SIDDAGANGA INSTITUTE OF TECHNOLOGY, TUMAKURU-572103

(An Autonomous Institute under Visvesvaraya Technological University, Belagavi)

Project Report on

"CAMPUS NAVIGATOR"

submitted in partial fulfillment of the requirement for the completion of VI semester of

BACHELOR OF ENGINEERING

in

ELECTRONICS & COMMUNICATION ENGINEERING

Submitted by

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

2020-21

SIDDAGANGA INSTITUTE OF TECHNOLOGY, TUMAKURU-572103

(An Autonomous Institute under Visvesvaraya Technological University, Belagavi)

DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

CERTIFICATE

Certified that the mini project work entitled "CAMPUS NAVIGATOR" is a bonafide work carried out by Besta Vamsi Krishna (1SI18EC020), Harsha Vardhan (1SI18EC041), Manojkumar N (1SI18EC054) and Neha Prasad (1SI18EC060) in partial fulfillment for the completion of VI Semester of Bachelor of Engineering in Electronics & Communication Engineering from Siddaganga Institute of Technology, an autonomous institute under Visvesvaraya Technological University, Belagavi during the academic year 2020-21 It is certified that all corrections/suggestions indicated for internal assessment have been incorporated in the report submitted in the department library. The Mini project report has been approved, as it satisfies the academic requirements in respect of project work prescribed for the Bachelor of Engineering degree.

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Course Outcomes

CO 1 : Identify , formulate the problem and define the objectives

CO 2 : Review the literature and provide efficient design solution with appropriate consideration for societal, health and safety issues

CO 3 : Select the engineering tools/components and develop an experimental setup to validate the design

CO 4 : Test, analyse and interpret the results of the experiments in compliance with the defined objectives

CO 5 : Document as per the standard, present effectively the work following professional ethics and interact with target group

CO 6 : Contribute to the team, lead the diverse team, demonstrating engineering and management principles

CO-PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO-1	3												3	
CO-2		2				1							2	1
CO-3			2		2							2	2	2
CO-4				2										2
CO-5								2		2		2		2
CO-6									2		1			1
Average	3	2	2	2	2	1		2	2	2	1	2	2	2

Attainment level: - 1: Slight (low) 2: Moderate (medium) 3: Substantial (high)

POs: PO1: Engineering Knowledge, PO2: Problem analysis, PO3: Design/Development of solutions, PO4: Conduct investigations of complex problems, PO5: Modern tool usage, PO6: Engineer and society, PO7: Environment and sustainability, PO8: Ethics, PO9: Individual and team work, PO10: Communication, PO11: Project management and finance, PO12: Lifelong learning

Abstract

Navigation is an approach which primarily concentrates on the process of tracking and directing the movement of person or vehicle from one place to another. The purpose of navigation is to locate the present position and to determine the speed, direction etc. and to arrive at the point of destination. College campus is a huge infrastructure and it consists of many departments and blocks. Therefore, it is very difficult to find the location of the desired destination given by the user. The existing systems for navigation use Global Positioning System (GPS) for locating different places. However, in the absence of GPS connectivity it would be difficult for navigation.

This mini-project aims at designing and developing a campus navigator system which can work even in the absence of GPS connectivity. The system will have the hand-held device which automatically locates the user location and updates it to the user. Based on the destination inputs given by the user, the system determines the shortest path to the desired destination of the user.

The device consists of Arduino, which controls the entire system. It includes Radio Frequency (RF) transmitter and receiver module. The RF transmitter module transmits the location information of different blocks to the receiver module. The information transmitted is decoded and analyzed in Arduino and displayed over liquid-crystal display (LCD). The device also displays the instructions to the user to reach the destination. .

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Chapter 1

Introduction

A college campus is a complex infrastructure. Every year a lot of new students get admitted to the college. Many new buildings are built, new courses are started and some departments may be relocated inside the campus. There are no facilities to find places like administrative building, department buildings, library, canteen etc. It creates problem for the new comers to reach easily and timely to their desired location. Therefore, to help them out, a Campus Navigator which tracks user's location and allows the user to reach his/her destined location is to be developed.

1.1 Motivation

There will be navigators at some points inside the campus, but users do not have continuous help to get to their destination. They can try to figure out a way to get to their target destination as per the navigators available in the campus. However when they start walking towards their target direction, they have no help anymore and face many problems. The campus navigator will help in overcoming these problems and provide efficient path to the desired destination.

1. The problem of navigating from one place to another is very common which is faced by each and every person who is new to the college campus.

2. There will be sign boards around the campus, but users do not have continuous help throughout the path to get to their destination.

3. Depending only on sign boards creates problem for the newcomers to reach easily and timely to their destination.

1.2 Objective of the project

The main objectives of the project are:

1. To design and develop a hand-held device which can help the freshers easily navigate around the campus, where Global Positioning System technology is unavailable.

2. To find the current location of the user inside the campus.

3. To provide the shortest path to the desired location of the user inside the campus.

1.3 Organisation of the report

The report is divided into 7 chapters. Chapter 1 gives the information about campus navigator, which also includes the objectives of the project. In Chapter 2, the literature on the Campus Navigators and the RF technologies i.e., the existing methodologies, accuracy of the system and their drawbacks are presented. The block diagram of the system to be developed with the implementation details is presented in Chapter 3. The hardware description and the implementation details are provided in Chapter 4. Chapter 5 consists of the software used for arduino code. Results/snapshots are provided in chapter 6. Chapter 7 contains the conclusion of the project.

Chapter 2

Literature Survey

This chapter includes the various literature survey carried out to propose the project, Campus Navigator. Literature covering the working principle of the Radio Frequency and the implementation of RF on the navigation system is referred. Further, the survey is extended to Arduino and its applications, the implementation principles necessary for the working of Arduino and some of the existing and related technologies related to Campus Navigator.

2.1 Existing Campus Navigation Systems

In [2], the authors Shruthi and Lakshmi illustrated a method of campus navigation. The system consists of RF receiver module, an array of switches and speakers which help in navigation of user. By using the switch placed in the device, one can enter the destination location where the user wants to go inside the complex infrastructure. The RF transmitters are placed at different locations in the route to destination. The receiver interprets the transmitted signal and gives voice direction to the user through speaker unit. The main drawback of this system is the complexity of the receiver circuit. The speaker or the voice module connected with the receiver faces clarity issues while giving instructions to the user.

In [3], authors Mayuri et al. provide a useful informative, mobile based solution for navigation inside the campus. The mobile application will contain all the necessary details to make sure easy and accurate navigation and identification of building blocks, departments and help the students or visitors to reach their destination without any trouble around the campus. The application uses the augmented arrows to instruct the user to their destination. This system uses GPS based navigation for tracking and also to find the destination paths. Use of GPS is the main drawback of this system because of the connectivity issues, satellite availability issues and accuracy.

2.2 RF Based Positioning & Navigation

In [4], the authors Veena V et al. have designed a device where the system is very convenient and handy to the user. The system guides the tourists inside amusement parks or zoos or other large area covered spots. It uses a RF receiver circuit in order to track the user location. The user has to carry the circuit with him. The system has the RF transmitters placed at various locations across the park. These transmitters constantly emit the RF signals encoded with the location information. This information is decoded in the receiver circuit which is carried by the user. It will be sent to the server of the tourist spot through the Global System for Mobile Communication (GSM). The system also has the GPS connectivity which is used when the availability of the RF signals is less. The main drawback of this system is, it tracks the user but will not give any information regarding it to the user. The direction to the destination location is not provided by the system.

In [5], the authors Ajay Sharma et al. have proposed a system which tracks the user in the grand and historical event of Indian Kumbh Mela. The system mainly works based on the RF signals. The visitors of Kumbh Mela were given the wrist bands which had the RF receiver circuit inside it. The RF transmitter should be placed within 50m range across the place of event. The receiver circuit in the band decodes the RF signals and sends back the user information to the transmitter module. This will help to track the user's travelling path in the event. If the user is missed, then this device will help to track the missed user's location. The main demerit of the system is that, Kumbh Mela is a vast event where millions of people come from across the world, and therefore providing wrist bands to each and every user will be almost impossible. As in [4], this system also does not show the current location of the user and neither the path information of the user's destination.

In [6], authors Giva Andriana et al. have proposed a conceptual model for blind people to navigate without any help from others. This model helps blind people to recognize the buildings near them. The design and implementation of the model is done in the cane used by the blind people. This model also uses RF signals to recognise the buildings near it. This system works similar to [2] and gives the location information to the user through speaker integrated in the smart cane.

2.3 Arduino Functions and Applications

In [7], the authors Santar Pal Singh and Shradha Sagar proposed a work which is related to the concept of role of Arduino in real world applications. This paper explains about the Arduino as an open-source programmable board, Arduino functions, digital and analog pins of Arduino, Arduino Integrated Development Environment (IDE) where we can write, run and dump the code to the board. The paper explains about the various real world roles of Arduino and controlling home activities such as motion sensors, outlet control, blower control sprinkler control etc.

2.4 Positioning Algorithms and Navigation System

In [8], authors Ahmed Hasan and Abd Rahman carried out the work on positioning algorithm which is used by the digital devices to track user on the surface of earth. This algorithm talks about both the 2-D and 3-D representation of the objects while tracking. It explains the four basic algorithms Proximity, Fingerprinting, Tri-angulation and Trilateration. This system explains the integrated navigation systems based on accuracy, low cost and other issues.

In [9], authors Sunil and Narendra proposed an event based navigation system. This system uses the GPS module to track the user's location. Based on the satellite's information to the GPS tags which is given to the user, the location information is updated in the event server. This system possesses the same drawbacks as [4]. The location information is shared only with the server but not with the user and also this system does not provide the destination path information to user.

2.5 Long Range (LoRa) Technology

In [10], authors Eko Murdyantoro et al. proposed a system which explains LoRa as the technology platform for Internet of Things (IoT). This technology provides a choice of wireless systems in addition to WiFi, bluetooth and GSM networks as infrastructure in Internet of Things. IoT is an information network that can connect various kinds of sensor and control equipment through the internet, with intelligent communication between connected equipments. The network generally consists of four parts: end-devices, gateways, servers and user applications. Gateway is connected with many end-devices on one side and network server on the other side. Communication from end-device to gateway uses singlehop LoRa communication. The gateway communicates to the network server through a standard IP connection.

Implementing LoRa technology in a system leads to the usage of internet. The gateways sometimes suffer from server down problems. The range of the gateway in this technology is around 1.5KM. A large infrastructure which is greater than this size may need many gateways. The end-devices which are taken beyond the range of gateways will get disconnected and will not be able to share the information with gateways. By considering all these difficulties and problems it is finalized to use the RF technology to implement this system.

Chapter 3

System Overview

In this chapter, the methodology which is implemented on the module to detect the user location is discussed. The processing and the transmission of the data from the transmitter is explained. Fig 3.1 gives the proposed block diagram approach for the system to perform the objectives discussed.

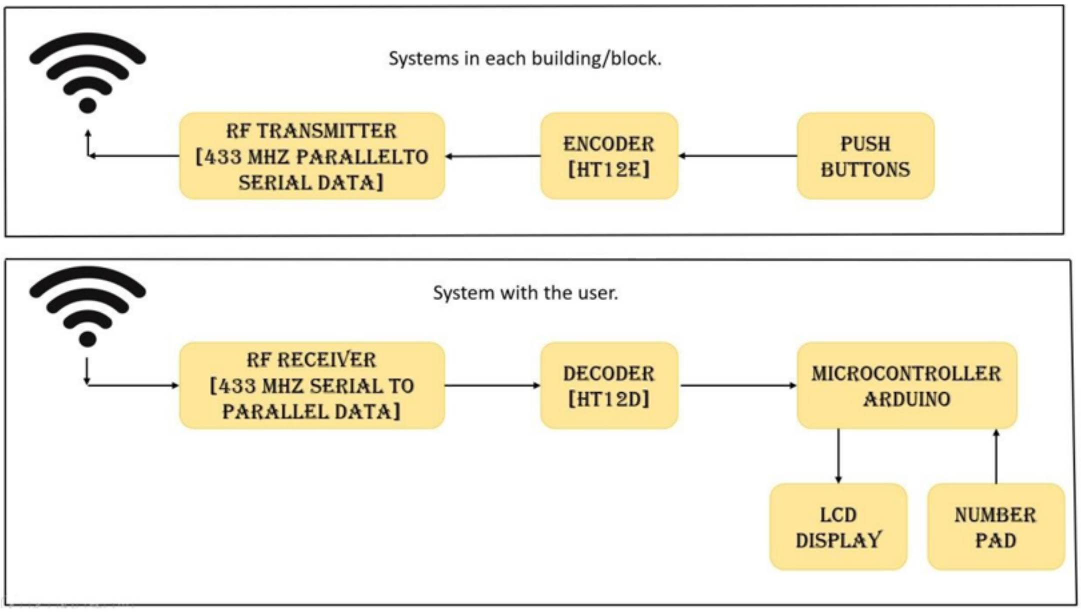

Figure 3.1: Proposed block diagram of campus navigator

The system is mainly based on the transmission of the data between the RF transceiver modules. The encoder integrated circuit (IC) is coded with the data bits which has the location information of the transmitting building or block. The IC generates series of bits which has both security bits and the data bits. These series of bits are continuously transmitted by the RF transmitters placed at every block in the campus. The user has to carry the RF receiver module with him. When the RF receiver module comes in the range of the transmitter signals, the code encoded in that signal is decoded by the decoder IC and sent to the Arduino board. The Arduino board processes the data bits received and the user location which is decoded will be displayed over the LCD screen.

The receiver module with the user then asks for the destination location information in the form of digits. Based on the current location and user input on the destination, the Arduino board estimates the shortest path to the destination. This information is displayed on the LCD screen.

Fig. 3.2 depicts the overall working of the system, Campus Navigator. It shows how a person who wants to navigate to other location inside the campus uses the module. The person with the receiver module comes towards a block which is near to him and the receiver module decodes the signal from RF transmitter in the block and shows user's current location inside the campus. In Fig 3.2, the user is near to the transmitter module-1. When he enters the destination input as block-3, the receiver module calculates the shortest path to block-3 from block-1 which is current location of the user and displays on the LCD screen.

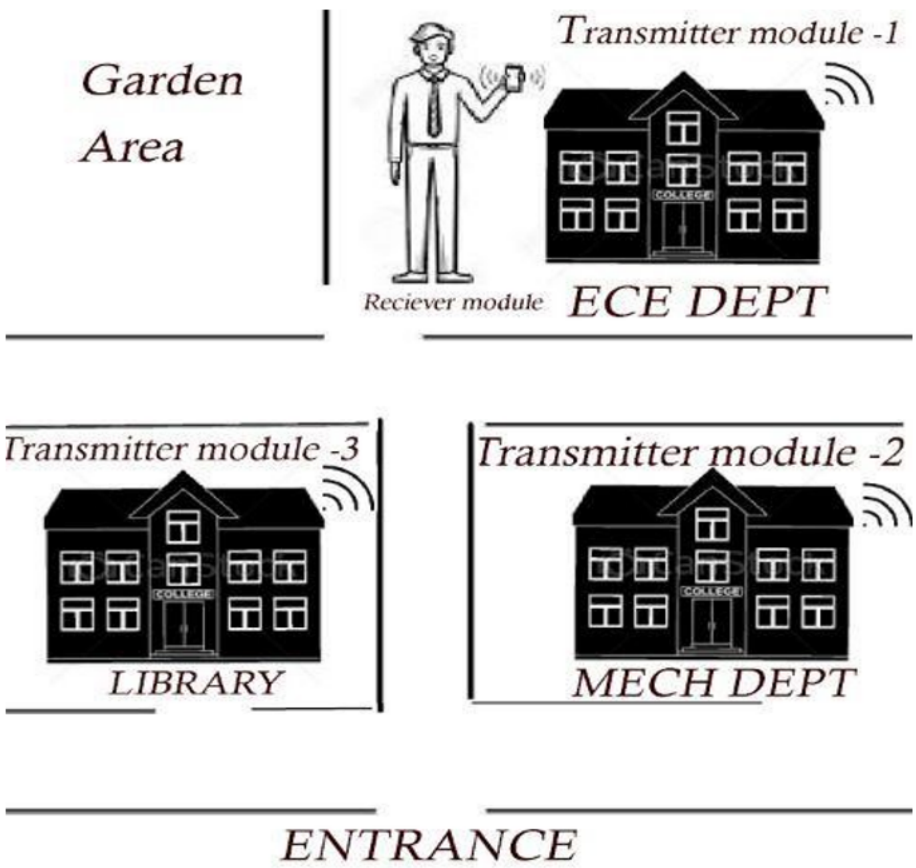

Figure 3.2: Proposed block diagram of campus navigator

3.1 Positioning

A geographic position is the location of the object on the earth's surface with respect to a known origin. Geographic positions may be described by a specific point of reference. Technologies for measuring the position, distance, direction, and other aspects of geography have evolved with the evolution of human civilization. Our ancestors depended on basic human senses for travelling and locating resources. Later, humans developed more advanced technologies for navigation such as the compass, hand-drawn maps, and printed maps. Now we have many digital devices which are used for navigation and they use four different types of positioning algorithms such as proximity, fingerprinting, tri-angulation and tri-lateration as shown in Fig 3.3.

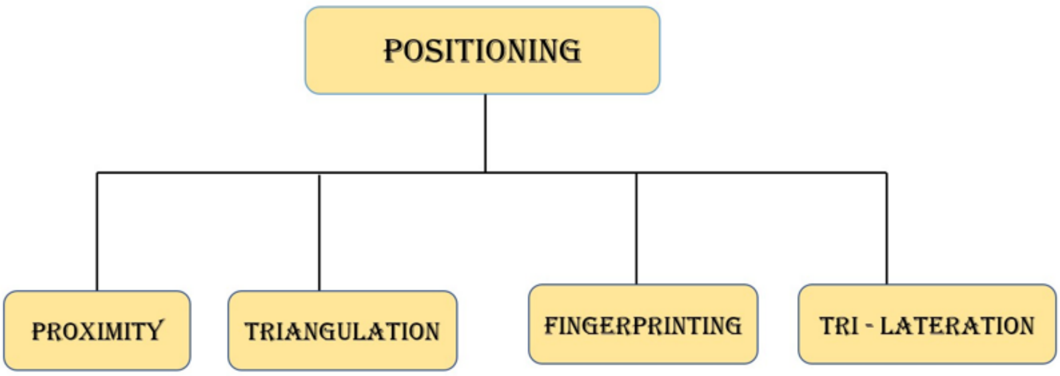

Figure 3.3: Types of positioning algorithms

3.1.1 Proximity

Proximity based systems can detect the general location of a person or object at room level. These systems use tags and beacons for indoor positioning, and they are either reader based or reference point-based.

In a reader-based system, simple RF tags transmit their identification continuously to a number of reader devices. Those reader devices then pass the tags' identifications and signal strength to a back end system, which then calculates the position of each tag.

A reference point-based system uses standard Bluetooth Low Energy (BLE) or RF transmitter anchors as location reference points together with location-aware tags. The tags calculate their own location based on the location of the reference points, and then connect to a central access point to relay this information. The RF access points, spaced about every 100 feet in a facility, receive the encrypted location data from the tag and send it to the server.

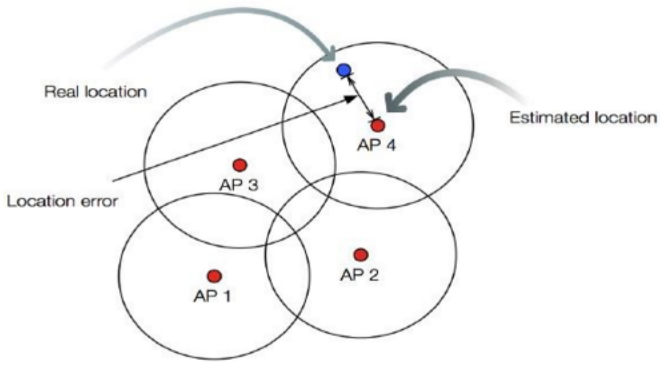

Figure 3.4: Working of proximity algorithm [11]

3.1.2 Fingerprinting, Tri-angulation & Tri-lateration

Fingerprinting methods are based on the uniqueness of radio signals received at different positions. This algorithm works on the basis of comparison of the intensity of received signal strength (RSS) from the anchor node and the fingerprint data base of radio signal strength measurements that were collected earlier at known positions, represented in Fig 3.5.

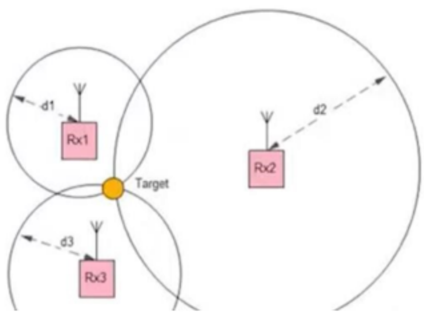

Figure 3.5: Working representation of Fingerprinting algorithm [8]

Tri-angulation works based on the Angle of Arrival (AoA) of the receiver module to the range of anchor node. In Fig 3.6, the distance between the baseline and the point 3 is determined based on the angle formed by the baseline and the point 1 line. This is achieved on the basis of trigonometric calculations made on the angle formed.

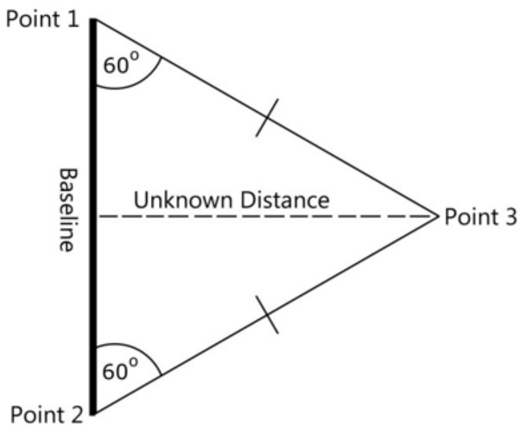

Figure 3.6: Approach representation of Tri-angulation algorithm [18]

Tri-lateration works based on the distance measured from the three known anchor points. This algorithm is mainly used in the satellite navigation system. In Fig 3.7, the three satellites range converges at the same point and that location is estimated as the user's current position on the surface of earth.

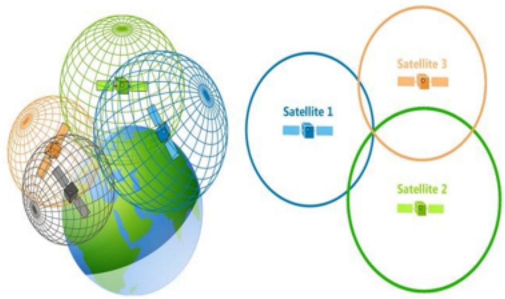

Figure 3.7: Tri-lateration algorithm used in satellites[18]

3.2 Data Communication

Data communication refers to the process of transferring data between two or more digital devices. Data is transmitted from one device to another in analog or digital format. Data transmission enables devices or components within the devices to speak to each other. Data is transferred in the form of bits between two or more digital devices. There are two methods used to transmit data between digital devices: serial transmission and parallel transmission. Serial data transmission sends data bits one after another over a single channel. Parallel data transmission sends multiple data bits at the same time over multiple channels. Fig 3.8 shows various types of data communication that occur over digital devices based on the duration and number of bits transmitted while achieving the same task.

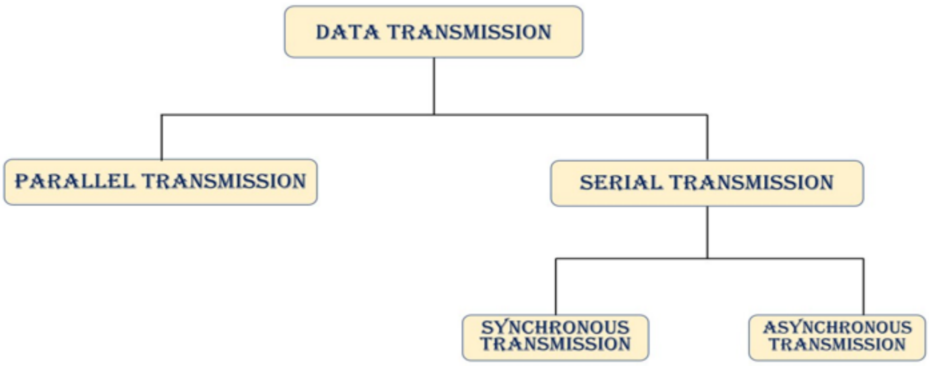

Figure 3.8: Types of data transmission

3.3 Serial Data Transmission

When data is sent or received using serial data transmission, the data bits are organized in a specific order, since they can only be sent one after another. The order of the data bits is important as it dictates how the transmission is organized when it is received. It is viewed as a reliable data transmission method because a data bit is only sent if the previous data bit has already been received. In Fig 3.9 the parallel data is generated and that data is converted to serial form and transmitted over a single channel.

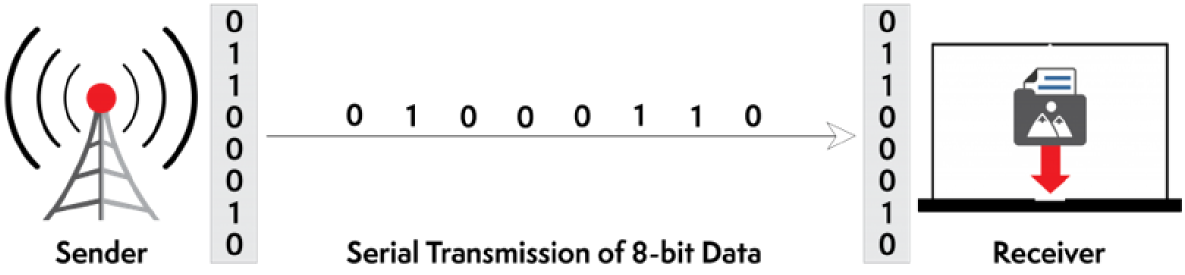

Figure 3.9: Data conversion and transmission by serial method [19]

3.3.1 Asynchronous Serial Transmission

Data bits can be sent at any point in time but stop bits and start bits are used between data bytes to synchronize the transmitter and receiver and to ensure that the data is transmitted correctly. The time between sending and receiving data bits is not constant, so gaps are used to provide time between transmissions. In Fig 3.10, the serial transmission of bits with a start or stop bit is sent over a single channel has been shown.

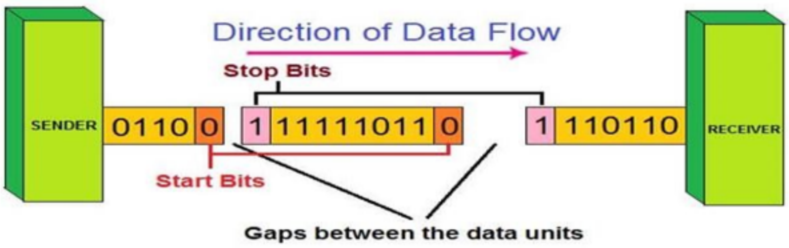

Figure 3.10: Data flow in asynchronous serial transmission [20]

3.3.2 Synchronous Serial Transmission

Data bits are transmitted as a continuous stream in time with a master clock. The data transmitter and receiver both operate using a synchronized clock frequency. Therefore, start bits, stop bits, and gaps are not used. This means that data moves faster and timing errors are less frequent because the transmitter and receiver time is synced. However, data accuracy is highly dependent on timing being synced correctly between devices. In comparison with asynchronous serial transmission, this method is usually more expensive. Fig 3.11 represents the flow of digital bits of data in synchronous serial transmission.

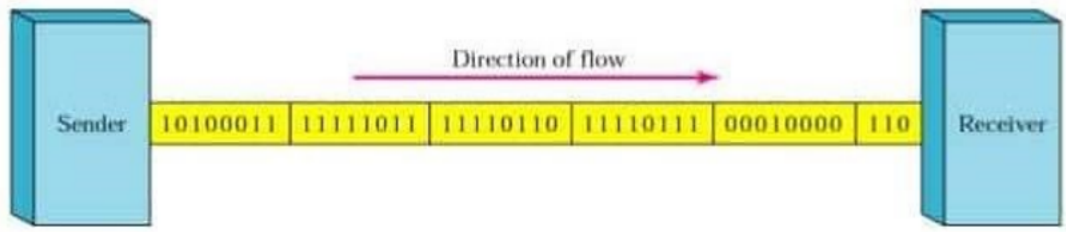

Figure 3.11: Data flow in synchronous serial transmission [21]

Chapter 4

System Hardware

In this chapter will discuss about the hardware components which are required for building the system. Detailed pin out diagrams, functions, specifications are illustrated in this chapter.

Hardware Description:Hardware requirements are the components which are used on the hardware platform to implement the system. Hardware requirements for the proposed system are:

1. Arduino uno
2. HT12E & HT12D decoder
3. RF transceiver module
4. LCD panel

4.1 Arduino uno

Arduino Uno is a microcontroller board based on ATmega328P. It has 14 digital input/output pins, 6 analog inputs, a 16MHz ceramic resonator, a USB connection, a power jack, and a reset button. It can be powered by a USB cable or by an external 9-volt battery. The digital pins have 32KB flash memory, 2KB Random Access Memory (RAM) and 1KB Electrically Erasable Programmable Read-Only Memory (EEPROM). It can be programmed using Arduino IDE.

The digital pins of Arduino uno receives the transmitted data bits. Those bits are analysed and detected to know the user location. The user enters the destination related inputs from the number pads. Those inputs and the current location are processed and the shortest path to the destination is determined. Fig 4.1 shows the typical pinout diagram of Arduino uno.

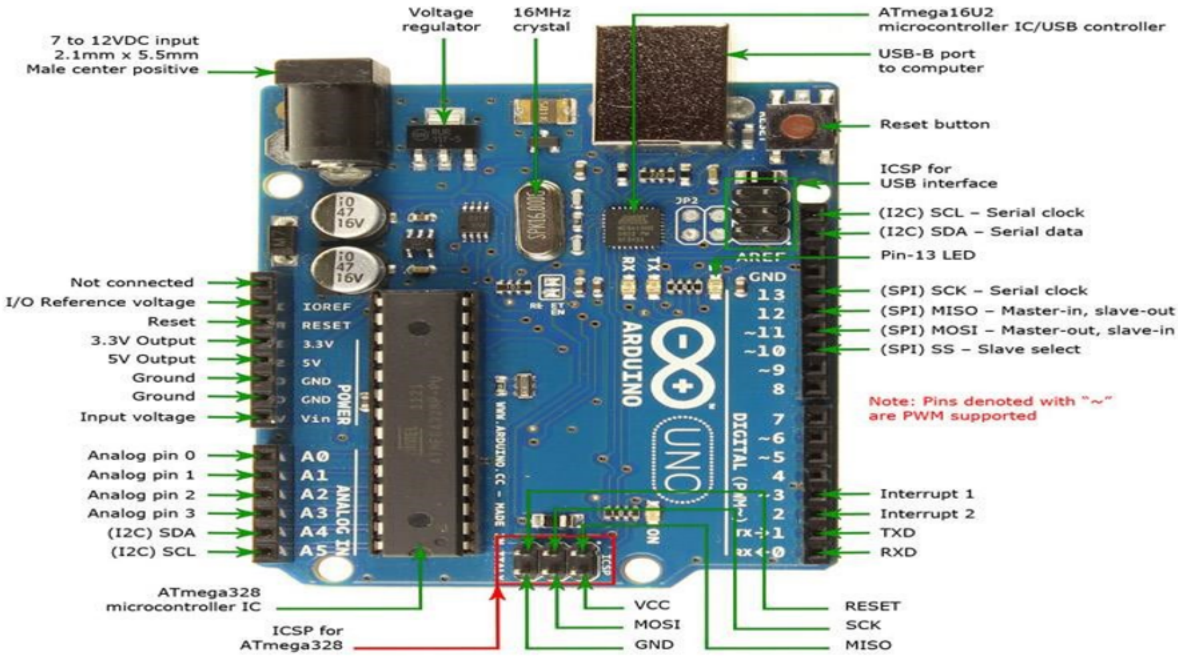

Figure 4.1: Pinout description of Arduino uno [22].

4.2 HT12E & HT12D

These ICs are series of Complementary Metal Oxide Semiconductor (CMOS) Large Scale Integration (LSI) for remote control system applications. For proper operation, a pair of encoder/decoder with the same number of address and data formats should be selected, therefore we have used this particular pair. The operating voltage for this pair of ICs is 2.4-12 V. Standby current is less than 0.1 uA at an operating voltage of 5V.

The primary function of HT12E is to encode12-bit of data and send it through the output pin serially. The IC comes with an inbuilt crystal oscillator which makes easy for its implementation in the system. In Fig 4.2, the pin number 15 and 16, osc1 and osc2 are dedicated for the controlling of the oscillation by placing resistor between those pins. In Fig 4.2, the TE pin is used for enabling and disabling the transmission. A low input to the TE pin will enable the transmission of the data bits from the IC. Pins A0-A7 are the input address pins used for secured transmission of the data. These pins can be connected to the Ground (GND) for high signals or to the Voltage Common Collector (VCC) for low signals. The pins AD0-AD3 are data feeding pins into the IC. DOUT pin is the output pin of the IC which will be connected to the RF transmitter.

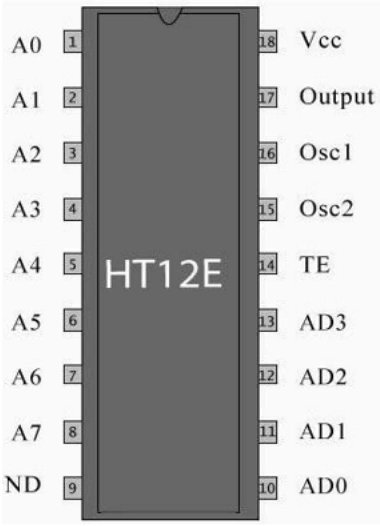

Figure 4.2: Pinout diagram of HT12E IC [23] .

The primary function of HT12D is to decode the 12-bit data, received by the input pins. This IC also comes with the inbuilt oscillator and has the same specifications as the encoder IC. The data bits are segregated and are sent according to which they are encoded from the HT12E IC. Fig 4.3 shows the pinout diagram of HT12D IC.

Figure 4.3: Pinout diagram of HT12D IC [23] .

4.3 RF Transceiver Module

The wireless system must satisfy two constraints, it must operate over a certain distance and transfer a certain amount of information within a data rate. The RF modules are very small in dimension and have a wide operating voltage range of 3V to 12V. The RF modules are 433 MHz RF transmitter and receiver modules. This operates on the basis of Amplitude Shift Keying (ASK) modulation technique. The transmitter draws no power when transmitting logic zero which is generally the fully suppressed carrier frequency, thus consumes very negligible power. When logic one is sent, carrier is fully on to about 4.5mA with a 3V power supply. The data is sent serially from the transmitter which is received by the tuner receiver. The transmitter and the receiver are interfaced with the pair of encoder and decoder IC for tuned data transfer. The Fig 4.4 shows the pinout diagram of a typical RF transmitter and the receiver module.

The performance of a RF module will depends on several factors, by increasing the transmitter module power a large communication distance will be gathered. However, which will result in a high electrical power drain on the transmitter device, which causes a shorter operating life of the battery powered devices. Using this device at higher transmission power will create interference with other RF devices causing a mixture of signals.

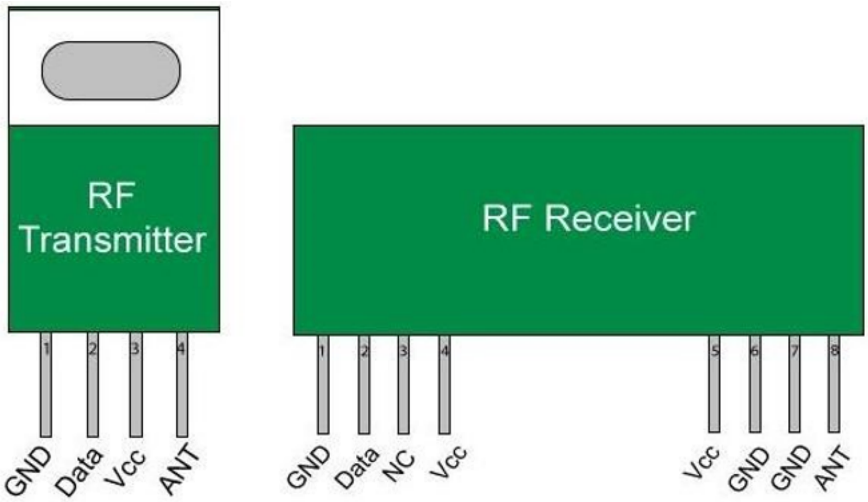

Figure 4.4: Pinout diagram of a typical RF transmitter and receiver [25] .

4.4 LCD panel

LCD is a flat panel display technology commonly used in TVs and computer monitors. It is also used in screens for mobile devices, such as laptops, tablets, and smartphones. The backlight in liquid crystal display provides an even light source behind the screen.

This light is polarized, means only part of the light shines through the liquid crystal layer to form letters or characters. The liquid crystals are made up of a part solid, part liquid substance that can be twisted by applying electrical voltage to them. They block the polarized light when they are off, but reflect red, green, or blue light when activated.

Each LCD screen contains a matrix of pixels that displays the image on the screen. Early LCDs had passive-matrix screens, which controlled individual pixels by sending a charge to their row and column. Since a limited number of electrical charges could be sent each second, passive-matrix screens were known for appearing blurry when images moved quickly on the screen. Modern LCDs typically use active-matrix technology, which contain thin film transistors, or Thin Film Transistors (TFTs). These transistors include capacitors that enable individual pixels to "actively" retain their charge. Therefore, active-matrix LCDs are more efficient and appear more responsive than passive-matrix displays. Fig 4.5 shows pinout diagram of LCD.

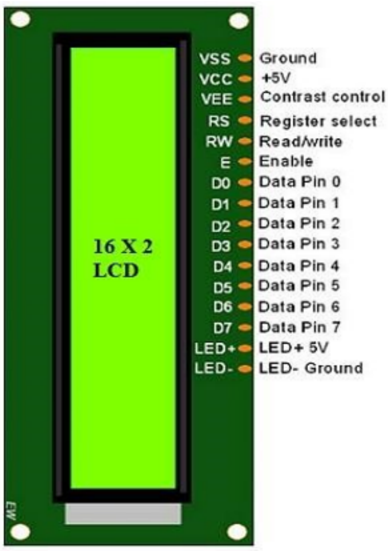

Figure 4.5: Pinout diagram of 16×2 LCD [26].

Chapter 5

System Software

This chapter gives information about the software used to code the Arduino. We have used the Arduino IDE Sketch for coding.

5.1 Arduino IDE

Arduino IDE is an open source software that is used for writing the code into the arduino module. IDE stands for "INTEGRATED DEVELOPMENT ENVIRONMENT", where it can be used to edit, compile and upload the code to the arduino device. It supports both C and C++ languages. The IDE environment mainly consists of two parts, editor and compiler where it is used for writing the code and later used for compiling and uploading the code into the given arduino module. The overview of the software is as shown in the figure 5.1.

Figure 5.1: Picture of Arduino IDE software

In the figure 5.1, the sketch option in the menu-bar is used to upload and compile the code. The code will run at once in the setup() function. Generally, the setup() function is used to set the pin-mode of the arduino and initializing the pins. The code in the loop() function will run continuously. Active control for the arduino board is controlled in loop() function. Fig 5.2 shows the flow chart of the Arduino code and the working system.

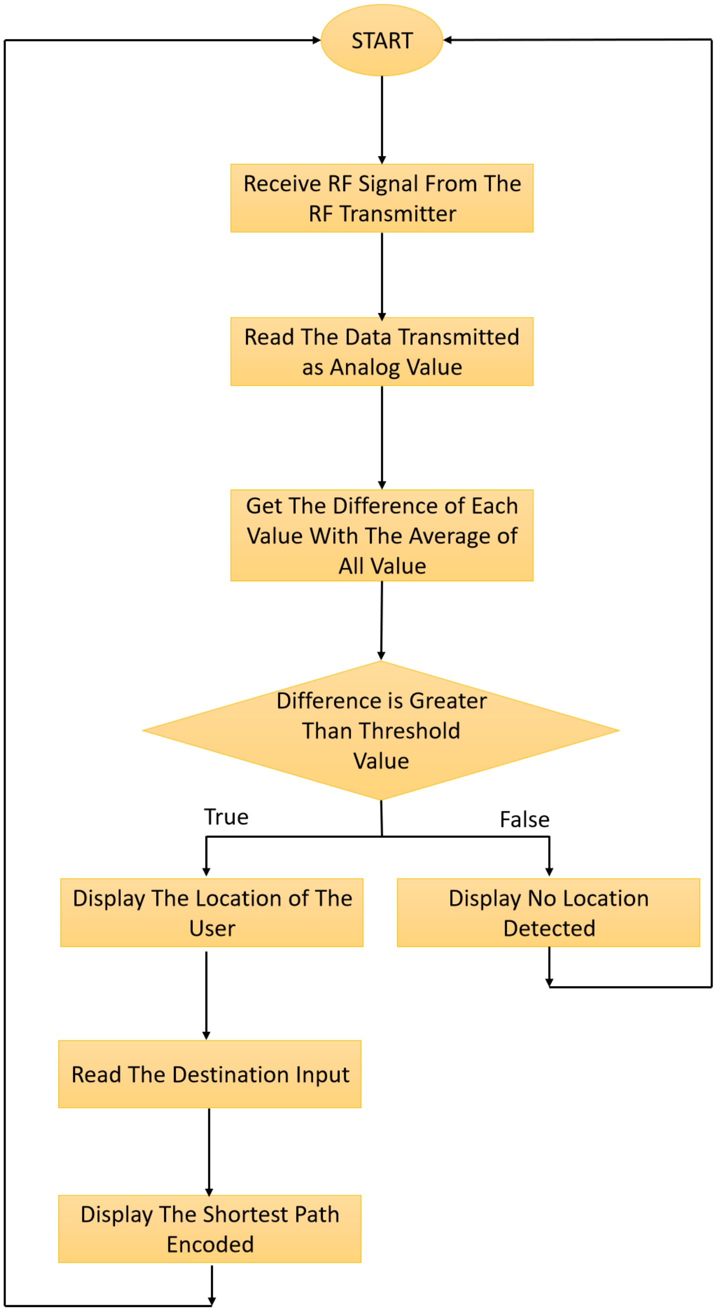

Figure 5.2: Flow Chart

Chapter 6

Results

The Campus Navigator system provides the current location of the user. It also gives the shortest path to the destination location by displaying path on the LCD panel. Fig 6.1 gives the snapshot of the “Campus Navigator” circuit.

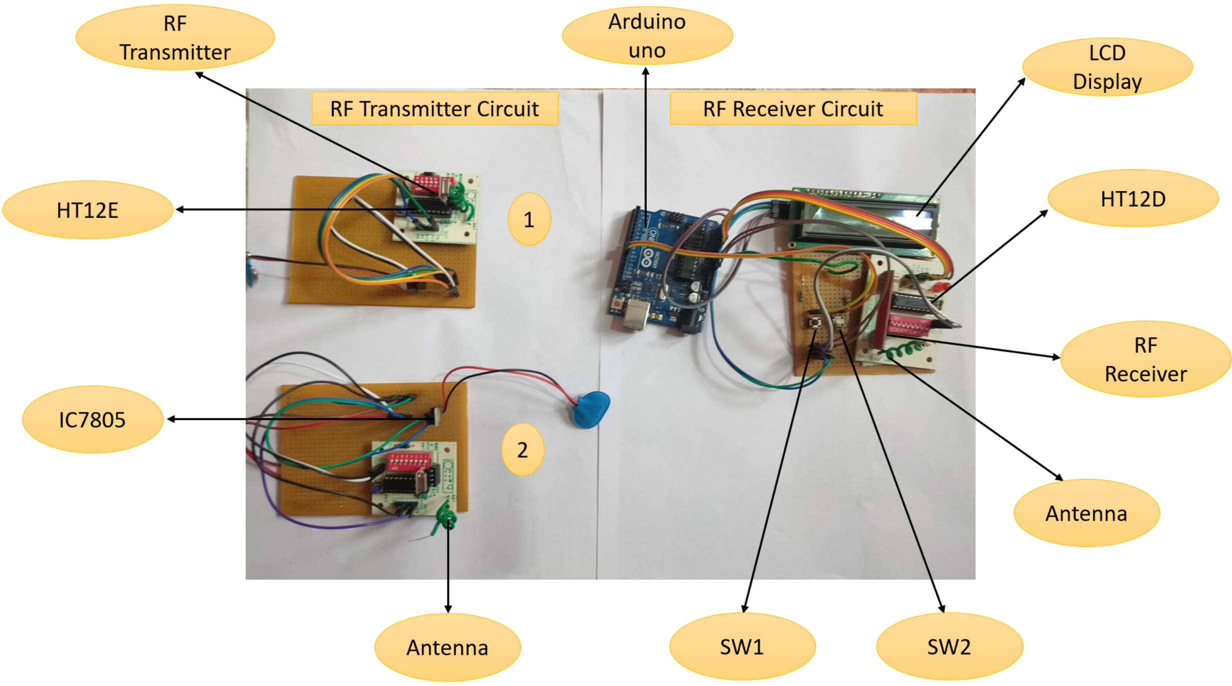

Figure 6.1: Circuit of Campus Navigator

- The RF Transmitters are placed in different departments of the campus. They transmit the encoded RF signals for a specified range. Fig. 6.2 shows the transmitter placed at Mechanical Department. Fig. 6.3 shows the transmitter placed at ECE Department. and Fig. 6.4 shows the transmitter placed at GJCB.

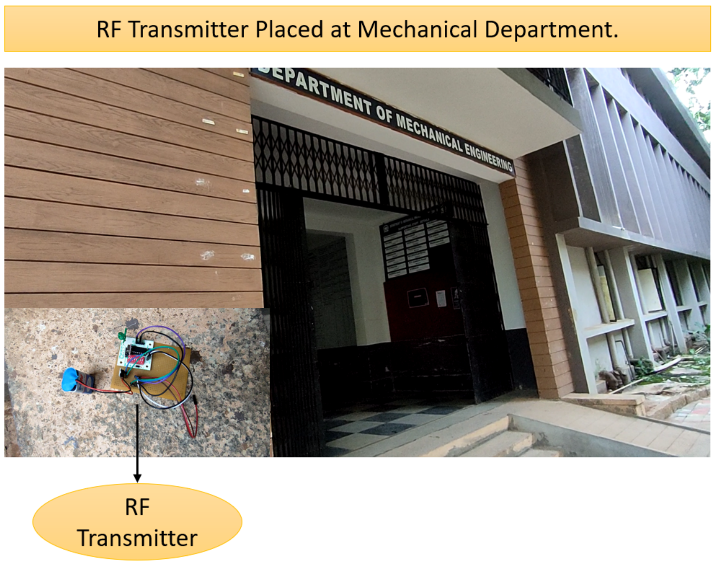

Figure 6.2: RF transmitter placed at Mechanical Department.

Figure 6.3: RF transmitter placed at ECE Department.

Figure 6.4: RF transmitter placed at GJCB

- Fig. 6.5 shows user holding the RF Receiver circuit. As the receiver circuit is not receiving any RF signals from transmitters placed at various locations, a message 'No Location Detected...' is displayed in LCD panel.

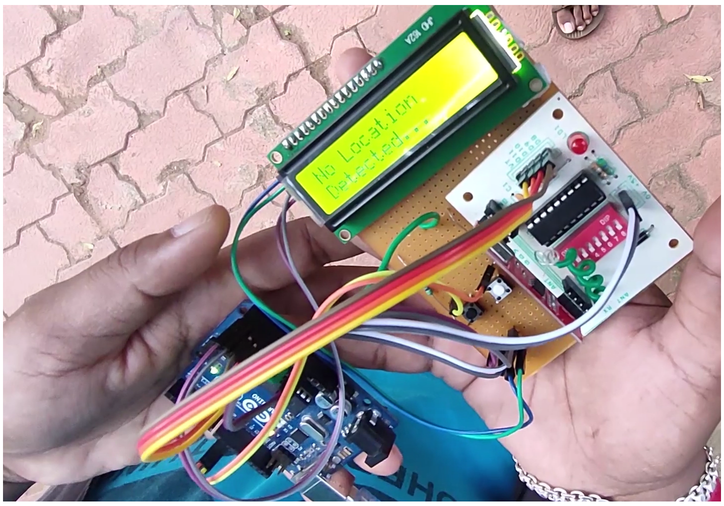

Figure 6.5: No Location Detected message display

- The user starts moving towards the transmitter location or near to a block. The RF Receiver circuit receives the encoded RF signals or location information from the transmitter.The location information is decoded and the current location of the user is displayed over LCD panel. Fig. 6.6 shows the receiver circuit displaying the current location of the user. In this case the user is near the Mechanical Department.

Figure 6.6: Displaying Current Location

- The receiver circuit asks the user for the destination location input. Based on the input it displays the shortest path to the destination. Fig. 6.7 shows the user giving destination location input to the receiver circuit.

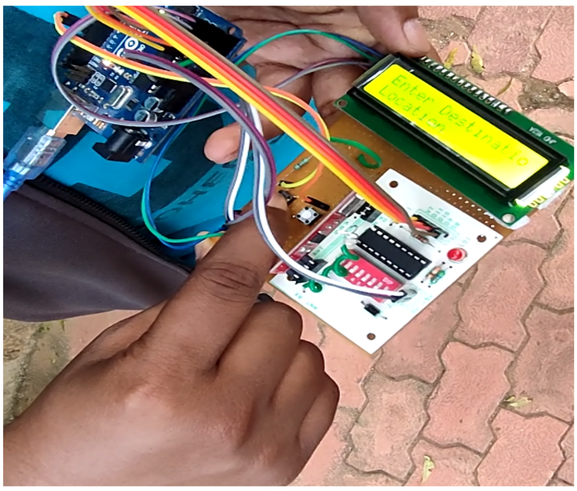

Figure 6.7: User enters the Destination

- The receiver circuit accepts the destination location input from the user. Based on the input the shortest path to the destination is displayed on the LCD panel. Fig. 6.8 shows the receiver circuit displaying the shortest path to the destination. The user has to follow the instructions given and travel accordingly. In Fig. 6.9, the user has reached the destination location and is displayed on the LCD panel.

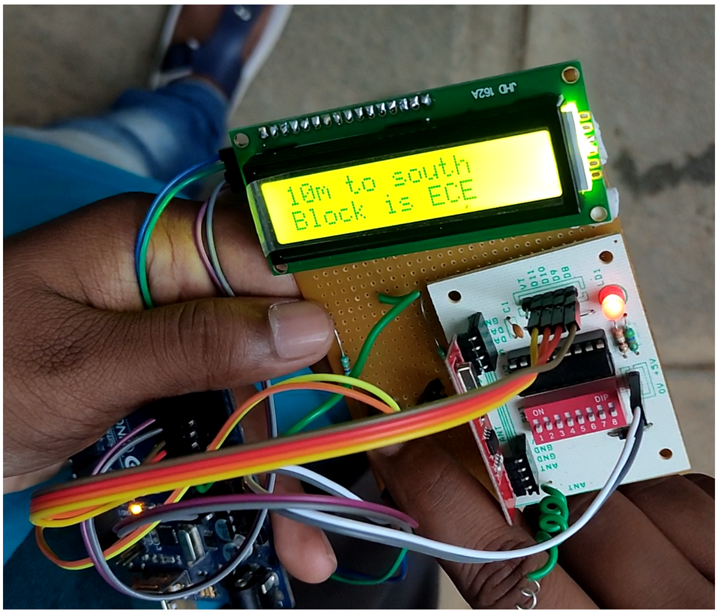

Figure 6.8: Displaying the destination path

Figure 6.9: Displaying the destination path

Chapter 7

Conclusion

The project titled "CAMPUS NAVIGATOR" is successfully implemented and tested under various conditions. The usage and functioning of Campus Navigator is discussed and an approach for the functioning of the system is proposed. The system is implemented in three blocks of SIT campus. The main objective of this project is to provide the current location of the user in the campus and also navigate the user to the desired destination.

7.1 Scope for future work

1. Provision for current location of the user while navigating can be implemented.

2. A Mobile application can be developed and the path can be displayed more precisely by arrow marks, specifying the distance covered and distance to be covered.

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Appendices

Appendix A

Data Sheet of HT12D

Features

- Operating voltage: 2.4V~12V
- Low power and high noise immunity CMOS technology
- Low standby current
- Capable of decoding 12 bits of information
- Binary address setting
- Received codes are checked 3 times
- Address/Data number combination
  - HT12D: 8 address bits and 4 data bits
  - HT12F: 12 address bits only
- Built-in oscillator needs only 5% resistor
- Valid transmission indicator
- Easy interface with an RF or an infrared transmission medium
- Minimal external components
- Pair with Holtek's 2^{12} series of encoders
- 18-pin DIP, 20-pin SOP package

Applications

- Burglar alarm system
- Smoke and fire alarm system
- Garage door controllers
- Car door controllers
- Car alarm system
- Security system
- Cordless telephones
- Other remote control systems

General Description

The 2^{12} decoders are a series of CMOS LSIs for remote control system applications. They are paired with Holtek's 2^{12} series of encoders (refer to the encoder/decoder cross reference table). For proper operation, a pair of encoder/decoder with the same number of addresses and data format should be chosen.

The decoders receive serial addresses and data from a programmed 2^{12} series of encoders that are transmitted by a carrier using an RF or an IR transmission medium. They compare the serial input data three times continuously with their local addresses. If no error or unmatched codes are found, the input data codes are decoded and then transferred to the output pins. The VT pin also goes high to indicate a valid transmission.

The 2^{12} series of decoders are capable of decoding informations that consist of N bits of address and 12–N bits of data. Of this series, the HT12D is arranged to provide 8 address bits and 4 data bits, and HT12F is used to decode 12 bits of address information.

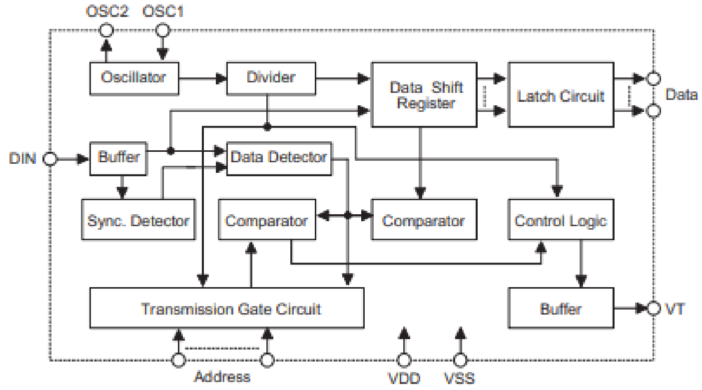
Selection Table

Function / Part No.	Address No.	Data No.	Data Type	VT	Oscillator	Trigger	Package
HT12D	8	4	L	√	RC oscillator	DIN active "Hi"	18DIP, 20SOP
HT12F	12	0	—	√	RC oscillator	DIN active "Hi"	18DIP, 20SOP

Notes: Data type: L stands for latch type data output.

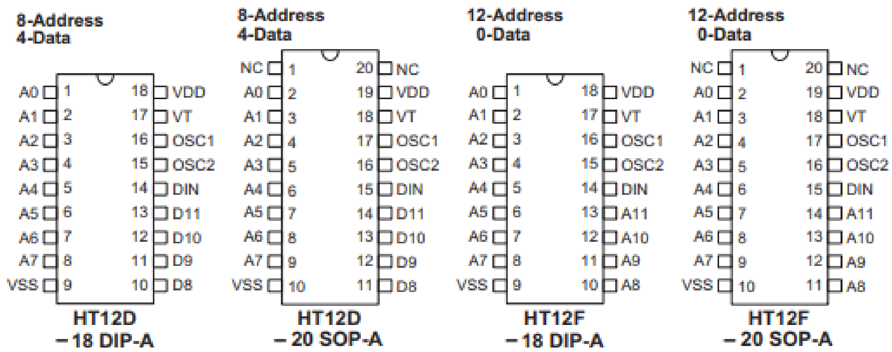
VT can be used as a momentary data output.

Block Diagram



Note: The address/data pins are available in various combinations (see the address/data table).

Pin Assignment



Pin Description

Pin Name	I/O	Internal Connection	Description
A0~A11 (HT12F)	I	NMOS Transmission Gate	Input pins for address A0~A11 setting These pins can be externally set to VSS or left open.
A0~A7 (HT12D)			Input pins for address A0~A7 setting These pins can be externally set to VSS or left open.
D8~D11 (HT12D)	O	CMOS OUT	Output data pins, power-on state is low.
DIN	I	CMOS IN	Serial data input pin
VT	O	CMOS OUT	Valid transmission, active high
OSC1	I	Oscillator	Oscillator input pin
OSC2	O	Oscillator	Oscillator output pin
VSS	—	—	Negative power supply, ground
VDD	—	—	Positive power supply

Appendix B

Data Sheet of HT12E

Features

- Operating voltage
  - 2.4V~5V for the HT12A
  - 2.4V~12V for the HT12E
- Low power and high noise immunity CMOS technology
- Low standby current: 0.1μA (typ.) at V_{DD}=5V
- HT12A with a 38kHz carrier for infrared transmission medium
- Minimum transmission word
  - Four words for the HT12E
  - One word for the HT12A
- Built-in oscillator needs only 5% resistor
- Data code has positive polarity
- Minimal external components
- Pair with Holtek's 2^{12} series of decoders
- 18-pin DIP, 20-pin SOP package

Applications

- Burglar alarm system
- Smoke and fire alarm system
- Garage door controllers
- Car door controllers
- Car alarm system
- Security system
- Cordless telephones
- Other remote control systems

General Description

The 2^{12} encoders are a series of CMOS LSIs for remote control system applications. They are capable of encoding information which consists of N address bits and 12–N data bits. Each address/data input can be set to one of the two logic states. The programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium upon receipt of a trigger signal. The capability to select a $\overline{TE}$ trigger on the HT12E or a DATA trigger on the HT12A further enhances the application flexibility of the 2^{12} series of encoders. The HT12A additionally provides a 38kHz carrier for infrared systems.

Selection Table

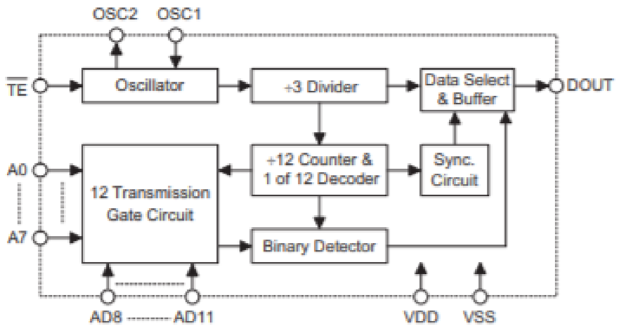
Function / Part No.	Address No.	Address/ Data No.	Data No.	Oscillator	Trigger	Carrier Output	Negative Polarity	Package
HT12A	8	0	4	455kHz resonator	D8~D11	38kHz	No	18DIP, 20SOP
HT12E	8	4	0	RC oscillator	$\overline{TE}$	No	No	18DIP, 20SOP

Note: Address/Data represents pins that can be either address or data according to the application requirement.

Block Diagram

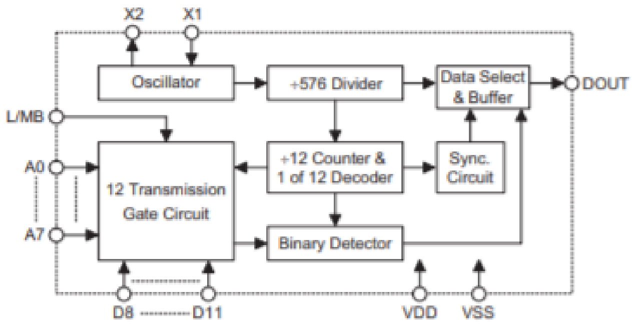
$\overline{\text{TE}}$ Trigger

HT12E



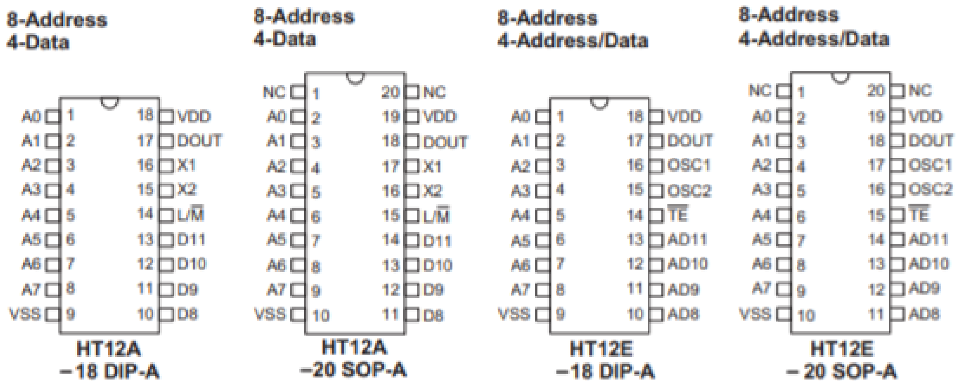
DATA Trigger

HT12A



Note: The address data pins are available in various combinations (refer to the address/data table).

Pin Assignment



Appendix C

Data Sheet of RF transmitter

RF Transmitter 433Mhz ASK Features: Frequency Range: 433.92 MHZ. Supply Voltage: 3 12V. Output Power : 4 16dBm Circuit Shape: Saw Temperature Range: - 40 degree C + 80 degree C

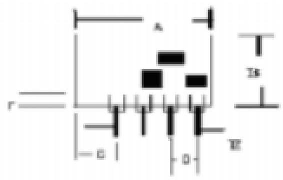
Absolute Maximum Ratings

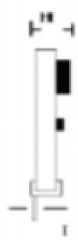
Parameter	Rating	Units
Supply Voltage	1.5–12.0	V DC
Operating Temperature	-20 to +85	℃

Absolute Maximum Ratings

Parameter	Symbol	Condition		Specification						Unit
				Min.	Typical				Max.	
Operation Voltage					1.5	3	5	12		V
Output power	Psens	DATA 5V 1Kbps Data Rate	315MHz		-11.8	4	10	16		dBm
			Supply current		3.1	11	20	57		mA
			434MHz		-8.5	4	10	16		dBm
			Supply current		2.9	11	22	59		mA
Tune on Time	Ton	Data start out by Vcc turn on		10	20					ms
Data Rate				200	1k				10k	bps
Input duty		Vcc=5V; 1kbps data rate		40					60	%

Pin Dimension





Dimensions	Millimeters	Dimensions	Millimeters
A	14 ± 0.25mm	F	2.50 ± 0.15mm
B	21 ± 0.25mm	G	3.50 ± 0.15mm
C	4. 1 ± 0.30mm	H	5. 5mm
D	2.54 ± 0.05mm	I	0.32 ± 0.05mm
E	0.65 ± 0.05mm		

Appendix D

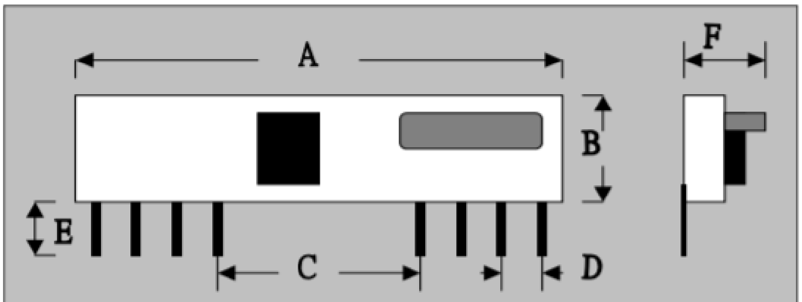
Data Sheet of RF Receiver

RF Receiver 433Mhz ASK (PLL) Features: 1)The circuit shape of is PLL. 2)On-Chip VCO with integrated PLL using crystal oscillator reference. 3)Integrated IF and data filters. 4)Receiver Frequency: 433.92 MHZ 5)Typical sensitivity: -105dBm 6)Supply Current: 2.5mA 7)IF Frequency: 500KHz 8)Low power consumption. 9)Operation voltage: 5 Volts.

Electrical Characteristics :

CHARACTERISTIC	MIN	TYP	MAX	UNIT
V_{cc} Supply Voltage		5		VDC
I_s Supply Current		2.3	3	mA
F_R Receiver Frequency		315/434		MHz
RF Sensitivity(Vcc=5V 1Kbps Data Rate)		-105		dBm
Max Data Rate	300	1	3	Kbit/
V_{OH} High Level Output (I=30uA)	0.7Vcc			VDC
V_{OL} Low Level Output (I=30uA)			0.3Vcc	VDC
Turn On Time(Vcc off-Turn on)	25	30		ms
T_{OP} Operating Temperature Range	-10		60	℃
Output Duty	40		60	%

Mechanical Dimension:



Name	Dimension	Name	Dimension
A	43mm+-0.5mm	D	2.54mm+-0.3mm
B	12.4mm+-0.5mm	E	5mm+-0.5mm
C	25.4mm+-0.3mm	F	6mm (Max)

Appendix E

Data Sheet of Arduino Uno

Microcontroller - ATmega328

Operating Voltage - 5V

Input Voltage (recommended) - 7-12V

Input Voltage (limits) - 6-20V

Digital I/O Pins - 14 (of which 6 provide PWM output)

Analog Input Pins - 6

DC Current per I/O Pin - 40 mA

DC Current for 3.3V Pin - 50 mA

Flash Memory 32 KB of which 0.5 KB used by bootloader

SRAM - 2 KB

EEPROM - 1 KB

Clock Speed - 16 MHz

The power pins are as follows:

• VIN. The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

• 5V. The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.

• 3V3. A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.

• GND. Ground pins.

The Atmega328 has 32 KB of flash memory for storing code (of which 0,5 KB is used for the bootloader); It has also 2 KB of SRAM and 1 KB of EEPROM

Each of the 14 digital pins on the Uno can be used as an input or output, using pinMode(), digitalWrite(), and digitalRead() functions. They operate at 5 volts. Each pin can provide or receive a maximum of 40 mA and has an internal pull-up resistor (disconnected by default) of 20-50 kOhms. In addition, some pins have specialized functions:

Serial: 0 (RX) and 1 (TX). Used to receive (RX) and transmit (TX) TTL serial data. TThese pins are connected to the corresponding pins of the ATmega8U2 USB-to-TTL Serial chip .

• External Interrupts: 2 and 3. These pins can be configured to trigger an interrupt on a low value, a rising or falling edge, or a change in value. See the attachInterrupt() function for details.

• PWM: 3, 5, 6, 9, 10, and 11. Provide 8-bit PWM output with the analogWrite() function.

• SPI: 10 (SS), 11 (MOSI), 12 (MISO), 13 (SCK). These pins support SPI communication, which, although provided by the underlying hardware, is not currently included in the Arduino language.

• LED: 13. There is a built-in LED connected to digital pin 13. When the pin is HIGH value, the LED is on, when the pin is LOW, it's off.

Appendix F

Data Sheet of LCD Display

■CHARACTERISTICS：

DISPLAY CONTENT： 16 CHAR x 2ROW

CHAR. DOTS： 5 x 8

DRIVING MODE： 1/16D

AVAILABLE TYPES：

TN， STN(YELLOW GREEN、GREY、B/W)

REFLECTIVE、WITH EL OR LED BACKLIGHT

EL/100VAC， 400HZ

LED/4.2VDC

■PARAMETER （V_{DD}=5. 0V±10%, V_{SS}=0V, T_a=25℃）

Parameter	Symbol	Testing Criteria	Standard Values			Unit
			Min.	Typ.	Max	
Supply voltage	V_{DD}-V_{SS}	-	4.5	5.0	5.5	V
Input high voltage	V_{IH}	-	2.2	-	V_{DD}	V
Input low voltage	V_{IL}	-	-0.3	-	0.6	V
Output high voltage	V_{OH}	-I_{OH}=02mA	2.4	-	-	V
Output low voltage	V_{OL}	I_{OL}=1.2mA	-	-	0.4	V
Operating voltage	I_{DD}	V_{DD}=5.0V	-	1.5	3.0	mA

■PIN CONFIGURATION

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
VSS	VCC	VEE	RS	R/W	E	DB0	DB1	DB2	DB3	DB4	DB5	DB6	DB7	LED+	LED-