DEVELOPMENT AND TESTING OF ANINFERNO REPORTING SYSTEM

1.0 Executive Summary

Fire, though an essential tool for man's livelihood, owing to its use for various form of activities, is a bad master when it manifests as inferno. Assets worth several millions of naira and lives have been destroyed by inferno. Government has put in place an agency for fighting inferno, but due to delay in reporting the inferno, the agency has in most cases been unable to quench the inferno. The activity of the fire-fighting agency has been characterized by the late arrival at the scene of the inferno or inadequate preparedness for the inferno.

This work presents an inferno reporting system that is intelligent, that is, it determines some information useful for the fire-fighting agency. It consists of four basic units; the sub-module, master module, burglary module and monitoring module.

The sub-modules are installed in particular locations of the building, it consists of sensors for smoke, flame and temperature. The sub-module in a specific location of the flat communicates via wifi with the master module (carries the identity of the flat). The master module communicates with the monitoring module via WLAN/CLOUD.

The coordinates of the master module is provided to the monitoring module by the google map incorporated.

At the instance of inferno, the sub-module detects the fire and communicates the situation with the master module and the master module in turn sends the information to the monitoring module. The following information will be supplied at the monitoring module;

- Time of inferno occurrence
- Distance of inferno scene to monitoring module
- Location of the start of fire
- In the event of burgle, the image of the burglar.

2.0 INTRODUCTION

2.1 Background to the Research

Fire is often described as the greatest servant but the worst master- difficult to control when it turns into inferno, burning and scorching everything on its path. Fire, as we all know, has no respect for man; rich and poor alike. Fire outbreak in the country has indeed assumed an alarming proportion. In Nigeria today, there is barely a day without one accident or the other and most has to do with fire outbreak.

The following fire outbreaks were so far reported in Nigeria's daily in the year 2016; Yola market fire inferno (Iro, 2016), behind Mandilas and Marina, Lagos, fire inferno (Sotubo, 2016), Kano

Singa market fire (Nkem, 2016), Vice-chancellor lodge's fire, Unilag (Wale, 2016) and Kano's Sabon-gari fire inferno (NAN, 2016).

Most of these fire outbreaks can be attributed to many factors which includes but not limited to the following; storing of adulterated fuel, Power surge, electric sparks, illegal connection of electricity, lighted match, stoves, cookers and gas cylinders, electrical faults in homes and offices, to firecrackers in marketplace or petrol tanker explosion on busy streets. These reported fire infernos had resulted in destruction of properties worth billions of naira and human life.

2.2 Problem Statement/Justification

The rate at which fire outbreaks occur is becoming worrisome calling to question the effectiveness of the Federal Fire Service (FFS) entrusted with firefighting and control (when it occurs). In most cases, it has always been tales of inefficiency on the part of the fire service that sometimes arrives late at the scene of the fire incident even with insufficient materials and equipment. This work seeks to assist the government and Nigerians in mitigating fire incident.

2.3 Objectives of the Research

- To design a wireless fire reporting system that will supply the required information to fire-fighting centre/service.
- To design a system that will implement wireless technology to display on the map the location of the inferno.
- To develop a system that will also furnish the occupants of the building that are away from home with the information about the inferno so as to take necessary steps.
- To locate the source of the inferno.

2.4 Scope of Research

The design is a deployment of the system. It could be deployed anywhere as it incorporates a google map.

3.0 LITERATURE REVIEW

A fire alarm system is a number of devices working together to detect and warn people through visual and audio appliances when smoke, fire, carbon monoxide or other emergencies are present. Neither of these measures can be used until people are made to be aware of the fire (Safety, 1926), (Goh & Kwek, 2005).

Two hundred years ago, America's early fire alarms were pragmatic. Communities announced fires by blowing whistles, ringing church bells, or even shooting guns into the air. American ingenuity and inventiveness revolutionized alarm systems with the technology of the telegraph.

Ensuing decades into the 21st century produced multi-functional community fire reporting methods through wireless transmitters. State of the art personal alarm systems installed in private homes and businesses keep families and hearing impaired in the forefront of fire alarm system

technology. The earliest American fire alarm came in 1658, when New York's first fire department employed eight men.

Using telegraph technology of 1852, William F. Channing and Moses Farmer designed two fire alarm boxes with each containing a telegraphic key.

A basic Fire detection and response system is as shown in Fig. 2 (Goh & Kwek, 2005).

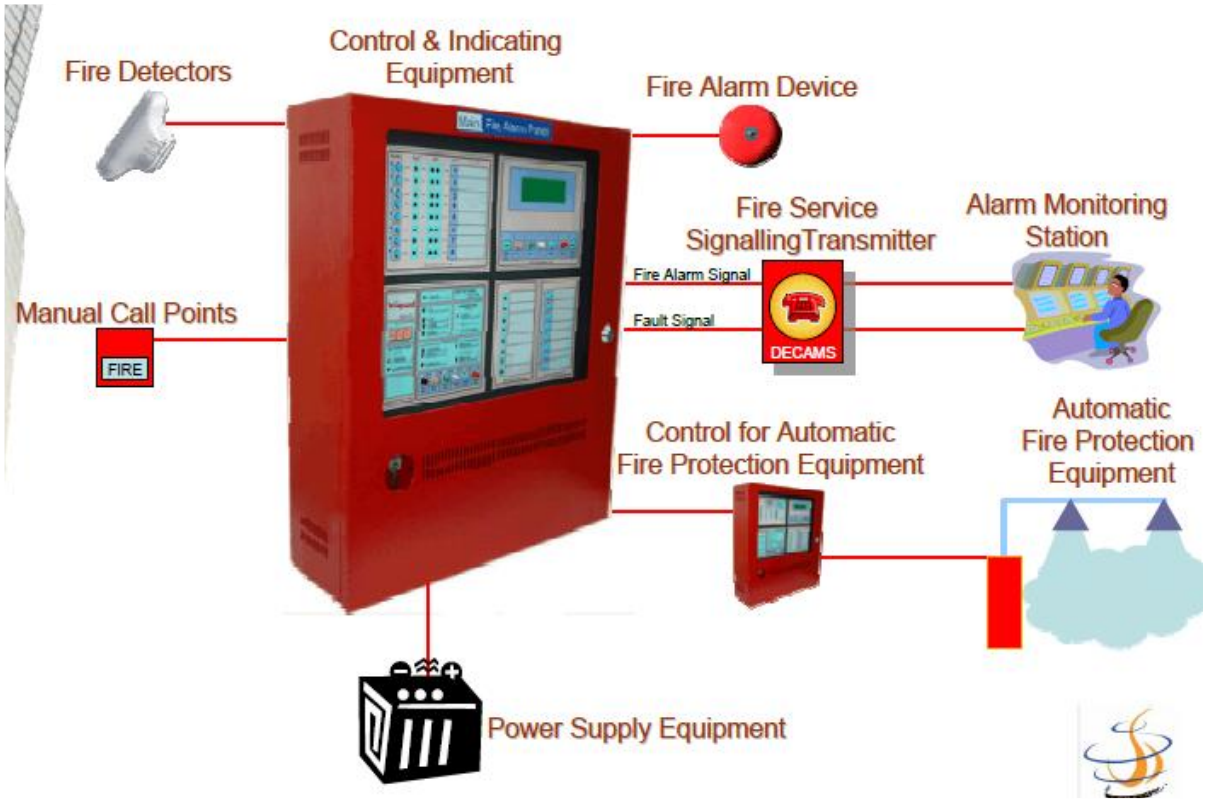

Figure 2: Fire alarm system

4.0 METHODOLOGY

4.1 Materials and Equipment

1. ATmega328P
2. 433Mhz RF Transmitter & Receiver Communication Module
3. MQ2 Smoke Sensor
4. MQ7 CO Carbon monoxide Sensor
5. DS1820 Temperature Sensor
6. 900Mhz – 1800Mhz GSM Modem
7. Passive Buzzer
8. 12 V 50 Ah battery

4.2 Procedure

Wireless Fire Alarm System is a device that senses smoke, typically as an indicator of fire. It should be reliable and in a timely way notify building occupants and also the nearest fire station about the presence of fire indicators, such as smoke or high temperatures. A fire detector is usually implemented as a smoke sensor due to its early fire detection capability, fast response time and relatively low cost. Wireless sensor network has become the most important technology in environmental monitoring and home or factory automation in recent years.

The block diagrams of the proposed system are as shown in Figs. 2 and 3. The procedure is as shown in the flow chart in Fig. 4.

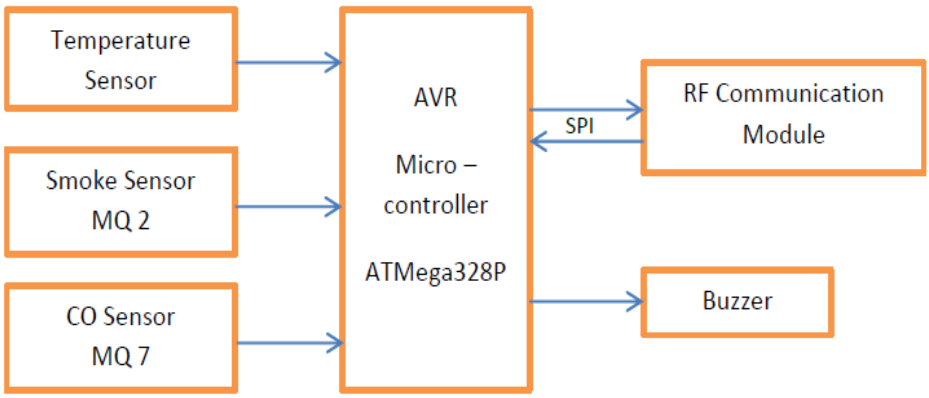

Figure 2: Fire sensing node block diagram

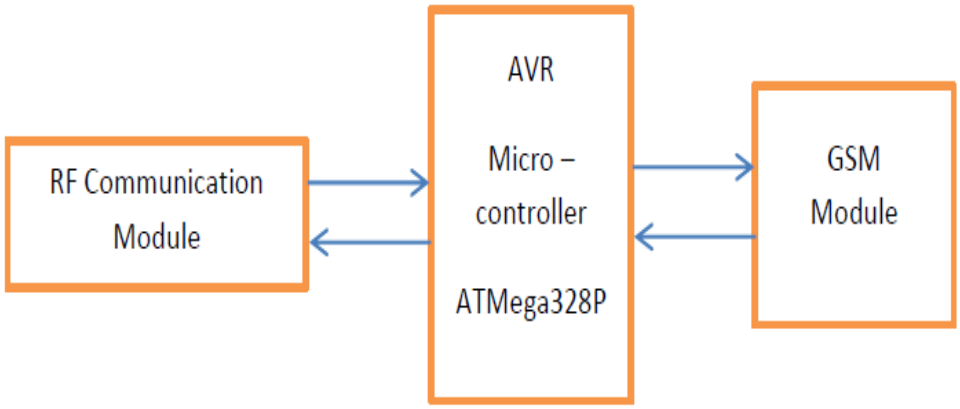

Figure 3: Fire signal receiving block diagram

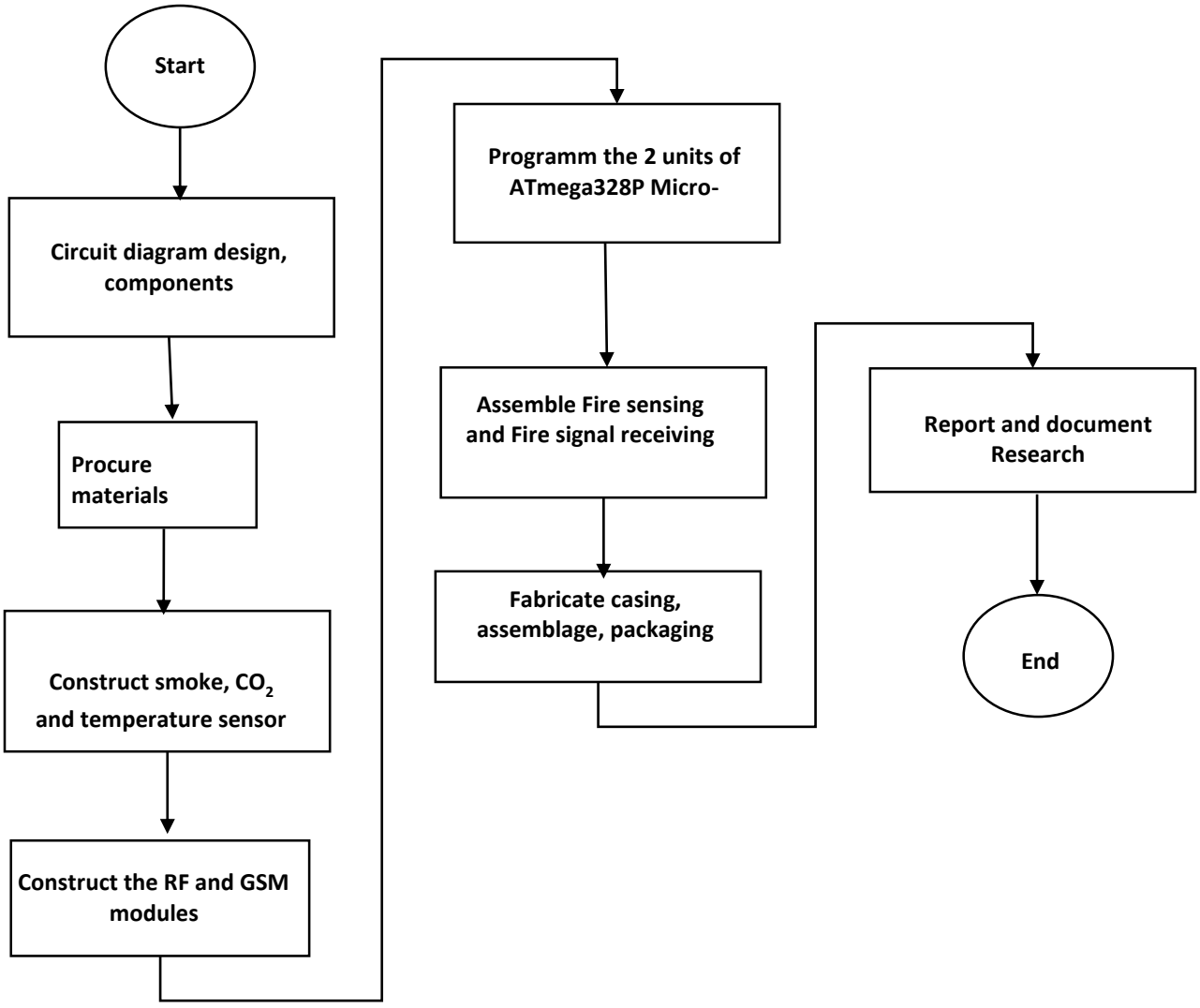

Figure 4: Procedural flow chart

5.0 RESULTS (EXPECTED OUTPUTS)

The proposed system will report the occurrence of fire inferno and provides the firefighting personnel with information about the distance to the scene of the inferno, enhancing prompt response time, and possibility of putting out the fire and rescuing the victims in good time.

6.0 WORK PLAN/TIME FRAME

	WK 1	Wk2	WK 3	WK 4	WK 5	WK 6	WK 7	WK 8	WK 9	WK 10	WK 11
Circuit diagram design, components identification and sourcing.											
Procurement of materials											
Programming of 2 units of **ATmega328P** Micro-controllers.											
Construction of smoke, CO_2 and temperature sensor unit.											
Construction of RF and GSM modules											
Construction of Fire sensing and Fire signal receiving nodes.											
Enclosure fabrication, assemblage, packaging and testing.											
Reporting and documentation of Research											

7.0 Budget

Materials and Equipment

S/N	Item	Quantity	Unit Price (₦)	Cost	Stage when needed in Research
1.	ATmega328P	4	250,000	1,000,000.00	Implementation Stage
2.	433Mhz RF Tx & Rx Communication Module	4	150,000	600,000.00	Implementation Stage
3.	MQ2 Smoke Sensor	2	120,000	240,000.00	Implementation Stage

4.	MQ7 CO Carbon monoxide Sensor	2	120,000	240,000.00	Implementation Stage
5.	DS1820 Temperature Sensor	2	120,000	240,000.00	Implementation Stage
	900Mhz – 1800Mhz GSM Modem	2	120,000	240,000.00	Implementation Stage
6.	Passive Buzzer	2	150,000	300,000.00	Implementation Stage
7.	12 V, 50 AH battery (Litium)	Lot (patched)	400,000	400,000.00	Implementation Stage
8.	Mapping out of study area	Lot	400,000:00	400,000:00	Implementation Stage
9.	Dell Laptop (1TB, 12 MB RAM) for programming and mapping	1	1,000,000:00	1,000,000:00	Implementation Stage
Total				**4,660,000:00**	

Others (Transport and Publication of Research)

S/N	Item	Description	Rate (₦)	Total Cost (₦)
1.	Purchase of components	Transportation	100,000	100,000:00
2.	Report Preparation and Binding	Typesetting, Printing and Binding	100,000	100,000:00
3.	Journal Publication	Publication	200,000	200,000:00
4	Consultation	Training	100,000	100,000:00
Total				**400,000:00**

4,660,000 + 400,000 = 5,060,000

A grand total of **₦5, 060,000:00**, Five million and sixty thousand naira only.

A grand total of **₦1, 860,000:00**, One million, eight hundred and sixty thousand naira only.

References

Bunker, M. (2007). Guide to Fire Alarm Sysytem Installation. (2. edition, Ed.) 15-20.

Goh, D., & Kwek, M. (2005). Overview of Fire Alarm Systems and Maintenance. Retrieved from http://www.scdf.gov.sg.

Heath, S. (2003). Embedded Systems Design. (2. ed, Ed.) *Series For Design Engineers* , 11-12.

Iro, D. F. (2016, January 4). Fire guts Yola market, Retrieved form www.premiumtimesng.com

News Agency of Nigeria (2016, March 26). Midnight fire destroys Sabon-Gari market in Kano. The Guardian, Retrieved from guardian.ng.

Nkem, I. (2016, February 28). Early morning fire guts popular Singa market in Kano (Photos). Naij.com, Retrieved form www.naij.com.

Robert, R. (1998). *Modern Control System.* (8th, Ed.) NewYork: MIT.

Wale, O. (2016, March 3). Ex-Borno Auditor General dies as fire guts UNILAG VC's lodge (Photos). Daily Post, Retrieved form dailypost.ng.

Wrang, R., & Carmody, R. (2010). Human adaptation to the control of fire. *Evolutional Anthropol* , 182-185.