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Autonomous Object and Obstacle Detection Car

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Abstract

Driverless self-working car based on the Internet of Things (IoT), where the work involves navigating a vehicle without any human intervention to the predestined roads thereby reducing the accidents to a major extent. The main role of these cars is to give efficient working standards for obstacles detections and work through it. Here the working is based on the hardware components where involved with IoT. Customized design with Arduino Uno, L293D Motor Shield for Arduino, Gear Motors, and Servo Motor is being involved for the working. Using an USB wire connection for the Arduino the code is being uploaded to the board field where the total control is happened. The I/O taken over the board field takes out the h/w components into work by using s/w Arduino IDE interface for the further execution part. All the instruments equipped is supposed to have an efficient output source through the given input defining several working components like for Servo to define direction for sensing waves, Ultrasonic sensors for sensing waves for obstacles, L293D motor shield for control over the gear motors . The main theme of this project is to protect the public from various disastrous situations, in turn aims in controlling of the risk factors and altogether diminish the number of accidents with advanced driver assistance abilities like (video cameras, path detection etc.), the economic advantages could be huge.

Keywords: *Arduino Uno, USB Cable, Motor Shield (L293D), Gear Motors, Servo Motor, DC Battery Switch, 12V Rechargeable Batter*

INTRODUCTION

The internet of things, or IoT, is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction [5]. A thing in the internet of things can be a person with a heart monitor implant, a farm animal with a biochip transponder, an automobile that has built-in sensors to alert the driver when tire pressure is low or any other natural or man-made object that can be assigned an IP address and is able to transfer data over a network. Increasingly, organizations in a variety of industries are using IoT to operate more efficiently, better understand customers to deliver enhanced customer service, improve decision-making and increase the value of the business. When we look at today's state of technologies, we get a clear indication of how IoT will be implemented on a global level in near future. Use of the internet is increasing day-by-day. Commute and connectivity became easier in the present scenario. In near future, the number of internet connected devices would increase exponentially. Although there are some issues in IoT. These issues can be removed in near future. With such a rapid growth, the day is not too far that we can decide our dinner even before reaching home on the way. Firstly, connecting devices and operations takes time, lots of it, and it's a very common hurdle to overcome. The quip about it taking two times longer that's based on research firm Gartner's estimates that in 2018, 75 per cent of IoT projects will take up to twice as long as originally planned. Rainer Schroeder, chief sales officer at Nexiot, which delivers an end-to-end, sensor and software solution for freight logistics and supply chain management, says: "The pure rollout of IoT sensors takes two to five years. Especially in the beginning, when only a limited amount of assets are equipped with IoT sensors, there are very limited benefits. Projects with a two-to-five-year horizon aren't sexy." Next, the cost. IoT deployments can involve costs of between $10 and $50 a sensor, with mounting prices and Mr. Schroeder estimates that most large-scale environments require budgets of $ 1million or above for IoT projects. Such budgets require executive approval and this involves an entirely different set of IoT challenges, notably the lack of expertise and confidence among business executives and board members when it comes to complex deployments of machine or IoT technologies. "Challenges can be multi-fold, from not knowing where

to start, to lack of internal expertise and resource, and the complexities of driving deployments securely," says Rob Sheppard, UK IoT director for Intel. Mr Sheppard adds that IoT is now increasingly a board-level discussion and there is probably an over-emphasis at this level on bottom-line operational cost-savings. The recent survey for the accidental fatal statistics is defining a numerous numbers on the crashes of the cars. Road Crash Statistics. Nearly 1.3 million people die in road crashes each year, on average 3,287 deaths a day. An additional 20-50 million are injured or disabled. More than half of all road traffic deaths occur among young adults ages 15-44.

APPLICATIONS ON IOT

Smart home

Smart Home clearly stands out, ranking as highest Internet of Things application on all measured channels. More than 60,000 people currently search for the term "Smart Home" each month. This is not a surprise. The IoT Analytics company database for Smart Home includes 256 companies and startups. More companies are active in smart home than any other application in the field of IoT. The total amount of funding for Smart Home startups currently exceeds $2.5bn. This list includes prominent startup names such as Nest or Alert Me as well as a number of multinational corporations like Philips, Haier, or Belkin.

Wearable's remains a hot topic too. As consumers await the release of Apple's new smart watch in April 2015, there are plenty of other wearable innovations to be excited about: like the Sony Smart B Trainer, the My gesture control, or Look-see bracelet. Of all the IoT startups, wearable's maker Jawbone is probably the one with the biggest funding to date. It stands at more than half a billion dollars!

Smart City

Smart city spans a wide variety of use cases, from traffic management to water distribution, to waste management, urban security and environmental monitoring. Its popularity is fueled by the fact that many Smart City solutions promise to alleviate real pains of people living in cities these days. IoT solutions in the area of Smart City solve traffic congestion problems, reduce noise and pollution and help make cities safer.

Smart grids

Smart grids are a special one. A future smart grid promises to use information about the behaviors of electricity suppliers

and consumers in an automated fashion to improve the efficiency, reliability, and economics of electricity. 41,000 monthly Google searches highlight the concept's popularity. However, the lack of tweets (Just 100 per month) shows that people don't have much to say about it.

Industrial internet

The industrial internet is also one of the special Internet of Things applications. While many market researches such as Gartner or Cisco see the industrial internet as the IoT concept with the highest overall potential, its popularity currently doesn't reach the masses like smart home or wearable's do. The industrial internet however has a lot going for it. The industrial internet gets the biggest push of people on Twitter (~1,700 tweets per month) compared to other non-consumer-oriented IoT concepts.

Connected car

The connected car is coming up slowly. Owing to the fact that the development cycles in the automotive industry typically take 2-4 years, we haven't seen much buzz around the connected car yet. But it seems we are getting there. Most large auto makers as well as some brave startups are working on connected car solutions. And if the BMWs and Fords of this world don't present the next generation internet connected car soon, other well-known giants will: Google, Microsoft, and Apple have all announced connected car platforms.

Smart supply chain

Supply chains have been getting smarter for some years already. Solutions for tracking goods while they are on the road, or getting suppliers to exchange inventory information have been on the market for years. So while it is perfectly logic that the topic will get a new push with the Internet of Things, it seems that so far its popularity remains limited.

EXISTING SYSTEM AND PREDICTIONS

The main system existed is working with the motor shields where the control is taken over the medium of the predictions of the pictures with the camera [1]. Now days the camera attached manual cars are being there for the rear side to get on the safer side for riding. If any weather forecasting is taken over it then the cars are unable to trace on the roads and objects detection will be tough than expected. For this working there should be a more work efficient equipment to be equipped. Predictions taken over manual based on the cars are being processed in the recent

times. Camera predictability is often hard to notice. Meanwhile the automatic functions that are been considered under the manual process is depending on the external human hand. Some major quality tests have been taken over under the notice by the miscellaneous various other dependencies.

Major purpose of any product is to keep socially safe[10]. The various contents makes some contemporary makeovers under certain things under the manual parts. Cars that have been generated in recent times is taking certain manual functions under the circumstances. Simultaneous possibilities are very low for the functioning. Any step under the main usual things should be done as simple and as quick for the better outcome.

Predictions that are taken under the part:

1. Economical expensive
2. Simultaneous working
3. Manual functioning
4. Human interfacing over machine (Manpower)

Every outcome should have some of the beneficial things more over than the predictability for the huge massive execution. Programming such things can take more even complexity.

Recent surveys for the accidental fatal things on roads is being on this are more while undergone in year by year in recent five years are like 2014 for 57.33% to 2018 for 71.87%

PROPOSED SYSTEM AND ADVANTAGES

Introducing a new concept of ease with the Arduino functioning under the basis of IoT. Every decent program things are done here more proficient and crystal clear. Each and every bit here is studied under the quality systems. The main theme of this system is to do the actions over the machine in auto process.

Proceedings over this system is processed in automation way [2][3]. Defining every system with simultaneous actions with sensing the wave theory gives more relevant outcomes [6]. The output of the hardware will be declared under the IDE code. Helps to sort out the main problem stating in the more reducing the accidents of fatal issues in a clean way to minor numbers.

IoT processes are always relevant under the manpower with some of the software and hardware tests. Developers declare this are always the better option to get over the relevant outcomes and gives us

extravagant results [2]. Sensing through the ultrasonic sensors gives the reducing of the fatal things as the output [4]. Servo motor takes out the direction and sensing the magnitude over the proceeding work.

Advantageous things that happened with the proposed system is like the various things:

1. Cost efficient
2. Less manpower
3. Automatic working
4. Ease of Access
5. Predefined functions

The functional and non-functional requirements to the enhanced system are being undergone with software quality testing.

HARDWARE AND SOFTWARE COMPONENTS

Arduino in brief

Arduino Uno is a microcontroller board based on the ATmega328P (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform [1]; for an extensive list of current, past or outdated boards see the Arduino index of boards

Figure 1: Arduino Uno board

Servo in brief

Servo motors have three wires: power, ground, and signal. The power wire is typically red, and should be connected to the 5V pin on the Arduino board. The ground wire is typically black or brown and should be connected to a ground pin on the Arduino board. The signal pin is typically yellow, orange or white and should be connected to a digital pin on the Arduino board. Note that servos draw considerable power, so if you need to drive more than one or two, you'll probably need to power them from a separate supply (i.e. not the +5V pin on your Arduino). Be sure to connect the grounds of the Arduino and external power supply together.

Table 1: Wiring Description

Wire Number	**Wire Color**	**Description**
1	Brown	Ground wire connected to the ground of system
2	Red	Powers the motor typically +5V is used
3	Orange	PWM signal is given in through this wire to drive the motor

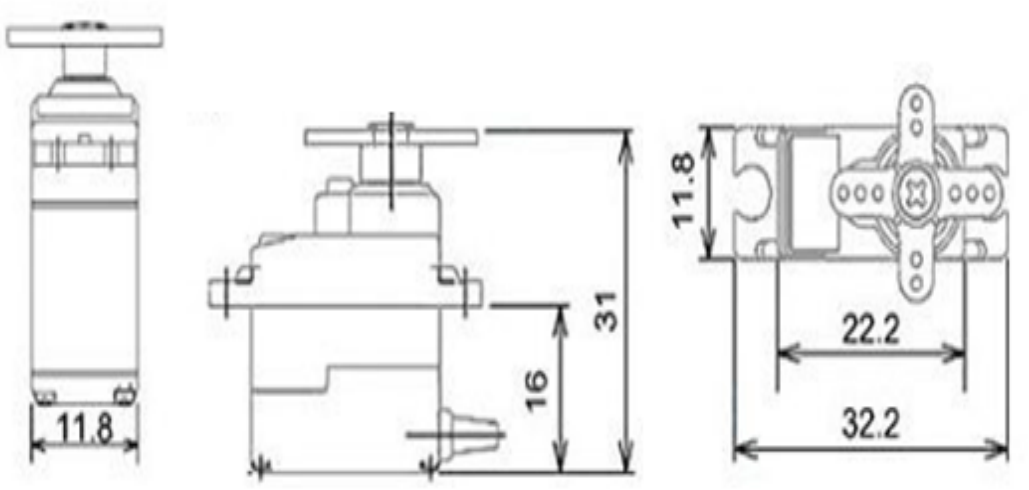

Figure 2: SG-90 Dimensions

DC Gear motors in brief:

Geared DC motors can be defined as an extension of DC motor which already had its Insight details demystified here. A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM .The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. This Insight will explore all the minor and major details that make the gear head and hence the working of geared DC motor. ***(See Figure:-3)***

L293D motor shield for arduino in brief:

L293D is a 16 pin motor driver IC consist of quadruple half H drivers. It can simultaneously control the direction and speed of two DC motors. L293d is a suitable device to use for stepper motors, gear motors etc. The IC has an operating voltage range from 4.5 V to 36 V. The L293 and L293D models can drive current up to 1A and 600mA respectively***. (See Figure:-4)***

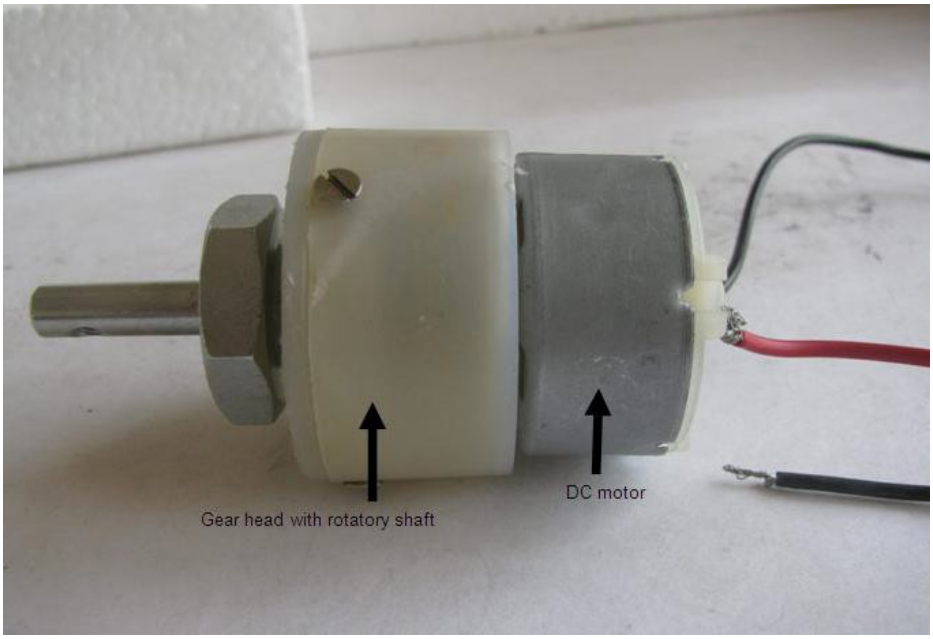

Figure 3: Gear motor external structure

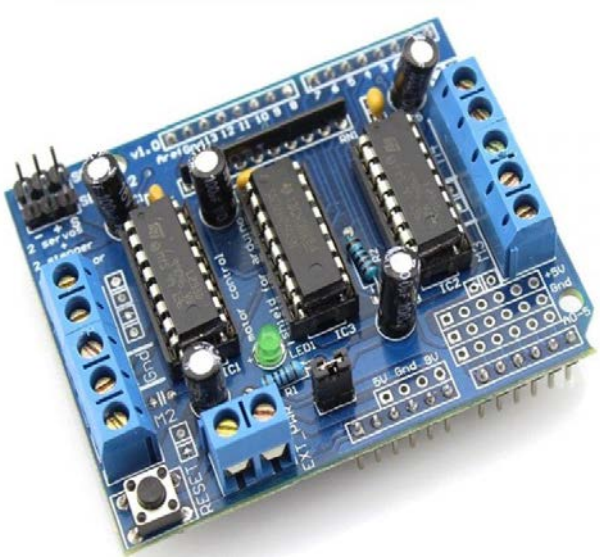

Figure 4: L293D Motor Shield for Arduino

Battery in brief:

1. Battery Type: SLA (Sealed Lead Acid)
2. Voltage: 12 volts
3. AH Rating: 1.2 AH
4. Meets or Exceeds Original Battery Specifications
5. Non-spill able Valve Regulated Lead Acid (V.R.L.A.) Design.
6. Advanced absorbed glass mat technology
7. Sealed construction for operation in any position except upside down.
8. Wide operating temperature range.
9. High discharge rates and low self discharge rates.
10. Available in VO Flame Retardant Material.

Figure 5: Battery 1300mah 12V Rechargeable

Ultrasonic Sensor:

Ultrasonic sensors measure distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receives the wave reflected back from the target. Ultrasonic Sensors measure the distance to the target by measuring the time between the emission and reception. An optical sensor has a transmitter and receiver, whereas an ultrasonic sensor uses a single ultrasonic element for both emission and reception. In a reflective model ultrasonic sensor, a single oscillator emits and receives ultrasonic waves alternately. This enables miniaturization of the sensor head.***(See Figure:-6)***

Software Arduino IDE:

The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino board. The source code for the IDE is released under the GNU General Public License, version 2. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program to convert the executable code into a text file in hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware.

(See Figure:-7)

Figure 6: Ultrasonic Sensor

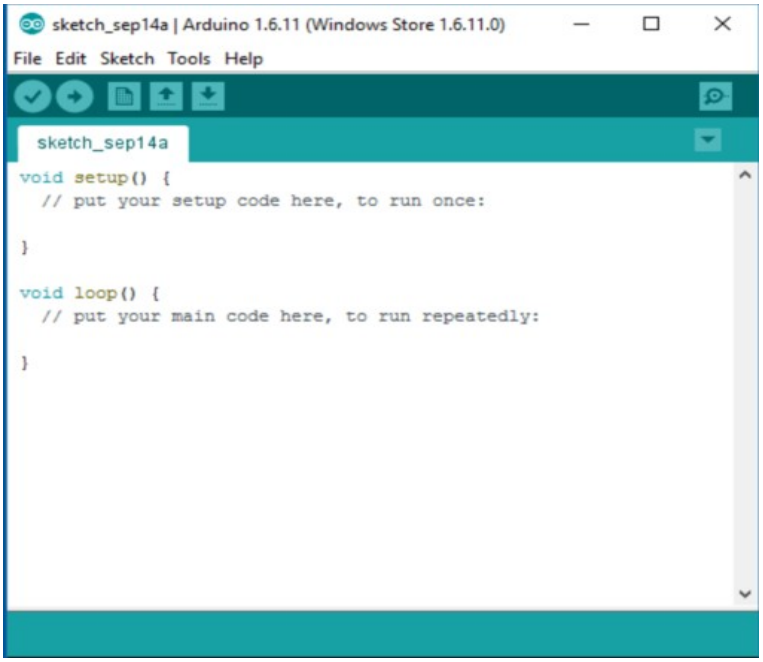

Figure 7: Software Arduino IDE

IMPLEMENTATION AND INTEGRATION

Hardware in brief:

Firstly, Arduino Uno is taken over a Chassis integrating with L293D Motor Shield for Arduino. Fixing their both the part of the hardware components, gear motors are affixed with the Motor Shields, taking jumper wires into the casing of the motor shield. Casting the SG-90 (Servo motor) attaching with a sensor board on it with HC-SR04 (Ultrasonic Sensor) for sensing the direction through servo motor and waves through ultrasonic sensor. Taking the both integrated Servo motor and Ultrasonic sensor for casting them to Motor Shield. All over the machine is done with the following components. Casting this whole thing to battery (12v 1300 MaH Rechargeable battery) with the help of wires to Motor Shield. The parting of h/w is done here for the sample working.

Software in brief:

The whole the machine is now connected to the Arduino with PC by USB Connector. The whole coding and testing part is done for the further proceedings. Once the sample code is being uploaded the communication for the machine is done by giving I/O as code.

So now the briefing is completed through I/O given. The communication between the parts will now start through this sample coding and the USB will be the interface between these two PC and the machine.

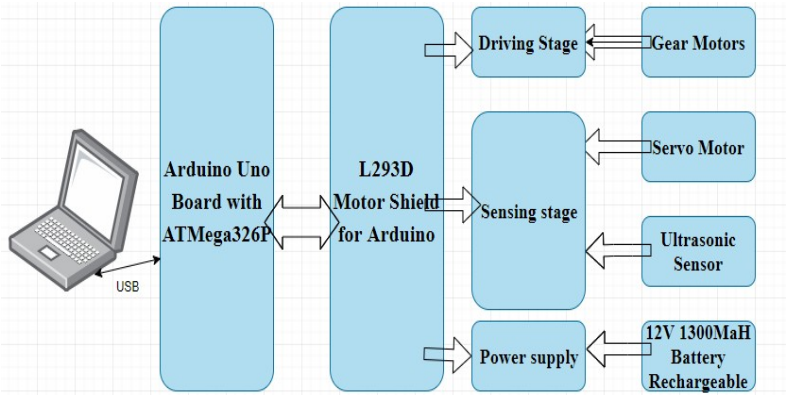

Figure 8: h/w and s/w integrations systems design

Testing and Screenshots

Now the testing part is taken over the sample code. The whole integrated part machine is now ready for the execution. The calculations are taken as following:

A. Ultrasonic Sensor:

The distance can be calculated with the following formula:

Distance L = 1/2 × T × C where L is the distance, T is the time between the emission and reception, and C is the sonic speed. (The value is multiplied by 1/2 because T is the time for go-and-return distance.)

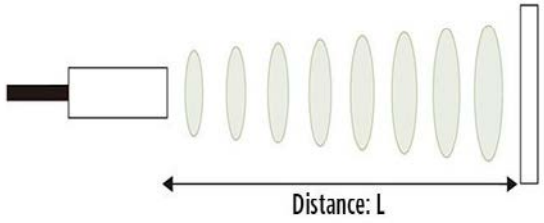

Figure 9: Distance calculation while sensing with waves

B. Gear Motor:

The DC motor works over a fair range of voltage. The higher the input voltage more is the RPM (rotations per minute) of the motor. For example, if the motor works in the range of 6-12V, it will have the least RPM at 6V and maximum at 12 V.

In terms of voltage, we can put the equation as:

RPM= K1 * V, where,

K1= induced voltage constant

V=voltage applied

C. Servo Motor:

The PWM signal produced should have a frequency of 50Hz that is the PWM period should be 20ms. Out of which the On-Time can vary from 1ms to 2ms. So when the on-time is 1ms the motor will be in 0° So, by varying the on-time from 1ms to 2ms the motor can be controlled from 0° to 180°

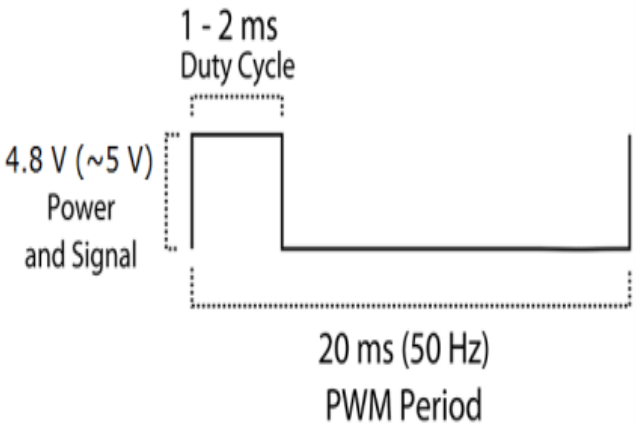

Figure 10: Working principle of Servo

Here are some screenshots while the car is working under the basis of above mentioned principles.

Figure 11: Working Model

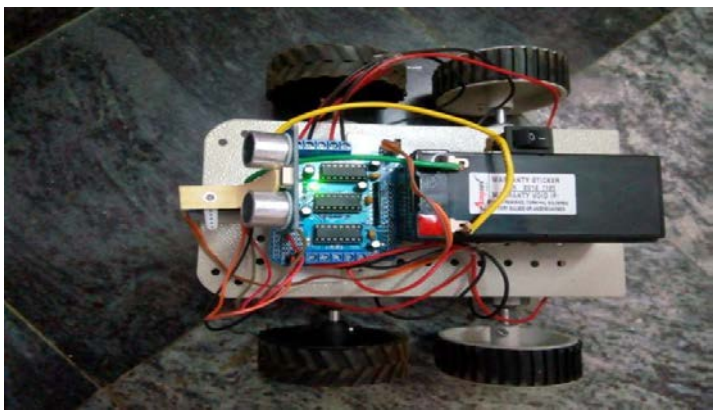

Figure 12: Changing its path by direction

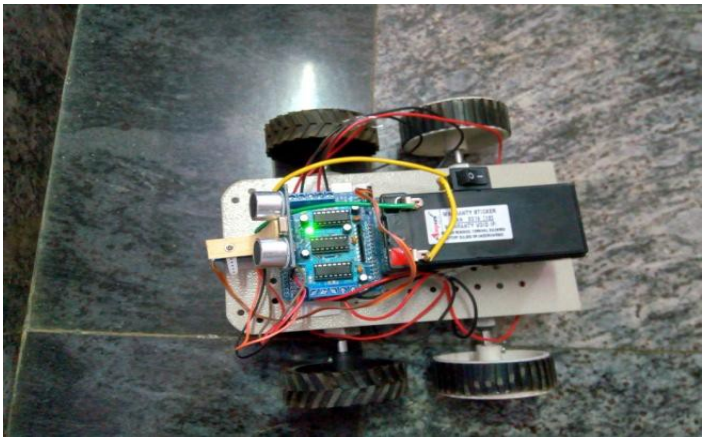

Figure 13: Working the sense over Servo

RESULTS AND OUTCOMES

The above considerations over the both hardware and software considerations are clearly established and captured over the screens. The USB interfacing with the PC and whole integrated machine is being working with suitable communication. Now the results are being cleared with the directional changes and sensing sensors.

The outcomes over the results established are taken over the consideration for working. The data retrieved here has been converted into the relevant outcome given. The machine car now shows us the results for useful interaction. This is more significant for the social purpose. As it is cost efficient, simultaneous work framed, it gives us the auspicious experience. A satisfactory result is being established.

CONCLUSION

The system design is cost relevant and significant for the USB controlled interface. The market is also considering with the low cost alternatives. The sensors based working will give out the tracking experience through path basing in low significant rates. Combination of the relevant sustainable components has been developed over the high classified declaration at low cost price gives the social response. Taking over the considerations of the society, this product gives out the high authorized experience with low cost relevant as well as plays a crucial role in observing the surroundings and scanning various directions unaffected by circumstances such as driver weariness, emotion, or sickness. This factor is what makes them safe. The way that we're looking at the self-sufficient vehicle innovation by 2020 is entirely astonishing.

The innovation could change the majority of our lives whether we possess a self-driving vehicle or not. Our general public can profit by self-sufficient vehicles, in regions, for example, driving benefits for the old and the physically impaired.

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