

# Design, Modelling and Application of Microcontroller (MCU) on Marine Fire Fighting System

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## ABSTRACT

As per SOLAS Chapter 3.6 Regulation 10 - Fire Fighting, it is required for any sea going vessel to have a remotely operated firefighting system which could be started remotely at various designated points upon fire detected. Hence this paper presents the simple cost saving method to ensure the system is always being maintained in remote position and **ALERT** the ship personnel if operated manually in local condition and application of the microcontrollers unit (MCU) based system. These design were simulated using the Proteus software and then later to implement and test in the hardware models. The program has then compiled in PIC C Compilers, and were programmed into the microcontroller using a programmer for PIC 8-bit microcontrollers. There is still lack of initial cautionary system to monitor these firefighting systems, readily standby at all the time. Thus, this paper will offer the precautions of the firefighting to be available at all time which will alert the crew in charge, through signals. The vital use of the system is to reduce or to ease the task of the crew members even there is an unexpected emergency situation.[2]

**KEY WORDS:** PIC microcontroller, MCU

## NOMENCLATURE

MCU	Micro-Controller Unit
GSM	Global System for Mobile
GPS	Global Positioning Service
SMS	Short Message Service
GPRS	General Packet Radio Service
LED	Light Emitting Diode
LCD	Liquid Crystal Display
UMS	Unmanned Machinery Space
PIC	Peripheral Interface Controller

## 1.0 INTRODUCTION

Unattended Machinery Space, or UMS class vessels is a way of operating automatically controlled by the machinery of a vessel. A new topics has been included covering the operations management and safety, which reflects changes in the seagoing engineer's duty. Modernized maintenance management is another new subject turning out to be more vital as a result of the wide utilization of unattended machinery spaces [1].

On vessels there is various parameters to be estimated or watch much of the time, these incorporate: the pressure, level, flow control, current, voltage, equipment position and machinery status.

### 1.1 Similar System

A. the paper centres around, Shrewd private criminal alert, crisis caution, alarm, lethal gas spillage remote programmed sound caution and remote control framework, which depends on 89c51 single chip PC. The framework can play out a programmed caution, which calls the police hotline number consequently. It can likewise be a voice caution and shows alert happened address. This keen security framework can be utilized control the electrical force remotely through phone (1).

B. There is another paper centres around, a minimal effort car confinement framework utilizing GPS and GSM-SMS administrations, which gives the situation of the vehicle on the driver's or proprietor's cell phone as a short message (SMS) on his solicitation. The framework can be interconnected with the vehicle caution framework which alarms the proprietor, on his cell phone, about the occasions that happens with his vehicle when it is left. The framework is made by a GPS beneficiary, a microcontroller and a GSM telephone. In extra the framework can be agreed to obtaining and transmitting the data, at whatever point mentioned about car status and alarms the client about the vehicle turned over motor. The framework can be utilized as a

minimal effort answer for vehicle position restricting just as in vehicle following framework application. (2)

### 1.2 Current System

Current Computerization and Controls covering various pieces of the vessel activity that fuses the plant activity, power organization procedure on the helper motors, right hand on machine tasks, cargo on-and-off-stacking activity, course and organization of help and buying of spares, however The putting out fires framework isn't completely mechanized and still requires some manual controls on the framework. The majority of the vessels utilizes the manual changing over switch without sounder alert when framework is put to manual mode.

### 1.3 Proposed System

A humble, cost saving, modest, configurable, simple to be worked electronic ready alert system is proposed to convey the signals and beneficial for the vessel teams.

## 2.0 METHODOLOGY

A microcontroller will maintain the fire pump default condition in remote. A three-way selector switch will be acting to complete the circuit, and eventually MCU will trigger a warning/alert system to the ship crew in the event of mis operation. The alert system comprises of LED, buzzer and LCD display. As resultantly the next course of action will decide by MCU fitted. Through MCU ports the warnings will be triggered and can display on panel boards. Thus, much component, fittings, and mechanism are not required for inexpensive better performance.

### 2.1 Component

The main component of the system is (1) PIC16F84A, this is a very basic MCU with 18 IO pins. The main source of alarm will be from Sounder (2) which include LED (3) as visual indication. (4) Motor is activated as per required depend on situation. (5) A 3-way selector (SW-ROT-3) is fixed to control the mode of operation. (6) A LCD(LM016L) is installed to show the current mode of operation. Figure 1 illustrates the schematic diagram of the system design.

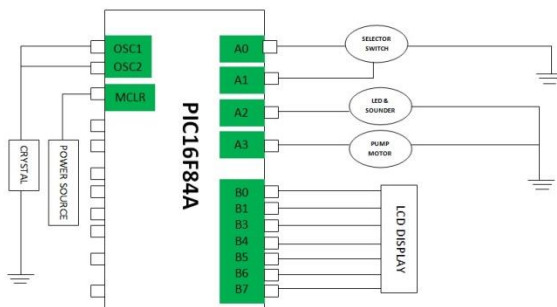


Figure 1: Simplified Schematic diagram

## 2.2 Operations

As per SOLAS requirement, the default settings for the pump should be able to operate remotely at various designated points. These methods can be describe as following:

1. Three-way selector at OFF – Pump unable to operate manually or remotely without triggering LED and buzzer. LCD displaying 'OFF' (used during maintenance).
2. Three-way selector at LOCAL – Pump able to operate manually only, triggering LED and buzzer. LCD displaying 'PUMP RUNNING LOCAL'.
3. Three-way selector at REMOTE – Pump able to operate remotely only, without triggering LED and buzzer. LCD displaying 'PUMP RUNNING REMOTE'.

Table 1, shows the logic of the operations.

Table 1: Truth Table

INPUT PORTS		OUTPUT PORTS					
SWITCH		MOTOR	BUZZER	LCD DISPLAY			
A0	A1	A2	A3	B4	B5	B6	B7
1	0	ON	ON	ON	ON	ON	ON
0	1	ON	OFF	ON	ON	ON	ON

### 2.3 Microcontrollers

PIC16F84A (Figure 2), is used for this system. This MCU is used as the brain of the system, it has the ability to function without other sophisticated modules to be attached. PIC is a family of reduced instruction set computing (RISC) microcontrollers manufactured by the Microchip Technology which is resultant from the PIC1650 that is formerly developed by General Instrument's Microelectronics Division. PIC is the integrated circuit which was frequently used to develop in controlling exterior devices and lightening the load from the main CPU in the system. Matched to a human being, the main CPU act as a brain and the PIC is same to our autonomic nervous system. Hence, it is recommended that 8-bit PIC16F84A microcontroller which is sufficient enough to act as the central control of the system.

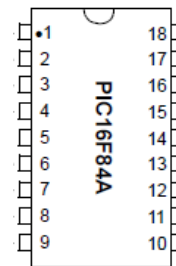


Figure 2 : PIC16F84A Microcontroller Pin assignment (PDLP)

### 2.4 Software

The "C compiler for the PIC MCU," is utilized for composing, editing, compiling, and programming the codes for the microcontroller. These compiler, which empowers the microcontroller to be customized in high level programming languages, together with PicKit2 programmer. The calculation of the codes will choose the condition of the parts by activating the

micro-controller's input - output ports considering the specific tasks. The essential ability of the whole work is to permit a planned with quick response, to recognize the sensor inputs, and to initiate the outputs with establishing the Alert system.

## 2.5 Programming Description

The program used to manage the whole procedure is inserted in PIC16F84A microcontroller's C language. All the codes have been aggregated and tried utilizing CCS compilers.

## 2.6 System Flow

This system works in sensing the position of three-way selector switch and send the signal to the Microcontroller Unit. The MCU then will intelligently decide on the next course of action, either triggering the Alarm, LCD display , Buzzer and LED or combination of all the element to alert the vessel crew to take further action (Figure 3).

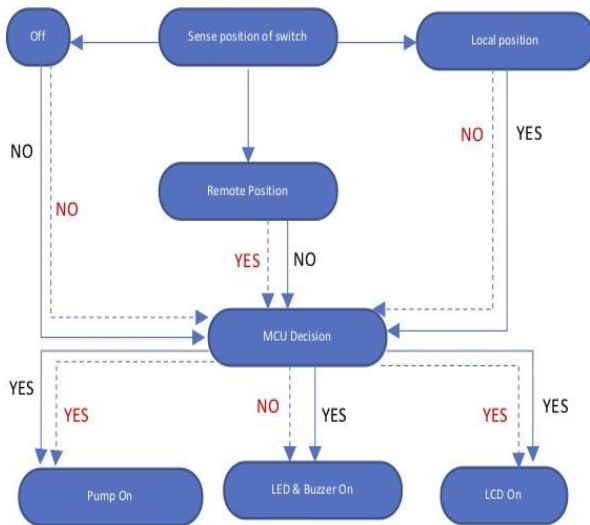


Figure 3: Flowchart of the system

## 2.7 Circuit

The circuit have four main elements: the power source section, microcontroller segment, which comprises the system input parts, and the output parts. All these modules are integrated to the MCU unit.

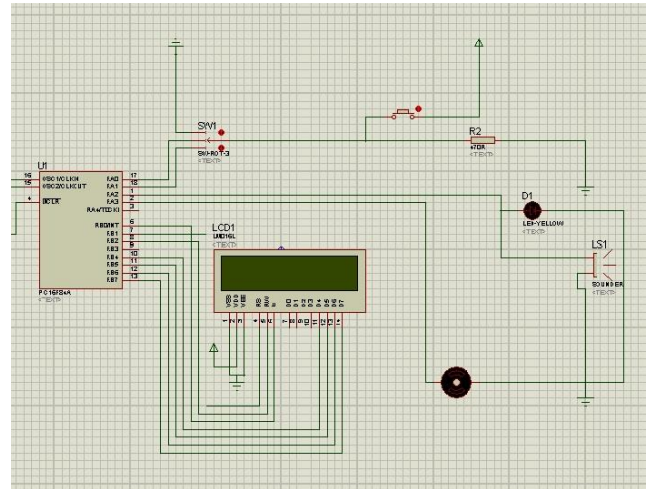


Figure 4 : Input & Outputs

As in figure 4, all the 5 input sensors are connected using the Port A, and all the output to LED display of the system are connected using the Port B.

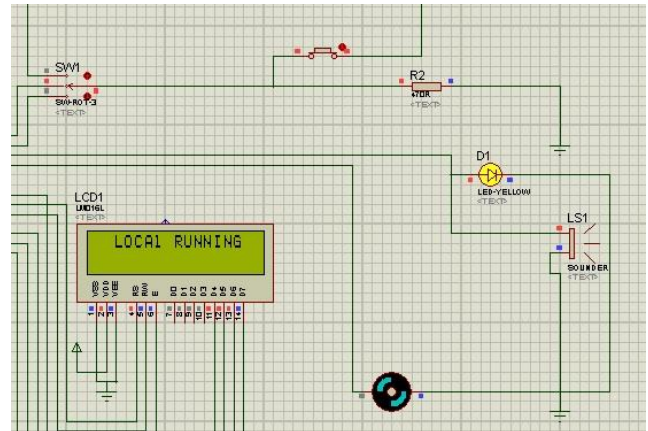


Figure 5 : Local Running Condition

Once the selector switch is put into local mode. The alarm and LED light signal will automatically trigger by the MCU, to indicate an immediate attention is needed by the crew of the vessel. The MCU will be connected to the Alarm as in figure 5. There is additional LCD display stating that Local Mode selected.

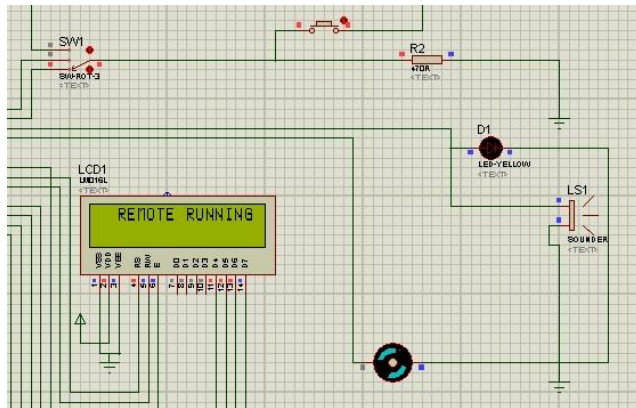


Figure 6 : Remote running Condition

The pump Motor, will start automatically when the selector is in Remote mode, LCD display will show remote mode selected. There won't be all sound alarm or LED indication as per Figure 6.

### 3.0 CIRCUIT DESIGN SIMULATION

The circuit was repeated then in Proteus v7.6 software. The entire components of the circuit that is important in this program were carefully selected from the software library, and lines made the connections. Later, the program was compiled using the CCS C compiler. The program's output, hex disk, is loaded into PIC microcontroller using the PicKit2. Simulation is finally tested for all the conditions. The circuit used for simulation is given in Figure. 4. The connection to the microcontroller separated into 3 parts of circuits. The inputs from the sensors were connected to RA0 till RA3 pins (using Port A) Of the microcontroller during connection of device outputs RB0 through RB7 for the display units (LEDs), and RA2 is connected to the alarm and finally the RA3 is used to connect to the Pump Motor. All the output pin is connected through (Port B) of the LCD display controller.

### 4.0 RECOMMENDATIONS

In this paper, the author gave the operation of customary fire pump alert system. Besides, it is demonstrated to utilize a practicality I/O sort MCU as the part to a circuit for fire pump alert system. This circuit check and control fire pump alert system, and utilized LED, LCD, Buzzer for signals. In addition, the MCU could be reprogrammed to suit the regular regulation changes on board. Every one of these components are controlled and intelligently decided by the PIC16F84A - MCU and more application cases could be further studied.

### 5.0 CONCLUSIONS

Accordingly, this proposed task will guarantee the word related security on board by decreasing the requirements for the group to over and again moving to see the status of fire pump without anyone else and the insurance of the hardware or machines too. This task could additionally be improved in distant future. Forthcoming task could be focused around improving the visual

guides, by permitting the crew to know precisely the state of the fire pump and in any event, permitting the teams to be alarmed through an IAS display associated with the MCU.

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