

# 数字摄像能见度系统及其比对实验

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**摘 要:** 传统的光学能见度仪分别存在各自的观测缺陷. 数字摄像能见度观测系统是采用先进的数字摄像技术, 完全仿照人眼观测能见度的原理, 根据能见度的定义研制的新型能见度自动观测仪. 本文重点介绍了它的基本原理、系统组成、硬件结构以及软件流程. 最后给出了数字能见度仪与传统光学能见度仪及人工观测的比对结果. 结果显示三者具有相同的变化趋势, 但存在一定的观测差异. 在降雨等复杂天气条件下, 会有较大差异.

**关键词:** 数字摄像技术; 能见度自动观测仪; CCD 摄像机; 控制电路; 比对实验

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## Digital Photography Visiometer System and Comparative Experiment

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**Abstract:** The traditional optical visibility instruments bear their respective observation defects. Digital photography visiometer system (DPVS) is one new type of visibility automation observation instrument, has been developed by adopting advanced digital photography technology and imitating manual visibility observation by human eye based on the definition of visibility visibility's theory and according to the definition of meteorological visibility. This thesis introduced the work theory of system, compose of system, structure of hardware and software flow, in the end some contrasted experiment results between DPVS and traditional optical visibility as well as manual visibility observation were given. The results show that the three ways share the same change trend with kind of differences. And in complicated weather conditions, like rain, the differences are more obvious.

**Key words:** digital photographic technology; visibility automation observation instrument; CCD camera; control circuit; comparative experiment

## 1 引言

能见度是三大基本气象观测要素之一, 是一个对航空、航海、陆上交通以及军事活动等都有重要影响的气象要素<sup>[1]</sup>. 特别是近年来, 随着北京向国际化大都市迈进步伐的加快, 许多领域已经把能见度的日常观测逐渐提到日程上来<sup>[2]</sup>, 如高速公路的关闭、车辆的限速、飞机的起降等等<sup>[3]</sup>. 特别是今年我国多个省市雾霾天气频发, 持续的低能见度天气造成多起恶性交通事故发生, 导致人民生命财产受到重大损失. 可见能见度的实时观测在道路交通中更是不可或缺. 可以说对能见度的实时观测和预报已经成为现实生活中不可缺少的重要内容. 但能见度的观测现状却与实际观测需求相差甚远, 目前国内外对能见度的探测大都还是采用人工观测方式<sup>[4]</sup>,

其原因就是迄今国内外尚未有能够取代人工能见度观测的、符合能见度定义的能见度自动观测仪问世.

能见度观测方法分为人工目测和器测两种. 人工目测方法符合能见度定义, 但客观性较差, 存在一定的误差. 器测目前采用的都是光学仪器<sup>[5]</sup>, 如散射能见度仪、透射能见度仪<sup>[6,7]</sup>. 前者是通过直接测量有限体积(微小体积)空气的散射光强, 估计大气消光系数而确定大气能见度<sup>[8,9]</sup>. 计算消光系数是建立在假定大气是均匀分布的、假定分子的吸收效应为零等前提下. 显然在实际观测环境中上述假设条件难以成立. 在大气极不均匀的环境下, 用微小采样体积空气的消光系数来外推几公里甚至几十公里的能见度显然是不可靠的. 后者是通过光束透过两固定点之间的大气柱直接测量气柱透射率, 以此来评估能见度值, 这种方法要求光束通过足够长的





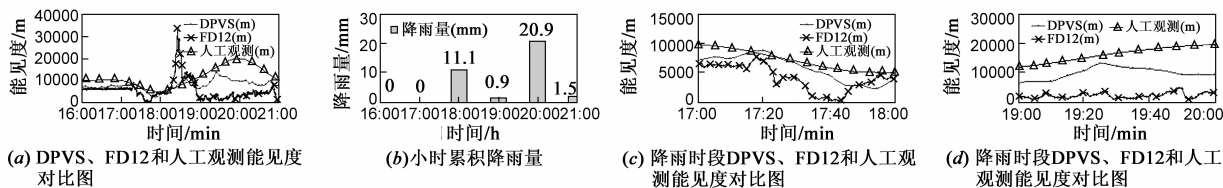


图7 降雨情况下DPVS、FD12和人工观测能见度对比

## 5 结论与讨论

数字能见度仪的室外控制单元,从整体电路设计上讲,其技术难度不是很大,但是由于它的工作环境和工作状态的特殊,需置于室外工作,故对电路设计要求比较高.实验证明,本系统完全可以满足室外工作要求.

数字能见度仪、前向散射能见度仪以及人工能见度观测结果显示,三种观测结果的变化趋势完全一致.人工观测模式,观测员存在视力差异,且具有较大主观性,因此会有一定观测误差,有时会出现大起大落的现象.数字能见度仪和前向散射仪由于是自动观测模式,变化相对平缓.在降雨等复杂气象条件下,由于数字能见度仪与人具有相同的观测原理,观测结果较为接近;它们与前向散射仪原理不同,观测结果存在一定的观测差异,前向散射能见度仪的观测值明显偏低.

数字能见度仪作为一种新型的唯一符合能见度定义的能见度观测仪,具有很高的实用价值和广阔的应用前景.随着 CCD-CAMERA 技术的飞速发展,其分辨率早已达到人眼分辨率(千万像素),成本却在直线下降.这种当今唯一符合能见度定义的能见度自动观测仪,由于其成本低、安装便捷等特点、必定会有很高的实用价值和广阔的应用前景.同时由于它是根据人工观测方法设计,必然是取代人工观测能见度的最佳仪器.

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