CHAPTER 1

INTRODUCTION

Nowadays robots are used remotely is getting popular especially in those fields where work posses' hazards to human life. In such scenarios these robots can be used to perform work and replace human workforce and do work effectively. This venture proposes a numerous movement-controlling component of a robotic auto utilizing Arduino UNO small-scale controller. Each device is uniquely identifiable by the controlling software that is the core concept of IOT. Client manages the activities of the car from remote or distant places over the wireless communication.

There is boom in today's world for use of remotely operated robots which can do task more effectively and efficiently. These are used to measure various variables from our environment and work on them. IoT is a very interesting and innovative concept that holds great future opportunities. The main aim of this project is that it leverages the efficiency of robot's motion controlling system because robotic car can receive direct commands at a time from main sources that make the manoeuvring system more efficient.

1.1 Introduction on IOT

The term Internet of Things (IOT) was arguably in an online article by Kevin Ashton in 1999, referring first coined to uniquely identifiable objects that are organized in an Internet like structure. Objects in IOT can sense the environment, transfer the data, and communicate with each other. The INTERNET OF THINGS (IOT) has been envisioned as one of the most promising networking paradigms that bridge the gap between the cyber and physical world. The prevalence of IOT leads toward a new digital context for configuring novel applications and services. IOT consists of a variety of things or objects such as RFID tags, sensors, actuators, mobile phones, etc., which are inter-connected through both wired and wireless networks to the Internet. The Internet of things (IOT) can be defined as the inter-networking of physical devices, vehicles (also referred to as "connected devices" and "smart devices"), buildings, and other items embedded with electronics, software, sensors, actuators, and network connectivity which enable these objects to collect and exchange data.

Fig 1.1:IOT network

The Internet of Things vision is grounded in the belief that the steady advances in microelectronics, communications and information technology we have witnessed in recent years will continue into the estimated future. In fact, due to their diminishing size, constantly falling price and declining energy consumption processors, Communications modules and other electronic components are being increasingly integrated into everyday objects today. ―Smart objects play a key role in the Internet of Things vision, since embedded communication and information technology would have the potential to revolutionize the utility of these objects. Using sensors, they are able to distinguish their context, and via built-in networking capabilities, they would be able to communicate with each other, access Internet services and interact with people.

1.2 History of IOT

The term Internet of Things (IoT) was first used in 1999 by British technology pioneer Kevin Ashton to describe a system in which objects in the physical world could be connected to the Internet by sensors. Ashton coined the term to illustrate the power of connecting Radio-Frequency Identification(RFID) tags used in corporate supply chains to the Internet in order to count and track goods without the need for human intervention. Today, the Internet of Things has become a popular term for describing scenarios in which Internet connectivity and computing capability extend to a variety of objects, devices, sensors, and everyday items.

While the term Internet of Things is relatively new, the concept of combining computers and networks to monitor and control devices has been around for decades. By the late 1970s, for example, systems for remotely monitoring meters on the electrical grid via telephone lines were already in commercial use. In the1990s, advances in wireless technology allowed machine–to–machine(M2M) enterprise and industrial solutions for equipment monitoring and operation to become widespread.

Using IP to connect devices other than computers to the Internet is not a new idea. The first Internet device an IP enabled toaster that could be turned on and off over the Internet was featured at an Internet conference in 1990. Over the next several years, other things were IP enabled, including a soda machine at Carnegie Mellon University in the US and a coffee pot18 in the Trojan Room at the University of Cambridge in the UK (which remained Internet connected until 2001). From these whimsical beginnings, a robust field of research and development into smart object networking helped create the foundation for today's Internet of Things.

1.3Application of IoT

Digitally upgrading conventional object in this way enhances their physical function by adding the capabilities of digital objects, thus generating substantial benefit. Harbinger of this development are already apparent today more and more devices such as sewing machines, exercise bikes, electric toothbrushes, washing machines, electricity meters and photo- copiers are being computerized and equipped with network interfaces. In other application domains, Internet connectivity of everyday objects can be used to remotely determine their state so that information systems can collect up-to-date information on physical objects and processes. This enables many aspects of the real world to be observed‖ at a previously unattained level of detail and at negligible cost. This would not only allow for a better understanding of the underlying processes, but also for control that is more efficient and management. The ability to react to events in the physical world in an automatic, rapid and informed manner not only opens up new opportunities for dealing with complex or critical situations, but also enables a wide variety of business processes to be optimized.

Environmental monitoring applications of the IOT typically use sensors to assist in environmental protection by monitoring air or water quality, atmospheric or soil conditions, and can even include areas like monitoring the movements of wildlife and their habitats.

Monitoring and controlling operations of urban and rural infrastructures like bridges, railway tracks, on- and offshore- wind-farms is a key application of the IOT. The IoT infrastructure can be used for monitoring any events or changes in structural conditions that can compromise safety and increase risk.

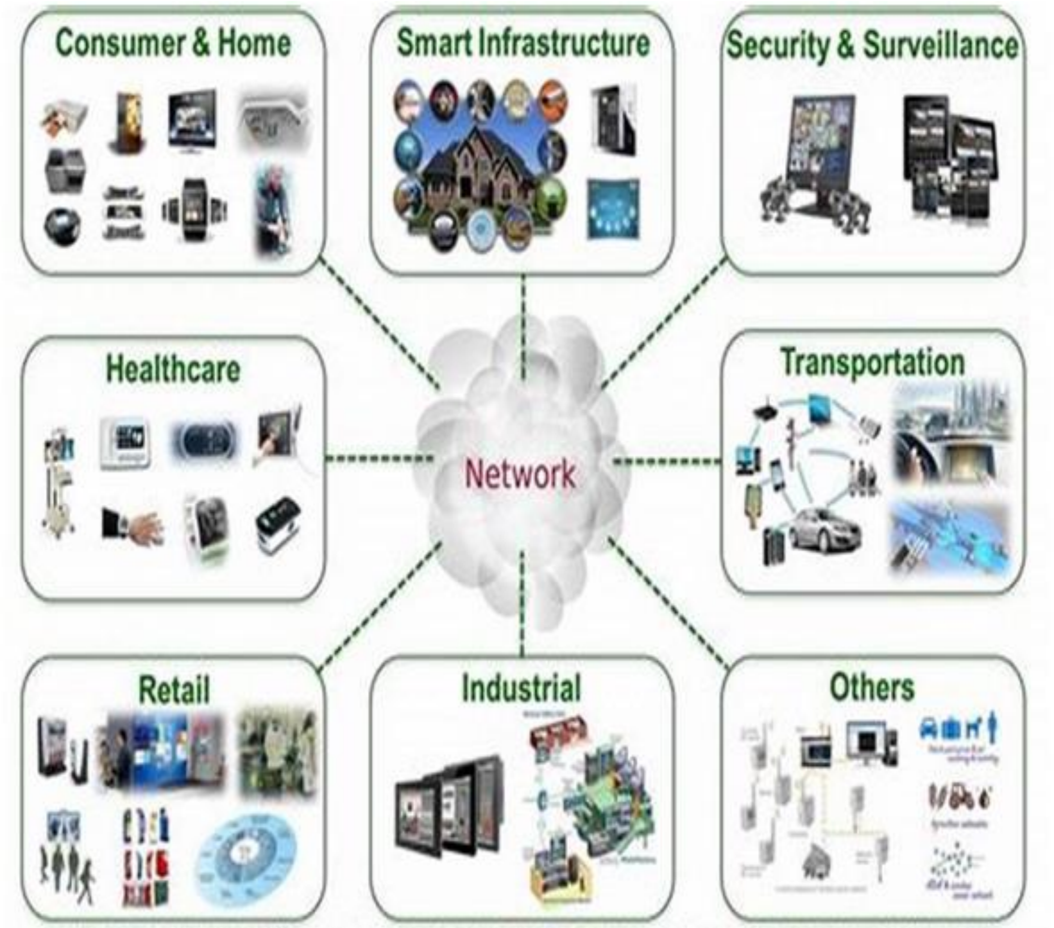

Fig 1.2: IoT Applications

Network control and management of manufacturing equipment, asset and situation management, or manufacturing process control bring the IOT within the realm on industrial applications and smart manufacturing as well.

Integration of sensing and actuation systems, connected to the Internet, is likely to optimize energy consumption as a whole. It is expected that IOT devices will be integrated into all forms of energy consuming devices (switches, power outlets, bulbs, televisions, etc.) and be able to communicate with the utility supply company in order to effectively balance power generation and energy usage.

IoT devices can be used to enable remote health monitoring and emergency notification systems. These health monitoring devices can range from blood pressure and heart rate monitors to advanced devices capable of monitoring specialized implants, such as pacemakers or advanced hearing aids.

IoT devices can be used to monitor and control the mechanical, electrical and electronic systems used in various types of buildings (e.g., public and private, industrial, institutions, or residential) in home automation and building automation systems.

The IoT can assist in integration of communications, control, and information processing across various transportation systems. There are myriads of application of IOT and we will limit the scope to our application.

IoT and INDIA

According to NASSCOM, the IOT market in India is expected to reach $15 Bn by 2020, which will be roughly 5% of the global market. Nearly 120 companies offer IOT solutions, 70% of these IOT start-ups have emerged in the last five years itself. Investors have been taking active interest in start-ups offering innovative IoT solutions and a cumulative amount of $60 MN has been invested in the last two years alone. Healthcare and manufacturing are the leading verticals demanding IOT solutions. Next-gen commerce along with transport and logistics are gaining adoption with connected vehicles and systems.

The industry has even witnessed the birth of new segments like smart lifestyle, connected homes & buildings and connected homes which were never heard of before. The IOT applications are broadly classified between industrial and consumer segments. The consumer segment is driven by personal interest and mostly covers health & fitness and home automation.

IOT provides a unique opportunity that enables businesses to turn data into insights. A number of market forces like cloud computing and analytics are driving the growth of IOT. The key factors contributing to the adoption of IOT are mobility, improved decision making, the evolution of a smarter lifestyle and analysis of critical data from connected sensors.

1.4 Advantages of Robotics

Having lesser limitations, more accuracy and being more reliable are what make an automaton more preferable. The controlling mechanism of these systems makes them more outstanding. Multiple control system ensures that a collection of independent computers appears to users as a single controlling system. It uses decentralized elements or subsystems to control distributed processes. They offer flexibility, extended equipment life, simplicity of new equipment integration, and centralized maintenance when used in an industrial environment. Several advanced control systems of robots have been developed based on existing control techniques or new control techniques that have been built on purposes. As a result, for efficient and flexible processing, the multiple control mechanism is more than a necessity.

The accessibility and availability of inexpensive credit card sized single board computer such as IEEE Raspberry Pi has enabled the creation of numerous automated and controlling system that has low power consumption, faster processing ability at a lower cost. The multiple control system of robots proposed in this paper integrates the use of affordable instruments, connectivity, wireless communication and efficiency of controlling mechanism.

Arduino is designed as an open-source electronics prototyping platform providing schematics and flexible development kits for enthusiastic users who intend to produce interactive objects or environments. Arduino can be used to sense surroundings by utilizing various transducers to read and interpret inputs in order to make responses for example through the controlling of motors or transferring of data. In today’s world there is a significant development in the field of robotic control. Mobile robotic vehicles are light, small and portable enough to be carried by an individual.

Our design serves as a solution to demonstrate how the control of the dc geared motors in coordination of the signals obtained from Wi-Fi module in conjunction of Arduino is used to achieve high degree of precise path control from the user side to achieve standard operations like moving at a particular target location, collecting data and avoiding any obstacle to prevent collision .In existing literature many works have been done on the implementation and analysis of the robotics for various aspects like disaster management, working in nuclear areas, photography and military application.

CHAPTER 2

LITERATURE SURVEY

There are many robots which perform different task easily and efficiently, here we found some of the best that are related to our project and how they will help us to complete our project.

2.1 Fire Fighting Robot

Now days, fire accidents are very common and sometimes it becomes very difficult for a fire-fighter to save someone’s life. It is not possible to appoint a person to continuously observe for accidental fire where robot can do that. Therefore, in such cases fire fighting robot comes in picture. Robot will detect fire remotely. These robots are mostly useful in industries where probability of accidental fire is more. The proposed vehicle is able to detect presence of fire and extinguishing it automatically by using gas sensor and temperature sensor. It contains gear motors and motor driver to control the movement of robot. Relay circuit is used to control the pump and when it will detect fire then it will communicate with microcontroller (Arduino UNO R3) through Bluetooth module.

The proposed robot has a water jet spray, which is capable of sprinkling water. The sprinkler can be move towards the required direction. At the time of moving towards the source of fire, it may happen that it will come across some obstacles, and then it has obstacle avoiding capability. It will provide GUI for Arduino operation using android. It detects obstacles using ultrasonic sensors up to range of 80 m. Communication between the mobile phone and robot will take place through Bluetooth, which will have GUI to control the movement of robot. When mobile is connected to Bluetooth firstly it will set module name, baud rate. It is feasible to implement Bluetooth communication between smart phones and microcontroller. Android controlled robot can be used easily in everyday life such as in homes, market, companies etc. The development of apps for Android in Android SDK is easy and free of cost.

Previously Fire Fighting Robots were controlled by using different electronics devices but this reduces the scope of control of fire fighting robot. However, with the advanced techniques we can build the same robot by using android application to control the actions of the robot. With the help of such robots work, really decreased and movements of robot are so much effective. By using an android app fire-fighter, detect the fire and can able to extinguish it. At the same time robot can detect the obstacles and can avoid them by using ultrasonic sensors.

Our project is designed to build an android application, which can control operations of the fire-fighting robot. Fire-fighter can send commands to robot through Bluetooth module, which is mounted on robot itself. Smart phones has facility of Bluetooth, through that Bluetooth fire-fighter can control the movement of fire fighting robot. For fire detection, it is using two sensors. One is temperature sensor and second is smoke detector. Fire extinguishing system will be activated when fire detection system detects fire. Sprinkler will start sprinkling water when it detects fire. At the transmitting end, android application is used and at receiving end two motors are interface to microcontroller.

In this movable robot consists of sensor like the one LM35 and Arduino Flame Sensors are used to detect the fire and distances on its way towards fire. In this for the mobility of the Robot, two wheels made of Nylon and a caster ball is used. This is mainly a rear wheel drive type of vehicle. The water container has the capacity to contain at least 1L water. It is made of strong cardboard, which has water resistant property.

1. A fuzzy controller is used to control an obstacle avoidance of Vehicle. The aim is to guide the Vehicle along its path to avoid any static environments containing some static obstacles in front of it. Obstacle avoidance in real-time is a mandatory feature for Vehicle in an unknown environment
2. In this the human can control the robot by using the Bluetooth module. The Bluetooth module is work with the android application. In this the Bluetooth model communicate android application by using driving motor, Arduino mega, voltage divider, tires , Bluetooth, motor driver.
3. In this there are three different types of system unit is use
   1. Locomotion system
   2. Fire detection system
   3. Extinguishing system
   4. Communication system.

The Locomotion system is used for obstacle detection and four ultrasonic range finder to find the distance between obstacle and system. Fire detection system is used for the detection of fire in this the gas sensor is used. Extinguishing system is for successfully extinguish the fire

4. In this paper Arduino (UNO R3), gas sensor, motor driver, gear motor, Relay driver, Bluetooth module, pump and sprinkler are used.

To program Arduino UNO R3 open source software Arduino IDE is required. The detection and extinguishing was done with the help of Arduino in which the gas sensor, gear motor and its driver, relay driver etc. are interfaced. The "Android controlled fire fighting robot" can be used easily in everyday life such as in homes, laboratories, parking lots, supermarkets, stores, shops etc. Important function of the robot is patrolling. Limitation of the robot is Bluetooth range and water capacity.

The robot will be used at places where it is dangerous for humans to enter. It can move automatically inside the room without any supervision. The automatic water sprinkler will start whenever the fire is detected. The robot is fire resistance and can be used at situations where temperature is 120 degree Celsius. It can be controlled by android phone externally.

2.2 Research on Intelligent Flight Software Robot Based on Internet of Things

Internet of things, also known as sensor network, the definition of things is: system, laser scanner and other information sensing equipment, according to the agreement, any items connected with the Internet To carry out information exchange and communication, in order to achieve intelligent identification, positioning, tracking, monitoring and management of a network. Intelligent flight spherical theory: spherical aircraft is mainly to help fly. Unmanned aircraft compared with the traditional manned aircraft, with a portable and transport light, good motor performance, low working environment requirements, low-altitude flight capability and other characteristics, quickly get the importance and favour of the nations of the world. As a mobile robot with spherical rolling movement, the spherical robot has the advantages of flexible movement, strong adaptability to environment, high movement efficiency and so on. It is paid more and more attention by researchers.

With the development of science and technology, people's research on robots is more and more in-depth, more and more mature, and gradually invented can help people take care of life, do simple housework robots, can automatically control, repeatable Programming, multi-functional operation of the robot, according to the order and conditions in advance, in turn, control the robot's mechanical action program controlled robot, through the guidance or other ways to first teach the robot action, enter the work program, automatically repeat the work lady a robot, a numerically controlled robot that can teach a robot by numerology, language, and the like, a sensor-controlled robot that controls the movement of the robot by the information acquired by the sensor, a robot capable of adapting to the change of the environment, controlling the adaptive control robot of its own action, Experience "work experience, have a certain learning function, and the" learning "experience for the work of the learning control of the robot, as well as artificial intelligence to determine the action of intelligent robots and so on.

The application of these robots, to industrial production, people’s lives and so has brought a lot of convenience, reducing the labour intensity. With the progress of science and technology, market demand and application of diversification, coupled with the past decade, artificial intelligence and sensor technology progress, people in the robot research has made great progress, dangerous operations robot, help Old robotic robots, lunar rover, underwater robots, humanoid robots, cooking robots, medical robots, and so have proved this point. Although the robot cannot break the machine now, but once it broke the "humanoid myth", the development of the robot will be infinite broad.

Looking to the future, robots will not only labour, surgical assistants, conductors, cleaners and pets, as long as our imagination is endless, intelligent robots will bring infinite surprise for our lives. New technologies are often expensive at the time of the rise, for example, many years ago, GPS is only used in the military field, and now in mobile phones, cars and other household items in the use of very common, robot is also the same, with the development of science and technology, robot technology will change Get easier to get. With the related chip, sensor and motor market prices down, the cost of the robot will gradually decline; the robot's imagination will eventually go down the screen, into the homes of ordinary people, so that life is better.

The application of things: through the construction of exchange platform and application resources sharing service platform. Digitalization is the inevitable trend of urban development. Although the "digital city" construction has made some achievements, but there are some problems. Need to break the time, space and department of the many restrictions for the development of the city under the new situation to provide a good social environment, innovative city management, and thus promote the "digital city" construction. For example, "digital city" refers to the use of remote sensing technology (RS), geographic information systems (GIS), global positioning system (GNNS), computer technology, multimedia and virtual simulation and other modern science and technology, the city's infrastructure and production, Life-related aspects of multi-subject, multi-level, all-round information processing and use, with the urban geography, resources, ecology, environment, population, economy, society and other aspects of digital, network management and services, Function of the information system.

First, the social security card. Social security card multi-purpose pilot project mainly includes social security card, traffic card, also includes "card" regulations, standards, system construction, "card" background support system construction project, "card" frontend application system construction project, "card" service Support the environment construction project, and then integrate human resources, social security, civil affairs, health, family planning and petition and other areas of management resources, with information technology to enhance social security, so that people enjoy the information technology to bring convenient and efficient public services, and Expand the card holders to seek medical coverage, and gradually cover the retired, municipal public health care and rural cooperative medical care and other fields; the construction of intelligent audit system to ensure the safety of social security funds; promote social security card more than one card, social security card in the pension insurance, unemployment insurance, Employment and other areas of application development.

To promote the traffic card in the traffic, garden, student management, small consumption and scenic spots and other areas of the use of more than one card, the use of real-name traffic card issued a disability card, free of charge in the disabled, free access to the park and enjoy rehabilitation services for the disabled In the promotion and application; second, intelligent transportation.

2.3 IoT Based Remote Access Human Control Robot Using MEMS Sensor

In today’s age robotic has the fundamental key for new invention. The development of human machine communications on an everyday basis has made the people to utilize the technology. Instead of giving rational methodology, physical methods have been welcomed by everyone. Coding to some 100’s of pages requires more instance, capital and power so to overcome that gesture recognition is enhanced. Everyone can easily make using gesture recognition coding. For gesture recognition, many active devices such as a trackball, remote, joystick and touch tablet are in practice. Some of the devices are used for giving motion recognizer but gesture recognition has the foremost utility.

So gesture recognizer like accelerometers with 3 axes is extensively used. Gesture can be captured by wearing gloves or having wrist band attached with the MEMS whereas using vision system and data glove is very expensive hence not utilized. To have a balance of precision data collection, Micro Inertial Measurement Unit‖ is developed for recognizing the gestures in 3 dimensional axis x, y, z. Gesture can be recognized by following approaches comprises of template-matching, arithmetical toning, vocabulary lookup, linguistic matching, and neural arrangement. However, in this paper the gesture recognition models are based on the signal succession3 and pattern toning. The gesture values are mapped by extracting a simple characteristic based on signal succession of acceleration, for achieving high efficiency and accuracy. For this type of methodology, the MEMS accelerometer is used to give the hand gestures.

MEMS acronym micro electro mechanical system which has 3 axis of x, y, z and a power supply port with ground is fabricated. MEMS use the knowledge, which is known as micro-fabrication knowledge. Has cavity, holes, channels, membranes, cantilevers and furthermore imitates motorized parts. The highlighting of MEMS is silicon fabrication acquires moisture. The enlargement of micro technology has many features like size, efficiency and capital. For a large-scale device micro fabrication is used because of its smallness, applicability and lessening of material utilization. Micro technology and electronics have great scope of innovation. MEMS can be mounted on the Raspberry Pi. In this project two Raspberry Pi is used to interface with IoT and MEMS.

The Raspberry Pi board is a miniature marvel, packing considerable computing power into a footprint no larger than a credit card. It is capable of some amazing things, but there are a few things you are going to need to know before you plunge headfirst into the bramble patch. The processor at the heart of the Raspberry Pi system is a Broadcom BCM2835 system-on-chip (SoC) multimedia processor. This means that the vast majority of the system’s components, including its central and graphics processing units along with the audio and communications hardware, are built onto that single component hidden beneath the 256 MB memory chip at the centre of the board.

The Raspberry Pi is sent MEMS instruction to recover side through Internet or wireless medium. Gesture instructions are given using MEMS which is attached in the wrist band. The gestures used to move the robot in all possible directions in the environment are Forward, Backward, Right, Left and Arm movement through IoT.

Special movements for arm in enhanced with the gripper. For more convenience button system is introduced to do the task often occurring. The output gesture production depends on the gesture input different output gesture is generated for every possible gesture input. DC motors attached to the robotic wheels is driven using the relay. The control signals will activate the robotic DC gear motor to move the robot. Similarly the DC motor connected with robotic arm will receive the control signal.

Robotics Automation is defined as a technology that is concerned with the use of Mechanical, electronic, and computer-based systems in the operation and Control of production. This technology includes transfer lines, mechanized Assembly machines, feedback control systems, and robots. There are three Broad classes of industrial automation: fixed automation, programmable Automation, and flexible automation. Of these three types, robotics coincides most closely with programmable Automation.

The robot can be programmed to move its arm through a sequence of motions in order to perform some useful task. It will repeat. That motion pattern repeatedly until reprogrammed to perform some other task. Hence, the programming feature allows robots to be used for a variety of different industrial operations, many of which involve the Robot working together with other pieces of automated or semiautomatic Equipment. These operations include machine loading, unloading, and many more.

Robot Anatomy Common Robot Configurations The vast majority of today's commercially available robots possess one of The four basic configurations: Polar configuration Cylindrical configuration Cartesian coordinate configuration Jointed-arm configuration Robot Motions The robots movement can be divided into two general categories: arm and Body motions, and wrist motions. The individual joint motions associated with these two categories are sometimes referred to by the term degrees of freedom, and a typical industrial robot is equipped with 4 to 6 degrees of freedom. Here we use Robotic Arm for Pick and Place purpose.

Wireless communication is a cheap and easy way to provide network communication at places where there is no wired infrastructure. In this design, the ZigBee provide low power consumption, low cost and simple wireless communication to allow remote control and current measurement of industrial outlets in order to save power. ZigBee technology is suitable for the application in power monitoring system. It can provide reliable protection for the operation of electric power systems. The system is small, simple, cost effective and good for wireless control of equipment.

2.4 Design and Construction of Microcontroller Based Wireless Remote Controlled Industrial Electrical Appliances Using ZigBee Technology

Industrial automations, which are mostly, depend upon the power systems & which requires distance controlled and regulated systems. Wireless technology, which meets to cost, speed and distance, will always be a point of an interest for research. This research proposes microcontroller based wireless remote controlled for electric systems parameters like voltage and current using ZigBee technology. PIC16F877A controller is used in a predominant way because it is rich in peripherals and hence many devices can be interfaced at ease, it is also very cheap and can be easily assembled and programmed. The PIC controller controls the devices and sends the sensor values to the PC via ZigBee module. Although Bluetooth is better than ZigBee for transmission rate, ZigBee has lower power consumption. Hence, ZigBee is generally used for 24 hours monitoring of communication transmission systems. Its main feature is its use of the ZigBee protocol as the communication medium between the transmitter and receiver modules. It illustrates that the new ZigBee standard performs well industrial environments.

The goal of the paper is to achieve intelligent device control and secure environmental working conditions by interfacing various sensors and devices to the PIC16F877A microcontroller and ZigBee modules with the PIC controller for data transmission respectively. Wireless based industrial automation is a prime concern in our day-to-day life. Industrial automations depend on the power systems and which requires distance control and regulated systems. Wireless Control Networks (WCNs) have revolutionized the design of emerging embedded systems and triggered a new set of potential applications.

In addition to building automation, environmental surveillance, or military operations Industrial automation is also expected to greatly benefit from WSNs in terms of faster installation and maintenance, cost savings, and easier plant reconfiguration. ZigBee is an emerging short-range, low rate wireless network technology. ZigBee also presents some potentially interesting features for supporting large-scale ubiquitous computing applications, namely power-efficiency, timeliness and scalability. In managing the move to wireless, it is clear that common wireless protocols such as Wi-Fi and Bluetooth can be utilized on the factory floor. The challenge is to understand how to utilize wireless solutions, developed for IT applications, as replacements for wired systems in time-critical scenarios typical of factory floor domains. To date, most wireless systems in production systems are focused on applications that require polling frequencies on the order of seconds or longer. Standardization of technology again plays an important role for globalization of these profile developments. ZigBee due to its standardize operational and network management properties will be suitable wireless interface technique, ZigBee also have low data rates over a middle distance and AES encryption properties which are again guaranteed for required communication system.

There are a wide variety of microcontrollers available to implement various tasks, among them the 8051 and PIC are the mostly used. The 8051 is probably the most popular 8-bit microcontrollers ever. Many different I/O features are integrated around the 8051 core to create a microcontroller which needs only very little extra hardware to do most of the jobs. The main disadvantage of the standard 8051 core is that there's only one 16 bit pointer register available. Moving a block of data is a very tedious job which takes far too much data moving overhead. It also does not have an internal Analogy to Digital Converter (ADC). PIC16F877A is an 8-bit microcontroller which has 40 pin DIP and is based on Harvard Architecture. PIC stands for Peripheral Interface Controller and F for flash memory. The PIC16F877A features 256 bytes of EEPROM data memory, self programming, an LCD, 2 Comparators, 8 channels of 10-bit Analogue-to-Digital converter, 2 capture/compare/PWM functions, the synchronous serial port can be configured as either 3-wire Serial Peripheral Interface for the 2-wire Inter-Integrated Circuit bus and a Universal Asynchronous Receiver Transmitter. All of these features make it ideal for more advanced level A/D applications in automotive, industrial, appliances and consumer applications. So we have utilized the MICROCHIP PIC16F877A microcontroller in the project.

ZigBee is the product of the ZigBee Alliance, an organization of manufacturers dedicated to developing a networking technology for small, ISM-band radios that could welcome even the simplest industrial and home end devices into wireless connectivity. The ZigBee specification was finalized in December 2004, and products supporting the ZigBee standard are just now beginning to enter the market. ZigBee is designed as a low-cost, low power, low-data rate wireless mesh technology. The ZigBee specification identifies three kinds of devices that incorporate ZigBee radios, with all three found in a typical ZigBee.

The ZigBee network layer (NWK) supports star, tree, and mesh topologies. In a star topology, the network is controlled by one single device called the ZigBee coordinator. The ZigBee coordinator is responsible for initiating and maintaining the devices on the network. All other devices, known as end devices, directly communicate with the ZigBee coordinator.

2.5 Anti-Personnel Mine Detection Manipulator

At present there are approximately 110 million landmines scattered around the world in 64 countries. The clearance of these mines takes place manually. Unfortunately, on average for every 5000 mines cleared one mine clearer is killed. A Mine Clearance Robot (MCR) using mechatronics approach is under development in this work. The robot arm imitates manual hand-prodding technique for mine detection. It inserts a bayonet into the soil and measures the stiffness variation in the soil to identify the mine. The movement of the bayonet is controlled by an explicit impact control system. An adaptive neuron-fuzzy controller (ASMOD) is employed to adapt the gain of the force controller according to the stiffness coefficient variation of the environment. The developed system is validated through simulation computer and experimental work.

According to the International Committee of the Red Cross and Red Crescent Societies (ICRC), there are approximately 110 million land-mines scattered around the world in 64 countries. There are also as many mines in the stockpiles around the world waiting to be deployed. As the result of explosions of mines, around 2000 people are killed or maimed monthly. The victims are mostly civilians including women and children who are trapped by mines after the end of hostilities.

For every mine cleared, 20 are laid. In 1994, around 100,000 mines were cleared whereas 2 million new mines were planted. At present mine clearance takes place manually. Unfortunately, on average for every 5000 mines cleared one mine clearer is killed. Using the current approach, it would take more than 1,100 years to clear the mines planted in the world at a cost of US$33 billion [Internet 2]. Overall, the anti-personnel mines are among tile deadliest weapons used in tile work today. The United Nations Secretary-General has stated that "land-mines may be the most widespread, lethal, and long-lasting form of pollution we have yet encountered." [Statement 1994]. The hand-prodding technique is the most reliable method of mile clearance. A probe is manually inserted into the soil at a 30 degree angle, approximately every five centimetres. When an object is detected with higher stiffness compared to the environment stiffness, more examinations are conducted to identify the shape and size of the object. If the object is determined to be a potential mine, a mine clearing team is called to uncover or detonate the object. This work is an attempt to automate the hand-prodding mine detection by a mechatronics machine imitating a human demined. The device inserts a bayonet into the soil and measures the stiffness variation in the soil to identify the mine.

The movement of the bayonet is controlled by a force-based complacence control system. In this application, tile characteristics of the environment (soil) changes during mine clearance operation. In other words, there is uncertainty about tile characteristics of the environment and ill parameters. In such application, an ideal impact controller should be able to overcome all the uncertainties and non-linearity of the environment. Intelligent Control (IC) in which neural network and fuzzy control are key components, is a good candidate to improve the control system performance by modelling the time varying parameters of the environment and adapt tile control system accordingly. Such approach is employed in this work to provide an adaptive compliant motion for tile bayonet, particularly, when it experiences a large variation in the environment stiffness at the instant of encountering the mine. In ml adaptive intelligent control the dynamic model of the environment is initially estimated off line. This model is then adapted to the dynamic variation of tile environment on line. In this work a neuro-fuzzy model of the environment is obtained using Adaptive Spline Modelling of Observation Data (ASMOD) algorithm as proposed by [Kavli. 1992].

The ASMOD algorithm is an off-line iterative modelling approach which has potential of real-time learning dealing with time-varying systems. It has been successfully implemented to a wide range of applications. ASMOD uses B-Splines to represent general non-linear and coupled dependencies in a multi-variable observation data. In the course of the paper, initially a summary of the literature review carried out on mine detection is provided. The experimental rig set up for the study and development of the control algorithm will be introduced. The mechanical de-miner arm, the soil and the interaction between the bayonet and the soil will be then modelled. Based on these models, an adaptive controller is designed which varies the controller gain according to the stiffness of the environment. The results obtained during the simulation of the system and the experimental work will be reported and some conclusions will be made.

During the mine detection process, tile performance of the robotic arm is deteriorated by the impact force generated when the end-effectors approaches the stiff environment from a free space motion. This impact force may cause the robot to lose its contact with the environment. Since the control algorithm tries to drive tile arm back towards the environment, the end effectors will oscillate.

There has been a growing research interest on velocity control or impact control of mechanical manipulators in order to avoid such oscillatory behaviour when a manipulator interacts with an uncertain environment of arbitrary stiffness.

2.6 Bluetooth Controlled Robot

Nowadays smart phones or android is an open-source operating system which means that any manufacturer on use it in their phones free of charge. More properties make the Android system very applicable for university use: Android uses the Java programming language, which our students are familiar with. Getting started with the Android API is easy; the API is open, i.e. developers can access almost every low-level function and are not sandboxed. In addition, the Android API allows easy access to the hardware components In principle, RF (Radio Frequency) emitted by Bluetooth can be regarded as the control which deals with the use of radio signal to remotely control any device.

A remotely controlled car may be defined as any mobile device which is control by means that it does not restrict it motion with origin external to the device that is the possibility of an existence of a radio control device, a wireless medium between the Remote Mobile and Smart car. A Remote Car is always control by a human operator and it takes no positive action autonomously.

Conventional Wireless Robotics: A robot is a mechanical or virtual artificial agent, usually an electro-mechanical machine that is guided by a computer program or electronic circuitry in conventional robotics, the controlling and operation of robots is usually done by using RF [Radio Frequency] circuits

Bluetooth is a wireless technology standard for exchanging data over short distances from fixed and mobile devices, and building personal area networks. Bluetooth technology was created by Ericsson in 1994 and is used to replace the cables in the office, in laboratories or at home as in. Bluetooth device operated in the range of 10 meters. The IEEE standardized Bluetooth as IEEE802.15.1 2.3 DC motor All tables and figures will be processed as images. need to embed the images in the paper itself. Please don’t send the images as separate files. Motor IC 1 High-performance, Low-power AVR® 8-bit Microcontroller.

Advanced RISC Architecture High Endurance Non-volatile Memory segments JTAG (IEEE std. 1149.1 Compliant) Interface Special Microcontroller Features Power-on Reset and Programmable Brown-out Detection – Internal Calibrated RC Oscillator – External and Internal Interrupt Sources – Six Sleep Modes: Idle, ADC Noise Reduction, Power-save, Power-down, Standby and Extended Standby upto 16 MIPS throughput at 16MHz 32*8 General Purpose Working Registers Six ADC channels in PDIP package Internal Calibrated Oscillation HC -05 BLUETOOTH The HC-05 Bluetooth Module has

6 pins – Vcc, GND, TX, RX, Key and LED. It comes pre-programmed as a slave, so there is no need to connect the key pin, unless you need it change it to master mode the major difference between master and slave modes is that, slave mode the Bluetooth module cannot initiate a connection, it can however accept incoming connections. After the connection is established the Bluetooth module can transmit and receive data regardless of the mode it is running in. If you are using upon to connect to the Bluetooth module, you can simply use it in the slave mode. The default data transmission rate is 9600kbps

The range for Bluetooth communication is usually 30m or less. The module has a factory set pin off ”1234” which is used while pairing the module to a phone. Frequency:2.4GHz ISM band, Power supply:+3.3VDC 50mA,Working temperature:-20 `+75 Centigrade.

A sensor is a device that measures a physical quantity and converts it into a signal which can be read by an observer or by an instrument. Sensors are used in everyday objects such as touch sensitive elevator buttons (tactile sensor) and lamps which dim or brighten by touching the base. Applications include cars, machines, aerospace, medicine, manufacturing and robotics.

The project is designed to control a robotic vehicle using an android. Bluetooth module is interfaced to the control unit on the robot for sensing the signals transmitted by the android application. This data is send to the control unit which moves the robot. 8051 microcontroller is used as control device in this project. Remote operation is achieved by any smart-phone/Tablet etc., with Android OS, upon a GUI (Graphical User Interface) based to screen touch operation. At transmitting end, an android device through commands is transmitted. Commands are used for controlling the robot in all directions at receiver end movements of two motors that are interfaced to the microcontroller. Android application is send data serially and received by a Bluetooth receiver interfaced with controller. The program on the microcontroller interfaced to the serial data to generate respective output based on the input data to operate the motors through motor driver integrated circuits. The motors are connected to the control unit through motor driver IC.

The objective of the paper is to realise the smart living, more specifically the home lighting control system using Bluetooth Technology. Wireless control is one of the most important basic needs for all the people all over the world. However, unfortunately the technology is not fully utilized due to a huge amount of data and communication overheads. Generally many of the wireless-controlled robots use RF modules.

2.7 Multiple Motion Control System of Robotic Car Based on IoT

IoT is a trending topic in today's world and it helps us in performing numerous task by making them easier and efficient. This paper proposes a robotic car where we will control its movement remotely using Arduino Uno controller. Client can manages the activities of the car from remote or far away spots over the remote correspondence using ZigBee module and cloud service. The prime duty of this undertaking is that it utilize the viability of robot's development controlling structure in light of the fact that robotic auto can get immediate summons at once from fundamental sources which make the moving framework more proficient. Commands and data are stored in local host service, which delivers them when the device is ready to receive. We display the engineering, outline of the Arduino and wireless IoT communication software, and represent how to control the car by methods for commands and application.

Nowadays use of robots, which can be used remotely, is getting popular especially in those fields where work posse's hazard to human life. In such scenarios, these robots can be used to perform work and replace human workforce and do work effectively. This venture proposes a numerous movement controlling component of a robotic auto utilizing Arduino UNO small scale controller.. Each device is uniquely identifiable by the controlling software which is the core concept of IoT. Client manages the activities of the car from remote or distant places over the wireless communication.

There is boom in today's world for use of remotely operated robots which can do task more effectively and efficiently. These can be used to measure various variables from our environment and work on them. IoT is a very interesting and innovative concept, which holds great future opportunities.

The main aim of this project is that it leverages the efficiency of robot's motion controlling system because robotic car can receive direct commands at a time from main sources, which make the manoeuvring system more efficient. The proposed robot can be used in war field, mines, power station, military operations, industries, research and educational institutions and so on. And be used wherever people cannot go or where things doing too dangerous for humans to do safely. The Robotic movement is controlled remotely through the local system. It can do task more effectively and efficiently than human labour and at same time take care of safety.

CHAPTER 3

METHODOLOGY

3.1 EXISTING SYSTEM

In the existing system they usedZigBee network where it is a technology a wireless protocol used for wireless networking and connectivity. ZigBee is the wireless language that every device used to connect to one another. It is the recently emerged technology of network communication system based on the IEEE 802.15.4 standard. ZigBee is a new standard developed by the ZigBee alliance for personal area network (called PAN).

The main disadvantages of ZigBee networks :

- ZigBee disadvantages mainly include short range
- Low complexity, and low data speed
- Its high maintenance cost, lack of total solution, and slow materialization,
- Low transmission, as well as low network stability, are also some of its disadvantages that takes it a step back as compared to others
- Replacement with ZigBee compliant appliances can be costly
- ZigBee is not secure like Wi-Fi based secured system
- It does not have end devices available yet

3.2 PROPOSED SYSTEM

To overcome the disadvantages or difficulties faced by ZigBee we are using ESP8266(Wi-Fi module) in the proposed system .There are many wireless interface options, Bluetooth Low Energy (BLE), ZigBee, Z-Wave, Wi-Fi and RFID, each with their own unique balance of power, range, data rates, mesh networking, interference immunity, and ease of use. However, some interfaces are not yet native-IP enabled, so cannot be addressed directly or exchange data with other devices and servers over the Internet. These then require a separate gateway, adding expense and complexity to the final solution.

This is where Wi-Fi stands out: it is based on the IEEE 802.11 standards with native IP addressability, is ubiquitous, well understood, and can scale well in terms of data rates to optimize for power consumption. According to the Wi-Fi Alliance, there are more than 6.8 billion installed Wi-Fi-capable devices, so the odds are pretty high that there is a local Wi-Fi access point available

Here, is the main advantages of using Wi-Fi module when compared to ZigBee:

1. **Network Range:** ZigBee is restricted to Wireless Personal Area Networks (WPAN), reaching 10-30meter in usual applications. Wi-Fi serves up for PAN and WLAN area networks with an average range between 30 to 100 meters.
2. **Data transfer speed:** Wi-Fi networks, though faster than ZigBee in terms of data transfer, show variation in terms of speed. Wi-Fi networks defined under 802.11b standard have maximum data transfer speed of 11mbps while a and c versions have 54mbps of maximum data transfer speed. Maximum speed in ZigBee networks is only 250kbps, fairly low than the lowest Wi-Fi offers.
3. **Bit Time:** It can be defined as time taken to transmit one bit at a given data rate of transfer. Bit time in ZigBee is 4micro seconds while in Wi-Fi it is only 0.00185 micro seconds.
4. **Applications:** Wi-Fi is a preferable choice for internet connection based network and now is also encouraged to interface various media/entertainment devices wirelessly. One can find Wi-Fi in data exchange between a computer and modem, streaming music and videos on a television through a Wi-Fi enabled computer or media device.

   ZigBee protocol has been precisely designed to exchange data and it is more prevalent in the wireless sensor based networks such as those in home automation systems or industrial machinery coordination systems.
5. **Channel Bandwidth**: ZigBee protocol based communications have a channel bandwidth of 1MHz while Wi-Fi channels have a bandwidth of 0.3, 0.6 or 2MHz.

STEP 1: The Architecture describes how the system implements the functions which are specified in the specification level.

STEP 2: The system architecture is further refined in to Hardware and software. Architecture which describes the components we need to build the entire system.

STEP 3: The sensors send the signals to the local system through ESP, the local system process the data and send the control signals to the Robot and switches the relay according to the conditions for ON or OFF the Motors.

STEP 4:The ESP connected to the microcontroller which sends the data from the ROBOT to the local system and the ESP at the local system receives the data and displays the output and the data is stored in the cloud.

STEP 5: This car can be operated via host pc remotely using hardware Arduino , motor driver, robotic model, ESP and sensors and software includes Arduino ide , host platform and virtuino app.

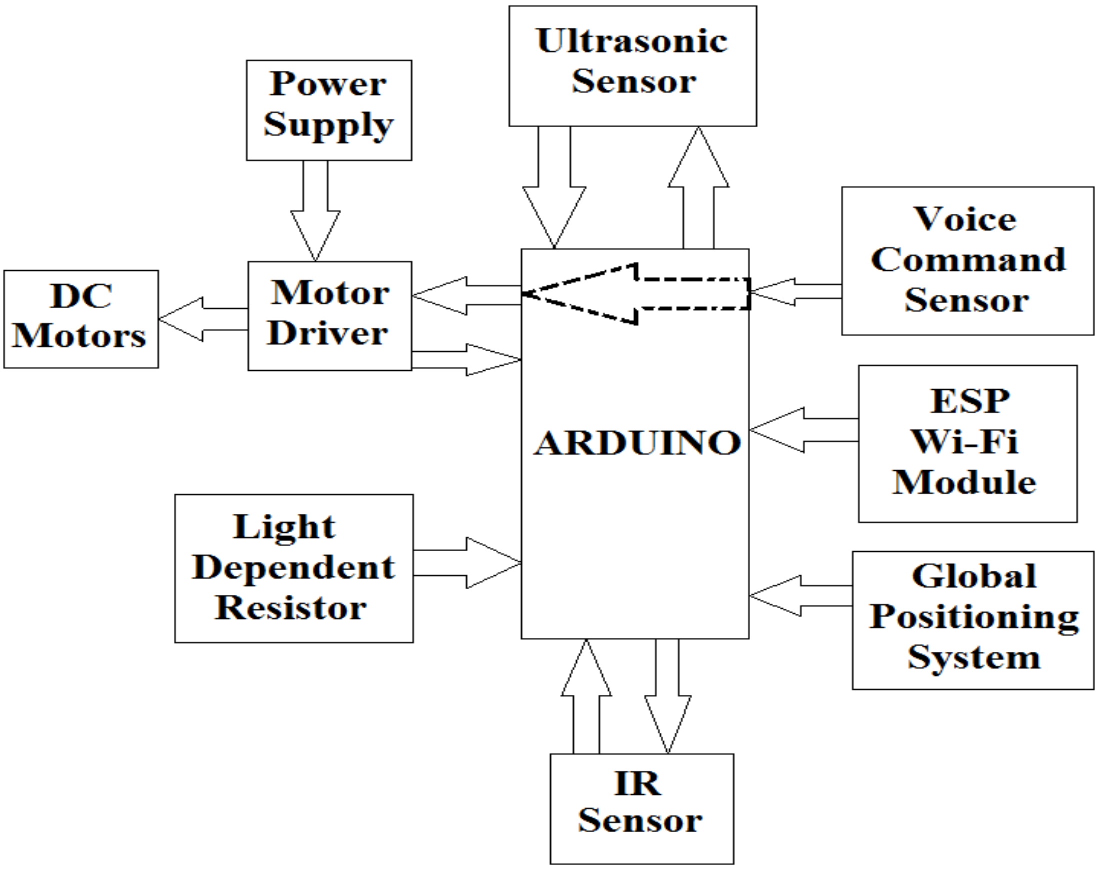

Fig 3.1: Block diagram of System Architecture

3.3 Modules

1. Motor functionalities.
2. Cloud storage.
3. GPS communication.
4. Graphical data transfer.
5. Multiple functionality modules.

3.4 Modules Description

1. Motor functionalities

- 2 motors are connected to the 2 wheels of thecar.
- The rotation of the motor is based on the commands sent.
- For the forward movement both the motorsrotate clockwise.
- Similarly, for the backward movement both themotors rotate in anti-clockwise.

- For the left and right movement, one of themotor rotates in clockwise and another motor rotates in anti-clockwise

2. Cloud storage

Based on the motion of the car following data are stored in the cloud:

- Graphical data is stored in the cloud.
- The distance between the car and the obstacleis stored in the cloud.
- The location of the car is stored in the cloud.
- The status of the headlights are stored.
- Through Arduino voice control sensor, voicecommand is sent.

3. GPS communication

- Using GPS sensor, the latitude and thelongitude are calculated automatically andthe location is traced.
- With the help of that location, the location of the car can be obtained.
- As the car move from its current location, GPS location will also change and that location is continuously calculated and sent by GPS sensor.

4. Graphical data transfer

- Visual camera is used for display purpose.
- Camera is mounted on the motor and so that we can view in 360°.
- Graphical data is not sent in the same way as numerical data.
- Therefore, we use Mat lab for this purpose.

5. Multiple functionality modules

- The photoelectric sensor can detect the headlight status of the car.
- Obstacle can detected using IR sensor.
- Wi-Fi module is used for creating internetconnection.
- Distance between the car and the obstacle canbe obtained using Ultrasonic sensor.

CHAPTER 4

SYSTEM REQUIREMENTS AND SPECIFICATION

System Requirements Specification (SRS), which gives information about the system behaviour to be created. SRS includes both functional and non-functional requirements.

4.1 SRS Objective

The objective of SRS is to meet the requirements for successful functioning of model without any failure and interruption.

4.1.1 Functional Requirements

Several hardware components are combined together for the movement of the car. Raspberry pi is used to create numerous automated and controlled system like low power consumption, faster processing ability at a lower cost. Arduino is used for controlling the motors or transferring of data and helps to achieve high degree of precise path control from the user side to achieve standard operations like moving at a particular target location, collection data and avoiding any obstacle to prevent collision. Cloud robotics is implemented that uses computing resources to enable great memory, computational power and collective learning for robotics applications.

4.1.2 Non-functional Requirements

A non-functional requirement is a requirement that explains the criteria requested to the analyse the operation of a system. It describes how the system works and what standard should be provided. It describes some system attributes like accessibility, availability, security, reliability etc. Service level requirements are the amount of attribute benefits required and are critical to quantity outlining and tangible design.

For each service level, we need to identify the realistic, measurable target values. These target values are like service hours, throughput etc. Access restrictions must specify what data should be protected, which information is constrained to a particular client.

- Accessibility: This factor to the system depends on the availability of a internet connection. To access our system anywhere and anytime it is deployed on a global server space.
- Availability: The system should be available at any time whenever required. The robotic car will perform the requested task whenever input is applied.

- Documentation: The documentation is carried out at each level to record the result since the time system development was started.
- Efficiency: The efficiency here means that how efficiently the car is performing the task without any latency.
- Failure management: Here to rectify the errors when failure occurs, various exceptions are created to provide notification to the users.

4.2 Requirement Specification

The requirements of the system are the description of services provided by the system and its operational constraints. These requirements reflect the needs of the customer for the system that helps to solve the problem such as controlling a device, placing in order to find information. The process of finding out, analysing, documenting and checking the services and constraints are called requirement engineering.

SYSTEM REQUIREMENTS

4.2.1 Hardware requirements

- System : Pentium IV 2.4 GHz
- Hard Disk : 160 GB
- Monitor : 15 VGA colour
- Mouse : Logitech.
- Keyboard : 110 keys enhanced
- Ram : 2 GB
- Arduino Uno : ATmega328P
- ESP Wi-Fi Module : ESP8266
- Motor Driver : L293D
- DC gear motor : Basic motor
- Backup Media : Hard disk

4.2.2 Software requirements

- Operating System : Windows XP, Windows 2000 or higher
- Language : Embedded C/C++.
- Front End : Visual Basic C++ Version 6.0
- Documentation tool : Microsoft Word

CHAPTER 5

SYSTEM DESIGN

5.1 System Architecture

- Arduino is used to take inputs from various sensors and give the required output.
- The voice command sensor is used to sense the input given in the form of voice then send it to the Arduino mounted on the car.
- As per the command is given to the car the DC motor will rotates and perform the motion of the car.
- Power supply will be given to dive the motors.
- During the motion of the car, if any obstacles is there the IR sensor will detect it and a LED will glow indicating the obstacle.
- The distance between the car and the obstacle will be calculated using the Ultrasonic sensor.
- For locating the position of the car, GPS sensor is connected to the Arduino which will give the latitude and longitude of the car.

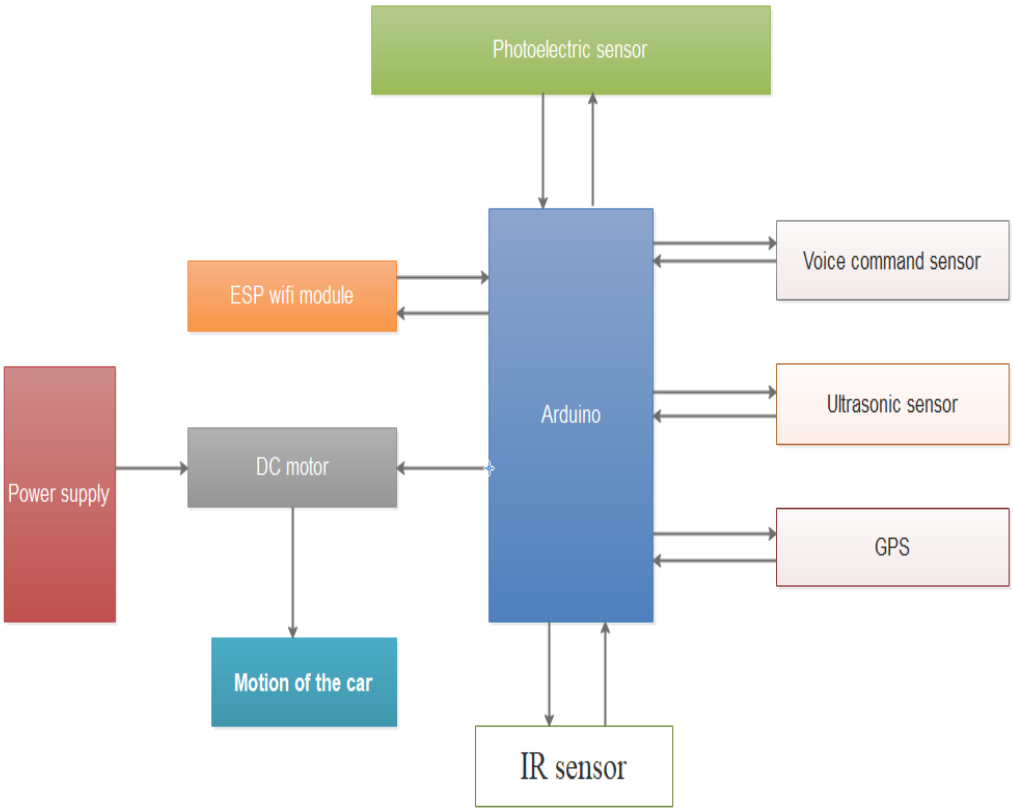

Fig 5.1: System Architecture

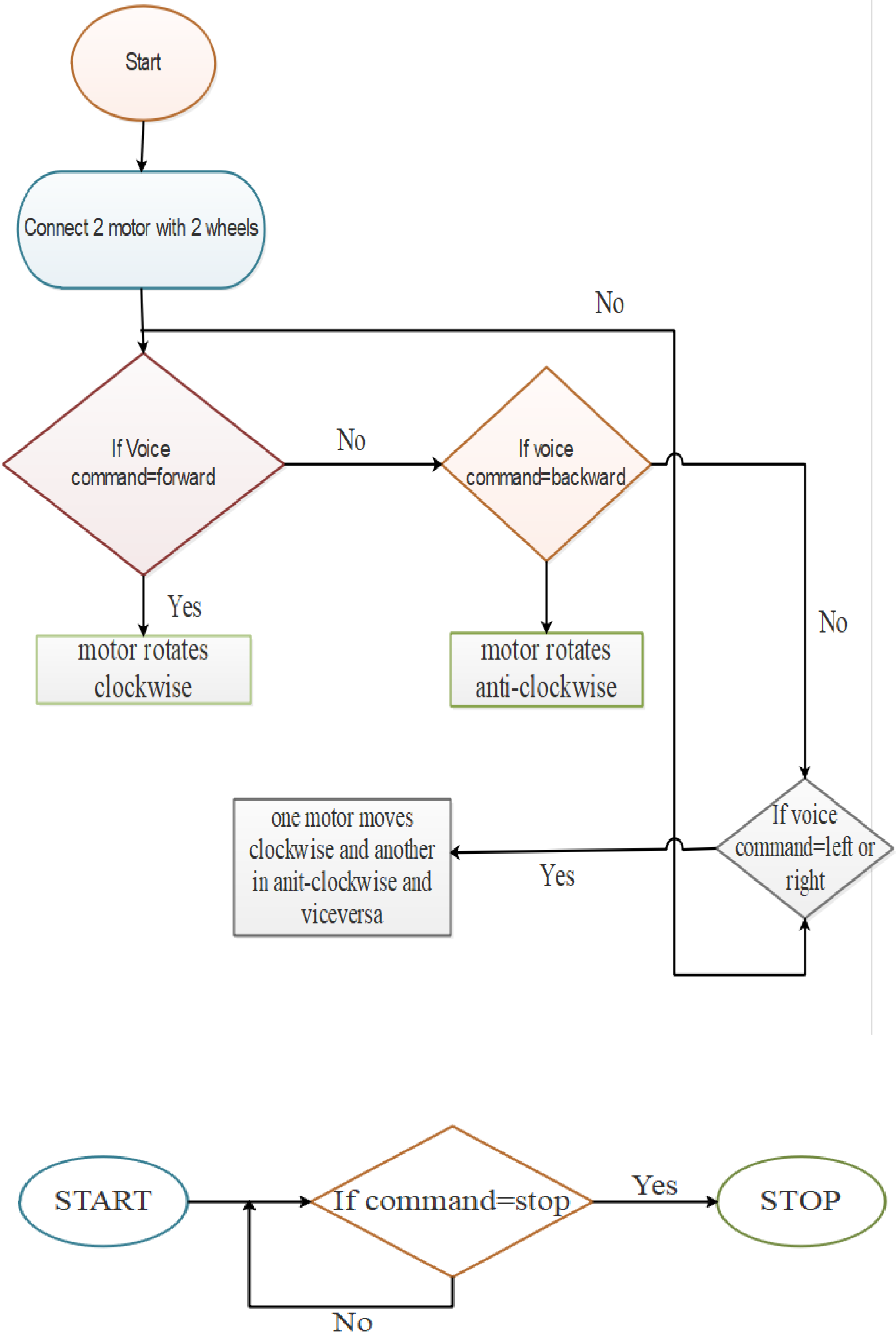

Fig 5.2: Motion of the car

- If the motors are connected to the wheels, through the voice control the command is given and according to that the wheels of the car rotate.
- If the command is forward, the motor rotates in clockwise direction, if it states backward then in anti-clockwise.
- If the voice command is left or right than one of the motor rotates in clock-wise and another in anti-clockwise.

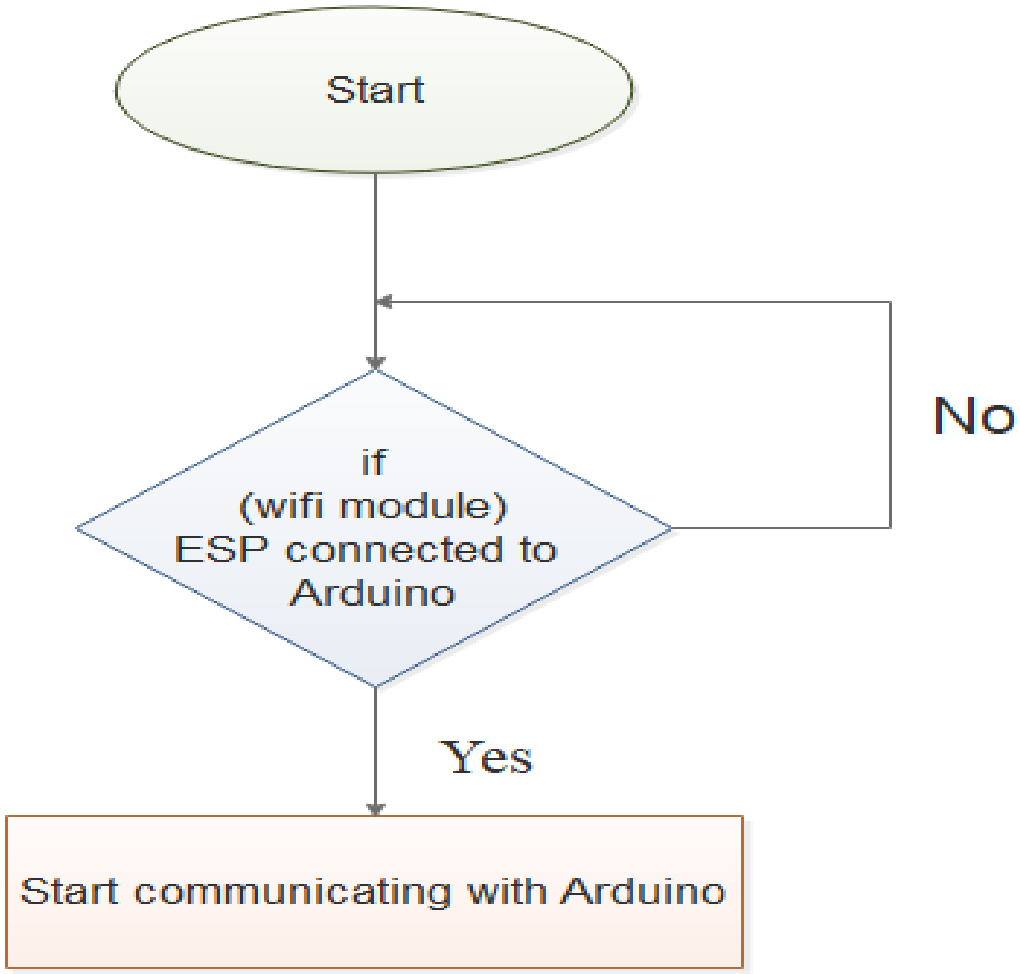

Fig 5.3: ESP (Wi-Fi module)

- The ESP module is used for Wi-Fi connection. This module is connected to Arduino.
- Using this internet connection, the information that are collected by the Arduino and other sensors will be sent to the cloud.

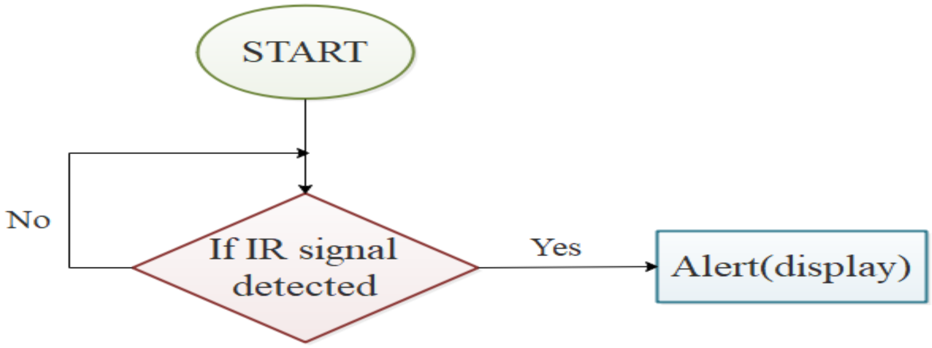

Fig 5.4 : IR sensor

- IR sensors are used to detect the objects. These sensors are connected to Arduino.
- If any object is detected in IR sensor, the light glows indicating alert.

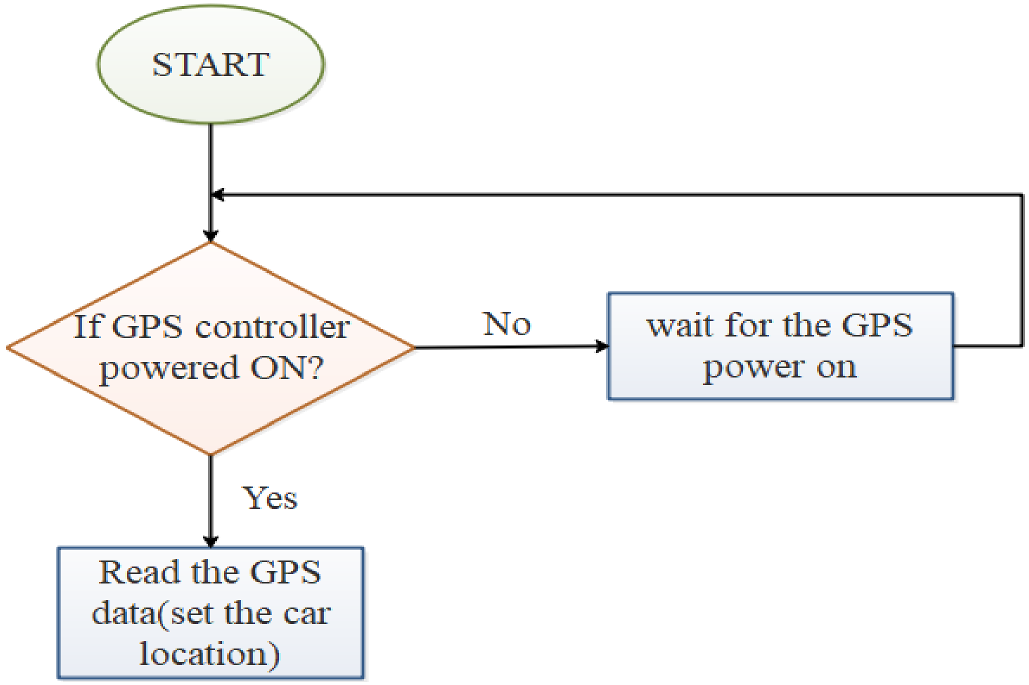

Fig 5.5: GPS sensor

- The GPS sensor is used to detect the location of the car and it is connected to the Arduino.
- The location is sent to the cloud in the longitude and latitude form.

CHAPTER 6

IMPLEMENTATION

6.1 Arduino Uno

Arduino is an open-source prototyping platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments.

All Arduino boards are completely open-source, empowering users to build them independently and eventually adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

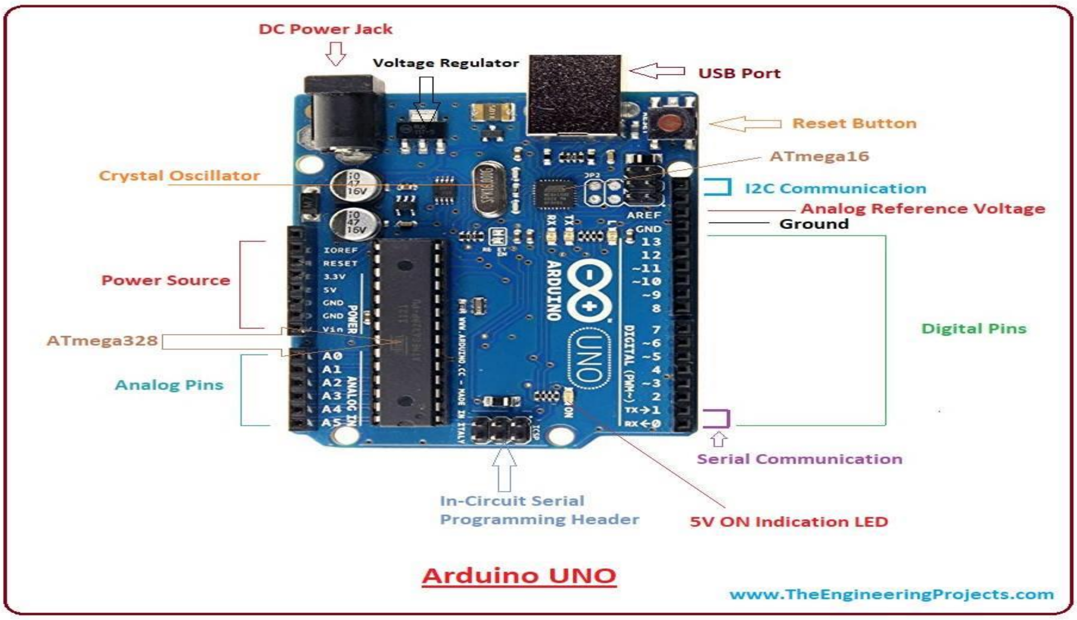

Fig 6.1: Arduino UNO

6.1.1 Advantages of Arduino

1. Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems:
2. Inexpensive – Arduino2 boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand, and even the pre-assembled Arduino modules cost less than $50
3. Cross-platform - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.
4. Simple, clear programming environment - The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with how the Arduino IDE works.
5. Open source and extensible software - The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.
6. Open source and extensible hardware - The plans of the Arduino boards are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money.

6.1.2 Specification

Microcontroller	:	ATmega328P
Operating Voltage	:	5V
Input Voltage (recommended)	:	7-12V
Input Voltage (limit)	:	6-20V
Digital I/O Pins	:	14 (of which 6 provide PWM output)
PWM Digital I/O Pins	:	6

Analog Input Pins	: 6
DC Current per I/O Pin	: 20 mA
DC Current for 3.3V Pin	: 50 mA
Flash Memory	: 32 KB (ATmega328P)
SRAM	: 2 KB (ATmega328P)
EEPROM	: 1 KB (ATmega328P)
Clock Speed	: 16 MHz
Length	: 68.6 mm
Width	: 53.4 mm
Weight	: 25 g

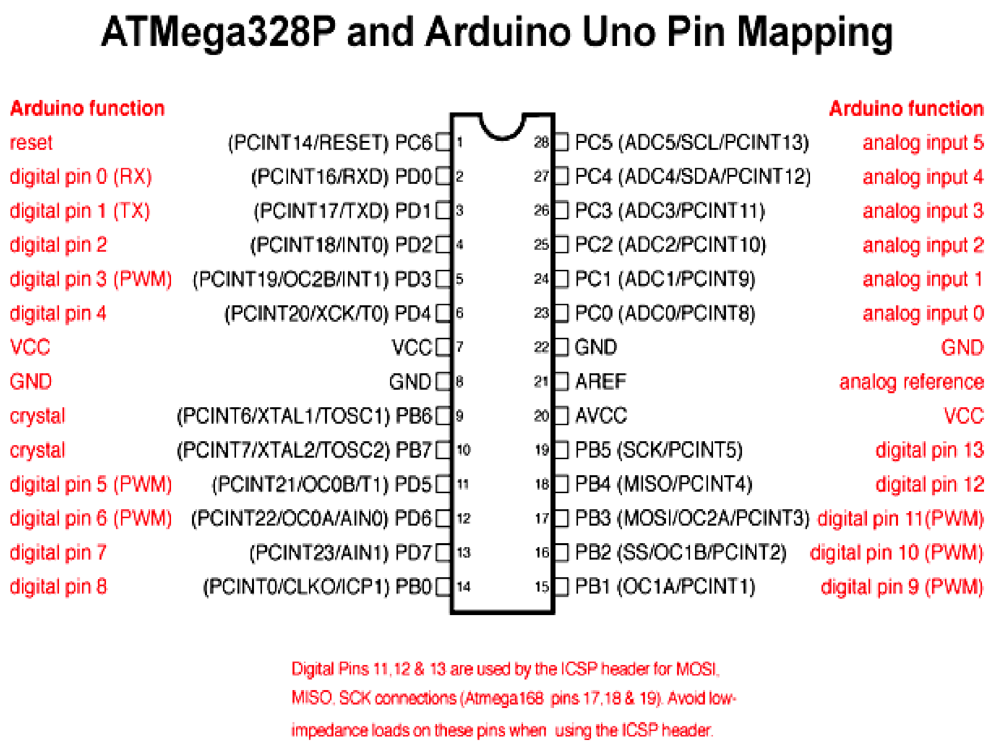

Fig 6.2 :ATmega328P

Programming

The Uno can be programmed with the Arduino Software (IDE). Select "Arduino/Genuino Uno" from the Tools > Board menu (according to the microcontroller on your board). For details, see the reference and tutorials.

The ATmega328 on the Uno comes pre-programmed with a boot-loader that allows you to upload new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol (reference, C header files).

6.2 Motor Driver

L293D is a double H-connect engine driver incorporated circuit which is used to convert low signal to high current signal to run motor.

6.2.1 Features

1) High operating voltage, which can be up to 40 volts;
2) Large output current, the instantaneous peak current can be up to 3A;
3) With 25W rated power;
4) Two built in H-bridge, high voltage, large current, full bridge driver, which can be used to drive DC motors, stepper motors, relay coils and other inductive loads.
5) Using standard logic level signal to control.
6) Able to drive a two-phase stepper motor or four-phase stepper motor, and two-phase DC motors.
7) Adopt a high-capacity filter capacitor and a freewheeling diode that protects devices in the circuit from being damaged by the reverse current of an inductive load, enhancing reliability
8) The module can utilize the built-in stabilivolt tube 78M05 to obtain 5v from the power supply. But to protect the chip of the 78M05 from damage, when the drive voltage is greater than 12v, an external 5v logic supply should be used.
9) Drive voltage: 5-35V; logic voltage: 5V
10) PCB size: 4.2 x 4.2 cm

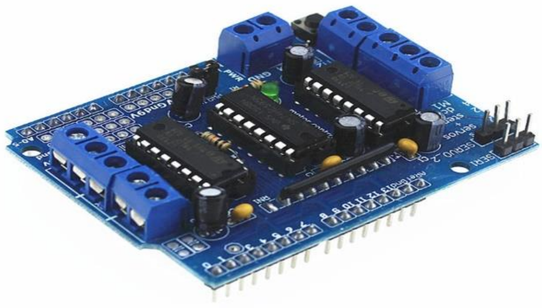

Fig 6.3: motor driver

6.3 Ultrasonic Distance Sensor

The HC-SR04 Ultrasonic Range Sensor uses non-contact ultrasound sonar to measure the distance to an object - they're great for any obstacle avoiding systems on Raspberry Pi robots or rovers! The HC-SR04 consists of two ultrasonic transmitters (basically speakers), a receiver, and a control circuit.

The transmitters emit a high frequency ultrasonic sound, which bounce off any nearby solid objects, and the receiver listens for any return echo. That echo is then processed by the control circuit to calculate the time difference between the signal being transmitted and received. This time can subsequently be used, along with some clever math, to calculate the distance between the sensor and the reflecting object.

6.3.1 The Hc-Sr04 Ultrasonic Range Sensor Features

- Input Voltage: 5V
- Current Draw: 20mA (Max)
- Digital Output: 5V
- Digital Output: 0V (Low)
- Working Temperature: -15°C to 70°C
- Sensing Angle: 30° Cone
- Angle of Effect: 15° Cone
- Ultrasonic Frequency: 40kHz
- Range: 2cm - 400cm

Fig6.4: Ultrasonic distance sensor

VCC - +5 V supply

TRIG – Trigger input of sensor. Microcontroller applies 10 us trigger pulse to the HC-SR04 ultrasonic module.

ECHO–Echo output of sensor. Microcontroller reads/monitors this pin to detect the obstacle or to find the distance.

GND – Ground

6.3.2 How Does it Work?

The ultrasonic sensor uses sonar to determine the distance to an object. Here's what happens:

1.The transmitter (trig pin) sends a signal: a high-frequency sound.

2. When the signal finds an object, it is reflected and…

3. The transmitter (echo pin) receives it.

The time between the transmission and reception of the signal allows us to calculate the distance to an object. This is possible because we know the sound's velocity in the air.

6.3.3 Applications Involving Ultrasonic Detection

- Ultrasonic Distance Measurement
  Ex. Distance measurement would be applied in a garage parking application, sensing when a vehicle is pulled completely into a garage.
- Ultrasonic Sensors for water level detection
  Tank level measurement, Fuel gauging, irrigation control.
- Ultrasonic Obstacle Detection
  Our UAV Sensors for Drones as well as our proximity sensors that are used for robots are for obstacle detection.

Ultrasonic sensors are a reliable, cost-effective solution for distance sensing, level, and obstacle detection.

6.4 Esp8266 Wi-Fi Module

ESP8266 is a complete and self-contained Wi-Fi network solutions that can 6.3.1 carry software applications, or through another application processor uninstall all Wi-Fi networking capabilities. ESP8266 when the device is mounted and as the only application of the application processor, the flash memory can be started directly from an external Move. Built-in cache memory will help improve system performance and reduce memory requirements. Another situation is when wireless Internet access assume the task of Wi-Fi adapter, you can add it to any microcontroller-based design, the connection is simple, just by SPI / SDIO interface or central processor AHB bridge interface. Processing and storage capacity on ESP8266 powerful piece, it can be integrated via GPIO ports sensors and other applications specific equipment to achieve the lowest early in the development and operation of at least occupy system resources.

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. The **ESP8285** is an ESP8266 with 1 MB of built-in flash, allowing for single-chip devices capable of connecting to Wi-Fi.

The ESP8266 highly integrated chip, including antenna switch balun, power management converter, so with minimal external circuitry, and includes front-end module, including the entire solution designed to minimize the space occupied by PCB. The system is equipped with ESP8266 manifested leading features are: energy saving VoIP quickly switch between the sleep / wake patterns, with low-power operation adaptive radio bias, front-end signal processing functions, troubleshooting and radio systems coexist characteristics eliminate cellular / Bluetooth / DDR / LVDS / LCD interference.

The reason for the popularity of many of these boards over the earlier ESP-xx modules is the inclusion of an on-board USB-to-UART bridge (like the Silicon Labs' CP2102 or the WCH CH340G) and a Micro-USB connector, coupled with a 3.3-volt regulator to provide both power to the board and connectivity to the host (software development) computer – commonly referred to as the console. With earlier ESP-xx modules, these two items (the USB-to-serial adapter and the regulator) had to be purchased separately and be wired into the ESP-xx circuit. Modern ESP8266 boards like the Node MCU are easier to work with and offer more GPIO pins. Most of the boards listed here are based on the ESP-12E module, but new modules are being introduced seemingly every few months.

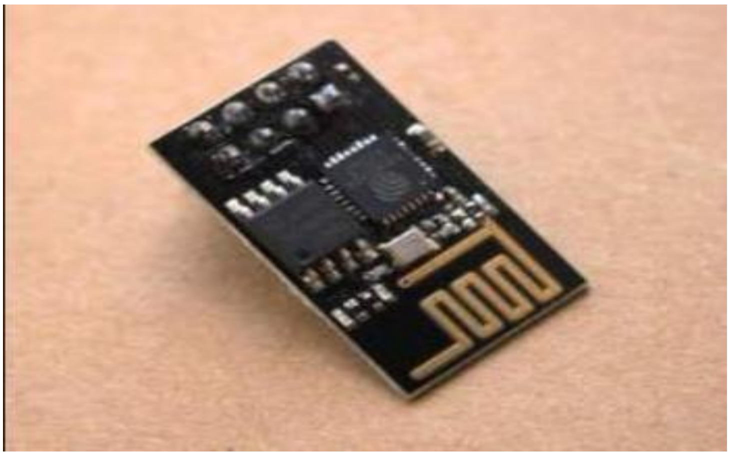

Fig 6.5: ESP8266

6.4.1 Characteristics

- 802.11 b / g / n
- Wi-Fi Direct (P2P), soft-AP
- Built-in TCP / IP protocol stack
- Built-in TR switch, balun, LNA, power amplifier and matching network
- Built-in PLL, voltage regulator and power management components
- 802.11b mode + 19.5dBm output power
- Built-in temperature sensor
- Support antenna diversity
- Off leakage current is less than 10uA
- Built-in low-power 32-bit CPU: can double as an application processor

- SDIO 2.0, SPI, UART
- STBC, 1x1 MIMO, 2x1 MIMO
- A-MPDU, A-MSDU aggregation and the 0.4 Within wake
- 2ms, connect and transfer data packets
- Standby power consumption of less than 1.0mW (DTIM3)

6.4.2 ESP8266 AT Command Set

AT – Attention

AT+RST - Reset the board

AT+CWMODE* - Operating Mode

Client

AccessPoint

Client and Access Point

AT+CWJAP*=<ssid>,<pwd> - Join network

AT+CIPSTART=<type>,<addr>,<port> - Connect to socket server

AT+CIPSEND=<length> Send TCP/IP data follows TCP/IP DATA

6.4.3 ESP8266-01 Module Pin Description

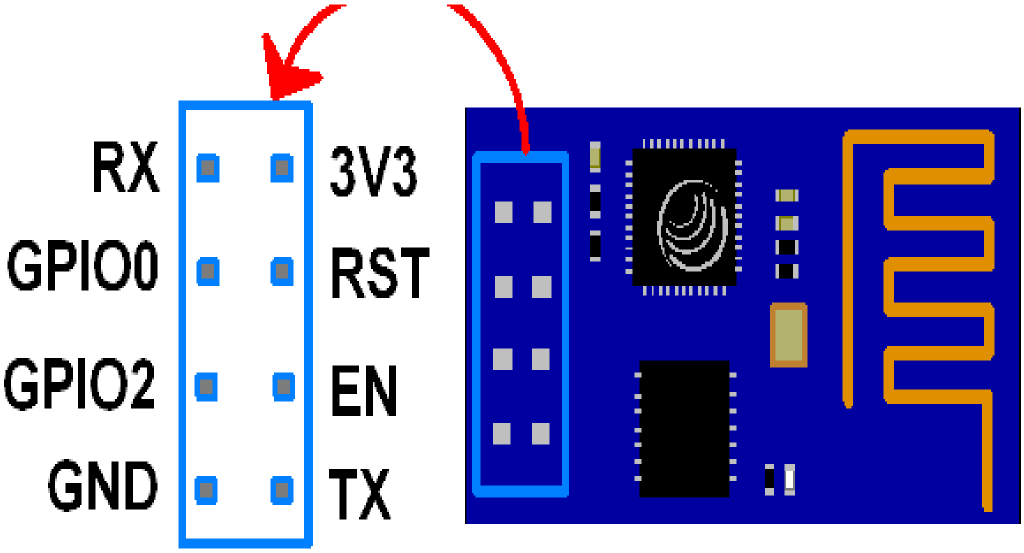

Fig 6.6: ESP8266-01 Module

ESP8266 : 01 Module Pins

3V3 : 3.3 V Power Pin.

GND : Ground Pin.

RST : Active Low Reset Pin.

EN : Active High Enable Pin.

TX : Serial Transmit Pin of UART.

RX : Serial Receive Pin of UART.

GPIO0 & GPIO2 : General Purpose I/O Pins. These pins decide what mode (boot or normal) the module starts up in. It also decides whether the TX/RX pins are used for Programming the module or for serial I/O purpose.

To program the module using UART, Connect GPIO0 to ground and GPIO2 to VCC or leave it open. To use UART for normal Serial I/O leave both the pins open (neither VCC nor Ground).

6.5 IR Sensor

Infrared technology addresses a wide variety of wireless applications. The main areas are sensing and remote controls. In the electromagnetic spectrum, the infrared portion is divided into three regions: near infrared region, mid infrared region and far infrared region. For optical sensing and optical communication, photo optics technologies are used in the near infrared region as the light is less complex than RF when implemented as a source of signal. Optical wireless communication is done with IR data transmission for short range applications.

6.5.1 Types of IR Sensors

Infrared sensors can be passive or active. Passive infrared sensors are basically Infrared detectors. Passive infrared sensors do not use any infrared source and detects energy emitted by obstacles in the field of view. They are of two types: quantum and thermal. Thermal infrared sensors use infrared energy as the source of heat and are independent of wavelength.

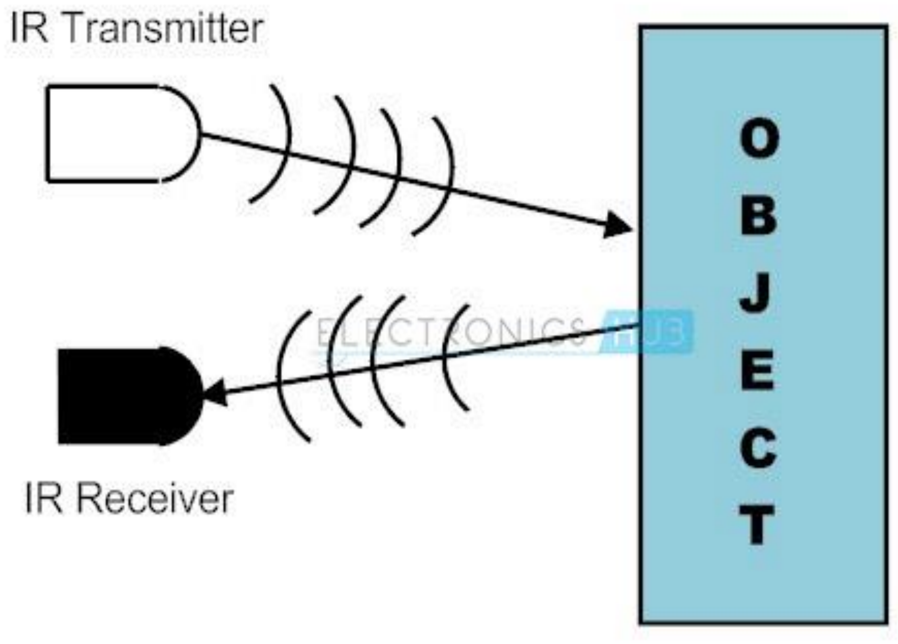

Fig 6.7: IR Sensor

6.5.2 IR Transmitter

Infrared Transmitter is a light emitting diode (LED) which emits infrared radiations. Hence, they are called IR LED's. Even though an IR LED looks like a normal LED, the radiation emitted by it is invisible to the human eye.

The picture of a typical Infrared LED is shown below.

Fig6.8: IR Transmitter

There are different types of infrared transmitters depending on their wavelengths, output power and response time.IR transmitters can be found in several applications. Some applications require infrared heat and the best infrared source is infrared transmitter. When infrared emitters are used with Quartz, solar cells can be made.

6.5.3 IR Receiver

Infrared receivers are also called as infrared sensors as they detect the radiation from an IR transmitter. IR receivers come in the form of photodiodes and phototransistors. Infrared Photodiodes are different from normal photo diodes as they detect only infrared radiation. The picture of a typical IR receiver or a photodiode is shown below. It consists of an IR phototransistor, a diode, a MOSFET, a potentiometer and an LED.

When the phototransistor receives any infrared radiation, current flows through it and MOSFET turns on. This in turn lights up the LED, which acts as a load.

The potentiometer is used to control the sensitivity of the phototransistor.

Fig 6.9: IR Receiver

Different types of IR receivers exist based on the wavelength, voltage, package, etc. When used in an infrared transmitter – receiver combination, the wavelength of the receiver should match with that of the transmitter.

6.6 GPS (Global positioning system)

The Global Positioning System (GPS) is a space-based satellite navigation system that provides location and time information in all weather, anywhere on or near the Earth, where there is an unobstructed line of sight to four or more GPS satellites. It is maintained by the United States government and is freely accessible by anyone with a GPS receiver.

The GPS program provides critical capabilities to military, civil and commercial users around the world. In addition, GPS is the backbone for modernizing the global air traffic system.

When people talk about "a GPS," they usually mean a **GPS receiver**. The **Global Positioning System** (GPS) is actually **a constellation** of 27 Earth-orbiting satellites (24 in operation and three extras in case one fails). The U.S. military developed and implemented this satellite network as a military navigation system, but soon opened it up to everybody else. Each of these 3,000- to 4,000-pound solar-powered satellites circles the globe at about 12,000 miles (19,300 km), making two complete rotations every day. The orbits are arranged so that at anytime, anywhere on Earth, there are at least four satellites "visible" in the sky.

Fig 6.10 : GPS

6.6.1 How it works?

GPS satellites circle the earth twice a day in a very precise orbit and transmit signal information to earth. GPS receivers take this information and use triangulation to calculate the user's exact location. Essentially, the GPS receiver compares the time a signal was transmitted by a satellite with the time it was received. The time difference tells the GPS receiver how far away the satellite is. Now, with distance measurements from a few more satellites, the receiver can determine the user's position and display it on the unit's electronic map

Fig 6.11:GPS Working

A GPS receiver must be locked on to the signal of at least three satellites to calculate a 2D position (latitude and longitude) and track movement. With four or more satellites in view, the receiver can determine the user's 3D position (latitude, longitude and altitude). Once the user's position has been determined, the GPS unit can calculate other information, such as speed, bearing, track, trip distance, distance to destination, sunrise and sunset time and more.

6.6.2 Pin Description

GPS Receiver Module

VCC: Power Supply 3.3 – 6 V

GND: Ground

TX: Transmit data serially which gives information about location, time etc.

RX: Receive Data serially. It is required when we want to configure GPS module.

6.6.3 GPS Distance Calculation

$$\text{Distance} = \text{Speed x Time}$$

Where,

- Speed = Speed of Radio signal which is approximately equal to the speed of light i.e.$3 * 10^8$
- Time = Time required for a signal to travel from the satellite to the receiver.
- By subtracting the sent time from the received time, we can determine the travel time.
- To determine distance, both the satellite and GPS receiver generate the same pseudocode signal at the same time.
- The satellite transmits the pseudocode; which is received by the GPS receiver.
- These two signals are compared and the difference between the signals is the travel time.
- Now, if the receiver knows the distance from 3 or more satellites and their location (which is sent by the satellites), then it can calculate its location by using Trilateration method

6.7 Cloud

IoT in **cloud** , like the StoneFly **Cloud** Connect to Microsoft Azure can provide customers with greater space which can increase as per the users demand. Helping to resolve the **storage** needs of customers. The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

Breaking it down, the internet of things meaning can be as simple as a person with a heart monitor implant or an automobile that has built-in sensors which alert the driver of imminent danger. Any object which is man-made or natural that can be designated an IP address and provided with the ability to transfer data over a network comes under the umbrella of IoT.

IoT has evolved with the greater generation of data. Internet of Things Cloud Service creates excessive communication between inexpensive sensors in the IoT which means even greater connectivity; billions of connected devices and machines will soon join human-users.

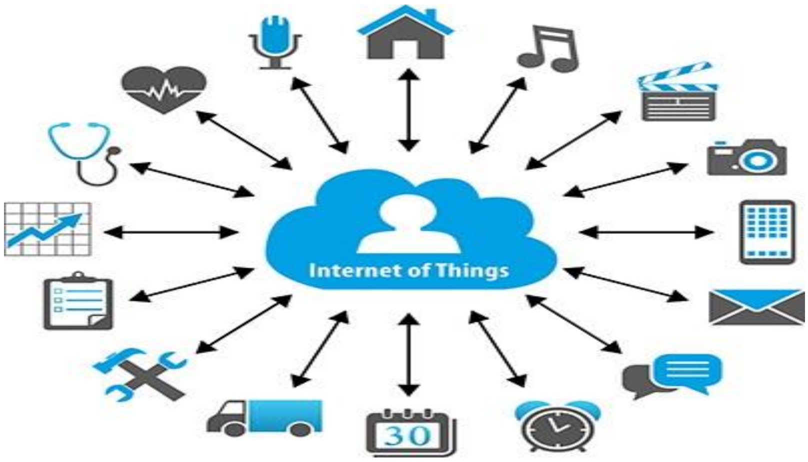

Fig 6.12: IoT in Cloud

There is an evident need of internet of things. IoT has practically taken many industries around the world including precision agriculture, healthcare, energy, transportation, building management and the likes. The connectivity options by internet cloud services are increasing by huge amounts for electronic engineers and application developers. Work is being done on products and systems of the IoT which will help in greater development with ease.

Greater connectivity of the devices in itself does not provide the benefits to people, however the devices connected to the network to provide information they gather from the environment is what makes IoT the next step to success. Connectivity provided by cloud services help the devices to provide valuable information by reaching out and acting upon the world. The devices IoT and cloud computing for Future Internet:

The question however remains how will the devices remain interconnected throughout? The answer lies in the connectivity provided by the internet of things cloud service. Greater usage of the IoT in cloud has acted as a catalyst for the development and deployment of scalable Internet of Things applications and business models.

6.7.1 Providing Infrastructure

IoT in cloud offers public cloud services can easily help the IoT area, by providing third party access to the infrastructure. Hence, the integration can help IoT data or computational components operating over IoT devices. Increased Scalability: IoT devices need a lot of storage to share information for valuable purposes. IoT in cloud, like the StoneFly Cloud Connect to Microsoft Azurecan provide customers with greater space which can increase as per the users demand. Helping to resolve the storage needs of customers. increased Performance: The large amounts of data produced by IoT devices need extreme performance to interact and connect with one another. IoT in cloud provides the connectivity which is necessary to share information between the devices and make meaning from it at a fast pace.

Internet Cloud Computing infrastructures help IoT to give meaning to the greater amount of data generated. Users have no worry of buying greater or less storage. They can easily scale the storage as the data generated increases and pay for the amount of storage they consume with Internet Cloud Computing. The **role of cloud** computing in the **IoT** revolution. The internet of Things is starting to transform daily tasks are completed. **Cloud** computing has entered the mainstream of information technology, providing scalability in delivery of enterprise applications and Software as a Service (SaaS).

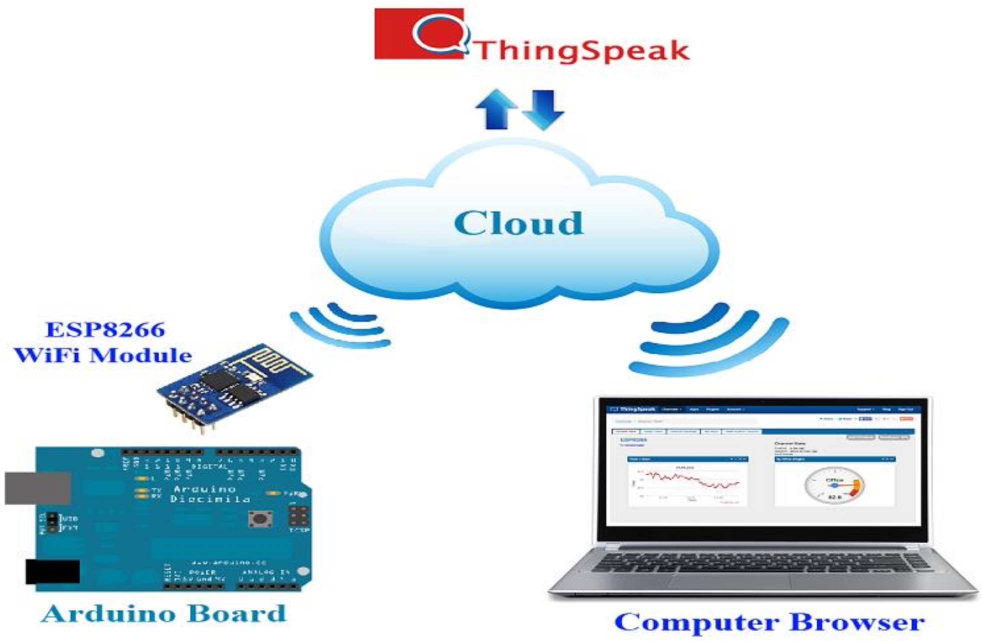

Fig 6.13: Communication process

6.7.2 How Cloud Computing Initiates And Complements The IOT

Cloud computing and the IoT both serve to increase efficiency in everyday tasks and both have a complementary relationship. The IoT generates massive amounts of data, and cloud computing provides a pathway for this data to travel.

Many Cloud providers charge on a pay per use model, which means that you only pay for the computer resources that you use and not more. Economies of scale is another way in which cloud providers can benefit smaller IoT start-ups and reduce overall costs to IoT companies.

Another benefit of Cloud Computing for the IoT is that Cloud Computing enables better collaboration which is essential for developers today. By allowing developers to store and access data remotely, developers can access data immediately and work on projects without delay.

Finally by storing data in the Cloud, this enables IoT companies to change directly quickly and allocate resources in different areas. Big Data has emerged in the past couple of years and with such emergence the cloud has become the architecture of choice. Most companies find it feasible to access the massive quantities of Big Data via the cloud.

6.8 LDR

The LDR gives out an analog voltage when connected to VCC (5V), which varies in magnitude in direct proportion to the input light intensity on it. That is, the greater the intensity of light, the greater the corresponding voltage from the LDR will be. Since the

LDR gives out an analog voltage, it is connected to the analog input pin on the Arduino. The Arduino, with its built-in ADC (analog-to-digital converter), then converts the analog voltage (from 0-5V) into a digital value in the range of (0-1023). When there is sufficient light in its environment or on its surface, the converted digital values read from the LDR through the Arduino will be in the range of 800-1023.

Fig. 6.14: A LDR

6.9 Pseudo Code

1. Code for motion of the car

```
digitalWrite(a1,1); digitalWrite(a2,0); digitalWrite(a3,1); digitalWrite(a4,0) //For right
digitalWrite(a1,0); digitalWrite(a2,1); digitalWrite(a3,0); digitalWrite(a4,1) //For left
digitalWrite(a1,1); digitalWrite(a2,0); digitalWrite(a3,0); digitalWrite(a4,1) //For back
digitalWrite(a1,0); digitalWrite(a2,1); digitalWrite(a3,1); digitalWrite(a4,0) //For front
digitalWrite(a1,0); digitalWrite(a2,0); digitalWrite(a3,0); digitalWrite(a4,0) //For stop
```

2. Code for connecting Wi-Fi

```
AT
  OK
AT+CWMODE=1
  OK
AT+CWJAP="ssid" "+password"
  OK
```

3. Code for uploading to the cloud

```
GET /update?api_key="api" & field1="level" & field2="lat" & field3="lon" &
field4="Ir"

AT+CIPSTART="TCP","host","port"
  OK
AT+CIPSEND="(getData.length()+2)
  >
```

4. Code for accessing the GPS module

```
start=millis();
  while(millis()-start < 2000)
  {
    while(Serial.available())
    {
      if(gps.encode(Serial.read()))
```

```
        {
            gps.f_get_position(&lat, &lon);
        }
    }
  }
```

5. Code for Ultrasonic sensor

```
digitalWrite(Tri,LOW);
delayMicroseconds(100);
digitalWrite(Tri,HIGH);

duration=pulseIn(Echo,HIGH);
distance=duration/2/29;
```

6. Code for IR sensor

```
 while(!digitalRead(Ir))
{
        sstop;
         Serial.println(digitalRead(Ir));
        v1=digitalRead(r0);
        v2=digitalRead(r1);
        v3=digitalRead(r2);
        if(v1==1&&v2==0&&v3==0)
        {
                front;
                break;
        }
        else if(v1==1&&v2==1&&v3==0)
        {
               left;
               break;
        }
        else if(v1==0&&v2==0&&v3==1)
```

```
        {
                right;
                break;
        }
  }
```

6.10 Code

```
#include<SoftwareSerial.h>
#include<TinyGPS.h>

#define r0 8
#define r1 9
#define r2 10

#define a1 4
#define a2 5
#define a3 6
#define a4 7

#define Tri 3
#define Echo 2

#define ldr A0
#define led1 A1
#define led2  A2

#define right digitalWrite(a1,1); digitalWrite(a2,0); digitalWrite(a3,1); digitalWrite(a4,0)
#define left digitalWrite(a1,0); digitalWrite(a2,1); digitalWrite(a3,0); digitalWrite(a4,1)
#define back digitalWrite(a1,1); digitalWrite(a2,0); digitalWrite(a3,0); digitalWrite(a4,1)
#define front digitalWrite(a1,0); digitalWrite(a2,1); digitalWrite(a3,1); digitalWrite(a4,0)
#define sstopdigitalWrite(a1,0); digitalWrite(a2,0); digitalWrite(a3,0); digitalWrite(a4,0)

int v1,v2,v3;
const byte tx=11, rx=12;
```

```
SoftwareSerial esp8266(rx,tx);

 String ssid="don";
 String password="DonDon23";
boolean found=false;
int value;
 String api="GU3WE97D70831I5U";
 String host="api.thingspeak.com";
 String port="80";
 float lat, lon;
TinyGPS gps;

 unsigned int Ir=13, level, cm;
 unsigned long start;

void setup() {
  // put your setup code here, to run once:
Serial.begin(9600);
esp8266.begin(115200);
connectwifi();
pinMode(a1,OUTPUT);
pinMode(a2,OUTPUT);
pinMode(a3,OUTPUT);
pinMode(a4,OUTPUT);
pinMode(Tri,OUTPUT);

pinMode(Echo,INPUT);
pinMode(r1,INPUT);
pinMode(r2,INPUT);
pinMode(r0,INPUT);
pinMode(led1,OUTPUT);
pinMode(led2,OUTPUT);
```

```
pinMode(ldr,INPUT);
pinMode(Ir,INPUT);

 start=millis();
}
void loop() {
  // put your main code here, to run repeatedly:
 v1=digitalRead(r0);
  v2=digitalRead(r1);
  v3=digitalRead(r2);

  while(!digitalRead(Ir))
   {
        sstop;

        Serial.println(digitalRead(Ir));

        v1=digitalRead(r0);
        v2=digitalRead(r1);
        v3=digitalRead(r2);

        if(v1==1&&v2==0&&v3==0)
        {
                front;
                break;
        }
        else if(v1==1&&v2==1&&v3==0)
        {
              left;
              break;
        }
        else if(v1==0&&v2==0&&v3==1)
        {
             right;
```

```
                    break;
            }
    }
 cm = ult();
Serial.println(cm);
while(cm<10)
{
            sstop;
            v1=digitalRead(r0);
            v2=digitalRead(r1);
            v3=digitalRead(r2);

            if(v1==0&&v2==1&&v3==0)
            {
                    back;
            }
            else if(v1==1&&v2==1&&v3==0)
            {
                     left;
            }
            else if(v1==0&&v2==0&&v3==1)
            {
                    right;
            }
            cm = ult();
}

  if(v1==1&&v2==0&&v3==0)
  {
    front;
  }
  else if(v1==0&&v2==1&&v3==0)
  {
    back;
```

```
  }
  else if(v1==1&&v2==1&&v3==0)
  {
    left;
  }
  else if(v1==0&&v2==0&&v3==1)
  {
    right;
  }
  else if(v1==1&&v2==0&&v3==1)
  {
sstop;
  }
gps_print();

Serial.print("latitude:");
Serial.println(lat,4);
Serial.print("longitude:");
Serial.println(lon,4);

 level = map(analogRead(A0), 0, 1023, 0, 100);
Serial.println(level);
  if(level>80)
  {
        digitalWrite(led1,1);
        digitalWrite(led2,1);
  }
  else
  {
        digitalWrite(led1,0);
        digitalWrite(led2,0);
  }

  if(millis()-start > 60000)
```

```
  {
        senddata();
        start=millis();
  }

}
int ult()
{
          long duration;
        int distance;

        digitalWrite(Tri,LOW);
        delayMicroseconds(100);
        digitalWrite(Tri,HIGH);

            duration=pulseIn(Echo,HIGH);
            distance=duration/2/29;

           return distance;
}

void sendcommand(String command, intmaxtime, charreadreply[])
{
           Serial.print(".at command =>");
           Serial.print(command);
           Serial.print(" ");

             while(maxtime--)
             {
               esp8266.println(command);
               if(esp8266.find(readreply))
               {
                 found=true;
                 break;
```

```
        }
    }

    if(found){
   Serial.println("OK Done");

    }
    else{
   Serial.println("Fail");

    }
    found= false;
}
void connectwifi()
{
   sendcommand("AT",5,"OK");
   sendcommand("AT+CWMODE=1",5,"OK");
   sendcommand("AT+CWJAP=\""+ssid+"\",\""+password+"\"",20,"OK");
}

void senddata()
{
   String getData1="GET /update?api_key="+api;
   String getData2="&field1="+String(level)+"&field2="+String(lat)+"&field3="+
   String(lon)+"&field4()="+String(Ir);
   sendcommand("AT+CIPSTART=\"TCP\",\""+host+"\","+port,5,"OK");

   sendcommand("AT+CIPSEND="+String(getData1.length()+getData2.length()+2)
   ,7,">");
   delay(10);
   esp8266.println(getData1+getData2);
   Serial.println(getData1+getData2);
   delay(1000);
   Serial.println("--------------------");
```

```
   }

void gps_print()
{
         unsigned long start=millis();

         while(millis()-start < 2000)
         {
           while(Serial.available())
           {
             if(gps.encode(Serial.read()))
             {
                gps.f_get_position(&lat, &lon);
             }
           }
         }
}
```

CHAPTER 7

TESTING

7.1 Introduction

Software testing is the main activity of evaluating and executing software with a view to find out errors. It is the process where the system requirements and system components are exercised and evaluated manually or by using automation tools to find out whether the system is satisfying the specified requirements and the differences between expected and actual results are determined. This paper at a high - level is divided into two sections. The first section covers optimized testing process, which elaborates all phases of the testing life cycle and the second section covers testing types. The first section emphasizes the main activities, which are Analysis [A], Planning and Preparation [P], Execution [E] and Closure[C]. Where closure includes release and root cause analysis activities and execution phase goes hand in hand with bug logging and tracking.

The software bug life cycle explained in the paper in the coming section highlights the mandatory steps for bug logging and tracking. The test preparation phase includes test case preparation, test case selection, test case optimization and test data preparation which is going to be elaborated later in this paper. There are lots of available testing types like black box testing, white box testing, state based testing, security testing, look and feel testing, acceptance testing, system testing, alpha and beta testing, and configuration based testing, verification and validation testing. Based on the research and study done this paper categorized all of them under three high - level testing types, which is Functional, Performance and Security (FPS).The last section deals with the conclusion, which shows relevance of our optimized software testing process and FPS as a basis for testing methods

7.2 Software Testing Types

There are various software testing techniques as per the research and study like black box, white box, grey box, regression, reliability, usability, performance, unit, system, integration, security, smoke, sanity and object oriented testing etc. It is impossible to perform all types of testing on a software as there is always fixed amount of time allocated for testing. Functional testing is very common and lots of research is done on them in past that’s why only in rare cases a site crashes due to lack of functional testing. The most recent failures happened in past are due to lack of Performance and Security testing. In 2014 Indian Railway site got crashed as it was not able to handle load of customers. Another failure in 2014 is of Delhi University (DU) online application form web site crash on last day of submission due to excessive load on site. Then there were instances in 2013 when Indian government sites were hacked by some external agencies. After analyzing and survey of all these techniques it is found that a right mix of testing types should be performed on a given software to ensure quality and overall reliable software. This paper will focus on the main testing techniques like Functional [F], Performance [P] and Security testing[S]. The right mix of testing should be included from all headers of F, P and S. Functionality is first and foremost aspect of software testing which ensure quality of software.

Verification and Validation is done using Static and Dynamic testing respectively. Static testing involves all types of reviews, inspections, and walkthroughs. Dynamic testing or actual validation involves all functional and non-functional testing types.

7.2.1 Functional Testing

The main quality factor in software is to meet its required functionality and behaviour. The functional part of software includes the external behaviour that mainly specifies all user requirements. The high level design of the software is produced so that the customer would be satisfied at an early stage of design and development. The functional testing revolves around the basic work flows and alternative flows of software. These flows can be represented by various use case diagrams like sequential diagrams, class diagrams, component diagrams etc. Automated Test cases are also generated by UML models. There are different types of functional testing methods and techniques which could be performed at various levels of testing i.e. unit testing, integration testing (top down and bottom up testing) and system testing.

There are lots of testing performed at various levels of testing like black box testing, white box testing, grey box testing regression testing, fuzz testing, use case testing, exploratory testing, smoke testing, sanity testing, acceptance testing, alpha, beta testing etc. Test cases are built around specifications and requirements i.e., what the application is supposed to do. The functional testing method basically focuses on “What” is supposed to do but not on “How”. Unit testing is usually done by developers. Integration testing and System testing is performed by testing team and user acceptance testing is mainly performed by end users or business team.

- **Unit Testing:-** The lowest level of testing mainly performed by developer to test the unit of code

- **Integration Testing: -** This is to test the communication between various modules to make sure data is flowing across various components correctly. This is done following either top-down approach OR bottom-up approach.
- **System Testing: -** The overall system is tested to ensure that it is behaving or functioning as intended and as specified in requirement document. Regression testing is performed to ensure that nothing is broken in system after fixing bugs and testing bugs. Overall Smoke and Sanity testing is performed to ensure all links and features are working and environment is stable.
- **Acceptance:-** Pre acceptance testing is performed mainly known as alpha and beta testing to ensure the customers are able to perform intended functionality and feedback is taken to further enhance quality of software.
- **White box and Black Box Testing:-** Black box testing is performed to ensure output of application is as correct for all various types of positive and negative inputs. There are various types of Black box testing types like Equivalence Class partitioning, Boundary value analysis, error guessing etc. White box deals with internal working of code to ensure there is no redundant code written in s

7.2.2 Manual Testing

Manual testing includes testing a software manually, i.e., without using any automated tool or any script. In this type, the tester takes over the role of an end-user and tests the software to identify any unexpected behaviour or bug. There are different stages for manual testing such as unit testing, integration testing, system testing, and user acceptance testing. Testers use test plans, test cases, or test scenarios to test a software to ensure the completeness of testing. Manual testing also includes exploratory testing, as testers explore the software to identify errors in it.

7.2.3 Automation Testing

Automation testing, which is also known as *Test Automation*, is when the tester writes scripts and uses another software to test the product. This process involves automation of a manual process. Automation Testing is used to re-run the test scenarios that were performed manually, quickly, and repeatedly. Apart from regression testing, automation testing is also used to test the application from load, performance, and stress point of view. It increases the test coverage, improves accuracy, and saves time and money in comparison to manual testing. It is not possible to automate everything in a software. Furthermore, all GUI items, connections with databases, field validations, etc. can be efficiently tested by automating the manual process.

When to Automate?

Test Automation should be used by considering the following aspects of a software:

- Large and critical projects
- Projects that require testing the same areas frequently
- Requirements not changing frequently
- Accessing the application for load and performance with many virtual users
- Stable software with respect to manual testing
- Availability of time

CHAPTER 8

RESULTS AND ANALYSIS

8.1 Snapshot 1

Fig. 8.1: The working model

8.2 Snapshot 2

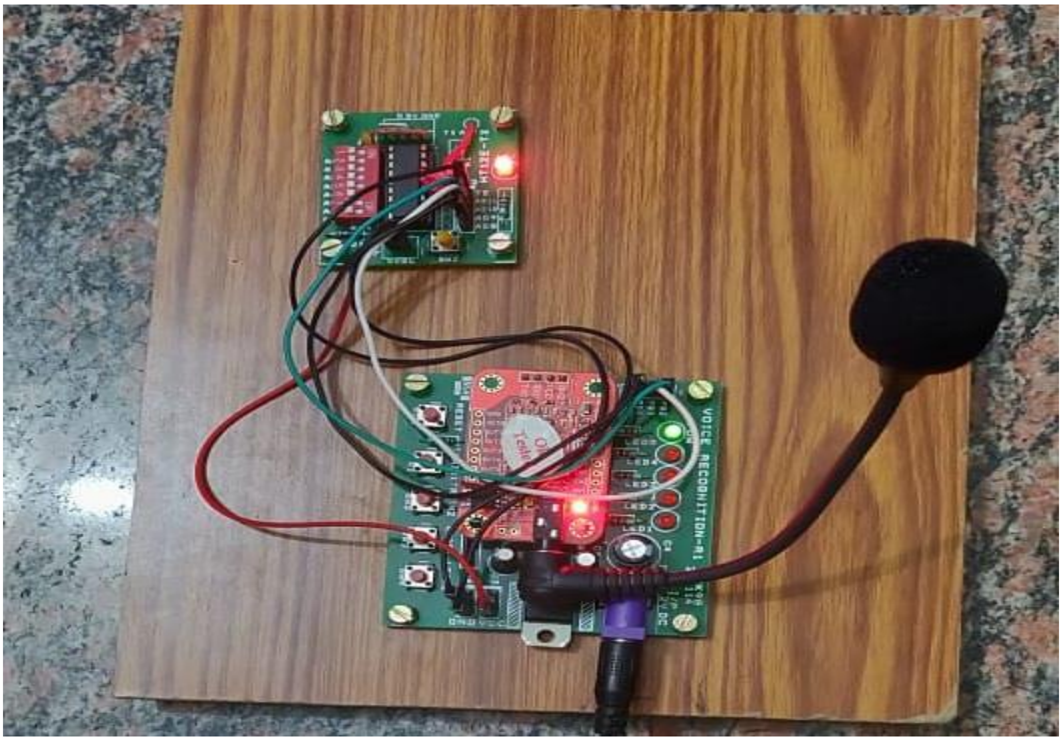

Fig. 8.2: Voice Control Transmitter

8.3 Snapshot 3

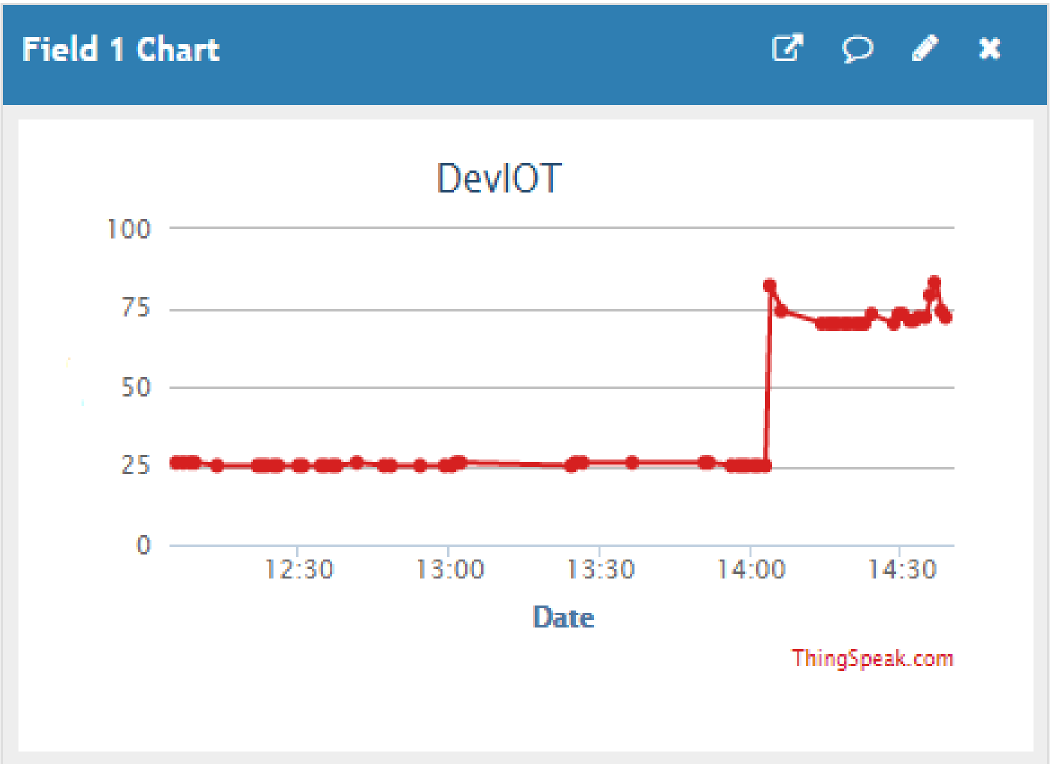

Fig 8.3: IR sensor

- IR sensor is connected to the Arduino to check whether any obstacle is coming in the way of car or not.
- If any signal is detected then the car will automatically stops and it waits for the command.
- This sensor is useful to avoid any kind of sudden accident to happen by detecting the obstacle.

8.4 Snapshot 4

Fig 8.4: Ultrasonic Sensor Data

- Ultrasonic sensor is used to measure the distance between the car and obstacle which is not possible to do with IR sensor.
- It is having a transmitter and a receiver through which is sends and receive the signal.

- It sends the ultrasonic signals and if they strike an object, then they are reflected back as echo signals to the sensor, which itself computes the distance to the target based on the time-span between emitting the signal and receiving the echo.

8.5 Snapshot 5

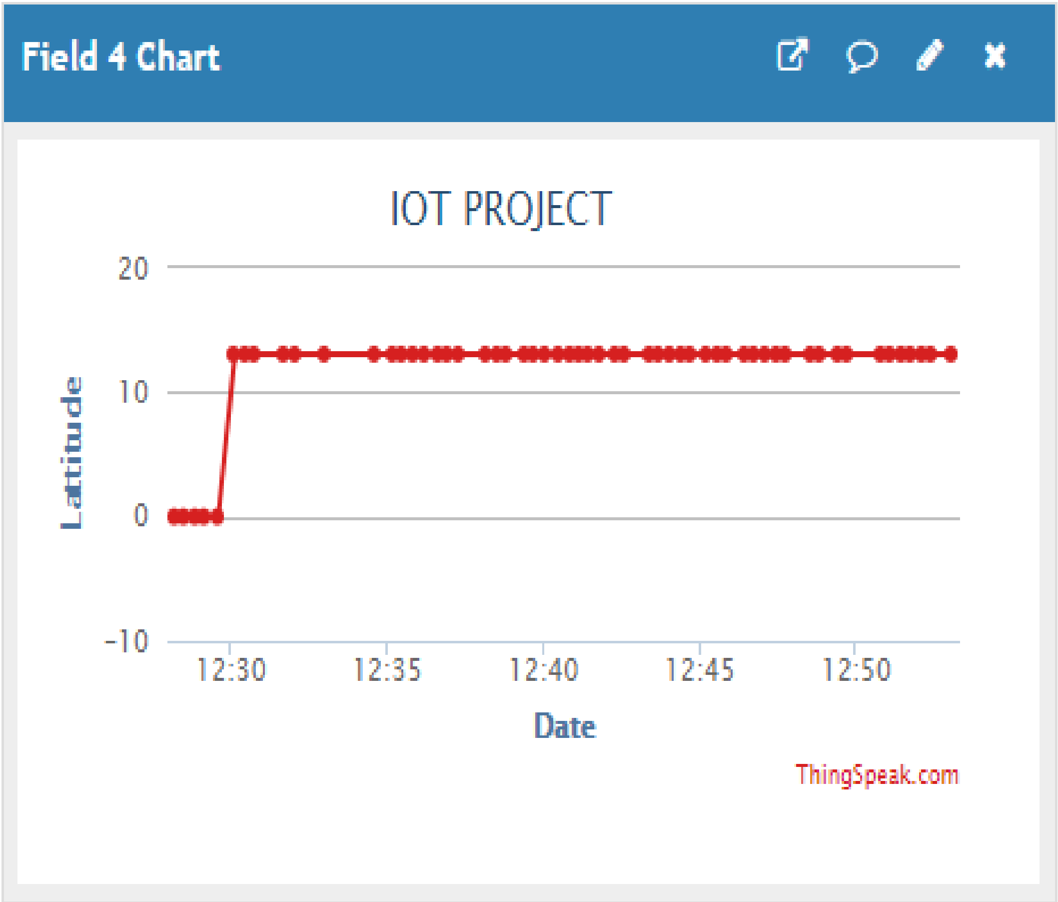

Fig 8.5: Latitude data

- The location of the car is obtained by the help of GPS sensor which is given in latitude and longitude.
- When the GPS starts getting the signal it generates a string value of latitude which is internally calculated and obtain the latitude position.
- This value is then forwarded to the Arduino and it shows the latitude position of the car.
- The obtained data is stored in the cloud for further access and monitoring.

8.6 Snapshot 6

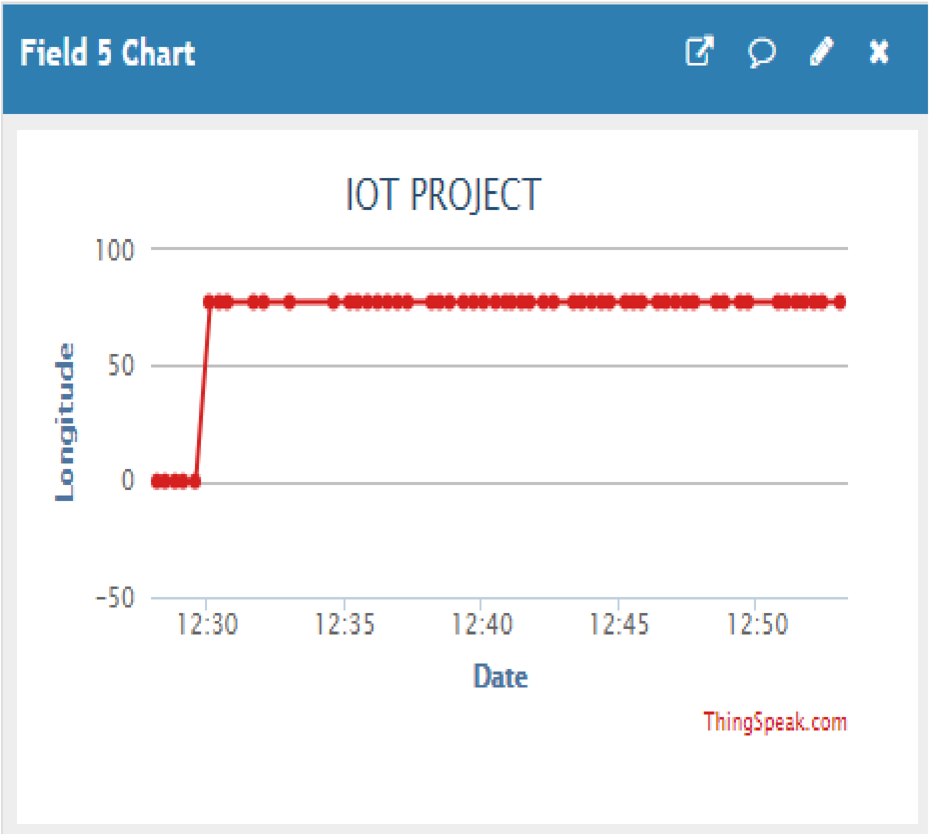

Fig 8.6: longitude data

- Similarly, when the GPS starts getting the signal it generates a string value of longitude which is internally calculated and obtain the longitude position.
- This value is then forwarded to the Arduino and it shows the longitude of the car.
- The obtained data is stored in the cloud for further access and monitoring.

CHAPTER 9

CONCLUSION AND FUTURE ENHANCEMENT

9.1 Conclusion

Today we find most robots working for people in industries, factories, warehouses, and laboratories. Robots are useful in many ways. For instance, it boosts economy because businesses need to be efficient to keep up with the industry competition. Therefore, having robots helps business owners to be competitive, because robots can do jobs better and faster than humans can, e.g. robot can built, assemble a car. Yet robots cannot perform every job; today robots roles include assisting research and industry. Finally, as the technology improves, there will be new ways to use robots which will bring new hopes and new potentials.

Robotics develops man made mechanical devices that can be moved automatically or with help of remote controls. Robotics technology is already in use in various different sectors like industrial, transportation, healthcare etc. The goal of robotic technology is to broaden the use and the effectiveness of the robots in various different fields. Robots are developed to perform multifarious activities for the welfare of the human being in the most integrated and planned manner by enhancing productivity and quality. Despite of the shortcomings and the problems faced, the robotics technology is yet to set a new era in the next decade and the tasks easier and smoother.

9.2 Futures Enhancement

- We can invoke technology so that the communication with the Arduino can even be made from miles.
- We can use the camera for the capturing live streaming movement of the car which will need huge storage in it.
- The robotic car further be invoked with the artificial intelligence.