SOLDIER ASSISTANCE BOT

MINI PROJECT REPORT

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INTERNAL EXAMINER EXTERNAL EXAMINER

TABLE OF CONTENTS

CHAPTER NO.	TITLE	PAGE NO
	LIST OF FIGURES	
	ABSTRACT	5
1	INTRODUCTION	
	1.1 INTRODUCTION TO SOLDIER ASSISTANCE BOT	6
	1.2 LITERATURE REVIEW	7
2	SOLDIER ASSISTANCE BOT	
	2.1 BLOCK DIAGRAM	8
	2.2 COMPONENTS REQUIRED	9
	2.3 ARDUINO UNO	10
	2.4 PWM MOTOR DRIVER	11
	2.5 DC MOTOR	12
	2.6 SERVO MOTOR	13
	2.7 LM7805 VOLTAGE REGULATOR	14
	2.8 ULTRASONIC SENSOR	14
	2.9 GPS MODULE	15
	2.10 GSM MODULE	16
	2.11 EXISTING METHODOLOGY	17
	2.12 PROPOSED METHODOLOGY	17
	2.13 IMPLEMENTATION	18
	2.14 RESUIT	19
3	CONCLUSION	20
	REFERENCE	21

LIST OF FIGURES

FIGURE NO	TITLE	PAGE NO
2.1	BLOCK DIAGRAM	8
2.2	ARDUINO UNO	10
2.3	PWM MOTOR DRIVER	11
2.4	DC MOTOR	12
2.5	SERVO MOTOR	13
2.6	7805 REGULATOR	14
2.7	ULTRASONIC SENSOR	14
2.8	GPS MODULE SKG13BL	15
2.9	GSM MODULE SIM900A	16
2.10	SOLDIER ASSSISTANCE BOT FRONT VIEW	19
2.11	SOLDIER ASSSISTANCE BOT SIDE VIEW	19

ABSTRACT

Soldier Assistance Vehicle (SAV) is an unmanned autonomous robot which is used to follow the soldier to battlefield by carrying their needs like ammunition, food, medicines etc. to the battle field at the appropriate time. The vehicle is also capable of working in rough terrains like mountains, slopes, deserts in a controlled manner. Ultrasonic sensors are used for detection in the movement of the soldiers and measuring the exact distance from the soldiers. The main controller of the vehicle is the Arduino UNO which drives the vehicle based on the values from the ultrasonic sensor. Several other components like GSM, GPS are mounted on the vehicle connected with the Arduino.The vehicle can be tracked with the help of the GPS and GSM module. IR (Infra-red) camera is placed in the vehicle in order to identify monitor the proper movement of the vehicle. Rocker Bogie mechanism is used to drive the vehicle in rough terrains.

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION TO SOLDIER ASSISTANCE BOT

In Real time battlefields the army soldiers need to carry their needs like ammunition, first aid, food etc. for a long distance which requires additional man power and soldiers. In order to overcome this situation we have designed an unmanned autonomous vehicle to carry their needs. Path tracking and obstacle avoidance is the two very important behaviours in developing a Soldier assistance vehicle (SAV).This work is about a proposed unmanned vehicle follows a group of soldiers to carry their payload and ammunition to battlefield.

The Soldier Assistance Vehicle (SAV) follows the soldier by detecting the movements of the soldier. Ultrasonic sensors are used to identify the movement of soldiers. Based on the observations from the sensors the vehicle is driven by Arduino UNO using servo motor and motor driver. Rocker bogie mechanism is used to drive the vehicle in rough terrains. A GPS module is used to track the location of the vehicle by sending the data through the GSM module. In addition to these the movement of vehicle can also be monitored by using IR cam.

1.2 LITERATURE SURVEY

The first major mobile robot development effort named Shakey was created during the 1960s as a research study for the Defence Advanced Research Projects Agency (DARPA).Shakey was a wheeled platform that had a TV camera, sensors, and a computer to help guide its navigational tasks of picking up wooden blocks and placing them in certain areas based on commands. DARPA subsequently developed a series of autonomous and semi-autonomous ground robots, often in conjunction with the U.S. Army. As part of the Strategic Computing Initiative, DARPA demonstrated the Autonomous Land Vehicle, the first UGV that could navigate completely autonomously on and off roads at useful speeds.

Mobile Robotics has been developed tremendously in recent years. Multi-wheeled autonomous robots can potentially transverse difficult Terrains. Waldron, Kumar and Burkat (1987) described a single bodied and six wheeled autonomous vehicle with 2 degree of freedom. The vehicle was able to recover from the self-tuned position. In addition to this, the locomotion of Dante II has enhanced by the use tether mechanism, which enables to rappel up and down during vertical mountains .Simon have states that “The development of mobile robotics have a major contribution in the defence of the country” in the year 1962.The article “Soldiers and Robots” have describes that the 72% of the soldier in the army are replaced by the Robots.

Daksh is a battery-operated remote-controlled robot on wheels that was created with a primary function of bomb recovery. Developed by Defence Research and Development Organisation, it is fully automated. It can navigate staircases, negotiate steep slopes, navigate narrow corridors and eliminates vehicles to reach hazardous materials.

CHAPTER 2

SOLDIER ASSISTANCE BOT

2.1 BLOCK DIAGRAM

Fig. 2.1 Block diagram

2.2 COMPONENTS LIST

1. Arduino UNO
2. PWM Motor Driver
3. Servo Motor
4. Regulator 7805
5. Ultrasonic Sensor
6. DC Gear Motors
7. GSM SIM900A
8. GPS SKG13BL
9. IP Camera.
10. IR sensor.
11. Jumper Wires
12. Tyres
13. Brushes
14. Screws
15. Woods
16. Connecting Wires
17. Charger Circuits

2.3 ARDUINO UNO

Arduino UNO is an open source platform which links hardware and software. It supports Embedded C program as well as AVR code. Arduino is a printed circuit board which contains microcontroller ATmega 328, oscillator with a clock speed of 16MHz, voltage regulator. It can be programmed with Arduino IDE (integrated Development Environment).

The main features of Arduino UNO are the following:

1. Microcontroller ATMega328.
2. Operating Voltage: 5V.
3. Input Voltage (recommended): 7-12V.
4. Input Voltage (limits): 6-20V.
5. Digital I/O Pins: 14(of which 6 provide PWM output)
6. Analog Input Pins: 6.

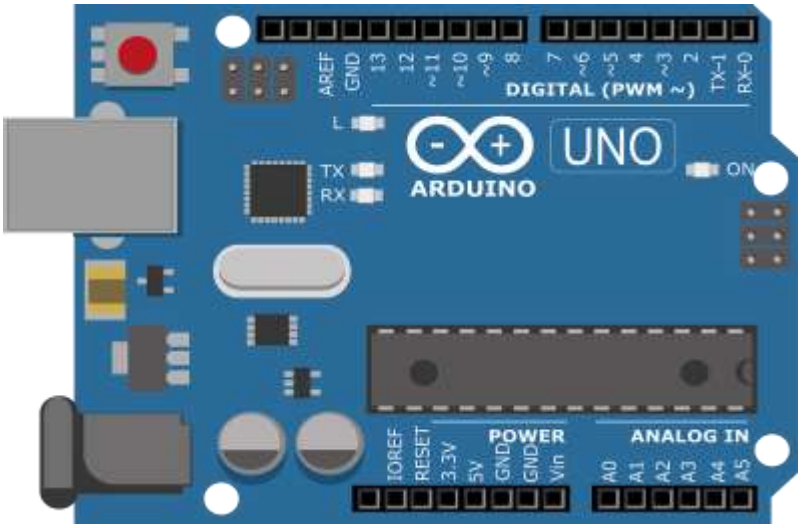

Fig.2.2 Arduino UNO

2.4 PWM MOTOR DRIVER

1. Pulse width modulation is a technique which allows us to adjust the average value of voltage that going to the electronic device by turning ON and OFF the power at fast rate.
2. The average voltage depends on the duty cycle, or the amount of time the signal is ON versus the amount of time the signal is OFF in a single period of time.
3. It is used for single phase motor and is capable of speed control by PWM pulse and thermal resistor at the same time.
4. A motor driver is a little current amplifier.
5. The motor driver takes the low-current signal and converts it into a high-current signal which is used to drive the motor.

Features:

1. The Motor Speed is controlled by PWM Pulse Directly and Thermal Resistor at the Same Time.
2. Low Corner Temperature Adjustable (30°C).
3. High Corner Temperature Adjustable (38°C).
4. Full Speed at Thermal Resistor Shorten.
5. Built-in Temperature Control Circuit.
6. Built-in Thermal Shutdown Circuit.
7. Auto-restart.

Fig. 2.3 LM 293d PWM Motor Driver

2.5 DC GEAR MOTOR

1. A DC motor is any of a class of rotary electrical machines that converts direct current electrical energy into mechanical energy.
2. DC Gear motors are type of electrical motors which produces maximum torque at low horse power.
3. A gear motor can be either an AC (alternating current) or a DC (direct current) electric motor.
4. Most gear motors have an output of between about 1,200 to 3,600 revolutions per minute (RPMs).

Fig. 2.4 DC Geared Motor

2.6 SERVO MOTOR

1. Servo motor working is based on PWM (Pulse Width Modulation) principle.
2. Their angle of rotation is controlled by the pulse duration applied to its control pin.
3. Basically, DC motors are used in servo motors which are controlled using a variable resistor (Potentiometer) and some gears.

4. A servo motor can usually only turn 90° in either direction for a total of 180° movement.

Fig. 2.5 Servo Motor

2.7 LM7805 VOLTAGE REGULATOR

1. Voltage sources used in the circuit have fluctuations results in changes in fixed output voltages fixed.
2. To maintain a constant value, voltage regulator ICs are used.
3. 78xx series fixed voltage regulators like 7805 IC to control fluctuations.
4. 7805 IC gives regulated power supply of 5 volts.
5. Heat sink can be added to the regulator.
6. Input voltage range ranges between 7V- 35V.

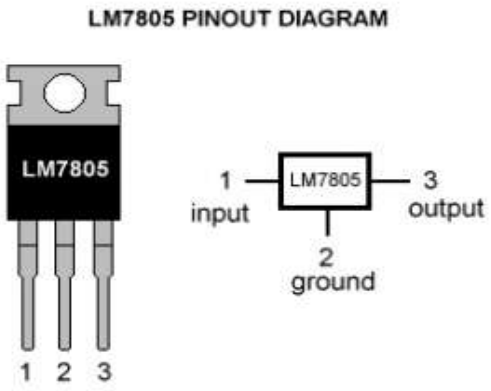

Fig. 2.6 LM 7805 voltage regulator

2.8 ULTRASONIC SENSOR

1. The Ultrasonic Sensor sends high-frequency sound pulse and counts how long it takes to return to the echo part.
2. The sensor has 2 openings or parts on its front. One opening which is TRIG part transmits ultrasonic waves and ECHO part other receives it.
3. The sound waves travels approximately at a speed of 343 meters per second in air.
4. The ultrasonic sensor uses the pulse duration time between sending and receiving the sound pulse to calculate the distance of an object.
5. It uses the mathematical equation:

Distance = Time x Speed of Sound in air divided by 2.

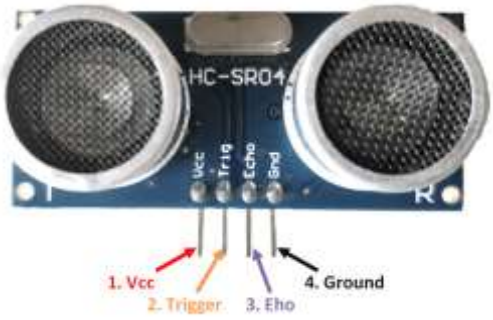

Fig. 2.7 Ultrasonic Sensor

2.9 GPS MODULE

Global Positioning System (**GPS**) is used to locate the position of the object by using a network of satellites. It uses the trilateration process.

Features:

1. It consumes low power.it operates at 3.3V of 22mA.
2. High level accuracy to access the geographical location. The period for time pulse is within 10 Nano seconds.
3. It is extremely fast and has Ultra high sensitivity.
4. Further it has UART (Universal Asynchronous Receiver Transmitter interface).

Applications:

1. It is used to track and navigate vehicles.
2. Widely used in mobile phone communications.
3. Using latitudinal and longitudinal positions, it can render service based the exact position of the receiver**.**

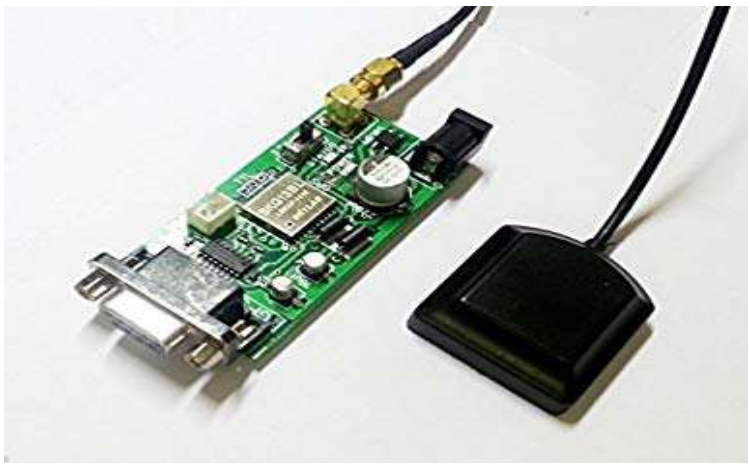

Fig. 2.8 GPS SKG13BL

2.10 GSM MODULE

Global system for mobile (GSM) is widely used in mobile communication system. It is digital cellular technology used to transmit services like data, messages and voice at a frequency of 850MHz, 900MHz, 1800MHz and 1900MHz. For communication, it uses Time Division Multiple Access (TDMA) technique.

GSM SIM900A is a Dual-band GSM module and it generally operates at 900/1800 MHz It uses AT commands like GSM 07.07, 07.05 and enhanced SIMCOM AT commands to communicate with controllers. It supports software power on and reset.

Features and Specifications:

1. It has small form factor and power consumption is low.
2. It supports firmware like Java, Embedded AT, and MMS etc.
3. Interfaces like GPIO, I2C, Serial Peripheral Interface, audio interface like analog signal.

Fig. 2.9 GSM SIM900A.

2.11 EXISTING METHODOLOGY

In India the Army soldiers need to carry their requirements to the battlefield on their own for a long distance. The main drawback of this convention method it requires additional man power and soldiers and also it takes more time to reach the destination. Later Trucks and jeeps are used to carry the goods to the battlefield. Usage of trucks and jeeps to carry the needs saved the time to reach the destination but it also requires some additional man power. So in future there is a need of unmanned autonomous vehicle to carry the needs of soldier to reach the destination.

2.12 PROPOSED METHODOLOGY

The proposed prototype is designed to overcome these drawbacks by making use of technologically more improved and efficient techniques. The Soldier Assistance Vehicle (SAV) is an unmanned autonomous robot which is used to follow the soldier to battlefield by carrying their needs like ammunition, food, medicines, etc. The vehicle is also capable of working in rough terrains like mountains, slopes, etc. The Soldier Assistance Vehicle (SAV) follows the soldier by detecting the movements of the soldier. The main controller of the vehicle is the Arduino UNO which is used to drive the vehicle based on the values from the ultrasonic sensor. The vehicle can be tracked with the help of the GPS and GSM module interfaced in the vehicle.

2.13 IMPLEMENTATION

Arduino UNO is used to control the components such as servo motors, motor driver, ultrasonic sensor, GSM Module and GPS Module. Servo motors has three pin (ground, Vin, input). All the pins of the servo motors are connected to the Arduino UNO pins. The ground connection is made at the particular point which is taken from the Arduino ground pin and negative terminal of the battery. The positive end of the battery is given along with the switch to the PWM motor driver. The motors are connected to the motor drive ports. Totally six motors is used in the base in which the three motors of the same side is given to the port A and next three motors of the next side is given to the port B of the motor driver. Here the 7805 Voltage regulator which converts 12 voltage into 5 voltage is attached with servo motors.

The servo motor is used as steering to turn the bot. The three ultrasonic sensor is continuously monitoring the distance from the object. Front ultrasonic sensor has first priority. When front ultrasonic sensor value is less than 20 cm the robot will stop if it continues for 15 second it considered as obstacles and alert the soldier via buzzer ,when the value is between 20 cm to 250 cm the robot run forward. When this value is above 250 cm the robot will stop. Otherwise if right and left sensor value is reached between 20 cm to 250 cm and front sensor value is above than 250 cm the robot will turn right and left respectively. GSM and GPS Module are connected with Arduino RX, TX and software serial ports. When GSM module receives a string TRACK via short message service, Arduino get latitude and longitude position from the GPS and sent data via GSM module via short message service.

2.14 RESULT

Fig. 2.10 Soldier assistance bot front view

Fig. 2.11 Soldier assistance bot side view

CHAPTER 3

CONCLUSION

Thus the proposed methodology can be used to carry the needs of the army soldier to the battlefield. Further, the addition of GPS greatly helps to know the exact longitudinal and latitudinal position of the soldiers. With the GSM module messages can be send to the main station. Therefore assistance can be provided during emergency periods at the appropriate time. Hence assistance can be given immediately by sending unmanned vehicles. Thus the delay time will be eliminated. Soldier Assistance Vehicle replaces the un-upgraded old equipment and tools in our army. These advancements paves new way of communicating and providing assistance to soldiers during the war time. Hence it serves as a life saver to the soldiers. These vehicles reduces the manpower and time required to reach the battlefield.

REFERENCES

1. Carullo, A. and Parvis, M., 2001. An ultrasonic sensor for distance measurement in automotive applications. *IEEE Sensors journal*.

2. Harrington, B.D. and Voorhees, C., 2004. The challenges of designing the rocker-bogie suspension for the mars exploration rover.

3. Badamasi, Y.A., 2014, September. The working principle of an Arduino. In *Electronics, computer and computation (icecco), 2014 11th international conference on* (pp. 1-4). IEEE.

4. Ohishi, K., Nakao, M., Ohnishi, K. and Miyachi, K., 1987. Microprocessor-controlled DC motor for load-insensitive position servo system. *IEEE Transactions on Industrial Electronics*, (1), pp.44-49.