A Project Report

On

INTELLIGENT SURVEILLANCE ROBOT

Submitted in partial fulfillment for the award of the degree

of

Bachelor of Technology

in

Electronics and Communication Engineering

by

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SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY

(AUTONOMOUS)

(Approved by AICTE & Affiliated to JNTUA, Ananthapuramu)
(Accredited by NBA for Civil, EEE, ECE, MECH and CSE, New Delhi)
(Accredited by NAAC with 'A+' Grade, an ISO 9001:2008 Certified Institution)
Siddharth Nagar, Narayanavanam road, Puttur-517583, A.P
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

CERTIFICATE

This is to certify that the Project entitled " *INTELLIGENT SURVEILLANCE ROBOT*"that is being submitted by

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is in partial fulfillment of the requirements for the award of *BACHELOR* OF *TECHNOLOGY* in ELECTRONICS AND COMMUNICATION ENGINEERING to JNTUA , ANANTHAPURAMU. *The results embodied in this Project report have not been submitted to any other University or Institute for the award of any degree.*

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Acknowledgement

TABLE OF CONTENTS

ABSTRACT

Robotics is an interesting and fast-growing field. The concept of Mobile robot is fast evolving and the number of mobile robots and their complexities are increasing with different applications. Nowadays robots are in wide usage due to their high level of performance and reliability and which is great for human beings. The Surveillance Robot is a vehicle robotics is used for live viewing or monitoring the required area and follows the instructions given by us to move. The Surveillance The robotics and automation industry which is ruled the sectors from manufacturing to household entertainments. It is widely used because of its simplicity and ability to modify to meet changes of needs. For remote operation attached with wireless camera for monitoring purpose. The robot along with camera wirelessly transmit real time video with low light vision capabilities. Metal detecting sensor and PIR sensor coupled with motors, microprocessor and few other components combined gives an intelligent live viewing with movement. They can also be used in dangerous environments, where human penetration could be fatal.

LIST OF FIGURES

LIST OF TABLES

SYMBOLS & ABBREVATIONS

S. No	Acronym	Expansion
1.	BLE	Bluetooth Low Energy
2.	CD	Compact Disk
3.	DVD	Digital Versatile Disk
4.	DSLR	Digital Single Lens Reflex Camera
5.	DDP	Discharge Double Pole
6.	DPST	Single Throw
7.	EDR	End Point Detection and Response
8.	EMF	Electro Motive Force
9.	IOT	Internet of Things
10.	LED	Light Emitting Diode
11.	LI-ON	Lithium Ion
12.	PCB	Printed Circuit Board
13.	QR	Response Random Access
14.	RAM	Random Access Memory
15.	ROM	Read Only Memory
16.	SD	Secured Digital
17.	SDHC	Secured Digital High Capacity
18.	SDVC	Speed Dependent Volume Control
19.	SDXC	Secured Digital Extended Capacity TF
20.	WI-FI	Wireless Fidelity

CHAPTER 1

INTRODUCTION

Surveillance is a real time collection and analysis of data that is timely distributes the information to the operator. Surveillance in Defense Applications plays an important role for keeping an eye out in order to protect its citizens and take necessary actions. Surveillance is the task of monitoring the set of conditions. This generally occurs in a military scenario were surveillance war areas, adversary territory. Human surveillance is carried by experienced work forces in close sensitive areas so as to continually monitor for changes. Whereas there is always added risks of losing work force in the time of getting caught by the adversary. With advanced technology in pasted years, there it is possibility to monitor areas of importance remotely by the use of robots instead of human. Apart from the given advantages of not losing any work forces, physical and elegant robots can be used detect subtle elements that are not conspicuous to people.

A surveillance robot is a partially automated machine that works as per instructed by operator and move to destination, Streaming video or pictures which can then analyzed by the operator. Surveillance is a crucial task, we cannot put someone life to risk, instead of that we can use this kind of robots which do not need sleep, they don't get hungry, they don't have emotions, they are just stick to their duties and follow the orders. Nothing can be more important than human life. Use of such robots can help to save many lives on border areas. And we can use this manpower in other tasks. Here we use an android device to control the robot. Connection is established to the micro-controller using WIFI. The base part of robot consists of wheels, so they can travel on rough & watery surfaces also. So, the one who is sitting on the output screen can have all the records of opponent activities.

This kind of robots can easily replace the soldiers and industrial workers where human access is impossible at that time this robot performs their duty with better modifications. So, in the future the warfare is handled by this kind of smart robots. The device Surveillance Robot is designed in a way to control robot through instruction given

by us and follow according via any browser and also in a particular application.

The connection between the mobile and the vehicle is facilitated with internet technology. The aim of the device is to perform required tasks by receiving the commands of the user. The controlling can be done by any smart phone, tab, iOS device or laptops etc. on any internet enabled devices which we use in our day-to-day life. The commands from the mobile are transmitted through the internet from the input given by mobile device from any range the commands forward, backward, right, left and stop are used to control the device. After receiving the commands given by user the microcontroller then operates the motors to move using the motor driver. The movement of the robot is facilitated by two 100 RPM motors connected to the motor driver. Also, there will be space available to store the things or objects and will be having a door like design controlled using servo motor.

Surveillance is a real time collection and analysis of data that is timely distributes the information to the operator. Surveillance in Defense Applications plays an important role for keeping an eye out in order to protect its citizens and take necessary action as needed. Surveillance is the task of monitoring the set of conditions, an area or a person. This generally occurs in a military scenario where surveillance war areas, adversary territory or hostage situation is crucial to a nation's security. Human surveillance is carried by experienced work forces in close sensitive areas so as to continually monitor for changes. Whereas there is always added risks of losing work force in the time of getting caught by the adversary. With advanced technology in pasted years, there it is possibility to monitor areas of importance remotely by the use of robots instead of human. Apart from the given advantages of not losing any work forces, physical and elegant robots can be used detect subtle elements that are not conspicuous to people. By embedding the robots with high resolution cameras, it is manageable to gather information about the designated location remotely. A surveillance robot is a partially automated machine that works as per instructed by operator and move to destination, Streaming video which can then analyzed by the operator. Surveillance is a crucial task, we cannot put someone life to risk, instead of that we can use this kind of robots.

The field of surveillance robots is quite popular. A lot of work has been done in navigational algorithms and control system of wireless surveillance robots. The surveillance robot is designed to be multitasking, cost efficient and feasible machine that can be implemented for the military purpose. These machines replaces the Indian army soldiers and dogs that are used at the borders during the time of war saving the lives from opponents or enemy nations and from environmental condition such as extreme cold and heat. The system is driven by a motor and the power supply is provided by a 12v battery. A robot which performs image processing using the camera on an Android smartphone has also been implemented. However, this method is limited by the processing power of the phone, a problem that we have addressed by remotely performing all imaging processing operations on a different computer, after transmitting the camera's feed. Our project is rather unique in the critical scenarios in military as well as in industries, it also offers video feedback.

Robotics, in the modern world, are tightly integrated with sensing, computing, and communication hardware which enables the robots to do all types of complex and coordinated operations. With the integration of IoT in robotics, several units complement the robot works like smart objects, sensors in the field areas, servers, and all sorts of network communication hardware. IoT-based robots these days are implemented in health care, industrial plants, military applications, research centers, and even automobile-based production units. In the real world, lots of researchers around the world are working on real-time automation IoT robotics product development for as such implementation in diverse areas.

The development of intelligent surveillance systems is an active research area. In this context, mobile and multi-functional robots are generally adopted as means to reduce the environment structuring and the number of devices needed to cover a given area. Nevertheless, the number of different sensors mounted on the robot, and the number of complex tasks related to exploration, monitoring, and surveillance make the design of the overall system extremely challenging. In this paper, we present our autonomous mobile robot for surveillance of indoor environments. We propose a system able to handle autonomously general-purpose tasks and complex surveillance issues simultaneously. It is

shown that the proposed robotic surveillance scheme successfully addresses a number of basic problems related to environment mapping, localization and autonomous navigation, as well as surveillance tasks, like scene processing to detect abandoned or removed objects and people detection.

Robotics has been a staple of advanced manufacturing for over half a century. As robots and their peripheral equipment become more sophisticated, reliable, and miniaturized, these systems are increasingly being utilized for entertainment, military, and surveillance purposes. A remote controlled surveillance robot is defined as any robot that is remotely controlled to capture images/video for specific purposes. Mobile robots that are controlled remotely have important rules in area of rescue and military. A rescue robot is a kind of surveillance robot that has been designed for the purpose of rescuing people. Common situations that employ rescue robots are mining accidents, urban disasters, hostage situations, and explosions. Military robots are autonomous robots or remote-controlled devices designed for military applications. Such systems are currently being researched by a number of militaries. US Mechatronics has produced a working automated sentry gun and is currently developing it further for commercial and military use that can be operated remotely, and another very popular one is The Multi-Mission Unmanned Ground Vehicle, previously known as the Multifunction Utility/Logistics and Equipment vehicle.

CHAPTER 2

LITERATURE SURVEY

2.1 Wireless Control Surveillance Robot, done by Shaikh Shoeb, Mir Ibrahim, Ansari Asagr Ali published in International Journal of Advance Foundation and Research in Science and Engineering, 2015.

This project describes a new economical solution of robot control systems In general; the Robots are controlled through wired network. The programming of the robot takes time if there is any change in the project the reprogramming has to be done. Thus, they are not user friendly and worked along with the user preferences. To make a robot user-friendly and to get the multimedia tone in the control of the robot, they are designed to make user commanded work. The modern technology has to be implemented to do this.

2.2 Surveillance robot using Arduino, done buy N. Pugazhenthi, K.Vinu Lakshmi,V. Preneeth published in International Journal of Innovative Technology and Exploring Engineering, 2019.

Surveillance is the method for observing a location, an area or a person for protection and security purpose. This activity always happens in a military, police, public places and even in houses nowadays for monitoring and to control the illegal activities. Especially, the surveillance activity is used mainly for human because the people were doing all illegal work against the government and at the same time to protect them from those activities. The advent of technology has brought a revolutionary change in the field of robotics, especially in the automation sector. The usage of robotics is increasing day by day, which reduces the human work.

2.3 Surveillance Robot using IoT, done by T.Akilan, Princi Kumar, Satyam Chaudhary published in International Journal of Research in Engineering, Science and Management, 2020.

Surveillance of human activities or any suspicious activities in war field and border

lines with the help of a robot based on IoT technology as human access is not possible everywhere and if possible, can lead to risk of losing life.

Surveillance takes place through wireless camera interfacing with Arduino and various sensors. WIFI/Bluetooth module is used for communication that is controlled from a distance by Smartphone or a PC. Wireless camera sends the real time video signals. Robot also collects data from various sensors send it to micro-controller. The movement of robot is controlled by the user through a Smartphone or PC. The robot is fully capable to work as required in defence areas as it can be controlled automatically and manually both. According to security perspective this robot is very useful not only in defence but also in domestic areas too.

2.4 Border Surveillance Robot, done by Sabiya Sultana, D. Shalini, Prashanth Varma, V.SriCharan published in International Journal of Advance Research, Ideas and Innovations in Technology, 2020.

Border security provides regional monitoring, immediate warning and border patrolling management. For a long time, this has been a major problem to protect the country's boundaries against terrorists, illegal immigrants, illegal trades etc. Currently, most of the military monitoring services lack the required standard's which is not up to expectation, leading to border soldiers' lives being put in constant danger. So as to decrease the soldier lives being lost and to improve the surveillance standard's there is need for a system which can effectively monitor the border with locomotion and surveillance capabilities.

2.5 Military Surveillance Robot, done by Abhijeet Dhule, Neha Sangle, Supriya Nagarkar, Asmita Namjoshi published in International Research Journal of Engineering and Technology, 2020.

Surveillance plays an important role in border areas to keep eye on enemies. In such situations it is difficult to allow duty of surveillance to a soldier, which may cause dangerous to the life on one. Rather we can use an robot to keep eye on border areas. So in such cases this kind of robots are very useful they are small in size and provided with

many abilities so they can perform the duty of surveillance and spying perfectly.

2.6 IOT Surveillance Robot Using ESP-32 Wi-Fi CAM & Arduino, done by Nookala Venu. Machine Learning Application for Medicine Distribution Management System, 2022.

This project details the development of a surveillance robot employing IoT technology, ESP-32 Wi-Fi camera, and Arduino for enhanced monitoring capabilities. The integration of these components enables real-time video streaming, remote control, and sensor data collection, showcasing the potential of combining IoT devices for advanced surveillance applications**.**

2.7 Military Surveillance Robot, done by J. Azeta, C.A. Bolu, D. Hinvi, A.A. Abioye, H. Boyo, P. Anakhu, P Onwordi, "An Android Based Mobile Robot for Monitoring and Surveillance", 2020.

This project focuses on the development of a state-of-the-art military surveillance robot designed for reconnaissance and monitoring in challenging environments. Equipped with advanced sensors and strategic mobility, the robot enhances military intelligence capabilities, providing a robust solution for surveillance in complex operational scenarios.

2.8 Real Time Violence Detection Using Autonomous Intelligent Surveillance Robot Aishwarya Shree J; Hari Ram Karthik M; Richie Soshan E; Sudhakar R 2023 2nd International Conference on Advancements in Electrical, Electronics, Communication, Computing and Automation (ICAECA).

This paper presents an intelligent surveillance robot capable of detecting and preventing violence in two modes - motion-controlled and autonomous. The motion-controlled mode allows the user to manually control the robot's movement and camera orientation, while the autonomous mode allows the robot to navigate and monitor the environment independently.

2.9 Persistent Surveillance Method of Multiple Mobile Robots Based on Pheromone Positive Incentive Mechanism Yaping Chen; Huajie Hong: Nan Wang: Zhaoyang Liu; Kunsheng Xing 2022 International Symposium on Control Engineering and Robotics (ISCER).

This paper focuses on the persistent surveillance method of multiple mobile robots. Firstly, the existing calculation method of grid element value is improved by using pheromone. Then, aiming at two problems brought by the traditional persistent surveillance. when the initial positions of multiple robots are close to each other, they are easy to concentrate in a local area-this paper adjusts the weighting parameters ω 1 , good results are obtained

2.10 Design of intelligent inspection robot system for electrical equipment based on visual recognition Hailin Wan; Guoping Liu; Jianping Wu; Zhimin Zhang, Yiping Yang 2021 IEEE 4th International Conference on Automation, Electronics and Electrical Engineering (AUTEEE)

This project focusses that Video surveillance has long been introduced into the remote monitoring of the operation state of power equipment. The early image monitoring in the production environment realized by "remote viewing" and robot only realized the digitization and long-distance transmission of image and sound signals, which provided comprehensive technical support for solving the remote multimedia monitoring system in the production environment.

2.11 IP Based Surveillance Robot Using IOT M. Sunitha; P. V. S. S. Datta Vinay; V. S. N. Lokesh; B. Dinesh Kumar 2020 Fourth International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud)

The term "Surveillance" has elevated like a most needy thing in recent world. A number of articles regarding increasing crime rate has being notable daily, but are not able to trace out due to lack of evidences.. In such a situation, one has to be with utmost care and secured with oneself, which can be provided by Surveillance. Surveillance is nothing but monitoring from a distance by means of gadgets made by electronics, such as even robots.

IOT (internet of things) platform connects these gadgets so that clients can perform operations with gadgets residing anywhere on Earth. This intelligent security robot using IOT will kept at key points of home to check about the presence of any intruder. The camera fixed with robot gives the picture of intruder in a `live-stream' method. The Node MCU attached GSM module notifies about the presence of intruder as soon as PIR sensor attached to robot detects a human and the buzzer at the user end starts sound thereby alerting him against the intruder

2.12 Design and Fabrication of Multi-Purpose Surveillance Mobile Robot Vimalesh Annadurai; Reshvanth V; Santhanam V; Thulasiram S; Kanagaraj Venusamy; Sathyanarayanan V 2023 Eighth International Conference on Science Technology Engineering and Mathematics

This paper presents about the review of recent research on the problem of home surveillance with having difficulty of path programming to the environment and high cost. The robot will have to be taught with manual lead through method by giving data to the Raspberry Pi, which the robot will learn its path so that the MSMR (multipurpose surveillance mobile robot) will repeat the programmed path, in case of any disturbance in front of the MSMR will look for its alternative path `to move or it indicates the user by bussing sound, popup massage using IOT devices, etc. We can change our desire path for different environment with the use of teach pendant. After teaching MSMR start to roam in the path which is instructed by the teach pendant.

CHAPTER-3

PROPOSED SYSTEM

Here, proposes surveillance robot with adding some important features. Live streaming method used in camera for the visibility of the area required using the internet. Using PIR sensor, can detect human and by using Metal detecting sensor, can detect metals and buzzer on detecting human or metal. Cam module is a WIFI camera, which is capable of doing live stream to the output screen. This camera connects to the internet where we can actually see the live feed by camera. This camera covers the activities in its field and display it to the user. This type of technique can be better in some cases than human eye, we can record all the activities by the opponent, hence we have proof of all of its activities. App or Browser for viewing live area view of the required area where the internet is available for the device and the controlling system, so that it can be connected and the information will be telecasted from the device to the required monitor or screen.

Esp-32 for controlling the device this is the heart of the device where the whole information will be sent and received and this will be sending to which sensor the information is to be send. PIR sensor can detect human movement in a requirement range. which is able to detect different levels of infrared radiation.
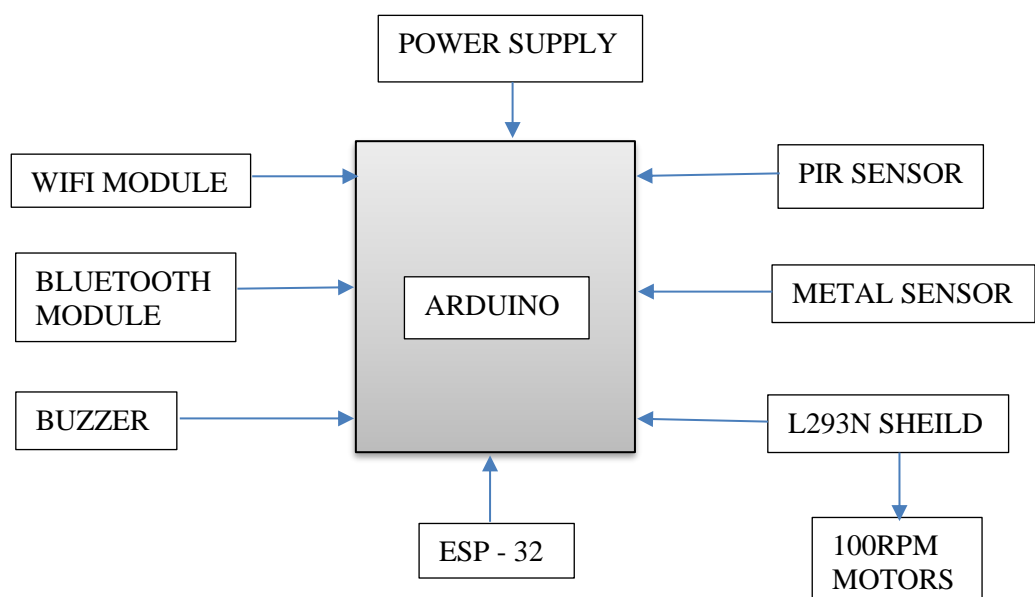
3.1 Block Diagram of proposed system:

Fig 3.1: Block diagram of Proposed system

PIR sensor can detect human movement in a requirement range. PIR is made of a pyroelectric sensor, which is able to detect different levels of infrared radiation. The detector itself does not emit any energy but passively receives it. It detects infrared radiation from the environment.

Once there is infrared radiation from the human body particle with temperature, focusing on the optical system causes the pyroelectric device to generate a sudden electrical signal. Simply, when a human body or any animal passes by, then it intercepts the first slot of the PIR sensor. This causes a positive differential change between the two bisects. When a human body leaves the sensing area, the sensor generates a negative differential change between the two bisects.

CHAPTER 4

HARDWARE DESCRIPTION

4.1 ESP-32 CAMERA MODULE

The ESP32-CAM is a small size, low power consumption camera module based on ESP32. It comes with an OV2640 camera and provides on board TF card slot. The ESP32-CAM can be widely used in intelligent IoT applications such as wireless video monitoring, Wi-Fi image upload, QR identification, and so on.

4.1.1 Features:

On-board ESP32-S module, supports Wi-Fi + Bluetooth; OV2640 camera with flash
On-board TF card slot, supports up to 4G TF card for data storage Supports Wi-Fi video monitoring and Wi-Fi image upload Supports multi sleep modes, deep sleep current as low as 6mA
Control interface is accessible via pin header, easy to be integrated and embedded into products

4.1.2 Specifications:

WIFI module: ESP-32S; Processor: ESP32-D0WD; Built-in Flash: 32Mbit
RAM: Internal 512KB + External 4M PSRAM; Antenna: On-board PCB antenna Wi-Fi protocol: IEEE 802.11 b/g/n/e/I; Bluetooth: Bluetooth 4.2 BR/EDR and BLE
WIFI mode: Station / Soft AP / Soft AP + Station Security: WPA/WPA2/WPA2-Enterprise/WPS
Output image format: JPEG (OV2640 support only), BMP, GRAYSCALE Supported TF card: up to 4G
Peripheral interface: UART/SPI/I2C/PWM
IO port: 9; UART baud rate: default 115200bps
Power supply: 5V

4.1.3 Receiving sensitivity:

CCK, 1Mbps: -90 dBm; CCK, 11Mbps: -85 dBm; 6Mbps (1/2 BPSK): -88 dBm; 54Mbps (3/4 64-QAM): -70 dBm; HT20, MCS7 (65Mbps, 72.2Mbps): -67 dBm

4.1.4 Power consumption:

Flash off: 180mA@5V; Flash on and brightness max: 310mA@5V; Deep-Sleep: as low as 6mA@5V; Modern-Sleep: as low as 20mA@5V; Light-Sleep: as low as 6.7mA@5V
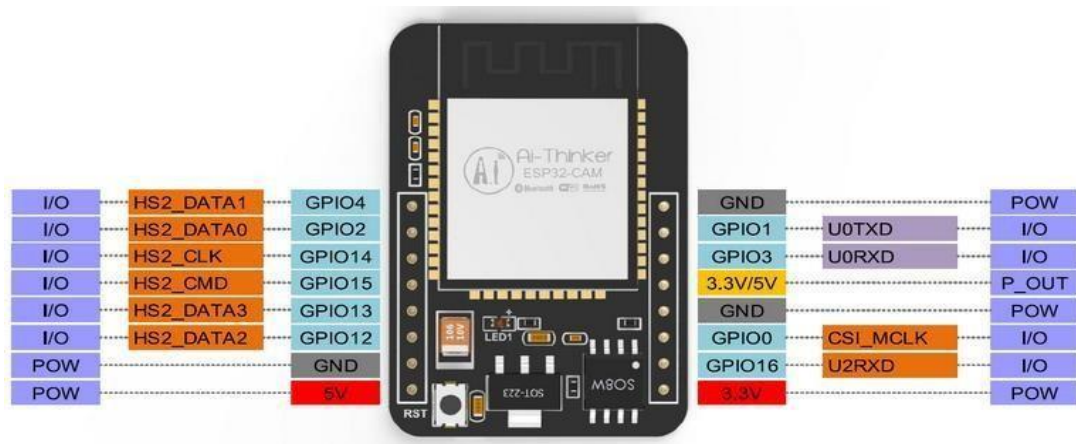
,

Fig 4.1: Pin Description of ESP-32 Camera Module

4.2 L293N MOTOR DRIVE SHIELD

This L298N Motor Driver Module is a high-power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. L298N Module can control up to 4 DC motors, or 2 DC motors with directional and speed control. The driver greatly simplifies and increases the ease with which you may control motors, relays, etc. from microcontrollers.

can drive motors up to 36V with a total DC current of up to 600mA. You can connect the two channels in parallel to double the maximum current or in series to double the maximum input voltage. This motor driver uses screw terminals for easy connections, mounting holes for easy mounting, back EMF protection circuit, on board heat sink for better heat dissipation and more efficient performance. This motor driver is perfect for

robotics and mechatronics projects for controlling motors from microcontrollers, switches, relays, etc. Perfect for driving DC and Stepper motors for micro mouse, line following robots, robot arms, etc.

Fig 4.2: L293N Motor Driver Shield

This motor driver is perfect for robotics and mechatronics projects for controlling motors from microcontrollers, switches, relays, etc. Perfect for driving DC and Stepper motors for micro mouse, line following robots, robot arms, etc.
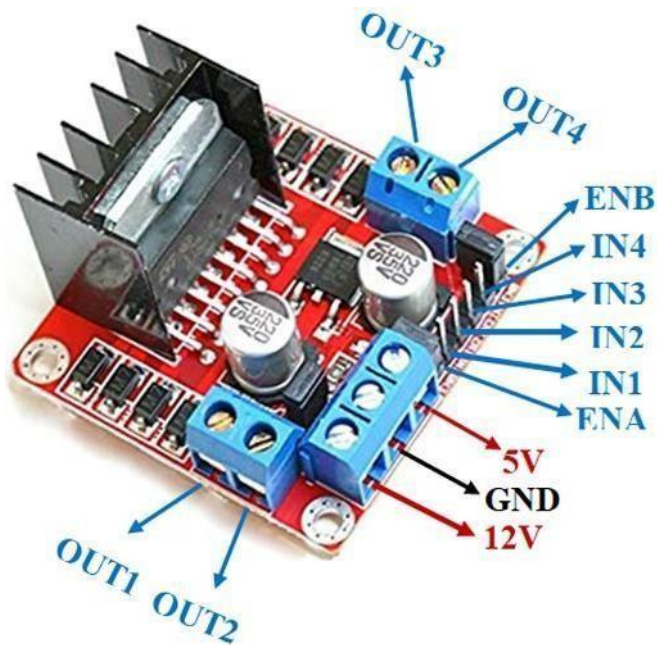
You may use this driver with our development boards to control DC and Stepper Motors. To use this driver with our development board, just connect the power pins on the driver to the power pins on the development board, and connect the driver's input pins to suitable IO pin on the development board. You may use our Female to Female - Jumper Wires to make the connections.

4.2.1 Features:

Driver Model: L298N 2A; Driver Chip: Double H Bridge L298N

Motor Supply Voltage (Maximum): 46V; Motor Supply Current (Maximum): 2A Logic Voltage: 5V; Logical Current: 0-36mA

Driver Voltage: 5-35V; Driver Current: 2A

Maximum Power (W): 25W; Current Sense for each motor; On-board Heat sink for better performance the driver two holes of 3mm diameter for easy mounting.

Table 4.1: L293N Motor Driver Shield Specifications

Pin Name	Description
IN1 & IN2	Motor A input pins. Used to control the spinning direction of Motor A
IN3 & IN4	Motor B input pins. Used to control the spinning direction of Motor B
ENA	Enables PWM signal for Motor A
ENB	Enables PWM signal for Motor B
OUT1 & OUT2	Output pins of Motor A
OUT3 & OUT4	Output pins of Motor B
12V	12V input from DC power Source
5V	Supplies power for the switching logic circuitry inside L298N IC
GND	Ground pin

4.3 BATTERIES

Rechargeable batteries, also known as secondary batteries, are batteries that can be recharged and reused multiple times. They are a more environmentally friendly and cost-effective alternative to disposable batteries, which are designed to be used once and then discarded.

Rechargeable batteries can be made of various chemistries, including nickel- cadmium (Ni-Cd), nickel-metal hydride (Ni-MH), and lithium-ion (Li-ion). Each type of battery has its own advantages and disadvantages, depending on the specific application and requirements.

One of the main advantages of rechargeable batteries is their ability to be recharged and reused multiple times, which reduces the amount of waste generated by disposable batteries. Rechargeable batteries also tend to have a higher energy density than disposable batteries, which means they can store more energy in a smaller size.

Nominal capacity: 6000mAh Charge method: CC-CV Continuous discharge current:5A

Instantaneous discharge current: 10A Maximum working current: 3A Maximum

instantaneous current: 5A Charge temperature: 0-45 °C Discharge temperature: -10-60?

Storage temperature: -20-45 °C Cycle life: 80%

DOD after 500 cycles

Weight: 300g Size: 110 * 70 * 19MM

Input: DC 5.5 * 2.1 plug wire with protection circuit: overcharge, over discharge, overcurrent, short circuit protection functions.

4.3.1 Scope of application

various power models, lighting tools, monitoring systems, electric tools, electric toys, etc. All 12 V electrical equipment, washing equipment, coal, hernia lamps, not 12 V batteries, standby power supply, LED lamp, instrumentation, amplifiers, monitors, electrical types, various 12 V lamps.

Fig 4.3: Battery

4.3.2 Specifications

Model Name: 12V 6Ah 18650 rechargeable battery 6000mAh Li-ion battery pack LED light backup power audio battery + 12.6V 1A charger

Type: Travel Adaptor Colour: Black

Power Requirement: 12V Style Code: HE0517 Colour Code: Black

4.4 Metal Detecting Sensor

Detects metal objects up to 7 cm giving active low output with LED indication & buzzer on detecting metal. The heart of this sensor is the inductive oscillator circuit which monitors high frequency current loss in coil. The circuit is designed for any metallic body detection by detecting the variations in the high frequency Eddy current losses. With an external tuned circuit they act as oscillators.

Output signal level is altered by an approaching metallic object. Output signal is determined by supply current changes. Independent of supply voltage, this current is high or low according to the presence or the absence of a close metallic object. If the metal object is near the searching coil, the output current will flow more. On the other hand, the current will be decrease when the object is far from the searching coil.

Fig 4.4: Metal Sensor

4.4.1 Applications

- Detect presence of any metallic object
- Locate pipes, cables, metal studs
- Avoid disasters when drilling holes in walls
- Great project for novices
- Your own unique application
- Interface with any microcontroller

4.4.2 Specifications

- Detection range adjustable up to 7 cm
- Operation range varies according to size of the metallic object
- Power Supply: 5V DC Power Consumption: 50mA max.
- Detection Indicator LED and Buzzer
- Digital output. Active with logic "0"
- Dimensions: 52x7

4.5 PIR Sensor

PIR sensor can detect human movement in a requirement range. PIR is made of a pyroelectric sensor, which is able to detect different levels of infrared radiation.

/

Fig 4.5: PIR Sensor

The detector itself does not emit any energy but passively receives it. It detects infrared radiation from the environment. Once there is infrared radiation from the human body particle with temperature, focusing on the optical system causes the pyroelectric device to generate a sudden electrical signal. Simply, when a human body or any animal passes by, then it intercepts the first slot of the PIR sensor. This causes a positive differential change between the two bisects. When a human body leaves the sensing area, the sensor generates a negative differential change between the two bisects.

- Pin1 corresponds to the drain terminal of the device, which connected to the positive supply 5V DC.
- Pin2 corresponds to the source terminal of the device, which connects to the ground terminal via a 100K or 47K resistor. The Pin2 is the output pin of the sensor. The pin 2 of the sensor carries the detected IR signal to an amplifier from the
- Pin3 of the sensor connected to the ground.

4.6 Arduino UNO

Arduino Uno is a very valuable addition in the electronics that consists of USB interface, 14 digital I/O pins, 6 analog pins, and Atmega328 microcontroller. It also supports serial communication using Tx and Rx pins. There are many versions of Arduino boards introduced in the market like Arduino Uno, Arduino Due, Arduino Leonardo, Arduino Mega,however, most common versions are Arduino Uno and Arduino Mega.
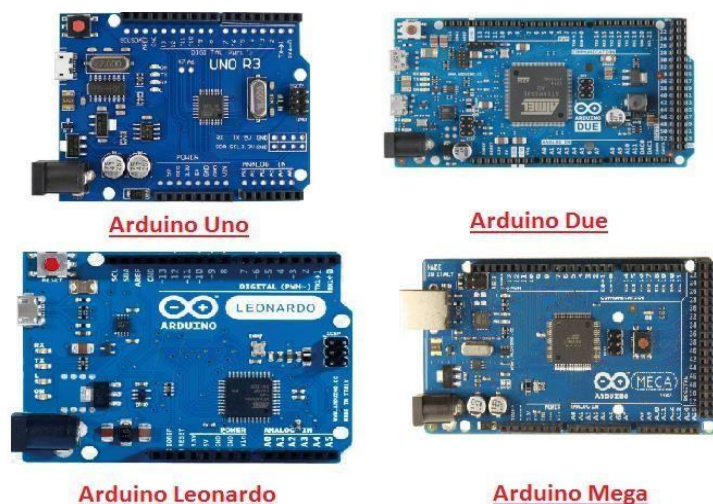

FIG 4.6: Versions of Arduino

It is an open-source platform, means the boards and software are readily available and anyone can modify and optimize the boards for better functionality. The software used for Arduino devices is called IDE (Integrated Development Environment) which is free to use and required some basic skills to learn it. It can be programmed using C and C++ language. Some people get confused between Microcontroller and Arduino. While former is just an on system 40 pin chip that comes with a built-in microprocessor and later is a board that comes with the microcontroller in the base of the board, boot loader and allows easy access to input-output pins and makes uploading or burning of the program very easy.

4.6.1 Introduction to Arduino:

- Arduino Uno is a microcontroller board developed by Arduino.cc which is an open-source electronics platform mainly based on AVR microcontroller Atmega328.

- First Arduino project was started in Interaction Design Institute Ivrea in 2003 by David Cuartielles and Massimo Banzi with the intention of providing a cheap and flexible way to students and professional for controlling a number of devices in the real world.

- The current version of Arduino Uno comes with USB interface, 6 analog input pins, 14 I/O digital ports that are used to connect with external electronic circuits. Out of 14 I/O ports, 6 pins can be used for PWM output.

- It allows the designers to control and sense the external electronic devices in the real world.
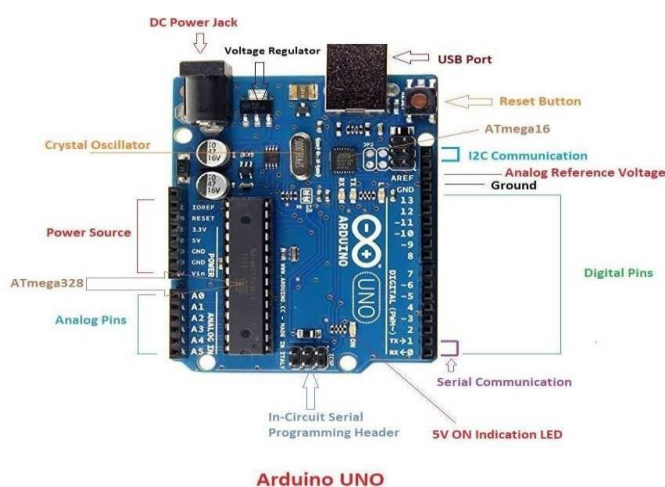
Fig 4.7: Arduino UNO Board

- This board comes with all the features required to run the controller and can be directly connected to the computer through USB cable that is used to transfer the code to the controller using IDE (Integrated Development Environment) software, mainly developed to program Arduino. IDE is equally compatible with Windows, MAC or Linux Systems, however, Windows is preferable to use. Programming languages like C and C++ are usedin IDE are shown in fig 4.2

- Apart from USB, battery or AC to DC adopter can also be used to power the board.

- Arduino Uno boards are quite similar to other boards in Arduino family in terms of use and functionality, however, Uno boards don't come with FTDI USB to Serial driver chip.

4.6.2 Features of Arduino

Atmega328 microcontroller is placed on the board that comes with a number of features like timers, counters, interrupts, PWM, CPU, I/O pins and based on a 16MHz clock that helpsin producing more frequency and number of instructions per cycle.

- It is an open-source platform where anyone can modify and optimize the board based on the number of instructions and task they want to achieve.

- This board comes with a built-in regulation feature which keeps the voltage under controlwhen the device is connected to the external device.

- Reset pin is added in the board that reset the whole board and takes the running program in the initial stage. This pin is useful when board hangs up in the middle of the running program; pushing this pin will clear everything up in the program and starts the program right from the beginning.

- There are 14 I/O digital and 6 analog pins incorporated in the board that allows the externalconnection with any circuit with the board. These pins provide the flexibility and ease of use to the external devices that can be connected through these pins. There is no hard andfast interface required to connect the devices to the board. Simply plug the external deviceinto the pins of the board that are laid out on the board in the form of the header.

- The 6 analog pins are marked as A0 to A5 and come with a resolution of 10bits.

4.6.3 Arduino Pin out

Arduino Uno is based on AVR microcontroller called Atmega328. This controller comes with 2KB SRAM, 32KB of flash memory, 1KB of EEPROM. Arduino Board comes with 14 digital pins and 6 analog pins. ON-chip ADC is used to sample these pins. A 16 MHzfrequency crystal oscillator is equipped on the board. Following figure 4.3 shows the pin out of the Arduino Uno Board.
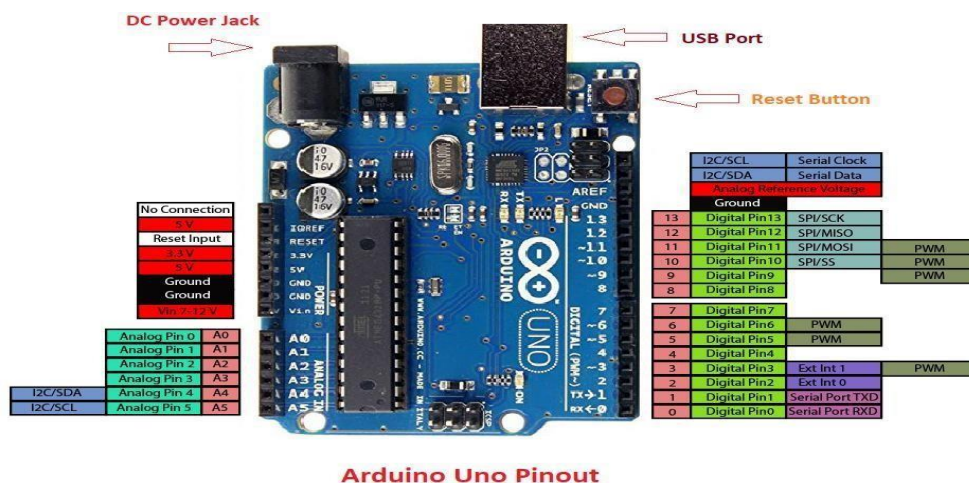

Fig 4.8: Pin out of Arduino Uno Board

Pin Description:

There are several I/O digital and analog pins placed on the board which operates at 5V. These pins come with standard operating ratings ranging between 20mA to 40mA. Internal pull-up resistors are used in the board that limits the current exceeding from the given operating conditions. However, too much increase in current makes these resisters useless anddamages the device.

LED: Arduino Uno comes with built-in LED which is connected through pin 13. Providing HIGH value to the pin will turn it ON and LOW will turn it OFF.

Vin: It is the input voltage provided to the Arduino Board. It is different than 5 V supplied through a USB port. This pin is used to supply voltage.

5V: This board comes with the ability to provide voltage regulation. 5V pin is used to provide output regulated voltage. The board is powered up using three ways i.e. USB, Vin pin of the board or DC power jack.

GND: These are ground pins. More than one ground pins are provided on the board which can be used as per requirement.

Reset: This pin is incorporated on the board which resets the program running on the board. Instead of physical reset on the board, IDE comes with a feature of resetting the board through programming.

IOREF: This pin is very useful for providing voltage reference to the board. A shield is used to read the voltage across this pin which then select the proper power source.

PWM: PWM is provided by 3, 5, 6,9,10, 11pins. These pins are configured to provide 8-bit output PWM.

Table 4.2: Arduino Uno Technical Specification

Parameters	Specifications
Microcontroller	ATmega328P–8 bit AVR family microcontroller
Operating Voltage	5V
Recommended Input Voltage	7-12V
Input Voltage Limits	6-20V
Analog Input Pins	6 (A0 – A5)
Digital I/O Pins	14 (Out of which 6 provide PWM output)
DC Current on I/O Pins	40 mA
DC Current on 3.3V Pin	50 mA
Flash Memory	32 KB (0.5 KB is used for Bootloader)
SRAM	2 KB
EEPROM	1 KB
Frequency (Clock Speed)	16 MHz

4.6.4 Applications of Arduino

Arduino Uno comes with a wide range of applications. A larger number of people are using Arduino boards for developing sensors and instruments that are usedin scientific research. Following are some main applications of the board.

- Embedded System
- Security and Defense System
- Digital Electronics and Robotics
- Parking Lot Counter
- Weighing Machines
- Traffic Light Count Down Timer
- Medical Instrument
- Emergency Light for Railways
- Home Automation
- Industrial Automation

4.7 100RPM MOTOR

DC Gear motor is also called DC Geared Motor, Geared Dc Motor and gearhead motor or gearbox motor. It consists of a electric DC motor and a gearbox or gearhead; these gearheads are used to reduce the DC motor speed, while increase the DC motor torque. Therefore, user can get lower speed and higher torque from gear motor.

Fig 4.9: RPM Motor

There are different types of 100RPM motors available, including DC (direct current) motors and AC (alternating current) motors. DC motors are typically powered by batteries or power supplies and are known for their simplicity, high torque, and precise speed control. AC motors, on the other hand, are typically powered by the mains electricity supply and are known for their reliability, efficiency, and low maintenance requirements.

The performance of a 100RPM motor depends on a variety of factors, including its power rating, voltage, and torque. Higher power ratings generally result in higher speed and torque, while higher voltages may be required to achieve the desired speed. The torque of the motor also affects its performance, with higher torque motors being able to handle heavier loads.

4.8 Mounting Wheels

The design and construction of wheels vary depending on the application, but they all share common features, including the hub, the spokes, and the rim. The hub is the central part of the wheel that attaches it to the axle. The spokes connect the hub to the rim and provide support and stability to the wheel. The rim is the outer edge of the wheel that provides the surface on which the tire is mounted.

Fig 4.10: Mounting Wheels

Wheels are made from a variety of materials, including steel, aluminum, carbon fiber, and plastic. The choice of material depends on the specific application and the desired properties, such as strength, durability, and weight.

In summary, wheels are a fundamental component of transportation and movement and have played a critical role in human history. They come in various designs and materials and are used in a wide range of applications, from cars to conveyor belts.

4.9 Jumper Wires

Jumper wires, also known as jumper cables or jumpers, are electrical wires that are used to make temporary connections between two points in an electronic circuit. They are often used for prototyping and testing circuits, as well as for repairing and modifying electronic devices.

Fig 4.11: Jumper Wires

Jumper wires are typically made of insulated wire with a small metal pin or clip at each end. The pins or clips are used to connect the jumper wire to the circuit components or to a breadboard, which is a tool used for prototyping circuits.

Jumper wires are available in various lengths, colors, and gauges (thicknesses), depending on the specific application. They may also come in pre- made sets, which include a variety of lengths and colors for easy organization and identification.

CHAPTER 5

SOFTWARE DESCRIPTION

5.1 Arduino IDE

Arduino IDE where IDE stands for Integrated Development Environment – An official software introduced by Arduino.cc, that is mainly used for writing, compiling and uploading the code in the Arduino Device. Almost all Arduino modules are compatible with this software that is an open source and is readily available to install and start compiling the code on the go.

5.1.1 Introduction to Arduino IDE

- Arduino IDE is an open-source software that is mainly used for writing and compiling the code into the Arduino Module.

- It is an official Arduino software, making code compilation too easy that even a common person with no prior technical knowledge can get their feet wet with the learning process.

- It is easily available for operating systems like MAC, Windows, and Linux and runs on the Java Platform that comes with inbuilt functions and commands that play a vital role for debugging, editing and compiling the code in the environment.

- A range of Arduino modules available including Arduino Uno, Arduino Mega, Arduino Leonardo, Arduino Micro and many more.

- Each of them contains a microcontroller on the board that is actually programmedand accepts the information in the form of code.

- The main code, also known as a sketch, created on the IDE platform will ultimately generate a Hex File which is then transferred and uploaded in the controller on theboard.

This environment supports both C and C++ languages.

5.1.2 How to install Arduino IDE

You can download the Software from Arduino main website. As I said earlier, the software is available for common operating systems like Linux, Windows, and

MAX, so make sure you are downloading the correct software version that is easily compatible with your operating system.

If you aim to download Windows app version, make sure you have Windows 8.1 or Windows 10, as app version is not compatible with Windows 7 or older version of this operating system.

The IDE environment is mainly distributed into three sections,

1. Menu Bar
2. Text Editor
3. Output Pane

As you download and open the IDE software, it will appear like an image belowfig 5.1.
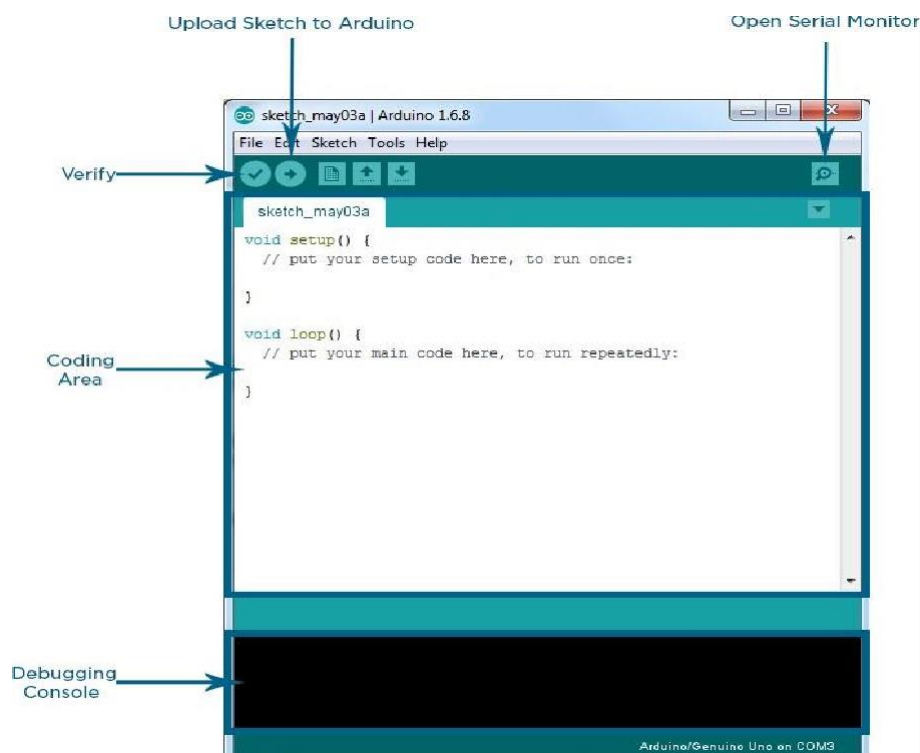

Fig 5.1: Installation and open the IDE Software

File – You can open a new window for writing the code or open an existing one.

Following table shows the number of further subdivisions the file option is categorized into
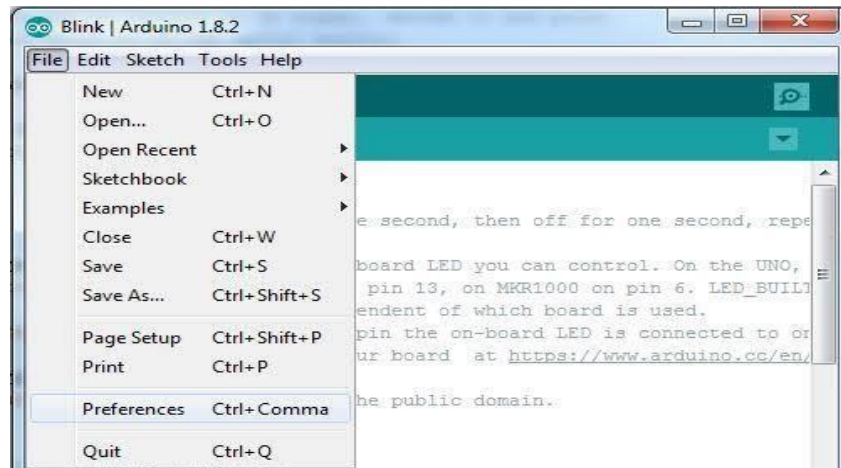

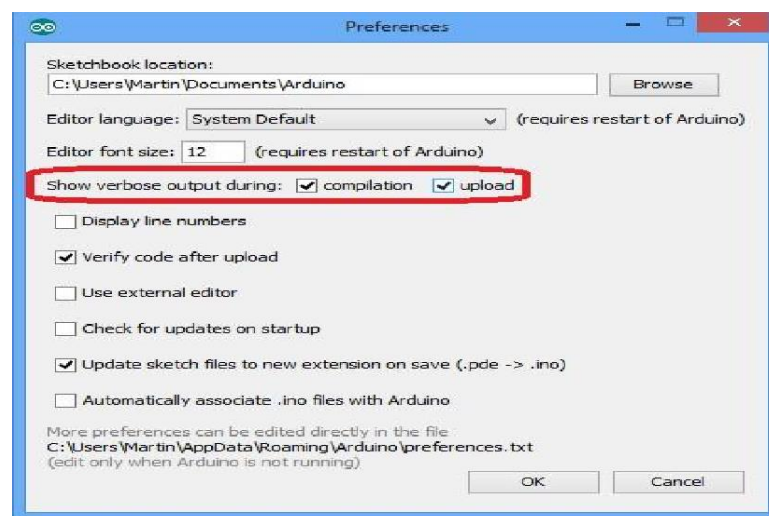**Fig 5.2: Opening the file in Arduino**

Fig 5.3: Output Panel of the Arduino

And at the end of compilation, it will show you the hex file it has generated for the recent sketch that will send to the Arduino Board for the specific task you aim to achieve.

Edit – Used for copying and pasting the code with further modification for font
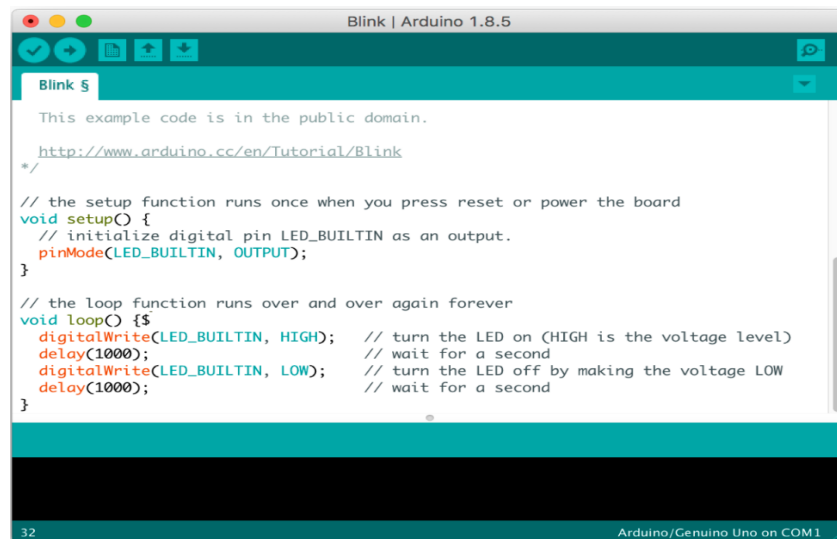
Fig 5.4: Text Editor for the Arduino board

The bottom of the main screen is described as an Output Pane that mainly highlights the compilation status of the running code: the memory used by the code, and errors occurred in the program. You need to fix those errors before you intend to upload the hex file into your Arduino Module shown in above fig.

5.2 Arduino Libraries

Libraries are very useful for adding the extra functionality into the Arduino Module. There is a list of libraries you can add by clicking the Sketch button in the menu bar and going to Include Library shown in below fig 5.6.
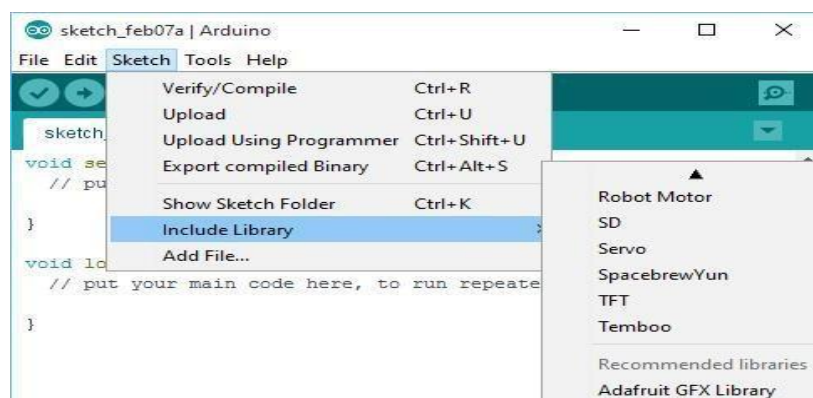

Fig 5.5: Selecting the Arduino library

5.2.1 Making pins Input and output

The digital Read and digital Write commands are used for addressing and making the Arduino pins as an input and output respectively. These commands are text sensitive i.e., you need to write them down the exact way they are given like digital Write starting with small "d" and write with capital "W". Writing it down with Digital write or digital write won't be calling or addressing any function.

5.2.2 How to select the board

In order to upload the sketch, you need to select the relevant board you are using and the ports for that operating system. As you click the Tools on the Menu, it will open like the figure below.

Just go to the "Board" section and select the board you aim to work on. Similarly, COM1, COM2, COM4, COM5, COM7 or higher are reserved for the serial and USB board. You can look for the USB serial device in the ports section of the Windows Device Manager.

- After correct selection of both Board and Serial Port, click the verify and then upload button appearing in the upper left corner of the six-button section or you can go to the Sketch section and press verify/compile and then upload.

- Once you upload the code, TX and RX LEDs will blink on the board, indicating the desired program is running successfully.

- The amazing thing about this software is that no prior arrangement or bulk of messis required to install this software, you will be writing your first program within 2 minutes after the installation of the IDE environment.

CHAPTER 6

APPLICATIONS

• The modification of this logic code is used in vacuum cleaners.

• This robot can be used for avoiding concealed paths and monitor the area, such as an industrial robot in a factory is expected to avoid workers so that it won't hurt those.

• It will be very useful in parking system.

• It can also be used in assembling automobiles and in chemical industries.

• They have great importance in scientific exploration and emergency rescue, there may be places that are dangerous for humans or even impossible for humans to reach directly, then we should use robots to help us gather information to about their surrounding challenging environments.

• This can be also used from anywhere and we can go out where ever we want and can monitor anything from where ever we are.

• This is also secured as to connect it the IP address is required so it can't be accessed by everyone. And can easy to connect.

CHAPTER 7

RESULT & DISCUSSION

- Today we are in the world of robotics. Knowingly or unknowingly, we have been using different types of robots in our daily life.

- The project is "ESP-32 based Surveillance Robot for Military Applications" is practically proved by using the Camera for live telecasting Motor Shield Driver for the driving the dc motors, dc motor is used for the movement of the robot with the help of the Esp-32 Microcontroller.

- A lot of factors determined the accuracy of the robot we designed. These factors were the environmental phenomenon in which the robot was tested, the number of obstacles present making the test space crowded or relatively less crowded the type and shape of the obstacle (the robot is designed for a uniform shaped obstacle). These factors majorly affected the sensors.

- The accuracy of the robot is dependent on the sensors used. Thus, the nature of the sensor and its accuracy defined the accuracy of my robot.

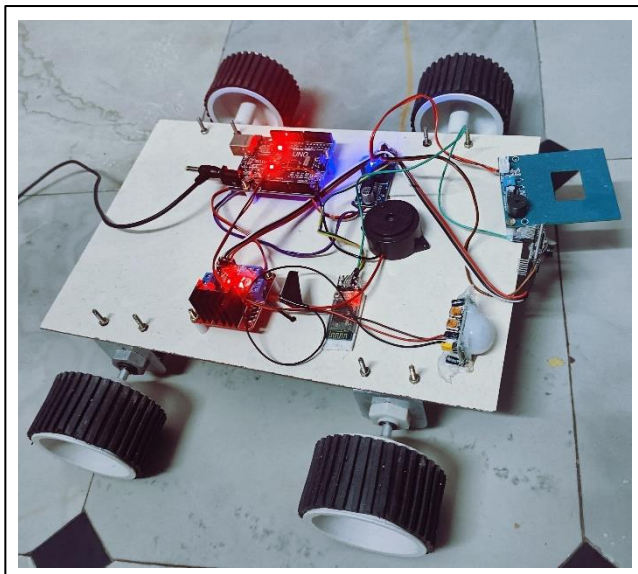- The Below figures shows the output of Intelligent Surveillance Robot.

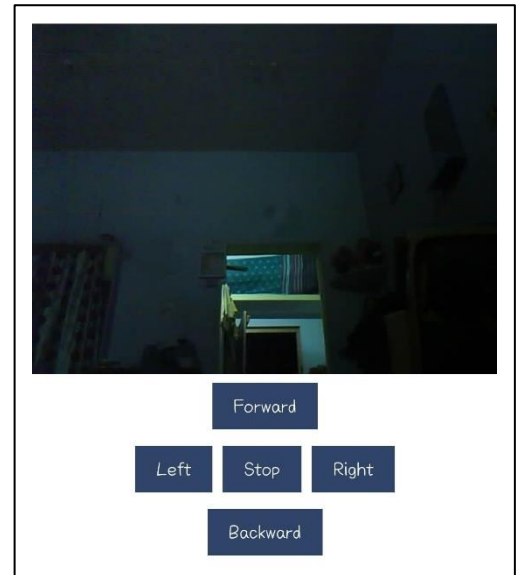**Fig 7.1: Working condition of proposed system**

Fig 7.2: Output Interface

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ANNEXURE - A

SOURCE CODE

```
#include <ThingSpeak.h>;
#include <OneWire.h>
#include<DallasTemperature.h>
#include <ESP8266WiFi.h>
#include <Wire.h>
#include <LiquidCrystal_I2C.h>
#define ONE_WIRE_BUS D4

//DHT dht(DHTPIN, DHTTYPE);
LiquidCrystal_I2C lcd(0x27, 16, 2);
OneWire oneWire(ONE_WIRE_BUS);
DallasTemperature DS18B20(&oneWire);


const int HEART = A0;
const char *ssid =  "embedded";
const char *pass =  "12345678";
const char* server = "184.106.153.149";
String apiKey = "NCFRWSRF959LZT4I";
WiFiClient client;
unsigned long myChannelNumber =  2090981;
const char * myWriteAPIKey = "NCFRWSRF959LZT4I";
int gh = 0;
const int analog_ip = A0;
int inputVal  = 0;
int heartBeat;
double alpha = 0.75;
int period = 20;
double refresh = 0.0;
float temperature_c;

void setup() {
  Serial.begin(9600);
  DS18B20.begin();
  lcd.begin();
  lcd.backlight();
  lcd.print("  pls wait....");
  delay(2000);
  lcd.clear();
  lcd.print("SSID: embedded");
  lcd.setCursor(0, 1);
  lcd.print("PASS: 12345678");
  delay(1000);
  WiFi.begin(ssid, pass);
  //WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED)
```

```
  {
   delay(100);
   lcd.clear();
   lcd.print(" Searching...");
   lcd.setCursor(0, 1);
   lcd.print(" Network");
   delay(400);
  }

  lcd.clear();
  lcd.print("     WIFI");
  lcd.setCursor(0, 1);
  lcd.print("  CONNECTED");
  delay(2000);
  pinMode(D8, INPUT);
  pinMode(D0, OUTPUT);
  pinMode(D6, OUTPUT);
  pinMode(13, OUTPUT);
  delay(2000);
  //  sv_on();
  delay(2000);
  //  sv_off();
  delay(1000);
  ThingSpeak.begin(client);
  lcd.clear();
  lcd.print("Searching");
  lcd.setCursor(0, 1);
  lcd.print("network...");
  delay(5000);
  lcd.clear();
  lcd.print(" Connecting....");
  delay(500);
  digitalWrite(D0, 1);
  delay(500);
  digitalWrite(D0, 0);
  delay(500);
  delay(500);
  digitalWrite(D0, 1);
  delay(500);
  digitalWrite(D0, 0);
  delay(500);
   delay(500);
  digitalWrite(D6, 1);
  delay(500);
  digitalWrite(D6, 0);
}

void loop()
{
```

```
heart_beat();
read_temperature();

Serial.println(heartBeat);
Serial.println(temperature_c);
delay(500);

lcd.clear();
lcd.print("HEART:");
lcd.print(heartBeat);
lcd.setCursor(0, 1);
lcd.print("TEMP: ");
lcd.print(temperature_c);
delay(3000);

if (temperature_c > 50)
{
  digitalWrite(D0, 1);
  delay(500);
  digitalWrite(D0, 0);
  delay(500);
  digitalWrite(D0, 1);
  delay(500);
  digitalWrite(D0, 0);
  delay(500);
  digitalWrite(D0, 1);
  delay(500);
  digitalWrite(D0, 0);
  delay(500);
}

delay(100);
lcd.clear();
lcd.print(" DATA UPDATING");
lcd.setCursor(0, 1);
lcd.print("Process...");

ThingSpeak.setField( 1, (float) heartBeat);
ThingSpeak.setField( 2, (float) temperature_c);
ThingSpeak.writeFields(myChannelNumber, myWriteAPIKey);

if (heartBeat < 10)
{

  lcd.clear();
  lcd.print("Heart beat low");
  lcd.setCursor(0, 1);
  lcd.print("ventilator ON");
  digitalWrite(D6, 1);
  delay(300);
```

```
    } else
    {
     digitalWrite(D6, 0);
     delay(300);
    }

   delay(13000);
   lcd.clear();
   lcd.print(" DATA UPDATING");
   lcd.setCursor(0, 1);
   lcd.print("Completed");
   delay(2000);
  }


  void heart_beat()
  {
   static double oldValue = 0;
   static double oldrefresh = 0;
   int beat = analogRead(HEART);
   double value = alpha * oldValue + (0 - alpha) * beat;
   refresh = value - oldValue;
   heartBeat = beat / 10;
   oldValue = value;
   oldrefresh = refresh;
   delay(period * 10);
  }


  void read_temperature()
  {
   DS18B20.requestTemperatures();
   temperature_c = DS18B20.getTempCByIndex(0);
}
```

ANNEXURE - B

PROJECT BUDGET DETAILS

S.NO	COMPONENT NAME	COST
1	Arduino Uno	5190
2	Dallas Temperature Sensor	335
3	Heartbeat Sensor	312
4	RTC	114
5	GSM Module	1099
6	Connectors	192
7	Power Supply	658
8	16x2 LCD	806
9	Adapters	164
10	LED's (White)	195
11	Switch	834
TOTAL		9899

ANNEXURE-C

CONFERENCE CERTIFICATE

Intelligent Surveillance Robot

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Abstract: Robotics is an interesting and fast growing field. The concept of Mobile robot is fast evolving and the number of mobile robots and their complexities are increasing with different applications. Nowadays robots are in wide usage due to their high level of performance and reliability and which is great for human beings. The Surveillance Robot is a vehicle robotics is used for live viewing or monitoring the required area and follows the instructions given by us to move. The Surveillance The robotics and automation industry which is ruled the sectors from manufacturing to household entertainments. It is widely used because of its simplicity and ability to modify to meet changes of needs. For remote operation attached with wireless camera for monitoring purpose. The robot along with camera wirelessly transmit real time video with low light vision capabilities. Metal detecting sensor and PIR sensor coupled with motors, microprocessor and few other components combined gives an intelligent live viewing with movement. They can also be used in dangerous environments, where human penetration could be fatal.

Keywords — Arduino, IoT, Robot, surveillances, Obstacle Detection, Metal Detector.

I. INTRODUCTION

Surveillance is a real time collection and analysis of data that is timely distributes the information to the operator. Surveillance in Defense Applications plays an important role for keeping an eye out in order to protect its citizens and take necessary actions. Surveillance is the task of monitoring the set of conditions. This generally occurs in a military scenario where surveillance war areas, adversary territory. Human surveillance is carried by experienced work forces in close sensitive areas so as to continually monitor for changes. Whereas there is always added risks of losing work force in the time of getting caught by the adversary. With advanced technology in pasted years, there it is possibility to monitor areas of importance remotely by the use of robots instead of human. Apart from the given advantages of not losing any work forces, physical and elegant robots can he used detect subtle elements that are not conspicuous to people. A surveillance robot is a partially automated machine that works as per instructed by operator and move to destination, Streaming video or pictures which can then analyzed by the operator. Surveillance is a crucial task, we cannot put someone life to risk, instead of that we can use this kind of robots which do not need sleep, they don't get hungry, they don't have emotions, they are just stick to their duties and follow the orders. Nothing can he more important than human life. Use of such robots can help to save many lives on border areas. And we can use this manpower in other tasks. Here we use an android device to control the robot. Connection is established to the micro-controller using wifi. The base part of robot consists of wheels, so they can travel on rough & watery surfaces also. So the one who is sitting on the output screen can have all the records of opponent activities. This kind of robots can easily replace the soldiers and industrial workers where human access is impossible at that time this robot perform their duty with better modifications. So in the future the warfare are handled by this kind of smart robots. Which minimize the life threats during wars. and in future instead of security guards we will use this kind of robots. The device Surveillance Robot is designed in a way to control robot through instruction given by us and follow according via any browser and also in a particular application. The connection between the mobile and the vehicle is facilitated with internet technology. The aim of the device is to perform required tasks by receiving the commands of the user. The controlling can he done by any smart phone, tab, iOS device or laptops etc. on any internet enabled devices which we use in our day to day life.

The commands from the mobile are transmitted through the internet from the input given by mobile device from any range the commands forward, backward, right, left and stop are used to control the device. After receiving the commands given by user the microcontroller then operates the motors to move using the motor driver. The movement of the robot is facilitated by two 100 RPM motors connected to the motor driver.

Also, there will be space available to store the things or objects and will be having a door like design controlled using servo motor. Surveillance is a real time collection and analysis of data that is timely distributes the information to the operator. Surveillance in Defense Applications plays an important role for keeping an eye out in order to protect its citizens and take necessary action as needed. Surveillance is the task of monitoring the set of conditions, an area or a person. This generally