Multiple Purpose Robot for Inspection in Industries

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***Abstract*—To reduce the human efforts and for the efficient way to do the work and for the safety purpose this multiple purpose robot is used. Even if machines are used, a single machine cannot be used to accomplish a range of operations. Multiple machines inherit problems of synchronization and hence lead to enhanced maintenance costs. This robot can move all around the industry to inspect the work in 'Industry-like' environment and carry out multiple operations like temperature sensing, pressure sensing, smoke-alarming, video transmission etc. seems to be a perfect solution to address the above problem.**

Implementation of such a robot has been made possible by controlling the wheels of the robot through a computer interface. Sensors on the robot can be customized based on the application. The usefulness and applications of such a robot in industries is found in different fields of interest such as remote sensing, alarm generation, security industrial inspection, and surveillance. Hence this robot, with many utility functions, is truly a 'Multi-Purpose Robot for Industrial Inspection and Surveillance'.

***Keywords*—robot, Industry-like, efficiency, multi-purpose, Inspection.**

I. INTRODUCTION

A robot is an automatically guided machine, able to do tasks on its own. It is a virtualor mechanical artificial agent. In practice, it is usually an electro mechanical system which,by its appearance or movements, conveys a sense that it has intent or agency of its own toperform any task. Such a robot can be used in hazardous working conditions where safety ofworkers must be ensured. This robot can be made to perform a range of operations such ascontinuous monitoring of physical parameters such as pressure, temperature etc, hazardousgas leakage detection, fire alarms, segregation of products, carrying heavy loads from oneplace to another, final testing with a reference, security to the industry and many more. Forimplementing this, various types of sensors are made use at various points on the robot andmake the information available to the operator at all points of time. The sensor collectsinformation and sends it electronically to the robot controller. The controller then decides theaction of the robot.

The objective of this project is to develop a multipurpose robot which reduces humaneffort, tirelessly executes repetitive jobs and reduces risk of hazard in an industrial environment.

II. METHODOLOGY

The conceptual block diagram is as shown in Fig. 1. The controller is fitted with IRsensor, Touch sensor, Precision Light sensor and Gas sensor. The data from these sensors aretransmitted to the system through wired or wireless medium. The device is programmed toacquire the sensors data analyze it and convey the sensor information to the user.

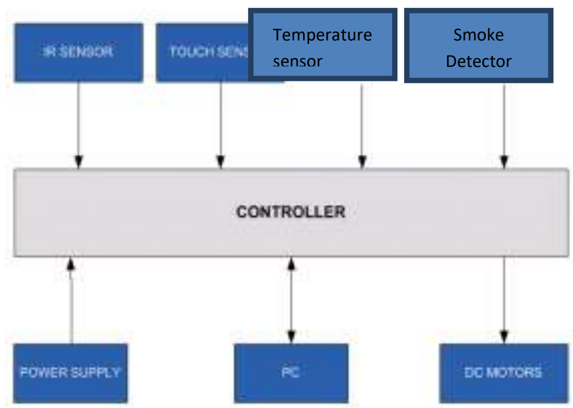

Fig 1. Overall block diagram

This multipurpose robotic vehicle can be used in military surveillance, space exploration, hazardous area maintenance like Nuclear power reactor, to maintain sterile environment in hospitals and many more. This can also sense the obstacles on its way to maneuvering its path by using Infrared sensors. This vehicle is equipped with a metal detector can detect any land mine on its way, and wireless camera can also be used which will transmit the live pictures and videos remotely.

This unit is helpful and useful for surveillance of an area in defense grounds for enemy, spying purpose where the human reach is not recommended or avoided. The unit is small handy portable and can reach places easily.

III. IMPLEMENTATION

Hardware implementation

As a Multi-Purpose Robot, a number of sensors are mounted on the Robot. All the information from the sensors needs to be continuously intimidated to the end user. Also continuous monitoring of the path taken by the Robot needs to be done.

For accomplishing all these operations, the Hardware is implemented in the following way.

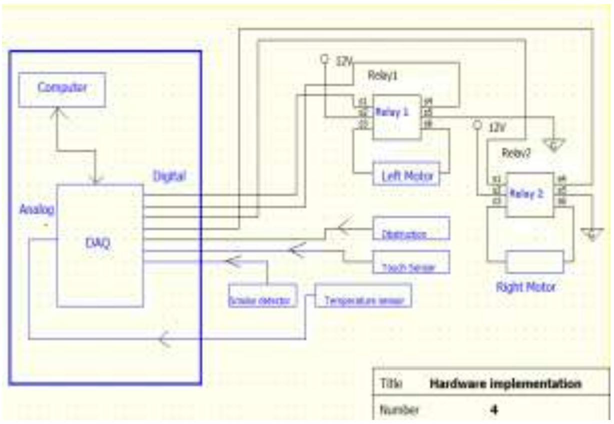

Fig. 2: Hardware Implementation block diagram

For the wireless implementation of Robot, FM transmission is being used. Two sets of FM transmitters and receivers are made use of.

1. One set near Robot 'Control System'
2. Another set is mounted on the Robot.

The Hardware consists of DAQ 6009 which as analog and Digital Sides 8 analog inputs and 2 analog outputs, 12 digital lines. All lines can be programmed as input or output. Two of the digital lines are being used to drive the motors of the Robot. Digital data lines from the receiver are connected to S1 and S4 of the Relay. When signals at S1 and S4 go high, the relay gets energized and a 12V path is created for the motor of the Robot.Human Body Resistance varies from 1kΩ-10kΩ .if Human will touch at the BASE of Q1,then transistor will be excited.Q2 is driven by the COLLECTOR of Q1 which in turn drives Q3.Output of Q3 is an input to the inverting-terminal (S2) of the Comparator LM358.The non-inverting terminal (S3) is given a constant supply of 12V.When S2>S3, output at S1 goes high.Comparator IC LM358 is used. At the non-inverting terminal (S3), voltage is maintained is constant depending upon the type of smoke to be sensed. At the inverting terminal (S2), LDR in series with a 10k Pot is used. During a smoke emergency, the resistance of LDR increases to MΩ range. Hence voltage at S2 also increases. Hence the Buzzer Circuit is driven at the output.

Software Implementation

Virtual Instrumentation uses off-the shelf mainstream computer technologies combined with innovative, flexible software and modular high-performance hardware technologies to create powerful computer based instrumentation solutions. The objective in Virtual Instrumentation is to use a PC to mimic real instruments with their dedicated controls and displays, but with the added versatility that comes with software.

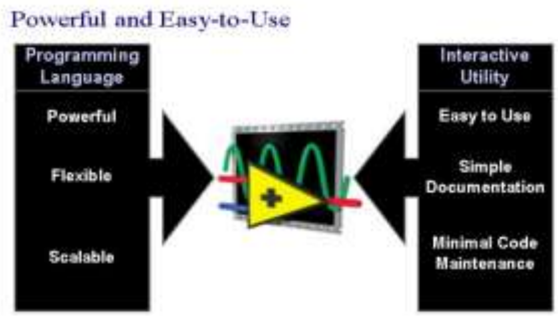

Fig. 3:interfacing with LabVIEW

LabVIEW predominantly performs three main functions are acquisition, analysis and presentation.

Acquire:

For considering temperature measurements with a low-cost plug-in board, analyzing waveforms on a stand-alone oscilloscope or measuring strain with a sophisticated signal conditioning system, LabVIEW is the ideal development environment for such applications. From data acquisition to instrument control, and image acquisition to motion control, LabVIEW provides the tools to rapidly develop an acquisition system.

Analyze:

Raw data is typically not the desired end result of a measurement and automation application. Powerful, easy-to-use analysis functionality is a must for the software application. LabVIEW has more than 400 built-in functions designed specifically for extracting useful information from any set of acquired data and for analyzing measurements and processing signals. Functions such as FFT and frequency analysis, signal generation, mathematics, curve fitting and interpolation, and time and frequency-domain analysis give the power to derive meaningful information from the data collected.

Present:

Presentation of the data encompasses visualization, report generation, data management, and connectivity. LabVIEW supplies a wide array of tools to make the data presentation powerful and simple to create.

IV. RESULTS AND DISCUSSION

Table 1: Results obtained from different components

SENSORS	INPUT	OUTPUT
IR SENSOR	NO OBSTRUTION	0 VOLTS
	OBSTRUCTION PRESENT	3.3 VOLTS
TEMPERATURE SENSOR	AMBIENT TEMPERATURE 27^{0}C	0.27 VOLTS

	50^{0}C	0.5 VOLTS
	75®C	0.75 VOLTS
	100®C	1 VOLTS, ALARM GENERATION
TOUCH SENSOR	HUMAN TOUCH PRESENT	LED ON
	HUMAN TOUCH ABSENT	LED OFF
SMOKE DETECTOR	SMOKE PRESENT	BUZZER ON
	NO SMOKE	BUZZER OFF

Table 2: Wheel functioning using relays

RELAY 1	RELAY 2	LEFT WHEEL	RIGHT WHEEL	EFFECT ON ROBOT
ENERGISED	NOT ENERGISED	ON	OFF	TURNS RIGHT
NOT ENERGISED	ENERGISED	OFF	ON	TURNS LEFT
ENERGISED	ENERGISED	ON	ON	MOVES FORWARD

As we can see from the above Table 1 different sensors such as IR sensor detects the obstruction, temperature sensor sensors the temperature with the limitation, touch sensor senses the human touch and smoke detector detects the smoke that is present in the environment.

From Table 2 we can see that to move the robot forward both the relays are energized and both the wheels will be in ON mode, to move the robot towards left relay 2 will be energized and right wheel will be ON causing robot to move left andto move the robot towards right relay 1 will be energized and left wheel will be ON causing robot to move right.

V. CONCLUSION

The robotics field is quite promising but to make a really intelligent robot takes supreme effort. The ultimate goal of robotics is a super human system that embodies all the skills (such as intelligence, touch and sensitivity) of humans without of any their limitations (such as strength, ageing).

Today we find most robots working for people in industries, factories, warehouses, and laboratories. Robots are useful in many ways. For instance, it boosts economy because businesses need to be efficient to keep up with the industry competition. Therefore, having robots helps business owners to be competitive, because robots can do jobs better and faster than humans can, e.g. robot can built, assemble a car. Yet robots cannot perform every job; today robots roles include assisting research and industry. Finally, as the technology improves, there will be new ways to use robots which will bring new hopes and new potentials.Some of the applications are Micro Mouse, Carry heavy loads, Detection of machine faults, Sensing of physical parameters such as temperature, pressure at various points, Fire detection, Gas leakage detection, Military surveillance, Space exploration, Hazardous area maintenance like Nuclear Power Reactors, Hospitals - To Maintain Sterile Environment, Tour Guides in Museums and other similar applications.

The above applications have motivated us in formulating the problem for an efficient and multi-purpose robot which will cater to more than one application listed above.

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