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AUTOMATED FLOOD DETECTION AND PREVENTION SYSTEM USING IOT

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Abstract - Flooding is one of the major disasters occurring in various parts of the world. The system for real-time monitoring of water condition such as water level flow and precipitation level, was developed to be employed in monitoring flood in Nakhon Si Thammarat, a southern province in Thailand. The two main objectives of the developed system is to serve as information channel for flooding between the involved authorities and experts to enhance their responsibilities and collaboration and as a web based information source for the public, responding to a heir need for information on water condition and flooding. The developed system is composed of three major components, sensor network, processing/transmission unit, and database/ application server. These real-time data of water condition can be monitored remotely by utilizing wireless sensors network that utilizes the mobile General Packet Radio Service (GPRS) communication in order to transmit measured data to the application server. We implemented a so-called Virtual COM, a middleware that enables application server to communicate with the remote sensors connected to a GPRS data unit (GDU). With Virtual COM, a GDU behaves as if it is a cable directly connected the remote sensors to the application server. The application server is a web-based system implemented using PHP and JAVA as the web application and MySQL as its relational database. Users can view real-time water condition as well as the forecasting of the water condition directly from the web via web browser or via WAP. The developed system has demonstrated the applicability of today's sensors in wirelessly monitor real-time water conditions.

Key Words**:** *General Packet Radio Service (GPRS),Flood Monitoring, Flood Alerting, Remote sensors*

1. INTRODUCTION

In the recent days, Many countries are facing of several social issues in aged population, healthcare, disaster reduction/prevention, safety, security, etc. the natural disasters occur in many areas and many people loss their life progress of India towards smart cities and digitalization is noticeable. India's historic vulnerability cannot be overstated. Around 57% land is vulnerable to earthquakes. Of these, 12% is vulnerable to severe earthquakes, 68% land is vulnerable to drought, 12% land is vulnerable to floods, 8% land is vulnerable to cyclones, and many cities in India are also vulnerable to chemical, industrial and man-made disasters In the recent years, on 30 July 2014 many people lost their lives because of Malin landslides disaster due to the heavy rain in Malin village of pune district in Maharashtra, India. Malin village receiving the heavy rain on 29th July 2014 and the date of 30th July landslide will occurred due to heavy rainfall. This issue will observed because of deforestation and many other several reasons. There are many more disasters will occurred but the solution is to be implemented the internet of things techniques to reduce the losses and makes an early warning system. This system utilizes the Internet-of-Things (IoT) technologies to helps in social infrastructures to opens a new door for innovative solutions to prevent the losses from natural disasters like floods, forest fire, earthquake, spark etc. and the most important thing is to we save our life and also saves the animals life we firstly focuses on flood alert system .Internet based sensor networks have recently gaining the attention Sensors are connected to the Internet and the information from the sensors is gathered at a server. When Particular region is equipped with sensor devices, microcontroller, and various application become a self-protecting and self-monitoring that environment is the smart environment. Sensors sensor information transmission and monitor the data which will be collected from various sensors and give alert message to people using SMS and using Calls.

2. BLOCK DIAGRAM

The proposed flood alerting system to check the flood level basically consists of a Arduino UNO which detects the water level and rain intensity using an float switch sensor and rain sensor respectively. The Rain Sensor is used to show the Rain status that it's raining or not, and its rain intensity Value. A float switch contains an internal mechanical switch that opens or closes an electrical circuit. The float switch moves up and down with the liquid level, detecting the amount of liquid in a tank, and sending an alarm when the level becomes too high or low. The electrical circuit is what turns the float switch on and off, similar to a water pump. Float switches are used to detect the level of a liquid in a tank. The switch floats on top of the surface and acts as a mechanical switch, going up or down depending on the liquid level. They are often used to control pump devices, valves, and alarms in various residential and industrial applications. The Pi board is also programmed to send the data to a cloud are using an external web server named as Things peak so as to alert the general public.

By applying an Internet of Thing can help people to monitor the flood water level and rain intensity via things view app in smart phone together with the alerting system for incoming flood. A wireless sensor node connected with Arduino UNO is used which consist of Float switch sensor and rain sensor to collect data and sent them via cloud to be viewed in Things view application.

A liquid-crystal display (LCD) is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly but instead use a backlight or reflector to produce images in color or monochrome. LCDs are available to display arbitrary images (as in a general-purpose computer display) or fixed images with low information content, which can be displayed or hidden. For instance: preset words, digits, and seven-segment displays, as in a digital clock, are all good examples of devices with these displays.

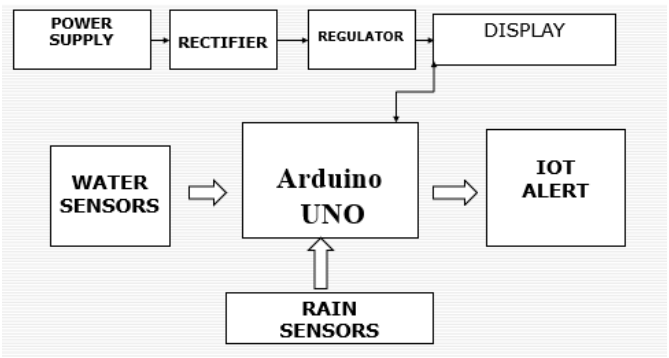

Fig -1: Block Diagram

Arduino UNO: A small computer board that serves as the central hub of the system. It is responsible for collecting, processing, and transmitting data from the sensors to the cloud-based monitoring and alerting system.

Water Sensor: A sensor that detects the water level in a particular body of water such as a river or a lake. It can be placed near the water body and connected to the Arduino UNO using wires.

Rain Sensor: A sensor that detects rainfall intensity and duration. It can be placed in an area that is exposed to rainfall and connected to the Arduino UNO using wires.

Cloud-Based Monitoring and Alerting System: A system that receives data from the Arduino UNO and analyzes it to determine if flooding is likely to occur. If it detects a potential flood, it sends an alert to the concerned authorities, stakeholders or the public, indicating the level of flood risk.

Internet Connectivity: The system requires internet connectivity to send data to the cloud-based monitoring and alerting system. This can be achieved using a Wi-Fi module or a GSM module. Overall, the system works by collecting data from the water and rain sensors using the Arduino UNO, which is then sent to the cloud-based monitoring and alerting system for analysis. Based on the analysis, alerts are sent to the concerned authorities, stakeholders, or the public, indicating the level of flood risk.

3. POWER SUPPLY & LCD

A power supply (sometimes known as a power supply unit or PSU) is a device or system that supplies electrical or other types of energy to an output load or group of loads. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

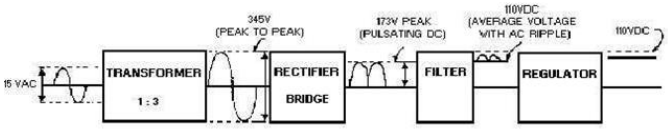

Fig -2: Block Diagram of Basic Power Supply

The pins on the 16-pin connector of the LCD Module are defined below. The table also shows how to connect each pin to the 2051 microcontroller. To connect the LCD Module to a standard 40 pin 8051, use the pin names listed below to find the correct pin number on the 8051 microcontroller. The programs need to be modified to work with a 40 pin.

Table -1: LCD Pin Description

Pin No.	Function	Name
1	Ground (0V)	Ground
2	Supply voltage; 5V (4.7V – 5.3V)	V_{cc}
3	Contrast adjustment; through a variable resistor	V_{EE}
4	Selects command register when low; and data register when high	Register Select
5	Low to write to the register; High to read from the register	Read/write
6	Sends data to data pins when a high to low pulse is given	Enable
7	8-bit data pins	DB_0
8		DB_1

9		DB_2
10		DB_3
11		DB_4
12		DB_5
13		DB_6
14		DB_7
15	Backlight V_{CC} (5V)	Led+
16	Backlight Ground (0V)	Led-

4. FLOAT SWITCH & RAIN SENSOR

A float switch contains an internal mechanical switch that opens or closes an electrical circuit. The float switch moves up and down with the liquid level, detecting the amount of liquid in a tank, and sending an alarm when the level becomes too high or low. The electrical circuit is what turns the float switch on and off, similar to a water pump.

Float switches are used to detect the level of a liquid in a tank. The switch floats on top of the surface and acts as a mechanical switch, going up or down depending on the liquid level. They are often used to control pump devices, valves, and alarms in various residential and industrial applications. Float switches are a popular choice for controlling liquid levels, because they are very reliable, cost-effective, and they can be used in different liquids.

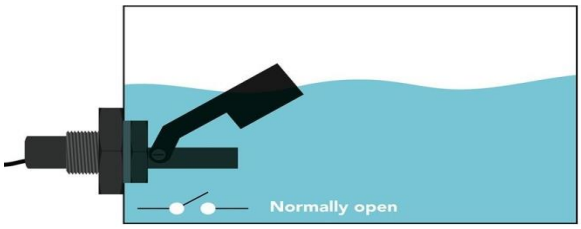

Fig -3: Float Switch Working In Normally Open

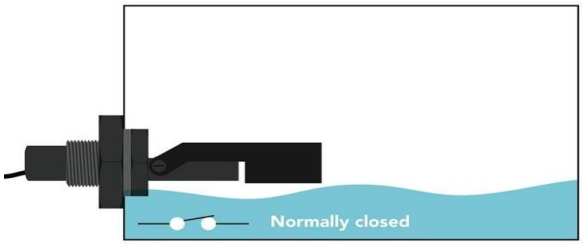

Fig -4: Float Switch Working In Normally Close

The specifications of the rain sensor include the following.

- This sensor module uses good quality of double-sided material.
- Anti-conductivity & oxidation with long time use
- The area of this sensor includes 5cm x 4cm and can be built with a nickel plate on the side
- The sensitivity can be adjusted by a potentiometer
- The required voltage is 5V
- The size of the small PCB is 3.2cm x 1.4cm
- For easy installation, it uses bolt holes
- It uses an LM393 comparator with wide voltage
- The output of the comparator is a clean waveform and driving capacity is above 15mA

Fig -5: Rain Sensor

5. HARDWARE PARAMETERS

ESP8266 is Wi-Fi enabled system on chip (SoC) module developed by Espress if system. It is mostly used for development of IoT (Internet of Things) embedded applications.

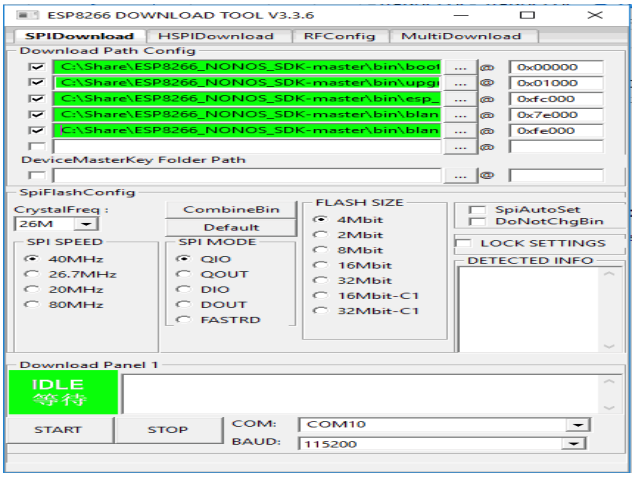

Fig -6: Float Switch Working In Normally Open

Note that, all binary (.BIN) files are available at ESP8266_NONOS_SDK- master\bin directory except user1.1024.new.2.bin which we can generate from SDK compilation and can be found in subfolder of ESP8266_NONOS_SDK- master\bin directory. Ensure that you have selected the correct COM port and BAUD rate (115200 default).Now let's connect ESP8266 module to computer with RS232 standard serial port (using USB to Serial converter in case of laptop) as shown in below Fig -7.

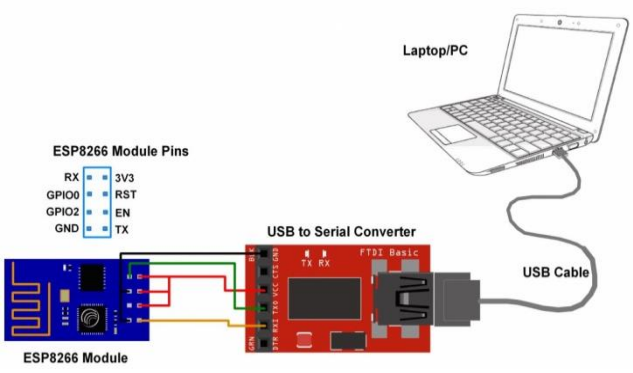

Fig -7: ESP8266 Module Serial Connection with PC

The Arduino Uno is a microcontroller board based on the ATmega325. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

Table -2: Summary of ATmega328

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 Ma
DC Current for 3.3V Pin	50 Ma
Flash Memory	32 KB of which 0.5 KB used by boot loader
SRAM	2 KB
EEPROM	1 KB

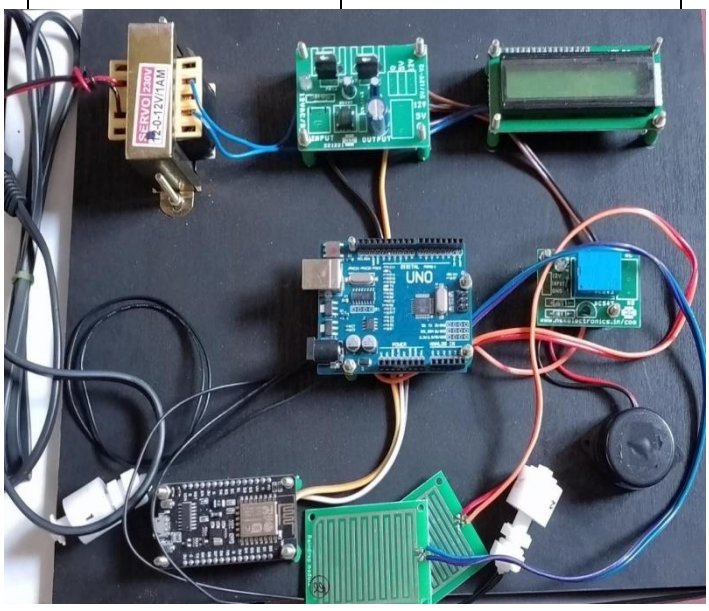

Fig -8: Hardware prototype

6. CONCLUSION & FUTURE SCOPE

Developments in sensor technologies and machine learning algorithms can help improve the accuracy of flood predictions and monitoring data. The use of low-cost sensors and wireless communication technologies can enable the deployment of flood monitoring systems in previously uncovered regions.

Real-time data collection and analysis can enable faster response times and more effective flood management. Integration with weather forecasting and water management systems can improve the accuracy of flood predictions and enable more effective coordinated responses.

Sustainable power:

The development of renewable energy sources, such as solar-powered sensors and monitoring stations, can reduce the reliance on grid power and enhance the sustainability of flood monitoring systems..

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