";   //Enter WIFI Password
#if defined(CAMERA_MODEL_WROVER_KIT)
#define PWDN_GPIO_NUM    -1
#define RESET_GPIO_NUM   -1
#define XCLK_GPIO_NUM    21
#define SIOD_GPIO_NUM    26
#define SIOC_GPIO_NUM    27
#define Y9_GPIO_NUM      35
#define Y8_GPIO_NUM      34
#define Y7_GPIO_NUM      39
#define Y6_GPIO_NUM      36
#define Y5_GPIO_NUM      19
#define Y4_GPIO_NUM      18
#define Y3_GPIO_NUM       5
#define Y2_GPIO_NUM       4
#define VSYNC_GPIO_NUM   25
#define HREF_GPIO_NUM    23
#define PCLK_GPIO_NUM    22
#elif defined(CAMERA_MODEL_AI_THINKER)
#define PWDN_GPIO_NUM     32
#define RESET_GPIO_NUM    -1
#define XCLK_GPIO_NUM      0
#define SIOD_GPIO_NUM     26
#define SIOC_GPIO_NUM     27
#define Y9_GPIO_NUM       35
#define Y8_GPIO_NUM       34
#define Y7_GPIO_NUM       39
#define Y6_GPIO_NUM       36
#define Y5_GPIO_NUM       21
#define Y4_GPIO_NUM       19
#define Y3_GPIO_NUM       18
#define Y2_GPIO_NUM        5
#define VSYNC_GPIO_NUM    25
#define HREF_GPIO_NUM     23
#define PCLK_GPIO_NUM     22
#else
#error "Camera model not selected"
#endif
// GPIO Setting
extern int gpLb =  2; // Left 1
extern int gpLf = 14; // Left 2
extern int gpRb = 15; // Right 1
extern int gpRf = 13; // Right 2
extern int gpLed =  4; // Light
extern String WiFiAddr ="";
void startCameraServer();
void setup() {
  Serial.begin(115200);
  Serial.setDebugOutput(true);
  Serial.println();
  pinMode(gpLb, OUTPUT); //Left Backward
  pinMode(gpLf, OUTPUT); //Left Forward
  pinMode(gpRb, OUTPUT); //Right Forward
  pinMode(gpRf, OUTPUT); //Right Backward
  pinMode(gpLed, OUTPUT); //Light
```

```
  //initialize
  digitalWrite(gpLb, LOW);
  digitalWrite(gpLf, LOW);
  digitalWrite(gpRb, LOW);
  digitalWrite(gpRf, LOW);
  digitalWrite(gpLed, LOW);
  camera_config_t config;
  config.ledc_channel = LEDC_CHANNEL_0;
  config.ledc_timer = LEDC_TIMER_0;
  config.pin_d0 = Y2_GPIO_NUM;
  config.pin_d1 = Y3_GPIO_NUM;
  config.pin_d2 = Y4_GPIO_NUM;
  config.pin_d3 = Y5_GPIO_NUM;
  config.pin_d4 = Y6_GPIO_NUM;
  config.pin_d5 = Y7_GPIO_NUM;
  config.pin_d6 = Y8_GPIO_NUM;
  config.pin_d7 = Y9_GPIO_NUM;
  config.pin_xclk = XCLK_GPIO_NUM;
  config.pin_pclk = PCLK_GPIO_NUM;
  config.pin_vsync = VSYNC_GPIO_NUM;
  config.pin_href = HREF_GPIO_NUM;
  config.pin_sscb_sda = SIOD_GPIO_NUM;
  config.pin_sscb_scl = SIOC_GPIO_NUM;
  config.pin_pwdn = PWDN_GPIO_NUM;
  config.pin_reset = RESET_GPIO_NUM;
  config.xclk_freq_hz = 20000000;
  config.pixel_format = PIXFORMAT_JPEG;
  //init with high specs to pre-allocate larger buffers
  if(psramFound()){
    config.frame_size = FRAMESIZE_UXGA;
    config.jpeg_quality = 10;
    config.fb_count = 2;
  } else {
    config.frame_size = FRAMESIZE_SVGA;
    config.jpeg_quality = 12;
    config.fb_count = 1;
  }
  // camera init
  esp_err_t err = esp_camera_init(&config);
  if (err != ESP_OK) {
    Serial.printf("Camera init failed with error 0x%x", err);
    return;
  }
  //drop down frame size for higher initial frame rate
  sensor_t * s = esp_camera_sensor_get();
  s->set_framesize(s, FRAMESIZE_CIF);
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED) {
    delay(500);
    Serial.print(".");
  }
  Serial.println("");
  Serial.println("WiFi connected");
  startCameraServer();
  Serial.print("Camera Ready! Use 'http://");
  Serial.print(WiFi.localIP());
  WiFiAddr = WiFi.localIP().toString();
  Serial.println("' to connect");
}
void loop() {
}
```

GENERAL DESCRIPTION OF BOREWELLS

The rescue operation mainly consists of three processes: **Approaching the Victim, Handling the body, Taking child out of the well**. A regular autonomous robot can easily perform the first and third operations in less time. But there is a great chance for injury of victim as they try hooking up body organs and cloths. To overcome these hurdles, we have designed a bore-well recue robot with advanced equipment and devices. Thus the objective of this project is to construct and design a bore well rescue system which not only rescues a trapped baby from bore well but also deals with extreme safe handling of the victim. The design of handling system is made in such a way that the victim gets hurt minimally. This project is a human controlled system which withthe help of wireless camera gives an insight view of the victim and steps taken to achieve this. The system consists of a gear assembly to fix the system with the inner walls of the well, two artificial arms to hold the victim by his hands to prevent from further sliding down inside the borewell, a cage like structure made up of thin strips is made to pass through the walls of the borewell to reach below the victim and a safety balloon attached to the lower end of the cage to give the victim support from below. The system is remotely operated using microcontroller technology and using wireless camera we can view both audio and video on the PC/phone.

6.1 The history behind Borewell rescues

A small delay in the accumulation of different resources for the rescue operation in the existing method will cost the life of an infant. If the area beside the borehole contains rocks below a certain depth, in such cases the chance of saving the child alive is very low. Lack of oxygen inside the bore well and lack of light sources causes the major difficulty during the rescue operation.

There is no special equipment for rescuing the child trapped inside the bore well. Not even a proper technique to rescue victims of such accidents. The time taken for the operation is more than 72 hours in most of the cases. Following are some of the details of the bore well mishaps in recent years in India. In most of the cases, rescue operations did not yield satisfactory results. Due to very long rescue operations and traditional techniques followed, infants could not be saved.

RESULT

The Smart Child Rescue System from Borewell (SCRS) is installed on Borewell which is under construction or under working. The robotic arm is present with EP32 camera module

CONCLUSIONS AND REFERENCES

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. Further, we would like to conclude that with the help of our project, we would be able to rescue the child safely within short period of time. The Smart Child Rescue System from Borewell (SCRS) is designed especially to save the child from borewell at short period of time. This system is designed in order to overcome the drawbacks faced by existing conventional system for rescuing the child from the borewell. This system prevent the child before it falls deep in to the borewell. All the units are powered by ArduinoMicroController which is best, latest, low cost, low power and provides superior performance. Thus by this Smart Child Rescue System, many child can be saved

The Child will land safely in the Horizontal Closure which is in around 10 feet. Once the system is activated it sends the message to the contractor and nearby fire service station along with location. The neighborhoods will get alert by the alarm system placed at the top of the borewell. Thus the accident information is send to the needy which help us to rescue the child easily and safely. With the help of this system the child can be rescued safely in short duration of time. This system will be useful for preventing child from falling into borewell.

References

1. G. Kavianand, K. Gowri Ganesh, P. Karthikeyan, “Smart child rescue system from borewell” (SCRS), Published in: Emerging Trends in Engineering, Technology and Science (ICETETS), International Conference on, 24-26 Feb. 2017
2. N. M. Kurukuti, M. Jinkala, P. Tanjeri, S. R. Dantla and M. Korrapati, “A novel design of systemic system for rescue in bore well accidents”, 2016 International Conference on Systemics and Automation for Humanitarian Applications (RAHA), Kollam, 2016, pp. 1-5.doi: 10.1109/RAHA.2016.7931875 International Journal of Trend in Scientific Research and Development (IJTSRD) @ www.ijtsrd.com eISSN: 2456-6470 @ IJTSRD | Unique Paper ID - IJTSRD23847 | Volume – 3 | Issue – 4 | May-Jun 2019 Page: 642
3. Raj Manish, P. Chakraborty, G. C. Nandi, Rescue systemics in bore well Environment, Cornell university library 5thJune,2017
4. N. Bourbakis and I. Papadakis-Ktistakis ATRC, “Design Ground Bio-inspired Micro-System Structure for Detecting Humans in disastrous region”. Wright State University, Dayton, OH 45435 and Technical University of Crete, Greece.10thJune,2017
5. K. P. Sridhar, C. R. Hema, S. Deepa Published online: “Design of a Wireless Sensor Fusion System to Analyze Conditions Inside Bore Wells”. Wireless Pers Commun (2017) 94:1951–1962 DOI 10.1007/s11277-016-3299- 4 on 12 April 2016.
6. Preedipat Sattayasoonthorn, “Battery Management for Rescue System Operation” 9th July,2017.