PROJECT

Report On

RACSHAK

Bachelor of Engineering
(Electronics and Telecommunication Engineering)

by

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ABSTRACT

Weapons like landmines are potentially harmful for any innocent person in a civilian area. Soldiers are exposed to be fatally injured by unfriendly tactical weapons and heavy ordinates. In a response to such situation, unmanned vehicles can be employed to tackle problem under investigation. Unmanned vehicles [1] are controlled and monitored remotely by any military personnel who need not to be present in the field at same time. These military personnel are thereby saved from landmines and other weapons like IEDCs. Various customizable weapons can be mounted such as machine gun or robotic arm. Defense bot is mounted with special type of arm which can be remotely controlled by military personnel for obstacle removal and also bomb defusing purpose. Robot's compactness helps it to blend in an enemy territory. Camouflaging technique can be implemented to improve its stealth capabilities.

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Chapter 1

Introduction

Military bots are autonomous robots or remote-controlled mobile robots designed for military operations which include transport of heavy machinery to forward base in extreme conditions to civilian search and rescue operations[2]. It also involves enemy reconnaissance and surveillance without detection and information gathering of enemy and also fighting enemy.

Nowadays, customized drones and bots are made so as to fulfil the conditions required in the aspects of military defence[3]. These remotely operational systems are immune to the threats posed by environments which are encountered by human personnel. To avoid such problems, deployment of Unmanned Ground Vehicle(UGV) systems is preferred. The main advantage of using UGV system is its operation ability in extreme difficult and hostile conditions.

1.1 Problem Statement

Weapons like landmines are potentially harmful for any innocent person in a civilian area. Soldiers are exposed to be fatally injured by unfriendly tactical weapons and heavy ordinates. Terror attacks and Border Conflicts result in the loss of lives of hundreds of Armed Forces every year. In Uri, 19 soldiers were martyred and around 30 injured. In Pulwama, 40 soldiers were martyred and around 35 injured. There are various hazardous places where direct human activities are not possible due to presence of radioactivity.

1.2 Solution

Here, we have a custom-built UGV, dubbed as ‘War Bot’ with respect to the project title. This robotic system contains a night-vision camera which proves useful in surveillance in reconnaissance activities even in low-light conditions. This UGV has a special feature of an arm, which can be used for lifting cargo or any other objects. Thus, this provides the bot of ‘pick-and-place’ feature. Also, this UGV also carries a gun, which can be mounted upon it and its aim controlled remotely for maximum effect. For the purpose of aiming, we have a laser dot targeting system.

1.3 What is UGV?

An unmanned ground vehicle (UGV) is a vehicle that operates while in contact with the ground and without an onboard human presence. UGVs can be used for many applications where it may be inconvenient, dangerous, or impossible to have a human operator present. Generally, the vehicle will have a set of sensors to observe the environment, and will either autonomously make decisions about its behavior or pass the information to a human operator at a different location who will control the vehicle through tele-operation.

The UGV is the land-based counterpart to unmanned aerial vehicles and unmanned underwater vehicles. Unmanned robotics are being actively developed for both civilian and military use to perform a variety of dull, dirty, and dangerous activities.

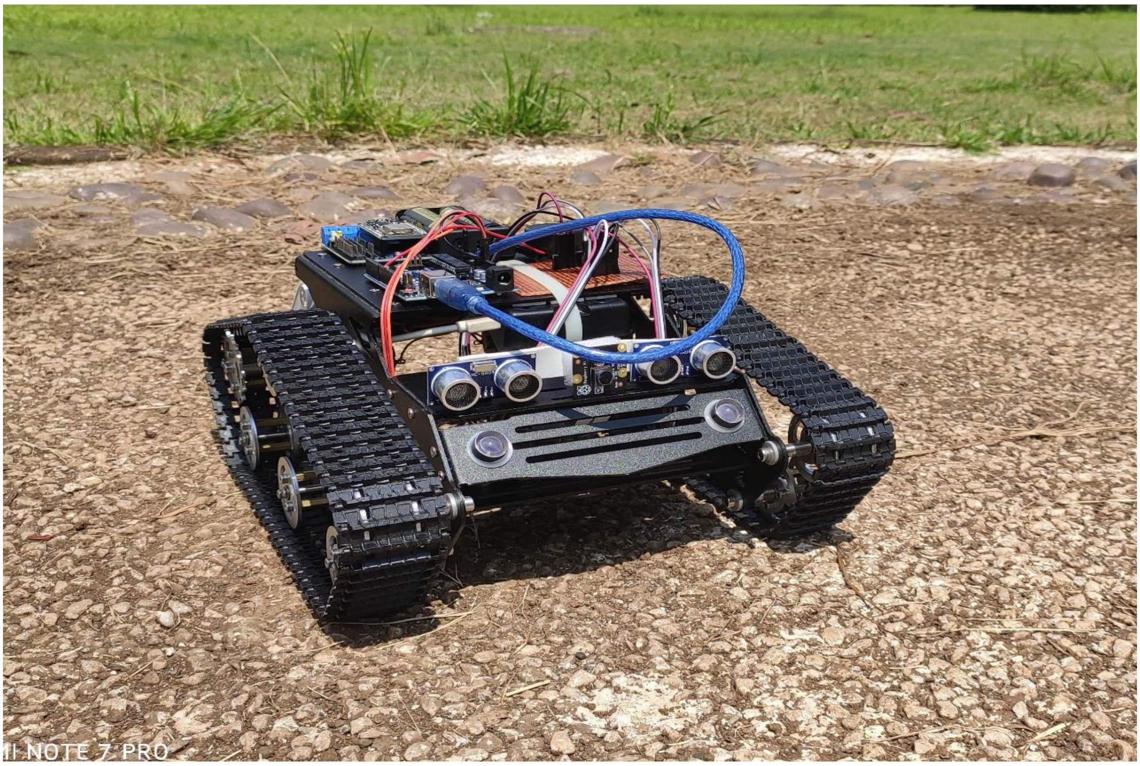

Figure 1.1: RACSHAK Bot

Chapter 2

Literature Survey

The foundation of this concept was laid by Nicolae Tesla, Serbian inventor living in United States. He built two remotely controlled steel boats of length six feet and equipped with electromechanical radio receiver with actuators connected to the steering system in 1898[4]. During the Second World War, England, Russia and Germany further developed this technology and used it for demolition work and explosive works. But due to the high costs involved, further deployment was curtailed.

In 1898, this concept was just introduced by Nicolae Tesla on an inventionary basis with a thought that it can become a force to reckon within the years to come. Massive developments in this field saw his dream turn to reality. With the World Wars, it gained massive popularity provided it helped save soldier's lives. Also, equipped with fire-arms, bombs and ammunition, it helped break enemy lines as the War began, thus fulfilling its main purpose. It was also used for Remote Surveillance due to introduction and advancement in the fields of Remote Technologies, Wireless Communication, Camera Technologies, etc. over the years.

The main drawback is delay in response, which is caused due to transmission of commands using Digital Transmission signals. Also, the main disadvantage is absence of adequate ground clearance, which hampers it ability to become an All-Terrain Vehicle (ATV)[5]. This also result in component damage in uneven ground scenarios. Restriction in movement also proves to be a disadvantage. By using Internet we will be able to increase range of the bot, Also operation of bot can be done when it is not in view.

The bot has high ground clearance which makes it an All-Terrain vehicle (ATV). Live streaming of camera can be used for different purposes with help of image processing. We can get 3D mapping of a region by the bot. The bot is provided with a gun which can be used to shoot the enemy at distance. The detachable arm can be used for different applications like obstacle removing, pick and place objects etc.[7]

Chapter 3

Methodology

3.1 Working

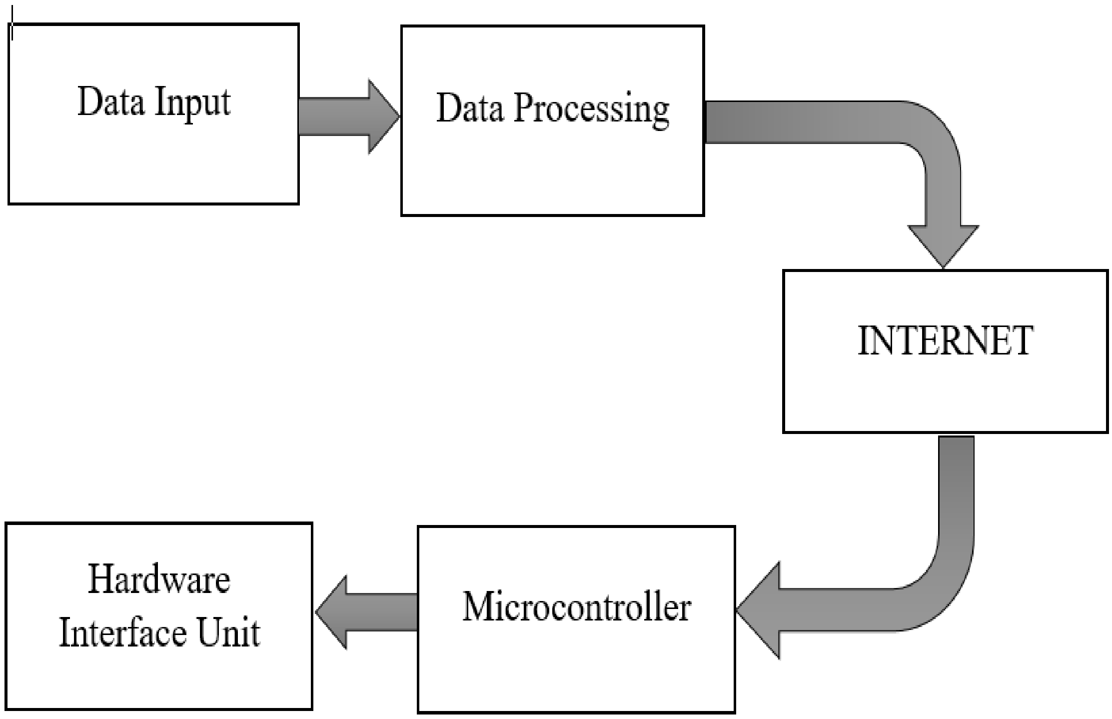

Figure 3.1: General Block Diagram

Figure 1 describes the general function block diagram. We need a mobile application for control and operation of Defence Bot. The processing unit comprises of a mobile application linked to Internet. Processing unit is core of Wireless Control. The processing of data results in assigning a desired command to specific device. The technique of operation is based on Internet of Things which uses Cloud based Server to transfer data. The range of operation can be increased by using long-range radio frequency module. The microcontroller present at the receiver side receives the data from the Internet Server and generates PWM Signals. The signals upon decoding will be able to drive other hardware present in the system. Motor driver ICs, geared motors and sensor shield etc. are some of the circuit elements contained in hardware unit.

3.2 Working of ARM

Robotic arms are widely-used tools that are capable of lifting heavy or hazardous materials that human workers could not otherwise handle. They have been used for decades in factories and laboratories and are a staple science project for middle or high school children. Like other robots, robotic arms consist of a variety of different parts that all contribute to making it properly function. Controllers are the main processors of the robotic arms and act as their brains. They can either act automatically as programmed or allow for manual operation by outputting instructions directly from a technician. They are essentially the control consoles of the robotic arms and come in a variety of styles according to what kind of processing power is needed. Some controllers in large factories are complex computer systems, while other controllers, like the ones found in science project kits, are simple joysticks.

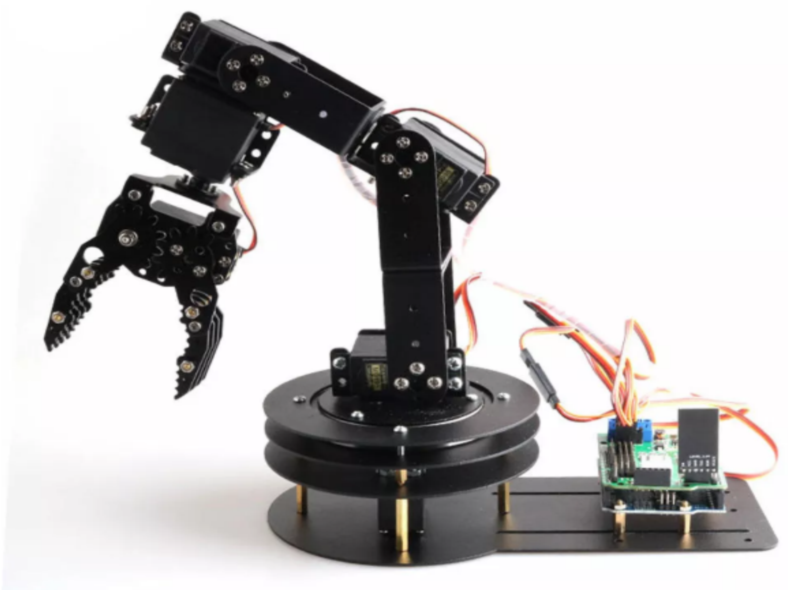

Figure 3.2: Robotic ARM

The arm is the main section of the robotic arm and consists of three parts: the shoulder, elbow and wrist. These are all joints, with the shoulder resting at the base of the arm, typically connected to the controller, and it can move forward, backward or spin. The elbow is in the middle and allows the upper section of the arm to move forward or backward independently of the lower section. Finally, the wrist is at the very end of the upper arm and attaches to the end effector. The end effector acts as the hand of the robotic arm. It is often composed of two claws, though sometimes three, that can open or close on command. It can also spin on the wrist, making maneuvering material and equipment easy. Drives are essentially the motors in between joints that control the movement and maneuvers. They typically use belts similar to what is found in car engines. Sensors are more often found on advanced robots. Some are riddled with sensors that allow them to sense their environment and react accordingly. For example, they prevent collisions between two robots who may be working in close proximity or allow the robot to adjust its grip on a fragile object to prevent damaging it.[8]

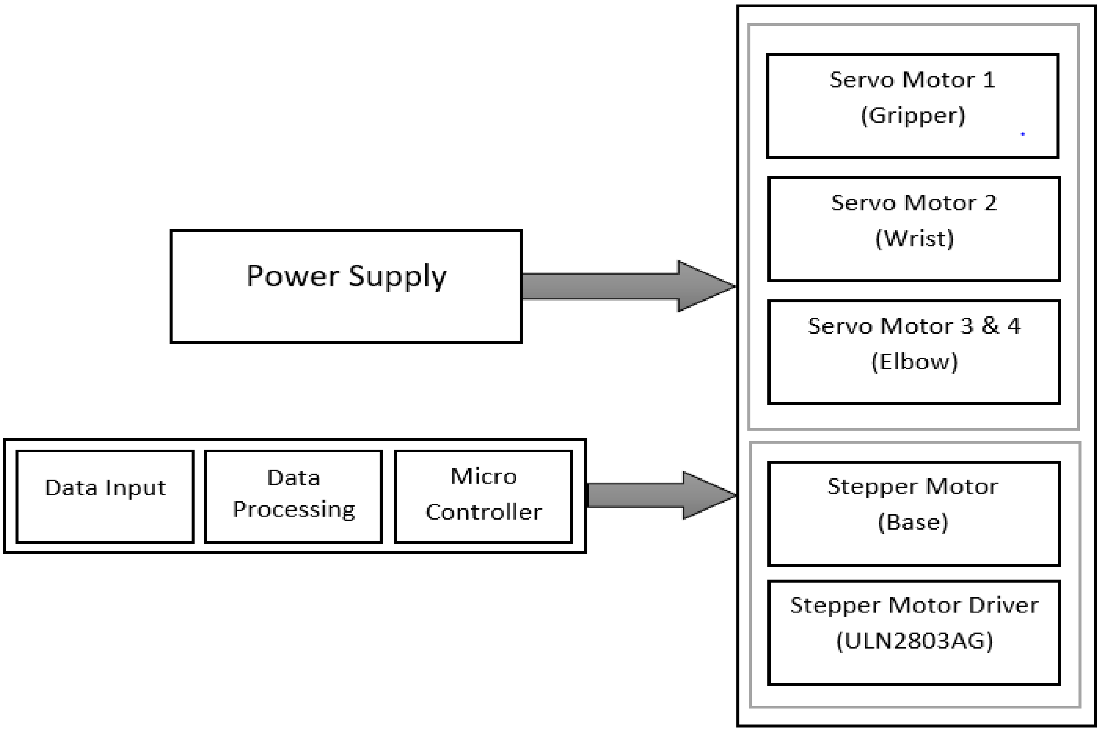

Figure 3.3: ARM Working Block Diagram

Figure 2 describes the working of the Robotic ARM equipped on the Bot. It requires a power supply of 5V required to activate the ARM. We need a mobile application for control and operation of the ARM. Input is given through app which is processed and given to Microcontroller (Arduino) where the output is given. The ARM has 6 degrees of freedom of rotation, which include a stepper/swivel base, a servo motor in the gripper, a servo motor in the wrist and a servo motor in the elbow. All the motors are master controlled by the Motor Shield.

3.3 Working of Camera

While video surveillance systems are not a new invention, the fact is advancements in technology are now fine-tuning this important aspect of nearly all home security systems. Wireless cameras work by transmitting the camera's video through a radio (RF) transmitter. The video is sent to a receiver that is connected to a built-in storage device or through cloud storage. Through your monitor or receiver, you'll have an easy link to access all of your image or video clips. That's because of five standard functions wireless security cameras introduce to home security systems. Those are:

Motion Detectors- Vivint wireless security camera systems can be outfitted with motion sensor technology that is both energy-efficient and more secure. Security cameras that include motion detectors will start recording automatically any time they sense movement in range. In the case of pan-and-tilt cameras, the camera lens will automatically point itself in the direction of the motion and record.

Figure 3.4: Raspberry Pie Camera Module

Scheduled Recording- One of the biggest advantages of a wireless camera is the option to control your system's recording schedule. Aside from receiving video clips whenever motion is detected, an alarm is activated, or a sensor is triggered, it's easy to schedule your surveillance system to automatically record at certain times. This safety feature allows you to ensure that your house is as secure as possible. Whether you are remotely monitoring the kids after school, keeping an eye on the babysitter, or simply ensuring hired personnel are doing their job while you are away, scheduled recording ensures you know what is going on in your home at all times.

Cloud Storage- Among the many advanced features of a wireless home surveillance system from Vivint, cloud storage is one of the key components that connect it all. All images and video clips recorded with a Vivint surveillance system are automatically transferred via your home's Wi-Fi network to Vivint Smart Drive cloud storage. This convenient storage allows you to access your clips at any time from your home's control panel, the Vivint Smart Home app, or your online account.

Remote Access- Finally, the key component that makes Vivint's wireless home surveillance systems more convenient than any other – remote access. Vivint allows you to remotely access, monitor, control, and adjust all of your home's surveillance systems from your online account, mobile app, or VivintSkyControl Panel. This means you can control, monitor, and manage your home from anywhere, whether you're at home, on vacation in the Bahamas, at work, or in your car. Anywhere that you go, you can access

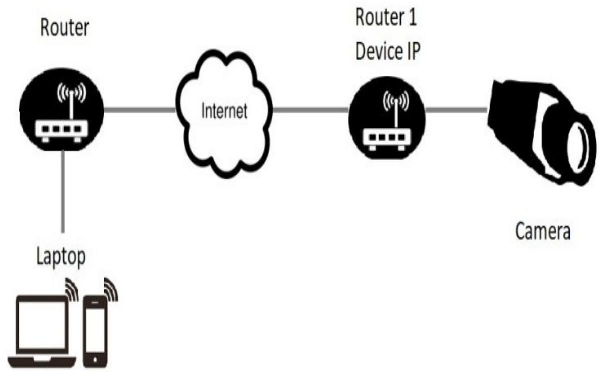

Figure 3.5: Camera Working Block Diagram

Figure 3 describes the working of the camera. The bot is implemented with wireless camera. The camera uplinks the data to the Internet using Router. This data can be accessed by user through Laptop by downlinking data from Internet using router.

3.4 Controlling BOT movement

There are many different ways to communicate with a bot. Bots are most often controlled using a tether (wired), wirelessly or autonomously. Tethered The easiest way to control a bot is using a handheld controller connected physically to the bot using wires or a cable. Toggle switches on the controller allow you to control the bot without using electronics and act to connect motors and battery directly. Such bots usually have no intelligence. Autonomous underwater vehicles tend to use fibre optic cables for communication while terrestrial bots use metal (copper) wiring. The next step is to incorporate a microcontroller into your bot but continue to retain the tether. Connecting the microcontroller to one of your computer's I/O ports (serial or USB) allows you to control its actions using a keyboard (or keypad), joystick or other peripheral device. Incorporating a microcontroller into your project allows you to gain experience that will be needed when programming a bot for remote control and subsequently autonomous control. Note that microcontrollers are not capable of providing sufficient power to motors and therefore need a motor controller to act as intermediary.[8]

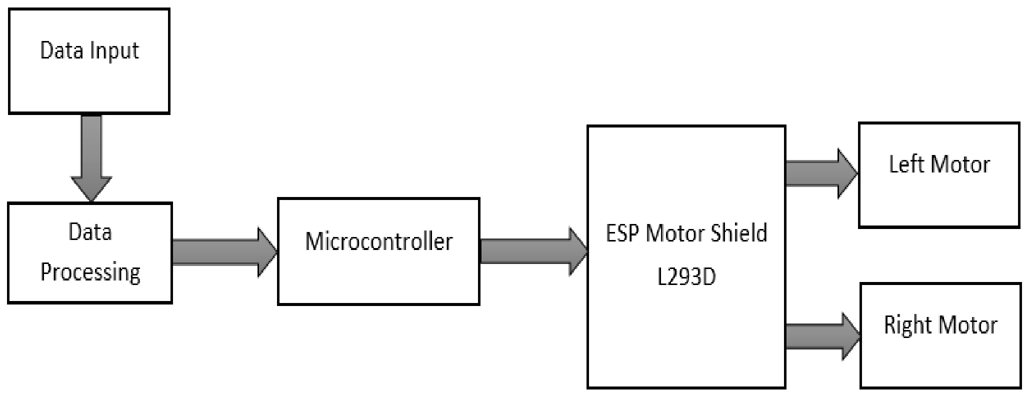

Figure 3.6: Bot Movement Block Diagram

Wireless Infrared transmitters and receivers are used to cut the cables connecting the bot to the user. This is usually a personal milestone for botic beginners. Infrared control requires ”line of sight” in order to function; the receiver must be able to see the transmitter at all times. Infrared remote controls (such as universal remote controls) are often used to control a bot’s actions. Commercially available Remote Control (R/C) units use small microcontrollers in the transmitter and receiver to send, receive and interpret data via RF. The receiver box also houses a servo motor controller. RF requires either a transmitter matched with a receiver, or a transceiver (which can both send and receive data). RF does not require line of sight and can also offer significant range. Radio frequency devices can allow for data transfer between devices as far away as several kilometers. Bluetooth is a form of RF and follows specific protocols for sending and receiving data. Bluetooth range is often limited though it does have the advantage of allowing users to control their bot via Bluetooth-enabled devices such as cell-phones, PDA’s and laptops (though some extra programming may be required). Bluetooth offers two-way communication.

Autonomous The next step is to use the microcontroller in your bot to its full potential and program it to react to input from its sensors. Microcontrollers are not capable of providing sufficient power to motors and therefore need a motor controller to act as intermediary. Microcontrollers are required for remote and autonomous control. A microcontroller is considered the ”brain” of a real bot and allows you to program your bot’s behavior. A bot can be controlled autonomously (no user input) or semi-autonomuosly (some user input). Semi-autonomous control involves some of the decision making processes to be transferred / programmed into to the bot. Autonomous control can come in various forms: pre-programmed with no feedback from the environment, limited sensor feedback and finally complex sensor feedback. True ”autonomous control” involves a variety of sensors and pre-written code to allow the bot to determine itself the best action to be taken in any given situation. The most complex autonomous mobile bots currently use GPS navigation, vision systems and a variety of onboard sensors to help them navigate their environment.

3.4.1 ESP 8266

The ESP8266 is a low-cost Wi-Fi microchip with full TCP/IP stack and microcontroller capability produced by manufacturer Espressif Systems in Shanghai, China.[9] The chip first came to the attention of Western makers in August 2014 with the ESP-01 module, made by a third-party manufacturer Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at first there was almost no English-language documentation on the chip and the commands it accepted. The very low price and the fact that there were very few external components on the module, which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, chip, and the software on it, as well as to translate the Chinese documentation.[10]

Figure 3.7: ESP 8266

- Processor: L106 32-bit RISC microprocessor core based on the Tensilica Xtensa Diamond Standard 106Micro running at 80 MHz
- Memory:
  - 32 KiB instruction RAM
  - 32 KiB instruction cache RAM
  - 80 KiB user-data RAM
  - 16 KiB ETS system-data RAM
- External QSPI flash: up to 16 MiB is supported (512 KiB to 4 MiB typically included)
- IEEE 802.11 b/g/n Wi-Fi
  - Integrated TR switch, balun, LNA, power amplifier and matching network

- WEP or WPA/WPA2 authentication, or open networks

- 16 GPIO pins
- SPI
- IC (software implementation)[6]
- IS interfaces with DMA (sharing pins with GPIO)
- UART on dedicated pins, plus a transmit-only UART can be enabled on GPIO2

3.4.2 ESP Shield

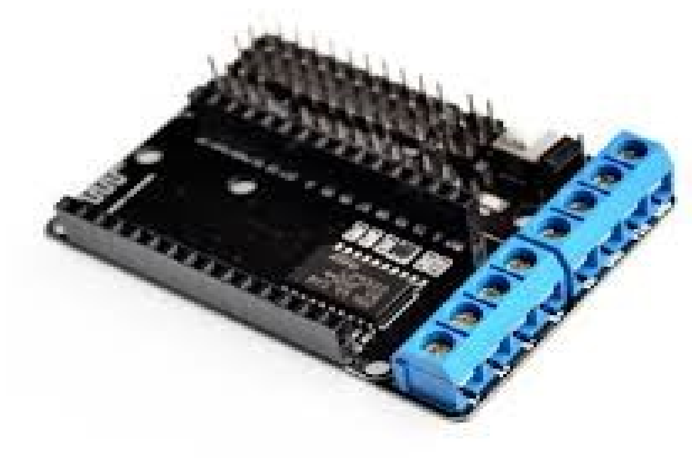

Figure 3.8: ESP Shield

ESP-12E Motor Shield is designed and developed by Shenzhen Doctors of Intelligence Technology (SZDOIT). This large current motor driven module can compatible with ESP12E Dev Kit and NodeMCU.By using the overlap-plug design, the motor shield can be directly plugged by ESP-12E Dev Kit and NodeMCU Lua module. This shield board is driven by the special excent large power full-bridge chip L293DD from the famous Stmicroelectronics company, which can directly drive 2-channels DC motors or one-channel stepper motor. The driven current can be arrived at 1.2A. This board is generated with national layout, SMT ensuption, and convenient installation. In this motor shield board, the IO port of ESP-12E Dev Kit is used as the control port. The logic chip configured inside can finish IC driven. Thus, the shield board has four ports: D1, D2, D3, and D3, which are used as PWMA(motor A), PWMB (motor B), DA (direction of motor A), and DB (direction of motor B), respectively. In addition, this shield board has many pins, such as VIN, 3.3V, DIO, AIO, SDIO, UART, SPI, RST, and EN, thus can conveniently connect all kinds of sensors (e.g., temperature and humidy, buzzer, light, relay sensor, etc.).[11]

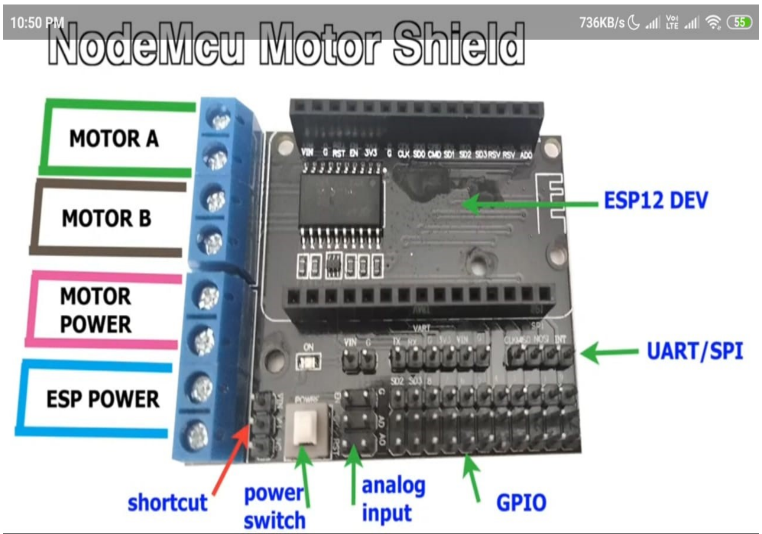

Figure 3.9: ESP Shield Connections

- Input Power :
  - Motor power (VM): 4.5 36V, can be powered separately
  - Control power (VIN): 4.5V 9V(10V MAX), can be powered separately
- Provide the shortcut connector (short by VM and VIN), thus can use one power source (must be 4.5V 9V) to complete the drive and control for motor at a time.
- Logic working current Iss:¡=60mA (Vi=L), ¡=(Vi=H)
- Driven working current Io: ¡=1.2A
- Max of dissipation power: 4W(T=90)
- Control signal input voltage: 2.3V¡=VIH¡=VIN (high), -0.3V¡=VIL¡=1.5V (low)
- Working temperature:* -25-+125
- Driven model: double ways large power H bridge driven
- ESP-12E Dev Kit control port: D1, D3 (motor A); D2, D4 (motor B);
- Weight: about 20g

Movement of the Bot is described in Figure 4. Data Input is given by an app which defines the movement manually obtained from the User. This data obtained is further processed by the app and then given to the Microcontroller. The Microcontroller is connected to the Motor Driver which is responsible for regulating and controlling the motors as defined by the User controls. When Bot is set into Forward motion, both the motors are switched into forward motion. For Left direction, only Right motor is activated. Similarly, for Right direction, only Left motor is activated.[12]

3.5 Working of Ultrasonic Sensor

Ultrasonic sensors work by emitting sound waves at a frequency too high for humans to hear. They then wait for the sound to be reflected back, calculating distance based on the time required. This is similar to how radar measures the time it takes a radio wave to return after hitting an object. [13]

While some sensors use a separate sound emitter and receiver, it's also possible to combine these into one package device, having an ultrasonic element alternate between emitting and receiving signals. This type of sensor can be manufactured in a smaller package than with separate elements, which is convenient for applications where size is at a premium.

Figure 3.10: Ultrasonic sensor

While radar and ultrasonic sensors can be used for some of the same purposes, sound-based sensors are readily available—they can be had for just a couple dollars in some cases—and in certain situations, they may detect objects more effectively than radar.[14]

For instance, while radar, or even light-based sensors, have a difficult time correctly processing clear plastic, ultrasonic sensors have no problem with this. In fact, they're unaffected by the color of the material they are sensing. On the other hand, if an object is made out of a material that absorbs sound or is shaped in such a way that it reflects the sound waves away from the receiver, readings will be unreliable.

If you need to measure the specific distance from your sensor, this can be calculated based on this formula:

Distance = T x C

(T = Time and C = the speed of sound) [15]

At 20C (68F), the speed of sound is 343 meters/second (1125 feet/second), but this varies depending on temperature and humidity. Specially adapted ultrasonic sensors can also be used underwater. The speed of sound, however, is 4.3 times as fast in water as in air, so this calculation must be adjusted significantly

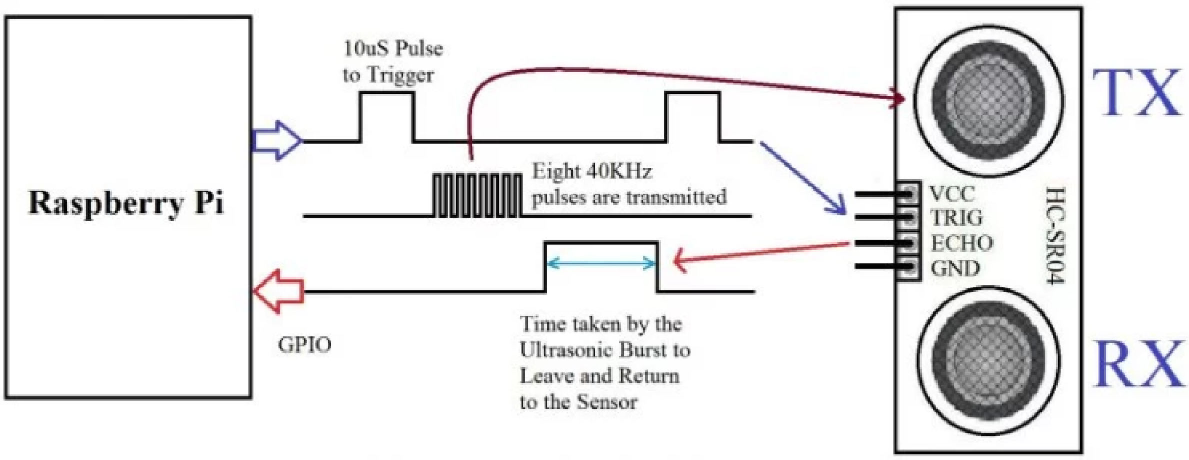

Figure 3.11: Ultrasonic Sensor Block Diagram

The above figure describes the working of the ultrasonic sensor in the bot. This is mainly used for defining object or obstacles and its relative distance from the bot. The ultrasonic sensor is connected to the Raspberry Pi, which can be accessed by us with the help of commands. Thus, readings can be obtained wirelessly from the Raspberry.[16]

3.6 Working of Gas Sensor

The MQ-2 Gas sensor can detect or measure gasses like LPG, Alcohol, Propane, Hydrogen, CO and even methane. The module version of this sensor comes with a Digital Pin which makes this sensor to operate even without a microcontroller and that comes in handy when you are only trying to detect one particular gas. When it comes to measuring the gas in ppm the analog pin has to be used, the analog pin also TTL driven and works on 5V and hence can be used with most common microcontrollers.

So if you are looking for a sensor to detect or measure gasses like LPG, Alcohol, Propane, Hydrogen, CO and even methane with or without a microcontroller then this sensor might be the right choice for you. [17]

Figure 3.12: MQ-2 Gas Sensor

Where to use MQ-2 Gas sensor:

The MQ-2 Gas sensor can detect or measure gasses like LPG, Alcohol, Propane, Hydrogen, CO and even methane. The module version of this sensor comes with a Digital Pin which makes this sensor to operate even without a microcontroller and that comes in handy when you are only trying to detect one particular gas. When it comes to measuring the gas in ppm the analog pin has to be used, the analog pin also TTL driven and works on 5V and hence can be used with most common microcontrollers. [18]

So if you are looking for a sensor to detect or measure gasses like LPG, Alcohol, Propane, Hydrogen, CO and even methane with or without a microcontroller then this sensor might be the right choice for you.[19]

How to use MQ-2 Sensors to detect gas:

Using an MQ sensor it detects a gas is very easy. You can either use the digital pin or the analog pin to accomplish this. Simply power the module with 5V and you should notice the power LED on the module to glow and when no gas it detected the output LED will remain turned off meaning the digital output pin will be 0V.

Remember that these sensors have to be kept on for pre-heating time (mentioned in features above) before you can actually work with it. Now, introduce the sensor to the gas you want to detect and you should see the output LED to go high along with the digital pin, if not use the potentiometer until the output gets high. Now every time your sensor gets introduced to this gas at this particular concentration the digital pin will go high (5V) else will remain low (0V). [20]

You can also use the analog pin to achieve the same thing. Read the analog values (0-5V) using a microcontroller, this value will be directly proportional to the concentration of the gas to which the sensor detects. You can experiment with this values and check how the sensor reacts to different concentration of gas and develop your program accordingly. [21]

How to use the MQ-2 sensor to measure PPM:

If you are looking for some accuracy with your readings then measuring the PPM would be the best way to go with it. It can also help you to distinguish one gas from another. So to measure PPM you can directly use a module. [22]

Features :

- Wide detecting scope
- Stable and long lifetime
- Fast response and High sensitivit
- Operating Voltage is +5V
- Can be used to Measure or detect LPG, Alcohol, Propane, Hydrogen, CO and even methane
- Analog output voltage: 0V to 5V
- Digital Output Voltage: 0V or 5V (TTL Logic)
- Preheat duration 20 seconds
- Can be used as a Digital or anaog sensor
- The Sensitivity of Digital pin can be varied using the potentiometer

Applications:

- Detects or measure Gases like LPG, Alcohol, Propane, Hydrogen, CO and even methane
- Air quality monitor
- Gas leak alarm
- Safety standard maintenance
- Maintaining environment standards in hospitals

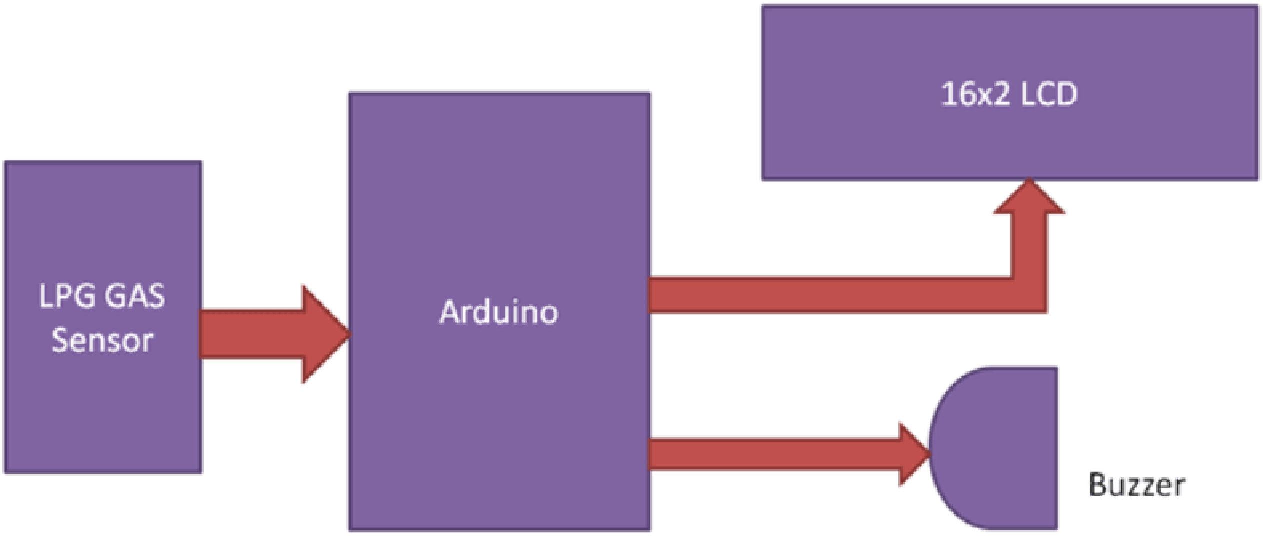

Figure 3.13: MQ-2 Gas Sensor Working Block Diagram

The above figure describes the working of the gas sensor in the bot. The sensor used is of MQ2 variant, which helps in the detection of H2, LPG, CH4, CO, Alcohol, Smoke or Propane. Due to its high sensitivity and fast response time, measurement can be taken as soon as possible. The sensitivity of the sensor can be adjusted by potentiometer. It is connected to Arduino which gives output instantaneously. [23]

3.7 Working of Metal Detector

A gas sensor is a device which detects the presence or concentration of gases in the atmosphere. Based on the concentration of the gas the sensor produces a corresponding potential difference by changing the resistance of the material inside the sensor, which can be measured as output voltage. Based on this voltage value the type and concentration of the gas can be estimated. [24]

The type of gas the sensor could detect depends on the sensing material present inside the sensor. Normally these sensors are available as modules with comparators as shown above. These comparators can be set for a particular threshold value of gas concentration. When the concentration of the gas exceeds this threshold the digital pin goes high. The analog pin can be used to measure the concentration of the gas.

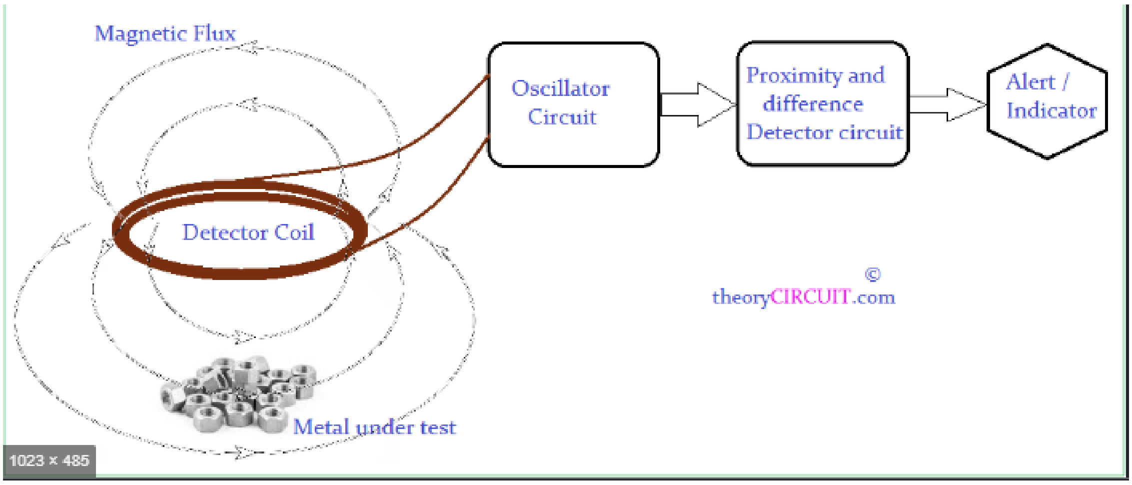

Figure 3.14: Metal Detector Working Block Diagram

The operation of metal detectors is based upon the principles of electromagnetic induction. Metal detectors contain one or more inductor coils that are used to interact with metallic elements on the ground. [25] The single-coil detector illustrated below is a simplified version of one used in a real metal detector. A pulsing current is applied to the coil, which then induces a magnetic field shown in blue. When the magnetic field of the coil moves across metal, such as the coin in this illustration, the field induces electric currents (called eddy currents) in the coin. The eddy currents induce their own magnetic field, shown in red, which generates an opposite current in the coil, which induces a signal indicating the presence of metal. [26]

Chapter 4

Analysis

4.1 Bot Control

The proposed technique is implemented using ESP8266 wifi module, so as to give commands wirelessly over the Internet, thus extending its range of operation. This is further enhanced with the help of a NodeMCU Shield used in combination with the ESP. The interface being used is the Blynk Server Application, which provides custom interface for Bot Control by acting as a Remote.[27]

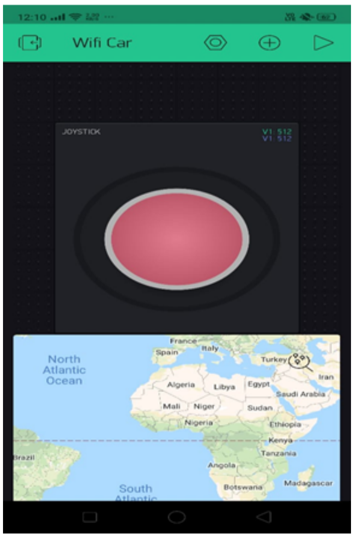

Figure 4.1: Bot Control using Blynkand Pi Camera

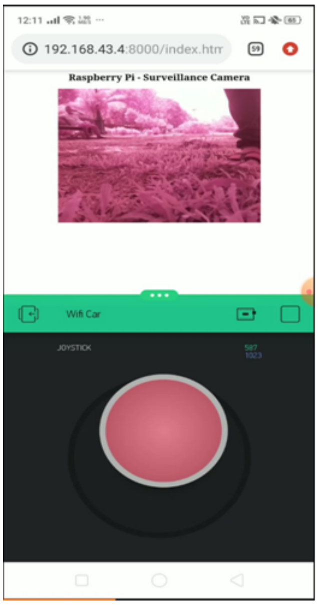

Figure 4.2: Bot Control and Location Access using Blynk

4.2 Camera Control

The proposed technique is implemented using Raspberry Pi and its camera. Pi is connected to Internet and the Camera feed is patched to required device through IP address and Port. This connection is wireless and nearly lag-free, thus enabling fast response.[28]

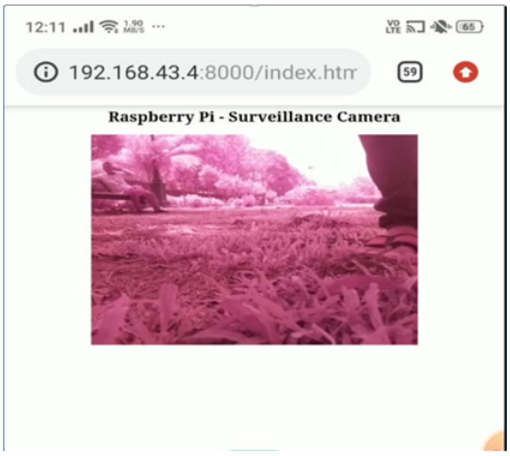

Figure 4.3: Live Camera Access

4.3 Gas Sensor

The proposed technique is implemented using MQ2 Gas Sensor to detect gases in large concentrations. The analog output voltage provided by the sensor changes in proportional to the concentration of smoke/gas. The greater the gas concentration, the higher is the output voltage; while lesser gas concentration results in low output voltage. This change in voltage triggers the buzzer, thus giving us the required output.[29]

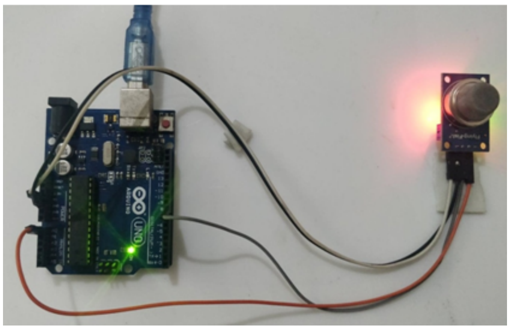

Figure 4.4: Gas Sensor

4.4 Ultrasonic Sensor

HC-SR04 Ultrasonic (US) sensor is a 4 pin module, whose pin names are Vcc, Trigger, Echo and Ground respectively. This sensor is a very popular sensor used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that[30]

$Distance = Speed * Time$

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor.

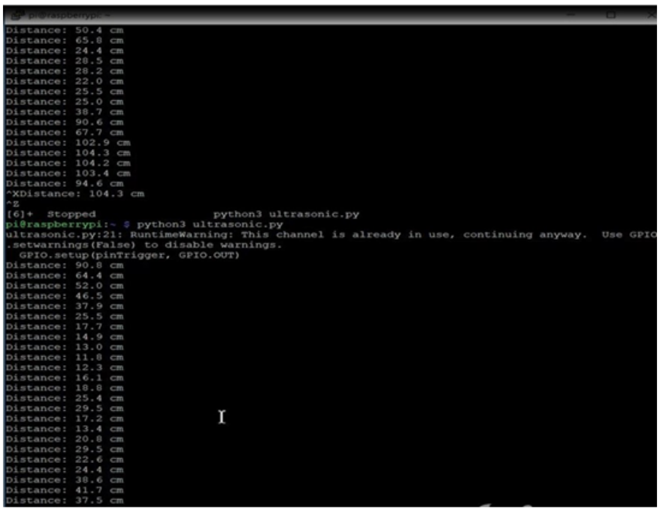

Figure 4.5: Ultrasonic Sensor Readings

Chapter 5

Proposal Results and Future Scope

Thus, from this proposal, we will be able to design a machine which can be used in defense operations like remote surveillance, bomb detection and disposal, 2D area mapping and offense operations like unmanned gun ring and seek and destroy operations.

Up until this stage the level of autonomy of the machine is medium, but with the help of the Algorithms we may be able reach level of fully automated machine , where if the machine is in unknown situation it may be able to take decisions like human level of intelligence. Also, night vision specs if enabled onto the machine, can be used in all military conditions thus improving operational availability, compounded with the machine's all terrain ability. The robot can be improvised to transverse vertical surfaces. Its mobility can be improved on air, land and water for stealth operations by certain improvisations. Also further improvisations can enable it to carry heavier loads, thus making it avail the ability to use mechanized guns in future.

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