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# DESIGN OF MINE DETECTING ROBOT USING UNDERGROUND SENSOR NETWORK

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***Abstract*—Robot application for human security is an important topic in the research domain. From military domain to medical one, many applications are developed to safeguard human life. A mine detecting robot is a revolutionary military advancement and a lifesaving invention that can benefit humanity as all. The robot allows it to scan the infected area, while a beat frequency oscillator is used as a mine detecting sensor placed on a servo motor infront of the vehicle. This paper proposes a design of a mine detecting sensor and implementing it in a robotic prototype the embedded proposed system is based on arduino technologies.**

***Index terms—IOT- Internet of Things.***

## I. I. INTRODUCTION

The primary factor in running any industry successfully is to ensure the safety of person working that work area. Underground mining industry comes to the same category, where each and every parameter such as methane gas, high temperature, fire accidents and so on has to monitor regularly. Every mining industry follows some basic precautions to avoid any type of unwanted phenomena. In this paper we are considering above mentioned situations and also monitoring mine workers activities e.g. Fall Detector that states workers position. A major improvement is to implement internet of things in collecting and plotting parameter and sensor values to web servers. Designing of IoT systems in Mines for Safety and Efficient Monitoring is based on wireless sensor network can be sensible and correctly redirect dynamic condition of workers in the underground areas to data servers and can be monitored regularly using web applications and servlets in computer system

The hybrid underpass radio propagation model comprising of the free space propagation and the modified waveguide propagation is proposed. However, using popular radio communication inside underground mines has some drawbacks. Though radio signals are transmitted, attenuation, diffraction, multi-path and scattering are frequently very serious. Therefore wireless communication is the important need today for the fast, flexible safety, accurate and production method in underground mines and we are using IEEE802.11 Wi-Fi wireless communication protocols to record the sensed parameters to data center or web servers. There are diverse added research ideas proposed by different people on wireless communication. In a network called chain-type wireless underground mine sensor network (CWUMSN) is recently proposed which consists of three kinds of sensor nodes: sensing nodes, cluster head nodes, and a monitor the underground environment and locate the miners.

## II. BLOCK DIAGRAM

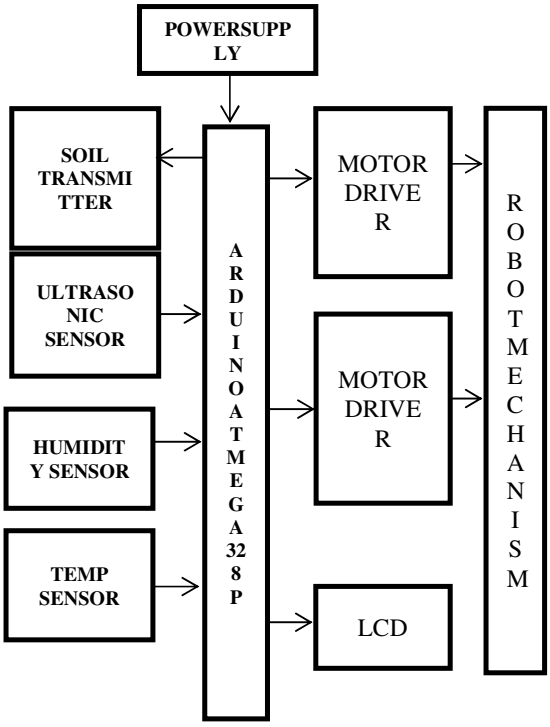


Fig. 1. Block diagram.

In this block diagram initially there is three sensors they are ultrasonic sensor, humidity sensor and temperature sensor. LM35 is the example of the temperature sensor which is used to measure the temperature and the another one is humidity sensor which is used to measure the relative content of air and the ultrasonic sensor is used to measure the reachable distance and the soil transmitter is used to trasmit the data and here LCD is acts a receiver and all the signals are send to the Arduino Atmega328p Here te soli transmitter and LCD are not interconnected it works trough wireless communication with the help of all the signals and the motor driver and robot mechanism, the robot mover towards the

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target.

## III. III. ARDUINO ATMEGA328P

Arduino Uno is a microcontroller board based on 8-bit ATmega328P microcontroller. Along with ATmega328P, it consists other components such as crystal oscillator, serial communication, voltage regulator, etc. to support the microcontroller. Arduino Uno has 14 digital input/output pins (out of which 6 can be used as PWM outputs), 6 analog input pins, a USB connection, A Power barrel jack, an ICSP header and a reset button. The 14 digital input/output pins can be used as input or output pins by using pin Mode, digital Read and digital Write functions in arduino programming. Each pin operate at 5V and can provide or receive a maximum of 40mA current, and has an internal pull-up resistor of 20-50 KOhms which are disconnected by default.

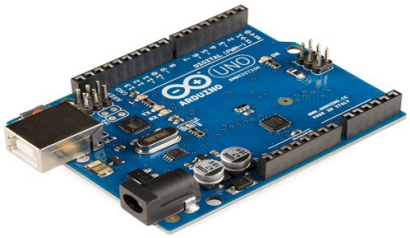

Fig 2.Arduino Atmega328P

### A. *A. Specification*

- Microcontroller: Microchip ATmega328P
- Operating Voltage: 5 Volts
- Input Voltage: 7 to 20 Volts
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 20 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader
- SRAM: 2 KB
- EEPROM: 1 KB

### B. *B. Special Pin Function*

Every of the 14 digital pins and 6 Analog pins on the Uno can be used as an input or output, using pin Mode, digital Write, and digital Read functions. They run at 5 volts. Each pin can provide or receive 20 mA as suggested operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A highest of 40mA is the value that must not be exceed on any I/O pin to avoid permanent damage to the microcontroller. The Uno has 6 analog inputs, labeled A0 through A5, each of which provide 10 bits of resolution (i.e. 1024 different values). By default they measure from ground to 5 volts, though is it possible to change the upper end of their range using the AREF pin and the analog Reference function.

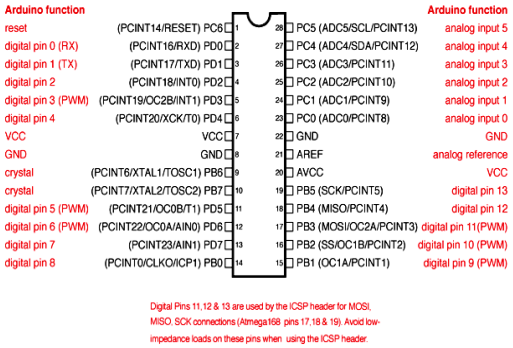


Fig 3. Pin diagram

- Serial Pins 0 (Rx) and 1 (Tx): Rx and Tx pins are used to receive and transmit TTL serial data. They are connected with the corresponding ATmega328P USB to TTL serial chip.
- External Interrupt Pins 2 and 3: These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value.
- PWM Pins 3, 5, 6, 9 and 11: These pins provide an 8-bit PWM output by using analog Write function.
- SPI Pins 10 (SS), 11 (MOSI), 12 (MISO) and 13 (SCK): These pins are used for SPI communication.
- In-built LED Pin 13: This pin is connected with a built-in LED, when pin 13 is HIGH – LED is on and when 13 pin is LOW, it's off.
- Analog pin 4 (SDA) and pin 5 (SCA) also used for TWI communication using Wire library. Arduino Uno has a couple of other pins as explained below:
- AREF: Used to provide reference voltage for analog inputs with analog Reference function.
- Reset Pin: Making this pin LOW, resets the microcontroller.

## IV. CIRCUIT DIAGRAM

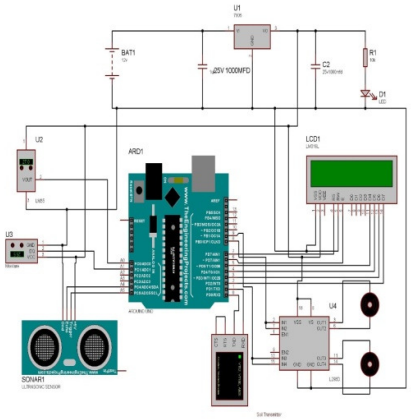

Fig 4.Circuit Diagram

Internet of Things (IoT) is a new revolution of the Internet. It makes Objects themselves recognizable, obtain intelligence, communicate information about themselves and

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they can access information that has been aggregated by other things. The Internet of Things allows people and things to be connected Anytime, Anyplace, with anything and anyone, ideally using any path/network and any service. This implies addressing elements such as Convergence, Content, Collections, Computing, Communication, and Connectivity. The Internet of Things provides interaction among the real/physical and the digital/virtual worlds.

The Applications of the IOT are numerous and diversified in all areas of every-day life of people which broadly covers society, industries, and environment. All the IOT applications developed so far comes under these three broad areas as shown in. According to Internet of Things Strategic Research Agenda (SRA) during 2010, 6 or more application domains were identified that are smart energy. According to the survey that the IOT-I project ran during 2010 65 IOT application scenarios were identified and grouped in to 14 domains, which are Transportation, Smart Home, Smart City, Lifestyle, Retail, Agriculture, Smart Factory, Supply chain, Emergency, Health care, User interaction, Culture and tourism, Environment and Energy. Some of the IOT applications.

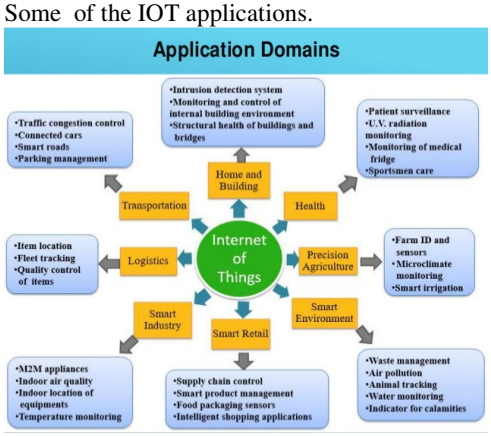


Fig 5.Application flow chart

## *IV. TEMPERATURE SENSOR (LM35)*

This is a temperature sensor circuit that uses an LM35, an IC that converts the ambient temperature in to an equivalent output voltage. The voltage output of an LM35 increases by approximately 10 mv for every 1degree kelvin of rise in temperature. Note that 1 degree kelvin is equal to 1 degree Celsius.

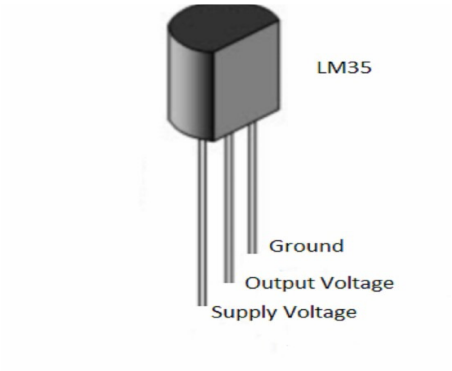


Fig 6: Temperature sensor

## *V. ULTRASONIC SENSOR (HC-SR04)*

This device detects the distance to an object and shows the result in centimeters. This device is activted by a trigger mechanism , pressing the trigger for one time will give us the distance to an object if there was no error like poor aiming .the distance to an object is displayed using a digital display with high intencity in order to be seen in any lighting conditions.


Fig 7: Ultrasonic sensor

### A. *Motivation*

The motivation of using this device is when construction engineers at any sites need to measure distances to unreachable places in a quick and easy way using this device with high efficiency and accuracy.

### B. *Characteristics*

This device detects the distance to an object and shows the result in centimeters. This device is activated by a trigger mechanism, pressing the trigger for one time will give us the distance to an object if there was no error like poor aiming. The distance to an object is displayed using a digital display with a high intensity in order to be seen in any lighting conditions. It is a simple and portable device similar to a gun as shown in Figure 2.2 that uses a laser pointer to aim at a specific area to get the reflection at the receiver side.

***Humidity sensor***

The humidity sensor for determine the humidity content or relative humidity of air .coverts relative humidity to output voltage

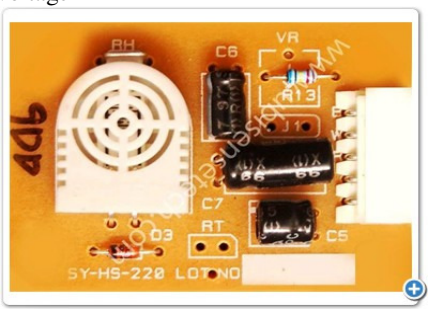


Fig 8. Humidity sensor

## *VI. L293D MOTOR DRIVE*

L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current

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signal. This higher current signal is used to drive the motors.

L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively.

Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

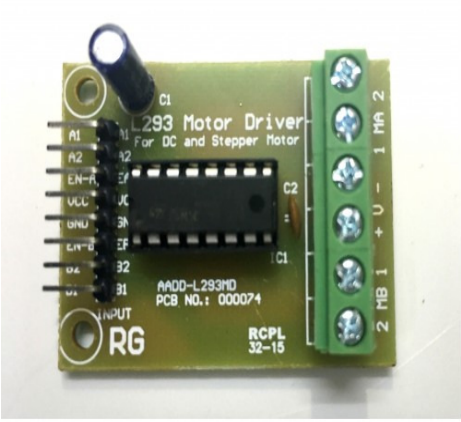


Fig 9. Motor drive

## A. *Working of L293D*

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

## *B. V. LOGIC FUNCTION*

Let's consider a Motor connected on left side output pins (pin 3, 6). For rotating the motor in clockwise direction the input pins has to be provided with Logic 1 and Logic 0.

- Pin 2 = Logic 1 and Pin 7 = Logic 0 | Clockwise Direction
- Pin 2 = Logic 0 and Pin 7 = Logic 1 | Anticlockwise Direction
- Pin 2 = Logic 0 and Pin 7 = Logic 0 | Idle [No rotation] [Hi-Impedance state]
- Pin 2 = Logic 1 and Pin 7 = Logic 1 | Idle [No rotation]

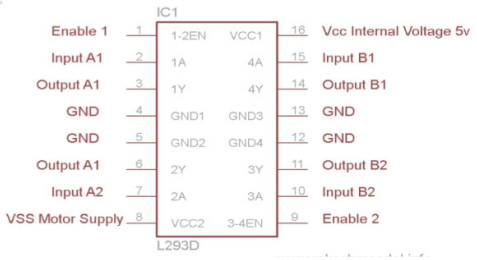


Fig 10 L293D Pin diagram

In a very similar way the motor can also operate across input pin 15, 10 for motor on the right hand side.

***Voltage Specification***

VCC is the voltage that it needs for its own internal operation 5v; L293D will not use this voltage for driving the motor. For driving the motors it has a separate provision to provide motor supply VSS (V supply). L293d will use this to drive the motor. It means if you want to operate a motor at 9V then you need to provide a Supply of 9V across VSS Motor supply. The maximum voltage for VSS motor supply is 36V. It can supply a max current of 600mA per channel. Since it can drive motors Up to 36v hence you can drive pretty big motors with this l293d. VCC pin 16 is the voltage for its own internal Operation. The maximum voltage ranges from 5v and upto 36v.

## VII. VI. CONCLUSION

This paper proposes internet of underground things (IOUT) for real time decision making in agriculture fields. We have presented completed architectural for precision agriculture based IOUT. We have analyzed the sensing and communications as the main compons of IOUT .challenges to realization of IOUT are highlighted and tested designs for IOUT realization are preented.

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