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AI based Early Flood Warning System

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Abstract: Community Based Early Flood Warning System". Which covers study of early warning system in India, Study of 1OT based software and hardware, to build small scale working model on IOT based Interface. Due to use of such technology impacted community will be brought into the network of disaster relief committee, local media, local, police, the military unit and flood monitoring and forecasting station of the department of Hydraulic and Metrology. This technology will be proved very effective and will give warning and response immediately during the time of flood. This paper also gives a brief idea about the work done for the preparation for small scale model and various kinds of IOT based hardware, software and components used in it.

***Keywords*: IOT based sensors, Arduino uno R3, early flood warning, Bluetooth module.**

I. INTRODUCTION

Automation is the technology by which a process or procedure is performed with minimum human assistance. These days, the sudden climate and rainfall changes, also unexpected natural phenomenon often happen. One of the problems often happen is flooding. Flooding can occur because of the heavy rainfall (natural cause) or the water flow is obstructed. The phenomenon causes much harm to the communities who live around the flood area. The purpose of our project is to present the automation in Community based early flood warning system.

This system gives 24/7 water level on app. The early flood alerts system is designed to send a warning message to the client and alert them before any flood occurs. Our project gives an overview about "Community Based Early Flood Warning System **. Which covers study of early warning system in India. Study of IOT based software and hardware, to build small scale working model on IOT based interface.

Due to use of such technology impacted community will be brought into the network of disaster relief committee, local media, local police, the military unit and flood monitoring and forecasting station of the Department of Hydrology and Meteorology. Firstly we have studied the literature review about IOT based hardware and software, Early flood warning system etc. further we have developed small scale working model on early flood warning system with the help of IOT based hardware and software. In this model we have used the float senser as sensing device. This sensor senses the water level and transmit it to the micro-processor i.e. Arduino. Then this micro-processor processes on it and send output to the application and this output will be used for early warning purpose.

A. What is Automation

Automation is the technology by which a process or procedure is performed with minimum human assistance. Automation or automatic control is the use of various control systems for operating equipment such as machinery, processes in factories, boilers and heat treating ovens, switching on telephone networks, steering and stabilization of ships, aircraft and other applications and vehicles with minimal or reduced human intervention. Some processes have been completely automated.

Automation covers applications ranging from a household thermostat controlling a boiler, to a large industrial control system with tens of thousands of input measurements and output control signals. In control complexity it can range from simple on-off control to multi-variable high level algorithms

B. Need of Automation

1) *Cost Reduction:* Automation software is a better and more intelligent approach to cost containment and reduction. The greatest opportunity is to increase service to the customer (end user) while systematically reducing costs. Management often overlooks this potential for savings. Most modern servers have a low operating cost and the total cost of ownership has been declining. Even so, the cost of the operations staff can be as high as 71% of the total cost.

2) *Productivity:* As an organization's technology demands grow, productivity becomes a bigger concern. Typically, as other business areas were given tools to increase their productivity and effectiveness, IT operations took a back seat. The proliferation of desktop productivity software has created substantial gains in the office and HR environments. But, instead of alleviating workload for the IT professionals in the back room, the spread of PCs has meant more tasks to be accomplished.
3) *Availability:* Companies are continually more reliant on their computers. Day-to-day business is routinely conducted with online systems: order entry, reservations, assembly instructions, shipping orders—the list goes on. If the computer is not available, the business suffers.
4) *Reliability:* Productivity is an obvious benefit of automation. However, reliability is the real gem that sparkles with automation. It is the cornerstone of any good IT operations department and without it you have confusion, chaos, and unhappy users. IT operations require two opposed skill sets: On one hand, an operations person needs highly technical skills, such as the ability to understand the complexities of an operating system and to analyse and solve problems as they arise. On the other hand, this same person has to be content pushing buttons and loading paper.
5) *Performance:* Every company would like to have their enterprise perform like a thoroughbred. In reality, it is more likely to be overburdened with work. Even though advancements in computers make them faster and less expensive every year, the demands on them always catch up and eventually exceed the level of capability that a company's computer infrastructure possesses. That leaves a lot of companies wanting to improve their system performance.

C. Advantages of Automation

Advantages of automation are Increased throughput or productivity, Improved quality or increased predictability of quality, Increased consistency of output, Reduced direct human labor costs and expenses, Installation in operations reduces cycle time, Can complete tasks where a high degree of accuracy is required, Replaces human operators in tasks that involve hard physical work, Replaces humans in tasks done in dangerous environments (i.e. fire, space, volcanoes, nuclear facilities, underwater, etc.),Performs tasks that are beyond human capabilities of size, weight, speed, endurance, etc. It also Reduces operation time and work handling time significantly, Frees up workers to take on other roles, Provides higher level jobs in the development, deployment, maintenance and running of the automated processes.

D. Disadvantages of Automation

Disadvantages of automation are Possible security threats/vulnerability due to increased relative susceptibility for committing errors, Unpredictable or excessive development costs, High initial cost, Displace workers due to job replacement, Leads to further environmental damage and could compound climate change.

E. Importance of AI based early flood Warning System

We chosen this topic because to alert people and save them from flood. As the level of water level is shown in mobile we get to know the changes in water level and we can take action before the flood occurs. Due this automation we get all information about level of water in river basin. Due to this system affected community get warned earlier. We made it to small scale to reduce all the possible damages economically. The current system alerts only higher authorities such as Collector, Police and Military etc. Our system alerts the local affected community and alert them earlier.

II. METHODOLOGY

Most of the community based early warning systems were initiated and implemented by NGOs. The majority of the documented community-based early warning systems are for natural disasters, flood warning systems most of all. Mercy Corps and Practical Action (2010) and also CARE Philippines (2006) provide step-by-step methodologies for the development of community-based early warning systems. A closer look at the two systems by CARE Philippines and Mercy Corps and Practical Action shows that one was derived from the other. The systems show a description of the characteristics of the community-based early warning systems from which methodologies for their development can be drawn. The major strengths of all the systems analysed are that they are low cost, relevant to the communities and promote sustainability. The ideal would be to integrate new knowledge and existing knowledge. Technology-based systems pose problems in that many people may not have access to the technology, such that the utilization of such systems is limited to users who do have access. The methodology for the early warning system by CARE Philippines and the flood early warning system by Practical Action and Mercy Corps can be adapted for the development of a community-based early warning systems.

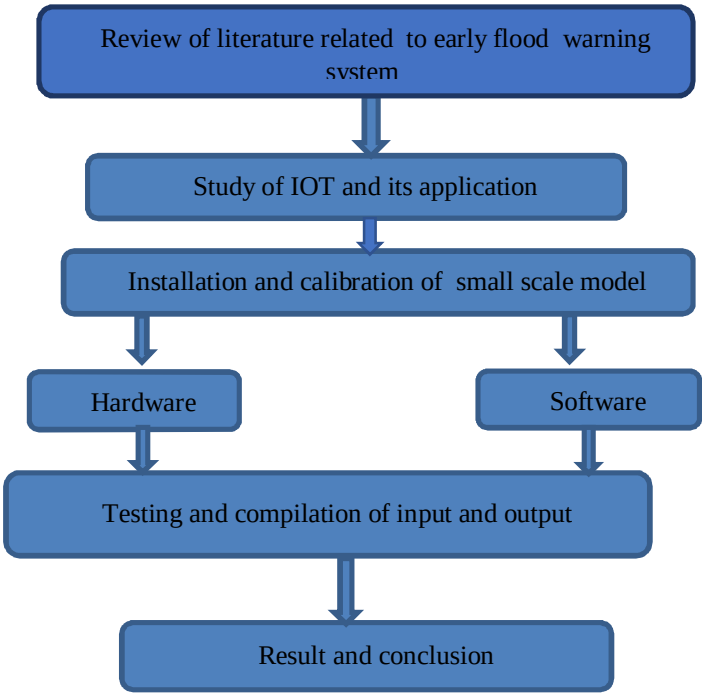


Fig. 1. Flowchart for model development

In community based early flood warning system, we prepared a model which is made up of various components i.e. Arduino, Bluetooth hc-5, float sensor, breadboard, jumper wires, resistor, led bulb also we study another components related to the project which are used instead of above components. Detailed specification of components are explained in this chapter. In working model we used the Bluetooth module but instead of this we can also use the GSM, Wi-Fi module as a community device

A. Components Used In Working Model With Detailed Specification

1) Arduino Uno (R3): The Uno is a huge option for your initial Arduino. It consists of 14-digital I/O pins, where 6-pins can be used as PWM (Pulse Width Modulation Outputs), 6-analog inputs, a reset button, a power jack, a USB connection and more. It includes everything required to hold up the microcontroller; simply attach it to a PC with the help of a USB cable and give the supply to get started with a AC-to-DC adapter or battery.

Arduino Uno (R3)

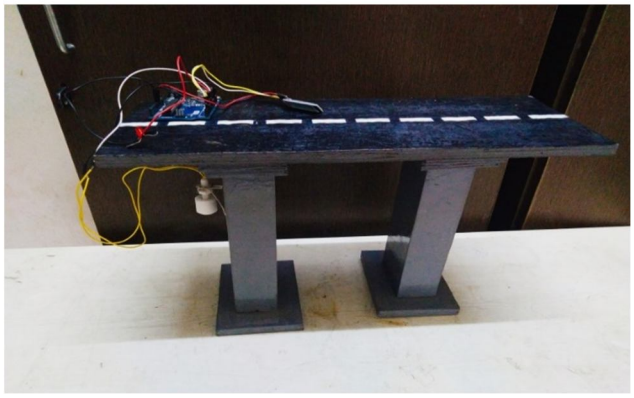
2) HC-05 Bluetooth Module: HC-05 is a Bluetooth module which is designed for wireless communication. This module can be used in a master or slave configuration.

HC-05 Bluetooth Module

3) *Float Sensor:* A float sensor is a device used to detect the level of liquid within a tank. The switch may be used in a pump, an indicator, an alarm, or other devices. Magnetic float sensor is an electromagnetic ON/OFF switch. It helps to sense the level of water present in the overhead tank or sump.

Float senser

4) *Jumper Wires:* Jump wire (also called jumper wires) for solderless breadboard can be obtained in ready-to-use jump



Small Scale Model Set Up

III. LITERATURE REVIEW

A. *Literatures on Community based early flood warning System*

1) *Mohamed Khalaf, Iraq had presented this paper based on Community Based Early Flood Warning System:* This paper presents a description of an alert generating system for flood detection. This paper focused on the development of the system which will determine the current water level by means of sensors and by using wireless sensor network will then provide notification via GSM modem. The system however do not just stops there but proceed to also send notification through popular social network like the Facebook and Twitters. It is felt that notification system such as flood warning system should be carried a step further in notifying the public. Since social networking is at the moment one of the popular medium of communication, sending an alert through it would hence reach a larger audience. A prototype of the proposed system is discussed in this paper and the result of the testing phase is also elaborated. The architecture of the system can be expanded further to a fully functioning system in alerting the public of a pending disaster caused by flood.

2) *Siva Kumar Subramaniam, Vigneswara Rao Gannapathy presented a paper on Flood level indicator and risk warning system for remote location monitoring using Flood Observatory System:* Flooding is a great treat towards mankind as it is also considered one of the most devastating natural disasters in the world. Flooding is not any abnormal scenario worldwide, since flooding results in great damages to agriculture land, residential area and even cities with high cost in lives and towards the economy of the country. The government has to spend tons of money in flood mitigation plans in afford to help the victims and also to reduce the number in the long run. Most of the flood mitigating plans has high cost and only can be implemented base on priority. Baring the cost and safety measures, this paper highlights the Flood Observatory System (FOS) as a warning and alert system to efficiently monitor the critical flood prone areas in real time basis. FOS can be deployed in flood prone areas in afford to create a well-used standard for remote flood observation systems. The ability to receive real time information on flood level empowers both government and private organizations to react to imminent danger in an effective manner.

With the real time flood information, allows public safety organizations and other emergency managers to effectively plan their resource deployment within the limited time of alert.
Warning as flood rises could be used to save lifes and properties in many ways can help such organization and government to spend sufficient amount of money in restoration process. The simple and practicality of a system should be useful in all means towards mankind.

B. Literature Review on Flood Warning System , IOT and Automation.

1) *Literature Review on Flood Warning System:* Community-based early warning systems involve community driven collection and analysis of information that enable warning messages to help a community to react to a hazard and reduce the resulting loss or harm. Most early warning systems are designed at the national or global level. Local communities' capacity to predict weather conditions using indigenous knowledge has been demonstrated in studies focusing on climate change and agriculture. This article reviewed the existing community-based early warning systems documented in literature. The types of disasters that are addressed by these systems and the methodologies utilised in the development of the systems were identified. The review showed that most of the documented community-based early warning systems focus on natural disasters such as floods, drought, and landslides. There is a clear gap in terms of community-based malaria early warning systems. The methodologies for the development of the community-based early warning systems reviewed mainly derive from the four elements of early warning systems; namely risk knowledge, monitoring, warning communication and response capability. The review indicated the need for the development of community based early warning systems.
2) *Literature Review on IOT:* One of the buzzwords in the Information Technology is Internet of Things (IOT). The future is Internet of Things, which will transform the real world objects into intelligent virtual objects. The IOT aims to unify everything in our world under a common infrastructure, giving us not only control of things around us, but also keeping us informed of the state of the things. In Light of this, present study addresses IOT concepts through systematic review of scholarly research papers, corporate white papers, professional discussions with experts and online databases. Moreover this research article focuses on definitions, geneses, basic requirements, characteristics and aliases of Internet of Things.

The main objective of this paper is to provide an overview of Internet of Things, architectures, and vital technologies and their usages in our daily life. However, this manuscript will give good comprehension for the new researchers, who want to do research in this field of Internet of Things (Technological GOD) and facilitate knowledge accumulation in efficiently.

IV. SCOPE OF PROJECT

As the world is going towards automation the community based early flood warning system is very useful. Early flood warning system is use full in smart cities where automation is required. As the water level increases up to pre-determined level the system send SMS to local community so they will get more time to prepare. Sensors are important elements in the Flood Observatory System. Further studies on wireless sensor technology will be best to replace the current sensors. Precise and accurate detection of water level will improve the data collection system for the monitoring station. The flood alert information's can be displayed on LED display boards for road users and for safety reasons could be placed at strategic locations. Such information's should be in real time and transmitted wirelessly from the measured location. A possible means of power supply for the sensors and centralized control unit is via solar cells. The Flood Observatory System will be easy to install and maintained if it is powered by solar cells. The use of solar energy will also provide cheaper source of power to the entire system to operate especially if the system is placed in a remote location
The AutoCAD 2016 generated drawing with extension *.dwg (drawing) is being converted to *.dxf (drawing exchange format) for importing it to QGIS 2.18. For importing the drawings the co-ordinate reference system WGS 84 UTM ZONE 43N was selected where study area is located.

V. RESULTS AND ANALYSIS

A. Introduction

In this chapter we estimate all the prices of each component that is used in working model for small project also we estimate the cost required for large scale project. Due to this we get the idea about actual working model about their cost and economy.

B. Cost Estimation

Cost Estimation For Small Scale Project :-

Sr. No.	Component	Model	Cost
1	Microcontroller	Arduino Uno R3	750/-
2	Bluetooth Module	HC-05	350/-
3	Jumper Wire	Male-to-Female Male-to-Male	50/- 50/-
4	Float Sensor	Xcluma BE-000157	350/-
5	Led Bulb	-	15/-
		Total	1565/-

C. Cost Estimation For Large Scale Project

There are various points considered while estimating for large scale project such as human resource (Cost of project manager, mobile application developer, software engineer and data analysis), Disaster and climate change expert (Flood disaster management expert and climate change modeling expert), Hardware/Equipment (Mobile and computers, GPS, Internet device, mobile sim card, cloud service and data space), Field expanses (Local level consultation and workshop, training, meetings and testing and verification), Administration and Management cost.

Sr. No.	Source	Cost
1.	Human Resource	34000/-
2.	Disaster and climate change expert	50000/-
3.	Hardware/Equipment	15000/-
4.	Field Expense	5500/-
5.	Administration and Management	10000/-
	Total	115000/-

VI. CONCLUSION

A. Summery

Firstly, we had studied the literature review about IOT based hardware and software, Early flood warning system etc. Further we have developed small scale working model on early flood warning system with the help of IOT based software and hardware. In this model we used the float sensor as a sensing device. This sensor senses the water level and transmit it to the micro-processor i.e. Arduino. Then this micro-processor processes on it and send output to the application and this output will be used by the user for early warning purpose.

VII. CONCLUSION

The system will determine the current water level by using float sensor, which will also provide notification of SMS. SMS is as an helpful alert communication tools that can distribute the information to flood victim in a particular area. This system is able to detect a level of water and send that data to the main flood control centre even if it close or far away from the sensor that detect the level of water. The Flood Observatory System can be linked to a visual and audio unit to display warnings and alerts the users via text displays or traffic light system in an event of flooding. The implementation cost is invaluable to the efficiency and usefulness of the system towards mankind. The practicality of the system helps to minimize overheads due to floods and also prevents catastrophe at flood locations. A system for flood monitoring and alert system is developed especially for critical flood locations to ensure mankind safety and savings to all sectors.

This system can be used in any cross-drainage structures like dams, bridges. Other advantages of this system is that the system can send the water level information to anyone who asked for water elevation data and this system worked for 24 hours to take measurements. The system is designed to send warning SMS to the people in that area. Early flood alerts system will also automatically notify the client if the flood is being in a safe condition. We have done this project on small scale with the help of Bluetooth as a communication device, Arduino as a microprocessor and water float sensor to sense the level of water. We can change this small scale project to a large scale project by changing the communication device to Wi-Fi, Microprocessor to Raspberry Pie and Water Level Sensors. A flood warning system is a way of detecting threatening events in advance. This enables the public to be warned and send massage so that actions can be taken to reduce the adverse effects of the event. The water level sensor Sense the water level as it increases, as water level reaches to the pre-determined level it will send SMS. Flood prevention is not possible but with an early flood warning system we can help to alert the people in that surrounding area, giving people more time to prepare**.**

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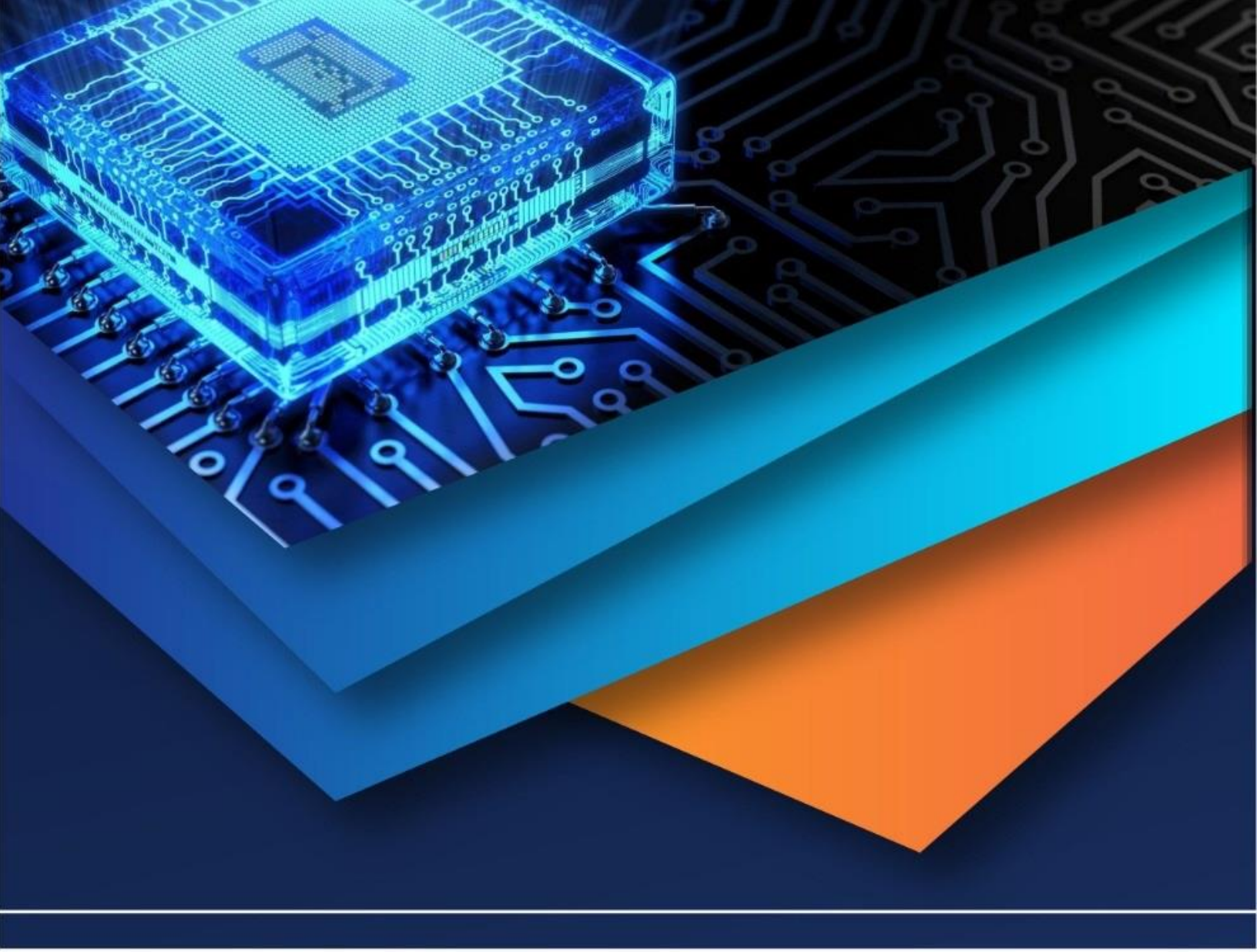

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