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Automatic Detection of squats and safety measures at railway infrastructure

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ABSTRACT: This paper is a standalone for Track Damages, fire detecting and also detects obstacles in front of the train and avoids accidents by using LPC2148 microcontroller. Use of Embedded technology makes this closed loop feedback control system efficient and reliable. Microcontroller allows dynamic and faster control. LPC2148 microcontroller is the heart of the circuit as it controls all the above mentioned functions.[1]

KEYWORDS: Text LPC2148, IR Sensor, Ultrasonic Sensor, fire sensor..

I. INTRODUCTION

We know that the railway network of India is the biggest in south Asia and perhaps the most complicated in all over the world. Although the time table is perfect it is not at all possible to maintain it. And that's why the train accidents are becoming more and more usual. So why not we add a kind of intelligence to the train engines itself so that it tries to avoid accidents.

Nowadays public is facing many threats from the railway department by which they are hesitating to plan a train journey. The main reason for this is due to the accidents that occur in the train. Though the railway department is trying to take actions to reduce such informal things but couldn't see the face of success. To help out the department, we have designed our system.

II. MICRO CONTROLLER

A. General Description:

The LPC2148 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combine microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and a unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty.[2] Due to their tiny size and low power consumption, LPC2148 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale .Serial communications interfaces ranging from a USB 2.0 Full-speed device, multiple UARTs, SPI, SSP to I2C-bus and on-chip SRAM of 8 kB up to 40 kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power.

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B. Specifications :

- 16-bit/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package.[2]
- 8kB to 40 kB of on-chip static RAM and 32 kB to 512 kB of on-chip flash memory.
- 128-bit wide interface/accelerator enables high-speed 60 MHz operation.
- In-System Programming/In-Application Programming (ISP/IAP) via on-chip boot loader software. Single flash sector or full chip erase in 400 ms and programming of 256 bytes in 1 ms.
- EmbeddedICE RT and Embedded Trace interfaces offer real-time debugging with the on-chip RealMonitor software and high-speed tracing of instruction execution.
- USB 2.0 Full-speed compliant device controller with 2 kB of endpoint RAM. In addition, the LPC2146/48 provides 8 kB of on-chip RAM accessible to USB by DMA.
- One or two (LPC2141/42 vs. LPC2144/46/48) 10-bit ADCs provide a total of 6/14 analog inputs, with conversion times as low as 2.44 μ s per channel.
- Single 10-bit DAC provides variable analog output (LPC2148 only).
- Two 32-bit timers/external event counters (with four capture and four compare channels each), PWM unit (six outputs) and watchdog.
- Low power Real-Time Clock (RTC) with independent power and 32 kHz clock input.

III. HARDWARE IMPLEMENTATION

Hardware implementation deals in drawing the schematic on the plane paper according to the application, testing the schematic design over the breadboard using the various IC's to find if the design meets the objective, carrying out the PCB layout of the schematic tested on breadboard, finally preparing the board and testing the designed hardware.[3]

a) Block Diagram:



Block Diagram

b) Units :

- **IR Sensors** are Placed at the bottom of the train engine so that if the received signal strength is at peaks then it detects the occurrence of damage at the Track then it stops the train[4].

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- **Ultrasonic sensors** generate high frequency sound waves and evaluate the echo which is received back by the sensor. When a train meet any obstacle with the help of ultrasonic sensor it identifies the obstacle at a certain distance and stops from accidents.
- Due to high temperature and any fire extinguish in any of the compartment it may lead to fire accident. So in order to overcome that **Fire Sensors** are used. These sensors are fixed in each compartment of the train. If any misuse of fire in compartment then the sensor senses it and sends the signal to the driver in the form of display on the LCD. So the driver detects it and prevents the fire accident with the help of fire sensor[4].
- The alphanumeric 16character X 2line **LCD** requires 8data lines and also 3 control signals and they are interfaced to 3664.By using 2 ports, port 0&3 data pins are connected to LCD as data bus. Port0 can be basically used as I/O port i.e. it can be programmed as an input or as an output port.
- The input to the circuit is applied from the regulated **Power Supply**. The a.c. input i.e., 230V from the mains supply is step down by the transformer to 12V and is fed to a rectifier. The output obtained from the rectifier is a pulsating d.c voltage. So in order to get a pure d.c voltage, the output voltage from the rectifier is fed to a filter to remove any a.c components present even after rectification. Now, this voltage is given to a voltage regulator to obtain a pure constant dc voltage. Instead of power supply 12v Battery with 1.3amp can be used[4].
- **L293D** is a dual H-Bridge motor driver, So with one IC we can interface two DC motors which can be controlled in both clockwise and counter clockwise direction and if you have motor with fix direction of motion the you can make use of all the four I/Os to connect up to four DC motors. L293D has output current of 600mA and peak output current of 1.2A per channel. Moreover for protection of circuit from back EMF output diodes are included within the IC. The output supply (VCC2) has a wide range from 4.5V to 36V, which has made L293D a best choice for DC motor driver.
- These **Buzzers** feature low power consumption, a safe, spark-free, non-contact structure, a small size and light weight for an easy mounting to printed circuit boards. As a result, an increasing number of piezoceramic buzzers are now used to generate an artificial voice in combination with voice synthesizing Ics[5].

IV. SOFTWARE IMPLEMENTATION

A. Keil μ Vision Software :

The u vision2 debugger provides complete simulation for the CPU and on chip peripherals of most embedded devices. To discover which peripherals of a device are supported, in u vision2. The Simulated Peripherals item from the Help menu.Use the web-based device database. We are constantly adding new devices and simulation support for on-chip peripherals so be sure to check Device Database often[6].

B. Flash Magic :

NXP Semiconductors produce a range of Microcontrollers that feature both on-chip Flash memory and the ability to be reprogrammed using In-System Programming technology. Flash Magic is Windows software from the Embedded Systems Academy that allows easy access to all the ISP features provided by the devices.

Under Windows, only one application may have access the COM Port at any one time, preventing other applications from using the COM Port. Flash Magic only obtains access to the selected COM Port when ISP operations are being performed. This means that other applications that need to use the COM Port, such as debugging tools, may be used while Flash Magic is loaded[6].

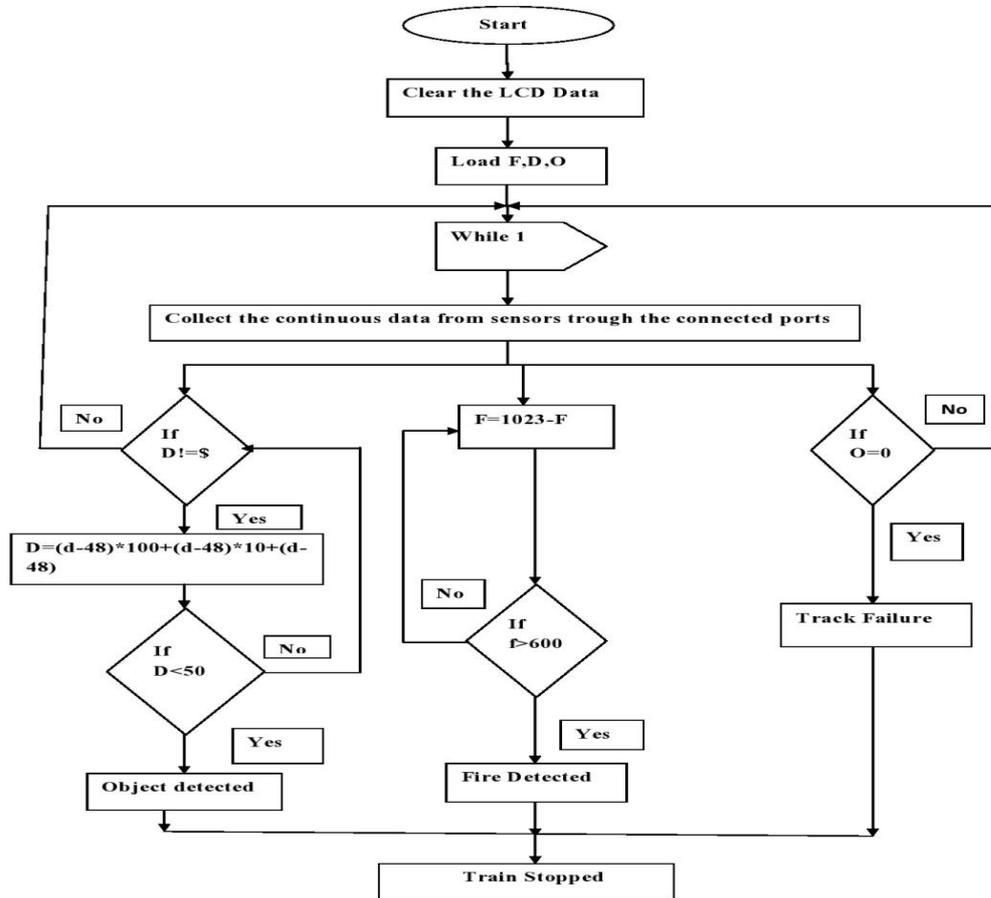
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V. STEPS OF WORKING

The Main role of the paper is to have safe journey or transportation particularly in railways. So in order to overcome some a raised problem in railway system the paper has been proposed some extra equipment which is necessary to meet basic requirement in railway safety techniques. The below flow chart describes how the sensors are placed and worked under the required conditions.



VI. RESULTS

By Using the Basic components in Electronics and ARM Processor (LPC2148) . This can be acting as a prototype model for Real environment. In this three cases are discussed Fire detection, obstacle detection and track damage detection.

If the fire caught at a particular compartment the fire detectors detects the temperature. When the value exceeds maximum value it sends information to the LCD.

The Ultrasonic Sensor continuously sends the sound singles .If the signal is received it sends all the details like how far the obstacle is then it displays the data on LCD.

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The line follower continuously checks the track if any peaks occurrence in the received signals then it displays the data on LCD.

If any occurrence of the above problems the system has been stopped.

The system has been successfully designed using microcontroller and sensors. Microcontroller (LPC2148) is the heart of the system where the data from sensors are continuously verified and any occurrence of fault detected data has been send to LCD.

The system has been successfully implemented using softwares like Keil μ Vision and flash magic. The Implementation was done in Keil μ Vision and it is successfully verified. The verified data has been dumped into IDE using Flash Magic.

The system has been successfully tested using Hardware Module. The system meets desired requirements.

VII. CONCLUSION

The implementation of train engine to avoid accidents and safety measures using sensors and microcontroller is done successfully. . The mechanism is controlled by the microcontroller. Software tools like Keil Uvision Simulator, Proload to dump the source code into the microcontroller. Design is done to meet all the specifications and requirements. The communication is properly done without any interference between different modules in the design. The transmitter unit continuously monitors the driver's action and if the controlling unit does not get any input within the predefined delay, the system immediately stops the train by switching off the power to the motors.

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