HAPER – A REMOTE SENSING IOT ALTIMETER AND SONAR ENABLED ROBOT

BY

TANOY KUMER HALDER
ID: 171-15-8799

AND

MD. SHAON MAHMUD HANNAN
ID: 171-15-

This Report Presented in Partial Fulfillment of the Requirements for the Degree of Bachelor of Science in Computer Science and Engineering

Supervised By

Tajim Md. Niamat Ullah Akhund
Lecturer
Department of CSE
Daffodil International University

Co-Supervised By

Akib Zabed Khan
Lecturer
Department of CSE
Daffodil International University

DAFFODIL INTERNATIONAL UNIVERSITY

DHAKA, BANGLADESH

10th DECEMBER 2019

APPROVAL

This Project titled "Haper – a remote sensing iot altimeter and sonar enabled robot", submitted by Tanoy Kumer Halder and Md. Shaon Mahmud Hannan to the Department of Computer Science and Engineering, Daffodil International University, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of B.Sc. in Computer Science and Engineering and approved as to its style and contents. The presentation has been held on 10th December, 2019.

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_____

Dr. Syed Akhter Hossain — **Chairman**
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Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University

_____

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Faculty of Science & Information Technology
Daffodil International University

_____

Saif Mahmud Parvez — **Internal Examiner**
Lecturer
Department of Computer Science and Engineering
Faculty of Science & Information Technology
Daffodil International University

_____

Dr. Mohammad Shorif Uddin — **External Examiner**
Professor
Department of Computer Science and Engineering
Jahangirnagar University

DECLARATION

We hereby declare that, this project has been done by us under the supervision of **Tajim Md. Niamatullah Akhund, Lecturer, Department of CSE** Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere for award of any degree or diploma.

Supervised by:

_____
Tajim Md. Niamatullah Akhund
Lecturer
Department of Computer Science and Engineering
Daffodil International University

Co-Supervised by:

_____
Akib Zabed Khan
Lecturer
Department of Computer Science and Engineering
Daffodil International University

Submitted by:

_____
Tanoy Kumer Halder
ID: 171-15-8799
Department of Computer Science and Engineering
Daffodil International University

_____
Md. Shaon Mahmud Hannan
ID: 171-15-1497
Department of Computer Science and Engineering
Daffodil International University

ACKNOWLEDGEMENT

First, we express our heartiest thanks and gratefulness to almighty God for His divine blessing makes us possible to complete the final year project/internship successfully.

We really grateful and wish our profound our indebtedness to **Tajim Md. Niamatullah Akhund**, **Lecturer**, Department of CSE Daffodil International University, Dhaka. Deep Knowledge & keen interest of our supervisor in the field of "*IoT*" to carry out this project. His endless patience, scholarly guidance, continual encouragement, constant and energetic supervision, constructive criticism, valuable advice, reading many inferior drafts and correcting them at all stage have made it possible to complete this project.

We would like to express our heartiest gratitude to **Dr. Syed Akhter Hossain**, Professor, and Head**,** Department of CSE, for his kind help to finish our project and also to other faculty member and the staff of CSE department of Daffodil International University.

We would like to thank our entire course mate in Daffodil International University, who took part in this discuss while completing the course work.

Finally, we must acknowledge with due respect the constant support and patients of our parents.

ABSTRACT

“Haper” - A Remote Sensing IoT Altimeter Enabled Robot. This is a robotics undertaking and we named it “Haper”. The word “Haper” comes from the word helper. As our robot could be a human helper, that’s why we named it like this. To build this robot we use a spider chassis which has 8 legs. By these legs “Haper” can makes a circulate like forward-backward, left-proper and movement like 360˚ via following its consumer training. It also can circulate via rough surface. It may be managed over remotely and for this we use Bluetooth Module HC-05. It can be controlled with the aid of any RC automobile driving android app from an android smartphone. Its primary feature is degree air-pressure, altitude and temperature of an area (current place of “Haper”) with its altimeter and sensors. Our robotic has an OLED show to reveal the end result of its dimension. We use “Arduino Microcontroller” to run its all fundamental operations. After accumulating data, it's going to ship the accumulated data to a cloud server (ThingSpeak server) and notify the user via SMS over mobile cellphone. We wish “Haper” might be a completely helpful hand of its users. In this text we display our task evaluation and inner-external structure of our spider-like robot “Haper.”.

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1.1 Summary

"Haper" - A Remote Sensing IoT Altimeter Enabled Robot. This is a robotics project and we named it "Haper". The word "Haper" comes from the word helper. As our robot will be a human helper, that's why we named it like this. To build this robot we use a spider chassis which has 8 legs. By these legs "Haper" can makes a move like forward-backward, left-right and movement like 360˚ by following its user instruction. It also can move through rough surface. It can be controlled over remotely and for this we use Bluetooth Module HC-05. It can be controlled by any RC car driving android app from an android phone. Its main feature is measure air-pressure, altitude, humidity and temperature of an area (current location of "Haper") with its altimeter and sensors. Our robot has an OLED display to show the result of its measurement. We use "Arduino Microcontroller" to run its all basic operations. After collecting data, it will send the collected data to a cloud server (Thingspeak server) and notify the user via SMS over mobile phone. We hope "Haper" will be a very helpful hand of its users.

1.2 Problem Statement

We are living in the 21st century, the revolutionary era of technology. Mankind wants to develop their life and life-style by applying advanced technology. "Robotics Technology" is playing key-role to developing or changing life-style. Now-a-days robots are replacing human hand in every sector. The goal of this project is to enhance "Robotics Technology" by contributing little more advance features in a robot. As we know "Altimeter" is an altitude measurement tool, we marge an altimeter with a robot to measure altitude and air-pressure of a place where, no one cannot go or risk to go. Our robot, "Haper" - a remote sensing IoT altimeter enabled robot will be able to go that risky place and collect data for decrease the possible human risk.

1.3 Objectives

- To make a robot which can be able to go remote and risky places
- Will be able to run in any kind of surface
- Will be able to measure air-pressure, altitude and temperature of a targeted area
- Collected data will be displayed in an OLED display
- Collected data status will be sent to a cloud server via Wi-Fi or internet
- Notify the user about collected data via SMS over mobile phone.

1.4 Background

Every developer develops a new project for new possibilities of mankind. So are we and our motive to develop this project to make things useful and serve to mankind. There are lots of tasks needed to be done by the human with hard work and risking life. We want to decrease life risk and find out simplest methods for a specific job. Thus, our robot can replace people to risking their life and done a specific job for its user. Our robot small in size, low in cost and useful to collect data like

air-pressure, altitude, temperature. It can go through tiny and narrow spaces and also can climb upward slope.

1.5 Social Impact

Simplicity is a common human nature. People lives in a society and they want to do their every task in the simplest way they can. Our robot will be very helpful hand for the human society. It will be a great advantage for people by doing tasks with it. People can send the robot in very remote places and collect data about those places without risking their life.

1.6 Features

- "Haper" can go remote, rough and risky places
- It can go through tiny and narrow spaces and can climb upward slope
- Replace the human from risky tasks
- Collect data from a targeted area (Data like air-pressure, altitude, humidity and temperature)
- Transmit data from a targeted area
- A wireless controlled robot (as per instruction via android mobile phone)
- Transmit collected data to a cloud database over Wi-Fi or internet.

CHAPTER 2
LITERATURE REVIEW

2.1.1 Field of Robotics Technology

The tendency of latest developers inside the subject of robotics is to construct and amplify that shape of robots which can be a hit to function in human society and beneficial to assist in everyday existence. Thus, it turns into the vital factor of robotics research to develop such type of robot which can engage with humans. Now-a-days in numerous fields like robotics, remedy, fitness-science, neuro-technological know-how and so on, the Human-Robot Interaction (HRI) for socially assistive robotics utility may be very demandable. For huge amount of people of users, modern-day programs for robots in health and mastering are being evolved. The populace of Earth is growing older and it may be said that in the center of the twenty first century the number of over aged humans of 85 will be 3 and a half times extra than they may be now. It may be feasible that bodily and cognitive assistance will be wanted for lots of them. So, socially assistive robots for fitness may be an outstanding criterion for serving mankind. [1]

The Potential Field Methods (PFMs) for obstacle avoidance have creates its space and become extra famous in developers and researchers' mind inside the subject of robotics and mobile robots during the last few decades. It has been discovered by means of few researchers like Andrews, Hogan and khatib that is the idea of imaginary forces appearing on robots. In impediment avoidance programs for mobile robots, the PFMs are being maximum preferred approach for its great principle and characteristics which could be very fashionable and easy. It is feasible to put in force simple PFMs for quick and ideal consequences without any claiming and refining. The PFMs used for making off-line course making plans in 1985 via researcher Thorpe and the following year he and his fellow researcher advanced a generalized potential field approach which became the combination of worldwide and nearby path planning. [2]

Very Large Scale Robotic (VLSR) device is a robotic machine in which it could consist many (thousand or extra) self-sufficient robots. Now-a-days robots are inexpensive in charges, compact and more flexible in size, quicker and extra correct in outcomes. It can be said that, few years after business and army packages of VLSR device may also take the region of assembling, transporting, dangerous inspection, patrolling, guarding, attacking and so forth. The robots need to interact with human environment and need to be co-operative in behaviors to make powerful use of the VLSR systems for update of humans. An allotted-manipulate framework proposed by the writer to use the artificial capacity fields as manage laws. This technique lets in to outline pairwise ability legal guidelines for ordered pairs of components for the worldwide controller of a VLSR gadget. Each robot of a VLSR device can sense the environment of the capacity subject with its components and take movement underneath the consequent pressure. After experience the surroundings the machine defines the force laws and individual robots of the system operates in a dispensed manner by means of the pressure calculations. [3]

The author develops an algorithm to create custom schooling forces to "trick" motives into changing their goal-directed reaching actions to a pre-selected motion as an after-effect of version based totally at the contemporary research of neuro-adaptive manipulate. The reason of the pre-

selected motion to build a sinusoidal-shaped route from start to end point and that allows you to by no means seemingly be conveyed to the situation. In the pre-selected motion, the edition would result an alternation inside the feedforward command. In the end result it showed that once disposing of the pressure of a schooling length of 330 actions, tracks have been considerably moved towards the pre-chosen movement. By the 50-75 movements which accompanied the elimination of the training forces causes de-variation ("washed out"). Another test showed that suppressed vision of hand place and a detectable discount observed within the washout of after-outcomes and demonstrating that visual remarks of mistakes severely influences in mastering. However, the final experiment proven that when-outcomes had been additionally existent within the community of education-44% of major directional shift and created unpracticed motion directions to goals which become 60 different from the objectives used for training. These outcomes display that the capability for these methods can be beneficial to train motor skills and neuro-rehabilitation of mind-injured patients. [4]

During the previous couple of decades, the researchers and the builders are aiming to discover the solutions for the technical necessities of applied robotics. This reasons robotics evolution in robotics network. Robotics evolution dominated for human necessities. Putting industrial robots inside the factory for human protection came about a business revolution inside the early 1960s. Time passes and robotics evolution growing new technology daily. The new trends in robotics studies is to build such form of robots that can fulfill the human social desires. Robot manipulators, mobile robots and biologically inspired robots are those 3 exclusive regions of robotics which exchange our way of lifestyles. [5]

2.1.2 IoT (Internet of Things)

Internet of Things (IoT) alternate our way of computing and dominating in each quarter of laptop and robotics generation. In the Internet of Things there may be a community wherein many items surround us be on that network and act like an embedded machine. Radio Frequency IDentification (RFID) and sensor community technologies makes the invisible embedded gadget with statistics and verbal exchange systems. This machine makes consequences on massive statistics garage, procedure and presentation gadget into seamless, efficient and easily interpretable. This model delivered its offerings within the equal way to standard commodities. Virtual infrastructure can be provided by the cloud computing for included tracking devices, storage gadgets, analytics tools, visualization platforms and customer service. IoT works with present networks, community assets and clever connectivity. Results of this machine are already affected at the universal information and communique networks with the growing life of Wi-Fi and 4G-LTE wi-fi internet access. [6]

The Internet of Things (IoT), which additionally may be called because the Internet of Everything or the Industrial Internet is the new technological example of ordinary community of machines and gadgets. By this system each machines and gadgets may be capable of interacting with every other. For destiny computing and the technological development of industries, it's miles taken as one of the most critical areas of research and expand. Its value may be sincerely recognizable whilst linked gadgets are able to speak with every other to make matters less complicated and easier for human daily life. IoT makes massive effect on B2B and B2C business and additionally to reshape the manufacturing unit workflows, substances tracking and optimize of distribution fees. Manufacturers adopting IoT to increase their sales and more advantageous their offerings to turn out to be the marketplace chief. [7]

Now-a-days cloud-based totally garage, manage and compute records come to be as a fashion. Centralized records centers, IP networks and cell center networks are the new subject matters of computing, storage and community management capabilities. However, cloud-primarily based computing dealing with numerous challenges for brand new necessities of the rising Internet of Things (IoT). Fog provide you with the answer of these demanding situations of Cloud Computing. Fog is a smart architecture for computing and networking that will convey numerous computing services toward give up customers at the side of Cloud-to-Things. It covers traverses of software and hardware, cell and wireline, information plane unique cases like "Cloudlets" and manage plane unique cases like "Crowd-sensing." Fog is a structure and it supports applications variety of Internet of Things (IoT), Fifth Generation (5G) wireless systems and embedded Artificial Intelligence (AI) also. There are many Fog structure are available now like - Fog computing, Fog networking, Fog garage, Fog manipulate, collectively Fog. [8]

Internet technologies and Wireless Sensor Networks (WSN) take us in the era of technological advancement which was unimaginable a few decades earlier. Internet of Things (IoT) is such kind of technology where all physical objects can talk to each other. Advance sensor technologies like WSN, Nanotechnology, Miniaturization will be the key technologies of future IoT. Now it is possible by the gift of IoT to control house environment from outside. Home appliances manufacturer company modifying home appliances so smart with IoT that, changing human daily life-style. [9]

2.1.3 Spider Robots

We all know how complicated structure spider's internet is. Mostly flying species caught on the spider's net. Though it's so complicated, spider make it so effortlessly. We can say the equal element about era. It is also very complicated in nature, but if all and sundry try and recognize its nature it's far virtually very easy to recognize. Sometimes evidently a few components of develop generation so complex to make solutions. But every hassle has a totally simple solution and it had to be explored. If we are dealing with a completely complicated manner of a era then we need to discover the answer via gazing incident occurring around us. Environment hiding many more solutions from us to make it long sport. We need to explore the surroundings round us for beneficial technological answers of any type of complexity. [10]

Many robotics duties have to be executed by using legged robots. It is extra suitable legged robots to have interaction with the human surroundings. To construct a spider-like robot is not so smooth however complex. For the capability of robotics operation author makes an algorithm called PCG (brief for Partitioned Cubes Gaiting). They constructed a robotic which could circulate via exerting forces on tunnel wall can support towards gravity with the aid of frictionless contacts climbed underneath the mechanism. Normally, a spider-like robot has a least three legs for you to pass quasi statically in a planar tunnel. Two legged robots set its next circulate of foothold position by setting its unfastened leg to the following position however all through the three-legged robots' motion is occur via changing its inner geometry. [11]
We all recognize about the life of legged robots; however, researchers are greater worried about their dynamics and manage. Motion planning problems are the primary challenge to build multi-legged robotic. There are a totally few papers exist on movement planning issues of robots. The

creator attempts to build a simple spider-like robot and the version of this robotic has been inspired via the Ambler, a legged robotic developed at Carnegie Mellon University.
The motion making plans of this robots are types. First, the robotic set its feet on a available foothold and, 2nd, in function the robotic could be strong. Author makes a plan to hold robots viable and stable placement of its feet. [12]

Multi Legged hiking robots may be useful for commentary, exam and research unique environments. Multi Legged mountain climbing robots are extra appropriate for lots environments than wheeled robots. Author attempted to symbolize special varieties of spider-like hexapod mountaineering robotic for you to be the high-quality for extraordinary kinds of surfaces. It appears that, many mountaineering robots entire their moves of mountain climbing with vacuum suckers or magnets. But, climbing with these can be feasible if the floor is easy or magnetic. Outside of artificial environments, vacuum suckers or magnets are not very beneficial. This trouble may be solved by changing vacuum suckers or magnets with polymer foot layout. [13]

2.1.4 IoT Enabled Robots

Internet of Things (IoT) revolutionizing our contemporary technologies. The principal goal of IoT is "to attach the whole thing and everybody anywhere to the entirety and all people else". Now it's miles feasible Machine-to-Machine (M2M) communique by using the grace of IoT. A large variety of smart items can be able to talk with each different and can be inter-operational with human beings. IoT can interplay between robots and things. IoT-aided robotics applications will create such sort of digital environment in which humans, robots and IoT nodes engage on a cooperative basis. By the usage of this framework, the worried actors will be free to autonomously agree on stable communique principles, based totally on what sort of statistics they need to alternate or provide/access. Thus, the studies on IoT-aided robotics packages expand quick variety verbal exchange technology to huge scale. [14]

Now-a-days quadrotor is very not unusual with its on-board camera. Two or you will operate both the flight of the vehicle and the digicam operation. By quadrotor now it's miles very easy to inspection of pipelines, bridges and large structures and navigating very faraway area or tough to get right of entry to. There are many civil applications like search and rescue, traffic tracking, fire tracking and dangerous web sites inspection were carried out by means of quadrotor. It could be very useful for crime scene documentation, gathering intelligence and surveillance in regulation enforcement. Aerial images, videography, assets tests are also very common responsibilities which completing by quadrotor. By allowing independent manage with these quadrotors might be a whole lot greater advanced and beneficial to apply. [15]

Author try to gift an aquatic drone setup with a Raspberry Pi this is linked with an array of sensors for air and water excellent monitoring. For air best tracking he makes use of temperature, humidity and fuel sensors and for water hydrophone sensing unite carried out. It is prepared to encompass additional sensors for water quality tracking like turbidity, DO, conductivity and pH. [16]

2.1.5 Remote Sensing Robots

The concept of Precision Agriculture (PA) is newly emerged on farming control strategy. PA is an agricultural smart device wherein facts technology used to collect and manner facts for progressing

the understanding and management of soil and landscape sources in greater clean and green way. Coupling small multifunctional sensors onboard unmanned aerial robots guided by way of autonomous navigation structures allows Precision Agriculture. It assists farmers and allows automation in a few basic farming obligations. Automation in agriculture is still in an early stage. It is a way extra hard to apply automation in agriculture due to unstructured environment and vicious environmental situations like humidity, temperature, rain, dust and so forth. The fundamental element of PA is Remote Sensing (RS), wherein aerial imagery is one of the maximum used programs of RS techniques. [17-18]

Remote sensing programs are extensively used inside the area of Robotics. Gathering information with the aid of use of robot platforms provides many benefits in risky and harsh environmental situations without threat of harm to human beings. Robots can without problems pass such type of areas where human observers are not in shape or unable to go and robots are inexpensive to perform. In many domains like space exploration and navy reconnaissance, robots are very effective device for exploring targets of hobby. Advance integration, actuator layout and energy management allow to construct mass produced, inexpensive robotic additives. Now it is possible to build small and independent robots in big numbers at a price-powerful way. Remote sensing robots are now exceptionally easy to construct and set up. However, the coordination and manage of the activities of those robots creates many hard troubles like scalability, autonomy, flexibility of deployment, fault-tolerance and security. Author evolved a manage set of rules for Distributed Robotic Macro sensors (DRMs). [19]

The Aerosonde is a small robot air automobile which is designed to expect a extensive range of operations in a pretty bendy and inexpensive way. The first prototype of Aerosonde turned into flown in 1993 with viability of the platform and usual idea. By 1998, the improvement application of Mark-1 plane exceeded all requirements in a full operational trial by means of the Australian Bureau of Meteorology. Since 1998, a remarkable studies and development software has ended in significant upgrades to the aircraft and its operational systems and those now make bigger properly beyond the authentic idea. [20]

2.2 Problems in previous works

Previously, many researchers and developers develop two or multi-legged robots. Many of their robots are successful and well featured. We think the problem consists of those developments are model complexity and motion planning.

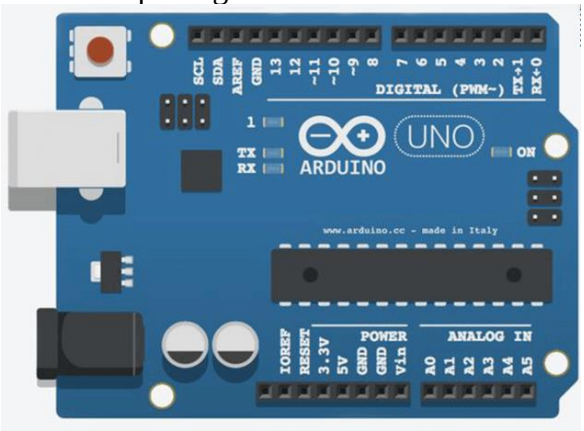
2.3 Solutions in our work

The nature of advance technologies is smarter and simpler to understand. In our project we address these concerns and we make a spider-like robot in the simplest way we can. We try to make it more flexible and simpler in nature and also well featured.

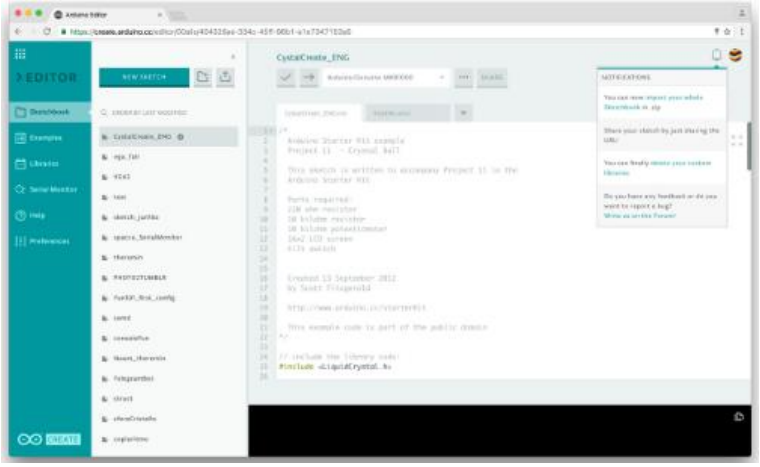
CHAPTER 3
REQUIREMENTS ANALYSIS

3.1 System Controlling Equipment's

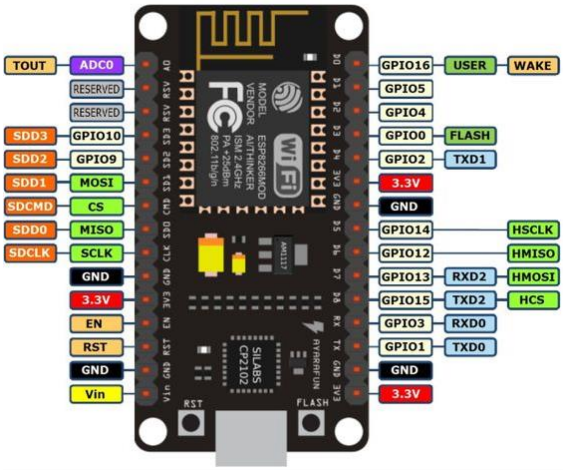
Arduino Microcontroller: Arduino is an open-supply platform to construct and broaden electronics initiatives. It is a combination of a bodily programmable circuit board, as a microcontroller and a software program or IDE (which run on computer to jot down programs for the physical board). It is a good platform and turn out to be very popular for whom are new in electronics. It permits developers to construct simple and complex electronics venture. A very simplified model of C++ language utilized in Arduino IDE. It breaks out the features of the microcontroller into a more on hand package.



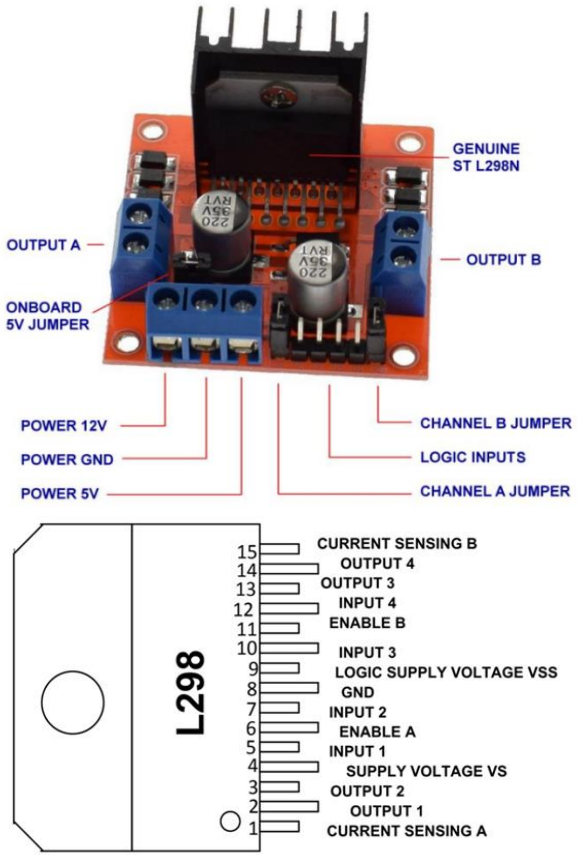
Arduino IDE: The Integrated Development Environment (IDE) of Arduino is a move-platform and that's written in Java programming language. It is used to put in writing and upload programs to Arduino well matched boards and also different vendor development board. Its supply code released under the GNU General Public License, model 2. The Arduino IDE helps C and C++ programming language the usage of unique guidelines of coding structure. It affords many common enter and output tactics by means of its software library. Written programs on it compiled and connected with a program stub main() into an executable cyclic govt software with the GNU toolchain included with the IDE distribution.



NodeMCU: NodeMCU is an open supply Lua firmware for ESP8266 WiFi-SOC build by way of Espressif and which uses an on-module flash-based SPIFFS document system. It is applied by using C and layered on the Espressif NON-OS SDK. It turned into first advanced as an accomplice undertaking for the popular DSP8266-based NodeMCU development modules, but now it's far community-supported and can be run on any ESP module.

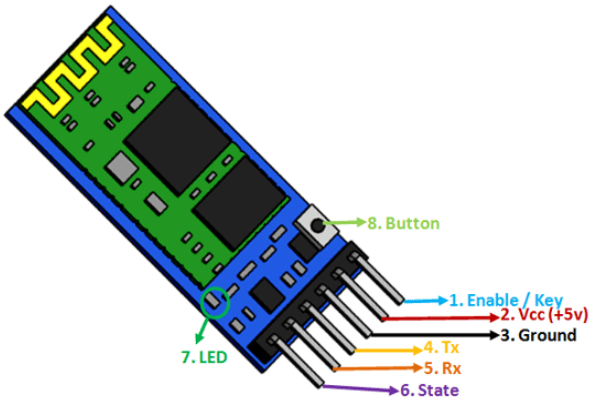


Motor Driver L298: L298 is a motor motive force which has a high voltage and excessive current and its chip gets TTS good judgment signals. It is used when a H-Bridge is needed and function into specific masses like motors and solenoid and many others. Its control unit can simplest offer TTL outputs. It can reach as much as 46v and might offer large quantity of modern-day, that can attain 3A. It has 25W rated energy with High-Voltage and Current complete-bridge driver with 2 H-Bridges used to power inductive hundreds like DC and Stepper Motors. It may be controlled with fashionable common-sense degree alerts. Its integrated stable tube 78M05 may be used to attain 5v from power supply. It has to be used with an outside 5v common sense deliver when more than 12v driving force voltage is carried out to defend the chip.

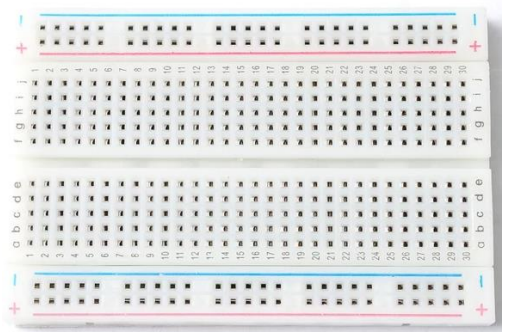


PinOut

Bluetooth Sensor HC-05: HC-05 is a Bluetooth module. This is designed for wi-fi communication. This module may be used in a master or slave configuration. Bluetooth serial modules permit all serial enabled gadgets to communicate with every different using Bluetooth generation. It is used for plenty packages which include wi-fi headset, recreation controllers, wireless mouse, wi-fi keyboard and many more consumer applications. It has range up to <100m. It is relying upon transmitter and receiver, atmosphere, geographic & city conditions. It is work on IEEE 802.15.1 standardized protocol, through which you possibly can build wi-fi Personal Area Network (PAN). It uses frequency-hopping spread spectrum (FHSS) radio technology for sending facts over the air. It uses serial verbal exchange to speak with different Bluetooth gadgets. It communicates with microcontroller the use of serial port (USART).

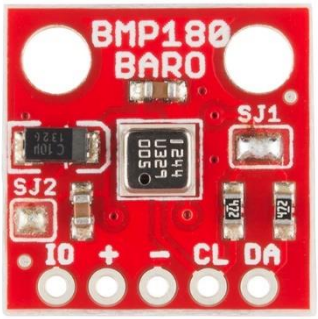


Breadboard: Breadboard such sort of electric powered equipment that could permit to make up brief circuits for trying out or to strive out an idea. There is not any soldering is needed to make connections, so it is easy to change connections and replace additives. Its elements are not got damage and it is also re-usable.



3.2 Data Collection Equipment's

BMP180: Bmp180 is one sort of sensor that may degree barometric stress and temperature. It is likewise can be usable as an altimeter. The sensor marge into a PCB with a 3.3v regulator, I2C level shifter and pull-up resistors on the I2C pins. It is built by way of Bocsh for low-value sensing solution.

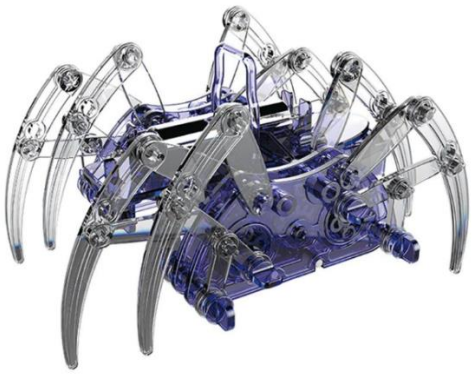


OLED Display: OLED stands for Organic Light Emitting Diode and additionally known as Organic Electroluminescent Diode. OLED generation contrasts starkly with LCD and plasma presentations. Unlike different display technologies, OLED shows use natural compounds that

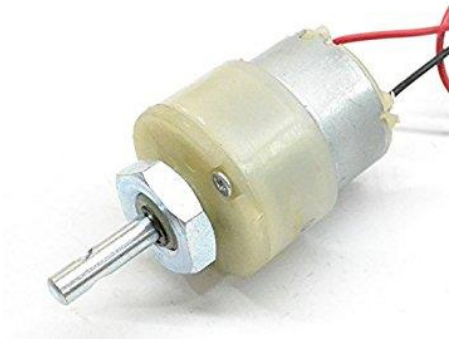
consist of carbon and other substances to create colorings. Each shade represented on the display screen has a distinct combination of carbon and different elements. When you switch on your TV or phone, the strength activates the OLEDs sitting inside your show, which light up or turn off based on what the image calls for. Because OLED would not require a backlight, it is considered an emissive generation. That singular feature the ability for OLEDs to show completely off creates so-referred to as proper blacks.

3.3 Other Equipment's

Chassis: A chassis is the bodily frame or shape of a vehicle, an airplane, a computing device computer, or other multi-element device. Case may be very similar in which means, however has a tendency to connote the protective element of the frame in place of its shape. People generally tend to choose one time period or the opposite. The rest of this definition makes use of chassis however applies as nicely to the time period case. Both terms (and casing) are derived from the Vulgate Latin for container. The plural shape is likewise chassis.



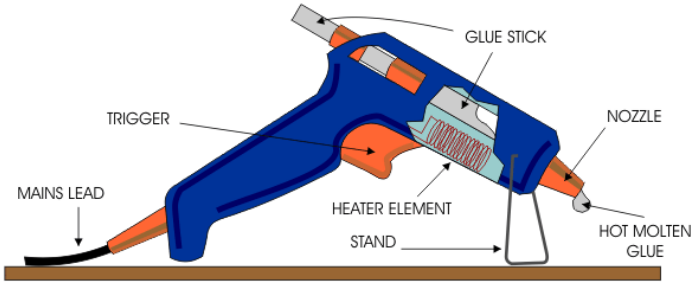
DC gear Motor: DC motors convert electric electricity to mechanical energy, and the velocity of the motor can be changed with variable supply voltage. DC geared automobiles are a form of DC motor with a gear assembly is attached. This will increase the torque and decreases the speed to be used in digital gadgets that require specific speeds.



DC geared motors can be used in any electronic items that require gears.

Battery: Batteries are a group of 1 or greater cells whose chemical reactions create a glide of electrons in a circuit. All batteries are made of three basic additives: an anode (the '-' facet), a cathode (the '+' facet), and some form of electrolyte. When the anode and cathode of a battery is hooked up to a circuit, a chemical response takes region between the anode and the electrolyte. This reaction reasons electrons to flow via the circuit and back into the cathode where another chemical reaction takes place. When the fabric in the cathode or anode is fed on or now not capable of be used within the reaction, the battery is unable to provide electricity. At that factor, your battery is "useless."

Glue Gun: To create lovely areas, you have to have the perfect equipment. This handy glue gun is the precise device to tackle all of your redecorating initiatives. Simply observe glue with just the squeeze of the trigger. A high temperature glue gun creates a strong bond for difficult materials which includes wooden, plastic, thicker fabrics or some thing this is exposed to out of doors climate.



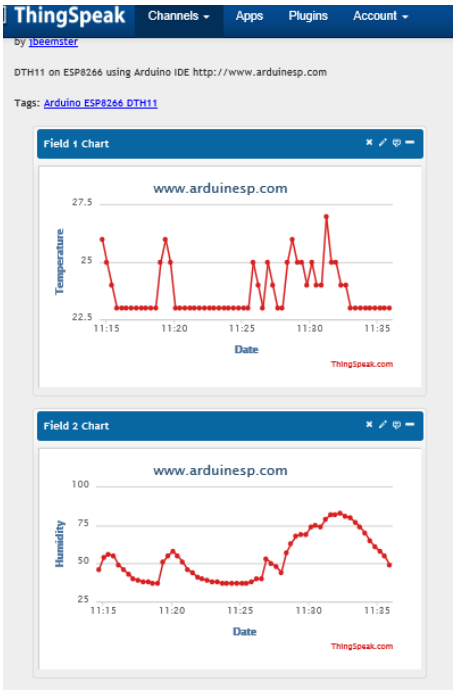
Charger: A Mobile Battery Charger, is a type of energy supply referred to as Switched Mode Power Supply. It offers a Constant Voltage (CV) and a Constant Current (CC) to the Battery, supplying it with the electricity required to charge it. Generally, the Voltage is 5V DC, and the Current is zero. Five A or 1 A. The manner it really works is, it takes the 220/a hundred and ten V AC from the Wall Socket, rectifies it and Converts it into DC Voltage, filters it and Passes it

thru a High Frequency (> than 20Khz usually) Semiconductor transfer, generally a MOSFET or BJT.

Wires: More frequently than now not, the terms wire and cable are used to explain the identical factor, but they're actually quite one-of-a-kind. Wire is a single electrical conductor, while a cable is a collection of wires swathed in sheathing. The term cable at first mentioned a nautical line of more than one ropes used to anchor ships, and in an electrical context, cables (like wires) are used to hold electric currents. The National Electrical Code (NEC) and Local Building Codes alter the way of installation and the kinds of wires and cables for numerous electrical programs.

3.4 Server and Programming Language

ThingSpeak: The Internet of Things(IoT) is a machine of 'linked matters'. The matters usually incorporate of an embedded operating system and a potential to speak with the internet or with the neighboring things. One of the key elements of a familiar IoT machine that bridges the various 'things' is an IoT service. A thrilling implication from the 'things' comprising the IoT structures is that the things through themselves cannot do whatever. At a naked minimal, they must have a capacity to hook up with different matters. But the actual electricity of IoT is harnessed whilst the matters hook up with a 'provider' either immediately or thru other 'matters'. In such systems, the provider performs the role of an invisible manager by way of presenting capabilities ranging from easy records series and tracking to complex statistics analytics.



C++ Language: C++ is a well-known-motive object-oriented programming (OOP) language, evolved by way of Bjarne Stroustrup, and is an extension of the C language. It is therefore viable to code C++ in a "C style" or "item-orientated style." In certain eventualities, it is able to be coded in either way and is for that reason an powerful instance of a hybrid language. C++ is taken into consideration to be an intermediate-level language, because it encapsulates each excessive- and coffee-degree language features. Initially, the language become known as "C with instructions" because it had all of the houses of the C language with an extra idea of "instructions." However, it become renamed C++ in 1983.

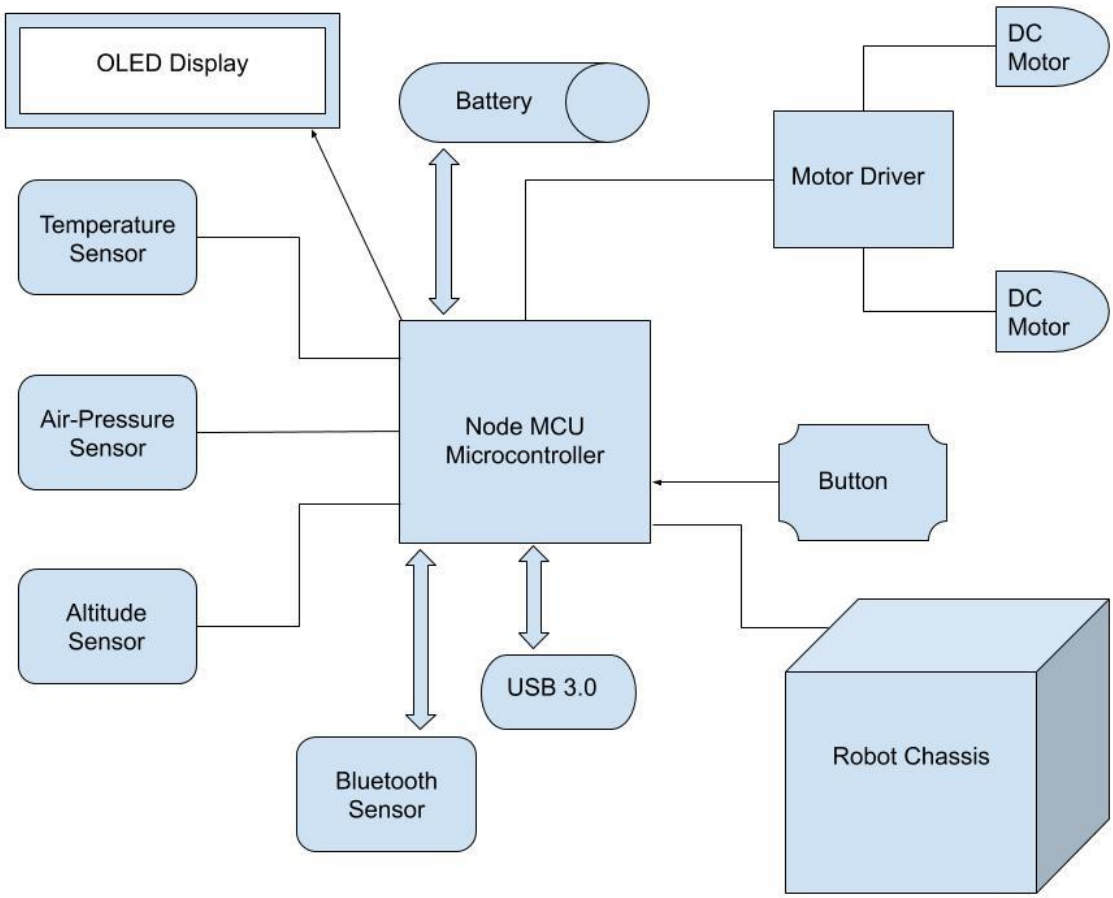
```
#include <iostream>
using namespace std;
int main()
{
    cout << "Hello World" << endl;
    return 0;
}
```

CHAPTER 4
IMPLEMENTATION AND RESULT ANALYSIS

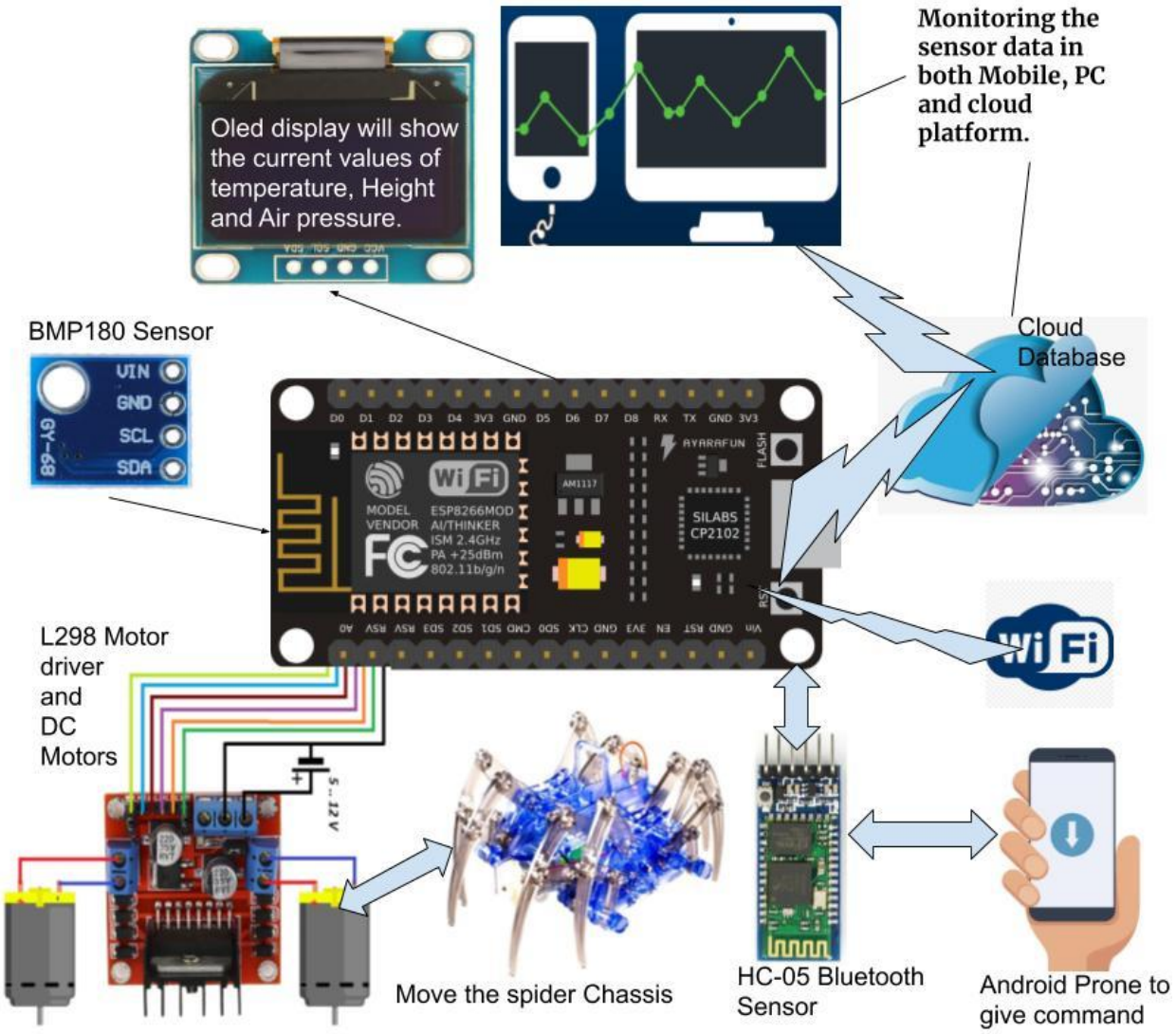
4.1.1 Working Procedure

I. It measures Air pressure with BMP 180 sensor.
II. It measures Temperature.
III. It measures Altitude with BMP 180 sensor.
IV. The full system can be controlled wirelessly with android mobile phone.
V. It is a spider robot and it can overcome minor obstacles.
VI. It can shift easily left and right.
VII. It can send the collected data to a cloud database through Wi-Fi.

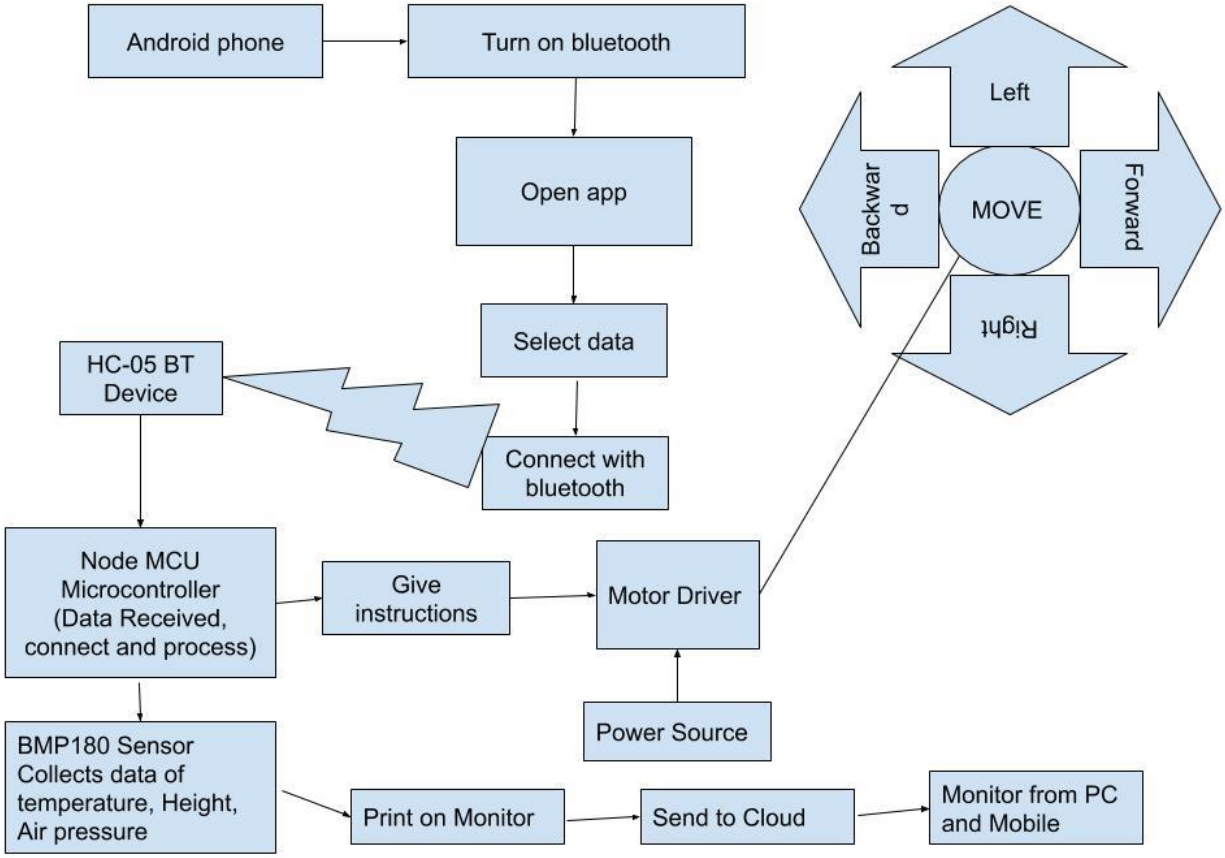
4.1.2 Block Diagram/Architecture



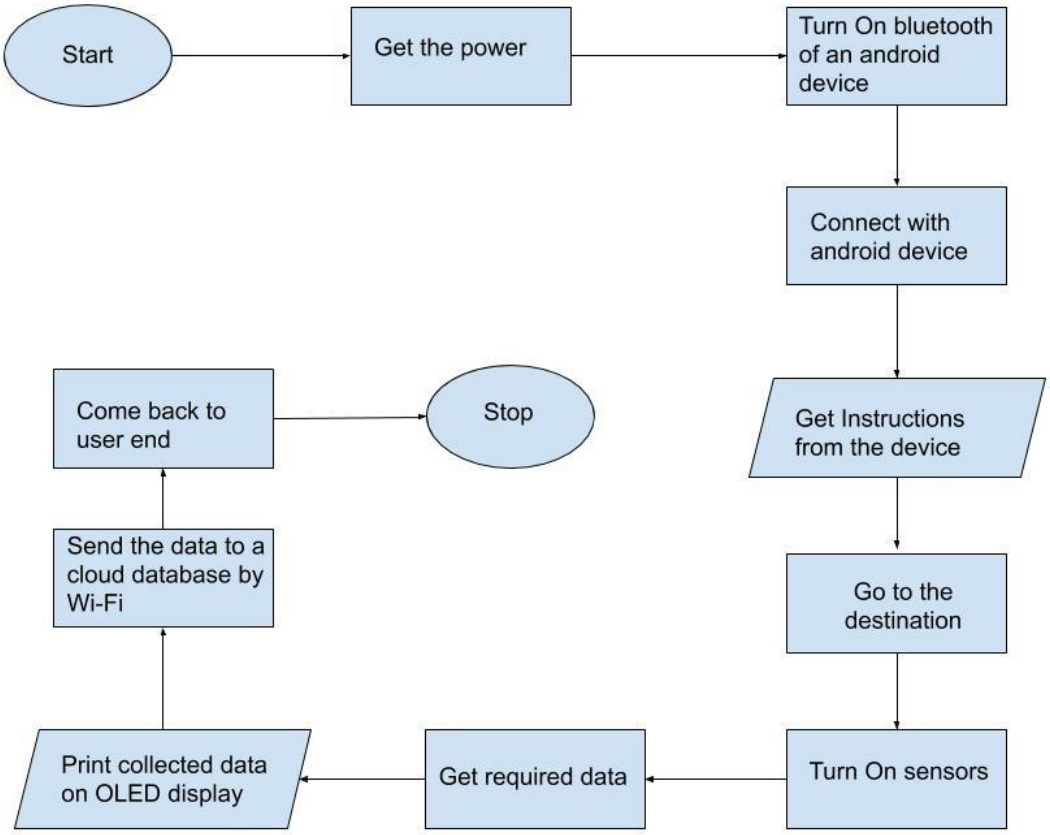
4.1.3 Conceptual Circuit Diagram:



4.1.4 Full System Diagram:



4.1.5 Flow Chart



4.1.6 Algorithm

I. Power On the robot.
II. Turn the Bluetooth "On" of the android phone or PC.
III. Connect the robot with android phone or PC.
IV. Give instructions from the phone or PC
  A. Forward
  B. Backward
  C. Left
  D. Right
V. Go to the targeted area by the instructions.
VI. Turn On sensors.
VII. Collect data by built-in sensors
  A. Air-pressure Sensor
  B. Altitude Sensor
  C. Temperature Sensor
VIII. Show the collected data on OLED display.

IX. Send the data to a cloud database with Wi-Fi.
X. Come back to the user end.
XI. Stop.

4.2.1 Results Discussion:

I. Project completion status - 90%
II. Successful power on status of the robot with 2 battery of 3.7 volt each - 100% (Based on 56 times test result)
III. Successful bluetooth connectivity status - 87.5% (49 time successful out of 56)
IV. Receive right instruction from mobile - 96.43%
V. Movement 360˚- 100%
VI. Data collection rate:
    A. Air-Pressure - 92.37%
    B. Altitude - 91%
    C. Temperature - 87%
VII. Display collected data on OLED display - 100%

//Pending issue - Set OLED display and Send the collected data to a cloud database with Wi-Fi.

CHAPTER 5
CONCLUSION AND FUTURE WORK

We successfully done the designing and development of our final project. Our robot "Haper" make success on air-pressure measurement and also temperature with altitude. Its given data 95% accurate. In future we want to work with inferred laser system in our project. Due to accounts problem we are now unable to complete this robot with inferred laser system. We hope that in future we can modify this robot with motion detection system as well as sonar system. Finally, we want to use AI technology in our robot.

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