EMERGENCY MUSTER COUNTER

Final Submission for INVESTING FOR SAFER TOMORROW COMPETITION

BY

Cadet. Rahul Gangaram Gawade

Cadet. Pranav S

Cadet. Ranvijay Singh

Cadet. Prateek Krishnakumar Mishra

UNDER THE GUIDANCE OF

Captain. Anuj Velankar

(Senior loss Prevention Advisor, UK P&I Club, Singapore)

DEPARTMENT OF MARINE ENGINEERING

SAMUNDRA INSTITUTE OF MARITIME STUDIES,

VILLAGE TAKWE KURD, LONAVALA, DIST. PUNE, PIN – 410405 (MAHARASHTRA), INDIA.

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ABSTRACT

Many onboard incidents has been taken place in past years such as fire, collusion, capsizing of ship which leads to “abandon ship” for entire crew.

During abandon ship situation each and every crew member has to rush to the muster station as soon as possible for headcount and then embark the life boat. But due to panic situation sometimes some crew left back onboard which eventually leads to their death.

The MAERSK HONAM incident which had taken place on 6 march 2018, a major fire broke out in one of the forward cargo hold. Unable to distinguish the fire , the crew sent out a distress signal and 23 crew members out of 27 evacuated the vessel, while remaining four were declared missing. Maersk Line announced on March 12 that remains of three crew members had been found on board and one is still missing.

Many other such incidents has been taken place, to avoid any other casualties in future during abandon ship, we have come up with the idea of EMERGENCY MUSTER COUNTER.

CURRENT PROBLEMS IN SHIP

- For calling or to find crew in Engine Room a horn is placed, which sometimes can't be heard in noisy Engine Room.
- Walkie-Talkie can't be reach at long distance due to thickness of steel bulkheads and decks.
- Blockages or interference in walkie-Talkie channels.
- Human negligence as crew doesn't know the current location of other crew members.

WHY OWNER SHOULD BUY OUR PRODUCT?

- Economical and cheap.
- Easy to install in ships without any modification in current structure.
- Reduces the P&I losses of owners such as man overboard, injuries to crew members, casualties due to human negligence, etc.
- Easy location tracking and health monitoring of crew member from anywhere in world

WHY CREW SHOULD USE OUR PRODUCT?

- Easy wearable.
- Increases their safety.
- Intrinsic safe and can be use in hazardous area.
- Can be used during various day to day activities.
- Can wear during bathing as is waterproof and during sleeping.
- Easy to monitor the location of fellow crew member.
- Easy to monitor the heart rate of each crew member.

CONTENT

1. INTRODUCTION.

EMERGENCY MUSTER COUNTER aim towards developing a hardware and software based system to obtain the location of user and to avoid any mistake done while taking headcounts. The time for search and rescue gets reduced and any casualties can be avoided.

The Emergency Muster counter consist of RFID coil based wrist band which will be issued to all crew member during sign in of vessel. Everyone will be instructed not to remove the band till their sign off, for their own safety.

The Primary RFID readers will be placed in every workspace and accommodation for continue reading and storing of users location in main memory of device. The Secondary RFID reader will be placed at embarkation deck of life boat or muster station.

When activation switch is pressed, the buzzer will get activated and secondary RFID reader at muster station will get activate for period of 5 mins and counts for 25 number of crew members or as per number of crew onboard .During given stipulated time, if anyone of the crew member fails to reach the muster station, the chief officer will press the activation switch again and the information regarding missing crew members name, rank and last location will be displayed on LCD. Since persons last location is known it is easy to carry out the rescue operation. Thus any casualties can be avoided.

2. FABRICATION OF PCB

Software used –MP Labs

- PCB is printed circuit board which is insulating base with layer of thin copper foil.
- The circuit is then drawn on the PCB with permanent marker and then it is dipped in the solution of ferric chloride so that unwanted copper is removed from the PCB thus leaving components interconnection on the board.
- The specification of the base material is not so important to know in most of the application, but it is important to know something about copper foil which is drawn through a thin slip.
- The resistance of copper foil will influence the circuit operation.
- Base material is made of lamination layer of suitable insulating material such as treated paper, fabric or glass fiber and binding them with resin. Most commonly used base material are formed with paper bonded with epoxy resin.
- It is possible to obtain thickness range between 0.5 mm to 3 mm.
- Thickness is the important factor in determining mechanical strength particularly when the commonly used base material is Formea from paper assembly.
- Physical properties should be self-supporting; these are surface resistivity, heat dissipation, dielectric constant and dielectric strength.
- Another important factor is the ability to withstand high temperature.

2.1 DESIGNING THE LAYOUT

- While designing the layout, it must be noted that size of the board should be as small as possible.
- Before starting all components should be placed properly so that an accurate measurement of space can be made.
- The components should not be mounted very close to each other or far away and neither one should neglect the fact that some components need ventilation.
- Layout is first drawn on paper, then traced onto a copper plate which is finalized with pen or marker.
- The most difficult part is converting the theoretical circuit diagram into working layout. Without introducing crossover and undesirable effects.
- Soldering requires to be of high quality.
- The first function is to connect the components together in the right sequence with the minimum need of interlinking i.e. the jumper wires with connection.

2.2 SOLDERING

- For soldering of any joints first the terminals to be soldered are cleaned to remove oxide film or dirt on it.
- Now the joints to be soldered is heated up with the help of soldering iron. Heat applied should be such that when the solder wire touches the joint, it must melt quickly.
- The joints and the soldering iron is held such that molten solder should flow smoothly over the joint.
- When joint is completely covered with molten solder, soldering iron is removed.
- The joint is allowed to cool, without any movement.
- The bright shining solder indicates good soldering.
- In case of dry solder joint, an air gap remains in between the solder material and the joint. It means the solder is improper. This is removed and again soldered.
- The soldering should be visibly lustrous, and be strong enough to not break while in use.

3. COMPONENTS

- RFID READER AND CARDS
- 8085 MICROPROCESSOR
- PCB
- POWER SUPPLY
- LCD
- BUZZER

3.1. RFID READER AND CARD

- A radio frequency identification reader (RFID reader) is a device used to gather information from an RFID tag, which is used to track individual objects. Radio waves are used to transfer data from the tag to a reader.

- RFID is a technology similar in theory to bar codes. However, the RFID tag does not have to be scanned directly, nor does it require line-of-sight to a reader. The RFID tag it must be within the range of an RFID reader, which ranges from 3 to 300 feet, in order to be read. RFID technology allows several items to be quickly scanned and enables fast identification of a particular product, even when it is surrounded by several other items.

- RFID technology uses digital data in an RFID tag, which is made up of integrated circuits containing a tiny antenna for transferring information to an RFID transceiver. The majority of RFID tags contain at least an integrated circuit for modulating and demodulating radio frequency and an antenna for transmitting and receiving signals. Frequency ranges vary from low frequencies of 125 to 134 kHz and 140 to 148.5 kHz, and high frequencies of 850 to 950 MHz and 2.4 to 2.5 GHz.

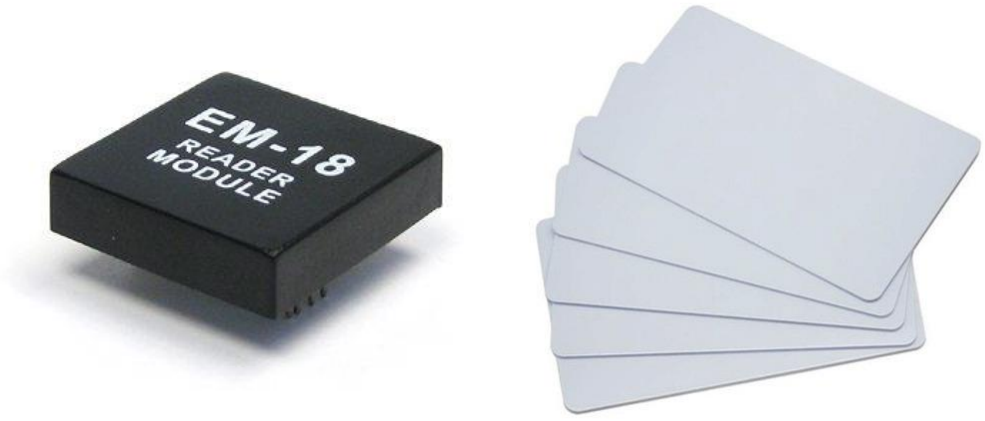


FIGURE 1 RFID READER AND CARDS

3.2 8085 Microprocessor

- It is a programmable electronics chip (Integrated Circuit (IC)). A single IC has computing and decision making capabilities similar to central processing unit of a computer.

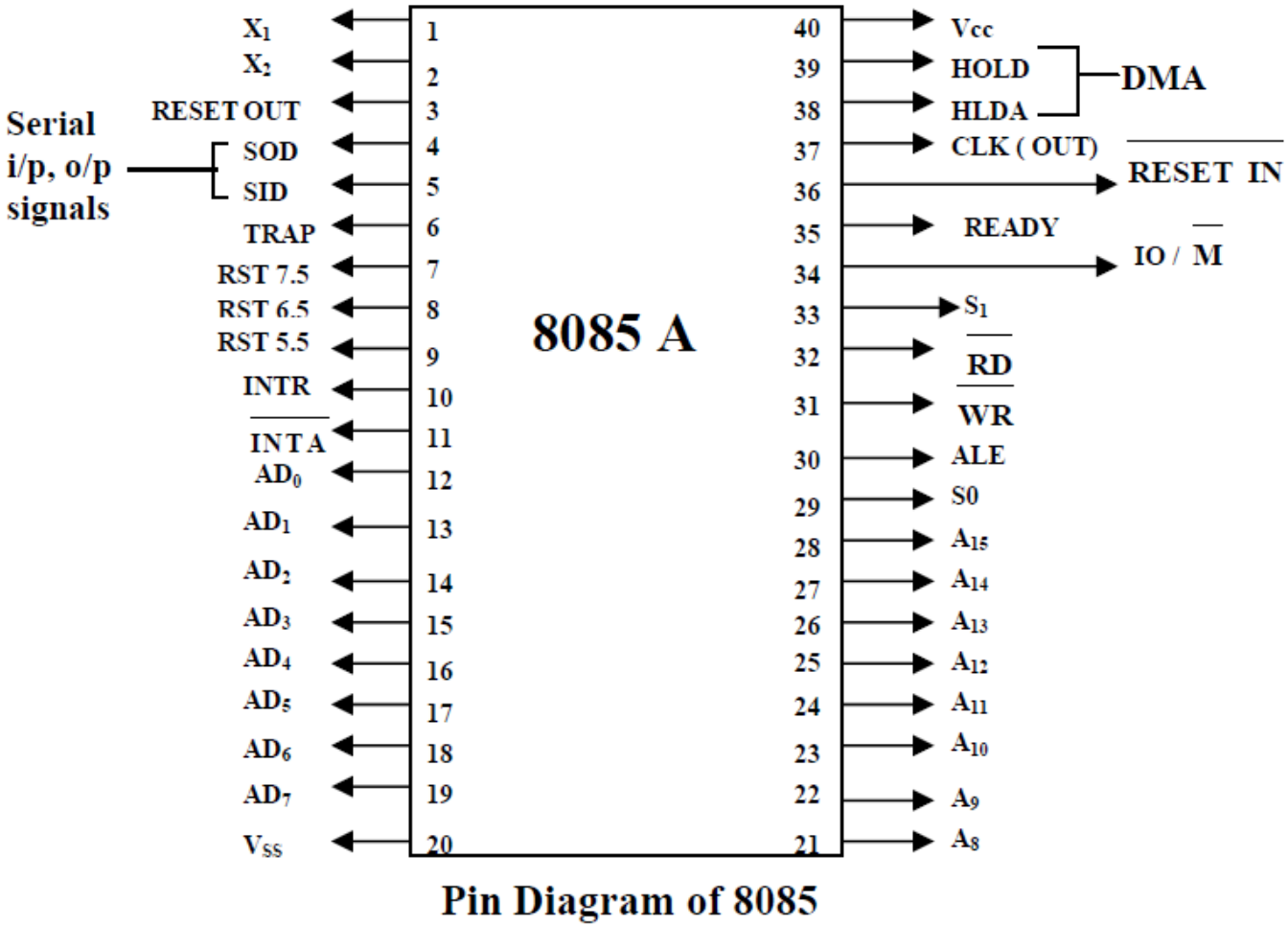
- It is used in almost all types of electronics devices like mobile phones, printers, washing machines, etc. and also used in advanced applications like radars, satellites and flights.

- It has 8 bit data bus and 16 bit address bus, thus it is capable of addressing 64 KB of memory.

- It has 8 bit ALU 8 bit ALU that can perform 8 bit operations.

- The 8085 microprocessor is an 8-bit processor available as a 40-pin IC package (shown the figure below) and uses +5 V for power. It can run at a maximum frequency of 3 MHz.

- Three status signals are available on chip: (i) IO/M: this is a status signal used to differentiate between IO and Memory operations. If it is high then IO operation and if it is low then Memory operation. (ii) S1 and S0: status signals similar to IO/M, can identify various operations that are rarely used in the systems.



Pin Diagram of 8085

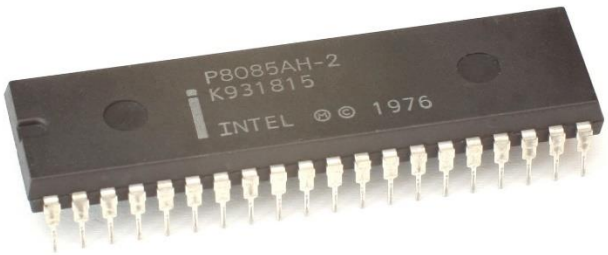


FIGURE 2 8085 MICROPROCESSOR

3.3PRINTED CIRCUIT BOARD(PCB)

- A **printed circuit board** (**PCB**) mechanically supports and electrically connects electronic components or electrical components using conductive tracks, pads and other features etched from one or more sheet layers of copper laminated onto and/or between sheet layers of a non-conductive substrate.

- Components are generally soldered onto the PCB to both electrically connect and mechanically fasten them to it.

- Printed circuit boards are used in all but the simplest electronic products. They are also used in some electrical products, such as passive switch boxes.

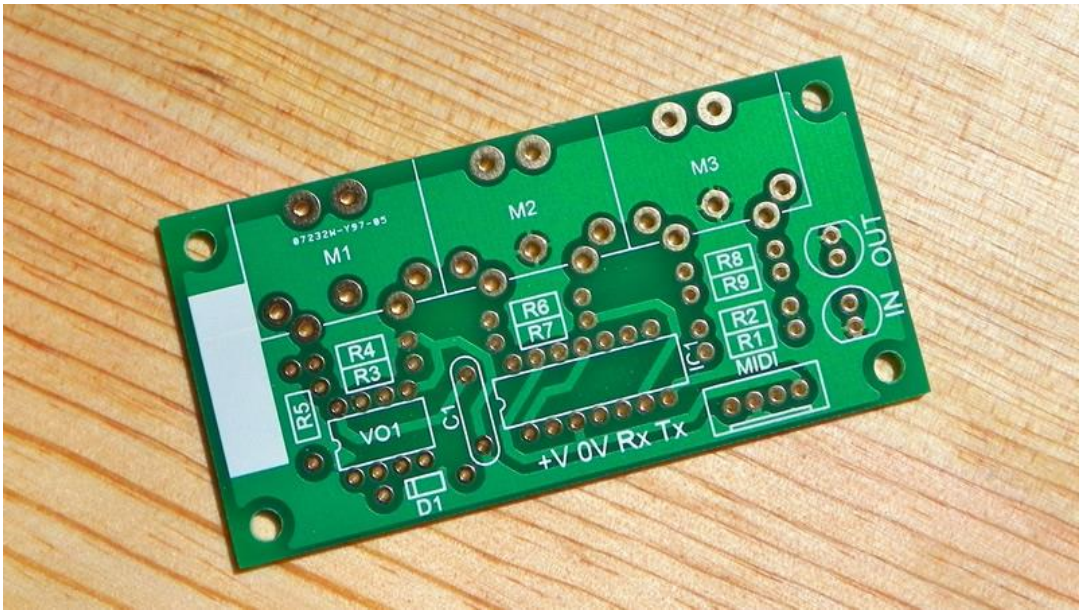


FIGURE 3 PCB

3.4 POWER SUPPLY

- When working with electronics, you always need one basic thing: Power. In every electronic circuit power supply is required
- The proper working of each and every component, the exact amount of voltage and current to be supplied to it. If the power exceed its limit, it can be fatal.
- Below is the circuit diagram of power supply which gives output of 5V, as only that much is required for microcontroller. Its circuit diagram and designing calculation are given below.

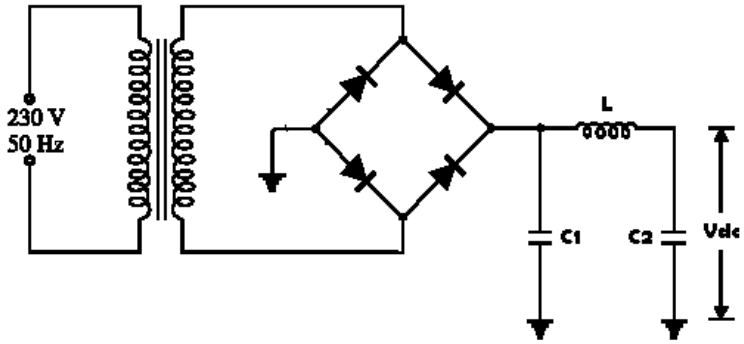


FIGURE 4 POWER SUPPLY CIRCUIT

3.4.1 DIODES:

- A **diode** is a two-terminal electronic component that conducts current primarily in one direction (asymmetric conductance); it has low (ideally zero) resistance in one direction, and high (ideally infinite) resistance in the other.
- A diode vacuum tube or **thermionic diode** is a vacuum tube with two electrodes, a heated cathode and a plate, in which electrons can flow in only one direction, from cathode to plate.
- A **semiconductor diode**, the most common type today, is a crystalline piece of semiconductor material with a p–n junction connected to two electrical terminals. Semiconductor diodes were the first semiconductor electronic devices. Today, most diodes are made of silicon, but other materials such as gallium arsenide and germanium are used.

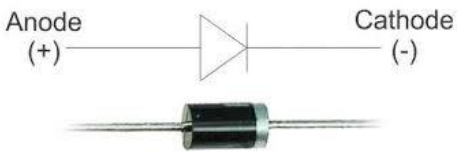


FIGURE 4.1 DIODE

3.4.2 TRANSFORMER:

- A **transformer** is a static electrical device that transfers electrical energy between two or more circuits.

- A varying current in one coil of the transformer produces a varying magnetic field, which in turn induces a varying electromotive force (emf) or "voltage" across a second coil. Electric can be transferred between the two coils, without a metallic connection between the two circuits

- Transformers are used to increase or decrease the alternating voltages in electric power applications.

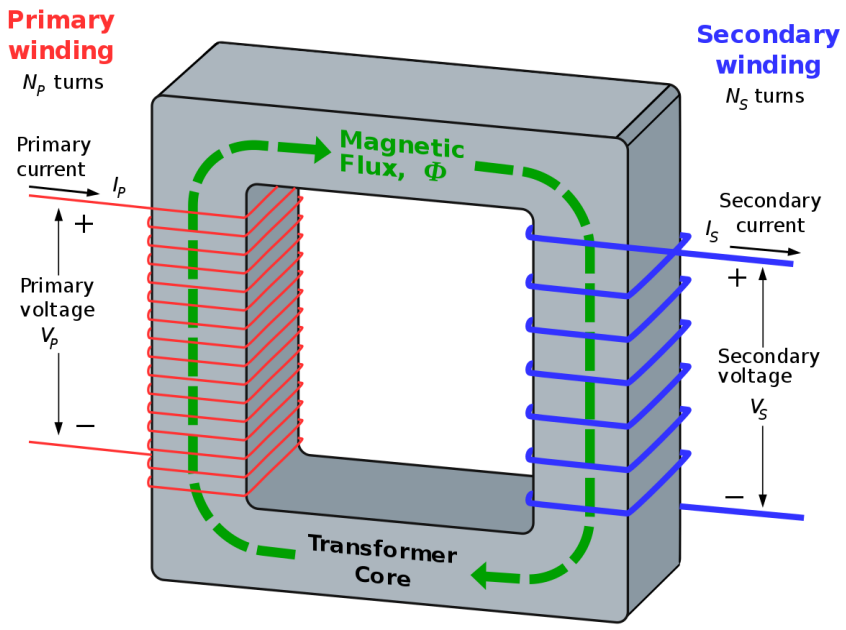


FIGURE 4.2 TRANSFORMER

3.4.3 RECTIFIER:

- A Bridge rectifier is an Alternating Current (AC) to Direct Current (DC) converter that rectifies mains AC input to DC output. Bridge Rectifiers are widely used in power supplies that provide necessary DC voltage for the electronic components or devices.

- They can be constructed with four or more diodes or any other controlled solid state switches. Depending on the load current requirements, a proper bridge rectifier is selected. Components' ratings and specifications, breakdown voltage, temperature ranges, transient current rating, forward current rating, mounting requirements and other considerations are taken into account while selecting a rectifier power supply for an appropriate electronic circuit's application.

- The bridge rectifier circuit diagram consists of various stages of devices like transformer, Diode Bridge, filtering and regulators. Generally all these blocks combination is called as regulated DC power supply that powers various electronic appliances.

FIGURE 4.3 RECTIFIER

3.5 LIQUID CRYSTAL DISPLAY

- A general purpose alphanumeric LCD, with two lines of 16 characters. LCD used here is the 16×2 line LCD.

- Liquid Crystal Display which is commonly known as LCD is an Alphanumeric Display it means that it can display Alphabets, Numbers as well as special symbols thus LCD is a user friendly display device which can be used for displaying various messages unlike seven segment display which can display only numbers and some of the alphabets.
-
- The only disadvantage of LCD over seven segment is that seven segment is robust display and be visualized from a longer distance as compared to LCD. Here we have used 16 x 2 Alphanumeric Display which means on this display. We can display two lines with maximum of 16 characters in one line.

FIGURE 5 LCD

3.6 BUZZER

Features

• Black in colour
• With internal drive circuit
• Sealed structure
• Wave solderable and washable
• Housing material: Noryl

Applications

• Computer and peripherals
• Communications equipment
• Portable equipment
• Automobile electronics
• POS system
• Electronic cash register

Diagram

Dimensions : Millimetres
Tolerance : ±0.5mm

FIGURE 6 BUZZER

4. WORKING

4.1 WORKING PRINCIPAL:

The input AC voltage of 240V is stepped down to 5V AC. This voltage is rectified to 5V pulsating DC by the help of full wave rectifier circuit utilizing four diodes. The ripple from the pulsating DC is filtered out with the help of capacitive filter. This filtered DC is fed into 40 pin IC which acts as a central hub for the whole system.

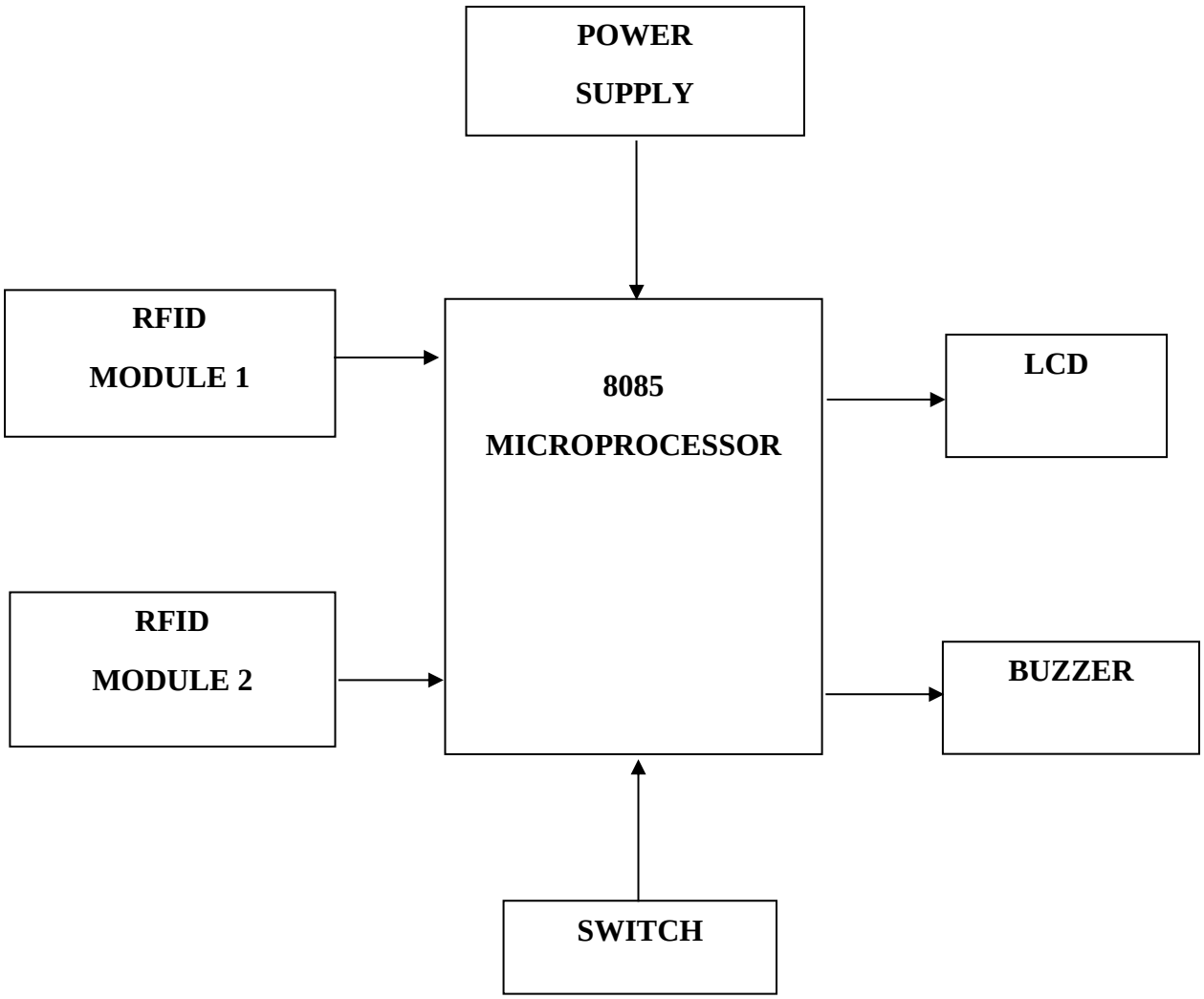
The 40 pin 8085 microprocessor receives the signals from primary RFID reader and the activation switch. The signal from the primary RFID reader located throughout the ship is converted to square wave form and is counted by processor and compares it to the set parameters. The information is being displayed on LCD at the same time.

In the case of emergency such as abandon ship the activation switch is pressed which activates the buzzer and gives signal to processor which initiates its emergency programming. According to the programming the secondary RFID reader which is situated at the embarkation deck gets activated.

The secondary RFID reader will take a count of 25 number of crew or as per the number of crew on board for a given period of 5 minutes. If any crew member fails to reach the embarkation deck within the stipulated period, the chief officer will press the activation switch and the details of missing crew members such as their name, rank and last location will be displayed on the LCD.

Thus the search and rescue operation becomes easy.

4.2 BLOCK DIAGRAM



4.3 CODE

```
#include<xc.h>
#include<stdio.h>
#include"lcd.h"
#include"gpio.h"
#include"configuration_bits.h"
#include "serial.h"

void Hardware_init();
//unsigned char buff[20],buff1[20],card[13];
void Read_IDs();
unsigned char buff[16],card[13],ch;
extern volatile unsigned char
card_buff[],card_buff2[],index,index2,Flag_ready,Flag_ready2;
unsigned char flg1=0,flg2=0,flg3=0,flg4=0;
void ID_Display(void);
unsigned int count=4;
unsigned char Flag_Emergency;
void Show_ID(void);
/*
08008857AA7D
0800884165A4
0800886CD23E
19004B28BDC7

 */
void main()
```

```
{
        Hardware_init();
   lcd_clr();
   lcd_string("*** Welcome ***",1);
   lcd_string("*** to UART 1 ***",2);
   tx_str("rfid test\n\r");
   Delay_ms(1000);
   while(1)
   {
      if(Flag_Emergency == 0)
      {
         lcd_clr();
         lcd_string("Give Access",1);
         if(sw1==0)
         {
            buzz = 1;
            Flag_Emergency = 1;
            lcd_clr();
            lcd_string("Emergency",1);
            Delay_ms(500);
         }
         if(Flag_ready==1)
         {
            card_buff[12] = '\0';
            Flag_ready = 0;
            index = 0;
            ID_Display();
           // Delay_ms(1000);
         }
```

```
            Flag_ready2 = 0;
            index2 = 0;
        }
        if(Flag_Emergency == 1)
        {
            sprintf(buff,"Count: %d",count);
            lcd_clr();
            lcd_string(buff,1);
            Delay_ms(500);
            if(Flag_ready2==1)
            {
                card_buff2[12] = '\0';
                Flag_ready2 = 0;
                index2 = 0;
                //if(Flag_Emergency == 1)
                    Read_IDs();
            }
            if(sw1==0)
            {
              while(1)
                    Show_ID();
            }
        }
    }
}
void ID_Display(void)
{
    if(card_buff[8]=='A' && card_buff[9]=='A')
    {
```

```
\
        lcd_clr();
        lcd_string("Pinaki B0623",1);
        lcd_string("Engine Room",2);
        Delay_ms(1000);
    }
    else if(card_buff[8]=='6' && card_buff[9]=='5')
    {
        lcd_clr();
        lcd_string("Prateek B0626",1);
        lcd_string("Accomodation",2);
        Delay_ms(1000);
    }
    else if(card_buff[8]=='D' && card_buff[9]=='2')
    {
        lcd_clr();
        lcd_string("Rahul B0627",1);
        lcd_string("Pump Room",2);
        Delay_ms(1000);
    }
    else if(card_buff[8]=='B' && card_buff[9]=='D')
    {
        lcd_clr();
        lcd_string("Pranav B0624",1);
        lcd_string("Bridge",2);
        Delay_ms(1000);
    }
}
```

```
void Read_IDs()
{
   if(card_buff2[8]=='A' && card_buff2[9]=='A' && flg1==0)       { flg1 = 1; if(count>=1) count--;}
   if(card_buff2[8]=='6' && card_buff2[9]=='5' && flg2==0)       { flg2 = 1; if(count>=1) count--;}
   if(card_buff2[8]=='D' && card_buff2[9]=='2' && flg3==0)       { flg3 = 1; if(count>=1) count--;}
   if(card_buff2[8]=='B' && card_buff2[9]=='D' && flg4==0)       { flg4 = 1; if(count>=1) count--;}
}

void Show_ID(void)
{
   if(count==0)
   {
      buzz = 0;
      lcd_clr();
      lcd_string("All Are Safe",1);
      Delay_ms(500);
   }
   else
   {
      if(flg1==0)
      {
         lcd_clr();
         lcd_string("Pinaki B0623",1);
         lcd_string("Engine Room",2);
         Delay_ms(250);
         buzz = 1;
```

```
    Delay_ms(250);
    buzz = 0;
}
if(flg2==0)
{
    lcd_clr();
    lcd_string("Prateek B0626",1);
    lcd_string("Accomodation",2);
    Delay_ms(250);
    buzz = 1;
    Delay_ms(250);
    buzz = 0;
}
if(flg3==0)
{
    lcd_clr();
    lcd_string("Rahul B0627",1);
    lcd_string("Pump Room",2);
    Delay_ms(250);
    buzz = 1;
    Delay_ms(250);
    buzz = 0;
}
if(flg4==0)
{
    lcd_clr();
    lcd_string("Pranav B0624",1);
    lcd_string("Bridge",2);
    Delay_ms(250);
```

```
            buzz = 1;
            Delay_ms(250);
            buzz = 0;
        }
    }
}

void Hardware_init()
{
            OSCCON = 0b01110110;
    ANSELD = 0X00;
    ANSELC = 0X00;
            serial_init();
    lcd_init();
    gpio_init();
}
```

FIGURE 7 PROJECT WORKING

FIGURE 8 PROJECT LCD WORKING

FIGURE 9 PROJECT LCD WORKING

5. ADVANTAGES

The project shows the following advantages

- Since location of missing crew member is known, the search and rescue operation becomes easy.
- Any casualties can be avoided due to human errors occurring in any panic or emergency situations.
- Time required for search and rescue is less.
- Such kind of device is useful in passenger vessels.
- P and I claims for any man overboard incident is easy, users locations can be tracked easily.

6. DISADVANTAGES

Even with pre-said advantages, there are some disadvantages

- The wire connections of device can get loosened up if not checked and soldered at prescribed time intervals.
- The enclosure of prototype is not water proof, the water ingress can damage the electronic components.
- The RFID readers used in prototype are short range readers hence the user should scan the RFID bands at close distance.
- Since the RFID readers are short range type, any form of cover will not be able to read or scan the RFID bands.

7. FUTURE ASPECTS

The following are the future advancements that can be done

- We had used short range RFID readers which can be replaced by long range RFID readers which provides the user to scan the RFID tags from a longer distance.
- The enclosure of the device can be waterproof and dustproof.
- We can use radio wave signal transmission to transmit the signals from various components.
- The RFID cards can be replaced by active RFID tags.
- The LCD can be replaced by a handy tablet.
- The entire system can be integrated to a computer console which acts as a central server and grants the access to the system.
- The RFID tags can be worn as bracelets by the ship's crew.

8. CONCLUSION.

This project is aimed to tackle the following problems:

- To reduce the time involved in search and rescue operation.
- Monitor the location of each and every individual.
- To eliminate human error in head counts.

Due to the restrictions for us in terms of finance as well as limitation in our knowledge in the field of electronics and development, this is the best we could have done.

With future research and development, this project can truly use to make sea even safer.

9. FUTURE DEVELOPMENTS IN ORIGINAL PRODUCT

- Fail sage protection with IR sensor which can sense any person crossing across it and will only send the signal to central control unit when RFID reader fail to read the RFID chip/ tag.
- Heart rate sensor to monitor the pulse rate of user, if any abnormality is observed it can give alarm to Officer On Watch.
- Connection with FIRE Alarm Panel to send the location about the zone in which the FIRE has taken place to the LCD / LED fitted on user's wrist band.
- Motion senor with vibrator to give a slight vibration to user's hand if there is no motion for long period of time.
- Ability to detect any toxic gases present in any space.
- Ability to send important messages to user's LCD / LED FITTED on wrist band.
- Intrinsic safety provided to entire device.

NOTE:- The above developments can only be done upon the demand of ship owner about how much safety features he / she want to incorporate, but the basic Product will remain the same based on RFID Principle.

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