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Android Mobile Phone Controlled Wi-Fi Robot

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***Abstract*— Today human-machine interaction is moving away from mouse and pen and is becoming ubiquitous and much more compatible with the physical world. In the present generation the gap between machines and humans is being reduced with the introduction of new technologies to free from trouble the standard of living.. In this paper, include rigorous analysis of different techniques of "Human-Machine Interaction" This paper analyses the motion technology to capture gestures through an android smartphone with an inbuilt accelerometer and Wi-Fi module to control the movements of a robot.Sensors placed on robot continuously update the temperture and gas values of surrounding area and display on mobile phone,lcd display.The signals of the Wi-Fi Module are controlled by the ARM 7 processor. Also a camera is equipped for remote view and the robot will automatically avoid obstacle and move when it is in operation without intervention from the operator.**

***Index Terms*— ARM7, Wi-fi technology, Temperature sensor, Ultrasonic sensor, Gas sensor, Android, Robotics..**

I. INTRODUCTION

Robots have been with us for less than 50 years but the idea of inanimate creations represents a sincere bid whose success is much older. But real robots did not come into existence until 1950s and 60s. With the growing invention of transistors and integrated circuits, computer industry added brains to the brawn of already existing machines. In 1959, researchers illustrated the possibility of robotic manufacturing when they unveiled a computer-controlled milling machine. Bluetooth technology was created by telecom vendor Ericsson in 1994. Android is an operating system made by Google that is open-source. With such feature, Android grows rapidly since people can develop their own applications without the burden of certain regulations. Many application developers have contributed to create applications that run on this operating system. There is one who focuses on creating the application of game, one who focuses on creating the application of social media.Usually a smart-phone is equipped with several sensors, such as accelerometer sensor. The accelerometer sensor is a sensor that can measure the acceleration due to gravity and vibration [1]. In android, this sensor is used to adjust the landscape or vertical position changes on the smartphone screen and set the hand movements as a tool for gaming consoles. On the other hand robot technology is developing rapidly, not only in software but also the hardware. Currently, it has already been developed a robot that can move flexibly, known as Omni-directional robot. The robot can move left and right and can be rotated on the axis point [2]. Based on the exposure and some research which have been done previously, this research developed a system to control robot motion, in accordance with the tilt of accelerometer sensor for android smart-phone. In other words, the smart-phones will be used as a remote control for robot movement.

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II. METHOD

The control of robot movement which is developed in this study is the control of motion direction of the robot. They are forward, backward, right and left motion. As in Figure 1, when any change occurs, the axis in the accelerometer will be sent to robot via Wi-Fi, then, the robot will move according to the changes of the value, and the axis is accepted.

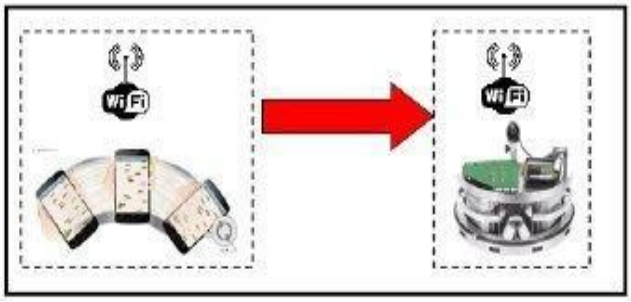

Fig 1.Concept of System

To be able to send information of the axis changes, there must first be established the connection between the smartphones and the robotino via Wi-Fi. As in Figure 2, an application running on a network, when it will send the data to a device or another process using the TCP protocol, must use a socket, so that the transmitted data can be received by the TCP. Then, next is the task of TCP Controlled by the operating system to be able to deliver the data being sent to the TCP on the other device or process. Each process which is associated with TCP will have the IP address and port.

A. Movement Direction Change Control

When the smart-phones and robot have already connected, then, these two devices are able to transmit data. The data sent is the data of the axis changes on the smart-phone which is detected by the accelerometer sensor. As in Figure 2, the x-axis is the horizontal position of the smart-phone, the y-axis is the vertical position of the smartphone, and the z-axis is the axis that leads out of the smartphone screen. In this system, behind the scene ordinate has negative value of z.

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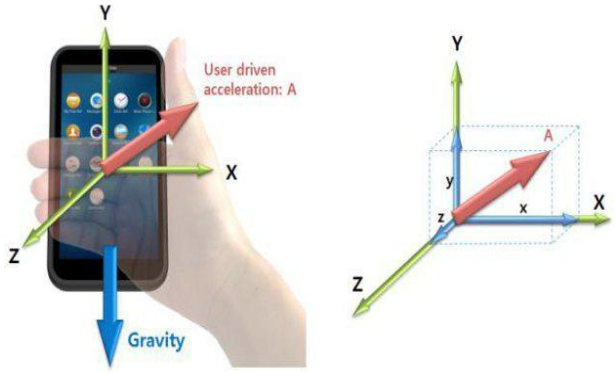

Fig 2. Coordinate System of Smart-phone

Acceleration occurs because of the increased velocity at a certain time. On the other hand, direction or orientation valso affects acceleration, because the changing of motion direction of the an object will also cause acceleration. Therefore, to obtain distance data from the accelerometer sensor, the process of double integral to the sensor output is needed.

II. BLOCK DIAGRAM

A. Hardware

The block diagram of the proposed system consists of Android smart phone,laptop and robot containing various sensors and modules.

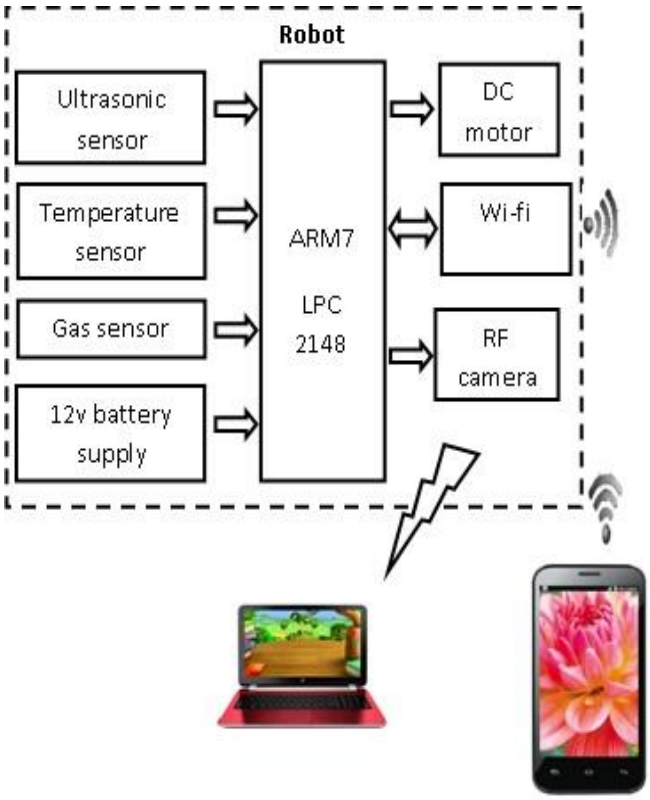

Fig 3 :Block diagram of proposed system

In figure 3,At initial it scans for the Wi-fi device with the available device. The input character from the android app is transmitted by Wi-fi adopter present in the phone to the Wi-fi module on the robot. By tilting Android phone in any directions, correspondingly robot moves in that particular directions.Similarly from Wi-fi module, remote temperature and gas update are transmitted to the phone and is displayed on the screen.Ultrasonic sensor used for obstacle detection purpose.Also robot continuously monitors sourrounding area by RF camera and display image or video on laptop.

1.LM 35 Sensor

- It is Calibrated directly in ° Celsius (Centigrade)
- LM 35 has scale factor linear a 10.0 mV/°C
- Its accuracy 0.5°C guaranteeable (at +25°C)
- Its rating full -55° to +150°C range
- Suitable for remote applications

2.Gas sensor(Mq6)

- They are used in gas leakage detecting equipments in family and industry.
- They are suitable for detecting of LPG, iso-butane, propane cooking fumes and cigarette smoke.
- It gives fast response and have a stable and long life.
- Its Heating consumption less than 750mw.
- Simple drive circuit

3.Wi-fi module

- 2.4 GHz 802.11 b/g/n compatible
- Support IEEE 802.3, IEEE 802.3 u
- Low cost UART-ETH-WIFI module
- Range of Baud rate -1200-500000bps
- Wi-fi client/AP/Router mode
- Support transparant transmission mode
- Benefits in Home and commercial building automation
- Use in telemetry,industrial system,toys and gaming peripherals

B. Algorithm for Android Code

- START
- Pair with Wi-fi module of robot
- Send ASCII code over Wi-fi
  Mobile Tilt Forward:Forward movement
  Mobile Tilt Backward:Backward movement
  Mobile Tilt Right :Right movement
  Mobile Tilt Left :Left movement
  Mobile stable:robot stop
- Receive temperature and gas update from module
- Display temperature and gas update on mobile screen
- End

C. Flowchart for microcontroller

In the Figure3.1 and Figure3.2 shows the typical sequence of events when a user runs the application. This sequence diagram assumes the user already has the software on his phone and the robot and it represents an abstract level of the interaction between the system components (mobile application and the robot).

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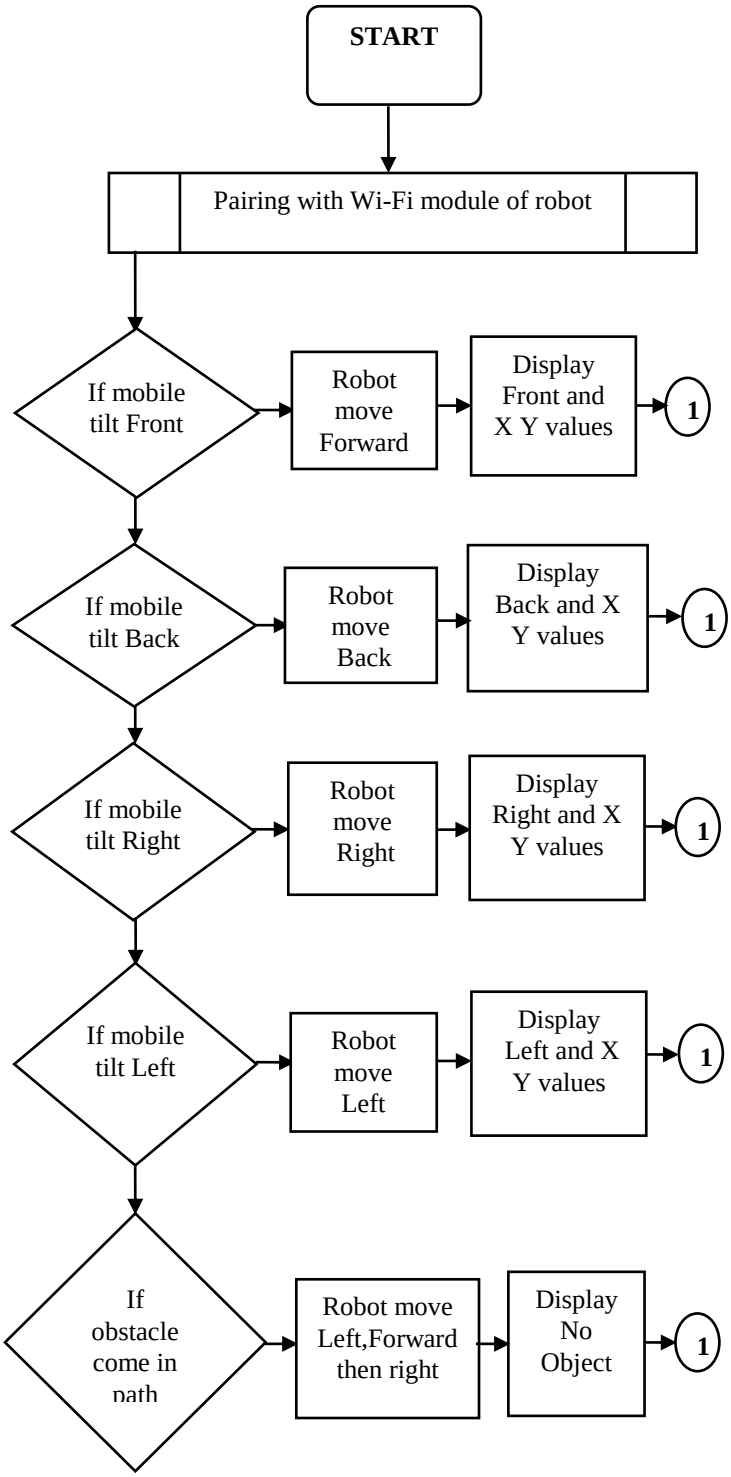

Fig 3.1 Flowchart 1A

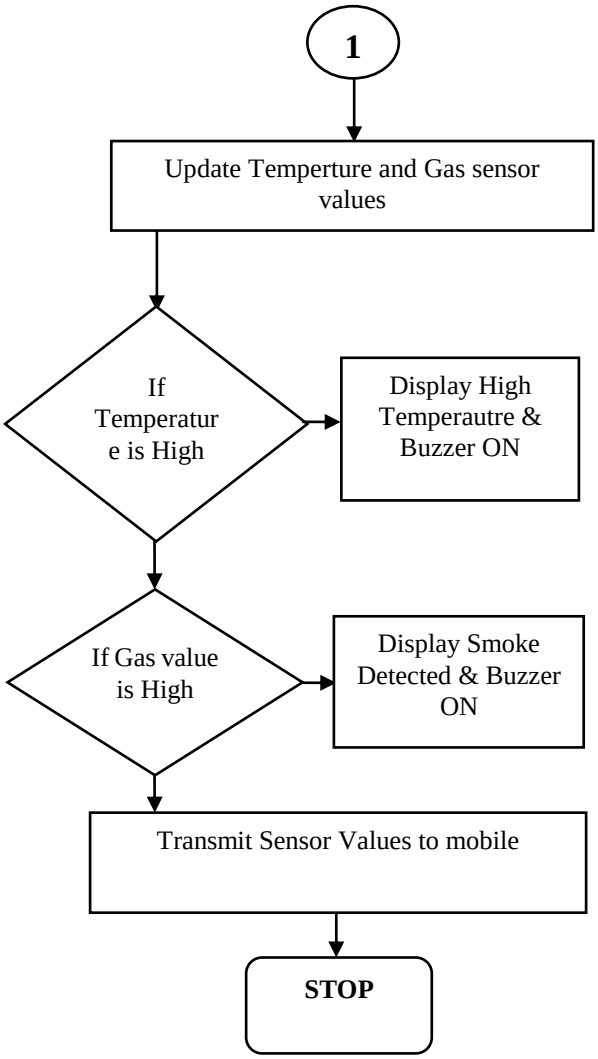

Fig 3.2 Flowchart 1B

III. RESULTS AND DISCUSSION

From the system evaluation the following conditions are analyzed**.** When android mobile tilt in forward direction robot moves forward and display "front" on the lcd display on the robot. As shown in below figure 4.1. Similarly by tilting mobile phone in Backward, right, left directions, robot moves in that particular direction and displayed its XY values on lcd display.

Table I.Robot actions accordingly Accelrometer XY values

Accelrometer X and Y values		Robot Action
X	Y	
Positive	Negative	Front
Negative	Positive	Back
Negative	Negative	Right
Positive	Positive	Left

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Fig 4.1 Forward movement of the robot

In figure 4.2 and 4.3-When temperature and gas values increases above a threshold value,it displayed a"High Temperature" and "Smoke Detected" on lcd display also Buzzer on respectively.

Fig 4.2 When gas values increases above its threshold value

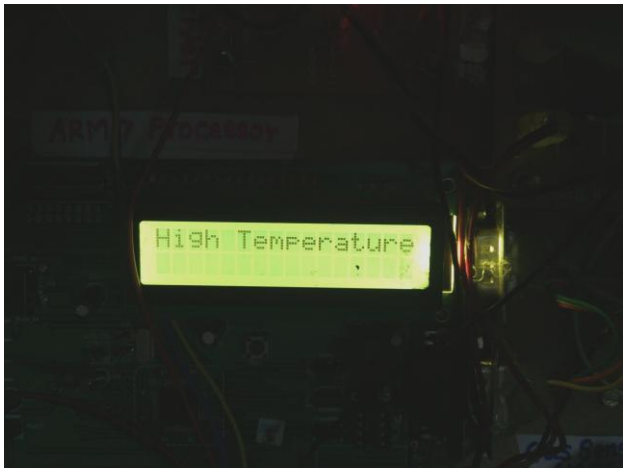

Fig 4.3 When temp. values increases above its threshold value

Figure 4.4 shows the robot movement use accelstreaming application in android phone.

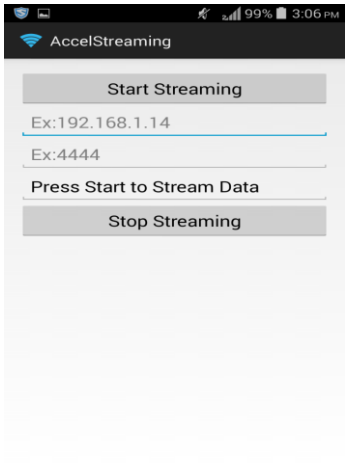

Fig 4.4 Displaying Streaming of robot

When robot goes in any remot place area it senses gas temperature,ultrasonic values by corresponding sensor are displayed on lcd display also it directly sent to android Phone.

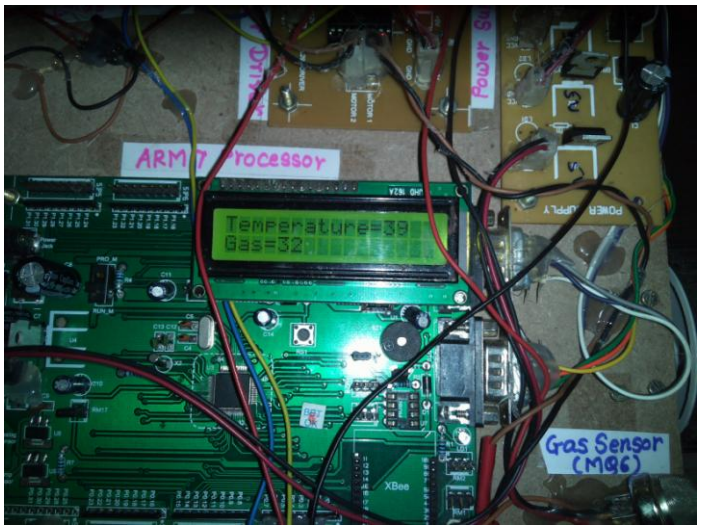

Fig 4.5 Displaying temperature & gas values on lcd display.

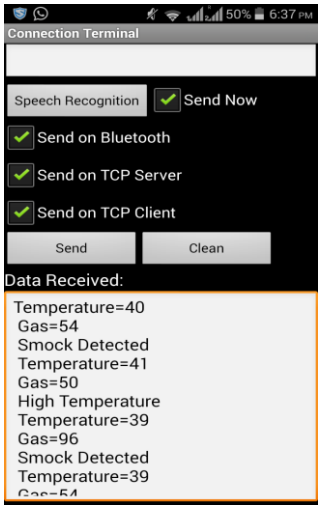

Fig 4.6 Displaying temperature & gas values on mobile phone

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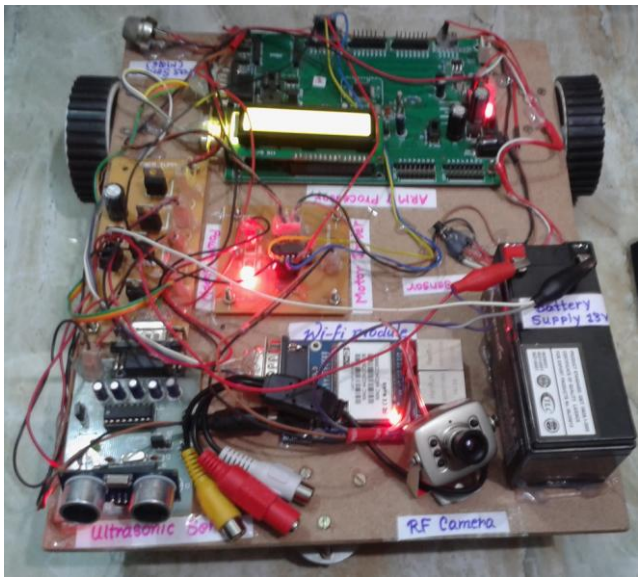

Fig 4.7 Wireless camera mounted on Robot

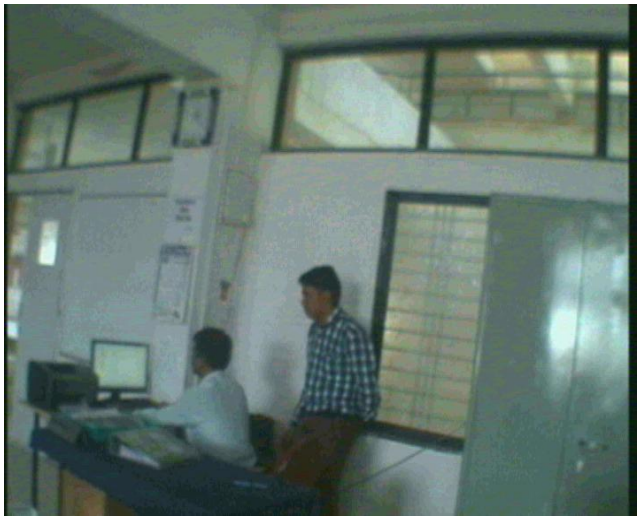

Fig 4.8 Real time image of wireless camera

IV. CONCLUSION

The conclusion for the results of the use of Wi-Fi and accelerometer sensor on the android-based phone to control the mobile robot motion is as follows: The accelerometer sensor on android smart-phone can be used as an motion control of robots. Overall, the control process goes well.. The farther the distance between the smart-phone and the robot, the slower the response time of robot in motion. In the future we have intention to test the system.

- Instead of ARM 7 controller we can use Raspberry pi board for the quick action takes place by robot.
- The robot can be controlled by any mobile using gps and gsm kit on the robot.
- We can implement the robotic arm on robot for pick and place object also using pressure sensor on robotic arm, the precise grip of the object can be controlled.

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