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Department of Electronics – Wayamba University of Sri Lanka

LOW COST SPEED DETECTOR

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ABSTRACT

The aim of this project was to design and construct a Low Cost system to detect over speeded vehicles. This is a device can be installed in roads temporally. Basically this device has three units, consisting two motion detecting units and a handheld speed monitoring device. Both of motion detection units separately consists with an Arduino, a motion detecting sensor and a wireless RF transceiver module. The motion sensor attached to Arduino detects when a vehicle passed through it and sends a given signal via NRF24l01 to hand held device. The distance between two sensors is 1m .The purpose of having Arduino is to control both of motion sensor and NRF module using given instructions. The developed system can detect the speed up to 100 kmh^{-1}. The speed range can be increased by replacing high speed industrial movement sensors for movement sensors. This project used coding in C++ language to provide a very efficient algorithm for carrying out required task.

Keywords: *NRF24l01, Arduino, RF transceiver*

1. INTRODUCTION

Most of the speed detecting systems are using radar methodology to capture the speed of vehicles. But still these systems have set of defects which cannot be avoided. The developed system will be capable of detect the speed in highest accuracy, enables traffic officer to use in bended roads, Make the handheld device is more smaller and light weight than the laser gun and Low power consumption.

Although most of the existing systems has some failures. Most of the speed detecting devices are using radar signals to capture vehicle speeds. Devices which are used radar signals have some defects. Rain can refract part of the signal so it does not return. Radar measures speed in relation to the unit, so it is most accurate when traveling directly towards, or directly away from the unit. As the angle between the object and the radar unit increases, so does the error

rate is also increases. This is called a "cosine effect", and is mathematically measurable[1] .Radar works by sending out a signal (sine wave) at a known frequency. This sine wave continues until it is reflected, refracted, or absorbed. Dense objects reflect, softer objects such as a tree full of leaves will absorb the signal. Rain would refract it, much like looking at a pencil in a glass of water. If the sine wave reflects off a stationary object, it does not change. If the object is moving, the frequency changes at a constant rate, in relation to the speed. This change is the same if it is moving towards the unit, or away. The unit reads the changed frequency, does the math, and registers the speed[2]. As far as the range, that can vary, but the power is reduced by what is called the "inverse square rule". This means as the distance doubles, the signal strength reduces by half. A large, flat object will reflect back a bigger portion of the signal. For this reason, the car closest to the radar unit always changes the speed. A large object behind a small sports car will return a stronger signal[3]. To overcome these effects, drawbacks, an improved version of low cost over speed detector was introduced.

2. EXPERIMENTAL

The block diagram of the designed system for low cost over speed detector is shown in figure1.

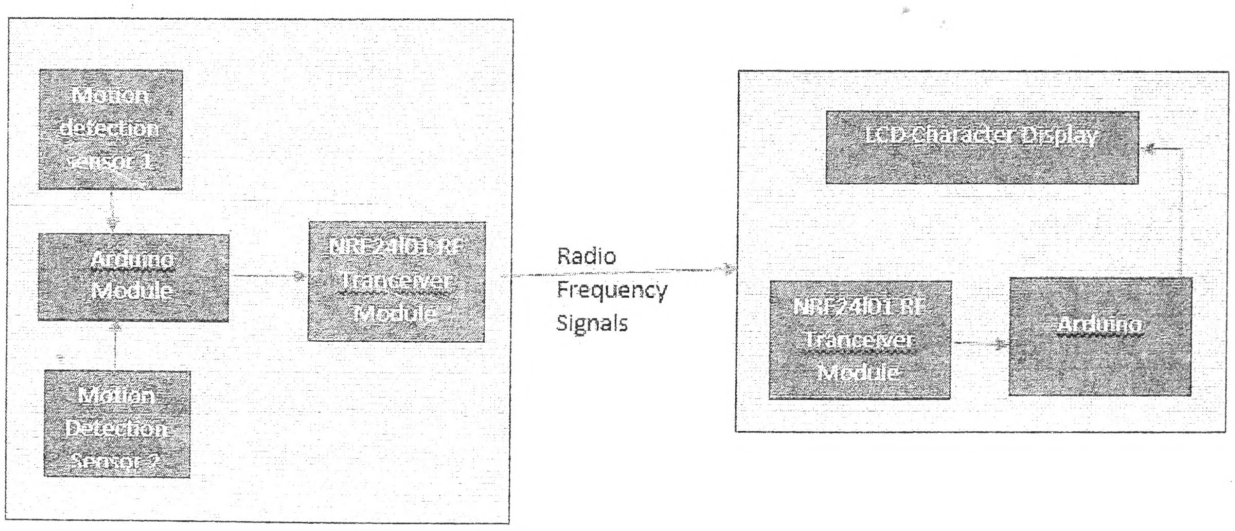

Figure 1: Block diagram of Proposed Low Cost over Speed Detector

To establish wireless connection between motion detectors and hand held device two NRF modules were used. NRF module is a device which can act as a transceiver and it operates in 2.4GHz RF signals. When a vehicle passes one of the motion detecting sensor, it sends a

signal to NRF module which installed in handheld device. The Arduino installed in handheld device calculates time taken to arrive two signal. Then it can calculate the time between two pulses. Using this the device can determine speed of the vehicle.

At the development of the stage C++ language was used to write the code and Arduino software was used as IDE.

3. RESULTS AND DISCUSSION

At the development stage of the system is designed to detect the maximum speed of 100kmph.The distance between two motion detectors have to be kept as 1m(one meter).When a vehicle passed 1st sensor it send a signal to handheld device, When the same vehicle passed 2nd sensor it also sends a signal to handheld device. Using time between two signals and the distance between two sensors speed can be measured using following simple equation.

Speed = distance / time

Speed = 1m / time taken to pass 1m.

The device tested by moving toy cars because the system was developed as a prototype. At each of the testing case the speed was given as expected.

The Arduino Uno (ATMEGA328) , NRF24l01 and sensors used were shown in following figure 02.

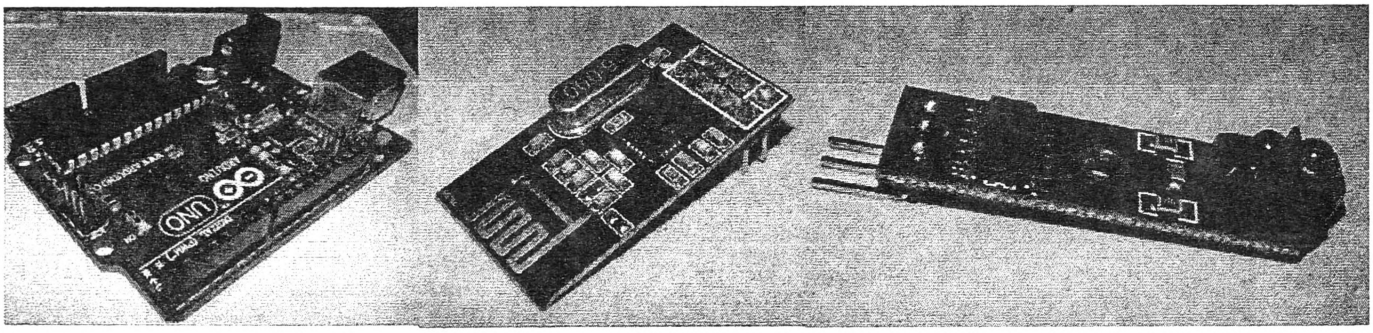

Figure 2: The electronic components used

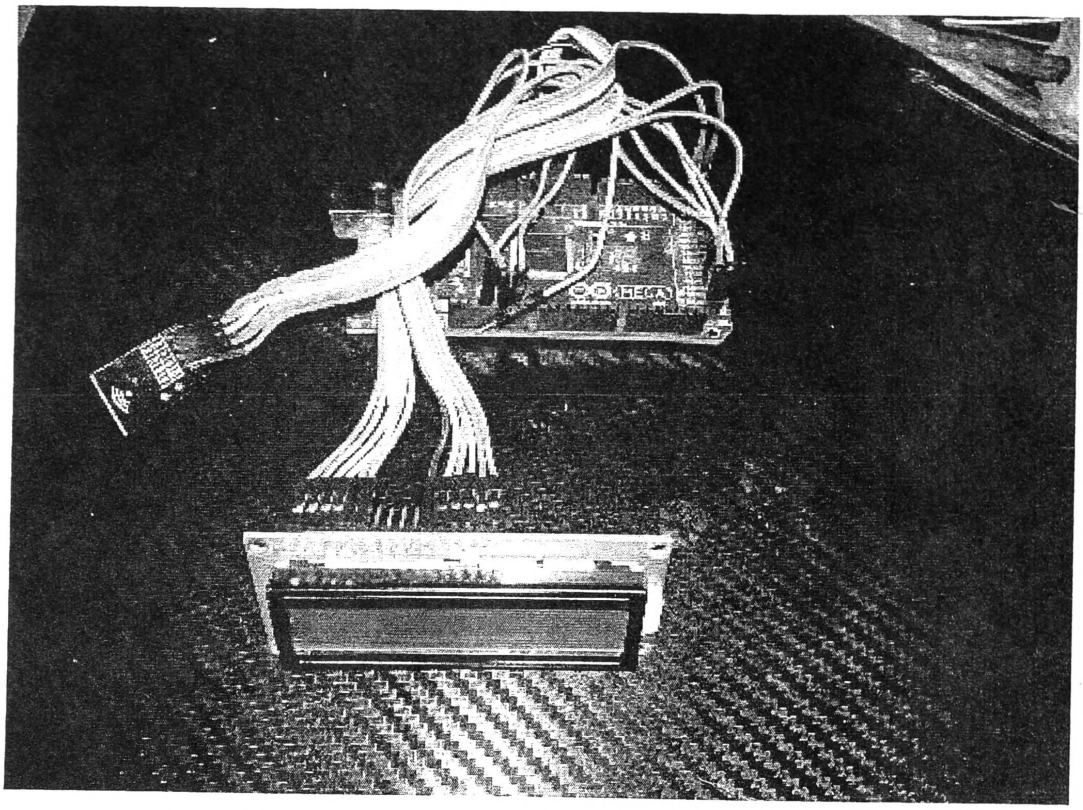

Figure 3: Circuitrical view of main unit

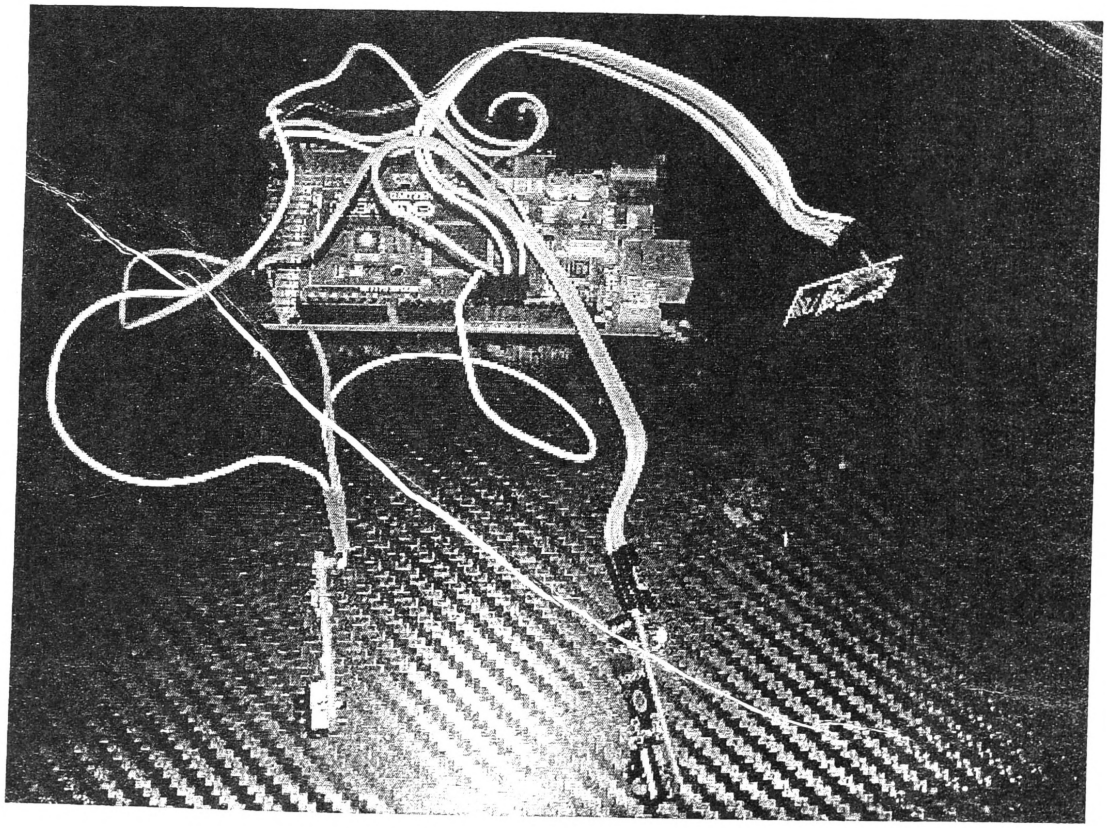

Figure 4: Circuitrical View of Hand held Unit

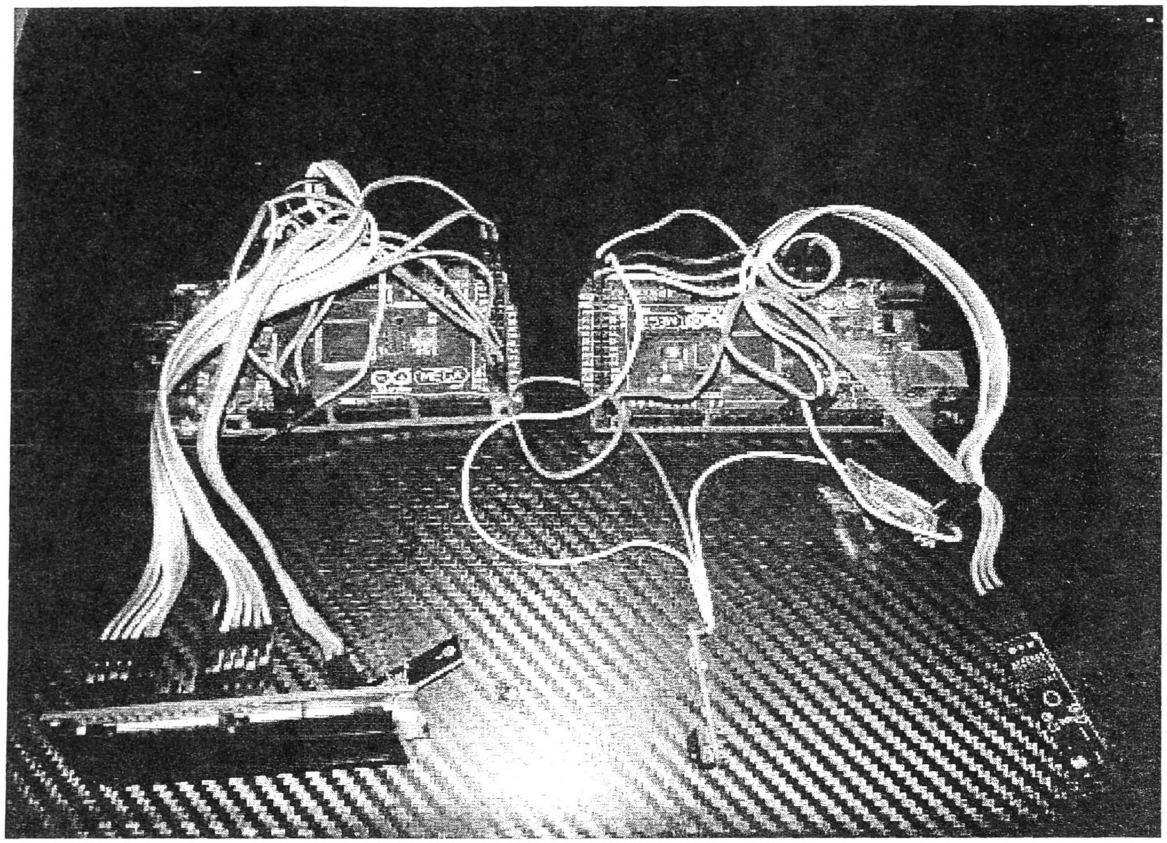

Figure 6: Circuit of the system

4. CONCLUSION

The main purpose of this project was to develop a system to detect speed of the vehicles. At the development stage it was only developed as a prototype. In practical scenarios it can be developed using industrial IR sensors. To do this motion detecting sensors and power supply replacement is must. Mainly this project was targeted to avoid errors existing systems and it will help traffic offices to capture speed of vehicles and punish over speeded vehicle owners. Also this system is having an ability to determine the speed in bending.

The main issue of the developed system is, when a vehicle passed the motion detector, the sensor cannot detect the vehicle if the vehicle speed is very high. To ignore this error high sensitive industrial motion detecting sensors should be applied.

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