SMS Flood Alerting System in Flood Affected Area

Kirti Bhausaheb Gavali

Department of Electronics and Telecommunication,
SVIT College of Enginnering, Chincholi, Nashik,

Abstract—Flood disaster usually happens due to improper irrigation method in a housing area or the sudden increase of water volume in a river. Flood disaster often causes lost of property, damages and life. Since this disaster is considered dangerous to human life, an efficient countermeasure or alert system must be implemented in order to notify people in the early stage so that safety precautions can be taken to avoid any mishaps.

This paper proposes a system that can early warn about the upcoming flash flood for the upstream and downstream areas. The system uses solar cells together with batteries as the main power and can be split into two parts. The first part is the transmitter installed at the upstream and composes of a data logger, with an SMS (Short Message Service) transmitter and a warning siren. The second is the receiver installed at the downstream and composes of an SMS receiver with a warning siren as well. The system can warn the upstream village immediately and then warn the downstream area about 2 hours in advance. System focuses on monitoring water level remotely and utilizes Global System of Mobile Connections (GSM) and Short Message Service (SMS) to convey data from sensors to the respective users through their mobile phone.

The hardware of the system includes Micro Controller Unit (MCU) PIC18F452, three (3) liquid sensors, Inverter and Easygate GSM Module. Software used for the system is C compiler thru (AT tention) AT commands. It is hoped that this project would be beneficial to the community and would act as a precautionary measure in case of flood disaster at any flood prone area. By having early detection, users could take swift action such as evacuation so that cases of loss of lives could be minimized.

Keywords—Flash Flood, Warning System, SMS, GSM Module, SMS, Liquid sensor, MCU PIC 18F452

I.   INTRODUCTION

Mobile phones are vital in modern day communication these days. For communication community, mobile phones act as a medium to communicate, interact or as a device to gain knowledge. Mobile phone is defined as a communication device used to interconnect between different geographical areas. There are many features available in modern mobile phones now a day that would satisfy users. Among the most popular applications in a mobile phone is Short Messaging System (SMS).SMS text messaging is the most widely used data application in the world. Based on this fact, SMS application can also be applied to other form of information in order to help mankind. One of the ideas is to connect a sensing system and send an alert or warning SMS indicating any mishaps to the user. Alert SMS can be exploited to be used using a proper system with the proper sensing system. Often cases of flood disaster happened due to residents unaware of the sudden increase of water level at their neighborhood. Due to that, a proper warning system must be implemented to notify people in the early stage so that safety precautions can be taken to avoid any mishaps.

Alert system implemented currently is via television and radio broadcasting to indicate which area is affected. However, warnings might fail to those affected due to ineffective and late information in the area. With the rapid development of technology, a sustainable and reliable monitoring system is

required to protect the community in any case of emergency. By implying liquid sensors and GSM technology, this paper aimed to build a reliable and real time response of water level alarm system that would detect the escalation level of water in the riverbanks and send SMS alarm to the user's mobile phone. SMS has been proven to be a reliable source of information recently. During Hurricane Katrina 2005 disaster, it has been found that most landlines were cutoff during that period. Most of the information was gathered using SMS as the lines are congested at that moment. This shows the reliability of SMS as it works on different band and can be used even though the lines are congested.

II. SYSTEM STRUCTURE AND WORKING PRINCIPLE

System structure is illustrated in Fig. 1. System composed of three sensors, one MCU-based PIC18F452, a GSM module and a mobile phone. Sensors used are retro reflective, NPN type. It uses system of blocking interruption where the system will give 5V signal to the amplifier. Liquid sensors been used for this project due to its unique ability of detection for liquid substance. MCU used is PIC18F452 from Microchip. MCU PIC18F452 was chosen because it is C compiler optimized architecture. Since this project runs on C compiler program, it is the best option to use this MCU. Other special features include 32K byte flash memory that could be used to write high capacity of programming language. GSM Module is a device used to transmit SMS signal to the intended user. By using GSM module, GSM network can be used since it is much more accountable during flood season.
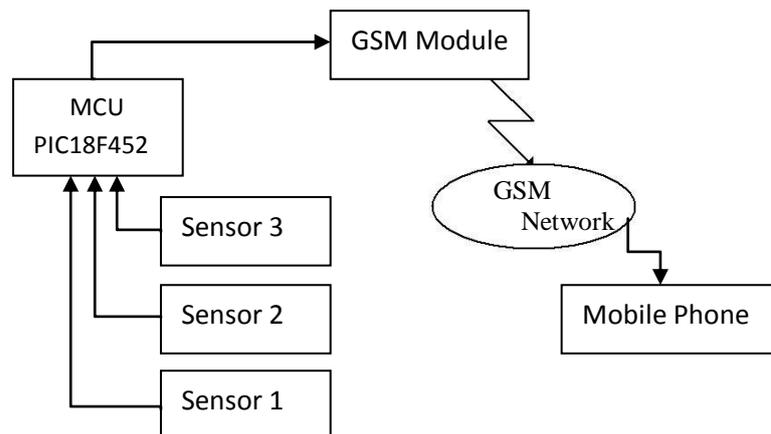

Figure1. System Structure

TABLE I.   SMS CONTENTS BASED ON CONDITIONS

Condition	SMS contents
Level One (Alert)	Flood at Alarm level
Level Two (Warning)	Flood at Warning level
Level Three (Danger)	Flood at Danger level
Flood Receding	Flood is over

The working principle of the system is based on sensor's detection shown in Table I. Level One sensor would be the lowest part of all sensors. When Level One sensor receives a signal which means the water has increased more than the threshold, the sensor would send '1' signal to the MCU. Upon reaching the MCU, program would identify it as Alert trigger. Hence, MCU would send AT command of "Flood at Alert level" to GSM module. Level Two sensor would be positioned higher than first sensor; hence the SMS display would be "Flood at Warning level". The highest positioned sensor which is Level Three would send SMS of "Flood at Danger level". The system also will check if the flood has receded from previous condition. SMS of flood recede will be based on previous sensor detection.
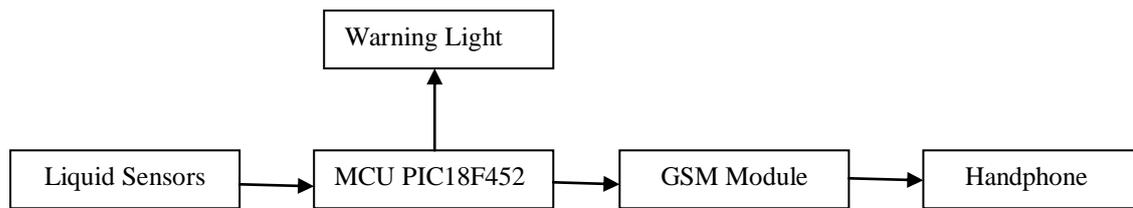
Figure 2. Block diagram

From Fig. 2, the block diagram shows the system consists of liquid sensors, an MCU, warning light, GSM module and hand phone. Three liquid sensors would be used to differentiate the escalation level. The data send by the sensors will be handled by the MCU. The MCU has been pre-programmed for different input and would send different output thru transmission pin. Commands are send using C compiler program with relevant AT commands. Data from the input also has been interconnected with the warning light to indicate any changes of condition of the sensors.

The transmitted output from the MCU will be conveyed thru to GSM module. By doing this, SMS alarm would be send to respective user. User will receive different SMS depending on the level of sensors' detection. GSM network is being exploited to convey data to the user via short message alarm. SMS via GSM network proven to be reliable due to it works on a different band and can be sent or received although the phone lines are congested. It also has the advantage of sending data to multiple users (SIMO).

This research presents a flash flood warning system to warn people in the upstream area such as Nashik City and the downstream such as Chandori Village about the upcoming flash floods by collecting and processing the data of rainfall, runoff and groundwater level by means of microcontrollers installed at River Bank of Godavari. The data will be determined to make an alarm based on the statistics of previous flash floods in Thailand. When the alarm decision is made by the microcontroller in the transmitter station at the upstream, there will be:

1. Siren wailing depending on the warning level and the warning information will be sent by an SMS to the receiver at the downstream for early warning at the same time.
2. A copy of the warning SMS will be sent to the administrator for checking. If the administrator ensures that the information is correct, which means there will be a flash flood certainly.
3. The administrator will send SMS messages to officers who govern these areas to prepare for coping with upcoming floods as shown in the Fig. 3.
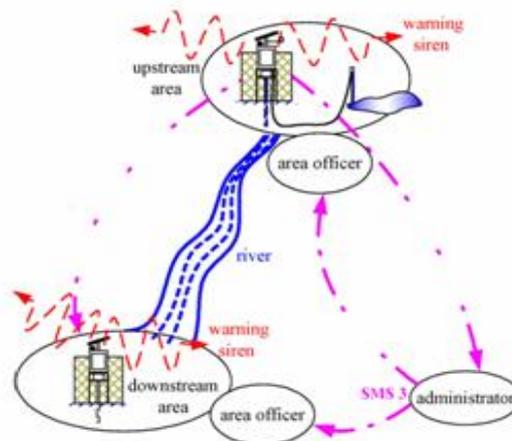

Figure 3. Warning SMSs sending in the system

- **Data logger** -This instrument based on the microcontroller is used for collecting data from the rain gauge, two water level sensors and another channel for a spare. The rain gauge will give one pulse signal to the data logger for every 1 mm of incoming rainfall. The data logger receives the data, accumulates the rainfall and then saves the rainfall data into its EEPROM for ensuring that the data will not be lost. Data from the water level meter to the data logger are runoff and groundwater data. When there is an incremental I-mm rainfall, the data logger will save all data including time from a real time clock to a flash drive and also will send data via RS323 to the processing unit. Incoming data must be read twice for comparing each other. If both data are not the same, they are noises and are not recorded. Data of groundwater and runoff above 255 will not be recorded as well for avoiding error signal.
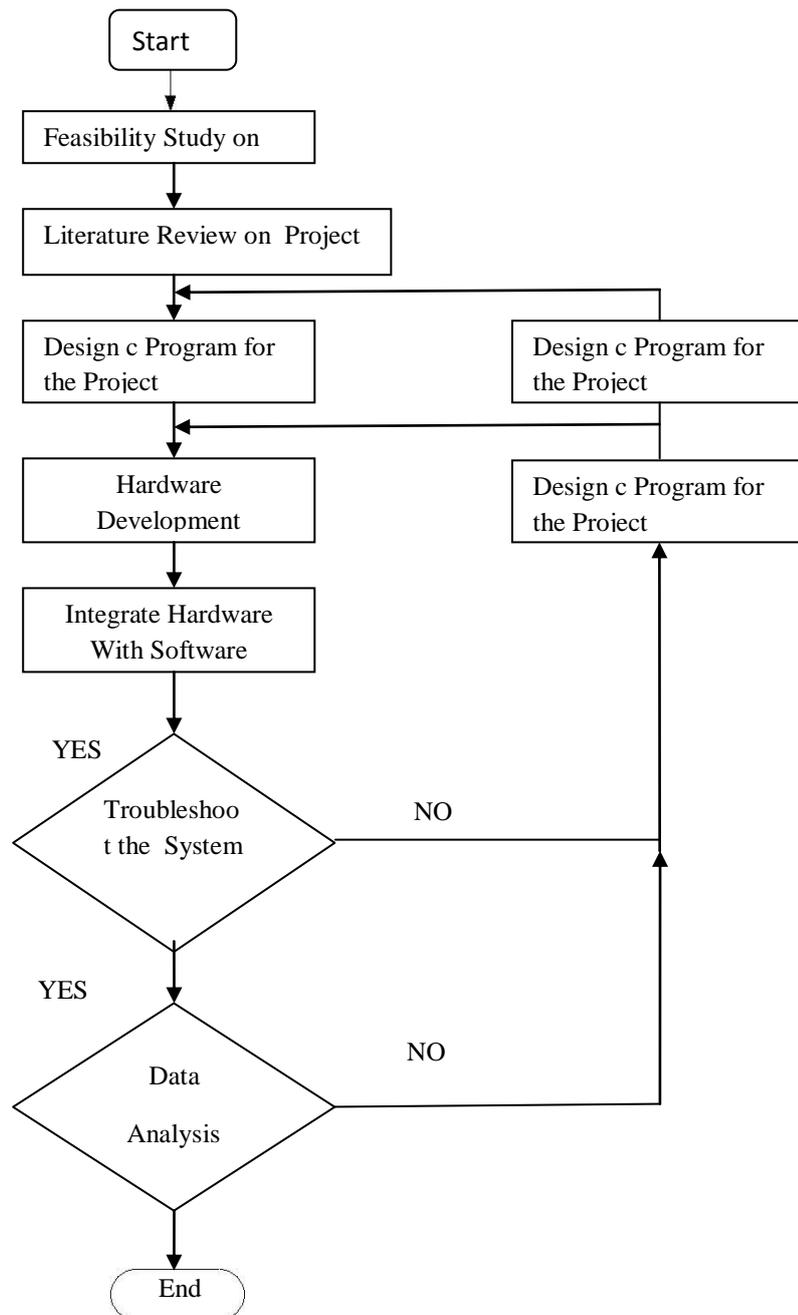
III.   METHODOLOGY

Figure 4. Flowchart

The project is based on the flowchart in Fig. 4. Initial Feasibility Study was done to check whether

the project able to fulfill the objective to give early warning whether a flood disaster has occurred or not. After that, C program need to be prepared for this project. C Compiler program is chosen due to the ability of the system to use AT commands. Once the C program completed, hardware modeling is prepared for prototype purpose. Integrating C program with hardware is done to check viability of the project. During this period, any problems encountered need to be adhered and amendments must be rectified. The last step is to do analysis for the system to ensure it worked properly.

IV.   DESIGN OF SYSTEM HARDWARE

Prototype system had been created for this system. As mentioned above, MCU PIC18F452 was chosen as it is the most common and widely used MCU available in the market. Besides that, it can be used with C compiler program. C compiler program was downloaded using appropriate downloader to the MCU. Three sensors have been selected as the inputs for the system and Easygate GSM module as the output. Inverter and warning light installed to provide indication at the control box. 15V power supply is used to supply voltage to the system.

V.   RESULT AND DISCUSSION

Several tests have been conducted to verify the condition of SMS Flood Alert System. The tests were conducted to accomplish the objective of the project that the system able to give SMS alert whenever the sensors detected changes of water level. The tests that have been done are:

- SMS alert receive by the user according to condition.
- Test at Water Tank at SVIT College, Nashik (India).

A.   SMS Alert Receive by the User According to Condition

For this test, system is tested to check whether SMS sent to user are according to the flowchart. Sensor's signal has been set using 5 V for each signal. The system has been connected to detect signal from the lowest sensor (Sensor 1) and gradually to the highest sensor (Sensor 3). System also has been tested to show condition of after receding from Sensor 3 to Sensor 1. Last step would show the condition of SMS after the sensors don't sense any changes at the sensors.

Fig. 5. Based on the result, the system shows that it is capable to send SMS based on the flowchart in Fig. 5.
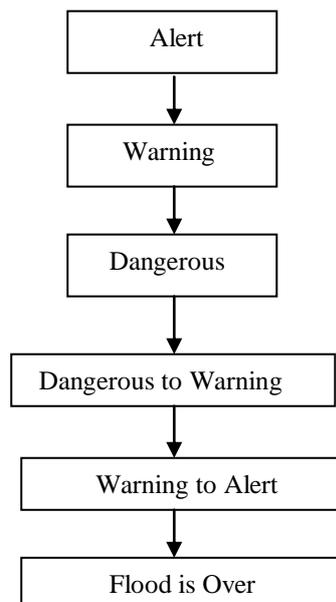

Figure 5. Block diagram of SMS to user

B. Test at Water Tank of SVIT College, Nashik

In order to prove the system is capable of functioning in real condition, the system has been applied to SVIT College, Nashhik's main water tank. Threshold level of water tank is 4 feet depth. Since this system will take effect after the threshold, sensors are placed at 5, 7, and 9 feet above the threshold. System must send SMS of any changes of water level above the threshold; which is 4 feet depth. Based on the observation, the system is able to send correct SMS if the water level reaches above the threshold level. System is also able to detect variations of water level from 4 feet to 9 feet and send correct SMS to user.

TABLE II.   DATA COLLECTION AT WATER TANK OF
SVIT College, Nashik

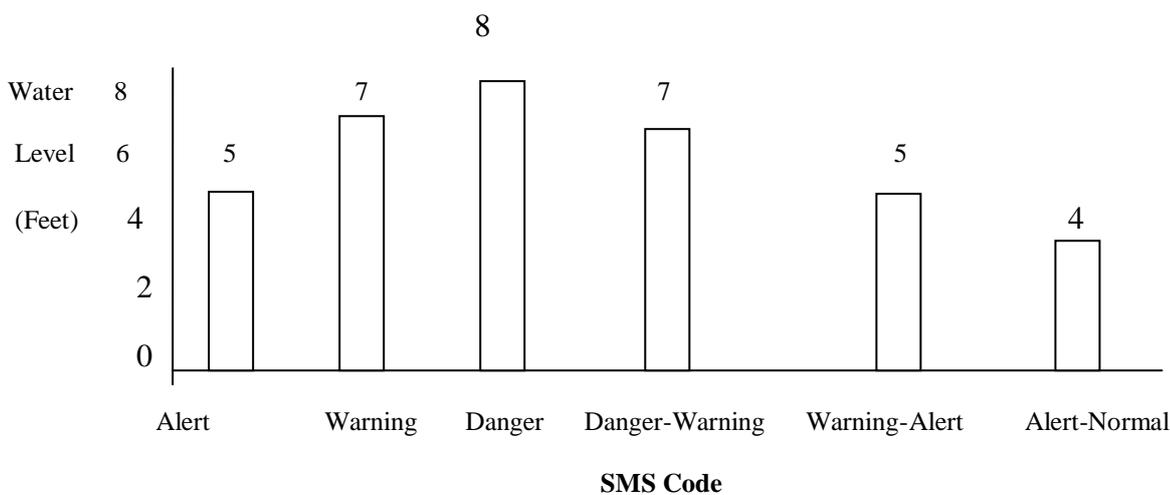| Water Level (Feet)	SMS Code
5	Alert
7	Warning
9	Danger
7	Danger Warning
5	Warning Alert
4	Flood Over

Water Level(Feet) Vs SMS Code

Figure 6. Graph of water level (feet) versus SMS code

Based from result in Table II, graph of Fig. 6 was able to be extrapolated. From the graph, it shows the system sent correct SMS to the user based on the variations of the condition. By applying this system, engineers of Facilities department of SVIT College, Nashik were able to monitor the condition of water level whenever there are any changes to the sensors. The system proved to be useful for the engineers and would help them in remotely monitoring the main water tank.

From the tests been done on the system, it is proven the system able to perform based on its criteria. The system is able to execute commands of C program according to specification and the flowchart. The output SMS alert also has been in correct order and thus it proves the system is functioning well.

VI. CONCLUSION

In conclusion, the project SMS Flood Alert System is deemed as a success. The project found able to be integrated between software development and hardware modeling. The system able to detect increase of water level and would send SMS alert to the respective user. System also had been tested under several conditions to check the viability and ease of usage.

The system could be placed at river banks and drainage system. It can also be placed in water tanks since it had been tested at SVIT College, Nashik's main water tank. The SMS alert received by the user is on real time basis and this feature allowed user to take early preventive measures.

REFERENCES

[1] S.Yumuang, "2001 debris flow and debris flood in Nam Ko area, Phetchabun province, central Thailand," Environmental Geology (2006) 51: 545-564,2006.

[2] Hillebrand & Trosby, "SMS The Creation of Personal Global Text Messaging", Wiley, 2008.

[3] H Huang S Xiao X Meng & Y Ziong, "A Remote Home Security System Based on Wireless Sensor Network and GSM Technology", Southwest Jiaotong University, IEEE, 2010.

[4] IA Aziz, IA Hamizan, NS Haron & M Mehat, "Cooperative Flood Detection using GSMD via SMS", Universiti Teknologi Petronas, IEEE, 2008.

[5] Mike Predko, "123 PIC Microcontroller Experiments for the Evil Genius", McGraw Hill, 2005.

[6] Dennis Rhody, "Satellite Communication 4th Edition", McGraw

[7] Amnuay Tipsriraj, "Prevention of flash floods and lanslides by yourself," Publication of Department of Disaster Prevention and Mitigation, Ministry of Interior: Thailand, 2006