

LORA BASED SMART ROBOT CONTROL

Submitted in partial fulfilment of requirements for the award of

Bachelor of Engineering in

Electronics and Communication Engineering

By

SHAIK RASOOL (37130372)

SHAIK MAHABOOB SHAREEF (37130369)



DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHOOL OF ELECTRICAL AND ELECTRONICS

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

**Accredited with Grade "A" by NAAC
JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI – 600119**

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BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of SHAIK RASOOL (Reg.No.37130372) and SHAIK MAHABOOB SHAREEF (Reg.No.37130369) who carried out the project entitled "**LORA BASED SMART ROBOT CONTROL**" under our supervision from December 2020 to March 2021.

Internal Guide

Dr.A.SAHAYA ANSELIN NISHA M.E., Ph.D.

Head of the Department

Dr.T.RAVI M.E., Ph.D.

Submitted for Viva voce Examination held on _____

Internal Examiner

External Examiner

DECLARATION

We, SHAIK RASOOL (Reg.37130372) and SHAIK MAHABOOB SHAREEF(Reg.37130369) hereby declare that the Project Report entitled “**LORA BASED SMART ROBOT CONTROL**” done by us under the guidance of Dr.A.SAHAYA ANSELIN NISHA M.E., Ph.D. is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering degree in Electronics and Communication Engineering

1.

Shaik Rasool.

2.

Shaik Shareef.

DATE:

PLACE:

Signature of Candidates

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ABSTRACT

A communication system, which employs Zigbee and Lora communication protocols is meant, developed, and tested during this experimental paper. The designed system contains a central receiver unit with Lora and Zigbee transceiver modules, a microcontroller, a Wi-Fi network with Lora and Zigbee transceiver modules, and a I298N unit. In the sensor card can be remotely or cloud-based controlled, and the robot location can be sent to the central receiver unit by using the Zigbee or Lora transceiver modules.

Taking advantage of the complementing performances of Zigbee and Lora wireless technologies, a diversified communication system with smart features is proposed, designed, and tested during a single IOT system.

As an emergent research area by which swarm intelligence is applied to multi-robot systems swarm robotics (a very particular and peculiar sub-area of collective robotics) studies how to coordinate large groups of relatively simple robots through the utilization of local rules. It specialise in studying the planning of huge amount of relatively simple robots, their physical bodies and their controlling behaviors. Since its introduction in 2000, several successful experimentations had been realized, and till now more projects are under investigations. This paper seeks to offer an summary of this domain research; for the aim to orientate the readers, especially those that are newly coming to the present research field.

This work includes the advancement of calculations that control the development of gathering robots. A bunch of two moving robots was set up and every robot is constrained by a microcontroller and moving vehicle. The robot speaks with a far off organisation. Data about the area of the robot is send and gotten by the worker, and clients can likewise get to the data progressively utilizing the UI(web application). The places of every of two portable robots are resolved dependent on the zigbee study. as per our tests differently, the high level calculation can handle the development of the robot at a choosen area inside the house.

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CHAPTER 1

INTRODUCTION

Swarm robotics is a field of multi-robotics in which large number of robots are coordinated in a distributed and decentralized way. It is based on the use of local rules, and simple robots compared to the complexity of the task to achieve, and inspired by social insects. Large number of simple robots can perform complex tasks in a more efficient way than a single robot, giving robustness and flexibility to the group. In this article, an overview of swarm robotics is given, describing its main properties and characteristics and comparing it to general multi-robotic systems. A review of different research works and experimental results, together with a discussion of the future swarm robotics in real world applications completes this work.

In the present day, technology has so improved that an Unmanned Aerial Vehicle (UAV) also called as Drone can be controlled from a distance ranging from 2km to 20,000km. The Mars Rover, which was sent to Mars to explore various features of the planet is an autonomous robot which is programmed such that it performs the desired task as it is intended to do. There are many such systems which are controlled either by Radio Frequency transmission or by creating intelligence. Robots are called Non autonomous robots. These robots have the programming logic to do the desired task but the decision power lies in the hand of controller (human) handling the robot .Here the interface can be made using two methods Wired.

The connection between controller and robot is maintained using wired interface. This interfaces can be serial or parallel but the technology is transmission of signal, which is sent in the form of specific pattern to the robot to carry out the specific task, these patterns with the help of a microcontroller governing its motion. Here the connection between controller and robot is achieved by wireless interface such as:

Bluetooth

Wi-Fi

The underlying technology is transmission of signals wireless in air by transmitter which is captured by the receiver and sent to microcontroller mounted on the robot to carry out the task. At the present demand for robots in this developing world to carry out work effectively.

1.1 EXISTING SYSTEM

In existing system there is no group of motion of the robot to robot communication.

In existing system robots operation was done by individually with remote or automatic moving operation.

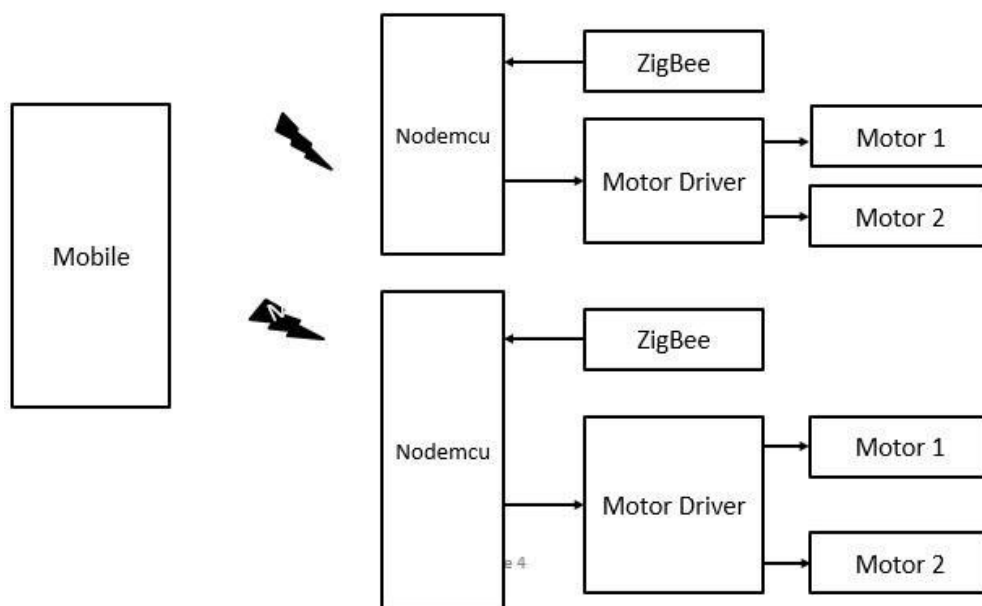
1.2 PROPOSED SYSTEM

The four mobile robots were able to perform a group motion and communicate through the LoRa Wan. The robots were able to successfully reach their target destinations with lower power consumption.

Since energy consumption was very important for the robot to sustain their service while navigating through the area, we found that using LoRa could help extend the longer period for robot to function.

The ZigBee navigation was able to assist the robot for navigation but the efficiency was only about 85.38%. Therefore, future work should focus on improving the accuracy of the ZigBee localization system as part of improving the efficiency of the system.

More data streaming from sensors on the robots which caused delay needed to be addressed. Our experiment presented that a group of mobile robots can function at the same time and can communicate among each other successfully through the LoRa Wan. The similar features could be applied in industrial logistic in factories.



1.1 Block diagram of lora based smart robot control

1.3 HARDWARE REQUIRED

Nodemcu

ZigBee transceivers Motor driver

Motor

1.4 OBJECTIVE

The four mobile robots were able to perform a group motion and communicate through the lora Wan. The robots were able to successfully reach their target destinations with lower power consumption. Since energy consumption was very important for the robot to sustain their service while navigating through the area, we found that using lora could help extend the longer period for robot to function.

The zigbee navigation was able to assist the robot for navigation but the efficiency was only about 85.38%. Therefore, future work should focus on improving the accuracy of the zigbee localization system as part of improving the efficiency of the system. More data streaming from sensors on the robots which caused delay needed to be addressed. Our experiment presented that a group of mobile robots can function at the same time and can communicate among each other successfully through the lora Wan. The similar features could be applied in industrial logistic in factories.

The lora based system can overcome the challenge of low power communication. An application has been developed to use a smart phone to control and monitor the target appliances through the lora module. ... Furthermore, lora wan can handle the data losses when different nodes are increased to 1000 per gateway. lora wan is a cloud-based medium access control (MAC) layer protocol but acts mainly as a network layer protocol for managing communication between LPWAN gateways and end-node devices as a routing protocol, maintained by the lora Alliance. Semtech innovation, lora devices offer compelling features for IoT applications including long range, low power consumption and secure data transmission. The technology can be utilized by public, private or hybrid networks and provides greater range than Cellular networks

1.5 MOTIVATION

This work involves the development of an algorithm to control a group motion of mobile robots. A group of two mobile robots was developed while each of them was controlled to move by the microcontroller and electrical motors. The robots communicate through long range wide area network. The information regarding the position of the robot were sent and received through the server while user can also obtain the information in real time through a user interface (web application). The locations of all four mobile robots were determined based on the zigbee were also used as part of the route planning. Based on our experiment with different paths, the developed algorithm was capable of controlling the motion of the robots in the indoor designated area.

The choice of Zigbee is motivated by the fact that it is a network specification for low-power Wireless Personal Area Networks (WPANs) and supports a large number of nodes. JiasongMuLiangHan et.al said that The ZigBee network is widely studied and deployed recently because of its low cost and simplicity features.

CHAPTER 2

LITERATURE SURVEY

Sreerenjini C. Nair; Erik M. Coronado; Michael T. Frye; Yong Qin et.al (2010) This paper investigates the science of sensory and sensorimotor systems that enable navigation and natural flight in insects with application to the collaborative control of robots. The authors discuss fundamental research being conducted at the Autonomous Vehicle Systems Lab located at the University of the Incarnate Word on developing biologically inspired robots that emulate insect foraging and search behavior. The objective of this talk is to highlight the different applications of the rapidly emerging field of swarm intelligence in solving complex problems of traditional and swarm robotics.

Belkacem Khaldi, Cherif Foudil et.al (2019) As an emergent research area by which swarm Intelligence is applied to multi- robot systems; swarm robotics (a very particular and peculiar sub-area of collective robotics) studies how to coordinate large groups of relatively simple robots through the use of local rules. It focuses on studying the design of large amount of relatively simple robots, their physical bodies and their controlling behaviors. Since its introduction in 2000, several successful experimentations had been realized, and till now more projects are under investigations.

Belkacem Khaldi et.al (2015) As an emergent research area by which swarm intelligence is applied to multi-robot systems; swarm robotics (a very particular and peculiar sub-area of collective robotics) studies how to coordinate large groups of relatively simple robots through the use of local rules. It focuses on studying the design of large amount of relatively simple robots, their physical bodies and their controlling behaviors. Since its introduction in 2000, several successful experimentations had been realized, and till now more projects are under investigations. This paper seeks to give an overview of this domain research; for the aim to orientate the readers, especially those who are newly coming to this research field. General Terms Swarm robotics, swarm intelligence, multi-robot systems

Dayal R. Parhi et.al (2010) This research investigates the application of swarm intelligence principles for the co-operative behavior of autonomous collective robots. Using swarm intelligence technique robots are able to get their optimized path during navigation. A successful way of structuring the navigation task deals with the issue of co-operative behavior among multiple mobile robots. Using Ant Colony Optimization, robot path planning in two-dimension environment is studied. In this paper the current study introduces the

intelligent finding optimum mechanism of ant colony. The theory has been tested both in simulation and experimental modes.

Ying Tan et.al (2013) The research progress of swarm robotics is reviewed in details. The swarm robotics inspired from nature is a combination of swarm intelligence and robotics, which shows a great potential in several aspects. First of all, the cooperation of nature swarm and swarm intelligence are briefly introduced, and the special features of the swarm robotics are summarized compared to a single robot and other multi-individual systems. Then the modeling methods for swarm robotics are described, followed by a list of several widely used swarm robotics entity projects and simulation platforms. Finally, as a main part of this paper, the current research on the swarm robotic algorithms are presented in detail, including cooperative control mechanisms in swarm robotics for flocking, navigating and searching applications

Rafael Stubs Parpinelli, Heitor Silvério Lopes et.al (2012) Natural swarms have generated various theories which have already been applied across several domains to address similar engineering challenges, from routing in communication network to combinatorial optimization and even multi robot systems, and so much more [31]. The foraging behavior of ant colonies in figuring out the shortest trajectories from their nesting sites to sources of food is one source of motivation; Then there is the behavior witnessed in flocking birds when they move together through vast distances to find food resources; Or indeed the collective movement observed in the various behaviors of fish schooling [32]. One of the key benefits of the distributed strategy is its superior suitability in dealing with the system's [35]. One way to secure modest global coherence within the entire system is to encourage interaction between the units of the system up to a level that could ensure global cohesion in the decision [31]. Arguably, since group achievement is expected to exceed the sum of individual unit performance, such cooperation only becomes possible unless the units are highly autonomous.

Manuele Brambilla, Eliseo Ferrante, Mauro Birattari et.al (2013) Swarm robotics is an approach to collective robotics that takes inspiration from the self-organized behaviors of social animals. Through simple rules and local interactions, swarm robotics aims at designing robust, scalable, and flexible collective behaviors for the coordination of large numbers of robots. In this paper, we analyze the literature from the point of view of swarm engineering: we focus mainly on ideas and concepts that contribute to the advancement of swarm robotics as an engineering field and that could be relevant to tackle real-world applications. Swarm

engineering is an emerging discipline that aims at defining systematic and well founded procedures for modeling, designing, realizing, verifying, validating, operating, and maintaining a swarm robotics system. We propose two taxonomies: in the first taxonomy, we classify works that deal with design and analysis methods; in the second taxonomy, we classify works according to the collective behavior studied. We conclude with a discussion of the current limits of swarm robotics as an engineering discipline and with suggestions for future research directions

Levent Bayindir et.al (2007) Swarm robotics is a new approach to the coordination of large numbers of relatively simple robots. The approach takes its inspiration from the system-level functioning of social insects which demonstrate three desired characteristics for multi-robot systems: robustness, flexibility and scalability. In this paper we have presented a preliminary taxonomy for swarm robotics and classified existing studies into this taxonomy after investigating the existing surveys related to swarm robotics literature. Our parent taxonomic units are modeling, behavior design, communication, analytical studies and problems. We are classifying existing studies into these main axes. Since existing reviews do not have enough number of studies reviewed or do have less numbers of or less appropriate categories, we believe that this review will be helpful for swarm robotics researchers

2.1 SUMMARY

To complete a mission, swarm robotics employs many robots in a distributed architecture. The framework is resilient to individual robot failures and versatile in its ability to add or delete robots as the task size shifts, thanks to its distributed architecture. As we saw in the examples of robots combining, a distributed architecture can perform tasks that individual robots cannot.

CHAPTER 3

EMBEDDED SYSTEMS

3.1 OVERVIEW OF EMBEDDED SYSTEMS

An embedded system may be a special-purpose computing machine that is programmed to perform one or a few specific functions, often under time constraints. It's normally incorporated as a part of an entire Hardware and mechanical components are included in the device. A general-purpose machine, on the other hand, is used for a variety of tasks., sort of Using programming, a personal computer can perform a variety of tasks. Embedded systems have become increasingly important in today's world, as they power many of the everyday devices we use.

Since the embedded system is committed to a specific purpose, design engineers may tweak it to make it smaller and less expensive.of the product while increasing its reliability and efficiency. Embedded devices are mass-produced in some cases.Taking advantage the importance of economies of scale cannot be overstated. Small portable devices like digital watches and MP3 players to large stationary structures like traffic lights, factory controllers, and nuclear power plant control systems are all examples of embedded systems.Complexity ranges from low to very high, depending on how many devices, peripherals, and networks are placed within.an outsized Enclosure or chassis in general, "embedded machine" isn't a well-defined concept since a large number of devices can be programmed in some way Handheld computers, for example, have many features in common with embedded systems, such as the operating systems and microprocessors that power them, but they aren't entirely embedded systems because they allow for different applications and peripherals.to be connected.

Embedded systems perform a variety of tasks, including monitoring the environment. Data from input sensors is interpreted by embedded systems. The The data is then interpreted, and the results are shown to a user or users in some format. Embedded systems generate and distribute actuator commands. Data transformation; embedded systems alter data in some way that is useful, such as Compression and decompression of data

While embedded systems provide They provide functionality specific to their applications, as well as interaction with the outside world through sensors and actuators.

Control rules, finite state machines, and signal processing algorithms are all examples of signal processing algorithms are popular examples of embedded applications. These systems must also be able to detect and respond to threats.

To Both the internal computing environment and the surrounding electromechanical structures are susceptible to faults.

Embedded systems fall into a variety of categories, ranging From communication devices to home appliances to control systems, there's something for everyone.

;Communication devices are an example of this.

Modems and mobile phones are two examples.

Appliances for the Home

CD player, VCR, and microwave oven are some examples.

System of Control

Automobile anti-lock braking systems, robotics, and satellite control are only a few examples.

3.2 EMBEDDED SYSTEM BLOCK DIAGRAM

Embedded software. An operating system is used in some embedded systems. Others are

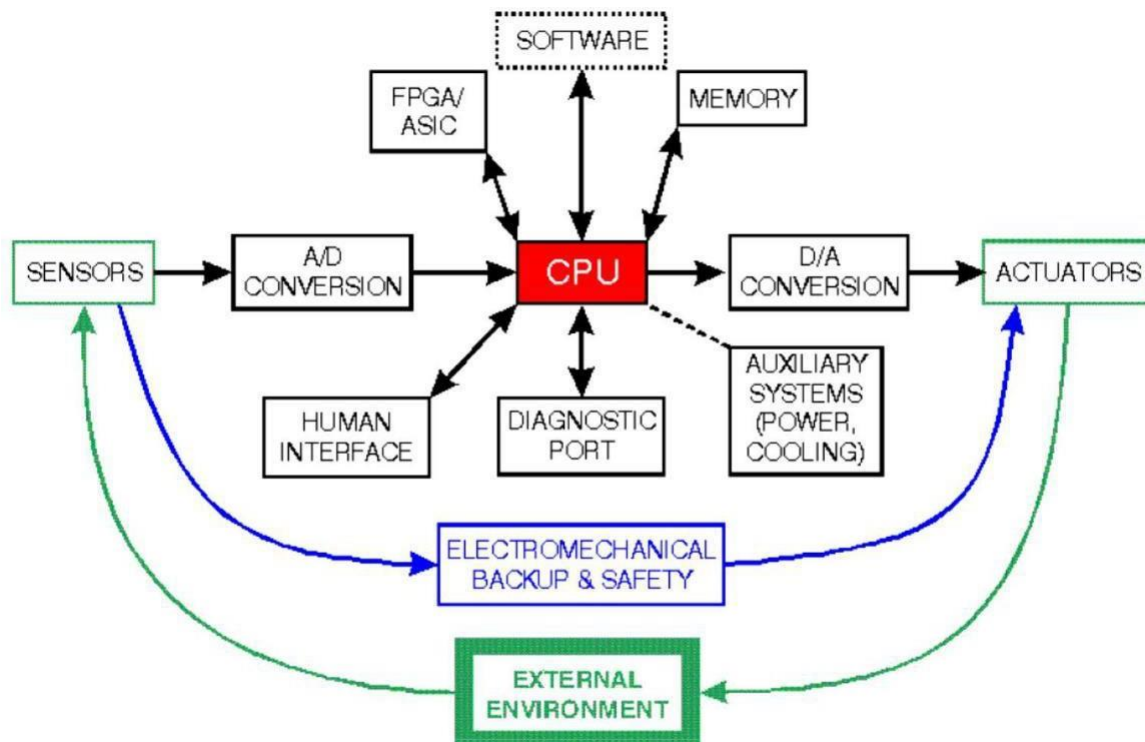


fig 3.1 embedded system of block diagram

highly specialised, resulting in the implementation of the entire logic as a single application. These systems are built into a computer for a particular purpose that is unrelated to general-purpose computing Figure

3.3 CHARACTERISTICS OF EMBEDDED SYSTEMS

Embedded systems have a unique set of characteristics that set them apart. - of these characteristics imposed distinct design constraints on the product.

3.3.1 Implementation of Specific systems

Standard computers are not the same as embedded systems. Embedded device designs are specific to a specific application. Many of the work characteristics are known before the hardware is installed. This allows the designer to focus on the specific design constraints of the application.

3.3.2 Structures that are reactive

As previously mentioned, a typical embedded systems model uses sensors to react to the environment and actuators to control the environment. This necessitates embedded systems running at the same rate as their surroundings. The term "reactive" describes this feature of embedded systems, which is known as reactive computation. External occurrences may be either regular or irregular. Periodic incidents make it easier to plan processing so that it runs smoothly. Aperiodic activities are more difficult to plan. In order to account for worst-case scenarios, the maximum. Performing an effective worst-case design study on systems with predictive performance characteristics is one of the most difficult tasks for embedded device designers in a real-time system. When dealing with this necessity, it's common to design for the worst-case scenario. On complex architectures, however, This sometimes results in excessively cautious forecasts that err on the side of caution. In order to satisfy external I/O and control stability criteria, many embedded systems have a major requirement for real-time operation.

3.3.3 Distruted of systems

This is due to financial constraints. Cost-effective 4 8-bit microcontrollers are likely to be less expensive than 32-bit processors. And when the cost of communication connections is factored in, this strategy could be preferable. Multiple processors are typically needed in this approach to handle multiple time-critical tasks. Physical distribution of devices regulated by embedded systems is also possible.

3.4 HETEROGENEOUS ARCHITECTURES

Embedded systems are often made up of disparate architectures (Fig 3.2). Different processors can be used in the same device solution. It's also possible that they're mixed signal systems. Embedded device architecture is truly unique due to the Embedded systems are therefore constrained in terms of configuration, and heterogeneity allows for more design versatility.

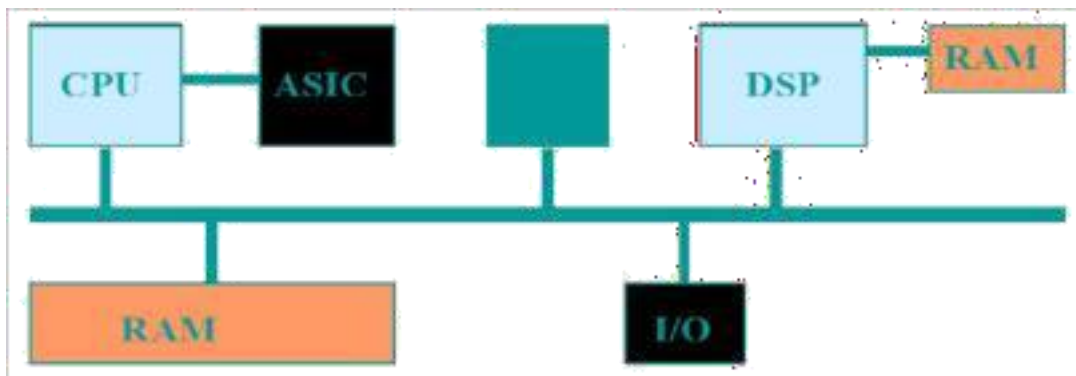


Fig 3.2 Heterogeneous Architecture

3.4.1 The Harsh environment

Many embedded systems aren't designed to work in a safe and regulated setting. Excessive heat is a common problem, particularly in applications involving combustion (e.g., many transportation applications). Defense vibrations, shock, lightning, power supply fluctuations, water, flooding, burning, and other physical hazards can all trigger additional

3.4.2 Machine Stability and Protection

As embedded device complexity and computational capacity increase, they are beginning to monitor more and more of the overall system's safety aspects. These safeguards could be implemented in the form of software or hardware. When a computer system loses power, mechanical safety backups are usually triggered to safely shut down the system. The problem of software security and reliability is becoming more severe. Normally, software does not "break" in the same way as hardware does. However, software can be so complex that a series of unanticipated events can result in software errors, resulting in an unsafe situation. but this is beyond the reach of this book.

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3.4.3 physical control system

The ability to communicate with the world is one of the key reasons for embedding a device. This is often accomplished by the use of external equipment to track and regulate. For processing, embedded computers convert analogue signals from sensors to digital signals. The outputs must be converted to analogue signal levels again. Large current loads can need to be transferred when controlling physical equipment a large number of non-digital components to meet these requirements.

3.4.4 Small and light in weight

A large number of embedded computers are physically embedded in a larger structure. Aesthetics can determine the form factor for the embedded device. A missile's form factor, for example, may need to fit within the missile's nose. Developing non-rectangular geometries for such solutions is one of the challenges faced by embedded device designers. Weight can also be a limiting factor. For example, embedded vehicle control systems must be light weight in order to save fuel. For portability, portable CD players must be light in weight.

3.4.5 Adversion to Cost

Cost is a problem in most systems, but in embedded it is more a function of the proportion of cost adjustments to overall device costs.

3.5 MANAGEMENT OF POWER

The power consumption of embedded systems is strictly controlled. Given the portability requirements of many embedded systems, power conservation is critical in order to maximise battery life. Another apparent problem for embedded systems is the reduction of heat generation.

3.5.1 Electricity

The AC voltage, which is usually 230 volts rms, is connected to a transformer voltage down tdc voltage, which not only has much less ripple voltage.

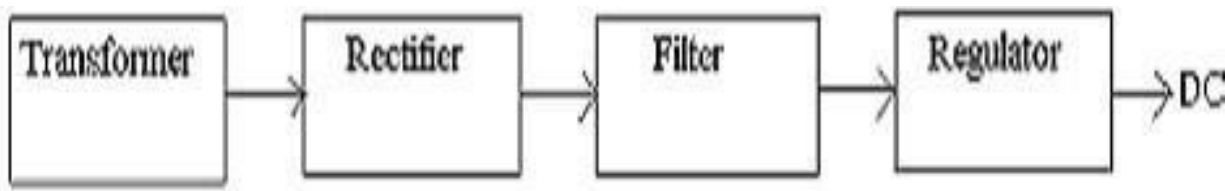


Fig 3.3 General Block Of Power Supply Unit

3.5.2 Transformer

A transformer is a permanent component that transfers electric power from one circuit to another circuit at the same frequency. It has the power to change the voltage in the circuit, but it does so at the cost of other components. of a decrease or increase in current. It operates on the mutual induction principle. A step down transformer is used in our project to provide the required supply for the electronic circuits. We're converting 230 volts .

3.5.3 Rectifier

Full wave rectification is a method that increases the dc level obtained from a sinusoidal input by 100%. In our project, we use a bridge rectifier for full wave rectification. As seen in the simple bridge setup, two diodes (say D2 & D3) conduct while the other two diodes (D1 & D4) are in the off state during the period $t = 0$ to $T/2$. D1 and D4 are the conducting diodes for the input's negative loop. As a consequence, the load's polarity is constant. The bridge rectifier can use a variety of diodes, including 1N4001, 1N4003, 1N4004, 1N4005, 1N4007, and so on. We use 1N4007 instead because it can withstand 1000 volts.

3.5.4 filters

A low pass filter is a filter that reduces the amount of information needed in order to achieve a 0 Hz dc voltage. As a consequence, a capacitive filter circuit with a capacitor connected to the rectifier output and a dc obtained through it is employed. The filtered waveform is essentially a dc voltage with minimal ripples, which is then fed to the load.

3.5.5 Registers

The controller IC has two 8 bit registers, an instruction register (IR) and a data register (DR). The IR stores the instruction codes and address information for display data RAM (DD RAM) and character generator RAM (CG RAM). The IR can be written, but not read by the MPU. The DR temporally stores data to be written to /read from the DD RAM or CG RAM. The data written to DR by the MPU, is automatically written to the DD RAM or CG RAM as an internal operation.

When an address code is written to IR, the data is automatically transferred from the DD RAM or CG RAM to the DR. data transfer between the MPU is then completed when the MPU reads the DR. likewise, for the next MPU read of the DR, data in DD RAM or CG RAM at the address is sent to the DR automatically. Similarly, for the MPU write of the DR, the next DD RAM or CG RAM address is selected for the write operation.

The dot-matrix liquid crystal display controller and driver LSI displays alphanumeric, Japanese kana characters, and symbols. It can be configured to drive a dot-matrix liquid crystal display under the control of a 4- or 8-bit microprocessor. Since all the functions such as display RAM, character generator, and liquid crystal driver, required for driving a dot-matrix liquid crystal display are internally provided on one chip, a minimal system can be interfaced with this controller/driver.

3.5.6 Regulatory bodies

The output voltage of the capacitor is filtered and then regulated. The voltage regulator is a device that maintains a constant output voltage regardless of supply, load, or temperature variations. The LM7805, which is a fixed voltage regulator, will be used. The LM7805 is a 5 volt regulator integrated circuit. It is commonly used in microcontrollers.

3.6 NODE MCU

The NodeMCU framework is a free and open source IoT platform. It includes firmware that runs on Espressif Systems' ESP8266 Wi-Fi SoC and hardware that is built on the ESP-12 board. By design, the name "NodeMCU" applies to the firmware, not the development kits. Lua is the scripting language used by the firmware. It was created using the Espressif Non-OS SDK for ESP8266 and is based on the eLua project. It makes use of a number of open source projects, including lua-cjson and SPIFFS. Shortly after the ESP8266 was released, NodeMCU was developed. Espressif Systems The ESP8266 is a Wi-Fi SoC with a Tensilica Xtensa LX106 core that is widely used in IoT applications (see related projects). On October 13, 2014, Hong uploaded the first nodemcu-firmware file to GitHub, kicking off NodeMCU. Developer Huang R contributed the gerber file for the devkit v0.9 ESP8266 board two months later, extending the project to include an open-hardware platform. PM Tuan ported Contiki's later that month, allowing NodeMCU. On the 30th of January, 2015, NodeMCU was able to drive LCD, Screen, OLED, and even VGA displays with ease after Devsaurus ported the u8glib library to the project.

In the summer of 2015, the developers left the firmware project, and it was taken over by a group of independent contributors. The NodeMCU had expanded to over 40 different modules by the summer of 2016. Due to resource constraints, users must choose the modules that are most relevant to their project.

3.6.1 Core Arduino

As Arduino.cc began to develop new MCU boards based on non-AVR processors, such as the ARM/SAM MCU used in the Arduino Due, they needed to adapt the Arduino IDE to embrace alternative toolchains so that Arduino C/C++ could be compiled for these new processors. They were able to accomplish this after the arrival of the Board Manager and the SAM Core. To compile an Arduino C/C++ source file for the target MCU's machine language, both the Board Manager and the Arduino IDE require a "core" of software components. An Arduino core for the ESP8266 was created by some ESP8266 fans.

The "ESP8266 Core for the Arduino IDE" is a common name for the ESP8266 WiFi So C. This has established itself as NodeMCU. NodeMCU firmware comes with ESP8266 Development board/kit, i.e. The NodeMCU Development Board/Kit, version 0.9, allows you to experiment with the ESP8266 chip (Version1). Since NodeMCU is an open source platform, anyone can edit, update, or develop their hardware design.

The NodeMCU Dev Kit/board uses the ESP8266 wifi enabled chip.

Espressif Systems developed the ESP8266, a low-cost Wi-Fi chip that uses the TCP/IP protocol. For more information on the ESP8266, see the ESP8266 WiFi Module. The NodeMCU Dev Kit is available in version 2 (V2), which is the NodeMCU Development Board v1.0 (Version2), which is normally black in colour.



Fig : 3.4 NodeMCU Development Board/kit v1.0 (Version

3.6.2 with ESPIORER IDE

Getting started with NodeMCU using ESPlorer IDE The Arduino IDE, which is a well-known IDE, is another choice for developing NodeMCU. The Arduino development environment can also be used to build NodeMCU applications. For Arduino developers, this makes learning a new language and IDE for NodeMCU much simpler. For more information on how to compose an Arduino sketch for the NodeMCU, see this article. Getting going with the Arduino IDE is used to programme NodeMCU. We can assume that there is a programming language difference when designing NodeMCU applications using ESPlorer IDE and Arduino IDE. We'll need to code in C++ if we're using the Arduino IDE to create NodeMCU applications, and we'll need to code in Lua if we're using the ESPlorer IDE. NodeMCU is a Lua translator, which means it understands the Lua language easily.

We use Lua to write NodeMCU send/upload scripts to NodeMCU, then we use the Arduino to write and compile code. The ESP8266 toolchain IDE is a development environment for the ESP8266 microcontroller. The ESP8266 toolchain generates a binary firmware file from the code we wrote earlier. The newly developed binary firmware code will be flashed to all NodeMCU firmware when we upload it to NodeMCU. It literally writes the entire firmware to the hard drive. As a result, NodeMCU will not allow any more Lua scripts or code after being flashed by Arduino IDE. After being flashed by Arduino sketch/code, there will be no Lua interpreter, and attempting to upload Lua scripts will result in an error. We'll need to flash the Lua script with NodeMCU firmware to get it working again they will be carried out.

3.7 GENERAL INFORMATION OF DC MOTOR

A DC motor is used to drive a mechanical load. In this lab, a separately excited DC generator provides the load. The load on the motor is adjusted by varying the generator field current. By increasing the field current of the DC generator, the load on the DC motor increases and thus the armature current increases. In general, DC motors are characterized by their torque-speed curves as shown in Figure 9.1. Since the measuring equipment for shaft torque is not available in the lab it is necessary to use alternative means of characterizing the DC motor. One alternative is to plot shaft speed versus armature current since torque is directly proportional to the armature current ($T = K_a \phi I_a$) with a constant field current supplied to the motor. Shaft speed is also a function of the field current in a DC motor while maintaining a constant armature voltage ($E_a = K_a \phi$) as field current is directly proportional to the direct axis flux produced in the machine.

3.7.1 Construction

The stator of the dc motor has poles, which are excited by dc current to produce magnetic fields.

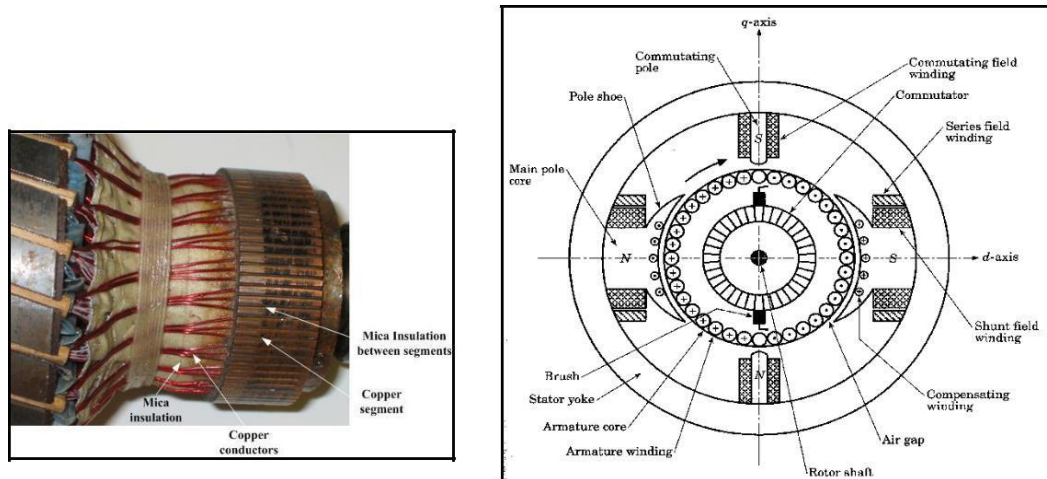


Fig.3.5 DC Motor

In the middle between the poles, commutating poles are placed to reduce sparking of the commutator. The commutating poles are supplied by dc current. Compensating windings are mounted on the main poles. These short-circuited windings damp rotor oscillations. The poles are mounted on an iron core that provides a closed magnetic circuit. The motor housing supports the iron core, the brushes and the bearings. The rotor has a ring-shaped laminated iron core with slots. Coils with several turns are placed in the slots. The distance between the two legs of the coil is about 180 electric degrees. The coils are connected in series through the commutator segments. The ends of each coil are connected to a commutator segment. The commutator consists of insulated copper segments mounted on an insulated tube. Two brushes are pressed to the commutator to permit current flow. The brushes are placed in the neutral zone, where the magnetic field is close to zero, to reduce arcing. The rotor has a ring-shaped laminated iron core with slots. The commutator consists of insulated copper segments mounted on an insulated tube. Two brushes are pressed to the commutator to permit current flow. The brushes are placed in the neutral zone, where the magnetic field is close to zero, to reduce arcing. The commutator switches the current from one rotor coil to the adjacent coil, the switching requires the interruption of the coil current. The sudden interruption of an inductive current generates high voltage.

3.7.2 DC Motor Operation

In a dc motor, the stator poles are supplied by dc excitation current, which produce dc magnetic field. The rotor is supplied by dc current through the brushes, commutator and coils. The interaction of the magnetic field and rotor current generates a force that drives the motor. The magnetic field lines enter into the rotor from the north pole (N) and exit toward the south pole (S). The poles generate a magnetic field that is perpendicular to the current carrying conductors. The interaction between the field and the current produces a Lorentz force; the force is perpendicular to both the magnetic field and conductor. The generated force turns the rotor until the coil reaches the neutral point between the poles. At this point, the magnetic field becomes practically zero together with the force. However, inertia drives the motor beyond the neutral zone where the direction of the magnetic field reverses. To avoid the reversal of the force direction, the commutator changes the current direction, which maintains the counterclockwise rotation. Before reaching the neutral zone, the current enters in segment 1 and exits from segment 2. Therefore, current enters the coil end at slot a and exits from slot b during this stage. After passing the neutral zone, the current enters segment 2 and exits from segment 1, this reverses the current direction through the rotor coil, when the coil passes the neutral zone. The result of this current reversal is the maintenance of the rotation.

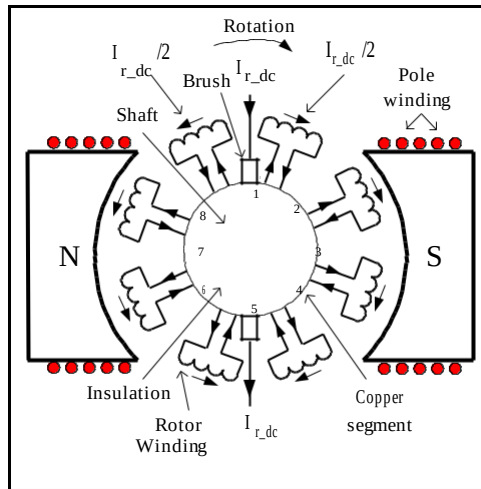


Fig3.6 DC Motor Operation

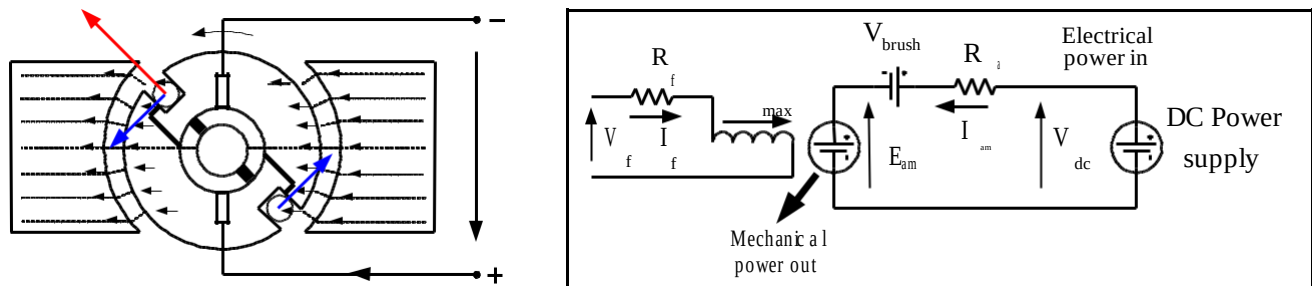


fig 3.7 DC Motor Equivalent circuit

The following figures show the equivalent circuit of a separately excited dc motor. Equivalent circuit is similar to the generator only the current directions are different. The operation equations are:

Armature voltage equation

$$V_{dc} = E_{am} + I_{am} R_a + V_{brush} \text{ -----Eq.(1)}$$

The induced voltage and motor speed vs angular frequency

$$W = 2\pi f \text{ -----Eq.(2)}$$

The combination of the equations results in

$$K_m I_f W = E_{am} = V_{dc} - I_{am} R_m \text{ -----Eq.(3)}$$

The current is calculated from this equation. The output power and torque are

$$T = P_{OUT}/W = K_m I_{am} I_f \text{ -----Eq.(4)}$$

Generally, even the simplest robot requires a motor to rotate a wheel or performs particular action. Since motors need more current than a microcontroller pin can normally produce, you'll need a switch (Transistors, MOSFETs, Relays, etc.) that can drive the motor. This entire procedure is carried out by a device known as a motor driver.

Motor driver is basically a current amplifier which takes a low-current signal from the microcontroller and gives out a proportionally higher current signal which can control and drive a motor. In most cases, a transistor can act as a switch and perform this task which drives the motor in a single direction.

Turning a motor ON and OFF requires only one switch to control a single motor in a single direction. What if you want your motor to reverse its direction? The simple answer is to reverse its polarity. This can be achieved by using four switches that are arranged in an intelligent manner such that the circuit not only drives the motor, but also controls its direction. Out of many, one of the most common and clever design is a H-bridge circuit where transistors are arranged in a shape that resembles the English alphabet "H".

As you can see in the image, the circuit has four switches A, B, C and D. Turning these switches ON and OFF can drive a motor in different ways.

Turning on Switches A and D makes the motor rotate clockwise

Turning on Switches B and C makes the motor rotate anti-clockwise

Turning on Switches A and B will stop the motor (Brakes). H-bridges can be built from scratch using relays, mosfets, field effect transistors (FET), bi-polar junction transistors (BJT), etc. But if your current requirement is not too high and all you need is a single package which does the job of driving a small DC motor in two directions, then all you need is a L293D IC. This single inexpensive package can interface not one, but two DC motors. L293, L293B and few other versions also does the same job, but pick the L293D version as this one has an inbuilt fly back diode which protects the driving transistors from voltage spikes that occur when the motor coil is turned off.

3.7.3 Introduction to L293D IC

L293D IC generally comes as a standard 16-pin DIP (dual-in line package). This motor driver IC can simultaneously control two small motors in either direction; forward and reverse with just 4 microcontroller pins (if you do not use enable pins). Some of the features (and drawbacks) of this IC are:

Output current capability is limited to 600mA per channel with peak output current limited to 1.2A (non-repetitive). This means you cannot drive bigger motors with this IC. However, most small motors used in hobby robotics should work. If you are unsure whether the IC can handle a particular motor, connect the IC to its circuit and run the motor with your finger on the IC. If it gets really hot, then beware... Also note the words "non-repetitive"; if the current output repeatedly reaches 1.2A, it might destroy the drive transistors. Supply voltage can be as large as 36 Volts. This means you do not have to worry much about voltage regulation.

L293D has an enable facility which helps you enable the IC output pins. If an enable pin is set L293D has an enable facility which helps you enable the IC output pins. If an enable pin is set to logic high, then state of the inputs match the state of the outputs. Datasheet also mentions an "over temperature protection" built into the IC. This means an internal sensor senses its internal temperature and stops driving the motors if the temperature crosses a set point. Another major feature of L293D is its internal clamp diodes. This flyback diode helps protect the driver IC from voltage spikes that occur when the motor coil is turned on and off (mostly when turned off). The logical low in the IC is set to 1.5V. This means the pin is set high only if the voltage across the pin crosses 1.5V which makes it suitable for use in high frequency applications like switching applications (upto 5KHz). Lastly, this integrated circuit not only drives DC motors, but can also be used to drive relay solenoids, stepper motors etc.

The circuit shown is the most simple L293D IC implementation. There are 16 pins protruding from this IC, and we need to know what each one does before we can use it in a circuit. The "Enable" pins are Pins 1 and 9. For the drivers to work, they must be wired to +5V. The outputs would be switched off regardless of the input states if they are pulled low (GND), stopping the motors. Attach these pins to the microcontroller, or simply to controlled positive 5 Volts, if your microcontroller has two spare pins. Ground pins Pins 4, 5, 12, and 13 should preferably be attached to the microcontroller's ground. Pins 2, 7, 10, and 15 are all logic input pins.

The first motor is powered by Pins 2 and 7. Pins 3, 6, 11, and positive lead. According to the datasheet, the supply voltage can reach 36 volts. I've shown you how to wire the motors, battery, and microcontroller together. I have shown you where to connect the motors, battery and the microcontroller. But how do we control the direction of these motors? Let us take an example. Suppose you need to control the left motor which is connected to Pin3 (O1)

and Pin6 (O2). As mentioned above, we require three pins to control this motor - Pin1 (E1), Pin2 (I1) and Pin7 (I2). Here is the truth table representing the functionality of this motor driver.

In the above truth table you can observe that if Pin1 (E1) is low then the motor stops, irrespective of the states on Pin2 and Pin7. Hence it is essential to hold E1 high for the driver to function, or simply connect enable pins to positive 5 volts.

With Pin1 high, if Pin2 is set high and Pin7 is pulled low, then current flows from Pin2 to Pin7 driving the motor in anti-clockwise direction? If the states of Pin2 and Pin7 are flipped, then current flows from Pin7 to Pin2 driving the motor in clockwise direction. The above concept holds true for other side of the IC too. Connect your motor to Pin11 and Pin14; Pin10 and Pin15 are input pins, and Pin9 (E2) enables.

3.8 INTERNET OF THINGS

The composition of the chapter is as follows: This segment explains why this project is being undertaken. This segment outlines the research objectives and concerns. This section outlines the steps that must be taken to achieve our objectives. The layout of the report is shown in section. are presented in this section. The report's structure is shown in section.

3.8.1 Historical context

The layout of the report is shown in section 3.8.1. Historical backgroundThe Future Internet's goal is to build an infrastructure that gives people immediate access to information about the real world and its artefacts. Artefacts in physical form *e-health, warehouse management, and other applications are only a few examples. Physical devices of various types may be used in various application domains. In order to communicate with a physical device, it must adhere to its own set of requirements. To achieve the future Internet goal, a layered vision that promotes data access is needed. The Internet of Things (IoT) is a concept that aims to link the virtual and physical worlds of information and devices.* using a layered approach. The phrase "Internet of Things" is made up of two words: internet and things. The Internet is a global network system with scalable, configurable features based on open, interoperable communication protocols.

3.8.2 Defination of Internet of Things

IoT connects physical objects to knowledge networks via transportation.IoT refers to the overall infrastructure that supports these information networks, including software, hardware, and facilities. The interconnected physical things will share knowledge and data about their physical properties and their surroundings. Identification technologies such as RFID, which enable each device to be uniquely identified, can be used to identify devices. IoT is described by the that enables Interconnecting (physical and virtual) stuff to provide advanced services based on current and evolving interoperable information and communication technologies. With RFID technology, the concept of a globally interconnected continuum of machines, artefacts, and things in general was born, and this term has since been greatly extended to include a multitude of heterogeneous artefacts interacting with the physical environment.” according to the Internet of Things-Architecture 2 (IoT-A).

3.8.3 The Technology layer at the edge

Embedded systems, RFID tags, sensor networks, and other forms of sensors are all part of the hardware layer. Gathering data from a computer or environment, processing data, and facilitating communication are all tasks that this hardware layer can perform. This is the hardware layer, which includes embedded systems, RFID tags, sensor networks, and all other types of sensors. This hardware layer can perform a variety of tasks, including gathering data from a device or environment, processing data, and facilitating communication.

3.8.4 layer ofAccess gateway

This layer is in charge of data handling and is in charge of This layer is responsible for data processing, as well as publishing and subscribing to the Stuff's services, as well as message routing and hovelling communication between platforms. in charge of data handling and is in charge of This layer is responsible for data handling, as well as publishing and subscribing to the Stuff's services, as well as message routing and hoveling communication between platforms.

3.8.5 Layer in the Middle

This layer performs critical functions such as such as aggregating and filtering data from hardware devices, conducting information discovery, and managing application system access.

3.8.6 Application layer

This layer is responsible for a wide range of application services. The middleware layer in IoT-based systems delivers these services to different applications and users. Logistics, retail, and healthcare are among the industries that can benefit from the application services.

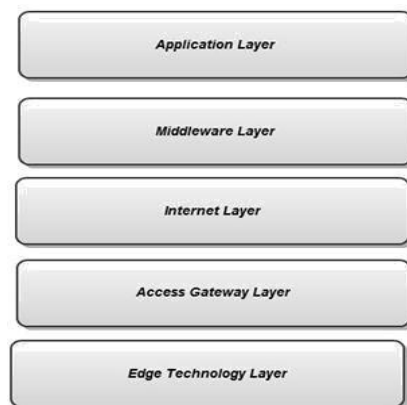


Fig: 3.8 Layered architecture of the Internet of Things (IoT)

3.9 TECHNOLOGY WITH EDGE

Since an IoT-based system must be able to collect enough data about the real world from a variety of sensors and environments, further research efforts are needed to boost the technology of embedded systems, sensors, actuators, and other devices at the hardware level (passive and active) recognition. As a result, there is still work to be done in terms of connecting heterogeneous devices and deploying them in IoT applications, as well as providing support for new devices.

3.9.1 Network technology

Things in the Internet of Things are linked via a variety of networks, including telephone, wired, and wireless networks. These networks allow bi-directional communication between real-world objects, devices, and services used by IoT applications at various levels. This highly distributed structure should allow for interconnection while consuming little resources.

3.9.2 Platform services

They allow for better coordinated management of all involved devices, ensuring scalability, high availability, and the safe and secure execution of tasks.system functionality. In the next section, we'll look at middleware problems, as we're looking for the features that a middleware.

3.9.3 Middleware for the Internet of Things (IoT) version

Setal Bandyopadhyay and Setal Bandyopadhyay analysed middleware systems used in IoT-based systems [1]. They divide middleware's required functionality for managing (2) system abstraction, (3) central control, context detection & management.

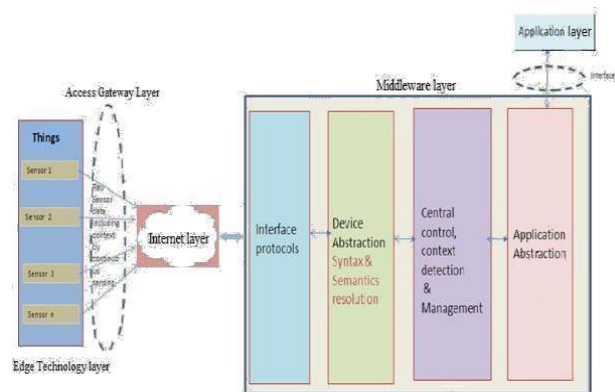


Fig : 3.9 Components of a middleware for IoT-based

3.10 INTERFACE PROTOCOL

Technical interoperability is the responsibility of this part. In the sense of Interface protocols, interoperability refers to the ability of two systems to communicate with each other using the same communication protocols. Technical interoperability is described by ETSI The European Telecommunications Standards Institute (ETSI) is an organisation that brings together hardware and software modules, systems, and platforms that enable machines to communicate with one another. The infrastructure and (communication) protocols are frequently the subject of this form of interoperability.required to support them.

In order to enable technical interoperability, The Interface Protocol section defines protocols for exchanging data between networks that use various communication protocols.This component is in charge of basic communication in the TCP/IP stack's The physical and data connections, the network, the transport, and, on rare occasions, the application layer are all protected. To handle system heterogeneity, we may build a wrapper for each device that converts the device's protocol to a more widely used protocol. This wrapper can be mounted on the device or the middleware.

We may place the wrapper in the middleware side if we want to interact directly with devices. Due to the fact that most systems have minimal computing capabilities, a wrapper on the middleware side would be a good idea. In the case of indirect contact with devices, on the other hand, an intermediate wrapper between the middleware and the devices can be created. The interface protocol portion ensures that the middleware can handle both direct and indirect interactions.

3.11 ANSTRACTION TO DEVICE (DA)

This part is in charge of providing an abstr act format that allows application components to communicate with devices more easily. This abstr action allows for syntactic and semantic interoperability, as described by ETSI [14]. Data formats are linked to syntactic interoperability. Communication protocols must transfer messages with with a well-defined syntax and encoding format that can be expressed with high-level transfer syntaxes such as HTML and XML The sense of a message's content that is understandable by humans is usually associated with semantic interoperability. This level of interoperability thus means that people have a shared understanding of the nature of the material (information) they are exchanging. However, since DA does not communicate with humans directly, semantic interoperability in the sense of DA is not possible responsible for delivering these applications. Semantic interoperability is based on semantic

models that are typically domain specific. Using Devices Profile for Web Services, for example, is each system type refers to a distinct service type in this context. The DA component has two main functions: (1) asking devices to perform a task and (2) defining and configuring devices. The XML format is used by DPWS.

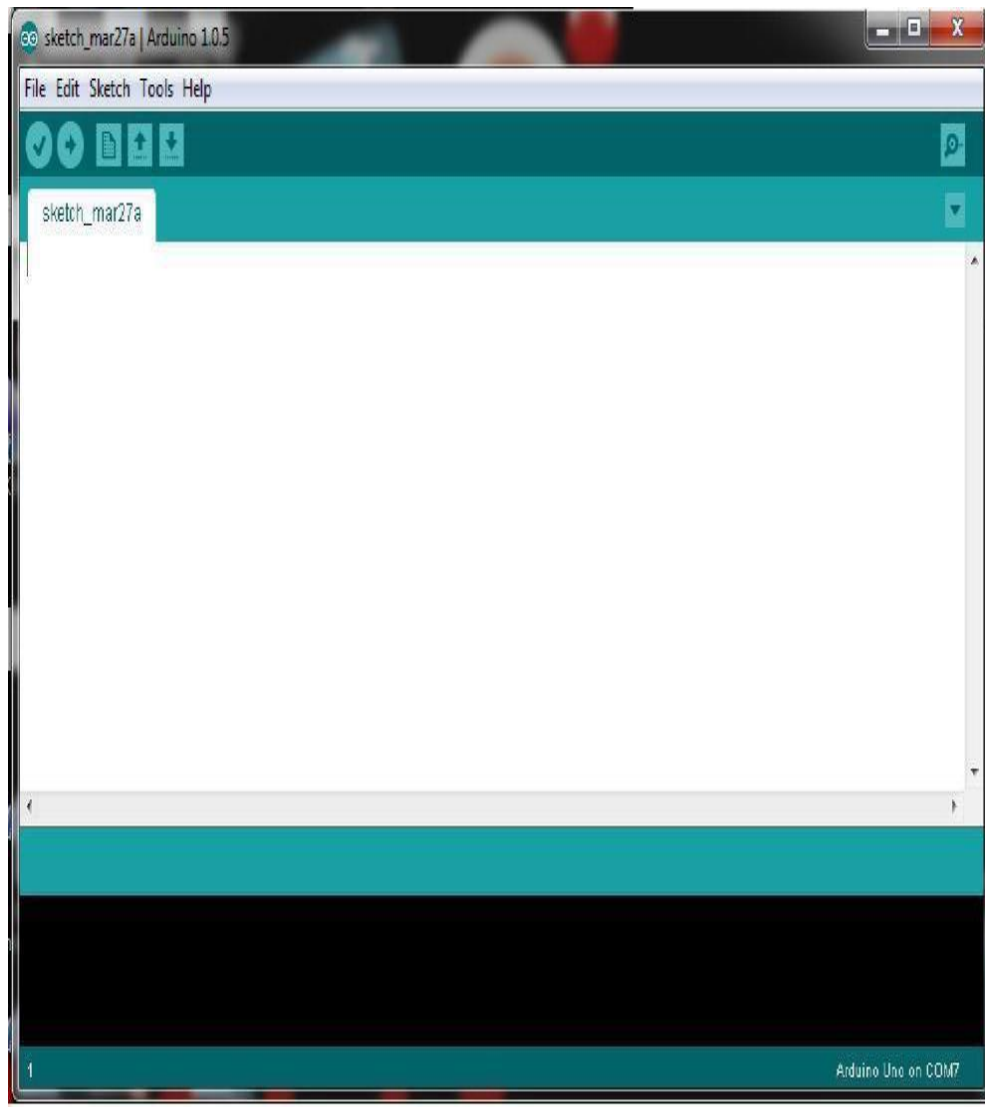
3.12 CENTRAL CONTROL, DETECTION & MANAGEMENT OF CONTEXT (CCM)

CONTEXT (CCM) An entity's situation, which can be a place, an individual, or an object, that is relevant to users, applications, and their interactions is defined by context. CCM is in charge of supporting context-aware computation, which is a form of computation that takes into account the context of the entities that communicate with the device. To function in smart environments, middleware for IoT-based systems must be context-aware. The term "smart world" refers to a physical environment that is richly, imperceptibly interwoven with sensors, displays, and computational components, and is seamlessly incorporated into everyday artefacts. Context detection is the process of gathering data from various sources and choosing information that may affect the computation. Context analysis is the method of using the information collected to complete a task or make a decision.

This functional component is used to communicate with devices for high-level systems as well as end-users This interface may be a RESTful interface or custom-built. For data processing and monitoring services, Malatras et al. [18] propose a SOA-based middleware. This software serves as a bridge between two systems.makes use of a restful interface to make it easier for high-level applications to connect with sensors that can communicate HTTP operations on a Wireless Sensor Network (WSN): (1) question an existing resource, (2) remove an existing resource, (3) post a new resource. Open Arduino IDE as shown below

3.13 ardino software

1. Open Arduino IDE as shown below



ig:3.10 Arduino IDE

2. Select the COM Port from tool Select the COM Port

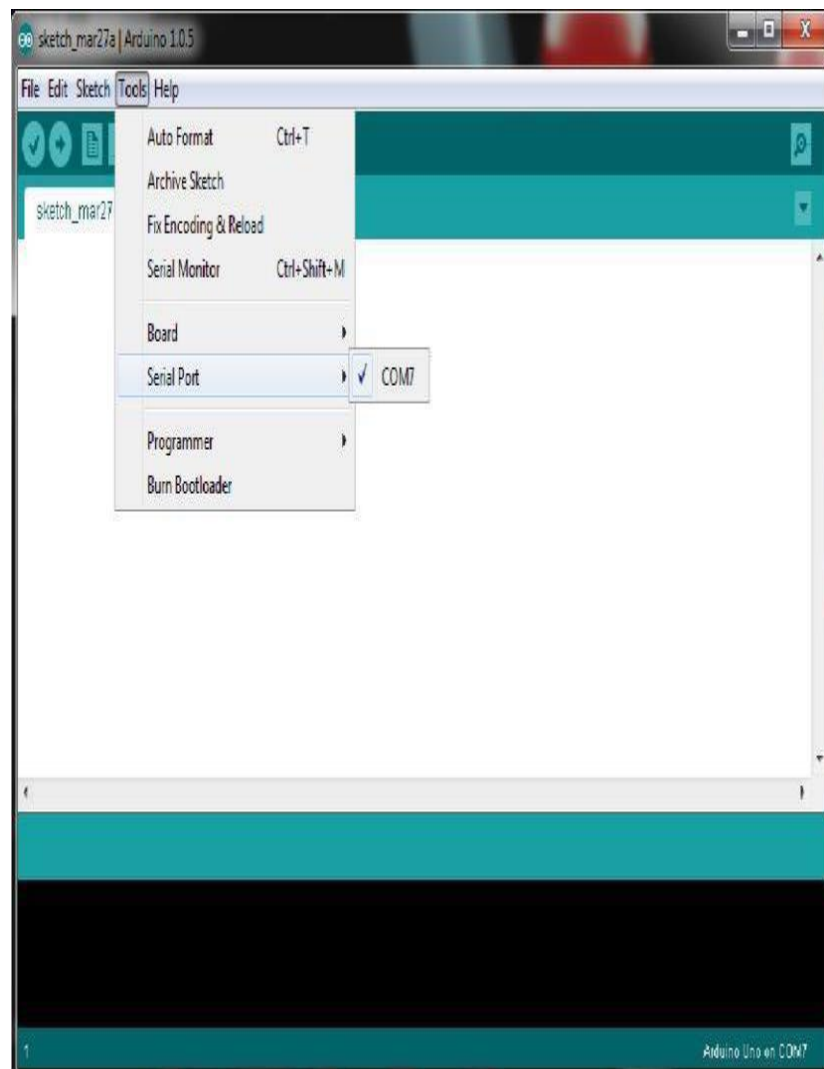


Fig: 3.11 COM Port

1. Select the required Arduino board from Tools as shown below Select the required Arduino board

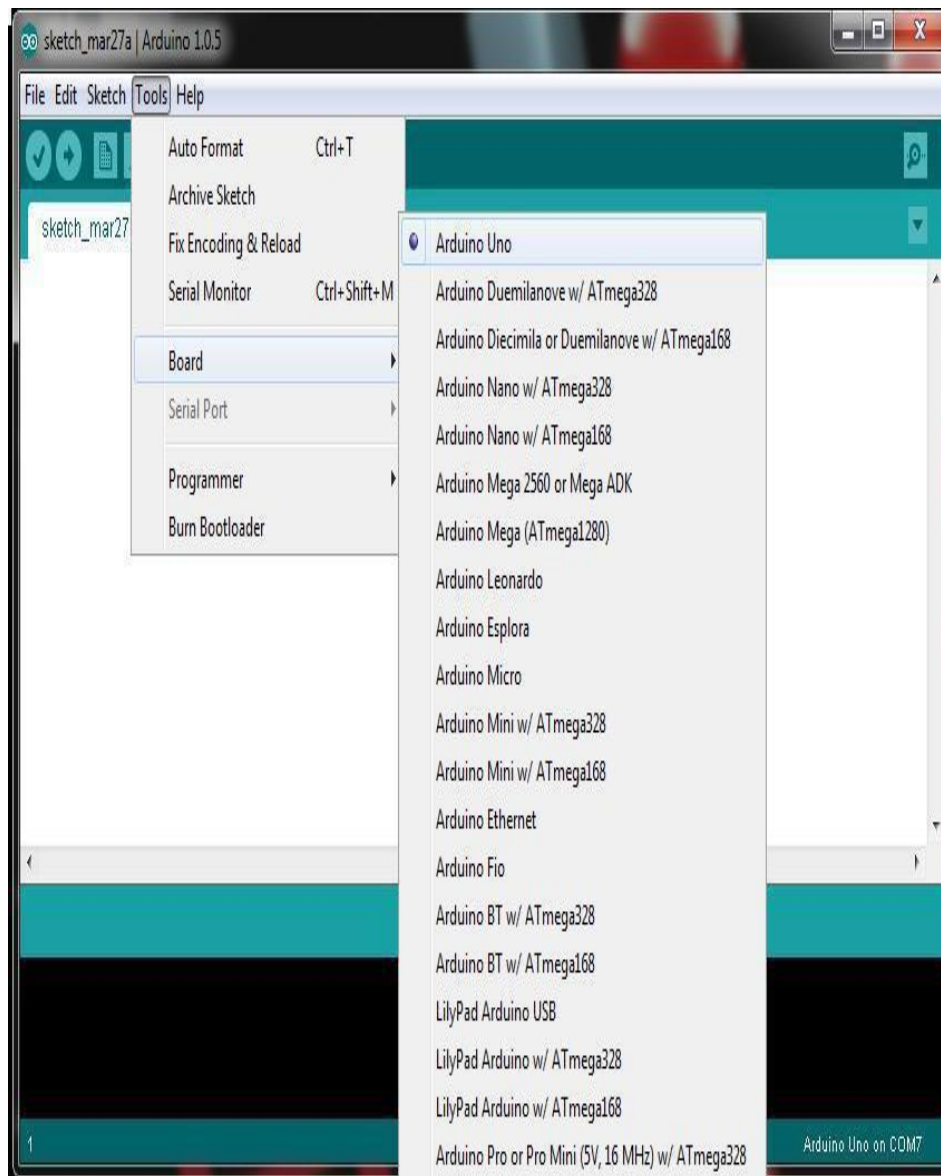


Fig: 3.12 Arduino board selection

2. Write the sketch in Arduino IDE Sketch in Arduino IDE



Fig: 3.13 Arduino IDE

3. Compile and upload the Sketch to Arduino board upload the Sketch to Arduino board



Fig:3.14 Sketch of Arduino board

3.14 ZIGBEE IEEE 802.15.4

Zigbee is an open global standard for low-cost, low-power wireless M2M network technology. The Zigbee standard, which works in unlicensed bands such as 2.4 GHz, 900 MHz, and 868 MHz, is based on the IEEE 802.15.4 physical radio specification. The 802.15.4 standard, on which the Zigbee stack is based, was ratified by the Institute of Electrical and Electronics Engineers (IEEE) in 2003. The protocol is a packet-based radio protocol designed for low-cost computers that run on batteries. Devices can communicate using the protocol in a variety of network topologies.

3.14.2 The zigbee protocol

The Zigbee Alliance's member companies developed and ratified the Zigbee protocol. Over 300 leading semiconductor manufacturers, technology companies, OEMs, and service providers make up the Zigbee Alliance. The Zigbee protocol was designed to provide a simple wireless data solution with reliable wireless network architectures. The Zigbee protocol was designed to transmit data in RF environments such as those found in commercial and industrial settings.

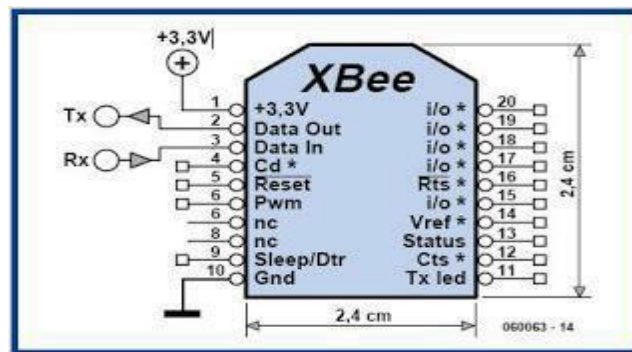


Fig. 3.15 Pin Diagram

Zigbee is a collection of high-level communication protocols developed by zigbee that are used to build on power output and environmental characteristics, Zigbee devices can transmit data over long distances by moving data through a mesh network of intermediate devices to reach more distant devices, limiting transmission distances to 10–100 metres line-of-sight, depending on power output and environmental characteristics. Zigbee is popular in low-data-rate applications that require long battery life and stable networking. 250 word sideal for data transfers from a sensor or input system on a regular basis. Wireless Just a few examples of applications include wireless light switches, electrical metres with in-home displays, traffic control systems, and other consumer and industrial devices with short-range low-rate wireless data transmission. The Zigbee specification is a set of rules for wireless communication.defines a system .

4.2 Mesh Networks

Mesh Networks are a type of network that is made up of the Zigbee protocol's ability to support mesh networking is a key feature. A mesh network's nodes are linked to one another so that each node can be reached through multiple paths. Connections between nodes are dynamically updated and optimised using a sophisticated, built-in mesh

routing table. Mesh networks are inherently decentralised, with each node capable of self-discovery. When nodes leave the network, the mesh topology allows them to reconfigure routing paths based on network structure. In changing conditions or when a single node fails, the mesh topology and ad-hoc routing characteristics provide more flexibility.

3.14.3 Applications for zigbee

Zigbee facilitates widespread wireless network deployment by providing low-cost, low-power solutions. It can operate for years on a single set of cheap batteries, making it suitable for a wide range of monitoring and control applications. Smart energy/smart grid, AMR (Automatic Meter Reading), lighting controls, building automation systems, tank monitoring, HVAC control, medical equipment, and fleet applications are just a few places where ZigBee technology is rapidly advancing. Digi is a Zigbee Alliance member and has developed a number of Zigbee-based networking solutions. Modules for XBee and XBee-PRO, as well as Zigbee-enabled devices

3.15 UBDOTS EXPLORER

Welcome to the rest hardware documentation for Ubidots. You'll learn how to use our supported communication protocols, such as http, mqtt, and tcp/udp, to send and that you can reproduce it in your firmware. As a result, we stop using examples that use please do so. A data-point or "dot" is generated every time a system updates a sensor value in a variable. Ubidots collects dots from your devices and stores them in variables.

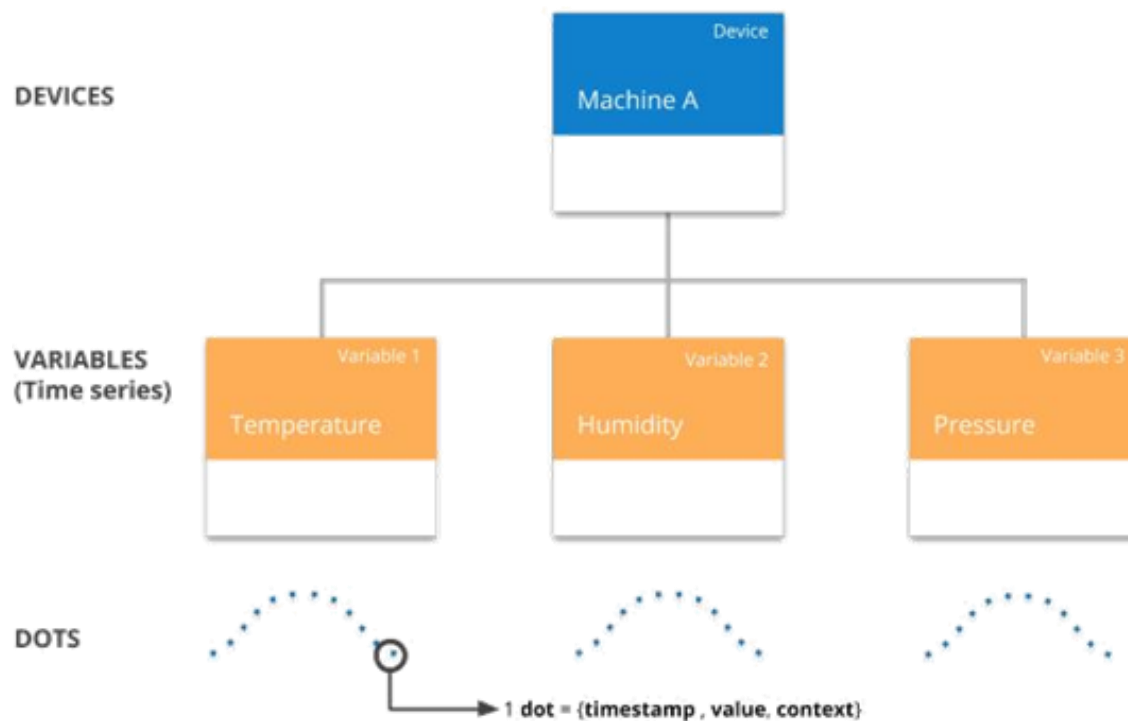


Fig 3.16 Ubdots Data Hierarchy

Item	Description	Mandatory
value	A numerical value. Ubidots accepts up to 16 floating-point length numbers.	YES
timestamp	Unix Epoch time, in milliseconds. If not specified, then our servers will assign one upon reception.	NO
context	An arbitrary collection of key-value pairs.	NO

TABLE.3.2 UBDOT Discription

Epoch Converter is a valuable method for converting between Unix timestamps and human-readable dates. You can also store string or char data types within what we call context, which is not limited to numerical values. The background is a key-value object that can be used to store both numerical and string values. Context is an example of how to use the context. For GPS/tracking application use cases, a background is typically used to store the device's latitude and longitude coordinates. All Ubidots maps extract the coordinates of your computer using the lat and lng keys from a dot's background, so you only need to submit a single dot with the coordinates values in the vector. Instead of submitting both latitude and longitude in two different variables, use background to plot a map. A standard background with coordinate values can be found below. Please keep in mind that string and numerical values can be mixed in the background. If you're using your application for geolocation, make sure the coordinates are in decimal degrees. Series of events in time On the basis of the above, we may depict a Ubidots time sequence.

3.16 HTTP

It is the most widely used internet protocol for data sharing on the Internet. It also supports data encryption, also known as stable HTTP or HTTPS. You submit and receive packages using As a result, it's no surprise that HTTPS has become a common method of data sharing in the IoT.

When a developer needs to introduce HTTP communication, he can look for a REST API, or Restful Application Programming Interface, which exposes all of the endpoints needed to communicate with a third-party application (like Ubidots). You can use our REST API in this section to undo stuff.

THE HTTP Method	Description FOR HTTP
GET	help to retrieve information
POST	help to create a new element
PATCH	help to update existing elements
DELETE	help to delete existing elements

TABLE 3.3 HTTP requests

HTTP is a request/response protocol, which means that the server responds to each request you make. A number (answer code) and a body are included in this response. A GET request is created when you request a file from a website (for example, "Get me the file 'websiteside.html'"). The server will respond if the request is correct. the server will usually respond with a 200 response code and the file that was requested (body). When a computer sends a GET request to the Ubidots server (i.e., asking for the most recent value of a variable), the server responds with the request status (response code) and a body.

API access is available via HTTP or HTTPSs, with the following endpoints depending on your Ubidots Account form. Note on security: We strongly suggest using HTTPSs to ensure that your data is encrypted and that your API token and/or sensor data exposed.

Ubidots of Account	Endpoint of ubdots	The Port
Educational	http://things.ubidots.com	80
Industrial	http://industrial.api.ubidots.com	80
Educational	https://things.ubidots.com	443
Industrial	https://industrial.api.ubidots.com	443

Table 3.4 Security Note

CHAPTER 4

RESULTS AND DISCUSSION

4.1 CONSTRUCTION

A communication system, which employs Zigbee and LoRa communication protocols is designed, developed, and tested in this experimental paper. The designed system contains a central receiver unit LoRa and zigbee transceiver modules, a microcontroller, a wifi network with LoRa and zigbee transceiver modules, and a 1298 unit.

The two mobile robots were able to perform a group motion and communicate through the LoRa Wan. The robots were able to successfully reach their target destinations with lower power consumption.

Since energy consumption was very important for the robot to sustain their service while navigating through the area, we found that using LoRa could help extend the longer period for robot to function.

The zigbee navigation was able to assist the robot for navigation but the efficiency was only about 85.38%. Therefore, future work should focus on improving the accuracy of the zigbee localization system as part of improving the efficiency of the system.

More data streaming from sensors on the robots which caused delay needed to be addressed. Our experiment presented that a group of mobile robots can function at the same time and can communicate among each other successfully through the LoRa Wan. The similar features could be applied in industrial logistic in factories.



Fig:4.1 Mobile Robot

Two robot are programmed with virtual mapping technique. Virtual mapping technique is a technique where robot is control through long distance in one go.

Two robots and mobile is connected through wifi module. Here mobile act as a server and robot act as a client.

communication between two robots is done by zigbee module.



fig 4.2 snap of Robot

If we give the command as 1,1 for the first robot it goes to room number '1'. In 1,1 the first '1' indicates robot one and second '1' indicates room number '1'. Now if we give the command as 2,1. In 2,1 the '2' indicates robot two and '1' indicates room number '1'. Now if we give the command as 2,1. The robot will not move because already robot one settles at first room. Now giving the command as 2,2. Now the second robot moves to second room and do his job.



fig:4.2 Swam robot control application

Each individual robot has unique IP address for the first robot the IP address is 192.168.43.128.

For the second robot IP address is 192.168.43.129.

CHAPTER 5

CONCLUSION

The hardware components are successfully assembled and interfacing the microcontroller with robot is achieved. Controlling the motion of robot via Wi-Fi as well as ZigBee from android applet is successfully obtained.

Hence the two modules of controlling the robot is successfully tested and demonstrated. Though controlling using Wi-Fi limits the range of distance for communication, a smart and easy means to guide a robot is achieved.

Using the hardware components like zigbee board, voltage regulator, bread board, node mcu this project is implemented. After these acute connections we operate these two robots by our mobile swarm robots application (each robot is give my unique IP address).

Finally we observe the robots moving in to two different directions eventually. The two robots wont accelerate into same direction by the help of zigbee technology the communication between the two robots were made. Hence they are also cappable of doing multi tasks.

6.1 FUTURE SCOPE

The working person of coal mines has to face various environmental parameters in their work place. They have the danger from methane, carbon monoxide, SpO2 level and temperature.

In future by using more number of salve to improve the data transmission distance. So, the rescue operation of miners can be carried out. The system can be enhanced further.

The system can be improved by adding more measuring devices to check miners blood pressure and using additional sensors all possible safety issues could be monitored such as dust, vibration, water leakage, fall detection etc.

CHAPTER 6

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Submitted in partial fulfilment of requirements for the award of Engi Bachleor of Engineering in Electronics and Communication Engineering By SHAIK RASOOL (37130372) SHAIK MAHABOOB SHAREEF (37130369) DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING SCHOOL OF ELECTRICAL AND ELECTRONICS SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY (DEEMED TO BE UNIVERSITY) Accredited with Grade "A" by NAAC JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI – 600119

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING BONAFIDE CERTIFICATE This is to certify that this Project Report is the bonafide work of SHAIK RASOOL (Reg.No.37130372) and SHAIK MAHABOOB SHAREEF (Reg.No.37130369) who carried out the project entitled "LORA BASED SMART ROBOT CONTROL" under our supervision from December 2020 to March 2021. Internal Guide Dr.A.SAHAYA ANSELIN NISHA M.E., Ph.D. Head of the Department Dr.T.RAVI M.E., Ph.D. Submitted for Viva voce Examination held on Internal Examiner External Examiner

iii DECLARATION We, SHAIK RASOOL (Reg.37130372) and SHAIK MAHABOOB SHAREEF(Reg.37130369) hereby declare that the Project Report entitled "LORA BASED SMART ROBOT CONTROL" done by us under the guidance of

Dr.

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v

ABSTRACT A

communication system, which employs Zigbee and Lora communication protocols is meant, developed, and tested during this experimental paper. The designed system contains a central receiver unit with Lora and Zigbee transceiver modules, a microcontroller, a Wi-Fi network with Lora and Zigbee transceiver modules, and a l298N unit. In the sensor card can be remotely or cloud-based controlled, and the robot location can be sent to the central receiver unit by using the Zigbee or Lora transceiver modules. Taking advantage of the complementing performances of Zigbee and Lora wireless technologies, a diversified communication system with smart features is proposed, designed, and tested during a single IOT system. As an emergent research area by which swarm intelligence is applied to multi-robot systems swarm robotics (a very particular and peculiar sub-area of collective robotics) studies how to coordinate large groups of relatively simple robots through the utilization of local rules. It specialise in studying the planning of huge amount of relatively simple robots, their physical bodies and their controlling behaviors. Since its introduction in 2000, several successful experimentations had been realized, and till now more projects are under investigations. This paper seeks to offer an summary of this domain research; for the aim to orientate the readers, especially those that are newly coming to the present research field. This work includes the advancement of calculations that control the development of gathering robots. A bunch of two moving robots was set up and every robot is constrained by a microcontroller and moving vehicle. The robot speaks with a far off organisation. Data about the area of the robot is send and gotten by the worker, and clients can likewise get to the data progressively utilizing the UI(web application). The places of every of two portable robots are resolved dependent on the zigbee study. as per our tests differently, the high level calculation can handle the development of the robot at a choosen area inside the house.

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1 CHAPTER 1 INTRODUCTION Swarm robotics is a field of multi-robotics in which large number of robots are coordinated in a distributed and decentralized way. It is based on the use of local rules, and simple robots compared to the complexity of the task to achieve, and inspired by social insects. Large number of simple robots can perform complex tasks in a more efficient way than a single robot, giving robustness and flexibility to the group. In this article, an overview of swarm robotics is given, describing its main properties and characteristics and comparing it to general multi-robotic systems. A review of different research works and experimental results, together with a discussion of the future swarm robotics in real world applications completes this work. In the present day, technology has so improved that an Unmanned Aerial Vehicle (UAV) also called as Drone can be controlled from a distance ranging from 2km to 20,000km. The Mars Rover, which was sent to Mars to explore various features of the planet is an autonomous robot which is programmed such that it performs the desired task as it is intended to do. There are many such systems which are controlled either by Radio Frequency transmission or by creating intelligence. Robots are called Non autonomous robots. These robots have the programming logic to do the desired task but the decision power lies in the hand of controller (human) handling the robot. Here the interface can be made using two methods Wired. The connection between controller and robot is maintained using wired interface. This interface can be serial or parallel but the technology is transmission of signal, which is sent in the form of specific pattern to the robot to carry out the specific task, these patterns with the help of a microcontroller governing its motion. Here the connection between controller and robot is achieved by wireless interface such as: Bluetooth Wi-Fi. The underlying technology is transmission of signals wireless in air by transmitter which is captured by the receiver and sent to microcontroller mounted on the robot to carry out the task. At the present demand for robots in this developing world to carry out work effectively.

2 1.1 EXISTING SYSTEM In existing system there is no group of motion of the robot to robot communication. In existing system robots operation was done by individually with remote or automatic moving operation. 1.2 PROPOSED SYSTEM The four mobile robots were able to perform a group motion and communicate through the LoRa Wan. The robots were able to successfully reach their target destinations with lower power consumption. Since energy consumption was very important for the robot to sustain their service while navigating through the area, we found that using LoRa could help extend the longer period for robot

to function. The ZigBee navigation was able to assist the robot for navigation but the efficiency was only about 85.38%. Therefore, future work should focus on improving the accuracy of the ZigBee localization system as part of improving the efficiency of the system. More data streaming from sensors on the robots which caused delay needed to be addressed.

Our experiment presented that a group of mobile robots can function at the same time and can communicate among each other successfully through the LoRa Wan. The similar features could be applied in industrial logistic in

fact ories. 1.1 Block diagram of lora based smart robot control

3 1.3

HARDWARE REQUIRED Nodemcu ZigBee transceivers Motor driver Motor 1.4 OBJECTIVE The four mobile robots were able to perform a group motion and communicate through the lora Wan. The robots were able to successfully reach their target destinations with lower power consumption. Since energy consumption was very important for the robot to sustain their service while navigating through the area, we found that using lora could help extend the longer period for robot to function. The zigbee navigation was able to assist the robot for navigation but the efficiency was only about 85.38%. Therefore, future work should focus on improving the accuracy of the zigbee localization system as part of improving the efficiency of the system. More data streaming from sensors on the robots which caused delay needed to be addressed. Our experiment presented that a group of mobile robots can function at the same time and can communicate among each other successfully through the lora Wan. The similar features could be applied in industrial logistic in factories. The lora based system can overcome the challenge of low power communication. An application has been developed to use a smart phone to control and monitor the target appliances through the lora module. ... Furthermore, lora wan can handle the data losses when different nodes are increased to 1000 per gateway.lora wan is a cloud-based medium access control (MAC) layer protocol but acts mainly as a network layer protocol for managing communication between LPWAN gateways and end-node devices as a routing protocol, maintained by the lora Alliance. Semtech innovation, lora devices offer compelling features for IoT applications including long range, low power consumption and secure data transmission. The technology can be utilized by public, private or hybrid networks and provides greater range than Cellular networks

4 1.5 MOTIVATION This work involves the development of an algorithm to control a group motion of mobile robots. A group of two mobile robots was developed while each of them was controlled to move by the microcontroller and electrical motors. The robots communicate through long range wide area network. The information regarding the position of the robot were sent and received through the server while user can also obtain the information in real time through a user interface (web application). The locations of all four mobile robots were determined based on the zigbee were also used as part of the route planning. Based on our experiment with different paths, the developed algorithm was capable of controlling the motion of the robots in the indoor designated area. The choice of Zigbee is motivated by the fact that it is a network specification for low- power Wireless Personal Area Networks (WPANs) and supports a large number of nodes. JiasongMuLiangHan et.al said that The ZigBee network is widely studied and deployed recently because of its low cost and simplicity features.

5 CHAPTER 2 LITERATURE SURVEY Sreerenjini C. Nair; Erik M. Coronado; Michael T. Frye; Yong Qin et.al (2010) This paper investigates the science of sensory and sensorimotor systems that enable navigation and natural flight in insects with application to the collaborative control of robots. The authors discuss fundamental research being conducted at the Autonomous Vehicle Systems Lab located at the University of the Incarnate Word on developing biologically inspired robots that emulate insect foraging and search behavior.The objective of this talk is to highlight the different applications of the rapidly emerging field of swarm intelligence in solving complex problems of traditional and swarm robotics. Belkacem Khaldi, Cherif Foudil et.al (2019) As an emergent research area by which swarm Intelligence is applied to multi-robot systems; swarm robotics (a very particular and peculiar sub-area of collective robotics) studies how to coordinate large groups of relatively simple robots through the use of local rules. It focuses on studying the design of large amount of relatively simple robots, their physical bodies and their controlling behaviors. Since its introduction in 2000, several successful experimentations had been realized, and till now more projects are under investigations.

Belkacem Khaldi et.

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navigation task deals with the issue of co-operative behavior among multiple mobile robots. Using Ant Colony Optimization, robot path planning in two-dimension environment is studied. In this paper the current study introduces the 6 intelligent finding optimum mechanism of ant colony. The theory has been tested both in simulation and experimental modes. Ying

Tan et.

al (2013) The research progress of swarm robotics is reviewed in details. The swarm robotics inspired from nature is a combination of swarm intelligence and robotics, which shows a great potential in several aspects. First of all, the cooperation of nature swarm and swarm intelligence are briefly introduced, and the special features of the swarm robotics are summarized compared to a single robot and other multi-individual systems. Then the modeling methods for swarm robotics are described, followed by a list of several widely used swarm robotics entity projects and simulation platforms. Finally, as a main part of this paper, the current research on the swarm robotic algorithms are presented in detail, including cooperative control mechanisms in swarm robotics for flocking, navigating and searching applications Rafael Stubs Parpinelli, Heitor Silvério Lopes et.al (2012) Natural swarms have generated various theories which have already been applied across several domains to address similar engineering challenges, from routing in communication network to combinatorial optimization and even multi robot systems, and so much more [31]. The foraging behavior of ant colonies in figuring out the shortest trajectories from their nesting sites to sources of food is one source of motivation; Then there is the behavior witnessed in flocking birds when they move together through vast distances to find food resources; Or indeed the collective movement observed in the various behaviors of fish schooling [32]. One of the key benefits of the distributed strategy is its superior suitability in dealing with the system's [35]. One way to secure modest global coherence within the entire system is to encourage interaction between the units of the system up to a level that could ensure global cohesion in the decision [31]. Arguably, since group achievement is expected to exceed the sum of individual unit performance, such cooperation only becomes possible unless the units are highly autonomous. Manuele Brambilla, Eliseo Ferrante, Mauro Birattari et.al (2013) Swarm robotics is an approach to collective robotics that takes inspiration from the self-organized behaviors of social animals. Through simple rules and local interactions, swarm robotics aims at designing robust, scalable, and flexible collective behaviors for the coordination of large numbers of robots. In this paper, we analyze the literature from the point of view of swarm engineering: we focus mainly on ideas and concepts that contribute to the advancement of swarm robotics as an engineering field and that could be relevant to tackle real-world applications. Swarm

7 engineering is an emerging discipline that aims at defining systematic and well founded procedures for modeling, designing, realizing, verifying, validating, operating, and maintaining a swarm robotics system. We propose two taxonomies: in the first taxonomy, we classify works that deal with design and analysis methods; in the second taxonomy, we classify works according to the collective behavior studied. We conclude with a discussion of the current limits of swarm robotics as an engineering discipline and with suggestions for future research directions Levent Bayindir et.al (2007) Swarm robotics is a new approach to the coordination of large numbers of relatively simple robots. The approach takes its inspiration from the system-level functioning of social insects which demonstrate three desired characteristics for multi-robot systems: robustness, flexibility and scalability. In this paper we have presented a preliminary taxonomy for swarm robotics and classified existing studies into this taxonomy after investigating the existing surveys related to swarm robotics literature. Our parent taxonomic units are modeling, behavior design, communication, analytical studies and problems. We are classifying existing studies into these main axes. Since existing reviews do not have enough number of studies reviewed or do have less numbers of or less appropriate categories, we believe that this review will be helpful for swarm robotics researchers 2.1 SUMMARY

To complete a mission, swarm robotics employs many robots in

a distributed architecture. The framework is resilient to individual robot failures and versatile in its ability to add or delete robots as the

task size shifts, thanks to its distributed architecture. As we saw in the examples of robots combining,

a distributed architecture can perform tasks that individual robots cannot.

8

CHAPTER 3 EMBEDDED SYSTEMS 3.1 OVERVIEW OF EMBEDDED SYSTEMS An embedded system may be a special-purpose computing

machine that is programmed

to perform one or a few specific functions, often under time constraints. It's normally incorporated as a part of an entire Hardware and mechanical

components are included in the device. A general-purpose machine, on the other hand, is used for a variety of tasks., sort of Using programming, a personal computer can perform a variety of tasks. Embedded systems have become increasingly important in today's world,

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as they power many of the everyday devices we use. Since the embedded system is committed to

a specific purpose, design engineers may tweak it to make it smaller and less expensive.of the product while increasing its reliability and efficiency. Embedded devices are mass-produced in some cases.Taking advantage

the importance

of

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economies of scale cannot be overstated. Small portable devices like digital watches and MP3 players to large stationary structures like traffic lights, factory controllers, and

nuclear power plant control systems

are all examples of embedded

systems.Complexity ranges from low to very high, depending on how many devices, peripherals, and networks are placed within.an outsized Enclosure or chassis in general, "embedded machine" isn't a well-defined concept since

a large number of devices can be programmed in some way Handheld computers, for example, have many features in common

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with embedded systems, such as the operating systems and microprocessors that power them, but they aren't entirely embedded systems because they allow for different applications and peripherals.to be connected. Embedded systems

perform a variety of tasks, including monitoring the environment. Data from input sensors is interpreted by embedded systems. The

The data is then interpreted, and the results are shown to a user or users in some format. Embedded systems generate and distribute actuator commands. Data transformation;

embedded systems alter data in some way that is useful, such as Compression and decompression of data While embedded systems provide They provide functionality specific to their applications,

as well as

interaction with the outside world through sensors and actuators.

9 Control rules, finite state machines, and signal processing algorithms are all examples of

signal processing algorithms are popular examples of embedded applications. These systems must also be able to detect and respond to threats. To Both the internal computing environment and the surrounding electromechanical structures are susceptible to faults. Embedded systems fall into a variety of categories, ranging From communication devices to home appliances to control systems,

there's something for everyone. ;Communication devices are an example of this. Modems and mobile phones are two examples. Appliances for the Home CD player, VCR, and microwave oven are some examples. System of Control Automobile anti-lock braking systems, robotics, and satellite control are only a few examples. 3.2 EMBEDDED SYSTEM BLOCK DIAGRAM

Embedded software. An operating system is used in some embedded systems. Others are

fig 3.1 embedded system of block diagram

10

highly specialised, resulting in the implementation of the entire logic as a single application. These systems are built into a computer for a particular purpose that is unrelated to general- purpose computing Figure 3.3

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CHARACTERISTICS OF EMBEDDED SYSTEMS Embedded systems have a unique set of characteristics that set them apart. - of these characteristics imposed distinct design constraints on

the product. 3.3.1

Implementation of Specific systems Standard computers are not the same as embedded systems. Embedded device designs are specific to

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a specific application. Many of the work characteristics are known before the hardware is installed. This allows the designer to focus on the specific design constraints of

the application. 3.3.2

Structures that are reactive As previously mentioned, a typical embedded systems model uses sensors to react to the environment and actuators to control the environment. This necessitates embedded systems running at the same rate as their surroundings. The term "reactive" describes this feature of embedded systems.

which is known as reactive computation. External occurrences may be either regular or irregular. Periodic incidents make it easier to plan processing so that it runs smoothly. Aperiodic activities are more difficult to plan. In order to account for worst-case scenarios, the maximum. Performing an effective worst-case design study on systems with predictive performance characteristics is one of the most difficult tasks for embedded device designers

in a real-time system. When dealing with this necessity, it's common to design for the worst-case scenario. On complex architectures, however, This sometimes results in excessively cautious forecasts that err on the side of caution. In order to satisfy external I/O and control stability criteria, many embedded systems have a major requirement for real-time operation. 3.3.3

Distributed of systems

This is due to financial constraints. Cost-effective 4 8-bit microcontrollers are likely to be less expensive than 32-bit processors. And when the cost of communication connections is factored in, this strategy could be preferable. Multiple processors are typically needed in this approach to handle multiple time-critical tasks. Physical distribution of devices regulated by embedded systems is also possible.

11 3.4 HETEROGENEOUS ARCHITECTURES Embedded systems are often made up of disparate architectures (Fig 3.2). Different processors can be used in the same device solution. It's also possible that they're mixed signal systems. Embedded device architecture is truly unique due to the

Embedded systems are therefore constrained in terms of configuration, and heterogeneity allows for more design versatility. Fig 3.2 Heterogeneous Architecture 3.4.1 The Harsh environment Many embedded systems aren't designed to work in a

safe and regulated setting

Excessive heat is a common problem, particularly in applications involving combustion (e.g., many transportation applications).

Defense vibrations, shock, lightning, power supply fluctuations, water, flooding, burning, and other physical hazards can all trigger additional safety concerns. As embedded device complexity and computational capacity increase, they are beginning to monitor more and more of the overall system's safety aspects. These safeguards could be implemented in the form of software or hardware. When a computer system loses power, mechanical safety backups are usually triggered to safely shut down the system. The problem of software security and reliability is becoming more severe. Normally, software does not "break" in the same way as hardware does. However, software can be so complex that a series of unanticipated events can result in software errors, resulting in an unsafe situation.

but this is beyond the reach of this book.

12 3.4.2

Machine Stability and Protection As embedded device complexity and computational capacity increase, they are beginning to monitor more and more of the overall system's safety aspects. These safeguards could be implemented in the form of software or hardware. When a computer system loses power, mechanical safety backups are usually triggered to safely shut down the system. The problem of software security and reliability is becoming more severe. Normally, software does not "break" in the same way as hardware does. However, software can be so complex that a series of unanticipated events can result in software errors, resulting in an unsafe situation.

but this is beyond the reach of this book. For embedded system designers, the key challenge is to achieve low-cost reliability with limited redundancy. 3.4.3 physical control system The ability to communicate with the world is one of the key reasons for embedding a device. This is often accomplished by the use of external equipment to track and regulate. For processing, embedded computers convert analogue signals from sensors to digital signals. The outputs must be converted to analogue signal levels again. Large current loads can need to be transferred when controlling physical equipment

a large number of non-digital components to meet these requirements. 3.4.4 Small and light in weight A large number of embedded computers are physically embedded in a larger structure. Aesthetics can determine the form factor for the embedded device. A missile's form factor, for example, may need to fit within the missile's nose. Developing non-rectangular geometries for such solutions is one of the challenges faced by embedded device designers. Weight can also be a limiting factor. For example, embedded vehicle control systems must be light weight in order to save fuel. For portability, portable CD players must be light in weight.

13 3.4.5 Adversion to Cost Cost is a problem in most systems, but in embedded

it is more a function of the proportion of cost adjustments to overall device costs. 3.5 MANAGEMENT OF POWER The power consumption of embedded systems is strictly controlled. Given the portability requirements of many embedded systems, power conservation is critical in order to maximise battery life. Another apparent problem for embedded systems is the reduction of heat generation. 3.5.1 Electricity

The AC voltage, which is usually 230 volts rms, is connected to a transformer voltage down tdc voltage, which not only has much less ripple voltage.

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Fig 3.3 General Block Of Power Supply Unit 3.5.2 Transformer A transformer is a permanent component that transfers electric power from one circuit

to another circuit at the same frequency. It has the power to change the voltage in the circuit, but it does so at the cost of other components.of a decrease or increase in current. It operates on the mutual induction principle. A step down transformer is used in our project to provide the required supply for the electronic circuits. We're converting 230 volts .

14 3.5.3 Rectifier Full wave rectification

is a method that increases the dc level obtained from a sinusoidal input by 100%. In our project, we use a bridge rectifier for full wave rectification. As seen in the simple bridge setup,

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two diodes (say D2 & D3) conduct while the other two diodes (D1 & D4) are in

the off state

during the period $t = 0$ to $T/2$. D1 and D4 are the conducting diodes for the input's negative loop. As a consequence, the load's polarity is constant. The bridge rectifier can use a variety of diodes, including 1

N4001, 1N4003, 1N4004, 1N4005, 1N4007, and so on. We use 1N4007 instead because it can withstand 1000 volts. 3.5.4 filters A low pass filter

is

a filter that reduces the amount of informationis needed in order to

in order to achieve a 0 Hz

dc voltage As a consequence, a capacitive filter circuit with a capacitor connected to the rectifier output and

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a dc obtained through it is employed. The filtered waveform is essentially a dc voltage with minimal ripples, which is then fed to the load. 3.5.5 Registers The

controller IC has two 8 bit registers, an instruction register (IR) and a data register (DR). The IR stores the instruction codes and address information for display data RAM (DD RAM) and character generator RAM (CG RAM). The IR can be written, but not read by the MPU.

The DR temporally stores data to be written to /read from the DD RAM or CG

RAM. The data written to DR by the MPU, is automatically written to the DD RAM or CG RAM as an internal operation. When an address code is written to IR, the data is automatically transferred from the DD RAM or CG RAM to the DR. data transfer between the MPU is then completed when the MPU reads the DR. likewise, for the next MPU read of the DR, data in DD RAM or CG RAM at the address is sent to the DR automatically. Similarly, for the MPU write of the DR, the next DD RAM or CG RAM address is selected for the write operation. The dot-matrix liquid crystal display controller and driver LSI displays alphanumeric, Japanese kana characters, and symbols. It can be configured to drive a dot-matrix liquid crystal display under the control of a 4- or 8-bit microprocessor. Since all the functions such as display RAM, character generator, and liquid crystal driver, required for driving a dot-matrix liquid crystal display are internally provided on one chip, a minimal system can be interfaced with this controller/drive.

15 3.5.6 Regulatory bodies

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The output voltage of the capacitor is filtered and then regulated. The voltage regulator is a device that maintains

a constant

output voltage regardless of supply, load, or temperature variations. The LM7805, which is a fixed voltage regulator,

will be used. The LM7805 is a 5 volt regulator integrated circuit.is commonly used in microcontrollers. 3.6 NODE MCU The NodeMCU framework is a free and

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open source IoT platform. It includes firmware that runs on Espressif Systems' ESP8266 Wi-Fi SoC and hardware that is built on the ESP-12

board. By design, the name "NodeMCU" applies to the firmware, not the development kits.

Lua is the scripting language used by the firmware. It was created using the Espressif Non-OS SDK for ESP8266 and is based on the eLua project. It makes use of a number of open source projects, including lua-cjson and SPIFFS. Shortly after the ESP8266 was

released. NodeMCU was developed. Espressif Systems

The

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ESP8266 is a Wi-Fi SoC with a Tensilica Xtensa LX106 core that is widely used in IoT applications (

see related projects). On October 13, 2014, Hong uploaded the first nodemcu-firmware

file to GitHub,

kicking off NodeMCU. Developer Huang R contributed the gerber file for the devkit v0.9 ESP8266 board

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two months later, extending the project to include an open-hardware platform.

PM Tuan ported Contiki's later that month, allowing NodeMCU On the 30th of January, 2015,

NodeMCU was able

to drive LCD, Screen, OLED, and even VGA displays with ease

after Devsaurus ported the u8glib library to the project. In the summer of 2015,

the developers left the firmware project, and it was taken over by a group of independent contributors. The NodeMCU had expanded to over 40 different modules

by the summer of 2016. Due to resource constraints, users must choose the modules that are most relevant to their project. 3.6.1 Core Arduino As Arduino.cc

began to develop

new MCU boards based on non-AVR processors, such as

the ARM/SAM MCU used in the Arduino Due, they needed to adapt the Arduino IDE

to embrace alternative toolchains so that Arduino C/C++ could be compiled for these new processors.

They were able to accomplish this after the arrival of

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the Board Manager and the SAM Core. To compile an Arduino C/C++ source file for the target MCU's machine language,

both the Board Manager and the Arduino IDE

require a "core" of software components.

An Arduino core for the ESP8266 was created by some ESP8266 fans.

16 The "ESP8266 Core for the Arduino IDE" is a common name for the ESP8266 WiFi So C. This has established itself as NodeMCU. NodeMCU firmware comes with ESP8266 Development board/kit, i.e. The NodeMCU Development Board/Kit, version 0.9, allows you to experiment with the ESP8266 chip (Version1). Since NodeMCU is an open source platform, anyone can edit, update, or develop their hardware design. The NodeMCU Dev Kit/board uses the ESP8266 wifi enabled chip. Espressif Systems developed the ESP8266, a low-cost Wi-Fi chip that uses the TCP/IP protocol. For more information on the ESP8266, see the ESP8266 WiFi Module. The NodeMCU Dev Kit is available in version 2 (V2), which is the

NodeMCU Development Board v1.0 (Version2), which is normally black in colour. Fig : 3.4 NodeMCU Development Board/kit v1.0 (Version 3.6.2

with ESPLORER IDE

Getting started with NodeMCU using ESPlorer IDE The Arduino IDE, which is a well- known IDE, is another choice for developing NodeMCU. The Arduino development environment can also be used to build NodeMCU applications. For Arduino developers,

this makes learning a new language and IDE for NodeMCU much simpler. For more information on how to compose an Arduino sketch for the NodeMCU,

see this article.

Getting going with the Arduino IDE is used to programme NodeMCU.

We can assume that there is a programming language difference

when designing NodeMCU applications

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using ESPlorer IDE and Arduino IDE. We'll need to code in C++ if we're using

the Arduino IDE

to create NodeMCU applications, and

we'll need to code in Lua if we're using the ESPlorer IDE. NodeMCU is a Lua translator, which means it understands the Lua language easily.

17 We use Lua to write NodeMCUsend/upload scripts.to NodeMCU, then we use the Arduino to write and compile code. TheESP8266toolchainIDE is a development environment for the ESP8266 microcontroller.

TheESP8266

toolchain generates a binary firmware file from the code we wrote earlier. The newly developed binary firmware code will be flashed to all NodeMCU firmware

when we upload it to NodeMCU. It literally writes the entire firmware to the hard drive. As a result, NodeMCU will not allow any more

Lua scripts or

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code after being flashed by Arduino IDE. After being flashed by Arduino sketch/code, there will be no Lua interpreter, and attempting to upload Lua scripts

will result in an error. We'll need to flash the Lua script with NodeMCU firmware to get it working again they will be carried out. 3.7

GENERAL INFORMATION OF DC MOTOR

A DC motor is used to drive a mechanical load. In this lab, a separately excited DC generator provides the load. The load on the motor is adjusted by varying the generator field current. By increasing the field current of the DC generator, the load on the DC motor increases and thus the armature current increases. In general, DC motors are characterized by their torque-speed curves as shown in Figure 9.1. Since the measuring equipment for shaft torque is not available in the lab

it is

necessary to use alternative means of

characterizing

the DC motor. One alternative is to plot shaft speed versus armature current since torque is directly proportional to the armature current (

$$T = K_a \phi I_a)$$

with a constant field current supplied to the motor. Shaft speed is also a function of the field current in a DC motor while maintaining a

constant armature voltage (

$$E_a = K_a \phi \omega)$$

as field current is directly proportional to the direct

axis flux produced in the machine.

18 3.7.1

Construction The stator of the dc motor has poles, which are excited by dc current to produce magnetic fields. Fig.3.5 DC Motor In the middle between the poles, commutating poles are placed to reduce sparking of the commutator. The commutating poles are supplied by dc current. Compensating windings are mounted on the main poles. These short-circuited windings damp rotor oscillations. The poles are mounted on an iron core that provides a closed magnetic circuit. The motor housing supports the iron core, the brushes and the bearings. The rotor has a ring-shaped laminated iron core with slots. Coils with several turns are placed in the slots. The distance between the two legs of the coil is about 180 electric degrees. The coils are connected in series through the commutator segments. The ends of each coil are connected to a commutator segment. The commutator consists of insulated copper segments mounted on an insulated tube. Two brushes are pressed to the commutator to permit current flow. The brushes are placed in the neutral zone, where the magnetic field is close to zero, to reduce arcing. The rotor has a ring-shaped laminated iron core with slots. The commutator consists of insulated copper segments mounted on an insulated tube. Two brushes are pressed to the commutator to permit current flow. The brushes are placed in the neutral zone, where the magnetic field is close to zero, to reduce arcing. The commutator switches the current from one rotor coil to the adjacent coil, the switching requires the interruption of the coil current. The sudden interruption of an inductive current generates high voltage.

19 3.7.2 DC Motor Operation

In a dc motor, the stator poles are supplied by dc

excitation current, which produces dc magnetic field. The rotor is

supplied by dc current through the brushes, commutator and coils. The interaction of the magnetic field and rotor current generates a force that drives the motor. The magnetic field lines enter into the rotor from the north pole (N) and exit toward the south pole (S). The poles generate a magnetic field that is perpendicular to the current carrying conductors. The interaction between the field and the current

produces a Lorentz force; the force

is perpendicular to both the magnetic field and conductor. The generated force turns the rotor until the coil reaches the neutral point between the poles. At this point, the magnetic field becomes practically zero together with the force. However, inertia drives the motor beyond the neutral zone where the direction of the magnetic field reverses. To avoid the reversal of the force direction, the commutator changes the current direction, which maintains the counterclockwise rotation. Before reaching the neutral zone, the current enters in segment 1 and exits from segment 2. Therefore, current

enters the coil end at slot a and exits from slot b during this stage. After passing the neutral zone, the current enters segment 2 and exits from segment 1, this reverses the current direction through the rotor coil, when the coil passes the neutral zone. The result of this current reversal is the maintenance of the rotation.

20

Fig3.6 DC

Motor Operation

fig 3.7

DC Motor Equivalent circuit The following figures show the equivalent circuit of a separately excited dc motor. Equivalent circuit is similar to the generator only the current directions are different. The operation

equations are:

Armature voltage equation

$$V_{dc} = E_a + I_a R_a +$$

V_{brush} -----Eq.(1) The induced voltage and motor speed vs angular frequency $\omega = 2\pi f$ -----
-----Eq.(2) The combination of the equations

results in $K_m I_f \omega =$

$$E_a = V_{dc} - I_a R_m$$

Eq.(3) The current is calculated from this equation. The output power and torque are $T =$

$$P_{OUT} / \omega = K_m I_a I_f$$
 -----Eq.(4)

Rotation $I / 2 r_{dc}$ Brush $I r_{dc} I r_{dc} / 2$ Shaft Pole winding | 1 8 2 N 7 3 S 6 4 5 Insulation Rotor Winding $I r_{dc}$ Copper segment R V brush R a Electrical power in $f_{max} V I I E_a a m V f f_{dc}$ DC Power supply Mechanic a l power out

21

Generally, even the simplest robot requires a motor to rotate a wheel or performs particular action. Since motors need more

current than

a microcontroller pin can normally produce, you'll need a switch (Transistors, MOSFETs, Relays, etc.) that can

that drives the motor. This entire procedure is carried out by a device

known as a motor driver.

Motor driver is basically a current amplifier which takes a low-current signal from the microcontroller and gives out a proportionally higher current signal which can control and drive a motor. In most cases, a transistor can act as a switch and perform this task which drives the motor in a single direction. Turning a motor ON and OFF requires only one switch to control a single motor in a single direction. What if you want your motor to reverse its direction? The simple answer is to reverse its polarity. This can be achieved by using four switches that are arranged in an intelligent manner such that the circuit not only drives the motor, but also controls its direction. Out of many, one of the most common and clever design is a H-bridge circuit where transistors are arranged in a shape that resembles the English alphabet "H". As you can see in the image,

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the circuit has four switches A, B, C and D. Turning these switches ON and OFF can drive a motor in different ways. Turning on Switches A and D makes the motor rotate clockwise Turning on Switches B and C makes the motor rotate anti-clockwise Turning on Switches A and B will stop the motor (Brakes).

H-bridges can be built from scratch using relays, mosfets, field effect transistors (FET), bi-polar junction transistors (BJT), etc. But if your current requirement is not too high and all you need is a single package which does the job of driving a small DC motor in two directions, then all you need is a L293D IC. This single inexpensive package can interface not one, but two DC motors. L293, L293B and few other versions also does the same job, but pick the L293D version as this one has an inbuilt fly back diode which protects the driving transistors from voltage spikes that occur when the motor coil is turned off.

3.7.3 Introduction to L293D IC

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L293D IC generally comes as a standard 16-pin DIP (dual-in line package). This motor driver IC can simultaneously control two small motors in either direction; forward and reverse with just 4 microcontroller pins (

if you do

not use

enable pins). Some of the features (and drawbacks) of this

IC are:

22

Output current capability is limited to 600mA per channel with peak output current limited to 1.2A (non-repetitive). This means you cannot drive bigger motors with this IC. However, most small motors

used in

hobby robotics should work. If you are unsure whether the IC can handle a particular motor, connect the IC to its circuit and run the motor with your finger on the IC. If it gets really hot, then beware... Also note the words "non- repetitive"; if the current output repeatedly reaches 1.2A, it might destroy the

drive transistors. Supply voltage can be as large as 36 Volts. This means you

do not have to worry much about voltage regulation. L293D has an enable facility which helps you enable the IC output pins. If an enable pin is

set

L293

D has an enable facility which helps you enable the IC output pins. If an enable pin is set to logic high, then state of the inputs match the

state

of

the outputs. Datasheet also mentions an "over temperature protection" built into the IC. This means an internal sensor senses its internal temperature and stops driving the motors if the temperature crosses

a set point. Another major feature of L293D is

its internal clamp diodes. This flyback diode helps protect the driver IC from voltage spikes that occur when the motor coil is turned on and off (mostly when

turned off)

The logical low in the IC is set to 1.5V. This means the pin is set high only if the voltage across the pin crosses 1.5V which makes it suitable for use in high frequency applications like switching applications (upto 5KHz). Lastly, this integrated circuit not only drives DC motors, but can also be used to drive relay

solenoids, stepper motors etc.

The circuit shown is the most simple L293D IC implementation. There are 16 pins

protruding from this IC, and we need to

know what each one does before we can use it in a circuit. The "Enable" pins are Pins 1 and 9. For the drivers to work, they must be wired to +5V. The outputs would be switched off regardless of the input states if they are pulled low (GND), stopping the motors. Attach these pins to the microcontroller, or simply to controlled positive 5 Volts, if your microcontroller has two spare pins. Ground pins Pins 4, 5, 12, and 13 should preferably be attached to the microcontroller's ground. Pins 2, 7, 10, and 15 are all logic input pins. The first motor is powered by Pins 2 and 7. Pins 3, 6, 11, and

positive lead. According to the datasheet, the supply voltage can reach 36 volts. I've shown you how to wire the motors, battery, and microcontroller together. I have shown you where to connect the motors, battery and

the microcontroller. But how do we control the direction of these motors? Let us take an example

Suppose you need to control the left motor which is connected to Pin3 (O1)

23 and Pin6 (O2). As mentioned above, we require three pins to control this motor - Pin1 (E1), Pin2 (I1) and Pin7 (I2). Here is the truth table representing the functionality of this

motor driver.

In the above truth table you can observe that if Pin1 (E1) is low then the motor stops, irrespective of the states on Pin2 and Pin7. Hence it is essential to hold E1 high for the driver to function, or simply connect enable pins to positive 5 volts. With Pin1 high, if Pin2 is set high and Pin7 is pulled low, then current flows from Pin2 to Pin7 driving the motor in anti-clockwise direction? If the states of Pin2 and Pin7 are flipped, then current flows from Pin7 to Pin2 driving the motor in clockwise direction. The above concept holds true for other side of the IC too. Connect your motor to Pin11 and Pin14; Pin10 and Pin15 are input pins, and Pin9 (E2) enables. 3.8

INTERNET OF THINGS The

composition of the chapter is as follows: This segment explains why this project is being undertaken. This segment outlines the research objectives and concerns. This section outlines the steps that must be taken to achieve our objectives. The layout of the report is shown in section.

are presented in this section.

The report's structure is shown in section.

24 3.8.1 Historical context The layout of the

report is shown in section 3.8.1. Historical background The Future Internet's

goal

is to build an infrastructure that gives people immediate access to information about the real world and its

artefacts. Artefacts in physical form e-health, warehouse management, and

other applications are only a few examples. Physical devices of various types may be used in various application domains. In order to communicate with a physical device, it must adhere to its own set of requirements.

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To achieve the future Internet goal, a layered vision that promotes data access

is needed. The

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Internet of Things (IoT) is a concept that aims to link the

virtual

and physical worlds of information and devices. using a layered approach.

The phrase "Internet of Things" is made up of two words: internet and things. The Internet is a global network system with scalable, configurable features based on open, interoperable communication protocols. 3.8.2

Defination of Internet of Things IoT connects physical objects to knowledge networks via transportation.

IoT refers to the overall infrastructure that supports these information networks, including software, hardware, and facilities. The interconnected physical things will share knowledge and data about their physical properties and their surroundings. Identification technologies such as RFID, which enable each device to be uniquely identified, can be used to identify devices. IoT is described

by the

that enables Interconnecting (physical and virtual) stuff to provide advanced services

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based on current and evolving interoperable information and communication technologies. With RFID technology, the concept of a globally interconnected continuum of machines, artefacts, and things in general was born, and this term has since been greatly extended to include a multitude of heterogeneous artefacts interacting with the physical environment."

according to the Internet of Things-Architecture 2 (IoT-A). 3.8.3 The Technology layer at the edge Embedded systems, RFID tags, sensor networks, and other forms of sensors

are all part of the hardware layer.

Gathering data from a computer or environment, processing data, and facilitating communication

are all tasks that this hardware layer can perform.

This is the

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hardware layer, which includes embedded systems, RFID tags, sensor networks, and all other types of sensors. This hardware layer can perform

a variety of tasks, including gathering data from a device or environment, processing data, and facilitating communication.

25 3.8.4

layer ofAccess gateway This layer is in charge of data handling and is in charge of This layer is responsible for data processing, as well as

publishing and subscribing to the Stuff's services, as well as message routing and hovelling communication between platforms.

in charge of data handling and is in charge of

This layer is responsible for data handling, as well as publishing and subscribing to the Stuff's services, as well as message routing and hoveling communication between platforms. 3.8.5 Layer

in the Middle

This layer performs critical functions such as aggregating and filtering data from hardware devices, conducting information discovery, and managing application system access. 3.8.6 Application layer This layer is responsible for

a wide range of application services.

The middleware layer in IoT-based systems delivers these services to different applications and users. Logistics, retail, and healthcare are among the industries that can benefit from the application services.

Fig: 3.8 Layered architecture of the Internet of Things (IoT) 3.9 TECHNOLOGY WITH EDGE

Since an IoT-based system must be able to

collect enough data

about the real world from a variety of

sensors and environments, further research efforts are needed to boost the technology of embedded systems, sensors, actuators, and

other devices at the hardware level (

passive and active) recognition. As a result, there is still work to be done in terms of connecting

heterogeneous devices and deploying them in IoT applications, as well as providing support for new devices.

26 3.9.1 Network technology Things in

the Internet of Things are linked via a variety

of networks, including telephone, wired, and wireless networks. These networks allow bi-directional communication between real-world objects, devices, and services used by IoT applications at various levels. This highly distributed structure should

allow for interconnection while consuming little resources. 3.9.2 Platform services They

allow for better coordinated

management of all involved devices, ensuring scalability, high availability, and the safe and secure execution of tasks.

system functionality. In the next section, we'll look at middleware problems, as we're looking for the features that a middleware. 3.9.3 Middleware for the Internet of Things (IoT) version Setal Bandyopadhyay and Setal Bandyopadhyay analysed middleware systems used in IoT- based systems [1]. They divide middleware's required functionality for managing (2)

system abstraction, (3) central control, context detection & management.

Fig : 3.9 Components of a middleware for IoT-based

27 3.10 INTERFACE PROTOCOL

Technical interoperability is the responsibility of this part. In the sense of Interface protocols, interoperability refers to the ability of two systems to communicate with each other using the same communication protocols. Technical interoperability is described by ETSI

The European Telecommunications Standards Institute (ETSI) is an organisation that brings together hardware and software modules, systems, and platforms that enable machines to communicate with one another. The infrastructure and (communication) protocols are frequently the subject of this form of interoperability.

required to support them. In order to enable technical interoperability, The Interface Protocol section defines protocols for exchanging data between networks that use various communication protocols. This component is in charge of basic communication in the TCP/IP stack's

The physical and data connections, the network, the transport, and, on rare occasions, the application layer are all protected. To handle system heterogeneity, we may build

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a wrapper for each device that converts the device's protocol to a more widely used protocol. This wrapper can be mounted on the device or the middleware. We may place the wrapper in the middleware side

if we want to interact directly with devices. Due to the fact that most systems

have minimal computing capabilities, a wrapper on the middleware side would be a good idea. In the case of indirect contact with devices, on the other hand, an intermediate wrapper between the middleware and the devices can be created. The interface protocol portion ensures that the middleware can handle both direct and indirect interactions. 3.11 ANSTRACTION TO DEVICE (DA) This part is in charge of providing an abstr act format that allows application components to communicate with devices more easily. This abstr action allows for syntactic and semantic interoperability, as described by ETSI [14]. Data formats are linked to syntactic interoperability. Communication protocols must transfer messages with

with

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a well-defined syntax and encoding format that can be expressed with high-level transfer syntaxes such as HTML and XML

The sense of a message's content that is understandable by humans

is usually associated with semantic interoperability. This level of interoperability

thus means that people have a shared understanding of

the nature of the material (information) they are exchanging. However, since DA does not communicate with humans directly, semantic interoperability in the sense of DA is

not possible

responsible for delivering these applications. Semantic interoperability is based on semantic

28 models that are typically domain specific. Using Devices Profile for Web Services, for example, is

each system type refers to a distinct service type in this context. The DA component has two main functions: (1) asking devices to perform a task and (2) defining and configuring devices. The XML format is used by DPWS. 3.12 CENTRAL CONTROL, DETECTION & MANAGEMENT OF CONTEXT (CCM) CONTEXT (CCM) An entity'

s situation,

which can be a place, an individual,

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or an object, that is relevant to users, applications, and their interactions

is defined by context. CCM is in charge of supporting context-aware computation, which is a form of computation that takes into account the context of the entities that communicate with the device. To function in smart environments, middleware for IoT-based systems must be context-aware. The term The term "smart world" refers

to a physical environment that is richly, imperceptibly interwoven with sensors, displays, and computational

components, and is seamlessly incorporated into everyday artefacts. Context detection is the process of gathering data from various sources and choosing information that may affect the computation. Context analysis is the method of using the information collected to complete a task or make a decision. This functional component is used to communicate with devices for high-level systems as well as end-users. This interface may be a RESTful interface or custom-built. For data processing and monitoring services,

Malatras et al. [18] propose a SOA-based middleware. This software serves as a bridge between two systems.

makes use of a restful interface to make it easier for high-level applications to connect with sensors that can communicate

HTTP operations on a Wireless Sensor Network (WSN): (1) question an existing resource, (2) remove an existing resource, (3) post a new resource. Open Arduino IDE as shown below

29 3.13 ardino

software 1. Open Arduino IDE as shown below ig:3.10 Arduino IDE

30 2.Select the COM Port from tool Select the COM Port

Fig: 3.11 COM Port

32 1. Select the required Arduino board from Tools as shown below Select the required Arduino board Fig: 3.12 Arduino board selection

33 2. Write the sketch in Arduino IDE Sketch in Arduino IDE Fig: 3.13 Arduino IDE

34 3.

Compile and upload the Sketch to Arduino board upload the Sketch to Arduino board

Fig:3.14 Sketch of Arduino board 3.14 ZIGBEE IEEE 802.15.4 Zigbee is

an open global standard

for low-cost, low-power wireless M2M network technology.

The Zigbee standard, which works in unlicensed bands such as 2.4 GHz, 900 MHz, and 868 MHz,

is based

on the IEEE 802.15.4 physical radio specification. The 802.15.4 standard, on

which the Zigbee stack is based,

was ratified by the Institute of Electrical and Electronics Engineers (IEEE) in 2003. The protocol is a packet-based radio protocol designed for low-cost

computers that run on batteries.

Devices can communicate using the protocol

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in a variety of network topologies. 35 3.14.2 The zigbee protocol The Zigbee Alliance's member companies developed and ratified the Zigbee protocol. Over 300 leading semiconductor manufacturers, technology

companies, OEMs, and service providers

make up the Zigbee Alliance.

The Zigbee protocol was designed to provide a simple wireless data solution with reliable wireless network architectures. The Zigbee protocol was designed to transmit data in RF environments

such as

those found

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in commercial and industrial settings. Fig. 3.15 Pin Diagram Zigbee is a collection of high-level communication protocols		

developed by zigbee that are used to build

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on power output and environmental characteristics, Zigbee devices can transmit data over long distances by moving data through a mesh network of intermediate devices to reach more distant		

devices,

limiting

transmission distances to 10–100 metres line-of-sight, depending on power output and environmental characteristics.

Zigbee

is popular in low-data-rate applications that require

long battery life and stable networking. 250

word sideal for data transfers from a sensor or input system on a regular basis. Wireless

Just a few examples of

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applications include wireless light switches, electrical metres with in-home displays, traffic		

control

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systems, and other consumer and industrial devices with short-range low-rate wireless data transmission. The Zigbee specification is		

a set of rules for wireless communication. defines a system . 4.2 Mesh Networks Mesh Networks are a type of network that is made up of the Zigbee protocol's ability to support mesh networking is a key feature. A mesh network's nodes are linked to one another

so that each node can be reached through multiple paths. Connections between nodes are dynamically updated and optimised

using

a sophisticated, built-in mesh

36 routing table. Mesh networks are inherently decentralised, with

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each node capable of self- discovery. When nodes leave the network, the mesh topology allows them to reconfigure routing paths based on network structure.		

In changing conditions or when a single node fails, the mesh topology and ad-hoc routing characteristics provide more flexibility. 3.14.3 Applications for zigbee Zigbee facilitates widespread wireless network deployment by providing low-cost, low-power solutions. It can operate for years on a single set of cheap batteries, making it suitable for a wide range

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of monitoring and control applications. Smart energy/smart grid, AMR (Automatic Meter Reading), lighting controls, building automation systems, tank monitoring, HVAC control, medical

equipment, and fleet applications are just

a few places

where ZigBee technology is rapidly advancing. Digi is a Zigbee Alliance member and has developed a

number of Zigbee-based networking solutions.

Modules for XBee and XBee- PRO, as well as Zigbee-enabled devices 3.15 UBDOTS EXPLORER Welcome to the rest hardware documentation for Ubidots. You'll learn how to use our supported communication protocols, such as http, mqtt, and tcp/udp, to send and

that you can reproduce it in your firmware. As a result, we stop using examples that use please do so. A data-point or "dot" is generated every time a system updates a sensor value in a variable. Ubidots collects dots from your devices and stores them in variables.

37 Fig 3.16 Ubdots Data

Hierarchy

Item Description Mandatory value A numerical value. Ubidots accepts up to 16 YES floating-point length numbers. timestamp Unix Epoch time, in millisec onds . If not specified , NO then our servers will assign one upon reception. context An arbitrary collection of key-value pairs.

NO

TABLE.3.2 UBDOT Discription

38 Epoch Converter is a valuable method for converting between Unix timestamps and human-readable dates.

You can also store string or char data types within what we call context,

which is not limited to numerical values. The background is a key-value object that can be used to store both numerical and string values. Context is an example of how to use the context. For GPS/tracking application use cases, a background is typically used to store the device's latitude and longitude coordinates. All Ubidots maps extract the coordinates of your computer using the lat and lng keys from a dot's background, so

you only

need to submit a single dot with the coordinates values in the vector. Instead of submitting both latitude and longitude in two different variables,

use background to plot a map. A standard background with coordinate values can be found below. Please keep in mind that string and numerical values can be mixed in the background. If you're using your application for geolocation, make sure the coordinates are in decimal degrees. Series of events in time On the basis of the above, we may depict a Ubidots

time sequence. 3.16 HTTP It is the most widely used internet protocol for data sharing on the Internet. It also supports data encryption, also known as stable HTTP or HTTPs. You submit and receive packages using

As a result, it's no surprise that HTTPs has become a common method of data sharing in the IoT. When a developer needs to introduce HTTP communication, he can look for a REST API, or Restful Application Programming Interface, which exposes all of

the endpoints needed to communicate with a third-party application (like Ubidots). You can use our REST API

in this section to undo stuff.

39

TABLE 3.3 HTTP

requests HTTP is a request/response protocol, which means that

the server responds to each request you make. A number (answer code) and a body are included in this response. A GET request is created when you request a file from a website (for example, "Get me the file 'websiteside.html'"). The server will respond

if the request is correct. the server will usually respond with a 200 response code and the file that was

requested (body). When a computer sends a GET request to the Ubidots server (i.e.,

asking for the most recent

value of a variable), the server responds with the request status (response code) and a body. API access

is available via HTTP or HTTPSs, with the following endpoints depending on your Ubidots Account form. Note on security: We strongly suggest using HTTPSs to ensure that your data is encrypted and that your API token and/or sensor data exposed. Table 3.4 Security Note THE HTTP Method Description FOR HTTP

GET help to retrieve information POST help to create a new element PATCH help to update existing elements DELETE

help to delete existing elements

Ubidots of Account Endpoint of ubidots The

Port

Educational <http://things.ubidots.com> 80 Industrial <http://industrial.api.ubidots.com> 80 Educational
<https://things.ubidots.com> 443 Industrial <https://industrial.api.ubidots.com> 443

40

CHAPTER 4 RESULTS AND DISCUSSION 4.1 CONSTRUCTION A communication system, which employs Zigbee and LoRa communication protocols is designed, developed, and tested in this experimental paper. The designed system contains a central receiver unit LoRa and zigbee transceiver modules, a microcontroller, a wifi network with LoRa and zigbee transceiver modules, and a 1298 unit.

The

two mobile robots were able to perform a group motion and communicate through the LoRa Wan. The robots were able to successfully reach their target destinations with lower power consumption. Since energy consumption was very important for the robot to sustain their service while navigating through the area, we found that using LoRa could help extend the longer period for robot to function. The zigbee navigation was able to assist the robot for navigation but the efficiency was only about 85.38%. Therefore, future work should focus on improving the accuracy of the zigbee localization system as part of improving the efficiency of the system. More data streaming from sensors on the robots which caused delay needed to be addressed. Our experiment presented that a group of mobile robots can function at the same time and can communicate among each other successfully through the LoRa Wan. The similar features could be applied in industrial logistic in factories.

41

Fig:4.1 Mobile Robot Two robot are programmed with virtual mapping technique. Virtual mapping technique is a technique where robot is control through long distance in one go.

Two robots and mobile is connected through wifi module. Here mobile act as a server and robot act as a client.

communication between two robots is done by zigbee module.

42 fig 4.2 snap of Robot

If we give the command as 1,1 for the first robot it goes to room number '1'.

In 1,1 the first '1' indicates robot one and second '1' indicates room number '1'.

Now if we give the command as 2,1. In 2,1 the '2' indicates robot two and '1' indicates room number '1'. Now if we give the command as 2,1. The robot will not move because already robot one settles at first room. Now giving the command as 2,2. Now the second robot moves to second room and do his job.

43

fig:4.2 Swam robot control application Each individual robot has unique IP address for the first robot the IP address is 192.168.43.128. For the

second robot

IP address is 192.168.43.129.

44 CHAPTER 5 CONCLUSION The hardware components are successfully assembled and interfacing the microcontroller with robot is achieved. Controlling the motion of robot via Wi-Fi as well as ZigBee from android applet is successfully obtained. Hence the two modules of controlling the robot is successfully tested and demonstrated. Though controlling using Wi-Fi limits the range of distance for communication, a smart and easy means to guide a robot

is achieved. Using the hardware components like zigbee board,

voltage regulator, bread board, node mcu this project is implemented. After these acute connections we operate these two robots by our mobile swarm robots application (each robot is give my unique IP address). Finally we observe the robots moving in to two different directions eventually. The two robots wont accelerate into same direction by the help of zigbee technology the communication between the two robots were made. Hence they are also cappable of doing multi tasks.

6.1 FUTURE SCOPE The working person of coal mines has to face various environmental parameters in their work place. They have the danger from methane, carbon monoxide, SpO2 level and temperature. In future by using more number of salve to improve the data transmission distance. So, the rescue operation of miners can be carried out. The system can be enhanced further. The system can be improved by adding more measuring devices to check miners blood pressure and using additional sensors all possible safety issues could be monitored such as dust, vibration, water leakage, fall detection etc.

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2/33	SUBMITTED TEXT	29 WORDS	73% MATCHING TEXT	29 WORDS
	as they power many of the everyday devices we use. Since the embedded system is committed to		as they control many of the common devices we use. Since the embedded system is dedicated to	
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	economies of scale cannot be overstated. Small portable devices like digital watches and MP3 players to large stationary structures like traffic lights, factory controllers, and		economies of scale. economies of scale. Small portable devices like digital watches and MP3 players to large stationary structures like traffic lights, factory controllers, and	

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4/33	SUBMITTED TEXT	36 WORDS	52% MATCHING TEXT	36 WORDS
	CHARACTERISTICS OF EMBEDDED SYSTEMS Embedded systems have a unique set of characteristics that set them apart. - of these characteristics imposed distinct design constraints on		Characteristics of embedded systems Embedded systems are characterized by a unique set of characteristics. Each of these characteristics imposed a specific set of design constraints on	
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5/33	SUBMITTED TEXT	28 WORDS	88% MATCHING TEXT	28 WORDS
	a specific application. Many of the work characteristics are known before the hardware is installed. This allows the designer to focus on the specific design constraints of		a specific application. Many of the job characteristics are known before the hardware is designed. This allows the designer to focus on the specific design constraints of	
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6/33	SUBMITTED TEXT	35 WORDS	64% MATCHING TEXT	35 WORDS
	Fig 3.3 General Block Of Power Supply Unit 3.5.2 Transformer A transformer is a permanent component that transfers electric power from one circuit		Fig 1.General Block of Power Supply Unit7.3.1 TRANSFORMER: A transformer is a static piece of which electric power in one circuit	
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15/33	SUBMITTED TEXT	24 WORDS	56% MATCHING TEXT	24 WORDS
	open source IoT platform. It includes firmware that runs on Espressif Systems' ESP8266 Wi-Fi SoC and hardware that is built on the ESP-12		open source IoT platform. It includes firmware which runs on the ESP8266 Wi-Fi system on chip (SOC) from Espressif Systems and hardware which is based on the ESP-12	
	W https://docplayer.net/amp/139703921-Industrial-device-control-using-wi-fi-module.html			

12/33	SUBMITTED TEXT	16 WORDS	73% MATCHING TEXT	16 WORDS
	using ESPlorer IDE and Arduino IDE. We'll need to code in C++ if we're using		using ESPlorer IDE and Arduino IDE.We need to code in C\C++ programming language if we are using	
	SA AUTOMATION OF STREET LIGHTS control.doc (D101050652)			

14/33	SUBMITTED TEXT	26 WORDS	61% MATCHING TEXT	26 WORDS
	code after being flashed by Arduino IDE. After being flashed by Arduino sketch/code, there will be no Lua interpreter, and attempting to upload Lua scripts		code after it is getting flashed by Arduino IDE. After getting flashed by Arduino sketch/code it will be no more Lua interpreter and we got error if we try to upload Lua scripts.	
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33/33	SUBMITTED TEXT	13 WORDS	87% MATCHING TEXT	13 WORDS
	Internet of Things (IoT) is a concept that aims to link the		Internet of Things (IoT) is a concept that aims to expand the	
	W https://retenfix.com.br/snj3/0mbiel1.php?td=YWhudT01Jmttc3B1ZXh9MTc2JnRkMzc0PWlvdC11c2luZy1waWMtb...			

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21/33	SUBMITTED TEXT	22 WORDS	57% MATCHING TEXT	22 WORDS
	hardware layer, which includes embedded systems, RFID tags, sensor networks, and all other types of sensors. This hardware layer can perform		hardware layer that consists of embedded systems, RFID tags, sensor networks and all of the other sensors in different forms. This hardware layer can perform	
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	SUBMITTED TEXT	43 WORDS	MATCHING TEXT	43 WORDS
	This layer performs critical functions such as aggregating and filtering data from hardware devices, conducting information discovery, and managing application system access.		This layer has some critical functionalities, such as aggregating and filtering the received data from the hardware devices, performing information discovery and providing access control to the devices for applications. 	
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23/33	SUBMITTED TEXT	37 WORDS	33% MATCHING TEXT	37 WORDS
	a wrapper for each device that converts the device's protocol to a more widely used protocol. This wrapper can be mounted on the device or the middleware. We may place the wrapper in the middleware side		a wrapper for each device to translate the protocol supported by the to a common protocol. This wrapper can be placed either on the device side or the middleware side. If we want to have direct interaction with devices, we should place the wrapper in the middleware side.	

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24/33	SUBMITTED TEXT	20 WORDS	76% MATCHING TEXT	20 WORDS
	a well-defined syntax and encoding format that can be expressed with high-level transfer syntaxes such as HTML and XML		a well-defined syntax and encoding format, which can be represented by using high-level transfer syntaxes such as, HTML and XML. ?	
SA	AUTOMATION OF STREET LIGHTS control.doc (D101050652)			

25/33	SUBMITTED TEXT	13 WORDS	83% MATCHING TEXT	13 WORDS
	or an object, that is relevant to users, applications, and their interactions		or an object that is relevant to the user, applications and their interactions [1].	
SA	AUTOMATION OF STREET LIGHTS control.doc (D101050652)			

27/33	SUBMITTED TEXT	34 WORDS	73% MATCHING TEXT	34 WORDS
	in commercial and industrial settings. Fig. 3.15 Pin Diagram Zigbee is a collection of high-level communication protocols		in commercial and industrial applications. Fig.Pin diagram ZigBee is a specification for a suite of high-level communication protocols	
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29/33	SUBMITTED TEXT	12 WORDS	87% MATCHING TEXT	12 WORDS
	applications include wireless light switches, electrical metres with in-home displays, traffic		Applications include wireless light switches, electrical meters with in-home-displays, traffic	
SA	AUTOMATION OF STREET LIGHTS control.doc (D101050652)			

30/33	SUBMITTED TEXT	18 WORDS	63% MATCHING TEXT	18 WORDS
	systems, and other consumer and industrial devices with short-range low-rate wireless data transmission. The Zigbee specification is		systems, and other consumer and industrial that requires short-range low-rate wireless data transfer. The technology by the ZigBee specification is	
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31/33	SUBMITTED TEXT	24 WORDS	70% MATCHING TEXT	24 WORDS
	each node capable of self- discovery. When nodes leave the network, the mesh topology allows them to reconfigure routing paths based on network structure.		each node is capable of self-discovery on the network. as nodes leave the network, the mesh topology allows the nodes to reconfigure routing paths based on the network structure.	
SA	AUTOMATION OF STREET LIGHTS control.doc (D101050652)			

32/33	SUBMITTED TEXT	23 WORDS	100% MATCHING TEXT	23 WORDS
	of monitoring and control applications. Smart energy/smart grid, AMR (Automatic Meter Reading), lighting controls, building automation systems, tank monitoring, HVAC control, medical		of monitoring and control applications. Smart energy/smart grid, AMR (Automatic Meter Reading), lighting controls, building automation systems, tank monitoring, HVAC control, medical	
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